

WHYCHUS CANYON REACH 4 PROJECT MONITORING 2009-2019													
Metric #	Hypothesis	Metric	Method / Protocol	Objective	Trigger?	Lead Entity	Pre-Project				Post-Project		
							2009	2011	2015	2016	2017	2018	2019
<b>PHYSICAL</b>													
Groundwater / Floodplain Connectivity													
1	Average depth to groundwater will decrease for the <u>baseflow period</u> of July 15 to August 31.	Depth to groundwater (monthly median)	Continuous monitoring of groundwater elevations in wells	Average depth of 2 ft below growing surface	Yes. If water levels remain deeper than 2 ft. through a season <u>and</u> vegetation shows obvious signs of water stress, root causes would be examined and potential action would be considered.	UDWC			X	X	X	X	X
Channel Morphology and Habitat													
2	Channels will remain within 1 ft. of the target geomorphic gradeline elevation.	Vertical stability and floodplain connectivity	Total station survey longitudinal profiles of baseflow water surface compared to geomorphic gradeline	Elevations remain within 1 ft of target geomorphic gradeline	Yes. If elevations drop below gradeline and are not exhibiting signs of recovery (e.g., deposition), the channels could be incising, headcutting and/or disconnecting from the floodplain. Further investigation would occur.	UDWC, USFS	X			X	X	X	X
3	Number of channels / flow paths wetted at base flow will increase	Active channels at cross-sections during base flow	Cross-sections or aerial imagery flown at baseflow	Increase the average number of active channels at each cross-section by >1	Yes. If number of channels reverts to the pre-project number, this could indicate recapture or excessive simplification. Further investigation would occur.	UDWC, USFS, and/or UoFN	X			X	X	X	
4	Total channel length will increase	Channel length	ODFW AIP Stream Habitat Surveys, Total Station surveys, and/or aerial imagery	Total channel length >3 miles	Yes. If total channel length reverts to the pre-project length, this would likely indicate recapture or excessive channel simplification. Further investigation would occur.	UDWC, USFS, ODFW and/or UoN		X		X	X	X	X
5	Ratio of lengths of secondary : primary channels will increase	Channel lengths	ODFW AIP Stream Habitat Surveys, Total Station surveys, and/or aerial imagery	Ratio >1.5:1	Yes. If ratio reverts to the pre-project value, this could indicate recapture or excessive channel simplification. Further investigation would occur.	UDWC, USFS, ODFW and/or UoN		X		X	X	X	X
6	Total wetted area at baseflow will increase	Total wetted area	ODFW AIP Stream Habitat Surveys, Total Station surveys, and/or aerial imagery	Increase total wetted area. Specific amount not defined.	No.	UDWC, USFS, ODFW and/or UoN		X			X		X
7	Percent riffle will decrease and the percent pool will increase.	Habitat unit distribution (percent riffle, pool, etc.)	ODFW AIP Stream Habitat Surveys	Increase percent pool. Specific amount not defined.	No.	UDWC, USFS, ODFW and/or UoN		X			X		X
8	The total number (abundance) and types (richness) of habitat units will increase as the site becomes more heterogeneous.	Histogram of habitat units	ODFW AIP Stream Habitat Surveys	Increase number (abundance) and richness (types) of habitat units. Specific amount not defined.	No.	UDWC, USFS, ODFW and/or UoN		X			X		X
9	Substrate distribution will reflect shift from high energy transport reach toward a lower energy depositional reach.	Substrate distribution in riffles	ODFW AIP Stream Habitat Surveys; USFS AREMP Survey Protocol; A. Scagliotti Substrate Monitoring Protocol	Shift distribution toward smaller substrate classes. Specific amount not defined.	No.	UDWC, USFS, ODFW and/or UoN		X			X		X
10	Pool metrics will change to reflect shift from high energy transport reach toward a lower energy depositional reach	Number of pools, number of complex pools, pool area, pool depth	ODFW AIP Stream Habitat Surveys	Increase number of pools and total area. Specific amount not defined.	No.	UDWC, USFS, ODFW and/or UoN		X			X		X
11	Amount of large wood and wood complexes will increase	Amount of large wood and wood complexes	ODFW AIP Stream Habitat Surveys	Increase amount of large wood and wood complexes. Specific amount not defined.	No.	UDWC, USFS, ODFW and/or UoN		X			X		X
Temperature													
12	Stream temperature rate of warming will remain below 0.36 °C per mile through the project reach (per USFWS plan).	July average temperature	Continuous temperature per DEQ / UDWC SOP	July average rate of warming between RM 18.25 and 10.25 remains below 0.3 °C	Yes. If rate of warming exceeds 0.3 °C for 3 successive years, USFWS and ODFW will be consulted.	UDWC	X	X	X	X	X	X	X

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<b>BIOLOGICAL</b>													
Primary Production													
<b>Riparian Vegetation</b>													
13	Total acreage of desired riparian and wetland vegetation communities will increase	Acreage of riparian cover classes	Digitization of cover classes from aerial imagery	Increase acreage of desired plant communities by >20 acres.	No.	UDWC				X	X		
Secondary Production													
<b>Macroinvertebrates</b>													
14	Number of taxa will increase (more diversity of habitats = more ecological richness = more species richness)	Total number of taxa	Main channel: Wadeable stream riffle habitat sampling protocol (OWEB, 2003) Side channels: Reach-wide multi-habitat protocol adapted from USEPA, 2009; Ode, 2016	None. Monitoring for adaptive learning and documentation.	No.	UDWC	X	X	X		X	X	X
15	Total macroinvertebrate abundance will increase (more suspended organic material = more food = more individuals that survive and reproduce; more aquatic habitat = more individuals that survive and reproduce)	Total abundance from percent of sample picked	Main channel: Wadeable stream riffle habitat sampling protocol (OWEB, 2003) Side channels: Reach-wide multi-habitat protocol adapted from USEPA, 2009; Ode, 2016	None. Monitoring for adaptive learning and documentation.	No.	UDWC	X	X	X		X	X	X
<b>Fish Populations and Passage</b>													
16	Juvenile fish density in project reach will increase relative to unrestored adjacent reach.	O. mykiss juvenile density	Electrofishing surveys	None. Monitoring for adaptive learning and documentation.	No.	USFS, ODFW			X			X	
17	Juvenile fish growth rate and size will be greater within the project area than in an adjacent unrestored reach.	O. mykiss juvenile length and weight	Electrofishing surveys	None. Monitoring for adaptive learning and documentation.	No.	USFS, ODFW							
18	Project site will provide fish passage.	Radiotagged fish movement: adult returns	Tracking	Project is passable by adult fish.	No.	PGE					X	X	X
19	Project site will provide fish passage (per USFWS plan).	Minimum 7.2" depth at low flow	Field measurements	Maintain passage routes of no less than 7.2" in depth	Yes. If depths less than 7.2" occur in stream reaches longer than the channel width, USFWS and ODFW will be consulted.	UDWC				X	X	X	X
<b>COMPLEMENTARY MONITORING &amp; RESEARCH</b>													
20	Floodplain and geomorphic spatial variability and patchiness will be higher in restored sites than in the unrestored site	Cover class and substrate frequency distribution and patchiness	A. Scagliotti (OSU) substrate monitoring protocol	None. Monitoring for adaptive learning and documentation.	No.	UDWC, OSU						X	
21	Periphyton and algae abundance and richness will be higher in restored sites than in the unrestored site	Periphyton and algae abundance and richness	PSU sampling protocol	None. Monitoring for adaptive learning and documentation.	No.	PSU, UDWC, UoN						X	X
22	Wetland functions will be more developed in restored sites than in the unrestored site	Wetland functions	Hydrogeomorphic Wetland Functions Assessment	None. Monitoring for adaptive learning and documentation.	No.	UoN						X	X
23	DLT-prioritized weed species will remain at or below pre-project abundance and distribution	Presence, absence, distribution	Visual surveys	No increase in DLT-prioritized weed species	Yes. If DLT-prioritized weeds are present on site, treatment will be initiated	DLT		X	X	X	X	X	X