Contact Information

2025 Upper Columbia Regional Project Pre-Application

* Pre-applications (SRFB & Monitoring) due March 12, 2025 (COB)

*Complete SRFB applications due in PRISM April 18, 2025 (COB)

*Complete Monitoring applications due in PRISM May 1, 2025 (COB)

*Revised SRFB proposals due in PRISM May 27, 2025 (COB)

*Final revised SRFB & Monitoring applications due in PRISM June 23, 2025 (noon)

Project Title	Roaring Creek Floodplain Reconnection Project
Sponsor	Cascadia Conservation District
Primary Contact	Mark Ingman
E-Mail Address	marki@cascadiacd.org

Project Summary

Please provide a description or summary of the proposed project, including project goals. The goal of the project should be to solve identified problems by addressing the root causes. Then clearly state the desired future condition.

This project will treat and reconnect the lowest 1.2 miles and over 40 acres of Roaring Creek floodplain that is located on Forest Service lands (RM 1.4-2.8). Grazing, timber harvest, uncharacteristic/catastrophic fire (2014, 1988), and historic extirpation of beaver are some of the leading causes of channel incision, floodplain disconnection with the stream, reduced baseflows, and simplification of the stream network. The project design separates the treated areas into three project segments (upper, middle, and lower), each with different treatment methods and goals. By aggrading and recovering the streambed, reconnecting floodplains, raising groundwater tables, increasing structural wood in the channel and system, increasing habitat complexity, and off channel habitat, the project will substantially benefit ESA threatened steelhead for multiple life stages.

What are the project objectives? Objectives support and refine biological goals, breaking them down into small steps. Objectives are specific, quantifiable actions the project will complete to achieve the stated goal. Each objective should be SMART (Specific, Measurable, Achievable, Relevant, and Time-bound). Note: This exact question is included in the PRISM application. Example format: The project seeks to address [specify limiting factor(s)] for [limiting life stage(s)] by [specific actions proposed] to create an estimated [include specific target metrics, as described below] upon implementation in [estimated year].

The objective are directly aligned and correspond to the limiting factors for Roaring 03 and 04, respectively, as follows:
1) baseflow (Score 1 red,1 red) , 2) cover-wood (3 yellow,1 red) , 3) off channel/side channel (3 yellow, 1 red), and 4) course substrate (3 yellow both reaches).

As such, using the same numbering as above limiting factors, our project objects will directly 1) benefit baseflows by raising groundwater to approaching the floodplain level and provide an anticipated delay of return to baseflows over 1.4 mile project scale (already measuring pre-project with up and downstream flow gauges per WA Ecology funded QAPP), 2) increase cover-wood through large wood additions in all treated reaches within the project (large scale wood loading), 3) provide new side and off channels through fully aggrading upper and lower reaches that are disconnect from floodplain through a combination of Stage Zero floodplain reset methods and heavy in-stream wood loading methods, and finally, 4) providing multiple flow paths and complexity to sort substrate of multiple sizes/classes (including coarse size) within the newly created, anastomosing stream network.

Budget Request

Values MAY be duplicative and do not have to equal TOTAL anticipated budget in pre-application.

Anticipated Request - SRFB Riparian Funding	470,000
Tributary Committee - Anticipated or Actual	330000
Anticipated or Actual Other Funding	220,000
Anticipated TOTAL Budget	1,020,000

Other Funding Source(s), please note if funding is anticipated or actual.

USFS Roaring Creek Floodplain Enhancement - $220,000, actual/secured

Project Location

Briefly describe the location of the project	The project will occur in Roaring Creek starting at RM 1.4 and ending at RM 2.8.
Latitude (decimal degrees)	47.682246
Longitude (decimal degrees)	-120.361772
Project subbasin	Entiat
Entiat Assessment Unit(s)	Roaring Creek

Does the proposed project span multiple assessment units?	No
Reach(es) Name	Roaring 03, Roaring 04
Identify the reach(es) priority/ reach ranking. Note: If the project involves work in multiple reaches, select "Multiple" and include details in the text box that will appear below. Please reference the Prioritization Web Map: https://prioritization.ucsrb.org/.	Rank 2 Unranked (not a priority or missing data) Multiple reaches (provide details below)

Please detail the reach-ranking of the reaches below

Roaring Creek 01-04 are listed as "unranked" on the basis of a FS valley confinement ratio algorithm. This is a error in the algorithm as the valley width is great that 8x bankfull width and there is considerable floodplain in which to do restoration for the greater extent of the 1.4 mile project area. We request a full review and consideration of this project despite is unranked status.

Project Information

1. What species will the project benefit?	Spring Chinook Steelhead Summer Chinook Coho
2. Select the project's objectives and the associated tracking metrics	Instream Flow Instream Habitat (Includes Floodplain & Off-Channel Reconnection) Riparian Habitat
Instream Flow: Reporting Code	Change in water flow
Instream Habitat: Reporting Code	Total miles of instream habitat treated Miles of off-channel stream created or connected Acres of channel/off-channel connected or added Number of structures placed in channel Pools created through channel structure placement
Riparian Habitat: Reporting Code	Total riparian miles streambank treated Total riparian acres treated

4. Does this project already exist in Salmon Recovery Portal or PRISM?

No

5. Has this project been submitted previously for funding through the SRFB and/or other process(es)?

No

6. What category is the project?

Restoration

If applicable, what is the secondary project category?

N/A

Is the project eligible for Riparian Funding?

Yes

Design and Restoration Proposals

7. What project phase(s) are proposed for completion?

Construction

8. Is your project within a completed (or soon-to-be completed) Reach Assessment or other type of assessment (e.g., Rapid Site Assessment, other)?

No

9. Which limiting factors does the project propose to address?

Cover - Wood
Flow - Summer Base Flow
Off-Channel - Floodplain
Off-Channel - Side-Channels
Pool Quantity & Quality
Riparian
Riparian - Canopy Cover

10. Which life stages will the proposed project address?

Fry
Spawning and Incubation
Summer Rearing
Winter Rearing

11. Freshwater Benefits - Describe how your project will improve survival, capacity and/or distribution for target species at the reach scale?

Habitat quantity (side and off channels, inundated extent, and floodplain habitat area) will be increased.

Habitat quality will also be improved. The predominantly single thread channel will become anabranching (multi-thread) in nature post treatment, and this quality improvement will be significantly increased through installation of large quantities of structural large wood in channel in within the treated floodplain extent. We anticipate relatively fast vegetative response in the widening of the riparian corridor both through active plantings and passive natural recruitment. As a result, edge habitat will be significantly expanded.

Fish: A total of 16 steelhead redds have been documented within the treated project area during surveys conducted in 2008, 2009 and 2011. Modeled peak flows in the planned treated area of the documented redd locations indicate the potential redds have been washed out by peak flows in some years in some

locations. The restoration methods will have the effect of slowing and spreading peak flows, spreading and sorting gravels, that combine to produce reduced flows and expanded spawning opportunities. An additional 13 steelhead redds were documented within Roaring Creek, downstream of the project area during the same survey years (data source: UCSRB). There is a PIT array in Roaring 01 ("RCT").

12. Temporal Effect - Briefly describe how and to what extent the project would promote natural stream/watershed process consistent with the geomorphology of the stream?

Restoration actions align with natural confinement patterns along of the project reach. Full floodplain treatments are proposed in the unconfined Upper and Lower reach segments. These segments have valley bottoms greater than 8 times the bankfull width and were historically depositional in nature. Through streambed raising, roughness (wood) treatment, and improved groundwater interactions, we anticipate vegetation response and development of multiple threads within 2-4 years.

The middle segment is naturally confined by colluvial and landslide deposits. The restoration approach accordingly targets and seeks to activate pocket floodplain areas with strategic low-tech and landslide-simulating wood treatments. We anticipate localized response in floodplain activation, sediment sorting, and pool development within similar timeframes.

13. Temporal Effect - How long will it take for the project to achieve its intended response?

1-10 years

14. Temporal Effect - How long will the restoration action and its benefits persist?

50+ years

15. Temporal Effect - What level and/or interval of maintenance is anticipated? What is the plan for any anticipated maintenance?

The level and interval of maintenance will depend upon the reach and its corresponding treatment methods. Overall, the project sponsor has extensive direct experience with low tech process based restoration in the Upper Columbia region. In our discussions with stakeholders we have received feedback that floodplain reset ("stage 0") methods benefit significantly through adaptively managing the desired stream response through low tech process based restoration (personal communication, Paul Powers, USFS). We will be monitoring fish response (separate SRFB proposal), stream response, and riparian establishment and growth through multiple funding sources (WA Ecology -secured; other proposals in progress). The project sponsor has been successful each cycle in applying and receiving state restoration maintenance/stewardship funding through the WSCC Riparian Grant Program (RGP). WSCC RGP can support both riparian maintenance and BDA/Low Tech maintenance. We foresee low tech restoration based adaptive management for 10 years following the implementation, and then less maintenance thereafter. The potential for beaver being a primary actor in ongoing maintenance and restoration is relatively high given the signs of both historical and recent beaver activity in Roaring Creek (above the project area, and within the project area).

16. Methods - Briefly describe the potential (for design) or proposed restoration methods and how they will achieve project objectives.

Upper Reach (naturally unconfined, high incision): The upper reach is naturally unconfined (valley bottom >8x channel width) but incised 4-6 feet from its historical floodplain level. This reach has proposed Stage 0 (streambed) raising restoration techniques. The lower end of this reach will include a transitional roughened channel meet grade with the middle reach.

Middle Reach (partially confined with localized "pocket" floodplains): The middle reach is naturally confined by hillslope and colluvial deposits. These deposits create localized floodplain pockets that have mixed to low connectivity. The proposed restoration actions will include low-tech structures to create localized complexity and connectivity in areas where riparian disturbance is undesirable. Restoration actions will also include landslide-simulating logjams to activate floodplain areas where equipment access is feasible.

Lower Reach (moderate-high incision): The lower reach has similar attributes to the upper reach, with a naturally wide valley bottom and high incision. The proposed restoration actions include Stage 0 (stream-bed raising) approaches to connect floodplains, reduce stream power, improve groundwater interactions, and promote riparian regrowth.

17. If the project is eligible and applying for Riparian Funding, does the project have in-stream components? If so, briefly describe those components, how they support riparian plant survival and/or natural regeneration, and why they are necessary for the success of the riparian habitat elements of the project.

Yes, the project is eligible for Riparian Funding. The in-stream components will raise the bed grade to a full floodplain reset (Stage 0) level in the upper and lower reaches where this method is appropriate and most needed. This means aggrading stream bed incision that is as much as 6 feet below the floodplain in its current and unrestored state. Stage Zero and large wood additions will significantly raise groundwater levels, delay the annual return to baseflows, that will invariably rewet the floodplain for robust riparian growth and establishment in which a response is expected in the 2-4 year time interval. The project will benefit riparian vegetation both passively through raising groundwater levels, but also actively through a riparian planting plan encompassing the upper, middle, and lower reaches.

Assessment Proposals

Protection Proposals

Monitoring Proposals

Project Risk and Economic Benefits

1. What is the landownership? Forest Service

2. Have you secured landowner participation in or acceptance for this project? Yes

Please explain

The landowner is the original project implementer and co-funder of the project and the Forest Service has partnered with Cascadia CD to implement the project. Cascadia CD has received an award from the Forest Service to implement the design and the construction (partial construction award as match). The Forest Service is reviewing all design milestones of the project and co-leading permitting for the project with Cascadia CD. The Roaring Creek Floodplain Enhancement project is named as part of the USFS Mad Roaring Mills Landscape Restoration NEPA of 2018, finalized in 2023.

3. Describe any land owner requirements (e.g., design elements, right-of-ways, access agreements, liability waivers, etc.) and if/how they could affect the project

The Forest Service has provided match funding for the design, and partial funding for construction. The Forest Service is reviewing the 30%, 60% and final design stages. There is Forest Service gate and primitive road that leads to the project area. The design team has been in conversation with the Forest Service about widening at least one part of the road in order to transport large quantities of wood to the staging areas.

4. Will the project raise potential concerns for interest groups (e.g., recreational users) or the community at large (including upstream/ downstream/ adjacent landowners)?

There is relatively low/infrequent use of Roaring Creek and the primitive roadway is mostly out of the floodplain and unaffected by the restoration methods. There is some occasional dispersed camping points in the treated area that were unpermitted and may be better displaced than encouraged. It is a relatively low recreational use adjacent and along the stream. Additionally, this project was part of the MRM NEPA that was finalized in 2023. The project sponsor organizes the Entiat Watershed Planning Unit

and utilizes this and other venues to present project updates and receive feedback.

5. Who will have the responsibility to manage and maintain the project? What is the responsibility of current or future landowners?

Cascadia CD will have the responsibility of managing the project for at least 10 years, which is the same duration we require as a district for all projects. The current and future landowners will remain the Forest Service. The Forest Service provides input at each design stage as well as funding for both design and construction (funding serving as match). The design project is on the Forest Services work plan for 2025. Cascadia CD looks forward to continuing it partnership with the Forest Service to complete the design, implement, and continue ongoing maintenance.

6. Are other projects being proposed immediately upstream or downstream of worksite?

No

7. Please describe the risk of failure associated with this project.

This project benefits from utilizing process based restoration at the full floodplain scale. In this way, it is utilizing natural processes coupled with engineering design and modeling. We have collected input from multiple agencies and stakeholders before and during the design process and we continue to take in feedback at every consequent design milestone. We have collected considerable field and remote sensing data, reviewed existing datasets and records, and consulted with outside experts who have experience with the same type of full floodplain projects (P. Powers, R. Flitcroft, and others, predominantly versed in full floodplain/stage 0 projects). We have intentionally focused on such risk factors as 1) grade control at the downstream location, 2) water rights – confirmed downstream users are in fact now groundwater users, 3) geophysical subsurface transects, 4) streamflow gauges upstream and downstream of treated project area, 5) limiting impacts to wetlands and sensitive species, and other leading risk considerations. The project sponsor is part of a CRM, which leverages our pooled resources among staff, community relationships, low tech processed based program, Wenatchee-Entiat Beaver Project, and other capabilities for all of our projects. This creates a level of redundancy and a depth of resources.

8. Is there any public outreach planned during and/or after implementation? Does the project build community support for salmon recovery efforts?

The Roaring Creek Floodplain Reconnection project is included in the “Mad Roaring Mills Landscape Project” as one primary component sites of the public NEPA process (See “Objective 3 – restore floodplain connection” https://www.fs.usda.gov/project/okawen/?project=59963). The NEPA was finalized in July of 2023. We continue to provide landowner outreach about this award through direct engagement with local landowners as well as through public venues such as the Entiat Watershed Planning Unit, a quarterly public meeting facilitated by Cascadia Conservation District. There has been past and recent outreach with downstream landowners on Roaring Creek regarding restoration activities.

9. Does the project represent an opportunity for economic benefit? How much benefit does the project create for the dollars invested?

The project will result in funds being invested into the local economy in the form of subcontracts, payroll, materials, supplies, fuel. The project sponsor is mindful of sourcing materials locally and regionally whenever possible. The Entiat watershed is an important recreation location in Nort Central Washington. The reconnection of over a mile of floodplain along Roaring Creek will not only benefit threatened steelhead and other native fish, but it will benefit wildlife on a watershed scale. This benefits extend to hikers, birders, and many other forms or recreation. Water scarcity is a real concern going forward and the slowing of water leaving Roaring Creek benefits the watershed at every location downstream in terms of the availability of water resources. While we do not have a calculation of dollars spent, we do feel that our ratio of dollars spent per distance and area restored is perhaps the best ratio of dollars invested for linear stream and acres restored ($1M for 1.4 miles and over 40 acres)!

10. Describe any partnerships, their experience, and types of contributions supporting the project.

Cascadia CD I part of a coordinated resource management (CRM) team with Cascade Fisheries and Trout Unlimited. Trout Unlimited initiated several BDAs with the Forest Service on Roaring Creek to arrest several

head cuts for fish passage. In 2023 Cascadia CD assisted Trout Unlimited in installed several beaver dam repairs upstream of the project area. Recently Cascadia CD and Cascade Fisheries and collaborated on project development of other sites on Roaring Creek. Cascadia CD will undoubtably utilize the CRM for assistance during all phases of implementation (such as Low Tech PBR components), maintenance, and monitoring.
The US Forest Service has been developing the Roaring Creek Floodplain Reconnection project since around 2018 that coincides with the Mad Roaring Mills Landscape Project (NEPA). The Forest Service received funding for landscape scale projects and awarded Cascadia CD funding for design and implementation of the project. The Forest Service team includes fisheries biologists, hydrologist, botanist, archeologist, and the ranger. We have also consulted with member of the USFS Pacific Northwest Research Station. Concurrent to the Forest Service's award, the WA Department of Ecology provided funding for design and monitoring of the Roaring Creek Reconnection Project. The WA Ecology has reviewed and approved streamflow monitoring of the project, which includes streamflow measurements above and below the project site. Our consultant design team includes Lichen Land and Water as principal, Nick Legg PG and Dominique Shore (geomorphologist), Gabe Williams, PE, Resource Specialists Inc. as lead engineer, Lauren Zatkos, Wetland Scientist, W2R, and AJ Jones, PE, ESCM, Wolf Water Resources. The consultant design team has extensive experience with full floodplain restoration projects in the Pacific Northwest to include full floodplain and Stage 0 restoration. The project sponsor, Mark Ingman has a MS in Water Resources and over ten years of experience in natural resources project management. Cascadia CD also has its own archeologists on staff for cultural resources inventories.

Optional Section - Preparation for PRISM (SRFB applications only)

The following questions are identical to the questions RCO requires in the PRISM application for SRFB projects. If desired, sponsors can complete associated questions early and copy responses into PRISM during the "Complete Application" phase due on April 18, 2025.
*please note, this section is not applicable for Monitoring proposals

Do you want to review and/or pre-populate PRISM questions?	No

Supporting Documents

Upper Columbia Process Guide 2025

SRFB Manual 18 (2025)

RCO Application Resources (2025)

PROJECT: 25-1232 REST, ROARING CREEK FLOODPLAIN RECONNECTION PROJECT

Sponsor: Cascadia Conservation District Program: Salmon State Riparian Status: Preapplication

Parties to the Agreement

PRIMARY SPONSOR

Cascadia Conservation District

Address 1350 McKittrick St, Suite B

City Wenatchee **State** WA **Zip** 98801

Org Type District-Conservation

Vendor # SWV0024685-00

UBI

Date Org created

Org Notes

link to Organization profile
link to PRISM Organization page
☐ Org data updated

SECONDARY SPONSORS

No records to display

MANAGING AGENCY

Recreation and Conservation Office

LEAD ENTITY

Upper Columbia Salmon Rcy Bd L

QUESTIONS

#1: List project partners and their role and contribution to the project.

USFS - funder for design & partial construction, landowner, permitting support
WA Ecology - funder for design and some monitoring

External Systems

SPONSOR ASSIGNED INFO

Sponsor-Assigned Project Number

Sponsor-Assigned Regions

LINK AN EXISTING SRP PROJECT

Unlink

25-1232, Roaring Creek Floodplain Reconnection Project,

Project Contacts

Contact Name Primary Org	Project Role	Work Phone	Work Email
Mark Ingman Cascadia Conservation District	Project Contact	(509) 906-1545	marki@cascadiacd.org
Ariel Edwards Upper Columbia Salmon Rcy Bd L	Lead Entity Contact	(208) 540-2691	ariel.edwards@ucsrb.org
Amee Bahr Rec. and Conserv. Office	Project Manager	(360) 867-8585	Amee.Bahr@rco.wa.gov

Worksites & Properties

#	Worksite Name
#1	Roaring Creek Floodplain Reconnection

Restoration	Property Name
✓	Roaring Creek Floodplain Reconnection

Worksite Map & Description

Worksite #1: Roaring Creek Floodplain Reconnection

WORKSITE ADDRESS

Street Address 47°41'11.5"N 120°20'51.7"W

City, State, Zip

Worksite Details

Worksite #1: Roaring Creek Floodplain Reconnection

SITE ACCESS DIRECTIONS

From Wenatchee, WA: Take US-97 ALT N to Entiat River Rd in Entiat, WA. Continue on Entiat River Rd for 7.5 miles heading upriver. Turn left onto Roaring Creek Rd, travel 1.8 miles and pass through USFS gate, arrive at lower end of project area, Latitude and longitude for downstream treatment area and parking area is 47°41'11.5"N 120°20'51.7"W.

TARGETED ESU SPECIES

Species by ESU	Egg Present	Juvenile Present	Adult Present	Population Trend
Steelhead-Upper Columbia River, Entiat River, Threatened	✓	✓	✓	Declining

Reference or source used

Upper Columbia Spring Chinook and Steelhead Recovery Plan

TARGETED NON-ESU SPECIES

Species by Non-ESU	Notes
Cutthroat	Weslope cutthroat documented above project area in Tamarack Creek tributary.

Questions

#1: Give street address or road name and mile post for this worksite if available.

Project linear extent along stream in vicinity of Roaring Creek Road: 47.682246
-120.361772 (downstream point) and 47.677732, -120.371776 (upstream point)

Project Location

RELATED PROJECTS

Projects in PRISM

PRISM Number	Project Name	Program Name	Current Status	Relationship Type	Notes
No related project selected					

Related Project Notes

Questions

#1: Project location. Describe the geographic location, water bodies or habitat types, and the location of the project in the watershed, i.e. nearshore, tributary, main-stem, off-channel, etc.

The project is located between river mile 1.4 and 2.8 on Roaring Creek on USFS property (1.4 total miles of stream) and 40 acres of aquatic, riparian, and floodplain habitat. Roaring Creek is a significant fish bearing tributary of the Entiat River.

#2: How does this project fit within your regional recovery plan and/or local lead entity's strategy to restore or protect salmonid habitat? Cite section and page number.

The assessment unit is ranked #2 for steelhead restoration and #2 for steelhead protection.

#3: Is this project part of a larger overall project?

No

#4: Is the project on State Owned Aquatic Lands? Please contact the Washington State Department of Natural Resources to make a determination. **Aquatic Districts and Managers**

No

Property Details

Property: Roaring Creek Floodplain Reconnection (Worksite #1: Roaring Creek Floodplain Reconnection)

✓ **Restoration**

LANDOWNER

Name	US Forest Service (USFS)
Address	215 Melody Ln
City	Wenatchee
State	WA Zip 98801
Type	Federal

CONTROL & TENURE

Instrument Type	Landowner Agreement
Timing	Existing
Term Length	Fixed # of years
# Yrs	3
Expiration Date	01/01/2028
Note	This is time existing on the USFS-CCD contract where USFS has awarded CCD the funding to design and implement the project on USFS land.

Project Proposal

Project Description

This project will treat and reconnect the lowest 1.4 miles and over 40 acres of Roaring Creek floodplain that is located on Forest Service lands (RM 1.4-2.8). Grazing, timber harvest, uncharacteristic/catastrophic fire (2014, 1988), and historic extirpation of beaver are some of the leading causes of channel incision, floodplain disconnection with the stream, reduced baseflows, and simplification of the stream network. The project design separates the treated areas into three project segments (upper, middle, and lower), each with different treatment methods and goals. By aggrading and recovering the streambed, reconnecting floodplains, raising groundwater tables, increasing structural wood in the channel and system, increasing habitat complexity, and off channel habitat, the project will substantially benefit ESA threatened steelhead for multiple life stages.

Project Questions

#1: Problem statement. What are the problems your project seeks to address? Include the source and scale of each problem. Describe the site, reach, and watershed conditions. Describe how those conditions impact salmon populations. Include current and historic factors important to understand the problems.

Roaring Creek is identified as a priority for steelhead restoration and protection by the
Upper Columbia Salmon Recovery (UCSRB, 2021). The reach has a documented
spawning use in WDFW redd surveys and is categorized as a high priority assessment
unit (AU) for adult migration, spawning, fry colonization, and summer rearing. The
project area spans Roaring Creek Entiat Reaches 02 & 03. Low summer base flows are
listed as an unacceptable limiting factor. Channel modification, instream
enhancement, and upland management are identified as action categories.

The project reach currently suffers from the effects of relatively extreme incision and disconnection of the creek from its floodplain (Figure 1). For a vast majority of the floodplain segments, the creek is entrenched below its historical floodplain level by 5-6 feet, which exceeds the creek's average bankfull depth (~1.5 feet) by a factor of three. The creek sits in an incision trench typically narrower than 20 feet wide, which is less than 2 times wider than the creek's bankfull width of 13 feet. These basic statistics indicate the degree of entrenchment and diminished floodplain connection.

Within the incision trench, the creek has developed little adjacent (inset) floodplain since the original incision. Vegetation within the incision trench is young deciduous trees (<6 inches diameter). These patterns indicate the incision likely occurred within the post-settlement period, likely from beaver trapping/removal and localized land-use impacts including historical homesteading.

As a result of the incision, the stream is primarily single-threaded with little off-channel habitat or floodplain connectivity. The creek has an observed lack of large wood and pools and naturally has elevated stream power as a result of the entrenchment.

#2: Describe the limiting factors, and/or ecological concerns, and limiting life stages (by fish species) that your project expects to address.

The objective are directly aligned and correspond to the limiting factors for Roaring 03 and 04,
respectively, as follows:
1) baseflow (Score 1 red,1 red) , 2) cover-wood (3 yellow,1 red) , 3) off channel/side channel (3 yellow, 1 red), and 4) course substrate (3 yellow both reaches).
Using the same numbering as above limiting factors, our project objects will directly 1) benefit baseflows by raising groundwater to approaching the floodplain level and provide an anticipated delay of return to baseflows over 1.4 mile project scale (already measuring pre-project with up and downstream flow gauges per WA Ecology funded QAPP), 2) increase cover-wood through large wood additions in all treated reaches within the project (large scale wood loading), 3) provide new side and off channels through fully aggrading upper and lower reaches that are disconnect from floodplain through a combination of Stage Zero floodplain reset methods and heavy in-stream wood loading methods, and finally, 4) providing multiple flow paths and complexity to sort substrate of multiple sizes/classes (i.e. coarse substrate, gravel sorting) within the newly created, anastomosing stream network.

#3: What are the project goals? The goal of the project should be to solve identified problems by addressing the root causes. Then clearly state the desired future condition. Include which species and life stages will benefit from the outcome, and the time of year the benefits will be realized. **Example Goals and Objectives**

The following goals were identified through discussion with the project team. In recognition that realistic SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound) objectives depend on the chosen alternative, detailed objectives have not been developed at this juncture.

1. Floodplain Ecosystem Function - The Roaring Creek floodplain is degraded due to historical impacts that have caused the stream to incise and disconnect
from its floodplain.

2. Target Fish Species Benefits - The reach is identified as critical habitat for
steelhead, with adult migration, spawning, and rearing uses.

3. Streamflow Improvement (baseflow) - Roaring Creek is known to go dry on an
intermittent basis in the reaches downstream of the project area.

4. Value - The project seeks to maximize value from public funding.

5. Learning - The benefits of headwater stream restoration are often described
qualitatively but rarely quantified with regionally specific studies.

#4: What are the project objectives? Objectives support and refine biological goals, breaking them down into smaller steps. Objectives are specific, quantifiable actions the project will complete to achieve the stated goal. Each objective should be SMART (Specific, Measurable, Achievable, Relevant, and Time-bound). **Example Goals and Objectives**

1. Floodplain Ecosystem Function - 1. Floodplain Ecosystem Function - The project seeks wholesale and sustainable ecosystem uplift through improved connectivity, improved riparian function, reduced stream power, improved sediment retention, and improved water storage and quality. Objective focus areas as follows: A) Existing beaver presence/use sustained and expanded, B) floodplain reconnection for riparian recovery of historical proportions and function, and C) improved ecosystem function and connectivity are expected to provide increased capacity for steelhead using the treated reaches.

2. Target Fish Species Benefits - improve productivity for steelhead, addressing known limiting factors related to instream complexity, floodplain connectivity, and limited baseflow.

3. Streamflow Improvement - Roaring Creek is known to go dry on an intermittent basis in the reaches downstream of the project area. The project seeks to raise groundwater tables and seasonal water storage to improve streamflow and connectivity within the reach and downstream.

4. Value - The project seeks to maximize value from public funding. For the purposes of this project, value conceptually considers benefits relative to costs as well as the durability (longevity) of anticipated benefits.

5. Learning - the project will serve as a regional pilot for full-floodplain restoration in a system with active beaver use and active wolf presence.

#5: Scope of work and deliverables. Provide a detailed description of each project task/element. With each task/element, identify who will be responsible for each, what the deliverables will be, and the schedule for completion.

Task 1. Complete permitting and finalize design, CCD & Lichen Land & Water, Winter 2025-26.
Task 2. Construction specifications, bidding, CCD & Lichen, Spring 2026
Task 3. Implementation, pending multiple factors, CCD & Lichen, 2026/2027.
Task 4. Asbuilts and begin maintenance & adaptive management, CCD & Lichen, 2026/2027
Task 5. Bi-annual reporting and final report, CCD, throughout life of contract.

#6: What are the assumptions and physical constraints that could impact whether you achieve your objectives? Assumptions and constrains are external conditions that are not under the direct control of the project, but directly impact the outcome of the project. These may include ecological and geomorphic factors, land use constraints, public acceptance of the project, delays, or other factors. How will you address these issues if they arise?

The USFS contract with Cascadia CD to implement this project named in the Mad Roaring Mills EA/NEAP (2021). As a federal agency, the USFS is experiencing funding and capacity challenges. As a result, Cascadia CD and the design team have addressed both project risks as follows: 1) funding - secured match from the WA Department of Ecology Streamflow program and CCD may apply for WSCC Riparian Grant Program funding as match at a later date if necessary (CCA funding for CDs to implement riparian projects), and 2) permitting - proactively built upon the existing permitting work of the completed NEPA by consulting with WA Ecology for wetland delineations, the WDFW, the USFWS, and other agencies so that they are aware of the project and able to assist as necessary throughout the permitting process.

Riparian success: we are excited about this riparian project to dramatically increase the riparian lateral extent and ecosystem function through raising the groundwater levels quickly and substantially. We are likewise interested to see the relatively recent presence of wolves (documented in 2021; source WDFW presentation to Entiat Watershed quarterly meeting 2024), will have in restoring the ecosystem.

#7: How have lessons learned from completed projects or monitoring studies informed this project?

Lichen Land and Water ranked extremely high in the contractor bidding process on account of their extensive experience in full floodplain projects. Lichen's team includes advisors additionally experienced in Stage 0 techniques (primarily in Oregon) as well as wood loading, low tech process based restoration, USFS land interactions, and wetland/regulatory compliance. Their combined list of stage 0 techniques includes their leadership in restoration for the following projects: Desolation Creek, Wilson-Haun (Wallawa River), Tucannon River PA 27/28, Steigerwald Floodplain (Columbia River), Finn Rock Reach P1 (McKenzie River), Crane Creek (Malheur River), Summit Creek (Malheur River), SF Toutle Headwaters, Whychus Creek, and Big Creek. Cascadia CD brings with it over 15 years of combined staff experience managing stream and river scale restoration projects and more recently, their low tech process based restoration program (LTPBR) that in just the last four seasons has installed over 450 structures and treated over 3.5 miles of continuous stream in 7 HUC12 scale watersheds within the Wenatchee and Entiat subbasins.

#8: Describe the alternatives considered and why the preferred was chosen.

The design alternative memo is attached that explains at length the reason for selection of design alternative three. Roaring Creek is unique as a project area in that it lacks infrastructure within the valley bottom extent (low risk to infrastructure). Alternatives 1 and 2 do not provide as much biological uplift nor on the same time table (alternatives 1 and 2 may take decades or even more than centuries to achieve comparable gains, and the gains are not as assured as those of Alternative 3). This is partially on account of the observed low sediment supply in the system. Alternative 3 provides by far the most biological uplift without an increase in risk to infrastructure, and is the most cost effect. While alternative 3 utilizes Stage 0 techniques to treat the primary channel incision in the upper and lower reaches, it is "hybrid" in that it uses less intensive techniques to enhance the ecosystem functions of the middle reach that are fundamentally less degraded than the upper and lower reaches.

#9: How were stakeholders consulted in the development of this project? Identify the stakeholders, their concerns or feedback, and how those concerns were addressed.

This project is a named sub-project of the larger Mad Roaring Mills Landscape Restoration Project #59963, listed as "Roaring Creek Floodplain Enhancement Project." The site where comments were collected is still viewable at this site: https://cara.fs2c.usda.gov/Public//CommentInput?Project=59963 . While this is an extensive public comment process carried out by the USFS, Cascadia CD and CRM partners have been in communication with downstream landowners on Roaring Creek and we continue to keep them updated. Additionally, the project applicant/sponsor is the Entiat Watershed coordinator, and will provide a project update to the public at the May 14, 2025 meeting. Agency stakeholder input from the USFS (biologists, ranger, hydrologist, NSAEC team), and area USFWS biologist were informally received through a site visit held last spring in 2024. Cascadia CD views stakeholder input as an ongoing and continual element of the project from beginning to completion.

#10: Does your project address or accommodate the anticipated effects of climate change?

Yes

#10a: How will your project be climate resilient given future conditions?

The applicant secured funding for a comprehensive Thermal IR survey of the Entiat and Mad Watersheds that includes Roaring Creek (2023 dataset). One of the most critically important cold water patches, in particular based upon its location in the lower Entiat River (warmest water is downriver), is the Roaring Creek tributary cold water patch where it confluences with the Entiat River. The Entiat River in its lower reaches average over 21 C and warmer, throughout the baseflow summer months. We are testing per the methods from Hunt et al. 2018 and funded by the WA Ecology (approved QAPP) the anticipated change to streamflow pre and post treatment, per above and below project streamflow gauges. This measurement of streamflow, along with the signficant storing of water subsurface in the aquifer, is anticipated to buffer the affects of climate change and potentially enhance the cold water patch where Roaring Creek flows into the Entiat River for cold water species critical habitat.

#10b: How will your project increase habitat and species adaptability?

Our selected Alternative is the most dynamic in the level of complexity, patchiness, and heterogeneity that it provides because it returns the stream back to stage 0 conditions (anastomosing). These more so anastomosing conditions of the stream, as compared to its predominantly single thread and entrenched current state of the stream, are the originating conditions from which salmonids evolved. The most dynamic habitat conditions (Alternative 3, stage 0 techniques) represents a dramatic increase in habitat quantity and quality for cold water species, which in term allows these species to utilize the full range of their genetics so to increase their productivity and move forward on the path towards recovery.

#11: Describe the sponsor's experience managing this type of project. Describe other projects where the sponsor has successfully used a similar approach.

The project sponsor has over 15 years of staff experience leading and managing aquatic restoration projects in multiple watersheds where engineering consulting is required to tackle large scale and highly technical problems (Entiat Watershed, Snohomish Watershed, Mason County/WRIA 14, and others). More recently, the Cascadia CD aquatic-riparian program has implement process based restoration that worked towards stage 0 conditions on an incremental timescale through the full scale implementation of low tech process based restoration (averaging implementation of over 150 structures per season; BDAs, PALS, LWD griphoisted jams, wood loading). These LTPBR projects includes Entiat River tributaries Stormy and Potato Creeks, and Wenatchee River tributaries, Chumstick, Little Chumstick, Eagle Creek and also Squilchuck Creek (direct tributary to the Columbia River). Cascadia CD has additionally provided technical and field support for most of Trout Unlimited and Cascade Fisheries' projects.

#12: Will veterans (including the veterans conservation corps) be involved in the project? If yes, please describe.

Yes

The applicant is a veteran having served in the US Navy for five years with multiple overseas tours. Cascadia CD has also utilized Team Rubicon through their local Wenatchee representative for implementing projects. We plan to use Team Rubicon's field support this summer on Stormy Creek for implementing low tech process based restoration (July 2025).

Restoration Supplemental

#1: Is the primary activity of the project riparian planting?

No

#2: Does the project include measures to stabilize an eroding stream bank?

No

#3: Does the project include side channel reconnection or floodplain re-grading worktypes?

Yes

#3a: Explain why the side channel reconnection or floodplain regrading is necessary and secondary to accomplish the riparian restoration.

I think the answer is actually "no," however to explain, I needed to state "yes." This is not a side channel project in the traditional sense. Rather, by aggrading the primary channel incision (only), we are allowing the stream to re-inundate historical flow pathways that have the full range of sizes and types (complex pathways), to include microtopography. In this way, this is not a "side channel project."

As for floodplain re-grading, alternative 3 does not do this either. If for instance the decision was to aggrade the primary channel through imported soils from beyond the project extent, the floodplain would be relatively unchanged. To be cost effective, alternative 3 does harvest needed alluvial soils and cobble from higher areas, but this is only in a few selected locations, and therefore does not constitute "regrading of the floodplain."

#4: Does the project include an instream structure placement worktype?

Yes

#4a: Explain why the instream structure placement is necessary and secondary to accomplish the riparian restoration.

The selected alternative 3 calls for structure placement in the stream within the middle reach only, where unlike the upper and lower reaches of the project area, incision is much less, but ecosystem function is still lacking and would greatly benefit from the complexity that small wood structures and wood loading would provide (primarily low tech process based restoration, i.e. BDAs, PALS, and wood loading). This preserves the wetland areas within the middle reach and makes permitting more streamlined.

#5: Is the primary activity of the project invasive species removal?

No

#6: Describe the steps you will take to minimize the introduction of invasive species during construction and restoration. Consider how you will use un-infested materials and clean equipment entering and leaving the project area.

Even thought we are not using BPA funding, we will adopt the HIP III

BMP's for the project. This includes pre and post invasive plant treatments, and ensuring equipment is clean and weed free prior to mobilization. We have the ability to freeze or chemically treat waders, boots and other gear when moving between projects that are different bodies of water.

#7: Describe the long-term stewardship and maintenance obligations for the project.

Cascadia CD has a 10 year plan of work with the USFS that is reviewed annually. We have multiple funded projects on USFS land and we highly value our strong relationship of working with the USFS. As a conservation district, we apply our universal standard, whether private or public landowner, to maintain all implemented practices for at least 10 years. We have direct access to the the WA WSCC riparian grant program (RGP) that we intend to use for stewardship funding of this riparian project. We are also in a planning mode to develop a second phase of construction on Roaring Creek after this project is implemented and being stewarded, sizably increasing our presence and investment in Roaring Creek well into the future.

Restoration Metrics

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Worksite: Roaring Creek Floodplain Reconnection (#1)

Miles of Stream and/or Shoreline Treated or Protected (C.0.b)	1.40
Project Identified In a Plan or Watershed Assessment (C.0.c)	UC Spring Chinook and Steelhead Recovery Plan Mad-Roaring-Mills EA Entiat Watershed Management Plan
Priority in Recovery Plan	Tier two priority for restoration for Steelhead
Type Of Monitoring (C.0.d.1)	None
Monitoring Location (C.0.d.2)	Downstream Onsite Upstream

INSTREAM HABITAT PROJECT

Total Miles Of Instream Habitat Treated (C.4.b)	1.40

Channel reconfiguration and connectivity (C.4.c.1)

Total cost for Channel reconfiguration and connectivity	$434,000
Type of change to channel configuration and connectivity (C.4.c.2)	Channel Bed Restored Creation of Instream Pools Creation/Connection to Off-Channel Habitat
Miles of Stream Treated for channel reconfiguration and connectivity (C.4.c.3)	1.40
Miles of Off-Channel Stream Created or Connected (C.4.c.4)	1.00 **Note:** Estimated per current state of design.
Acres Of Channel/Off-Channel Connected Or Added (C.4.c.5)	14.0
Instream Pools Created/Added (C.4.c.6)	20

Channel structure placement (C.4.d.1)

Total cost for Channel structure placement	$434,000
Material Used For Channel Structure (C.4.d.2)	Individual Logs (Anchored) Individual Logs (Unanchored) Rocks/Boulders (Unanchored) Stumps With Roots Attached (Rootwads)
Miles of Stream Treated for channel structure placement (C.4.d.3)	1.40
Acres Of Streambed Treated for channel structure placement (C.4.d.4)	2.2
Pools Created through channel structure placement (C.4.d.5)	20
Number of structures placed in channel (C.4.d.7)	25 **Note:** Estimated per stage of design development.

RIPARIAN HABITAT PROJECT

Total Riparian Miles Streambank Treated (C.5.b.1)	1.40
Total Riparian Acres Treated (C.5.b.2)	14.0

Planting (C.5.c.1)

Total cost for Planting	$42,000
Species Of Plants planted in riparian (C.5.c.2)	Under development, consistent with willow-cottonwood riparian ecosystem and site existing native plants. Please see Riparian Enhancement Plan (under development, attached).
Acres Planted in riparian (C.5.c.3)	14.0 **Note:** Restore up to 14 acres. Planting actively less acres.
Miles of streambank planted (C.5.c.4)	0.90 **Note:** 1.8 miles assuming both banks.
Average Riparian Width	60 **Note:** We are seeking to restore the full

	floodplain, but in multiple cases the STPH is more than the valley bottom extent.
Site Potential Tree Height at 200 years (SPTH-200)	115

CULTURAL RESOURCES

Cultural resources

Total cost for Cultural resources
Acres surveyed for cultural resources

ARCHITECTURAL & ENGINEERING

Architectural & Engineering (A&E)

Total cost for Architectural & Engineering (A&E)

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Overall Project Metrics

COMPLETION DATE	
Projected date of completion	11/15/2027

Restoration Cost Estimates

Worksite #1: Roaring Creek Floodplain Reconnection

Category	Work Type	Estimated Cost	Note
Cultural Resources	Cultural resources	$0	
Instream Habitat Project	Channel reconfiguration and connectivity (C.4.c.1)	$434,000	
	Channel structure placement (C.4.d.1)	$434,000	
Riparian Habitat Project	Planting (C.5.c.1)	$42,000	
	Subtotal:	$910,000	
Admin, Architecture, and Engineering		$0	
	Total Estimate For Worksite:	$910,000	

Summary

Total Estimated Costs Without AA&E:	$910,000
Total Estimated AA&E:	$0
Total Estimated Restoration Costs:	$910,000

Cost Summary

	Estimated Cost	Project %	Admin/AA&E %
Restoration Costs			
Restoration	$910,000		
Admin, Architecture, and Engineering	$0		0 %
SUBTOTAL	$910,000	100.00 %	
Total Cost Estimate	$910,000 !	100.00 %	

Funding Request and Match

FUNDING PROGRAM

Salmon State Riparian	$470,000	46.078431 '

SPONSOR MATCH

Other Monetary Funding	Grant - Federal		
Amount			$220,000.00
Funding Organization			US Forest Service Okanogan-Wenatchee National Forest Entiat Ranger District
Grant Program			Federal
Other Monetary Funding	Grant - Local		
Amount			$330,000.00
Funding Organization			PUD TRIB Committee
Grant Program			PUD TRIB Committee
	Match Total:	$550,00053.921569 '	
	Total Funding Request (Funding + Match):	$1,020,000 !100.000000	! Difference from Total Cost Estimate: ($110,000)

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Questions

#1: Explain how you determined the cost estimates

Cost estimates are based upon the consultant/engineers itemized preliminary budget, combined with costs needed for project staking, project management, and supervision.

Other Funding

OTHER FUNDING DETAILS

Cultural Resources

Cultural Resource Areas

Worksite #1: Roaring Creek Floodplain Reconnection

Area: Relative APE

#1: Provide a description of the project actions at this worksite (acquisition, development and/or restoration activities that will occur as a part of this project)

Only restoration, in-stream and riparian. Staging of materials and equipment/monilization, elevating stream bed (fill), harvest of few higher areas for fill material (excavation), installation of wood and wooden structures. Planting. Vehicle/equipment traffic.

#2: Describe all ground disturbing activities (length, width and depth of disturbance and equipment utilized) that will take place in the Area of Potential Effect (APE). Include the location of any construction staging or access roads associated with your project that will involve ground disturbance.

There will be up to 14 acres disturbed through planting, and lesser quantities of excavation, fill. Installation of logs for wood loading, and likely BDAs and PALS. The depth of earth work and disturbance will be up to 8' but generally 1-4' deep.

#3: Describe any planned ground disturbing pre-construction/restoration work. This includes geo-technical investigation, fencing, demolition, decommissioning roads, etc.

If cultural resources is determined not to have been completed as part of the existing NEPA, then preconstruction ground disturbance will involve hand dug holes a part of the wetland delineation and cultural resource survey.

#4: Describe the existing project area conditions. The description should include existing conditions, current and historic land uses and previous excavation/fill (if depths and extent is known, please describe).

The site is undeveloped, rural, public land, that is partially vegetated with
native trees and shrubs.

#5: Will a federal permit be required to complete the scope of work on the project areas located within this worksite?

Yes

#5a: List the agency that will be issuing the permit and the date you anticipate applying for and receiving the permit. Will the federal permit cover ALL proposed ground disturbing activities included in the project?

ACOE, USFWS

#6: Are you utilizing Federal Funding to complete the scope of work? This includes funds that are being shown as match or not.

Yes

#6a: Please list the federal agency and funding sources.

USFS - This federal funding to Cascadia CD includes design and partial construction funding. The amount available for construction is estimated to be $220,000, depending on the amount used for design.

#6b: Does the federal funding you are utilizing as match require you to receive state funding?

No.

#7: Do you have knowledge of any previous cultural resource review within the project boundaries during the past 10 years?

Unknown

We believe the NEPA issued in 2021 included cultural resources, however we are having the USFS Heritage office confirm this. If not, we will commence with the cultural resources process.

#8: Is the worksite located within an existing park, wildlife refuge, natural area preserve, or other recreation or habitat site?

Yes

#8a: Please name the area and specify when the site was established.

Okanogan Wenatchee National Forest lands

#9: Are there any structures over 45 years of age within this worksite? This includes structures such as buildings, tidegates, dikes, residential structures, bridges, rail grades, park infrastructure, etc.

No

Project Permits

Permits and Reviews	Issuing Organization	Applied Date	Received Date	Expiration Date	Permit #
NEPA	Federal Agencies		07/31/2023		59963

Note: The applicant did not apply for this. It was USFS led and issued.

Permit Questions

#1: Are you planning on using the federal permit streamlining process? **Limit 8**

Yes

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Attachments

Required Attachments	8 out of 8 done
Applicant Resolution/Authorizations	✓
CCA Tribal Notification	✓
Cost Estimate	✓
Landowner acknowledgement form	✓
Map: Restoration Worksite	✓
Photo	✓
RCO Fiscal Data Collection Sheet	✓
Riparian Enhancement Plan	✓

PHOTOS (JPG, GIF)

Photos (JPG, GIF)


666435


666525

PROJECT DOCUMENTS AND PHOTOS

Project Documents and Photos

File Type	Attach Date	Attachment Type	Title	Person	File Name, Number Associations	Shared
	04/18/2025	Landowner acknowledgement form	Landowner Acknowledgemen Form - Roaring Cr RCO SRFB.pdf	MarkI	Landowner Acknowledgemen Form - Roaring Cr RCO SRFB.pdf, 666704	
	04/17/2025	Project Application Report	Project Application Report, 25-1232C (sub 04/17/25 15:31:58)	MarkI	Project Application Report - 25-1232 (submitted 04-17-2025_15-31-58).pdf, 666581	✓
	04/17/2025	Cost Estimate	SAL-CostEstimate Roaring Creek 4.17.2025.xlsx	MarkI	SAL-CostEstimate Roaring Creek 4.17.2025.xlsx, 666579	✓
	04/17/2025	Design document	Roaring Creek Alternatives Memo draft.pdf	MarkI	Roaring Creek Alternatives Memo draft.pdf, 666526	✓
	04/17/2025	Map: Planning Area	Map - Upper Reach Selected Alternative.JPG	MarkI	Map - Upper Reach Selected Alternative.jpg, 666525	✓
	04/17/2025	Application Document	Jotform - Roaring-03-Roaring-04-Roaring-Creek-Floodplain-Rec	MarkI	Jotform - Roaring-03-Roaring-04-Roaring-Creek-Floodplain-Reconnection-Project.pdf, 666499	✓
	04/17/2025	Project Review Comments	Project Review Comments Report, 25-1232C (04/17/25 06:16:18)	AmeeB	Project Review Comments Report - 25-1232 (04-17-2025_06-16-18).pdf, 666476	✓
	04/17/2025	Project Application Report	Project Application Report, 25-1232C (04/17/25 06:15:28)	AmeeB	Project Application Report - 25-1232 (04-17-2025_06-15-28).pdf, 666475	✓
	04/16/2025	Stewardship plan	Appendix A - Riparian QAPP.pdf	MarkI	Appendix A - Riparian QAPP.pdf, 666458	✓
	04/16/2025	Riparian Enhancement Plan	SAL-RiparianPlan DRAFT Roaring Creek 4.16.2025.pdf	MarkI	SAL-RiparianPlan DRAFT Roaring Creek 4.16.2025.pdf, 666457	✓
	04/16/2025	CCA Tribal Notification	Tribal Notification Letter.docx	MarkI	Tribal Notification Letter.docx, 666447	✓
	04/16/2025	Map: Restoration Worksite	Roaring EC Map HAWS.pdf	MarkI	Roaring EC Map HAWS.pdf, 666442	✓
	04/16/2025	Applicant Resolution/Authorizations	2025-04-CCDApplicantAuthorizationResolution for signature.pd	MarkI	2025-04-CCDApplicantAuthorizationResolution for signature.pdf, 666440	✓
	04/16/2025	Photo	Roaring Photos - Comparison.JPG	MarkI	Roaring Photos - Comparison.jpg, 666435	✓
	04/16/2025	RCO Fiscal Data Collection Sheet	CascadiaCD - FiscalDataCollectionSheet.pdf	MarkI	CascadiaCD - FiscalDataCollectionSheet.pdf, 666431	

Project Application Report - 25-1232

Application Status

Application Due Date: 06/23/2025

Status Name	Status Date	Submitted By	Submission Notes
Preapplication	04/03/2025		

I certify that to the best of my knowledge, the information in this application is true and correct. Further, all application requirements due on the application due date have been fully completed to the best of my ability. I understand that if this application is found to be incomplete, it will be rejected by RCO. I understand that I may be required to submit additional documents before evaluation or approval of this project and I agree to provide them.

Date of last change: 04/21/2025

RESTORATION

				OVERALL PROJECT	GRANT REQUEST	MATCH			
				Budget must account for all costs to complete the project	*Enter only the amount of the grant request*	*The Grant Request and Match should equal the total project cost and Budget Check cell should be 0. Sponsors must account for all sources and types of match need to complete the project.*			
				Amount	Grant Amount	Match in PRISM	Funding not reported in PRISM	Source (Grant, Cash, Materials, Labor, Volunteers, etc)	Match Type (federal, state, local)
Construction									
Category (choose one)	**Task Description**	**Qty**	**Rate**						
Construction	*Construction of the project*	1.00	$ 910,000.00	$ 910,000	$ 419,328	$ 294,412	$ 196,260		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -				$ -		
			$ -				$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			STotal	**$ 910,000**	**$ 419,328**	**$ 294,412**	**$ 196,260**		

Administrative, Architechtural & Engineering				Amount	Grant amount	Match in PRISM	Funding not reported in PRISM	Match Source	Match Type (federal, state, local)
Category	**Task Description**	**Qty**	**Rate**						
Final design	*Design consultant produces final design*	1.00	$ 30,000.00	$ 30,000.00	$ 13,820	$ 9,706	$ 6,475		
Other	*Design consultant staking and construction support*	1.00	$ 50,000.00	$ 50,000.00	$ 23,033	$ 16,176	$ 10,791		
Administrative	*Construction Supervision and Admin of construction by CCD; indirect*	1.00	$ 24,000.00	$ 24,000.00	$ 11,056	$ 7,765	$ 5,180		
Administrative - Indirect	*Indirect at NICRA approved*	1.00	$ 6,000.00	$ 6,000.00	$ 2,764	$ 1,941	$ 1,295		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			$ -	$ -	$ -	$ -	$ -		
			STotal	**$ 110,000**	**$ 50,672**	**$ 35,588**	**$ 23,740**		

Indirect Costs				Amount	Grant amount	Match in PRISM	Funding not reported in PRISM	Match Source	Match Type (federal, state, local)
	Description	**Approved Rate**	**Total Project Base**						
	Indirect	0.000%	$ -	$ -	$ -	$ -	$ -		
	Indirect	0.000%	$ -	$ -	$ -	$ -	$ -		
			STotal	**$ -**	**$ -**	**$ -**	**$ -**		

AA&E Budget Check	
A&E maximum allowed in PRISM	$ *214,122.09*
A&E validation	127,863

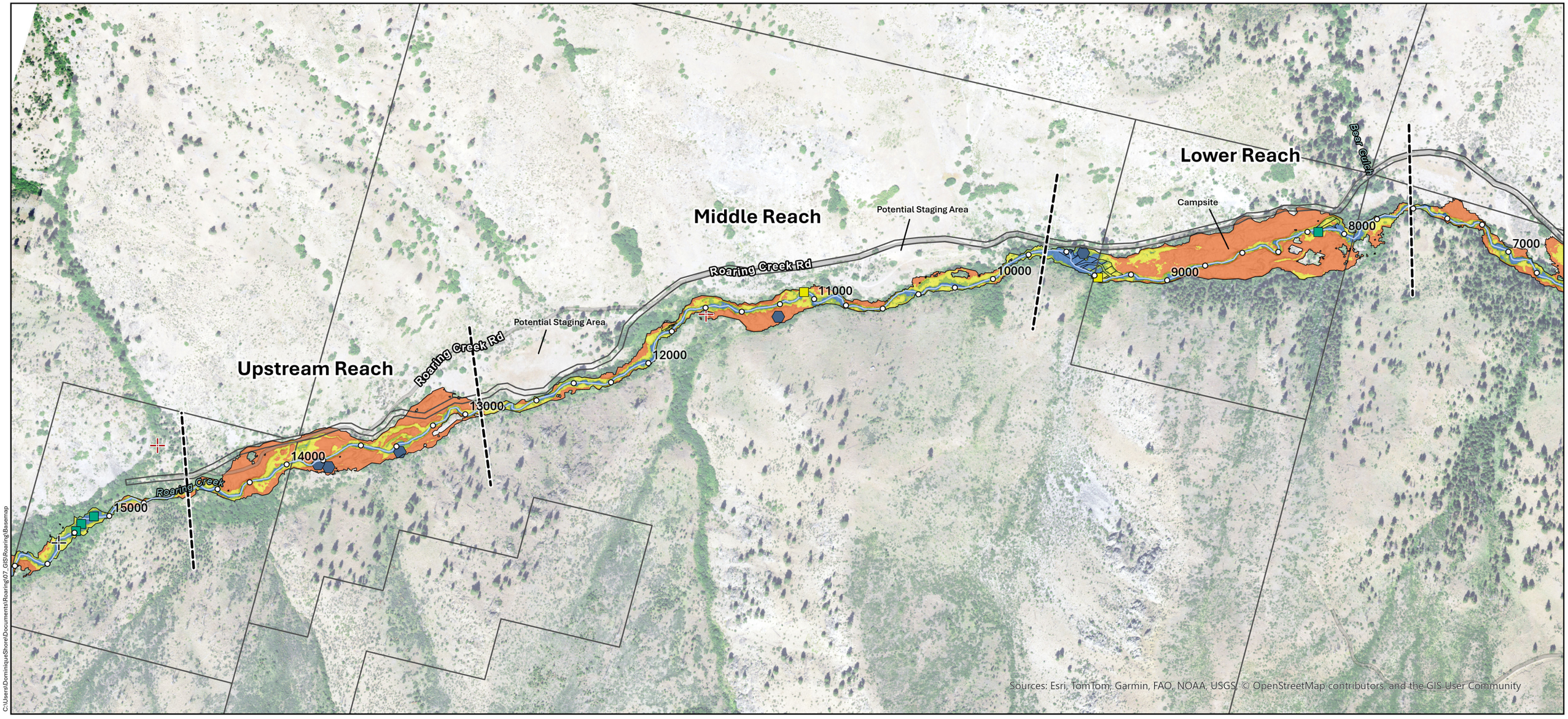
Totals	**$ 1,020,000**	**$ 470,000**	**$ 330,000**	**$ 220,000**
		PRISM Project Total	$ 800,000	
		RCO Percentage	**Match Percentage**	
		58.749954%	**41.250046%**	

CUMULATIVE TOTALS

This sheet contains automatic calculations

Project Name	Roaring Creek Floodplain Reconnection Project
SRFB #	25-1232
Sponsor	Cascadia Conservation District

	OVERALL PROJECT Cost	GRANT REQUEST Amount	PRISM MATCH Amount	MATCH NOT IN PRISM Amount	*Budget Check*
Sheet #1 Acquisition					
Property Costs	$ -	$ -	$ -	$ -	0
Incidental Costs	$ -	$ -	$ -	$ -	0
Administrative Costs	$ -	$ -	$ -	$ -	0
Indirect Costs	$ -	$ -	$ -	$ -	
STotal	$ -	$ -	$ -	$ -	0
Sheet #2 Design					
Design Costs	$ -	$ -	$ -	$ -	
Indirect Costs	$ -	$ -	$ -	$ -	
STotal	$ -	$ -	$ -	$ -	0
Sheet #3 Restoration					
Construction Costs	$ 910,000	$ 419,328	$ 294,412	$ 196,260	0
AA&E	$ 110,000	$ 50,672	$ 35,588	$ 23,740	0
Indirect Costs	$ -	$ -	$ -	$ -	
STotal	$ 1,020,000	$ 470,000	$ 330,000	$ 220,000	0
Totals	$ 1,020,000	$ 470,000	$ 330,000	$ 220,000	0



C:\Users\DominiqueShore\Documents\Roaring\07_GIS\Roaring\Basemap

- Roaring Creek
- Station (ft)
- Tax Parcels (approx.)
- Reach Boundaries
- Historic Valley Bottom (approx.)
- Observed Wetlands
- Observed Wetland

Monitoring
- Hobo Logger
- Streamflow Gage

Complexity Features
- Beaver Dam Analogs
- Beaver Dam

Landscape Zones based on REM* and bankfull stage
- Seasonal Inundation: <1 ft (<0.5x BF Stage)
- Annual Inundation: 1-2 ft (0.5-1x BF Stage)
- Decadal Inundation: 2-4 ft (1-2x BF Stage)
- Upland: >4ft (>2x BF Stage)

0 375 750 1,500 Feet

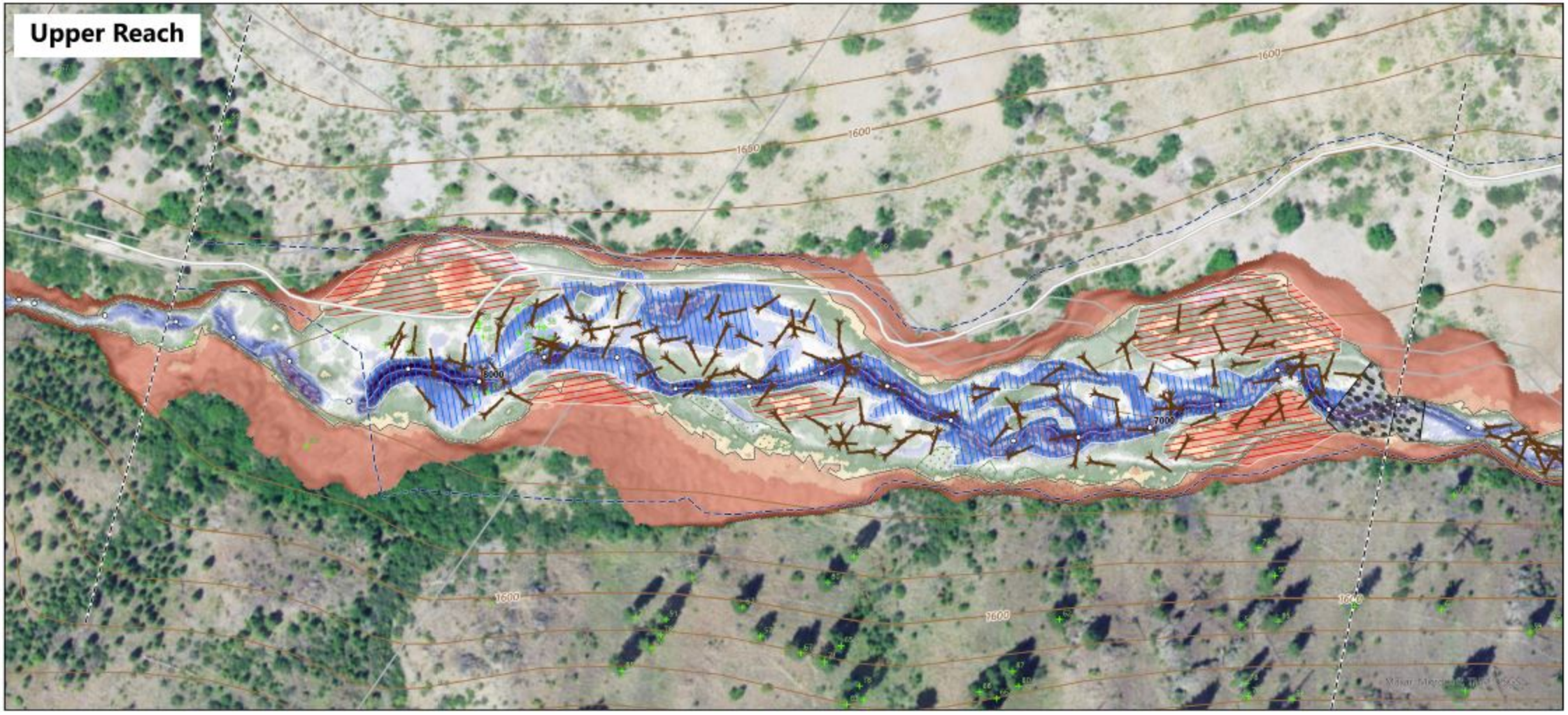
Existing Conditions Map (HAWS)

Roaring Creek Floodplain Restoration Design

* Classified landscape zones based on relative elevation model (REM) tied to the streambed centerline elevation. The REM used for landscape classification was developed using topobathymetric LiDAR collected by NV5 Geospatial on behalf of WA Department of Natural Resources (2022).

LICHEN LAND & WATER

CASCADIA CONSERVATION DISTRICT



Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NVS on behalf of Washington Department of Natural Resources

Basemap Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS.

Wood structures and pieces shown on map are for reference only. The actual number of features installed will likely exceed what is depicted.

0 75 150 300 Feet

1:1,500

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Earthwork (Grading)

- Floodplain Lowering
- Channel Aggradation
- Roughened Channel

Wood Structures

- Large Log Jam
- Log Jam
- Single Log

Elevations relative to the Geomorphic Grade Line (ft)

- 7 - 10
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2.5 - 3
- 2 - 2.5
- 1.5 - 2
- 1 - 1.5
- 0.5 - 1
- 0 - 0.5
- -0.5 - 0
- -1 - -0.5
- -1.5 - -1
- -2 - -1.5
- -2.5 - -2
- -3 - -2.5
- -4 - -3
- < -4

Alternative 3 - Stage 0 and Simulated Landslide

Roaring Creek Floodplain Restoration Design

03/18/2025

RSI

LICHEN

CASCADIA CONSERVATION DISTRICT

TECHNICAL MEMO (DRAFT)

DATE:	April 17, 2025
TO:	Cascadia Conservation District
FROM:	Lichen: Nick Legg, LG, Dominique Shore RSI: Gabe Williams, PE
PROJECT:	Roaring Creek Restoration Project
SUBJECT:	Conceptual Design - Alternatives Selection

1 Introduction

This memorandum (memo) summarizes the conceptual alternatives and selection process for the Roaring Creek Restoration Project. The project area includes river miles 1.4-2.8 of Roaring Creek, a major tributary of the Entiat River in Chelan County, Washington. The goals of the project are to reconnect floodplains, improve complexity, restore streamflow, and enhance habitat for listed salmonids, particularly steelhead as prioritized in the Upper Columbia Salmon Recovery Board's (UCSRB's) strategy. This memo introduces three potential design alternatives intended to address project goals and objectives.

Cascadia Conservation District (CCD) is leading and sponsoring the project with existing funding support from the Washington Department of Ecology and the US Forest Service. CCD is also seeking funding from Washington's Salmon Recovery Funding Board. Lichen Land and Water, Resource Specialists Inc., and Wolf Water Resources are leading the site evaluation and design engineering.

This memo is accompanied by two attachments:

A: Existing Conditions Maps

B: Conceptual Design Alternatives Plans

The information in this memorandum is planned for incorporation into the Preliminary (30%) Basis of Design Report, where more extensive project background will be included. Therefore, this memorandum may not provide all background material.

2 Site Description and Summary

2.1 Project Area Description

Roaring Creek is a right-bank tributary to the lower Entiat River, entering river mile 6.1 near the town of Farris, Washington. Restoration actions will be focused within river miles 1.4 – 2.8. The project area lies entirely with United States Forest Service (USFS) land and accessed by USFS road 110. The historical floodplain, which ranges from 40 to 300 feet, generally defines the lateral extents of the project area.

For the purposes of project design, the project reach has been subdivided into three sub-reaches ("upstream", "middle", and "downstream") to account for the geomorphic differences within the project area. The upstream and downstream sub-reaches have wider valley bottoms whereas the middle reach is more naturally confined by hillslopes and related deposits. The upper and lower sub-reaches have historical floodplains averaging 180 feet in width and greater than 10 times the bankfull width. Floodplains in the middle reach are generally less than 80 feet with the exception of localized pocket floodplain areas that expand out to 150 feet.

2.2 Fish Use and Identified Priorities

Roaring Creek is identified as a priority for steelhead restoration and protection by the Upper Columbia Salmon Recovery (UCSRB, 2021). The reach has a documented spawning use in WDFW redd surveys and is categorized as a high priority assessment unit (AU) for adult migration, spawning, fry colonization, and summer rearing. The project area spans Roaring Creek Entiat Reaches 02 & 03. Low summer base flows are listed as an unacceptable limiting factor. Channel modification, instream enhancement, and upland management are identified as action categories.

Based on review of published fish use timing in nearby tributaries (Inter-Fluve and Yakama Nation, 2018), adult migration of steelhead primarily occurs from December – February with spawning following in the later winter-early summer and fry emergence within the summer. Potential rearing use is distributed throughout the year.

2.3 Summary of Existing Floodplain Conditions

The project reach currently suffers from the effects of relatively extreme incision and disconnection of the creek from its floodplain (Figure 1). For a vast majority of the floodplain segments, the creek is entrenched below its historical floodplain level by 5-6 feet, which exceeds the creek's average bankfull depth (~1.5 feet) by a factor of three. The creek sits in an incision trench typically narrower than 20 feet wide, which is less than 2 times wider than the creek's bankfull width of 13 feet. These basic statistics indicate the degree of entrenchment and diminished floodplain connection.

Within the incision trench, the creek has developed little adjacent (inset) floodplain since the original incision. Vegetation within the incision trench is young deciduous trees (<6 inches diameter). These patterns indicate the incision likely occurred within the post-settlement period, likely from beaver trapping/removal and localized land-use impacts including historical homesteading.

As a result of the incision, the stream is primarily single-threaded with little off-channel habitat or floodplain connectivity. The creek has an observed lack of large wood and pools and naturally has elevated stream power as a result of the entrenchment.

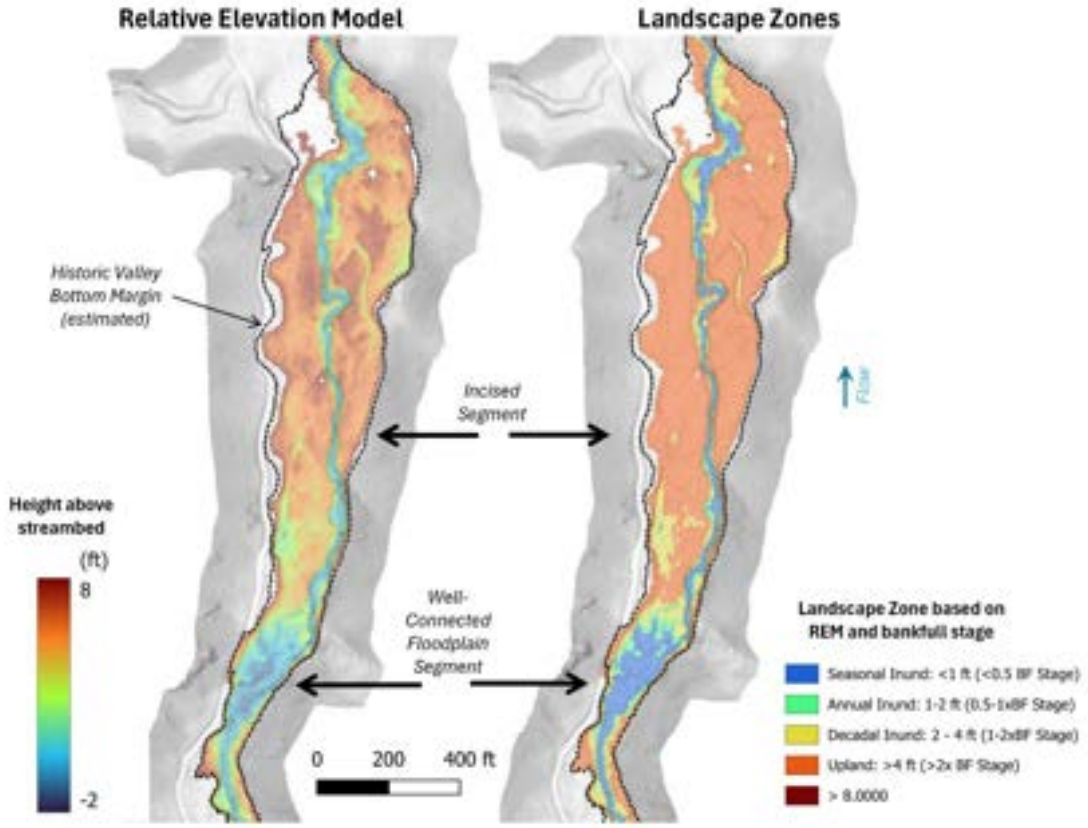


FIGURE 1: RELATIVE ELEVATION MAP OF THE LOWER SUB-REACH, SHOWING THE PERVASIVE DISCONNECTION OF THE FLOODPLAIN WITH EXCEPTION OF A SMALL SEGMENT OF FLOODPLAIN IN THE LOWER PART OF THE MAP.

Despite the degradation, the potential for a functioning and expansive floodplain is present and observable. Specific indicators include:

- A network of relict side channels within the historical floodplain surface
- Active beaver use in localized segments of the site, and immediately upstream
- A single isolated segment of well-connected floodplain as shown in Figures 1 and 2. This floodplain segment has multiple threads, dense riparian vegetation indicative of near-surface groundwater, and beaver use.

Together the site conditions suggest a strong opportunity for floodplain reconnection as a way to reduce stream power, improve connection with the alluvial aquifer, and promote riparian vegetation. Promoting these physical and ecosystem responses will have direct benefits for spawning (e.g. gravel retention) and rearing (e.g. increased off-channel and edge habitats) for steelhead.

FIGURE 2. PHOTOS OF AN ISOLATED SEGMENT OF WELL-CONNECTED FLOODPLAIN (LEFT), AND THE MORE PERVASIVE INCISED CONDITIONS (RIGHT).

3 Project Goals and Objectives

The following goals were identified through discussion with the project team. In recognition that realistic SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound) objectives depend on the chosen alternative, detailed objectives have not been developed at this juncture.

1. **Floodplain Ecosystem Function** - The Roaring Creek floodplain is degraded due to historical impacts that have caused the stream to incise and disconnect from its floodplain. The project seeks wholesale and sustainable ecosystem uplift through improved connectivity, improved riparian function, reduced stream power, improved sediment retention, and improved water storage and quality.
    - The reach also has active and localized beaver use. Ecosystem improvements seek to expand and increase sustainability of beaver populations.
    - Reestablishing a well-connected and robust riparian zone also will add resilience to wildfire.
    - Improved ecosystem function and connectivity are expected to provide increased capacity for steelhead using the reach.
2. **Target Fish Species Benefits** - The reach is identified as critical habitat for steelhead, with adult migration, spawning, and rearing uses. The project seeks to improve productivity for steelhead, addressing known limiting factors related to instream complexity, floodplain connectivity, and limited baseflow.
3. **Streamflow Improvement** - Roaring Creek is known to go dry on an intermittent basis in the reaches downstream of the project area. The project seeks to raise groundwater tables and seasonal water storage to improve streamflow and connectivity within the reach and downstream.

4. **Value** - The project seeks to maximize value from public funding. For the purposes of this project, value conceptually considers benefits relative to costs as well as the durability (longevity) of anticipated benefits.

5. **Learning** - The benefits of headwater stream restoration are often described qualitatively but rarely quantified with regionally specific studies. This project has a head-start on monitoring for ecosystem benefits and streamflow augmentation. A key goal of this project is to build off these initial efforts to create a learning laboratory that enumerates the benefits (and risks) of headwater stream restoration to inform regional strategies for watershed restoration and management. Furthermore, this project has an opportunity to serve as a regional pilot for full-floodplain restoration in a system with active beaver use.

4 Restoration Alternatives

Based on early project discussions, and the recognized need to expand floodplain connectivity and address incision, the team identified three alternative restoration strategies for consideration. Conceptual design plans for each alternative are included in Attachment B: Conceptual Design Alternatives Plans.

Alternative 1 | Low-tech Only – This alternative includes instream placement of beaver-dam analog (BDA) and post-assisted log structures (PALs) as well as opportunistic winching of local conifers and riparian trees. These structures would be focused on providing localized complexity while improving floodplain activation by increasing roughness and aggrading the stream to the historic floodplain where possible. In cases where incision is too extensive to reconnect the historic floodplain, structures will focus on encouraging bank erosion to promote the development of inset floodplains.

Alternative 2 | Wood Enhancement and Targeted Floodplain Grading – This alternative includes instream treatment of equipment-placed log jams coupled with targeted floodplain lowering and side-channel grading. Large wood will be placed primarily as discrete jam structures, with broader wood loading applied selectively in areas with strong floodplain connectivity. Grading will widen the floodplain at the existing channel elevation, which may be below the current valley floor resulting in a widened inset floodplain. This alternative promotes recovery towards a "Stage 8" condition according to the Stream Evolution Model (SEM, Cluer and Thorne, 2014).

Alternative 3 | Stage 0 & Targeted Landslide Simulation – This alternative involves full floodplain reconnection in the floodplain reaches through channel fill and distributed wood loading. Alluvial fill placed in the existing (incised) channel would be sourced from high areas and margins of the historical floodplain. This alternative promotes recovery towards a "Stage 0" condition according to the Stream Evolution Model (SEM, Cluer and Thorne, 2014), which means that restoration actions seek to reconnect the historical valley bottom.

The exception to the Stage 0 approach is within the middle reach, where the floodplain is narrower, and the riparian zone is more intact. Here, the proposed strategy is to install natural accumulations of large wood that simulate landslides. This approach aligns with the geomorphic setting, promotes sediment retention, and minimizes disturbance of the riparian zone.

Proposed treatments generally vary by sub-reach within each alternative, as summarized in Table 1.

TABLE 1. RESTORATION ACTIONS BY REACH AND ALTERNATIVE.

Alternative	Upper Reach	Middle Reach	Lower Reach
Alternative 1 | Low-tech Only	BDAs, PALs & winching where appropriate		
Alternative 2 | Wood Enhancement and Targeted Floodplain Grading	LWD placement and targeted floodplain lowering & side channel grading	LWD placement	LWD placement and targeted floodplain lowering & side channel grading
Alternative 3 | Stage 0 & Earthwork	Stage 0 (streambed raising) with distributed wood loading	Targeted Landslide simulation with wood & wood enhancement	Stage 0 (streambed raising) with distributed wood loading

4.1 Alternatives Analysis

The alternatives analysis involved a combination of quantitative and qualitative analysis to inform a preferred alternative.

4.1.1 Quantitative Analyses

Quantitative analyses (Table 2) included estimation of reconnected floodplain area and construction costs.

- Reconnected floodplain area informs potential benefits from multiple ecosystem and fish-focused perspectives, including riparian response, wetland expansion, stream power reduction, spawning gravel retention, rearing habitat area, and large woody debris retention.
- Construction costs (and cost per acre reconnected) were calculated using preliminary estimates of structure/wood densities, grading volumes, and installation methods.

TABLE 2. QUANTITATIVE (HIGH-LEVEL) COMPARISON OF ALTERNATIVES

Metric	Existing	Alt 1	Alt 2	Alt 3
Well-Connected Floodplain Area (ac)	4	6	13	19
Floodplain Area Gained (ac)	-	2	9	15
Estimated Construction Costs	-	$180,000	$600,000	$1,000,000

Estimated Cost per Acre Floodplain Reconnected **Does not account for longevity of benefits*	-	$90,000	$70,000	$70,000

4.1.2 Qualitative Analyses

Qualitative analyses were logic-based, drew on the quantitative results above, and followed the categories specified in SRF Board's Manual 18. The direct tie of these SRF Board evaluation categories to project goals are indicated. Qualitative (comparative) ratings are summarized in Table 3.

4.1.2.1 Tangible benefit to all targeted species and life-stages (Goal 1 and 2)

The potential for added floodplain connectivity was identified as the most fundamental driver of benefits to steelhead. Specifically, expanded floodplain connection improves ecosystem function, spawning gravel retention, redd resilience, rearing habitat (quantity and quality), instream complexity, and riparian function. Therefore, Alternative 3 appears to have the greatest overall benefit, and Alternative 1 the least.

Note, further design level refinements are required to address risk factors like summer passage and stranding. At this time, these risks are considered addressable for all alternatives.

4.1.2.2 Community comments and support

At this time, we have support for restoration from the primary landowner (USFS). We are actively seeking input from USFS and other partners on the preferred alternative. The site experiences minor recreation use. The USFS has indicated support for the relatively minor impacts to recreational use from this project.

The project currently has funding support from the WA Department of Ecology and USFS.

4.1.2.3 Likelihood of Success (Goals 1-3)

Maximized floodplain connectivity is considered essential to achieve benefits to overall ecosystem function (Goal 1), direct benefits to target species (Goal 2), and streamflow (Goal 3).

Alternative 1 was identified as having the least likelihood of success based on questionable long-term benefits to floodplains based on the need for maintenance and uncertain effectiveness in addressing incision within reasonable timescales.

Alternative 2 improves connectivity broadly and has a high likelihood of improving ecosystem function and habitat for fish species. However, the alternative does not raise the streambed and therefore does not raise groundwater levels.

Alternative 3 is considered the most likely to have success in all three categories based on the strategy to address the core issue of incision and resulting expansion of connected floodplain and alluvial aquifer.

4.1.2.4 On-going Maintenance Requirements (Goal 4)

Alternative 1 is most likely to require regular maintenance given that several rounds of low-tech structures would be necessary to address the effects of incision.

Alternatives 2 and 3 are expected to require relatively minimal maintenance.

4.1.2.5 Economic Feasibility (Goal 4)

As shown in Table 2, the estimated cost per area of connected floodplain is similar across alternatives. However, those calculations did not account for the need for on-going maintenance (especially in Alternative 1). Given these considerations, Alternatives 2 and 3 are likely to have the most preferrable value from the perspective of long-term floodplain reconnection benefits. Alternative 3 is considered to have the most overall value, given that it provides more anticipated groundwater and streamflow benefits than Alternative 2.

All alternatives were considered to have equal feasibility in constructability and permitting feasibility. The site has limited wetland area that can be avoided with ground disturbance areas. Cultural resources are the most significant unknown at this stage.

4.1.2.6 Project Sustainability and Resilience (Goals 1-4)

Alternative 3 addresses the core issue of incision and reconnects the most floodplain. As a result, Alternative 3 is identified as the most sustainable and resilient.

Alternative 1 has the largest requirement for on-going maintenance and has questionable ability to sustainably reconnect floodplains based on the severity of incision.

Alternative 2 is considered to have moderate sustainability and resilience.

4.1.2.7 Connection to project goals and objectives

As discussed above, the relative benefits for Goals 1-4 are least for Alternative 1 and most for Alternative 3.

The goal not directly covered above is learning. Given the ongoing streamflow monitoring effort, this project specifically has potential to inform the streamflow augmentation benefits from floodplain restoration in headwater streams. Alternative 3 provides the most potential for learning because it is likely to connect the largest volume of alluvial aquifer and therefore have the most measurable changes to streamflow.

TABLE 3. QUALITATIVE COMPARISON OF ALTERNATIVES, SUMMARIZING DISCUSSION ABOVE. CATEGORIES FOLLOW THOSE SPECIFIED IN SRFBOARD'S MANUAL 18.

Objective	Corresponding Goals	Alt 1	Alt 2	Alt 3
Tangible Benefit to All Targeted Species and Life Stages	1 & 2	Least	Mid	Most
Community and Partner Support	-	Conversations in progress on preferred alternative		
Likelihood Of Success	1, 2, & 3	Least	Mid	Most
Ongoing Maintenance Requirements	4	Most	Least	Least
Economic Feasibility (Appropriate Cost-To-Benefit Ratio)	4	Least	Mid	Most
Project Sustainability and Resilience	1-4	Least	Mid	Most
Connection to Project Goals and Objectives	1-5	Least	Mid	Most

5 Preferred Alternative

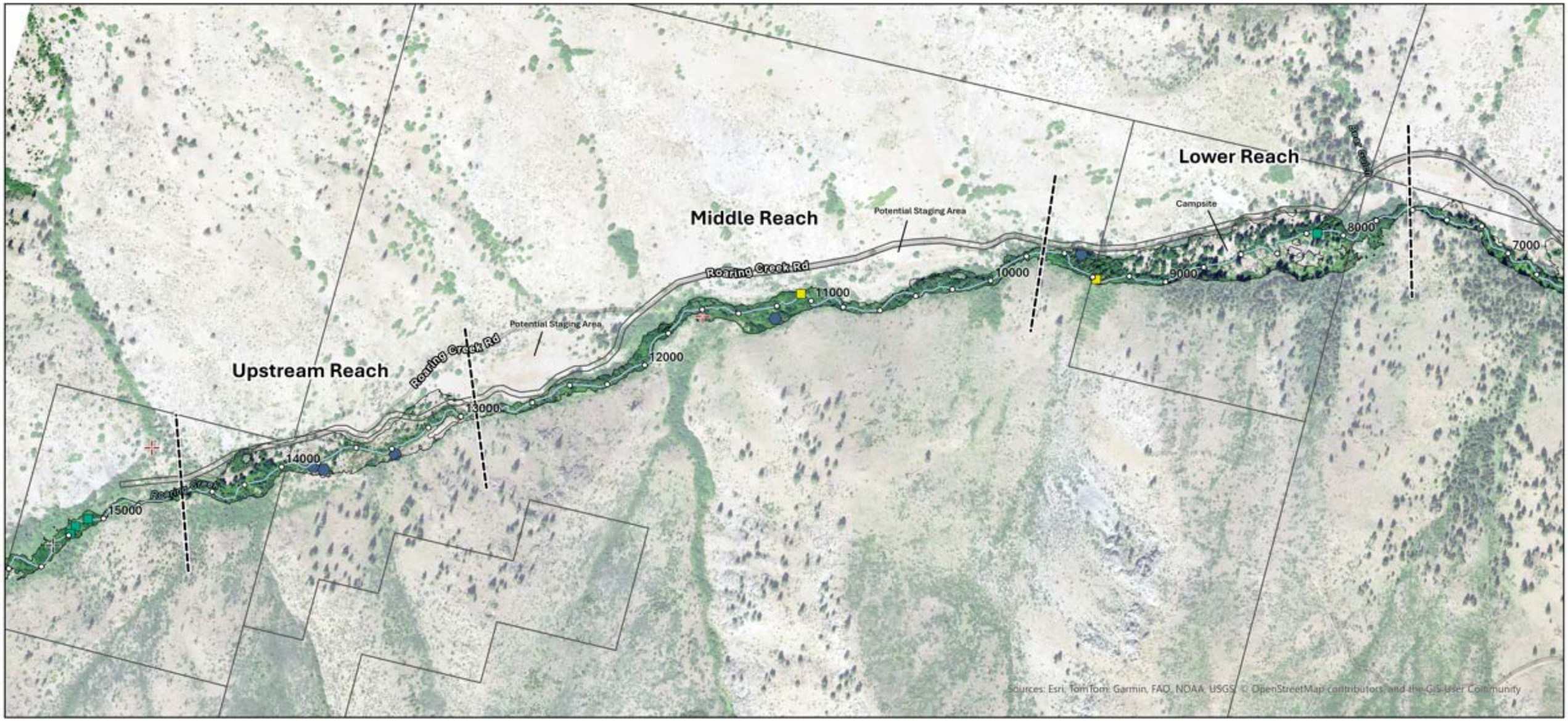
Alternative 3 – Stage 0 & Targeted Landslide Simulation – is determined to have the most overall benefit based on quantitative and qualitative comparisons above.

6 References

Cluer, B., & Thorne, C. (2014). A stream evolution model integrating habitat and ecosystem benefits. *River Research and Applications*, *30*(2), 135-154.

Inter-Fluve and Yakama Nation, 2018, Lower Mad River Reach Assessment and Restoration Strategy Report

Upper Columbia Salmon Recovery Funding Board, 2021, Biological Prioritization and Restoration Strategy



- Roaring Creek
- Station (ft)
- Tax Parcels (approx.)
- Reach Boundaries
- Historic Valley Bottom (approx.)
- Observed Wetland
- Observed Wetlands

Monitoring
- Hobo Logger
- Streamflow Gage

Complexity Features
- Beaver Dam Analogs
- Beaver Dam

Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS

0 375 750 1,500 Feet

Existing Conditions Map (Aerial)

Roaring Creek Floodplain Restoration Design

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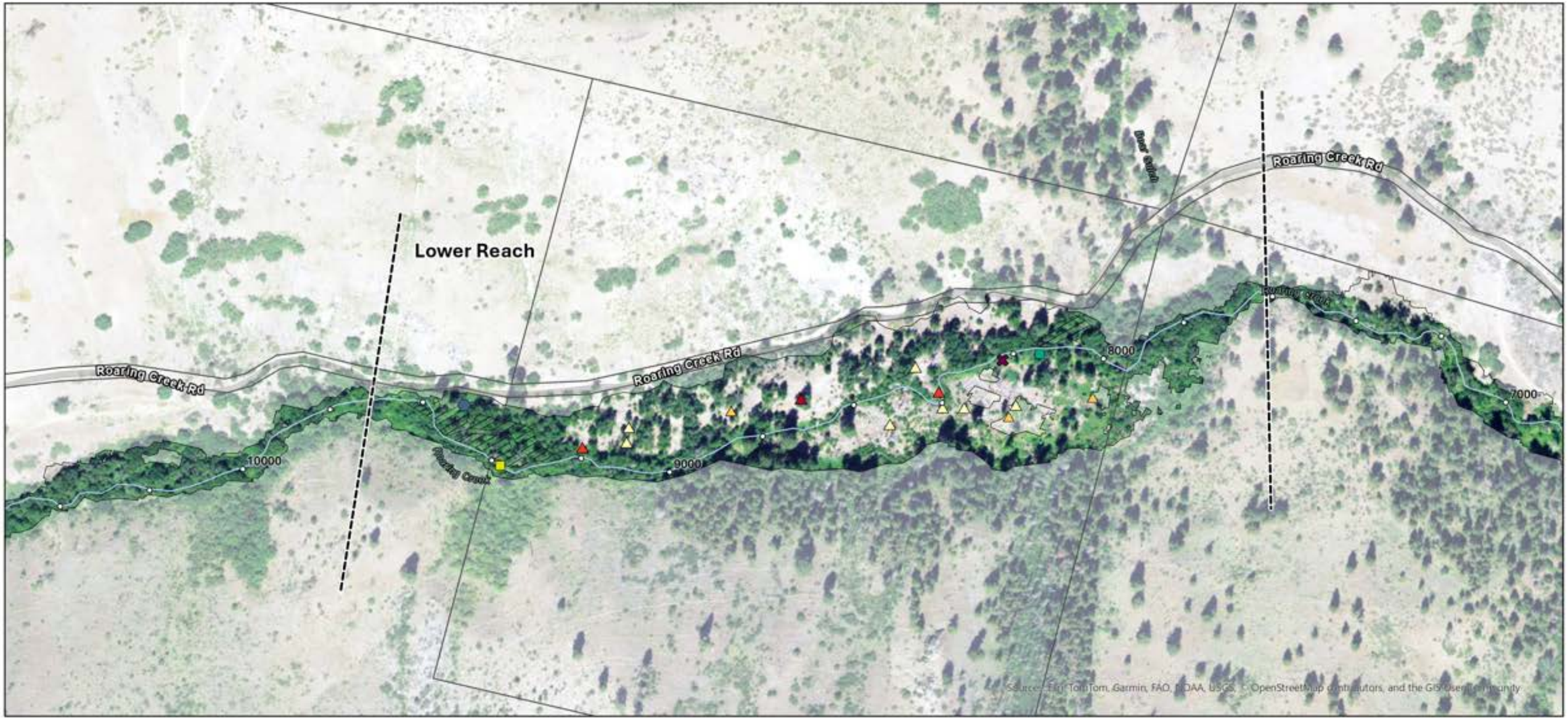

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Observed Wetland
Observed Wetlands

Headcut

Monitoring
Hobo Logger
Streamflow Gage

Complexity Features
Beaver Dam Analogs
Beaver Dam

Depth to Gravel (in)
Gravel at Surface
0 - 5
5 - 15
15 - 36
No gravel observed in soil pit

Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS

0 125 250 500 Feet

Existing Conditions Map (Aerial)

Roaring Creek Floodplain Restoration Design

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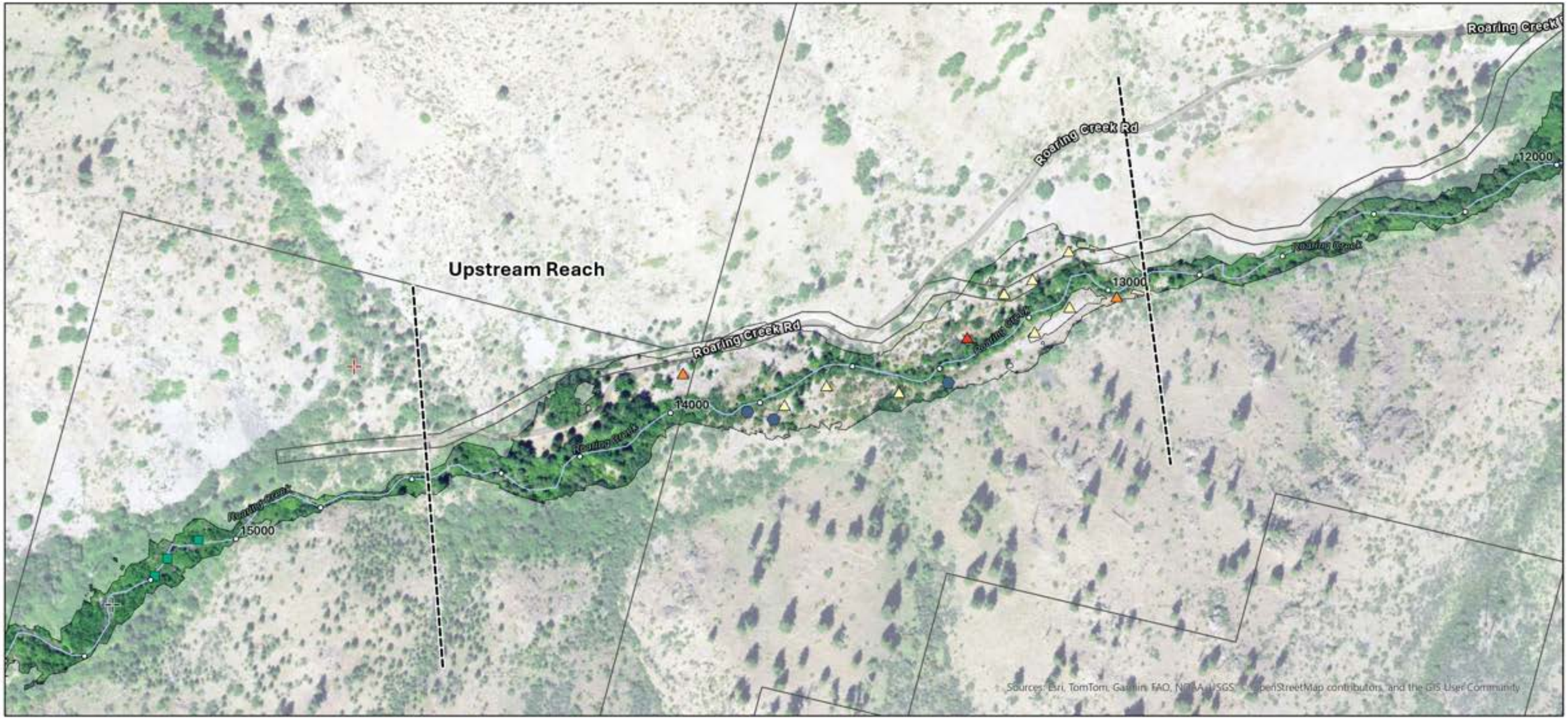

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Roaring Creek Floodplain Restoration Design

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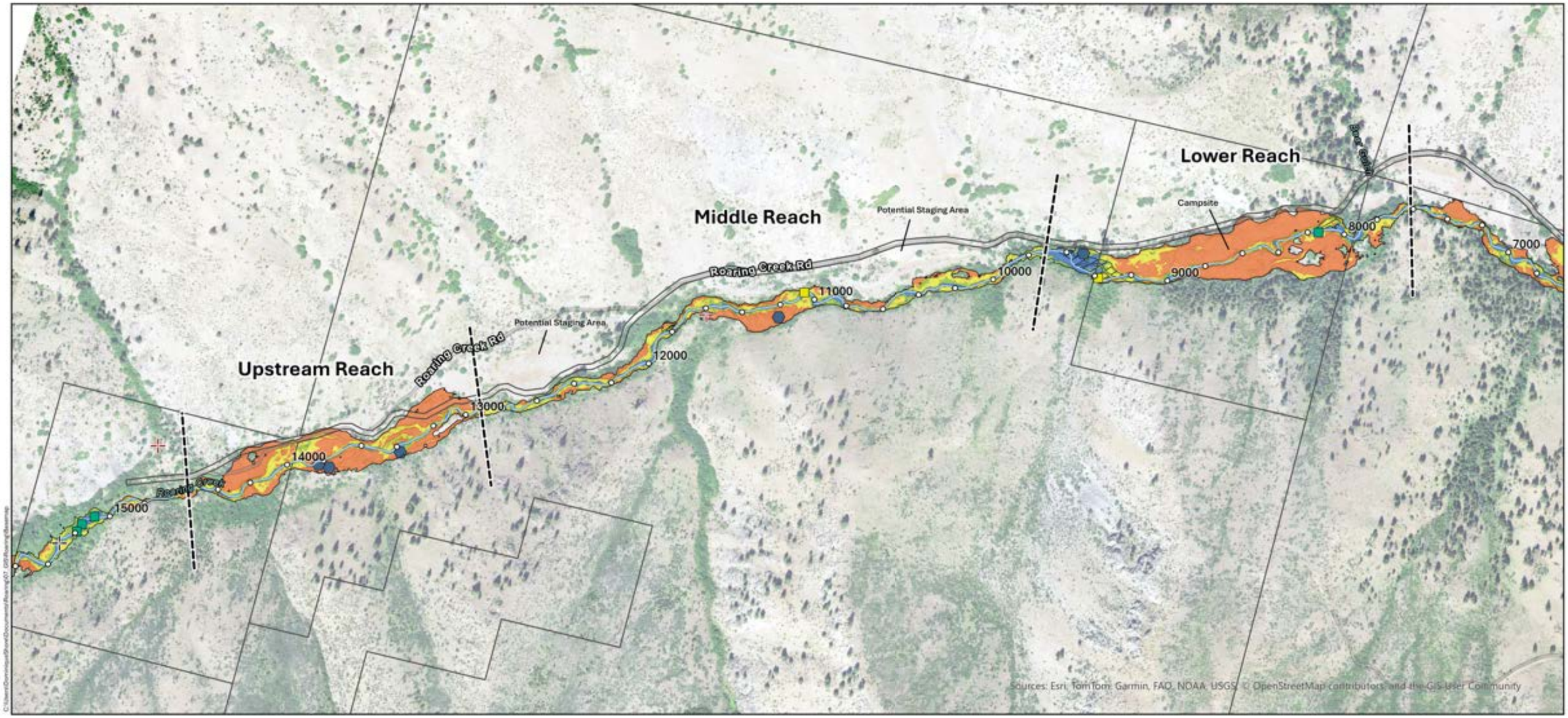
CASCADIA CONSERVATION DISTRICT



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- Hobo Logger
- Streamflow Gage

Complexity Features

- Beaver Dam Analogs
- Beaver Dam

Landscape Zones based on REM* and bankfull stage

- Seasonal Inundation: <1 ft (<0.5x BF Stage)
- Annual Inundation: 1-2 ft (0.5-1x BF Stage)
- Decadal Inundation: 2-4 ft (1-2x BF Stage)
- Upland: >4ft (>2x BF Stage)

0 375 750 1,500 Feet

Existing Conditions Map (HAWS)

Roaring Creek Floodplain Restoration Design

* Classified landscape zones based on relative elevation model (REM) tied to the streambed centerline elevation. The REM used for landscape classification was developed using topobathymetric LiDAR collected by NV5 Geospatial on behalf of WA Department of Natural Resources (2022).

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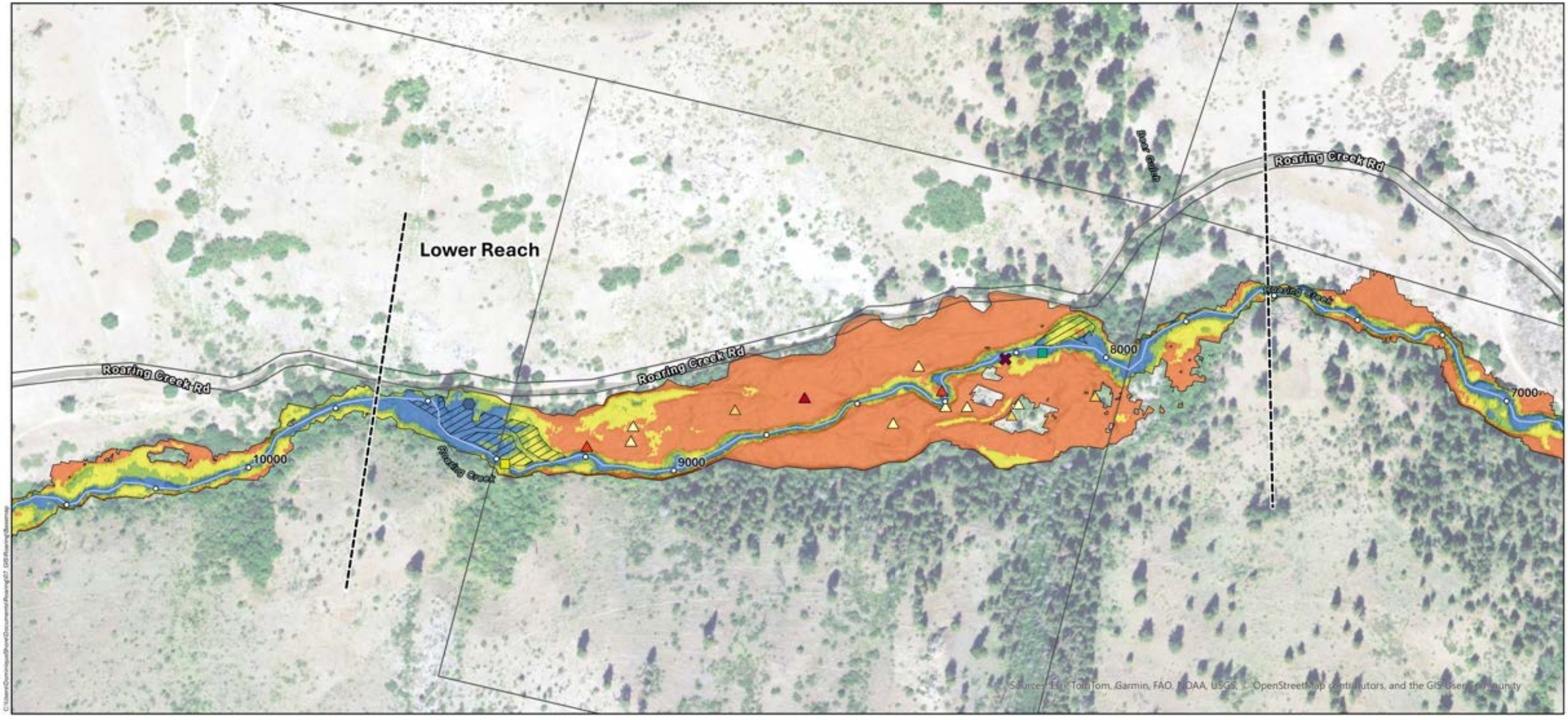

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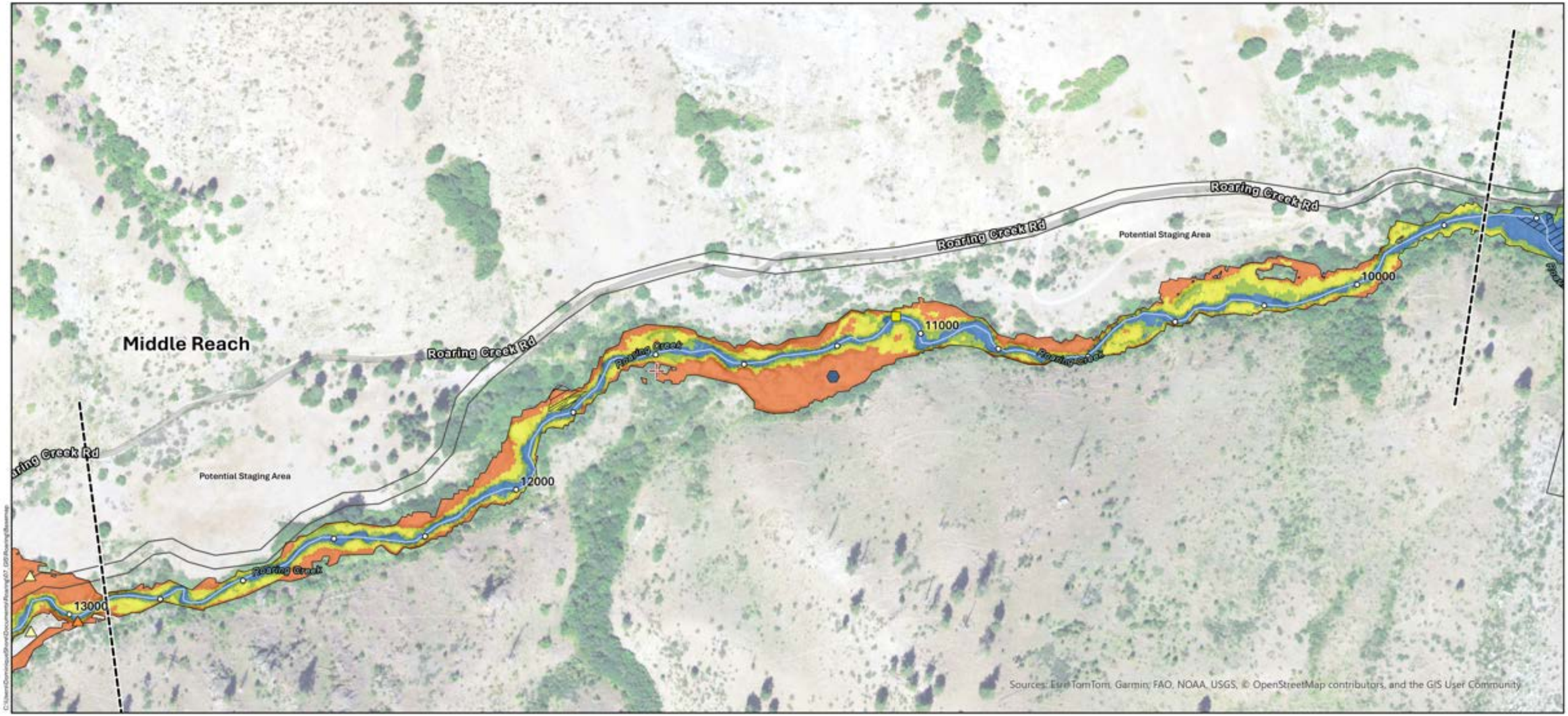

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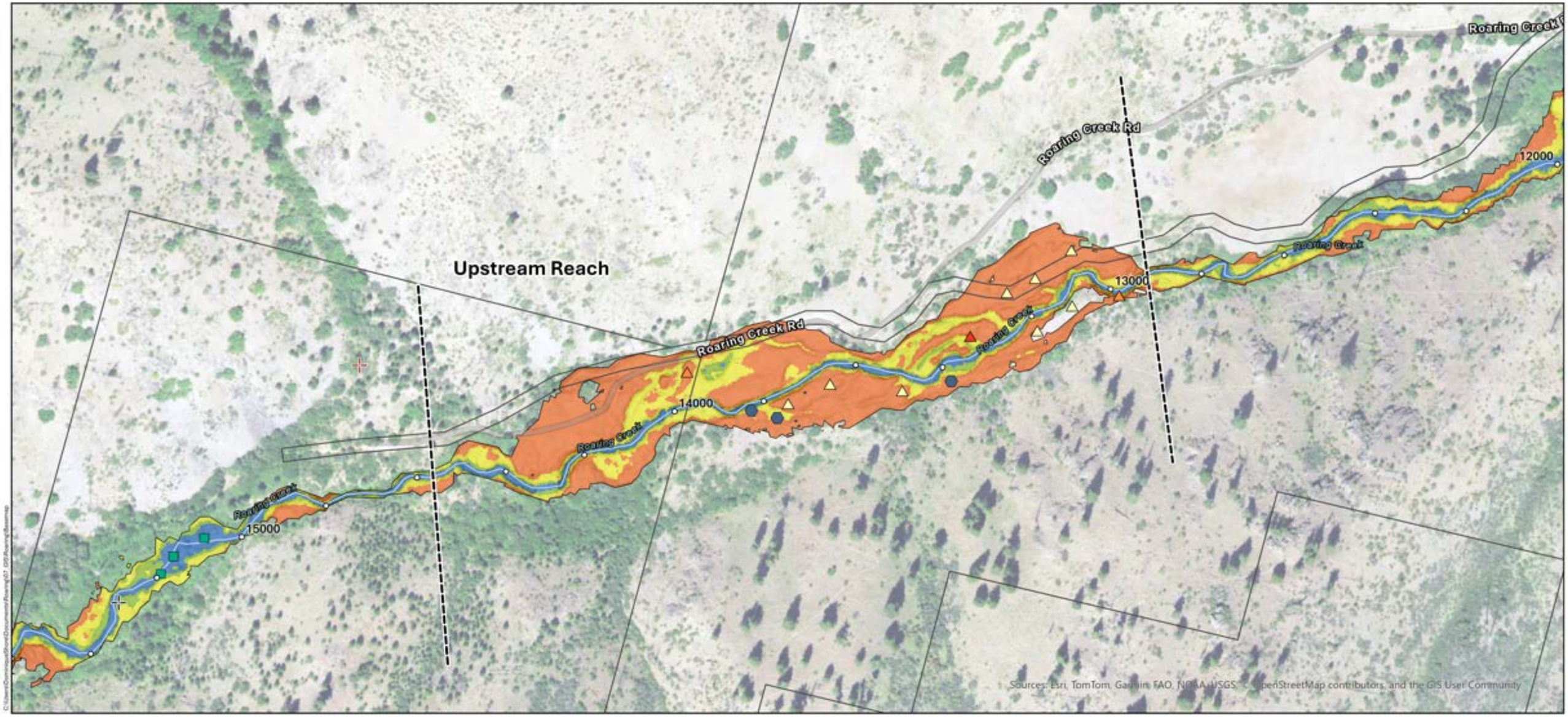

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Existing Conditions Map (HAWS)

Roaring Creek Floodplain Restoration Design

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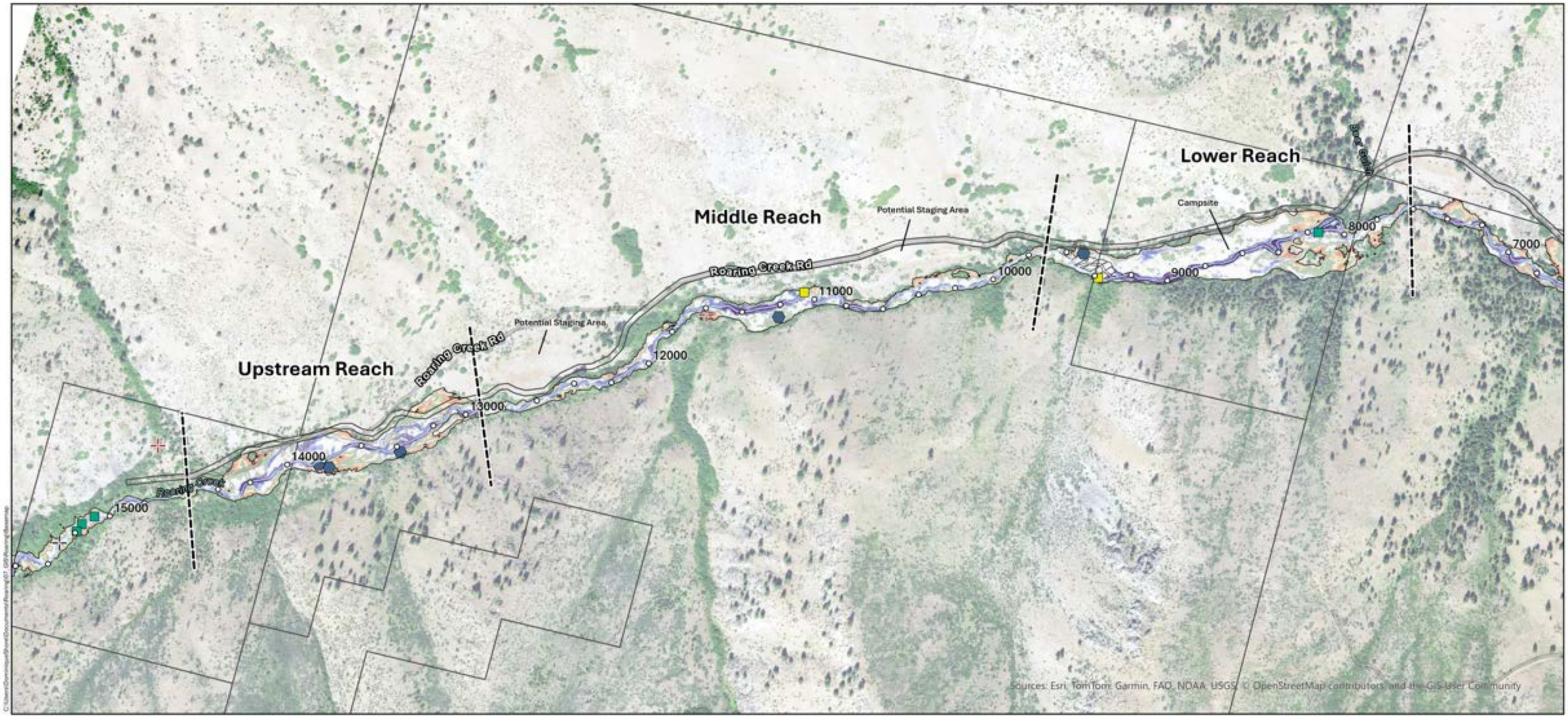

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- Observed Wetland

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Complexity Features
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- Beaver Dam

Geomorphic Grade Line* (ft)
- 3.1 - 4
- 2.6 - 3
- 2.1 - 2.5
- 1.6 - 2
- 1.1 - 1.5
- 0.6 - 1
- 0.1 - 0.5
- -0.5 - 0
- -1 - -0.5
- -1.5 - -1
- -2 - -1.5
- -2.5 - -2
- -3 - -2.5
- -4 - -3
- -10 - -4

0 375 750 1,500 Feet

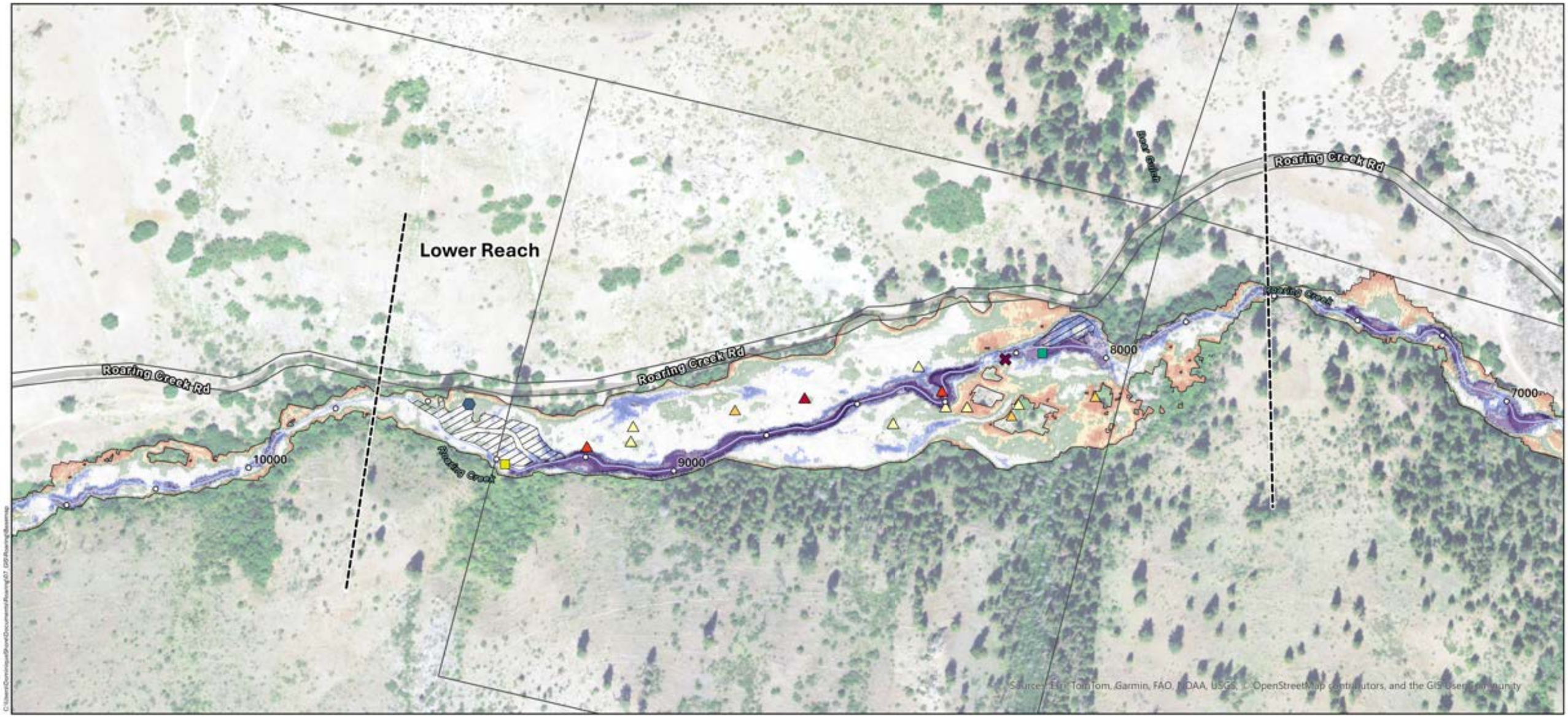
Existing Conditions Map (GGL)

Roaring Creek Floodplain Restoration Design

* Geomorphic Grade Line (GGL) Relative Elevation Model (REM) relative to estimated of historic floodplain elevation along baseline shown. GGL REM developed using topobathymetric LiDAR collected by NV5 Geospatial on behalf of WA Department of Natural Resources (2022)

LICHEN RIVER & WATER

CASCADIA CONSERVATION DISTRICT



- Roaring Creek
- Station (ft)
- Tax Parcels (approx.)
- Reach Boundaries
- Historic Valley Bottom (approx.)
- Observed Wetlands
- Observed Wetland
- Headcut

Monitoring
- Hobo Logger
- Streamflow Gage

Complexity Features
- Beaver Dam Analogs
- Beaver Dam

Depth to Gravel (in)
- Gravel at Surface
- 0 - 5
- 5 - 15
- 15 - 36
- No gravel observed in soil pit

Geomorphic Grade Line* (ft)
- 3.1 - 4
- 2.6 - 3
- 2.1 - 2.5
- 1.6 - 2
- 1.1 - 1.5
- 0.6 - 1
- 0.1 - 0.5
- -0.5 - 0
- -1 - -0.5
- -1.5 - -1
- -2 - -1.5
- -2.5 - -2
- -3 - -2.5
- -4 - -3
- -10 - -4

0 125 250 500 Feet

Existing Conditions Map (GGL)

Roaring Creek Floodplain Restoration Design

* Geomorphic Grade Line (GGL) Relative Elevation Model (REM) relative to estimated of historic floodplain elevation along baseline shown. GGL REM developed using topobathymetric LiDAR collected by NV5 Geospatial on behalf of WA Department of Natural Resources (2022)

LICHEN LAND & WATER

CASCADIA CONSERVATION DISTRICT

Roaring Creek
Station (ft)
Tax Parcels (approx.)
Reach Boundaries
Historic Valley Bottom (approx.)
Observed Wetlands
Observed Wetland

Headcut

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Hobo Logger
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1.1 - 1.5
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0.1 - 0.5

-0.5 - 0
-1 - -0.5
-1.5 - -1
-2 - -1.5
-2.5 - -2
-3 - -2.5
-4 - -3
-10 - -4

0 125 250 500 Feet

Existing Conditions Map (GGL)

Roaring Creek Floodplain Restoration Design

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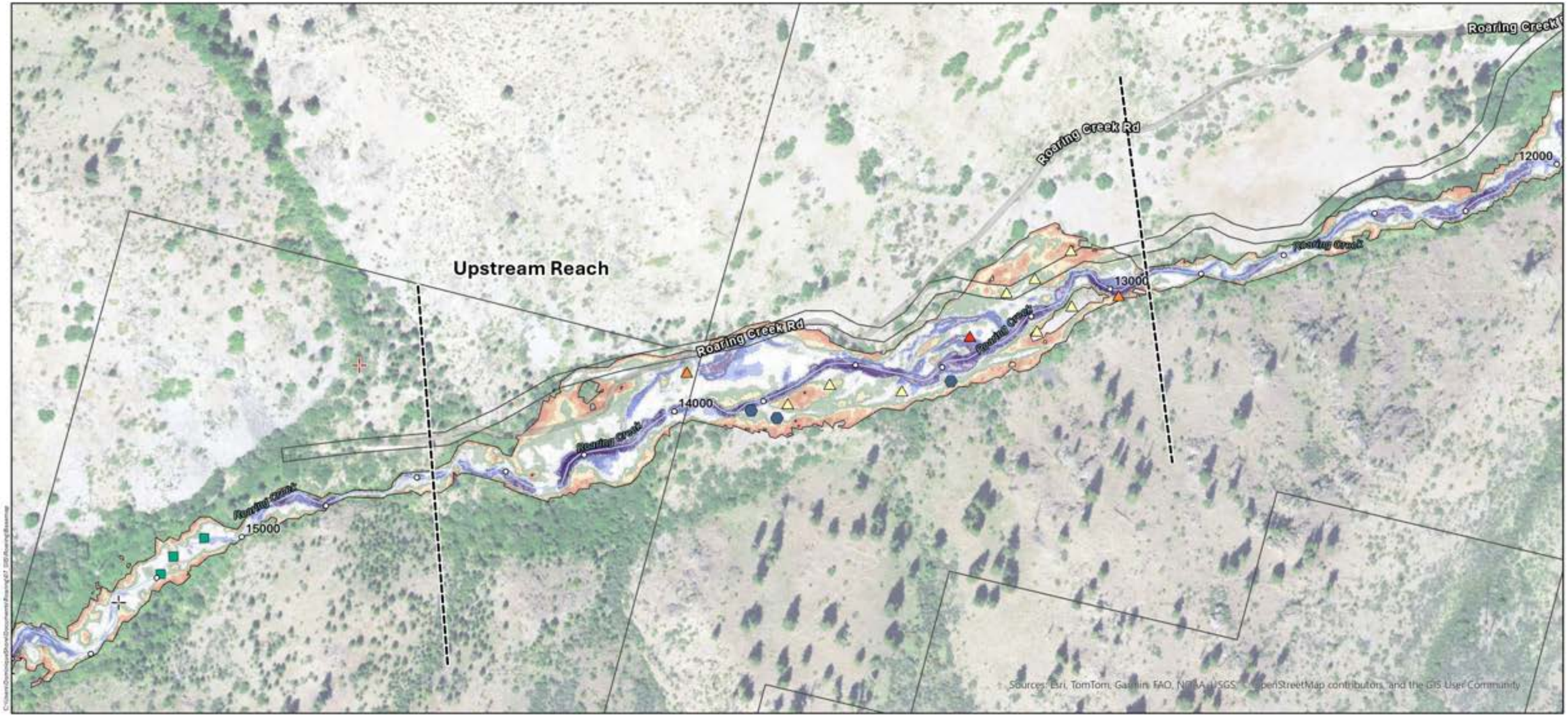
LICHEN
CASCADIA CONSERVATION DISTRICT



Roaring Creek
Station (ft)
Tax Parcels (approx.)
Reach Boundaries
Historic Valley Bottom (approx.)
Observed Wetlands
Observed Wetland

Headcut

Monitoring
Hobo Logger
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Complexity Features
Beaver Dam Analogs
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3.1 - 4
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1.6 - 2
1.1 - 1.5
0.6 - 1
0.1 - 0.5

-0.5 - 0
-1 - -0.5
-1.5 - -1
-2 - -1.5
-2.5 - -2
-3 - -2.5
-4 - -3
-10 - -4

0 125 250 500 Feet

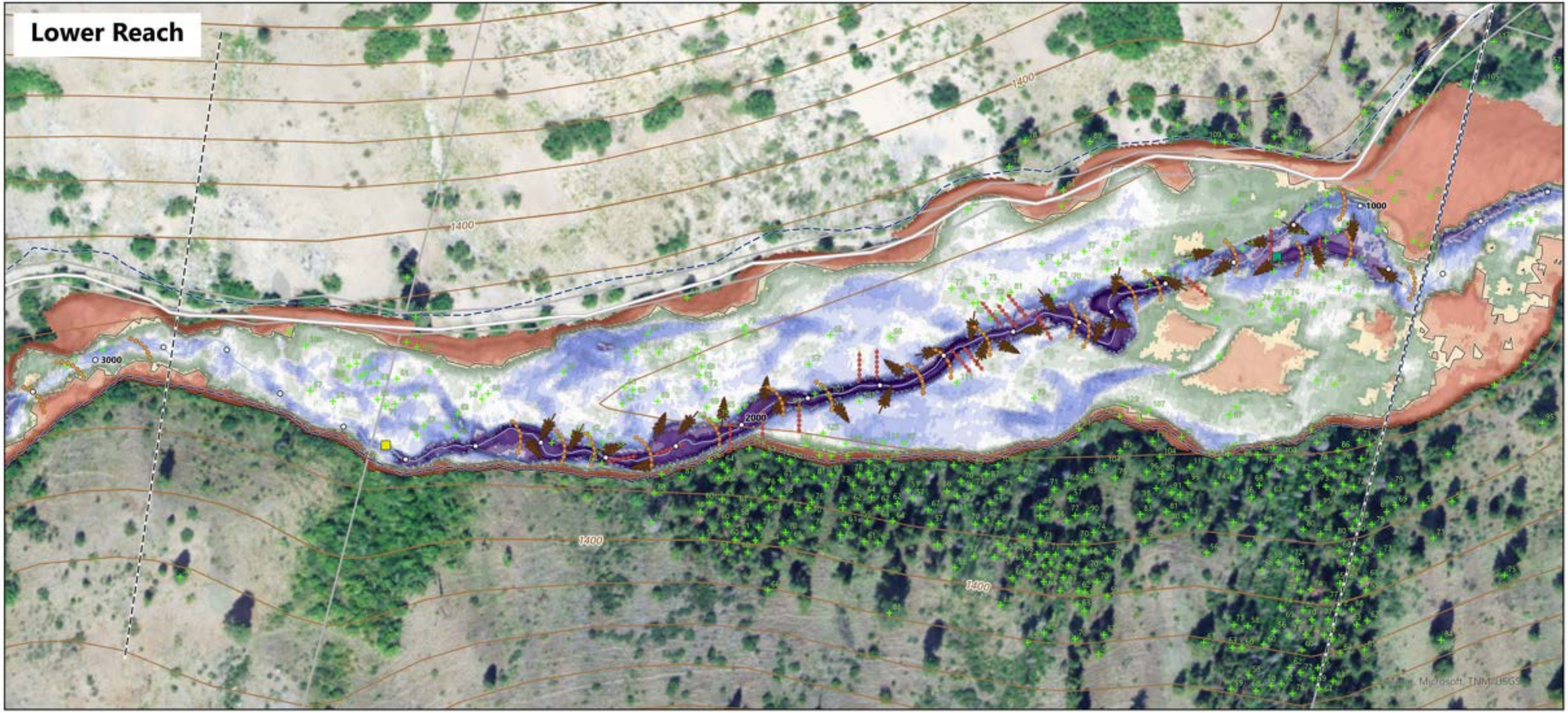
Existing Conditions Map (GGL)

Roaring Creek Floodplain Restoration Design

* Geomorphic Grade Line (GGL) Relative Elevation Model (REM) relative to estimated of historic floodplain elevation along baseline shown. GGL REM developed using topobathymetric LiDAR collected by NV5 Geospatial on behalf of WA Department of Natural Resources (2022)

LICHEN FISH & WATER

CASCADIA CONSERVATION DISTRICT



Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NV5 on behalf of Washington Department of Natural Resources

Basemap Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS.

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Proposed Structures

- Post-Assisted Log Structure (PAL)
- Felled Tree
- Beaver Dam Analog (BDA)

Elevations relative to the Geomorphic Grade Line (ft)

- 7 - 10
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2.5 - 3
- 2 - 2.5
- 1.5 - 2
- 1 - 1.5
- 0.5 - 1
- 0 - 0.5
- -0.5 - 0
- -1 - -0.5
- -1.5 - -1
- -2 - -1.5
- -2.5 - -2
- -3 - -2.5
- -4 - -3
- < -4

0 75 150 300 Feet

1:1,500

Alternative 1 - Low Tech Restoration Strategy

Roaring Creek Floodplain Restoration Design

03/18/2025

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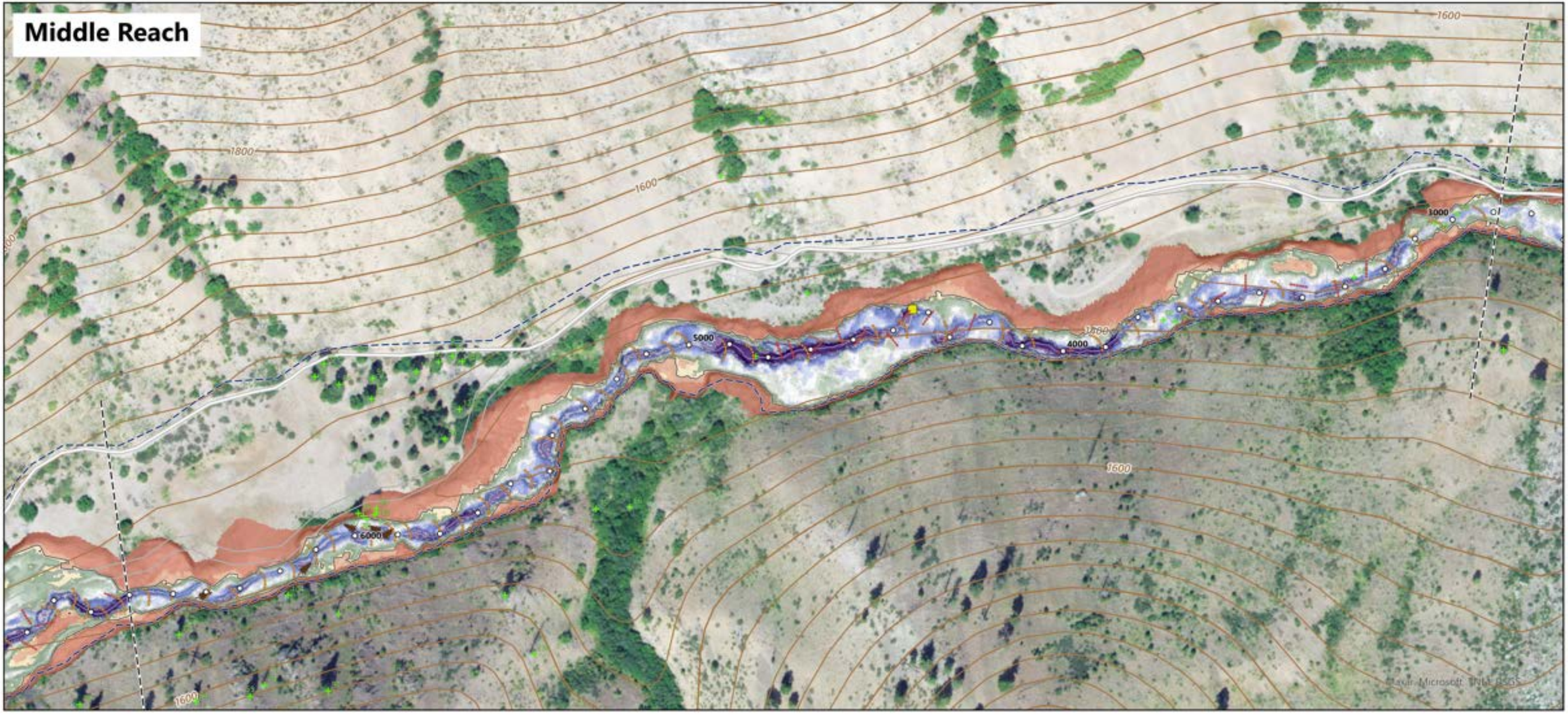
CASCADIA CONSERVATION DISTRICT



Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NV5 on behalf of Washington Department of Natural Resources

Basemap Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS.

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- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Proposed Structures

- Post-Assisted Log Structure (PAL)
- Felled Tree
- Beaver Dam Analog (BDA)

Elevations relative to the Geomorphic Grade Line (ft)

7 - 10	1 - 1.5
6 - 7	0.5 - 1
5 - 6	0 - 0.5
4 - 5	-0.5 - 0
3 - 4	-1 - -0.5
2.5 - 3	-1.5 - -1
2 - 2.5	-2 - -1.5
1.5 - 2	-2.5 - -2
	-3 - -2.5
	-4 - -3
	< -4

0 125 250 500 Feet

1:2,500

Alternative 1 - Low Tech Restoration Strategy

Roaring Creek Floodplain Restoration Design

03/18/2025

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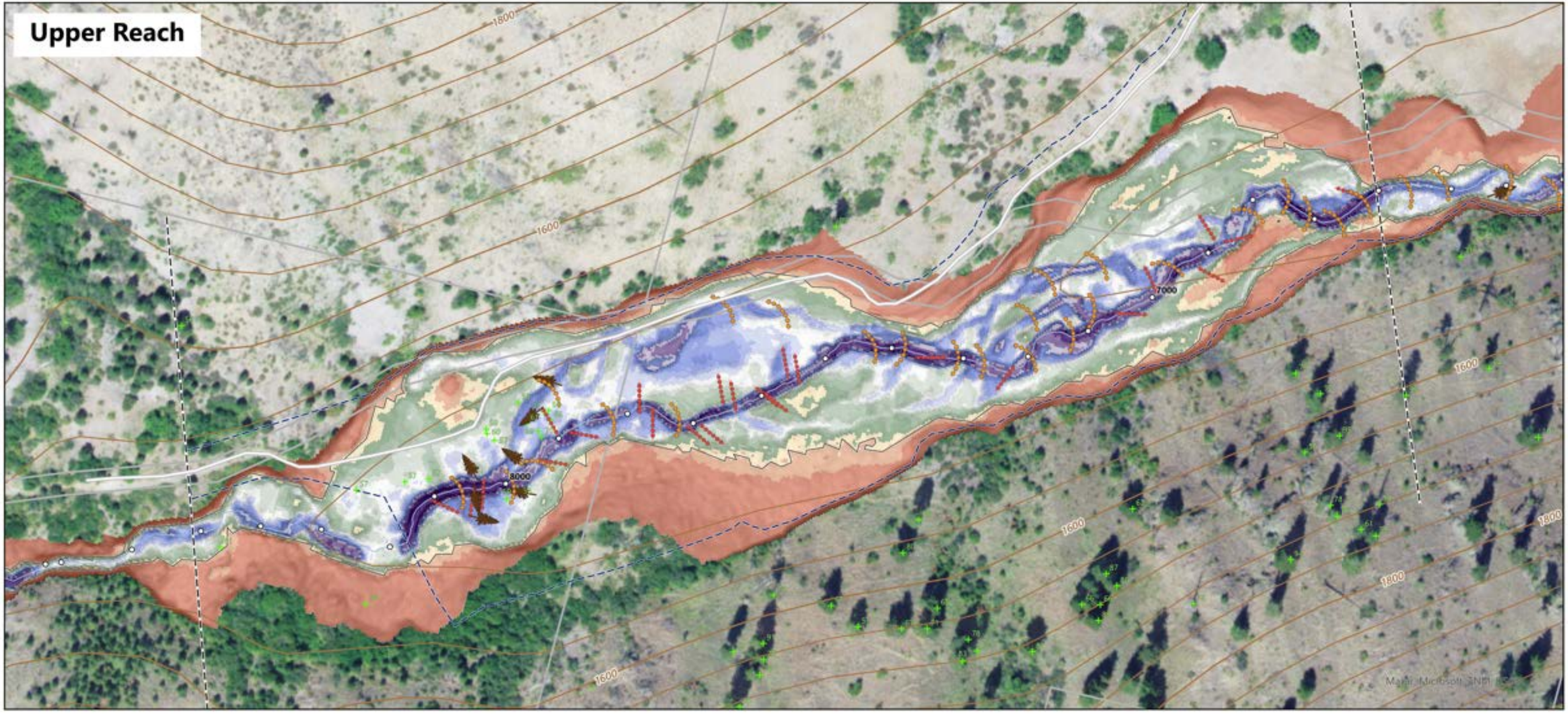

Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NV5 on behalf of Washington Department of Natural Resources

Basemap Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS.

- Roaring Creek Channel
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- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Proposed Structures

- Post-Assisted Log Structure (PAL)
- Felled Tree
- Beaver Dam Analog (BDA)

Elevations relative to the Geomorphic Grade Line (ft)

7 - 10	1 - 1.5
6 - 7	0.5 - 1
5 - 6	0 - 0.5
4 - 5	-0.5 - 0
3 - 4	-1 - -0.5
2.5 - 3	-1.5 - -1
2 - 2.5	-2 - -1.5
1.5 - 2	-2.5 - -2
	-3 - -2.5
	-4 - -3
	< -4

0 75 150 300 Feet

1:1,500

Alternative 1 - Low Tech Restoration Strategy

Roaring Creek Floodplain Restoration Design

03/18/2025

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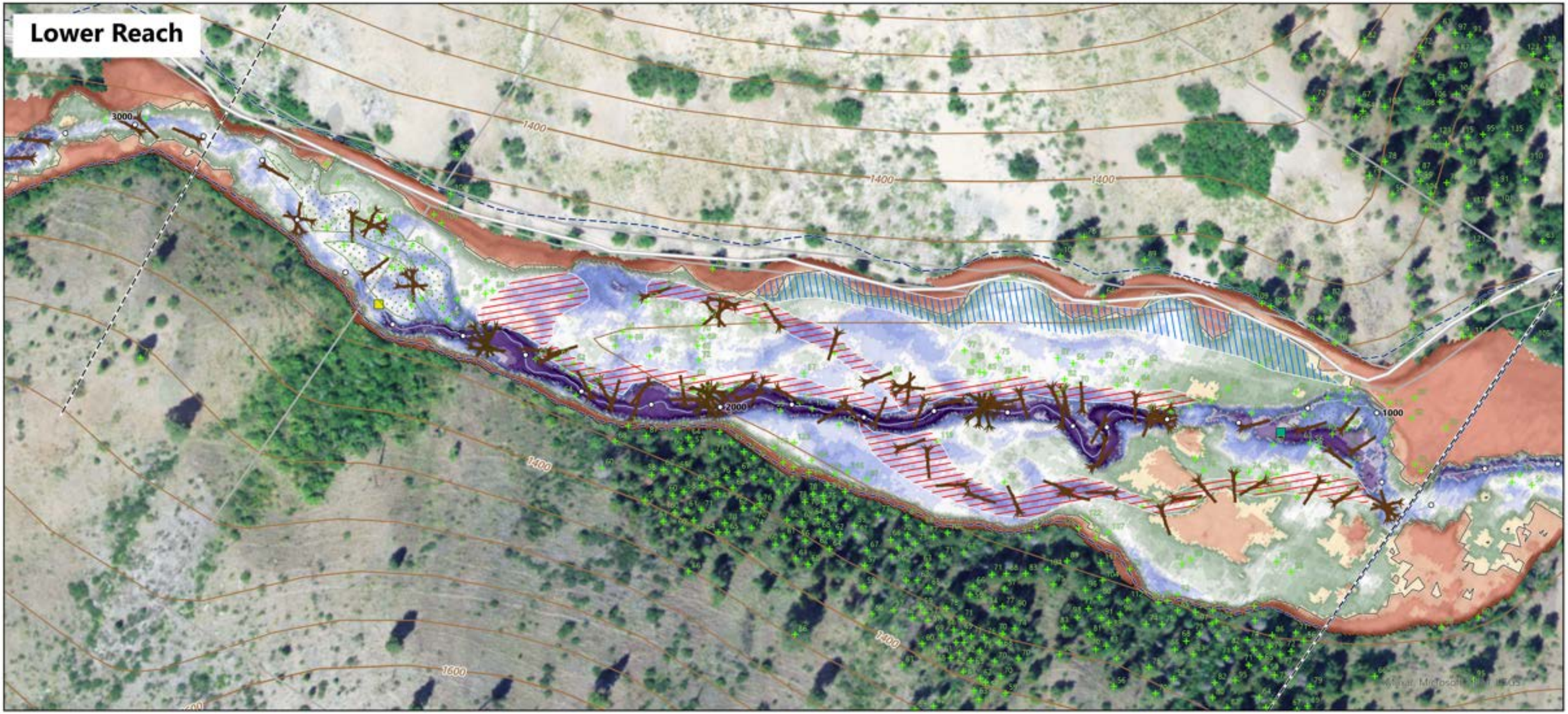
CASCADIA CONSERVATION DISTRICT



Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NV5 on behalf of Washington Department of Natural Resources

Basemap Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS.

Wood structures and pieces shown on map are for reference only. The actual number of features installed will vary from what is depicted.

0 75 150 300 Feet

1:1,500

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Earthwork (Grading)
- Floodplain Lowering
- Channel Aggradation

Wood Structures
- Large Log Jam
- Log Jam
- Single Log

Elevations relative to the Geomorphic Grade Line (ft)

7 - 10	1 - 1.5
6 - 7	0.5 - 1
5 - 6	0 - 0.5
4 - 5	-0.5 - 0
3 - 4	-1 - -0.5
2.5 - 3	-1.5 - -1
2 - 2.5	-2 - -1.5
1.5 - 2	-2.5 - -2
	-3 - -2.5
	-4 - -3
	< -4

Alternative 2 - Wood Enhancement and Targeted Floodplain Grading

Roaring Creek Floodplain Restoration Design

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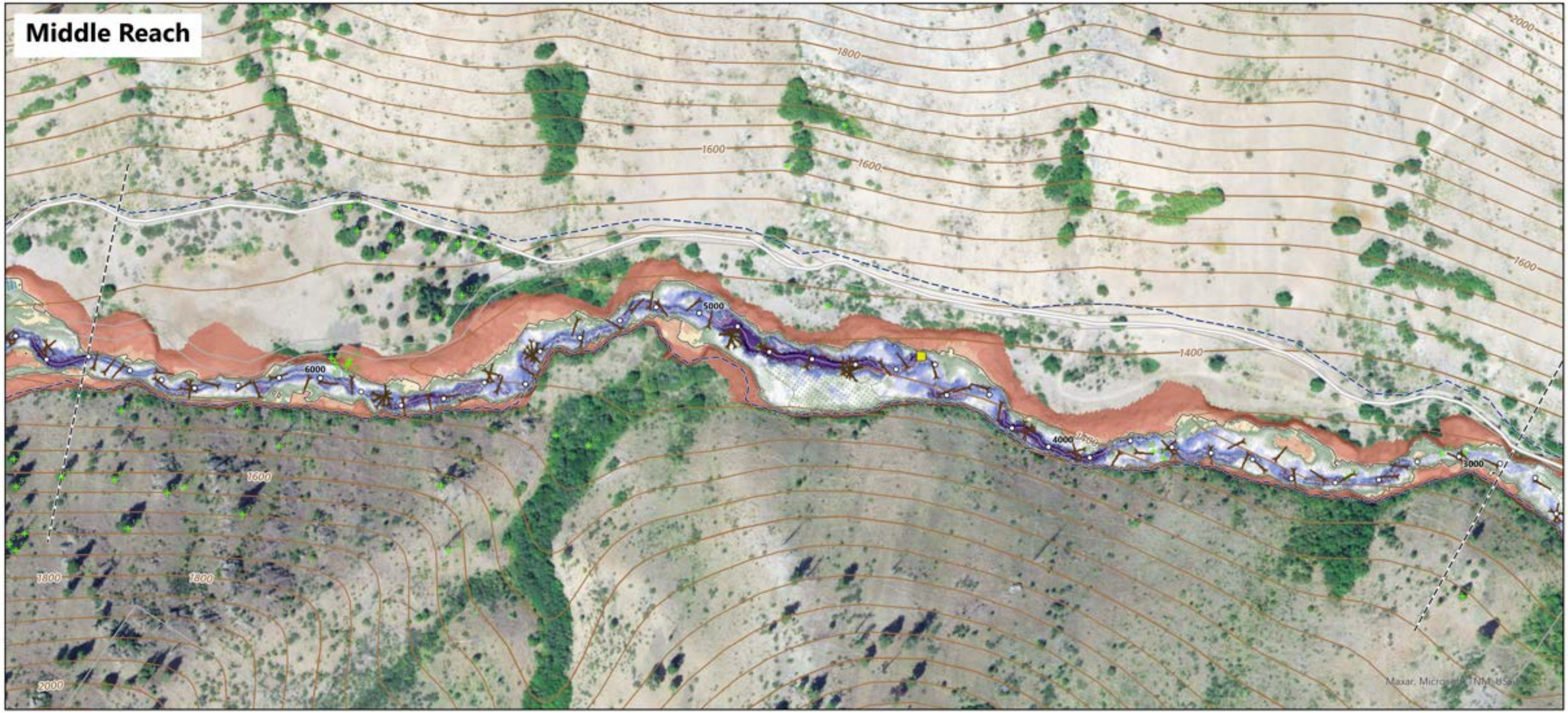
CASCADIA CONSERVATION DISTRICT



Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NV5 on behalf of Washington Department of Natural Resources

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0 125 250 500 Feet

1:2,500

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Earthwork (Grading)

- Floodplain Lowering
- Channel Aggradation

Wood Structures

- Large Log Jam
- Log Jam
- Single Log

Elevations relative to the Geomorphic Grade Line (ft)

7 - 10	1 - 1.5
6 - 7	0.5 - 1
5 - 6	0 - 0.5
4 - 5	-0.5 - 0
3 - 4	-1 - -0.5
2.5 - 3	-1.5 - -1
2 - 2.5	-2 - -1.5
1.5 - 2	-2.5 - -2
	-3 - -2.5
	-4 - -3
	< -4

Alternative 2 - Wood Enhancement and Targeted Floodplain Grading

Roaring Creek Floodplain Restoration Design

03/18/2025

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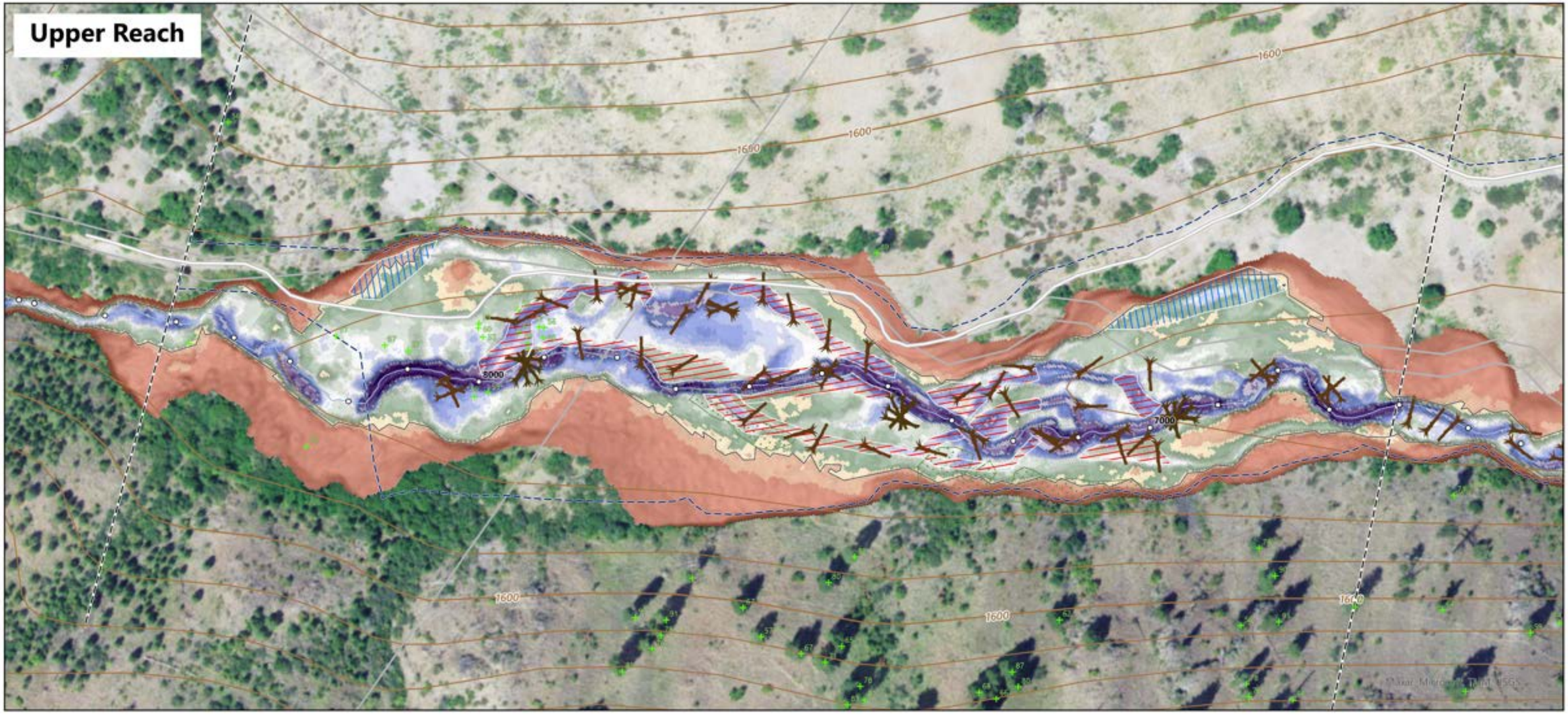

Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NVS on behalf of Washington Department of Natural Resources

Basemap Imagery: National Agriculture Imagery Program (NAIP), 2021, State of Washington, USDA NRCS.

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0 75 150 300 Feet

1:1,500

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Earthwork (Grading)
- Floodplain Lowering
- Channel Aggradation

Wood Structures
- Large Log Jam
- Log Jam
- Single Log

Elevations relative to the Geomorphic Grade Line (ft)

7 - 10	1 - 1.5
6 - 7	0.5 - 1
5 - 6	0 - 0.5
4 - 5	-0.5 - 0
3 - 4	-1 - -0.5
2.5 - 3	-1.5 - -1
2 - 2.5	-2 - -1.5
1.5 - 2	-2.5 - -2
	-3 - -2.5
	-4 - -3
	< -4

Alternative 2 - Wood Enhancement and Targeted Floodplain Grading

Roaring Creek Floodplain Restoration Design

03/18/2025

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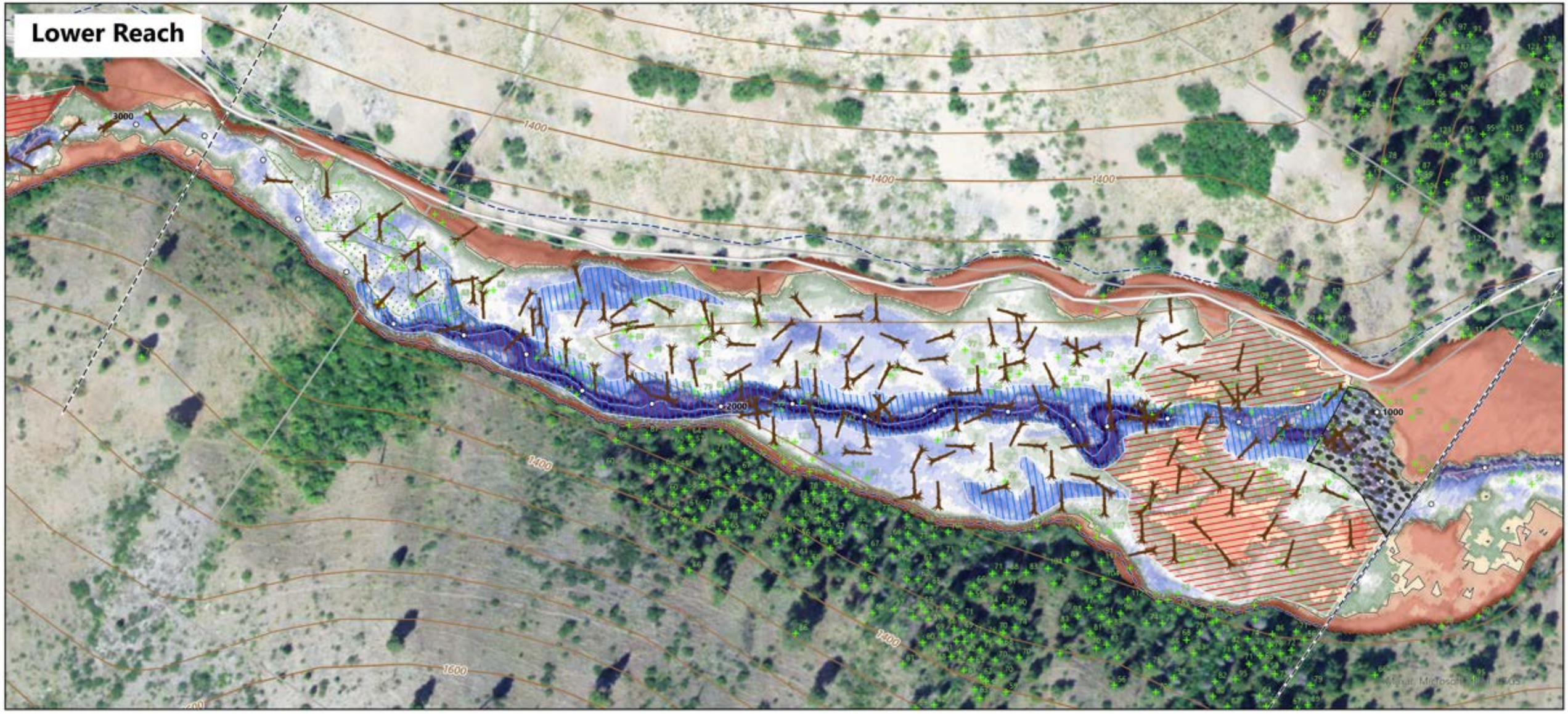

Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NV5 on behalf of Washington Department of Natural Resources

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0 75 150 300 Feet

1:1,500

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Earthwork (Grading)

- Floodplain Lowering
- Channel Aggradation
- Roughened Channel

Wood Structures

- Large Log Jam
- Log Jam
- Single Log

Elevations relative to the Geomorphic Grade Line (ft)

7 - 10
6 - 7
5 - 6
4 - 5
3 - 4
2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0 - 0.5
-0.5 - 0
-1 - -0.5
-1.5 - -1
-2 - -1.5
-2.5 - -2
-3 - -2.5
-4 - -3
< -4

Alternative 3 - Stage 0 and Simulated Landslide

Roaring Creek Floodplain Restoration Design

03/18/2025

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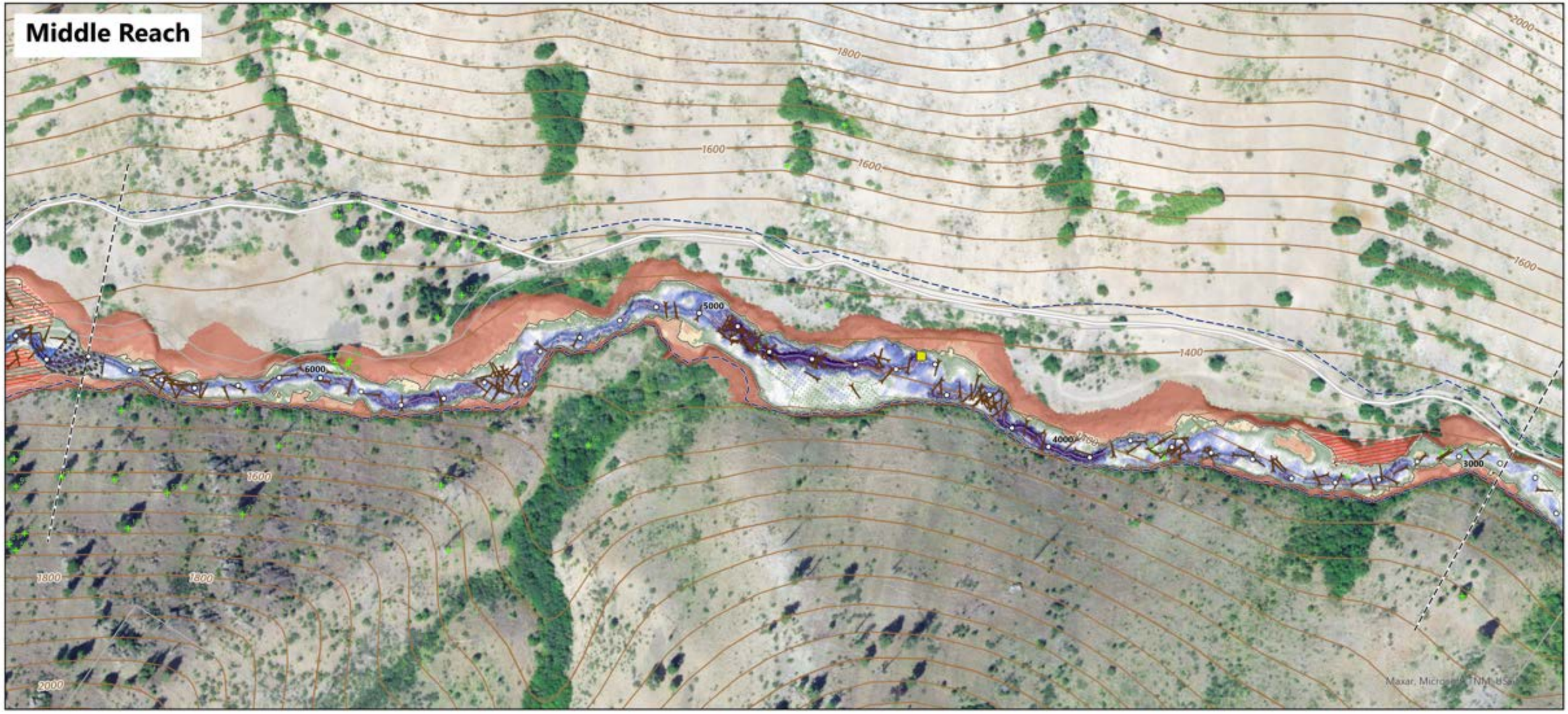

Geomorphic Grade Line built from topobathymetric LiDAR (2022) collected by NV5 on behalf of Washington Department of Natural Resources

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0 125 250 500 Feet

1:2,500

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Earthwork (Grading)
- Floodplain Lowering
- Channel Aggradation
- Roughened Channel

Wood Structures
- Large Log Jam
- Log Jam
- Single Log

Elevations relative to the Geomorphic Grade Line (ft)

7 - 10	1 - 1.5
6 - 7	0.5 - 1
5 - 6	0 - 0.5
4 - 5	-0.5 - 0
3 - 4	-1 - -0.5
2.5 - 3	-1.5 - -1
2 - 2.5	-2 - -1.5
1.5 - 2	-2.5 - -2
	-3 - -2.5
	-4 - -3
	< -4

Alternative 3 - Stage 0 and Simulated Landslide

Roaring Creek Floodplain Restoration Design

03/18/2025

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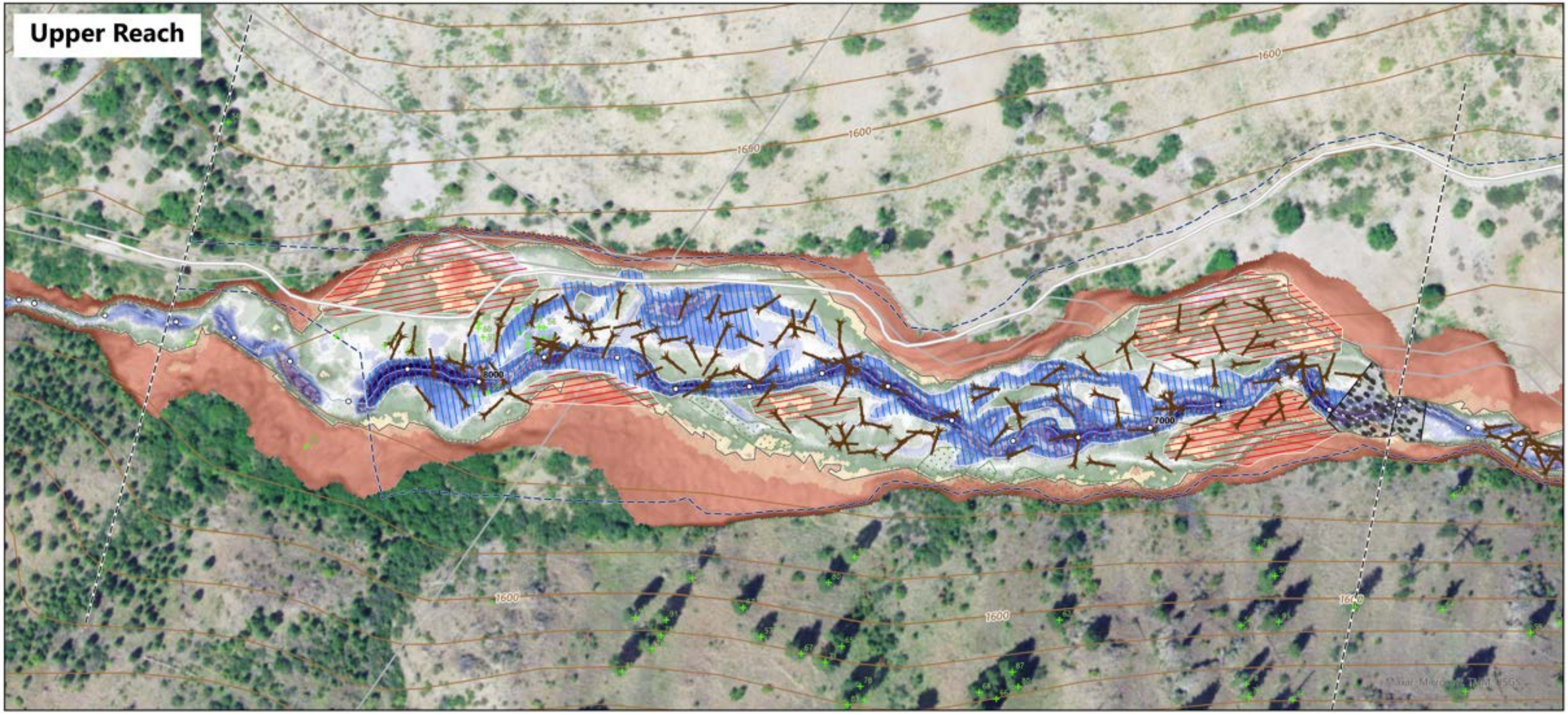
LICHEN LAKE & WATER

CASCADIA CONSERVATION DISTRICT



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0 75 150 300 Feet

1:1,500

- Roaring Creek Channel
- Stationing (ft)
- Reach Boundaries
- USFS Road
- Taxlots (approx.)
- Area of Potential Effects (est.)
- Estimated Historic Valley Bottom
- Estimated Wetland
- Beaver Dam Analogs
- Beaver Dam
- Trees >55 ft

Earthwork (Grading)

- Floodplain Lowering
- Channel Aggradation
- Roughened Channel

Wood Structures

- Large Log Jam
- Log Jam
- Single Log

Elevations relative to the Geomorphic Grade Line (ft)

- 7 - 10
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2.5 - 3
- 2 - 2.5
- 1.5 - 2
- 1 - 1.5
- 0.5 - 1
- 0 - 0.5
- -0.5 - 0
- -1 - -0.5
- -1.5 - -1
- -2 - -1.5
- -2.5 - -2
- -3 - -2.5
- -4 - -3
- < -4

Alternative 3 - Stage 0 and Simulated Landslide

Roaring Creek Floodplain Restoration Design

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Upper & Lower Reaches (mostly disconnected)

Middle Reach (mostly connected)

Dry floodplains and severe incision

Wetland conditions mostly needing large wood