Phase II – Design Summary Fact Sheet for Sky Ranch

Project Name:	Sky Ranch Channel Rehabilitation
Project Location:	River Mile (RM) 81.08 to RM 80.20
Project Ownership:	Public - BLM, multiple private parcels
Principle Designer(s):	Federal Design Team, TRRP
Percent Design Completed:	60% - January 2019
Total Earthwork Volume: (Cut & Fill)	244,800 yd cut; 239,700 yd fill 5,100 yd tailings processed for coarse sediment supply.
Environmental Analysis completed:	
Year Constructed:	TBD
Total Cost of Construction:	Contract award TBD
Construction Contractor:	TBD
Design Hypotheses (Goal/Objective) (Reach Scale):	This site includes a wide range of actions over 0.9 mile of river. Various hypotheses associated with specific design features are given below.
Hypothesized Design Evolution (Reach Scale):	Hypotheses for future evolution at this site are based on several extensive terrace excavations to create topographically complex floodplains that greatly increase the extent of inundation during relatively frequent flow events. It is also hypothesized that some local channel expansions will encourage bar deposition and increase sinuosity and restoration actions will re-activate an existing side channel.

Individual Features - Design Purpose

Identifier	Type	Earthwork (CY) (Excavation/Cut or Placement/Fill)	Purpose
IC-1/IC-2	Bar Expansion Complex	IC-1 - 1.0 acres; 9700 CY of excavation. IC-2 - 0.5 acres; 1,500 CY of gravel placement.	Increased channel width to promote gravel deposition on an existing riffle and constructed medial bar (IC-2) to improve salmon spawning by reducing the size of material composing the riffle. Deposition on the riffle to increase the hydraulic gradient across the riffle to increase hyporheic flow through the substrate. In conjunction with IC-1, this is expected to improve salmon spawning by reducing the substrate size distribution of the material composing the riffle and slightly increase the elevation of the hydraulic control.
R-1	Floodplain	9.3 acres; 133,000 CY of excavation.	Increasingly large areas of slow water habitat with increasing discharge, nearly complete inundation discharge approaches bankfull stage. Central hydraulic control for low flow velocities across the area to provide rearing habitat over a wide range of flows and limit conveyance over the floodplain to maintain sediment transport capacity in the main channel. The area will provide a

			variety of other ecosystem services to the riverine environment assuming groundwater elevations are controlled by river stage.
R-2	Floodplain	5.4 acres; 61,200 CY of excavation. Additional excavation to construct W-1.	Similar purpose as R-1. Upstream hydraulic control for low flow velocities through the area to provide rearing habitat over a wide range of flows. The habitat value of R-2 will increase as it becomes vegetated through natural recruitment and planting.
W-1	Oxbow Pond	0.14 acre; 1,500 CY of excavation.	Provide off-channel rearing habitat, primarily for Coho salmon. The habitat value of W-1 will increase as margins become vegetated. Distance of W-1 from flow entering the R-4 floodplain and perimeter fine sediment removal to limit sediment inputs and delay pond succession.
R-3	Floodplain	1.2 acres; 9,400 CY of excavation.	Provide areas suitable for riparian recruitment, and additional slow water habitat for fry rearing during flood events. Conveyance back to the main channel and low conveyance through the downstream two-thirds of R-3 will maintain sediment transport capacity in the main channel and limit overbank flow velocities.
IC-3/IC-4	Meander Complex	IC-3 - 1.0 acre; 12,300 CY of excavation. IC-4 - 0.86 acres; 4,100 CY of gravel and cobble placement.	Increase bend amplitude to encourage pool scour in the bend apex and increase form roughness to decrease flow velocities upstream of the bend. Creates new low velocity habitat in the alcove along the downstream edge at lower discharge levels and increase water surface elevations on its right (upstream) side, thereby decreasing the discharges at which flow enters the R-4 floodplain and the existing side channel. IC-3 is expected to result in some additional erosion of the concave right bank, but significant bend migration is unlikely. IC-4 is expected to persist or even grow as more coarse material deposits in the area.
WJ-1	Wood Jam	0.04 acres; 200 CY of excavation; 300 CY of large rock ballast material; ~25 trees & 100 CY of slash.	Create a local backwater to reactivate the existing side channel (in conjunction with the IC-3/IC-4 meander complex). Help to direct bedload toward river left and promote scour in the immediate vicinity of the side channel entrance. 5-10 year expected lifespan, incorporating rock, live wood, and existing shrubs to create a vegetated obstruction remains after the

			original wood has rotted. Persistence of an obstruction at this location is needed to maintain adequate flow in the existing side channel.
R-4	Floodplain	2.24 acres; 17,700 CY of excavation.	Provide slow water habitat for fry rearing during moderate flood events and additional areas suitable for riparian recruitment. This area is also intended to rack significant quantities of large wood at elevations that are frequently inundated, thereby creating an abundance of especially valuable cover habitat. The habitat value is expected to increase as additional wood accumulates and becomes vegetation establishes through natural recruitment and planting.
WJ-2	Wood Jam	0.07 acres; 500 CY of excavation; 700 CY of large rock ballast material; ~50 trees & 200 CY of slash.	Constrict flow conveyance and maintain stream power near an existing deep pool (Pool 2) and direct a portion of the stream flow and floating debris onto the R-4 floodplain. 5-10 year expected lifespan.
WH-1, WH-2, WH-3	Habitat Wood	0.16 acres (along the main channel margin); Acreage varies within other design features; ~100 trees with rootwads & 200 CY of slash.	Provide valuable cover habitat for juvenile salmonids and produce substrate for trophic basis of production.
WR-1, WR-2, WR-3	Wood Racking	0.1 acres; features keyed into existing substrate vertically or in a batter configuration; ~10 trees with rootwads. Exposed cut ends roughened to appear as natural breaks.	Improve rearing habitat by creating woody debris piles in areas that are frequently inundated. Vertical member installations to promote secondary debris accumulation (racking) with and expected lifespan of 5-10 years. Once established and colonized with vegetation, woody debris piles may be effective at continuing to rack more debris.
U-1	Terrace Enhancement	8 acres; fill volumes associated with feature grading.	Provide bulk material spoiling area and enhance an existing degraded area of dredged and mechanically flattened tailings to a more natural condition by capping with fine sediment to develop upland forest or savannah.
U-1A	Terrace Enhancement	2.1 acres; fill volumes associated with feature grading.	Provide bulk material spoiling area and restore dredged and terraced landscape to a more natural condition to develop upland forest or savannah.
U-2	Upland Placement	6.7 acres; 300,000+ CY of spoils	Provide primary upland placement area to dispose of excess material excavated from the project site. Occupies a hydraulic mining scar to restore the area to a more natural state. Planted with upland species following construction.

Construction/Post-Project Access - Description			
Identifier	Type	Size/Quantities	Description
A-1	Existing Main Access Road	480 ft long (existing); 30 ft average width; 580 ft of new road construction with turnaround	Existing Access to site across the U-1 terrace and within the R-1 floodplain. New road construction required for proposed river access location only accessible when stream flows are 2000 ft^3/s or less.
A-2	Temporary Construction Access Road	390 ft long; 30 ft wide	Construction access from the U-1 terrace area to U-2 upland spoils area. Decommissioned following construction. Intersects Sky Ranch Road.
A-3	Temporary Construction Access Road	30 ft long; 20 ft wide	New road crossing the existing side channel between R-2 and R-4 to provide access to R-4. Due to low elevations within the existing side channel, this road will revegetate rapidly following construction.
A-4	Alternative Main Access Road	60 ft long (Sky Ranch Rd to U-1); 350 ft long (U-1 to River);	Access to an alternative river access location providing a direct connection to Sky Ranch Road and the east end of the U-1 terrace area, and access loop from U-1 to the river. With inclusion of IC-1/IC-2, this river access location will be adjusted to remain accessible at stream flows exceeding 3000 ft^3/s.

Design Milestone Timeline		
Date (Month/Year)	Milestone	Notes (Reference Document)
September 2010	Phase II Conceptual Design Value Engineering Study	Base Design – DWR, Phillip Williams and Assoc., Cramer Fish Sciences; VE Proposal – CH2MHILL, ENTRIX; Project ranked 8th out of 9 based on priority; VE Alternative recommended based on Scoring in 11 weighted categories.
January 2011	Geologic Explorations Report	Prepared by USBR – Mid-Pac, Geology Branch; Total of 17 test pits (15 encountered groundwater, none encountered bedrock, nine groundwater wells); planer surface formed by floodwaters prior to construction of Trinity Dam;

		10 feet above the Trinity River water surface; bounded by steep/high riverbanks or tall piles of coarse dredge tailings; 158,000 CY of potential spawning gravel.
November 2017	Existing Conditions Report	Prepared by TRRP Federal Design Group (USBR, USFWS); Site Characteristics; Location and Ownership; Hydrology; Channel and Valley Morphology; Biological Significance and Use; Constraints identified.
February 2018	Conceptual Design Report	Prepared by TRRP Federal Design Group (USBR, NMFS); Current Hydraulic Conditions; Design Objectives; 3 Proposed Conceptual Designs
May 2018	30 Percent Design Report	Hydraulic performance analysis completed; Biological performance analysis completed; Constructability and Earthwork analysis completed; 2 Design alternatives
January 2019	60 Percent Design Report	Preferred Alternative selected based on comparative habitat analysis; modeling analysis to estimate fry and presmolt rearing habitat (Capacity & WUA); additional upstream in-channel feature proposed; one of two upland spoils areas removed, alternate spoils; Sequencing/phased implementation; All wood and slash sourced off site.

Design Analysis Performed

Type of Analysis	Reason Performed	Date Completed & Software Used
1-D Hydraulic Analysis	To determine baseline hydraulic data (depth & velocity)	April 2010; 2007 DWR HEC-RAS
2-D Hydraulic Analysis	To determine habitat availability under existing conditions	November 2017; SRH-2D w/ habitat module
2-D Hydraulic Analysis, Digital Terrain Modeling	To determine current hydraulic conditions,	February 2018; SRH-2D, ArcGIS
2-D Hydraulic Analysis, Digital Terrain Modeling, Design Surface Grading	To evaluate hydraulic and biological performance, cut/fill volumes	May 2018; SRH-2D, ArcGIS, AutoCAD
2-D Hydraulic Analysis, Digital Terrain Modeling, Design feature grading	To determine depth contours and velocity vectors of preferred design alternative, topographic differencing, and cut/fill balance	January 2019; SRH-2D, ArcGIS, AutoCAD

Design Criteria

- The design concept was based on ideas contained in programmatic documents that emphasize increasing the quantity and enhancing the quality of habitat for all salmonids and establishing channel and floodplain morphology to allow rehabilitation of geomorphic processes. The concept of low-flow and high-flow side

channel construction has been modified to include extensive floodplain lowering, substantially driven by an objective to create a complex floodplain surface that inundates at discharges between 1500 and 8500 ft^3/s.

- The Sky Ranch site offers several opportunities to incorporate features into the design that enhance the ecological function of the reach including upstream sediment source (Oregon Gulch), functioning riparian expansion, invasive species reduction, and large wood racking. Manipulating the floodplain with strategic lowering and wood placement to develop sustainable wood jams with increasing habitat function.

Design Constraints

Constraints identified include:

- Space/access for spoiling material requires crossing Sky Ranch Rd.
- Mining claim interest, cultural constraints
- Privately owned land within ESL
- Land transfer/River access and improved parking on BLM lands