

Icicle Creek Reach Assessment

Appendix B | Reach-Based Ecosystem Indicators (REI)

Icicle Creek (RM 0 – 22.02)

February 2026

Table of Contents

1	Introduction	1
1.1	Background	1
1.2	Summary of Results	1
2	Metrics & Indicators	4
2.1	Watershed-Scale Metrics	4
2.2	Reach-Scale Metrics	5
3	REI Ratings	8
3.1	Watershed-Scale Ratings	8
3.2	Reach-Scale Ratings – Reach 1 - Reach 10	9
3.3	Reach-Scale Ratings – Reach 11 – Reach 20	16
4	References & Sources	23

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 matrix of pathways and indicators (NMFS, 1996) and the U.S. Fish and Wildlife Service matrix of pathways for eastside streams (USFWS, 1998).

The REI evaluation for Icicle Creek 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 Icicle Creek ranged from Unacceptable to Adequate. Watershed-scale impairments are primarily related to historical or ongoing anthropogenic disturbance to the watershed. Fish passage impediments in the mainstem of Icicle Creek were observed in Reaches 3 – Reach 5 and were largely related to LNFH current or historical infrastructure. Across all reaches, the most impaired indicators occurred in the Riparian Vegetation and Habitat Quality categories. High-quality riparian vegetation conditions that support aquatic ecosystem processes, such as mature, old-growth trees in the riparian zone that offer channel shading and contribute large wood to the channel are limited within the study area, largely due to the presence of roads, residences and recreational facilities such as campgrounds. Riparian Vegetation condition indicators predominantly rated At Risk or Unacceptable. Most Unacceptable ratings within the study area occurred in Disturbance (Human); Reach 20 was the only reach in the study area to rate Adequate. Habitat Quality indicators ranged from Adequate to Unacceptable with most Unacceptable ratings occurring in the Large Woody Material (LWM) and Pool Quantity/Quality Indicators. The middle and upper reaches offer relatively little high-quality, deep pool habitat. Off-channel habitat is intermittently available within the study area, with Unacceptable or At Risk ratings in more of the lower reaches due to anthropogenic impacts to the channel and floodplains. Suitable spawning-sized substrates where natural channel form and stream power support the development of spawning areas occurred in all reaches. Geomorphic channel conditions, documented in the Channel Dynamics Pathway and Indicators, are relatively stable within the project area, with Reach 3 having the only Unacceptable rating for Bank Stability/Channel Migration.

Table 1. Summary ratings for the Icicle Creek reach assessment (Reach 1 – Reach 10). 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
Habitat Access	Physical Barriers	Main Channel Barriers	Adequate	Adequate	At Risk	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Habitat Quality	Substrate	Dominant Substrate/ Fine Sediment	Adequate	At Risk	Adequate							
	LWM	Pieces per Mile at Bankfull	Unacceptable	Unacceptable	Unacceptable	Adequate*	Adequate*	Unacceptable	Adequate*	Adequate*	Adequate*	Adequate
	Pools	Pool Frequency and Quality, Presence of Large Pools	Adequate	Adequate	Adequate	Unacceptable	At Risk	At Risk	At Risk	Unacceptable	At Risk	At Risk
	Off-Channel Habitat	Connectivity with Main Channel	At Risk	Unacceptable	At Risk	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Riparian Vegetation	Condition	Structure	At Risk	Unacceptable	Unacceptable	At Risk	At Risk	At Risk				
		Disturbance (Human)	At Risk	Unacceptable	Unacceptable	At Risk	Unacceptable	Unacceptable	Unacceptable	Unacceptable	At Risk	Unacceptable
		Canopy Cover	Unacceptable	At Risk	At Risk	At Risk	At Risk	Unacceptable	At Risk	Adequate	Adequate	Adequate
Channel	Dynamics	Floodplain Connectivity	Adequate	At Risk	Unacceptable	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
		Bank Stability/ Channel Migration	At Risk	At Risk	Unacceptable	At Risk	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate
		Vertical Channel Stability	Adequate	At Risk	At Risk	At Risk	Adequate	Adequate	Adequate	At Risk	Adequate	Adequate

*Although the LWM maybe be adequate from a habitat/cover perspective, this indicator does not consider the geomorphic function of LWM. An asterisk is indicated in the LWM reach rating where the rating would potentially be lowered if geomorphic function of LWM was taken into account.

Table 2. Summary ratings for the Icicle Creek reach assessment (Reach 11 – Reach 20). Ratings are color-coded, with green shading for Adequate condition, yellow for At Risk condition, and red for Unacceptable.

Category	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Habitat Quality	Physical Barriers	Main Channel Barriers	Adequate									
	Substrate	Dominant Substrate/ Fine Sediment	Adequate	Adequate	Adequate	Adequate	At Risk	At Risk	At Risk	Adequate	Adequate	At Risk
	LWM	Pieces per Mile at Bankfull	Unacceptable	Unacceptable	Adequate*	Adequate*	Adequate*	Adequate*	Adequate*	Unacceptable	Adequate*	Adequate
	Pools	Pool Frequency and Quality, Presence of Large Pools	At Risk	Unacceptable	Unacceptable	Adequate	Unacceptable	Unacceptable				
Riparian Vegetation	Off-Channel Habitat	Connectivity with Main Channel	Adequate	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk	Adequate	At Risk	Unacceptable
	Condition	Structure	At Risk	Adequate								
		Disturbance (Human)	Unacceptable	At Risk	At Risk	At Risk						
		Canopy Cover	At Risk	Unacceptable	Unacceptable	Unacceptable	At Risk	At Risk				
Channel	Dynamics	Floodplain Connectivity	Adequate	Adequate	Adequate	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	At Risk
		Bank Stability/ Channel Migration	Adequate	Adequate	Adequate	Adequate	At Risk	Adequate	At Risk	Adequate	At Risk	At Risk
		Vertical Channel Stability	Adequate	Adequate	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk	Adequate	At Risk

*Although the LWM maybe be adequate from a habitat/cover perspective, this indicator does not consider the geomorphic function of LWM. An asterisk is indicated in the LWM reach rating where the rating would potentially be lowered if geomorphic function of LWM was taken into account.

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 increases 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 ≥2.5 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 average maximum temperatures	<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>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>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>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	Gravels or small cobbles make up >50% of the bed materials where natural channel form and stream power support development of spawning areas, with ≤12% of substrates <5.6 mm in spawning gravel.	Gravels or small cobbles make up 30-50% of the bed materials where natural channel form and stream power support the development of spawning areas, with 12-20% of substrates <5.6 mm in spawning gravel.	Gravels or small cobbles make up <30% of the bed materials where natural channel form and stream power support the development of spawning areas, with >20% of substrates <5.6 mm in spawning gravel.
	LWM	Pieces per Mile at Bankfull	<p>67.5 pieces of medium or large wood (M+L)/mile, based on the 75th percentile values for unmanaged streams in eastside forests from Fox and Bolton (2007). Qualifying pieces are the “Medium” and “Large” size large woody material (LWM) based on USFS (2020) size classifications. USFS Stream Inventory protocol (2020) large woody material criteria, under the Eastside Forests criteria:</p> <p>Medium = diameter > 12 in, length > 35 ft</p> <p>Large = diameter > 20 in, length > 35 ft</p> <p>In addition to a minimum of 67.5 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 long-term recruitment within the reach.</p>	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 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> </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	Pool frequency meets or almost meets the values for the "adequate" rating, but pools have inadequate cover/temperature 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/temperature 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																		
	Off-Channel Habitat and Refugia	Connectivity with Main Channel	Reach has side channels and/or groundwater fed tributaries. Aquatic refugia such as backwaters, alcoves, 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, as well as no visual evidence of human impacts on vegetations (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, as well as a moderate amount of visual evidence of human impacts 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, as well as moderate-high visual evidence of human impacts on vegetation (e.g. logging or residential/agricultural clearing) in the floodplain.															
		Disturbance (Human)	<20% disturbance (e.g. agriculture and grazing, residential, roads, etc.) and <2 mile/miles ² road density in the 200-foot channel buffer.	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.															
		Canopy Cover	Canopy cover provides high level of channel shading relative to likely natural condition, based on the number of shaded daylight hours on the summer solstice according to publicly available map tool 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.															

Pathway	General Indicators	Specific Indicators	Adequate Condition	At Risk Condition	Unacceptable Risk Condition
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 watershed-scale or reach-scale for all 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	Adequate	Hydrologically impaired surfaces (roads, parking lots, and buildings) in the watershed were calculated using the 2010 Statewide Landuse GIS dataset (Washington Department of Ecology, 2010). Parcels were classified as “hydrologically impaired” or “Not hydrologically impaired” for the watershed based on landuse codes in the dataset. Hydrologically impaired parcel polygon areas were summed and compared to the total watershed area, as determined using the StreamStats online mapper application (U.S. Geological Survey, 2024). The average percentage of hydrologically impaired surfaces for the entire contributing watershed was 1.3%. Road density was calculated using Washington state Department of Natural Resources roads GIS datasets, as well as visual interpretation of lidar and aerial photos (WADNR Active Roads, 2017). Total length of roads in the Icicle Creek watershed was calculated and compared to the total watershed area. The watershed road density is 0.6 miles of road per square mile of watershed. The Icicle River watershed is relatively undeveloped, with most of the impaired surfaces in the valley bottom and in the downstream portion of the study area near the town of Leavenworth (Reach 4 and below). There is some development in the upstream reaches, and often the roads and structures are immediately adjacent to the river. Overall, road density and percentage of impaired surfaces is low, therefore this indicator receives an Adequate condition.
	Disturbance Regime	Natural/Human Caused	At Risk	This disturbance history rating reflects historical accounts of riparian and hillslope timber harvest, fire suppression, beaver trapping, mining, agriculture and roads and residential development. These human-caused disturbances have historical and on-going impacts on the watershed and have altered the natural disturbance cycles. Fire suppression policies altered the natural fire regimes. In 1994, a major forest fire burned 12% of the watershed in the lower subbasin, followed in 1999 by a landslide originating from a slope burned in the fire, which reached Icicle Creek above Snow Creek (Carlson et al., 2004). Agricultural practices expanded by 1912 and much of the lower basin was converted into orchards (The Watershed Company, 2005). Timber harvest became a significant resource in the 1960s. Roads were built to facilitate access for timber harvest, recreation, and development. The removal of old growth conifers for timber harvest in the hillslopes and valley bottom has resulted in a lack of LWM that has significant influence on channel processes and morphology, as well as diminished amount of shade, nutrient contribution, and floodplain moisture retention. Large trees surveyed in the riparian zone within the study area have been observed as 2 nd growth. Residential and commercial development expanded in the 20 th century, removing over 11% of the vegetative cover along the lower Icicle Creek (Carlson et al., 2004). The Icicle Creek watershed has the highest recreational use of any watershed in the Wenatchee basin, with activities including kayaking, rock climbing, hiking, fishing, and camping (USFS, 1999; Andonaegui, 2001). Water from Icicle Creek is used by the City of Leavenworth, rural Chelan County residents, the Cascade Orchards Irrigation Company (COIC), Icicle Peshastin Irrigation District (IPID), and the Leavenworth National Fish Hatchery (LNFH) (Forsgren Associates, 2014; WDOE, 2019; USFWS, 2022; USFWS, 2009). In consideration of these factors, the watershed receives an At Risk rating for disturbance.
Flow/Hydrology	Streamflow	Alterations to Peak/Base Flows	At Risk	The hydrology of the Icicle Creek watershed is driven by snowmelt and precipitation. Peak flows occur in the spring from snowmelt runoff, often with a secondary peak in the late fall from precipitation. Gage data is available from the USGS Icicle Creek Above Snow Creek Near Leavenworth gage (#12458000) located at RM 11.2, upstream of major diversions. The period of record is from 1936-present. In a comparison between decades 1993 – 2003, 2004 – 2013 and 2014 – 2023, more recent data shows earlier timing in peak flow events occurring in April to June, and higher discharge events in the fall. This aligns with predictions from regional climate change models, which estimated an increased proportion of the precipitation would fall as rain rather than snow throughout the water year, and that the timing and magnitude of peak flow will change. In addition to the observed change in fall discharge patterns and timing of peak flow which are related to global/regional effects for climate change, hydrologic alterations at the watershed-scale are also present. Several diversion dams are present, largely in the lower reaches of Icicle Creek, to support water use by the City of Leavenworth, rural Chelan County residents, the Cascade Orchards Irrigation Company (COIC), Icicle Peshastin Irrigation District (IPID), and the Leavenworth National Fish Hatchery (LNFH). Therefore, the watershed receives an At Risk Rating.
Water Quality	Temperature	Daily maximum and 7-day mean daily maximum temperatures	Unacceptable	Recent water temperature data exists from a Washington Dept of Ecology gage (Gage #45B070, data from 2011-2024). Temperature data was evaluated for the period 2011-2024. Over the course of the 13-year period, the 7-DADMax exceeded 15°C 12 out of the 13 years. Between 2011-2024, the 7-DADMax was exceeded roughly every year. Water temperatures over 15 °C most regularly occurred in August. The duration of water temperatures over 15 °C lasted for an average of 51 days. For these reasons, this indicator receives an Unacceptable rating.

3.2 REACH-SCALE RATINGS – REACH 1 - REACH 10

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
Habitat Access	Physical Barriers	Main Channel Barriers	Adequate	Adequate	At Risk	At Risk	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate
			There were no anthropogenic barriers in the main channel.	There were no anthropogenic barriers in the main channel.	Two anthropogenic barriers are present in the mainstem. A dam located at Rm 2.95 has potential to inhibit upstream and downstream migration at extreme low flow events. The hatchery channel Dam 2 at RM 4.8 known to prevent fish passage seasonally, when managed by LNFH.	One anthropogenic barrier is present in the mainstem. The diversion located at the upstream end of the reach, RM 5.05, has been modified to improve fish passage but may still act as a barrier during a subset of flows.	One anthropogenic barrier is present in the mainstem. A diversion structure located at Rm 6.27 may inhibit fish migration at a subset of flows.	There were no anthropogenic barriers in the main channel. Fish passage through the boulder field within the reach has been studied by Dominguez et al., 2013 and may limit upstream passage at a subset of flows. Modifications to the boulder field have been made to improve passage.	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.
Habitat Quality	Substrate	Dominant Substrate/ Fine Sediment	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	At Risk	Adequate
			Dominant substrate: Gravel (4-64mm) At pebble count GC 26, 59% of substrate was gravel. At pebble count GC 25, 83% of the sampled substrate was gravel. The combined average between the two counts showed 5% of substrates are <5.6 mm.	Dominant substrate: Gravel (4-64mm) At pebble count GC 24, 95% of substrate was gravel. At pebble count GC 23, 83% of the sampled substrate was gravel. The combined average between the two counts showed 1% of substrates are <5.6 mm.	Dominant substrate: Gravel (4-64mm) At pebble count GC 22, 87% of substrate was gravel. The count showed 1% of substrates are <5.6 mm.	Dominant substrate: Cobble (64.1-256mm) and Boulder At pebble count GC 21, 15% of substrate was gravel. At pebble count GC 20, 10% of the sampled substrate was gravel. The combined average between the two gravel counts showed 4% of substrates are <5.6 mm.	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) No gravel counts were performed in this Reach.	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) No gravel counts were performed in this Reach.	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) At pebble count GC 19, 21% of substrate was gravel. At pebble count GC 18, 18% of the sampled substrate was gravel. The combined average between the two counts showed 3% of substrates are <5.6 mm. Substrates are appropriate to geomorphic context of the reach.	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) At pebble count GC 17, 21% of substrate was gravel. The count showed 15% of substrates are <5.6 mm.	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) At pebble count GC 16, 39% of substrate was gravel. At pebble count GC 15, 7% of the sampled substrate was gravel. The combined average between the two counts showed 4% of substrates are <5.6 mm. Substrates are appropriate to geomorphic context of the reach.	

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
Habitat Quality	LWM	Pieces per Mile at Bankfull	Unacceptable	Unacceptable	Unacceptable	Adequate*	Adequate*	Unacceptable	Adequate*	Adequate*	Adequate*	Adequate*
			<p>M+L pieces/mi = 39</p> <p>Percent in Jams = 22%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams, and there are extremely limited potential sources of woody debris for long-term recruitment due to anthropogenic land-use modifications.</p>	<p>M+L pieces/mi = 34</p> <p>Percent in Jams = 11%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams, but there are extremely limited potential sources of woody debris for long-term recruitment due to anthropogenic land-use modifications.</p>	<p>M+L pieces/mi = 10</p> <p>Percent in Jams = 3%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are limited potential sources of woody debris for long- and recruitment due to anthropogenic land-use modifications.</p>	<p>M+L pieces/mi = 87</p> <p>Percent in Jams = 24%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are limited potential sources of woody debris for long-term recruitment within the reach.</p>	<p>M+L pieces/mi = 107</p> <p>Percent in Jams = 31%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are limited potential sources of woody debris for long- term recruitment within the reach.</p>	<p>M+L pieces/mi = 55</p> <p>Percent in Jams = 10%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are limited potential sources of woody debris for long-term recruitment within the reach.</p>	<p>M+L pieces/mi = 155</p> <p>Percent in Jams = 23%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams, though there are some potential sources of woody debris available for long- term recruitment within the reach.</p>	<p>M+L pieces/mi = 237</p> <p>Percent in Jams = 49%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are some potential sources of woody debris available for long-term recruitment within the reach.</p>	<p>M+L pieces/mi = 200</p> <p>Percent in Jams = 40%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are some potential sources of woody debris available for long-term recruitment within the reach.</p>	<p>M+L pieces/mi = 108</p> <p>Percent in Jams = 43%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams, though there are some potential sources of woody debris available for long-term recruitment within 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
Habitat Quality	Pools	Pool Frequency and Quality; Presence of large pools.	Adequate	Adequate	Adequate	Unacceptable	At Risk	At Risk	At Risk	Unacceptable	At Risk	At Risk
			Total Pools = 5 Pools/mi = 4 Pools ≥ 3 ft = 3 (60%) Pools ≥ 6 ft = 1 (20%) Avg residual pool depth: 6.5 ft Cover: Low Reach is affected by backwatering from Wenatchee River and is dominated by pools. Though pool frequency criteria are not met for bankfull width (average BFW = 125, requires 15 pools/mile), the pools are large and deep. Overhanging cover and LWM is relatively minimal.	Total Pools = 14 Pools/mi = 8 Pools ≥ 3 ft = 12 (86%) Pools ≥ 6 ft = 5 (36%) Avg residual pool depth: 6.0 ft Cover: Low Though pool frequency criteria are not met for bankfull width (average BFW = 115, requires 15 pools/mile), reach is almost entirely pool habitat. Pools are large and deep. Overhanging cover is low, though there is LWM present.	Total Pools = 15 Pools/mi = 12 Pools ≥ 3 ft = 7 (47%) Pools ≥ 6 ft = 1 (7%) Avg residual pool depth: 3.0 ft Cover: Low Though pool frequency criteria are not met for bankfull width (average BFW = 57, requires 23 pools/mile), reach is almost entirely pool habitat. Pool residual depths are highly variable with low amount of vegetative cover and LWM.	Total Pools = 5 Pools/mi = 7 Pools ≥ 3 ft = 5 (100%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 4.5 ft Cover: Low Does not meet the pool frequency criteria for bankfull width (average BFW = 100, requires 18 pools/mile). Limited availability of vegetative cover and LWM.	Total Pools = 9 Pools/mi = 7 Pools ≥ 3 ft = 7 (78%) Pools ≥ 6 ft = 2 (22%) Avg residual pool depth: 4.2 ft Cover: Low - Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 90, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present, and pools that were recorded were relatively deep and LWM and cover moderately available.	Total Pools = 9 Pools/mi = 10 Pools ≥ 3 ft = 8 (89%) Pools ≥ 6 ft = 2 (22%) Avg residual pool depth: 5.5 ft Cover: Low Does not meet the pool frequency criteria for bankfull width (average BFW = 80, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present, and pools that were recorded were relatively deep. Vegetative cover is moderate, but very little LWM is present.	Total Pools = 12 Pools/mi = 8 Pools ≥ 3 ft = 10 (83%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 4.1 ft Cover: Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 102, requires 15 pools/mile). LWM and cover moderately available where pools are present.	Total Pools = 4 Pools/mi = 4 Pools ≥ 3 ft = 4 (100%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 4.9 ft Cover: Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 118, requires 15 pools/mile), though pools are deep. Vegetative cover and LWM are relatively available.	Total Pools = 4 Pools/mi = 7 Pools ≥ 3 ft = 3 (75%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 3.9 ft Cover: Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 97, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present, and pools that were recorded were relatively deep. Vegetative cover and LWM are moderately available.	Total Pools = 3 Pools/mi = 3 Pools ≥ 3 ft = 2 (67%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 3.6 ft Cover: Moderate - High Does not meet the pool frequency criteria for bankfull width (average BFW = 99, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present. LWM and cover are relatively available.

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
Habitat Quality	Off-Channel Habitat and Refugia	Connectivity with Main Channel	At Risk	Unacceptable	At Risk	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
			Total SC = 1 Fast water = 0 Slow water = 1 Very little off-channel habitat exists that is connected at a variety of flows; however, floodplains are hydraulically connected at a greater range of flows than other reaches. Some confinement still occurs from human impacts.	Total SC = 1 Fast water = 1 Slow water = 0 Very little off-channel habitat exists. Floodplains have been disconnected by incision and human structures, as determined by field observations and hydraulic modeling.	Total SC = 8 Fast water = 0 Slow water = 8 The reach has side-channel habitats that are connected at a range of flows. However, a large portion of the historical floodplain is anthropogenically disconnected or has other impacts (levees, roads, fill, canal).	Total SC = 3 Fast water = 1 Slow water = 2 Some off-channel habitat exists that is connected at a range of flows. Available floodplains are marginally hydraulically connected to the channel.	Total SC = 8 Fast water = 8 Slow water = 0 A moderate amount of off-channel habitat exists within the reach, and floodplains are hydraulically well connected to the channel.	Total SC = 0 Minimal off channel habitat exists; however, natural conditions (steep slope and bedrock confinement) limit the natural potential for off-channel habitat to be present.	Total SC = 8 Fast water = 7 Slow water = 1 A moderate amount of off-channel habitat exists within the reach, and floodplains are hydraulically well connected to the channel.	Total SC = 8 Fast water = 6 Slow water = 2 A moderate amount of off-channel habitat exists within the reach, and floodplains are hydraulically well connected to the channel.	Total SC = 3 Fast water = 3 Slow water = 0 Minimal off channel habitat exists; however, natural conditions (steep slope and bedrock confinement) limit the natural potential for off-channel habitat to be present. Where geomorphically available, floodplains are hydraulically well-connected to the channel	Total SC = 3 Fast water = 2 Slow water = 1 Minimal off channel habitat exists; however, natural conditions (steep slope and bedrock confinement) limit the natural potential for off-channel habitat to be present.

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
Riparian Vegetation	Condition	Structure	At Risk	At Risk	At Risk	At Risk	At Risk	Unacceptable	Unacceptable	At Risk	At Risk	At Risk
			The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 57% Large Tree, 29% Mature Tree and 14% 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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 73% Large Tree, 9% No Vegetation and 18% Other. Other is this reach was non-native vegetation in residential areas. Reach has some 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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 86% Large Tree and 14% Small Tree. Reach has some 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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 100% Large Tree. Reach has some 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.	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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 80% Small Tree and 20% Shrub/Seedling. Reach has some 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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 28% Small Tree, 18% Large Tree, 18% Mature Tree, 18% Sapling/Pole and 18% Shrub/Seedling. Reach has some 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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 100% Large Tree. Reach has some 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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 100% Large Tree. Reach has some 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.	The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 62% Large Tree, 25% Small Tree and 13% Other. Other category recorded dead, burned trees as the overstory. Reach has some 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.
		Disturbance (Human)	At Risk	Unacceptable	Unacceptable	At Risk	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	At Risk
			4.1% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 4.6 miles/miles ² road density in the 200-foot riparian buffer zone.	20.5% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 8.1 miles/miles ² road density in the 200-foot riparian buffer zone.	21.1% disturbance in the 200-foot buffer zone (e.g. LNFH, residential, roads, etc.) and 10.6 miles/miles ² road density in the 200-foot riparian buffer zone.	11.1% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 4.8 miles/miles ² road density in the 200-foot riparian buffer zone.	16.1% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 22.5 miles/miles ² road density in the 200-foot riparian buffer zone.	9.0% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 13.4 miles/miles ² road density in the 200-foot riparian buffer zone.	9.6% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 15.6 miles/miles ² road density in the 200-foot riparian buffer zone.	4.4% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 8.2 miles/miles ² road density in the 200-foot riparian buffer zone.	2.2% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 4.2 miles/miles ² road density in the 200-foot riparian buffer zone.	7.3% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 13.8 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
Riparian Vegetation	Condition	Canopy Cover	Unacceptable	At Risk	At Risk	At Risk	At Risk	Unacceptable	At Risk	Adequate	Adequate	Adequate
			<p>Reach average of 2.9 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 3.2 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 3.7 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 3.1 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 3.2 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 2.7 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>Few large trees are present within the 100-foot riparian buffer. Some disturbance or clearing within the 100-foot buffer has likely further reduced shading potential in reach.</p>	<p>Reach average of 3.7 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>Few large trees are present within the 100-foot riparian buffer. Some disturbance or clearing within the 100-foot buffer has likely further reduced shading potential in reach.</p>	<p>Reach average of 5.2 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>Large trees within the 100-foot riparian buffer are present and limited disturbance or clearing is evident within the riparian buffer.</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>Large trees within the 100-foot riparian buffer are present and limited disturbance or clearing is evident within the riparian buffer.</p>	<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>Large trees within the 100-foot riparian buffer are present, though some disturbance or clearing is evident within the riparian buffer.</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	
Channel	Dynamics	Floodplain Connectivity	Adequate	At Risk	Unacceptable	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	
			Connectivity to the existing modern floodplain is currently adequate.	Road crossing bridge at mid-reach imposes confinement and associated floodplain disconnection that will continue.	Constructed levees, canal, terraces, and flow control structures limit connectivity to historical floodplain.	Infrastructure and development, including structure confinement at the downstream end, impose continued confinement and reduces potential floodplain connectivity.	Naturally confined reach. Where valley width allows, narrow functional floodplains and islands exist, and connectivity is maintained.	Naturally confined reach. Where valley width allows, narrow functional floodplains and islands exist, and connectivity is maintained.	Naturally confined reach. Where valley width allows, functional floodplains and islands exist, connectivity is maintained.	Naturally partially confined reach. Where valley width allows, functional floodplains and islands exist, connectivity is maintained.	Naturally confined reach. Where valley width allows, functional floodplains and islands exist, connectivity is maintained.	Naturally confined reach. Where valley width allows, functional floodplains and islands exist, connectivity is maintained.	
		Bank Stability/ Channel Migration	At Risk	At Risk	Unacceptable	At Risk	At Risk	At Risk	Adequate	Adequate	Adequate	Adequate	Adequate
			Channel has reduced rate of lateral migration in portions of the reach as a result of anthropogenic confinement (bank armoring).	Channel has reduced rate of lateral migration as a result of anthropogenic confinement and development.	Anthropogenic influences have notably decreased lateral processes.	Channel has reduced rate of lateral migration as a result of anthropogenic confinement and infrastructure.	Channel has reduced rate of lateral migration as a result of anthropogenic confinement and infrastructure.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.
		Vertical Channel Stability	Adequate	At Risk	At Risk	At Risk	At Risk	Adequate	Adequate	Adequate	At Risk	Adequate	Adequate
			No measurable trend of aggradation or incision beyond the natural geomorphic processes of the reach.	Trends of continued incision associated with anthropogenic confinement and development.	Altered hydrology reduces flow hydraulics and channel dynamics.	Trends of continued incision associated with anthropogenic confinement and development.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	Localized trend of incision and channel widening at upstream end of the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.

**Although LWM may be adequate from a habitat/cover perspective, this does not consider the geomorphic function of the LWM, which may be lacking.*

3.3 REACH-SCALE RATINGS – REACH 11 – REACH 20

Pathway	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Habitat Access	Physical Barriers	Main Channel Barriers	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
			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.
Habitat Quality	Substrate	Dominant Substrate/ Fine Sediment	Adequate	Adequate	Adequate	Adequate	At Risk	At Risk	At Risk	Adequate	Adequate	At Risk
			Dominant substrate: Boulder (>256.1mm) No gravel counts were performed in this reach.	Dominant substrate: Boulder (>256.1mm) At pebble count GC 14, 9% of substrate was gravel and 27% was cobble. 8% of substrates are <5.6 mm	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) No gravel counts were performed in this Reach.	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) At pebble count GC 13, 38% of substrate was gravel and 30% was cobble. At pebble count GC 12, 18% of the sampled substrate was gravel and 27% was cobble. The combined average between the two counts showed 4% of substrates are <5.6 mm.	Dominant substrate: Cobble (64.1-256mm) and Gravel (4-64mm) At pebble count GC 11, 55% of substrate was gravel and 40% was cobble. At pebble count GC 10, 20% of the sampled substrate was gravel and 45% was cobble. The combined average between the two counts showed 5% of substrates are <5.6 mm.	Dominant substrate: Cobble (64.1-256mm) At pebble count GC 9, 21% of substrate was gravel. At pebble count GC 8, 18% of the sampled substrate was gravel. The combined average between the two counts showed 6% of substrates are <5.6 mm.	Dominant substrate: Boulder (>256.1mm) and cobble (64.1-256mm) At pebble count GC 7, 35% of substrate was gravel and 52% was cobble. At pebble count GC 6, 27% of the sampled substrate was gravel and 27% was cobble. The combined average between the two counts showed 2% of substrates are <5.6 mm.	Dominant substrate: Cobble (64.1-256mm) No gravel counts were performed in this reach.	Dominant substrate: Gravel (4-64mm) At pebble count GC 5, 54% of substrate was gravel. At pebble count GC 4, 56% of the sampled substrate was gravel. At pebble count GC 3, 51% of the sampled substrate was gravel. The combined average between the three counts showed 7% of substrates are <5.6 mm.	Dominant substrate: Cobble (64.1-256mm) At pebble count GC 2, 38% of substrate was gravel. At pebble count GC 1, 35% of the sampled substrate was gravel. The combined average between the two counts showed 4% of substrates are <5.6 mm.

Pathway	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Habitat Quality	LWM	Pieces per Mile at Bankfull	Unacceptable	Unacceptable	Unacceptable	Adequate*	Adequate*	Adequate*	Adequate*	Unacceptable	Adequate*	Adequate*
			<p>M+L pieces/mi = 52</p> <p>Percent in Jams = 25%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are some potential sources of woody debris for long- and recruitment.</p>	<p>M+L pieces/mi = 60</p> <p>Percent in Jams = 32%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are some potential sources of woody debris for long- term recruitment within the reach.</p>	<p>M+L pieces/mi = 50</p> <p>Percent in Jams = 18%</p> <p>Does not meet the minimum criteria of 67.45 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams, and there are limited potential sources of woody debris for long-term recruitment.</p>	<p>M+L pieces/mi = 106</p> <p>Percent in Jams = 32%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams, and there are some potential sources of woody debris for long-term recruitment within the reach.</p>	<p>M+L pieces/mi = 122</p> <p>Percent in Jams = 32%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams, and there are potential sources of woody debris for long-term recruitment within the reach.</p>	<p>M+L pieces/mi = 180</p> <p>Percent in Jams = 45%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are potential sources of woody debris for long-term recruitment within the reach.</p>	<p>M+L pieces/mi = 103</p> <p>Percent in Jams = 32%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are potential sources of woody debris for long- term recruitment within the reach.</p>	<p>M+L pieces/mi = 58</p> <p>Percent in Jams = 18%</p> <p>Does not meet the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are some potential sources of woody debris for long- term recruitment within the reach.</p>	<p>M+L pieces/mi = 121</p> <p>Percent in Jams = 40%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are potential sources of woody debris for long- term recruitment within the reach.</p>	<p>M+L pieces/mi = 94</p> <p>Percent in Jams = 20%</p> <p>Meets the minimum criteria of 67.5 pieces of M+L wood per mile. Less than 50% of M+L wood is within jams and there are potential sources of woody debris for long- term recruitment within the reach.</p>

Pathway	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Habitat Quality	Pools	Pool Frequency and Quality; Presence of large pools.	At Risk	At Risk	At Risk	At Risk	At Risk	Unacceptable	Unacceptable	Adequate	Unacceptable	Unacceptable
			Total Pools = 8 Pools/mi = 14 Pools ≥ 3 ft = 6 (75%) Pools ≥ 6 ft = 1 (13%) Avg residual pool depth: 4.0 ft Cover: Low Does not meet the pool frequency criteria for bankfull width (average BFW = 76, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present. Vegetative cover for the pools is relatively low.	Total Pools = 4 Pools/mi = 7 Pools ≥ 3 ft = 2 (50%) Pools ≥ 6 ft = 1 (25%) Avg residual pool depth: 4.7 ft Cover: Low - Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 92, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present, and pools that were recorded were relatively deep. Vegetative cover is moderately available, but LWM is limited.	Total Pools = 3 Pools/mi = 9 Pools ≥ 3 ft = 2 (67%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 4.1 ft Cover: Low Does not meet the pool frequency criteria for bankfull width (average BFW = 86, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present, and pools that were recorded were relatively deep. Availability of cover in the reach is low.	Total Pools = 9 Pools/mi = 5 Pools ≥ 3 ft = 4 (44%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 2.9 ft Cover: Low - Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 85, requires 18 pools/mile), however, natural conditions (steep slope and bedrock confinement) limit formation of pools that met survey criteria. Additional smaller pool habitat is likely present. Pools residual depths are relatively low and availability of cover in the reach is low.	Total Pools = 12 Pools/mi = 6 Pools ≥ 3 ft = 7 (58%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 3.5 ft Cover: Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 105, requires 15 pools/mile). Cover from riparian vegetation and LWM is relatively available.	Total Pools = 6 Pools/mi = 10 Pools ≥ 3 ft = 1 (17%) Pools ≥ 6 ft = 0 (0%) Avg residual pool depth: 2.4 ft Cover: Low - Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 98, requires 18 pools/mile). Pool residual depths are relatively low. Vegetative cover is moderately available, but LWM is limited.	Total Pools = 6 Pools/mi = 4 Pools ≥ 3 ft = 4 (67%) Pools ≥ 6 ft = 2 (33%) Avg residual pool depth: 7.0 ft Cover: Moderate - High Does not meet the pool frequency criteria for bankfull width (average BFW = 78, requires 18 pools/mile). LWM and cover are relatively available.	Total Pools = 10 Pools/mi = 23 Pools ≥ 3 ft = 9 (90%) Pools ≥ 6 ft = 2 (20%) Avg residual pool depth: 5.7 ft Cover: Low Meets the pool frequency criteria for bankfull width (average BFW = 79, requires 18 pools/mile). Pools within the reach are large, however LWM and cover are relatively low.	Total Pools = 18 Pools/mi = 9 Pools ≥ 3 ft = 14 (78%) Pools ≥ 6 ft = 3 (17%) Avg residual pool depth: 5.3 ft Cover: Moderate - High Does not meet the pool frequency criteria for bankfull width (average BFW = 82, requires 18 pools/mile), though pools are deep. Availability of cover in the pool is moderate to high.	Total Pools = 3 Pools/mi = 3 Pools ≥ 3 ft = 0 (0%) Pools ≥ 0 ft = 0 (0%) Avg residual pool depth: 2.0 ft Cover: Moderate Does not meet the pool frequency criteria for bankfull width (average BFW = 86, requires 18 pools/mile). Pools residual depths are relatively low, though LWM and cover are moderately available.

Pathway	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Habitat Quality	Off-Channel Habitat and Refugia	Connectivity with Main Channel	Adequate	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk	Adequate	At Risk	Unacceptable
			<p>Total SC = 0</p> <p>Natural conditions (steep slope and bedrock confinement) limit the potential for off-channel habitat forming.</p> <p>Minimal constriction from human impacts are present in the reach.</p>	<p>Total SC = 1</p> <p>Fast water = 1</p> <p>Slow water = 0</p> <p>Natural conditions (steep slope and bedrock confinement) limit the potential for off-channel habitat forming. Minimal constriction from human impacts are present in the reach.</p>	<p>Total SC = 0</p> <p>Natural conditions (steep slope and bedrock confinement) limit the potential for off-channel habitat forming. Minimal constriction from human impacts are present in the reach.</p>	<p>Total SC = 3</p> <p>Fast water = 3</p> <p>Slow water = 0</p> <p>Natural conditions (steep slope and bedrock confinement) limit the potential for off-channel habitat forming.</p> <p>Where available, floodplains are hydraulically connected at a slightly greater range of flows but constricted by high incision rates and human impacts (Highway 2).</p>	<p>Total SC = 6</p> <p>Fast water = 1</p> <p>Slow water = 5</p> <p>A moderate amount of off-channel habitat exists that is connected at a variety of flows.</p> <p>Available floodplains are somewhat connected to the channel. Entrenched sections have the potential to reduce connectivity of other sections.</p>	<p>Total SC = 1</p> <p>Fast water = 0</p> <p>Slow water = 1</p> <p>Very little off-channel habitat exists that is connected at a variety of flows.</p> <p>Floodplains are hydraulically connected at a greater range of flows than other reaches, though some confinement still occurs from human impacts. Downstream entrenchment has potential to continue to impact floodplain connectivity.</p>	<p>Total SC = 3</p> <p>Fast water = 2</p> <p>Slow water = 1</p> <p>Very little off-channel habitat exists.</p> <p>Where available in this naturally partially confined reach, floodplains are hydraulically connected at a greater range of flows than other reaches.</p>	<p>Total SC = 2</p> <p>Fast water = 1</p> <p>Slow water = 1</p> <p>Minimal off channel habitat exists; however, natural conditions (steep slope and bedrock confinement) limit the potential for off-channel habitat forming. Minimal constriction from human impacts are present in the reach.</p>	<p>Total SC = 4</p> <p>Fast water = 0</p> <p>Slow water = 4</p> <p>Some off-channel habitat exists that is connected at a variety of flows, natural confinement that limits the potential for off-channel habitats.</p> <p>Available floodplains are hydraulically well connected to the channel.</p>	<p>Total SC = 0</p> <p>Reach is lacking off-channel habitats that are connected at a high range of flows.</p> <p>Where valley width allows, floodplains and islands exist.</p>

Pathway	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Riparian Vegetation	Condition	Structure	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	At Risk	Adequate
			<p>The riparian canopy overstory composition within the 100-foot riparian buffer was recorded as 100% large tree.</p> <p>Reach has some 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 trees.</p> <p>Reach has some 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.</p> <p>Reach has some 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 56% large tree and 44% small tree.</p> <p>Reach has some 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 73% large tree, 14% small tree, and 13% sapling pole.</p> <p>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 83% large tree and 17% small tree.</p> <p>Reach has some 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 69% large tree, 15% small tree, 8% sapling pole and 8% no vegetation.</p> <p>Reach has visual evidence of human disturbance that that impacted the riparian buffer 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 93% large tree and 7% mature tree.</p> <p>Reach has some 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.</p> <p>Reach has very little visual evidence of human disturbance that that impacted the riparian buffer as determined by field estimates, tree height data, or aerial photographs.</p>	
		Disturbance (Human)	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	At Risk	At Risk
<p>6.9% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 13.2 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>6.3% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 9.5 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>8.0% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 12.1 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>5.8% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 10.4 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>4.2% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 8.5 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>7.2% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 12.6 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>2.6% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 4.6 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>2.6% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 7.9 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>2.5% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 5.2 miles/miles² road density in the 200-foot riparian buffer zone.</p>	<p>0% disturbance in the 200-foot buffer zone (e.g. residential, roads, etc.) and 0.0 miles/miles² road density in the 200-foot riparian buffer zone.</p>			

Pathway	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Riparian Vegetation	Condition	Canopy Cover	At Risk	Unacceptable	Unacceptable	Unacceptable	At Risk	At Risk				
			<p>Reach average of 5.4 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 5.2 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 5.1 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 4.1 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 3.0 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 2.7 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>Large trees are present within the 100-foot riparian buffer in some locations, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 2.8 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 2.5 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>Large trees within the 100-foot riparian buffer are present, but disturbance or clearing within the 100-foot buffer were observed likely reducing shading potential in reach.</p>	<p>Reach average of 2.5 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>Large trees within the 100-foot riparian buffer are present, and little disturbance or clearing within the 100-foot buffer were observed.</p>	<p>Reach average of 3.6 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>Large trees within the 100-foot riparian buffer are present, and little disturbance or clearing within the 100-foot buffer were observed.</p>

Pathway	General Indicators	Specific Indicators	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Reach 17	Reach 18	Reach 19	Reach 20
Channel	Dynamics	Floodplain Connectivity	Adequate	Adequate	Adequate	Adequate	At Risk	At Risk	At Risk	Adequate	At Risk	At Risk
			Naturally confined reach. Where valley width allows, narrow functional floodplains and islands exist, and connectivity is maintained.	Naturally confined reach. Where valley width allows, narrow functional floodplains and islands exist, and connectivity is maintained.	Naturally confined reach. Where valley width allows, narrow functional floodplains and islands exist, and connectivity is maintained.	Naturally confined reach. Where valley width allows, narrow functional floodplains and islands exist, and connectivity is maintained.	Floodplain connectivity varies in the reach. Entrenched sections have the potential to reduce connectivity of other sections.	Naturally confined to partially confined reach. Where valley width allows, floodplains and islands exist. Downstream entrenchment has potential to impact floodplain connectivity.	Naturally confined to partially confined reach. Where valley width allows, floodplains and islands exist. Downstream entrenchment has potential to impact floodplain connectivity.	Naturally confined reach. Where valley width allows, narrow functional floodplains and islands exist, and connectivity is maintained.	Partially confined reach. Where valley width allows, floodplains and islands exist. Simplification from lack of functional large wood has potential to continue to reduce floodplain connectivity.	Partially confined reach. Where valley width allows, floodplains and islands exist. Simplification from lack of functional large wood has potential to continue to reduce floodplain connectivity.
Channel	Dynamics	Bank Stability/ Channel Migration	Adequate	Adequate	Adequate	Adequate	At Risk	Adequate	At Risk	Adequate	At Risk	At Risk
			Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach.	Channel has reduced rate of lateral migration where trend of entrenchment occurs due to loss of channel complexity.	Channel is laterally migrating near natural rates within the geomorphic construct of the reach.	Channel has reduced rate of lateral migration where trend of entrenchment occurs due to loss of channel complexity.	Channel is laterally migrating at or near natural rates within the geomorphic construct of the reach	Channel has reduced rate of lateral migration where trend of entrenchment occurs due to loss of channel complexity.	Channel has reduced rate of lateral migration where trend of entrenchment occurs due to loss of channel complexity.
Channel	Dynamics	Vertical Channel Stability	Adequate	Adequate	Adequate	Adequate	At Risk	Adequate	At Risk	At Risk	Adequate	At Risk
			No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	Subtle trend of incision due to loss of complexity (lack of effective large wood).	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	Trend of incision due to loss of complexity (lack of effective large wood).	Subtle trend of incision due to loss of complexity (lack of effective large wood).	No measurable trend in incision or aggradation beyond natural geomorphic processes was observed in the reach.	Subtle trend of incision due to loss of complexity (lack of effective large wood).

**Although LWM may be adequate from a habitat/cover perspective, this does not consider the geomorphic function of the LWM, which may be lacking.*

4 References & Sources

- Andonaegui, C. (2001). *Salmon, Steelhead, and Bull Trout Habitat Limiting Factors for the Wenatchee Subbasin (Water Resource Inventory Area 45) and Portions of WRIA 40 within Chelan County (Squilchuck, Stemilt and Colockum drainages)*.
- Carlson, L., Rose, B., Kaputa, M., & Jerabeck, J. (2004). *Wenatchee Subbasin Plan*.
- Forsgren Associates, Inc. (2014). *Icicle Irrigation District Instream Flow Improvement Options Analysis Study*.
- Fox, M., & Bolton, S. (2007). A Regional and Geomorphic Reference for Quantities and Volumes of Instream Wood in Unmanaged Forested Basins of Washington State. *North American Journal of Fisheries Management*, 27(1), 342–359.
- National Marine Fisheries Service (NMFS). (1996). *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale*. National Marine Fisheries Service, Environmental and Technical Services Division Habitat Conservation Branch.
- ShadeMap. (n.d.). ShadeMap, MapLibre, Protomaps, OpenStreetMap. Retrieved January 26, 2025, from <https://shademap.app/@47.91255,-120.90288,11.24709z,1736796715983t,0b,0p,1m!1687349140214!1687406815846,qdGVsbWEsIHdh!47.84411!-120.81766>
- The Watershed Company. (2005). *Lower Icicle Creek Reach Level Assessment*.
- U.S. Fish and Wildlife Service (USFWS). (2009). *Leavenworth National Fish Hatchery Proposed Flow Management Operations for 2009-2014*.
- U.S. Fish and Wildlife Service (USFWS). (2022). *Leavenworth National Fish Hatchery: Climate Change Vulnerability Assessment, Final Report, January 2022*.
- U.S. Fish and Wildlife Service. (1998). *Matrix of Physical/Environmental Pathways and Indicators for East-Side Streams*.
- U.S. Forest Service (USFS). (1999). *Mainstem Wenatchee River Watershed Assessment*.
- U.S. Forest Service (USFS). (2020). *Stream Inventory Handbook: Level I and Level II. Version 2.20. Pacific Northwest Region*. United States Department of Agriculture, United States Forest Service.
- U.S. Geological Survey. (2024). *StreamStats*. <https://streamstats.usgs.gov/ss/>
- Washington State Department of Ecology (WDOE). (2010). 2010 Statewide Landuse. *Washington State Department of Ecology, GIS Technical Services*.
- Washington State Department of Ecology (WDOE). (2019). *Icicle Creek Strategy Icicle Creek Water Resource Management Strategy Final Programmatic Environmental Impact Statement*. In *Washington State Department of Ecology* (pp. 1–892). Ecology Publication No: 18-12-016.
- Washington State Department of Natural Resources (WADNR). (2017). Active Roads GIS Open Data, February 3, 2017. <https://data-wadnr.opendata.arcgis.com/datasets/wadnr::wadnr-active-roads/about>.