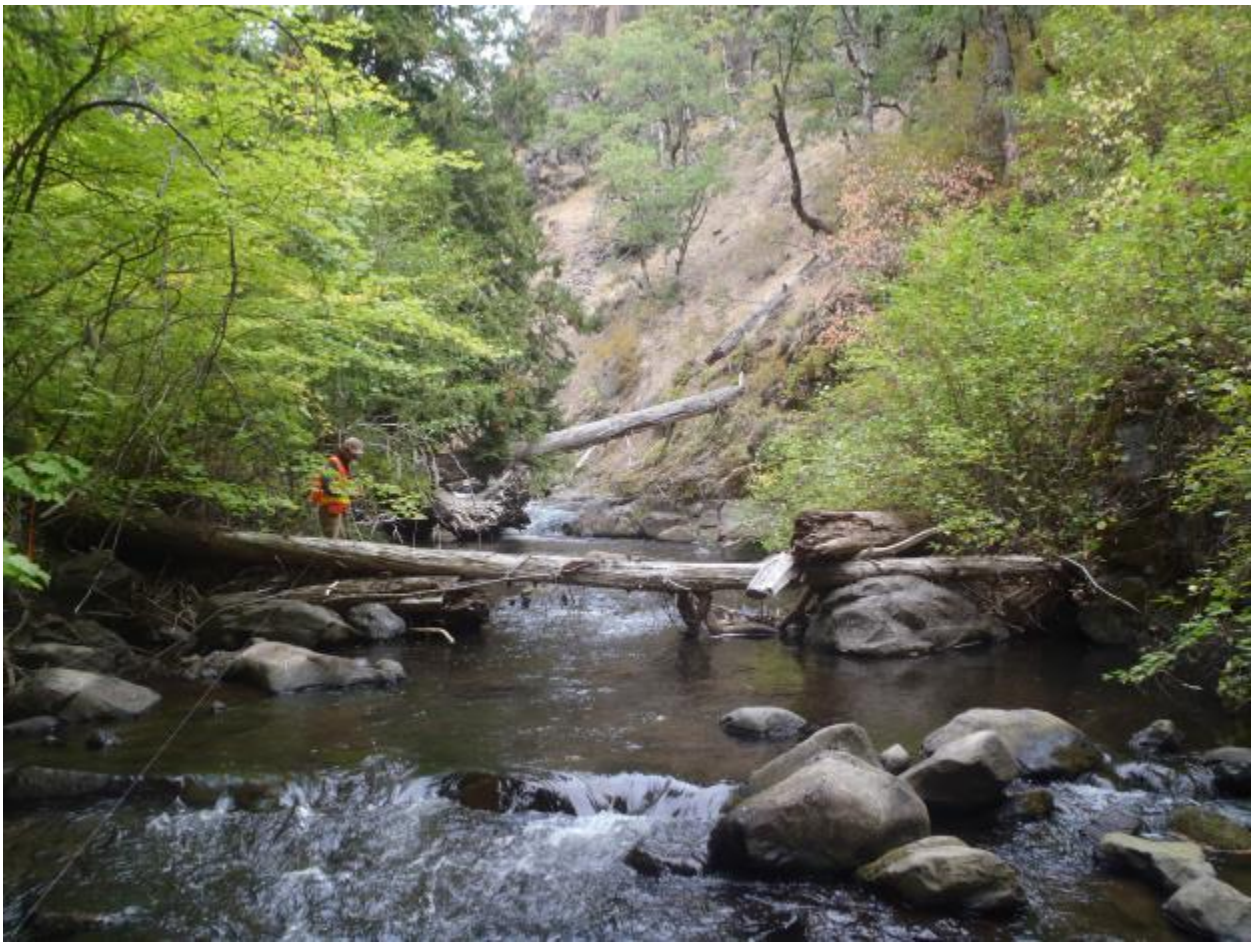
Summit Creek (Klickitat River Subbasin, Washington) Rapid Aquatic Habitat Assessment Stream Report



Confederated Tribes and Bands of the Yakama Nation
Yakama Nation Fisheries Program, Yakima/Klickitat Fisheries Project
Klickitat Research, Monitoring, and Evaluation Project
Klickitat Water Enhancement Project
Klickitat Field Office
1575 Horseshoe Bend Rd
Klickitat, WA 98628

Summit Creek (Klickitat River Subbasin, Washington) Rapid Aquatic Habitat Assessment Stream Report

Prepared by:
Nicolas Romero

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Prepared for:
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Portland, Oregon 97208

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Suggested citation:
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Yakima Klickitat Fisheries Project-Klickitat Monitoring and Evaluation Project (KM&E) and Klickitat Watershed Enhancement Project (KWEP)-Rapid Aquatic Habitat Assessment Stream Report

Stream: Summit Creek

LLID: 1211246459864

Basin: Klickitat River

HUC Number: 17070106

Ecoregion: Eastern Cascades Slopes and Foothills

Watershed Area: 117 km^{-2}

Survey Dates: Reach 1 – September 15, 2014

Reach 2 – September 15-17, 2014

Survey Crew: Reach 1 – Nicolas Romero and David Lindley

Reach 2 – Nicolas Romero and David Lindley

Report Prepared By: Nicolas Romero

Introduction:

The Rapid Aquatic Habitat Assessment Protocol (RAHAP) is designed to provide quantitative information on stream habitat and fish distribution at the watershed scale. Data collected from the stream inventory surveys are used to provide baseline information for fisheries biologists, hydrologists, and foresters to guide natural resources management and land use practices on Yakama Nation Southern Ceded lands. This protocol establishes hierarchical spatial context and fish habitat relationships at habitat unit, reach, and basin scales. The spatially continuous method is useful when the scale(s) necessary to detect pattern are unknown. This level of pattern detection is useful to managers for refining study designs; locating, identifying, and prioritizing projects; and establishing reference or control sites for project design. Existing stream inventory protocols were reviewed during the development of the RAHAP methodology. Upon review, two widely used Pacific Northwest stream classification systems, Washington Timber, Fish, and Wildlife (TFW) Monitoring Program and the Aquatic Inventory Project (AIP), were incorporated into the RAHAP methodology (Moore et al. 2010, Pleus et al. 1999, and Schuett-Hames et al. 1999).

RAHAP quantifies both the abiotic and biotic state of aquatic habitat. The abiotic components are: geomorphic reach segments, habitat units, bedrock features, wood pieces, wood jams, and streamflow. These physical parameters are coupled with a separate one-pass fish survey that ties fish abundance to habitat. The geomorphic reach and habitat unit level delineation methodology was derived primarily from AIP (Moore et al. 2010). The wood piece and wood jam inventories follow protocols established by Schuett-Hames et al. 1999. Yakama Nation Fisheries personnel identified bedrock features as habitat of interest and subsequently developed survey methodologies. Refer to Romero and Lindley 2012 for the complete RAHAP protocol.

Stream Level Description:

The Summit Creek habitat survey began at the confluence with the Klickitat River (rkm 60.0) and extended upstream approximately 2 kilometers. The habitat survey ended at a waterfall barrier that delineated the upstream extent to salmonid anadromy. Two reaches were delineated over the length of the habitat survey. A valley transition from wide to narrow delineated Reach 1 from Reach 2. A narrow v-shaped valley was the dominant valley form encountered. The stream channel was generally constrained by alternating terrace and hillslope.

A primary channel was the only channel type encountered. The stream gradient was high at 5.7%. The total wetted area quantified was 14,171.2 m^{-2}. The average wetted and bankfull widths were 6.3 and 9.8 meters, respectively. Boulders and cobble were the dominant substrate accounting for approximately two-thirds of the substrate area. Gravel comprised an additional one-fifth of the quantified substrate. Riffle was the most common geomorphic unit delineated comprising 65% of the wetted area and 64% of the survey length. A total of 13 pools were quantified. The average residual pool depth was 0.85 meters. Nearly half the pools had a maximum depth ≥1 meter. The number of pools/kilometer and pools ≥1 meter /kilometer was estimated at 6.1 and 2.8, respectively. Pool frequency was measured at 16.8 (bankfull widths/pool).

Ponderosa Pines and Oregon White Oaks were the most common upslope trees. Red Alder and Big Leaf Maple were the dominant and sub-dominant riparian vegetation, respectively. The canopy covered approximately 41% of the wetted area. A total of 56 pieces of large wood were counted resulting in a frequency of 2.6 pieces/100 meters and a volume of 3.3m^{-3}/100 meters. Conifers accounted for 53 of the 56 pieces and 99% of the wood volume. Rootwads accounted for 11 of the 56 pieces and one-third of the wood volume. Eight of the 56 pieces qualified as key pieces accounting for approximately 50% of the quantified wood volume. Of the 56 larger wood pieces, 24, 51, 20, and 14 were located completely or partially in the wetted channel, within bankfull but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. Of the pieces exhibiting a level of stability, pinned and rooted stability forms were observed in 55% and 9% of the pieces, respectively. Slightly more than one-third of pieces were unstable. There were no pieces that functioned as a pool forming agent. Large wood pieces were most commonly oriented perpendicular (36%) followed by parallel (30%), upstream (18%), and downstream (16%). There were no large wood jams observed over the course of the survey.

A total of 10 distinct bedrock features were quantified. The cumulative measured length was 241.2 and 39 meters on the left bank and right bank, respectively. The dominant cross-sectional shape was sloped bedrock which accounted for 7 of 10 identified bedrock rock features. Bedrock cliffs accounted for the remaining three bedrock features. The majority of the bedrock features projected into the wetted channel.

Reach Level Descriptions:

Reach 1 began at the confluence with the Klickitat River (rkm 60.0) and extended upstream 418.4 meters. A valley transition from a wide valley to narrow valley delineated the end of Reach 1. The reach

was characterized by a wide alluvial fan valley. The stream channel was constrained by a road along the north bank.

A primary channel was the only channel type encountered. The stream gradient was high at 6.2%. The total wetted area quantified was 2,611.4 m^{-2}. The average wetted and bankfull widths were 5.8 and 9.3 meters, respectively. Boulder was the dominant substrate for approximately one-third of the wetted area. Cobble and gravel comprised an additional 50% of the quantified substrate. Riffles were the most common geomorphic unit delineated comprising 70% of the wetted area and 67% of the survey length. A total of 2 pools were quantified. The average residual pool depth was 1.47 meters. One of the pools had a maximum depth ≥1 meter. The number of primary channel pools/kilometer and pools ≥1 meter/kilometer was estimated at 4.8 and 2.4, respectively. Pool frequency was measured at 22.5 (bankfull widths/pool).

Ponderosa Pines and Oregon White Oaks were the most common upslope trees. Red Alder and Scouler's Willow were the dominant and sub-dominant riparian vegetation, respectively. The canopy covered approximately 50% of the wetted area. A single conifer log was counted resulting in a frequency of 0.24 pieces/100 meters and a volume of 1.0 m^{-3}/100 meters. The conifer log qualified as a key piece. The log was located within the wetted channel, pinned, and oriented downstream. There were no large wood jams observed over the course of the survey.

A total of 3 distinct bedrock features were quantified. The cumulative measured length was 108.4 meters. The bedrock features were all located along the left bank. Each identified bedrock feature was sloped and projected into the wetted channel.

Reach 2 began 418.4 meters upstream from the confluence with the Klickitat River (rkm 60.0) and extended upstream 1,716 meters. The habitat survey ended at a waterfall barrier that delineated the upstream extent to salmonid anadromy. A valley transition from wide to narrow delineated Reach 1 from Reach 2. The reach was characterized by a narrow v-shaped valley. The stream channel was generally constrained by alternating terrace and hillslope.

A primary channel was the only channel type encountered. The stream gradient was high at 5.6%. The total wetted area quantified was 11,559.8 m^{-22}. The average wetted and bankfull widths were 6.4 and 9.9 meters, respectively. Boulders and cobble were the dominant substrate accounting for two-thirds of the substrate area. Gravel comprised an additional one-fifth of the quantified substrate. Riffle was the most common geomorphic unit delineated comprising 64% of the wetted area and 63% of the survey length. A total of 11 pools were quantified. The average residual pool depth was 0.70 meters. Nearly half the pools had a maximum depth≥1 meter. The number of pools/kilometer and pools ≥1 meter /kilometer was estimated at 6.4 and 2.9, respectively. Pool frequency was measured at 15.8 (bankfull widths/pool).

Ponderosa Pines and Oregon White Oaks were the most common upslope trees. Red Alder and Big Leaf Maple were the dominant and sub-dominant riparian vegetation, respectively. The canopy covered approximately 39% of the wetted area. A total of 55 pieces of large wood were counted resulting in a frequency of 2.6 pieces/100 meters and a volume of 3.3m^{-3}/100 meters. Key pieces accounted for 7 of

the 55 pieces and 50% of the quantified wood volume. Conifers accounted for 52 of the 55 pieces and 99% of the wood volume. Rootwads accounted for 11 of the 55 pieces and one-third of the wood volume. Of the 55 large wood pieces, 23, 50, 20, and 14 were located completely or partially in the wetted channel, within bankfull but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. Of the pieces exhibiting a level of stability, pinned and rooted stability forms were observed in 55% and 9% of the pieces, respectively. Slightly more than one-third of pieces were unstable. There were no pieces that functioned as a pool forming agent. Large wood pieces were most commonly oriented perpendicular (36%) followed by parallel (30%), upstream (18%), and downstream (15%). There were no large wood jams observed over the course of the survey.

A total of 7 distinct bedrock features were quantified. The cumulative measured length was 151.8 meters. Four encountered bedrock features were sloped and three cliffs. All four sloped bedrock features projected into the wetted area.

References:

Moore, K. K. Jones, J. Dambacher, and C. Stein. 2010. Aquatic Inventories Project: Methods for Stream Habitat Surveys. Oregon Department of Fish and Wildlife, Aquatic Inventories Project, Conservation and Recovery Program, Corvallis, OR 97333.

Plues, A.E., D. Schuette Hames, and L. Bullchild. 1999. TFW Monitoring Program methods manual for the habitat unit survey. Prepared for the Washington State Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-00-003. DNR #105.

Romero, N., and Lindley, D. 2012. Rapid Aquatic Habitat Assessment Protocol: Methods for Stream Inventory Surveys. Yakima/Klickitat Fisheries Project (YKFP). Yakama Nation, Fisheries Program, Klickitat Washington.

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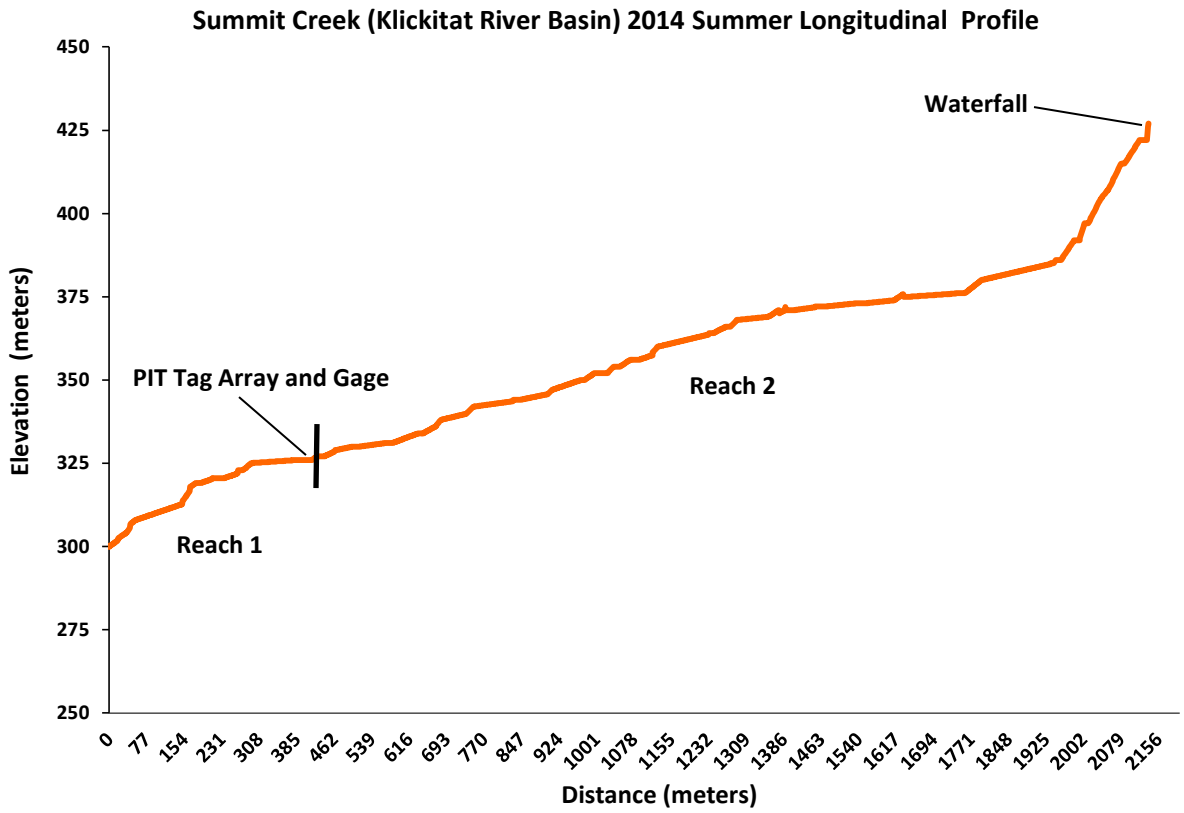
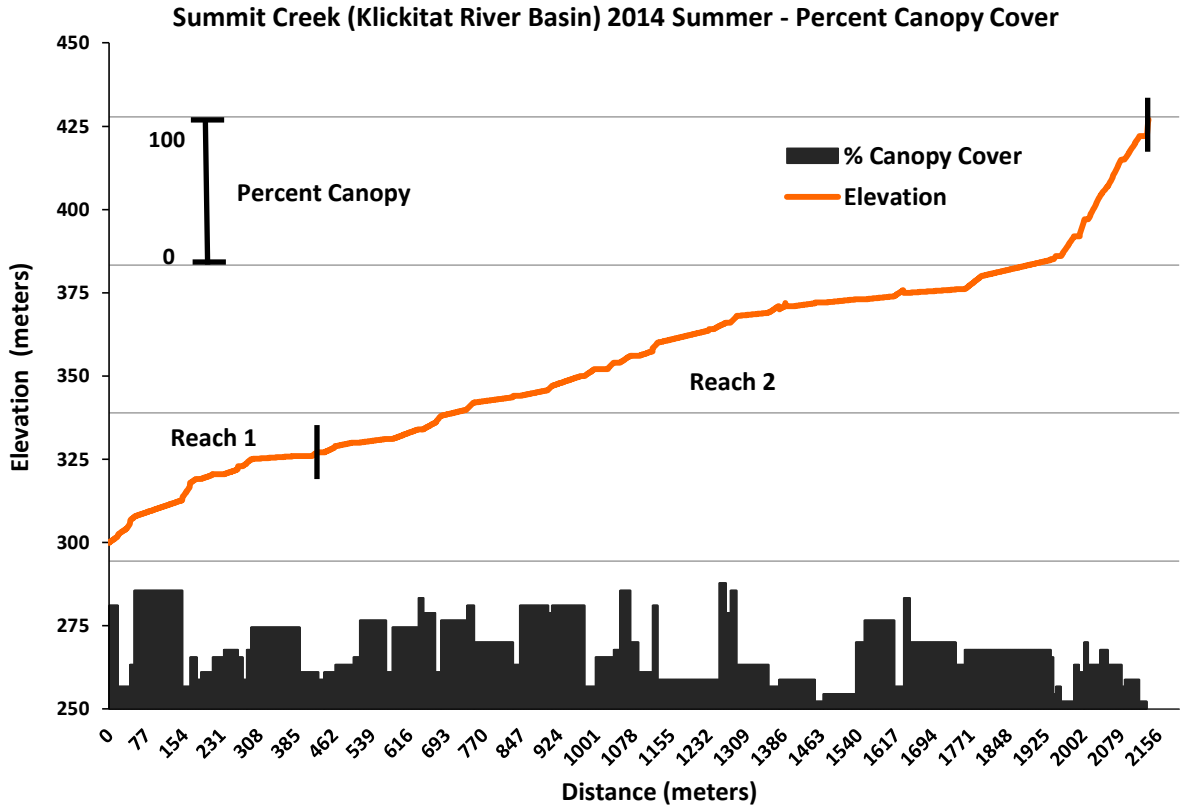
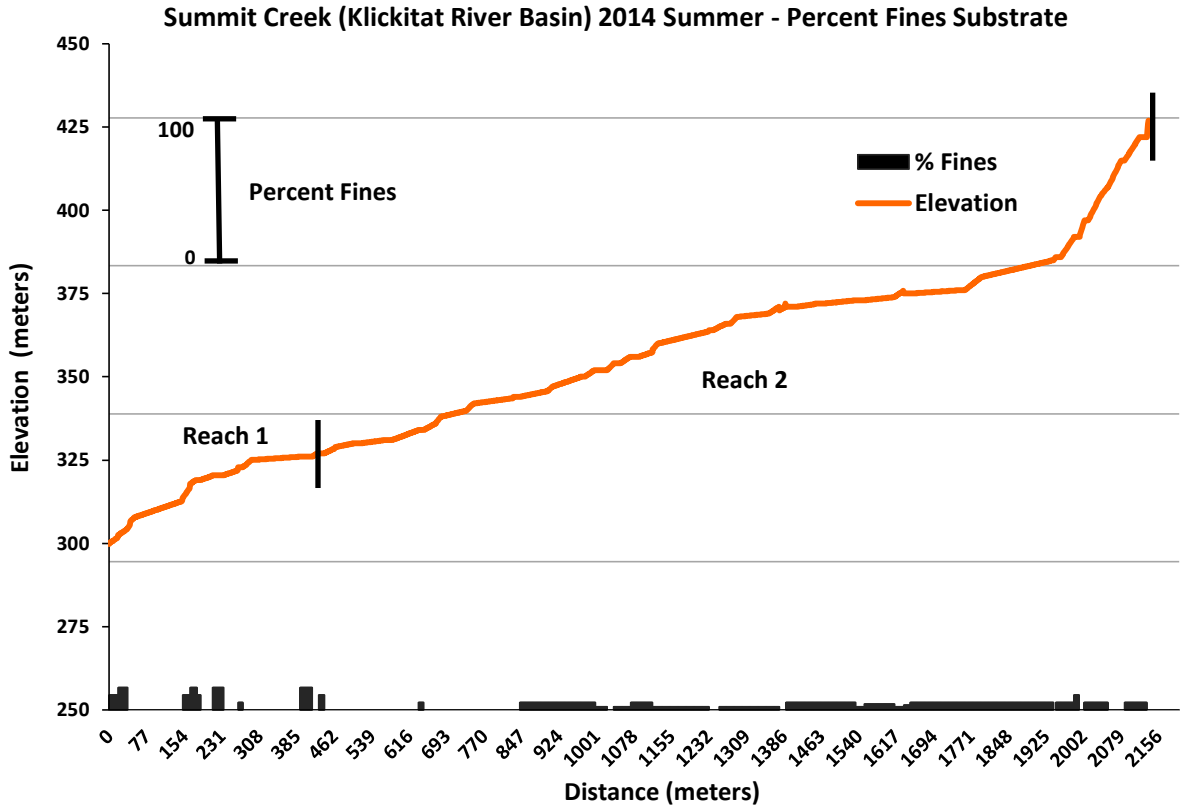
Schuett-Hames, D., A.E. Pleuse, and D. Smith. 1999. TFW Monitoring Program method manual for the salmonid spawning habitat availability survey. Prepared for the Washington Stare Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-00-007. DNR #109. November.

Summary Figures:






Summit Creek (Klickitat River Basin) 2014 Summer - Percent Fines Substrate
Elevation (meters)
Distance (meters)
100
0
Percent Fines
% Fines
Elevation
Reach 1
Reach 2
450
425
400
375
350
325
300
275
250
0
77
154
231
308
385
462
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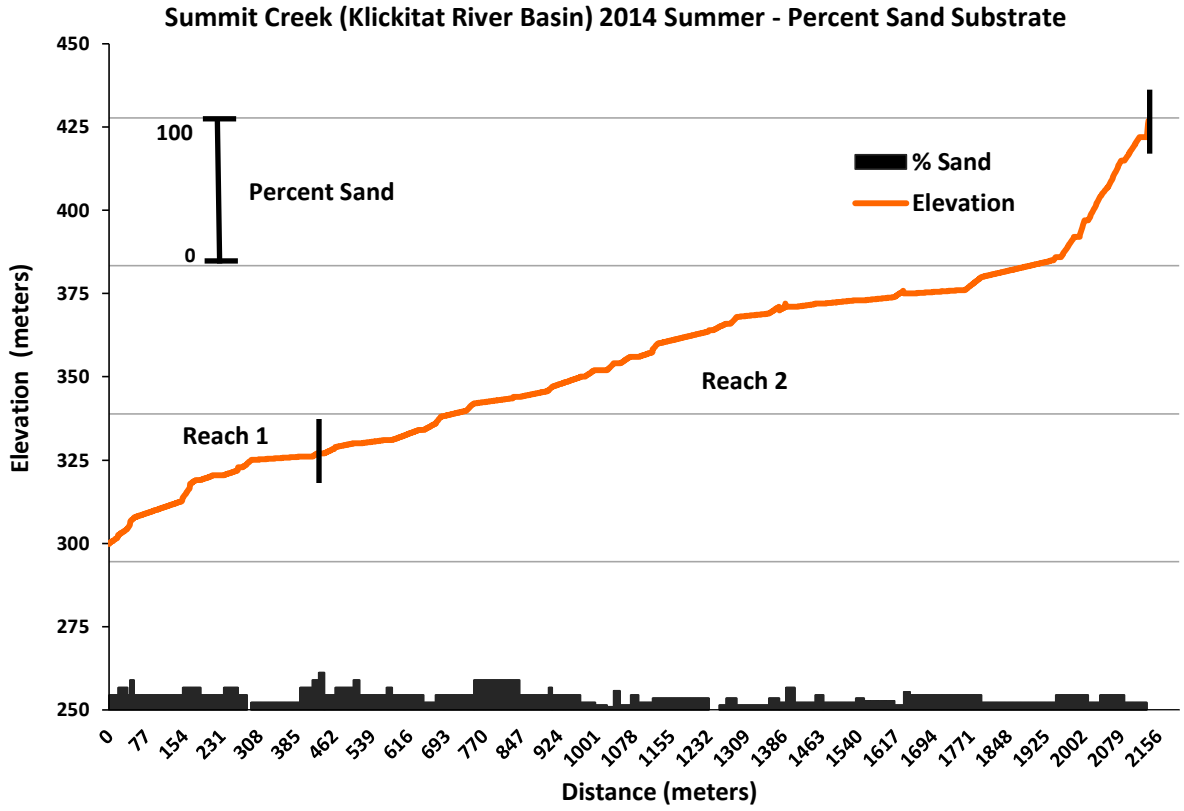
Summit Creek (Klickitat River Basin) 2014 Summer - Percent Sand Substrate
Elevation (meters)
Distance (meters)
100
0
Percent Sand
% Sand
Elevation
Reach 1
Reach 2
450
425
400
375
350
325
300
275
250
0
77
154
231
308
385
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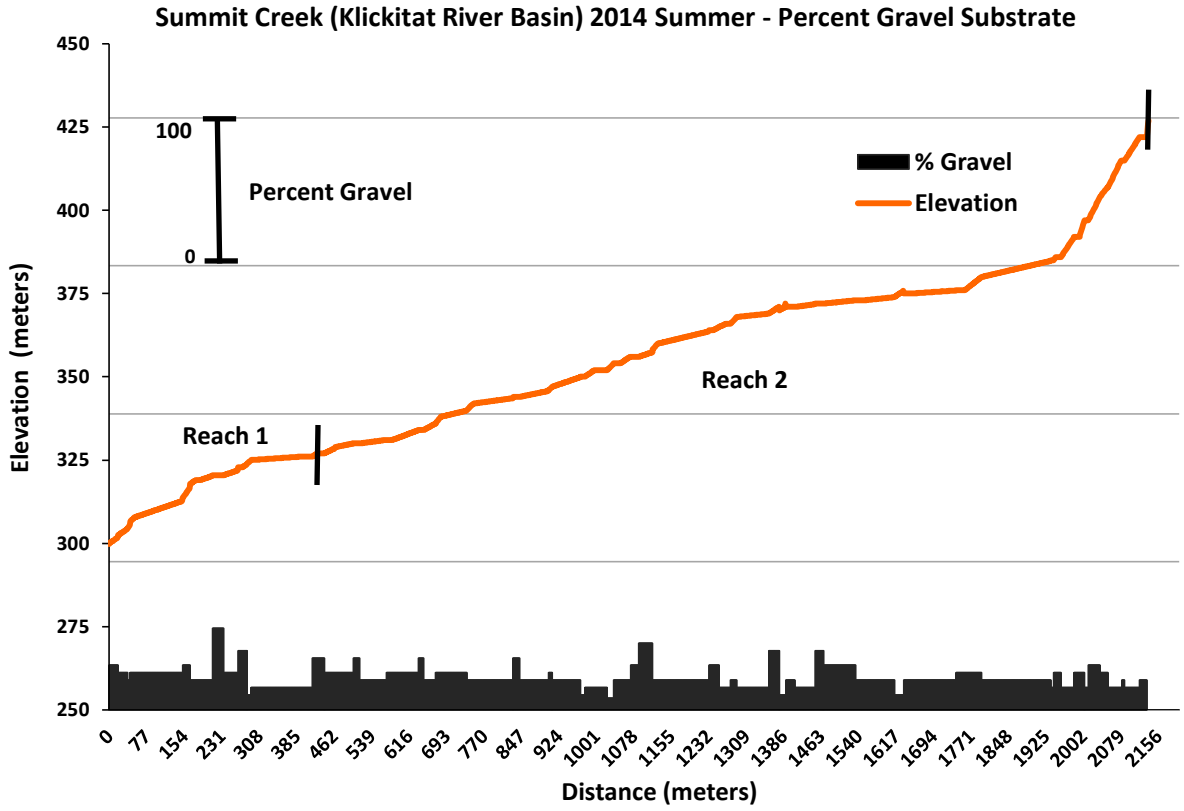
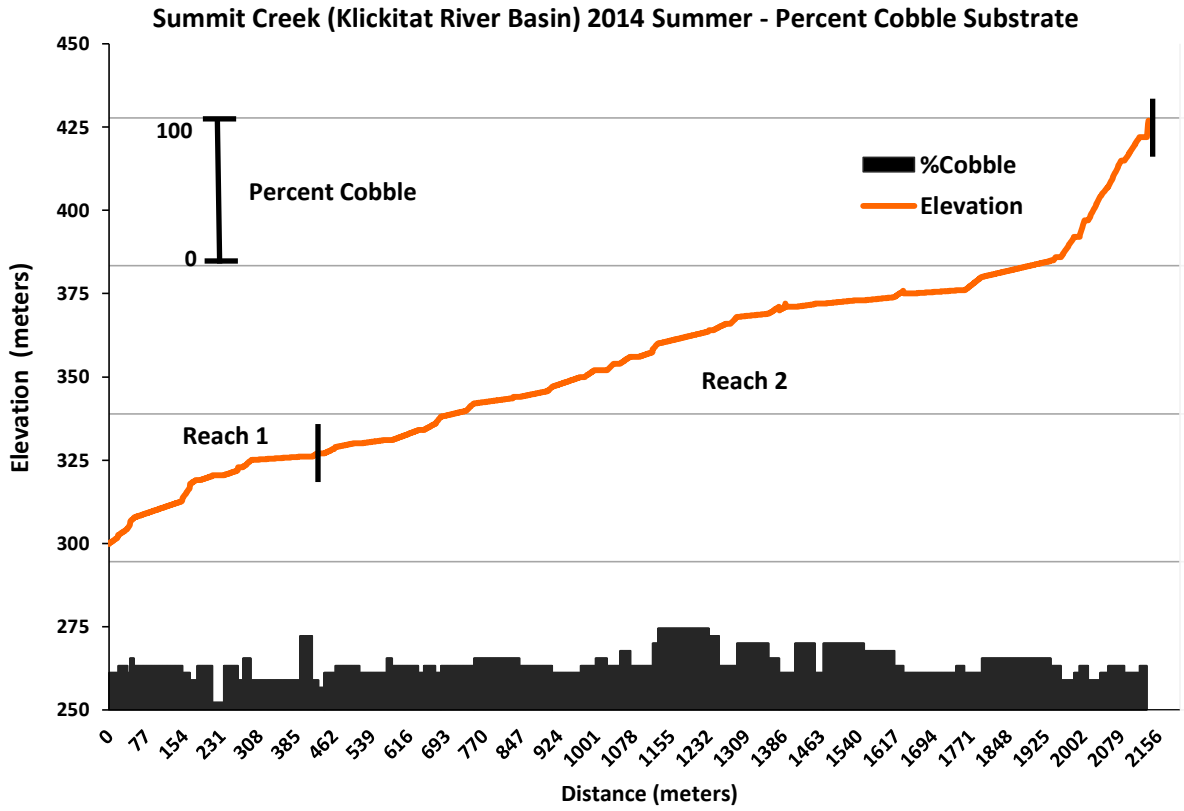
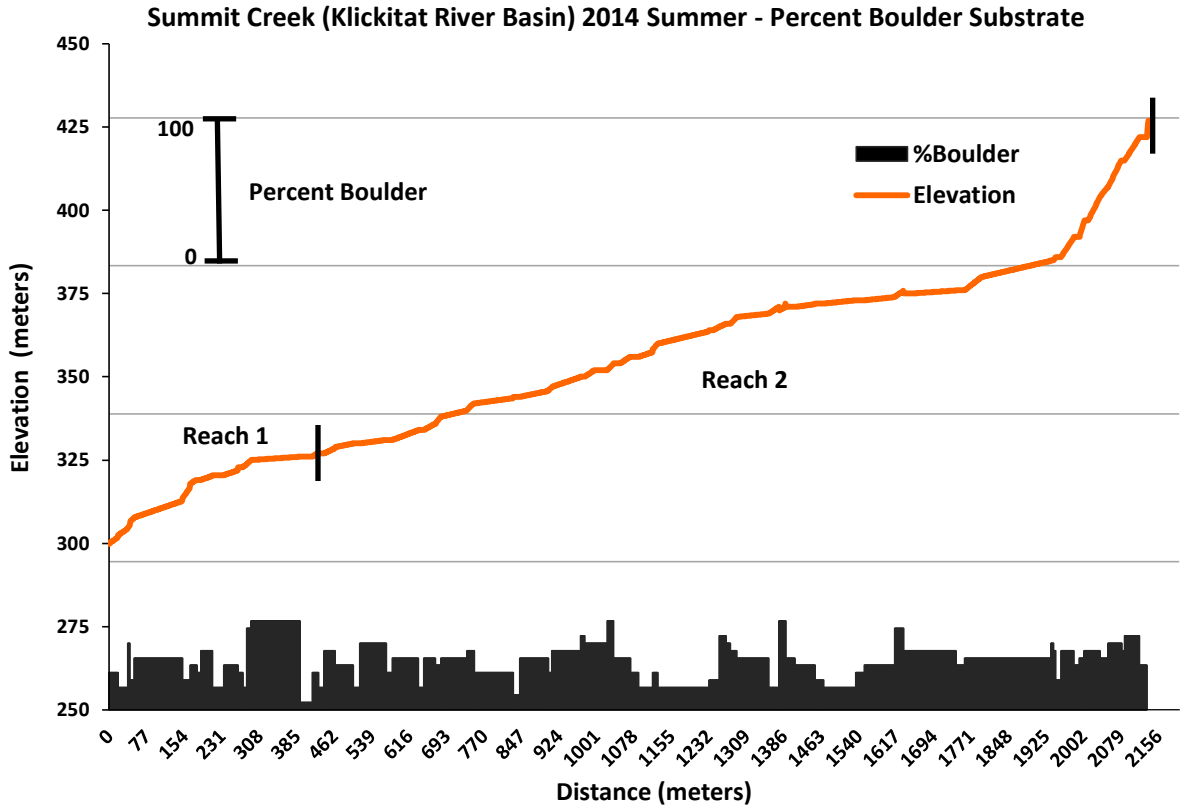
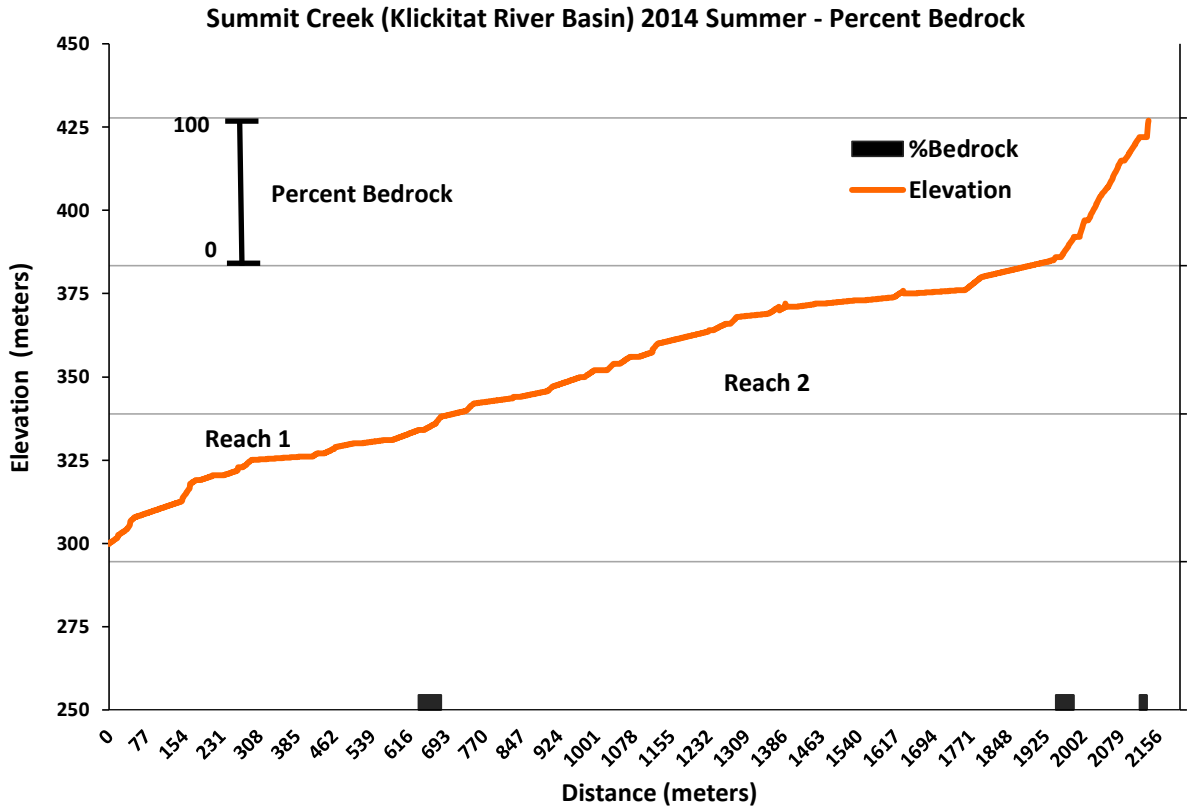

Summit Creek (Klickitat River Basin) 2014 Summer - Percent Gravel Substrate
Elevation (meters)
450
425
400
375
350
325
300
275
250
100
0
Percent Gravel
% Gravel
Elevation
Reach 1
Reach 2
0 77 154 231 308 385 462 539 616 693 770 847 924 1001 1078 1155 1232 1309 1386 1463 1540 1617 1694 1771 1848 1925 2002 2079 2156
Distance (meters)


Summit Creek (Klickitat River Basin) 2014 Summer - Percent Cobble Substrate
Elevation (meters)
450
425
400
375
350
325
300
275
250
100
0
Percent Cobble
%Cobble
Elevation
Reach 1
Reach 2
0 77 154 231 308 385 462 539 616 693 770 847 924 1001 1078 1155 1232 1309 1386 1463 1540 1617 1694 1771 1848 1925 2002 2079 2156
Distance (meters)


Summit Creek (Klickitat River Basin) 2014 Summer - Percent Boulder Substrate
Elevation (meters)
450
425
400
375
350
325
300
275
250
100
0
Percent Boulder
%Boulder
Elevation
Reach 1
Reach 2
0 77 154 231 308 385 462 539 616 693 770 847 924 1001 1078 1155 1232 1309 1386 1463 1540 1617 1694 1771 1848 1925 2002 2079 2156
Distance (meters)


Summit Creek (Klickitat River Basin) 2014 Summer - Percent Bedrock
Elevation (meters)
450
425
400
375
350
325
300
275
250
100
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Percent Bedrock
%Bedrock
Elevation
Reach 1
Reach 2
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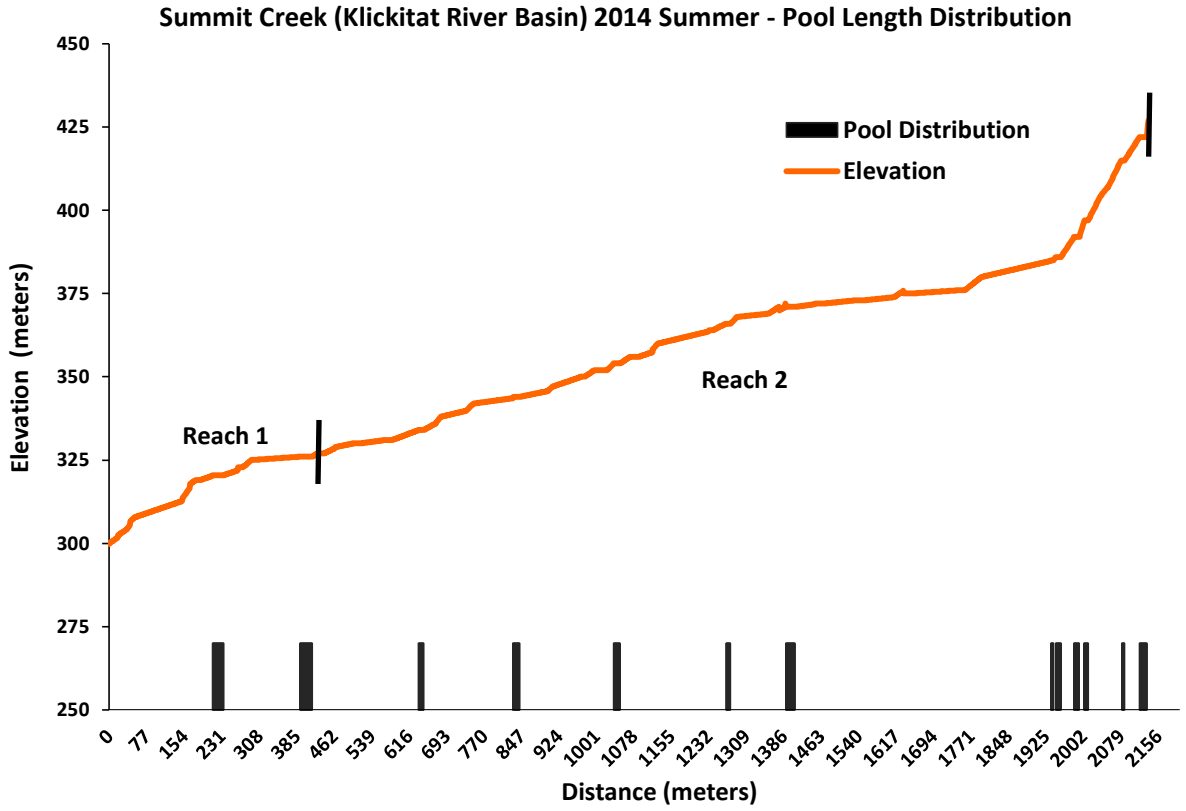
Distance (meters)


Summit Creek (Klickitat River Basin) 2014 Summer - Pool Length Distribution
Pool Distribution
Elevation
Reach 1
Reach 2
Elevation (meters)
Distance (meters)
450
425
400
375
350
325
300
275
250
0
77
154
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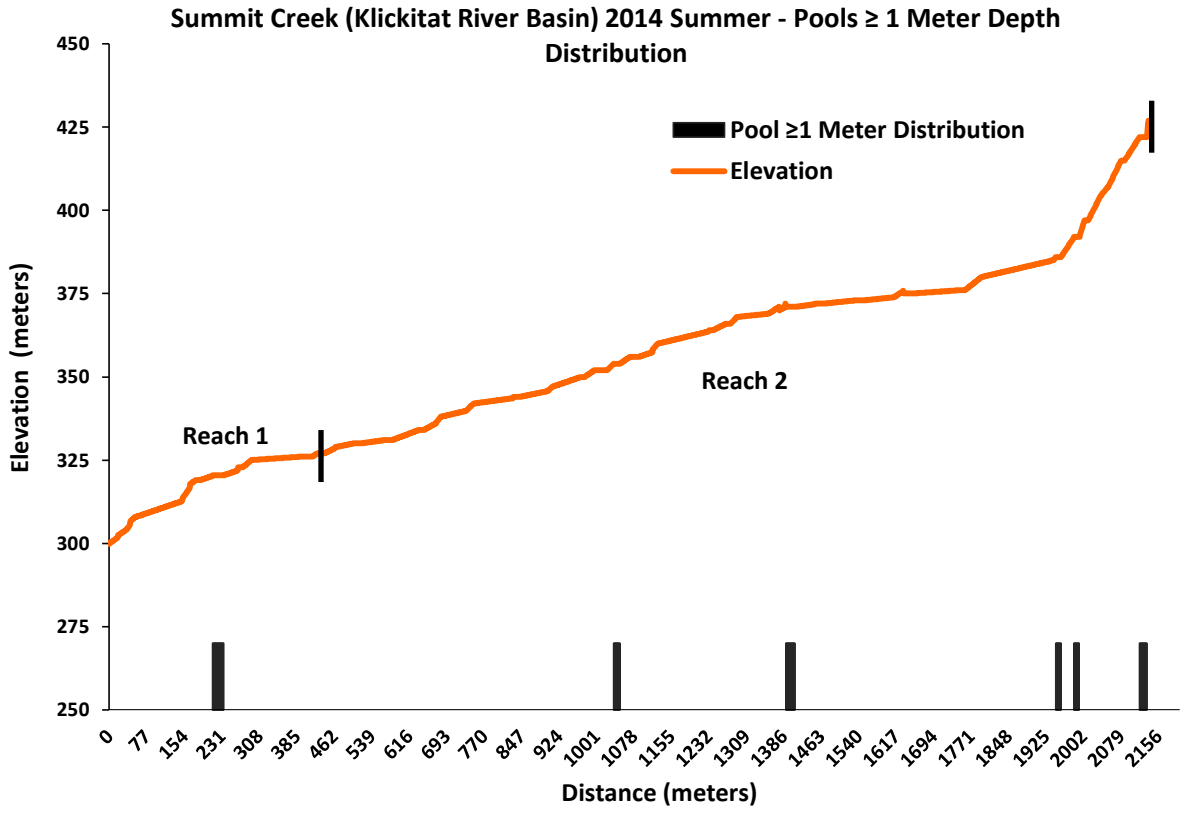
Summit Creek (Klickitat River Basin) 2014 Summer - Pools ≥ 1 Meter Depth Distribution
Pool ≥1 Meter Distribution
Elevation
Reach 1
Reach 2
Elevation (meters)
Distance (meters)
450
425
400
375
350
325
300
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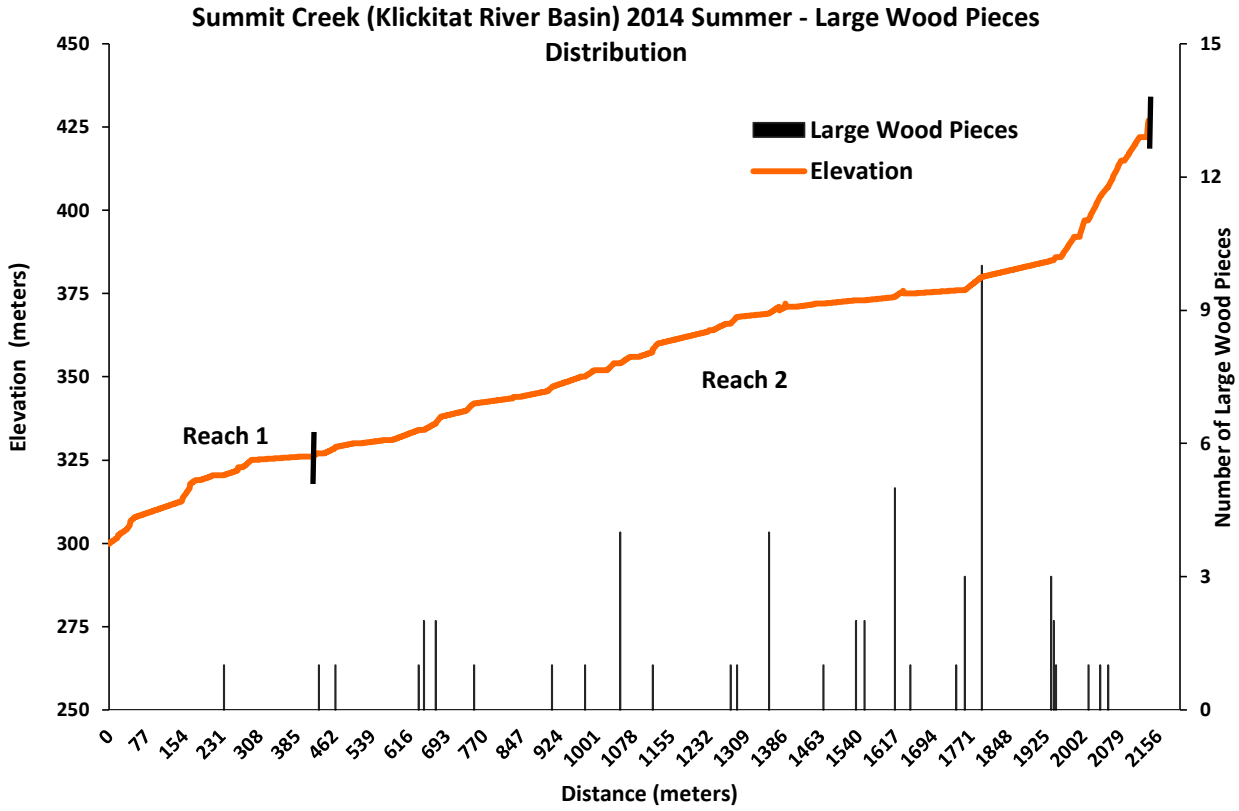
Summit Creek (Klickitat River Basin) 2014 Summer - Large Wood Pieces Distribution
Large Wood Pieces
Elevation
Reach 1
Reach 2
Elevation (meters)
Number of Large Wood Pieces
Distance (meters)
450
425
400
375
350
325
300
275
250
15
12
9
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77
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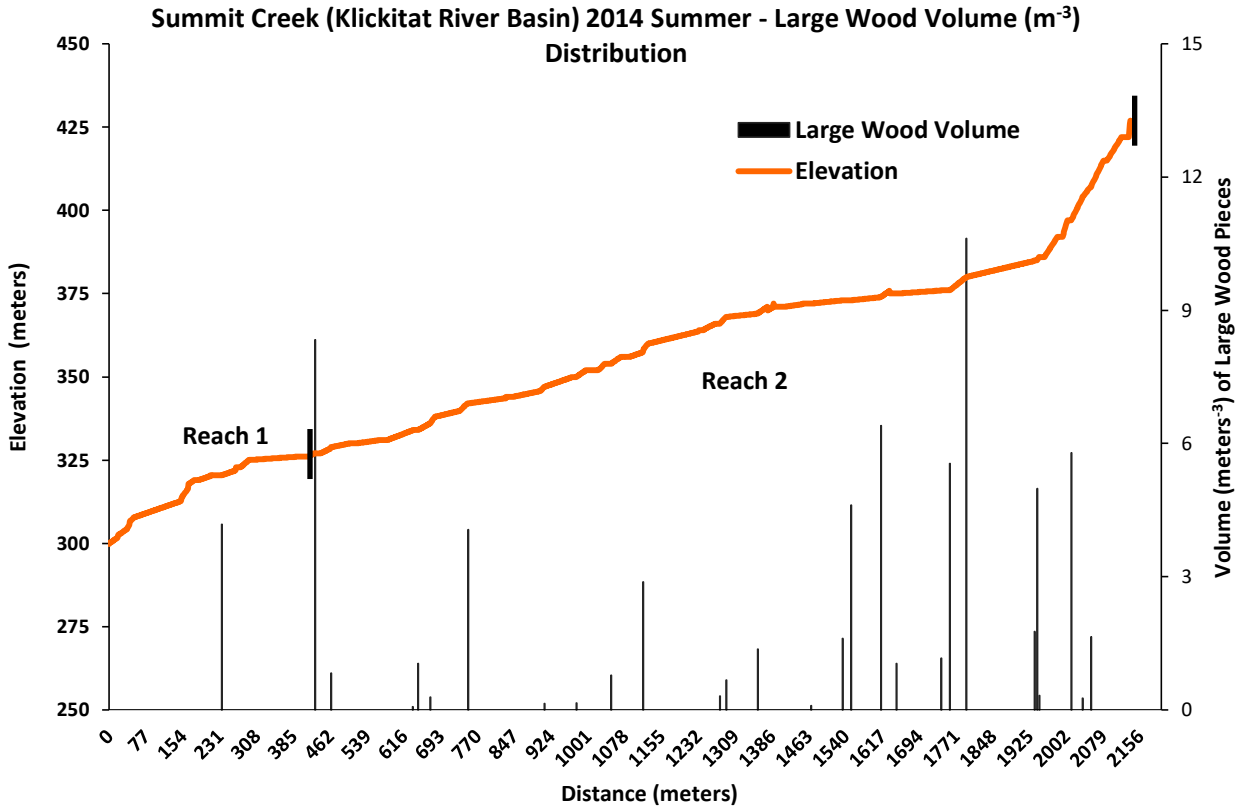
Summit Creek (Klickitat River Basin) 2014 Summer - Large Wood Volume (m-3) Distribution
Large Wood Volume
Elevation
Reach 1
Reach 2
Elevation (meters)
Volume (meters-3) of Large Wood Pieces
Distance (meters)
450
425
400
375
350
325
300
275
250
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12
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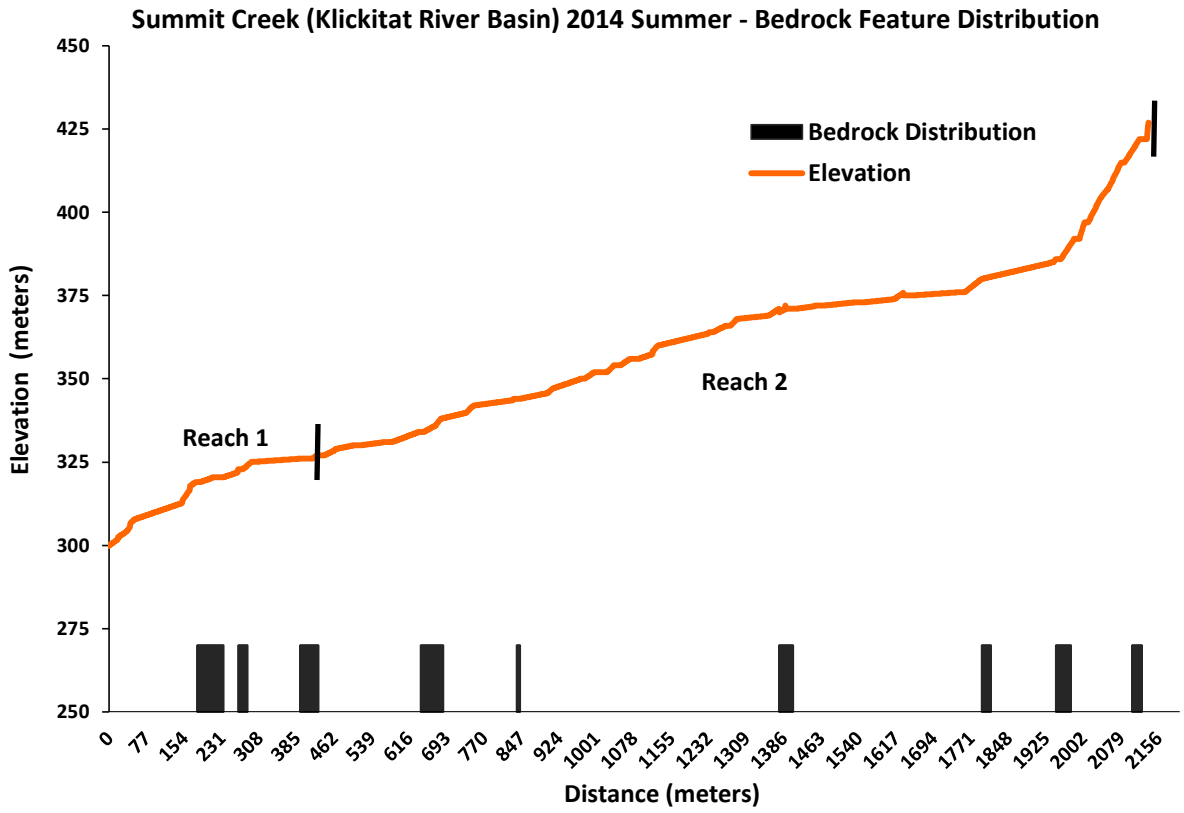
Summit Creek (Klickitat River Basin) 2014 Summer - Bedrock Feature Distribution
Bedrock Distribution
Elevation
Reach 1
Reach 2
Elevation (meters)
Distance (meters)
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375
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Summary Tables:

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction

Reach: 1
Survey Date: 09/15/2014
End Location: 45.989231206, -121.123473309
End Elevation: 326.0 m
Reach Ending Agent: Valley Transition

CHANNEL SUMMARY

Channel Characteristics (m)

Channel Type	No. Units	Length (m)	Area (m^{-2})	Gradient (%)	Dry Units
Primary	16	418.4	2,611.4	6.2	0
Secondary	-	-	-	-	-

Channel Dimensions (m)

Channel Type	Unit Avg. Length	Avg. Wetted Width	Avg. Bankfull Width	LB Undercut Bank Length	RB Undercut Bank Length
Primary	26.2	5.8	9.3	0.0	0.0
Secondary	-	-	-	-	-

Substrate Summary

	Substrate Percent Wetted Area						Substrate Wetted Area					
Hab Type	Fin	Snd	Grv	Cbl	Bld	Bdrk	Fin	Snd	Grv	Cbl	Bld	Bdrk
Pools	15.0	12.2	37.1	25.2	10.5	0.0	40.8	33.3	100.9	68.5	28.6	0.0
Glides	9.6	15.0	27.6	28.1	19.7	0.0	32.7	51.2	93.9	95.8	67.3	0.0
Runs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riffles	0.8	8.9	20.8	25.8	43.7	0.0	14.6	162.6	381.6	473.4	801.0	0.0
Rapids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cascades	7.3	7.3	24.6	27.7	33.1	0.0	12.1	12.1	40.7	45.7	54.6	0.0
Steps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alcoves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iso Pools	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obscured	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culverts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**3.8**	**9.9**	**23.6**	**26.2**	**36.4**	**0.0**	**100.2**	**259.2**	**617.0**	**683.4**	**951.5**	**0.0**

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.989231206, -121.123473309
Start Elevation: 326.0 m
Reach Forming Agent: Valley Transition

Reach: 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

CHANNEL SUMMARY

Channel Characteristics (m)

Channel Type	No. Units	Length (m)	Area (m^{-2})	Gradient (%)	Dry Units
Primary	62	1,716.1	11,559.8	5.6	0
Secondary	-	-	-	-	-

Channel Dimensions (m)

Channel Type	Unit Avg. Length	Avg. Wetted Width	Avg. Bankfull Width	LB Undercut Bank Length	RB Undercut Bank Length
Primary	27.7	6.4	9.9	2.7	6.8
Secondary	-	-	-	-	-

Substrate Summary

	Substrate Percent Wetted Area						Substrate Wetted Area					
Hab Type	Fin	Snd	Grv	Cbl	Bld	Bdrk	Fin	Snd	Grv	Cbl	Bld	Bdrk
Pools	4.4	10.3	22.6	28.9	30.1	3.6	34.4	81.2	179.2	229.0	238.5	28.8
Glides	3.3	10.2	27.1	32.7	26.7	0.0	37.9	117.3	312.9	376.6	308.4	0.0
Runs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riffles	3.1	8.7	21.8	35.3	30.9	0.2	226.5	640.6	1,604.8	2,597.4	2,274.0	13.6
Rapids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cascades	2.8	6.9	18.7	27.3	43.3	1.0	62.9	155.4	421.6	616.6	978.5	23.7
Steps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alcoves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iso Pools	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obscured	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culverts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**3.1**	**8.6**	**21.8**	**33.0**	**32.9**	**0.6**	**361.7**	**994.4**	**2,518.5**	**3,819.6**	**3,799.4**	**66.1**

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction

Reach: 1
Survey Date: 09/15/2014
End Location: 45.989231206, -121.123473309
End Elevation: 326.0 m
Reach Ending Agent: Valley Transition

HABITAT SUMMARY

Geomorphic Habitat Type Summary

	Primary Channel (PC)					Secondary Channel (SC)				
Habitat Type	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m^2)	% Wetted Area (m^2)	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m^2)	% Wetted Area (m^2)
Pools	2	48.4	5.7	272.1	10.4	0.0	0.0	0.0	0.0	0.0
Glides	5	60.6	5.6	341.0	13.1	0.0	0.0	0.0	0.0	0.0
Runs	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riffles	7	282.2	6.0	1,833.2	70.2	0.0	0.0	0.0	0.0	0.0
Rapids	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cascades	2	27.2	5.8	165.2	6.3	0.0	0.0	0.0	0.0	0.0
Steps	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backwater	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alcoves	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isolated Pools	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obscured	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culvert	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**16**	**418.4**	**5.8**	**2,611.4**	**100**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Pool Summary

Variable	Total Pool #	PC Pool #	SC Pool #	# Pools/KM	# PC Pools/KM	# SC Pools/KM
All Pools	2	2	-	4.8	4.8	-
Pools ≥1m	1	1	-	2.4	2.4	-
Pool frequency (channel widths/pool)	22.5	22.5	-			
Residual pool depth (avg)	1.47	1.47	-			

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.989231206, -121.123473309
Start Elevation: 326.0 m
Reach Forming Agent: Valley Transition

Reach: 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

HABITAT SUMMARY

Geomorphic Habitat Type Summary

	Primary Channel (PC)					Secondary Channel (SC)				
Habitat Type	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m^{-2})	% Wetted Area (m^{-2})	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m^2)	% Wetted Area (m^{-2})
Pools	11	121.2	6.6	791.0	6.8	0	0.0	0.0	0.0	0.0
Glides	14	194.9	5.9	1,153.1	10.0	0	0.0	0.0	0.0	0.0
Runs	0	0.0.	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Riffles	20	1,077.0	6.5	7,356.9	63.6	0	0.0	0.0	0.0	0.0
Rapids	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Cascades	16	323.0	6.8	2,258.7	19.5	0	0.0	0.0	0.0	0.0
Steps	1	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Backwater	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Alcoves	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Isolated Pools	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Obscured	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Dry Channel	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Culvert	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Total	**62**	**1,716.1**	**6.4**	**11,559.8**	**100**	**0**	**0.0**	**0.0**	**0.0**	**0.0**

Pool Summary

Variable	Total Pool #	PC Pool #	SC Pool #	# Pools/KM	# PC Pools/KM	# SC Pools/KM
All Pools	11	11	0	6.4	6.4	-
Pools ≥1m	5	5	-	2.9	2.9	-
Pool frequency (channel widths/pool)	15.8	15.8	-			
Residual pool depth (avg)	0.7	0.7	-			

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction

Reach: 1 and 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

STREAM CHANNEL AND HABITAT SUMMARY

Channel Summary

Channel Type	No. Units	Total Length (m)	Wetted Area (m^{-2})	Avg Width (m)	Avg Bankfull Width (m)	% Gradient	% Fin	% Snd	% Grv	% Cbl	% Bldr	% Bdrk
PC	78	2,134.0	14,171.2	6.3	9.8	5.7	3.3	8.8	22.1	31.8	33.5	0.5
SC	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Geomorphic Habitat Type Summary

	Primary Channel (PC)					Secondary Channel (SC)				
Habitat Type	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m^{-2})	% Wetted Area(m^2)	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m^{-2})	% Wetted Area (m^{-2})
Pools	13	169.6	6.4	1,063.1	7.5	0.0	0.0	0.0	0.0	0.0
Glides	19	255.5	5.8	1,494.1	10.5	0.0	0.0	0.0	0.0	0.0
Runs	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riffles	27	1,359.2	5.3	9,190.1	64.9	0.0	0.0	0.0	0.0	0.0
Rapids	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cascades	18	350.2	6.7	2,423.9	17.1	0.0	0.0	0.0	0.0	0.0
Steps	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backwater	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alcoves	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isolated Pools	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obscured	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culvert	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**78**	**2,134.5**	**6.3**	**14,171.2**	**100**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Pool Summary

Variable	Total Pool #	PC Pool #	SC Pool #	# Pools/KM	# PC Pools/KM	# SC Pools/KM
All Pools	13	13	0	6.1	6.1	0
Pools ≥1m	6	6	-	2.8	2.8	-
Pool frequency (channel widths/pool)	16.8	16.8	-			
Residual pool depth (avg)	0.85	1.47	-			

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction
Reach: 1
Survey Date: 09/15/2014
End Location: 45.989231206, -121.123473309
End Elevation: 326.0 m
Reach Ending Agent: Valley Transition

RIPARIAN AND LARGE WOOD PIECES SUMMARY

Riparian Characteristics

Type	Total Canopy Cover Area (m^2)	Total % Canopy Cover	Unit Avg. % Canopy Cover	Dom Canopy Species	Sub-dom Canopy Species
Primary	1,311.3	50.2	34.7	Red Alder	Scouler's Willow
Secondary	-	-		-	-

Large Wood Piece Inventory Summary

Channel Type	Primary Channel	#Pieces	Volume (m^{-3})	Pieces/100 m	Volume (m^{-3})/100 m
Primary	All Pieces[1]	1	4.2	0.2	1.0
	Key Pieces[2]	1	4.2	0.2	1.0
	Logs	1	4.2	0.2	1.0
	Rootwads	0	0.0	0.0	0.0
	Conifer	1	4.2	0.2	1.0
	Deciduous	0	0.0	0.0	0.0
Secondary	All Pieces[1]	-	-	-	-
	Key Pieces[2]	-	-	-	-
	Logs	-	-	-	-
	Rootwads	-	-	-	-
	Conifer	-	-	-	-
	Deciduous	-	-	-	-

[1]Minimum Qualifying Large Wood Piece (≥2 m x ≥0.10 m dia.); [2] Minimum Qualifying Key Pieces (≥2.5 m^{-3})

Large Wood Piece Zone Location Summary

Channel Type	Total Pieces	# Zone 1 (%)	# Zone 2 (%)	# Zone 3 (%)	# Zone 4 (%)
Primary	1	1 (100)	1 (100)	0 (0.0)	0 (0.0)
Secondary	-	-	-	-	-

*Pieces may span multiple zones
*Zone 1 (wetted channel); Zone 2 (within bankfull); Zone 3 (above bandfull); Zone 4 (flood plain/terrace/hillslope)

Large Wood Piece Stability and Pool Forming Summary

Channel Type	Total Pieces	# Rooted (%)	# Buried (%)	# Pinned (%)	# Unstable (%)	# Pool Forming (%)
Primary	1	0 (0.0)	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)
Secondary	-	-	-	-	-	-

Large Wood Piece Orientation Summary

Channel Type	Total Pieces	# Parallel (%)	# Perpendicular (%)	# Downstream (%)	# Upstream (%)
Primary	1	0 (0.0)	0 (0.0)	1 (100)	0 (0.0)
Secondary	-	-	-	-	-

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.989231206, -121.123473309
Start Elevation: 326.0 m
Reach Forming Agent: Valley Transition
Reach: 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

RIPARIAN AND LARGE WOOD PIECES SUMMARY

Riparian Characteristics

Type	Total Canopy Cover Area (m^2)	Total % Canopy Cover	Unit Avg. % Canopy Cover	Dom Canopy Species	Sub-dom Canopy Species
Primary (PC)	4,528.2	39.2	38.6	Red Alder	Big Leaf Maple
Secondary (SC)	-	-		-	-

Large Wood Piece Inventory Summary

Channel Type	Primary Channel	#Pieces	Volume (m^{-3})	Pieces/100 m	Volume (m^{-3})/100 m
Primary	All Pieces[1]	55	66.8	3.2	3.9
	Key Pieces[2]	7	33.0	0.4	1.9
	Logs	44	45.3	2.6	2.7
	Rootwads	11	21.5	0.6	1.3
	Conifer	52	66.1	3.0	3.9
	Deciduous	3	0.7	0.2	0.04
Secondary	All Pieces[1]	-	-	-	-
	Key Pieces[2]	-	-	-	-
	Logs	-	-	-	-
	Rootwads	-	-	-	-
	Conifer	-	-	-	-
	Deciduous	-	-	-	-

[1]Minimum Qualifying Large Wood Piece (≥2 m x ≥0.10 m dia.); [2] Minimum Qualifying Key Pieces (≥2.5 m^{-3})

Large Wood Piece Zone Location Summary

Channel Type	Total Pieces	# Zone 1 (%)	# Zone 2 (%)	# Zone 3 (%)	# Zone 4 (%)
Primary	55	23 (41.8)	50 (90.9)	20 (36.4)	14 (25.5)
Secondary	-	-	-	-	-

*Pieces may span multiple zones
*Zone 1 (wetted channel); Zone 2 (within bankfull); Zone 3 (above bankfull); Zone 4 (flood plain/terrace/hillslope)

Large Wood Piece Stability and Pool Forming Summary

Channel Type	Total Pieces	# Rooted (%)	# Buried (%)	# Pinned (%)	# Unstable (%)	# Pool Forming (%)
Primary	55	5 (9.1)	0 (0.0)	30 (54.5)	20 (36.4)	0 (0.0)
Secondary	-	-	-	-	-	-

Large Wood Piece Orientation Summary

Channel Type	Total Pieces	# Parallel (%)	# Perpendicular (%)	# Downstream (%)	# Upstream (%)
Primary	55	17 (30.9)	20 (36.4)	8 (14.5)	14 (18.2)
Secondary	-	-	-	-	-

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction
Reach: 1 and 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

STREAM RIPARIAN AND LARGE WOOD PIECES SUMMARY

Riparian Characteristics

Type	Total Canopy Cover Area (m^2)	Total % Canopy Cover	Unit Avg. % Canopy Cover	Dom Canopy Species	Sub-dom Canopy Species
Primary	5,839.5	41.2	37.8	Red Alder	Big Leaf Maple
Secondary	-	-		-	-

Large Wood Piece Inventory Summary

Channel Type	Primary Channel	#Pieces	Volume (m^{-3})	Pieces/100 m	Volume (m^{-3})/100 m
Primary	All Pieces[1]	56	71.0	2.6	3.3
	Key Pieces[2]	8	37.1	0.4	1.7
	Logs	45	49.5	2.1	2.3
	Rootwads	11	21.5	0.5	1.0
	Conifer	53	70.3	2.5	3.3
	Deciduous	3	0.7	0.1	0.03
Secondary	All Pieces[1]	-	-	-	-
	Key Pieces[2]	-	-	-	-
	Logs	-	-	-	-
	Rootwads	-	-	-	-
	Conifer	-	-	-	-
	Deciduous	-	-	-	-

[1]Minimum Qualifying Large Wood Piece (≥2 m x ≥0.10 m dia.); [2] Minimum Qualifying Key Pieces (≥2.5 m^{-3})

Large Wood Piece Zone Location Summary

Channel Type	Total Pieces	# Zone 1 (%)	# Zone 2 (%)	# Zone 3 (%)	# Zone 4 (%)
Primary	56	24 (42.9)	51 (91.1)	20 (35.7)	14 (25.0)
Secondary	-	-	-	-	-

*Pieces may span multiple zones
*Zone 1 (wetted channel); Zone 2 (within bankfull); Zone 3 (above bankfull); Zone 4 (flood plain/terrace/hillslope)

Large Wood Piece Stability and Pool Forming Summary

Channel Type	Total Pieces	# Rooted (%)	# Buried (%)	# Pinned (%)	# Unstable (%)	# Pool Forming (%)
Primary	56	5 (8.9)	0 (0.0)	31 (55.4)	20 (35.7)	0 (0.0)
Secondary	-	-	-	-	-	-

Large Wood Piece Orientation Summary

Channel Type	Total Pieces	# Parallel (%)	# Perpendicular (%)	# Downstream (%)	# Upstream (%)
Primary	56	17 (30.4)	20 (35.7)	9 (16.1)	10 (17.9)
Secondary	-	-	-	-	-

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction

Reach: 1
Survey Date: 09/15/2014
End Location: 45.989231206, -121.123473309
End Elevation: 326.0 m
Reach Ending Agent: Valley Transition

LARGE WOOD JAM SUMMARY

Large Wood Jam Inventory Summary

Channel Type	Total Jams	# Pieces	Avg # Pieces	Jam Frequency[1]	# Jams/KM
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

[1]Jam frequency (total bankfull channel widths/jam)

Large Wood Jam Composition Summary

			Large Wood Piece Size					
Channel Type	Total Jams	Total Pieces	#Rootwad (Dia≥20cm)	#Log (Dia≥10>20cm)	#Log (Dia20<50cm)	#Log (Dia≥50cm)	#Rtwd Key Pieces	#Log Key Pieces
Primary	0	-	-	-	-	-	-	-
Secondary	0	-	-	-	-	-	-	-

Large Wood Piece Zone Location and Pool Forming Summary

Channel Type	Total Jams	Wetted Channel Area (%)	Bankfull Channel Area (%)	Flood plain/Terrace Area (%)	Pool Forming (%)
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

*A jam was assigned to wetted or bankfull zone if a LWD piece extended 0.1 meters into a zone

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.989231206, -121.123473309
Start Elevation: 326.0 m
Reach Forming Agent: Valley Transition

Reach: 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

LARGE WOOD JAM SUMMARY

Large Wood Jam Inventory Summary

Channel Type	Total Jams	# Pieces	Avg # Pieces	Jam Frequency[1]	# Jams/KM
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

[1]Jam frequency (total bankfull channel widths/jam)

Large Wood Jam Composition Summary

			Large Wood Piece Size					
Channel Type	Total Jams	Total Pieces	#Rootwad (Dia≥20cm)	#Log (Dia≥10>20cm)	#Log (Dia20<50cm)	#Log (Dia≥50cm)	#Rtwd Key Pieces	#Log Key Pieces
Primary	0	-	-	-	-	-	-	-
Secondary	0	-	-	-	-	-	-	-

Large Wood Piece Zone Location and Pool Forming Summary

Channel Type	Total Jams	Wetted Channel Area (%)	Bankfull Channel Area (%)	Flood plain/Terrace Area (%)	Pool Forming (%)
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

*A jam was assigned to wetted or bankfull zone if a LWD piece extended 0.1 meters into a zone

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction

Reach: 1 and 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

STREAM LARGE WOOD JAM SUMMARY

Large Wood Jam Inventory Summary

Channel Type	Total Jams	# Pieces	Avg # Pieces	Jam Frequency[1]	# Jams/KM
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

[1]Jam frequency (total bankfull channel widths/jam)

Large Wood Jam Composition Summary

			Large Wood Piece Size					
Channel Type	Total Jams	Total Pieces	#Rootwad (Dia≥20cm)	#Log (Dia≥10>20cm)	#Log (Dia20<50cm)	#Log (Dia≥50cm)	#Rtwd Key Pieces	#Log Key Pieces
Primary	0	-	-	-	-	-	-	-
Secondary	0	-	-	-	-	-	-	-

Large Wood Piece Zone Location and Pool Forming Summary

Channel Type	Total Jams	Wetted Channel Area (%)	Bankfull Channel Area (%)	Flood plain/Terrace Area (%)	Pool Forming (%)
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

*A jam was assigned to wetted or bankfull zone if a LWD piece extended 0.1 meters into a zone

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction

Reach: 1
Survey Date: 09/15/2014
End Location: 45.989231206, -121.123473309
End Elevation: 326.0 m
Reach Ending Agent: Valley Transition

BEDROCK FEATURE SUMMARY

Bedrock Feature Inventory Summary

Channel Type	Total #	# Left Bank Loc	# Right Bank Loc	# Channel Bottom Loc	# Channel Span Loc	Total Length (m)
Primary	3	3	0	0	0	108.4
Secondary	0	-	-	-	-	-

Bedrock Feature Characteristic Summary

Channel Type	# Ledge	# Slope	# Cliff	# Projecting	# Non-projecting	# Surface Control
Primary	0	3	0	0	0	0
Secondary	0	-	-	-	-	-

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.989231206, -121.123473309
Start Elevation: 326.0 m
Reach Forming Agent: Valley Transition

Reach: 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

BEDROCK FEATURE SUMMARY

Bedrock Feature Inventory Summary

Channel Type	Total #	# Left Bank Loc	# Right Bank Loc	# Channel Bottom Loc	# Channel Span Loc	Total Length (m)
Primary	7	5	2	0	0	151.8
Secondary	0	-	-	-	-	-

Bedrock Feature Characteristic Summary

Channel Type	# Ledge	# Slope	# Cliff	# Projecting	# Non-projecting	# Surface Control
Primary	0	4	3	4	3	0
Secondary	0	-	-	-	-	-

Klickitat Monitoring and Evaluation Project and Klickitat Water Enhancement Project Rapid Aquatic Habitat Inventory

Survey Stream: Summit Creek
Report Date: 04/06/2020
Start Location: 45.98575749, -121.124608302
Start Elevation: 300.0 m
Reach Forming Agent: Tributary Junction

Reach: 1 and 2
Survey Date: 09/15-9/17/2014
End Location: 45.997314211, -121.10842729
End Elevation: 422.0 m
Reach Ending Agent: Waterfall Barrier

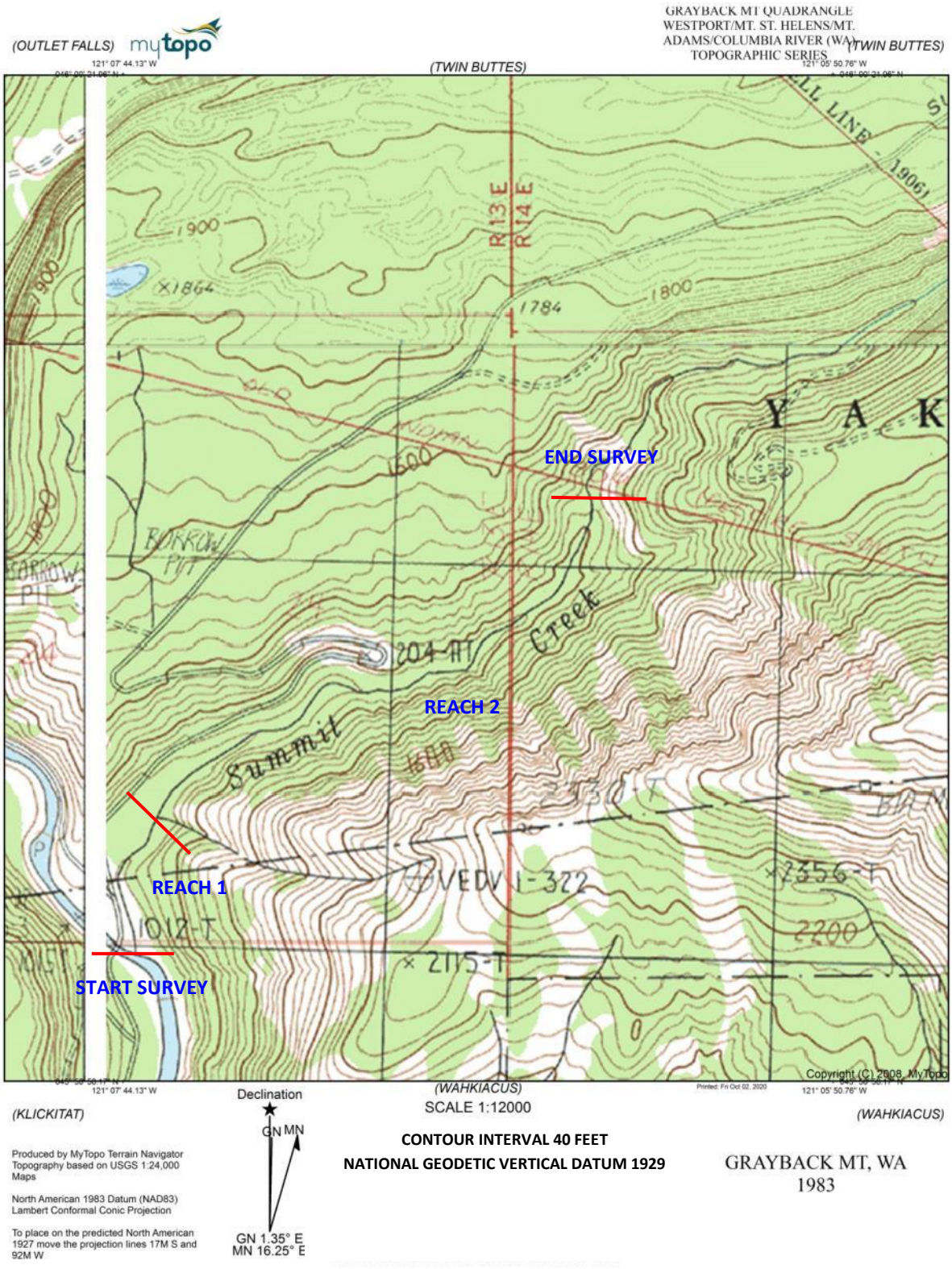
STREAM BEDROCK FEATURE SUMMARY

Bedrock Feature Inventory Summary

Channel Type	Total #	# Left Bank Loc	# Right Bank Loc	# Channel Bottom Loc	# Channel Span Loc	Total Length (m)
Primary	10	8	2	0	0	260.2
Secondary	0	-	-	-	-	-

Bedrock Feature Characteristic Summary

Channel Type	# Ledge	# Slope	# Cliff	# Projecting	# Non-projecting	# Surface Control
Primary	0	7	3	7	3	0
Secondary	0	-	-	-	-	-


GRAYBACK MT QUADRANGLE
WESTPORT/MT. ST. HELENS/MT.
ADAMS/COLUMBIA RIVER (WA)
TOPOGRAPHIC SERIES
(OUTLET FALLS)
mytopo
(TWIN BUTTES)
(TWIN BUTTES)
121° 07' 44.13" W
121° 05' 50.76" W
R13E
R14E
1900
1800
1784
1600
1864
Y A K
END SURVEY
BORROW PIT
204-TT
Creek
Summit
1610
REACH 2
REACH 1
VEDV 1-322
1012-T
2356-T
2200
2115-T
START SURVEY
Copyright (C) 2008, MyTopo
(KLICKITAT)
(WAHKIACUS)
(WAHKIACUS)
SCALE 1:12000
Declination
GN MN
GN 1.35° E
MN 16.25° E
CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM 1929
Produced by MyTopo Terrain Navigator
Topography based on USGS 1:24,000 Maps
North American 1983 Datum (NAD83)
Lambert Conformal Conic Projection
To place on the predicted North American 1927 move the projection lines 17M S and 92M W
GRAYBACK MT, WA
1983

Summit Creek (Klickitat River Basin) 2014 Summer Habitat Survey – Reach 1 Photos

Unit1 – Upstream view of cascade at survey start

Unit 4 – Upstream view of glide

Unit 10– Upstream view of bedrock scour pool

Unit 11 – Upstream view of riffle

Unit 15 – Aerial view of riffle and PIT tag arrays

Unit 16 – Upstream view of bedrock scour pool

Summit Creek (Klickitat River Basin) 2014 Summer Habitat Survey – Reach 2 Photos

Unit 1 – Upstream view of riffle

Unit 3 – Upstream view of cascade

Unit 15 – Upstream view of bedrock scour pool

Unit 26 – Upstream view of riffle

Unit 35 – Upstream view of glide

Unit 45 – Upstream view of riffle

Summit Creek (Klickitat River Basin) 2014 Summer Habitat Survey – Reach 2 Photos

Unit 49 – Boulder scour pool w/channel spanning logs

Unit 51 – Bedrock scour pool w/root wad

Unit 54 – Upstream view of cascade

Unit 55 – Upstream view of boulder scour pool

Unit 57 – Upstream view of riffle

Units 61 and 62– Upstream view of survey ending pool and falls