Matilija Dam Removal TAC

Dam Removal Plans and Sediment Transport Analysis: Scope of Work

January 28, 2013

Background and Introduction

The State Coastal Conservancy (SCC), Ventura County Watershed Protection District (VCWPD) and the Army Corps of Engineers (Corps) have been active partners and fiscal supporters of the multi-year Federal effort to develop an environmentally and economically sound plan for removing Matilija Dam on the Ventura River, and collectively form the Management Team for the project.

Determining how to manage six million cubic yards of fine and coarse sediment that have accumulated behind the dam since its construction in the late 1940s has proven challenging. Utilizing an extensive public stakeholder process, the local Sponsor (VCWPD) and the Corps completed a feasibility study for removal of the Dam. That study included as a preferred alternative (known as Alternative 4b), the removal of about two million cubic yards of fine sediment behind the dam and their transport to temporary storage sites located downstream in or along the vicinity of the Baldwin Road bridge in Ojai.

After the certification of the project's EIS/EIR in 2004, initiation of the design phase, Congressional project authorization (WRDA 2007) and extensive subsequent study and investigation, the Corps reported concerns related to increasing construction cost estimates and constructability concerns related to the slurry and disposal of fine sediment at the Baldwin Road Disposal Area (BRDA) sites. The subsequent alternate proposals offered by the Corps in late 2009 and early 2010 as conceptual plans for managing the fine sediments upstream of the dam met with opposition from some of the major stakeholder groups, resource agencies, and other members of the project's Design Oversight Group (DOG).

To help resolve this issue, and at the urging of some stakeholders, the Management Team initiated a facilitated technical dialogue with selected stakeholders. The objectives of the process were to assess the current status of the project, evaluate the utility of additional scientific consultation, and develop

a process for resolving the sediment management issue, so that final engineering work on the dam removal project could be completed within the scope of the federally authorized project. The SCC retained a professional mediation team led by Mary Selkirk from the Center for Collaborative Policy (a program of CSU Sacramento) to assist in this effort.

This facilitated effort recommended the formation of a Technical Advisory Council (TAC) to address data and research needs that could facilitate the resolution of the sediment management issue associated with Matilija Dam Removal.

The Technical Advisory Council for the proposed removal of Matilija Dam developed this scope of work to guide the feasibility assessment and cost estimation for a variety of dam removal scenarios. The scope of work for the study is divided into two tasks. Task 1 is the development of specific dam removal plans. Task 2 is the analysis of sediment transport patterns for discreet dam removal options.

The study will develop the engineering details and cost estimates associated with several different alternatives for dam removal, mechanical and passive sediment and flow management during dam removal. This study will not evaluate the downstream slurry options, but would focus on the mechanical placement of sediment upstream of the dam and evaluate options for controlling discharge and sediment transport during dam removal.

Task 1: Dam Removal Plans and Cost Estimates

This task will identify feasible methods and associated order of magnitude cost estimates to remove Matilija Dam, located on Matilija Creek in Ventura County, California.

At least 3 plans will be evaluated, and each will share in common specific design objectives. The design objectives are:

1. Biological Objectives: 1) Restore effective fish passage within 1 year after the dam is removed; 2) minimize to the degree feasible ecological impacts from project implementation; 3) restore aquatic/riparian/upland habitats in reservoir area; 4) encourage beach nourishment as feasible

2. Cost-Effectiveness Objectives: 1) Reduce cost/maximize cost-effectiveness; 2) Develop feasible removal plan within the context of the federally authorized project.

3. Sediment Transport and Water Quality Objectives: 1) Maximize mobilization of fine material during high flow events; 2) Reduce mobilization during low flows; 3) Minimize artificial or permanent stabilization material (e.g. riprap or soil cement) in project area and environmentally sensitive areas: 4) Minimize project-related turbidity increases and nutrient inputs to Casitas reservoir; 5) Maintain existing level of safe supply of water to the customers of all water districts.

The study will be performed in two phases: Phase 1 is a conceptual level study to develop a range of feasible dam removal alternatives. Phase 2 will analyze promising alternatives in greater detail and develop order of magnitude cost estimates as well as rudimentary environmental impact evaluations for those alternatives.

Phase 1

Phase 1 has two parts: Part A is the conceptual design and analysis of complete dam removal[1] and Part B is the conceptual design and analysis of an interim notch.[2] The conceptual level design and analysis should be such that the costs and sediment impacts are computed in a relative sense, and lend themselves to ranking on the basis of cost and environmental impacts associated with sediment transport.

Part A: Conceptual Design of Full Removal

The following dam removal and associated sediment management plans would be investigated at a conceptual level:

1. Progressive Notching: This plan entails the incremental notching of the dam until the main channel is reached and complete removal of the dam

[1] The Full Removal option consists of removing the dam such that a free flowing river is restored and the dam has no effect on river flows.

[2] The Interim Notch would have the main purpose of preventing further deposition in the reservoir area, but could also induce a small amount of erosion of sediment already stored in the reservoir so that the sediment removal process could begin and could also provide data on the sedimentation processes that would occur upon dam removal.

is achieved. Minimal mechanical sediment management upstream of the dam is envisioned. The notching plan will investigate up to four notch increment scenarios. This dam removal plan will develop measures to minimize the transport of the approximately 2 million tons of detained fine sediment during low flow periods while maximizing the transport of that same fine material during high flow events. The plan shall account for the range of hydrologic conditions that may be present in Matilija Dam. The feasibility and sediment transport control capability of the following measures should be investigated:

a. Diversion of water around the reservoir site during non-flood periods, meaning when flows are below a given threshold such as 500 cfs. The diversion would be designed in conjunction with Task 3 and the purpose of Task 3 is to analyze the cost and benefits of diversions with various capacities ranging from 20 to 500 cfs. The diversion could serve multiple purposes such as diverting water around the construction site, supplying clean water to the river downstream, and supplying clean water to Robles Diversion.
b. A structure such as a reusable gate, removable stop logs, or controlled blasting of a notch that can be timed with floods that would be expected to erode significant amounts of reservoir sediment.
c. A low-level outlet at the base or mid-level of the dam.
d. Other options or combinations

2. Mechanical transport of reservoir fines to acceptable locations upstream of the dam and removal of dam in a one to two year time frame. The dam would be notched during the mechanical transport of the remaining reservoir fines and the upstream delta deposits, so that at the end of 2 years flows in Matilija Creek would not be impeded by Matilija Dam. The plan should also include construction of a pilot channel through the remaining delta sediments to limit the initial erosion concentrations.

3. Combining mechanical transport of reservoir fines with natural erosion. Using the information from the previous two conceptual design items, propose an optimal dam removal scenario that combines both mechanical transport and natural transport. The optimum will ideally balance the cost of removal versus time required for complete removal. The analysis should include the basis for the selection of the optimum removal scenario.

Each of the conceptual level plans should address the following questions:

1. Sediment Handling:

a. Where and how will the silt-clay size reservoir material be placed? What is to be the composition of the various sediment disposal areas?
b. Can fine-grained reservoir material be used as fill beneath roads?
c. What is the time required to excavate, transport and stabilize the sediment at these sites?
d. In the areas where reservoir sediment is mechanically placed, what is the feasibility of grading and vegetation practices to create disposal sites that are stable in relatively small and frequent floods (e.g. < 3-yr to 10-yr flood)? The disposal areas should replicate natural land forms and processes in the basin. There should be a re-vegetation plan proposed for the disposal areas.
e. Consider and discuss the impacts of the presence of organic materials in terms of constructability and disposal. Identify future studies necessary.
f. What are the construction risks associated with the measures used to control sediment transport? Evaluate the constructability and operation of each sediment control measure.

2. Dam Removal:
   a. Using previous analyses, what are the notch depths and widths that can be safely constructed throughout the dam removal process?
   b. What are important results from other recent large dam removal that can inform this design? What are the differences between this and other sites which limit direct transfer of experience between the sites?
   c. What are flexible construction scenarios that identify action triggers, equipment, and construction schedules? For example, action triggers would support the decision to perform the next notch based upon monitoring of the sediments in the reservoir and downstream channel.
   d. What are the potential time ranges associated with the dam removal?
   e. What are the risks of construction? For each plan, given the range and probability of potential hydrologic events and site conditions, identify the likely range of potential consequences that would have significant financial, safety, and environmental costs or could affect scheduling.
3. Water management during construction.

a. What are the potential methods for diversion of inflows, draining the reservoir, and dewatering the sediment to be excavated?

The conceptual level plans will be presented to the TAC and then a more detailed scope of work will be developed to present plans, costs, and impacts associated with a select number of alternatives.

Part B: Interim Notch Analysis

Several different interim notch heights will be evaluated. The interim notch depth evaluated would be 5 feet above the current sediment elevations in the reservoir; then notches 0, 5, 10 and 15 ft below the current reservoir sediment elevations will be evaluated. No mechanical sediment management upstream of the dam is envisioned.

Each of the conceptual level plans for interim notching should address the following questions:

1. What is the conceptual level cost estimate for interim notching?
2. What are the appropriate notch widths to prevent further sediment deposition in the reservoir?
3. For the notch depths below the current reservoir sediment elevations, is it possible to time the drawdown of the reservoir with the occurrence of high flow by installing a removable water-level control in the notch?
4. What is the most appropriate method to remove the concrete to form the notch?
5. Where could the dam material be placed?
6. What type of access is necessary for construction equipment?

Phase 2

The Phase 2 study will be to develop more detailed designs of one or more selected alternatives as decided upon by the TAC and County of Ventura.

Task 2: Sediment Analysis of Interim and Dam Removal Plans

The goal of this task will be to simulate the sediment transport processes for the proposed interim notching and full removal plans that will be evaluated in Task 1. It is organized into the same phases as Task 1.

Phase 1

Part A: Analysis of Conceptual Alternatives

Phase 1 will assess the sediment transport of each of the conceptual plans developed by Task 1 Phase 1 Part A. The sediment transport assessment will be performed using a simple spreadsheet tool provided by the TAC as a starting point. The contractor will be free to suggest additional or alternative analysis techniques. The objectives of the sediment transport analysis at the conceptual phase will be to assess dam-removal induced sediment transport patterns under multiple hydrologic scenarios. The contractor shall:

1. Qualitatively describe the sediment transport processes that will occur under the dam removal scenarios outlined in Task 1;
2. Estimate the likely range in the magnitude and duration of high fine sediment concentrations downstream of Matilija Dam;

Part B: Notching Analysis

The goal of this part of Task 2 Phase 1 Part B is to perform more detailed sediment transport analysis of successive notching as defined in Task 1 Part A and B. The successive notching will be consistent with the successive notching assumed in the conceptual plans. The interim notch would have the main purpose of preventing further deposition in the reservoir area, but could also have the additional purposes of inducing a small amount of erosion so that the sediment removal process could begin and providing data on the sediment processes that would occur upon dam removal. Several different interim notch heights will be evaluated. The interim notch depth evaluated would be 5 feet above the current sediment elevations in the reservoir; then notches 0, 5, 10 and 15 ft below the current reservoir sediment elevations will be evaluated. No mechanical sediment management upstream of the dam is assumed.

The analysis of the interim and successive notching will assess the following items for multiple hydrologic scenarios, each at least 50 years in duration:

1. Expected erosion volumes of reservoir sediment by size fraction
2. Expected base level lowering and bank erosion within reservoir and delta areas
3. Magnitude and duration of sediment transport concentrations by size fraction downstream of Matilija Dam. Predict daily concentration during the 50-yr simulations.
4. Magnitude, location, and timing of sediment deposition downstream of Matilija Dam
5. Expected change to bed material sizes downstream of Matilija Dam.

The same calculations will be performed for the No Action case for the same hydrologic scenarios, where no notching of the dam is performed.

The analysis would be performed using a one-dimensional (1D) mobile bed model similar to SRH-1D (Reclamation, 2012) or DREAM (Cui et al., 2006).

Phase 2

The second phase of the work will be to use the mobile bed model developed in analysis of the interim notch of the first phase to assess a reduced number of alternatives developed under Task 1. The specific scope of work will be based upon the results of Phase 1 analysis.

Data Provided to Contractor

The following existing data will be provided to the contractor:

1. Acceptable locations of disposal areas upstream of the dam and environmentally and culturally sensitive areas. The majority of these areas have been identified by the Feasibility Study.
2. Hydrologic data at existing stream gages within the Ventura Basin
3. The base 2005 topography will be provided by the County of Ventura or Technical Service Center of Reclamation
4. Reservoir and river sediment data will be provided by the Corp of Engineers Los Angeles District and Technical Service Center of Reclamation.
5. Bed material data in Matilija Creek and Ventura River
6. Suspended sediment measurements collected by US Geological Survey and County of Ventura
7. Existing Conditions HEC-RAS and SRH-1D models will be provided based upon the 2005 topography.
8. Geo-referenced 2005 and historical aerial photography will be provided by Reclamation.
9. Current reservoir bathymetry
10. Electronic versions of relevant reports

Deliverables

The deliverable for Task 1 Phase 1 Part A and B will be a single report that contains the following items:

1. Overview of the work performed
2. Summary of the full dam removal and interim notching alternatives considered
3. Answers to the questions posed in the Task 1 Phase 1 scope of work for each of the alternatives considered in Part A and B
4. Appropriate conceptual level drawings of the alternatives considered

The contractor will submit a draft report for review by the TAC. The final report will include response to all comments

The deliverable for Task 2 Phase 1 Part A and B will be a single report that contains the following items:

1. Overview of the alternatives analyzed
2. Summary of the data used in the sediment analysis including the hydrology, river geometry, and sediment conditions.
3. Summary of simulation assumptions and limitations.
4. Answers to the questions posed in the Task 2 Phase 1 scope of work for each of the alternatives considered in Part A and B

Phase 2 deliverables will be defined after definition of the scope of work for Phase 2.

Qualifications

Task 1: Geotechnical Engineer, Construction Engineer, Hydraulic Engineer

Task 2: Hydraulic Engineer with experience in sediment transport simulation, Geomorphologist with experience in river processes and river restoration

References

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