MEMORANDUM

February 23, 2017

Subject: SHERIDAN CREEK AND DEEP GULCH PROJECT REVIEW

To: Caryn Huntt DeCarlo, Executive Director, Trinity River Restoration Program, Weaverville, California

From: Conor Shea, Ph.D., P.E., Hydrologist, U.S. Fish and Wildlife Service, Arcata, California

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EXECUTIVE SUMMARY

This memorandum documents my review of the Sheridan Creek and Deep Gulch project channel rehabilitation projects to evaluate:

(1) If there are any project design features that are not critical to project success that could be eliminated; and

(2) If construction of any project design features could be delayed beyond the 2017 construction season.

The review examines the criticality of channel rehabilitation project design elements in terms of performance in meeting Trinity River Restoration Program fundamental objectives and means objectives. The review identifies and evaluates alternative construction schedule alternatives. The alternative construction schedules account for construction access constraints and earthwork logistics.

My conclusions are:

(1) All of the construction rehabilitation project design elements contribute to achieving project objectives in amounts proportionate to earthwork volume. (My review employs earthwork volume as a surrogate for construction costs). I was unable to characterize any of the design elements as non-critical to project success.

(2) The close proximity of the Sheridan Creek and Deep Gulch channel rehabilitation projects will create construction efficiencies and potentially lower implementation costs if constructed in a single year.

(3) If budget limitations preclude construction of both projects in a single year, then a two-year schedule is recommended in which the Sheridan Creek Project and the downstream portion of Deep Gulch (R-4 Floodplain lowering and IC-9, IC-10, and IC-11 Wood Augmentation) are constructed in one year and the upstream portion of Deep Gulch constructed in a second year.

I have two recommendations for improving planning, design, and implementation of remaining channel rehabilitation projects.

(1) TRRP should conduct better short-term (three to five year) planning for implementing channel rehabilitation projects. Planning should incorporate preliminary assessments of project scale, costs, and permitting complexities. Short term planning should identify when projects will be built, design development schedules, and allow for back-up plans. Currently, it appears that designs are developed without a preliminary understanding of project scale or constraints.

(2) The Design Team's current objective for developing channel rehabilitation designs is to maximize increase in quality rearing habitat for fry and pre-smolt salmonids for the range of Record of Decision (ROD) discharges. There is no identified upper limit for habitat increase and designers operate under the assumption that channel rehabilitation projects should exploit all opportunities to maximize the increase in habitat area at all sites

TRRP staff and Partners are working on tools to help identify how much habitat increase is necessary to achieve the TRRP fundamental objective and where it should be located. Planning and design of channel rehabilitation projects should incorporate habitat assessment tools with the River Corridor Management Plan to develop numeric goals for habitat increase.

PURPOSE OF REVIEW

Trinity River Restoration Project (TRRP) design teams have completed 90 percent designs for the Sheridan Creek and Deep Gulch channel rehabilitation projects. The Deep Gulch project area is located directly upstream of the Sheridan Creek project area. Both projects are located on the Trinity River near Junction City, California, just above the confluence of Oregon Gulch with the Trinity River. The projects are two of the 47 rehabilitation sites identified in the Record of Decision (ROD, USDOI 2000) for the Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement/Report (FEIS/EIR) to implement the Record of Decision's (ROD) physical channel rehabilitation component.

As designed, both projects involve excavation and grading in and adjacent to the river channel, placement of wood, gravel processing, and placement of excess spoils in upland disposal sites. Sheridan Creek would require approximately 72,000 cubic yards (CY) of combined excavation and placement of processed gravel. Deep Gulch would require approximately 41,000 CY of combined excavation and placement of processed gravel.

The Bureau of Reclamation (Reclamation) expressed concerns to TRRP about the magnitude of the Sheridan Creek and Deep Gulch projects and the associated costs to implement project construction. Reclamation requested that TRRP examine the proposed project designs to determine if some project design features were not critical to project success, and therefore might be eliminated; and to determine if any project design features could be delayed and constructed at a later time.

At the request of Caryn Huntt DeCarlo, TRRP Executive Director, I reviewed the project plans and design reports to evaluate two questions:

> (1) Are there any project design features that are not critical to project success, and thus, could be eliminated?
>
> (2) Can the construction of any project design features be delayed beyond the 2017 construction season?

This memorandum documents my review.

SCOPE OF REVIEW

The scope of my review is limited to the current design plans. My review examines if project elements are critical to meeting overall TRRP objectives and individual site goals; and if individual project elements could be eliminated or constructed at a later date. My review assumes that the design analyses developed by the design teams are reasonable and correctly prepared. My review does not evaluate the methods, assumptions, or design approaches used in developing in designs.

MATERIALS REVIEWED

I examined the following documents as part of my review:

- Yurok Tribe Design Team (2016a). DRAFT 90 Percent Design Report Trinity River Restoration Program Sheridan Creek Channel Rehabilitation Project (River Mile 81.6 to 82.1), prepared 89/22/2016.
- Yurok Tribe Design Team (2016b). Sheridan Creek Channel Rehabilitation Project 90 Percent Plans
- TRRP Federal Design Group (2016a). Draft Final Design Report Deep Gulch Rehabilitation Project, prepared February 2016.
- TRRP Federal Design Group (2016b). Deep Gulch Preliminary Drawings Plans, prepared 11/29/2016.

In addition, I had several discussions and email exchanges with individual design team members including Aaron Martin and Andreas Krause from the Yurok Tribe, Dave Gaueman from the Federal Design Group and TRRP Project staff, and Brandt Gutermuth from TRRP Project staff.

I also reviewed project habitat projections that were developed by D. Nathan Bradley (U.S. Bureau of Reclamation – Denver Technical Service Center) using SRH-2D hydraulic modeling.

PROJECT OBJECTIVES

TRRP is implementing channel rehabilitation projects as part of program efforts to achieve the overall TRRP's *Fundamental Objective* of restoring salmonid populations to pre-dam levels. The Design Teams have identified three *Means Objectives* for channel rehabilitation projects as ways of achieving the TRRP fundamental objective. Table 1 lists the three primary means objectives and design metrics used by design teams to develop the Sheridan Creek and Deep Gulch project designs. The Design Teams use the design metrics listed in Table 1 to evaluate potential benefits provided by rehabilitation project elements.

Table 1: Sheridan Creek and Deep Gulch Projects Fundamental and Means Objectives		
Fundamental Objective: Restore salmonid populations to pre-dam level		
Means Objective 1: Increase/enhance juvenile salmonid rearing habitat	Means Objective 2: Restore fluvial/physical processes	Means Objective 3: Restore/enhance riparian function
Rearing habitat metric: Change in area of fry and juvenile rearing habitat at 11 flows levels	Fluvial process metric: No generalized metric has been developed for fluvial processes. Design elements are evaluated on a case by case basis.	Riparian function metric: Change in floodplain area at elevations less than 4 feet above the baseflow water surface.

Means objectives 1 and 2 represent two different paradigms for river restoration. Project elements designed to achieve Means Objective 1 can be characterized as a "build it now" approach to restoration. Project elements designed to achieve Means Objective 2 can be characterized as a

"process-based" approach to restoration in which the river's geomorphology is adjusted to allow the river to develop and *maintain* habitat through stream hydraulics, sedimentation, and vegetation. Both "build it now" and "process-based" approaches are valid means of restoring rivers and riparian habitat. Successful restoration projects often employ a combination of the two approaches.

PROJECT ELEMENTS AND DESIGN FEATURES

Project elements are collections of one or more *project design features* that collectively have been designed to accomplish one or more specific project *means objectives*. Collectively, the project elements are designed to work together to achieve the overall TRRP's *fundamental objective*:

Project design features are identified using an alphanumeric prefix that identifies the feature type and a sequential number to identify the specific design feature. Design feature labels are associated with area polygons on project maps and plans. The prefixes A, C, IC, R, U, W, and X refer respectively to Access Roads, Contractor Use Areas, In-Channel Features, Riparian Features, Upland Features, Wetland Feature, and River Crossings.

Sheridan Creek and Deep Gulch project elements and habitat design features are listed in Table 2. Table 2 lists only the project's habitat design features which are directly related to achieving project means objectives. Project design features that do not directly achieve means objectives such as access roads and contractor use areas are not listed in Table 2.

Table 2 also lists the earthwork quantities required for each project element. Earthwork quantities are the sum of excavation quantities and fill quantities. Soil and rock material generated by excavation is typically not suitable for reuse as fill-in riparian or in-channel design features. Hence, soil and rock material generated by excavation is typically placed in an upland disposal area outside the 500-year return period flood limit. Fill materials typically have site-specific specifications for gravel particle size distributions. Fill materials are developed by processing mine tailings on-site or at nearby locations. Although unit costs for excavation and fill may differ within and across sites, total earthwork serves as a good surrogate for the scale, schedule time, and costs associated with specific project elements. (This review does not employ construction cost estimates because Reclamation policy precludes the release of construction cost estimates to protect fair construction bidding).

Table 2: Design Elements, Features, Earthwork, and Means Objectives

Design Element	Project Design Features	Earthwork (Cubic Yards)	Primary Means Objectives
Sheridan Creek			
Meander Complex	IC-1, IC-2, IC-4, IC-5, IC-6, R-1, R-2	31,800	Restore/enhance fluvial/physical processes
River Left Wetland Complex	IC-3, W-1, W-2, W-3, R-3, R-4	26,600	Increase/enhance juvenile salmonid rearing habitat

Sheridan Creek Daylighting	W-4	2,230	Improve water quality and quantity for River Right Wetland Complex
River Right Wetland Complex	W-5	11,500	Increase/enhance juvenile salmonid rearing habitat
Downstream Wood Jam Complex	IC-7, IC-8, IC-9, IC-10, R-5	34	Restore/enhance fluvial/physical processes
Total		72,100	
Deep Gulch			
R-1 Floodplain Lowering	R-1, R-1a	23,300	Increase/enhance juvenile salmonid rearing habitat Restore/enhance fluvial/physical processes
Diagonal Bar Complex	IC-1, IC-2, IC-3, R-2	5,960	Restore fluvial/physical processes
Side Channel with Wood Structure	R-3, IC-4	2,560	Increase/enhance juvenile salmonid rearing habitat
IC-5 Wood Jam	IC-5	925	Restore/enhance fluvial/physical processes
R-4 Floodplain Lowering	R-4, IC-6, IC-7, IC-8	8,490	Increase/enhance juvenile salmonid rearing habitat
Wood Augmentation	IC-9, IC-10, IC-11	0	Increase/enhance juvenile salmonid rearing habitat
Total		41,300	

REVIEW QUESTION 1: CRITICALITY OF PROJECT DESIGN FEATURES

Means Objective 1: Increase Rearing Habitat

My primary means of evaluating if project design elements are critical to achieving Means Objective 1 (increase rearing habitat) is through habitat modeling conducted during the design process. The Reclamation Denver Technical Service Center prepared hydraulic models of existing conditions and proposed conditions. Reclamation used the models to determine the area of habitat by identifying areas that had suitable depth of flow, flow velocity, and distance to cover. Reclamation computed

weighted useable area (WUA) using habitat equations developed by the TRRP habitat team. Total project WUA for existing and proposed conditions was summed for each project for a range of discharges.

Habitat modeling shows that the Sheridan Creek and Deep Gulch project designs will increase habitat for fry and pre-smolt salmonids over the full range of discharges at the project sites. The project designs also eliminate dips in habitat availabilities that occur under existing conditions at intermediate discharges (approximately 800-5000 cfs).

I reviewed Reclamation's SRH-2D habitat modeling to assess the contribution of individual project design features to total project habitat increase because the Reclamation habitat assessments provided only a project-wide total. The assessment was made visually because a computational assessment would have required a larger time investment than warranted by this review.

A design element with a primary means objective of immediately increasing habitat could be classified as non-critical if the design elements were inefficient in increasing rearing habitat. I examined the design elements that have the primary design intent to increase rearing habitat (Sheridan Creek::River Left Wetland Complex, Sheridan Creek Daylighting, and River Right Wetland Complex; Deep Gulch: R-1 Floodplain Lowering, Side Channel with Wood Structure, and R-4 Floodplain Lowering) to determine if any were not efficient at increasing habitat area. All of these design elements increased habitat area in amounts proportionate to the design element's earthwork volume. Thus, none of the design elements offer an obvious target for elimination based on inefficiency in producing habitat area increases[1].

TRRP has not established a numeric goal or limit that identifies how much habitat increase is required to achieve the program's fundamental objective. Because there is no identified limit or target, the Design Teams' approach is to maximize the amount of habitat increase created at each channel rehabilitation site. Because there is not a numeric target except to maximize habitat increase, all design elements that increase habitat area can be considered as critical to achieving TRRP objectives.

Means Objective 2: Restore Fluvial Processes

Sheridan Creek and Deep Gulch collectively have several design elements that are proposed primarily to achieve Means Objective 2 (process-based design elements). The design reports provide detailed descriptions of the process-based design element's configuration, design intent, hydraulic performance, geomorphic evolution, and restoration benefits. The process-based design elements are varied in purpose and configuration. Each of the process-based design elements has a unique set of initial conditions, site constraints, and proposed outcomes.

It is difficult for me to assess the criticality of the individual process-based design elements to overall success of the channel rehabilitation project in meeting the TRRP fundamental objective because

[1] The Sheridan Creek project has 1.75 times as much earthwork as the Deep Gulch site (see Table 2), but only creates a similar increase in habitat area. This seems to suggest that Deep Gulch is a more efficient design than Sheridan Creek, but it is a mistake to directly compare these projects on the basis of earthwork. Sheridan Creek requires more earthwork because legacy mining impacts confine the river at Sheridan Creek much more than at Deep Gulch.

there is not a standard metric for assessing enhancement of geomorphic processes. My review of the process-based design elements showed that the design of each is consistent with TRRP staff's and Partners' understanding of geomorphic causes of poor habitat conditions and rehabilitation measures to address those causes. Each of the design elements will create conditions that will improve river function and directly or indirectly improve habitat conditions. All of the design elements have undergone review, revision, and approval by the Design Team Workgroup. My review did not identify any design elements that in my assessment would not achieve the stated objectives in the design reports. I was not able to classify any of the design elements as not being critical to meeting design objectives.

Wood Augmentation and Structures

My assumption in this review is that wood augmentation and wood structures are cost efficient means of improving habitat and effecting geomorphic change. This assumption is based on my experience with constructing and placing wood structures, my observations of wood structures and augmentation at other projects as part of aquatic habitat improvement projects throughout northwest California, and on observations made by TRRP habitat assessments. Placed wood creates immediate habitat benefits in the form of cover. Placed wood enhances sorting of sediment and hydraulic heterogeneity with long lasting effects on river form. Thus, all wood augmentation and structures in the Deep Gulch and Sheridan Creek projects are considered critical.

Summary

My review did not identify any design features at the Sheridan Creek or Deep Gulch projects that are not critical to design success.

REVIEW QUESTION 2: CONSTRUCTION SEQUENCING

Review question 2 evaluates if construction of any project design features be delayed beyond the 2017 construction season. This question might be better formulated at asking for a review of construction sequencing and to identify alternative construction schedules. The Design Teams considered construction sequencing in the development of the Sheridan Creek and Deep Gulch designs. The designs were optimized to limit river crossings, to minimize haul distance for disposal of spoils and hauling of processed sediment, and to address problems with limited site access. The Design Teams assumed that each channel rehabilitation project would be constructed in a single construction season. Development of alternate construction schedules needs to consider the relationship between current designs' excavation volumes and locations, fill volumes and source locations, disposal areas and volumes, and access roads.

Several construction schedules are identified and assessed below. Because construction access is a dominant constraint on how projects can be built and scheduled, a summary of project access plans is provided first.

Project Access

The difficulty of project access to the Sheridan Creek and Deep Gulch project areas is a significant design constraint that directly impacts project design and potential construction sequencing. TRRP does not have direct access to the Sheridan Creek and Deep Gulch project areas. On river left (west side), there is a steep bluff that prevents practicable equipment access to the river. On river right

(east side), there are no public roads or corridors of public lands that provide access to the project areas. TRRP is negotiating agreements with local landowners on river right for use of private roads as access roads to reach the project areas. Current plans are to access the Sheridan Creek project area and the north (downstream) portion of the Deep Gulch project area using a private road that connects to the northern (downstream) portion of the Sheridan Creek project area. The southern (upstream) portion of the Deep Gulch project area will be accessed by a private road that connects to the upstream end of the Deep Gulch project area.

Because river left is not accessible from the left bank, construction will require four equipment crossings of the river. Project designers have placed and sized upland disposal areas to minimize river crossings with excavated materials.

Construction Schedule Options

A series of construction schedule options is presented below. Each option is briefly evaluated in terms of benefits and disadvantages.

Option 1: Construct both projects in 2017 as designed

The first option is to implement the projects as designed in a single construction season.

Advantages:

(1) Project tribal Partners are anxious that channel rehabilitation projects are completed without delay. Design teams have also expressed concerns that agreements for private road access may be hard to obtain for more than one construction season and that the landowners would likely be concerned if construction disturbances are extended beyond one construction season.

(2) There are expected cost savings and efficiencies created by constructing the two projects under one construction contract. Gravel processing and spoil disposal operations can be shared across site boundaries, which may decrease haul distances and reduce contractor uncertainties.

Disadvantages:

(1) The disadvantage to this construction sequence is that Reclamation has expressed concerns that there is likely insufficient funding to support construction in a single season.

Option 2: Delay construction until full funding is available and then build in single season

This option is a mirror image of Option 1 in terms of advantages and disadvantages.

Advantages:

(1) Project could be fully constructed when sufficient funding is available to support full construction.

Disadvantages:

(1) TRRP staff and Partners are concerned that channel rehabilitation projects be completed without extended delays. Delays could provide more time for those who don't support the channel rehabilitation to potentially impede implementation.

Option 3: Two-year construction Option 1

Split the Sheridan Creek and Deep Gulch projects into two construction contracts with one contract constructed in 2017 and one in 2018.

Advantages:

(1) Project could be constructed as funding is available.

Disadvantages:

(1) The lower portion of the Deep Gulch Project is accessed from the north while the upper end is accessed from the south. If Deep Gulch and Sheridan Creek are constructed in separate years, TRRP will need to keep north access road open for two years and bear additional rental costs.

(2) Splitting the projects in to two separate construction contracts limits contractor flexibility to adjust excavation disposal and gravel processing operations between project sites, which may lead to higher total construction costs than a single project.

Option 4: Two-year construction Option 2

Construct the downstream portion of Deep Gulch (RC-4, IC-6, IC-7, IC-8, and IC-11) and the Sheridan Creek under one construction contract. Construct the remainder of Deep Gulch project as a separate contract in a separate year.

Advantages:

(1) Project could be constructed as funding is available.

(2) Each contract would require one construction access road which would be employed for only one construction season.

Disadvantages:

(1) Splitting the projects into two separate construction contracts limits contractor flexibility to adjust excavation disposal and gravel processing operations between project sites, which would likely lead to higher total construction costs than a single project.

CONCLUSIONS

My conclusions from reviewing the Sheridan Creek and Deep Gulch project plans and documents are that all design elements are consistent with meeting TRRP objectives for restoring salmonid populations to pre-dam level by construction of channel rehabilitation projects.

(1) All of the rearing habitat design elements contribute to achieving increases in habitat areas in amounts proportionate to earthwork volume. I was unable to characterize any of the design elements as non-critical to project success.

(2) Design of process-based design elements is consistent with current understanding of geomorphic causes of poor habitat conditions and potential remedy of those causes.

(3) The close proximity of the Sheridan Creek and Deep Gulch channel rehabilitation projects will create construction efficiencies and potentially lower implementation costs if constructed in a single year.

(4) If budget limitations preclude construction of both projects in a single year, then a two-year schedule is recommended in which the Sheridan Creek Project and the downstream portion of Deep Gulch (R-4 Floodplain lowering and IC-9, IC-10, and IC-11 Wood Augmentation) are constructed in one year and the upstream portion of Deep Gulch constructed in a second year.

RECOMMENDATIONS

Additionally, I have two recommendations for improving planning, design, and implementation of remaining channel rehabilitation projects.

(1) TRRP should conduct better short-term (three to five year) planning for implementing channel rehabilitation projects. Planning should incorporate preliminary assessments of project scale, costs, and permitting complexities. Short term planning should identify when projects will be built, design development schedules, and allow for back-up plans. Currently, it appears that designs are developed without a preliminary understanding of project scale or constraints.

(2) The Design Teams current objective for developing channel rehabilitation designs is to maximize increase in quality rearing habitat for fry and pre-smolt salmonids for the range of Record of Decision (ROD) discharges. There is no identified upper limit for habitat increase and designers operate under the assumption that channel rehabilitation projects should exploit all opportunities to maximize the increase in habitat area at all sites.

TRRP staff and Partners are working on tools to help identify how much habitat increase is necessary to achieve the TRRP fundamental objective and where it should be located. Planning and design of channel rehabilitation projects should incorporate habitat assessment tools with the River Corridor Management Plan to develop numeric goals for habitat increase.

The River Corridor Management Plan should be employed to set specific process-based means objectives for each channel rehabilitation project. As it stands, it is difficult to assess the value of potential process-based design objective in meeting TRRP's fundamental objective. This would also allow better integration pf process strategies among rehabilitation projects.