

Middle Entiat River Reach Assessment Update

Appendix B | Reach-Based Ecosystem Indicators (REI)

Entiat River (RM 15.6 - 26.7)

February 2026

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1 Introduction

1.1 BACKGROUND

The Reach-based Ecosystem Indicators (REI) provide a consistent means of evaluating biological and physical conditions of a watershed in relation to regional standards and known habitat requirements for aquatic biota. These indicators, along with other scientific evaluations, describe the current quality of stream biophysical conditions and can help inform restoration targets and actions. The REI indicators used in this assessment are adaptations from previous efforts including the National Marine Fisheries Service (NMFS) matrix of pathways and indicators (NMFS, 1996), the U.S. Fish and Wildlife Service (USFWS) matrix of pathways for bull trout populations at the watershed scale (USFWS, 1998; USFWS, 1999).

The REI evaluation for Entiat River was conducted using field data, observations, previous studies, and available data for the study area. In particular, the rankings were developed based on: 1) quantitative inventory information from the Habitat Assessment performed as part of the Reach Assessment using U.S. Forest Service (2020) protocols, 2) assessment of geomorphic patterns and processes and how they have deviated, if at all, from historical conditions, and 3) analysis of existing watershed assessments and data (e.g., available GIS data). Functional ratings include Adequate, At Risk, or Unacceptable. The REI analysis helps to summarize habitat impairments and to distill the impairments down to a consistent value that can be compared among reaches. The REI results help to inform the identification of recommended restoration measures in the Restoration Strategy (Appendix C). They are also used in the project prioritization framework, where existing conditions are rated and compared to target conditions (typically equivalent to an REI Adequate rating) to determine project priorities.

1.2 SUMMARY OF RESULTS

At the watershed scale, REI ratings for the Entiat River ranged from At Risk to Unacceptable. Watershed-scale impairments are primarily related to historical or ongoing anthropogenic disturbance to the watershed, particularly timber harvest and wildfires. Reach-scale metrics ranged from Adequate to Unacceptable. Across all reaches, the most impaired indicators occurred in the Habitat Quality and Riparian Vegetation categories. The Entiat River does not have any full fish passage barriers and suitable spawning-sized substrates are present in all reaches where geomorphic conditions are suitable. However, sufficient amounts of large woody material (LWM) to provide habitat and drive geomorphic processes, along with high quality riparian conditions, such as undisturbed, mature trees were limited in nearly all the surveyed reaches. The downstream reach, Reach 1, was the most impaired across all indicators.

Table 1. Summary ratings for Entiat River reach assessment study area. Ratings are color-coded, with green shading for Adequate condition, yellow for At Risk condition, and red for Unacceptable condition

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Habitat Access	Physical Barriers	Main Channel Barriers	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Habitat Quality	Substrate	Dominant Substrate/ Fine Sediment	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	At Risk	Adequate	Adequate	Adequate
	LWM	Pieces per Mile at Bankfull	Unacceptable	At Risk	At Risk	At Risk	At Risk	At Risk	Adequate	Unacceptable	Adequate	Unacceptable	Unacceptable	At Risk
	Pools	Pool Frequency and Quality, Presence of	Unacceptable	Adequate	At Risk	Adequate	At Risk	At Risk	Adequate	Unacceptable	At Risk	Unacceptable	At Risk	At Risk
	Off-Channel Habitat	Connectivity with Main Channel	Adequate	Unacceptable	At Risk	Unacceptable	Adequate	Unacceptable	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk
Riparian Vegetation	Condition	Structure	Unacceptable	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk
		Disturbance (Human)	At Risk	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk
		Canopy Cover	Unacceptable	At Risk	At Risk	At Risk	Adequate	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Channel	Dynamics	Floodplain Connectivity	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk
		Bank Stability/ Channel Migration	Adequate	Adequate	At Risk	Adequate	Adequate	At Risk	At Risk	Adequate	At Risk	Adequate	At Risk	At Risk
		Vertical Channel Stability	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	At Risk	Adequate	At Risk	Adequate	At Risk	Adequate

1.3 COMPARISON TO PREVIOUS REI ANALYSES

Reach assessments that included REI evaluations have been previously conducted within the Entiat River assessment area (RM 15.6 – 26.7), including:

- Gray Reach Assessment (USBR, 2013), RM 16.6 – 18.7
- Stormy Reach Assessment (USBR, 2009b), RM 19.0 – 22.1
- Preston Reach Assessment (USBR, 2009a), RM 22.45 – 24.55, and
- Reach 0 of the Upper Stillwaters Reach Assessment (Inter-Fluve, 2013), RM 24.8 – 25.6

Ratings for watershed-scale metrics and reach-scale metrics were included in the previous REI assessments. Watershed-scale metrics generally evaluated hydrology, disturbance, and water quality within the entire Entiat River watershed. Reach-scale metrics evaluated instream aquatic habitat quality and access, riparian vegetation conditions, and physical channel dynamics of the Entiat River. In some cases, rating criteria differed among the previous REI analyses. To the extent possible, the comparisons described below acknowledge where key differences in rating criteria occurred.

At the watershed-scale, land disturbance and road density indicators have consistently been rated in an At Risk condition since the 2009 Stormy and Preston Reach Assessments (USBR 2009b, USBR 2009a). The flow/hydrology and water quality indicators are generally described as in an At Risk condition, though the turbidity metric was rated as Adequate in all of the REIs in which the specific indicator was evaluated. The Gray Reach Assessment rated the watershed-scale flow/hydrology indicator Adequate based primarily on the lack of significant change in peak flows observed and due to the lack of fish passage barriers. The Stormy, Preston and Upper Stillwaters Assessments, as well as this 2024/2025 assessment, considered additional factors in the rating criteria, such as climate change impacts and land use changes. The Stormy and Preston Reach Assessments used the Instream Flow Incremental Methodology to evaluate hydrological conditions within the watershed, and stream gage data (from USGS gage #12452800, near Ardenvoir) was directly analyzed in the Upper Stillwaters Reach Assessment and this 2024/2025 REI effort. In addition, previous assessments generally rated the watershed-scale water temperature metric as At Risk. From evaluation of existing water temperature monitoring data in the assessment area and owing to the continued lack of substantial improvement in water temperatures since previous assessments, the watershed-scale water temperature rating for this 2024/2025 assessment was categorized as Unacceptable. The anticipated continued impacts of climate change on water temperatures were also factored into the Unacceptable rating. A summary of previous REI assessment ratings at the watershed scale are shown below in Table 3 - Table 6.

At the reach-scale, the habitat access metric has remained in an Adequate condition over the period covered by the REI assessments. Reach 1 in the 2024/2025 assessment was categorized as At Risk due to the irrigation diversion feature in the main channel of the Entiat River that may impede fish passage for some species or at certain flows. Habitat quality metrics, including quantity of Large Woody Material (LWM), pool frequency, and presence of off-channel habitat would appear to have degraded over time based on REI ratings. However, these decreases are largely assumed to be attributed to the differences in rating criteria. Comparisons of habitat survey data (see Appendix A) suggest LWM counts, the

proportion of pool habitat, and the number of side or off-channel habitats have increased or stayed the same since the 2009 Stormy and Preston Reach Assessments.

The REI LWM rating criteria for this 2024/2025 assessment required higher pieces per mile for an Adequate rating than previous assessment criteria. The Gray, Stormy, and Preston Reach Assessments required 20 M+L pieces per mile and the Upper Stillwaters Reach Assessment required 42.5 M+L pieces per mile for an Adequate rating, compared to the 67.45 M+L pieces per mile in this 2024/2025 assessment. The Gray Reach Assessment used smaller size criteria (in both length and diameter) for the LWM counts (see Appendix A).

There was little change in the amount of pool habitat (as a percentage of habitat composition) between previous assessments and this assessment. However, the REI pool frequency criteria used in the previous reach assessments were slightly different compared to this 2024/2025 assessment, and may account for many of the changes in the REI metric rating comparisons. The Stormy, Preston, Gray, and Upper Stillwaters Reach Assessments followed the USFWS (1998) matrix for eastside streams pool frequency criteria and required a lower pool frequency for an Adequate rating. This 2024/2025 assessment followed NMFS (1996) matrix of pathways and indicators criteria based on the average channel bankfull width for the reach. A comparison of the two pool frequency criteria is in Table 2 below.

Table 2. Table of the pool frequency criteria from the previous assessments, following USFWS (1998) criteria, compared to the criteria used in this 2024/2025 assessment, following NMFS (1996) criteria.

USFWS (1998) Criteria		NMFS (1996) Criteria	
Channel Width	Pools/Mile	Channel Width	Pools/Mile
20-30 ft	23	25-50 ft	26
30-35 ft	18	51-75 ft	23
35-40 ft	10	76-100 ft	18
40-65 ft	9	101-130 ft	15
65-100 ft	4	131-140 ft	14

Side and off-channel habitat ratings generally were lower in this 2024/2025 assessment than previous assessments, despite similar or increased counts of side channels (see Appendix A) and relatively inconsequential differences in side channel definitions among the various assessments. This 2024/2025 REI evaluated the number of side channels within the reach geomorphic context, evaluating the observed field data against the natural geomorphic potential to form/maintain off-channel features.

Channel dynamics and riparian vegetation condition ratings appear to be largely steady over time within the assessment area, with vegetation conditions in the upper reaches (specifically, the Upper Stillwaters reach) showing slight improvement over time (Table 10). This improvement may reflect riparian recovery and growth over the past decade in the reach. It may also reflect slight differences in methods. The Upper Stillwaters Reach 0 reported vegetation conditions at every habitat unit, whereas the 2024/2025 assessment recorded vegetation conditions at a subset of units per USFS (2020) protocols.

A summary of the past assessment ratings at the reach scale is shown in Table 7 - Table 10 below. Details on the methods used to determine REI ratings can be found in the past assessments listed above.

Table 3. Watershed scale rating from the 2013 Gray Reach Assessment (RM 16.6-18.7) compared to the equivalent watershed scale ratings from this 2024/25 assessment.

2013 Gray Reach Assessment Watershed Scale Ratings			vs.	2024/25 Entiat Reach Assessment Equivalent Watershed Scale Ratings		
General Indicator	Specific Indicator	Rating		General Indicator	Specific Indicator	Rating
Watershed Condition	Effective Drainage Network and Watershed Road Density	At Risk		Watershed Condition	Drainage Network and Hydrologically Impaired Surfaces	At Risk
	Disturbance Regime	At Risk			Disturbance Regime (natural & human caused)	At Risk
Flow/Hydrology	Streamflow	Adequate		Flow/Hydrology	Streamflow (alterations to peak/base flow)	At Risk
Water Quality	Temperature	At Risk		Water Quality	Temperature	Unacceptable
	Turbidity	Adequate				
	Chemical Contamination/Nutrients	At Risk				

Table 4. Watershed scale rating from the 2009 Stormy Reach Assessment (RM 19.0-22.1) compared to the equivalent watershed scale ratings from this 2024/25 assessment.

2009 Stormy Reach Assessment Watershed Scale Rating			vs.	2024/25 Entiat Reach Assessment Equivalent Watershed Scale Ratings		
General Indicator	Specific Indicator	Rating		General Indicator	Specific Indicator	Rating
Watershed Condition	Disturbance Regime	At Risk		Watershed Condition	Disturbance Regime (natural & human caused)	At Risk
Flow/Hydrology	Streamflow	At Risk		Flow/Hydrology	Streamflow (alterations to peak/base flow)	At Risk
Water Quality	Temperature	At Risk		Water Quality	Temperature	Unacceptable
	Turbidity	Adequate				
	pH	At Risk				
	Suspended Solids	At Risk				

Table 5. Watershed scale rating from the 2009 Preston Reach Assessment (RM 22.45-24.55) compared to the equivalent watershed scale ratings from this 2024/25 assessment.

2009 Preston Reach Assessment Watershed Scale Ratings			vs.	2024/25 Entiat Reach Assessment Equivalent Watershed Scale Ratings		
General Indicator	Specific Indicator	Rating		General Indicator	Specific Indicator	Rating
Watershed Condition	Effective Drainage Network and Watershed Road Density	At Risk		Watershed Condition	Drainage Network and Hydrologically Impaired Surfaces	At Risk
	Disturbance Regime	At Risk			Disturbance Regime (natural & human caused)	At Risk
Flow/Hydrology	Streamflow	At Risk		Flow/Hydrology	Streamflow (alterations to peak/base flow)	At Risk
Water Quality	Temperature	At Risk		Water Quality	Temperature	Unacceptable
	Turbidity	Adequate				
	pH	At Risk				
	Suspended Solids	At Risk				

Table 6. Watershed scale rating from the 2013 Upper Stillwaters Reach Assessment (Reach 0; RM 24.8-25.6) compared to the equivalent watershed scale ratings from this 2024/25 assessment.

2013 Upper Stillwaters Watershed Scale Rating			vs.	2024/25 Entiat Reach Assessment Equivalent Watershed Scale Ratings		
General Indicator	Specific Indicator	Rating		General Indicator	Specific Indicator	Rating
Watershed Condition	Effective Drainage Network and Watershed Road Density	At Risk		Watershed Condition	Drainage Network and Hydrologically Impaired Surfaces	At Risk
	Disturbance Regime (natural & human caused)	At Risk			Disturbance Regime (natural & human caused)	At Risk
	Streamflow (change in peak/base flow)	At Risk		Flow/Hydrology	Streamflow (alterations to peak/base flow)	At Risk

Table 7. REI ratings from the 2013 Gray Reach Assessment (RM 16.6-18.7). The Gray Reach area is equivalent to the upper portion in Reach 1- the lower half of Reach 4.

2013 Gray Reach Assessment Watershed Scale Ratings, RM 16.6-18.7			vs.	2024/25 Entiat Reach Assessment Equivalent Reach Scale Ratings					
Pathway	Specific Indicator	Rating		Pathway	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4
Habitat Access	Physical Barriers	Adequate		Habitat Access	Physical Barriers	At Risk	Adequate	Adequate	Adequate
Habitat Quality	Substrate	Adequate		Habitat Quality	Substrate	At Risk	Adequate	Adequate	Adequate
	LWM (frequency)	At Risk			LWM (frequency)	Unacceptable	At Risk	At Risk	At Risk
	Pools (frequency and quality)	Adequate			Pools (frequency and quality)	Unacceptable	Adequate	At Risk	Adequate
	Off-Channel Habitat	Adequate			Off-Channel Habitat	Adequate	Unacceptable	At Risk	Unacceptable
Riparian Vegetation	Structure	Unacceptable		Riparian Vegetation	Structure	Unacceptable	At Risk	At Risk	At Risk
	Disturbance	At Risk			Disturbance (Human)	At Risk	Adequate	At Risk	At Risk
	Canopy Cover	At Risk			Canopy Cover	Unacceptable	At Risk	At Risk	At Risk
Channel Dynamics	Floodplain Connectivity	Adequate		Channel Dynamics	Floodplain Connectivity	Adequate	At Risk	At Risk	At Risk
	Bank Stability and Channel Migration	Adequate			Bank Stability/ Channel Migration	Adequate	Adequate	At Risk	Adequate
	Vertical Channel Stability	Adequate			Vertical Channel Stability	Adequate	At Risk	At Risk	At Risk

Table 8. REI ratings from the 2009 Stormy Reach Assessment (RM 19.0-22.1). The Stormy Reach area is equivalent to the upper half of Reach 4-Reach 7 of this 2024/25 assessment.

2009 Stormy Reach Assessment Reach-Scale Rating, RM 19.0-22.1			vs.	2024/25 Entiat Reach Assessment Equivalent Reach Scale Ratings					
Pathway	Specific Indicator	Rating		Pathway	Specific Indicator	Reach 4	Reach 5	Reach 6	Reach 7
Habitat Access	Physical Barriers	Adequate		Habitat Access	Physical Barriers	Adequate	Adequate	Adequate	Adequate
Habitat Quality	Substrate	Adequate		Habitat Quality	Substrate	Adequate	Adequate	Adequate	Adequate
	Fine Sediment	At Risk			LWM (frequency)	At Risk	At Risk	At Risk	Adequate
	LWM (frequency)	Adequate			Pools (frequency and quality)	Adequate	At Risk	At Risk	Adequate
	Pools (frequency and quality)	Adequate			Off-Channel Habitat	Unacceptable	Adequate	Unacceptable	Adequate
Riparian Vegetation	Structure	Adequate		Riparian Vegetation	Structure	At Risk	At Risk	At Risk	At Risk
	Disturbance	At Risk			Disturbance (Human)	At Risk	At Risk	Adequate	At Risk
	Canopy Cover	At Risk			Canopy Cover	At Risk	Adequate	At Risk	Adequate
Channel Dynamics	Floodplain Connectivity	At Risk		Channel Dynamics	Floodplain Connectivity	At Risk	Adequate	At Risk	Adequate
	Bank Stability and Channel Migration	At Risk			Bank Stability/ Channel Migration	Adequate	Adequate	At Risk	At Risk
	Vertical Channel Stability	At Risk			Vertical Channel Stability	At Risk	Adequate	At Risk	At Risk

Table 9. REI ratings from the 2009 Preston Reach Assessment (RM 22.45-24.55). The Preston Reach area is equivalent to Reach 9 - the lower half of Reach 10 in this 2024/25 assessment.

2009 Preston Reach Assessment Reach Scale Ratings, RM 22.45-24.55			vs.	2024/25 Entiat Reach Assessment Equivalent Reach Scale Ratings			
Pathway	General Indicators	Rating		Pathway	General Indicators	Reach 9	Reach 10
Habitat Access	Physical Barriers	Adequate		Habitat Access	Physical Barriers	Adequate	Adequate
Habitat Quality	Substrate	Adequate		Habitat Quality	Substrate	At Risk	Adequate
	Fine Sediment	At Risk			LWM (frequency)	Adequate	Unacceptable
	LWM (frequency)	At Risk			Pools (frequency and quality)	At Risk	Unacceptable
	Pools (frequency and quality)	Adequate			Off-Channel Habitat	At Risk	Adequate
	Off-Channel Habitat	At Risk			Riparian Vegetation	Structure	At Risk
Riparian Vegetation	Structure	Adequate		Disturbance (Human)		At Risk	At Risk
	Disturbance	At Risk		Canopy Cover		Adequate	Adequate
	Canopy Cover	Adequate		Channel Dynamics	Floodplain Connectivity	At Risk	Adequate
Channel Dynamics	Floodplain Connectivity	At Risk			Bank Stability/ Channel Migration	At Risk	Adequate
	Bank Stability and Channel Migration	At Risk			Vertical Channel Stability	At Risk	Adequate
	Vertical Channel Stability	At Risk					

Table 10. Ratings from the 2013 Upper Stillwaters (Reach 0, RM 24.8-25.6). The Upper Stillwaters area covered is equivalent to Reach 11 in this 2024/25 assessment.

2013 Upper Stillwaters Reach-Scale Ratings (Reach 0), RM 24.8-25.6			vs.	2024/25 Entiat Reach Assessment Equivalent Reach Scale Ratings		
Pathway	Specific Indicator	Rating		Pathway	Specific Indicator	Reach 11
Habitat Access	Physical Barriers	Adequate		Habitat Access	Physical Barriers	Adequate
Habitat Quality	Substrate	Adequate		Habitat Quality	Substrate	Adequate
	LWM (frequency)	Unacceptable			LWM (frequency)	Unacceptable
	Pools (frequency and quality)	At Risk			Pools (frequency and quality)	At Risk
	Off-Channel Habitat	Unacceptable			Off-Channel Habitat	At Risk
Riparian Vegetation	Structure	Unacceptable		Riparian Vegetation	Structure	At Risk
	Disturbance	Unacceptable			Disturbance (Human)	At Risk
	Canopy Cover	At Risk			Canopy Cover	Adequate
Channel Dynamics	Floodplain Connectivity	At Risk		Channel Dynamics	Floodplain Connectivity	At Risk
	Bank Stability and Channel Migration	Unacceptable			Bank Stability/Channel Migration	At Risk
	Vertical Channel Stability	At Risk			Vertical Channel Stability	At Risk

2 Metrics & Indicators

2.1 WATERSHED-SCALE METRICS

Pathway	General Indicators	Specific Indicators	Adequate Condition	At Risk Condition	Unacceptable Risk Condition
Watershed Scale					
Watershed Condition	Drainage Network and Hydrologically Impaired Surfaces	Increase in Drainage Network/ Hydrologically Impaired Surfaces	Zero or minimal increase in the drainage network that is correlated with human caused disturbances. Hydrologically impaired surfaces in watershed total <8%. Road density <1 mile/miles ² .	Low to moderate increase in the drainage network correlated with human caused disturbances. Hydrologically impaired surfaces in watershed total between 8 and 14.9%. Road density 1-2.4 miles/miles ² .	Substantial increase in the drainage network correlated with human caused disturbances. Hydrologically impaired surfaces in watershed total >15%. Road density >2.4 miles/miles ² .
	Disturbance Regime	Natural/Human Caused	Environmental disturbance is short-lived; predictable hydrograph, high-quality habitat and watershed complexity providing refuge and rearing space for all life stages or multiple life-history forms. Natural processes are stable.	Localized events of hillslope contributions, avulsion, lateral migrations, minor bed incision, or wildfires. Resiliency of habitat to recover from environmental disturbances is moderate.	Frequent flood or drought producing highly variable and unpredictable flows, hillslope contributions, avulsion, lateral migrations, minor to major bed incision (head cuts), or wildfires throughout a majority of the watershed. The channel is simplified, providing little hydraulic complexity in the form of pools or side channels. Natural processes are unstable.
Flow/Hydrology	Streamflow	Alterations to Peak/Base Flows	Magnitude, timing, duration, and frequency of peak flows within a watershed are not altered relative to natural conditions of an undisturbed watershed of similar size, geology, and geography.	Some evidence of altered magnitude, timing, duration and/or frequency of peak flows relative to natural conditions of an undisturbed watershed of similar size, geology, and geography.	Pronounced changes in magnitude, timing, duration and/or frequency of peak flows relative to natural conditions of an undisturbed watershed of similar size, geology, and geography.
Water Quality	Temperature	7-Day Rolling Mean of Daily Maximum Temperatures (7-DADMax)	<p>Bull Trout:</p> <p>incubation 2 - 5°C</p> <p>rearing 4 - 12°C</p> <p>spawning 4 - 9°C</p> <p>Other salmonids:</p> <p>spawning <13°C</p> <p>rearing <15°C</p> <p>holding & migration <15°C</p> <p>Lamprey:</p> <p>rearing 10 – 18 °C,</p> <p>migration <18°C</p> <p>And, temperatures do not exceed 15°C in areas used by adults during migration (no thermal barriers)</p>	<p>Bull Trout:</p> <p>incubation <2 or 6°C</p> <p>rearing <4 or 13 - 15°C</p> <p>spawning <4 or 10°C</p> <p>Other salmonids:</p> <p>spawning 14-15.5°C</p> <p>rearing <14 – 17.5°C</p> <p>holding & migration <14 – 17.5°C</p> <p>Lamprey:</p> <p>rearing 18 – 22°C,</p> <p>migration 18 – 22°C</p> <p>And, temperatures in areas used by adults during migration sometimes exceed 15°C</p>	<p>Bull Trout:</p> <p>incubation <1 or >6°C</p> <p>rearing >15°C</p> <p>spawning <4 or >10°C</p> <p>Other salmonids:</p> <p>spawning >15.5°C</p> <p>rearing >17.5°C</p> <p>holding & migration >17.5°C</p> <p>Lamprey:</p> <p>rearing >22°C,</p> <p>migration >22°C</p> <p>And, temperatures in areas used by adults during migration regularly exceed 15°C (thermal barriers present)</p>

2.2 REACH-SCALE METRICS

Pathway	General Indicators	Specific Indicators	Adequate Condition	At Risk Condition	Unacceptable Risk Condition
Reach Scale					
Habitat Access	Physical Barriers	Main Channel Barriers	No man-made barriers present in the mainstem that limit upstream or downstream migration at any flow.	Man-made barriers are present in the mainstem that have the potential to prevent or inhibit upstream or downstream migration at a subset of flows.	Man-made barriers present in the mainstem that prevent upstream or downstream migration at multiple or all flows.
Habitat Quality	Substrate	Dominant Substrate/Fine Sediment	Substrate fits the geomorphic condition of the reach, with no anthropogenic impacts affecting the substrate size, quantity, or deposition, as determined by observations made during the geomorphic assessment. There is no observed interspersions of fines in spawning gravels within the reach.	Substrate fits the geomorphic condition of the reach, with no anthropogenic impacts affecting the substrate size, quantity, or deposition, as determined by observations made during the geomorphic assessment. However, there is observed interspersions of fines in spawning gravels within the reach.	Substrate does not fit the geomorphic condition of the reach and there is evidence of anthropogenic impacts affecting the substrate size, quantity, or deposition, as determined by observations made during the geomorphic assessment. Interspersions of fines in spawning gravels is observed within the reach.
	LWM	Pieces per Mile at Bankfull	Based on Fox and Bolton (2007) metrics for Eastern Washington, at least 67.45 pieces/mile of “Medium” and “Large” size large woody material (LWM) are present in the reach, based on USFS (2020) size classifications. USFS Stream Inventory protocol (2020) large woody material criteria, under the Eastside Forests criteria: Medium = diameter > 12 in, length > 35 ft Large = diameter > 20 in, length > 35 ft In addition to a minimum of 67.45 pieces of medium or large wood/mile, an adequate rating also indicates the LWM are well-distributed throughout the reach and there are sources of woody debris available for both long- and short-term recruitment within the reach.	Current levels are able to maintain the minimum requirements for an “adequate” rating, but potential sources for long-term woody debris recruitment, as determined by the Riparian Structure reach metrics, are lacking in order to maintain these current levels or wood is not well-distributed throughout the reach.	Current levels are not meeting the minimum requirements for an “adequate” rating, and potential source of woody debris for short- and/or long-term recruitment are lacking or wood is not well-distributed throughout the reach.

Pathway	General Indicators	Specific Indicators	Adequate Condition	At Risk Condition	Unacceptable Risk Condition																											
	Pools	Pool Frequency and Quality; presence of large pools.	<p>Pool frequency: Number of pools/mile for a given bankfull width (BFW) equal or exceed NMFS (1996) criteria (below). For channels with bankfull >100 ft, minimum number of pools/mile were extrapolated based on relationship between BFW and pools/mile in NMFS (1996) criteria.</p> <p>Bankfull width:</p> <table border="1"> <tr><td>25-50</td><td>26</td><td>pools/mile</td></tr> <tr><td>51-75</td><td>23</td><td>pools/mile</td></tr> <tr><td>76-100</td><td>18</td><td>pools/mile</td></tr> <tr><td>101-130</td><td>15</td><td>pools/mile</td></tr> <tr><td>131-140</td><td>14</td><td>pools/mile</td></tr> <tr><td>141-150</td><td>13</td><td>pools/mile</td></tr> <tr><td>151-170</td><td>12</td><td>pools/mile</td></tr> <tr><td>171-180</td><td>11</td><td>pools/mile</td></tr> <tr><td>181-190</td><td>10</td><td>pools/mile</td></tr> </table> <p>In addition, at least 50% of the total pools must be large pools with >1 m (3 ft) of residual depth and good fish cover.</p>	25-50	26	pools/mile	51-75	23	pools/mile	76-100	18	pools/mile	101-130	15	pools/mile	131-140	14	pools/mile	141-150	13	pools/mile	151-170	12	pools/mile	171-180	11	pools/mile	181-190	10	pools/mile	Pool frequency meets or almost meets the values for the "adequate" rating, but pools have inadequate cover and/or there has been a moderate reduction of pool volume by fine sediment. Reaches have between 20-50% large pools present with good fish cover.	Pool frequency does not meet the pools/mile metric given in the "adequate" rating. Reaches have <20% large pools (>1 m deep). Pools also have inadequate cover and/or there has been a major reduction of pool volume by fine sediment.
	25-50	26	pools/mile																													
51-75	23	pools/mile																														
76-100	18	pools/mile																														
101-130	15	pools/mile																														
131-140	14	pools/mile																														
141-150	13	pools/mile																														
151-170	12	pools/mile																														
171-180	11	pools/mile																														
181-190	10	pools/mile																														
	Off-Channel Habitat and Refugia	Connectivity with Main Channel	Reach has side channels and/or groundwater fed tributaries. Aquatic refugia such as backwaters, alcoves, and large boulder eddies exist within the reach. Well-vegetated floodplains with healthy riparian community are inundated on a 1-2-year recurrence frequency. No man-made barriers that prevent access to off-channel areas.	Reach provides some aquatic off-channel and refugia features but access varies or is at risk of disconnection due to human impacts or man-made barriers. Floodplains along the off-channel habitat are well-vegetated with inundation recurrence of 2-5-years.	Reach provides no or only minimal off-channel refugia. Floodplains are disconnected and riparian vegetation has been altered.																											
Riparian Vegetation	Condition	Structure	>80% large trees (>21" DBH; USFS, 2020) in the riparian zone (defined as a 100ft buffer along each bank) based on habitat assessment data. No visual evidence of human impact on vegetation (e.g., logging or residential/agricultural clearing) in the floodplain.	50-80% large trees (>21" DBH; USFS, 2020) in the riparian zone (defined as a 100ft buffer along each bank) based on habitat assessment data. Some visual evidence of human impact on vegetation (e.g., logging or residential/agricultural clearing) in the floodplain.	<50% large trees (>21" DBH; USFS, 2020) in the riparian zone (defined as a 100ft buffer along each bank) based on habitat assessment data. Extensive visual evidence of human impact on vegetation (e.g., logging or residential/agricultural clearing) in the floodplain.																											
		Disturbance (Human)	<20% disturbance and <2 mile/miles ² road density in the 200-foot channel buffer. The percentage of disturbed areas was calculated through digitizing the areas of human disturbances (e.g., agriculture and grazing, residential, roads, etc.) on the aerial imagery and field observations. The road density was determined using the Washington Department of Natural Resources state roads GIS dataset (OpenData WADNR, 2025).	20-50% disturbance (e.g., agriculture and grazing, residential, roads, etc.) and 2-3 miles/miles ² road density in the 200-foot channel buffer zone.	>50% disturbance (e.g., agriculture and grazing, residential, roads, etc.) and >3 miles/miles ² road density in the in the 200-foot channel buffer zone.																											

Pathway	General Indicators	Specific Indicators	Adequate Condition	At Risk Condition	Unacceptable Risk Condition
		Canopy Cover	Canopy cover provides high level of channel shading, based on the number of shaded daylight hours on the summer solstice (using publicly-available mapping dataset Shademap: https://shademap.app/). In addition, a high proportion of large trees (height > 100 feet) and little or no anthropogenic clearing or disturbance are present within 100-feet of the channel bank.	Canopy cover provides moderate level of channel shading, based on the number of shaded daylight hours on the summer solstice. In addition, a moderate proportion of large trees (height > 100 feet) and some anthropogenic clearing or disturbance is present within 100-feet of the channel bank.	Canopy cover provides low level of channel shading, based on the number of shaded daylight hours on the summer solstice. In addition, a small proportion of large trees (height > 100 feet) and substantial anthropogenic clearing or disturbance are present within 100-feet of the channel bank.
Channel	Dynamics	Floodplain Connectivity	Floodplain areas are hydrologically linked to main channel within the context of the local process domain; overbank flows occur and maintain wetland functions, and riparian vegetation. Naturally confined channels are considered adequate.	Reduced linkage of floodplains and riparian areas to main channel in reaches with historically strong connectivity; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of floodplain soil accumulations and riparian vegetation/succession.	Severe reduction in hydrologic connectivity between off-channel, floodplain, and riparian areas relative to historical connectivity; riparian vegetation/succession is altered significantly.
		Bank Stability/Channel Migration	Channel is migrating at or near natural rates within the geomorphic construct of the reach.	Channel migration is occurring at a faster or slower rate relative to natural rates, but significant change in channel width or planform is not detectable; large woody debris is still being recruited.	Little or no channel migration is occurring because of human actions preventing reworking of the floodplain and large woody debris recruitment; or channel migration is occurring at an accelerated rate such that channel width has at least doubled, possibly resulting in a channel planform change, and sediment supply has noticeably increased from bank erosion.
		Vertical Channel Stability	No measurable trend of aggradation or incision beyond the natural geomorphic processes of the reach.	Measurable trend of aggradation or incision that has the potential to, but has not yet caused, disconnection of the floodplain or a visible change in channel planform (e.g. single thread to braided.)	Enough incision or human infrastructure has occurred that the floodplain and off-channel habitat areas have been disconnected from the main channel; or enough aggradation has occurred to create a visible change in channel planform (e.g. single thread to braided.)

3 REI Ratings

This section discusses the results for each indicator, rated at either the reach-scale or watershed-scale for all four reaches.

3.1 WATERSHED-SCALE RATINGS

General Characteristics	General Indicators	Specific Indicators	Rating	Discussion
Watershed Scale				
Watershed Condition	Drainage Network and Hydrologically Impaired Surfaces	Increase in Drainage Network/ Hydrologically Impaired Surfaces	At Risk Condition	Hydrologically impaired surfaces (roads, parking lots, and buildings) in the watershed were calculated using the 2024 National Land Cover Database (U.S. Geological Survey, 2024). The raster dataset is broken into three categories: developed, roads, and non-developed. The percentage of developed and roads raster cells were compared to the cell count for the entire watershed, which was delineated using the Washington State Department of Ecology HUC-10 Watershed Boundary Dataset (WDOE, 2016). The percentage of hydrologically impaired surfaces for the entire contributing watershed was 1.0%. Road density was calculated using a Washington Department of Natural Resources state roads GIS dataset (OpenData WADNR, 2025). The total length of roads in the Entiat River watershed was calculated and compared to the total watershed area. The watershed road density is 2.5 miles of road per square mile of watershed. The Entiat River watershed is relatively undeveloped, however, the primarily residential development is most frequently located along the valley bottom, directly adjacent to the Entiat River. This is especially true closer to the mouth of the Entiat, near the town of Entiat. There are a significant number of roads located within the watershed, primarily a consequence of historic and current logging in the watershed. Given the low percentage of hydraulically impaired surfaces but relatively high level of road density, this indicator receives an At Risk rating.
	Disturbance Regime	Natural/Human Caused	At Risk Condition	This disturbance history rating for the Entiat watershed reflects a history of logging, fire suppression, dams, road and residential development, and agriculture. These human-caused disturbances have historical and on-going impacts on the watershed and have altered the natural disturbance cycles. Since the late 1800's, when Euro-American settlement began in the Entiat watershed, the land use along the river has been altered from timber, orchards, grazing, and development (Godaire et al., 2009). Timber harvest and riparian clearing for anthropogenic uses have reduced the width and structure of the riparian vegetation, as well as reduced the amount of LWM available for recruitment (Chelan County Conservation District [CCCD], 2004; Erickson, 2004; U.S. Bureau of Reclamation, 2009). Past splashing damming and the simplification of in-channel conditions to assist in timber transport have reduced the amount and quality of in-stream habitat. Multiple impassable dams were constructed on the Entiat, downstream of the assessment area, which blocked fish passage for years during the early 1900's (Godaire et al., 2009; Inter-Fluve, 2018; U.S. Bureau of Reclamation, 2012). Legacy effects from these fish passage barriers may still impact anadromous fish populations in the basin (U.S. Bureau of Reclamation, 2012). The Entiat watershed historically had frequent low intensity fires (CCCD, 2004), but fire suppression efforts have led to an increase in the size and intensity of fires since the early 1900's (U.S. Bureau of Reclamation, 2013). Roughly 60% of the Entiat watershed has been burned in the past five decades (CCCD, 2004; Washington State Department of Natural Resources, n.d.). Though these legacy effects and on-going disturbance within the watershed are negatively impacting geomorphic and habitat-forming processes in the Entiat River system the development within the watershed is relatively low and there are signs of localized riparian recovery post-fire (US Bureau of Reclamation, 2009, 2009a). For these reasons, the Entiat watershed receives an At Risk rating.
Flow/Hydrology	Streamflow	Alterations to Peak/Base Flows	At Risk Condition	The hydrology of the Entiat River watershed is driven by snowmelt and precipitation. Peak flows occur in the spring from snowmelt runoff, with a secondary peak in the late fall from precipitation. Streamflow data from USGS gage #12452800, near Ardenvoir, WA from water years 1957-2023 (as far back as data was available) was analyzed to help determine this rating. The streamflow data was split by decade, and the daily mean, 5% exceedance, and 95% exceedance was determined for each decade. Over the past seven decades the peak flows, both the spring snowmelt and fall precipitation, appear to be occurring earlier in the year, but otherwise there are no discernible trends in the data. There are relatively few major tributaries that input flow into the Entiat, and discharge is more dependent on snowpack and precipitation, rather than drainage area (Godaire et al., 2009), which makes the hydrology more susceptible to snowpack changes from the predicted warming the Pacific Northwest will endure with climate change (Mote & Salathé, 2010). Increasing fire severity and resulting flood events could also severely impact the flow pattern of the Entiat. Given these probable changes in snowpack from climate, and how peak stream flows appear to be occurring earlier in the year, this rating receives an At Risk rating.

<p>Water Quality</p>	<p>Temperature</p>	<p>7-Day Rolling Mean of Daily Maximum Temperatures (7-DADMax)</p>	<p>Unacceptable Condition</p>	<p>Water temperature data in the Entiat River is relatively limited and largely relies on datasets with short duration or limited spatial scale. Data reviewed for this rating includes one year of water level and temperature logger data, thermal-infrared imagery, and literature reviews. Inter-Fluve collected water temperature data within the assessment area (Reach 11, near RM 25.5) between September 2014 and September 2015 for a restoration project with Yakama Nation (Entiat 3D Project). Water temperature logger data was used to calculate the 7-Day Rolling Mean of Daily Maximum Temperatures (7-DADMax). The 7-DADMax values for the period from September 2014 – September 2015 were compared to salmonid water temperature preferences. The salmonid rearing temperature preference threshold of 15°C was exceeded in June-August of 2015. The salmonid spawning temperature preference threshold (13°C) was met or exceeded in August and September 2015, during the spring Chinook spawning period.</p> <p>Thermal-Infrared (TIR) data was collected within the assessment area in August of 2023 by NV5 Geospatial (2023). The longitudinal profile from the TIR data revealed a typical downstream warming trend, though the trend plateaus throughout much of the assessment area, correlated with a high concentration of cold patches (NV5 Geospatial 2023). Inter-Fluve staff manually identified 16 cold patches within the assessment area from the TIR data, some of which align with those identified in the NV5 Geospatial Report (2023). However, of the 16 cold patches identified, all were above the salmonid rearing temperature preference threshold (15°C), most were small plumes that dissipated quickly, and five were disconnected or had minimal surface flow from the mainstem during the 2024 habitat assessment.</p> <p>Previous studies and assessments that reported shorter-term or local water temperature monitoring data were also reviewed to inform this rating. These studies suggest water temperatures have been elevated above water quality standards and salmonid thresholds during the summer months since at least 2001 (Chelan and Entiat Ranger Districts, 2001; Godaire et al., 2009; Inter-Fluve, 2013; NV5 Geospatial, 2023; U.S. Bureau of Reclamation, 2009, 2009a, 2013). Increased water temperatures in the Entiat have largely been attributed to riparian vegetation disturbance (and the associated loss of canopy cover) as a result of land development, agriculture, or fire. Tributaries were identified as important cold-water inputs to the Entiat River based on the TIR data collected by NV5 Geospatial (2023). However, changes in the fire regime and storm severity within the watershed due to fire management and climate change may limit future cold- or cool-water benefits from these tributaries. Decades of fire suppression have resulted in a large build up in fuels, increasing the intensity and spatial extent of wildfires in the basin. A 2001 Stream Monitoring Report found increased landslides and mud/debris flows post-fire or storm can create wider, shallower streams, reducing the temperature resiliency of tributaries along the Entiat (Chelan and Entiat Ranger Districts, 2001). There is little evidence to suggest water temperatures have improved or will improve under continued climatic changes. Based on the 2014/15 water temperature data, TIR data, and literature review, the Water Quality – Temperature metric in the Entiat watershed receives an Unacceptable rating.</p>
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3.2 REACH-SCALE RATINGS

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Habitat Access	Physical Barriers	Main Channel Barriers	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
			There were no anthropogenic barriers in the main channel. Two channel-spanning rock weirs associated with the McKenzie Ditch Irrigation Diversion, located near RM 16.6, were recorded, though fish were present upstream suggesting they are not likely to be fish passage barriers except under extremely low flow conditions.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Habitat Quality	Substrate	Dominant Substrate/ Fine Sediment	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	At Risk	Adequate	Adequate	Adequate
			Based on ocular estimates during the geomorphic survey, the substrate was primarily boulder (>256 mm), with gravels (2.1-64mm) and sand (<2 mm) observed at upstream end. The McKenzie diversion created a backwater effect that interspersed small amounts of fines with spawning gravel at the upstream end of the reach. Based on the Washington Large Fires dataset from 1973-2022, this reach is in the footprint of recent large fires (Washington State Department of Natural Resources, n.d.). Increased sediment from mass wasting or reduced vegetation post-fire may contribute to the amount of fines in the reach.	Based on ocular estimates during the geomorphic survey, the substrate alternated between sand (<2 mm) and gravels (2.1-64mm). The McKenzie diversion created a backwater effect that interspersed small amounts of fines with spawning gravel at the downstream end of the reach.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily cobbles (64.1-256 mm) with gravels (2.1-64mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.	Based on ocular estimates during the geomorphic survey, the substrate was primarily gravel (2.1-64mm) and cobbles (64.1-256 mm). There was no interspersed of fines with spawning gravels observed.

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Habitat Quality	LWM	Pieces per Mile at Bankfull	Unacceptable	At Risk	At Risk	At Risk	At Risk	At Risk	Adequate	Unacceptable	Adequate	Unacceptable	Unacceptable	At Risk
			<p>M+L pieces/mi = 37</p> <p>Percent in Jams = 17%</p> <p>Does not meet the minimum criteria of 67.45 pieces of M+L wood per mile. Less than 50% of the wood is within jams, none of which are constructed. The potential sources for short and long-term woody debris recruitment are limited, as determined by riparian condition ratings.</p>	<p>M+L pieces/mi = 242</p> <p>Percent in Jams = 77%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams and most of those jams are constructed. Without constructed jams, there would be 35 M+L pieces per mile. The potential sources for short and long-term woody debris recruitment are limited, as determined by riparian condition ratings.</p>	<p>M+L pieces/mi = 244</p> <p>Percent in Jams = 82%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams and most of those jams are constructed. Without constructed jams, there would only be 33 M+L pieces per mile. The potential sources for short and long-term woody debris recruitment are limited, as determined by riparian condition ratings.</p>	<p>M+L pieces/mi = 102</p> <p>Percent in Jams = 73%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams (both natural and constructed). Without constructed jams there would be 56 M+L pieces per mile. The potential sources for short and long-term woody debris recruitment are limited, as determined by riparian condition ratings.</p>	<p>M+L pieces/mi = 265</p> <p>Percent in Jams = 77%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams and most of those jams are constructed. Without constructed jams there would be 83 M+L pieces per mile. The potential sources for short and long-term woody debris recruitment are limited. There is minimal disturbance in this reach but most of the trees are small, likely a result of the intensive logging history of the Entiat.</p>	<p>M+L pieces/mi = 143</p> <p>Percent in Jams = 79%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams (both constructed and natural). Without constructed jams there would be 39 M+L pieces per mile. The potential sources for short and long-term woody debris recruitment are limited. There is minimal disturbance in this reach but most of the trees are small, likely a result of the intensive logging history of the Entiat.</p>	<p>M+L pieces/mi = 482</p> <p>Percent in Jams = 87%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams and most of those jams are constructed. Without constructed jams there would be 94 M+L pieces per mile. The potential sources for short and long-term woody debris recruitment are limited, as determined by riparian condition ratings and without restoration efforts this reach would be At-Risk. However, field observations indicate that riparian conditions are improving and with the high number of constructed jams, it is currently in Adequate condition.</p>	<p>M+L pieces/mi = 13</p> <p>Percent in Jams = 0% (no jams observed)</p> <p>Does not meet the minimum criteria of 67.45 pieces of M+L wood per mile. There were no jams observed in the reach. The potential sources for short and long-term woody debris recruitment are limited. The trees in the riparian are large, but there is development alongside the reach and a lack of geomorphic processes that prevent recruitment.</p>	<p>M+L pieces/mi = 226</p> <p>Percent in Jams = 69%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams. Without constructed jams there would be 72 M+L pieces per mile. There are potential sources for both short and long-term woody debris recruitment within the reach.</p>	<p>M+L pieces/mi = 21</p> <p>Percent in Jams = 40%</p> <p>Does not meet the minimum criteria of 67.45 pieces of M+L wood per mile. Less than 50% of the wood is within jams, none of which were constructed. The potential sources for short and long-term woody debris recruitment are limited. The trees in the riparian are large, but there is development alongside the reach and a lack of geomorphic processes that prevent recruitment.</p>	<p>M+L pieces/mi = 63</p> <p>Percent in Jams = 49%</p> <p>Does not meet the minimum criteria of 67.45 pieces of M+L wood per mile. Less than 50% of the wood is within jams, none of which are constructed. The potential sources for short and long-term woody debris recruitment are limited. The trees in the riparian are large, but there is development alongside the reach and a lack of geomorphic processes that prevent recruitment.</p>	<p>M+L pieces/mi = 319</p> <p>Percent in Jams = 66%</p> <p>Meets the minimum criteria of 67.45 pieces of M+L wood per mile. Most (>50%) of the wood is within jams and most of those jams are constructed. Without constructed jams there would be 80 M+L pieces per mile. The potential sources for short and long-term woody debris recruitment are limited. There is minimal disturbance in this reach but most of the trees are small, likely a result of the intensive logging history of the Entiat.</p>

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Habitat Quality	Pools	Pool Frequency and Quality; Presence of large pools.	Unacceptable	Adequate	At Risk	Adequate	At Risk	At Risk	Adequate	Unacceptable	At Risk	Unacceptable	At Risk	At Risk
			Total Pools = 4 Pools/mi = 4 Pools ≥ 3 ft = 1 (25%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 2.6 ft Cover: low Does not meet the pool frequency criteria for bankfull width (average BFW = 95, requires 18 pools/mile). Only one of the pools is large and cover is low, with only moderate amounts of LWM and cover.	Total Pools = 12 Pools/mi = 12 Pools ≥ 3 ft = 7 (58%) Pools ≥ 6 ft = 2 (17%) Avg residual pool depth: 4.3 ft Cover: high Almost meets the pool frequency criteria for bankfull width (average BFW = 115, requires 15 pools/mile), however, this reach is not lacking in pool habitat (89% by area), but rather in the heterogeneity of habitat units. Most of the pools are large, and cover is relatively high with LWM and riparian vegetation offering high quality pool availability.	Total Pools = 4 Pools/mi = 6 Pools ≥ 3 ft = 2 (50%) Pools ≥ 6 ft = 2 (50%) Avg residual pool depth: 5.2 ft Cover: moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 93, requires 18 pools/mile), however, this reach is not lacking in pool habitat (72% by area), but rather in the heterogeneity of habitat units. Most of the pools are large, with LWM and cover relatively available.	Total Pools = 12 Pools/mi = 13 Pools ≥ 3 ft = 9 (75%) Pools ≥ 6 ft = 1 (8%) Avg residual pool depth: 4.1 ft Cover: moderate Almost meets the pool frequency criteria for bankfull width (average BFW = 95, requires 18 pools/mile), however, this reach is not lacking in pool habitat (70% by area), but rather in the heterogeneity of habitat units. Most of the pools are large, with LWM and cover relatively available.	Total Pools = 9 Pools/mi = 11 Pools ≥ 3 ft = 8 (89%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 4.3 ft Cover: moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 63, requires 23 pools/mile), however, this reach is not lacking in pool habitat (65% by area), but rather in the heterogeneity of habitat units. Most of the pools are large, with LWM and cover relatively available.	Total Pools = 6 Pools/mi = 9 Pools ≥ 3 ft = 3 (50%) Pools ≥ 6 ft = 1 (17%) Avg residual pool depth: 4.0 ft Cover: moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 119, requires 15 pools/mile) however, this reach is not lacking in pool habitat (76% by area), but rather in the heterogeneity of habitat units. Most of the pools are large, with LWM and cover relatively available.	Total Pools = 13 Pools/mi = 10 Pools ≥ 3 ft = 10 (77%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 3.8 ft Cover: high Almost meets the pool frequency criteria for bankfull width (average BFW = 118, requires 15 pools/mile). Most of the pools are large, and cover is relatively high with LWM and riparian vegetation offering high quality pool availability.	Total Pools = 0 Pools/mi = 0 Pools ≥ 3 ft = 0 Pools ≥ 6 ft = 0 Avg residual pool depth: N/A Cover: N/A Does not meet the pool frequency criteria for bankfull width (average BFW = 85, requires 18 pools/mile). There were no pools observed in the reach and very few pieces of LWM observed to provide cover or refugia from high water velocities.	Total Pools = 18 Pools/mi = 11 Pools ≥ 3 ft = 9 (50%) Pools ≥ 6 ft = 1 (6%) Avg residual pool depth: 3.5 Cover: moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 101, requires 15 pools/mile). Most of the pools are large, with LWM and cover relatively available.	Total Pools = 1 Pools/mi = 1 Pools ≥ 3 ft = 1 (100%) Pools ≥ 6 ft = 0 Avg residual pool depth: 4.5 Cover: low Does not meet the pool frequency criteria for bankfull width (average BFW = 88, requires 18 pools/mile). There was only one pool observed in the reach, with very few pieces of LWM observed to provide cover or refugia from high water velocities.	Total Pools = 5 Pools/mi = 7 Pools ≥ 3 ft = 4 (80%) Pools ≥ 6 ft = 1 (20%) Avg residual pool depth: 5.7 Cover: high Does not meet the pool frequency criteria for bankfull width (average BFW = 93, requires 18 pools/mile). Most of the pools are large, and cover is relatively high with LWM and riparian vegetation offer high quality pool availability.	Total Pools = 2 Pools/mi = 2 Pools ≥ 3 ft = 2 (100%) Pools ≥ 6 ft = 0 Avg residual pool depth: 3.8 Cover: high Does not meet the pool frequency criteria for bankfull width (average BFW = 103, requires 15 pools/mile). Most of the pools are large, and cover is relatively high with LWM and riparian vegetation offering high quality pool availability.

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Habitat Quality	Off-Channel Habitat and Refugia	Connectivity with Main Channel	Adequate	Unacceptable	At Risk	Unacceptable	Adequate	Unacceptable	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk
			<p>Total SC = 1</p> <p>Fast water = 0</p> <p>Slow water = 1</p> <p>Very little perennial off-channel habitat exists and floodplains are not regularly inundated. However, this reach is naturally geomorphically confined.</p>	<p>Total SC = 0</p> <p>Fast water = 0</p> <p>Slow water = 0</p> <p>No perennial off-channel habitat exists. Two alcoves, one of which functions as a complete side channel at higher flows, exist within the reach.</p> <p>Floodplains are well connected at the 2–5-year flood events, but residential development and road infrastructure has minimized the amount of off-channel habitat available, as determined by field observations, aerial imagery, and hydraulic modeling.</p>	<p>Total SC = 2</p> <p>Fast water = 0</p> <p>Slow water = 2</p> <p>Connected off-channel habitat is present, but infrequent.</p> <p>Floodplains are well connected at the 2-5 year flood events, but are constricted by a bridge and residential development, as determined by field observations, aerial imagery, and hydraulic modeling.</p>	<p>Total SC = 0</p> <p>Fast water = 0</p> <p>Slow water = 0</p> <p>No perennial off-channel habitat exists.</p> <p>Floodplains are moderately connected at the 2-5 year flood events, and off-channel habitat is limited by relic bridge infrastructure near the downstream end of the reach and residential development along the river left of the reach, as determined by field observations, aerial imagery, and hydraulic modeling.</p>	<p>Total SC = 4</p> <p>Fast water = 0</p> <p>Slow water = 4</p> <p>Off-channel habitat that is connected at a variety of flows exists within the reach.</p> <p>Floodplains are well connected at the 2-5 year flood events, and human impacts are minimal, as determined by field observations, aerial imagery, and hydraulic modeling.</p>	<p>Total SC = 0</p> <p>Fast water = 0</p> <p>Slow water = 0</p> <p>No perennial off-channel habitat exists.</p> <p>Floodplains are inundated at the 2–5-year flood events. The lack of LWM driving geomorphic processes, likely from the history of logging in the watershed, has resulted in disconnected floodplains and no off-channel habitat, as determined by field observations, aerial imagery, and hydraulic modeling.</p>	<p>Total SC = 6</p> <p>Fast water = 0</p> <p>Slow water = 6</p> <p>Off-channel habitat that is connected at a variety of flows exists within the reach.</p> <p>Floodplains are regularly inundated, though some confinement still occurs from residential development and the Entiat River Road on river left.</p>	<p>Total SC = 0</p> <p>Fast water = 0</p> <p>Slow water = 0</p> <p>No perennial off-channel habitat exists and floodplains are not regularly inundated. However, this reach is naturally geomorphically confined.</p>	<p>Total SC = 2</p> <p>Fast water = 0</p> <p>Slow water = 2</p> <p>Connected off-channel habitat is present, but infrequent.</p> <p>Floodplains are connected at the 2-5 year flood event. Multiple levees, residential development, and bridge infrastructure at the downstream end have minimized the amount of off-channel habitat available, as determined by field observations, aerial imagery, and hydraulic modeling.</p>	<p>Total SC = 0</p> <p>Fast water = 0</p> <p>Slow water = 0</p> <p>No perennial off-channel habitat exists and floodplains are not regularly inundated. However, this reach is naturally geomorphically confined.</p>	<p>Total SC = 4</p> <p>Fast water = 0</p> <p>Slow water = 4</p> <p>Off-channel habitat that is connected at a variety of flows exists within the reach.</p> <p>However, floodplains are not connected at the 2-5-year flood event and only moderately connected at the 10-year event or above. This is, in part, from residential development and bridge infrastructure that has minimized lateral migration and the development of off-channel habitat, as determined by field observations, aerial imagery, and hydraulic modeling.</p>	<p>Total SC = 2</p> <p>Fast water = 1</p> <p>Slow water = 1</p> <p>Off-channel habitat that is connected at a variety of flows exists within the reach, however, the full potential for off-channel habitat Reach 12 is not fully utilized.</p> <p>Floodplains are moderately connected at the 2-5 year flood events, and off-channel habitat is limited by residential development along the river left at the upstream end of the reach, as determined by field observations, aerial imagery, and hydraulic modeling.</p>

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Riparian Vegetation	Condition	Structure	Unacceptable	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk
			<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 20% large tree, 20% small tree, 20% shrub/seedling, 20% grassland/ forb, and 20% other (burned snags and planted Ponderosa pine). Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach as determined by field estimates, tree height data, and aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 60% large tree and 40% small tree. Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach as determined by field estimates, tree height data, or aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 50% large tree and 50% small tree. Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach as determined by field estimates, tree height data, or aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 57% large tree and 43% small tree. Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach, as determined by field estimates, tree height data, or aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 60% small tree and 40% large tree. Reach has minimal visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach, as determined by field estimates, tree height data, or aerial photographs. However, historical records indicate logging was prevalent throughout the watershed (CCCD, 2004) and is likely the reason behind the lack of large trees in the reach.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 80% small tree and 20% large tree. Reach has minimal visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach, as determined by field estimates, tree height data, or aerial photographs. However, historical records indicate logging was prevalent throughout the watershed (CCCD, 2004) and is likely the reason for the lack of large trees in the reach.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 57% small tree and 43% large tree. Recorded vegetation data was following USFS protocols under-represented large trees within the riparian zone. . Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach as determined by field estimates, tree height data, or aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 100% large tree. Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach, as determined by field estimates, tree height data, or aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 11% small tree and 89% large tree. Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach, as determined by field estimates, tree height data, or aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 25% small tree and 75% large tree. Reach has visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach, as determined by field estimates, tree height data, or aerial photographs.</p>	<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 80% small tree and 20% large tree. Reach has minimal visual evidence of human disturbance that has reduced the width of the riparian buffer and impacted stand age and structural complexity in many areas of this reach, as determined by field estimates, tree height data, or aerial photographs. However, historical records indicate logging was prevalent throughout the watershed (CCCD, 2004) and is likely the reason for the lack of large trees in the reach.</p>	

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Riparian Vegetation	Condition	Disturbance (Human)	At Risk	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk
			14% disturbance in the 200-foot buffer zone and 0.1 miles/miles ² road density in the 200-foot riparian buffer zone.	7% disturbance in the 200-foot buffer zone and 1.8 miles/miles ² road density in the 200-foot riparian buffer zone.	8% disturbance in the 200-foot buffer zone and 7.1 miles/miles ² road density in the 200-foot riparian buffer zone.	11% disturbance in the 200-foot buffer zone and 15.0 miles/miles ² road density in the 200-foot riparian buffer zone.	3% disturbance in the 200-foot buffer zone and 5.7 miles/miles ² road density in the 200-foot riparian buffer zone.	0.3% disturbance in the 200-foot buffer zone and 0 miles/miles ² road density in the 200-foot riparian buffer zone.	4% disturbance in the 200-foot buffer zone and 5.3 miles/miles ² road density in the 200-foot riparian buffer zone.	4% disturbance in the 200-foot buffer zone and 5.0 miles/miles ² road density in the 200-foot riparian buffer zone.	3% disturbance in the 200-foot buffer zone and 4.1 miles/miles ² road density in the 200-foot riparian buffer zone.	3% disturbance in the 200-foot buffer zone and 17.9 miles/miles ² road density in the 200-foot riparian buffer zone.	10% disturbance in the 200-foot buffer zone and 16.8 miles/miles ² road density in the 200-foot riparian buffer zone.	1% disturbance in the 200-foot buffer zone and 9.9 miles/miles ² road density in the 200-foot riparian buffer zone.

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Riparian Vegetation	Condition	Canopy Cover	Unacceptable	At Risk	At Risk	At Risk	Adequate	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	At Risk
			<p>Reach average of 5.8 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Few tall trees are present within the riparian buffer. Wildfire significantly impacted canopy cover in this reach. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 6.9 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Few tall trees are present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 6.5 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Few tall trees are present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 6.3 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Few tall trees are present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 7.7 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>A moderate number of tall trees are present within the riparian buffer. Very little anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 5.9 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Few tall trees are present within the riparian buffer. Very little anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 8.4 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>A moderate number of tall trees are present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 11.7 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Tall trees are widely present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 7.5 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>A moderate number of tall trees are present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 10.7 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Tall trees are widely present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 9.4 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>Tall trees are widely present within the riparian buffer. Anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>	<p>Reach average of 8.7 hours shaded during daylight hours on the summer solstice, determined from the weighted average of raster data from the shademap tool for each reach.</p> <p>A moderate number of tall trees are present within the riparian buffer. Very little anthropogenic clearing has occurred in this reach based on field observations and aerial photos.</p>

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Channel	Dynamics	Floodplain Connectivity	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk
			<p>The channel is naturally confined between the river right hillslopes and the Potato Terminal Moraine, Decker Creek fan, and Potato Creek fan on river left. Where width allows, pocket floodplains exist, however, natural confinement limits the presence of floodplain surfaces.</p>	<p>Although prior restoration projects have improved floodplain connectivity compared to the degraded pre-project condition, connected low-flow off-channel habitat is still generally lacking in sections of the reach where valley bottom width allows for floodplain surfaces to exist. Unless additional complexity is added to the channel to encourage floodplain inundation, floodplain connectivity in Reach 2 will remain at risk.</p>	<p>Floodplain connectivity below the 5-year flow event is significantly reduced compared to presumed historical conditions. Large wood and riprap bank protection and leveeing along the river right bank contribute to reduced floodplain connectivity. Floodplain connectivity is likely to be further reduced if levees continue to grow.</p>	<p>The channel is naturally confined between fans including the Stormy Creek alluvial fan in the middle of the reach. Therefore, the bridge at RM 18.9 does not significantly impact floodplain connectivity. Elevated surfaces related to the former bridge at RM 18.45 likely limit flow over floodplain surfaces in the lower portion of the reach. Elsewhere, where valley width allows, vegetated floodplains exist throughout the valley floor.</p>	<p>Where valley width allows, vegetated floodplains exist throughout the valley floor. Connectivity to the existing modern floodplain is adequate.</p>	<p>Off-channel habitat that is wetted at low flows is currently lacking in Reach 6. Existing floodplain channels are modeled as wetted at or above the two-year flow event. Without enhancement channel complexity (e.g., large wood additions) floodplain connectivity is likely to remain limited in Reach 6.</p>	<p>Where valley width allows, vegetated floodplains exist throughout the valley floor. Connectivity to the existing modern floodplain is adequate. Prior restoration projects have improved floodplain connectivity by created wetted floodplain side channels.</p>	<p>The channel is naturally confined between the Dill Creek fan on river left and the fan of an unnamed tributary on river right. Natural confinement limits the presence of floodplain surfaces. Artificial protection placed at the base of the bridge at RM 22.45 does not further reduce floodplain connectivity beyond limits imposed by naturally confining features.</p>	<p>Artificial levees near RM 23.2 and RM 23.7 limit local floodplain connectivity compared to presumed historical conditions. Elsewhere in the reach, floodplain channels are typically wetted at or below the two-year flow event, and connectivity to the modern floodplain is adequate.</p>	<p>The channel is naturally confined between the hillslopes on river right and the Preston Creek fan on river left. Natural confinement limits the presence of floodplain surfaces.</p>	<p>The channel is naturally confined between the hillslopes on river right and the Brennegan Creek fan on river left through the upper portion of the reach. Downstream, connectivity to the river right floodplain is reduced due to channel straightening, however, overall floodplain availability is somewhat limited by natural confinement throughout the reach.</p>	<p>Bank protection (e.g., large wood structures) and levees limit floodplain inundation throughout the reach. Floodplain connectivity is unlikely to be restored unless levees and bank protection are removed and channel complexity is increased.</p>

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Channel	Dynamics	Bank Stability/ Channel Migration	Adequate	Adequate	At Risk	Adequate	Adequate	At Risk	At Risk	Adequate	At Risk	Adequate	At Risk	At Risk
			<p>The channel is naturally confined between the river right hillslopes and the Potato Terminal Moraine, Decker Creek fan, and Potato Creek fan on river left. Natural confinement limits channel migration within the reach.</p>	<p>Where valley-width and channel complexity allow, lateral processes are occurring.</p>	<p>Artificial bank protection limits lateral processes in several locations resulting in channel straightening and levee growth. Unless bank protection structures are removed or channel complexity increases lateral channel migration is unlikely to improve.</p>	<p>Where valley-width and channel complexity allow, lateral processes are occurring.</p>	<p>A recent avulsion near RM 20 has placed the channel against the river left road embankment and hillslopes. Unless channel complexity (e.g., large wood) increases, the channel may become locked into place through this stretch. However, at present, lateral processes are occurring at or near presumed historical rates where valley-width and channel complexity allow.</p>	<p>The channel is relatively straight and lateral migration rates are likely lower than presumed historical rates. Unless channel complexity increases lateral channel migration is unlikely to improve.</p>	<p>The channel in the middle section of the reach travels along the road embankment which limits lateral migration into the floodplain on river right. Unless additional complexity is added to the channel lateral migration rates are unlikely to be restored through this section. Elsewhere in the reach lateral processes are occurring where valley-width allows.</p>	<p>The channel is naturally confined between the Dill Creek fan on river left and the fan of an unnamed tributary on river right. Natural confinement limits channel migration within the reach. Artificial protection placed at the base of the bridge at RM 22.45 does not further reduce lateral migration beyond limits imposed by naturally confining features.</p>	<p>The artificial levee at RM 23.2 limits leftward channel migration leading to local channel straightening between RM 23 and RM 23.2. Elsewhere in the reach lateral migration is actively occurring where valley-width and channel complexity allow.</p>	<p>The channel is naturally confined between the hillslopes on river right and the Preston Creek fan on river left. Natural confinement limits channel migration within the reach.</p>	<p>The Brennegan Creek fan and hillslopes provide a natural limit to leftward lateral channel migration throughout the reach. Although the valley bottom is naturally narrow, lack of channel complexity (e.g., naturally occurring large wood) likely exacerbates channel straightening limiting rightward channel migration.</p>	<p>Lateral processes are occurring, however, bank protection (e.g., large wood structures) limits local migration in several sections. Lateral processes are unlikely to improve unless bank protection is removed and channel complexity is increased.</p>

Pathway	General Indicators	Specific Indicators	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12
Channel	Dynamics	Vertical Channel Stability	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	At Risk	Adequate	At Risk	Adequate	At Risk	Adequate
			Localized backwatering associated with the boulder weir near the upstream reach boundary has resulted in fine sediment deposition and slight channel aggradation. Without weir removal, this process is expected to continue, however, these effects are not at risk of propagating downstream farther into Reach 1. Elsewhere, the channel is naturally confined and no measurable trend in incision or aggradation beyond natural geomorphic processes was observed.	Localized backwatering associated with the boulder weir in Reach 1 has resulted in fine sediment deposition and slight channel aggradation. Without weir removal, this process is expected to continue. Elsewhere in the reach, no measurable trend in incision or aggradation beyond natural geomorphic processes was observed, however, large wood removal and bank armoring have simplified the channel which may lead to future incision if measures are not taken to increase channel complexity	No active measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach, however, large wood removal and bank armoring have simplified the channel which may lead to future incision if measures are not taken to increase channel complexity	The channel throughout most of Reach 4 is naturally confined and no measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach. The former Cottonwood Flats bridge, which likely generated local incision in the downstream portion of the reach, was removed as part of the Cottonwood Flats restoration project.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No active measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach, however, large wood removal and bank armoring have simplified the channel which may lead to future incision if measures are not taken to increase channel complexity.	Levees and bank armoring that previously straightened the channel in the downstream portion of Reach 7 were removed as part of the Stormy B restoration project, and processes affecting vertical channel stability are in the process of recovery. No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	The channel is naturally confined and no measurable trend in incision or aggradation beyond natural geomorphic processes was observed.	Channel straightening associated with artificial levees in Reach 9 place the reach at risk of vertical incision. Although portions of the Upper Tyee Levee were breached during the Entiat Tyee restoration project, the channel remains simplified relative to historical conditions and is at risk of incision if not addressed.	The channel is naturally confined and no measurable trend in incision or aggradation beyond natural geomorphic processes was observed.	The channel is naturally confined throughout the majority of the reach, with no measurable trend in incision or aggradation beyond natural geomorphic processes observed through this section. As the valley bottom widens in the downstream portion of the reach, channel simplification limits lateral channel migration and may drive incision in the future. This lower portion is at risk of incisional processes unless additional measures are taken to increase channel complexity downstream.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed.

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