Jan Road Levee Setback Project
Year 3 Monitoring Report (2025)



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EXECUTIVE SUMMARY

What is this report about?

This report documents Year 3 post-construction monitoring results from the Jan Road Levee Setback Project on the Cedar River in the 2025 calendar year, primarily prior to the December flood event. The project aimed to reduce flood risk and provide ecological benefits through reconnecting the river to its floodplain. Completed in fall 2022, actions included acquiring property, removing an existing levee, building a setback levee and buried biorevetment, installing 13 engineered log structures, protecting the Cedar River Trail 7 revetment with a new ballasted wood jack structure, building a new culvert under 221st Avenue SE, and installing nearly 19,000 native plants.

Is the project meeting its goals?

The project met the majority of its permit-associated performance standards. Native woody plant cover was the only permit-associated performance standard that was not met in Year 3; percent cover has continued to increase over time, but the performance standard may have been unrealistic given site conditions.

How is the river responding?

We observed relatively slow mainstem channel widening until the December 2025 flood, when substantial channel migration occurred, creating new high flow channels in the floodplain and widening both the mainstem and side channel. Side channel connectivity had been decreasing due to reduced porosity of the channel spanning log jam at the side channel inlet, but after the December 2025 flood, floodplain connectivity was much greater than pre-project and pre-flood conditions.

How has habitat changed?

For most of Year 3, habitat conditions were similar to Year 1 conditions, with decreasing side channel connectivity, moderate growth of vegetation, and similar availability of aquatic habitat. After the flood, habitat conditions improved dramatically, with increased wood loading in the project reach, increased floodplain connectivity, and more diverse aquatic habitat in the side channel from bank erosion, pool formation, and sediment deposition. Riparian area decreased after the flood, after the mainstem migrated into planting areas and floodwaters deposited sediments that buried other plantings under feet of cobble and/or sand.

How has flood risk changed?

The project successfully achieved its flood protection goals during the December 2025 flood event; SE 197th Place was not overtopped and slower water velocities were observed along the CRT 7 revetment during the event.

What new lessons have been learned?

Channel spanning jams at side channel inlets can reduce channel connectivity over time, but large flood events can dramatically change floodplain connectivity. Increased hydraulic diversity provided by engineered wood structures can increase bioenergetically favorable habitat for juvenile salmon growth. Large flood events on the Cedar River can create conditions that can mobilize ballasted log jacks.

Table ES1. Summary of permit-required indicators evaluated, and project performance compared to permit-associated performance standards for Year 3.

Indicator	Year 3 Performance Standard	Year 3 Status	Details
Active Channel Area	Active channel area will increase by ≥20% compared to baseline.	NOT ACHIEVED	The active channel increased by 16.7% compared to baseline, due to creation of the side channel.
Side Channel	Constructed (or naturally formed) side channels are connected at summer low flow (147 cfs).	ACHIEVED	The side channel remained connected year-round, with most areas ≥1 foot deep during summer low flow season.
Sediment Storage	Net deposition in the project reach by Year 10. Some years may show net decrease.	N/A[1]	Low flows between 2023-2025 resulted in minimal overall changes in sediment storage with localized erosion and deposition prior to the December flood.
Wood Load	Abundance and volume of natural/placed wood in project area will increase by 200% from baseline.	ACHIEVED	The abundance of large wood volume in the project area increased by 506% compared to baseline.
Juvenile Salmonid Habitat	Hydraulically modeled area of low velocity habitat (<1.5 ft/sec) is ≥50% higher at median spring rearing flows and 2-year flood flow than baseline.	ACHIEVED	Year 3 hydraulic conditions remained similar to Year 1, when modeled low velocity habitat showed a 337% increase at spring rearing flow and 285% increase at the 2-year flood flow.
	Area of hydraulically suitable habitat[2] for Chinook and steelhead juvenile rearing is ≥50% higher at median spring rearing flow than baseline.	ACHIEVED	Area highly suitable for juvenile Chinook and steelhead rearing in Year 1 at 482 cfs increased by 454% and 379%, respectively.
Juvenile Salmonid Use	Juvenile salmonids are observed during spring-time snorkel surveys in created habitat areas.	ACHIEVED	Juvenile Chinook, coho, and trout observed within the side channel, mainstem ELJs, and ballasted wood jacks between March and May 2025.
Native Vegetation	Percent cover of planted and naturally recruited woody species in the project area will be 40% by Year 3 and 60% by Year 5.	NOT ACHIEVED	Percent cover of native woody vegetation averaged 15% across transects. Percent cover of all desirable native species averaged 20%.
	Survival of installed plants is ≥ 80% in Year 3.	ACHIEVED	Across eight transects sampled, average survival was 94%.
Structural Stability	No damage to levee and/or biorevetment that would impact facility stability and its ability to resist channel or containment of flood water.	ACHIEVED	No damage was observed to the levee or biorevetment prior to the December 2025, but after the flood event damages to the setback levee were observed. Implications for facility stability and resisting channel migration are being assessed.

[1] Performance Standard for Year 3 not established.
[2] Hydraulically suitable habitat are areas with water velocities and depths preferred by a species and life stage.

Table ES2. Summary of other indicators evaluated, and project performance compared to performance standards for Year 3.

Indicator	Year 3 Performance Standard	Year 3 Status	Details
Geomorphic unit diversity	Geomorphic unit diversity will increase compared to baseline.	ACHIEVED	Shannon diversity index of geomorphic patches increased to 1.92 in 2025, from 1.77 in 2021 and similar to 1.94 in 2023.
Groundwater Levels	Groundwater elevations are higher in summer compared to baseline.	UNKNOWN	Prior to the December flood, one of three wells showed a slight positive trend in minimum groundwater elevation, but more years of data are needed to determine change. Preliminary post-flood data suggests elevations may have increased.
Water Temperature	Temperature change between gages upstream and downstream of project area is ≤0 degrees C.	ACHIEVED	Median mainstem temperature change was ≤0 degrees C during 11 months of the year in 2025. Side channel temperatures were warmer than the mainstem between November - February. Evidence of groundwater-surface water exchange created thermal diversity in the side channel.
Bioenergetically Suitable Habitat	Aquatic areas that are bioenergetically favorable (positive net rate of energy intake) for juvenile Chinook salmon will increase compared to baseline.	ACHIEVED	Based on Year 1 results, average net rate of energy intake for Chinook fry increased by 346%.
Ballasted Log Jacks	Deposition of fine sediment and low velocity wetted areas will be visually observed around and within log jacks.	ACHIEVED	Low velocity area was observed within ballasted wood jack structures. Fine sediment deposition has been observed in select areas around the structures.
Habitat Snags	Evidence of foraging and nesting is observed by Year 5.	N/A[1]	Excavations were observed on 3 of 28 installed snags by Year 3, but no evidence of nesting was observed.
Deep Pools	Number of deep pools (>6 ft water depth) at median spawning flow will increase compared to baseline.	N/A[1]	New pools have formed within the side channel and mainstem, estimated to be 2-4 feet deep at low flows prior to the December flood event. Pre-existing deep pools in the mainstem persisted.

[1] Performance Standard for Year 3 not established.

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I. Project Summary

Project Setting and Goals

The Jan Road Levee Setback Project ("project") is located on the Cedar River between RM 12.9 and 13.4. This reach includes the Jan Road Levee and the Cedar River Trail 7 (CRT7) Revetment. Under pre-project conditions, the Jan Road levee protected a private road that served as sole access for a residential neighborhood but did not provide flood containment at a 100-year flood (9,440 cfs). During low to moderate flood events (20-year flood; 6,020 cfs), the sole access road for the Jan Road neighborhood was overtopped by floodwater, leading to isolation of approximately 15 single-family homes on the right (east) bank. On the left (west) bank, the CRT7 revetment protects the Cedar River Trail and State Route 169. This infrastructure was at risk due to bank erosion and scour of the revetment. The Project is intended to reconnect the river to its floodplain to reduce flood risk and improve habitat in the reach.

The Project also fulfills mitigation requirements under the Washington State Department of Fish and Wildlife (WDFW) HPA 2017-4-544+01 which authorized King County to relocate 23 pieces of large wood within the Cedar River in 2017. Mitigation requirements included placement of at least 100 pieces of wood, meeting a pre-established metric of wood function and creation of at least one deep mainstem holding pool. King County worked with WDFW and Muckleshoot Indian Tribe Fisheries Division staff during design to develop a project that would meet mitigation requirements. King County developed this monitoring plan in accordance with King County Department of Local Services (DLS) Shoreline Exemption (SHOR21-0016), US Army Corps of Engineers (USACE) permit NWS-2021-496 and WDFW's HPA 2022-4-120 which authorized construction of the project in 2022. Monitoring reports will be submitted to DLS, USACE, WDFW, the Muckleshoot Indian Tribe Fisheries Division and posted to King County's public-facing website.

Project goals include:

1. Improve habitat-forming processes, function, and habitat, where feasible.
2. Establish resilient and sustainable floodplain infrastructure to reduce flood risks to people, property, and public infrastructure.
3. Provide required mitigation for the 2017 Cedar River wood relocation efforts.

Project Actions

The Project removed approximately 1,200 linear feet of the Jan Road levee, built a 2,300 linear foot setback levee, constructed a buried biorevetment riverward of the setback, excavated a new perennial side channel, installed a culvert to convey flood flow under SE 197th Place, constructed a containment berm to control flow over SE 197th Place, constructed large wood

structures to divert flow and reconnect floodplain along the mainstem Cedar River and new side channel, placed log jacks along the CRT7 revetment, installed habitat snags, placed sediment in the mainstem, and revegetated and enhanced riparian areas with native plants (Figure 1). These project actions are tied to the project goals and objectives as outlined in Table 1.

II. Monitoring Focus

Monitoring focuses on whether project actions had the intended effects on habitat conditions, watershed processes, and flood risk reduction, and documents accomplishment of mitigation requirements . This report focuses on habitat monitoring, river process, and flood risk reduction to improve design, construction, maintenance practices, and adaptive management. While improving natural river processes was a project goal itself, evaluation of geomorphic process changes can also inform progress towards meeting habitat goals and objectives.

Changes between baseline (pre-2022) and Year 3 (2025) post-construction are evaluated in the current document, to determine whether the project actions are effectively meeting the stated habitat and flood risk goals and objectives. This report primarily assesses changes prior to the flood event in late December 2025. Effectiveness of actions are evaluated by measuring indicators, which are associated with a performance standard used to determine success as well as the need for any adaptive management actions. The links between project goals, objectives, actions, and monitored indicators are outlined in Table 1.

The primary audiences for implementation and effectiveness monitoring results include King County staff (to inform future project design and adaptive management needs), and regulatory agencies (to determine compliance with performance standards and mitigation requirements) (King County 2022a).

Monitoring methodology is described in Appendices A and B.

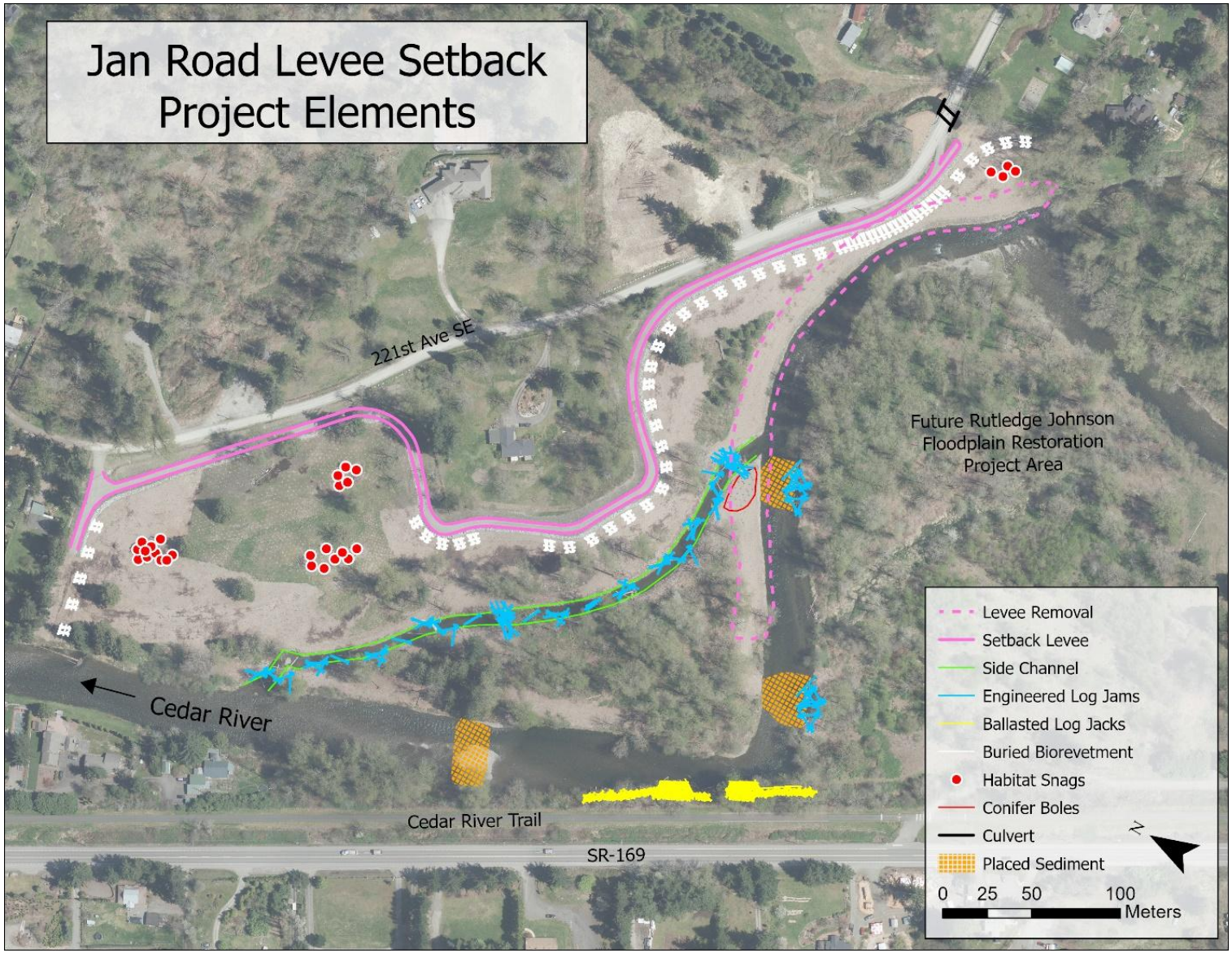


Figure 1. Jan Road Levee Setback project actions.

Table 1. Links between monitoring indicators and project goals, objectives, and actions.

Project Goal	*Objective*	*Action*	*Indicator*
Improve natural habitat-forming processes, function, and habitat, where feasible.	Increase active channel area compared to baseline.	Construct side channel, place wood and streambed material in mainstem, remove old levee prism and revetment.	• Active channel area
	Provide perennially connected side channel.	Construct side channel, place wood and streambed material in mainstem, remove old levee prism and revetment.	• Flowing water in the side-channel at summer low flow
	Provide sediment storage.	Set back Jan Road levee and remove former revetment and levee prism to match floodplain grade.	• Sediment movement and volume
	Reduce streambed armoring in the mainstem Cedar River.	Construct side channel and remove old levee prism, place wood and streambed material in the mainstem to promote gravel retention.	• Surface D_{50} • Armoring ratio
	Increase groundwater exchange to benefit water temperature through the reach.	Place wood and streambed material in the mainstem, remove old levee prism and revetment, construct side channel.	• Groundwater elevation • Surface water temperature
	Increase wood loading in the project area.	Wood placement, remove old levee prism, install conifer boles at channel split (to trap naturally recruited wood).	• Large wood
	Increase aquatic habitat complexity.	Construct side channel, place wood, remove old levee prism and revetment.	• Geomorphic unit distribution and diversity

Project Goal	*Objective*	*Action*	*Indicator*
Improve natural habitat-forming processes, function, and habitat, where feasible.	Increase availability of low velocity and hydraulically suitable habitat for juvenile Chinook and steelhead trout at median spring rearing flow and 2-year flood flow.	Construct side channel, place wood and streambed material in mainstem, remove old levee prism and revetment, place log jacks along CRT7.	• Low velocity habitat area • Hydraulically suitable habitat area
	Provide aquatic habitat that is used by juvenile salmonids.	Construct side channel, place wood and streambed material in mainstem, remove levee, place log jacks along CRT7.	• Fish presence
	Riparian plantings replace vegetative cover temporarily impacted during construction.	Replant disturbed areas with native species.	• Percent vegetation cover
	Successful establishment of installed plants in disturbed areas.	Replant disturbed areas with native species, conduct site maintenance during 10-year post-construction period.	• Plant survival
	Prevent establishment of invasive plant species.	Remove invasive vegetation including reed canary grass and Japanese knotweed by excavation during construction, conduct site maintenance during 10-year post-construction period.	• Percent vegetation cover
	No net loss of wetland habitat.	Restore disturbed wetland habitat north of the new culvert and downstream of the side channel. Passively establish new wetlands in the side channel, within the ballasted wood jacks and within the floodplain.	• Wetland area
	Provide bird nesting and foraging habitat.	Install snags in upland areas.	• Foraging/nesting cavity presence

Project Goal	*Objective*	*Action*	*Indicator*
Establish resilient and sustainable floodplain infrastructure to reduce flood risks to people, property, and public infrastructure.	Reduce erosion potential along CRT 7 Revetment compared to baseline at 1% Annual Chance Flood (ACF).	Install mainstem ELJs, place log jacks along CRT7, remove old levee prism.	• Modeled flow velocity • Displacement of log jacks
	Provide safe neighborhood egress at floods up to and including the 1% ACF (9,443 cfs).	Upgrade roadway culvert under SE 197th Place, remove old levee, construct new setback levee.	• Roadway overtopping observations • Levee profile settling
	Downstream water levels do not increase compared to baseline, for the 10% ACF.	Construct set back levee.	• Surface water elevation observations
	Flood risk reduction facility remains structurally stable.	Remove existing levee and construct new setback levee to current engineering standards.	• Visual damage • Levee profile settling
Provide required mitigation for the 2017 Cedar River wood relocation efforts.	Create 1 deep pool in the mainstem Cedar River.	Install mainstem ELJs, log jacks along CRT7 to form spurs/irregularity along the bank, side channel wood structures.	• Pool count
	Install at least 100 and up to 120 pieces of large woody material that meet or exceed the 60-point metric as determined by agreement between King County, WDFW, and the MITFD.	Install mainstem ELJs, log jacks along CRT7, side channel wood structures.	• Large wood meeting 60-point metric

III. Monitoring Results and Discussion

River Process and Habitat

Active Channel Area

Year 3 Performance Standard	Year 3 Status	Details
Area of channel that is active will be at least 20% greater than pre-project baseline in every monitoring year.	NOT ACHIEVED	In Year 3, active channel area increased from baseline by 16.7% and increased 1.96% from Year 1 (2023).

The area of active channel was delineated from 300 feet upstream to 300 feet downstream of the project boundary using aerial imagery in 2022 (baseline), 2023 (Year 1), and 2025 (Year 3). Analysis extents were chosen based on the expected extent of project influence on the active channel. The active channel is defined by the low-flow wetted channel that encompasses gravel bars and non-woody vegetation. From baseline conditions to Year 1 (2023), the active channel increased approximately 12.6% from 7.73 to 8.84 acres. This increase was in large part due to the excavation of the project side channel. In Year 3, continued bank erosion along the mainstem right bank occurred at the right bank Taylor Creek confluence, on the right bank between RM 13.18-13.23 (Figure 2), and marginally along the left bank between RM 12.9-13 (Figure 3). The bank erosion resulted in the active channel area increasing from approximately 8.84 in Year 1 to 9.02 acres in Year 3. Small adjustments to the active channel areas that appear to have decreased in size are likely due in part to growth of channel bars and establishment of immature vegetation. The 2025 active channel trace was completed prior to the December 2025 flooding, (Water Year 2026) when widespread channel change took place.



Figure 2. **Bank erosion opposite from mainstem ELJ at RM 13.2 in April 2023 (top; 455 cfs at USGS gage 12117600) and April 2025 (bottom; 950 cfs). Green line delineates top of bank in 2023.**

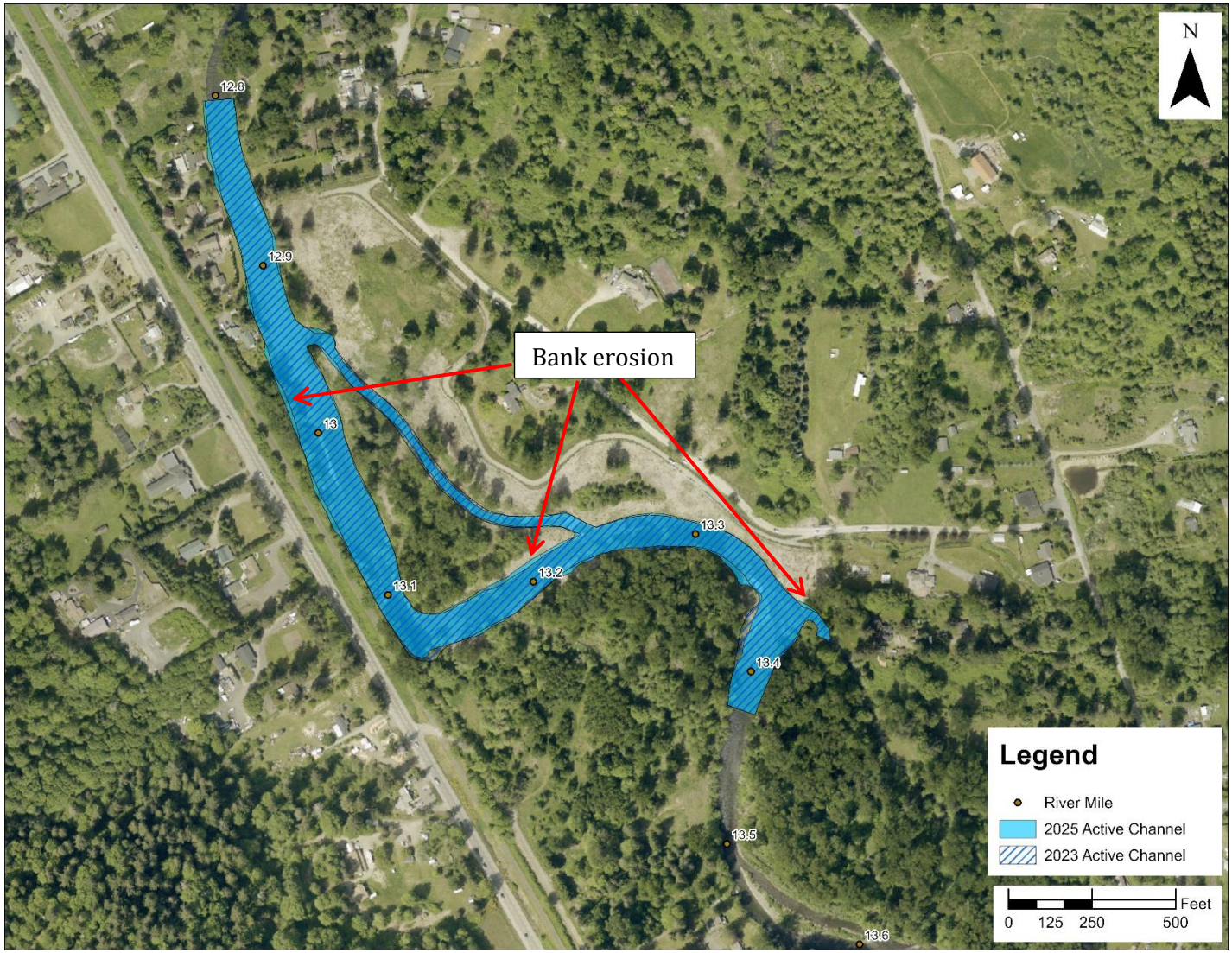


Figure 3. Active channel area in Year 1 (2023) and Year 3 (2025) prior to the December 2025 flood event.

Side Channel Connectivity

Year 3 Performance Standard	Year 3 Status	Details
Constructed side channel (or naturally formed side channels) are connected at median summer low flow (147 cfs) to the main channel.	ACHIEVED	The side channel remained connected year-round, with most areas wetted with at least one foot of water throughout summer low flow season.

The constructed side channel remained connected to the mainstem Cedar River throughout the summer low flow period, including at the 2023, 2024 and 2025 minimum annual flows (respectively: 104 cfs, 122 cfs, and 93 cfs at USGS 12119000 Cedar River at Renton). Until December 2025, water depth in the side channel decreased due to accumulation of small woody material and sediment on the installed channel-spanning log jam at the side channel inlet (Figure 4, Figure 5). Side channel discharge measurements in summer 2025 when total river flow was approximately 350 cfs showed that the 2.4% of Cedar River flow entered the side channel at approximately the median spawning flow, compared to 5.7% anticipated in final designs and 6.1% measured in 2022. After the December 2025 flood, water volume and depths in the side channel increased as the channel-spanning log jam accumulated more large wood and mainstem migrated right, creating a new inlet to the side channel (Figure 6). In May 2026 at 335 cfs, 11.3% of Cedar River flow now enters the side channel.



Figure 4. **Side channel on July 22, 2025, at 169 cfs (USGS gage 12119000 Cedar River at Renton). Downstream section looking upstream (left), and wood and sediment accumulation at the upstream-most side channel-spanning jam (right).**



Figure 5. **Small wood accumulation on installed channel spanning log jam at side channel inlet. Year 0 condition (10/29/2022) at left, and Year 3 condition (4/14/2025) at right. Flow direction shown with arrow.**



Figure 6. **Side channel inlet geometry pre-flood (4/14/2025) at left, and post-flood (4/4/2026) at right. Flow direction shown with arrow, including new side channel inlet flow path.**

Sediment Storage

Year 3 Performance Standard[1]	Year 3 Status	Details
Net deposition in the project reach as measured by LiDAR differencing by end of monitoring period (10 years). Some years may show net decrease.	N/A	Low flows between 2023 and 2025 prior to the December flood resulted in localized erosion and deposition resulting in minimal overall change in sediment storage.

[1] No performance standard for Year 3 established, but Year 10 performance standard included here for reference.

Repeat LiDAR differencing between 2023 post-construction and 2025 was completed to examine ongoing shifting sediment patterns at the site into Year 3. Five project zones and a larger subreach extent identified in Year 1 were utilized for examining volumetric changes in sediment between years in Year 3. For the Year 3 analysis, a zone of fluvial impact from the river was also identified (Figure 7).

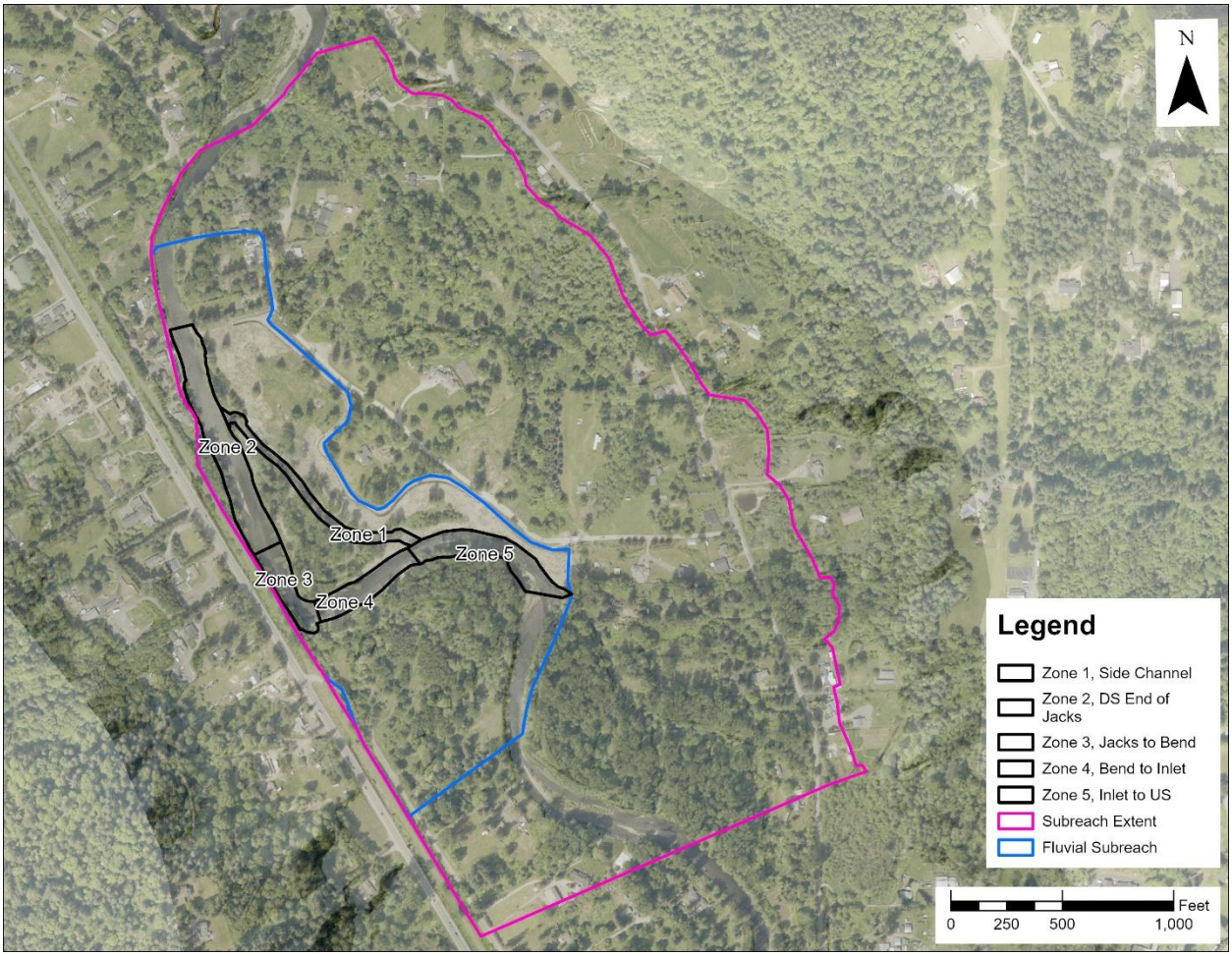


Figure 7. Subreach Extent of Jan Road illustrating the project vicinity and analysis zones.

Volumetric change was calculated for each zone by multiplying its area by the mean elevation difference between years (Figure 8). Overall volumetric error and upper and lower error bounds were calculated using a model accounting for both systematic error and spatially correlated random errors (Anderson, 2018; Table 2). Analyses were limited to conditions prior to the December 2025 flood; post flood data were not available at the time of this report.

Each zone experienced statistically significant aggradation or degradation between 2023 and 2025 other than the side channel, where volumetric change fell within the upper and lower uncertainty bounds (Table 2). In the zones where the upper and lower uncertainty bounds are entirely negative or positive, the volumetric change trending towards erosion or aggradation can be considered real, often in localized areas within a given zone.

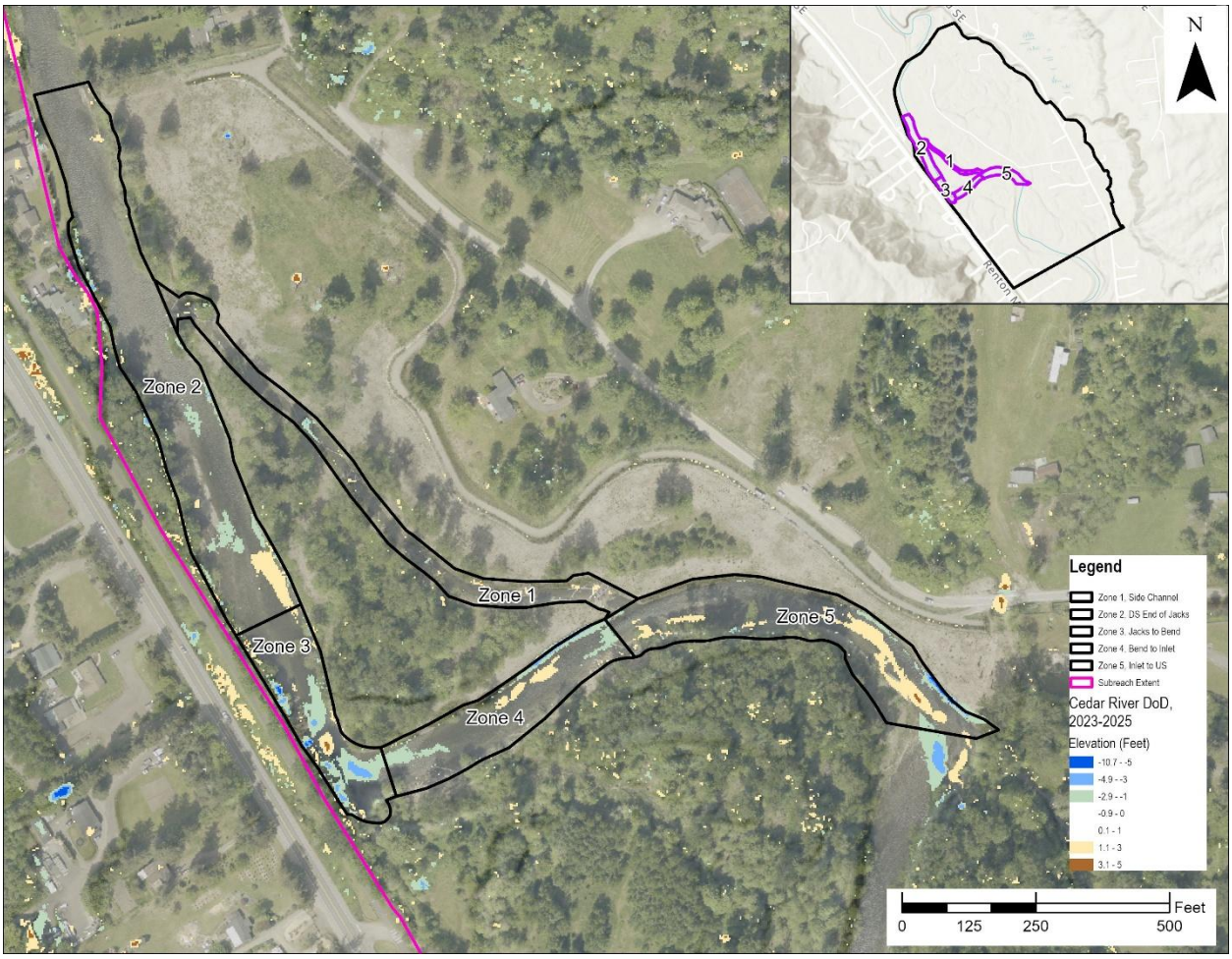


Figure 8. Elevation differencing between 2023 (Year 1) and 2025. Zones 1-5 demarcate areas relevant to design elements within the delineated active channel area. The area used to calculate the reach total is shown in black in the inset (inclusive of future Rutledge Johnson project area).

Table 2. Volumetric change and propagated error from the 2023 DEM of Difference, by zone; shown in Figure 8.

Zone	Location	Mean Elevation Change (feet)	Volumetric Change (cubic feet)	Error (cubic feet)	Upper Uncertainty Bound (cubic feet)	Lower Uncertainty Bound (cubic feet)
1	Side Channel	-0.02	-830	2,200	1,300	-3,000
2	Downstream mainstem	-0.09	-12,000	6,200	-5,900	-18,000
3	Bend to Log jacks	-0.42	-18,000	2,000	-16,000	-20,000
4	Side Channel Inlet to Bend	-0.18	-8,600	2,300	-6,400	-11,000
5	Upstream of Side Channel Inlet	0.13	9,800	3,500	13,000	6,400
Subreach	Reach Extent	0.07	490,000	350,000	833,000	140,000
Fluvial Subreach	Project Extent	0.03	56,000	96,000	152,000	-40,000

Upstream of the side channel inlet, within Zone 5, 9,800 ± 3,500 cubic feet of sediment deposition occurred along the outer portion of the existing point bar on the left bank indicative of bar growth. In response to the point bar growth, erosion occurred on the right bank opposite from the deposition on the outer edge of the meander bend where the thalweg is located and shear stress is concentrated.

Upstream and outside of Zone 5, scour is noticeable on the upstream end of the point bar that appears to be associated with large woody debris extending into the center of the mainstem channel. The location of the log has created erosion between the point bar and the log, and a scarp is visible in the 2025 topobathymetry on the channel bed.

In the side channel (Zone 1), no significant net change occurred across the zone (-830±2,200 cubic feet), but some local erosion was observed on the downstream end of logjams between RM 12.95 and RM 13. The location of the erosion suggests ongoing pool formation as a result of scour influenced by the logjams. The side channel's grade slightly increases just downstream from the log jams at approximately RM 13, which may drive future bed erosion processes.

In Zone 4, aggradation occurred on the edge of the point bar across from the side channel which may drive increased flow into the side channel. However, the zone overall trended towards erosion (-8,600±2,300 cubic feet). Right bank erosion of the island and additional erosion in Zone 4 at the center of the mainstem channel at the bend was observed. The eroded material along the right bank is not likely to have transported far as shown by deposition in the same vicinity at RM 13.2. Erosion overlapping the location of mainstem gravel placement from Year 1 heading into the downstream meander bend suggests some remobilization and downstream export of a portion of the placed gravels. Some of the erosion leading into Zone 3 may more simply relate to the location of the thalweg and associated scour at a tight meander bend. Scoured and mobilized sediment appeared to aggrade downstream parallel to the right bank of the island as the channel widens coming out of the meander bend.

Zone 3 displays the largest amount of erosion with the least amount of error at -18,000±2,000 cubic feet. The scour within the transition area from Zone 4 to Zone 3 appears to have formed a pool at the apex of the downstream meander bend to the east of CRT 7's log jack structures. The sediment scoured out of the pool doesn't appear to have transported far as deposition directly downstream is also present. Erosion in Zone 3 follows the thalweg, and the mobilized sediment deposits downstream along the right-bank margin of the island as the channel widens downstream of the meander bend. Development of longitudinal pool formation can also be seen downstream of the log jacks, providing slow water edge habitat.

Within Zone 2, the channel eroded -12,000±6,200 cubic feet. Erosion and reworking of sediment where previous mainstem gravels were placed in Year 1 can be seen based on the identified location in the Year 1 report and sediment difference raster. Deposition downstream of the meander bend is visible on the right bank of the inner point bar.

At a project reach scale, aggradation appears to have occurred in the greater subreach (490,000±350,000 cubic feet), but it is important to note that the project subreach extends to the east and captures floodplain that is not accessed by the active channel or influenced by the Cedar River and levee setback. The majority of the subreach extent experienced aggradation on the order of a foot. Construction on private property accounts for some of the observed aggradation over one foot, while artifacts of the LiDAR in the floodplain may account for some of the change too.

To more meaningfully examine change close to the Cedar River, a zone of greater fluvial impact was delineated closer to the levee setback to analyze change on the floodplain with the potential for influence by the river. Examining the floodplain closer to the river, volumetric change is found to be 56,000±96,000 cubic feet. Since the calculated error is higher than the calculated volumetric change, the uncertainty in aggradation is large and the fluvial subreach can't confidently be reported to have aggraded. Therefore, the floodplain change in the project vicinity appears to be negligible in Year 3.

Between 2023 and 2025, Zones 2-5 and the subreach exhibit substantial elevation change on the order of 3-5 feet of localized erosion and deposition. In contrast, the overall project reach experienced minimal change in elevation. The minimal amount of change is consistent with low peak flows from Water Years 2023 through 2025. At the Cedar River Near Landsburg gage

(USGS12117500), flows did not exceed 2,000 cfs from Water Years 2023 through 2025 (Figure 9). At the Cedar River at Renton (USGS 12119000) for the same period, flows reached a maximum of 2,500 cfs (Figure 10). Flows between 2,000 to 2,500 cfs fall near a 50% annual exceedance probability based on the Cedar River Near Landsburg gage (Degasperi 2021). Initial movement of riverbed sediment is calculated to occur at about 2,000 cfs near Landsburg and 2,700 cfs in Renton (Perkins et al. 2002), so relatively low winter flows indicate minimal overall ability to cause large-scale geomorphic channel change along the river and at the project site in Year 3.

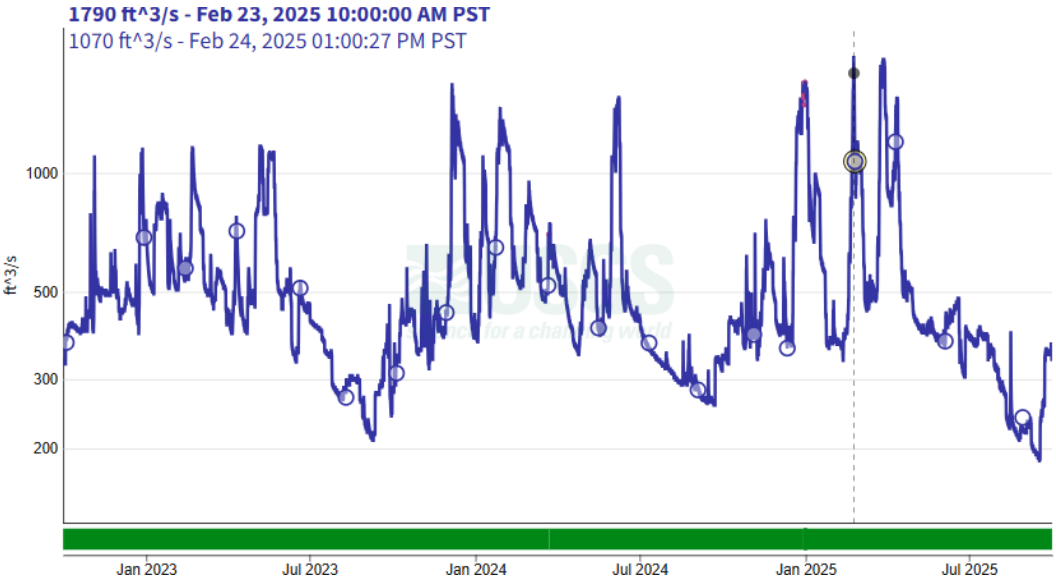


Figure 9. Cedar River Near Landsburg, WA gage, Water Years 2023 to 2025.

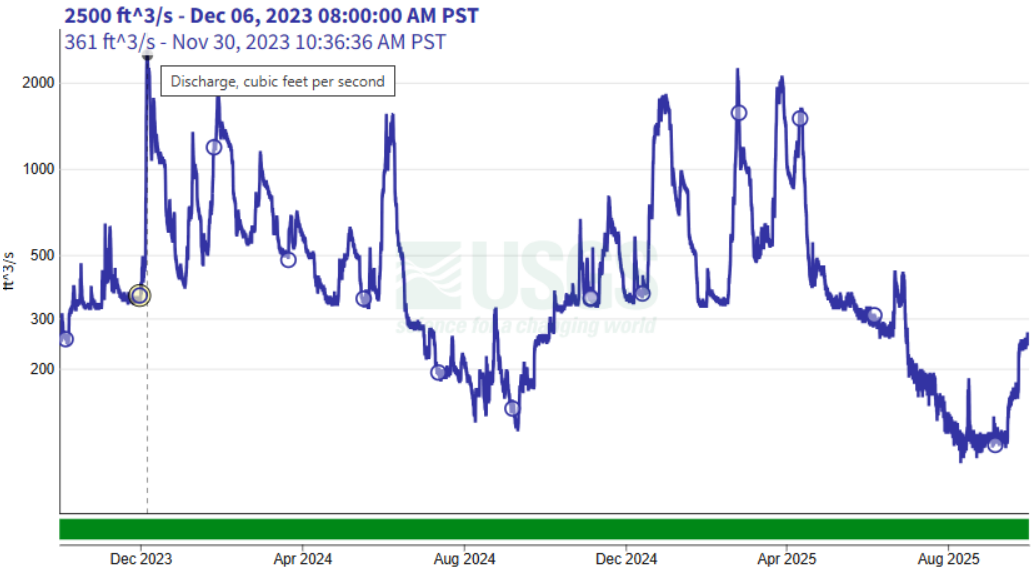


Figure 10. Cedar River at Renton, WA gage, Water Years 2023 to 2025.

Geomorphic Units

Year 3 Performance Standard	Year 3 Status	Details
Geomorphic unit diversity will increase compared to baseline.[1]	ACHIEVED	Shannon diversity index of geomorphic patches increased to 1.92 in 2025, from 1.77 in 2021 and similar to 1.94 in 2023.

[1] Geomorphic unit diversity is not a formally defined performance standard for the Jan Road Levee Setback project but is an appropriate metric to evaluate project goals.

Geomorphic unit mapping supported measurements of geomorphic unit diversity. We used a set of definitions of geomorphic units to evaluate pre- and post-project geomorphic process presence and function. The geomorphic unit types are listed below with detailed definitions used for this study included in Appendix B:

- Connected floodplain.
- Floodplain overbank channels, including disconnected backwaters.
- Islands.
- Active channel, including bars, pools, riffles and other, undifferentiated areas.
- Connected backwater channels.
- Terrace or disconnected floodplain.

Geomorphic units delineated from aerial imagery before (2021) and after the project (2023, 2025) are presented in Figure 11. Geomorphic units delineated in 2023 (A), and 2025 (B). Changes between years are minimal but are primarily observed in bars, riffles, and pools. Figure 11 and Table 3. From 2021 to 2023, the number of distinct geomorphic units and the diversity of geomorphic units as measured by the Shannon diversity index increased (from 1.77 in 2021 to 1.94 in 2023). The Shannon diversity index measures both richness (number of different unit types) and evenness (how evenly distributed across unit types), with values of 0 representing a community with just one unit type and higher values representing a more diverse and even community. This increase in the Shannon diversity index persisted into 2025, when the Shannon diversity index of geomorphic patches was 1.92.

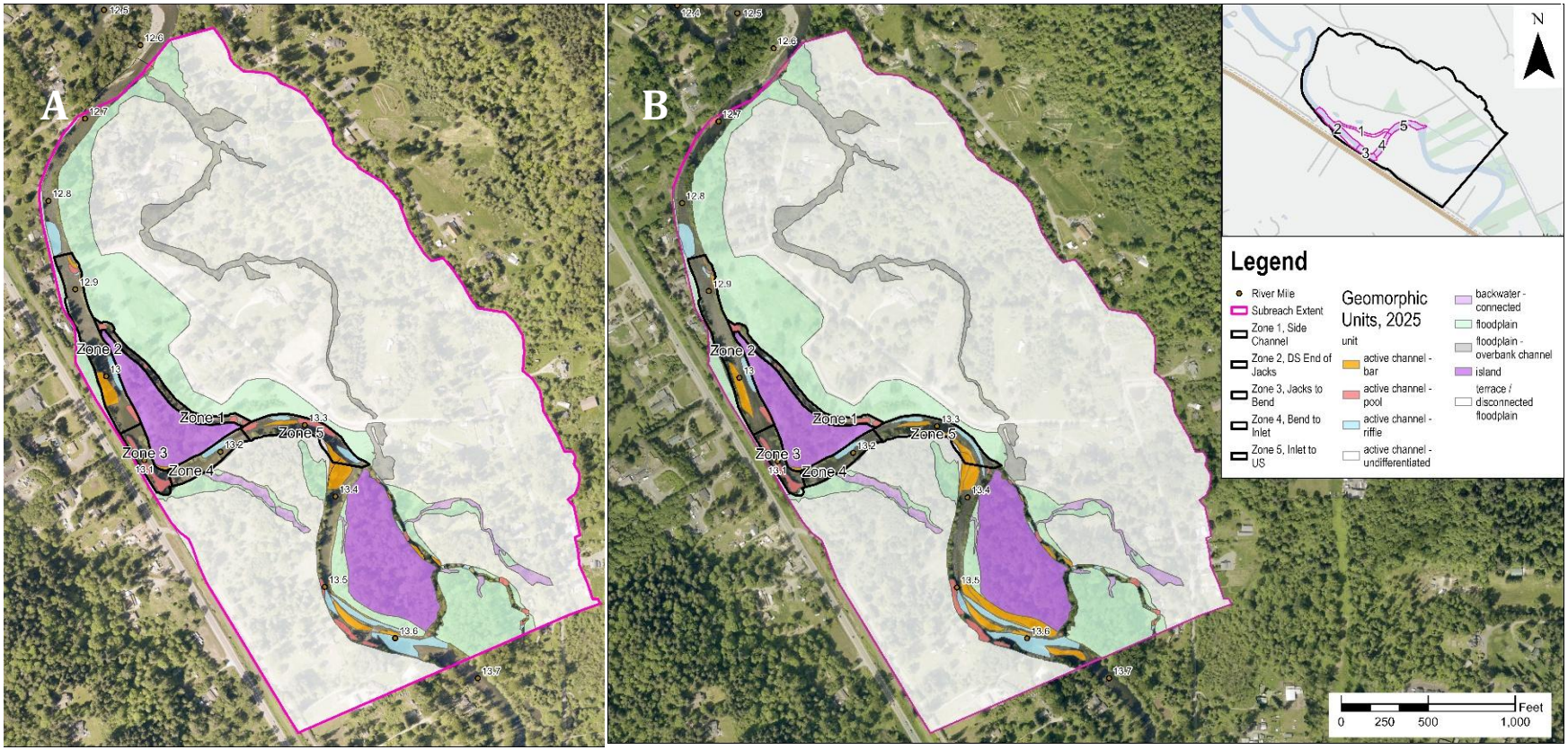


Figure 11. Geomorphic units delineated in 2023 (A), and 2025 (B). Changes between years are minimal but are primarily observed in bars, riffles, and pools.

Table 3. Jan Road Levee Setback geomorphic units, 2021-2025.

	Acres by Year				
Geomorphic Unit	2021	2023	2025	Percent Change 2021-2025	Percent Change 2023-2025
Active channel – undifferentiated[1]	11.3	10.7	10.7	-5.4	-0.5
Active channel - bar	1.9	2.2	2.5	25.7	12.9
Active channel - riffle	0.5	1.9	2.0	74.2	7.0
Active channel - pool	1.7	1.3	1.1	-52.3	-11.1
Active channel - total	**15.4**	**16.1**	**16.4**	6.0	1.8
Floodplain	14.7	22.5	22.9	35.5	1.5
Disconnected floodplain	127.6	114.1	114.0	-12.0	-0.1
Floodplain - overbank channel	4.4	4.6	4.6	3.3	0.0
Floodplain - total	**146.8**	**141.2**	**141.4**	-3.8	0.2
Backwater - connected	1.7	1.5	1.5	-16.5	0.0
Island	6.4	10.7	10.8	41.3	1.0

[1] Active channel undifferentiated acreage will be a different number than the reported acreage in the Active Channel Area section as this analysis incorporates portions of Taylor Creek and a channel in the Rutledge Johnson project area. The active channel (undifferentiated) in the Geomorphic Units section is not inclusive of pools, riffles, and bars.

In 2025, increases in acreage from 2023 were observed in the following geomorphic units types: Active channel (bar), Active channel (riffle), and Floodplain. The active channel (undifferentiated) acreage decreased from 2023 by 0.5%; however, all features representing the active channel increased from 2023 to 2025 by 1.8%. Within the active channel designation, the greatest change was represented by an increase in active channel bars (and thus deposition) which occurred in the project reach and grew by 12.9%. These bars are likely influencing the increase in active channel riffle count and areas of localized erosion observed on the channel banks as the active channel expands, but the presence of more bar area is causing a reduction in undifferentiated active channel. Where the active channel has locally widened, the river is able to access more of its floodplain, and the active channel at the project site continues to be dynamic during years where only moderate flow is present.

The percent change and reduction in active channel pools can partially be accounted for by minor adjustments to the geomorphic unit polygon delineations to better represent features. Increased deposition in Zone 2 also appears to be reducing pool size and in Zone 5 the point bar growth is creating a riffle on the opposite (right) bank where a pool previously existed.

The most static features within the project area are the disconnected floodplain, the backwater-connected, and the islands. The lack of change (prior to the December 2025 flood event) is likely due to these areas not regularly being inundated with flow capable of causing geomorphic change and the vegetation contributing to a stable surface on the islands.

Groundwater Levels

Year 3 Performance Standard	Year 3 Status	Details
Groundwater elevation shows trends that are higher during summer compared to baseline pre-project.	UNKNOWN	Prior to the December flood, one of three wells showed a slight positive trend in minimum groundwater elevation, but more years of data are needed to determine change. Preliminary post-flood data suggests elevations may have increased.

Two groundwater wells located landward of the levee setback, JanRd_AMW01 and JanRd_AMW03, and one in the floodplain (JanRd1) offer the potential to gain insight into long term groundwater table changes following project completion (Figure 12).



Figure 12. Jan Road Setback Levee Groundwater Wells, AMW01, AMW03, and JanRd1.

Data was pulled for all three gages from their starting data collection dates in 2021 or 2022 through 4/6/2026 and the annual minimum groundwater level was plotted. The annual minimum groundwater level was chosen since it is less likely to reflect fluctuating surface-water discharge relationships and establishes a minimum threshold for groundwater levels during stable late summer and early autumn baseflow conditions.

Data was analyzed prior to the significant flood in December 2025 and combined with observations collected following the flood. A linear regression applied to the annual minimum values pointed to a potential trend slight increases in groundwater levels at the upstream well, JanRoad_AMW01. However, with only four years of data the ability to confidently validate that trend is limited and it is subsequently difficult to point to specific factors that may have influenced the groundwater. Cherry et al. (2024) suggest that at least 10 years of groundwater data are necessary to reliably examine long-term trends in time series data. Therefore, we cannot definitively say that the trend visible in AMW01 is real.

Following the December 2025 flood, all three wells showed an increase in groundwater levels. This abrupt shift suggests something is occurring at the project site post-flooding that appears to be perching the groundwater higher than previously. A lower flow indicative of stabilization after the December flood and prior to late March flooding, between 450 cfs to 455 cfs, was selected for discharge comparison to previous years within the same time frame; it is plotted in lime green on the graphs below. Initial data suggests groundwater is approximately 1.9 feet higher at JanRd_AMW01 (Figure 13), 1.2 feet higher at JanRd_AMW03 (Figure 14), and 0.8 feet higher at JanRd1 (Figure 15) for the comparable discharges between March and April. Results are preliminary and limited to available post-flood data at the time of reporting.

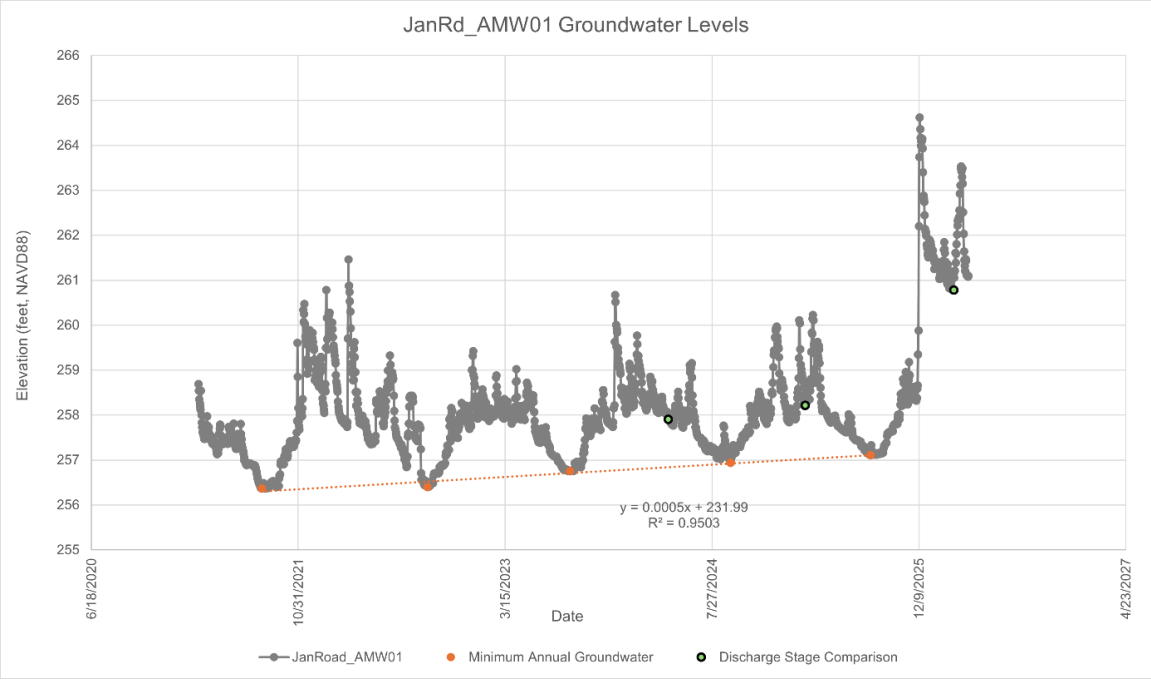


Figure 13. Groundwater levels at AMW01.

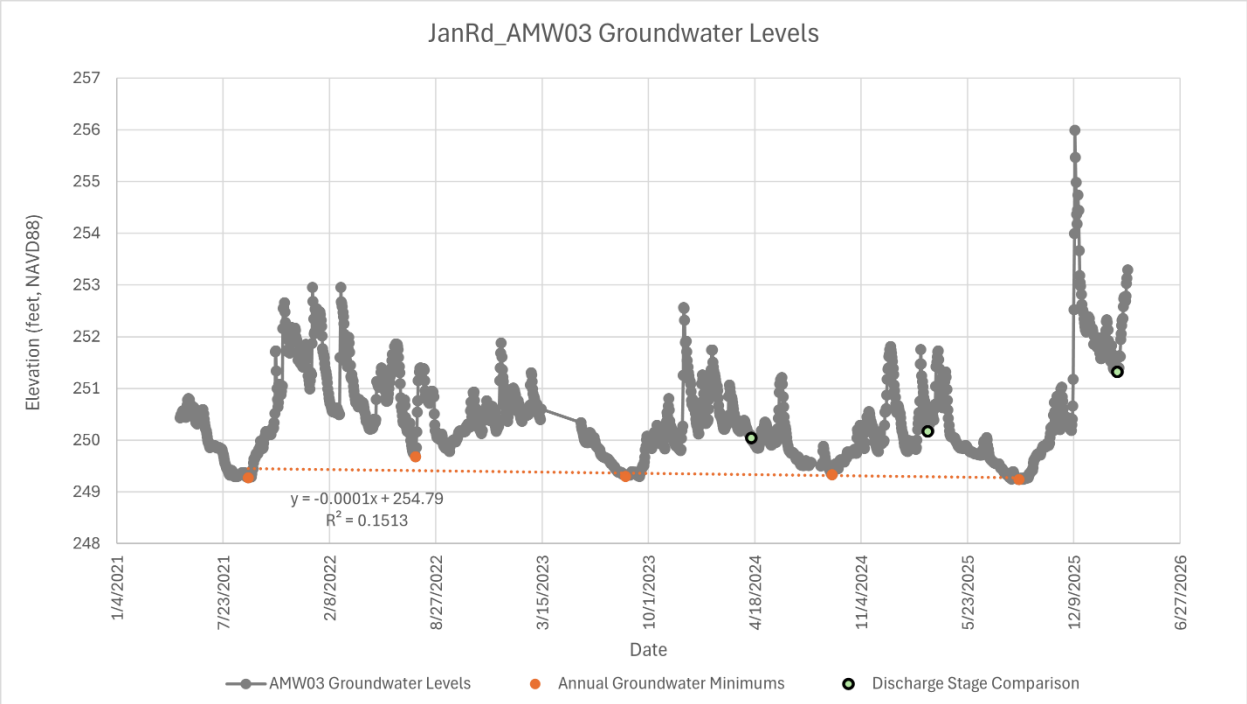


Figure 14. Groundwater levels at AMW03.

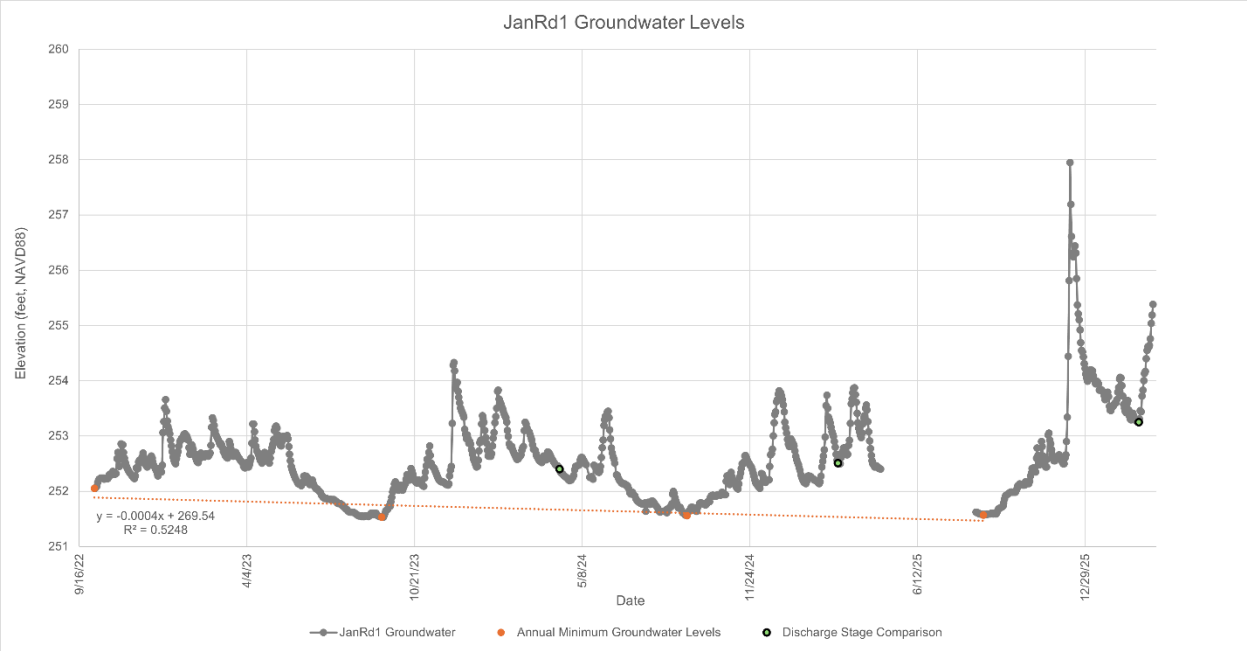


Figure 15. Groundwater levels at JanRd1.

Large Wood

Year 3 Performance Standard	Year 3 Status	Details
Increase in abundance and volume of natural and placed wood in the project area by 200% compared to pre-project baseline	ACHIEVED	The abundance of large wood volume in the project area increased by 506% compared to baseline.

Large wood abundance and volume were calculated within the project area from aerial imagery collected pre-project (2021) and in Year 1 (2023) and Year 3 (2025) pre-flood. Large wood was defined as pieces >1m in length and 10 cm in diameter. Wood area was delineated from orthoimagery (Figure 16), and a pre-established relationship between wood area and volume in the Cedar River was used to calculate wood volume (WSE 2023), except for ballasted wood jack volumes which were calculated from as-built drawings.

In Year 3 (prior to the December flood), large wood abundance and volume was similar to observations made in Year 1, which was a substantial increase over pre-project conditions (Table 4). Small pieces of wood continued to accumulate on the constructed log jam at the side channel inlet, and large wood started accumulating on certain ballasted wood jacks. Deposition of wood has also been observed in front of and below the conifer boles placed at the channel split, though these were not captured by the boles themselves. Overall, large wood volume within the project area increased by 506% between pre-project conditions and Year 3 (from 3,040 to 18,422 cubic feet of wood; Table 4), largely due to placement of 16,357 ft^3 of large wood (King County 2024).

Following the December 2025 flood event, wood loading is likely much higher, as the channel spanning jam at the side channel inlet expanded greatly and large wood moved into the side channel and floodplain. An updated delineation representing post-flood conditions was not available at the time of this report.

Table 4. Large wood volume (cubic feet) within the project area, calculated from wood area.

Storage pattern	Pre-project (2021)	Year 1 (2023)	Year 3 (2025)[1]
Jam	2,380	16,787	16,414
Piece	660	1,433	2,007
Total	**3,040**	**18,220**	**18,421**

[1] Prior to the December 2025 flood event.

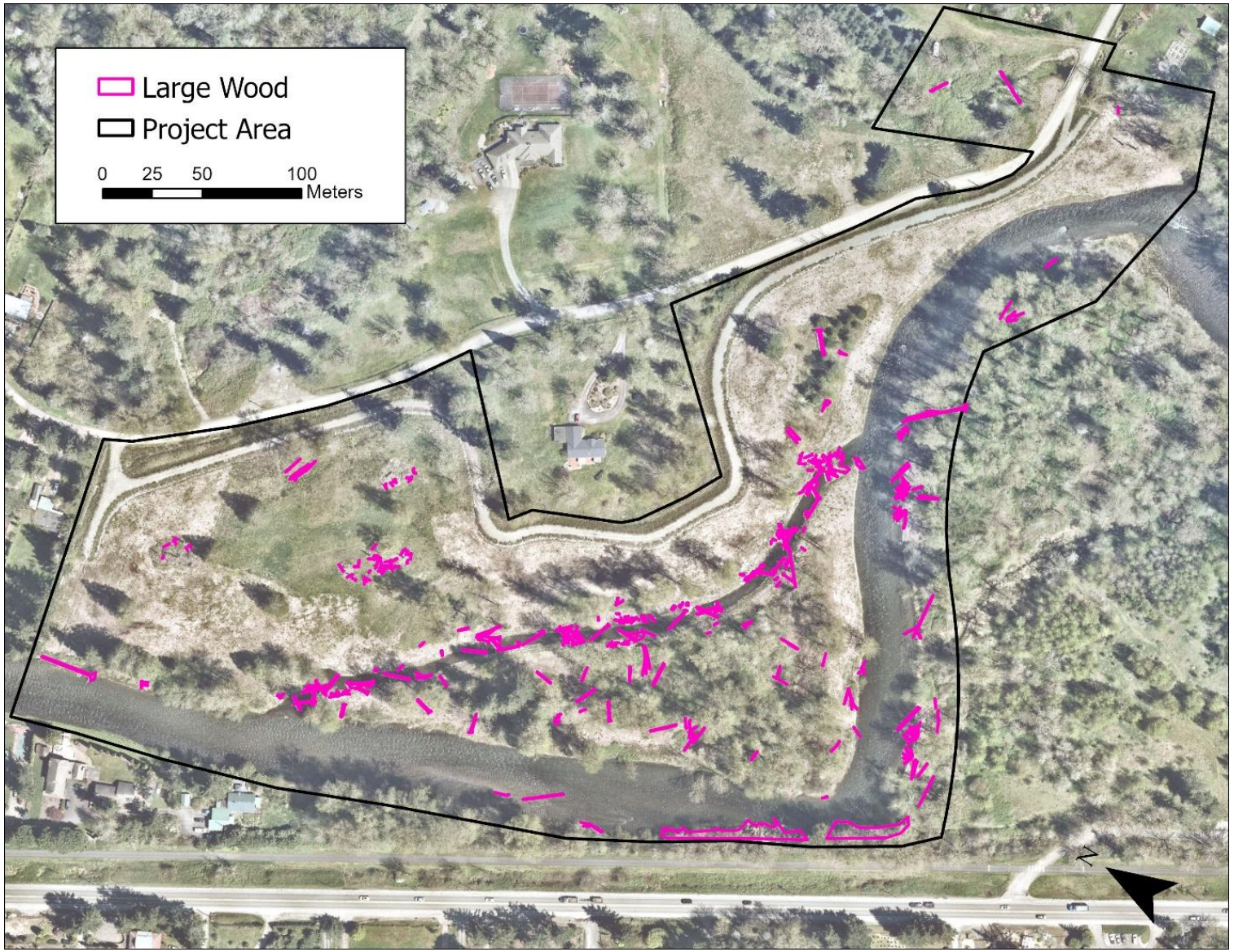


Figure 16. Large wood in the Jan Road project area delineated from aerial imagery in April 2025, prior to the December flood event.

Aquatic Habitat

Low Velocity Habitat

Year 3 Performance Standard	Year 3 Status	Details
Hydraulically modeled area **of low velocity habitat** (<1.5 ft/sec) is at least 50% higher at median spring rearing flows and 2-year flood flow compared with pre-project baseline.	ACHIEVED	Based on Year 1 results, when similar hydraulic conditions were observed, modeled low velocity habitat increased 337% at the median spring rearing flow, and increased 285% at the 2-year flood flow. Field collected data in Year 3 confirmed increased low velocity habitat.

Hydraulically modeled low velocity area (< 1.5 ft/sec) at median spring rearing flow (482 cfs) within the Jan Road project area boundary showed a 337% increase between 2020 and 2023 (from 1,557 m^2 to 6,797 m^2; King County, 2024). At the 2-year flood flow (2,419 cfs at the site), when low velocity areas are crucial for juvenile salmonid refuge, hydraulic model results showed a 285% increase in low velocity area between 2020 and 2023 (King County, 2024). Major hydraulic changes were not observed between 2023 and the December 2025 flood event, so conditions throughout most of Year 3 were similar. Updated hydraulic modeling with 2025 conditions was not available at the time of this report.

Field measured low velocity habitat (<1.5 foot/sec) at near the median spring rearing flow (550-570cfs at Renton) remained similar to area measured in Year 1, which represented a dramatic increase from baseline conditions (282% increase) and substantially more habitat than at a control reach (Figure 17, Figure 18). While overall low velocity area measured in Year 3 was slightly lower than Year 1, the amount of low velocity habitat in the side channel increased, reflecting decreased flows through the side channel prior to the December flood event. Following the flood, habitat complexity in the side channel and floodplain increased dramatically, and we anticipate low velocity areas have shifted.

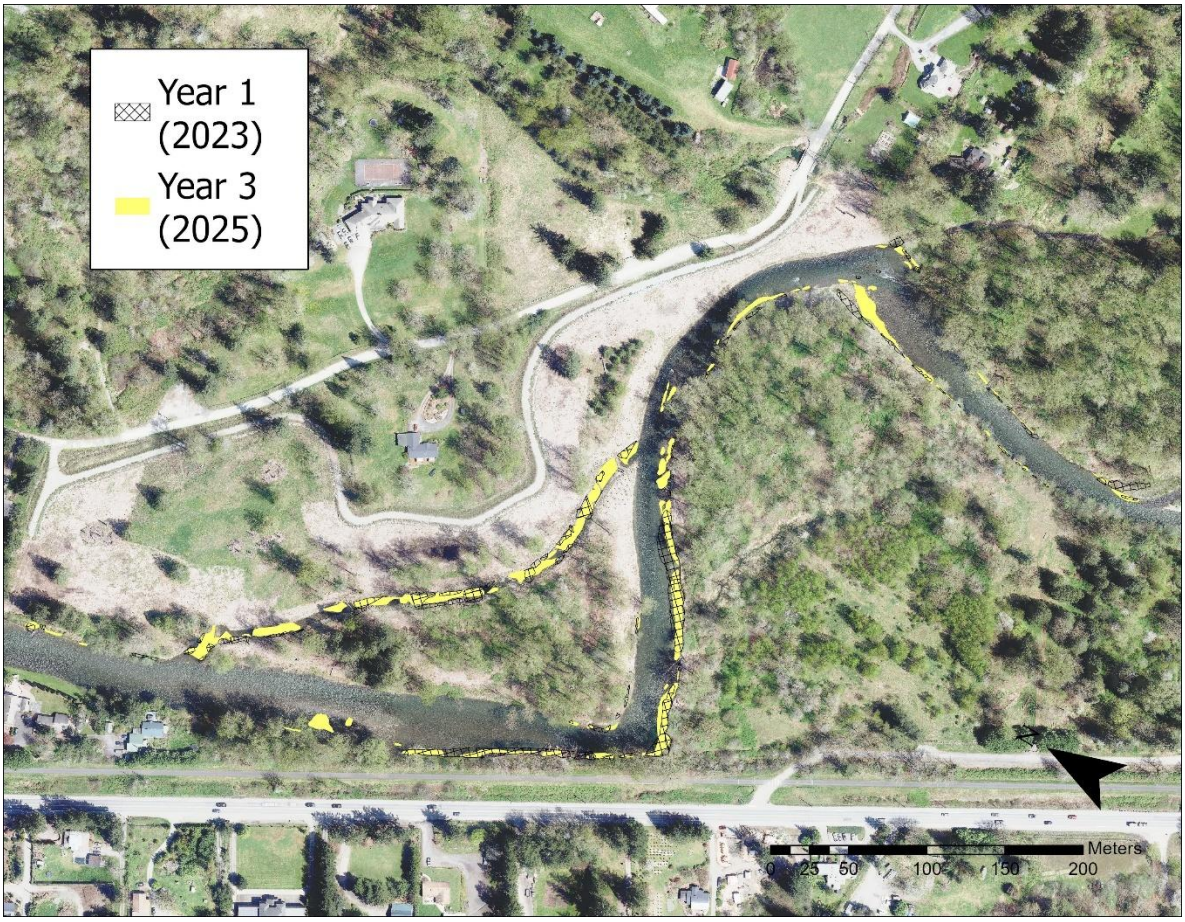


Figure 17. **Low velocity habitat areas (<1.5 fps) measured in the field in Year 1 (3/14/2023) and Year 3 (3/18/2025).**

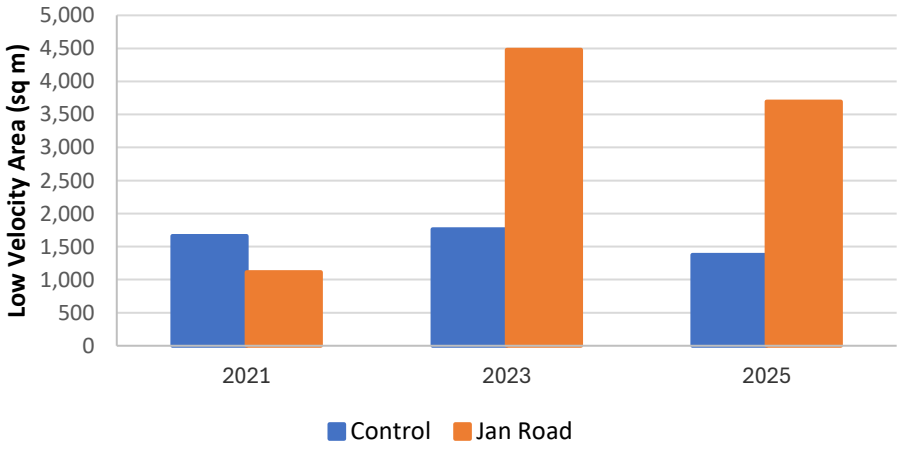


Figure 18. **Low velocity habitat areas (<1.5 fps) measured in the field before (2021) and after (2023, 2025) construction. Flows during data collection ranged from 550-620 cfs at Renton.**

Deep Pools

Year 3 Performance Standard[1]	Year 3 Status	Details
Number of deep pools at median spawning flow (350 cfs) as determined from LiDAR and hydraulic modeling will increase in Year 1 compared to pre-project baseline.	N/A	New pools have formed within the side channel and mainstem, estimated to be 2-4 feet deep at low flows prior to the December flood event. Pre-existing deep pools in the mainstem persisted.

[1]Performance standard for Year 3 not established.

Deep pools in the mainstem Cedar along the CRT7 revetment persisted in Year 3, with both the pool at the upstream end of the revetment and the pool along the 1998 repair site estimated at over 6 feet deep. The shallow mainstem pools created from placement of river gravels that were observed in Year 1 were absent in Year 3, as placed gravels had mobilized downstream.

Pools observed in the side channel in Year 1 (King County, 2024) persisted into Year 3: at 355 cfs (USGS Cedar Below Landsburg) the side channel inlet pool was measured at 3 feet deep, the plunge pool formed by a channel spanning log was 3.4 feet deep, and the pool near the side channel outlet was 4.3 feet deep. Thirteen other shallower pools were also observed in the side channel, ranging from 1.6 to 2.8 feet deep (Figure 19). Following the December 2025 flood event, several new pools formed around natural and placed wood in the side channel, and some of the pools measured in summer 2025 had been filled in. Updated post-flood pool data was not available at the time of this report.



Figure 19. Pool locations labeled by water depth (feet) on June 23, 2025, at 355 cfs (USGS at Renton).

Ballasted Log Jacks

Year 3 Performance Standard	Year 3 Status	Details
Deposition of fine sediment and low velocity wetted areas will be visually observed around and within log jacks.	ACHIEVED	Low velocity area was observed within ballasted wood jack structures. Fine sediment deposition has been observed in select areas around the structures.

Ballasted log jacks continued to slow water velocities along CRT7, providing low velocity areas within log jacks and in the alcove adjacent to the 1998 repair where no jacks were placed. Deposition of fine sediments has been observed in front of log jacks at the upstream-most area (where flow eddies) and within and in front of jacks at the downstream end of the CRT7 Revetment (Figure 20). Evaluation of the flood performance and stability of log jacks is included in the “Flood Hazard” section of this report.



Figure 20. Low velocity habitat observed within ballasted wood jacks and deposition of fine sediments at the downstream end (white arrow). Photo taken April 21, 2025.

Hydraulically Suitable Habitat

Year 3 Performance Standard	Year 3 Status	Details
Area of **hydraulically suitable habitat**[1] for Chinook and steelhead juvenile **rearing** is at least 50% higher at median spring rearing flow than pre-project baseline.	ACHIEVED	Based on Year 1 results, when similar hydraulic conditions were observed, area highly suitable for juvenile Chinook and steelhead rearing at 482cfs increased by 454% and 379%, respectively.
Area of **hydraulically suitable habitat**[1] for Chinook **spawning** is at least 25% higher at median spawning flow than pre-project baseline.	NOT ACHIEVED	Based on Year 1 results, when similar hydraulic conditions were observed, area that was highly hydraulically suitability for Chinook spawning decreased 18% in the project area compared to pre-project conditions.

[1] Hydraulically suitable habitat are areas with water velocities and depths preferred by a species and life stage.

Hydraulic conditions in 2025 prior to the December 2025 flood event were not dramatically different from conditions in 2023, with the largest difference being less water flowing through the side channel. Updated 2025 hydraulic modeling was unavailable, so results using Year 1 (2023) modeling were considered generally representative of Year 3 (2025) conditions. In Year 1, hydraulically suitable habitat (i.e., suitable water velocities and depths for a species and life-stage using WDFW habitat suitability curves) at median spring rearing flow (482 cfs) for juvenile Chinook and *Oncorhynchus mykiss* rearing increased by 59% and 42% respectively compared to pre-project conditions. When considering only areas that would be highly hydraulically suitable (i.e., index ≥ 0.7 when it ranges from 0-1), results showed a 454% and 379% increase in highly suitable rearing habitat for Chinook and *O. mykiss* respectively (King County, 2024). Area with highly suitable hydraulics for Chinook spawning at median spawning flow (351 cfs) decreased by 18% in Year 1 compared to pre-project conditions, primarily due to the observed reduced water velocities which were both an intended project outcome and a primary reason that suitability for juvenile salmonid rearing increased. Additional details of the hydraulic habitat suitability analysis and results are available from King County (2024).

Bioenergetically Suitable Habitat

Year 3 Performance Standard	Year 3 Status	Details
Bioenergetically suitable habitat (positive net rate of energy intake) for juvenile Chinook salmon will increase compared to baseline[1].	ACHIEVED	Based on Year 1 results, average net rate of energy intake for Chinook fry increased by 346%.

[1] Bioenergetically suitable habitat is not a formally defined performance standard for the Jan Road Levee Setback project but is an appropriate metric to evaluate project goals.

Bioenergetics models for drift-feeding fish like salmonids provide a way to evaluate habitat beyond physical suitability (e.g., water depth and velocity) by including energy gains and losses, thereby providing a more biologically relevant metric of habitat quality. We used an open-source habitat suitability curve-based bioenergetics model, "BioenergeticsHSC", and hydraulic model output to evaluate changes in energetically-favorable habitat for juvenile Chinook salmon (Naman et al., 2020a, 2020b). Hydraulic modeling output from 2025 was not available, but hydraulic conditions in 2025 prior to the December flood event were observed to be similar to 2023 so hydraulic modeling results from 2023 were used to evaluate bioenergetically favorable habitat in Years 1-3.

Bioenergetics modeling using hydraulic modeling output from Year 1 (2023) showed improvements in bioenergetically-favorable habitat for drift-foraging juvenile salmon in the project area compared to pre-project. Specifically, the average net rate of energy intake (NREI; which incorporates both energy intake from feeding and energetic costs of swimming, feeding, and metabolizing) for a 45-mm , 1.0 gram (g)Chinook salmon fry increased by 346% (from -0.004 to 0.01 J/s). While the magnitude of change in mean NREI appears relatively small, this represents a change from no growth (negative NREI) to potential for growth (positive NREI), and the gains in bioenergetically favorable habitat are clear when comparing histograms of NREI values (Figure 23). Results showed substantial increases in the frequency of model cells with NREI values between 0.02 – 0.1 J/s (Figure 23). For salmonid fry, an energy intake of 10 kJ of digestible energy per 1 g of weight gain has been proposed (Kaushik and Médale, 1994). Assuming a fish forages for 4 hrs./day in areas with NREI values of 0.02 – 0.1 J/s, that fish could grow approximately 0.03 – 0.1 g/day, achieving 1 g of weight gain in 10 – 33 days. Under the same assumptions, growth of a 1.0 g Chinook salmon at the maximum modeled NREI value of 0.16 J/s could be 0.2 g/day and it would achieve 1 g weight gain in only 5 days.

The increase in NREI can be explained by substantial increases in modeled mean prey capture success, prey ingestion rate, and the resulting gross rate of energy intake, as well as decreases in energetic costs of swimming (Table 5). All of these are likely attributable to greater availability of habitat with lower water velocities in the constructed side channel and in mainstem areas influenced by ELJs and sediment placement (Figure 21, Figure 22). We obtained similar results in increased NREI when modeling a 75-mm, 4.7-g juvenile Chinook, representing parr that use the site later in the spring.

Interestingly, the pool at the upstream end of the CRT7 revetment where we have observed high densities of yearling coho did not show up as bioenergetically favorable habitat (i.e., high NREI) in the Chinook fry model (Figure 22). This observation is likely due to near-zero velocities in this area that create low rates of prey delivery in the model, and thus low rates of energy gain. These habitats (deep pools) are known to be high quality habitats, but fish may switch to different foraging strategies like benthic- or search-foraging in these habitats (Rossi et al. 2021), which are not represented in this bioenergetics model.

Following the December 2025 flood event, dramatic changes in side-channel and floodplain habitat were observed, which likely changed location and magnitudes of bioenergetically favorable habitat in the project area. The increase in habitat diversity suggests that bioenergetically-favorable habitat would have been maintained or enhanced by the flood event, but updated quantitative analyses were not available for this report.

Table 5. Bioenergetics model results[1] for a drift feeding 45-mm 1-g juvenile Chinook salmon pre-project (2020) and in Year 1 (2023) at median spring rearing flows (492 cfs).

	2020	2023	Percent change
Mean Net rate of energy intake (J/s)	-0.004	0.01	346%
Mean Gross rate of energy intake (J/s)	0.01	0.02	111%
Mean Total energy costs (J/s)	0.014	0.011	-19%
Mean reaction distance (cm)	22.91	21.33	-7%
Mean energy cost of maneuvering (J/s)	0.002	0.001	-25%
Mean energy cost of focal swimming (J/s)	0.012	0.010	-18%
Mean capture success proportion	0.04	0.10	162%
Mean proportion of time handling prey	0.026	0.029	14%
Mean prey ingestion rate (items/s)	0.001	0.003	128%
Mean prey encounter rate (items/s)	0.064	0.061	-5%

[1]See Naman et al. 2020 for further explanation of these metrics.

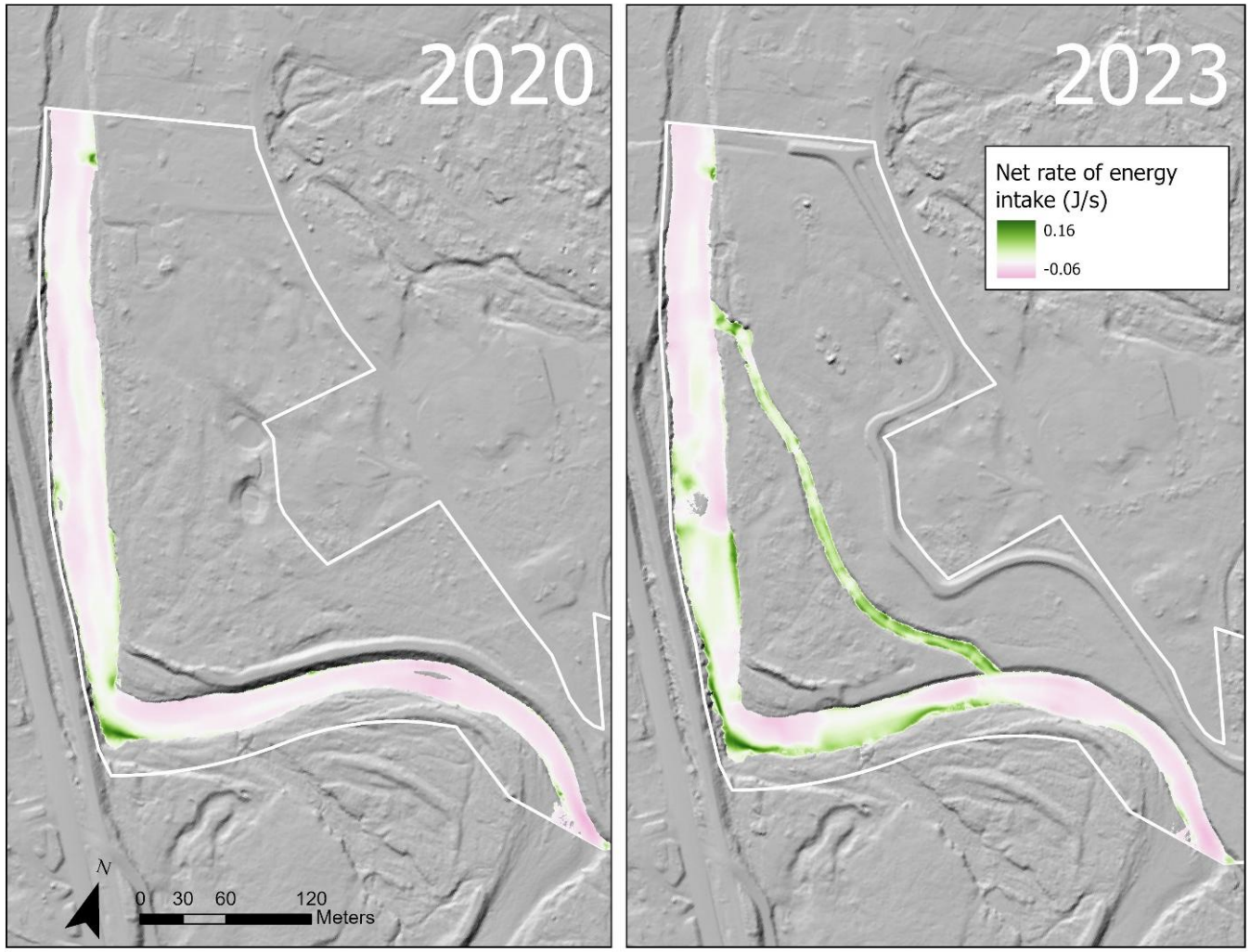


Figure 21. **Net Rate of Energy Intake (NREI) for a drift-feeding 45-mm 1-g juvenile Chinook in pre-project (2020) and Year 1 (2023) conditions at mean spring rearing flows (492 cfs). Green areas represent a positive NREI, pink areas represent a negative NREI.**

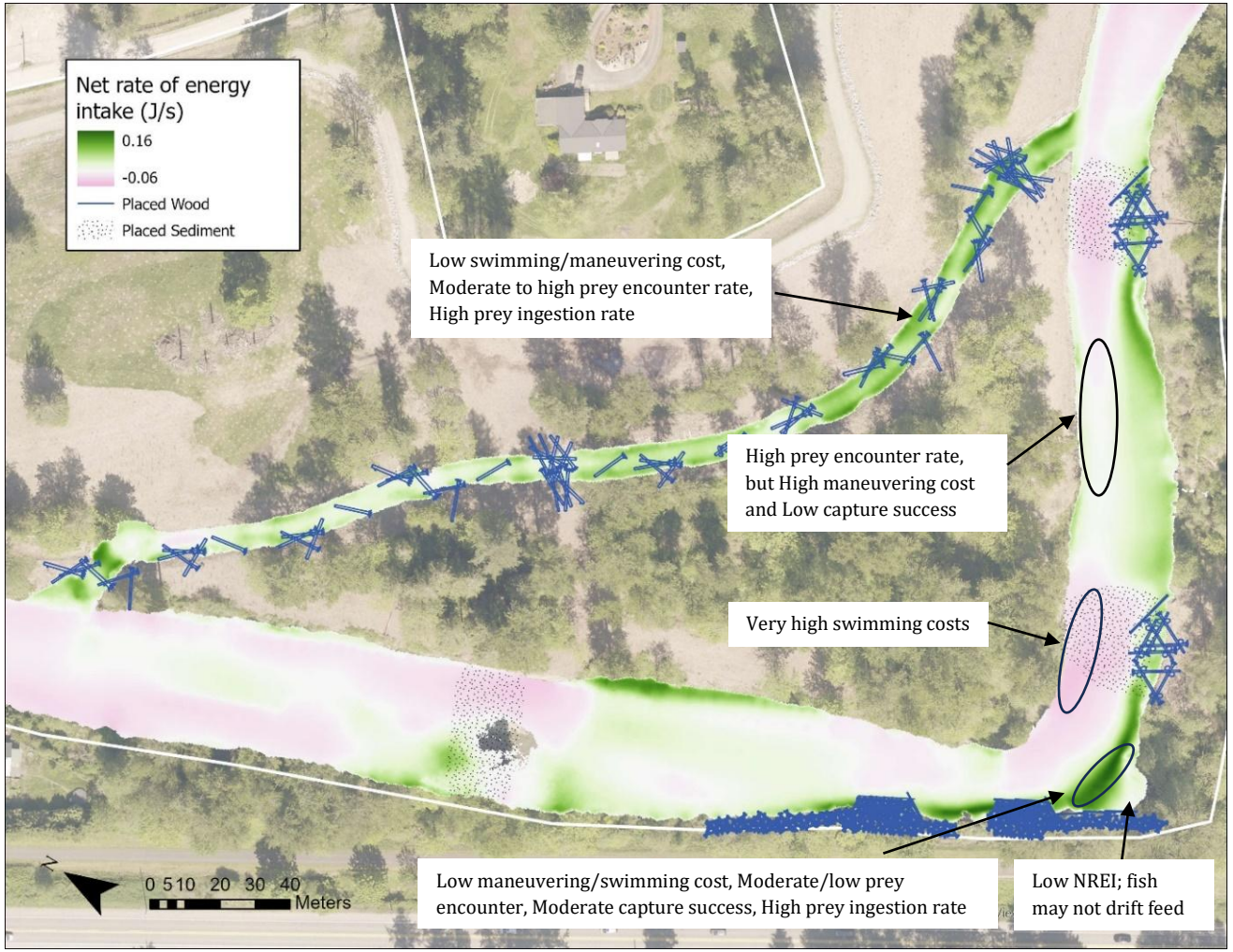


Figure 22. **Placed wood and sediment in relation to modeled Net Rate of Energy Intake (NREI) for a drift-feeding 45-mm 1-g juvenile Chinook in Year 1 (2023) at mean spring rearing flows (492 cfs). Annotations describe why areas are modeled to have high (green), moderate (white), or low (pink) NREI.**

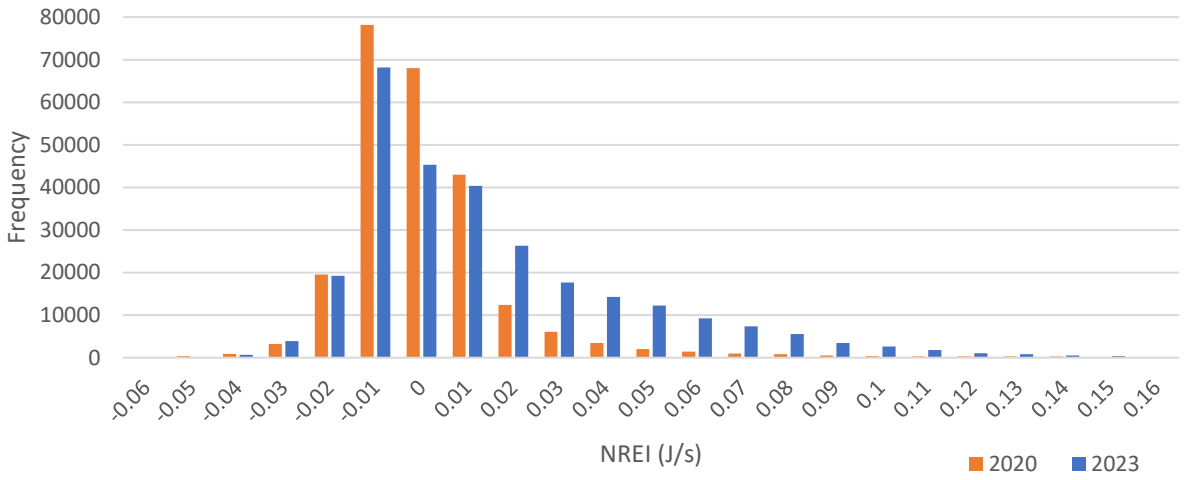


Figure 23. **Frequency of modeled Net Rate of Energy Intake (NREI) values for a drift-feeding 45-mm 1-g juvenile Chinook pre-project (2020) and in Year 1 (2023) at mean spring rearing flows (492 cfs). Shift to more positive NREI values is seen in 2023.**

Water Temperature

Year 3 Performance Standard	Year 3 Status	Details
Temperature change between gages upstream and downstream of the project area is ≤0 degrees C.	ACHIEVED	Median mainstem temperature change was ≤ 0ºC during 11 months of 2025. Side channel temperatures were similar to mainstem temperatures between March – October but warmer between November - February. Evidence of groundwater-surface water exchange created thermal diversity in the side channel.

Change in surface water temperature across the project reach was evaluated using mainstem temperature gages; the upstream gage was located just downstream of Taylor Creek on the right bank (JanRd_H2), and the downstream gage was located downstream of the project on the left bank (JanRd_H4). Gages recorded data between March 30, 2019, and November 21, 2025, on 15-minute intervals. The median difference between downstream and upstream mainstem temperature was equal to or less than zero in all months but December in 2025. Year 1 analyses also found that there was no difference in temperature between upstream and downstream gages in most months. By comparison, pre-project data indicated higher downstream water temperatures (Figure 24),

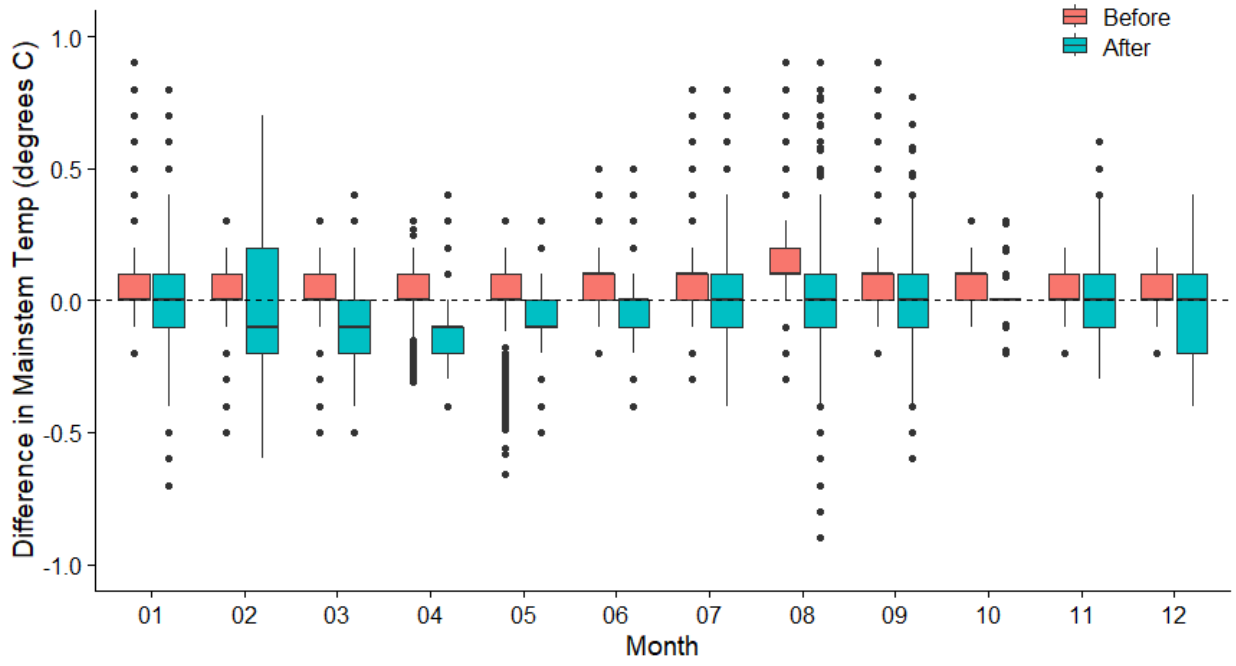


Figure 24. **Difference in 15-minute mainstem water temperature downstream versus upstream of the Jan Road project before (2019 – April 2022) and after (March 2023 – November 2025) construction. Values above zero indicate side channel temperatures higher than mainstem temperatures.**

possibly suggesting that the project may have influenced water temperature; more years of data are needed to evaluate this hypothesis.

Water temperatures in the center of the side channel were similar to mainstem temperatures from March through October in 2024 and 2025 (median difference 0.2°C), but were slightly warmer than mainstem temperatures from November through February (median difference 0.5°C, Figure 25). Temperatures collected from a groundwater seep along the bank of the side channel may provide some insight as to why these patterns are observed. Water temperatures at the seep were warmer in winter (by up to 3.0ºC between Oct-Feb) and cooler in summer (by up to 6.1ºC between Mar-Sept) compared to water temperatures collected in the center of the side channel (Figure 26). This warmer winter temperatures in the side channel may provide better overwintering rearing habitat for juvenile salmonids than was present previously in the reach. In summer, some locations (e.g., gage location at center of side channel) exceed 16°C (Figure 26) which may be unfavorable for salmonids; however groundwater seep data remained below 16°C throughout the monitoring period, indicating that some locations within the side channel would remain suitable for salmonid use. Thermal diversity provided by the side channel and apparent groundwater-surface water exchange has likely improved aquatic habitat quality throughout the reach.

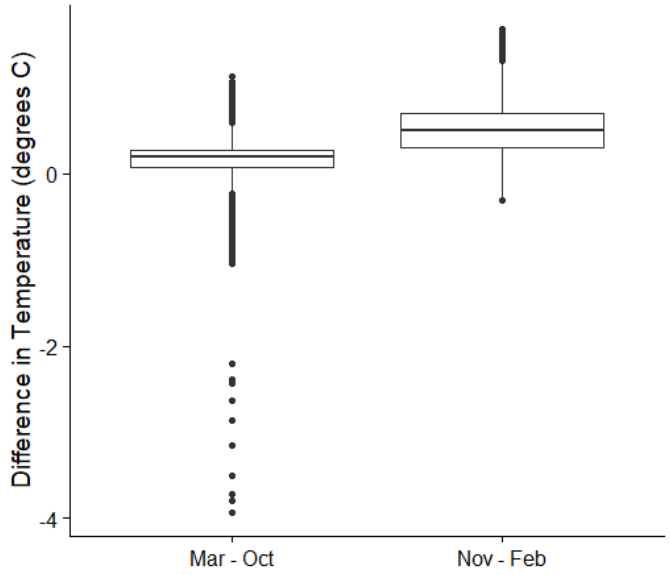


Figure 25. **Difference in mainstem and side channel water temperatures in warmer (Mar – Oct) and cooler (Nov – Feb) months. Data collected between June 2024 and November 2025. Values above zero indicate side channel temperatures higher than mainstem temperatures.**

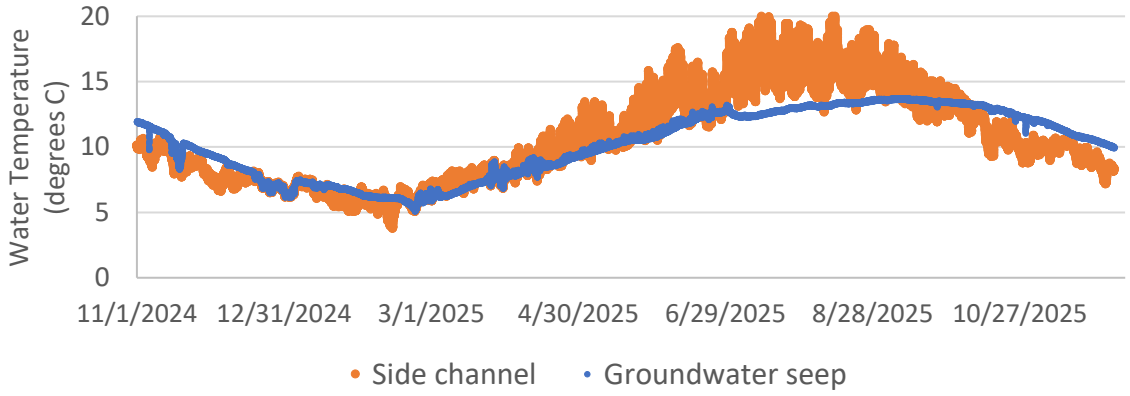


Figure 26. **Water temperature in the center of the side channel and an adjacent groundwater seep along the side channel bank.**

Fish Use

Year 3 Performance Standards	Year 3 Status	Details
Juvenile salmonids are observed during spring-time snorkel surveys in newly created habitat areas (e.g., side channels, mainstem log jams).	ACHIEVED	Juvenile Chinook, coho, and trout were observed within the constructed side channel, mainstem ELJs, and ballasted wood jacks between March and May 2025.

During night-time snorkel surveys, target salmonid species (juvenile Chinook, coho, and trout) were observed using low velocity habitats created by constructed features, including within the side channel and constructed log structures within the side channel and mainstem (Figure 27). These observations demonstrate the project has met the performance standard of juvenile salmonid use of newly created habitat.

Similar to 2023, juvenile Chinook salmon were found in all constructed habitat types (side channel, mainstem and side channel ELJs, ballasted wood jacks; Figure 27). Chinook densities at Jan Road were relatively similar to those observed in 2023 (averaged across all units surveyed: 0.15 fish/m^2 in 2023, 0.11 fish/m^2 in 2025), and lower than densities at a downstream control reach (0.26 fish/m^2) as was also observed in 2023. Chinook densities at the project site tended to be higher in mainstem habitats than side channel habitats, with highest densities observed in mainstem bars, unarmored banks, and engineered log jams (Figure 27, Figure 28). Of 246 Chinook observed in 2025, 119 were <50mm fork length (FL) and 47 were 50-100mm FL.

Juvenile coho were also observed in all constructed habitat types, and higher densities of coho were observed compared to other salmonid species (Figure 29). Generally, coho densities in 2025 were higher than those observed in 2023 (averaged across all units surveyed: 0.48 fish/m^2 in 2023, 0.78 fish/m^2 in 2025). Notably, larger juvenile coho and trout (>1000mm) were observed using the sheer line created by the jacks and the alcove along the 1998 repair site in May 2025, where bioenergetic modeling showed that juveniles could attain some of the highest net rate of energy intake in the project area (see Bioenergetics section above). As in 2023, March snorkel surveys found a high density of yearling coho using the eddy at the upstream end of the CRT7 revetment along the ballasted wood jacks. Across all Jan Road snorkeling events in 2025, 994 coho were observed; 556 were <50mm FL, 270 were 50-100mm FL, and 168 were >100mm FL.

Juvenile trout densities were comparable to Chinook densities in 2025 (Table 6); averaged across all units surveyed, trout density was 0.9 fish/m^2. Of 160 trout observed at Jan Road in 2025, 102 of them were <100mm FL, 35 were 100-200mm FL, and 23 were >200mm.

Table 6. **Average spring-time salmonid density (fish/m^2) by constructed habitat type and along remaining armored banks (Rutledge Johnson Levee) in the Jan Road reach and control reach. All snorkeled units and snorkeling events in 2025 combined. Jan Road snorkeled reach includes upstream areas adjacent to the future Rutledge Johnson project.**

	Chinook density (SD)		Coho density (SD)		Trout density (SD)	
Habitat type	Jan Road	Control	Jan Road	Control	Jan Road	Control
Mainstem ELJ	0.39 (0.19)	--	0.60 (0.55)	--	0.10 (0.08)	--
Mainstem BWJ	0.10 (0.04)	--	0.45 (0.35)	--	0.24 (0.20)	--
Mainstem bar	0.29 (0.35)	0.0	0.55 (0.79)	0.0	0.08	0.0
Mainstem unarmored bank	0.24 (0.20)	0.0	0.81 (0.79)	0.26 (0.35)	0.21 (0.24)	0.0
Side channel*	0.08 (0.05)	0.22 (0.37)	0.39 (0.33)	0.26 (0.35)	0.20 (0.30)	0.06 (0.06)
Side channel ELJ	0.13 (0.13)	--	0.22 (0.21)	--	0.09 (0.06)	--
Mainstem armored bank	0.06 (0.03)	0.21 (0.38)	0.31 (0.44)	0.12 (0.16)	0.10 (0.02)	0.12 (0.16)
Backwater	0.46 (0.59)	0.0	2.37 (2.55)	0.0	0.0	0.0

*Side channel type combines side channel, side channel bars, and side channel banks.

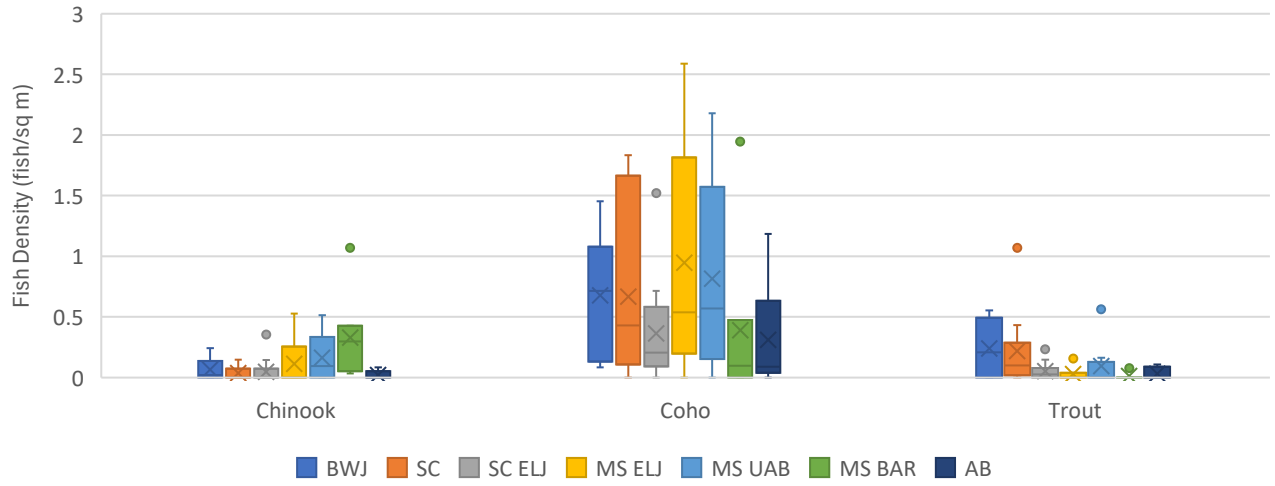


Figure 27. **Spring-time salmonid density by constructed habitat type and along remaining armored banks in the Jan Road reach in 2025. BWJ = ballasted wood jacks, SC = side channel, SC ELJ = side channel engineered log jam, MS ELJ = mainstem engineered log jam, MS UAB = mainstem unarmored bank, MS BAR = mainstem bar, AB = armored bank. All snorkeled units and events combined. Boxes represent the 25th, 50th, and 75th quartiles. The whiskers indicate values up to 1.5x the inter-quartile range and points are observations beyond 1.5x the inter-quartile range. X markers represent the mean.**

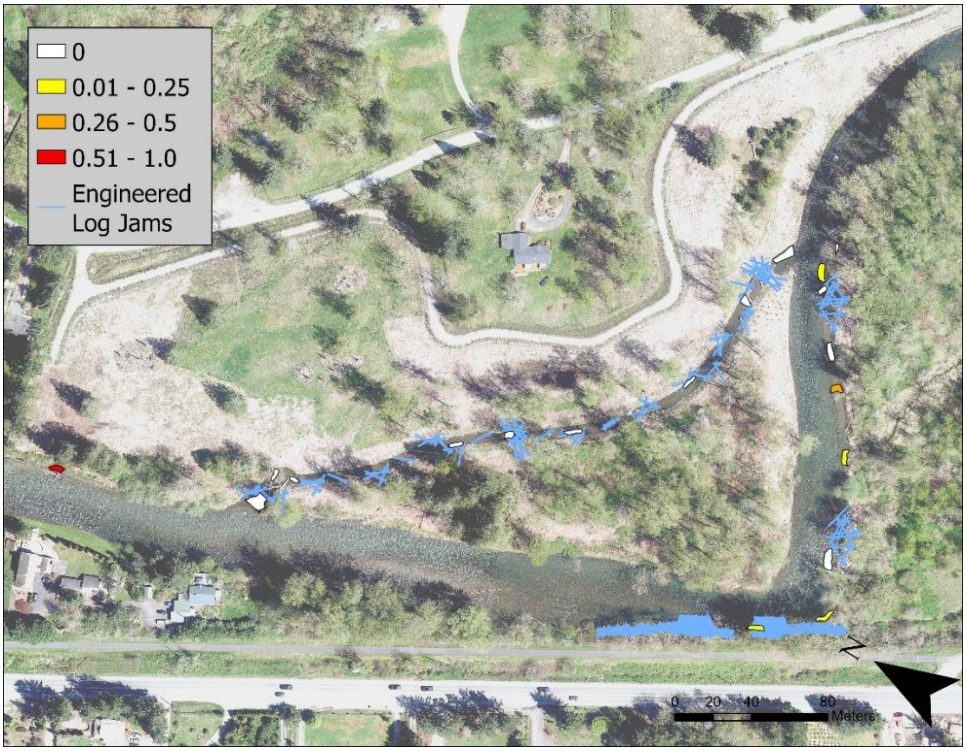


Figure 28. **Juvenile Chinook salmon densities in snorkeled low velocity habitat units (5/21/2025). Blue polygons represent placed wood structures.**



Figure 29. **Juvenile coho salmon densities in snorkeled low velocity habitat units (5/21/2025). Blue polygons represent placed wood structures.**

Riparian Vegetation

Year 3 Performance Standard	Year 3 Status	Details
Survival of installed plants is 80% after Year 3.	ACHIEVED	Across eight transects sampled, average survival was 94% after re-plantings in early 2024 and 2025.
Percent cover of planted and naturally recruited woody species will be 40% by Year 3.	NOT ACHIEVED	Average percent cover of woody natives was 14.7%, and percent cover of all desirable native species averaged 20.3%.
Less than 20% invasive cover in planted areas (0% KC Class A noxious weeds, bindweed, knotweed).	ACHIEVED	Invasive cover averaged 2.6% across transects, with no Class A noxious weeds, bindweed, or knotweed.

Survival of planted woody species, as measured by 2-m wide belt transects, averaged 94% by Year 3, ranging from 63% to 116% between the eight transects monitored. Survival was greater than the 80% performance standard in all but two transects. Survival was lowest in a portion of the riparian enhancement planting area where pre-existing grasses were retained, and no sheet mulch or compost were added (transect RE2). Survival in this area has increased substantially since 2023 (Figure 31), after replanting, watering, and herbicide treatments around plantings were implemented, however vegetative cover is still very low (Table 7). Plantings in all other areas did not receive irrigation, suggesting that plantings will survive even without irrigation if soil preparation is sufficient. In contrast, establishment has been more difficult in areas without adequate soil preparation (compost, mulch) and with competing grasses.

Table 7. Vegetation cover and survival by transect in 2025. Transects named by planting zone (RE = Riparian Enhancement, RU = Riparian Upland, WET = areas observed with standing water most of the year, RT = Riparian Transition).

Transect	Total % Native Woody Cover	Total % Desirable Native Cover[1]	Total % Nonnative Invasive Cover	Survival
RE1	27.8%	41.1%	2.0%	100%
RE2	0.1%	4.3%	0.4%	63%
RU1	4.1%	4.1%	5.2%	78%
RU2	7.3%	11.9%	2.7%	96%
WET1	9.6%	19.1%	3.6%	94%
WET2	12.3%	15.7%	0.7%	90%
RT1	25.3%	34.8%	2.1%	116%
RT2	30.9%	31.0%	4.1%	111%

[1]Includes sedges, rushes, Pacific blackberry, and western sword fern.



Figure 30. **Representative vegetation monitoring transects in 2025: RU2 (a), RT2 (b), RE1 (c), and WET2 (d).**

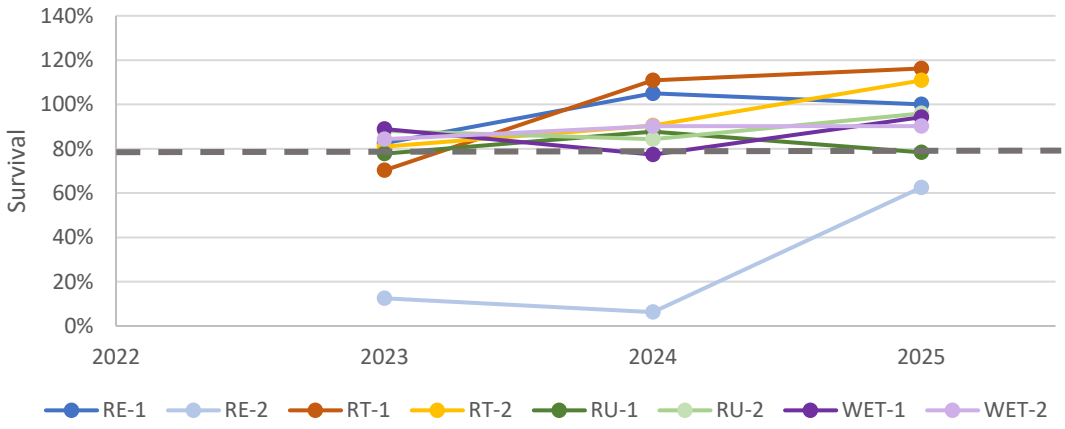


Figure 31. **Vegetation survival by transect between Year 1 (2023) and Year 3 (2025), including installed stakes. Year 3 performance standard shown with dashed line.**

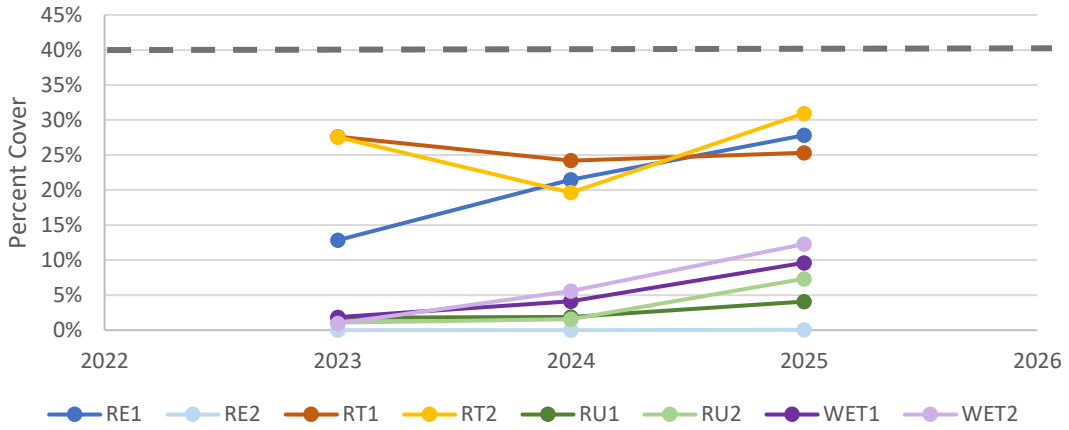


Figure 32. Vegetation cover by transect between Year 1 (2023) and Year 3 (2025). Year 3 performance standard shown with dashed line.

Vegetation cover was measured by the line intercept method across eight 50-m long transects (Figure 30). Percent cover of native woody species that were installed or naturally recruited averaged 14.7% across transects; three transects had >25% cover of native woody species (Table 7, Figure 32). This is well below the performance standard of 40% cover of native woody species; however, the performance standard may be higher than is realistic given that it was informed by planting performance at a site in a different basin with regular irrigation and far more natural recruitment of woody species than has been observed at the Jan Road site. Additionally, the December 2025 flood exposed a layer of hard packed materials within planting areas at the upstream end of the site, which may have contributed to slower growth and establishment in these areas (RU1, WET1, WET2). When considering all desirable native species, including naturally recruited sedges and rushes, average cover across transects was 20.3%.

The performance standard for invasive cover (<20% cover in planted areas, and 0% King County Class A noxious weeds, bindweed, and knotweed) was met, with an average of 2.6% cover of non-native invasive species observed across transects. Non-native invasive species encountered included wild carrot (*Daucus carota)*, Himalayan blackberry (*Rubus armeiacus*), Saint John's wort (*Hypericum perforatum*), birds-foot trefoil (*Lotus corniculatus*), bull thistle (*Cirsium vulgare*), bittersweet nightshade (*Solanum dulcamara*), common tansy (*Tanacetum vulgare*), butterfly bush (*Buddleja davidii*), and creeping buttercup (*Ranunculus repens*). While no Japanese knotweed (*Polygonum cuspidatum*) was observed within monitoring transects, sparse resprouts were observed in a handful of areas along the mainstem.

Habitat Snags

Year 3 Performance Standards	Year 3 Status	Details
Evidence of foraging (bark flaking, excavation holes) and nesting (nest cavities) is observed by Year 5.	PARTIAL	Excavations were observed on 3 of 28 installed snags by Year 3, but no evidence of nesting was observed.

Installed habitat snags were inspected for new cavities and excavation in Year 2 (September 2024) and Year 3 (late June 2025). By Year 2, the snag with evidence of excavation in Year 1 (snag N12) had an additional two excavation holes, and we observed two excavation holes in a second snag (N8). In Year 3, we observed an additional excavation in snag N8 and a new circular excavation in snag N6 (Figure 33), both within areas of recent bark loss. All excavations were generally circular but somewhat irregular in shape. All snags with evidence of excavations were intended as nesting snags, rather than foraging snags (i.e., nesting snags were larger in diameter and generally taller than installed foraging snags), though excavations did not yet appear deep enough to support nesting. We did not directly observe birds using cavities or excavating these holes, so species use is unknown, although Northern flickers, sapsuckers, and woodpeckers have been observed on site.

While it is likely that installed snags have little decay at this point, we observed an adult banded alder borer beetle on a snag in June 2025. Adults of this species lay eggs on dead wood and larvae bore into wood, so if these beetles are using the snags to reproduce, they may help soften the material and improve their quality for nesting and foraging in the future.



Figure 33. Snag in September 2024 (left) and June 2025 with evidence of new excavation highlighted with white arrow (right).

Flood Hazard

Year 3 Performance Standards	Year 3 Status	Details
Hydraulically modeled flow velocity at two locations along the CRT7 revetment will decrease relative to pre-project baseline.	ACHIEVED	Based on Year 1 results, when similar hydraulic conditions were observed, water velocities along CRT7 were reduced to 2-5 ft/sec from 6-9 ft/sec at the 100-year flood flow. Observations during the December 2025 flood event anecdotally confirmed lower velocities than pre-project.
Visual inspection (and review of LiDAR) does not identify substantial lateral (riverward) displacement of log jacks that would impact the stability of the CRT7 facility and its ability to provide reduction in erosive forces near infrastructure.	ACHIEVED	Visual observation did not identify substantial lateral displacement of log jacks in Year 3 prior to the December 2025 flood, though some settling occurred. Some displacement of jacks was observed after the flood event; implications are being assessed.
Roadway overtopping of no more than six inches (safe vehicle egress) observed.	ACHIEVED	Roadway overtopping was not observed during 2025, including during the December flood event.
Settling of levee profile of no more than six inches (freeboard maintained).	ACHIEVED	Visual observation and LiDAR differencing revealed no detectable settling.
Visual inspection does not identify damage to levee and/or biorevetment components that would impact the stability of the facility and its ability to resist channel migration into the neighborhood access road or containment of flood water.	UNKNOWN	No damage was observed to the levee or biorevetment prior to the December 2025, but after the flood event damages to the setback levee were observed. Implications for facility stability and resisting channel migration are being assessed.

The two primary flood risk reduction goals of the project were to eliminate roadway overtopping at SE 197th Place and to reduce water velocities along the CRT 7 revetment during flood events. No roadway overtopping of SE 197th Place was observed in 2025, including during the December flood event when peak flows in the Cedar River reached 9,140 cfs (12/11/2025; USGS 12117600 Cedar River below Diversion near Landsburg). Visual inspections during the December flood found low water velocities along CRT7 within the ballasted log jacks. Supporting this observation, hydraulic modeling conducted using 2023 conditions showed a decrease in modeled water velocities along the CRT7 Revetment at the 100-year flow (King County, 2024).

No major damage to constructed elements was observed in 2025 prior to the December flood event. After the December flood, some rock was observed to be missing from a short section of

the levee face, as well as minor erosion along the waterward top edge of the levee. Sections of the buried biorevetment were exposed by the flood. Mainstem bank log structures and side channel log structures did not appear damaged though some were partially buried. Visual inspection did not identify settling of the levee profile following the December flood, and a comparison of LiDAR data from 2023 and 2025 did not reveal significant differences in elevation along a profile of the setback levee. Damages from the December 2025 flood event and their implications are still being assessed.

Between 2023 and 2024, four log jacks in the front row of the upstream-most cluster of jacks appeared to shift and settle. Visual observations and comparison of images taken from a photo point show these jacks moving down and rotating out, as if falling into a scour hole (Figure 34); formation of a deeper pool in this area was observed in sediment analyses (Figure 8). Visual observations during repeated site visits throughout 2024 and 2025 prior to the flood event did not identify any further detectable displacement of log jacks. During the December flood event, one log jack along CRT7 mobilized approximately 700’ downstream and at least four others were damaged. Several floating bumper logs that were chained to log jacks were also displaced. The impact of these changes was still being assessed at the time of this report.

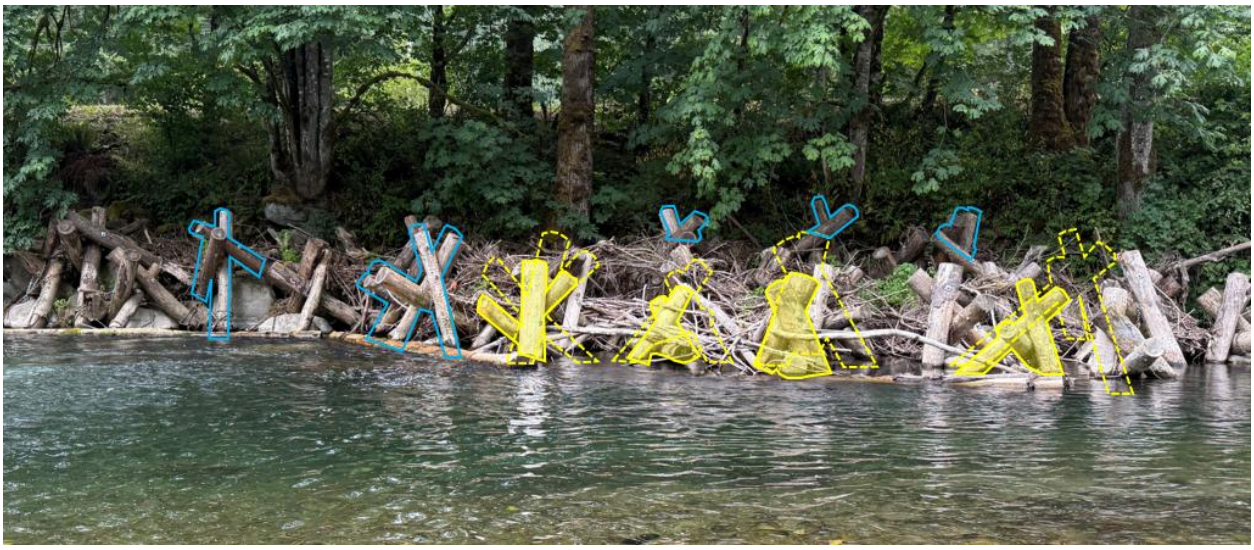


Figure 34. **Ballasted wood jacks movement over time. Photo shows conditions on 7/22/2025 with yellow polygons highlighting current position of jacks that have moved. Blue polygons show locations of jacks on 9/6/2023; solid blue lines represent jacks that haven't moved, dashed yellow lines represent previous locations of jacks that have moved.**

Metrics Not Monitored in Year 3

Sediment size was not evaluated in Year 3, as the Cedar River did not reach a peak discharge of at least 3,000 cfs prior to the December flood event, and so substantial changes to sediment size was not anticipated. This metric will be evaluated in future monitoring years.

IV. Site Maintenance and Adaptive Management

Additional plantings to replace plant mortalities were installed in early 2025 (Table 8). Plantings and re-plantings installed in the area that did not receive soil amendment, where poor survival was observed, were irrigated regularly during the summer. Regular manual and chemical weed removal were also conducted throughout the growing season. In total, 350 crew hours were spent on replanting, 240 hours on weed control, and 70 hours on irrigation.

Following the December 2025 flood, additional adaptive management actions may be needed; future actions had not yet been decided at the time of this report.

Table 8. Replacement plantings installed in early 2024 and 2025.

Species	2024 Quantity	2025 Quantity
Douglas fir (*Pseudotsuga menziesii*)	800	0
Western red cedar (*Thuja plicata*)	400	200
Sitka spruce (*Picea sitchensis*)	400	0
Quaking aspen (*Populus tremuloides*)[1]	375	0
Paper birch (*Betula papyrifera*)[1]	375	0
Bigleaf maple (*Acer macrophyllum*)	300	0
Western white pine (*Pinus monticola*)[1]	200	0
Hemlock (*Tsuga heterophylla*)[1]	0	300
Beaked hazelnut (*Corylus cornuta*)[1]	300	60
Osoberry (*Oemleria cerasiformis*)[1]	300	0
Snowberry (*Symphoricarpos albus*)	300	0
Red-osier dogwood (*Cornus sericea*)	0	150
Twinberry (*Lonicera involucrata*)[1]	300	175
Pacific crabapple (*Malus fusca*)[1]	300	0
Cascara (*Rhamnus purshiana*)	0	68
Salmonberry (*Rubus spectabilis*)	0	175
Pacific ninebark (*Physocarpus capitatus*)	0	175
Black Hawthorn (*Crataegus douglasii*)[1]	0	175
Red elderberry (*Sambucus racemosa*)	0	325
Scouler's willow (*Salix scouleriana*)[1]	0	450
Pacific willow (*Salix lucida spp. Lasiandra*)	0	200
Fringecup (*Tellima grandiflora*)[1]	300	0
Sword fern (*Polystichum munitum*)	0	150
Oregon low grape (*Mahonia nervosa*)[1]	0	30
TOTAL	**4,650**	**2,633**

[1]Species was not included in initial planting design but included in replacement plantings to increase species diversity.

V. Conclusions

Overall, the Jan Road Levee Setback project is effectively meeting its goals of restoring habitat-forming processes and functions and reducing flood risk. Riparian establishment through Year 3 as measured by cover of woody species was slower than expected, though plant survival was high on average. Aquatic habitat quantity for juvenile salmonids remained higher than baseline, and habitat quality as measured by bioenergetically favorable habitat increased compared to pre-project conditions. Surface water temperature across the reach did not increase, and the side channel provided areas with thermal diversity due to groundwater-surface water exchange. Prior to the December 2025 flood event, side channel connectivity had been decreasing, and sediment storage, wood volume, hydraulic conditions, fish use, and structural stability of facilities were relatively similar to Year 1 conditions. After the flood event, substantial channel migration and large wood recruitment improved habitat quality and increased the active channel area. The flood event also decreased the size of riparian areas in some locations, and some facility elements were damaged. However, the project achieved the goal of eliminating roadway overtopping at SE 197th Place and reducing water velocities along the CRT 7 revetment during the flood event.

Lessons Learned

Monitoring Year 3 conditions confirmed many of the lessons learned in Year 1 (King County 2024), as well as several others:

- Channel spanning jams at side channel inlets can reduce side channel connectivity over time, even if designed to be porous. Slow accumulation of small wood and sediment at this jam resulted in less flow in the side channel during summer low flow conditions.
- Increasing hydraulic diversity by creating shear zones and adjacent areas of both slow and fast water with engineered log structures can increase the availability of bioenergetically favorable habitat that is needed to support juvenile salmon growth.
- Large flood events can dramatically change floodplain connectivity, groundwater levels, and plant establishment.
- Very high flows (near 100-year flood) on the Cedar can create conditions that can mobilize ballasted log jacks. Impacts of the December 2025 flood event and potential mechanisms for mobilization are still being assessed.
- Assessing soil conditions across the project site prior to initial planting to determine where suitable conditions occur and to what extent soil amendment and preparation may be necessary could improve native plant establishment and cover. Lower performance standards for percent cover of native woody vegetation may be more realistic in this system.

Future project monitoring should continue to contribute additional lessons learned to inform design and implementation of future projects.

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Appendix A. Monitoring Objectives and Evaluation

Each objective to meet project goals is associated with an action taken and performance standard, method, and analysis plan to evaluate success over the 10-year monitoring period (Table A1; King County, 2022).

Table A1. Overview of monitoring plan to evaluate whether the project has met its overall goals. Each objective is tied to a project action, and performance standards are used to determine if actions have met the objectives. Monitoring methods and the analytical approach are also described. Performance standards in blue are required by permits or were included in the approved mitigation/monitoring plan for USACE.

Project Goal	*Objective*	*Action*	*Performance Standard*	*Monitoring Method*	*Analysis Plan*
Improve natural habitat-forming processes, function, and habitat, where feasible.	Increase active channel area compared to baseline.	Construct side channel, place wood and streambed material in mainstem, remove old levee prism and revetment.	Area of channel that is active will be at least 20% greater than pre-project baseline in every monitoring year.	Delineation from aerial imagery; active channel area defined as areas of water, banks, unvegetated gravel bars (Collins & Montgomery 2011, Konrad 2015).	Before-After comparison
	Provide perennially connected side channel.	Construct side channel, place wood and streambed material in mainstem, remove old levee prism and revetment.	Constructed side channel (or naturally formed channels) are connected at summer low flow (147 cfs).	Observation, cross sections, aerial imagery, LiDAR inspection to evaluate side channel connectivity. Flow transect to evaluate flow split between mainstem and side channel.	Before-After comparison (baseline is as-built for flow split)
	Provide sediment storage.	Set back Jan Road levee and remove former revetment and levee prism to match floodplain grade.	Net deposition in the project reach as measured by LiDAR differencing by end of monitoring period (10 years). Some years may show net decrease.	LiDAR differencing to calculate change in sediment volume.	Before-After comparison
	Reduce streambed armoring in the mainstem Cedar River.	Construct side channel and remove old levee prism, place wood and streambed material in the mainstem to promote gravel retention.	• Following a 3,000 cfs flow event, reach-averaged surface D_{50} in the mainstem decreases compared to pre-project. • Following a 3,000 cfs flow event, armoring ratio (ratio of surface to subsurface D_{50}) decreases compared to pre-project.	Pebble counts and pre-project subsurface samples to calculate D_{50} and armoring ratio.	Before-After comparison
	Increase groundwater exchange to benefit water temperature through the reach.	Place wood and streambed material in the mainstem, remove old levee prism, construct side channel.	• Groundwater elevation measured by wells at 2 cross sections shows trends that are higher during summer compared to baseline pre-project. • Temperature change between gages upstream and downstream of the project area is ≤0 degrees C.	Groundwater well monitoring at 2 established cross sections. Surface water gage monitoring at established stations.	Before-After comparison
	Increase wood loading in the project area.	Wood placement, remove old levee prism, install conifer boles at channel split (to trap naturally recruited wood).	Increase in abundance and volume of natural and placed wood in the project area by 200% compared to pre-project baseline.	Remote imagery analysis (using orthophotos and LiDAR) with ground-truthing.	Before-After comparison

Project Goal	*Objective*	*Action*	*Performance Standard*	*Monitoring Method*	*Analysis Plan*
[*continued*] Improve natural habitat-forming processes, function, and habitat, where feasible.	Increase availability of low velocity edge and hydraulically suitable habitat for juvenile Chinook salmon and steelhead trout at median spring rearing flow and 2-year flood flow.	Construct side channel, place wood and streambed material in mainstem, remove old levee prism and revetment, place log jacks along CRT7.	• Hydraulically modeled area of low velocity habitat (<1.5 ft/sec) is at least 50% higher at median spring rearing flows and 2-year flood flow compared with pre-project baseline. • Area of hydraulically suitable habitat for Chinook and steelhead juvenile rearing is at least 50% higher at median spring rearing flow than pre-project baseline. • Area of hydraulically suitable habitat for Chinook and steelhead spawning is at least 25% higher at median spawning flow than pre-project baseline. Deposition of fine sediment and low velocity wetted areas will be visually observed around and within log jacks.	Hydraulic modeling with field validation to measure area of low velocity habitat (<1.5 ft/sec) at median spring rearing and 2-year flood flows. Habitat suitability evaluated with hydraulic modeling output and WDFW suitability curves. Observation with photo documentation of sediment conditions and water velocities surrounding wood jacks.	Before-After comparison (baseline is as-built for wood jacks)
	Provide aquatic habitat that is used by juvenile salmonids.	Construct side channel, place wood and streambed material in mainstem, remove levee, construct log jacks along CRT7.	Juvenile salmonids are observed during spring-time snorkel surveys in newly created habitat areas (e.g., side channels, mainstem log jams).	Snorkel surveys in spring (Feb-May) to document fish presence and abundance.	Presence/Absence
	Riparian plantings replace vegetative cover temporarily impacted during construction.	Replant disturbed areas with native species.	Percent cover of planted and naturally recruited woody species in the project area will be 40% by Year 3 and 60% by Year 5.	Percent cover of native and invasive species along fixed transects. Photo stations at start and end of transects.	Compare to threshold
	Successful establishment of installed plants in disturbed areas.	Replant disturbed areas with native species, conduct site maintenance during 10-year post-construction period.	Data collected within representative monitoring locations shall exhibit: • Survival of installed plants is 100% after Year 1 and meets or exceeds 80% in Year 3. • Survival of installed cottonwood boles is 80% in Year 1 and 60% in Year 3.	Survival counts along fixed transects. Total count for cottonwood boles.	Compare to threshold
	Prevent establishment of invasive plant species.	Remove invasive vegetation including reed canary grass and Japanese knotweed by excavation during construction, conduct site maintenance during 10-year post-construction period.	Less than 20% invasive cover in planted areas (0% KC Class A noxious weeds, bindweed, knotweed).	Percent cover of native and invasive species along fixed transects.	Compare to threshold
	No net loss of wetland habitat.	Restore disturbed wetland habitat north of the new culvert and downstream of the side channel. Passively establish new wetlands in the side channel, within the ballasted wood jacks and within the floodplain.	Total area of wetlands restored and created within the project limits is the same or greater the pre-construction wetland area (5,000 square feet).	Verify wetland conditions in the restored area of Wetland 4; wetland delineation.	Before-After comparison

Project Goal	*Objective*	*Action*	*Performance Standard*	*Monitoring Method*	*Analysis Plan*
[*continued*] Improve natural habitat-forming processes, function, and habitat, where feasible.	Provide nesting and foraging habitat for birds.	Install snags in upland areas.	Evidence of foraging (bark flaking, excavation holes) and nesting (nest cavities) is observed by Year 5.	Visual inspection of foraging- and nesting-sized snags.	Presence/Absence
Establish resilient and sustainable floodplain infrastructure to reduce flood risks to people, property, and public infrastructure.	Reduce erosion potential along Cedar River Trail 7 Revetment compared to baseline at 1% Annual Chance Flood (ACF).	Install mainstem ELJs, log jacks along CRT7, remove old levee prism.	• Hydraulically modeled unit discharge (toe [scour]) and flow velocity (embankment [particle erosion]) at two locations along the CRT7 revetment will decrease relative to pre-project baseline. Visual inspection (and review of annual survey information [LiDAR]) does not identify substantial lateral (riverward) displacement of log jacks that would impact the stability of the CRT7 facility and its ability to provide reduction in erosive forces near infrastructure.	Hydraulic model output to calculate flow intensity and surface velocity. Visual field inspection and LiDAR inspection of log jacks.	Before-After comparison
	Provide safe neighborhood egress at floods up to and including the 1% ACF (9,443 cfs).	Upgrade roadway culvert under SE 197th Place, remove old levee, construct new setback levee.	• Roadway overtopping of no more than six inches (safe vehicle egress [FEMA, 2007]) observed. Settling of levee profile of no more than six inches (design function [freeboard] maintained).	Visual observation during flood patrol, with water depth measurements. Review of levee profile survey (LiDAR or traditional) elevation data.	Before-After comparison; Compare to threshold
	Downstream water levels do not increase compared to baseline, for the 10% ACF.	Set back levee.	Water surface elevations at river stage gage “JanRD_H4” will not increase compared to pre-project baseline at the 10% ACF.	Stream gage data to evaluate water surface elevation at a given discharge.	Before-After comparison
	Flood risk reduction facility remains structurally stable.	Remove existing levee and construct new setback levee to current engineering standards.	• Visual inspection does not identify damage to levee and/or biorevetment components that would impact the stability of the facility and its ability to resist channel migration into the neighborhood access road or containment of flood water. • Settling of levee profile, no more than one foot (design function [stability] maintained).	Annual inspections during low flow and during/following flood events.	Before-After comparison (baseline is as-built)

Project Goal	*Objective*	*Action*	*Performance Standard*	*Monitoring Method*	*Analysis Plan*
Provide required mitigation for the 2017 Cedar River wood relocation efforts.	Create 1 deep pool in the Cedar River.	Install mainstem ELJs, log jacks along CRT7 to form spurs/irregularity along the bank, side channel wood structures.	Number of deep pools (>6 ft water depth) at median spawning flow (350 cfs) as determined from LiDAR and hydraulic modeling will increase compared to pre-project baseline.	Pool count from hydraulic modeling and field verification. Pools are included in the count if 6 feet deep at median spawning flow (350 cfs) to reflect functionality as adult salmonid holding habitat (WDFW 2004).	Before-After comparison
	Install at least 100 and up to 120 pieces of large woody material that meet or exceed the 60-point metric as determined by agreement between King County, WDFW, and the MITFD.	Install of mainstem ELJs, log jacks along CRT7, side channel wood structures.	At least 100 pieces of large wood meeting the 60-point metric are installed under as-built conditions.	2017 HPA scoring spreadsheets.	Compare to threshold

Appendix B. Monitoring Methods

Active Channel Area

Channel location and planform were mapped using GIS measurements taken from high-resolution orthoimagery captured before project construction (April 17, 2022, 500 cfs at Cedar Below Diversion Near Landsburg 12117600) and compared to orthoimagery captured post-project (April 26, 2023, 350 cfs; April 14, 2025, 950 cfs). Total active channel area was delineated in GIS, defined as the sum of area of water, banks, unvegetated gravel bars, and bars without perennial vegetation (Collins and Montgomery 2011; Konrad 2015).

Side Channel Connectivity

Connectivity of the side channel over Year 1 was monitored by observation at regular site visits and documented with photos. Summer site visits to evaluate connectivity coincided with low flow (169 cfs), but not the lowest flow of 2025 (93 cfs at USGS 12119000 Cedar River at Renton). Side channel discharge was measured using a velocity meter across a transect with relatively uniform flow in the side channel at approximately the median spawning flow of 350 cfs. During data collection in October 2022 and 2025, the flow at Renton was 315 cfs and 310 cfs respectively.

Sediment Storage

To evaluate changes in sediment volume and to estimate quantities of sediment deposited in and eroded from the project area, the change in surface elevation was calculated by subtracting LiDAR data collected in Year 1 (2023) from Year 3 (2025). The Year 3 methodology diverged from Year 1 methods; rather than using thresholding of a DEM of Difference to remove non-significant measurements, a method following Anderson's research (2018) was followed to evaluate uncertainty in the volumetric change introduced by the LiDAR datasets. Anderson's method relies on quantifying uncertainty through error propagation of systematic error, the magnitude of spatially correlated random error, and the range over which the errors correlate to place upper and lower certainty bounds around the differencing result. This practice facilitates accurately describing how well constrained the estimates of volumetric or mean change are.

Five project zones and a larger subreach extent identified in Year 1 monitoring efforts were used for examining sediment change between years in Year 3. A zone of fluvial influence was added to Year 3 analyses. Volumetric change was calculated from each zone's area multiplied by the mean elevation difference. Overall volumetric error and upper and lower error bounds were calculated using a model accounting for both systematic error and spatially correlated random errors (Anderson, 2018).

Geomorphic Units

Delineation of the pre-project units are from the Cedar Large Wood Study (WSE, 2023), simplified and modified to units chosen to match this project (Table B1). Delineation of 2023 and 2025 geomorphic units use the same definitions. Units were delineated using a combination of aerial imagery and topobathymetric LiDAR. Mapping extents were determined by the valley walls and the Jan Road and Rutledge Johnson subreach as defined in the Cedar Large Wood Study (WSE, 2023).

Table B1. Geomorphic unit definitions, modified from WSE (2023).

GEOMORPHIC UNIT	*DEFINITION*
Floodplain	Pseudo-planar surface showing morphology and/or vegetative signs of recent or frequent flood inundation and morphologic change.
Floodplain, overbank channel	Channel (i.e., with bed and banks and displaying typical fluvial bedforms that extend to the upstream and downstream ends of a floodplain or originate within a floodplain) recently reshaped by overbank flow. May include disconnected backwater areas (frequently or perennially wetted areas that do not show evidence of recent downstream flow nor surface-water connectivity with the active channel during flows less than or equal to bankfull stage).
Island	Floodplain surfaces, as defined above, entirely surrounded by active channel
Active channel, pool	Deep (relative to surrounding channel), concave-up, and baseflow-wetted portions of the mainstem channel
Active channel, riffle	Shallow, convex-up in downstream profile, but planar in cross-stream profile, portions of the mainstem channel
Active channel, undifferentiated	Shallow, pseudo-planar active mainstem channel surfaces in downstream and cross-stream profile (e.g., runs, glides, etc.)
Active channel, bar	Shallow surface that is convex-up along all active channel adjacent sides
Backwater, connected	Frequently or perennially wetted areas that do not show evidence of recent downstream flow but do show evidence of recent or active hydraulic connectivity with the active channel during flows less than or equal to bankfull stage
Terrace / Disconnected floodplain	Area with elevation above the 100-year floodplain; no evidence of recent fluvial erosion and vegetation or land cover that reflects no inundation, also including areas that would otherwise be considered floodplain if not hydraulically disconnected from the active channel (artificially by anthropogenic features or otherwise).

Geomorphic unit diversity was calculated using the Shannon Diversity Index (H'):

$$H' = -\sum p_i * \ln p_i$$

where p_i is the proportion of all geomorphic units made up of that geomorphic unit type. The Shannon Diversity Index is commonly used in community ecology (Shannon 1948, Morris et al. 2014) and was selected from other diversity indices based on its strength in distinguishing between groups with rare species (or in our case, rare geomorphic unit types).

Groundwater Levels

Three groundwater wells within the Jan Road project area were used to evaluate groundwater level over time. Two were located landward of the setback levee (JanRoad_AMW01 and JanRoad_AMW03). JanRoad_AMW01 was installed on 3/04/2021 to a screen depth of 20 feet while JanRoad_AMW03 was installed on 6/03/2021 to a screen depth of 22.5 feet. A shallower piezometer, JanRd1, was also installed to a depth of approximately 3 feet in the riverward floodplain on 10/04/2022. All wells collect continuous 15-minute interval data, and the daily average water level was reported when data is collected quarterly.

Large Wood

Naturally occurring and placed large wood pieces and log jams were remotely delineated from true color leaf-off low-flow orthoimagery from Year 1 (imagery collected April 26, 2023), Year 3 (April 14, 2025), and pre-project (March 17, 2021). Large wood was defined as pieces at least 1 m long and 0.1 m in diameter. Jams were defined as having at least 3 overlapping pieces of large wood. Volumes were calculated using a predictive model that estimates wood volume in jams and pieces from aerial imagery-delineated wood area, which was derived from data on the Cedar River (WSE 2023):

$$\text{Wood volume } (ft^3) = e^{-1.9659}(\text{wood area}(ft^2))^{1.4170}$$

Wood volume placed as the 116 ballasted wood jacks was calculated separately, due to the difficulty in accurately delineating these pieces from aerial imagery. For these pieces, log lengths and diameters were taken from record drawings to calculate the bole volume; none of these pieces contained a root wad.

Wood totals presented in this report therefore include all naturally occurring and placed wood within the project area. Remotely delineated wood was ground-truthed by collecting wood dimensions within randomly selected 10-m radius plots throughout the project area in 2023 (n=11) and 2025 (n=20). Results from this exercise showed that remote delineation did occasionally miss pieces of large wood under canopy cover, but generally wood area delineated remotely and in the field were well aligned as indicated by high R^2 values and a positive linear relationship that was close to the 1:1 line in both years (Figure B1). Results also showed that in

2025, the remote delineation may have somewhat underestimated large wood load by underestimating large wood area compared to field measurements.

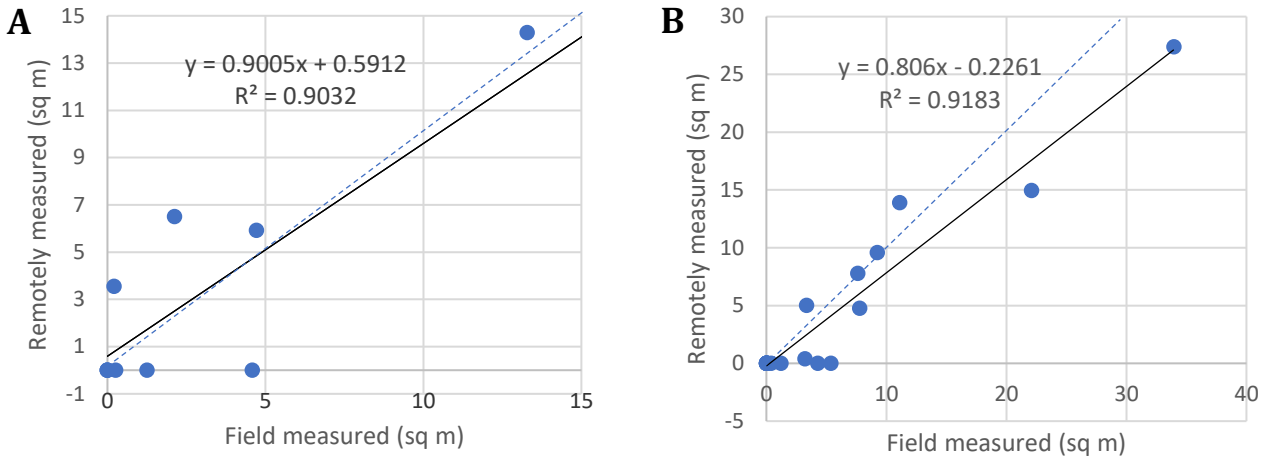


Figure B1. **Field versus remotely measured large wood surface area in 2023 (a) and 2025 (b). Black line shows the linear relationship described by the equation and R^2 value. Blue dashed line shows the 1:1 line.**

Aquatic Habitat

Low Velocity Habitat

Juvenile salmonids rely heavily on shallow, relatively slow-moving waters for rearing (Bjornn, 1991, Beechie et al. 2005), so low velocity area was field-delineated in the project reach and downstream control reach as a measure of available rearing habitat. The margins of low velocity habitat were located by visually determining the shear line (water velocity was approximately <0.45m/sec), and the slow-water boundary was mapped using a Trimble DA2 GPS. Low velocity habitat was categorized into backwater, bar, armored bank, unarmored bank, biorevetment bank and side channel habitat types, modified from Beechie et al. (2005). Low velocity habitat was only mapped if the habitat unit area was greater than approximately 1 m^2.

These habitat surveys were conducted once in 2025 (in March). Pre-project habitat surveys at Jan Road were also conducted in 2019, 2020, and 2021, and at the downstream control reach in 2020 and 2021 (Table B2); a subset of this data is presented here, focusing on survey events that are most relevant to the analyses and comparisons in the current report. Data collected in 2019 only included the reach between Taylor Creek and CRT7 and did not survey the entire study reach. Jan Road data collected in 2020, 2021, and 2023 included areas of the Cedar River upstream of Jan Road project actions to include the future Rutledge Johnson project area. Downstream control reach surveys extended from RM 8.8 to 8.2, a reach that is confined by the Progressive Investment and Scott-Indian Grove levees.

Table B2. Low velocity habitat field mapping events. Flow data are from the Cedar River at Renton USGS gage.

Project Phase	*Date*	*Flow (cfs)*	*Reach surveyed*
Pre-project	4/15/2019	816	Jan Road (partial)
Pre-project	5/19/2019	378	Jan Road (partial)
Pre-project	6/11/2019	388	Jan Road (partial)
Pre-project	3/5/2020	760	Jan Road
Pre-project	5/19/2020	450	Jan Road
Pre-project	6/16/2020	750	Jan Road
Pre-project	3/22/2021	620	Jan Road
Pre-project	4/19/2021	390	Jan Road
Pre-project	**6/7/2021**	**630**	**Jan Road**
Year 1	**3/14/2023**	**520**	**Jan Road**
Year 1	5/17/2023	900	Jan Road
Year 3	**3/18/2025**	**550**	**Jan Road**
Pre-project	3/5/2020	760	Downstream Control
Pre-project	5/19/2020	450	Downstream Control
Pre-project	6/16/2020	750	Downstream Control
Pre-project	3/22/2021	620	Downstream Control
Pre-project	4/19/2021	390	Downstream Control
Pre-project	**6/7/2021**	**630**	**Downstream Control**
Year 1	**3/14/2023**	**520**	**Downstream Control**
Year 1	5/17/2023	900	Downstream Control
Year 3	**3/18/2025**	**550**	**Downstream Control**

Bolded rows highlight the data compared in this report.

Changes in low velocity area at the median spring rearing flow (482 cfs) and 2-year flood flow (2,419 cfs) was evaluated using hydraulic model output, using the same models described in the following subsection.

Hydraulic modeling results were also used to evaluate how changes in low flow depths and velocities in the Jan Road project area affected habitat suitable for specific salmonid species and life history stages. Modeling was performed by TetraTech using a 2-D HEC-RAS model of the Cedar River to evaluate pre-project conditions at the time of April 2020 LiDAR collection (Tetra Tech 2020) and as-built conditions as represented by a combination of survey and April 2023 LiDAR. Output modeled at median spring rearing flow (482 cfs; 50% exceedance from

January – July) at the Jan Road project site was used to evaluate juvenile rearing habitat, while model output at the two year flood flow (2,419 cfs at the site) was used to evaluate flood refuge habitat.

Deep Pools

Evaluation of pool habitat was conducted by field measurement of water depth, where pools were identified by depth, water velocity, and channel bedform. Water depths in pools were either measured with a depth rod or estimated visually if inaccessible on foot.

Hydraulically Suitable Habitat

Hydraulic modeling results were used to evaluate how changes in low flow depths and velocities in the Jan Road project area affected habitat suitable for salmonid species and life history stages. Output modeled at the median spring rearing flow (482 cfs, 50% exceedance from January – July) at the site was used to evaluate juvenile rearing habitat, and model output at median spawning flow (351 cfs) was used to evaluate spawning habitat. Habitat suitability was modeled using a tool based on habitat suitability curves from Washington Department of Fish and Wildlife. Full methodology is described in King County (2024).

Bioenergetically Suitable Habitat

We used an open-source habitat suitability curve-based bioenergetics model, “BioenergeticsHSC”, and hydraulic model output to evaluate changes in energetically favorable habitat for juvenile Chinook salmon (Naman et al., 2020a, 2020b). The BioenergeticsHSC software uses user-inputted depths, velocities, water temperature, fish species and size (length and weight), and concentration and size distributions of invertebrate drift. We elected to model habitat for a 45mm, 1g Chinook salmon both before (2020) and after (2023) project construction at median spring rearing (482 cfs). We used depth and velocity output from hydraulic modeling, and a median water temperature for the spring rearing period as determined by stream gages (9.5 degrees C). For invertebrate drift, we used a composite dataset representing drift concentration and sizes from several rivers in British Columbia provided by Naman et al. (2020a). The stock drift invertebrate dataset was used because site-specific data was not available, and the focus of this analysis was on changes due hydraulic changes. In the future, we could collect site-specific invertebrate drift data to refine model results. Additional model settings and justification can be found in Table B3.

Table B3. BioenergeticsHSC model settings used for both the existing conditions and Year 1 model runs.

Setting	*Value*	*Description / Rationale*
Drift density file	DriftComposite BC.csv	Dataset provided by Naman et al. (2020a), representing average drift concentration and size across several southwest BC rivers including 2 tributaries to the Fraser, upper Skagit, and Sumallo rivers.
Fish wet mass	1 gram	Derived from length-weight data collected at Lower Russell and Countyline levee setback projects. Largely agrees with size/weight data from Chinook entering Lake Washington (Koehler et al. 2006).
Fish fork length	4.5 cm	Represents fry life stage.
Water temperature	9.5 ºC	Derived from median temperatures measured on site between Feb-June in 2019-2022.
Fish focal point depth	0.8, as proportion of depth	This corresponds to 20% off of the stream bottom, which was determined to be representative based on snorkeling observations in Naman et al. (2019).
Turbidity	0.0 NTUs	Represents realistically ideal conditions in the Cedar River.
Vertical velocity profile	Logarithmic	Allows the velocity within the capture area to vary with depth, providing more realistic conditions.
Bed roughness height	5 cm	Default value. Sets the height above the bed that is influenced by protruding substrate.
Swimming cost sub-model	Chinook (Trudel and Welch 2005)	Sets the relationship between velocity, temperature, swimming costs by species.
Velocity refuge multiplier	1	A multiplier of 1 means there is no scaling to reduce focal velocities to account for small scale velocity refuges
Turbulence adjustment	On	Accounts for additional energetic costs of focal swimming in unsteady flow conditions

Setting	*Value*	*Description / Rationale*
Energy assimilation method	Wisconsin Bioenergetics Model (Chinook/coho)	Defines energy lost to metabolic processes as a function of body size, temperature, and consumption
Prey detection probability	1	Unaltered from default. This parameter is used to fit model results to an empirical model.
Reaction distance multiplier	1	Unaltered from default. This parameter is used to fit model results to an empirical model.
Diet optimization	On	Incorporates optimal foraging theory; prey types are dropped from diet if interception costs exceed prey energy content.
Maximum water velocity / Velocity intervals	Not used	These parameters are used to generate habitat suitability curves.
Maximum water depth / Depth intervals	Not used	These parameters are used to generate habitat suitability curves.
Spatial grid resolution	10 cm	Sets grid cell size within the reactive foraging area. Largest recommended by BioenergeticsHSC manual, to reduce model run time.

Model output includes the net rate of energy intake (J/s), which combines the energy acquired from feeding and the energetic costs of swimming, feeding, and metabolizing, as well as metrics related to energy gains (gross energy intake, prey ingestion rate, prey encounter rate), energy costs (maneuvering, focal swimming), and prey handling (reaction distance, capture success, handling time). Note that the model predicts suitability based on depths and velocities at a specific point (i.e., hydraulic model cell) without considering conditions in adjacent cells, and so the suitability of habitats like shear zones (where fish may hold in slower water and dart out to feed in faster water) is not represented.

Water Temperature

Mainstem surface water temperature was measured at JanRd_H2, just downstream of Taylor Creek on the right bank (coordinates: 47.42471, -122.046247), and JanRd_H4 located downstream of the project on the left bank (coordinates: 47.42854, -122.053085). Gages recorded data between March 2019 and November 2025. Gage JanRd_H2 was temporarily removed during construction, and so data is not available between May 2022 and mid-March 2023. Surface water temperature in the side channel was measured using 2 Onset HOBO MX Temp loggers, once placed near the center of the side channel and one along the bank where a groundwater seep entered the side channel.

Fish Use

Fish surveys aimed to evaluate pre- and post-construction juvenile salmonid use of project areas with low velocity habitats. Night-time snorkel surveys were conducted in spring to align with the juvenile salmon rearing and outmigration season. The Jan Road reach was surveyed 3 times per spring in 2019, 2020, 2021, 2023, and 2025 while the downstream control reach (RM 8.2 – 8.8) was surveyed 3 times in spring in 2020, 2021, 2023, and 2025 (Table B4). A subset of low velocity habitats delineated during the day were selected for snorkel surveys, including side channel, bar, backwater, armored bank, unarmored bank, and biorevetment bank habitats; units were selected to be representative of the habitat types available on the date of sampling.

Snorkel surveys began at least 30 minutes after sunset to increase the probability of observation, because juvenile salmonid activity increases at night when water temperatures are low (Metcalfe et al. 1999, Roni and Fayram 2000). Fish counts were conducted by a single-pass survey by one snorkeler moving downstream to upstream. Species and size class was recorded for each salmonid observed. Chinook and coho were categorized as <50mm, 50-100mm, or >100mm fork length, while trout were categorized as <100mm, 100-200mm, or >200mm fork length and sculpins were categorized as <75mm or >75mm. We did not distinguish between steelhead/rainbow trout and cutthroat trout. All other species encountered were counted but size was not recorded.

Table B4. Dates of snorkel surveys at Jan Road and downstream control reach.

Reach	Project Phase	Year	Survey Date	Flow (cfs at Renton)
Jan Road	Pre-project	2018	May 16	560
Jan Road	Pre-project	2019	April 15	747
Jan Road	Pre-project	2019	May 15	366
Jan Road	Pre-project	2019	June 11	380
Jan Road, Control	Pre-project	2020	March 5	760
Jan Road, Control	Pre-project	2020	May 19	450
Jan Road, Control	Pre-project	2020	June 16	750
Jan Road, Control	Pre-project	2021	March 22	630
Jan Road, Control	Pre-project	2021	April 19	400
Jan Road, Control	Pre-project	2021	June 7	620
Jan Road, Control	Year 1	2023	March 14	570
Jan Road, Control	Year 1	2023	April 13	586
Jan Road, Control	Year 1	2023	May 17	975
Jan Road, Control	Year 3	2025	March 18	520
Jan Road, Control	Year 3	2025	April 21	415
Jan Road, Control	Year 3	2025	May 21	311

Riparian Vegetation

Eight 50-m long monitoring transects were established to evaluate the success of planted and naturally recruited vegetation. Two transects were established within each of four strata roughly aligned with different areas within the planting design: riparian enhancement (RE), riparian transition (RT), riparian upland (RU), and areas with wetter soil conditions and standing water observed throughout much of 2023-2025 (WET) (Figure B2). Transects did not cross strata and locations were randomly chosen within the appropriate strata.

Within each transect, percent cover of native and invasive tree, shrub, and groundcover species was measured using line intercept methodology. Naturally recruited vegetation and pre-existing mature canopy cover was included. Percent cover of a species was calculated as the percentage of the transect where vegetation intersected with the transect tape, verified with a plumb bob and densitometer. To calculate the percent cover of all native woody vegetation or all invasive vegetation, sections of tape with multiple species overlaps were not double counted such that the total percent cover along a transect cannot exceed 100%. Photos were taken from

the start and end of each transect, angled along the transect, for a visual record of vegetation establishment over time. In Year 3, field data was collected on July 27-31, 2025.

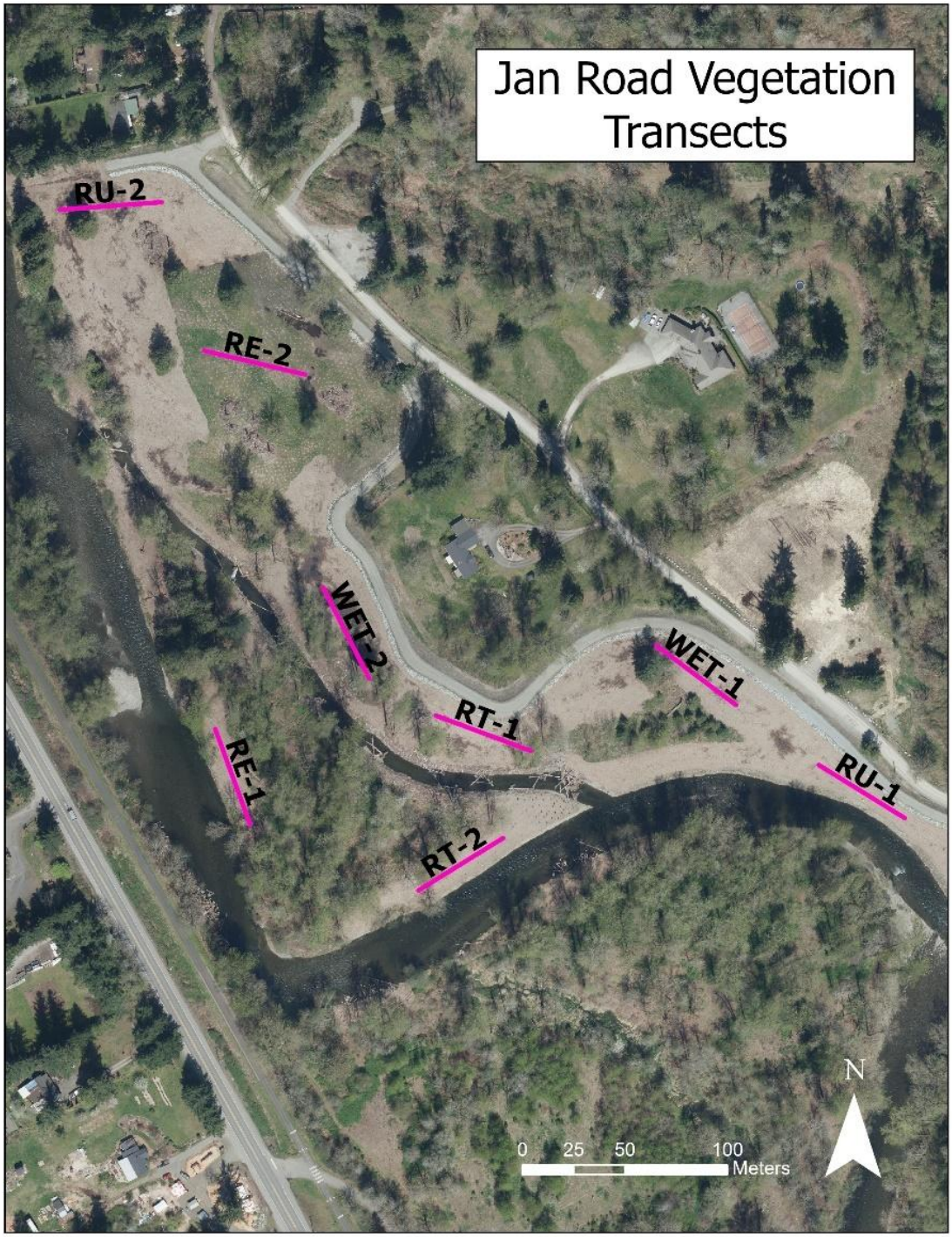


Figure B2. Vegetation sampling transects.

Habitat Snags

Use of habitat snags by birds was monitored opportunistically via observation and by comparing photos of snags taken in winter 2022, July 2023, September 2024, and late June 2025 to document evidence of cavity excavation.

Flood Hazard

Change in water velocities along CRT 7 was evaluated using hydraulic models run at a 100-year flood flow and pre-project (2020) or Year 1 (2023) terrain, and by visual observation during the December 2025 flood event (12,500 cfs at Renton). The flood event corresponded to a 100-200 year recurrence interval, based on preliminary data (Judi Radloff, personal communication). Presence of water flowing over the roadway was evaluated by visual observation during the December 2025 flood event. Levee settling was assessed using LiDAR differencing (subtracting the 2023 surface from 2025 surface) along a levee center profile. The structural stability of the setback levee and engineered log structures, and damages from the flood event were evaluated visually by inspection by engineers and the project team.