This meeting is not subject to
Brown Act noticing requirements.
The agenda is subject to change.

Water Supply Planning Committee Members:
Robert S. Brower, Sr. Chair
Jeanne Byrne
David Pendergrass

Alternate:
Andrew Clarke

Staff Contact
David J. Stoldt, General Manager

After staff reports have been distributed, if additional documents are produced by the District and provided to the Committee regarding any item on the agenda, they will be made available at 5 Harris Court, Building G, Monterey, CA during normal business hours. In addition, such documents may be posted on the District website at mpwmd.net. Documents distributed at the meeting will be made available in the same manner.

AGENDA
Water Supply Planning Committee
Of the Monterey Peninsula Water Management District
****
Wednesday, January 11, 2017, 9:15 AM
MPWMD Conference Room, 5 Harris Court, Bldg. G, Monterey, CA

Call to Order

Comments from Public - *The public may comment on any item within the District's jurisdiction. Please limit your comments to three minutes in length.*

Action Items – *Public comment will be received.*
1. Consider Adoption of Committee Meeting Minutes of October 18, 2016

2. Consider Development of Recommendation to the Board regarding the Los Padres Dam Alternatives Study

Discussion Items – *Public comment will be received.*
3. Update on Salinas and Carmel River Basin Study

4. Update on Local Water Projects

Set Next Meeting Date

Adjournment

Upon request, MPWMD will make a reasonable effort to provide written agenda materials in appropriate alternative formats, or disability-related modification or accommodation, including auxiliary aids or services, to enable individuals with disabilities to participate in public meetings. MPWMD will also make a reasonable effort to provide translation services upon request. Please send a description of the requested materials and preferred alternative format or auxiliary aid or service by 5PM on January 6, 2017. Requests should be sent to the Board Secretary, MPWMD, P.O. Box 85, Monterey, CA, 93942. You may also fax your request to the Administrative Services Division at 831-644-9560, or call 831-658-5600.

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WATER SUPPLY PLANNING COMMITTEE

ITEM: ACTION ITEM

1. CONSIDER ADOPTION OF COMMITTEE MEETING MINUTES OF OCTOBER 18, 2016

Meeting Date: January 11, 2017

From: David J. Stoldt,
General Manager

Prepared By: Sara Reyes

SUMMARY: Attached as **Exhibit 1-A** are draft minutes of the October 18, 2016 Water Supply Planning Committee meeting.

RECOMMENDATION: The Committee should adopt the minutes by motion.

EXHIBIT
1-A Draft Minutes of the October 18, 2016 Water Supply Planning Committee Meeting

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MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

EXHIBIT 1-A

DRAFT MINUTES
Water Supply Planning Committee of the
Monterey Peninsula Water Management District
October 18, 2016

Call to Order The meeting was called to order at 10:00 am in the Water Management District conference room.

Committee members present: Robert S. Brower, Sr. - Committee Chair
David Pendergrass
Jeanne Byrne

Committee members absent: None

Staff members present: David Stoldt, General Manager
Larry Hampson, Water Resources and Engineering Manager
Sara Reyes, Office Services Supervisor

District Counsel present: David Laredo

Comments from the Public No comments were directed the committee.

Action Items

1. Consider Adoption of September 20, 2016 Committee Meeting Minutes
On a motion of Byrne and second by Pendergrass, the September 20, 2016 meeting minutes were approved unanimously on a vote of 3 – 0 by Pendergrass, Byrne and Brower. No comments from the public were directed to the committee during the public comment period on this item.

2. Review and Consider Approval of RFP for Los Padres Dam Sediment Management Study
On a motion by Byrne and second by Pendergrass, the committee voted 3 to 0 to recommend the Board review the draft Request for Proposal and provide comments and direction to staff for incorporation into the final RFP. The Committee observed that the draft RFP appeared to list many positive considerations to be taken into account with a dam removal alternative, but it failed to adequately describe the negative aspects of dam removal to be considered. Director Byrne's motion included a request that additional information be provided in the RFP so that the negative impacts of dam removal will be considered.

This request was incorporated into the motion and agreed upon unanimously by the committee. No comments from the public were directed to the committee during the public comment period on this item.

Set Next Meeting Date: No date was scheduled. Staff will coordinate with the committee on a future meeting date.

Adjournment: The meeting was adjourned at 10:59 am.

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WATER SUPPLY PLANNING COMMITTEE

ITEM: ACTION ITEM

2. CONSIDER DEVELOPMENT OF RECOMMENDATION TO THE BOARD REGARDING THE LOS PADRES DAM ALTERNATIVES STUDY

Meeting Date: **January 11, 2017**

From: **Dave Stoldt,**
General Manager

Prepared By: **Larry Hampson**

SUMMARY: The District and Cal-Am are working cooperatively to develop a comprehensive long-term management plan for Los Padres Dam and Reservoir. In addition, the California Department of Fish and Wildlife (CDFW) and the National Marine Fisheries Service (NMFS) have a significant role in this effort by providing input and critical review of component studies. Attached as **Exhibit 2-A** and **Exhibit 2-B** are proposals received from AECOM and MWH in response to the Request for Proposals for Los Padres Dam and Reservoir Alternatives and Sediment Management Study.

The proposed work focuses on three main alternatives: 1) management of existing and future sediment accumulation in the reservoir; 2) expansion of reservoir storage; and 3) dam removal. The work is related to efforts involving watershed and steelhead habitat modeling that the District will complete in 2017 and that will be used to inform analysis of the alternatives developed in the Los Padres Dam alternatives study.

RECOMMENDATION: The Committee should review the Proposals and consider whether to make a recommendation to the full Board about selection of one of the firms to carry out the proposal.

DISCUSSION:

Scope of Work: AECOM's proposal included significantly more detail on the approach to the scope. This was true in every section except for the work to locate and obtain reservoir sediment samples, where the MWH proposal was more robust. AECOM's proposal shows a clear understanding of the need to consider the water supply function of Los Padres Reservoir in a dam removal alternative and the proposal devotes a considerable amount of discussion to analyzing the impact to steelhead from potential changes in sediment load. There are some tasks in MWH's proposal where it is not clear how the task would be accomplished.

Qualifications. AECOM's team appears stronger overall and has relevant experience for this project both from previous and present work on the Carmel River and from other projects with similar issues around the State of California.

Project Management. It is noted that the AECOM team will include a Principal-in-Charge, Noel Wong, who served as Project Manager for the initial alternative evaluations for seismic mitigation at the San Clemente Dam. Interest in this project at a high level of management could assure a top quality product.

Cost. AECOM's proposal at about $500,000 is almost 40% lower in cost than the MWH proposal at about $800,000.

Staff recommends selecting AECOM for this project.

EXHIBITS
2-A AECOM proposal
2-B MWH proposal

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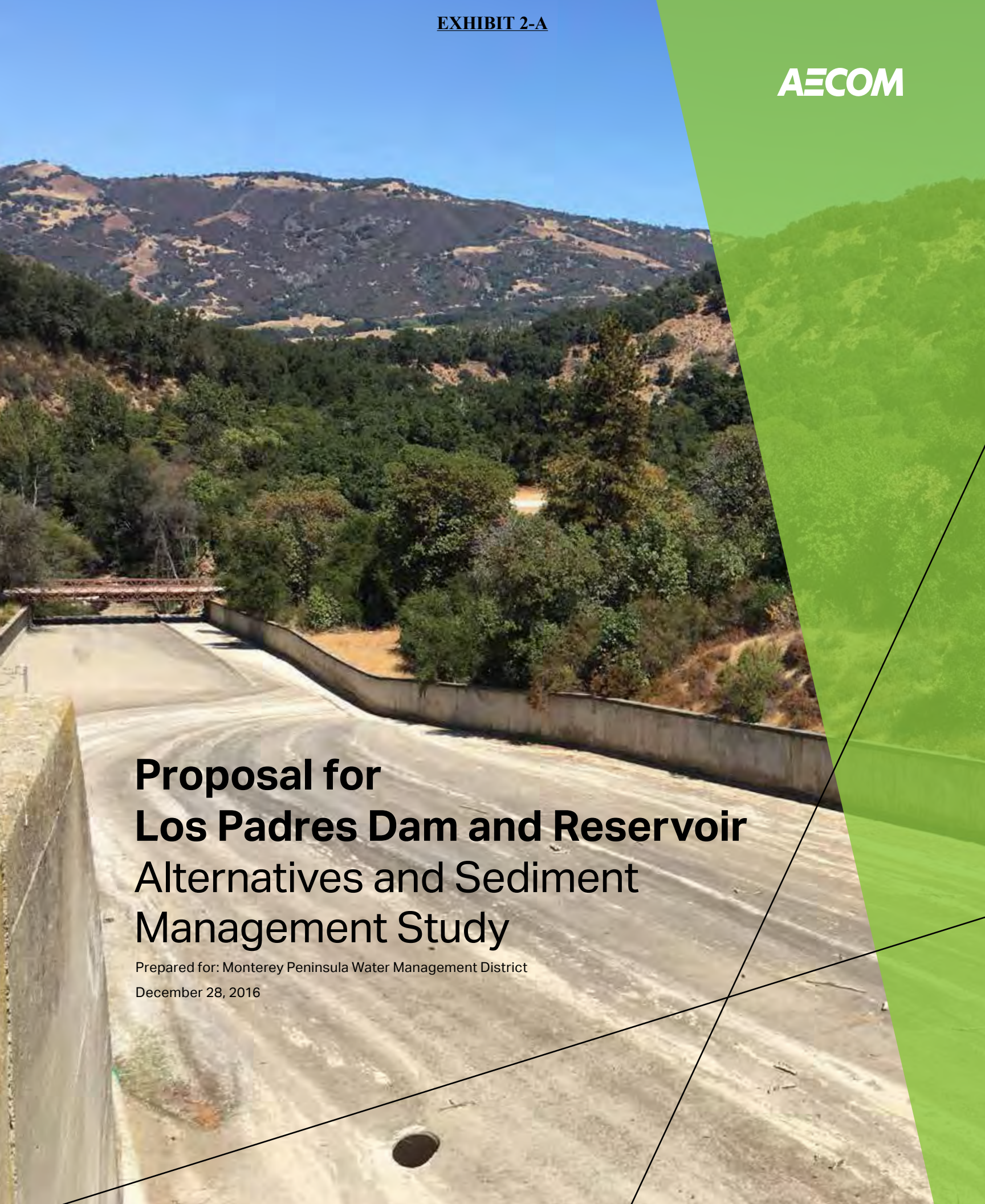
EXHIBIT 2-A

AECOM



Proposal for Los Padres Dam and Reservoir Alternatives and Sediment Management Study

Prepared for: Monterey Peninsula Water Management District

December 28, 2016

EXHIBIT 2-A

AECOM
300 Lakeside Drive, Suite 400
Oakland, CA 94601
www.aecom.com

510 893 3600 tel
510 874 3268 fax

December 28, 2016

Larry Hampson
District Engineer
Monterey Peninsula Water Management District
5 Harris Court, Bldg. G
Monterey, California 93940

Subject: Los Padres Dam and Reservoir Alternatives and Sediment Management Study

Dear Mr. Hampson:

AECOM Technical Services, Inc. (AECOM) is pleased to provide the Monterey Peninsula Water Management District (MPWMD) with a proposal in response to your Request for Proposals (RFP) for the subject services. With the addition of URS Corporation to the AECOM family in 2014, AECOM and its subsidiaries have been providing innovative solutions to our clients since the early 1900s. The proposed AECOM Team has comprehensive and unsurpassed ability and qualifications to conduct all work associated with this contract, as we will demonstrate in this proposal.

The AECOM Team will be led by Jon Stead out of AECOM's Oakland, California office. Jon is a key member of a core team of legacy-URS water resources professionals centered in Oakland who have repeatedly demonstrated their leadership in dam removal, fish passage, stream restoration, and water infrastructure planning, design, permitting, and construction. Jon has managed steelhead-driven engineering contracts worth over $4M; managed large portions of the scope of work on other reservoir alternatives analysis projects; and is AECOM's project manager for the Los Padres Dam Fish Passage Feasibility Study. He has superior organizational and interdisciplinary management skills; has worked in a productive manner with multi-stakeholder groups to achieve desirable project outcomes; and seamlessly blends teams composed of AECOM staff and subconsultants, cooperating agencies, and clients, to deliver high-quality products on time and within budget.

Jon has selected AECOM's most capable staff and strongest subconsultants to work on this project. Jon has found a tremendous resource in Noel Wong, PE, our Principal-in-Charge, drawing on his vast experience with water resources projects during challenging times to deliver previous projects with confidence. Jon will frequently involve our Senior Consultant, Seth Gentzler, PE, in team discussions, technical review, and critical decisions so that the entire team can benefit from Seth's depth of experience with dam removal and reservoir alternatives analysis projects. Jon will work closely with our Project Engineer, John Roadifer, PE, and other discipline leads to provide a world-class alternatives analysis. John has 29 years of civil design experience with dams and reservoirs, and has been the project engineer on many similar projects, including the San Clemente, Matilija, and Searsville dam removal and/or reservoir alternative analysis projects. Both Jon S. and John R. work regularly with Shannon Leonard, our Reservoir Alternatives Analysis lead, and Dave Simpson, PG, CEG, our Sediment Characterization lead.

The AECOM Team includes Balance Hydrologics, Stillwater Sciences, and HDR—all firms that have long, successful relationships collaborating with AECOM on similar projects, and have substantial experience in the Carmel River Watershed.

- **Balance Hydrologics** assisted AECOM with sediment transport analysis for the San Clemente Dam Removal and Searsville Reservoir Alternatives Analysis projects, and is currently working on the MPWMD's Instream Flow Incremental Method Study of the Carmel River. Balance

AECOM

Hydrologics' Shawn Chartrand, PG, CEG, will lead the AECOM Team's geomorphology and sediment transport analyses.

- **Stillwater Sciences** led steelhead analyses to assess restoration alternatives for the Carmel River lagoon, and worked with AECOM on the sediment transport and effects to steelhead tasks for the Matilija Dam Removal Alternatives Analysis. Stillwater Sciences' Ethan Bell will lead the AECOM Team in evaluation of the effects of increased sediment transport on steelhead.
- **HDR** is currently working with AECOM on the MPWMD's Fish Passage Feasibility Study, and has worked with AECOM for many years on steelhead-related evaluations and design in the Alameda Creek Watershed. HDR's Mike Garello, PE, will support the AECOM Team in all things related to fish passage.

Together, AECOM and our proposed subconsultants have worked on a majority of the most significant reservoir alternatives analyses and dam removal projects that have occurred on the West Coast, and are currently involved in at least four projects at—or related to—Los Padres Dam. The AECOM Team is the most qualified to address the proposed study because we have:

- More experience with reservoir alternatives analysis projects than any other team.
- Depth of experience in the Carmel River Watershed and at Los Padres Dam.
- Built a high level of trust and efficiency working together on similar projects.
- Unsurpassed enthusiasm to continue working with a team we love on this important issue.

We are excited about the opportunity to provide critical information to answer key questions related to Los Padres Dam, including:

- Are Carmel River steelhead better off with or without Los Padres Dam and Reservoir?
- Is Los Padres Reservoir critical for water supply on the Monterey Peninsula?
- What will the geomorphic response of the Carmel River be to management actions considered, and will there be an increased flood risk?

We are confident that the AECOM Team has the qualifications and the most relevant experience to answer these questions and help you determine the long-term future of Los Padres Dam and Reservoir, and we look forward to continuing our support and commitment to the MPWMD, Cal-Am, and the entire TRC.

Our primary contact during the solicitation process through to contract award is our proposed project manager, Jon Stead, who can be reached at jon.stead@aecom.com; or at the address, telephone number, and fax number at the top of this letter. Please let us know if you have any questions about our proposal. We are committed to providing you with the services you need, and are happy to consider any comments you may have.

Sincerely,
AECOM Technical Services, Inc.

Jonathan Stead
Project Manager
(510) 874-3058 (direct)

Noel Wong
Vice President, Principal-in-Charge
(510) 874-3112 (direct)

EXHIBIT 2-A

SIGNATURE PAGE

ISSUE DATE: November 2016

RFP EXTENSION DATE:_____

RFP: Los Padres Dam Sediment Management Study

PROPOSALS ARE DUE IN THE DISTRICT OFFICE BY 3:00 P.M., LOCAL TIME, ON: December 28, 2016

MAILING ADDRESS:
Monterey Peninsula Water Management District
5 Harris Court, Building G
Monterey, CA 93940

QUESTIONS ABOUT THIS RFP #10340 SHOULD BE DIRECTED TO
Larry Hampson, larry@mpwmd.net, (831) 658-5620 or (831) 238-2543

Consultant MUST INCLUDE THE FOLLOWING IN EACH PROPOSAL:
1 original plus 3 copies = total of 4 copies plus one CD or DVD (no USB sticks)

[X] ALL REQUIRED CONTENT AS DEFINED PER SECTION 7.1 HEREIN

This Signature Page must be included with your submittal in order to validate your proposal.
Proposals submitted without this page will be deemed non-responsive.

[X] **CHECK HERE IF YOU HAVE ANY EXCEPTIONS TO THIS SOLICITATION.**

Consultant MUST COMPLETE THE FOLLOWING TO VALIDATE PROPOSAL

I hereby agree to furnish the articles and/or services stipulated in my proposal at the price quoted, subject to the instructions and conditions in the Request for Proposal package and the identified exceptions. I further attest that I am an official officer representing my organization and authorized with signatory authority to present this proposal package.

Company Name: AECOM Technical Services, Inc. Date December 28, 2016

EXHIBIT 2-A

Signature: _____ Printed Name: Noel Wong, PE, Vice President

Street Address: 300 Lakeside Drive, Suite 400

City: Oakland State: CA Zip: 94612

Phone: ( ) 510.893.3600 Fax: ( ) 510.874.3268 Email: noel.wong@aecom.com

Registered California Civil Engineer Name and License No.

John Roadifer (Project Engineer), #C65035

Additionally, the AECOM Team has the following California Civil Engineers:
Noel Wong (Principal-in-Charge), #32353
Seth Gentzler (Senior Consultant/Senior Technical Review), #C62765
Michael Forrest (Quality Assurance/Quality Control), #27855
Mourad Attalla (Structural Engineer), #C58793
Sam Gambino (Geotechnical Engineer), #C63520
Steve McNeely (Cost Estimation and Geomorphology, Hydrology, Hydraulics, and Sediment Transport), #80567
Edward Ballman - Balance (Geomorphology, Hydrology, Hydraulics, and Sediment Transport), #64095
Eric Reidner - Balance (GeomorphologyHydrology, Hydraulics, and Sediment Transport), #69728
Mike Garello - HDR (Fish Passage), #C68106
Nick Gooding - HDR (Cost Estimation), #C79872

Table of Contents

02
Prequalifications/ Licensing Requirements

EXHIBIT 2-A

02 Pre-Qualifications/Licensing Requirements

AECOM Meets All Qualification Requirements

AECOM exceeds the minimum requirements for pre-qualification, as described in Section 7 of the Los Padres Dam and Reservoir Alternatives and Sediment Study (LPD & Reservoir Study) RFP.

Bios for many of these individuals can be found in Section 04, Key Staff Persons, and resumes for all personnel are provided in Appendix B: Resumes.

The following paragraphs address the bulleted list of minimum qualifications from the RFP.

DSOD Experience:

Several members of the AECOM Team have extensive professional experience in coordinating with the California Division of Safety of Dams (DSOD), gained on the various dam and reservoir projects that AECOM has been involved in over the years. John Roadifer, PE, our proposed Project Engineer, has experience coordinating with the DSOD on the review and approval of several projects, including the San Clemente Dam Removal Project and the Calaveras Dam Replacement Project, highlighted in Section 03.

DSOD References

Mr. Roadifer has provided two DSOD references related to his work on the Calaveras project:

1. Russ Bowlus, (916) 227-4627, russell.bowlus@water.ca.gov
2. Wallace Lam, (916) 227-4626, wallace.lam@water.ca.gov.

Licensed Professional Engineers:

The AECOM Team also includes several licensed Professional Civil Engineers (PEs) with expertise in reservoir operations, hydrology, flood control, and mapping. Licensed PEs on our team include John Roadifer (Project Engineer), Noel Wong (Principal-in-Charge), Seth Gentzler (Senior Consultant/Senior Technical Reviewer), Michael Forrest (Quality Assurance/Quality Control), Mourad Attalla (Structural Engineer), Sam Gambino (Geotechnical Engineer), Steve McNeely (Cost Estimation and Geomorphology, Hydrology, Hydraulics, and Sediment Transport), Mike Garello (Fish Passage), Edward Ballman, and Eric Reidner (Geomorphology, Hydrology, Hydraulics, and Sediment Transport).

Certified Fisheries Biologist:

AECOM's staff includes several certified fisheries biologists with steelhead experience in California. For this team we have proposed Cynthia LeDoux-Bloom, a Certified Fisheries Professional with the American Fisheries Society since 2003. Our fisheries biology team also includes Jon Stead, our Project Manager, and Ethan Bell, task lead for Impacts to Steelhead.

Qualified Geomorphologist:

Recognizing the importance of geomorphology to the proposed study, we have included on the AECOM Team some of the world's leading geomorphologist and sediment transport modelers with experience in fluvial processes, mass wasting, sediment transport analysis, and floodplain development. These team members include Shawn Chartrand, PG, CEG (Sediment Transport Lead), Edward Ballman, PE, Barry Hecht, Shannon Leonard, Jonathan Owens, Eric Reidner, PE, QSP/D, Carles Ferrer-Boix, Ph.D., Marwan Hassan, Ph.D., and Yantao Cui, Ph.D.

AECOM Has the Ability to Successfully Complete All SOW Tasks

AECOM has the qualifications, resources, and technical capabilities necessary to support the District's studies to inform the alternatives analysis for Los Padres Dam. We combine these qualities with a demonstrated commitment to the District's success.

Corporate Qualifications

AECOM is a publicly traded company headquartered in Los Angeles, California. We are a premier, fully integrated professional and technical services firm that helps public- and private-sector clients around the world design, build, finance, and operate infrastructure. AECOM's global staff—including architects, engineers, designers, planners, scientists, and management and construction service professionals—serves clients in over 150 countries around the world. The firm is a leader in all of the key markets that it serves, including water, transportation, facilities, environmental, energy, oil and gas, high-rise buildings, and government. AECOM provides a blend of global reach, local knowledge, innovation, and technical excellence in delivering customized and creative solutions that meet the needs of clients. As one of ENR's Top 400 Contractors, AECOM has construction expertise in areas crucial to successful dam removal and reservoir maintenance, including dredging, cofferdam construction and river armoring, levee construction, concrete demolition, and river training.

AECOM has a proud legacy of companies with dam and reservoir expertise:

- AECOM
- Tecsult
- RSW
- Earth Tech
- TCB
- Boyle
- STS Consultants
- ECI
- TAMS Consultants
- Maunsell
- UMA
- URS Corporation
- Davis Langdon
- Woodward-Clyde Consultants
- Dames & Moore
- Scott Wilson
- Ebasco Services
- Morrison Knudsen
- Raytheon Engineers & Constructors
- Washington Group International

AECOM is an international leader in the design and construction of dams and reservoirs, as well as the decommissioning and removal of dams, and proudly maintains the reputation of being the industry's global leader in dam, reservoir, and water projects. In 2016, Engineering News-Record named AECOM the No. 2 Dams and Reservoirs firm[1], the No. 1 Global Design firm[2], and the No. 3 Water firm[3].

With our comprehensive team of specialists working across the full project lifecycle, we deliver solutions to the world's most complex water resource problems. Our specific qualifications for this contract are described below.

[1] ENR 2016, The Top 500 Design Firms: The Top Design Firms in Environment
[2] ENR 2016, The Top 500 Design Firms
[3] ENR 2016, The Top 150 Global Design Firms: The Top 10 by Market

AECOM served as designer and Owner's Representative for Carmel River Reroute and San Clemente Dam Removal Project, California's largest dam removal project ever. AECOM also served as construction manager for the largest dam removal in the U.S. at Elwha and Glines Canyon Dams.

500

AECOM has designed and/or constructed over 500 dams greater than 100 feet in height.

160

AECOM is a premier dam engineering firm in California, where we have been integrally involved in the planning, investigation, design and/or construction management of 160 dams.

75

AECOM has completed over 75 dam removal projects in the United States.

29

AECOM dam experience includes 29 of the 73 largest dams under the jurisdiction of the Division of Safety of Dams (with storage capacities greater than 50,000 acre-feet).

The AECOM Team includes key subconsultants with whom we have a demonstrated record of success on similar projects. Balance Hydrologics (Balance) worked with AECOM to develop an indicative channel design, and served as the owner's representative during construction on the San Clemente Dam Removal and Carmel River Reroute project, and Balance assisted AECOM with sediment transport modeling and analysis on the Searsville Reservoir Alternatives Study, which included several dam modification and removal alternatives. Stillwater Ecosystem Watershed and Riverine Sciences (Stillwater Sciences) worked with AECOM on sediment transport modeling and impacts to steelhead in support of an alternatives analysis for the Matilija Dam Removal and Ecosystem Restoration Project, and has collaborated with AECOM on steelhead-driven studies in the Alameda Creek Watershed. AECOM and HDR have worked together on several steelhead-driven projects, and we are currently working together on the LPD Fish Passage Feasibility Study. Through collaboration on these and other projects, our team members have built a high level of trust and efficiency, and have developed the ability to seamlessly execute similar projects.

Through our past and present efforts, the AECOM Team brings a high level of participation in and experience with related studies in the Carmel River that will inform the LPD & Reservoir Study. Our team's experience in the Carmel River began with Balance's staff monitoring changes in Carmel River channel conditions, and Los Padres Reservoir sediment toxicity following the Marble Cone Fire in 1977; and has continued through various phases of work at the former San Clemente Dam, culminating in its removal. The AECOM Team developed a sediment transport model for the Carmel River while working on the San Clemente Dam Removal project, and Balance is currently working on the Carmel River Instream Flow Incremental Method (IFIM) Hydraulic Study.

Both AECOM and HDR have multiple active projects at Los Padres Dam. Our team's involvement in these studies, including the IFIM and LPD fish passage studies, which directly inform the LPD Reservoir Alternatives study, will greatly facilitate the transfer and sharing of information among the current studies. For these reasons, the AECOM Team is uniquely qualified to conduct the LPD & Reservoir Study, and facilitate a decision regarding the long-term fate of LPD and the Reservoir.

Proposed AECOM Team members Mike Garello (center) and Jon Stead (right) at the Alameda Creek Diversion Dam

03
Project Experience & References

EXHIBIT 2-A

03 Project Experience & References

Introduction

The AECOM Team has provided services to many water districts and dam and reservoir owners for their critical projects. Working collaboratively and with dedication, successfully delivering challenging projects, including those presented in this section. Our project manager, task leaders, and other team members proposed for this project served on these and similar projects, as described in this proposal, and summarized in Section 02, Pre-qualifications.

AECOM's Oakland, California office leads our current work at the Los Padres and San Clemente dams on the Carmel River, and work on the proposed LPD & Reservoir Study would also be led out of our Oakland office. This location has been a center of excellence for dam and geotechnical engineering since the days of Woodward Clyde in the 1950s, and has evolved through acquisition by URS, and then AECOM, to become a leader in reservoir alternatives analysis, sediment transport and management, dam removal, stream restoration, and fish passage. Throughout this evolution, the Oakland office has maintained its strong culture of integrity, technical excellence, and creativity.

Highlighted AECOM Western USA Dam Removal Projects

San Clemente Dam
Monterey County, CA

Matilija Dam
Ventura County, CA

Lagunita Dam
Palo Alto, CA

Glines Canyon Dam
Port Angeles, WA

Searsville Dam
Woodside and Portola Valley, CA

Boardman River Dam
Traverse County, Michigan

Klamath Hydroelectric Project
Humboldt County, CA

Elwha Dam
Port Angeles, WA

Fish Passage Facilities in the Alameda Creek Watershed

Sunol, California

Owner: City and County of San Francisco, Public Utilities Commission

Ravi Krishnaiah, (415) 242-2233, rkrishnaiah@sfwater.org

Key Subconsultants: HDR

Size: 31-foot-tall ogee-crested spillway structure

Date Completed: Ongoing

Key Team Members: Jon Stead (Contract and Project Manager), Noel Wong (Principal-in-Charge), Ben Kozlowicz (Geologist), David Simpson (Senior Technical Peer Reviewer and QA/QC Officer), Mike Garello (Fisheries Project Engineer), Steven Tough (Civil Design Engineer), Sam Gambino (Geotechnical Engineer and Construction Project Manager), Mourad Attalla (Structural Engineer)

Relevant Features

- Alternatives Analysis
- Fisheries Biology/Impacts to California Steelhead
- Consideration of Retrofitting an Existing Dam with Fish Passage Facilities
- Geomorphology
- Sediment Transport Analysis
- Civil Engineering Design and Cost Estimating

The SFPUC has been working with other stakeholders since the late 1980s to restore Central California Coast steelhead to the Alameda Creek Watershed. Following technical studies completed under the Calaveras Dam Replacement Project (CDRP) (see following project description), it was proposed and approved that the Alameda Creek Diversion Dam (ACDD) and its operation be modified to benefit steelhead in Alameda Creek. In 2011, our proposed Project Manager, Jon Stead, led an AECOM team (formerly URS) that was awarded the contract for the Fish Passage Facilities in the Alameda Creek Watershed, mitigation for the CDRP, including technical studies and final engineering design of a fish ladder and fish screens at the ACDD. and fish passage improvements downstream at Little Yosemite. Under Jon's leadership, the team identified and designed a fish passage and protection solution that met the needs of multiple external stakeholders. Because the project was developed as mitigation for CDRP, design was not initiated until CDRP construction was under way; and the regulatory agencies required this project to be completed prior to completion of CDRP and refilling of Calaveras Reservoir; therefore, this was a schedule-driven project. Jon managed this $4M contract, nine subcontractors, and the majority of task orders, including task orders for conceptual design (with alternatives analysis), final engineering design, and bid and award, and saw the project go to construction on schedule in 2016.

The ACDD is a 31-foot-tall, concrete, ogee-crested spillway structure completed in 1931. Water is diverted by the ACDD 1.8 miles through a tunnel to Calaveras Reservoir. Major design elements of the fish passage and protection facility designed by the team for ACDD included a new diversion intake structure, a fish screen system, diversion

"AECOM Staff under the leadership of Jon Stead performed an excellent job in completing the project on schedule."

-Ravi Krishnaiah – SFPUC Assistant Sunol Regional Project Manager

conveyance, a fish ladder, sluiceways, power supply, control and maintenance buildings, solar and propane power supplies, VSAT and SCADA communication and controls, landslide mitigation, access roadway improvements, and upgrades to the existing facility to improve worker access and safety.

During design, the AECOM Team conducted several technical studies, including geomorphic mapping at the nearby "Little Yosemite" stream reach and development of a sediment transport analysis and water yield model for ACDD. Under Jon's leadership, a unique design approach was developed for the Little Yosemite reach to satisfy diverse stakeholders with interest in the project. A topographic survey and detailed geomorphic mapping were prepared, which included denoting locations of exposed bedrock; size, shape, and orientation of boulders in the channel; and survey and mapping of key hydraulic controls and other relevant features. These data were used to create a "geomorphic layer" that became part of the base map, and used in hydraulic analyses that informed design of nature-like fish passage improvements in the reach.

At ACDD, the AECOM Team conducted a sediment analysis that involved evaluating sediment accumulation scenarios, revising the project hydraulic model to interpret potential sediment mobility, and developing the sediment management scenarios used to establish expectations and operational frameworks for sediment and debris removal. Using output from the sediment analysis, a spreadsheet model was developed to estimate the total volume of water that would be diverted annually to Calaveras Reservoir, as well as the timing and duration of sediment sluicing and associated interruptions to fish ladder flow. The water yield analysis incorporated permit conditions and sediment management scenarios. The sediment and water yield analyses allowed the San Francisco Public Utilities Commission (SFPUC) and regulatory agencies to understand agree on the operational framework for the project, ultimately facilitating approval of the final environmental permits.

Construction at ACDD began in March 2016, and AECOM continues to provide engineering support to SFPUC during construction. Operational capability and control of the diversion at ACDD are expected to be improved by the project. Managing sediment and debris in the forebay will be one of the most important aspects of future operation and maintenance activities. Several innovative methods developed by the AECOM Team will be used to convey sediment, debris, and bedload downstream through the project so that it does not overwhelm the fish passage and water diversion facility.

Calaveras Dam Replacement Project

Sunol, California

Owner: City and County of San Francisco, Public Utilities Commission

Susan Hou, (925) 862-1294, shou@sfwater.org

Key Subconsultants: HDR

Size: 200-foot-tall (hydraulic height) dam

Date Completed: Ongoing

Key Team Members: Noel Wong (Contract Manager), Michael Forrest (Engineering Manager and Task Order Manager), Jon Stead (Fisheries and Task Order Manager), John Roadifer (Dam Design), Ben Kozlowicz (Geologist), David Simpson (Senior Technical Peer Reviewer and QA/QC Officer), Mike Garello (Fisheries Design Engineer), Steven Tough (Civil Design Engineer), Sam Gambino (Project Engineer), Mourad Attalla (Structural Engineer), George Strnad (Project Restoration Ecologist and Landscape Architect), Keith Wright (Landscape Architect), Shannon Leonard (Design Engineer)

Relevant Features

- History and Data Compilation
- Alternatives Analysis
- Earth Fill Dam Modifications
- Fisheries Biology/Impacts to California Steelhead
- Consideration of Retrofitting an Existing Dam with Fish Passage Facilities
- Geomorphology
- Civil Engineering Design and Cost Estimating
- Mapping
- Earthen Materials Disposal

AECOM (formerly URS) has been involved with many aspects of the high-profile CDRP, a project now under construction. Calaveras Dam was found to be subject to liquefaction failure due to the Maximum Credible Earthquake on the nearby Calaveras Fault. AECOM was retained to prepare a Contingency Action Plan that included formulating project objectives, conceptual design of dam and spillway replacement alternatives, project delivery alternatives evaluation, permitting strategy, and project cost and schedule estimates. AECOM was then retained to complete the conceptual and final engineering design, conduct biological studies and mapping of biological resources and wetlands, and coordinate environmental permitting efforts. Environmental permitting support led to a new task, Fisheries-Related Feasibility Studies, which provided key information describing fish barriers and fish passage in the watershed, and ultimately led to design of the Fish Passage Facilities in the Alameda Creek Watershed, a mitigation for CDRP that is also now under construction (see previous project description). Our proposed Project Manager, Jon Stead, played a key role in developing and managing the Fisheries-Related Feasibility Studies, which led to acquisition of required resource agency permits for construction and operation of the CDRP, and gained support for the project by members of the concerned public.

A number of repair and replacement alternatives for Calaveras Dam were evaluated with respect to environmental constraints, cost, construction duration, constructability, construction material availability, and seismic performance, and a conceptual engineering report was completed in October 2005. Subsequently, AECOM prepared a

detailed analysis of disposal site alternatives for placement of more than 3 million cubic yards of surplus material. This analysis was reviewed by many regulatory agencies and was used to demonstrate that the proposed project was the "least environmentally damaging practicable alternative" for purposes of the Clean Water Act.

AECOM completed final design of the project, including assisting the SFPUC with the DSOD approval process. AECOM has also assisted the owners with the reviews of the draft Environmental Impact Report (EIR) and permit applications for the DSOD, U.S. Army Corps of Engineers (USACE), Regional Water Quality Control Board (RWQCB), California Occupational Safety and Health Administration (OSHA), and the Bay Area Air Quality Management District. AECOM's assistance was instrumental in gaining key regulatory approvals for the project.

Following receipt of environmental permits, Bid Documents were released, and tight and competitive bids that were very close to the engineer's estimate were received. The construction contract was awarded in spring 2011, and the project is currently under construction. AECOM continues to provide engineering support during construction.

Despite a delay in Notice to Proceed for the construction contract and unfavorable winter conditions, the AECOM team completed a major geotechnical and seismic investigation program at Calaveras Dam on schedule and within budget. The planning and coordination effort taken by AECOM allowed the program to proceed smoothly, with full support from all regulatory and lead management agencies.

Fisheries-Related Feasibility Studies

These studies, managed as a separate Task Order by Jon Stead, focused on assessing the feasibility of creating fish passage at Calaveras Dam and the Alameda Creek Diversion Dam, and evaluating the potential for steelhead to migrate past natural impediments in the watershed. They involved integration of existing background information, field data, and design considerations to produce four interrelated technical memoranda in parallel, ultimately producing comprehensive technical analyses that were well-reviewed by the resource agencies and the public. The technical work included detailed hydrological analyses; field evaluations of passage at critical riffles, cascades, and waterfalls; identification of design options; and complex annualized cost estimates that included lost water diversion opportunity costs, capital cost, and operations and maintenance costs. Following completion of the studies, SFPUC was able to identify feasible measures to benefit Central California Coast steelhead that could be implemented as part of the project in balance with water supply requirements.

"This letter is in recognition of the outstanding professional services provided in the subject scope of work completed by Jon Stead, David Reel, Steve Leach, and other URS staff, as well as Mike Garello of HDR."

"URS and HDR successfully developed critical analyses regarding steelhead restoration and migration in the Alameda Creek Watershed. The information produced by URS/HDR was essential in the ongoing and successful environmental review and regulatory permitting for the proposed replacement of Calaveras Dam in Alameda County, California."

"It was a pleasure to work with and receive the support of highly motivated and talented consultant staff."

-Craig Freeman –
SFPUC Sunol Region Environmental Project Manager

Los Padres Dam Fish Passage Feasibility Study

Monterey, California

Owner: Monterey Peninsula Water Management District

Larry Hampson, (831) 658-5620, Larry@mpwmd.net

Key Subconsultants: HDR (prime) AECOM (sub)

Size: 148-foot-high dam

Date Completed: Ongoing

Key Team Members: Mike Garello (PM, Fish Passage Design Engineer), Jon Stead (AECOM PM, Meeting Facilitation, Fisheries), John Roadifer (Dam Safety)

Relevant Features

- Los Padres Dam
- Dam Safety
- History and Data Compilation
- Operations and Maintenance Evaluation
- Civil Engineering Design and Cost Estimating
- Alternatives Analysis
- Fisheries Biology/Impacts to California Steelhead
- Mapping

The consultant team synergy and relationships developed with the TRC under the LPD Fish Passage Feasibility Study will add knowledge and efficiency to the AECOM Team proposed for the LPD & Reservoir Study not likely met by other teams.

This study is one of several being conducted to answer questions about the future of LPD, including the question of "Are the Carmel River and the steelhead fishery better off with or without Los Padres Dam and Reservoir?" In particular, this study is to investigate whether it is feasible to improve juvenile and adult steelhead passage by installing upstream volitional facilities at LPD. Existing downstream passage facilities are intended to provide interim improvements until a permanent solution can be found. HDR and AECOM are also evaluating whether upstream passage facilities can act in the downstream direction to provide enhanced opportunities for downstream migration. Jon Stead, our proposed Project Manager, is the AECOM Project Manager for this project, and he works closely with proposed team member Mike Garello, HDR's Project Manager for the LPD Fish Passage Feasibility Study. The entire study is being conducted in close coordination with the Technical Review Committee (TRC) which includes experts from the National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (CDFW), California American Water Company (Cal-Am), and Monterey Peninsula Water Management District (MPWMD).

Reservoir sediment accumulation may affect passage between the dam and the upstream influence of the reservoir backwater. A re-survey of the reservoir was conducted to create a bathymetric map, and a determination will be made of whether accumulated sediment affects passage through the reservoir. The understanding of reservoir sediments and passage through the reservoir gained by the AECOM Team in this task will be of direct benefit to the proposed LPD & Reservoir Study.

The feasibility evaluation includes six tasks: four tasks to determine feasibility and identify fish passage alternatives, one for alternative development and a decision point, and one task to complete a final report. The HDR/AECOM Team reviewed diverse background information from various technical memoranda and other sources, and compiled the information into a report and a presentation delivered to the TRC. Data gaps were identified; and collaboratively with the TRC, decisions were made regarding how they would be filled. A draft Technical Memorandum describing evaluation criteria was also prepared and presented to the TRC, and a preliminary list of fish passage concepts for LPD was developed.

The team has begun to prepare a biological performance tool, where biological performance is defined as the proportion of migrants passing through the dam and reservoir. This tool will provide a transparent means of identifying performance assumptions that go into evaluation results, and will allows stakeholders to see and test the effects of those assumptions that go into evaluating biologic performance. The HDR/AECOM Team will continue to develop and review fish passage alternatives through an iterative process that continually seeks feedback and input from the TRC. The final evaluation will summarize fish passage alternatives receiving detailed evaluation, including conceptual engineering drawings and opinions of probable construction and operating costs. Dam safety is among the evaluation criteria. Along with the results of other studies, recommendations will be developed to inform the Los Padres Dam and Reservoir Alternatives and Sediment Study, and contribute to the determination of the long-term future of LPD. Selecting the proposed AECOM Team for the LPD & Reservoir Study will allow for seamless transfer of compiled background information and fish passage analysis results into the proposed alternatives analysis.

Searsville Dam and Reservoir Alternatives Study

San Mateo and Santa Clara Counties, California

Owner: Stanford University
Tom Zitgerman, (650) 725-3400, twz@stanford.edu

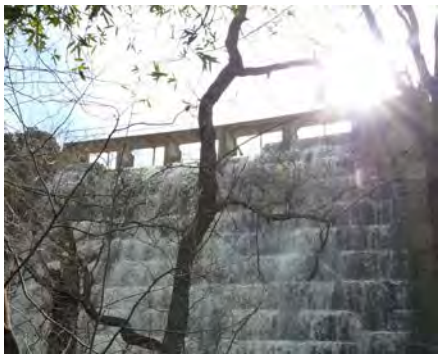
Key Subconsultants: Balance Hydrologics

Date Completed: Ongoing

Size: 60-foot-tall, 280-foot-long crest

Key Team Members: Seth Gentzler (Project Manager), John Roadifer (Project Engineer), Jon Stead (Environmental Project Manager), David Simpson (Project Geologist), Ben Kozlowicz (Geologist), Shannon Leonard (Alternatives Analysis Lead), Shawn Chartrand (Sediment Transport Analysis), Steve McNeely (Civil Design Engineer)

Relevant Features:
- History and Data Compilation
- Reservoir Alternatives Analysis
- Sediment Management
- Geomorphology/Sediment Transport Analysis
- Civil Engineering Design and Cost Estimating
- Fisheries Biology/Impacts to California Steelhead
- Mapping



Searsville Dam, originally built in 1892, is a 60-foot-high curved concrete gravity dam with a 280-foot-long crest and a central overflow spillway section. Complex environmental issues and worries by communities affected by the dam and reservoir surround the dam's future. Many of these issues are similar to those at LPD and reservoir, including steelhead habitat and migration, sedimentation in the reservoir, and downstream flood impacts of increased sediment transport. Our proposed Project Manager, Jon Stead, was the Environmental Project Manager, responsible for developing information to inform decisions on these issues from 2012-2016.

The reservoir's capacity has been severely limited by over 2.5 million cubic yards of accumulated sediment, and the declining pool volume will eventually impact water supply. In addition, Stanford and environmental organizations are concerned about the welfare of the Central California Coast steelhead population that spawns in San Francisquito Creek. Stanford has been working for more than a decade to improve the habitat for steelhead and other protected species in the San Francisquito Creek watershed, and dam removal or passage past the dam could become a part of those efforts. Stanford is also mindful of potential flood impacts upstream and downstream of any proposed solution.

AECOM was selected by Stanford University, with subconsultant Balance Hydrologics, to provide an Alternatives Study for the Searsville Dam and Reservoir. The study is driven by Stanford's desire to determine Searsville's role in their long-term sustainable water management planning, its function as a teaching and research facility, and particularly recognizing the need to address the increasing siltation condition and its potential impact on the watershed as a whole. Sedimentation has reduced the reservoir to less than 10 percent of its original water storage capacity. Similar to the proposed LPD & Reservoir Study, the Searsville study involved an external group of stakeholders that participated in

the alternatives evaluation. AECOM led workshops and facilitated alternatives scoring and weighting by the various stakeholders. A variety of possible options for the dam were considered, including:

- Continuing to allow the reservoir to fill with sediment, and transition to a marsh and forested wetland.
- Maintaining the dam and reservoir through sediment removal.
- Modifying the dam and reservoir to enable flood mitigation and management, in addition to fish passage to key tributaries.
- Removing the dam to allow Corte Madera Creek and other streams to flow downstream unimpeded.

AECOM's work began with compiling diverse, relevant background information from technical reports and other sources. The AECOM Team prepared documents and presentations summarizing the relevant physical, biological, and regulatory conditions at Searsville Dam, as well as previous concepts and studies related to the long-term future of Searsville Dam and Reservoir.

Jon Stead, our proposed Project Manager for the LPD & Reservoir Study, managed a fish passage feasibility study, evaluation of habitat suitability for steelhead upstream of the dam, evaluation of the effects on steelhead of increased sediment transport, identification of federal and state permitting requirements and processes for the various actions being considered, and identification of possible federal and state grant funding opportunities. Jon worked closely with Seth Gentzler, the Searsville PM and proposed Senior Consultant for the LPD & Reservoir Study, and Shannon Leonard, who led the alternatives analysis for Searsville and is proposed to do the same for LPD, to complete multiple aspects of the alternatives analysis.

A thorough understanding of the geomorphology of the watershed was developed to analyze and predict sediment transport and fluvial processes in the watershed; understand the reservoir effects on the watershed; and predict the effects of various actions at the reservoir on the watershed. The AECOM Team developed a sediment budget; used aerial photograph interpretation; and conducted a field investigation to characterize sediments in the reservoir and describe how those sediment conditions had changed, and would change, over time.

The Searsville Dam and Reservoir Alternatives Study involved staff, issues, and a process very similar to the proposed LPD & Reservoir Study, and the AECOM Team was successful in helping Stanford select a preferred alternative.

AECOM's work also included development of alternatives evaluation criteria; concept development of all dam, sediment, water supply, water storage, and flood management actions; preparing conceptual engineering designs, preparing rough-order-of-magnitude estimates of cost, and assessing impacts. The technical analyses and stakeholder facilitation provided by the AECOM Team was instrumental in helping Stanford reach a short list of preferred alternatives on schedule.

AECOM Team subconsultant, Balance, has been providing hydrology and geomorphology services for Stanford University for nearly 20 years. This information provided a strong foundation for the Searsville Dam and Reservoir Alternatives Study. Among these efforts have been:

- A major, multi-year investigation of sediment delivery and sedimentation in Searsville Reservoir, sources of the sediment, and changes over time, including bedload, suspended load, and delivery of large wood and other organics.
- Estimating sediment loading to the lake following episodes such as large wildfires or seismic events.
- Downstream impacts of sediment, in the scenario that Searsville becomes completely filled with sediment.

Matilija Dam Removal and Ecosystem Restoration Project

Ventura County, California

Owner: Ventura County Watershed Protection District

Peter Sheydayi
(805) 654-2016
Peter.Sheydayi@ventura.org

Key Subconsultants: Stillwater Sciences

Date Completed: 2016

Size: 168-foot-high, 620-foot-long crest dam

Key Team Members: Seth Gentzler (Project Manager), Noel Wong (Principal in Charge), Shannon Leonard (Alternatives Analysis Lead), Jon Stead (Lead Biologist), John Roadifer (Project Engineer), George Strnad (Landscape Architecture), Mike Forrest (Technical Reviewer), Ethan Bell (Impacts to Steelhead), Shawn Chartrand (Geomorphologist), Steve McNeely (Civil Design Engineer), Roy Watts (Cost Estimation)

Relevant Features

- History and Data Compilation
- Reservoir Alternatives Analysis
- Sediment Management
- Geomorphology/Sediment Transport Analysis
- Civil Engineering Design and Cost Estimating
- Fisheries Biology/Impacts to California Steelhead
- Mapping

Matilija Dam is a double-curvature concrete-arch structure built in 1947, approximately 16 miles upstream from the Pacific Ocean on Matilija Creek. The dam is suffering from an alkali-silica reactivity in the dam's concrete, and severely diminished storage capacity due to sediment accumulation behind the dam. The dam crest has been notched twice in the past to mend its stability. It was originally constructed to provide flood control and water supply to the local area, but has not been used for water supply in decades. The original storage capacity was 3,800 acre-feet; but currently, there are less than 500 acre-feet remaining, with expected zero capacity by 2020. Furthermore, the dam blocks migration of endangered steelhead to 16 miles of prime spawning habitat, providing a strong impetus for dam removal.

AECOM (formerly URS) was retained by Ventura County Watershed Protection District (VCWPD) in 2014 to perform an updated structural analysis and stability evaluation for the dam, as well as conduct hydrologic and sediment assessments and modeling, and develop dam removal and water supply mitigation design alternatives and preliminary construction cost estimates, all in consideration of impacts to Southern California steelhead, flooding, and water supply. Alternatives were evaluated on consensus-based evaluation criteria, and presented at numerous design oversight and stakeholder workshops. In 2016, AECOM supported VCWPD and the project funding sub-committee in submitting two large grant applications to support planning and design work on the dam removal project.

AECOM Team focused on identifying sediment management and dam removal alternatives that would result in acceptable fine-sediment impacts without mechanical sediment removal. Our sediment transport modeling and analysis was used to eliminate several alternatives from consideration, including the phased dam removal alternative, due to its relatively high cost and multiple impacts, leaving only three potential alternatives for further consideration, as requested by the client. Among these three alternatives, two were focused on

releasing all the sediment downstream with natural erosion, while minimizing the duration of the downstream impact by timing the sediment release to a high-flow event; and one focused on mechanical removal of fine sediment and temporary storage in the reservoir floodplain area prior to dam removal.

The scope of work for this project began with a comprehensive review of background technical reports and environmental documentation to evaluate all concepts and options previously contemplated to meet the various project objectives; to summarize associated opportunities, constraints, and obstacles that may have led to a specific concept being screened from further consideration; and to summarize "lessons learned" from other projects. Our proposed Project Manager, Jon Stead, managed biological aspects of the project, including development of biological and steelhead evaluation criteria and analyses. A matrix was developed to summarize the various concepts and information, and a workshop was held with the Technical Advisory Committee to obtain input on likely concepts to move forward to alternatives analysis.

Next, the AECOM Team developed six initial dam removal options to evaluate using selected screening criterion, including construction cost, duration and impact to downstream resources. Initial Options included (1) containment berm with high-flow bypass; (2) uncontrolled orifices; (3) gated orifices; (4) gated notches; (5) temporary upstream storage of fines; and (6) downstream slurry and temporary upstream storage of fines. Information provided by the AECOM Team allowed the Technical Advisory Committee to eliminate several of these options.

AECOM developed conceptual designs of the three preferred concepts selected by the Technical Advisory Committee. Associated plan sheets were developed to a level that appropriately and clearly detailed, defined, and coordinated the proposed project features and the project site conditions. These conceptual designs were evaluated across a broad range of evaluation criteria associated with steelhead health, ecological health, cost, risk mitigation, and impact to water supply.

AECOM also developed concepts to mitigate water supply impacts during dam removal scenarios. First, we evaluated the hydrologic conditions of the watershed for the purposes of water supply by coordinating and reviewing historical hydrologic data, developing an understanding of hydrologic cycles, and developing forecast scenarios using a reservoir operational model. Next, AECOM developed methods to mitigate the impact to downstream water supply infrastructure and operations that went through a similar alternatives analysis process with the stakeholders, as did the dam removal concepts. Conceptual designs for mitigation options were documented in a Conceptual Design Report and associated plan sheets.

Rigorous technical analyses, clear communication, and insightful presentations delivered by the AECOM Team, including Stillwater Sciences, were instrumental in moving the Technical Advisory Committee through the alternatives analysis process to selection of a preferred alternative.

Similar to the proposed LPD & Reservoir Study, an important component of the project was the project manager and key technical leads preparing for, attending, and documenting input and discussions associated with key brainstorming topics, deliverables, and project milestones with the Client Management Team and Technical Advisory Council members at meetings, for which AECOM developed summary presentations to facilitate input and resolution on key technical challenges. AECOM's clear communication and insightful presentations were instrumental in moving the stakeholder group along through the process, and the Client Management Team was able to reach consensus and select a preferred alternative. The AECOM team further assisted the client by providing technical assistance and writing for grant funding applications to pursue the design of the preferred alternative, and the project was awarded Prop 1 grant funds from CDFW, one of the grants AECOM assisted with.

Carmel River Reroute and San Clemente Dam Removal

Monterey County, California

Owner: California State Coastal Conservancy and California American Water

Trish Chapman, State Coastal Conservancy, (510) 286-0749, trish.chapman@scc.ca.gov

J. Aman Gonzalez, California American Water, (831) 646-3230, julio.gonzalez@amwater.com

Key Subconsultants: Balance Hydrologics

Date Completed: Ongoing

Size: 105-foot-tall (hydraulic) dam

Key Team Members: Seth Gentzler (Project Manager), John Roadifer (Project Engineer), Noel Wong (Principal-in-Charge), Jon Stead (Biology Task Manager), Shawn Chartrand (Sediment Transport, Design Engineer), Shannon Leonard (Design Engineer), Steve McNeely (Civil Design Engineer), George Strnad (Restoration Task Manager), Keith Wright (Biologist), Ben Kozlowicz (Geologist)

Relevant Features

- History and Data Compilation
- Reservoir Alternatives Analysis
- Sediment Management
- Geomorphology/Sediment Transport Analysis
- Civil Engineering Design and Cost Estimating
- Fisheries Biology/Impacts to California Steelhead
- Mapping

Award: Green Project of the Year, American Infrastructure, 2016

San Clemente Dam was a 106-foot-high concrete-arch dam approximately 18.5 miles from the Pacific Ocean on the Carmel River. Cal-Am owned and operated the dam. When the dam was constructed in 1921, it had reservoir storage of approximately 1,424 acre-feet. Before removal, the reservoir was more than 90 percent filled with sediment, and had lost its usefulness as a water supply source.

Although the dam had a fish ladder, annual steelhead counts revealed that passage was inconsistent and sub-optimal. With the removal of the dam in 2015, South-Central California Coast steelhead are now

able to migrate up the river again to 25 miles of pristine main-stem river and many miles of tributary habitat.

In the early 1990s, the California Department of Water Resources (DWR) DSOD issued a safety order, determining that the dam could potentially fail in the event of either the maximum credible earthquake or probable maximum flood. In response to the safety order, Cal-Am evaluated alternatives that included both dam strengthening and dam removal. The State Coastal Conservancy (SCC) and Cal-Am led a group of agencies and stakeholders in designing, permitting, and constructing the alternative that removed the San Clemente Dam, and restored a naturally functioning river channel that bypassed much of the accumulated reservoir sediments by rerouting the river into an adjacent tributary canyon.

The removal of San Clemente Dam and the reroute and restoration of the Carmel River is the first of its kind in terms of both size and complexity; and the end results will be instrumental for the planning and implementation of future dam removal and river restoration projects.

The AECOM Team, including subconsultant Balance Hydrologics and many of our proposed team members for the LPD & Reservoir Study, was instrumental in moving the San Clemente Dam Removal from concept to a completed project.

In 2008 and subsequently, Cal-Am and SCC hired AECOM (formerly URS) to complete geotechnical investigations and sediment characterization(2009); develop a Long-Term Management Plan and Risk Assessment (2009); refine the conceptual design and basis of design (2010); complete detailed flood and sediment transport modeling (2011); conduct biological and archaeological surveys (2011-2013); prepare permit applications and provide permitting support (2011-2013); develop a design-build (D-B) Request for Proposal (RFP) (2011); develop and implement a plan for D-B procurement (2011), issue an RFP, and support development of conformed D-B contract (2012-2013); secure all environmental permits, including supplemental EIR documents (2011-2013); as well as provide support for public outreach, DSOD coordination, and engineering and environmental compliance during construction (ongoing).

AECOM was responsible for preparing a full suite of environmental and local agency permits for the project; and in conjunction with DWR as the Lead Agency, determined that a Supplemental EIR (SEIR) was needed due to project design changes occurring during the final design phase. AECOM prepared and circulated the Draft SEIR, responded to public comments, and prepared the Final SEIR, which was certified in July 2012. AECOM's diverse skill set and ability to effectively translate engineering data into environmental permit applications allowed the project to move forward.

The project was constructed by a D-B contractor selected based on a competitive D-B procurement process led by Cal-Am. Cal-Am and SCC retained AECOM throughout the construction to serve as the owner's representative and provide technical oversight and management. The construction took place over 3 years, and the project is entering the post-construction monitoring period. AECOM continues to support the owner by providing technical reviews and guidance on monitoring and maintenance items.

Relevant to the proposed project, AECOM completed tasks related to history and data compilation, civil engineering design and cost estimating, fisheries biology, and geomorphology. These aspects of the project are highlighted below.

History and Data Compilation: AECOM reviewed historical data regarding fish and wildlife habitat from MPWMD, and previous annual reservoir drawdown reports to inform the take analyses presented in the biological assessments. The results of previous geomorphological and botanical surveys, as well as existing conditions reported in the EIR/Environmental Impact Statement (EIS)

document for the project, were also reviewed and summarized in AECOM's work.

Civil Engineering Design and Cost Estimating: AECOM developed an indicative design, construction plan, and construction cost estimate for the project, and an evaluation of the cost-benefit of numerous options and refinements throughout the design process. The indicative design report summarized all key engineering analyses, including geotechnical engineering, structural and seismic stability, geomorphology, sediment transport, hydraulic performance, habitat restoration, and long-term monitoring and maintenance requirements.

Fisheries Biology: As part of the environmental permitting, previous fisheries data were reviewed, including migration, rescue, and relocation data for South-Central California Coast steelhead in the Carmel River. These existing data were integrated with knowledge of steelhead life histories and project design to minimize impacts of the proposed project to steelhead. For example, to reduce impacts, steelhead biology informed the reservoir dewatering method and timing, fish rescue and relocation operations, water treatment system design, and erosion protection measures. Fish passage and rearing, spawning, resting, and foraging habitat were incorporated into the conceptual designs for the restored channel. Weir, step-pool, and resting-pool dimensions were designed to facilitate passage; while large, woody debris was provided to enhance floodplain habitat. Throughout construction, AECOM reviewed designs, plans, and reports prepared by the D-B contractor and provided oversight during channel construction.

Geomorphology: Analyzing and predicting sediment transport and fluvial processes in the Carmel River was a key part of this project. A particularly challenging issue was what to do with the approximately 2.5 million cubic yards of sediment behind San Clemente Dam. Access to the site was limited, and sediment and cost analyses showed that dredging and disposal of the sediment via trucking was cost-prohibitive. Flood analyses showed that the sediment could not be allowed to naturally erode downstream due to potential flood impacts. The proposed solution was to re-route a 0.5-mile portion (3,000 linear feet) of the Carmel River into San Clemente Creek to isolate and stabilize the accumulated sediment in the current river channel. The new combined flow reach was restored to accommodate fish passage and sediment transport, and maximize ecological benefit; and the abandoned reach, which already contained sediment, was used as a permanent sediment storage area. A clever solution on many fronts, the design reduced the potential for environmental impacts, flood risk, and potential project costs by minimizing the amount of sediment to be excavated and moved.

Almaden Dam Improvement Project – Planning, Design, and Environmental Consulting Services

Santa Clara County, California

Owner: Santa Clara Valley Water District

Victor Gutierrez, (408) 630-3118, vgutierrez@valleywater.org

Key Subconsultants: N/A

Size: 107-foot-tall (hydraulic height from spillway invert to discharge into stream below) dam. The maximum height of the dam is about 110 feet, and the crest is approximately 500 feet long and 20 feet wide, with a capacity of about 1,586 acre-feet.

Date Completed: Ongoing

Key Team Members: Noel Wong (Project Manager), Sam Gambino (QA/QC), Shannon Leonard (Hydrology/PMP/PMF), David Simpson (Project Geologist), Benjamin Kozlowicz (Geologist), Steve McNeely (Civil Design Engineer), John Roadifer (Geotechnical Design Reviewer), Jon Stead (Fisheries and Fish Passage), Steven Tough (Civil Design Engineer), Mourad Attalla (Structural Engineering)

Relevant Features

- History and Data Compilation
- Alternatives Analysis
- Design of modifications to earth fill dam with ogee-crest spillway
- Fisheries Biology/Impacts to California Steelhead
- Consideration of Retrofitting an Existing Dam with Fish Passage Facilities
- Civil Engineering Design and Cost Estimating
- Mapping

Almaden Dam is an earth-fill dam in Santa Clara County on Alamitos Creek in the Guadalupe River Watershed. Construction of the dam was completed in 1937; it is owned by the Santa Clara Valley Water District (District). The dam and reservoir provide about 1,584 acre-feet of storage used for conservation, groundwater recharge, flood control, environmental flows, and recreation. Since Almaden Reservoir went into service, sediment inflow has reduced the maximum storage in the reservoir by over 20 percent from the original capacity of 2,000 acre-feet.

In 2007, the District contracted with AECOM (Legacy URS) to perform a new seismic safety evaluation. The study included reviewing previous work at the site, reviewing the construction history, evaluating the site geology, performing additional field exploration and lab testing, updating the earthquake ground motions, evaluating material properties, and performing static and seismic stability analyses. The study results indicated that damage during the design earthquake should be repairable and is not expected to compromise the safety or integrity of the dam, providing key information to the District regarding the long-term future of the dam. The information provided by

AECOM allowed the District to focus on upgrading the dam's appurtenances.

In 2013, AECOM was hired by the District to provide integrated engineering and environmental services for the Almaden Dam Improvement Project (ADIP), including the EIR, environmental permitting, and studies of fish passage feasibility that address the District's plans to seismically stabilize or replace the Dam intake structures, renovate the outlet works, and modify the spillway to accommodate the maximum probable flood event. Because of our excellent services, the District has since awarded AECOM with two major contract amendments for additional scope of work. The ADIP includes the construction of a new sloping intake structure, spillway modifications, installation of a seepage collection and monitoring system, replacement of both outlet structures, and a limited raise of the dam and adjacent Alamitos Road.

The goal of the Fish Passage Feasibility Study was to provide a practical solution for reliable passage around Almaden Dam for adult Central California Coast steelhead migrating upstream; and passage for both juvenile and adult steelhead emigrating downstream. Solutions needed to be consistent with existing water rights and settlement agreement rule curves, compatible with the ADIP, and based on the best available science. Existing data were reviewed and compiled in a technical memorandum, and steelhead habitat upstream of the dam was characterized and mapped. Fish ladders, surface collectors, tributary collectors, and spillway improvements were all evaluated. The analysis took into consideration hydrological and biological conditions in the watershed and likelihood of DSOD and regulatory approval. Capital and operations and maintenance costs were developed based on conceptual engineering designs as part of the analysis. The information developed by AECOM allowed the District to understand the potential financial and operational impacts of providing fish passage at Almaden Dam.

The AECOM Team is currently working with the District to solicit input and provide project information to key regulatory agencies, including USACE, NMFS, CDFW, and the RWQCB. Permits that the team is coordinating on behalf of the District include an Individual Permit from the USACE, a Lake and Streambed Alteration Agreement from the CDFW, and a 401 Water Quality Certification from the RWQCB. We are also preparing the documentation for the Santa Clara Valley Habitat Conservation Plan.

The District has realized several benefits by retaining the AECOM Team on this project:

- Integrating the environmental and engineering design team streamlined communication and resolution of potential environmental issues.
- Evaluating fish passage feasibility in advance of agency consultation minimized delays during project permitting and provided an opportunity to address feedback during project design.
- Developing strong relationships with key regulatory agencies helped to expedite approvals for design geotechnical investigations.
- Coordinating project permitting with three other major dam retrofit projects currently in progress with the District increased efficiency.

The AECOM Team is conducting Computational Fluid Dynamics (CFD) modeling to iteratively aid in the design of a side-channel labyrinth spillway upgrade to the existing spillway as part of the ADIP. The existing side-channel ogee-crest spillway, with a design capacity of approximately 7,000 cubic feet per second (cfs), is inadequate to pass the flow resulting from the Probable Maximum Precipitation event. The AECOM Team's creative approach to water infrastructure design helped the District determine that a labyrinth spillway arrangement would be a more efficient and practical approach than a traditional spillway. A physical model is being prepared to calibrate the CFD results and aid in design refinement.

Lagunita Diversion Dam Removal

Palo Alto, California

Owner: Stanford University

Tom Zitgerman, (650) 725-3400, twz@stanford.edu

Key Subconsultants: Balance Hydrologics

Date Completed: Ongoing

Size: 70-foot-wide and approximately 8-foot-high dam

Key Team Members: Seth Gentzler (Project Manager), Jon Stead (Environmental Project Manager), David Simpson (Sediment Characterization), George Strnad (Erosion Protection, Bank Stabilization, Biological Resources), Shannon Leonard (Technical Review), John Roadifer (Constructability, Geotechnical Engineering), Steve McNeely (Civil Design Engineer)

Relevant Features

- History and Data Compilation
- Alternatives Analysis
- Sediment Characterization
- Geomorphology
- Civil Engineering Design and Cost Estimating
- Fisheries Biology/Impacts to California Steelhead
- Mapping

The 70-foot-wide and approximately 8-foot-high concrete run-of-the-river weir was constructed in the late 1800s to provide gravity diversion to an adjacent flume; however, settlement along the flume and canal has prevented diversion operation since 1985. The diversion dam also includes a fishway that provides limited passage past the dam for Central California Coast steelhead. Stanford, environmental groups, and resource agencies have concluded that dam removal is the preferred option.

AECOM's services for the first phase of work included reviewing and compiling relevant background information from technical reports and other sources; hydraulic and hydrologic modeling; characterization of sediment quality, quantity, and mobility; evaluation of dam removal alternatives and selection of the preferred alternative; and preparation of 30 percent design plans and construction cost estimate for the dam removal and bank stabilization. Also during the first phase of work, AECOM mapped wetlands, vegetation types, woodrat nests, and other biological resources in the project area. This initial information was presented to regulatory agencies and was very well received, allowing Stanford to gain the support of key stakeholders for the project.

AECOM prepared grant funding applications for the project, and is currently preparing final design drawings, specifications, and cost estimates, in addition to all permitting applications. Our proposed Project Manager, Jon Stead, was instrumental in concept development and managed all environmental work for the project.

The design incorporates dam removal and non-structural bank stabilization construction that results in simulation of a natural creek channel. The design intent is to fit seamlessly into the local topography and geology to produce a stable horizontal and vertical creek alignment, as well as optimum biological conditions for habitats and fish passage. The project design also incorporates construction logistics planning for activities in the Creek and adjacent sensitive habitats.

Los Padres Dam Emergency Action Plan

Monterey, California

Owner: California American Water

J. Aman Gonzalez, (831) 236-6828, julio.gonzales@amwater.com

Key Subconsultants: N/A

Size: 148-foot-high dam

Date Completed: Ongoing

Key Team Members: Seth Gentzler (Project Manager and Design Engineer), John Roadifer (Dam Safety Assessment)

Relevant Features

- Los Padres Dam
- Dam Safety
- History and Data Compilation
- Operations and Maintenance Evaluation
- Civil Engineering Design and Cost Estimating

Los Padres Dam is on the Carmel River, approximately 7.5 miles southeast of Carmel Village, 6 miles upstream of the now-removed San Clemente Dam, and 24.5 miles upstream of the Carmel River mouth. The dam was constructed in 1948 and 1949, and came under the ownership of Cal-Am in 1966.

The original purpose of the dam was primarily to provide additional water storage for municipal and domestic supplies for the Monterey Peninsula Area. Currently, releases are made from the reservoir to regulate and maintain flows in the Carmel River during the dry season.

Cal-Am hired AECOM in 2014 to complete a Dam Safety Assessment, an Emergency Action plan, and a Mechanical Assessment. The Dam Safety Assessment involved review of available information from Cal-Am and DSOD; completion of a physical inspection; and documentation of visible evidence of distress, cracking, seepage, deterioration, movement, or other conditions potentially relevant to the long-term performance, safety, and service life of the dam. The Emergency Action Plan was developed using guidance from DSOD, the Federal Emergency Management Agency (FEMA), and the California Emergency Management Agency (CalEMA).

The plan included a dam break analysis, in addition to a summary of structural background, the five-step Emergency Action Plan process, roles and responsibilities, evacuation responsibilities, and maintenance. The Mechanical Assessment involved an evaluation of the outlet valves at the dam, and a maintenance assessment with rough order-of-magnitude costs. The information developed by AECOM has given the dam owner a much better understanding of the condition of the dam and its appurtenances.

Los Padres Dam Fish Passage Assessment, Design, and Implementation

Carmel Valley, California

Owner: Cal-Am

Ian Crooks
(831) 646-3217
Ian.Crooks@amwater.com

Key Subconsultants: HDR Project

Size: 148-foot-high dam

Date Completed: 03/2016

Key Team Members: Mike Garello (Project Engineer and Engineer of Record)

Relevant Features

- Los Padres Dam
- Alternatives Analysis
- History and Data Compilation
- Earth-Fill Dam Modifications
- Fisheries Biology/Impacts to California Steelhead
- Civil Engineering Design and Cost Estimating
- Mapping

In 2008, HDR was retained by Cal-Am to prepare a long- and short-term alternative analysis for upstream and downstream fish passage over Carmel River's Los Padres Dam. Results from the short-term alternative assessment were used to select an interim course of action to improve safe and effective downstream passage of juvenile and post-spawn adult migration. Both alternative assessments included historical data collection and synthesis from existing records, topographic surveys, concept formulation, preliminary design, and cost estimating. At that time, the long-term study was never finalized due to Cal-Am's desire to quickly move forward to the interim action. However, an interim action was selected that included implementation of a one-of-a-kind floating weir collector (FWC), physical

guidance structure, downstream fish bypass, and fish bypass outfall. In 2010, Cal-Am selected HDR to initiate final design drawings for the FWC concept near the spillway of Los Padres Reservoir. The design included a gravity-fed, 30-foot by 22-foot collector fixed into position on four steel pilings. A unique articulated-pipe bridge support structure was connected to the spillway face, which transferred water and fish from the collector to a 1,100-foot-long fish bypass pipe. A fish guidance system included 300 feet of floats with 10-foot-tall steel panels; and a new debris boom with 2-foot debris screens was designed to provide debris management and guide outmigrating fish to the collector entrance. Two-dimensional hydrodynamic modeling was performed to assess design velocities around the collector, as well as to demonstrate the potential impact that such a facility would have on reservoir stages during extreme flood events.

The final design process included facilitation of meetings, direct coordination, and technical review by DSOD, CDFW, and the NMFS. Comments received during final design changed the project's scope of complexity. HDR engineers developed solutions to address each concern, and to keep the project moving forward.

In 2015, Cal-Am bid the project and successfully negotiated a contract for construction. HDR was again brought on board by Cal-Am to provide engineering support throughout construction and implementation. Support services included request for information reviews, shop-drawing submittal reviews, value engineering assessments, periodic on-site construction observation, coordination with DSOD, and attendance at weekly construction meetings with the construction contractor, CDFW, NMFS, and the MPWMD. During construction, the anchor design for the fish guidance system and debris boom—tasked to a specialty vendor—was of primary concern to DSOD. To avoid schedule delays, HDR provided a team of engineers and naval architects to create an implementable and defendable solution, which was ultimately approved by DSOD.

The downstream passage facility was completed in early 2016, and HDR provided on-site hydraulic testing and commissioning services to facilitate operational start-up in March 2016. HDR continues to provide operational support for the facility on an as-needed basis to Cal-Am engineering and operations staff, as well as directing coordination with resource agencies, such as CDFW and NMFS.




Assistance with IFIM characterization of the Carmel River

Carmel Valley, California

Owner: MPWMD

Larry Hampson
(831) 659-2543
larry@mpwmd.dst.ca.us

Key Subconsultants: Balance was a sub to Normandeau Associates, Inc.
Steve Eggers, Fisheries Biologist
890 L Street, Arcata, CA 95521

Size: This study was conducted throughout the Carmel River Watershed.

Date Completed: 07/2016

Key Team Members: Edward Ballman (Client Principal), Barry Hecht (Principal-in-Charge), Jonathan Owens (Field Mobilization and Safety Plan Guidance)

Relevant Features
- Stream Gaging
- Stream Velocity and Depth
- Stream Profiles
- Q Measurements
- IFIM
- Carmel River
- ADCP
- Los Padres Dam
- Steelhead Habitat

The MPWMD conducted an IFIM study of the Carmel River from Highway 1 to Los Padres Reservoir for the purpose of developing instream flow criteria to understand and optimize dry-season recession flows for steelhead habitat. Balance hydrologists, trained in CDFW's Instream Flow Program (IFP) field methods, assisted the project team with the collection of hydrologic data, including streamflow measurements, cross-sectional bed and water-level transects, and stream-bed ranking for fish habitat. Targeted flows ranged from 100 cfs downwards to 10 cfs, or just prior to intermittent flow and the formation of isolated pools. Having extensive experience with conducting and interpreting Acoustic Doppler Current Profile (ADCP) flow measurements on other rivers, Balance staff was given the lead for this project to collect high-flow data using ADCP methods, where needed. A Hach (or March McBirney) flow meter and top-setting wading rod was used at lower flows per IFP protocols. To complete the work, Balance led a field team that included MPWMD biologists and Balance hydrologists.

Balance's participation in this study has given them a recent, close-up knowledge of the physical characteristics of the Carmel River that will be extremely useful for the AECOM Team when completing the proposed LPD & Reservoir Study.

EXHIBIT 2-A

04
Key Staff Persons

EXHIBIT 2-A

04 Key Staff Persons

The ability of any organization to succeed lies in the talent, experience, and commitment of its members. AECOM has chosen the strongest possible group of professionals, whose talents and experience are directly aligned to meet the MPWMD's expressed project needs.

Key Staff

AECOM project manager, **Jon Stead**, brings 18 years of experience that includes responsibility as project manager leading multidisciplinary teams on complex stream restoration, fish passage, water infrastructure, and dam removal projects. He provides services ranging from planning, environmental surveys, and permitting, through engineering feasibility, alternatives analysis, and final design. Jon managed the $4M Fish Passage Facilities in the Alameda Creek Watershed engineering contract for the City of San Francisco, including three task orders and nine subconsultants, delivering the project on time despite a very aggressive schedule.

Jon is the AECOM Project Manager for the Los Padres Dam Fish Passage Feasibility Study, and was the Environmental Project on similar alternatives analyses, including the Matilija and Searsville dam and reservoir alternatives analyses, and on the Lagunita Diversion Dam Removal Project. He has worked collaboratively with all subconsultant firms on our proposed team on these and other projects. Jon has strong leadership skills and superior attention to detail, allowing him to seamlessly blend large and diverse teams composed of AECOM staff, subconsultants, cooperating agencies, and clients to deliver high-quality products on time and within budget. Frequently, Jon Stead has risen under challenging circumstances to support clients' rigorous objectives for cost, schedule, safety, and quality.

Our principal-in-charge, **Noel Wong, PE,** will bring his 40 years of water resources, dam, and reservoir experience to work for the LPD & Reservoir Study by making himself available as a resource to the AECOM and MPWMD project managers. Noel Wong has served as principal-in-charge for many of the projects that Jon Stead has managed, and Jon has repeatedly demonstrated how Noel's depth of experience can be leveraged to provide exceptional project outcomes. Noel Wong is Vice President and Project Director of AECOM's Water Resources Department for our Oakland operations, responsible for our water quality, watershed management, hydrologic/hydraulic, and dam engineering practices. As manager of these operations, Noel is experienced in leading and serving our clients on major projects, with responsibilities in overall program development, project management, staffing, and quality assurance. As a nationally acclaimed dam practitioner, Noel has directed and participated in planning, investigation, design, and construction of major water projects.

AECOM's Project Engineer, **John Roadifer, PE,** will oversee all engineering and design-related elements of the LPD & Reservoir Study, and will work in close coordination with our project manager. John Roadifer is a registered civil engineer with 29 years of experience in a wide range of water

infrastructure projects, with particular expertise in dams and reservoirs. He has extensive experience coordinating with the DSOD. His responsibilities for past projects include management or performance of development and evaluation of alternatives; site investigations; laboratory testing programs; conceptual and final engineering; preparation of plans, specifications and other contract documents; construction cost estimation and scheduling; engineering support for CEQA and permitting; coordination with state agencies and regulatory agencies; and construction management. John Roadifer was a key team member on similar studies, including the Searsville and Matilija dam and reservoir alternatives studies.

Alameda Creek Diversion Dam Fish Passage Facilities under construction, 2016

Our project manager, Jon Stead, hand-selected the following Key Personnel because of their water supply, geomorphology, and steelhead experience and their proven ability to work together in an integrated environment with our clients and their stakeholders. We have presented a short bio for our Key Personnel. For more detailed information on all team members, please see Appendix B: Resumes. Our Key Team includes the following professionals:

- **Seth Gentzler, PE, Senior Consultant/Senior Technical Reviewer,** is a leader in the dam removal industry, managing the technical and environmental compliance work for the three largest dam removal projects in California (San Clemente, Matilija, and Searsville Dams). Jon will frequently involve Seth in team discussions, technical review, and critical decisions so that the entire team can benefit from Seth's depth of experience with dam removal and reservoir alternatives analysis projects. Seth is a Vice President of AECOM and heads up the Hydrology and Hydraulics Practice. Mr. Gentzler excels at bridging the gap between engineering and habitat restoration, facilitating discussion to find common ground within a wide range of expertise and perspectives, and transforming project concepts into buildable, permittable construction documents. His specific technical expertise includes dam removal, river and wetland restoration design and construction, river and inter-tidal system hydrodynamic modeling, levee and bay trail design, water resource planning, site design, and utility coordination. Recent projects include the San Joaquin River Restoration Project in Fresno and Madera counties, California; the Searsville Dam & Reservoir Alternatives Study in Santa Clara County, California; the Matilija Dam Removal Project in Ventura County, California; and the Carmel River Reroute and San Clemente Dam Removal Project in Monterey County, California.
- **Shawn Chartrand, CEG (Balance), Fluvial Geomorphology and Sediment Transport,** specializes in conducting fluvial geomorphic and hydrologic studies for the management of a wide range of biological and physical resources, often informing restoration or re-habilitation plans, which he has overseen from conceptualization through post-construction monitoring. Shawn is experienced in 1-dimensional and 2-dimensional hydrodynamic and sediment

transport modeling. He brings unique expertise to steep channel design through his applied research on step-pools, and routinely develops numerical models to explore problems and identify solutions and/or points of compromise. Shawn has developed analytical tools to evaluate water supply and in-stream habitat vulnerabilities due to climate change projections, and has guided water supply planning efforts to minimize potential effects of climate change on water supply availability and in-stream habitat. He has been involved in three of the largest dam removal projects in California. For the San Clemente Dam Removal, he led the geomorphic assessment and channel design effort, and served as one of the owner's representatives for construction.

- **Dave Simpson, PG, CEG, Sediment Characterization,** has experience characterizing and evaluating complex geologic site conditions for a variety of projects, including more than 20 dams and reservoirs, tunnels, penstocks, pipelines, spillways, bridges and roadways, buildings, flood, landslide, and fault hazard studies through his development, management, and performance of multifaceted geologic investigations. He has extensive field experience with geologic and geomorphic mapping, sediment, soil and rock drilling and sampling, and in situ testing, large-diameter borehole logging, and interpretation of borehole and surface geophysical investigations. His Quaternary geologic expertise includes evaluating soil and alluvial stratigraphy, age-dating methods, and interpreting Quaternary geologic history, logging, and interpretation of trench excavations for paleoseismic and landslide studies, and aerial photograph and LiDAR interpretation. Dave is a core member of AECOM's water resources practice and is relied on to lend his expertise to our most challenging and important projects.

Jon Stead collecting stream data for the Fish Passage Facilities in the Alameda Creek Watershed project

- **Ethan Bell (Stillwater), Impacts to Steelhead,** has an in-depth understanding of South-Central California Coast steelhead habitat use and requirements. He evaluated steelhead habitat and population dynamics in the Carmel Lagoon and led in the design of its habitat restoration; conducted an evaluation of steelhead limiting factors in the Big Sur River and helped identify measures to enhance that population; and assisted with a watershed management plan for Santa Rosa Creek in San Luis Obispo County. Ethan has been the lead fisheries biologist on a number of studies evaluating impacts to fisheries from dam removal alternatives, including on the Sandy River, the Klamath River, and the Matilija River. He has nearly 20 years of experience leading large-scale watershed assessments, fish passage analysis, population dynamics modeling, limiting factors analysis, and input on restoration design, and has published seven papers in peer-reviewed, scientific journals on steelhead and salmonids.
- **Shannon Leonard, Reservoir Alternatives Analysis,** brings more than 16 years of

experience in civil and environmental engineering, integrating multiple disciplines on complex and high-profile projects. Her expertise includes stream restoration design, hydrology and hydraulics modeling, fluvial geomorphic assessment and analysis, watershed studies, wetland waters budget modeling, stormwater management modeling and design, and water quality management and master planning. Shannon also has experience with diverse environmental tasks. Her spectrum of engineering and environmental experience allows her to capably manage and integrate technical information from various resources on multi-disciplinary river and restoration projects. She has helped manage alternatives studies for a number of water resources projects, and has particular expertise with development, weighting, and scoring of evaluation criteria and manipulation of evaluation matrices. Shannon is a key asset at stakeholder and TRC review committee meetings, and in soliciting stakeholder and reviewer input to the evaluation process. Recent projects include the San Clemente Dam removal project and the Searsville and Matilija dam and reservoir alternatives studies.

- **Mike Forrest, PE, GE, Quality Assurance/Quality Control,** brings more than 40 years of engineering experience. Jon will look to Mike to oversee implementation of AECOM's Quality Management System and conduct key technical reviews. Mike's wide range of responsibilities includes managing reservoir site selection studies, geotechnical investigations, feasibility studies, alternatives evaluation, conceptual through final designs, and construction management. He has led multi-disciplinary teams and has managed many projects for design and rehabilitation of major dams, levees, canals, tunnels, and shafts. He is also actively involved in post-construction performance monitoring of many reservoirs. He has been extensively involved on projects requiring state and federal agency approvals, including the DSOD.

Subconsultants

Balance Hydrologics

Balance Hydrologics staff collecting stream data for the Lagunita Diversion Dam Removal project

Balance Hydrologics, Inc. is a full-service site-specific hydrology consulting firm in Berkeley, California, established in 1988, with offices in Santa Cruz and Truckee. The firm has more than 30 professional staff with a broad array of experience in California; most have an advanced graduate degree in the fields of hydrology, geology, or engineering. Balance offers flexible and practical approaches to problems, good communication on complex and controversial projects, and develops realistic, implementable solutions. One of Balance's principal goals is providing planners, engineers, biologists, and land managers with rigorous analyses quantifying significant watershed processes. Their emphasis is on intensive field study coupled with application of cutting-edge modeling platforms, generally structured to meet the specific needs of the habitat or watershed manager. Most investigations are designed to measure, simulate, and plan to control the effects of specific land uses on aquatic, riparian,

or estuarine habitat conditions. Balance's projects cover the full spectrum of services, from studies to establish baseline hydrologic, hydraulic, geologic, and water quality conditions, to developing mitigation or restoration designs, providing construction-phase support, and post-project monitoring.

Balance has conducted a number of projects related to dams and reservoirs throughout California. They have worked extensively as a subconsultant to AECOM on numerous dam removal and river restoration projects, many of which are summarized in this proposal. Among these projects, Balance's services have varied from dam seismic retrofit feasibility investigations, lake hydrologic studies, hydraulic and sediment transport modeling, geomorphic feasibility of dam lowering, sediment management for fisheries enhancement, hydrology and wetlands mitigation design, response to episodic events such as post-fire sediment, reservoir dam strengthening, hydrologic spillway design, diversion dam floodplain mapping, and dam removal, including habitat and channel restoration.

Balance has worked in the Carmel River corridor for 28 years on a spectrum of high-water and sediment issues, including a range of hydrologic, hydraulic, and scour modeling on the Carmel River. Projects have included evaluating post-fire channel sedimentation effects of the 1977, 2008, and 2016 fires on sediment supply and channel behavior; assessing various alternatives for decommissioning San Clemente Dam, including predicting the behavior and attenuation of the post-removal sediment pulse on channel in the lower Carmel, fish passage step-pool design for the Carmel River reroute, lower Carmel floodplain restoration, feasibility of passive managed aquifer recharge, programmatic biological assessment and initial study for projects in the Carmel River Lagoon area and Carmel River Lagoon restoration and management plan; to most recently, the IFIM analysis of flow in the Carmel River, designed to identify how much of the river is usable by steelhead at various life stages, a study that included 80 cross-sections along 20 miles of river. Shawn Chartrand, the AECOM Team's lead for Fluvial Geomorphology and Sediment Transport, has a close working relationship with leading academics in the field at the University of British Columbia who are on the forefront of sediment transport analysis. Balance has an existing contractual relationship with the University, and will integrate University researchers into the AECOM Team for sediment transport modeling.

HDR

Founded in 1917, HDR Engineering, Inc. (HDR) is a multidisciplinary architectural, engineering, and environmental firm. HDR has been delivering technically superior solutions to meet clients' needs and to manage natural resources since the company began. HDR's staff represents nearly 10,000 employee-owners and more than 100 engineering and scientific disciplines in 225 offices globally, sharing a strong connection of culture and a common design philosophy and intent among their many areas of focus. HDR's national experts and practice leaders provide senior technical oversight to each project, and bring decades of experience and knowledge from some of the most challenging projects in the nation.

HDR has been providing professional services for Cal-Am at Los Padres Dam since 2008; more recently for the MPWMD. Team member Mike Garello is currently managing the sister study to the LPD & Reservoir Study, and plays an active role in the ongoing coordination, evaluation, and implementation of water-related infrastructure and fish passage technologies at Los Padres Dam,

alongside the MPWMD, Cal-Am, CDFW, and NMFS. Given HDR's long history and current understanding of water supply operations, the existing facility, and the environmental resources in the Carmel River and at the project location, HDR's engineers bring a high level of synergy and efficiency to this new study.

Mike Garello at the Little Yosemite reach of Alameda Creek during the Calaveras Dam Replacement Project

In addition to fish passage expertise, HDR has a world class Dams and Hydraulic Structures Practice based out of Denver, Colorado and Folsom, California. For this project, HDR offers resources to provide cost estimating for heavy structural, heavy civil, and hydraulic structures experience to support the development and assessment of alternatives related to changes in reservoir maintenance, operations, and/or replacement or removal of the dam itself. This technical and cost-estimating support will improve the efficiency and accuracy of the information generated for the purposes of alternatives comparison and evaluation performed by the project team and the TRC.

Stillwater Sciences (WBE/SB)

Stillwater Sciences (Stillwater) is a 65-person environmental consulting firm with offices in Berkeley, Davis, Arcata, Morro Bay, and Los Angeles, California, and Portland, Oregon. Stillwater was founded in 1996 as an S-Corporation to help clients solve environmental management problems by providing a strong scientific basis for resource evaluation and decision-making. For 20 years, Stillwater has been specializing in science-based, technical approaches to environmental issues. Stillwater's geomorphologists, engineers, biologists, and water quality scientists work together to develop practical, scientifically supported, and consensus-based solutions to complicated watershed management questions.

Stillwater Sciences

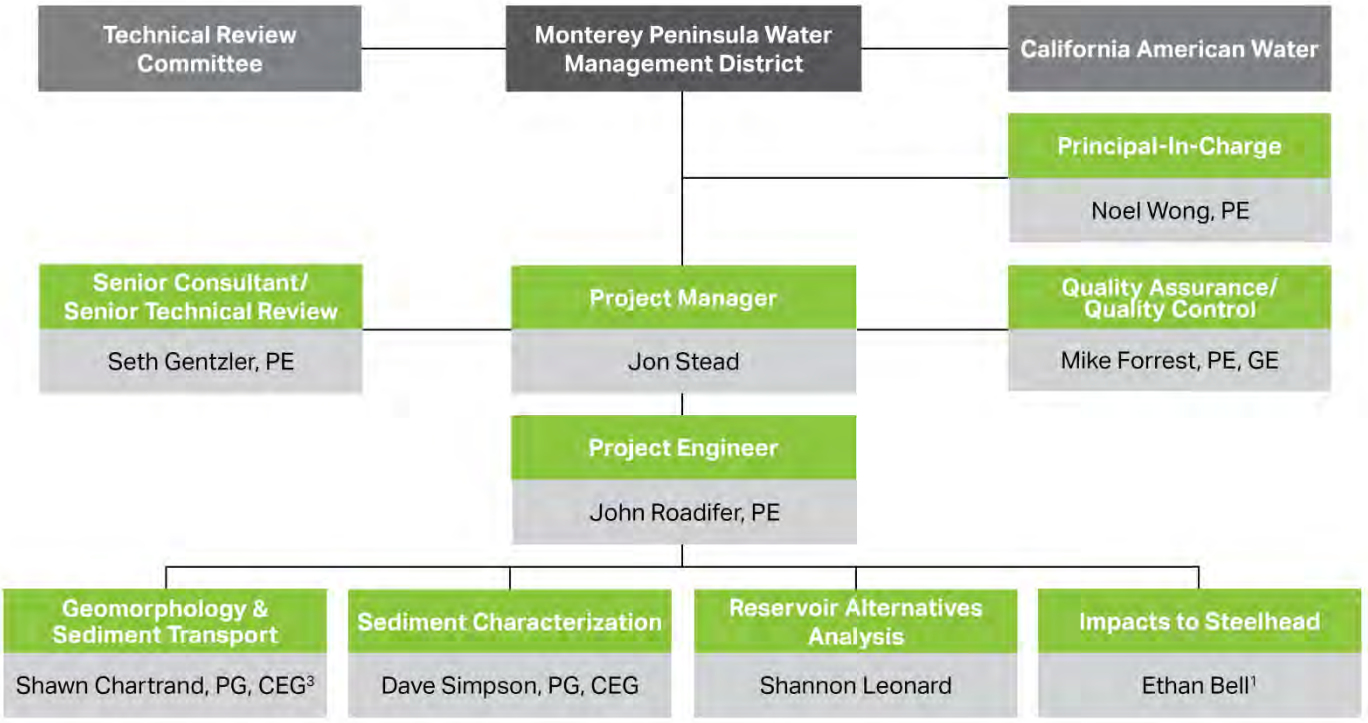
Stillwater has built a successful practice in integrating sediment transport modeling and other predictive evaluations of sediment management and dam removal with the potential biological and ecological impacts of these large-scale restoration projects. Stillwater has experience on steelhead projects throughout California, including in the Carmel River Watershed, and has developed methods for evaluating the effects of dam removal or other disturbances to geomorphic processes on steelhead and their habitat. Stillwater analyzed the potential impacts of dam removal on steelhead and aquatic biota on Klamath River, the Ventura River, and the Sandy River. Because of Stillwater's reputation for objective work and the respect staff has gained from state and federal agencies, non-governmental organizations, and industry, the firm has a proven record of effectively bringing stakeholder groups to consensus on the basis of objective, credible scientific data and analysis.

Stillwater has a long history of supporting sediment management and water diversion projects with great success. Stillwater has worked collaboratively or individually on nearly 40 dam removal or dam sediment management projects throughout the U.S.

Organizational Chart

We have designed the AECOM Team's organization to be adaptable and responsive, providing maximum efficiency, while meetings the needs of the project and client. Key organizational benefits are discussed below.

Exhibit 4.1 Organizational Chart



Technical Resources

Fish Passage
Mike Garello, PE2
Jon Stead

Fish Biology
Cynthia LeDoux-Bloom, PhD*
Katie McLean
Jon Stead

Landscape Architecture
George Strnad, RLA
Keith Wright

Structural and Geotechnical Engineering
Mourad Attalla, PhD, PE, SE
Sam Gambino, PE, GE

Reservoir Expansion
Madeleine Bray
John Roadifer, PE
Steve Tough, PE

Cost Estimation
Nick Gooding, PE2
Steve McNeely, PE
John Roadifer, PE
Roy Watts

Geology
Ben Kozlowicz, PG, CEG
Dave Simpson, PG, CEG

Sediment Removal Management
John Roadifer, PE

Geomorphology, Hydrology, Hydraulics & Sediment Transport
Edward Ballman, PE3
Carles Ferrer-Boix, PhD4
Marwan Hassan, PhD4
Barry Hecht, CHG, CEG3
Shannon Leonard
Jonathan Owens3
Eric Reidner, PE, QSP/D3

DREAM Modeling
Yantao Cui, PhD1

Legend

1 Stillwater Sciences
2 HDR
3 Balance Hydrologics
4 University of British Columbia

* Certified Fisheries Biologist

Establishes Clear Accountability. The team's project manager, Jon Stead, will be the single point of contact and responsibility for the AECOM Team. He will be held accountable to the MPWMD's project manager for all aspects of the project's execution. It is his responsibility to set goals and priorities with the District, advise on how to accomplish these goals, and ensure performance and delivery according to plan. Jon has previously demonstrated that he has the attention to detail, appropriate tools, and communication skills required to manage scope, schedule, and budget for large projects that include multiple subcontractors. Jon will work closely with John Roadifer, PE, our Project Engineer, and all discipline leads shown in the boxes on our organizational chart to internally manage all aspects of the study.

Employs a Focused Project Approach. The AECOM organizational chart is centered on key focus areas associated with the project. Each lead manager will oversee their technical teams and work collaboratively to develop their portion of each deliverable. Jon and the other key leads will meet regularly to ensure consistency and efficiency in development of all project reports and materials. Lead managers will ensure there is no duplication of effort, but will use the necessary resources, policies, procedures, and management support to successfully complete the project.

Provides Executive Oversight and Support. Our principal-in-charge will have executive oversight of the team, and will ensure that they have all resources necessary to effectively complete the work. Regular communication between Jon and Noel will help ensure that the team is consistently aligned with MPWMD's needs. The MPWMD will have direct access to the principal-in-charge to address any needs and issues, thereby providing reassurance that AECOM's management is focused on performance and delivery of the project.

Our Senior Consultant/Senior Technical Reviewer, Seth Gentzler, PE, will frequently participate in team discussions, technical review, and critical decisions so that the entire team can benefit from Seth's depth of experience with dam removal and reservoir alternatives analysis projects. Additionally, as managing supervisor of several staff members on the organizational chart, Seth will have the ability to balance resources so that the project has the necessary resources to stay on schedule.

Mike Forrest, PE, our proposed Quality Assurance/Quality Control officer for the project, will oversee implementation of AECOM's Quality Management System and conduct key technical reviews.

Jon Stead and Seth Gentzler examining sediment deposited behind the Lagunita Diversion Dam

05
Litigation History

EXHIBIT 2-A

05 Litigation History

AECOM Technical Services, Inc. – Litigation History

AECOM Technical Services, Inc. (AECOM) is a large design, engineering, planning, and related professional services company that executes thousands of projects annually. As with any large services company, from time to time, AECOM is involved in claims and litigation, many of which involve third-party personal injury and property damage claims. However, we strive to avoid litigation and have a risk management program in place that includes early recognition of situations that might give rise to a claim, open lines of communication and proactive dispute resolution.

Upon knowledge and belief formed after reasonable inquiry, AECOM has been involved in the following disclosed litigation over the past five (5) years related to the performance of professional engineering, design, and construction services in the U.S. No judgments have been entered against AECOM, and none of our current claims could reasonably be expected to have a material adverse effect on AECOM or its ability to perform under the contract contemplated by the proposal. If you require additional information, please contact Armond Tatevossian, Region Chief Counsel, DCS Americas, at 213-996-2451.

Claimant Name & Case Number	Date Filed & Venue	Status	Claim Description
The Association of Apartment Owners of the Hawaii Kai Peninsula and Board of Directors of the Association of Apartment Owners of the Hawaii Kai Peninsula, etc., v. Peninsula Hawaii Kai, LLC et al., including AECOM Technology Corporation Case No. 101175108JHC	Filed 12/28/2015 Circuit Court of the First Circuit, State of Hawaii	Pending	Complaint against multiple parties alleging negligence and breach of implied warranty in connection with the construction of a condominium project known as the Hawaii Kai Peninsula.
The Connecticut Light & Power Company dba Eversource Energy v. Joken Development Corporation, et al., incl. AECOM Technical Services, Inc. Case No. UWY-CV-15-6027719-S	Filed July 1, 2015 Superior Court of Connecticut Judicial District at Waterbury	Pending	Claim for damages to electrical facilities related to the contractor's (Joken) excavation services. AECOM is tendering its defense to the contractor.
Trumbull Corporation v. CSX Transportation and AECOM Technical Services, Inc. Case No. GD 14-012294	Filed Dec.19, 2014 Court of Common Pleas of Allegheny County, PA	Pending	Claim for property damage allegedly due to AECOM's failure to monitor or otherwise control the vertical clearance around the bridge project.

Claimant Name & Case Number	Date Filed & Venue	Status	Claim Description
City of Rochester, NH v. Marcel A. Payeur, et al, incl. AECOM Technical Services, Inc. Case No. 219-2012-CV-00550	Filed April 14, 2014 Strafford Superior Court, NH	Pending	Complaint filed by the City of Rochester alleging inadequate supervision of construction of a Water Storage Tank. Construction took place in 1985.
Valley Truck Service, Inc. v. Textron, Inc., et al., incl. AECOM Technical Services, Inc. Case No. 1:14-cv-00034-MOC-DLH	Filed Feb. 14, 2014 United States District Court Western District of North Carolina, Asheville Division	Settled October 2014	Complaint against multiple parties alleging nuisance, negligence and injunctive relief, among others, related to soil and groundwater contamination.
The Charter County of Wayne, etc. and the Charter County of Wayne Building Authority v. AECOM Services of Michigan, Inc. et al., including AECOM Technical Services, Inc. Case No. 13-014183-CK	Filed October 31, 2013 Wayne County Circuit Court, Michigan	Pending	Complaint against multiple parties alleging cost overruns, construction defects, and errors and omissions.
Time Warner Cable v. AECOM Management Services Corp, AECOM Technology Corporation, Herzog Contracting Corporation, et al. Case No. 30-2013-DD-00676796-CU-PO-CJC	Filed Sept. 20, 2013 Orange County Superior Court	Settled June 2014	Claim for property damage to a fiber optic cable and utility vault during the installation of a sidewalk.
Waterstone Environmental Hydrology Engineering, Inc. v. Earth Tech, Inc., et al. Case No. 2013CV033347	Filed July 29, 2013 District Court, City and County of Denver, Colorado	Settled February 2015	Complaint filed for Breach of Contract based on alleged promises made by Earth Tech to use Waterstone's services as a sub-consultant. No formal agreement was ever entered into.
Rothman Engineering, Inc. v. AECOM Technical Services, Inc., et al. Case No. NC58899	Filed June 10, 2013 Superior Court of California, County of Los Angeles-South District	Settled March 2014	Complaint filed by a subcontractor alleging breach of contract related to professional services rendered in connection with the POLB Middle Harbor Terminal Redevelopment, Operations and Maintenance Building Project.
City of Sarasota v. AECOM Technical Services, Inc., et al. Case Number 2013-CA-001728 NC	Filed Feb. 25, 2013 Circuit Court of the Twelfth Judicial Circuit for Sarasota County, Florida	Pending	Complaint for damages in connection with the design and construction of sewage lift station and sewer line.

Claimant Name & Case Number	Date Filed & Venue	Status	Claim Description
Taos County, New Mexico v. DMJM H&N, Inc. et al. (incl. AECOM Technical Services, Inc.) Case Number 2012-493	Filed Dec.11, 2012 Eighth Judicial District Court, Taos, New Mexico	Pending	Complaint against multiple parties alleging breach of contract and damages associated with alleged deficiencies in the design and construction of a public building.
Metropolitan Domestic Water Improvement District v Pima County and AECOM Technology Corporation Case No. C20127018	Filed November 9, 2012, Superior Court of Arizona	Settled March 2014	Complaint filed by Metropolitan Domestic Water Improvement District against County of Pima and AECOM alleging breach of contract, negligence and breach of implied warranty in connection with a roadway improvement project.
United States of America for the use and benefit of CPM Development Corporation dba ICON Materials v. AECOM Technical Services, Inc. and Federal Insurance Company Case No. CV-12-590-LRS	Filed Nov. 5, 2012 United States District Court, Eastern District of Washington	Dismissed with no contribution from AECOM January 2014	Subcontractor alleged certain changes, extra work and/or delays on the Project giving rise to additional costs or time under the Subcontract; ATS position is that all such issues are the responsibility of Owner.
TYCO Healthcare Group, LP dba Covidien v. AECOM Technical Services, Inc. Case Number 1:12-cv-11420-PBS	Filed August 1, 2012 United States District Court – District of Massachusetts	Settled Dec. 2015	Complaint alleging breach of contract and negligence related to a site decommissioning project. Suit was filed following ATS's suit for non-payment.

**The above table was comprised from identifiable and retrievable corporate records for AECOM Technical Services, Inc. and excludes (i) claims involving personal injury and property damage claims not otherwise connected with the claims identified, (ii) employment-related matters, and (iii) subsidiaries and affiliates of AECOM Technical Services, Inc.*

AECOM Technical Services, Inc. – Contract Terminations History (5 years)

AECOM Technical Services, Inc. ("AECOM") performs thousands of contracts each year. From time to time, occasions arise when AECOM does not complete the performance of an awarded contract. These situations include (i) where a client terminates the contract for its convenience; e.g. where the client is unable to secure continued funding for the underlying project and, as a result, terminates the associated contract, (ii) where AECOM ceases performance under the contract in accordance with the applicable terms of the contract in response to the client's nonpayment or other breach, and the contract is ultimately terminated; and (iii) where one of the contracting parties terminated the contract for default.

Upon knowledge and belief formed after reasonable inquiry, within the past five (5) years, AECOM (i) has not failed to complete a contract where the other party to such contract was not in breach unless the contract afforded AECOM that right and (ii) AECOM has not had a contract terminated by a client wherein that termination was ultimately determined to be other than for convenience, except in the following instances:

1. In May 2012, AECOM received a letter of termination from its client Covidien, Inc., relating to a remediation project being performed on a Time & Materials basis. At the time this letter was received, AECOM was awaiting authorization to continue site activities as the project budget had been exhausted. Covidien refused to issue additional authorizations and refused to make payment on overdue amounts within the prior Covidien-issued authorization. AECOM was subsequently forced to file a claim in the Massachusetts state court. Covidien had the matter removed to Federal Court where the claims were consolidated. AECOM disputed the validity of the termination. This matter has been settled with payment to AECOM.
2. In November of 2012, AECOM received a notice from the City of Sarasota, Florida, notifying AECOM that it has terminated its contract with AECOM for the design of a sewer lift station for default. AECOM disagrees with the termination. The City of Sarasota ultimately filed suit. AECOM is vigorously defending the City's claims and the matter remains pending.
3. In March of 2016, AECOM received a Notice of Termination for Cause from Atlantic City Electric, a PHI Company, on a Substation Project. AECOM disagrees with the purported basis for the notice and is contesting this notice.
4. In August 2016, AECOM received a letter from the Redevelopment Authority for the City of Milwaukee asserting that the Authority considered its contract with AECOM terminated for cause. AECOM believes the termination is unjustified and ignores relevant Project history. AECOM is contesting the termination, and will actively work with the client to address the client's underlying concerns.

Los Padres Reservoir, December 2016

06
Technical Aspects

EXHIBIT 2-A

06 Technical Aspects

Project Approach

Our approach to the Los Padres Dam and Reservoir Alternatives and Sediment Management Study (the LPD & Reservoir Study) will be driven by our understanding of the project requirements, beginning with our commitment to the MPWMD, Cal-Am, and the entire TRC. Our Team has unique experience with comparable projects, and a thorough understanding of the needs and challenges of this project. This experience will allow us to efficiently support MPWMD in making the LPD & Reservoir Study a success, within the proposed schedule and budget.

Searsville Dam and Reservoir

A number of major California reservoir alternatives studies have been undertaken in recent years, many of them involving issues related to sediment accumulation, sediment effects on downstream resources, fisheries, and fish habitat effects, including fish passage. The AECOM Team led many of these studies, and will bring that experience to the current Study. At the same time, we recognize that the Los Padres Dam (LPD) and Carmel River Watershed is unique. For the current Study, the AECOM Team will investigate:

1. Alternatives and methods to manage existing and future sediment deposits in the reservoir to maintain or augment surface storage capacity;
2. Benefits and impacts of sediment management alternatives to steelhead passage, water quality, water supply, steelhead spawning habitat, flooding, traffic, and noise;
3. Alternatives and methods for dam removal, and the associated benefits and impacts; and
4. Alternatives and methods for a dam raise and or/reservoir expansion, and the associated benefits and impacts.

There is some overlap among these four areas of investigation stated in the RFP, and our ability to recognize these overlaps and approach each analysis efficiently will be of benefit to the process.

The intent of the Study is to determine the feasibility of managing existing and future sediment deposits at the site, enlarging reservoir storage, and removing LPD. The AECOM Team of fishery biologists, scientists, and engineers understand the importance of these considerations in determining the future of LPD—be it dam removal, reservoir expansion, and/or provision of permanent fish passage; and are confident that we can identify the most appropriate and practical suite of solutions for evaluation. Details of our approach to delivering a successful project are presented below, in direct response to the RFP. Tasks described below include the following:

– Task 1: Feasibility Study Preparation

- Task 1-1 Compile Background Information
- Task 1-2 Prepare Evaluation Criteria
- Task 1-3 Identify Critical Data Gaps
- Task 1-4 TRC Meeting No. 1
- Optional Task 1-5 Attend Sediment Disposal Visit

– Task 2 Sediment Management Options
- Task 2-1 Obtain and Analyze Reservoir Sediment Samples
- Task 2-2 Describe Alternatives
- Task 2-3 Evaluate Geomorphic Effects of Changes in Sediment Load
- Optional Task 2-4 Drilling Investigation Upstream of Reservoir

– Task 3 Evaluate Effects on Steelhead
- Task 3-1 Increases in Sediment Transport
- Task 3-2 No Increase in Sediment Transport
- Task 3-3 Incorporate Data from Alternative Water Supply Options

– Task 4 Identify Feasible Alternatives
- Task 4-1 TRC Meeting No. 2
- Task 4-2 Alternatives Development
- Task 4-3 TRC Meeting No. 3

– Task 5 Final Report
- Task 5-1 Prepare Draft and Final Report
- Optional Task 5-2 TRC Meeting No. 4
- Optional Task 5-3 Additional Support to Address Long-Term Fate of LPD
- Optional Task 5-4 Project Funding

– Task 6 Project Management
- Task 6-1 Project Administration
- Task 6-2 Meetings and Conference Calls

Task 1: Feasibility Study Preparation

Task 1 is focused on the technical analyses and engineering required for concept development. The AECOM Team will compile and review available background information to prepare for a concept development workshop with the TRC, and will prepare workshop materials, including preliminary thoughts on alternative concepts based on extensive experience with similar projects, evaluation criteria, and an evaluation process. Background review and opportunities and constraints associated with the specifics of the dam, site topography, and sediment will be identified. The information will be compiled into a Technical Memorandum (TM); will be provided to the TRC for review prior to the workshop; and will be presented and discussed at the workshop. The review will allow TRC members to become familiar with the operational, physical, hydrologic, and biological setting of the LPD and potential effects to the Carmel River; the range of options that could be considered; and draft criteria to evaluate concepts. This information will be important for identifying concepts and alternatives that are compatible with hydrological and physical constraints, and that meet study objectives. This background information will be used and added to as necessary throughout all tasks of the Study, and will be documented in the Final Report.

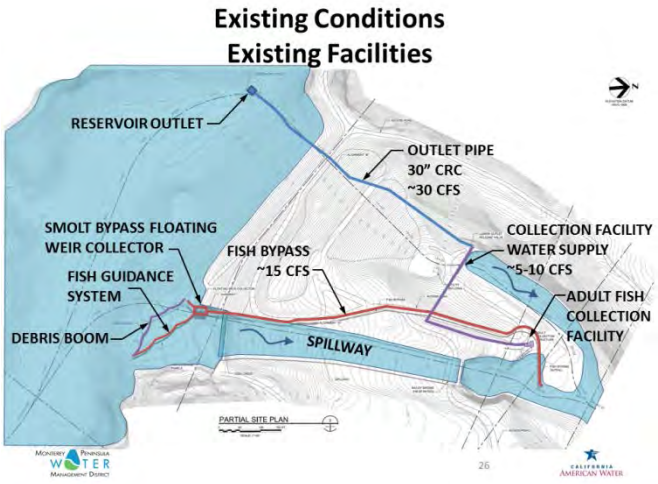
Deliverables, Schedule, and Assumptions

The deliverable for Task 1 is a TM summarizing work completed under Tasks 1-1, 1-2, and 1-3. The draft TM will be provided for TRC review prior to TRC Meeting No. 1, and will be presented at TRC Meeting No. 1. The TM will be revised based on comments or input received from the TRC.

Task 1-1 Compile Background Information

The AECOM Team will draw from our experience on other projects in the Carmel River Watershed (e.g., Carmel River Reroute and San Clemente Dam Removal), at LPD (e.g., LPD Fish Passage Feasibility Study, LPD Emergency Action Plan, and LPD Fish Passage Assessment, Design, and Implementation), and on other similar projects (e.g., Searsville Dam and Reservoir Alternatives Study) to

efficiently compile background information and identify critical data gaps.



Available background information will be compiled to address physical considerations and setting for consideration during development of feasible dam removal and sediment management options. Existing features of interest include the dam, reservoir, facility operations, river channel, hydrology, and steelhead biology, as summarized in more detail below:

1. Existing inflow/outflow and reservoir operations summary, with a brief narrative on operations in a(n):
    a. Average water year
    b. Wet water year
    c. Single critically dry-water year, and
    d. Multiple dry-water-year scenarios (up to 4 years with dry or critically dry conditions)
2. Biological design criteria and data summary that includes:
    a. Water quality data in the reservoir and downstream of LPD, including temperature, turbidity, dissolved oxygen, and other constituents affecting steelhead
    b. Water quality goals
3. Geomorphic data
    a. Past geomorphic analyses of the Carmel River
    b. Active channel data, including particle-size distributions, thalweg and cross-section surveys, bedload and suspended-load data, sediment transport and stream power relationships
    c. Flood maps, including identification of frequently flooded areas
    d. Aerial photographs, including assessments of streamside vegetation
    e. Structural protection along the river
    f. Reservoir data
    g. Historic and existing reservoir bathymetric data
    h. Studies of fire effects
    i. Sedimentation rates and reservoir trap efficiency
    j. Previous dredging studies
    k. Steelhead studies on behavior through reservoirs
4. Water rights summary with description of related State Water Resources Control Board (SWRCB) orders
5. Summary of available dam safety data and DSOD inspection reports
6. Summary of the 2013 Los Padres Dam Sediment Removal Feasibility Study report
7. Costs (e.g., on a per acre-foot or other basis of comparison) from other relevant dam decommissioning, dredging, expansion projects, and sediment management projects

Deliverables, Schedule, and Assumptions

An overview of Task 1-1 will be included in the Task 1 TM and provided for TRC review prior to TRC Meeting No. 1.

For this subtask, AECOM assumes that information requested from or recommended for inclusion by the TRC not otherwise readily available will be provided by the TRC in a timely manner that does not affect the task schedule. AECOM also assumes that, for all tasks, any Carmel River Basin Hydrologic Model (CRBHM) or Carmel River IFIM

model runs or reporting would be completed by others, or would require additional effort for the AECOM Team.

Task 1-2 Prepare Evaluation Criteria

	Criteria / Category Weight	US ALT 1		US ALT 2		US ALT 3		US ALT 4		St Dev of Alt Prods
		Score 0-10	Weighted Score	Score 0-10	Weighted Score	Score 0-10	Weighted Score	Score 0-10	Weighted Score	
Water Supply Sustainability	10									
Criterion 1	7	8	56	5	35	2	14	4	28	15.2
Criterion 2	2	4	28	8	56	4	28	9	63	15.9
Criterion 3	8	8	56	3	21	2	14	6	42	16.7
Criterion 4...	9	9	63	3	21	8	56	6	42	16.0
Total Score			203		133		112		175	
Normalized Score			33%		21%		18%		28%	
Rank			1		3		4		2	

Example alternatives evaluation matrix

The AECOM Team will develop draft evaluation criteria, beginning with the evaluation criteria from the RFP included in the attached Appendix A – Alternatives Evaluation Process and Criteria.

These criteria may be modified or refined, and the criteria will include water rights, technical, biological, and economic feasibility.

We will draw on the AECOM Team's extensive experience developing evaluation criteria for other dam and reservoir alternative studies, and also consider the specific needs of the Los Padres Dam and Reservoir, and the Carmel River, to help the TRC identify the most appropriate suite of criteria for the proposed study.

The criteria will cover "fatal flaws" that would preclude a concept from advancing further, and a time period will be allotted for comparing alternatives.

If an analysis is available of climate change effects on long-term water availability at LPD, at least the mean of the ensemble of outlooks will be included as one of the evaluation criteria.[4]

[4] MPWMD is developing a linked surface-groundwater model (the CRBHM) based on GSFLOW and MODFLOW. The U.S. Bureau of Reclamation will be contracting with the U.S. Geological Survey in late 2016 to downscale a Global Climate Change model to the Carmel River watershed. Several future scenarios will be evaluated out to year 2099, and results will be incorporated by others into the CRBHM to determine long-term water availability in the watershed.

Juvenile steelhead

Deliverables, Schedule, and Assumptions

The work completed under Task 1-2 will be summarized in the Task 1 TM, and provided for TRC review prior to TRC Meeting No. 1.

Task 1-3 Identify Critical Data Gaps

The AECOM Team will identify missing or additional desired information, and appropriate steps to acquire the necessary material. The process to address any informational gaps will be identified based on the specifics of the necessary information, and a plan to address the informational needs will be formulated for TRC review.

Deliverables, Schedule, and Assumptions

The deliverables for this task include a table identifying missing data or information, to be included in the Task 1 TM, provided prior to TRC Meeting No. 1, and reviewed at the meeting. The plan for acquiring the missing data or information will be added to the table following the meeting.

AECOM assumes that any work scope not specifically identified in this proposal needed to fill data gaps would require additional effort or would be completed by others. AECOM would provide a proposal for acquiring additional data or information, if necessary.

Task 1-4 TRC Meeting No. 1

The TRC and AECOM Team will meet to discuss project goals and expected outcomes, background information, evaluation criteria, and critical data gaps. Information developed under Task 1 will be packaged and distributed to the TRC in advance of the meeting. An update on the sediment characterization field investigation and preliminary results will be presented at the meeting. The AECOM Team will send at least two Team members to the meeting to participate in and assist with conducting the meeting. They will be prepared to facilitate web meeting and conference call participation for participants unable to attend in person, and will record and distribute draft meeting notes for review. In addition to physical considerations (see definition in Task 1-1 description), evaluation criteria to estimate each alternative's expected level of success (evaluation criteria are similar to physical considerations, but are specific and quantified), discussion of the preliminary list of alternatives to be developed under subsequent tasks, and the following, additional considerations will be included in the TRC discussion:

- Additional dam and reservoir considerations include the topography and habitat around it, access to and from the site, and ancillary structures.
- Additional operational considerations include any effects on dam operation, both during normal operations and during any construction activity that may take place in the future.
- Biological considerations include potential temporary impacts to steelhead as a result of activities at the dam and reservoir.
- A discussion of the timescale over which alternatives should be evaluated; for example, how to define "short term" and "long term."

Deliverables, Schedule, and Assumptions

Deliverables for this task include:

- Distribution of the draft Task 1 TM summarizing background information, evaluation criteria, and data gaps, and the draft sediment characterization TM (Task 2-1), to be distributed to the TRC 3 to 6 weeks prior to the meeting.
- Workshop agenda, to be distributed to the TRC prior to the meeting.
- Draft meeting notes, to be provided within 2 weeks of completion of the meeting.

Upstream end of Los Padres Reservoir, December 2016

For all TRC Meetings, AECOM assumes that the MPWMD Ryan Ranch office, the Cal-Am Pacific Grove office, or other agreed-on location will be suitable for a team meeting, with access to web broadcast, presentation screen, and teleconference facilities for TRC members unable to attend in person. Should the TRC prefer to meet in the San Francisco Bay Area, AECOM will host TRC meetings at our 300 Lakeside Drive office beside Lake Merritt in Oakland. A TRC member will be selected as a facilitator prior to the meeting to assure the workshop is conducted in an efficient manner.

Optional Task 1-5 Attend Sediment Disposal Site Visit

The TRC is expected to make a field visit to sediment disposal sites proposed in the 2013

Sediment Removal Feasibility Study and evaluate their suitability for sediment disposal. The sites are located (a) in the upstream watershed beyond the southwestern end of the reservoir in Cal-Am's property; and (b) on a flat terrace immediately downstream of LPD. The alternatives contained in the 2013 report have not been discussed or visited in a forum such as the one set up by the policy and technical advisory committees between 2000 and 2012 to evaluate alternatives and designs for the removal of San Clemente Dam and construction of the rerouted Carmel River. Although dredging and placing material upstream of Los Padres Reservoir in one of the upper watershed side or box canyons may be physically possible, similar alternatives at the San Clemente Dam site were investigated in the field and through other studies, and were determined not to be suitable for off-channel storage, or were too expensive. As part of this optional task, an AECOM biologist knowledgeable in assessing biological effects and an AECOM engineer knowledgeable in sediment disposal construction, along with other professionals, if appropriate, will accompany the TRC during the site visit to discuss impacts and other considerations.

Task 2: Sediment Management Options

This task involves obtaining and analyzing sediment data in the reservoir (Task 2-1), developing initial alternative descriptions (Task 2-2), and evaluating the geomorphic effects of changes in sediment load (Task 2-3). These tasks are described below.

Task 2-1 Obtain and Analyze Reservoir Sediment Samples

This task includes development of a field investigation work plan, field investigation, laboratory analysis, and preparation of a TM. See also the related Optional Task 2-4, Drilling Investigation Upstream of Reservoir.

Field Investigation

All field investigation work will be completed under the guidance of a Field Work Plan that the AECOM Team will develop and review with MPWMD and Cal-Am prior to mobilizing to the field.

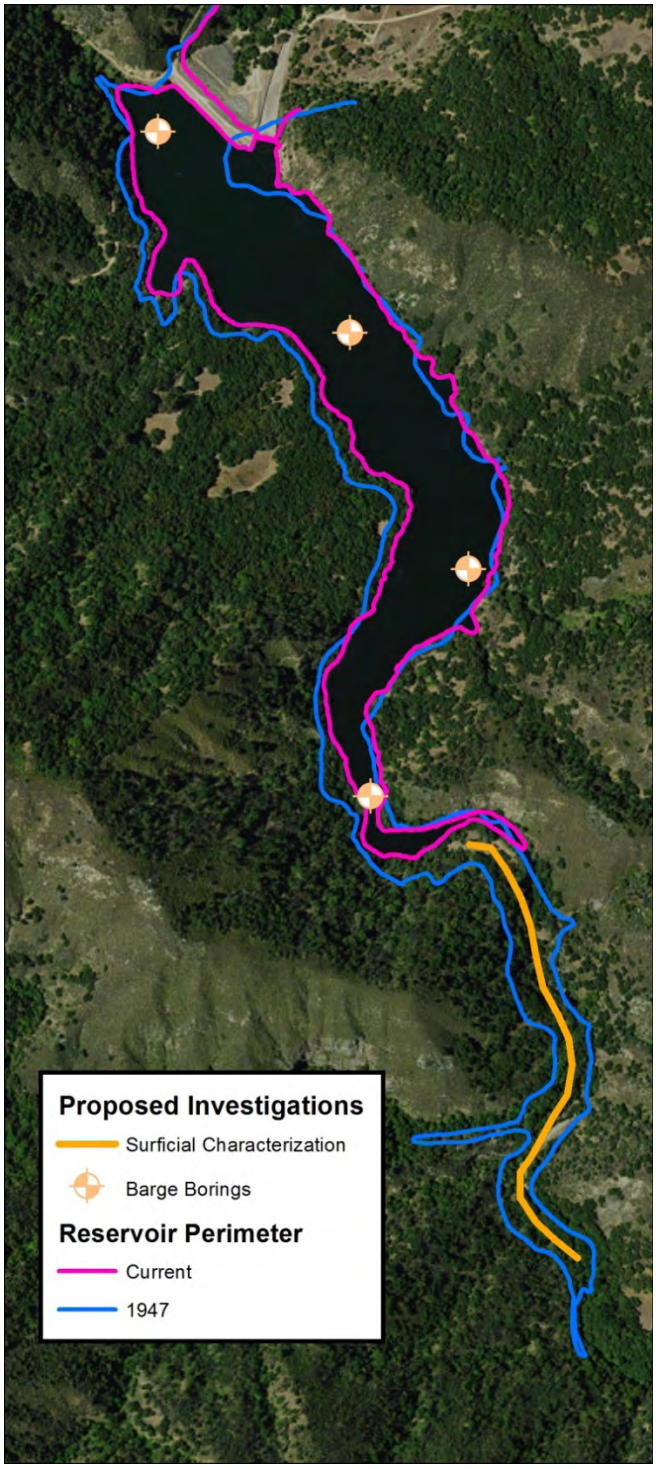


Figure 6.1 Reservoir Exploration Locations

This work plan will describe the intent of the investigations, the number, depth, and location for each boring, and the sample types and depths that are desired. This Field Work Plan will also include a Safety Plan that describes the potential health and safety hazards related to this study, and the actions and equipment that will be incorporated to eliminate them and allow the work to proceed without incident.

To evaluate the stratigraphy, sedimentology, and volume of alluvial sediment deposited behind Los Padres Dam and farther upstream, the AECOM Team will complete the following field investigation program developed after our geologist, hydrologist, and drilling subcontractor completed a site reconnaissance visit.

AECOM Team geologists and geomorphologists recently completed a field investigation to characterize sediment in Searsville Reservoir in 2016, and previously conducted a similar study for San Clemente Reservoir; our experience with investigation of reservoir sediments is one reason why we are the best choice for the proposed study.

We will use a combination of a barge-mounted drill rig in the reservoir, and hand sampling in sediment deposits upstream of the reservoir. Figure 6.1 shows four potential reservoir exploration locations; the locations of the upstream sediment hand-samples will depend on site access limitations at the time of the sampling, and have not been selected.

A small, portable barge with drilling rig will be launched to the reservoir from the ramp on the upstream side of the dam to sample up to four borings in the reservoir. AECOM will steam clean the barge, if necessary, and any equipment that comes into contact with the water and the watershed. During drilling, the barge will be maintained in place with four anchors placed in the reservoir. We anticipate up to 3 days of drilling from the barge. The reservoir borings will be drilled and sampled to the pre-dam surface, to depths between about 27 and 47 feet below the mudline, as indicated in the table below. We will use thin-walled tubes and thick-walled drive samplers to collect sufficient sediment samples, approximately every 5 feet throughout the borings, for both the sedimentologic evaluation, and also the chemical analysis described below. All drill cuttings will be removed from site and disposed at an appropriate landfill.

We will also use hand tools to sample the upstream alluvial deposits that have filled the channel above the reservoir. The upstream sediment sampling area will extend from the upstream edge of the reservoir to approximately elevation 1,060 feet (near the upstream extents of the reservoir when built), and will be accessed on foot from the upstream end of the reservoir. We anticipate that this field work will take 1 day. We will select the sampling locations in the field to provide samples that are representative of the sedimentology. The investigation will include some combination of photographic/visual documentation of sediment, pebble counts, and/or use of picks, shovels, hand augers, or other miscellaneous digging tools to excavate and collect samples. If samples are collected, we will perform initial particle size screening and weighing of portions of the samples in the field, followed by additional analysis in the office or laboratory. Field sieving, if used, will minimize the amount of sample material requiring transportation from the upstream area. If additional detail regarding sediment upstream of the current reservoir extent is desired, see Optional Task 2-4, which describes a potential drilling investigation upstream of the reservoir.

Table 6.2. Anticipated water depth and sediment thickness for proposed borings at Los Padres Reservoir

Boring	Water Depth at Full Reservoir (feet)	Sediment Thickness (feet)	Lake Bed Elevation (feet)
B-1	75	40	965
B-2	65	30	975
B-3	23	47	1,017
B-4	12	43	1,028
	Total	214	

Sediment Analysis

All samples from the reservoir drilling and any collected during upstream alluvial sediment sampling will be taken to a geotechnical testing laboratory for grain-size analysis (American Society for Testing and Materials [ASTM] D422) and plasticity evaluation (ASTM D4318). Because concentrations of nutrients, metals, and certain organic pollutants can be elevated in post-fire runoff, and the Marble Cone fire led to a significant amount of sedimentation in the reservoir, samples will also be collected for chemical analysis to understand potential effects to fish and other downstream uses. We propose to analyze approximately three samples per boring, corresponding to recent fire-related and pre-fire sediment deposition. Analyses will be performed for metals, organics, nutrients, hardness, and pH. Chemical analyses will be performed at Curtis & Tompkins Laboratories in Berkeley, California, or an equivalent laboratory.

The AECOM Team will create a longitudinal subsurface profile from the furthest upstream sampling location downstream to the dam, which will show the base of the sediment, describe the stratigraphy that is apparent from the samples, and show the reservoir surface. From this profile and the pre-dam channel topographic cross–section, we will confirm previous estimates of sediment volume that has accumulated below about elevation 1,060 feet. This cross section will also depict schematically the stratigraphy of the sediments that were encountered in the borings and upstream sampling locations.

Deliverables, Schedule, and Assumptions

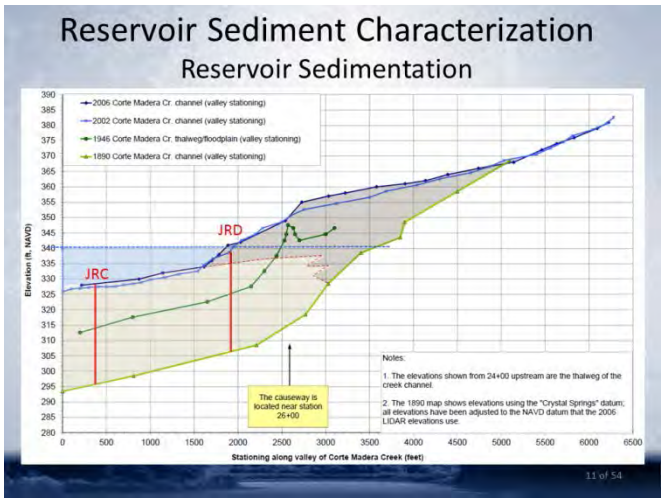
The deliverable for this task includes a Field Work Plan, and a TM that will include the following information:

- Logs of bores and/or test pits
- Grain-size analysis
- Particle-size distribution
- Sediment profile along pre-dam main-stem alignment
- Estimate and location of volumes of organics, fines, sands, gravel, and cobble

The draft sediment characterization TM will be provided to the TRC prior to Meeting No. 1. The draft TM will be prepared within 1 month of completion of the field investigation and receipt of laboratory test results, and finalized based on comments received from the TRC.

AECOM understands that Los Padres Reservoir is normally drawn down to its lowest level in the fall, and that the reservoir will not be drawn down to accommodate sediment sampling. Because the preferred Study schedule from the RFP includes initiation of the Study in February 2017, and completion of the sediment characterization field investigation prior to TRC Meeting No. 1, AECOM assumes that the sediment characterization work will be completed with a full reservoir. AECOM will

obtain environmental health drilling permits for the proposed investigation, and assumes either no other permits are required, or MPWMD or Cal-Am has—or will identify and obtain—any other permits required for the investigation, including any insurance requirements beyond those prescribed in our professional service contract for this project. We anticipate up to 3 days of drilling from the barge, and will adjust the boring locations and/or number of borings if unforeseen conditions or circumstances limit our ability to drill all four planned borings within the 3 days of planned drilling.



Example from previous project

Task 2-2 Describe Alternatives

The AECOM Team will describe reservoir alternatives and potential effects, both positive and negative, from each alternative. The discussion of each alternative will provide enough detail to adequately understand the location of a proposed alternative, potential extent of effects, complexity of the alternative, whether the alternative is short-term or long-term, and list the potential impacts and benefits. A qualitative characterization of costs will be developed (e.g., to help screen alternatives from relatively low-cost to extreme high-cost). The following four alternatives will be among those addressed, as well as a sediment management program:

The AECOM Team recently completed an alternatives analysis for Matilija Dam and Reservoir that included a similar, iterative process of narrowing a list of alternatives collaboratively with a TRC, and is currently implementing this process for the LPD Fish Passage Feasibility Study. Our experience with the process is one reason why we are the best choice for this study.

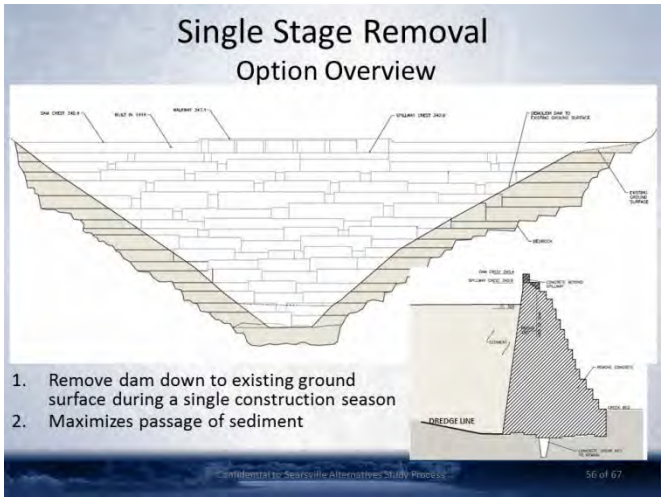
1. No Action (Alternative 1) may become the baseline for comparing alternatives. The AECOM Team will evaluate the effect of taking no action to manage the existing sediment accumulation in the reservoir or future sediment inputs. Considerations include:
    a. Effects on the downstream Behavioral Guidance System;
    b. Effects on steelhead migration over LPD and through Los Padres Reservoir;
    c. Effects to downstream channel geometry and habitat for steelhead;
    d. Compliance with SWRCB water rights permit conditions;
    e. Effects to the water supply for the Monterey Peninsula; and
    f. Dam safety.
2. Dam Removal (Alternative 2) includes sediment management and dam removal. Considerations include:
    a. Disposal or stabilization of existing reservoir sediment;
    b. Potential improvements to steelhead passage and restoration of river habitat in the reservoir area;
    c. Potential for public ownership of reservoir property;
    d. Expected response of active channel and potential impacts to downstream properties from resumption of the natural sediment load;

e. Reduction in dry season flow and the effect on steelhead habitat below LPD;

f. The effect to water rights and municipal water supply;

g. Impacts to local residents from construction traffic; and

h. For phased removal, dam safety assuming a Probable Maximum Flood (PMF) of 36,000 cfs.



Example from previous project

3. Dredge and Dispose (Alternative 3) includes two sub-alternatives that differ in the location where sediment is disposed, summarized in more detail below:

   a. Sub-alternative 3a: Dredge and place sediment on Cal-Am property downstream of LPD – The AECOM Team will review the 2013 MWH report and evaluate whether the downstream sediment disposal site can be expanded to accommodate dredging the reservoir to original capacity. Considerations include:

      i. maintaining dam safety;

      ii. DSOD requirements for disposal containment;

      iii. sustainability;

      iv. impacts to local residents from construction traffic;

      v. effects to downstream channel geometry and habitat for steelhead;

      vi. effects on steelhead passage over LPD and through the reservoir;

      vii. municipal and environmental benefits from an increased water supply.

   b. Sub-alternative 3b: Dredge and place sediment off the Cal-Am property – The AECOM Team will describe dredging the reservoir to original capacity and transporting some or all reservoir sediment to an off-site disposal area. With this alternative, existing public roads in Cachagua Valley would not be used (i.e., Nason Road, Cachagua Road, and Tassajara Road); however, the concept of building a new road or conveyor system on private property will be evaluated. This concept could be combined with placement of a portion of material on the Cal-Am property and the remainder off site. It is expected that many of the same considerations as Sub-alternative 3a would apply.

4. Storage Expansion (Alternative 4) includes four sub-alternatives that differ in the type and location of the upgraded dam or dams.

   a. Sub-alternative 4a: Expand reservoir storage expansion with a rubber dam – The AECOM Team will describe an expansion of surface storage of up to 9,000 acre-feet through the use of a rubber dam. Considerations include:

      i. maintaining dam safety and passage of the PMF[5];

[5] The current PMF of 36,000 cfs is based on Hydrometeorological Report (HMR) No. 36, which has been superseded by HMR Nos. 58 and 59. Revised PMF studies that we completed using HMR Nos. 58 and 59 often increase

ii. sustainability, especially of surface storage;

iii. local impacts from traffic and noise;

iv. effects to downstream channel geometry and habitat for steelhead;

v. effects on steelhead passage over a dam and through the reservoir;

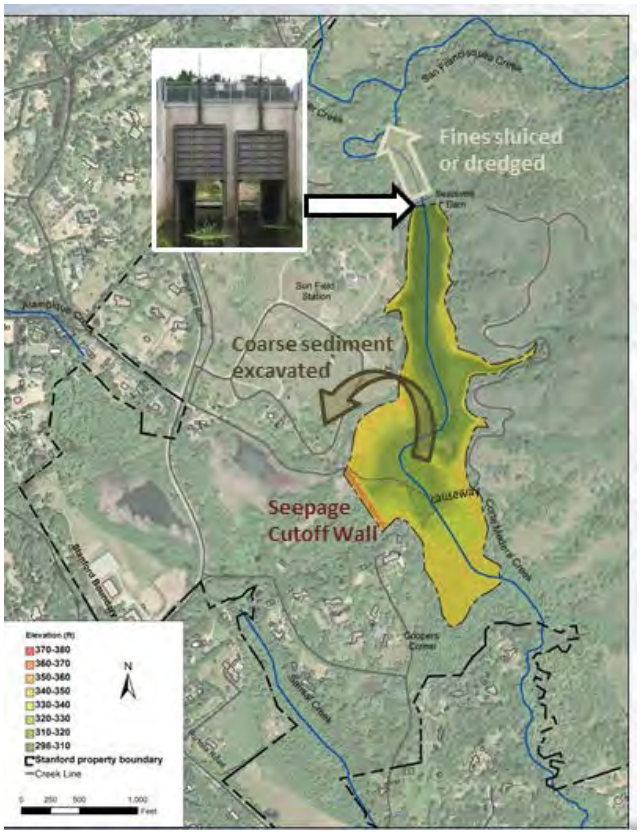
vi. water availability analysis (i.e., what effects would alternatives have on instream flows); and

vii. municipal and environmental benefits from an increased water supply.

b. Small dam raise at the existing dam – The AECOM Team will describe an expansion of surface storage of up to 9,000 acre-feet with a small dam raise at the existing dam. It is expected that many of the same considerations as Alternative 4a would apply.

c. Construction of a new dam downstream at the elevation of the existing dam (i.e., elev. = 1042.9 NGVD 88) that would inundate the existing dam – The AECOM Team will describe an expansion of surface storage, with a new dam located downstream. It is expected that many of the same considerations as those for Alternative 4a would apply.

d. Expand surface storage with a combination of two or three methods described above, an alternative that could provide an opportunity to use the original reservoir to continue capturing sediment, allowing a lower reservoir to trap less. It is expected that many of the same considerations as those for Alternative 4a would apply.



Example from previous project

Sediment Management Program

A Sediment Management Program would be relevant to alternatives involving retention or expansion of LPD, and would include evaluation of a long-term sediment management program. The evaluation will describe levels of sediment management that could result in either maintaining the existing surface storage capacity, or increasing surface storage over time up to the original reservoir capacity. In addition to reviewing options previously developed for dredging, the AECOM Team will determine if there are additional feasible alternatives for removing material from the reservoir and transporting it to a disposal site. The evaluation might consider periodic dredging and removal off site; periodic dredging and placement downstream of LPD, with the intent to allow the material to be captured and entrained by the river at high flows;

the PMF peak flow rate that the dam and spillway must safely pass. We anticipate that for any of the options under Alternative 4, DSOD would require an updated PMF study to be completed, as well as updated seismic and stability evaluations. The costs of performing these studies and evaluations will be included in the cost estimates for alternatives evaluation, but it is assumed these studies would be completed by others, or under a separate task order.

constructing a sediment capture area in the reservoir; sluicing fine sediment during high flows; or construction of a bypass tunnel for incoming sediment. Other combinations could be evaluated. Considerations include:

1. Maintaining dam safety;
2. DSOD requirements for placement of sediment downstream of the dam, a sediment capture area, sediment sluicing, and bypass tunnel;
3. Sustainability (how frequently would sediment management be required?);
4. Effect of fire/landslides in the watershed;
5. Beneficial effects to downstream aquatic habitat (e.g., from restoring a more natural sediment load);
6. Harmful effects on steelhead passage (e.g., from increased bedload and suspended load during high flows);
7. Effects to downstream channel geometry;
8. Effects on flood elevations; and
9. Municipal and environmental benefits from an increased water supply.

The AECOM Team recently evaluated a conceptual sediment management program for Stanford University's Searsville Reservoir, and will bring that experience to the proposed study.

Deliverables, Schedule, and Assumptions

The deliverable for this task is a TM describing alternatives and considerations, with preliminary sketches as appropriate. The draft TM will be provided prior to TRC Meeting No. 2, and will be revised based on comments received from the TRC, and additional alternatives development conducted under Task 4.

Dam safety considerations will be evaluated based on information contained in reports made available by Cal-Am, the DSOD, or the MPWMD.

The AECOM team assumes up to 15 alternatives and sub-alternatives will be described as part of Task 2-2.

Task 2-3 Evaluate Geomorphic Effects of Changes in Sediment Load

AECOM understands that despite previous sediment studies, there remains uncertainty regarding how much material can be transported through the channel without significant deposition that would lead to an adverse effect on 100-year flood elevations. Our analyses prior to removal of San Clemente Dam estimated bed elevation and flood elevation changes resulting from transport of the background sediment supply (as opposed to accumulated sediment in the reservoir) past the dam, and found potential changes to flood elevations varied depending on timeline and location (e.g., results showed 2 feet of 100-year water level increase in the upper-most reach after 51 years of sediment transport). Post-dam removal monitoring found deposited sediment depths of up to 1.2 meters in pools in the first 2 miles downstream of San Clemente Dam, but no site-specific studies have been completed to understand the effects of this pool filling on flooding.

For the LPD & Reservoir Study, the AECOM Team will evaluate the potential geomorphic effects from future sediment loading in the river downstream of LPD. Consideration will be given to the following sediment transport alternatives: 1) existing and future effects from the No Action Alternative; 2) existing and future effects from alternatives that do not involve passage of sediment (background or accumulated) downstream of LPD; and 3) effects on the active channel from increased sediment transport past LPD (background sediment and background plus accumulated sediment). The study results will include a description of the range of expected effects to the active channel. Preliminary results will inform alternative descriptions in Task 2-2.

Glines Canyon dam removal

To understand the flooding and steelhead effects of changes in sediment load, the AECOM Team proposes to estimate the natural range of sediment transport in the Carmel River (Subtask 2-3.1), and then simulate the geomorphic response to changes in sediment supply using a one-dimensional (1D) morphodynamic model (Subtask 2-3.2). Although a more conventional approach might be to perform 1D hydrodynamic and sediment transport modeling of the river channel and two-dimensional (2D) hydrodynamic and sediment transport modeling in the reservoir; these modeling techniques require more substantial input data and effort to set up, run, and validate, and they only result in a narrow selection of potential future conditions based on the specific scenarios modeled. Because the LPD & Reservoir Study is in its early stages (i.e., specific alternatives will be selected at the end of the proposed scope of work), and due to our understanding of MPWMD's budgetary constraints, we have proposed an approach that will meet the intent of the RFP, produce a statistical range of channel responses, and allow for evaluation of alternatives at a lesser cost.

Our intent is for the level of effort of any modeling to be commensurate with the level of design detail available for the project. Our proposed approach, developed by leading researchers in the field of geomorphology and sediment transport, is robust, physically based, and allows for the analysis of hundreds of sediment and hydrology scenario combinations. The 1D morphodynamic model will enable the TRC to understand the trajectory of potential effects for various alternatives without investing heavily in development of results that might not be applicable to future stages of the project. An early version of this model was used to validate HEC-RAS sediment transport modeling of San Francisquito Creek for the Searsville Alternatives Study.

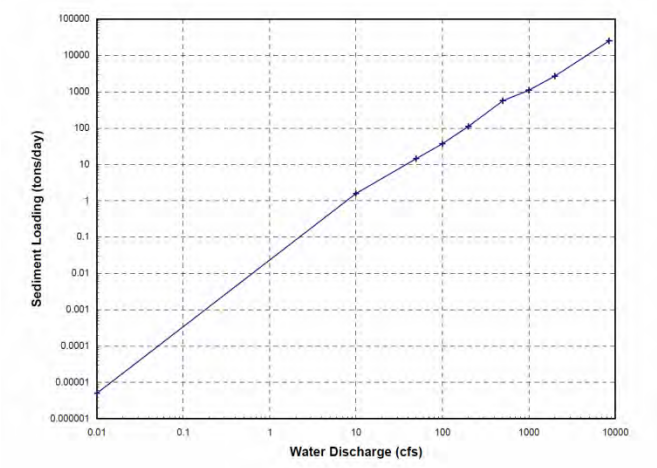
The AECOM Team has also proposed optional tasks that could provide additional detail or validation. If additional quantification is desired by the TRC, we have included an optional, and potentially alternative approach to Subtask 2-3.2 (Optional [Alternate] Subtask 2-3.2, DREAM-1, DREAM-2, and HEC-6 Hydrodynamic and Sediment Transport Modeling) that could replace the 1D morphodynamic model (and would include additional effort and cost). If additional validation is desired, we have included an optional subtask (Optional Subtask 2-3.3, Qualitative Evaluation of Geomorphic Response to Changes in Sediment Supply), a GIS analysis that could be used to validate the results of either 1D morphodynamic modeling (Subtask 2-3.2), or the results of hydrodynamic and sediment transport modeling (Optional [Alternate] Subtask 2-3.2). The AECOM Team is highly qualified to perform all of these analyses.

The following subsections describe the scope of Task 2-3 and subtasks, including Subtasks 2-3.1 and 2-3.2, Optional (Alternate) Subtask 2-3.2, and Optional Subtask 2-3.3.

Subtask 2-3.1 Estimate Natural Range of Sediment Transport in the Carmel River

The purpose of Subtask 2-3.1 is to develop sediment-rating curves for the Carmel River system from Los Padres Reservoir to the ocean. Bedload curves will be used as model input in Subtask 2-3.2, and suspended sediment curves will allow for qualitative discussion of the effects of changes to

suspended sediment supply. At a minimum, rating curves will be developed for the following reaches: 1) the inter-dam reach between LPD and the upstream end of the inundation zone of the former San Clemente Reservoir; 2) San Clemente Reservoir to Camp Stephani at RM 15.5; 3) Camp Stephani to the Narrows at RM 9.8; 4) from the Narrows to the Carmel River lagoon; and 5) from the lagoon to the ocean.



Example sediment rating curve from previous project

Using work previously completed for the Carmel River Reroute and San Clemente Dam Removal Project and other Carmel River efforts, the AECOM Team will prepare bedload and suspended-load sediment rating curves for reaches 2 through 5, from the former San Clemente Dam site to the Pacific Ocean. This part of the effort will be informed by available measurements of instantaneous bedload and suspended sediment transport, previously measured by the USGS and Balance Hydrologics.

We will also develop bedload and suspended-load sediment rating curves for Reach 1, from LPD to the former San Clemente Dam, reflective of incoming sediment conditions since dam construction, which we assume captures the near-immediate pre-dam era at Los Padres. This will be accomplished using records of reservoir sedimentation, information regarding the gradation of sediments in the reservoir deposits (to be collected in Task 2-1), and an understanding of episodic cycles of sedimentation associated with fire. Episodic cycles must be appropriately considered, because the magnitude of sedimentation post-fire period is much larger than in average years. For example, Los Padres Reservoir sedimentation following the Marble Cone fire was estimated as 555 acre-feet, of a total estimated sedimentation of 1,255 acre-feet.

Geomorphologist Barry Hecht, CHG, CEG, has worked on high-water and sediment issues on the Carmel River for 28 years, including evaluation of the effects of the 1977, 2008, and 2016 fires on sediment supply and channel behavior. This experience will be brought to bear on the proposed study.

Sediment rating curves developed under this subtask will aid development (under Task 4-2) of periodic dredging and placement downstream of LPD (described in Task 2-2), and will help determine the engineering feasibility of replicating the pre-dam sediment transport rates downstream of LPD. The AECOM Team will establish a range of flows at which sediment could be entrained; determine the gradation of material to entrain; propose a method to relocate sediment to an area where the river can capture the sediment (one of the sediment management approaches preliminarily described as part of Task 2-2); and estimate the range of annual volume of sediment that could be transported for the range of water-year scenarios developed in Task 1-1.

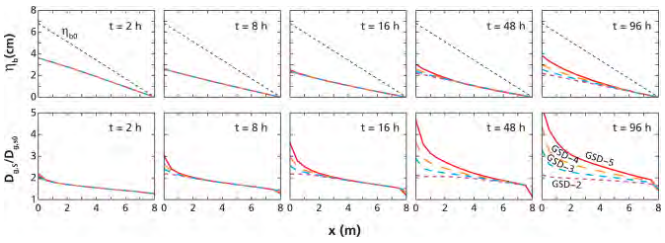
Sediment deposition at the head of Los Padres Reservoir, Dec. 2016

Subtask 2-3.2 Simulation of Geomorphic Response to Changes in Sediment Supply

To simulate probable downstream channel responses to upstream variations in both water and bedload sediment supply (Scenario 3 above, effects on the active channel from increased sediment transport past LPD) and to understand the timeline of those changes, we will use an efficient 1D morphodynamic model based on the work of Gary Parker[6] at the University of Illinois and refined by Carles Ferrer-Boix and Marwan Hassan at the University of British Columbia.[7] The model is set up to permit evaluation of many different scenarios of bedload sediment supply frequency and magnitude, similar to a Monte Carlo analysis. The simulations run efficiently in parallel, allowing for analysis of many sediment and hydrology scenarios without significantly effecting model run times. From the results, we will estimate a time series of downstream channel slope and bed sediment character responses, and identify statistically probable downstream equilibrium channel slopes and bed sediment character associated with each particular supply case. The model was built recognizing the importance of the force magnitude and frequency concept, pioneered by Wolman and Miller (1960), coupled with the observation that the river's capacity to rework bedload material compared to the frequency of supply events is a key driver of river system response. It is a rigorous model, and it stores stratigraphy for cycles of erosion and deposition.

Simulations will be prepared for the five reaches of the Carmel River described under Subtask 2-3.1, from LPD to the Pacific Ocean, with cross-sections spaced roughly 100 to 250 meters apart. For efficiency's sake, simulations will assume steady flow, and will use the normal flow approximation. Sediment supply magnitude, frequency, and composition will be varied to reflect the dam removal alternative, as well as the identified sediment management alternatives. For any given simulation, many different sediment supply magnitude, frequency, and compositional scenarios can be dispatched to evaluate sensitivity of simulated equilibrium slope to the character of sediment supply. Topographic input to the model will rely on LiDAR or other available data such as the National Elevation Dataset, augmented with available channel section data from previous modeling or data collection efforts (e.g., 2009 FEMA Flood Insurance Study or Carmel River IFIM).

The model represents a modified version of that suggested by Wong and Parker (2006)[8] and that used by Ferrer-Boix and Hassan (2014)[9], and importantly stores bed stratigraphy. Results from the Subtask 2-3.2 simulations will include tables, maps, and plots of probable equilibrium slope conditions and bed sediment character for the five reaches.



Ferrer-Boix et al. model output example

[6] Parker, G. 1D Sediment Transport Morphodynamics with Applications to Rivers and Turbidity Currents. University of Illinois, Department of Civil and Environmental Engineering and Department of Geology. Accessible here: http://hydrolab.illinois.edu/people/parkerg/morphodynamics_e-book.htm

[7] Balance has an existing contractual relationship with the University of British Columbia and will integrate University researchers into the AECOM Team for sediment transport modeling.

[8] Wong, Miguel, & Parker, Gary. 2006. One-dimensional modeling of bed evolution in a gravel bed river subject to a cycled flood hydrograph, Journal of Geophysical Research: Earth Surface, 111(F3).

[9] Ferrer-Boix, Carles, and Marwan A. Hassan, 2014. Influence of the sediment supply texture on morphological adjustments in gravel-bed rivers, Water Resources Research, 50(11)8868-8890.

Task 2-3 Deliverables, Schedule, and Assumptions

The deliverable for Task 2-3 is a TM describing the sediment transport alternatives evaluated; potential geomorphic changes to downstream reaches, including consideration of resulting effects to downstream properties adjacent to the active channel, changes in sediment transport, and methods for moving, sorting, storing, and entraining sediment downstream of LPD; and a qualitative evaluation of the timing and amount of sediment that could be passed into the river and to the ocean. The draft TM will be provided prior to TRC Meeting No. 2, and revised based on input received at the meeting.

We have assumed a total of six model builds, with three for the dam removal alternative and three for a single representative sediment management alternative. The three builds for each alternative will reflect (a) a slightly above-critical flood magnitude, (b) a medium-flood magnitude, and (c) a large-flood magnitude. We have planned for up to five different sediment supply scenarios for each flow event run. We recommend that the supply scenarios reflect critically dry, dry, average, wet, and very wet hydrologic analogs for the sediment supply magnitude and frequency. We recommend one sediment gradation be simulated; otherwise, comparing and contrasting results among different sediment supply compositions will make it difficult to achieve useful conclusions and findings. An exception to this would be to model two supply compositions: one relatively fine and narrow in size composition, and one relatively coarse and broad in size composition; a choice between these would increase the number of simulations from 6 to 12. Currently, we are budgeted for 6 simulations.

Optional (or Alternate) Task 2-3.2 DREAM Sediment Transport Modeling

The AECOM Team is confident that the approach described above will provide information adequate to identify pros and cons of the sediment transport alternatives, and will provide a meaningful basis for the evaluation of alternatives for LPD at a lower cost than would more detailed sediment transport modeling. However, if dam removal proves to be the preferred alternative and additional detail is desired at that time to evaluate among various dam removal scenarios, or if more detailed sediment transport modeling is desired to demonstrate that there is no significant channel aggradation, the AECOM Team is well-qualified to conduct 1D and 2D sediment transport modeling.

For more detailed sediment transport modeling, the study conducted by Stillwater for Englebright Dam, led by Yantao Cui, would provide a relevant blueprint for the proposed study; DREAM-1 and/or DREAM-2 modeling would be used to evaluate sediment transport and HEC-RAS, in combination with DREAM model results would be used to evaluate flood risk. For dam removal, if it could be determined that most of the sediment in Los Padres Reservoir would be dredged (as was done at San Clemente), then the analysis could focus on the reestablishment of sediment supply to the downstream reaches (i.e., release of accumulated sediment in the reservoir would not need to be modeled). Additional effort would be required to model release of accumulated reservoir sediment.

The AECOM Team has proposed a technically robust approach to Task 2-3 that will efficiently satisfy the intent of the RFP, as well as two optional subtasks that could provide additional detail and verification.

Optional Subtask 2-3.3 Qualitative Evaluation of Geomorphic Response to Changes in Sediment Supply

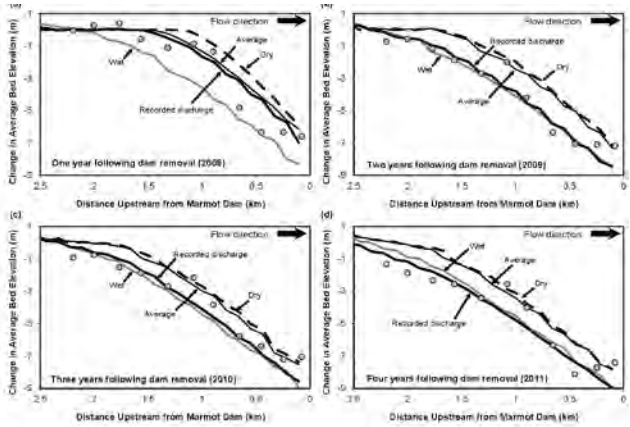
To validate probable locations of channel deposition or entrainment (bed elevation response) under an increased sediment supply alternative (i.e., sediment supply increases from the present-day case), we would use a GIS-based analysis. The analysis computes downstream gradients in total stream power over the length of the system, assuming some base structure of streamflow supplies (discrete flow

magnitudes as opposed to hydrographs). The GIS-based analysis is reported in Gartner et al. (2015)[10] and Gartner (2016)[11], and was developed to use readily available topographic and hydrologic data to assess probable river response and associated hazards during floods.

Sediment sluffing off slope at LPD following 2016 Soberanes Fire

The concept is that longitudinal gradients in stream power, or its associated physical variables like mean channel velocity and bed stress, determine the probable patterns of channel response (i.e., net deposition or entrainment) during floods, as compared to simply using local values of stream power (e.g., the Shields parameter). This is important and useful because many physical phenomena are responsive, or evolve according to gradients, as compared to static, local values. Analyzing the erosion and deposition zones using this technique will add robustness and certainty to the results of the modeling efforts, further confirming locations that are of potential flooding concern and warrant additional planning and study.

The analysis would be informed by the AECOM Team's existing knowledge of the Carmel River hydrology and sediment supply character, as well as information developed in Subtask 2-3.1, coupled with available data on bed material size and channel width. Topographic input to the GIS analysis will rely on available LiDAR, or other available data such as the National Elevation Dataset.



Example DREAM model output from Marmot Dam on the Sandy River

Results from Optional Subtask 2-3.3 would consist of tables, maps, and plots indicating likely channel-bed elevation response from LPD to the Pacific Ocean for the five reaches for the following scenarios: 1) no action; 2) no increase in sediment transport at LPD; and 3) increased sediment transport at LPD (background sediment and background plus accumulated sediment). In each reach, calculations would occur at a spacing of roughly 250 to 500 meters, as well as at tributary junctions, and we would compare Optional Subtask 2-3.3 results with previously published discussions of possible downstream channel response patterns.

Optional Task 2-4 Drilling Investigation Upstream of Reservoir

An alternative to shallow hand-sampling of the upstream alluvial sediments would be to bring a small drill rig to the upstream area with a helicopter. The drill could be driven to the dam and then picked up by the helicopter and ferried upstream to the drill locations on the alluvial deposits. This would enable collection of deeper samples in the upstream area, which could potentially provide a more

[10] Gartner, J.G. et al. 2015, Gradients in stream power influence lateral and downstream sediment flux in floods, Geology 43(11), 983 LP – 986.

[11] Gartner, J.G., 2016. Stream Power: Origins, Geomorphic Applications, and GIS Procedures. Manual prepared for the RiverSmart program: accessible here: https://extension.umass.edu/riversmart/.

comprehensive evaluation of the sedimentology. This will incur extra costs; however, this may not be necessary if the stratigraphy reflected by the deep sampling in the reservoir and from the shallow upstream sampling is consistent.

Task 3: Evaluate Effects on Steelhead

The AECOM Team will evaluate and summarize potential effects to steelhead and their habitats, in the context of the South-Central California Coast (S-CCC) steelhead population, as a result of the alternatives to be studied. Preliminary results from Task 3 (or Tasks 3-1 and 3-2, if Task 3-3 results are not available) will inform the alternative descriptions in Task 2-2.

Task 3-1 Increases in Sediment Transport

The AECOM Team will evaluate the effect of increases in suspended load and bedload associated with alternatives that would result in sediment being transported past LPD in the foreseeable future on all steelhead life stages. This will include effects on juvenile and adult migration; spawning substrate, redds, and alevins; and rearing substrate and habitat. The effect of increased sediment transport on the overall steelhead population will also be evaluated, to the extent possible, based on available data.

The analysis will focus on the response of steelhead and their habitat to increases in sediment in at least the following five response reaches: 1) the inter-dam reach between LPD and the upstream end of the inundation zone of the former San Clemente Reservoir; 2) San Clemente Reservoir to Camp Stephani at RM 15.5; 3) Camp Stephani to the Narrows at RM 9.8; 4) from the Narrows to the Carmel River lagoon; and 5) from the lagoon to the ocean. These response reaches are consistent with the sediment transport analysis in Task 2, and may be subdivided, based on key tributary junctions, expected geomorphic responses to increased sediment, and other reach-scale features, to provide a more detailed level of analysis. Increased suspended sediment could affect adult migrating steelhead and rearing juveniles in any of these reaches depending on the time of year; however, based on our analyses in the Klamath and Matilija rivers, we expect impacts to decrease substantially with distance downstream from the dam. The quality and extent of spawning and rearing habitat will also be influenced by increased sediment deposition, with effects that vary with distance from the dam, as well as reach-specific channel gradient, confinement, or other factors. Increased sediment deposition in the Carmel River lagoon may also influence the extent and quality of estuarine rearing habitat, as well as sandbar breaching dynamics.

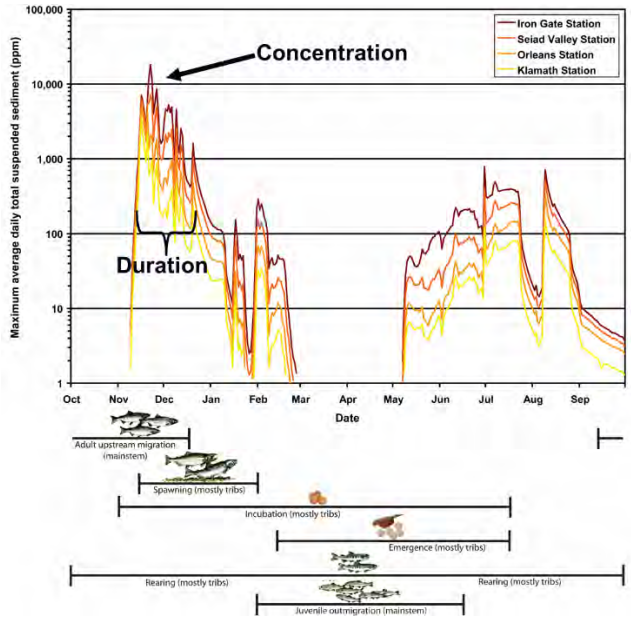
Based on the steelhead population data available from the NMFS' steelhead recovery plan, trapping and fish count data available from the MPWMD, CDFW habitat and fish surveys, and other readily available sources, the effects analysis will consider the proportion of the steelhead cohort (of each life stage) predicted to be present in the response reaches during suspended sediment events under each alternative, considering both spatial distribution (proportion of the life stage expected to be in the response reaches compared to tributaries, and proximity to LPD), and life-history timing (proportion of the population expected to be present during the period of effect). In our analysis of increased sediment transport in other rivers (e.g., Sandy, Klamath, and Matilija rivers), we found that describing which life-stages of steelhead will occur in each response reach during key periods of expected increases in sediment is critical to understanding—and not exaggerating—potential effects.

For the proportion of each life stage anticipated to be exposed to increased sediment, the predictions of the order–of-magnitude changes in Total Suspended Sediment (TSS) relative to an unimpaired condition from the sediment transport analysis for each alternative (Task 2) will be integrated with an evaluation of the impacts of varying TSS concentrations and durations on each stage of steelhead life. As we did in the Klamath Dam Removal EIR, the Matilija Dam analysis, and the Searsville Alternatives Analysis, this evaluation will

rely on the synthesis of the effects of high TSS on salmonids by Newcombe and Jensen (1996) (since Carmel River-specific thresholds are not available).

Severity	Category of effect	Description
0	Nill effect	•No behavioral effects
1	Behavioral effects	•Alarm reaction
2		•Abandonment of cover
3		•Avoidance response
4	Sublethal effects	•Short-term reduction in feeding rates •Short-term reduction in feeding success
5		Minor physiological stress: •Increase in rate of coughing •Increased respiration rate
6		•Moderate physiological stress
7		•Moderate habitat degradation •Impaired homing
8		Indications of major physiological stress: •Long term reduction in feeding rate •Long term reduction in feeding success •Poor condition
9	Lethal effects	Reduced growth rate: •Delayed hatching •Reduced fish density
10		•0–20% mortality •Increased predation of effected fish
11		•>20–40% mortality
12		•>40–60% mortality
13		•>60–80% mortality
14		•>80–100% mortality

Newcombe and Jensen (1996) severity of effects from suspended sediment



Evaluation of suspended sediment impacts in Klamath River

This method will be used to estimate the relative magnitude-of-severity of ill effects on specific life stages (juvenile and adult migration, spawning and rearing, and alevins) of steelhead in each of the response reaches. All effects analysis is based on comparing the severity of effect with sediment management, in comparison to existing conditions. Each alternative (and various scenarios of each alternative) will be assessed based on the season of sediment release, and the severity, frequency, and persistence of the effects.

Using this analytical approach, the AECOM Team will estimate the proportion of juvenile steelhead that are expected to rear in the affected reaches and will suffer some level of direct mortality; the proportion anticipated to be far enough downstream to suffer only sub-lethal effects; and the proportion in tributaries able to avoid effects entirely. The same analysis will be conducted for each life stage, and for each scenario. The population-level consequences of each scenario will then be assessed, based on the loss of the estimated proportion of redds, alevins, juveniles, and adults from each cohort anticipated to be present during each year of potential increased sediment.

In addition to assessing the potential effects of suspended sediment on steelhead, the AECOM Team will also assess the effects of increased sediment transport on habitat for steelhead, including juvenile rearing habitat and spawning habitat. Results of sediment transport analysis (Task 2) will be used to predict the effect of each alternative (and scenarios of each alternative) on the channel profile (Task 2) in each of the response reaches, and over time. These results will be used to assess the degree to which sediment deposition reduces pool volume, increases available spawning habitat, and increases floodplain habitat access from increased bed elevation. Predictions of bedload substrate size composition (Task 2) will also be assessed to predict how changes in substrate facies affect spawning habitat. The predicted effects on steelhead habitat will be compared with the spatial distribution of steelhead spawning and rearing in the watershed to evaluate the likely population level effects of the various alternatives.

This task will include a 1-day field reconnaissance survey to evaluate existing habitat conditions.

Task 3-2 No Increase in Sediment Transport

For alternatives that result in no sediment being transported past LPD in the foreseeable future, we will describe the expected effect of continued lack of sediment transport on spawning and rearing habitat downstream of LPD in the same response reaches described in Task 3-1.

Existing channel cross-section data and descriptions of current channel morphology will be assessed, as well as results of current gravel augmentation projects. In particular, we will focus on the distribution, quantity, and quality of current spawning habitat in the Carmel River downstream of LPD. Areas with affected rearing habitat will also be evaluated. Based on this assessment, to the extent feasible, an estimate will be made of the minimum volume and gradation of bedload material necessary to re-establish spawning and rearing in areas considered to be armored, or otherwise impacted by existing sediment starvation.

Task 3-3 Incorporate Data from Alternative Water Supply Options

MPWMD will provide time-series data of water availability and availability of steelhead habitat based on water availability in the main stem for the alternatives to be studied. For alternatives involving reservoir storage expansion, the effect of a larger volume of water in the reservoir will be described. The AECOM Team will include the information as part of the evaluation criteria, and present the information at one of the TRC meetings if it is available.

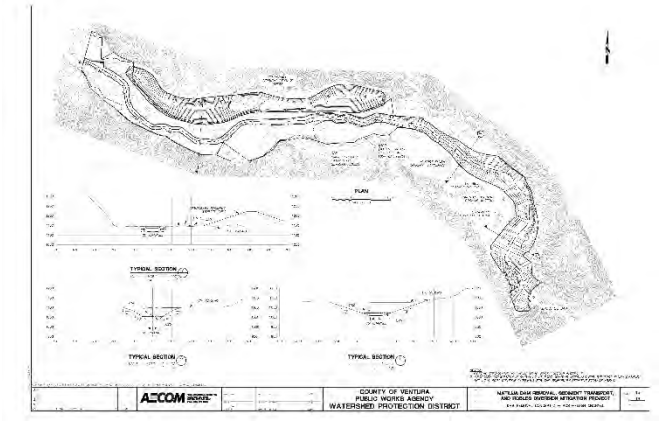
Deliverables, Schedule, and Assumptions (all Task 3)

The deliverable for Task 3 is a TM summarizing effects to steelhead of varying levels of water supply and sediment transport in the river, and potential changes to steelhead and their habitats. The draft TM will be provided prior to TRC Meeting No. 2, and will be revised based on comments received from the TRC after the meeting.

AECOM assumes that information related to water and steelhead habitat availability, to be provided by others, will be available 2 months prior to the scheduled due date of the Task 3 draft TM, or will require additional effort to incorporate into the Study. This task does not include collection of data describing existing conditions in the Carmel River (e.g., locations of channel armoring), and will use existing data and the results of Task 2 as the basis for analysis.

Task 4: Identify Feasible Alternatives

For this task, the AECOM Team will present the final results of Task 2 and the initial results from Task 3 at TRC Meeting No. 2; and develop feasible alternatives, evaluate benefits and impacts, and rank alternatives, the results of which will be presented at TRC Meeting No. 4.



Example from the Matilija Dam Removal and Ecosystem Restoration project

Task 4-1 TRC Meeting No. 2

The AECOM Team will meet with the TRC to discuss feasible alternatives and criteria for evaluation. Using the information developed in Tasks 1, 2, and 3, the AECOM Team will develop a draft evaluation matrix of alternatives and evaluation criteria prior to scoring. Information developed will be packaged and distributed to the TRC in advance of the meeting. A key objective of this meeting will be to discuss and confirm a list of feasible alternatives for additional development. The meeting

will be conducted as a workshop, with the following preliminary agenda items:

1. Briefly review background information, including previous TMs.
2. Review and update evaluation and comparison criteria prior to beginning discussion, so all meeting attendees are familiar with the criteria that must be met or addressed.
3. Discuss alternatives matrix; identify risks and uncertainties associated with each concept, and develop a list of study and informational needs that will be required to finalize selection of concepts. This will include any information needed to confirm poor viability of any concept with fatal flaws.
4. Review concepts with respect to obvious fatal flaws. Any alternatives that are not constructible, or that have less than a good chance of satisfying all crucial criteria (i.e., are fatally flawed) will be dropped from consideration. If a concept is to be dropped due to high risk or uncertainty, discuss how this uncertainty could be reduced. Descriptions of those alternatives and their fatal flaws will be summarized with a meeting record for the final report.
5. Assign a priority to develop additional information or design drawings for short-listed alternatives.
6. Document those alternatives that were not selected.
7. Adopt a common format for alternative development.

The AECOM Team will send at least two Team members to the meeting to participate in and assist with conducting the meeting; they will be prepared to facilitate web meeting and conference call participation for participants unable to attend in person, and will record and distribute draft meeting notes for review.

The AECOM Team has participated in or facilitated scores of stakeholder meetings similar to those included in the proposed study, for projects such as the Matilija Dam Removal and Ecosystem Restoration Project, Searsville Dam and Reservoir Alternatives Study, Fish Passage Facilities in the Alameda Creek Watershed, and the LPD Fish Passage Feasibility Study. Our experience working with stakeholder groups has led to many successful project outcomes.

Deliverables, Schedule, and Assumptions

Deliverables for this task include:

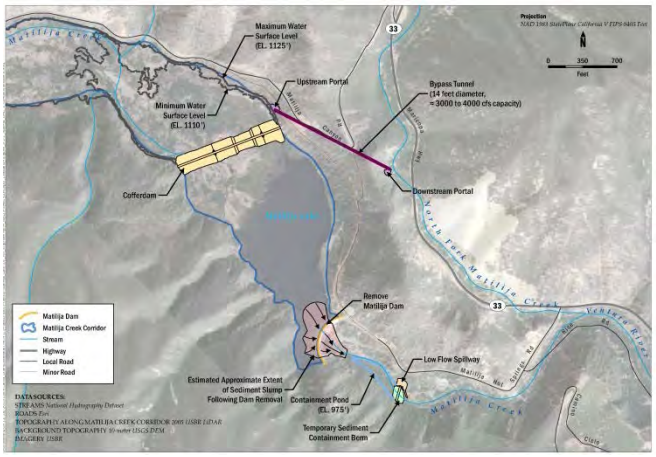
- Distribution of the final Task 1 (background information, evaluation criteria, and data gaps) and Task 2-1 (sediment characterization) TMs, and draft documents developed under Task 2-2 (preliminary alternatives descriptions), Task 2-3 geomorphic effects), and Task 3 (effects on steelhead) to the TRC 3 to 6 weeks prior to the meeting.
- Workshop agenda provided prior to TRC Meeting No. 2.
- Meeting report with notes from TRC Meeting No. 2 describing the alternatives considered and discarded, conclusions, and recommendations for further analysis, to be provided 2 weeks after completion of the meeting.

Task 4-2 Alternatives Development

This task is to further develop the alternatives selected during TRC Meeting No. 2, and focus on uncertainties concerning impacts, benefits, costs, environmental compliance, and permitting of alternatives. Alternatives that are not feasible will be dropped from consideration, and reasons for them being dropped will be described. It may be that an alternative scores low due to a specific uncertainty; in this case, the alternative will be retained and a plan to address this uncertainty identified. The final list of feasible alternatives identified during TRC

Meeting No. 2 will be considered for additional development. The primary goals of this task are to:

- Define each concept with respect to its operational characteristics.
- Draw and define the concepts so that the design intent is clearly communicated. The AECOM team will develop a common format for drawings in this task.



Example from the Matilija Dam Removal and Ecosystem Restoration project

For each alternative, the AECOM Team will provide:

1. Plan and section drawings to scale, to adequately define the concept.
2. Function design features, shown on the sketches, or on separate sheets.
3. Brief write-up suitable for review to describe the concept's key characteristics and how the alternative operates.
4. List of pros and cons for each alternative relative to operations.
5. An evaluation matrix containing alternatives and the evaluation criteria. The evaluation matrix will build on the criteria previously developed, and will be presented in a grid form or Pugh Matrix, which breaks down the alternatives into discrete elements for comparison, evaluation, and optimization.

With the additional investigation, some of the preliminary concepts or alternatives developed under Task 2-2 may prove to be infeasible, or may be modified as part of this Task.

Deliverables, Schedule, and Assumptions

The deliverable for this task is a TM that includes:

- compilation of alternatives
- an evaluation matrix
- supporting documentation

This TM will be developed by revising and expanding on the TM developed for Task 2-2 (preliminary alternatives), and will be provided 3 to 6 weeks prior to TRC Meeting No. 3. A preliminary outline for the TM is provided in the box below. The AECOM Team will retain a dam removal alternative and a reservoir expansion alternative for the duration of the study, through the final set of alternatives, regardless of their perceived feasibility. The AECOM Team assumes up to five alternatives and sub-alternatives will be further defined in Task 4-2. The contents of the TM will be revised based on comments received at TRC Meeting No. 3 for inclusion in the Task 5 report.

The AECOM Team will develop an opinion of probable construction and operations and maintenance costs for alternatives carried forward to Task 5. If the project proponent(s)' ability to afford or obtain funding for the project is to be included in the evaluation criteria, AECOM assumes that information will be provided by others, or will be developed under Optional Task 5-4.

Task 4-3 TRC Meeting No. 3

The AECOM Team and TRC will meet to finalize the alternatives and the evaluation criteria, and review the evaluation matrix. Protocols will be similar to Meeting Nos. 1 and 2.

The evaluation matrix will be used during this meeting to prepare an evaluation of the alternatives, and will result in consolidated scores. The results of the matrix evaluation can be used to further refine

facility components, identify data gaps, and assess the potential influence of uncertainties. However, the matrix evaluation is only a decision tool; the results will be used to influence decisions, but not dictate them. The process of developing and using the matrix, along with provisional criteria that will be used in it, will follow the guidelines explained in Appendix A: Alternatives Evaluation Process and Criteria. Based on the results of our evaluation, the AECOM Team will work to update descriptions and drawings for the alternatives (Task 4-2). The results will be presented to the TRC for review at TRC Meeting No. 3, with the goals of receiving input and the TRC reaching consensus on a final list of alternatives, and making recommendations for scoring the alternatives.

The meeting will be organized as follows:

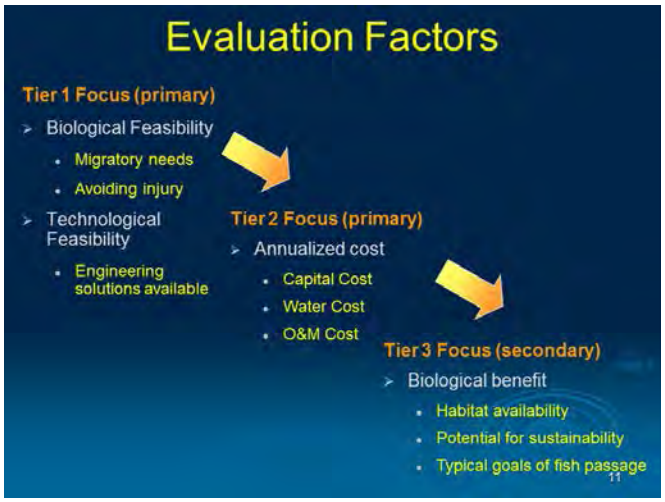
1. The AECOM Team will present an overview of the work completed to date, and will address any questions from the previously distributed meeting notes.
2. Discuss and refine evaluation criteria based on the current state of the alternatives.
3. Identify any criteria that would constitute a fatal flaw, if not fundamentally satisfied.
4. Identify any uncertainties and/or risks associated with each alternative, and a means to address these issues.
5. Review the alternatives evaluation matrix, select weighting factors, and update the matrix based on input at the meeting.
6. Perform a fatal flaw analysis on each alternative; eliminate alternatives with fatal flaws; and record eliminated alternatives for reporting in the meeting notes.

Deliverables, Schedule, and Assumptions

The deliverable for this task will include a meeting agenda, and a meeting summary with the following:

1. Final evaluation spreadsheet.
2. List of alternatives identified in the session.
3. List of additional information necessary to reduce uncertainty or risks associated with each alternative.
4. A discussion of the fatal flaw analysis and documentation of alternatives eliminated from further consideration at this time.
5. A recommendation of alternatives for further development.

A draft meeting summary will be provided for review by the TRC within 2 weeks of completion of the meeting. The meeting summary will be finalized following TRC review of the draft, based on feedback from the TRC.



Example from the Calaveras Dam Replacement Project

Task 5: Final Report

Once alternatives are defined, an initial opinion of probable construction and operating cost will be provided in this task for each alternative. Estimates will be to a Class 5 level, as defined by the Association for the Advancement of Cost Engineering International (AACE)[12]. The cost

[12] "AACE International Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. Typically, engineering is 0% to 10% complete. They are typically used for any number of business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, or long-range capital planning.

estimates will be suitable for comparison of the alternatives, but may not reflect an accurate number for capital budgeting, because they will be developed based on very limited information. The level of accuracy of the estimate will be commensurate with a concept-level screening process, and—depending on the complexity of an alternative—may have a wide expected accuracy range. The estimated performance of the alternatives over the long-term (where long-term has been previously defined in coordination with the TRC) will be compared. While working on this task, the AECOM Team will describe operational protocols and issues, address comments and/or issues brought up at previous meetings, and address constructability issues and any remaining data needs or significant risks. A dam removal option and reservoir expansion option will be included in the final list of alternatives.

Example from Calaveras Dam Replacement Project

Virtually all Class 5 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric and modeling techniques. Expected accuracy ranges are from -20% to -50% on the low side and +30% to +100% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. As little as 1 hour or less to perhaps more than 200 hours may have been spent preparing the estimate depending on the project and estimating methodology."

Task 5-1 Prepare Draft and Final Report

Prior to preparing the Draft LPD and Reservoir Alternatives and Sediment Management Study Report (Report), the AECOM Team and TRC will have reviewed the final set of alternatives and made recommendations at TRC Meeting No. 3. A Report (including a Report Outline, Draft Report, and Final Report) will be developed to document the scope of the study, background information used, design criteria, the process used to conduct the analyses, the results of the analyses, and the TRC recommendation. A preliminary outline for the Report is provided in Figure 6.3.

An updated Report Outline will be developed by the AECOM Team for review by the TRC, and the Draft Report will be developed in consideration of any comments received on the Report Outline. The AECOM Team will provide a Draft Report to the TRC for review. The TRC will review the technical feasibility of the alternative(s), the expected performance, and the cost to construct and operate each alternative. Evaluation of alternatives will include strong consideration of the risk; uncertainties associated with the implementation and performance of the alternatives; and whether alternatives would include continuation of the existing trap and transport facilities. If no substantive issues are raised during the review, the AECOM Team will respond to minor comments in writing and during a 2-hour conference call, and move on to production of the Final Report.

Deliverables, Schedule, and Assumptions

Deliverables for this task include:

- Report Outline
- Draft Report, to be provided for TRC review at least 30 calendar days prior to the scheduled preparation of the Final Report
- Response to comments on Draft Report (written and via 2-hour conference call)
- Final Report

Figure 6.3 Preliminary Outline of the Draft and Final Report

1. Introduction
    a. Problem statement
    b. Purpose, objective
        i. Fish passage goal statement
    c. Overview of process
        i. Summary of meetings, coordination, and progress reports
2. Descriptions of alternatives
    a. Short descriptions of all initial brainstorm concepts
        i. Documentation of concepts that were dropped for fatal flaws or low ranking
    b. Preferred concepts
        i. Detailed physical, functional, and operational descriptions
        ii. Pros and cons
        iii. Constructability considerations
        iv. Opinions of probable construction and operating costs
        v. Two to five scale drawings will be provided for each alternative, with applicable site overviews, site plans, sections, elevations, and hydraulic design parameters clearly defined.
3. Evaluation of Alternatives
    a. Description of evaluation process
        i. Description of evaluation matrix and criteria
            1. Weighting and scoring
        ii. Criteria that could lead to fatal flaws
    b. Graphics and summaries of evaluation
        i. Ranking of alternatives based on evaluation matrix
        ii. Ranking of alternatives-based fish passage criteria
        iii. Relative ranking compared to cost and operations criteria
4. Conclusions and Recommendations
5. References cited

AECOM assumes there are no more than three alternatives or sub-alternatives carried forward through the Study to Task 5, and that no substantive issues requiring additional TRC meetings or Web meetings are raised during Task 5, or in response to the Draft Report. For all tasks (1 through 6), all reports will be provided electronically, and hard-copy deliverables may be provided with additional effort.

Optional Task 5-2 TRC Meeting No. 4

If substantive issues are raised by the TRC during review of the Draft Report, the AECOM Team, Cal-Am, and MPWMD may elect to work directly with the commenter(s) to address any issues, or hold a meeting to address issues. If necessary, the AECOM Team and TRC will meet to review the final set of alternatives or receive final TRC recommendations before the Final Report is accepted.

Optional Task 5-3 Additional Support to Address Long-Term Fate of LPD

If there is a consensus on evaluation of alternatives by the TRC, the Study terminates, and Cal-Am and others may formulate an implementation plan to carry the recommendation(s) forward. If there is no consensus, it is presumed that the status quo would not change (i.e., the dam remains as is and no feasible sediment management alternative is recommended). However, if no consensus is reached, Cal-Am, MPWMD, and the TRC should consider what steps, if any, should be taken to address the long-term fate of the dam. Under this task, the AECOM Team may continue to provide technical support, develop additional analyses and reports, and/or participate in additional meetings to help determine the long-term fate of LPD.

Additionally, if the results of other studies that may help determine the long-term fate of LPD (e.g., the CRBHM, IFIM, and climate change model studies) are not available in time to be incorporated into this Study, or if the schedule of this Study must be extended to sync with progress on related studies, this task would allow for the AECOM Team to revisit the alternatives, their evaluation, and the Final Report, and update the Study results with the results

of related studies potentially unavailable during Study implementation.

Optional Task 5-4 Project Funding

AECOM has experience assisting water agencies and other clients with development of lost water diversion opportunity costs and water replacement costs, and has assisted clients with preparation of grant applications, including for the Matilija Dam removal project. Should the MPWMD desire assistance with evaluating whether it can afford or obtain funding for the alternatives evaluated, with evaluating the potential for various alternatives to qualify for funding, or with applications to obtain funding for alternatives study or a preferred alternative, the AECOM Team has water resources professionals, economists, and grant writers prepared to assist.

Task 6: Project Management

This task consists of standard project management tasks, including scheduling, budget tracking, invoicing, health and safety, quality management, and general project communications.

Task 6-1 Project Administration

AECOM has developed a Project Delivery System to assist its project managers in the successful execution of every project. This Project Delivery System encompasses elements such as:

A Project Work Plan that defines the project goals, limits, schedule, and:

- Provides the scope of work;
- Outlines planned staffing for the project;
- Describes AECOM's duties in relation to duties of other parties;
- Identifies project deliverables;
- Provides a detailed budget of design cost;
- Includes a plan for management, control, and format of documents and electronic files;
- Provides Safety, Health, and Environment Procedures such as Task Hazard Analyses and Training Needs Assessments so that all team members have the required training to conduct their work in a safe manner; and
- Implements a Quality Management System (QMS).

Quality management is an extremely important part of project management at AECOM. All AECOM deliverables are reviewed by qualified staff identified in their respective fields prior to submittal to our clients. To manage and enforce this mandate, AECOM has developed an ISO 9001:2008 certified QMS. Unique to the engineering consulting industry, our ISO 9001-certified QMS provides guidance and uniformity for documentation and electronic file control, and firm direction to our project managers on when and how to conduct the Quality Assurance/Quality Control (QA/QC) reviews by qualified experts prior to delivery to the client.

The web interface with our internal system for managing the QMS procedures is called "Q-Dash," and is built into our company's Intranet. Q-Dash provides a central location where implementation of QMS procedures are tracked for each project, and applications for QMS implementation are readily available to our project managers at all times. Having been ISO-certified since 2005, AECOM has streamlined our QMS to maximize its effectiveness for enforcing QA/QC procedures while minimizing the project manager's time and effort. This allows our project managers to focus on doing the best job they can with their client's projects.

AECOM's Q-Dash interface gives our project managers a snapshot of the status of QA/QC procedures on their projects, identifying what efforts have been completed and what still needs to be done.

Per our QMS, no milestone deliverables can be released to our clients without a Technical Quality Review Record (TQRR). The TQRR summarizes the QA/QC procedures conducted for the deliverable, and includes the signoffs from the discipline leads confirming that the mandatory reviews were completed.

AECOM's proposed Project Manager, Jon Stead, is well-known for his ability to keep projects on track. An additional tool he uses is the project log. The AECOM Project Manager will maintain logs of Action Items, Deliverables, and Decisions that will be included, as appropriate, in progress reports or Project Management meeting minutes, to keep key participants informed of project status.

Task 6-2 Meetings and Conference Calls

In addition to project tracking and quality control, under this task the AECOM Project Manager will facilitate meetings (in addition to the TRC Meetings described under other tasks) with MPWMD, Cal-Am, and other interested parties, including, but not limited to: 1) kick-off meeting with MPWMD and Cal-Am; 2) review of existing and proposed operations in the field with MPWMD and Cal-Am; 3) meetings with regulatory agencies as required to determine constraints. Meetings will generally be held at the MPWMD Ryan Ranch office or at the Cal-Am Pacific Grove office, unless other arrangements are made. AECOM will host meetings at our 300 Lakeside Drive office beside Lake Merritt in Oakland, on request. AECOM will also facilitate a monthly, 1-hour conference call with the MPWMD Project Manager and any other appropriate parties to coordinate various aspects of the Study.

Deliverables, Schedule, and Assumptions

Deliverables under this task include:

- Invoices and progress reports transmitted monthly to the MPWMD. Each invoice will be transmitted with a progress report that includes a description of tasks performed and accomplishments, a comparison of budgeted versus actual expenses, and a discussion of the schedule progress.
- Copies of communications among agencies and the AECOM Team (if appropriate).
- Minutes for meeting conducted under this task.
- Periodic transmittals of Action Items, Deliverables, and Decision logs, as appropriate.

AECOM assumes that meetings conducted under this task will include three in-person meetings (one kick-off meeting, one operations meeting in the field, and one meeting with regulatory agencies to identify constraints), held in the Monterey Peninsula/Carmel River area (travel required), each to be attended by two AECOM Team staff. All other meetings are assumed to be simple conference calls (no presentation or travel required), also with participation of up to two AECOM-Team staff, and AECOM has budgeted for a total of twenty 1-hour conference calls.

07
Pricing

EXHIBIT 2-A

07 Pricing

Our proposed project budget is summarized by task, with a not-to-exceed amount for the proposed total budget. The estimated level-of-effort in hours and dollars are presented for each task. Hours are provided for the prime and subconsultants combined. Costs for optional tasks are available on request. The proposed budget is based on our substantial experience with similar projects. If the proposed budget is beyond what the MPWMD has available for the proposed study or what you were planning to spend, we would be happy to discuss ways in which the scope of work could be modified to meet the intent of the RFP with a lesser budget.

Our Project Manager, Jon Stead, developed a detailed project implementation schedule indicating our approach to completing the work over an 18-month period. Our timeline begins with Notice to Proceed, assumed to be February 6, 2017, and continues through July 5, 2018. The schedule is provided on the following page, and will be updated at Notice to Proceed to address any new information.

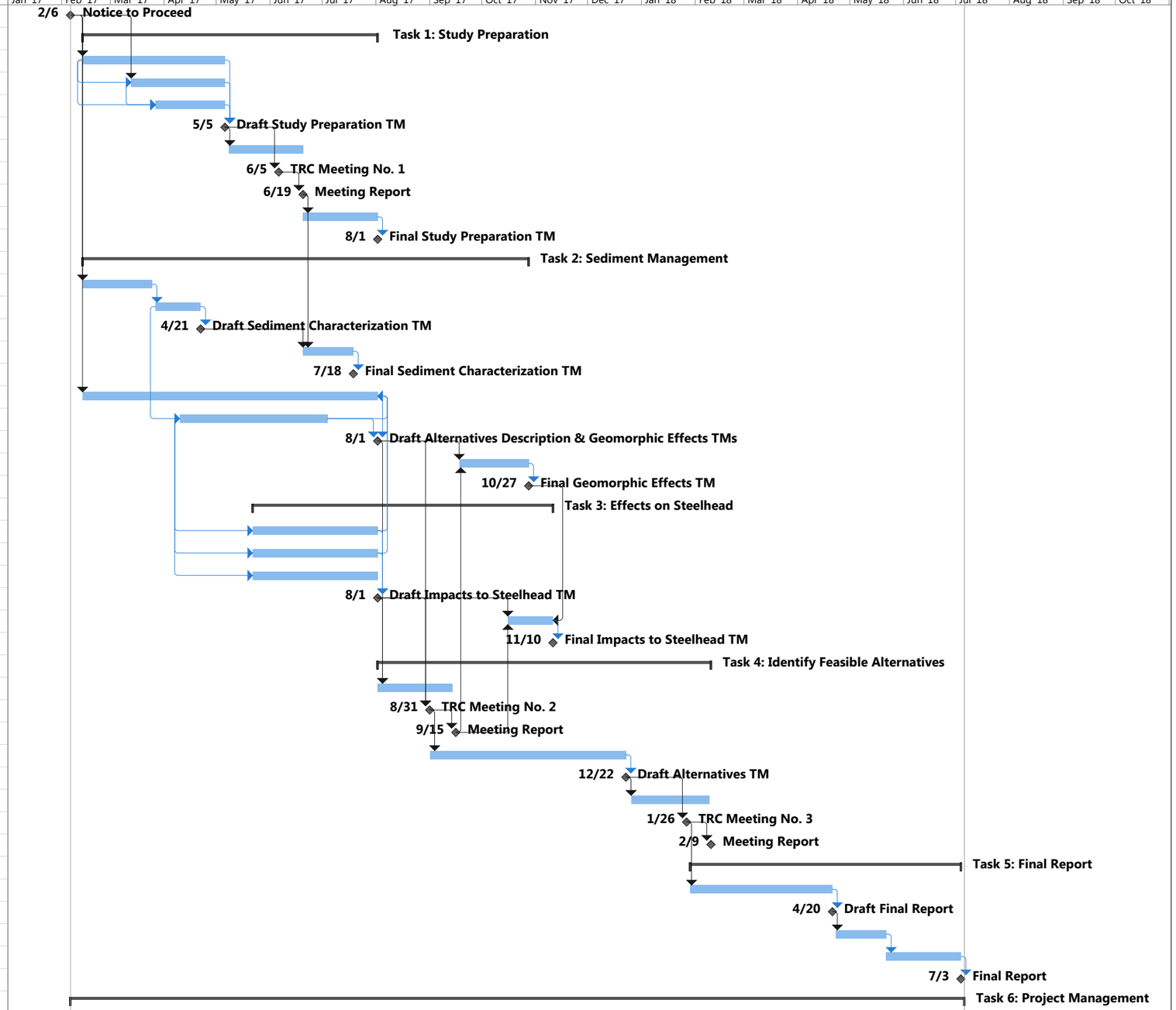
Task	Description	Hours	Budget
1	**Feasibility Study Preparation**	**250**	**$44,392**
1-1	Compile Background Information	75	$12,195
1-2	Prepare Evaluation Criteria	59	$10,225
1-3	Identify Critical Data Gaps	42	$7,158
1-4	TRC Meeting No. 1	74	$14,814
2	**Sediment Management Options**	**749**	**$210,500**
2-1	Obtain and Analyze Reservoir Sediment Samples	252	$94,273
2-2	Describe Alternatives	258	$42,692
2-3	Evaluate Geomorphic Effects of Changes in Sediment Load	239	$73,535
3	**Evaluate Effects on Steelhead**	**267**	**$40,975**
3-1	Increase in Sediment Transport	123	$18,266
3-2	No Increase in Sediment Transport	55	$9,080
3-3	Incorporate Alternative Water Supply Options and Task 3 TM	89	$13,629
4	**Identify Feasible Alternatives**	**590**	**$91,295**
4-1	TRC Meeting No. 2	128	$20,221
4-2	Alternative Development	388	$56,260
4-3	TRC Meeting No. 3	74	$14,814
5	**Final Report**	**340**	**$51,878**
5-1	Prepare Draft and Final Report	340	$51,878
6	**Project Management**	**337**	**$60,660**
6-1	Project Administration	207	$34,536
6-2	Meetings and Conference Calls	130	$26,124
	Total	**2533**	**$499,700**

EXHIBIT 2-A

Los Padres Dam and Reservoir Alternatives and Sediment Management Study

Proposed Schedule for Monterey Peninsula Water Management District

ID	Task Name	Duration	Start
1	Notice to Proceed	0 days	Mon 2/6/17
2	**Task 1: Study Preparation**	**120 days**	**Mon 2/13/17**
3	Task 1-1: Compile Background Information	60 days	Mon 2/13/17
4	Task 1-2: Prepare Evaluation Criteria	40 days	Mon 3/13/17
5	Task 1-3: Identify Critical Data Gaps	30 days	Mon 3/27/17
6	Draft Study Preparation TM	0 days	Fri 5/5/17
7	Task 1-4: TRC Meeting No. 1	30 days	Mon 5/8/17
8	TRC Meeting No. 1	0 days	Mon 6/5/17
9	Meeting Report	0 days	Mon 6/19/17
10	Revise Study Preparation TM	30 days	Tue 6/20/17
11	Final Study Preparation TM	0 days	Tue 8/1/17
12	**Task 2: Sediment Management**	**182 days**	**Mon 2/13/17**
13	Task 2-1: Obtain Reservoir Sediment Samples	30 days	Mon 2/13/17
14	Prepare Draft Sediment Characterization TM	20 days	Mon 3/27/17
15	Draft Sediment Characterization TM	0 days	Fri 4/21/17
16	Revise Sediment Characterization TM	20 days	Tue 6/20/17
17	Final Sediment Characterization TM	0 days	Tue 7/18/17
18	Task 2-2: Describe Alternatives	120 days	Mon 2/13/17
19	Task 2-3: Geomorphic Effects of Changes in Sediment Load	60 days	Mon 4/10/17
20	Draft Alternatives Description & Geomorphic Effects TMs	0 days	Tue 8/1/17
21	Revise Geomorphic Effects TM	30 days	Mon 9/18/17
22	Final Geomorphic Effects TM	0 days	Fri 10/27/17
23	**Task 3: Effects on Steelhead**	**122 days**	**Mon 5/22/17**
24	Task 3-1: Increased Sediment Transport	50 days	Mon 5/22/17
25	Task 3-2: No Increase in Sediment Transport	50 days	Mon 5/22/17
26	Task 3-3: Incorporate Data from Alternative Water Supply Options	50 days	Mon 5/22/17
27	Draft Impacts to Steelhead TM	0 days	Tue 8/1/17
28	Revise Impacts to Steelhead TM	20 days	Mon 10/16/17
29	Final Impacts to Steelhead TM	0 days	Fri 11/10/17
30	**Task 4: Identify Feasible Alternatives**	**133 days**	**Wed 8/2/17**
31	Task 4-1: TRC Meeting No. 2	30 days	Wed 8/2/17
32	TRC Meeting No. 2	0 days	Thu 8/31/17
33	Meeting Report	0 days	Fri 9/15/17
34	Task 4-2: Alternatives Development	78 days	Fri 9/1/17
35	Draft Alternatives TM	0 days	Fri 12/22/17
36	Task 4-3: TRC Meeting No. 3	32 days	Tue 12/26/17
37	TRC Meeting No. 3	0 days	Fri 1/26/18
38	Meeting Report	0 days	Fri 2/9/18
39	**Task 5: Final Report**	**111 days**	**Mon 1/29/18**
40	Prepare Draft Final Report	60 days	Mon 1/29/18
41	Draft Final Report	0 days	Fri 4/20/18
42	TRC Review of Draft Final Report	21 days	Mon 4/23/18
43	Prepare Final Report	30 days	Tue 5/22/18
44	Final Report	0 days	Tue 7/3/18
45	**Task 6: Project Management**	**360 days**	**Mon 2/6/17**



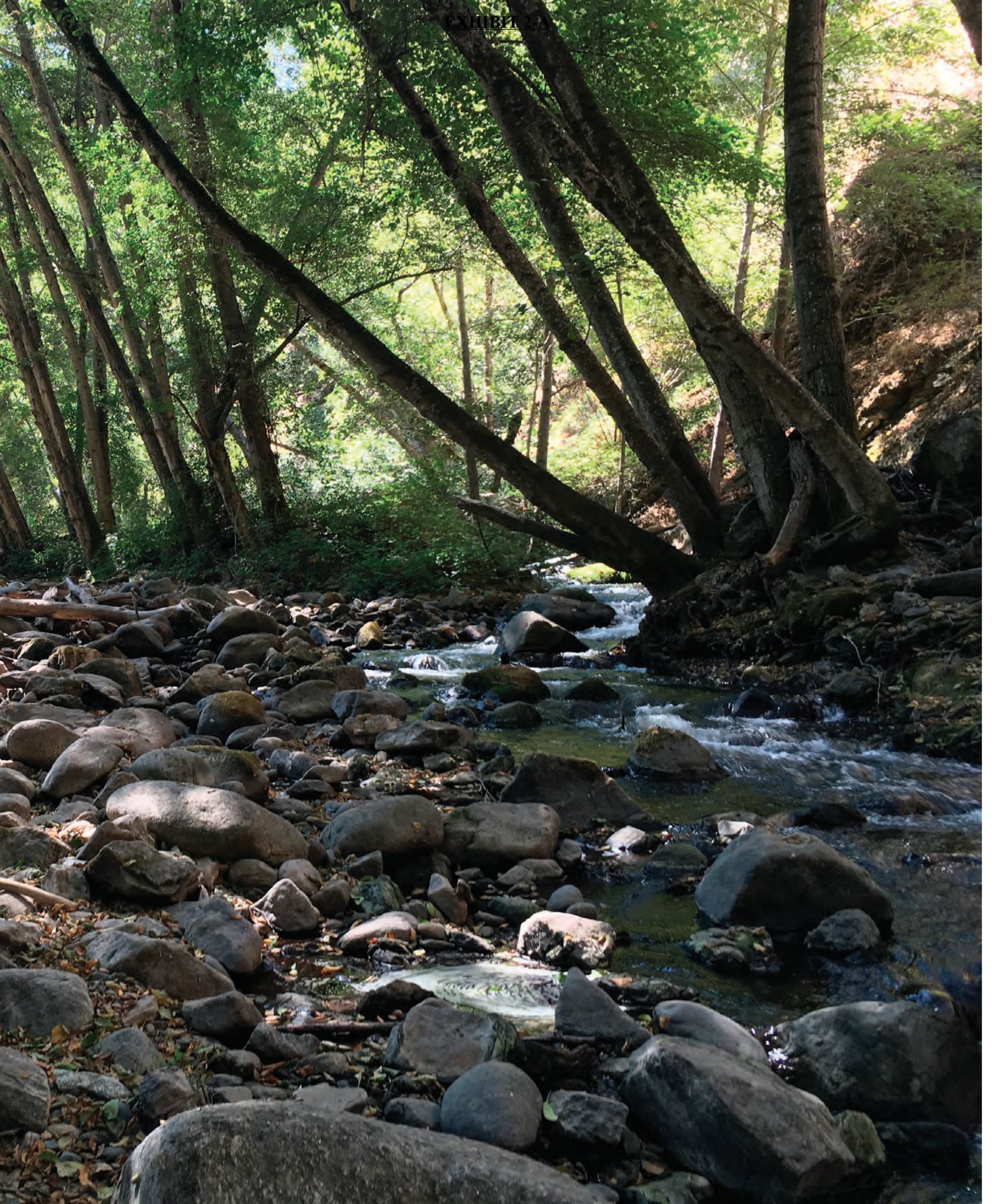
Date: Wed 12/21/16

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress		
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline			
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress			

AECOM

08 Exceptions

EXHIBIT 2-A



08 Exceptions

AECOM respectfully requests the following revisions to Appendix B Sample Agreement:

- Add the following language to the agreement: Consistent with the professional standard of care and except as otherwise expressly set forth herein, Consultant shall be entitled to rely on the accuracy of data and information provided by MPWMD or others without independent review or evaluation. This Agreement shall not create any rights or benefits to parties other than Consultant and MPWMD. No third party shall have the right to rely on Consultant opinions rendered in connection with the Services without the written consent of Consultant and the third party's agreement to be bound to the same conditions and limitations as MPWMD. Notwithstanding the foregoing, it is understood that Cal-Am may use the deliverables provided hereunder for the purposes contemplated under this Agreement. The parties agree that the work product hereunder, in whole or in part, is not suitable for financing purposes.
- Insurance Requirements, III, Second Sentence: The District shall be listed as a certificate holder on the Consultant's Comprehensive General Liability insurance policy, and the policy must be endorsed to provide a ~~60~~ 30-day prior written notice of cancellation.
- Insurance Requirements, IV, B.: The ~~"Persons Insured" provision on each~~ comprehensive general liability policy shall include as an additional insured the "Monterey Peninsula Water Management District, its officers, directors, agents and employees."
- Insurance Requirements, IV, D.: All policies shall contain a provision that the insurance company shall give the District at least thirty (30) days prior written notice mailed to the address shown below prior to any cancellation ~~lapse~~ or non-renewal. The 30-day written notice must be shown on all certificates of insurance.
- Insurance Requirements, VII, All such policies of insurance shall be issued by ~~domestic United States~~ insurance companies with general policy holders' rating of not less than "B" and authorized or admitted to do business in the State of California. The policies of insurance so carried shall be carried and maintained throughout the term of this Agreement.

EXHIBIT 2-A

Appendices

EXHIBIT 2-A

09 Appendices

- Appendix A: Alternatives Evaluation Process and Criteria
- Appendix B: Resumes

Appendix A: Alternatives Evaluation Process and Criteria

Appendix A: Alternatives Evaluation Process and Criteria

This is a description of the process the TRC may use to evaluate alternatives developed in this Project for potential feasibility and effectiveness. A grid analysis technique (Pugh Matrix) will be used, which breaks down the alternatives into discrete elements for comparison, evaluation, and optimization. This description is taken directly from the RFP and will be a starting point for revision and further development of the criteria and process by the AECOM Team under Task 1-2.

A-1. EVALUATION PROCESS

A weighted grid analysis can be used to help develop consensus of design solutions that could be pursued. It is essential to developing a mutual understanding of each alternative, understanding each other's values and points of view, and optimizing alternatives. This basic process is commonly used to assist engineering decisions. The following chart is a schematic example of the grid analysis. This is greatly simplified for the sake of explanation. The LPD evaluation will likely consist of several categories of factors—engineering, biological, economic, geomorphic, water supply, and water rights.

Schematic Example of Weighted Grid Analysis

Weight	Default Choice	Alternate #1	Alternate #2	Alternate #3
Criteria #1	1	0		
Criteria #2	1	0		
Criteria #3	1	0		
Totals				

Benefits of using this method are:

- Quantitative technique to rank multi-dimensional options
- Increases objectivity of evaluation
- Develops a clear common understanding of options being considered
- Helps diverse stakeholders understand each other's values and issues
- Can test sensitivity of objectives and project features
- Rational and consistent
- Can be a framework for consensus-building.

The process of the analysis is as follows. Each component of the grid is explained further below.

- Define evaluation criteria
- Weight criteria
- Describe alternatives
- Score alternatives for each criterion
- Multiply each score by the criteria weight
- Sum the score-weight products for each alternative

A-1.1 DEFINE EVALUATION CRITERIA

Each criterion is a positive attribute, and can be considered an objective of the project by which the alternatives will be evaluated. Some of the criteria may be pass/fail (e.g., meet a threshold score), although most are likely to be satisfied to different degrees by various alternatives. Criteria may have different levels of importance, and will be weighed appropriately as part of the alternatives comparison. Initial provisional criteria are described below, and will be refined through the Project process. The evaluation criteria will be entered as a column in spreadsheets, with the alternatives listed in a row across the top of the spreadsheet.

A-1.2 WEIGHT CRITERIA

The weighting uses a scale of zero to ten. To challenge users to differentiate among the criteria by not allowing all criteria to be weighed "ten," it should be stipulated that the average weight has to be five.

A-1.3 SCORE ALTERNATIVES

The next step is to score how well each alternative satisfies each criterion. A ten-point (zero to ten) scoring system is recommended to allow an alternative to be incrementally improved by modifying it. The TRC should come to a consensus about specific criteria that are considered essential and must be satisfied to a high degree, or the alternative might be fatally flawed. For example, alternatives that do not score a value of ten for dam safety would likely be fatally flawed. Large differences among the products of individual scores and weights highlight differences that most affect the final results, and that therefore merit discussion. Large differences may be due to various factors, each of which should be addressed. Each alternative and criterion should be thoroughly understood by each person ranking the alternative. The point is to achieve a true common understanding of each score, not just to agree on a number.

A-1.4 OPTIMIZATION OF ALTERNATIVES

Using simple math to score alternatives offers an opportunity to focus on strengths and weaknesses of alternatives and can be a starting point for a discussion of how to improve an alternative or how to exclude an alternative. The matrices showing the ranking of the alternatives will be included in the text of the report. Relative ranking of alternatives can be considered using all categories or can also be considered using specific categories.

A-2. DRAFT EVALUATION CRITERIA FOR PREFERRED SEDIMENT MANAGEMENT ALTERNATIVES

The following criteria are proposed for consideration in evaluating the alternatives for sediment management. As the process proceeds, other evaluation criteria may be included. These criteria will be refined and changed as information on alternatives and conditions specific to the Project are gathered. There are several project factors to consider, including difficult access into and out of the LPD reservoir, fish passage over the dam and through the reservoir, limited sites for placement of dredging material, potentially significant effects on downstream steelhead habitat and infrastructure from continued sediment starvation or from an increase in sediment load, and potential effects to water rights from increases or decreases in surface storage. Increases in water supply from dredging or reservoir expansion can be important in the short-term, and for such long-term effects as predicted climate change.

Some consideration should be given to specific quantitative threshold criteria (e.g., quantity of water stored, quantity and quality of water released, length and time of stream benefited or impacted, risk to downstream

owners, economics, frequency of maintenance, etc.). These may not apply at the concept review, but should be considered during alternative development.

A-2.1 CRITERIA FOR SEDIMENT MANAGEMENT ALTERNATIVES

- **Effects on passage of juvenile and adult fish into and out of the upper watershed**
  Downstream passage facilities have been constructed at LPD. Upstream volitional passage is being considered for LPD under another effort associated with the long-term plan for the dam and reservoir. After the rainy season ends and the reservoir is drawn down below spillway level, storage is metered out to augment downstream flow—often at levels below 10 cfs. Flow availability during periods of migration should be evaluated. The effect of sediment management alternatives on migration over the dam and through the reservoir, including dam removal, should be compared with alternatives proposed in the Los Padres Dam Fish Passage Study. Scoring for passage will reflect the degree of passage; long-term pure volitional alternatives for both juveniles and adults would likely be scored the highest possible score. Both short-term and long-term effects should be considered. A No Action Alternative that results in the reservoir silting in and sediment periodically blocking passage facilities would likely result in the lowest possible rating for fish passage.
- **Attraction, passage, and flows for Non-target Species**
  The target species for fish passage is adult and juvenile steelhead. There might be added ecological value or risk in providing for or blocking passage of other species and life stages. Risks could include the passage of non-native species, including resident brown trout. Enhanced flows from reservoir dredging or reservoir expansion could improve habitat for such non-native species as bullfrogs and striped sea bass. Reduced dry season flows could reduce habitat for the same species.
- **Potential for sediment transport monitoring**
  This characteristic is the ability to add facilities for monitoring changes in sediment transport to assess performance of the alternative.
- **Certainty of sediment transport alternatives on steelhead and channel morphology**
  This is a measure of how certain the TRC is regarding benefits and impacts to steelhead, their habitats, downstream channel morphology, and the effects to properties and infrastructure downstream of the alternatives to be studied. It is based on the combined knowledge of characteristics of the site, hydrology, the Carmel River steelhead population, sediment transport, channel morphology, risks to property and infrastructure, and precedents of other similar projects.
- **Adaptability of sediment management alternatives**
  Certainty may be increased with adaptability in design and/or operation. For example, an incremental approach to either dredging or bypassing sediment in the reservoir may allow for more adaptability in locating disposal sites and/or evaluating changes to downstream channel morphology.
- **Sustainability of water supply**
  LPD and the reservoir associated with it are an important source of supply for the Monterey Peninsula. The risk of losing this supply either due to inaction or from a dam removal project must be balanced with the risk that a replacement supply may not be feasible, or may not be available in a timely fashion.

Appendix B: Resumes

AECOM

Jon Stead

Project Manager; Fish Passage; Fish Biology

Areas of Expertise

Freshwater Ecology
Fish & Wildlife Biology
Agency & Stakeholder Consultation
Fish Passage Evaluation & Design
Habitat Assessment
Special-Status Species Surveys
Alternatives & Impact Analysis
Mitigation & Restoration Planning
Interdisciplinary Contract, Project, & Task Management
Permitting & Environmental Compliance

Education

MS, Ecology, University of California, Davis
BS, Ecology, University of California, San Diego

Licenses/Registrations

Federal Fish & Wildlife Permit for Listed Branchiopods

Years of Experience

With AECOM	16
With Other Firms	3

Professional Associations

Salmonid Restoration Federation

Training and Certifications

Upstream Fish Passage: Fish Behavioral, Engineering, and Related Considerations
Fish Passage Design and Engineering Workshop
California Red-Legged Frog Workshop
Identification and Ecology of Sensitive Amphibians and Reptiles of the Central and Southern Sierra Nevada
Desert Tortoise Training Workshop
Fairy Shrimp Identification Course
Ichthyology (Field Techniques)

Jonathan Stead is a freshwater ecologist, fish biologist, and senior project manager. He leads multidisciplinary teams on complex stream restoration, fish passage, and dam removal projects to provide services ranging from planning, environmental surveys, and permitting, through engineering feasibility, alternatives analysis, and final design.

Experience

Monterey Peninsula Water Management District (MPWMD) (as sub to HDR Engineering, Inc.), Los Padres Dam Fish Passage Feasibility Study, Monterey County, CA. Project Manager. Investigated the feasibility of providing passage for South-Central California Coast Steelhead at the Los Padres Dam on the Carmel River. Coordinated, led preparation for, and facilitated Technical Review Committee meetings. Led AECOM staff in technical reviews of deliverables with focus on fisheries and geotechnical aspects of the project.

San Francisco Public Utilities Commission (SFPUC), Fish Passage Facilities within the Alameda Creek Watershed, Alameda County, CA. Project Manager. Managed technical studies, alternatives analysis, conceptual and final engineering design, and bid and award for retrofit of the Alameda Creek Diversion Dam with a fish ladder and fish screens, in support of restoring Central California Coast Steelhead to the watershed. Mr. Stead successfully managed this complex project, including nine subconsultants, to deliver a final design that met the needs of internal and external stakeholders on an aggressive schedule. In the words of the SFPUC Project Manager "AECOM Staff under the leadership of Jon Stead performed an excellent job in completing the project on schedule."

Stanford University, Searsville Dam Alternatives Study, Santa Clara and San Mateo Counties, CA. Environmental Project Manager. Managed biological resources and fish passage evaluations to develop alternatives to address dwindling water storage and a reservoir blocking migration of Central California Coast Steelhead to suitable spawning and rearing habitat upstream, all in close coordination with client group and stakeholders. Identified and summarized relevant data, identified data gaps, and filled data gaps. Conducted field studies and developed reports and presentations describing resources and potential consequences of alternatives, ranging from dam removal and diversion relocation to fish passage and sediment maintenance. Presented results of all biological and fish

passage studies and evaluations, and evaluated alternatives collaboratively with stakeholders.

Ventura County Watershed Protection District, Matilija Dam Removal Plans, Sediment Transport Analysis, and Robles Diversion Mitigation, Ventura County, CA. Biology and Fish Passage Task Manager. Collaboratively developed and evaluated alternatives for dam removal. Objectives included restoring passage for Southern California steelhead, minimizing ecological impacts, and restoring habitat. Considerations included time between construction and unimpaired steelhead migration and effects of turbidity exposure (intensity and duration) on steelhead.

Stanford University, Lagunita Dam Removal Project, San Mateo and Santa Clara Counties, CA. Environmental Project Manager. Collaboratively developed design alternatives that addressed fish passage and habitat preservation and creation for Central California Coast steelhead, and managed project permitting and environmental compliance.

Santa Clara Valley Water District, Almaden Dam Fish Passage Feasibility Evaluation, Santa Clara County, CA. Senior technical advisor and technical reviewer for feasibility evaluation of providing passage for Central California Coast steelhead at a 100-foot-tall dam in the Guadalupe River Watershed. Led development of fisheries habitat field investigation, data interpretation, technical fish passage analyses, and report preparation.

SFPUC, Calaveras Dam Replacement Project, Alameda County, CA. Task Manager. Assessed feasibility of providing passage for Central California Coast steelhead at two dams. Evaluated potential for steelhead to immigrate past natural impediments to migration. According to the SFPUC Project Manager the information developed "was essential in the ongoing and successful environmental review and regulatory permitting for the proposed replacement of Calaveras Dam in Alameda County, California." Managed sediment transport and sluicing analyses in support of retrofit of a 30-foot-tall diversion dam. Led development of performance criteria for design of Central California Coast Steelhead passage improvements through the "Little Yosemite" reach of Alameda Creek.

State Coastal Conservancy, Carmel River Reroute and San Clemente Dam Removal, Monterey County, CA. Biology Task Manager. Developed plan for aquatic bioassessment. Led biological monitoring during geotechnical investigations. Advised riparian habitat design team regarding approaches to benefit South-Central California Coast steelhead.

AECOM

Noel Wong, PE

Principal-in-Charge

Areas of Expertise

Program Management
Project Management
Dam Safety and Rehabilitation
Roller-Compacted Concrete
Quality Management System
Resource Planning, Staff Development and Training

Education

MS, Geotechnical Engineering, University of California, Berkeley
BS, Civil Engineering, Syracuse University, New York

Licenses/Registrations

Professional Engineer (Civil), CA

Years of Experience

With AECOM	33
With Other Firms	6

Professional Associations

American Society of Civil Engineers
Association of State Dam Safety Officials
Tau Beta Pi
United States Society on Dams

Awards

Rehabilitation Designer of the Year Award for the Littlerock Dam and Reservoir Restoration Project/Association of State Dam Safety Officials
Yves Lacroix Innovative Practice Award for the Gibraltar Dam Seismic Strengthening Project / Woodward-Clyde Consultants

Noel Wong is Vice President and Project Director of AECOM's Water Resources Department for our Oakland operations, responsible for our water quality, watershed management, hydrologic/hydraulic, and dam engineering practices. From 1997 to 1998, Mr. Wong was the Managing Director of our Hong Kong office, which primarily provides environmental services. Before then, Mr. Wong was the Manager of the Oakland Civil/Geo-Engineering Department, which is responsible for our design and construction engineering services. As manager of these operations, Mr. Wong is experienced in leading and serving our clients with major projects with responsibilities in overall program development, project management, staffing, and quality assurance. As a nationally acclaimed dam practitioner, Mr. Wong has directed and participated in planning, investigation, design, and construction of major water projects.

Experience

State Coastal Conservancy (SCC) and California American Water Company (CAW), Carmel River Reroute and San Clemente Dam Removal Project, Monterey County, CA. Served as Project Manager for the initial alternative evaluations for seismic mitigation and later as Principal-in-Charge for the final design for seismic improvements to this concrete arch dam. Now serving as Principal-in-Charge overseeing design, permitting, and procurement support services for this $83M dam removal project, a first of its kind in California. The project resolves the existing dam safety problem through the removal of the dam. A portion of the Carmel River filled with about 2.5 million cubic yards of sediment is permanently bypassed by the construction of a diversion dike and a bypass-channel between the Carmel River and San Clemente Creek upstream of the dam. By removing the dam, steelhead has unimpaired access to over 25 miles of natural spawning and rearing habitat. Personally worked steadily with the private-public partnership of CAW and SCC and a large group of stakeholders to refine, develop, and advance the design and permitting of this complex and challenging dam safety and stream restoration project. Worked with CAW and SCC, individually and jointly, to manage and address obstacles related to flooding, sustainability, risk analysis, project delivery, and the long-term management plan.

San Francisco Public Utilities Commission (SFPUC), Calaveras Dam Replacement Project, Alameda and Santa Clara Counties, CA. Served initially as Project Manager for the conceptual design

phase, which included alternative evaluation of dam types and appurtenant works, to replace an 80-year-old hydraulic fill dam that is vulnerable to seismic liquefaction failure. Systematically assisted the SFPUC Infrastructure Division's Project Management, Engineering and Environmental staff to define, develop, and advance the design of the $450M Calaveras Dam Replacement Project from condition/needs assessment through alternative analysis to conceptual design. Subsequently served as Principal-in-Charge, overseeing AECOM's (legacy URS) engineering and environmental permitting teams to prepare the engineering design and technical studies required to support and advance the project through the dam safety regulatory approval process and the environmental review and California Environmental Quality Act (CEQA) certification process. Mr. Wong was also responsible for developing and conducting the first series of formal technical training sessions on geotechnical, dam, and tunnel engineering that SFPUC has since adopted as the model for technology transfer sessions for consultants working with the SFPUC.

Nevada Irrigation District, Centennial Reservoir Project, Grass Valley, CA. Served as Principal-in-Charge for geotechnical investigations and evaluations of type dam alternatives studies, including 280-foot-high RCC dams and CFRDs, that include considerations of dam foundation, construction materials, evaluations, river diversion, spillway and outlet facilities, potential environmental impacts including risks and costs for construction.

Stanford University, Searsville Dam Alternatives Study, Santa Clara and San Mateo Counties, CA. Served as Principal-in-Charge for systematic and comprehensive evaluations of alternatives to address fish passage and water storage that require close coordination with a very knowledgeable client group and stakeholders. The studies include dam stability, hydrology, hydraulics, sediment transport, flooding, channel geomorphology, fish passage, biological, and water supply analyses.

Ventura County Watershed Protection District, Matilija Dam Removal Plans, Sediment Transport Analysis, and Robles Diversion Mitigation, Ventura County, CA . Served as Principal-in-Charge for development and evaluation of alternatives for dam removal to restore passage for Southern California steelhead that included considerations of time between construction and unimpaired steelhead migration and effects of turbidity exposure (intensity and duration) on steelhead .

AECOM

Mourad Attalla, PhD, PE, SE

Structural and Geotechnical Engineering

Areas of Expertise

Structural Engineering
Geotechnical Engineering
Dams and Hydraulic Structures
Seismic Design and Engineering

Education

PhD, Structural Engineering, Cornell University
MS, Structural Engineering, Cairo University
BS, Civil Engineering, Cairo University

Licenses/Registrations

Professional Engineer (Structural), CA
Professional Engineer (Civil), CA

Years of Experience

With AECOM	8
With Other Firms	20

Dr. Mourad Attalla has over 28 years of experience in project management and structural engineering with extensive focus on dams and hydraulic structures. Dr. Attalla was a project manager and/or technical lead for numerous projects that involved seismic evaluation and retrofit of dam outlet works, control towers, tunnels and conduits, flood walls, basins and reservoirs. He also has extensive experience in building seismic design and engineering. He has authored several technical publications and keeps up to date with most recent research in the field.

Experience

San Francisco Public Utilities Commission (SFPUC), Calaveras Dam Replacement Project, Alameda County, CA. Lead Structural Engineer. Provided engineering support services during construction. AECOM (formerly URS) has been involved with many aspects of the high profile Calaveras Dam Replacement Project (CDRP), a project now under construction. The AECOM team completed a major geotechnical and seismic investigation program at Calaveras Dam on schedule and within budget. The planning and coordination effort taken by AECOM allowed the program to proceed smoothly with full support from all regulatory and lead management agencies.

Santa Clara Valley Water District (SCVWD), Almaden Dam Improvement Project – Planning, Environmental and Final Design Services, Santa Clara County, CA. Lead Structural Design for on the design of the spillway for the Almaden Dam Improvement Project, which involves seismic improvements of the intake structure, reconstruction of the outlet works, and spillway modifications for increased capacity and fish passage.

US Army Corps of Engineers, Folsom Dam Auxiliary Spillway Control Structure - South Pacific Region Wide Dam & Levee Safety Program TO 14 – Welding QA Support – Construction Phase Services, Folsom, CA. Managing a team of engineers and weld inspectors to conduct the quality assurance activities during construction. Work involves non-destructive testing and engineering assessment of the welds and bolts for the hydraulic steel structures. The contract includes the fabrication of six bulkhead gates, six tainter gates including trunnion assemblies, associated assemblies, and miscellaneous platforms and access steel structures. The team reviews the contract documents, shop drawings, welding procedures, and other documents necessary prior to QA testing.

US Army Corps of Engineers, Success Dam Intake Structure – South Pacific Region Wide Dam & Levee Safety Program TO 05 – Seismic Evaluation, Porterville, CA. Managed the design team to evaluate the dam intake structure and wingwalls. The structure was evaluated for two earthquake levels - the Operating Basis Earthquake and the Maximum Credible Earthquake and for two pool elevations: the current gross pool elevation and a raised gross pool elevation. A dynamic response spectrum analysis was carried out on a 3-dimensional computed model of the structure. The evaluation incorporated soil-structure and water-structure interaction effects. A detailed technical report was issued to the USACE that outlined the methodology, criteria, and expected damage for each condition studied.

US Army Corps of Engineers, Lake Isabella Dam TO 17 – Outlet Works Structures Seismic Evaluation and Conceptual Retrofit Design, Kern County, CA. Led the technical team to perform seismic analysis and develop conceptual retrofits for 10 outlet works structures in the main and auxiliary dams. The structures are evaluated for the OBE, MDE, and MCE earthquakes using a variety of analysis methods. Depending on the structure geometry and boundary conditions, either time history SSI analysis, modal response analysis, 3D pseudo-static analysis on a 2D pseudo-static analysis is performed. Seismic vulnerabilities were identified for each structure under each earthquake level. Two 10% concept retrofit designs were developed for each structure for the MDE and MCE. Cost estimates were developed for each retrofit.

Irvine Ranch Water District, Santiago Creek Dam Outlet Tower – Seismic Evaluation Structural Engineering Services, Santa Ana, CA. The Division of Safety of Dams of the California's Department of Water Resources has requested the IWRD and the Serrano Water District perform a seismic evaluation of the Santiago Creek Dam outlet tower to determine the potential failure mode under a major earthquake event to ensure adequate drawdown capacity following such an event. The Santiago Creek Dam is a rolled earth fill embankment completed in 1932 and certified by the DSOD. The dam is located in Orange County, California, and impounds water from Irvine Lake on Santiago Creek, a tributary to the Santa Ana River. The outlet works for the dam consist of the outlet tower, conduit and control house. The outlet tower is 135 feet high and has an interior diameter of 8 feet and an exterior diameter of 11 feet. The tower contains eight intakes located at 10-foot intervals. Responsibilities include performing an independent technical review and providing quality control of the structural analysis and evaluation of the outlet tower.

EXHIBIT 2-A

Balance Hydrologics, Inc.®

EDWARD D. BALLMAN, P.E.

Geomorphology, Hydrology, Hydraulics & Sediment Transport

Education:

M.E. Environmental Water Resources, Department of Civil and Environmental Engineering, University of California at Berkeley, 1998

B.Ch.E. University of Minnesota, 1982

Registered Professional Engineer: California #64095

Certified Professional in Stormwater Quality: CPSWQ #0379

Professional Affiliations:

Floodplain Management Association

American Society of Civil Engineers

Summary of Experience

Mr. Ballman is a leader in applying innovated solutions modeling the movement of water – in streams, rivers, and wetlands – relative to ecological function. Mr. Ballman regularly works with multiple-stakeholders on restoration projects and is known for successfully navigating permitting needs and facilitating collaboration amongst stakeholders. He leads the technical direction of Balance's 1D and 2D modeling efforts for fluvial and floodplain restoration projects, this work may include alternative analysis, modeling shear stresses, fish passage, depth analysis – relative to habitat needs, sediment studies, and water quality. Additionally, Mr. Ballman leads Balance's model calibration program – integrating real-time flow and sediment measurements for model calibration and verification. He also directs the development of complex plansets for stream, floodplain, and wetland restoration design including structural and biotechnical approaches. Lastly, he prepares floodplain analyses including LOMRS, CLOMRs and related documents supporting wetland and habitat restoration permitting.

Responsible for the development and application of computer models to all levels of water resource problems. Directs Balance's efforts in the fields of urban stormwater management including mitigating impacts related to both quantity and quality, and carries out statistical analyses of hydrologic data to support current design work. Prepares floodplain analyses including LOMRS, CLOMRs and related documents supporting wetland and habitat restoration or permitting. Assists in channel-stability and stream restoration efforts. Supports stream gaging, well-monitoring and other hydrographic functions performed by Balance.

Relevant Experience

Carmel River Floodplain Restoration and Environmental Enhancement, Monterey County, California. Mr. Ballman served as Principal Engineer for the floodplain restoration and flood control engineering component for this multi-year project carried out by the County of Monterey and the Big Sur Land Trust. Project goals include removal of extensive reaches of levees along the south bank of the Carmel River within the iconic Highway 1corridor, grading and habitat enhancement features for the multi-channel restored floodplain, and geomorphically appropriate transitions to the lagoonal environment that borders the west boundary of the site – goals were successfully met using 2-D hydraulic modeling.

Watsonville Slough Hydrologic Study, County of Santa Cruz, California. Mr. Ballman was the Principal-in-Charge for the hydrologic, hydraulic, and sediment transport models developed for Watsonville Slough system in Santa Cruz County that will be used as a dynamic planning tools by stakeholders in the watershed. The models were developed to assess impacts of potential land use and management changes within the 20 square mile watershed as well proposed restoration projects within the sloughs. In order to capture the complex hydrologic interactions of the system, a continuous simulation hydrologic model is being

developed to provide a detailed accounting of rainfall rates, applied irrigation, evapotranspiration, groundwater recharge, and shallow groundwater returns over a simulated 10-year period. A complex hydrodynamic model was developed to route the resulting 10-years of calculated inflows through the sloughs, interconnecting channels, pump stations, and shallow groundwater storage basins.

Enhancement of Wrigley Creek as Mitigation for Freight Rail Relocation to Support BART Extension, Santa Clara Valley Transit Authority, City of Milpitas, California. As the Principal Engineer for the Wrigley Creek Mitigation project, Mr. Ballman led the engineering efforts to prepare a restoration design package for a segment of engineered channel on Wrigley Creek. Wrigley Creek is primarily a naturalized flood conveyance channel which drains much of the urbanized area of Milpitas and transports a significant load of suspended sediment. This effort included a sediment transport model using data we collected from our local monitoring station on Berryessa Creek, only about 3000 feet distant from the project site. The final Design Feasibility Study formed the technical basis for completion of the project environmental review process.

Salinas River Diversion Dam Floodplain Mapping, Monterey County, California. Mr. Ballman served as Principal-in-Charge for remapping of the lower reaches of the Salinas River under contract to MCWRA. The remapping was conducted as part of the Salinas River Diversion Facility project located approximately 3 river miles upstream of the Highway 1 crossing. Work included reviewing the original FEMA modeling files, design plans of the proposed facilities, and other information regarding the river floodplain upstream to Blanco Road. Hydraulic modeling of the river required consideration of complex channel and overbank flow conditions to assess how the diversion dam facilities could be operated in a manner consistent with the County's Floodplain Management Plan.

Carmel River Lagoon Ecosystem Protective Barrier Project, City of Carmel, Monterey County, California. As Principal Engineer, Mr. Ballman coordinated Balances role in this effort, which includes hydrologic and hydraulic support for the planning and feasibility analysis for the proposed Carmel River Lagoon Ecosystem Protective Barrier (EPB). Our team is developing a number of design concept alternatives that consider a range of wall alignments, heights, and barrier types. Balance is collecting and analyzing existing data and reporting related to the Ecosystem Protective Barrier. This data will aid in identifying opportunities and constraints for the project, describe the range of project alternatives considered, present conceptual level designs for the preferred project alternatives, and summarize results of the hydraulic modeling and other qualitative impacts assessments.

Searsville Dam and Reservoir Alternatives, San Mateo County, California. As Principal Engineer Mr. Ballman has provided senior review of the 1-D and 2-D hydraulic and sediment-transport models for the San Francisquito Creek system and Searsville Reservoir. The models have been calibrated with flow and sediment field measurements collected by Balance's team during high-flow events, and to observed bed conditions and changes from year to year. Numerous alternatives have been explored with Stanford's project team, as well as citizen and agency forums.

Santa Ynez River Floodplain Mapping, Santa Barbara County, California. Mr. Ballman served as Principal Engineer for floodplain management assessments associated with aggregate mining operations along the Santa Ynez River in the County of Santa Barbara. This work included coordination and technical review of floodplain mapping activities with a particular emphasis on how alternative mining management strategies would impact flood flow conveyance along some of the most heavily populated reaches of the river corridor. This work required close cooperation with staff at both NOAA Fisheries and the California Department of Fish and Wildlife to assure that the management alternatives were consistent with anadromous fish habitat enhancement initiatives, while forwarding the objectives of the County's Floodplain Management Plan. Work products included FEMA mapping reflecting variable channel morphologies associated with mining cycles and sediment transport predictions.

EXHIBIT 2-A

Ethan Bell
Impacts to Steelhead

Ethan Bell (*M.S, Fisheries Biology*) has an in-depth understanding of steelhead habitat use and requirements in Central Coast streams of California. He has also been the lead fisheries biologist on a number of studies associated with evaluating impact to fisheries with dam removal alternatives, including on the Sandy River, the Klamath River, and the Matilija River. Mr. Bell has nearly 20 years of experience leading large-scale watershed assessments, fish passage analysis, population dynamics modeling, limiting factors analysis, and input on restoration design.

AREAS OF EXPERTISE

- Hydroelectric and Instream Flows
- Fish Stranding Evaluations
- Aquatic Ecology

EDUCATION

M.S., *Fisheries Biology*, Humboldt State University, 2001

B.S., *Ecology and Evolution*, University of California at Santa Barbara, 1990

PERMITS

USFWS Section 10(A)(1)(A) (Permit #TE198917-1) For Native Endangered Species Recovery – Wildlife

PROFESSIONAL AFFILIATIONS

- American Fisheries Society

SELECTED PUBLICATIONS

Krug, J., E. Bell, and R. Dagit. 2012. **Growing up fast in a small creek: diet and growth of a population of *Oncorhynchus mykiss* in Topanga Creek, California.** California Fish and Game 98: 38–46.

Bell, E., S. Albers, and R. Dagit. 2011. **Implications of juvenile growth for a population of southern California steelhead (*Oncorhynchus mykiss*).** California Department of Fish and Game Fish Bulletin.

SELECTED PROJECT EXPERIENCE

Effects of Sediment Release Following Dam Removal on Aquatic Biota of the Klamath River, CA (*Client: California Coastal Conservancy*): Mr. Bell served as the lead fisheries biologist for the analysis of the potential impacts of dam removal on aquatic biota of the middle and lower Klamath River, California. The fisheries analysis combined results of sediment transport modeling under a dam removal scenario with an in-depth knowledge of life-history timing for six focal fish species.

EIS/EIR and Secretarial Determination Overview Report for Klamath River Dam Removal *(Client: US Bureau of Reclamation)*: Mr. Bell served as aquatics lead for the synthesis and analysis of a large body of existing aquatics information on the Klamath River in support of the Klamath Facilities Removal EIS/EIR and Secretarial Determination Overview Report. Technical analyses have focused on evaluating the feasibility and potential impacts of fine sediment from the removal of four dams.

Matilija Dam Removal, Ventura County, CA *(Clients: Ventura County Watershed Protection District, as a subconsultant to URS)*: Mr. Bell is the aquatics lead to evaluate alternatives for removal of the Matilija Dam. Evaluations include assessing impacts from suspended sediment during dam removal, and effects to channel morphology and aquatic habitat from sediment transport downstream.

Dam Removal Evaluation, Bull Run Hydroelectric Projects, OR *(Client: Portland General Electric):* Mr. Bell led efforts to evaluate dam removal alternatives for the Marmot Dam on the Sandy River. Analysis included assessing the potential impacts of suspended sediment during removal, as well as the long-term effects of increased sediment supply on downstream habitat. Mr. Bell coordinated with NMFS and USFWS for ESA consultations for the dam decommissioning effort.

Carmel Lagoon Habitat Enhancement Project, Monterey County, CA *(Client: Carmel River Steelhead Association)*: Mr. Bell evaluated steelhead habitat and population dynamics within the Carmel Lagoon to assess habitat restoration alternatives. Based on this analysis he led the design

Bell, E., R. Dagit, and F. Ligon. 2011. **Colonization and Persistence of a Southern California Steelhead (*Oncorhynchus mykiss*) Population.** Bulletin of the Southern California Academy of Sciences.

Bell, E., S. Kramer, D. Zajanc, and J. Aspittle. 2008. **Salmonid fry stranding mortality associated with daily reservoir fluctuations in Trail Bridge Reservoir, Oregon.** North American Journal of Fisheries Management 28: 1515–1528.

Bell, E. and W. Duffy. 2007. **Previously undocumented two-year freshwater residency of juvenile coho salmon in Prairie Creek, California.** Transactions of the American Fisheries Society 136: 996–970.

Bell, E., W. G. Duffy, and T. D. Roelofs. 2001. **Fidelity and survival of juvenile coho salmon in response to a flood.** Transactions of the American Fisheries Society 130: 450–458.

Bell, E. 2001. **Survival, growth and movement of juvenile coho salmon (*Oncorhyncus kisutch*) over-wintering in alcoves, backwaters, and main channel pools in Prairie Creek, California.** Master's thesis. Humboldt State University, Arcata, California.

of a habitat restoration effort for the lagoon. Permitting is complete, and the project will be constructed in spring 2017.

Big Sur River Steelhead Management Plan, Monterey County, CA; Technical Lead (*Client: Resource Conservation District of Monterey County)*: Mr. Bell led Stillwater Sciences' contributions to this collaborative planning project. He conducted an evaluation of steelhead limiting factors, based on an integration of results of assessments of hydrology, geology, water quality, and habitat conditions. He had a critical role in integrating the results of these evaluations, along with the work of project partners, to identify appropriate measures to conserve, manage, and potentially enhance the steelhead population in the watershed.

Flooding Solutions and Aquatic Analysis in Lower Butano Creek, San Mateo County, CA; Project Manager and Technical Lead (*Client: San Mateo County Resource Conservation District)*: Mr. Bell coordinates with cbec Engineering to develop and analyze (i.e., model) several management action alternatives to identify a solution to chronic flooding, while minimizing impacts to the threatened and endangered species which utilize the area. He is responsible for identifying options to enhancing habitat for the listed species, while still achieving a solution to the chronic flooding. He will also participate in efforts to provide the community and the regulatory agencies with the knowledge and tools necessary to take action.

Topanga Canyon Creek Southern Steelhead Analysis; Project Manager and Lead Fisheries Scientist (*Client: Resource Conservation District of the Santa Monica Mountains)*: Mr. Bell led an analysis on growth, survival, and life history of southern steelhead in Topanga Canyon Creek, Malibu County, California. Key research efforts included using passive integrated transponders (PIT tags) and stationary antennas to monitor migration (including fish passage), survival, population size, and growth of the population.

Santa Rosa Creek Watershed Management Plan, San Luis Obispo County, CA (*Client: Greenspace – the Cambria Landtrust)*: Mr. Bell provided technical assistance for the development of a watershed management plan, which included a steelhead limiting factors analysis.

AECOM

Madeleine Bray, EIT

Reservoir Expansion

Areas of Expertise

Geotechnical Engineering
Structural Engineering
Field Engineering

Education

BS, Civil Engineering, Structural Engineering Concentration, University of Notre Dame

Licenses/Registrations

Engineer-in-Training, CA, 2016

Years of Experience

With AECOM	<1
With Other Firms	<1

Madeleine Bray is a recent graduate from the University of Notre Dame, joining AECOM in July 2016. Prior to joining AECOM, Madeleine spent 3 months during the summer of 2015 as a geotechnical engineering intern with ENGEO Incorporated in San Ramon, California, and Christchurch, New Zealand. Her work included site reconnaissance and field testing, design, quality assurance for construction activities, and laboratory materials testing. Since her start with AECOM, she has been involved in a number of projects, assisting with field reconnaissance, production of drawing sets using Civil 3D, and performing slope stability analyses.

During her time with ENGEO Incorporated, Ms. Bray performed geotechnical design calculations, wrote geotechnical design reports, prepared quality control plans, and reviewed daily field reports. She also performed field testing and observed foundation construction activities. Madeleine has expanded this experience during her time with AECOM, leading geotechnical field work, project budget management, production of drawing sets, and assisting with geotechnical analyses. Madeleine has developed a level of expertise in the use of industry standard software such as AutoCAD Civil 3D, CLiq v.2.0, SLIDE7.0, SLOPE/W and gINT.

Experience

EBMUD Mokelumne Aqueduct Delta Tunnel, Stockton, CA. Madeleine worked as a field representative during the geotechnical investigation phase of the project and was responsible for tracking all geotechnical investigation activities and budget. She is now in charge of developing a subsurface characterization profile for the 16.5 mile tunnel alignment and is assisting in writing the Geotechnical Data Report.

Oakland Airport Perimeter Dike, Oakland, CA. Madeleine has supported the project team by running slope stability analyses and helping to find alternatives to minimize surrounding wetland impacts. She has also assisted in developing a new alignment for the perimeter dike structure as an alternative to reduce the overall cost of the project. With this project, she has expanded her knowledge of SLOPE/W and Civil3D.

EXHIBIT 2-A

Balance Hydrologics, Inc.®

SHAWN CHARTRAND, PG, CEG

Geomorphology

& Sediment Transport

Education:

PhD Candidate, Physical Geography, University of British Columbia

M.S. Geological Sciences, Department of Geology, Case Western Reserve University, 1997

B.A. Environmental Geology, Case Western Reserve University, 1995

Registered Professional Geologist:

California #7817

Certified Engineering Geologist:

California #2442

Professional Affiliations:

American Geophysical Union

Geological Society of America

Summary of Experience

He specializes in conducting fluvial geomorphic, geochemical and hydrologic studies for the protection and management of a wide-range of biological and physical resources. Many studies lead to the development of restoration or re-habilitation plans, which he oversees from conceptualization through post-construction monitoring. Experienced in 1-D and 2-D hydrodynamic models to guide restoration design development including, use of habitat suitability indices with 2-D output to refine design concepts and communicate results to stakeholders and regulators. He brings unique expertise to steep channel design through his applied research on step-pools, and routinely develops numerical models to explore problems and identify suitable solutions and/or points of compromise. Mr. Chartrand has been involved in 3 of the California Big 5 dam removal projects. For San Clemente Dam Removal on the Carmel River he led the geomorphic assessment and channel design effort, and is now the Owner representative for the dam removal construction.

He has developed analytical tools to evaluate water supply and in-stream habitat vulnerabilities due to climate change projections. Based on these evaluations, he provides guidance to water supply planning efforts, with the goal to minimize potential effects of climate change on water supply availability and in-stream habitat.

Mr. Chartrand has currently advanced to candidacy for a PhD at the University of British Columbia. His thesis involves numerical modeling and physical experimentation to explore pool-riffle formation in coarse-grained mountain streams. A proposed pool-riffle formative regime forms the basis of his work, and it is hoped that research findings can translate into improved strategies to design pool-riffle stream reaches.

Relevant Experience

Searsville Dam and Reservoir Alternatives, San Mateo County, California. Mr. Chartrand provided input to the development of a quasi-unsteady state 1D model for existing conditions. Additionally, calibrating the model with sediment field measurements collected by Balance's team during high flow events. This 1D model has been compared to the previous 2D non-steady state model. As the project moves forward, project alternatives will be run through the 1D model.

Carmel River Odello Floodplain Restoration, Monterey County, California. Lead Geomorphologist responsible for historic review of river conditions along the Odello floodplain, development of risk-based avulsion assessment for the Odello reach, and development of a 1-D sediment transport model of the floodplain at flood flow conditions. The sediment transport model was custom built and includes multiple transport functions and steady and unsteady flow. In progress.

Restoration Design: Carmel River Reroute and the San Clemente Dam Removal, Monterey County, California. Working collaboratively with Interfluve, Inc., and under a Coastal Conservancy contract to URS Corporation, served as

Balance Hydrologics, Inc.®

lead design Geomorphologist for the Carmel River reroute portion of this ambitious dam removal and river relocation whose focus is the use of step-pools to re-build a functioning, fish-passable river reach.

Matilija Dam Removal Plans and Sediment Transport Analysis and Robles Diversion Mitigation, Ventura County, California. Balance Hydrologics, under the direction of Shawn Chartrand, Principal Geomorphologist, is responsible for final review and validation of the sediment-transport modeling and grade attenuation simulations for the proposed removal of Matilija Dam. Responsibilities include review of assumptions, calibration, and computations, and making recommendations to URS, the prime contractor for the dam removal investigation and design.

Catalog of Active Sediment Sources and Control Opportunities, Apanolio Creek, Half Moon Bay, San Mateo County, California. Mr. Chartrand was the technical lead the for this inventory of unstable and/or active erosion sites in the Apanolio basin, a tributary to Pilarcitos Creek, related to erosion of channel banks, hillslopes and roads due to either natural processes, or anthropogenic influenced practices. The final product of the inventory was a catalog for restoration which identifies apparent sediment source sites, and recommends cost-effective repairs for these sites. The catalog of problem sites and repairs can serve as a root list from which the RCD of San Mateo County and involved owners can select repairs as funding becomes available to reduce sediment delivery to Apanolio Creek and lower Pilarcitos Creek.

Hydrology for the City of Santa Cruz Habitat Conservation Plan (HCP), Santa Cruz County-wide, California. Mr. Chartrand led the effort to assist the City prepare a Habitat Conservation Plan (HCP) for the watersheds from which the community draws its water supply. Balance has and is presently leading HCP efforts focused on hydrologic characterization of watersheds which provide drinking water through diversions at run-of-the-river dams. Mr. Chartrand developed a custom-built MATLAB model framework to evaluate how diversion operations interact with water supply demand and the quality of downstream steelhead (Oncorhynchus mykiss). Along with the development of a custom-built hydrologic model to evaluate how climate change predictions in air temperature and rainfall for three different emissions scenarios may affect water supply availability, and the quality of steelhead habitat under future conditions.

Lagunitas Creek Tocaloma Floodplain Restoration, Marin County, California. Principal-in-Charge and Lead Geomorphologist/Hydrologist for the Tocaloma floodplain restoration. Responsible for development of floodplain inundation study and assessment, avulsion risk assessment and baseline geomorphic characterization report. Lead development of 100% construction plans and specifications. Construction planned for summer 2016. In progress.

Restoration Design: Stevens Creek at Blackberry Farm Phase I, City of Cupertino, Santa Clara County, California. Senior Design Geomorphologist for development of the stream corridor restoration plan for Stevens Creek at Blackberry Farm. The corridor designs were rooted within a set of robust fluvial geomorphic, hydrologic, sediment transport, and fishery habitat analyses, each of which were peer reviewed by staff at the Santa Clara Valley Water District.

Enhancement of Wrigley Creek as Mitigation for Freight Rail Relocation to Support BART Extension, Santa Clara Valley Transit Authority, City of Milpitas, Santa Clara County, California. As the Principal-in-Charge for the Wrigley Creek Mitigation project Mr. Chartrand led the restoration design, working closely with Balance engineers, and prepared a restoration design package for a segment of engineered channel on Wrigley Creek. This effort included a sediment transport model using data we collected from our local monitoring station on Berryessa Creek, only about 3000 feet distant from the project site.

Restoration Design: Upper Penitencia Creek at Berryessa BART Station, Santa Clara County, California. Principal-in-Charge and Project Manager for development of a corridor enhancement plan for Upper Penitencia Creek at the planned Berryessa BART campus in northeast San Jose. The design planning and review process occurred under a very compressed timeline in order to meet construction schedule goals for the Berryessa BART campus. To meet the compressed timeline and prepare a defensible enhancement plan, Balance staff utilized the CFAAR design process framework, developed in house, which focuses on understanding first and foremost project site context. The primary ecological focus of the project was to enhance passage conditions for steelhead, and improve general aquatic habitat character as much as feasible.

EXHIBIT 2-A

Yantao Cui, Ph.D.

DREAM Modeling

Dr. Yanto Cui (*Ph.D., Civil Engineering*) has 25 years of experience in hydraulic, hydrologic, sediment transport, and fluvial geomorphologic analyses. He has developed state-of-the-art numerical sediment transport models for simulations of physical processes related to landslide, sediment pulse evolution, dam removal, mine waste rock and tailings disposals, and with experiences for rivers both large and small in the U.S. and abroad. Dr. Cui is the author or coauthor of more than two dozen peer-reviewed journal publications and book chapters, including a chapter in ASCE Manual 110 Sedimentation Engineering, and was a co-recipient of the International Association for Hydraulic Research's Harold Jan Schoemaker Award in 1999. He was an invited speaker/lecture at many national conferences and national and international institutions as a recognized expert in sediment transport and river mechanics.

EDUCATION

Ph.D., *Civil Engineering,* University of Minnesota, 1996

M.E., *Hydraulic Engineering,* Institute of Water Conservancy and Hydro-electric Power Research, Beijing, China, 1987

B.E., Water Resources *Engineering,* Tsinghua University, Beijing, China, 1984

YEARS OF EXPERIENCE

At Stillwater: 16 years
In Total: 25 years

HONOR

International Association for Hydraulic Research (IAHR) Harold Jan Schoemaker Award, 1999

PEER-REVIEWED JOURNAL PAPERS & BOOK CHAPTERS

Cui, Y., Booth, D.B., Monschke, J., Gentzler, S., Rodifer, J., and Gathard, D. (in preparation) **Analyses of fine sediment transport for a large dam removal project.** In preparation for submission to Water Resources Research (currently under co-authors' review, targeted for submission before March 15, 2016).

Cui, Y., Collins, M.J., Andrews, M., Boardman, G.C., Wooster, J.K., Melchior, M., and McClain, S. (under review). **Modeling sand transport**

SELECTED PROJECT EXPERIENCE

Study for the potential removal of J.C. Boyle, Copco 1, Copco 2, and Iron Gate dams on the Klamath River, CA *(Clients: California State Coastal Conservancy):* Dr. Cui led a Stillwater Sciences multidisciplinary team to provide sediment transport, fisheries biology and water quality analyses for the proposed removal of the four downstream most dams on the Klamath River in California and Oregon. Four technical reports (available at www.stillwatersci.com) and several technical memoranda were produced, providing detailed sediment transport modeling results, evaluations of fisheries impacts associated with the modeled sediment release, and synthesis of current knowledge in water quality issues in the Klamath River. Prior to this study, Dr. Cui provided a preliminary analysis for the potential sediment transport dynamics in the Klamath River following the proposed dam removal under the worst-case-scenario with limited field data (*Client: American Rivers*). The team also provided technical support to a State and Federal water quality team for the Secretarial Determination process in evaluating the feasibility and potential impacts of the removal of four dams on the Klamath River (*Client: Bureau of Reclamation*).

Matilija Dam Ecosystem Restoration (*Client: Ventura County Watershed Protection District*): The AECOM-Stillwater team evaluated over a dozen alternatives previously proposed over the past 20 years by various parties for the removal of Matilija Dam and proposed six alternatives for further screening. Through sediment transport and cost analysis, the team further narrowed the number of potential alternatives to three for stakeholders to consider. Dr. Cui's primary responsibility during this study was to provide sediment transport analysis associated with various dam removal alternatives. He was the primary proponent for two of the three alternatives proposed to the stakeholders that encourage quick sediment release as a means to minimize the duration of environmental impact and project cost. The project is currently ongoing.

Iowa Hill Pumped Storage Facility turbidity analysis *(Client: SMUD):* Provided analysis for potential turbidity problems in and downstream of Slab Creek Reservoir associated with the operation of the proposed construction of Iowa Hill facility. Dr. Cui was approached by the client to

following Simkins Dam removal: DREAM-1 prediction compared with field observations. Journal of Hydraulic Engineering (Submitted on 21 December 2015, manuscript number HYENG-9873).

Cui, Y., J.K. Wooster, C.A. Braudrick, and B.K. Orr, 2014. **Marmot Dam removal project, Sandy River, Oregon: Lessons learned from sediment transport model predictions and long-term post-removal monitoring.** Journal of Hydraulic Engineering, doi: 10.1061/(ASCE)HY.1943-7900.0000894.

Booth, D.B., Y. Cui, Z. Diggory, D. Petersen, J. Kear, M. Bowen, 2013. **Determining appropriate instream flows for anadromous fish passage on an intermittent mainstem river, coastal southern California, USA.** Ecohydrology, doi: 10.1002/eco.1396.

Cui, Y., Dusterhoff, S.R., Wooster, J.K., and Downs, P.W. 2011. **Practical considerations for modeling sediment transport dynamics in rivers.** Stream Restoration in Dynamic Fluvial Systems: Scientific Approaches, Analyses, and Tools, Simon, A., Bennett, S.J., and Castro, J. eds., 503-527, American Geophysical Union, ISBN 978-0-87590-483-2.

Downs, P. W., Y. Cui, J. K. Wooster, S. R. Dusterhoff, D. B. Booth, W. E. Dietrich, and L. Sklar. 2009. **Managing reservoir sediment release in dam removal projects: an approach informed by physical and numerical modeling of non-cohesive sediment.** The International Journal of River Basin Management, in press.

construct a sediment transport numerical model as requested by the regulating agency. After an initial consultation, Dr. Cui proposed that the analysis be conducted without the use of a sediment transport model, and a simple mass balance exercise should be able to address the issue. The analysis proceeded as Dr. Cui proposed and, after a thorough peer-review process, was determined to answer the question satisfactorily. See Cui et al. 2007 and Cui et al. 2011 for brief descriptions.

Evaluation of sediment transport and other geomorphic processes in the Sacramento River (*Client: TNC/CALFED*): Developed the Unified Gravel-Sand (TUGS) model for evaluation of sediment transport, channel aggradation/degradation, and changes in bed material grain size distributions. Dr. Cui is a major technical contributor to this project. Detailed descriptions of the model and its applications can be found in two publications (Cui 2007a,b).

Sediment transport modeling following Ercon Mat in Alameda Creek *(Client: PG&E):* Provided sediment transport modeling service to assist the client in their effort to relocate a pipeline that crosses the creek.

Numerical Modeling, Merced River Corridor Restoration Plan (*Client: CALFED*): Dr. Cui, a major technical contributor to this project, developed a numerical model for evaluation of sediment transport issues, which can potentially be used for evaluation of restoration strategies if the project moves forward.

Assessment of fine sediment transport following the proposed removal of the Soda Springs Dam, North Umpqua River, OR (*Client: PacifiCorp*): A sediment transport model was developed to evaluate the sediment transport characteristics following the proposed removal of Soda Springs Dam on the North Umpqua River, Oregon. Model results indicated that fine sediment will be transported downstream through the steep channel (approximately 0.006 channel gradient) as a wave with extremely high suspended sediment concentration that lasts for a short period of time. **Note:** The Soda Springs Dam will not be removed as part of the relicensing settlement agreement between PacifiCorp and the regulatory agencies.

Development of the Dam Removal Express Assessment Models (DREAM) *(Client: NMFS)*: Based on the experiences for Marmot Dam and Soda Sprint Dam removal sediment transport modeling, Dr. Cui developed DREAM-1 and DREAM-2 models for simulation of coarse and fine sediment transport following dam removal. The development of the two models allowed us to conduct sediment transport modeling following dam removal more efficiently. The two models are also easy to adapt for simulation of other sedimentation problems in rivers and have been used in several such projects. Two articles describing the models were peer reviewed and published in Journal of Hydraulic Research (Cui et al. 2006a,b).

EXHIBIT 2-A

University of British Columbia

Carles Ferrer-Boix, PhD

Geomorphology, Hydrology, Hydraulics, & Sediment Transport

Research Interests

Fluvial Geomorphology
Sediment Transport
River and Delta Morphodynamics
Hydraulic Engineering

Education

PhD, River bed degradation due to gravel mining and dam removal. Mathematical and experimental study. Technical University of Catalonia
MSc, Civil Engineering, Technical University of Catalonia
BSc, Civil Engineering (Specialization in Hydrology), Technical University of Catalonia

Reviewer Scientific Committee

Water Resources Research
Journal of Hydraulic Engineering
Geomorphology
Journal of Applied Water Engineering and Research
Water Technology and Sciences
Cuadernos de Investigacion Geografica
Member, Restaurarios, 2015: II Iberian River Restoration Congress, Pamplona, Spain

Years of Experience

18

Invited Presentations

Channel evolution after dam removal in a poorly-sorted sediment mixture: experiments and numerical model. LCH - Laboratoire de constructions hydrauliques - School of Architecture, Civil and Environmental Engineering, Ecole Politechnique Federal de Lausanne, EPFL, 2014.

Mathematical and experimental study of river bed degradation due to gravel mining and dam removal. UNESCO International Hydrological Programme, through the International Sediment Initiative. Instituto de Ingeniera, Universidad Nacional Autonoma de Mexico, 2011.

Mathematical model for river bed degradation due to gravel mining. Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, 2007.

Selected Teaching Experience

Water and Landscapes. An introduction to Hydrology and Geomorphology (fuvial, coastal and glacial systems, tectonics, surface and subsurface hydrology). Undergraduate course. Department of Geography, University of British Columbia, Canada. Years 2013-2014, 2014-2015, and 2015-2016. Number of students: 250.

Watershed Geomorphology. Hillslope and stream channel processes and their rates of operation. Analysis and modeling geomorphic processes and associated hazards at the watershed scale. Applications in geoscience and engineering. Undergraduate course. Department of Geography, University of British Columbia, Canada. Years 2015-2016. Number of students: 25.

Sediment transport and fluvial morphology. An advance course on one-dimensional numerical modelling in rivers. Application to sediment mixtures. Numerical modelling. Graduate course (MSc. and PhD students). Department of Geography, University of British Columbia, Canada. Years 2012-2013. Number of students: 10-15.

River Engineering (4th year Civil Engineering B.Sc.) & Fluvial Hydrosystems (5th year Civil Engineering, M.Sc. and Ph.D. students). Technical University of Catalonia. Two-three sessions per semester, from 2005 until 2011. Number of students: 15-75.

Selected Publications

Ferrer-Boix, C., S. M. Chartrand, M. A. Hassan, J. P. Martin-Vide, and G. Parker, On how spatial variations in channel width influence river prole curvature, Geophysical Research Letters, in review, 2016.

Ibisate, A., V. Acn, D. Ballarin, C. Ferrer-Boix, D. Granado, J. Horacio, A. Mesanza, D. Mora, A. Ollero, J.P. Martin-Vide, Geomorphic monitoring and response to two dam removals: Urumea and Leitzaran Rivers, Earth Surface Processes and Landforms, in review, 2016.

Juez, C., C. Ferrer-Boix, J. Murillo, M. A. Hassan, and P. Garcia-Navarro, A model based on Hirano-Exner equations for two-dimensional transient flows over heterogeneous erodible beds, Advances in Water Resources, 87, 1-18, doi: 10.1016/j.advwatres.2015.10.013, 2016.

Ferrer-Boix, C., and M. A. Hassan, Channel adjustments to a succession of water pulses in gravel bed rivers, Water Resources Research, 51, doi: 10.1002/2015WR017664, 2015.

Ferrer-Boix, C., J. P. Martin-Vide, and G. Parker, Sorting of a sand-gravel mixture in a Gilbert-type delta, Sedimentology, doi: 10.1111/sed.12189, 2015.

Ferrer-Boix, C. and M. A. Hassan, Influence of the sediment supply texture on morphological adjustments in gravel-bed rivers, Water Resources Research, 50, doi: 10.1002/2013WR015117, 2014.

Ferrer-Boix, C., J. P. Martin-Vide, and G. Parker, Channel evolution after dam removal in a poorly sorted mixture. Experiments and numerical model, Water Resources Research, 50, doi: 10.1002/2014WR015550, 2014.

Viparelli, E., A. Blom, C. Ferrer-Boix and R. Kuprenas, Comparison between experimental and numerical stratigraphy emplaced by a prograding delta, Earth Surf. Dynam., 2, 323-338, doi:10.5194/esurf-2-323-2014, 2014.

Selected Book Chapters

Hassan, M. A., Ferrer-Boix, C., Cienciela, P., Chartrand, S. M., Sediment transport and channel morphology: implications for fish habitat, In A. Radecki-Pawlik, S. Pagliara and J. Hradecky (Eds.) Open Channel Hydraulics, River Hydraulics Structures and Fluvial Geomorphology, Taylor and Francis group, accepted, 2016.

Ferreira, R. M. L., Hassan, M. A. and Ferrer-Boix, C., Principles of bedload transport of non-cohesive sediment in open-channels, In P. Rowinski and A. Radecki-Pawlik (Eds.), Rivers Physical, Fluvial and Environmental Processes, 323-372, Springer International Publishing AG, ISBN: 978-3-319-17718-2, doi: 10.1007/978-3-319-17719-9, 2015.

AECOM

Michael Forrest, PE, GE

Quality Assurance/Quality Control

Areas of Expertise

Dams
Tunnels and Shafts
Foundation Treatment
Cutoff Walls
Canals
Constructability Reviews

Education

MS, Foundation Engineering, University of Birmingham, England
BS, Civil Engineering, University of California, Berkeley

Licenses/Registrations

Professional Engineer (Civil), CA AK, MT, OR, TX, UT, CO
Professional Engineer (Geotechnical), CA

Years of Experience

With AECOM	26
With Other Firms	18

Professional Associations

American Society of Civil Engineers (ASCE)
Association of State Dam Safety Officials (ASDSO)
United States Society on Dams (USSD)

Mike Forrest has more than 40 years of engineering experience. His wide range of responsibilities has included managing site selection studies, geotechnical investigations, feasibility studies, alternatives evaluation, conceptual through final designs, and construction management. He has lead multi-disciplinary teams and has managed many projects for design and rehabilitation of major embankment dams, roller compacted concrete (RCC) dams, levees, canals, tunnels and shafts, and has extensive experience in treatment of both soil and rock foundations. He is also actively involved in post-construction performance monitoring of many reservoirs. He has been extensively involved on projects requiring state and federal agency approvals including the California Division of Safety of Dams.

Experience

Nevada Irrigation District, Centennial Reservoir Project, Grass Valley, CA. Project Manager for geotechnical investigations and type of dam studies, including 280-foot-high RCC dams and CFRDs. Responsible for design of the selected RCC dam alternative, including foundation and material evaluations, river diversion, spillway and outlet facilities.

Ventura County Watershed Protection District, Matilija Dam Removal and Ecosystem Restoration Project, Ventura, CA. Technical reviewer for restoration alternatives that included diversion through the dam, abutment tunnel, and hydraulic control structures.

U.S. Army Corps of Engineers, Folsom Approach Channel Excavation Feasibility Study for Folsom Dam Joint Federal Project, Sacramento County, CA. Project Manager for alternatives to excavate the approach channel for the Folsom Dam Auxiliary Spillway. The scope of work included engineering services to develop a feasibility level study and final design of temporary cofferdam alternatives and auxiliary spillway approach channel excavation methods and associated construction cost estimates. Work components included feasibility design of cofferdam alternatives up to 100 feet high, evaluations of blasting parameters (e.g., air and water over-pressure and vibration control) for land-based and under-water blasting, cost estimation, and evaluations of constructability and risk. Potential environmental impacts to air, water, noise, cultural resources, and biological (aquatic and terrestrial) resources were also evaluated. Mr. Forrest managed the final design and preparation of construction plans and specifications of the approach channel and the instrumentation of the control structure.

SFPUC, Calaveras Dam Conceptual and Final Design Engineering, Alameda and Santa Clara Counties, CA. Engineering and Project Manager for evaluation of dam types and appurtenant works to replace an 80-year-old hydraulic fill dam that is vulnerable to liquefaction failure. Project features include a 160-foot-deep, 20-foot-diameter intake shaft with four connecting intake tunnels, and large side channel spillway. Design parameters included initial construction of a 220-foot-high dam that could be raised in the future to 390 feet, increasing the reservoir capacity four-fold. Mr. Forrest's responsibilities included preparing designs and cost estimates for various alternative projects and for providing support to the environmental review process, final design, coordination of analyses and geotechnical investigations, and preparation of plans and specifications for this $250 million project. He is currently providing engineering services during construction.

California Department of Water Resources, Delta Habitat Conservation and Conveyance Project, Sacramento, Yolo, Contra Costa and San Joaquin Counties, CA. Engineering Manager for conveyance options that include Isolated Conveyance-East, Isolated Conveyance-West, Through Delta, Dual Conveyance, and All-Tunnel Option (ATO). Mr. Forrest's responsibilities include development of QC procedures, design standards, work plans, work coordination including staffing and developing task order scopes, budgets and schedules. He led development of seismic criteria for geotechnical design and conducted independent technical reviews of conceptual engineering reports and other DHCCP documents. Mr. Forrest led the Engineering Design and Operations group for a Risk Workshop that evaluated cost and schedule risks to the ICF-East ICF-West and ATO alternatives.

California Department of Water Resources, Delta Risk Management Strategy, Sacramento-San Joaquin Delta, CA. Task Leader was in charge of damage estimates for infrastructure resulting from levee failures caused by flooding or earthquakes within the Delta-Suisun Marsh, covering an area of 750,000 acres. Infrastructure asset evaluations included aqueducts, gas and petroleum pipelines, transmission lines, airports, railroads, highways, bridges, and commercial and industrial structures. Damage assessments were made for single and multi-island failure scenarios, and addressed sea level rise resulting from global warming. He was also involved in risk reduction strategies for this project.

U.S. Bureau of Reclamation, B.F. Sisk Dam, Merced County, CA. Independent technical reviewer for the groundwater characterization and foundation and embankment material characterization technical memoranda. He is also the independent technical reviewer for the nonlinear (FLAC) dynamic deformation analyses for the embankment dam.

AECOM

Samuel Gambino, PE, GE

Structural and Geotechnical Engineering

Areas of Expertise

Slope Stability Analysis and Design
Dams, Reservoirs, and Levees
Foundation Design and Excavation

Education

MS, Geotechnical Engineering, University of Texas, Austin
BS, Civil and Environmental Engineering, University of Michigan, Ann Arbor

Licenses/Registrations

Professional Engineer (Geotechnical), CA
Professional Engineer (Civil), CA

Years of Experience

With AECOM	20
With Other Firms	0

Professional Associations

Member of American Society of Civil Engineers (ASCE)
Chair of ASCE's San Francisco Geotechnical Institute
Chi Epsilon National Civil Engineering Honor Society

Training and Certifications

Regional Quality Officer for NorCal Operations
Office Quality Officer for Oakland Operations
CPN Radiation Safety and Use of Nuclear Gauges
OSHA 40-Hour HAZWOPER Training

As a Regional Quality Officer, Group Director, Project Manager, and Senior Geotechnical and Civil Engineer, Sam Gambino has contributed to a broad array of tunneling, geotechnical, water resource, and environment-related projects. His project experience encompasses a wide variety of tunnels, dams, and reservoirs. He offers a valuable combination of varied project experience and commitment to quality. As part of project teams, he has repeatedly served as internal reviewer and performed field quality-assurance testing.

Experience

SFPUC, Calaveras Dam Seismic Rehabilitation Conceptual Engineering Study, Alameda County, CA. Project Engineer. Assignment entailed development and evaluation of alternative rehabilitation, enlargement, and landslide treatment schemes for seismically vulnerable hydraulic-fill dam. The dam failed during original construction in 1918, and was reconstructed without removing the failed material. Alternative remedial schemes were analyzed for seismic stability and deformation, including partial excavation, buttressing, and in-situ ground improvement with stone columns. Assisted the Lead Project Engineer in developing repair and enlargement alternative designs, performed slope stability analyses for these scenarios, and peer reviewed, guided and critiqued calculations performed by junior staff.

California Department of Water Resources (DWR), Urban Levee Geotechnical Evaluations Program, West Sacramento, CA. Task Order Manager. The Urban Levee Geotechnical Evaluations (ULE) Program evaluates levee systems estimated to protect more than 10,000 people. Analyses results are presented in a Geotechnical Evaluation Report (GER) that includes analyses of freeboard, erosion, seepage, stability, and seismic vulnerability. A GER identifies levee reaches not meeting evaluation criteria that may require remediation (Volume 1, Existing Conditions) and includes feasible conceptual repair alternatives and estimated costs (Volume 2, Remedial Measures). Investigations include continuous rotary wash borings, cone penetration tests, geophysical investigations, and laboratory testing. Task order manager for the evaluations in the West Sacramento and South West Sacramento study areas and principal author of the Program's prototype GER.

U.S. Army Corps of Engineers (USACE), Chico-Mud Creek Periodic Levee Inspection, Chico, CA. Task Manager. Coordinated and conducted field inspections for approximately 25

miles along the Chico and Mud Creek levee systems near Chico. Prior to field inspections, reviewed historical data and design drawings to identify potential problems or areas where the levees were not up to current design standards. During inspections, coordinated with local maintaining agency and organized field crew to document via tablet computer with ArcMap and GPS capabilities observed deficiencies in these levee systems. Coordinated and co-authored multiple drafts of the report and database of deficient areas, complete with detailed descriptions and photos, which was provided to both the USACE and local maintenance authorities. This project involved extensive interaction with local and federal authorities and planning of lengthy field investigations.

DWR, Urban Levee Geotechnical Evaluations Program, Deep Water Ship Channel Study Area, South West Sacramento CA. Task Order Manager. DWR has identified approximately 30 miles of Urban Non-Project levees for investigation. These levees protect urban communities in southern West Sacramento. This includes over 3 miles of Port North levees, over 3 miles of Port South levees, over 1 mile of South Cross levee, and approximately 23 miles of Deep Water Ship Channel (DWSC) West Bank levee. URS was responsible for task coordination and management of this study area's geotechnical evaluations. URS reviewed the area's geomorphology, helicopter-borne electromagnetic (HEM) survey data and other historical exploration data. The proposed supplemental investigation fills identified data gaps and includes additional explorations at levee crests and near landside toes, and an associated laboratory testing program.

DWR, Non-Urban Levee Geotechnical Evaluations, West Sacramento, CA. Independent Technical Reviewer. Investigation and evaluation of non-urban levees in California. Investigations include continuous rotary wash borings, cone penetration tests, geophysical investigations, and laboratory testing. Evaluations include through-seepage, under-seepage, stability, and erosion. Task order co-manager for the evaluations in the West Sacramento area.

Lopez Dam Seismic Strengthening Project, County of San Luis Obispo, CA. Project Engineer. Project entailed seismic remediation of this 166-foot-high embankment dam. To address the liquefaction of the foundation alluvium during the design earthquake, a stone column foundation strengthening design was implemented. Evaluated Standard Penetration Test (SPT) and Becker Penetration Test (BPT) data with regard to accepting the as-built stone columns.

Mike Garello, PE

Fish Passage

Mike is a senior water resources and fisheries engineer. He has 18 years experience as the design lead and/or project manager on numerous multi-disciplinary fisheries projects emphasizing the implementation of complex ecohydraulic principals. His experience includes the assessment, design, and implementation of river mechanics, floodplain connectivity, riverine habitat development, natural barrier, stream crossing, low-head, and high-head fish passage projects across the US. He is also very familiar with the guidelines and regulatory processes associated with multi-stakeholder involvement and collaboration with state and federal resource agencies, tribal entities, and NGOs.

EDUCATION
BS, Environmental Resources Engineering, California State University, Humboldt

REGISTRATIONS
Professional Engineer - Civil, California, No. C68106

Professional Engineer - Civil, Washington, No. 44052

PROFESSIONAL MEMBERSHIPS
American Fisheries Society

American Fisheries Society, Bioengineering Section

RELEVANT EXPERIENCE

State of Washington, Chehalis Basin Strategy, *Pe Ell, WA*
Mike was the fish passage study design leader through Phase I and Phase II of fish passage feasibility and conceptual design of selected fish passage technologies for proposed 280-foot tall high dam on Chehalis River in Washington.

Best Best Krieger LLP, Friant Water Users Authority, San Joaquin River Fish Passage Assessment, *San Joaquin River, CA*
Mike was the lead fish passage engineer and evaluated major passage barriers along the Lower San Joaquin River from Friant Dam to Merced River and developed a conceptual passage strategy for adult and juvenile steelhead trout and Chinook salmon.

Bonneville Power Administration, Lostine River Satellite Facility, *Lostine, OR*
Mike was the lead hydraulic engineer for the design of a fish barrier, trapping, and biometric facility on the Lostine River in Eastern Oregon.

California American Water, Los Padres Dam Fish Passage Assessment and Design, *Carmel River, Carmel Valley, CA*
Mike was the project manager and lead fish passage engineer for the preparation of a study to assess the biological, technical, and economic feasibility of providing long-term upstream and downstream passage at the 148-foot tall Los Padres Dam.

California American Water, Los Padres Dam Downstream Fish Passage Project, *Carmel Valley, CA*
Mike was the project manager and lead fish passage engineer for alternative analysis, final design, and construction phases for implementation of one-of-a-kind floating weir collector, fish guidance structure, 1,100-foot fish bypass conduit, and fish bypass outfall constructed to improve safe and timely passage of juvenile outmigrating steelhead at the 149-foot tall Los Padres Dam.

City of Cosmopolis, Mill Creek Park Dam Improvements, *Cosmopolis, WA*
Mike was the fish passage and hydraulics engineer through feasibility assessment, conceptual design, and final design phases of low-head dam repair and reconstruction project which included integration of both fishway and cross-vane weir fish passage components to accommodate run-of-river and high pool operations scenarios.

Gardena Farms Irrigation District, Gardena Farms Diversion Fish Passage, *Walla Walla River, WA*
Mike was the project manager for the investigation, alternative analysis, and final design of modifications to an existing diversion facility and fish ladder which incorporated a sediment wasteway at the entrance to the diversion, multiple sluice gates, a new sediment bypass conduit, and Obermeyer adjustable weir system.

San Francisco Public Utilities Commission, Alameda Creek Diversion Dam Fish Passage Improvements, *Sonol, CA*
Mike was the lead fish passage engineer for the feasibility study, design, and construction phases for a new 500-foot long fish ladder and 370 cfs screened diversion to improve Central Coastal California steelhead trout fish passage and protection at San Francisco Public Utilities Commission's surface water collection facility on Alameda Creek.

Sonoma County Water Agency, Mirabel Fish Screen and Fish Ladder Replacement, *CA*
Mike was the fish passage design engineer throughout preliminary design and preparation of construction documents for construction of 100 cfs screened diversion and vertical-slot fish ladder at the 11 foot high Mirabel bladder dam, located on the Russian River near Forestville, California.

Stevens Public Utility District, Mill Creek Water Feasibility Study, *Mill Creek, WA*
Mike was the fish passage design lead for this study to identify feasible and potentially viable upstream and downstream fish passage concepts at potential water storage projects within the Colville River Basin.

USACE Portland District, Direct Capture of Turbine Passed Fish, Lower Granite Dam, *Columbia River, WA*
Mike was the senior technical advisor during preparation of detailed final design drawings, specifications, and biological study design for horizontal weir collection facility used to capture juvenile salmonids exiting the draft-tubes at federal hydropower facilities on the Snake and Columbia Rivers.

USACE Portland District, Cougar Dam Portable Floating Fish Collector (PFFC), McKenzie River, *OR*
Mike was the hydraulic design engineer throughout design, construction, and commissioning of unique PFFC design. The facility is used to capture native juvenile out-migrants and collect research data on future size, configuration, and location of full size Floating Surface Collector.

USBR Pacific Northwest Regional Office, Tieton Dam, *Naches River,* OR
Mike was the fish passage design lead for study to identify feasible and potentially viable upstream and downstream fish passage concepts at the 319-foot tall Tieton Dam.

EXHIBIT 2-A

AECOM

Seth Gentzler, PE

Senior Consultant/Senior Technical Review

Areas of Expertise

Project Management
Habitat Restoration Engineering
Hydrology and Hydraulics
Hydrodynamic Modeling
Public Space Design
Stormwater and Nonpoint Source Control
Utility Design and Coordination
Water Resources

Education

MS, Environmental Engineering, Georgia Institute of Technology
BS, Civil Engineering, Bucknell University

Licenses/Registrations

Professional Engineer (Civil), CA, #C62765

Years of Experience

With AECOM	12
With Other Firms	6

Professional Associations

Water Environment Federation
American Society of Civil Engineers

Training and Certifications

ArcView
Autocad LDD
Hydrodynamic Modeling – HEC programs, MIKE11/21, RMA

Seth Gentzler is a senior engineer and project manager, and heads up the Hydrology and Hydraulics Group in the Oakland AECOM office. He has over 17 years of experience in the field of civil and environmental engineering. Expertise includes wetland and inter-tidal system hydrodynamic modeling, wetland restoration design and construction plan development, levee and bay trail design, water resource planning, site design, utility coordination, stormwater and non-source point control modeling, flood studies, detention and retention pond design, stormwater management reports, as well as municipal wastewater treatment plant design and operation. Seth has conducted environmental water chemistry and sediment sampling in rivers, salt marshes and estuaries, and gained experience in statistical analysis of inter-tidal sediment monitoring data and simulated mesocosm design development. Current projects include the San Joaquin River Restoration Project in Fresno and Madera Counties, California, and the San Clemente Dam Removal and River Restoration Project in Monterey County, California.

Experience

Stanford University, Searsville Dam and Reservoir Alternatives Study and Engineering and Hydrology Co, Woodside and Portola Valley, CA. Project manager for an alternatives study for the dam and reservoir, to determine their role in Stanford's long-term sustainable water management planning, its function as a teaching and research facility within the Jasper Ridge biological preserve, and particularly recognizing the need to address the increasing siltation condition and its potential impacts on the watershed as a whole. Sedimentation has reduced the reservoir to less than 10 percent of its original water capacity. Also responsible for coordination with the state's Division of Safety of Dams.

Ventura County Public Works Agency, Matilija Dam - Removal Plans, Sediment Transport Analysis & Robles Diversion Mit, Ventura, CA. Participated in engineering services for the Matilija Dam removal, as part of a larger ecosystem restoration project. Removing the dam will, among other things, open up steelhead trout habitat on Matilija Creek and restore sediment transport functions down the river to the Pacific Ocean.

State Coastal Conservancy, San Clemente Dam Removal Project, Monterey County, CA. Project Manager and Engineer. Includes Geotechnical Exploration, Design Services and Design-Build Procurement Support for the San Clemente Dam Removal

Project. The project will meet the existing dam seismic safety goals through the removal of the dam and relocation of approximately 370,000 cubic yards (235 acre-feet [ac-ft]) of accumulated sediment behind the dam on the San Clemente Creek arm of the San Clemente Reservoir. A portion of the Carmel River would be permanently bypassed by cutting a 450-foot-long channel between the Carmel River and San Clemente Creek, approximately 2,500 feet upstream of the dam. The bypassed portion of the Carmel River would be used as a sediment disposal site for the accumulated sediment. The rock spoils from channel construction (145 ac-ft or 235,000 cubic-yards) would be used for construction of a diversion dike at the upstream end of the bypassed reservoir arm.

Elkhorn Slough Foundation, Parsons Slough Sill Design and Permitting Support, Monterey County, CA. Design manager for design services and CEQA permitting support for the 30 percent design of the sill, to provide a moderate reduction in energy compared to the existing tidal regime, maintain sufficient tidal exchange and flushing to provide acceptable water quality, and minimize the impact on the adjacent railroad.

US Department of Interior - Bureau of Reclamation - Mid-Pacific Region, San Joaquin River Restoration Program Mendota Pool Bypass & Reach 2B Environment, Various Locations, CA. Project manager and design coordinator for environmental consulting services to support the project, which involves the construction, operation, and maintenance of the Mendota Pool bypass and improvements in the San Joaquin River channel in Reach 2B to convey at least 4,500 cubic feet per second. The scope of services included biological and cultural resource field surveys, alternatives formulation and evaluation, followed by the preparation of the draft and final environmental impact statements/reports and submittal of all required permit applications.

SFPUC, Calaveras Dam Replacement Project – Habitat Reserve Program, Santa Clara County, CA. Engineering Manager. Currently in the process of conducting fluvial geomorphic studies on over 15,000 linear feet of stream on San Antonio and Calaveras Creeks to inform the designs and specifications for stream restoration and habitat enhancement. Additional studies include soils mapping and testing, groundwater piezometer installation and analysis, and stream gage installation and analysis for hydrology and hydraulics studies as necessary for design of SFPUC's off-site impact compensation areas located in the vicinity of San Antonio Reservoir and Calaveras Reservoir. The project includes stream restoration, pond restoration, gully restoration, wetland creation, oak woodland/savannah creation, sagebrush-Alameda whipsnake habitat creation, serpentine grassland enhancement, and grazing management.

EXHIBIT 2-A

NicK Gooding, PE

Cost Estimation

Nick has 8 years of experience in water resources, civil design, and flood protection. He has experience in MCACES (M2) cost estimating for flood protection, water resources, environmental restoration, and military site improvement in construction and feasibility phases. He has developed cost estimates for projects in Northern California, Nevada, New Jersey, New York, and Hawaii. Nick has also participated in risk assessment for contingency development. Nick's experience includes plan and specification development for flood control for Federal, State, and local clients.

EDUCATION

Bachelor of Science, Civil Engineering, California State University, Sacramento

REGISTRATIONS

Professional Engineer, California, No. C79872

SPECIALIZED TRAINING AND CERTIFICATIONS

MCACES, 2nd Generation (MII) Basic Training (2010)

RELEVANT EXPERIENCE

USACE Sacramento District, Dam and Levee Safety IDIQ Contract, *California*
Nick performed cost estimating for various levee projects along the Sacramento and American Rivers. These projects included a diverse range of levee remediation including cutoff walls, seepage and stability berms, and jet grouting. Projects also included erosion repair measures such as riprap revetment and slope repair.

USACE Honolulu District, Reservoirs 155 and 225 Design, *Hawaii*
The Waiahole Ditch Irrigation System consists of a 26-mile-long transmission system of ditches, tunnels and reservoirs owned by the State of Hawaii that provides a source of irrigation water to local farmers from the windward side of the island of Oahu. Rehabilitation for two off-stream reservoirs, Reservoirs 155 and 225, included dredging, reconstructing earthen embankments, repairing pump facilities, installing slope protection, and improving local drainage ditches at two reservoirs. Nick prepared the quantity takeoffs and cost estimates for all items of work. Work required coordination with local suppliers and researching local labor and equipment rates.

USACE, Louisville District, Fort Hunter Liggett Improvements, *California*
The Louisville District has overseen several improvement projects and studies for Fort Hunter Liggett in Jolon, California. Projects have included civil improvements to sidewalks, roadways, and staff housing. Studies included mass grading and drainage plans for larger scale improvements to the site. Nick performed cost estimating for these various projects as required by the client.

USACE San Francisco District, South San Francisco Bay Shoreline Study, *California*
The South San Francisco Bay Shoreline Study was a planning study which considered multiple plans to address flood control and environmental restoration near Alviso, California. The flood control plans included reconstructing levees, installing wick drains, and constructing a closure structure at a railroad crossing. The environmental components included marine habitat restoration achieved through a targeted combination of dredging and berm construction within various ponds. Nick prepared cost estimates for the flood control and environmental project components as well as participating in the risk assessment.

USACE Kansas City District, Ellis Property Superfund Site, *New Jersey*
The Ellis Property Superfund Site was used for drum storage and reconditioning operations and as a result the subsurface soil became contaminated. The ongoing treatment of the site includes excavation and disposal of material and in-situ thermal treatment. Nick developed the cost estimate for these site remedies with close coordination with the ISTT design consultant and the client.

Sacramento Area Flood Control Agency, Sacramento River East Levee Improvement Project, *California*
HDR was hired to develop alternatives and assist in design of levee improvements to control under-seepage for 5.9 miles of levee in the Pocket area of Sacramento. Nick developed the programmatic cost estimate to compare alternative fixes for all project reaches. Nick assisted in site investigation and quantity takeoffs in order to develop an accurate estimate. Nick is the technical lead for several design features and specification development as well as developing the construction cost estimate as design progresses.

Log Cabin Diversion Dam Sediment Removal Project, Yuba County Water Agency, *California*
The Log Cabin Diversion Dam Sediment Removal Project removed 10,000 cubic yards of material from the upstream side of the Log Cabin Diversion Dam and constructed a long-term material stockpile. Nick prepared the quantity takeoffs and cost estimates for all items of work including dewatering, excavation, hauling, and stockpile construction. The cost estimate considered the remote location of Log Cabin Dam and how the limited access would affect costs.

EXHIBIT 2-A

University of British Columbia

Marwan Hassan, PhD

Geomorphology, Hydrology, Hydraulics, & Sediment Transport

Education

PhD, Geomorphology, Institute of Earth Sciences, The Hebrew University of Jerusalem
MS, Geomorphology, Institute of Earth Sciences, The Hebrew University of Jerusalem
BA, Geography, Department of Geography, Ben Gurion University of Negev

Years of Experience

33

Professional Associations

Member, American Geophysical Union
Member, Canadian Geophysical Union
Member, International Association of Hydrological Sciences

Dr. Hassan has been active nationally and internationally with water issues for 20 years, exploring topics with broad societal relevance. Dr. Hassan has examined the relation between sediment transport and habitat modification by salmon in small streams in BC, which has been noted in science media (ScienceNow, Nature Geosciences, etc.) as innovative and interdisciplinary research. He was solely responsible for the design, development, and construction of a laboratory to study sediment transport at the Geography Department of The Hebrew University. In 2008 he was awarded the CFI Leadership Opportunity Fund to establish and equip a state-of-the-art laboratory for the experimental study of channel stability and sediment transport in steep mountain streams, as well as the effects these processes have on stream channel ecology. He has published countless papers, edited books, developed models, and taught many other sin the fiels of sediment transport.

Selected Invited Presentations

Hassan, M.A., 2015, Channel adjustment to changes in sediment supply and flow regimes, Dept. of Civil Engineering, EPFL, Lausanne, November 2015.

Hassan, M.A., 2015, Stories of sand: channel response to changes in sediment supply and flow regimes, Oregon State University, Corvallis, Oregon, April 2015.

Marwan A. Hassan, 2014, Move over floods, here come the salmon, Chinese Academy of Sciences, Beijing, China, April 2014.

Marwan A. Hassan, 2014, Sediment dynamics along the Yangtze, Yellow and Mississippi rivers, Dept. of Civil Engineering, ETH, Zurich, June 2014.

Marwan A. Hassan and Piotr Cienciala, 2013, Beyond a single life stage: investigating the effects of hydro-geomorphic processes on complementary types of fish habitat, American Geophysical Union Annual Meeting, San Francesco, December 9-13, 2013.

Hassan, M.A. Does sediment supply control sediment transport in streams? Geological Survey of Norway, Trondheim, Norway, April 2010.

Hassan, M.A. Channel morphology and sediment transport in small streams. Paper presented at Università di Milano-Bicocca,

Department of Geological Sciences and Geotechnologies, Milano, Italy, August 2009.

Hassan, M.A., 2007. Sediment transport in gravel bed rivers: observations and modeling. Department of Civil Engineering, University of Iowa; April 2007.

Books Edited

Church, M. and M.A. Hassan, 2002. Drainage Dynamics and Morphology. Geomorphology, 45, 1-163. (9 contributions)

Church, M. and M.A. Hassan, 2001. Sediment Transport Dynamics. Earth Surface Processes and Landforms, 26, 1367-1459. (6 contributions)

Hassan, M.A., O. Slaymaker, and S.M. Berkowicz, 2000. The Hydrology-Geomorphology Interface: Rainfall, Floods, Sedimentation, Land Use. International Association of Hydrological Sciences, Publication No. 261. Wallingford, UK, 326 pp. (21 contributions)

Selected Publications

Cienciala, P., and Hassan, M.A., in press, Sampling variability in estimates of flow characteristics in coarse-bed channels: Effects of sample size, Water Resources Research.

Abalharth, M., Hassan, M.A., Klinkenberg, B., Leung, V., and McCleary, R., 2015. Using LiDAR to characterize logjams in lowland rivers, Geomorphology, 246, 531–541.

Ferrer-Boix, C., Hassan, M. A. 2015. Channel adjustments to a succession of water pulses in gravel bed rivers, Water Resources Research, 51, 8773–8790, doi:10.1002/2015WR017664.

Saletti, M., P. Molnar, P., A. Zimmermann, A., Hassan, M.A., and M. Church, M., 2015. Temporal variability and memory in sediment transport in an experimental step-pool channel, Water Resources Research, 51, 9325–9337, doi:10.1002/ 2015WR016929.

Chartrand, S. M., Hassan, M.A., and Radic, V., 2015. Pool-riffle sedimentation and surface texture trends in a gravel bed stream, Water Resources Research, 51, 8704–8728, doi:10.1002/2015WR017840.

Buxton, T. H., Buffington, J.M., Yager, E.M., Hassan, M.A., and Fremier, A.K., 2015. The relative stability of salmon redds and unspawned streambeds, Water Resources Research, 51, 6074–6092, doi:10.1002/2015WR016908.

Ferrer-Boix, C. and M.A. Hassan, 2014. Influence of the sediment supply texture on morphological adjustments in gravel, Water Resources Research, 50, doi: 10.1002/2013WR015117, 8868-8890.

EXHIBIT 2-A

Balance Hydrologics, Inc.®

Summary of Experience

Mr. Hecht co-founded Balance in 1988. For more than 48 years, he has directed specialized investigations of complex geomorphic, recharge, hydrogeologic, bed-sedimentation, water-quality, and sediment-quality questions in aquifers, streams, lakes, and tidal environments. Mr. Hecht has directed many of the firm's watershed assessment studies, including multi-year sediment-transport and bed-condition investigations/simulations on Lagunitas Creek (1979-pres), San Francisquito Creek and other channels near Stanford University (1994-pres), and throughout Santa Cruz, San Mateo, Monterey, San Luis Obispo, Santa Barbara, San Diego and Orange Counties. He has also led field assessment of bed conditions, watershed dynamics, and sediment transport in Washington, Oregon, and Alaska. Recognized as a leader in the science of surface/groundwater interactions, he has quantified infiltration in sandy soils of varying types; Mr. Hecht has also quantified changes in the seasonality and amounts of recharge in response to changes in land use or agricultural practices, and has written extensively about the hydrogeologic properties of deeply-weathered aquifers. He has also presented expert work on recharge dynamics in basins with volcanic boundaries such as Shasta and Butte Valleys (Siskiyou County) and in coastal California and Oregon, and the hydrogeologic functions of the Mazama (Crater Lake) Ash. He served as one of three principal investigators for U.S. EPA's Manual (2010) on quantifying and restoring vernal-pool functions and values.

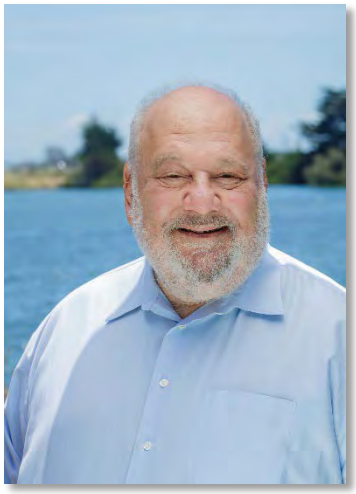
He has served as the CDFW Director's representative on the Upper Sacramento Salmon and Steelhead Advisory Committee (1982-1992), a key precursor to most current habitat programs in the Sacramento Valley, participated in several TACs which developed and tested California rapid assessment methods for riparian corridors and episodic channels statewide, and was appointed to the Alameda County's Fish and Game Commission in 2013. Before entering consulting in 1977, he taught geomorphology and hydrogeology at UC Santa Cruz for several years, served as Santa Cruz County's first County Geologist, and worked with sediment-transport research groups of the USGS and USFS.

Relevant Experience

Technical Support for Water Quality Litigation: Los Padres Reservoir Sediment Releases, Carmel River, Monterey County, California. On behalf of the USFS, Barry Hecht was retained as an Expert Witness by the U.S. Attorney's Office, to provide the necessary technical assistance in assessing both Marble-Cone fire-related sedimentation and toxicity of the sediment to fish. Working in conjunction with aquatic biologists, Balance staff obtained cores of sediment from the reservoir, using both truck- and raft-based drilling techniques. We split and preserved the samples for analysis of the presence of toxic concentrations of trace elements, oxygen demand, and bacterial toxins, and interpreted the results, including projecting likely downstream effects.

BARRY HECHT, CHG, CEG

Geomorphology, Hydrology, Hydraulics & Sediment Transport



Education:

PhD Cand., Geography, University of California, Berkeley, 1975

M.A. Physical Geography, UC Berkeley, 1972

B.S. Geology (Honors), UC Santa Cruz, 1970

A.B. Geography and Regional Planning (Honors), UC Santa Cruz, 1970

Certified Engineering Geologist:

California #1245, Oregon #E1262

Certified Hydrogeologist:

California #50

Professional Affiliations:

Am.Water Resources Association

Assoc. of State Floodplain Managers

Society of Wetland Scientists

Friends of the Pleistocene

Gilbert Club

Balance Hydrologics, Inc.®

CPOA Post-Wildfire Preparedness and Response, Monterey County, California. Mr. Hecht provided post-fire services to Coast Properties Owners Association (CPOA) following the Basin-Indians fire (2008), which burned most areas uphill of Highway 1. He assisted with immediate response concerning post-fire slope-stability and road-protection. Water-system evaluation and repair, with emphasis on water-source protection (wells and springs). Mr. Hecht is very familiar with USFS BAER and CalFire SEAT reports and their various follow-up reports regarding the completeness and implications for lands and improvements downstream from burnt USFS lands. Three public workshops were conducted, where Mr. Hecht presented water-system protection, erosion-control measures and winter preparedness. Assessed effects of the fire on peak flows, bed sedimentation and woodjams, along with cumulative effects on inundation hazards during the post-wildfire recovery period. In addition, he worked closely with the USGS, for debris flow hazard modeling and NRCS in identifying areas where erosion control/reseeding measures were appropriate.

Analysis and Mitigation of Post-Fire Debris Flows at Pfeiffer Big Sur State Park, Monterey County, California. Mr. Hecht led the effort to clearly delineate debris flows following the Basin Complex fire (2008), four separate debris flows along Pfeiffer Redwood Creek during the very dry winter of 2009 threatened facilities at the Big Sur Lodge. Analyzed sequential triggering events in this and surrounding watersheds; (b) reconstructing the depth, velocities, and splash-line height of the larger events; and (c) recommending initial measures to minimize risk to the historic structure and its surrounding facilities. Results were used to estimate forces and volumes affecting different portions of the debris-flow fan on which the Lodge is constructed.

Carmel River Integrated Floodplain Management, County of Monterey, California. Mr. Hecht has participated in a large number of investigations and studies since 1978 that have been integral in defining and assessing flood hazard and risk throughout the 247-squaremile watershed of the Carmel River. Early assignments included assessments of the impact of wildfires on the peak flow hydrology and geomorphology of the upper river system and characterization of the geomorphic considerations related to the proposed removal or modification of the San Clemente Dam. Mr. Hecht is currently leading geomorphic services associated with the design of the bypass channel for the San Clemente Dam Removal Project. These projects have involved close coordination with numerous project stakeholders, including the Monterey Peninsula Water District, the local County Service Area Board and various State and Federal agencies, among others.

Santa Ynez River Integrated Flow-Management Investigations, Santa Barbara County, California. Beginning in 1993, Mr. Hecht assisted the City of Santa Barbara, and Montecito, Goleta, and Carpinteria Water Districts in assessing the resilience of their water rights under extreme conditions, including floods, fires, earthquakes and drought. Work involved a comprehensive historical analysis of flows back into the late 1860s, which established that fires strongly affected peak and mean annual flows throughout the Santa Ynez watershed. Modeling of daily sediment transport upstream of Cachuma Reservoir indicated that fires just prior to a 1916 peak flow event had anomalously elevated the riverbed. This realization led to a 1993 USGS downscaling of the event, and as a result, flood risks in the lower river were recomputed and Flood Insurance Rate Maps revised. Subsequent work identified an intermittent, but long-term, decrease in base elevation for the reach between Bradbury Dam and Buellton; evaluating the effects on the Highway 101 bridge crossing; and developing management recommendations.

Baseline Assessment of Sediment Transport and Bed Sedimentation, Rancho San Carlos, Monterey County, California. Mr. Hecht was the Principal-in-Charge for this project where Balance hydrologists and geomorphologists measured sediment transport and habitat-impairing sedimentation affecting native rainbow and steelhead trout in six streams south of Carmel Valley.

Feasibility of Passive Managed Aquifer Recharge (MAR) of MF/RO Concentrate at the Lower Carmel River Lagoon for Steelhead Habitat, Monterey County, California. Mr. Hecht was the Principal-in-Charge for this project supporting Applied Marine Sciences in developing a design for a recharge wetland to infiltrate 300 acre-feet (AF) of water every year to the lagoon. The Project entails a feasibility study for the siting and design of a managed aquifer recharge (MAR) facility to use from the CAWD facility to supplement water in the Carmel River Lagoon through passive recharge for steelhead and CRLF habitat.

AECOM

Benjamin Kozlowicz, PG, CEG

Geology

Areas of Expertise

Geologic and Geomorphic Mapping
Engineering Geology
Paleoseismology
GIS and Remote Sensing
Instrumentation

Education

BS, Geology, Western Michigan University

Licenses/Registrations

Professional Geologist, CA
Certified Engineering Geologist, CA

Years of Experience

With AECOM	9
With Other Firms	6

Professional Associations

Association of Environmental and Engineering Geologists
Geological Society of America--Professional Member
American Geophysical Union

Training and Certifications

40-Hour HAZWOPER
First Aid, Wilderness First Aid, and CPR Competent Person

Ben Kozlowicz has a broad range of experience performing geologic and geomorphic investigation and characterization in a variety of complex settings. He has extensive field experience with geologic and geomorphic mapping, soil and rock drilling, sampling and in situ testing, paleoseismic fault trench and soil pit logging, and interpretation of borehole and surface geophysical investigations. His project experience includes field and desktop work for a variety of large civil projects including dams, levees, tunnels and penstocks, pipelines, spillways, bridges and roadways, and buildings, as well as geohazard investigations for flood, landslide, and fault hazard studies. His land management experience includes forest road and stream inventories, site-specific fluvial geomorphic mapping for habitat evaluation and stream condition inventories, sediment source investigations for basin-scale evaluations and management of large-scale geodatabases in commercial GIS software. He has also assisted with the installation and maintenance of hydrologic and geotechnical instrumentation.

Experience

Stanford University, Searsville Dam & Reservoir Alternatives Study, Santa Clara County, CA. Project Geologist. Project involves initial technical studies to support Stanford in the development of alternatives for Searsville Dam and reservoir.

Nevada Irrigation District, Centennial Reservoir Project, Nevada and Placer Counties, CA. Assistant Project geologist responsible for implementation of geologic and geophysical investigations and geologic characterization for the foundation of a new dam on Bear River. Investigations included twenty rock core borings to evaluate the dam foundation and twelve borings to evaluate two rock borrow areas. Hydraulic conductivity was evaluated in all foundation borings. Borehole televiewer and seismic velocity surveys were run in many of the borings. Approximately 7000 feet of surface seismic refraction surveys were completed. All work was completed on schedule and under budget.

Santa Clara Valley Water District (SCVWD), Anderson Dam Seismic Remediation Project, Morgan Hill, CA. As assistant project geologist, Mr. Kozlowicz directed field investigations required to support the engineering design of modifications to Anderson Dam, outlet tunnel and spillway. These investigations include soil and rock drilling and sampling on land and from a barge in the reservoir, installation of in situ monitoring instruments, shallow backhoe test pits, collection of seismic refraction and DC resistivity surface

geophysical surveys, borehole seismic velocity and televiewer surveys, and excavation and logging of fault evaluation trenches.

Carmel River Reroute and San Clemente Dam Removal, California American Water, Carmel, CA. Construction-Phase Geologic Inspector. Performed construction phase inspection of excavated foundations, exposed dam abutments and zoned-earth placement for owner's engineering team.

San Francisco Public Utilities Commission (SFPUC), Calaveras Dam Replacement Project, Alameda and Santa Clara Counties, CA. Field Geologist. Performed supplemental subsurface investigation including core logging, test pit logging and in situ soil strength testing. During construction phase of the project, mapped dam abutment excavations, assisted in slope stability investigation and mapping, and compiled geologic data for foundation report.

U.S. Army Corps of Engineers (USACE), Folsom Dam Auxiliary Spillway Approach Channel Cofferdam Project, Folsom, CA. Assistant Project Geologist. Assisted in developing and implementing a multi-phase geotechnical investigation for a 1000-foot long, 100-foot deep approach channel excavation and 1300-foot long, 100-foot deep secant pile cutoff wall at Folsom Lake, California.

Contra Costa Water District (CCWD), Los Vaqueros Dam Expansion, Contra Costa County, CA. Field Geologist. Provided on-site engineering geology services for the expansion of an existing zoned-embankment dam for Contra Costa Water District in Northern California, including abutment mapping, supervision of foundation curtain grouting and foundation inspection and approval for the placement of concrete and roller compacted concrete.

USACE, Lake Isabella Auxiliary Dam-Kern Canyon Fault Evaluation, Lake Isabella, CA. Assistant Project Geologist. Directed field operations for paleoseismic trenching at remote sites, performed geomorphic and surficial geologic mapping and sampling, and worked with a team of geologists to write, review and edit final report.

Department of Water Resources (DWR), Non-Urban Levee Evaluations, Sacramento, CA. Geologist. Worked with a team of geologists to develop a surficial geologic map of areas beneath and adjacent to NULE levees in the Sacramento Valley. The project included a review of aerial photographs, published geologic and soils maps, and historical documents, and the development of a digital map and GIS database.

AECOM

Cynthia Le Doux-Bloom, PhD

Fish Biology

Areas of Expertise

Anadromous Salmonids (Chinook, Coho, & Steelhead)
Behavior, Physiology & Health
Watershed Assessment
Restoration Ecology

Education

PhD, Fish Behavior – Physiology, University of California, Davis
MS, Marine Science, San Jose State University, Moss Landing
BSc, Biology – University of California, Santa Cruz

Years of Experience

With AECOM	3.5
With Other Firms	22

Professional Associations

American Fisheries Society
American Institute of Research Fisheries Biologists
Salmonid Restoration Federation
Appointed Salmon Scientist by the Natural Resources Agency, Timber Regulation and Restoration Program (2016)
Elected to Board of Directors, Salmonid Restoration Federation (2015)

Training and Certifications

Certified Fisheries Professional
USFWS Electro-Fishing NAUI SCUBA
Swift Water Rescue
USFWS Motorboat Operator
AFS Certified Fisheries Professional (2004)

Dr. Cynthia Le Doux-Bloom is a senior fisheries scientist that specializes in designing studies evaluating fish-habitat relationships and movement patterns of steelhead, Chinook, and predatory fishes. She has over 18 years of experience leading collaborative watershed assessment and restoration site monitoring, and has been an American Fisheries Society Certified Fisheries Professional since 2003. Her most recent projects include assessing the increases in sediment during construction on steelhead spawning habitat, assessing acoustically tagged juvenile Chinook movement around instream barriers, developing best management practices to capture, handle, transport, and release wild and hatchery fishes, and assessing the health of aquatic organisms in highly altered watersheds.

Experience

California Department of Water Resources, Bay-Delta Office, Sacramento, CA. Senior Scientist on the following studies: Clifton Court Fish Removal and Transfer, Engineering Solutions for Salmonids, Head of Old River Barrier, Georgiana Slough Non-Physical Barrier, and Predation and Temporary Barriers. Duties included developing the SOPs for capture, handling, transporting, and releasing wild and hatchery fishes, assessing environmental issues around barriers, and evaluating water and habitat quality. Methods include surgical implantation of acoustic transmitters into juvenile steelhead and Chinook, assessing health of study fish, and using seines, electrofishing (backpack and boat), and specialized software to analyze movement patterns.

California Department of Transportation, Willits Bypass, Willits, CA. Lead Senior Scientist on the instream sediment monitoring during the construction of the Willits Bypass. Duties included assessing the pre-, during-, and post- project instream sediment quality related to steelhead, Chinook, and coho spawning substrate throughout the creeks in Little Lake Valley. Methods included photo documentation, monumenting transects, pebble counts, D50s, and recording young-of-the year and juvenile salmonid presence.

California Department of Water Resources, Environmental Studies Office, West Sacramento, CA. Lead Senior Scientist on the following studies: Suture performance and surgical method in predatory fishes, Tracy Fish Facility trash rack redesign, and acoustic biotelemetry studies of predatory fishes. Develop SOPs for surgical implantation, capture, handling, transport, release, and general husbandry. Also, assisted with acoustic biotelemetry studies of

juvenile hatchery reared steelhead and Chinook and provided State and Federal Water Contractor updates on fish salvage. Duties include surgical implantation of transmitters, ultra-sounding fishes post-surgery, photo documenting incisions, necropsy, blood draws and analyses to assess health, developing methods to analyze telemetry data to assess fish movement patterns, and pairing water quality data with fish movement patterns to evaluate preference. Published white and technical papers.

California Department of Fish & Wildlife, Coastal Watershed Assessment Program, Outlet Creek Watershed Assessment, Mendocino County, CA. Lead Fish Scientist on the Outlet Creek Watershed Assessment using General Random Tessellation Sampling. Duties include designing studies, collecting data, and conduct multi-agency watershed assessment on coastal watersheds to assist salmonid recovery, restoration planning and evaluation, and Timber Harvest Planning. Conducted habitat and channel typing. Led juvenile and adult coho and steelhead surveys (e-fishing, snorkel, redd, carcass, and tissue collection), water quality assessment (flow, temperature, DO, periphyton, and macroinvertebrate), and sediment, roads, and barrier surveys and monitoring. Conducted interdisciplinary synthesis of multi-scale data sets with State agency hydrologists, geologists, foresters, and tribal peoples. Participated in modeling analyses. Evaluated restoration projects. Published watershed assessments and technical reports.

California Department of Fish & Wildlife, Coastal Watershed Assessment Program, Mendocino Coastal Streams Assessment, Mendocino County, CA. Lead Fish Scientist on the Mendocino Coastal Streams Instream Habitat assessment. Conducted salmonid habitat and channel typing. Led juvenile and adult steelhead and coho surveys (downstream migrant traps, e-fishing, snorkel, redd, carcass, and tissue collection). Led water quality assessment (flow, temperature, DO). Led sediment, roads, and barrier surveys and monitoring. Conducted interdisciplinary synthesis of multi-scale data sets with State agency hydrologists, geologists, foresters, and tribal peoples. Participated in modeling analyses. Evaluated restoration projects. Publish watershed assessments and technical reports.

Natural Resources Agency, North Coast Watershed Assessment Program, Gualala River Watershed Assessment, Mendocino County, CA. Lead Fish Scientist on the Gualala Watershed Assessment. Duties and tasks similar to those described above for Mendocino Coastal Streams Assessment.

Natural Resources Agency, North Coast Watershed Assessment Program, Albion River Watershed Assessment, Mendocino County, CA. Lead Fish Scientist on the Albion River Watershed Assessment. Duties and tasks similar to those described above for Mendocino Coastal Streams Assessment.

AECOM

Shannon Leonard

Reservoir Alternatives Analysis; Geomorphology, Hydrology, Hydraulics & Sediment Transport

Areas of Expertise

Stream Restoration Design
Hydrology and Hydraulics
Fluvial Geomorphology
Watershed Studies
PMF/PMP Calculations

Education

BS (cum laude), Biological Systems Engineering, Virginia Polytechnic Institute and State University

Licenses/Registrations

Professional Engineer (Civil), VA, #0402038848

Years of Experience

With AECOM 7

With Other Firms 10

Professional Associations

American Society of Civil Engineers
American Water Resources Association

Ms. Leonard has over 17 years of experience in civil and environmental engineering integrating multiple disciplines on complex and high-profile projects. Her expertise includes stream restoration design, hydrology and hydraulics modeling, fluvial geomorphic assessment and analysis, watershed studies, flood modeling, and Probable Maximum Precipitation and Probable Maximum Flood studies. Ms. Leonard's spectrum of engineering and environmental experience allows her to capably manage and integrate technical information from various resources on multi-disciplinary river and restoration projects. Current and recent projects include the Matilija Dam Removal, Sediment Transport, and Robles Diversion Mitigation Study, Ventura County, California, the San Joaquin River Restoration Program Reach 2B and Mendota Pool Bypass Project in Fresno and Madera counties in California, and the Searsville Alternatives Study in San Mateo and Santa Clara counties in California.

Experience

State Coastal Conservancy and California American Water, Carmel River Reroute and San Clemente Dam Removal Project, Monterey County, CA. Task Manager and Engineer. This project included design and geotechnical exploration services for the San Clemente Dam Removal Project. The project met the steelhead passage and dam seismic safety goals through the removal of the dam, relocation of accumulated sediment in San Clemente Creek, and restoration of San Clemente Creek to pre-dam conditions. Riparian corridor restoration was a major component of the project and included natural channel design throughout the project area to encourage stable banks and floodplain features with appropriate vegetative and hydrologic regimes. Involved in design of the East Tributary conveyance channel, PMP and PMF calculations, review of hydraulic and sediment transport modeling and channel restoration designs. During the permitting phase of the project, she acted as a liaison between the design team and the permitting team.

Stanford University, Searsville Alternatives Study, San Mateo and Santa Clara counties, CA. Deputy Project Manager and Engineer. This project includes initial technical studies to support development and analysis of alternatives for the Searsville Dam and Reservoir area of the Stanford University campus. The studies include dam stability, hydrology, hydraulics, sediment transport, flooding, channel geomorphology, fish passage, biological, and water

supply analyses to assess the effects of a range of potential changes to the area. An initial set of alternatives have been developed and have undergone multi-criteria evaluation as part of Stanford's decision making process. The refined alternatives are now proceeding with feasibility studies and preliminary design. Assisted the project management for the preliminary studies and alternative evaluation, led the development of technical memoranda for each study, and conducted the multi-criteria evaluation. Currently, Ms. Leonard is working on water supply analyses for components of the project.

Ventura County Watershed Management District, Matilija Dam Removal, Sediment Transport, and Robles Diversion Mitigation Study, Ventura County, CA. Engineer and Geomorphologist. This project includes dam removal and diversion mitigation alternatives development and evaluation, sediment transport modeling of the alternatives, and development of preliminary design plans and cost estimates for the selected dam removal and diversion mitigation concepts. Primarily involved in coordinating the alternatives evaluation and sediment transport modeling and providing technical reviews on memoranda. Currently leading the development of a planning level cost estimate of the selected alternative.

San Joaquin River Restoration Program Reach 2B and Mendota Pool Bypass Project, U.S. Department of the Interior (DOI), Bureau of Reclamation (USBR), Fresno and Madera Counties, CA. Deputy Project Manager and Engineer/Geomorphologist. This project primarily involved developing project alternatives, preparing an Environmental Impact Statement/Environmental Impact Report (EIS/EIR), and providing permitting support for the project. Components of the project include increasing channel capacity, incorporating riparian habitat, and providing fish passage through the reach via the modification of existing structures, installing fish screens and diversions, and bypassing the Mendota Pool by constructing a new channel. The project is the result of a Settlement Agreement requiring the release of flows from Friant Dam to support salmon populations and reintroduction of the salmon. Assisted with project management, conducted project coordination, and led the development of the Initial Options, Analytical Tools, and Project Description Technical Memoranda as well as provided engineering and technical guidance and review for the EIS/EIR.

Santa Clara Valley Water District (SCVWD), Almaden Dam Improvement Project, Santa Clara County, CA. Engineer and Hydrologist. This project includes design, NEPA/CEQA compliance documents, and permitting for seismic improvements to the Almaden Dam, outlet, and spillway. Prepared the PMP/PMF study for the dam using HMR 58/59, including hydraulic modeling of the spillway.

AECOM

Katie McLean

Fish Biology

Areas of Expertise

Fisheries and Aquatic Ecology
Wildlife Biology
Environmental Physiology

Education

MS, Biology: Ecology and Systematic Biology, San Francisco State University (SFSU)
BS, Environmental Systems, U.C. San Diego

Years of Experience

With AECOM	2
With Other Firms	5

Permits

CDFW Scientific Collecting Permit, CA, SC-11953
CDFW Scientific Collecting Permit, CA, SC-12249

Professional Associations

American Fisheries Society (AFS) – California-Nevada Chapter
The Wildlife Society – San Francisco Bay Area Chapter

Training and Certifications

2016/Electrofishing Safety/U.S. Department of the Interior
2015/Certificate in Geographic Information Systems (GIS)/City College of San Francisco
2016/Ecology of the California Tiger Salamander/Eklhorn Slough Coastal Training Program
2016/California Red-legged Frog Workshop/Alameda County Resource Conservation District
2015/Fish Passage and Fish Screening Workshop/AFS

Katie McLean has 7 years of experience as a fisheries and wildlife biologist. Her educational and research background is in environmental physiology studying the effects of environmental change on the physiological processes of plants and animals with a particular interest in organisms' abilities to withstand climate change. Her field experience has focused on surveying for special-status species and monitoring habitat in streams and wetlands. She has performed snorkel surveys, seine netting, and electrofishing for steelhead and fyke trapping and PIT tagging for coho salmon. She also has experience conducting stream geomorphic monitoring, mapping salmonid habitat in streams, and analyzing hydrological and physiological data. Ms. McLean has prepared ESA consultations, written technical reports, and created maps in GIS.

Experience

California Coastal Commission and California American Water, Carmel River Reroute and San Clemente Dam Removal Project, Monterey County, CA, Biologist. Performed environmental compliance inspections of the project site and of project activities, including construction of 54 step pools and placement of large woody debris for steelhead (*Oncorhynchus mykiss*) in the South-Central California Coast Distinct Population Segment (DPS). 2015 – 2016.

Santa Clara Valley Water District, Almaden Dam Fish Passage Feasibility, Santa Clara County, CA, Biologist. Conducted field studies and developed technical report describing existing biological conditions, fish passage options at Almaden Dam, and potential biological consequences of fish passage options. Developed analysis of habitat quality and potential passage impediments for steelhead in the Central California Coast (CCC) DPS in the watershed upstream and downstream of Almaden Dam. Analyzed hydrology, including reservoir water surface elevation and outflow data. Calculated inflow using mass balance equation. 2015 – 2016.

San Francisco Public Utilities Commission, Alameda Creek Diversion Dam – Fish Passage Facility Fish Relocation, Sunol, CA, Fisheries Biologist. Rescued and relocated rainbow trout (upstream of the dam) and CCC steelhead (downstream of the dam) after cofferdam installation and dewatering of the construction area. Backpack electrofishing was used to capture fish. 2016.

Publications

McLean, K.M. and Todgham, A.E. 2015. Effect of Food Availability on the Growth and Thermal Physiology of Juvenile Dungeness Crabs (Metacarcinus magister). Conservation Physiology.

McLean, K.M. 2013. Effect of Food Availability on Stress Tolerance of Juvenile Dungeness Crabs. Master's Thesis. SFSU.

Posters and Presentations

McLean, K., Tremain, K., Greer, N., Graybehl, R., Ward, K., Martin, K., and Ponferrada, N. 2016. California Grunion in the Presidio, San Francisco. Poster presented at the Annual Meeting of the Western Division of the AFS.

Ponferrada, N and **McLean, K.** 2016. Dam Removal and Creation of Fish Passage to Reconnect Steelhead to Their Historical Spawning Grounds. Presented to the AECOM Protected Species Technical Practice Group.

McLean, K. and Todgham, A. 2013. Effect of Food Availability on Thermal Tolerance of Juvenile Dungeness Crabs in the San Francisco Estuary. Poster presented at the Annual Meeting of the Society for Integrative and Comparative Biology.

Awards

2016 AFS California-Nevada Chapter Travel Award

2015 AECOM Quarterly Outstanding Achievement Award, 1st Quarter

2013 California State University COAST Graduate Student Award for Marine Science Research

2012 Achievement Rewards for College Scientists Foundation Scholar

2012 Gloria Spencer University Women's Association Scholarship, SFSU

2012 Biology Department Arthur Nelson Scholarship, SFSU

Stanford University, Lagunita Diversion Dam Removal Project, San Mateo and Santa Clara Counties, CA, Task Lead. Wrote National Marine Fisheries Service (NMFS) biological assessment (BA) for a diversion dam removal and stream restoration project covering the CCC steelhead DPS, designated critical habitat (DCH), and Pacific Coast Salmon Essential Fish Habitat (EFH). 2016.

U.S. Bureau of Reclamation, San Joaquin River Restoration Program Reach 2B Project, Fresno, CA, Biologist. Wrote NMFS programmatic biological assessment covering the Central Valley (CV) spring-run Chinook salmon (*Oncorhynchus tshawytscha*) ESU, the CV steelhead DPS, DCH, and Pacific Coast EFH. 2015 – 2016.

Santa Clara County Parks and Recreation Department, Guadalupe Fish Sampling Project, Santa Clara County, CA, Biologist and Task Lead. Collected age 1+ California roach (*Lavinia symmetricus*) from five stream reaches and young-of-year largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*) from four reservoirs in Santa Clara County for mercury analysis. Collection methods included backpack electrofishing, seine netting, and minnow trapping. Wrote 5-year report discussing 2016 sampling results and comparing results to 2011 and 2012 sampling. 2016.

El Dorado Irrigation District, Project 184 Geomorphic Monitoring of Representative Channel Areas, El Dorado County, CA, Task Lead. Conducted geomorphic monitoring at eight stream channel sites as part of a long-term monitoring program. Stream channel measurements included cross section surveys, longitudinal profile surveys, pebble counts, bank erosion potential ratings, and photo point monitoring. Wrote monitoring report discussing results of the 2016 monitoring efforts and comparing them to the 2011 monitoring period. 2016.

Golden Gate National Recreation Area, Redwood Creek Coho Salmon Surveys and Extirpation Prevention, Sausalito, CA, Aquatic Ecology Intern. Conducted field surveys and CCC coho salmon collections using a range of survey techniques to monitor and collect fish including fyke traps, snorkel surveys, implanting PIT tags, seining, and electrofishing. Identified and handled CCC coho salmon and CCC steelhead during surveys. Assisted in data management and created maps of observation and collection locations. 2014.

Golden Gate National Recreation Area, Redwood Creek Habitat Mapping Survey, Sausalito, CA, Aquatic Ecology Intern. Created the first comprehensive habitat map of CCC steelhead habitat in Redwood Creek since the Muir Beach restoration. Used aerial photos, transect tapes, and a compass to map abiotic, biotic, and hydrologic features. 2014.

AECOM

Steven McNeely, PE

Cost Estimation

Areas of Expertise

River, Stream & Wetland Restoration
Watershed Hydrology
Fluvial Geomorphology
Riparian & Aquatic Ecology
Fish Passage Improvement
Stormwater Pollution Prevention
Low Impact Development

Education

MS, Civil Engineering (Water Resources concentration), San Jose State University
BS, Earth Systems Science and Policy (Dual Concentrations in Watershed Systems and Marine and Coastal Ecology), California State University, Monterey Bay

Licenses/Registrations

California Registered Professional Civil Engineer #80567
Certified Professional in Storm Water Quality (CPSWQ) #0699
CA Stormwater Quality Association Qualified SWPPP Developer/ Practitioner (QSD/QSP) #24228

Years of Experience

With AECOM	1+
With Other Firms	13

Steven McNeely is a Senior Water Resources Engineer and Fluvial Geomorphologist with more than 14 years of experience as an engineering and environmental consultant. His professional experience has included performance of a wide range of geomorphic and hydrologic analyses. He has been involved in the planning, design, and construction supervision of numerous stream restoration projects. Mr. McNeely has also designed and produced site construction, grading, drainage, erosion control and stormwater pollution prevention plans.

Steven has a wide range of technical expertise, including total station and GPS surveying, digital terrain modeling and remote sensing using Civil3D and ArcGIS software, as well as hydrologic, hydraulic and sediment transport modeling utilizing a variety of platforms. He also has experience in instream flow assessments, mapping of habitat for anadromous fish and integrated hydraulic modeling of instream habitat.

Experience

State Coastal Conservancy and California American Water, Carmel River Reroute and San Clemente Dam Removal Project, Monterey County, CA. This project will meet dam seismic safety and steelhead passage goals through the removal of the dam and reroute of approximately 4,200 ft. of the Carmel River. Mr. McNeely is involved in the review of hydraulic and sediment transport modeling and channel restoration designs and is providing oversight of channel construction activities.

Stanford University, Searsville Alternatives Study, San Mateo and Santa Clara counties, CA. This project includes initial technical studies to support development and analysis of alternatives for the Searsville Dam and Reservoir area of the Stanford University campus. The studies include dam stability, hydrology, hydraulics, sediment transport, flooding, channel geomorphology, fish passage, biological, and water supply analyses to assess the effects of a range of potential changes to the area. Mr. McNeely has been involved in conducting a multi-criteria evaluation of alternatives to assist Stanford in their decision making process.

Santa Clara Valley Water District, Almaden Dam Fish Passage Feasibility Evaluation, Santa Clara County, CA. This project included evaluation of the feasibility of providing passage for Central California Coast steelhead at a 100-foot-tall dam in the Guadalupe

River Watershed. Mr. McNeely developed engineering cost estimates for several upstream and downstream passage options.

Ventura County Wastershed Protection District, Matilija Dam Removal Project, Ventura, CA. This project includes dam removal and diversion mitigation alternatives development and evaluation, sediment transport modeling, and development of design plans and cost estimates for the selected dam removal and diversion mitigation concepts. Mr. McNeely has been responsible for modeling of stream channel corridor development during reservoir sediment flushing for various dam removal alternatives.

Stanford University, Lagunita Dam Removal Project, Stanford, CA. This project proposes to remove the Lagunita Diversion Dam on San Francisquito Creek and restore the creek bed in order to enhance habitat and improve passage for steelhead and address sediment transport, erosion, and flood control issues. Mr. McNeely evaluated existing channel conditions and the developed alternatives for restoration and fish passage improvement following removal of the dam and has been responsible for the design and development of engineering plans and cost estimates.

Vedanta Society of San Francisco, Vedanta Sediment Management Plan and Gravel Creek Restoration Design, Olema, Marin County, CA. The goal of this project was the removal of an instream sediment pond and restoration of fish passage along Gravel Creek. Mr. McNeely conducted a hydrologic and geomorphic analysis of the Gravel Creek watershed, including an evaluation of sediment delivery and transport processes and estimation of historic sediment yields, and prepared a sediment management plan for the property. He was also responsible for the design of restoration plans to realign the stream channel and provide for steelhead passage at multiple road crossings.

Waste Management, Inc. (WM), Alum Rock Stream Restoration, Santa Clara County, CA. This project was designed to remove an approximately 40 ft. high earthen embankment dam and construct 1,000 ft. of step-pool and boulder cascade channel reaches ranging in slope from 3 to 15% to reconnect Upper Penetencia Creek with the headwaters of its watershed. Responsibilities included hydrologic and geomorphic analyses and development of restoration designs and construction plans.

Tahoe Resource Conservation District and City of South Lake Tahoe, Upper Truckee River, Middle Reach, Habitat Restoration Project, El Dorado County, CA. This project was designed to improve fisheries habitat and water quality by restoring natural geomorphic channel function. Mr. McNeely analyzed historic aerial photos and developed design strategies for the project, which included bank bioengineering, floodplain modifications and instream habitat elements. He was also responsible for the producing conceptual design plans and preliminary construction documents.

EXHIBIT 2-A

Balance Hydrologics, Inc.®

JONATHAN A. OWENS

Geomorphology, Hydrology, Hydraulics, & Sediment Transport

Education:

M.S., Civil Engineering, University of California, Berkeley, 1993

B.S. Engineering Sciences, Dartmouth College, 1990

Summary of Experience

Mr. Owens has been conducting hydrologic field studies in diverse settings since 1993. He uses his background in engineering, geology, and geomorphology to model hydrologic systems and perform field studies. He has experience designing, implementing, and directing integrated hydrologic investigations and long-term monitoring projects. His research focused both on fluvial and subsurface systems. Mr. Owens manages projects involving flow hydraulics, riparian roughness, channel morphology, sediment-transport and hydrologic effects of proposed land use changes. Responsible for many streamflow, constituent-transport, and recharge simulations. Evaluates historic flow records and identifies hydrologic patterns. Models stream network discharges and temporal requirements for targeted biological species to establish water availability for consumptive uses. Coordinates Balance's stream gaging program. Is in charge of storm monitoring to collect field data used to calibrate the model runs. Performs field investigations and modeling to assess flood levels in both natural streams and vegetated, urban, flood-control channels.

Relevant Experience

Searsville Dam and Reservoir Alternatives, San Mateo County, California. As Balance's Principal-in-Charge and Project Manager Mr. Owens has overseen the creation of various 1-D and 2-D hydraulic and sediment-transport models for the San Francisquito Creek system and Searsville Reservoir. The models have been calibrated with flow and sediment field measurements collected by Balance's team during high-flow events, and to observed bed conditions and changes from year to year. Numerous alternatives have been explored with Stanford's project team, as well as citizen and agency forums.

Santa Clara Valley Water District On-call Sediment Sampling, Santa Clara County, California. Mr. Owens samples suspended and bedload sediment, and water flow during high-flow events at eight different locations within Santa Clara County. Results from the sampling will be used to aid SCVWD in understanding sediment transport during high flow conditions in streams throughout the County.

Santa Clara Valley Water District High-Flow Sediment Sampling, Santa Clara County, California. Mr. Owens is the principal-in-charge and project manager for this effort where Balance conducted high-flow sediment sampling at multiple sites for the District during water year 2016. The effort includes the installation of staff plates, measuring flow and sampling for bedload-sediment, suspended-sediment during storm events.

Baseline Assessment of Sediment Transport and Bed Sedimentation, Town of Rancho San Carlos, Monterey County, California. Mr. Owens was a Senior Geomorphologist for this project where Balance hydrologists and geomorphologists measured sediment transport and habitat-impairing

sedimentation affecting native rainbow and steelhead trout in 6 streams south of Carmel Valley.

Bear Creek Water Quality Study, 1999–2002, Town of Woodside, San Mateo County, California. Mr. Owens directed a three-year study of flows and water quality in the Bear Creek watershed, where restoration of steelhead habitat has been the focus of substantial efforts over the past decade. He installed dataloggers on three streams and monitored five partial-record stations at other locations. In addition to streamflow gaging, the project consisted of water quality sampling both during storms and in the dry season, for analysis of nitrogen, trace metals, pesticides, salinity and suspended sediment. Data analysis showed copper and zinc concentrations were often near or above aquatic acute toxicity levels, but other constituents were of less concern.

San Francisquito Creek Watershed Gaging Stations, California. Mr. Owens has managed the operations and data for flow- and sediment-gaging stations in the San Francisquito Creek watershed since 1995. Combining data from individual stations on Los Trancos Creek, Corte Madera Creek, Bear Creek, Searsville Lake, San Francisquito Creek, and other tributaries allows for a comprehensive understanding of how streamflow and sediment from different arms of the watershed coalesce to determine the downstream conditions.

Santa Cruz County Long-Term Sediment-Monitoring Program, Santa Cruz County, California. Mr. Owens is the Senior Lead on this study for Santa Cruz County is committed to reducing soil loss and the amount of fine sediment entering its stream system. This long-term effort is one of the largest watershed-scale erosion- and sediment-control programs on the west coast. Mr. Owens developed a sampling program to quantify and evaluate long-term changes in both bed sedimentation and in sediment transport. The program includes direct measurements of bed permeability, embeddedness, net accumulation and downcutting.

San Francisquito Creek Watershed Long-Term Water Quality Monitoring and Assessment Program, 1999–Present, San Mateo and Santa Clara Counties, California. As Project Manager, Mr. Owens co-leads this ongoing project for Stanford University, which entails monitoring flows and water quality in the San Francisquito Creek watershed, key habitat for federally-listed steelhead trout. From 1999-2002, eight sites on three headwaters streams were monitored for flow and water samples were collected under a full range of storm runoff and low-flow conditions for analysis of nutrients, trace metals, pesticides, salinity, and suspended sediment. From 2001 to 2007, Balance managed automated (Isco) sampling stations at three lower watershed sites and collected composite water quality samples for these same pollutants. Since 2008, monitoring has focused on gaging flows, measuring salinity and characterizing suspended sediment transport.

Stanford University - Searsville Lake, San Mateo County, California. Mr. Owens participated in Balance's first investigations at Searsville Lake in 1995, and has managed subsequent projects addressing sediment inputs from 5 tributaries (1998), downstream sediment impacts (2000 and 2001), water and sediment outflow (2002 to 2012), flood elevations in and around Searsville Lake (2009 to 2010), and downstream flooding implications (2011). Mr. Owens continues to manage all work related to the Searsville Dam alternatives study.

National Park Service, Redwood Creek, Pump Test, Marin County, California. As Project Manager, Mr. Owens directed the assessment and quantification of the effects of well pumping on Redwood Creek, Golden Gate National Recreation Area, in Marin County, California. Balance staff collaborated with National Park Service hydrologists on project design and execution, including datalogger wiring and programming, calibrating pressure transducers, and synchronizing monitoring at several observation wells, as well as upstream and downstream creek-monitoring stations.

Stevens Creek Blackberry Farm Stream Restoration City of Cupertino Department of Public Works, Santa Clara County, California. Mr. Owens was Balance's primary Construction-Observation Geomorphologist for this project. Balance Hydrologics cooperatively led the development of a stream corridor restoration plan for Stevens Creek at Blackberry Farm. The stream corridor designs were rooted within a set of robust fluvial geomorphic, hydrologic, sediment transport, and fishery habitat analyses, each of which were peer reviewed by scientists and engineers at the Santa Clara Valley Water District. The primary focus of the project was to replace four steelhead trout migration barriers with stable, self-sustaining channel forms providing geomorphic, hydraulic and ecological functionality.

EXHIBIT 2-A

Balance Hydrologics, Inc.®

ERIC RIEDNER, PE, QSP, QSD

Geomorphology, Hydrology, Hydraulics & Sediment Transport

Education:

B.S. Civil and Environmental Engineering, Emphasis in Water Resources Engineering, University of Wisconsin, 2001

Registered Professional Engineer:

California #69728,

Nevada #019020

Qualified Stormwater Developer and Practitioner QSD/QSP:

California #23629

Summary of Experience

Mr. Riedner is a professional engineer with a background in surface water hydrology and hydraulics, flood control and floodplain management, riparian restoration, and urban runoff treatment design. He is experienced in a wide range of hydraulic and hydrologic modeling platforms applied towards FEMA floodplain mapping, dam break simulations, sediment transport and scour analyses, design feasibility assessments, CEQA analyses, and stormwater management plans. He is also involved in stream and wetland restoration and stormwater facility design from conceptual level to construction document preparation and construction management.

Relevant Experience

Two-Dimensional Hydraulic Modeling of Flooding at Searsville Lake, San Mateo County, California. As Balance's Lead Modeler Mr. Riedner has created a quasi-unsteady state 1D model for existing conditions. Additionally, calibrating the model with sediment field measurements collected by Balance's team during high flow events. This 1D model has been compared to the previous 2D non-steady state model. As the project moves forward, project alternatives will be ran through the 1D model.

Two-Dimensional Hydraulic Modeling of Flooding at Searsville Lake, San Mateo County, California. As Lead Modeler, Mr. Riedner assisted Stanford University in assessing flooding risk to properties along the tributary system that discharges into Searsville Lake. Using the CCHE2D software platform, an unsteady state two-dimensional hydraulic model was developed to simulate the 100-year flood event along 5 separate channels with a combined length of over 3 miles. Mr. Riedner also provided oversight of the development of a one-dimensional hydraulic model used to assess changes in flow patterns and water surface elevations that would result from a range of design concepts proposed for the Lake.

Watsonville Slough Hydrologic Study, County of Santa Cruz, California. Mr. Riedner developed a comprehensive set of hydrologic, hydraulic, and sediment transport models of the Watsonville Slough system in Santa Cruz County that will be used as a planning tool by stakeholders in the watershed. The models were developed to assess impacts of potential land use and management changes within the 20 square mile watershed as well proposed restoration projects within the sloughs. In order to capture the complex hydrologic interactions of the system, a continuous simulation hydrologic model was developed to provide a detailed accounting of rainfall rates, applied irrigation, evapotranspiration, groundwater recharge, and shallow

groundwater returns over a simulated 10-year period. A complex hydrodynamic model was developed to route the resulting 10-years of calculated inflows through the sloughs, interconnecting channels, pump stations, and shallow groundwater storage basins.

Carmel River Lagoon Ecosystem Protective Barrier Project, City of Carmel, Monterey County, California. Mr. Riedner is the Project Manager for Balance's portion of this effort, which includes hydrologic and hydraulic support for the planning and feasibility analysis for the proposed Carmel River Lagoon Ecosystem Protective Barrier (EPB). Our team is developing a number of design concept alternatives that consider a range of wall alignments, heights, and barrier types. Balance is collecting and analyzing existing data and reporting related to the Ecosystem Protective Barrier. This data will aid in identifying opportunities and constraints for the project, describe the range of project alternatives considered, present conceptual level designs for the preferred project alternatives, and summarize results of the hydraulic modeling and other qualitative impacts assessments.

East Garrison Fort Ord Hydrologic Modeling, Monterey County, California. As Project Engineer, Mr. Riedner generated a complex hydrologic model used to develop an infiltration based stormwater management scheme for a 244-acre residential development. This effort resulted in the design of a series of interconnected infiltration basin and other distributed infiltration facilities that are capable of infiltrating runoff up to the 100-year design storm.

Salinas River Diversion Facility Flood Hazard Assessment, Monterey County, California. Mr. Riedner led the effort to prepare this model for use in assessing flood hazard impacts resulting from the Salinas River Diversion Facility to the surrounding agricultural areas and to process a floodplain mapping revision through FEMA. Balance Hydrologics was contracted by the Monterey County Water Resources Agency to develop a hydraulic model covering over 2 miles of the Salinas River upstream from Highway 1.

Salinas River Diversion Dam Floodplain Mapping, Monterey County, California. Mr. Riedner served as Lead Engineer for remapping of the lower reaches of the Salinas River under contract to the Monterey County Water Resources Agency. The remapping was conducted as part of the Salinas River Diversion Facility project located approximately 3 river miles upstream of the Highway 1 crossing. Work included reviewing the original FEMA modeling files, design plans of the proposed facilities, and other information regarding the river floodplain upstream to Blanco Road. Hydraulic modeling of the river required consideration of complex channel and overbank flow conditions to assess how the diversion dam facilities could be operated in a manner consistent with the County's Floodplain Management Plan.

Design Concepts for the Odello Property Along the Lower Carmel River, County of Monterey, California. As Project Engineer, Mr. Riedner assisted the Big Sur Land Trust to identify and assess a number of restoration alternatives along the Lower Carmel River Valley that would both reconnect a leveed agricultural parcel to the adjacent main channel of the Carmel River as well as address significant flooding issues along the developed portions of the floodplain. Mr. Riedner developed a HEC-RAS model extending 2 miles inland from the mouth of the river at the Pacific Ocean, including numerous lateral weirs, bridges, split flows, and culverts and a two-dimensional hydraulic and sediment transport model to identify impacts of the proposed design on flow patterns and channel stability.

EXHIBIT 2-A

AECOM

John Roadifer, PE

Project Engineer; Cost Estimation; Sediment Removal Management; and Reservoir Expansion

Areas of Expertise

Dams
Sediment Management
Civil Engineering
Construction Management
Cost Estimation

Education

MS, Civil Engineering, University of Utah
BS, Geological Engineering, Colorado School of Mines

Licenses/Registrations

Professional Engineer (Civil), CA, WA

Years of Experience

With AECOM	18
With Other Firms	13

Professional Associations

United States Society on Dams
Association of State Dam Safety Officials

John Roadifer is a registered civil engineer with 31 years of experience in a wide range of water infrastructure projects including the design of new dams, modification of existing dams, and dam removal. His responsibilities for these projects have included management or performance of development and evaluation of alternatives, site investigations, laboratory testing programs, conceptual and final engineering, preparation of plans, specifications and other contract documents, construction cost estimation and scheduling, provision of engineering support for CEQA and permitting, coordination with state agencies and regulatory agencies, and construction management.

Experience

Ventura County Public Works Agency, Matilija Dam Removal, Ventura, CA. Project Engineer for the development of alternatives for dam removal, for the Matilija Dam removal project, part of the larger Matilija Dam ecosystem restoration. Removing the 168-foot-high arched concrete dam will, among other things, open up steelhead trout habitat on Matilija Creek and restore sediment transport functions down the river to the Pacific Ocean. Mr. Roadifer managed tasks that included alternatives development, conceptual level engineering, estimation of construction cost and schedule for the alternatives, alternatives evaluation, risk analysis, and further conceptual refinement to the two most likely alternatives.

California American Water & State Coastal Conservancy, Carmel River Reroute and Dam Removal Project, Monterey County, CA,. Engineering Manager for geotechnical exploration, design services and design-build procurement support for this project to remove San Clemente Dam and improve fish passage up the Carmel River. The project met the existing dam seismic safety goals through the removal of the 106-foot-high concrete arch dam and relocation of approximately 370,000 cubic yards of accumulated sediment behind the dam to a portion of the Carmel River that was permanently bypassed by cutting a 450-foot-long channel between the Carmel River and San Clemente Creek. Mr. Roadifer managed and performed tasks for conceptual engineering, evaluating alternatives for stabilizing sediments in the bypassed arm of the Carmel River that overlie liquefiable sediment, developing 30 percent design plans and specifications and construction cost estimates and schedules, developing contract documents for design-build procurement, providing bid support and evaluation.

Stanford University, Searsville Dam and Reservoir Alternatives Study, Santa Clara and San Mateo Counties, CA. Mr. Roadifer was the task manager for conceptual engineering services in cost estimation and alternatives development and evaluation for dam stability and modifications; water diversion, supply, and storage; and reservoir sediment management and dredging, that were part of the alternatives study for the 60-foot-high gravity dam and reservoir that has had its capacity reduce to about 10 percent of its original capacity due to sedimentation. The study is being conducted to determine the future of the dam and reservoir.

Monterey Peninsula Water Management District (MPWMD) (as sub to HDR Engineering, Inc.), Los Padres Dam Fish Passage Feasibility Study, Monterey County, CA. Geotechnical Reviewer and DSOD Coordination. Investigated the feasibility of providing passage for South-Central California Coast Steelhead at the Los Padres Dam on the Carmel River. Providing geotechnical review and DSOD considerations review alternatives.

Stanford University, Lagunita Diversion Dam Removal, Mountain View, CA. Providing constructibility reviews and geotechnical engineering for the project, which involves removal of a 65-foot-wide by 10-foot-deep diversion dam that is no longer in use and restoration of the creek bed to enhance endangered steelhead habitat.

Santa Clara Valley Water District, Anderson Dam Seismic Retrofit, San Jose, CA. Engineering manager for the development of plans and specifications for the seismic retrofit of Anderson Dam, a 240-foot-high zoned rockfill embankment founded on alluvium, older deposits, and Franciscan bedrock. The dam is near the active Calaveras Fault, and the site straddles the conditionally active Coyote Creek Range Front faults, with traces mapped crossing the dam footprint and the outlet works alignment.

San Francisco Public Utility Commission (SFPUC), Calaveras Dam Replacement Project/Conceptual Engineering, Sunol, CA. Senior Project Engineer for the replacement of a 220-foot-high 80-year-old hydraulic fill dam located within 1,500 feet of the Calaveras Fault that is vulnerable to liquefaction failure. Project features include the new dam, a 160-foot-deep, 20-foot-diameter intake shaft with four connecting intake tunnels, a large side channel spillway, and multiple disposal sites in the reservoir area for more than 4,000,000 cubic yards of excess soil and rock. Mr. Roadifer's responsibilities included managing, coordinating or performing alternatives evaluations of dam type, seepage control, and disposal sites, coordination of geotechnical investigations for final design, disposal area stability analyses, preparation of plans, specifications, construction cost estimates and schedules, and for providing support to the environmental review process, and currently assisting in providing engineering services during construction.

AECOM

David Simpson, PG, CEG

Sediment Characterization; Geology

Areas of Expertise

Engineering Geology
Dams and Levees
Pipelines and Tunnels
Environmental Geology
Quaternary Geology
Construction Management

Education

MS, Geology, University of New Mexico
BS, Geology, University of California, Davis

Licenses/Registrations

Professional Geologist, CA
Professional Engineer (Civil), CA

Years of Experience

With AECOM	24
With Other Firms	4

Professional Associations

Association of Environmental and Engineering Geologists
Association of State Dam Safety Officials

Training and Certifications

Certified Engineering Geologist

David Simpson has experience evaluating complex geologic site conditions for a variety of projects including dams, tunnels, penstocks, pipelines, spillways, bridges and roadways, buildings, and flood, landslide, and fault hazard studies, and environmental impact studies through developing, managing and performing multifaceted geologic investigations. He has served as project manager on numerous projects and task leader for geologic and geotechnical investigations for many large complicated civil projects. He has extensive field experience with geologic and geomorphic mapping, sediment, soil and rock drilling and sampling, and in situ testing, large diameter borehole logging, and interpretation of borehole and surface geophysical investigations. His Quaternary geologic expertise includes evaluating soil and alluvial stratigraphy, age dating methods, and interpreting Quaternary geologic history, logging, and interpretation of trench excavations for paleoseismic and landslide studies, and aerial photograph and LiDAR interpretation. He has acted as lead geologist for large civil construction projects that have involved daily communication with project team, client, and contractor as well as fast-tracked mapping of foundation geology and approving final excavations.

Experience

Stanford University, Searsville Dam & Reservoir Alternatives Study, Santa Clara County, CA. Senior Review Geologist. Project involves initial technical studies to support Stanford in the development of alternatives for Searsville Dam and reservoir.

Santa Clara Valley Water District (SCVWD), Anderson Dam Seismic Remediation Project, Morgan Hill, CA. As project geologist and geotechnical exploration task manager, Mr. Simpson developed and managed all field and laboratory investigations required to support the engineering design of modifications to Anderson Dam, outlet tunnel, and spillway. These investigations including lake sediment, soil, and rock drilling and sampling from a barge in the reservoir and on land, installation of in situ monitoring instruments, shallow backhoe test pits, collection of surface geophysical surveys and borehole surveys, and excavation and logging of fault evaluation trenches. He also worked with California Division of Safety of Dams geologists and engineers to keep them apprised of the exploration progress, findings, and interpretations.

SCVWD, Seismic Stability Evaluation Project – Phase 1B Dams, CA. Project Geologist. Tasks included directing the geotechnical evaluation of three earth embankment dams: Almaden, Calero, and

Guadalupe to support seismic stability analyses. The dams are all essentially homogeneous embankments built in the 1930s. As project geologist and exploration task manager for all three dams, managed the field and laboratory investigations including lake sediment, soil, and rock drilling and sampling from a barge in the reservoirs and on land, installation of in situ monitoring instruments, and working with DSOD geologists and engineers to keep them apprised of the exploration progress, findings, and interpretations. Site exploration was described and dam and foundation properties were summarized in a report that facilitated the deformation and stability analyses of all three dams.

SFPUC, Calaveras Dam Replacement Project, Sunol, CA. Acted as a senior technical peer reviewer and quality control officer for numerous geologic field investigation boring logs, geologic maps, and fault trench logs. As such he confirmed that all field interpretations were consistent with applicable standards (e.g. ASTM, USCS) and were consistent with the logs and descriptions generated by other geologists for the project.

Stanford University, Lagunita Dam Removal Project. Senior Review Geologist. Project involves initial technical studies to support Stanford. This project proposes to remove the Lagunita Diversion Dam on San Francisquito Creek and restore the creek bed in order to enhance habitat and improve passage for steelhead and address sediment transport, erosion, and flood control issues.

Nevada Irrigation District (NID), Centennial Dam Project, Nevada and Placer Counties, CA. Project geologist responsible for planning and directing all geologic and geophysical investigations for the foundation of a new dam on Bear River and to evaluate two potential rock borrow areas. Investigations included twenty rock core borings to evaluate the dam foundation and twelve borings to evaluate two rock borrow areas. Hydraulic conductivity was evaluated in all foundation borings. Borehole televiewer and seismic velocity surveys were run in many of the borings. Approximately 7000 feet of surface seismic refraction surveys were completed. All work was completed on schedule and under budget. Project design is ongoing.

AECOM

George Strnad, RLA

Landscape Architecture

Areas of Expertise

Ecological Restoration
Park, Recreation Planning
Sustainable Landscape Architecture
Green Infrastructure
Streetscaping
Wetland/Riparian Mitigation
Land Use Planning
Botanical Surveys
Wetland Delineation
Project Management
Visual Resource Analysis

Education

MS, Regional Planning and Landscape Architecture, Czech Technical University, Praha
BA, Architecture, Czech Technical University, Praha
Post-Graduate Studies, Ecological Landscape Design, University California, Berkeley, Davis

Licenses/Registrations

Landscape Architect, CA, WA, NV

Years of Experience

With AECOM	15
With Other Firms	18

Professional Associations

American Society of Landscape Architects
Association of Environmental Professionals
California Native Plant Society
Society for Ecological Restoration
UC Berkeley Jepson Herbarium

Training and Certifications

HAZWOPER/Certified
Wetland Delineation Training, Sausalito, CA.
Project Management continuing education series, AIA, Oakland
Certified Project Manager
Autocad Training
MicroStation Training

George Strnad manages the AECOM Sacramento Landscape Architecture and Habitat Restoration Group. He is registered Landscape Architect, Restoration Ecologist, and Environmental Scientist with over 30 years of experience in landscape architecture, sustainable landscape design, ecological restoration, land use planning, biological resource assessment, and project management. His projects have included master plans, street greening plans, park and trail design, self-sustainable landscape plans, habitat restoration plans, wetland and riparian corridor restoration plans, habitat mitigation and monitoring plans, botanical surveys, wetland delineations and environmental compliance documentation for a number of private and government clients. Mr. Strnad has extensive knowledge of ecology, wetland biology, and native flora of the western U.S. He possesses an in-depth understanding of state and local landscaping and irrigation codes, ordinances, and other regulatory legislation. His projects range from small private client landscaping projects to large government sponsored habitat restoration projects with a total constructed value in excess of tens of millions of dollars.

Experience

San Francisco Public Utilities Commission, Calaveras Dam Replacement Project, Sunol Regional Wilderness, CA. Project Restoration Ecologist and Landscape Architect. Participated in the restoration design for several disturbed and mitigation areas. Prepared irrigation design and Plans, Specifications and Cost Estimate for these areas and performed QA/QC of the construction documents (PS&E).

California State Coastal Conservancy, California American Water, Carmel River Restoration, Carmel Valley, CA. Served as the lead restoration ecologist responsible for the restoration design of a 60-acre area at the Carmel River and San Clemente Creek confluence recovered after the San Clemente Dam removal. The project will improve wetland and riparian habitats, facilitate fish passage and provide quality habitat for the rearing of coastal steelhead trout in the Carmel River and its combined channel with the San Clemente Creek. Responsible for development of the detailed ecological design criteria, revegetation plans and habitat cross-sections for the restoration of the riparian, wetland and upland habitats; irrigation demand calculations for the entire restoration area; preparation of a Design/Build restoration criteria; restoration plans for the Old Dam Area and access roads; restoration plans,

specifications, cost estimates. Currently he is participating in the construction administration of the project.

State Coastal Conservancy and Ventura County Watershed Protection District, Matilija Dam Ecosystem Restoration Project, Ventura County, CA. Plant and Restoration Ecologist. Performed plant surveys and prepared conceptual restoration plans for the initial options, development and evaluation of alternatives and detailed design for removal of Matilija Dam and accumulated sediments.

Stanford University, Searsville Dam & Reservoir Alternatives Study, Santa Clara County, CA. Plant and Restoration Ecologist. Performed botanical surveys and prepared restoration plans for initial technical studies to support Stanford in the development of alternatives for Searsville Dam and reservoir.

Stanford University, Lagunita Diversion Dam Removal, Mountain View, California. Plant and Restoration Ecologist. Performed botanical survey, and prepared restoration design and plans, specs and estimate for revegetation, erosion protection and bank stabilization for the project, which involves removal of a 65-foot-wide by 10-foot-deep diversion dam that is no longer in use and restoration of San Francisquito Creek to enhance endangered steelhead habitat.

U.S. Bureau of Reclamation (USBR), San Joaquin River Restoration Program Mendota Pool Bypass and Reach 2B Improvements, Fresno and Madera County, CA. Lead environmental scientist and restoration ecologist for this river channel reconfiguration, and riparian and wetland restoration project of the 11-mile long Reach 2B of the San Joaquin River from Mendota Dam to the Chowchilla Bifurcation Structure (RM 205–216). The primary tasks he was responsible for were: the design of wetland and riparian habitats, placement and selection of native vegetation alliances; the development of riverine processes ecological recovery plan; comparison study of eight restoration alternatives; the jurisdictional delineation of wetlands; vegetation alliance and listed plants surveys and agency reports preparation; Initial Options, Selection, Existing Environmental Conditions and Use of Analytical Tools technical memoranda; and vegetation data input for the USBR vegetation succession computer model. Developed the significance criteria for vegetation and wetland impacts, and is currently assisting with the preparation of the Environmental Impact Report for the restoration of Reach 2B.

AECOM

Steve Tough, PE

Reservoir Expansion

Areas of Expertise

Civil Works Design
Stormwater Drainage & Wetlands Design
Dam Embankment and Spillway Earthworks Modeling
Dam Instrumentation
Superintendency & Contract Administration
Water-Sensitive Road Design

Education

BS, Civil Engineering, Monash University, Clayton

Licenses/Registrations

Professional Engineer (Civil), CA

Years of Experience

With AECOM	10
With Other Firms	4

Training and Certifications

HAZWOPER 40 hour training
12D Drainage Interface
Stormwater Management
Road Safety Auditing
MUSIC Computer Program
WSUD (5-day course at Monash University)

Steven Tough has over 10 years' experience in civil works design and construction, including construction drawing preparation, technical specification preparation, 3D modeling, quantity and cost estimation, stormwater drainage incorporating Water Sensitive Urban/Road Design treatments such as constructed wetlands, bio-retention swales and detention ponds. He has developed and supervised the development of construction plans including excavation, dam embankments, instrumentation, site drainage and earthworks. He has also prepared hydraulic and hydrologic models for large catchment drainage studies. He has experience as a construction superintendent for large-scale industrial and residential subdivisions. He has computer skills in pipe networks, digital terrain modeling, and hydraulic and hydrologic modeling. Design programs include Civil 3D, 12D, AutoCAD, HECRAS, MapInfo, MUSIC, Drains, XP Storm, PC Drain & RORB.

Experience

Santa Clara Valley Water District, Anderson Dam Seismic Retrofit, San Jose, CA. Participating in the seismic retrofit of Anderson Dam, a 240-foot-high zoned rockfill embankment founded on alluvium, older deposits, and Franciscan bedrock. The dam is near the active Calaveras Fault, and the site straddles the conditionally active Coyote Creek Range Front faults, with traces mapped crossing the dam footprint and the outlet works alignment.

Santa Clara County Department of Parks and Recreation, Almaden Quicksilver County Park - Calcine Paved Roads Initial Study, Los Gatos, CA. Participated in an initial study and mitigated negative declaration for a calcine pavement remediation project, which involved removal of pavement used as surface cover on fire roads and trails in the park that are identified as containing calcine and replacement with clean soil, repair of inboard drainage ditches, and stabilization of slumps and over steepened road edges.

California Department of Water Resources (DWR), Delta Habitat Conservation and Conveyance Program: Conceptual-Level Engineering and Design/Alternatives Analysis, Sacramento Delta, CA. Currently working as a Design Engineer in the Canals group on the Isolated Facility Eastern & Western Alignments. Assisted in the development of the Conceptual Engineering Report for four conveyance alternatives. Tasks involved 3D modeling and conceptual analysis of canal alignment and cross section. Coordinated the production of the Western Alignment canal drawing set, including detail checking to ensure conformity with

CADD standards. 3D model was used to generate earthwork quantities for Conceptual Report cost estimate.

San Francisco Public Utilities Commission (SFPUC), Calaveras Dam Replacement, Sunol, CA. Design Engineer. Preparation and checking of specifications for 95% dam replacement design. Tasks include design of drainage, haul roads, detailed checking of 95% design drawings, quantity estimates and detailed check of quantities.

Panama Canal Authority, Panama Canal Expansion Project, Borinquen Dams, Panama. Currently working as a design engineer for the conceptual and detailed design of the New Borinquen dams that will retain the Pacific Access Channel for the proposed expansion of the Panama Canal. Conceptual design included analysis and evaluation of different dam embankment internal zonings. Preparing 3D sub-surfaces for the dam foundation and quantity estimates using geologic information and incorporating into Civil 3D design package. Current work includes coordination of dam and excavation 3D modeling, developing earthworks quantities for cost estimation, preparing specifications.

Lower Bear Dam Raise Feasibility Study, CA. Engineer. Worked on the preparation of a data gap memorandum to establish subsequent steps for the continuation of the preliminary feasibility study for increasing storage at Lower Bear River Reservoir. Tasks involved evaluating further information/steps required to facilitate feasibility analysis. Work involved review of existing information dating back to 1952.

Lopez Reservoir Expansion Pre-planning Assessment, County of San Luis Obispo, CA. Engineer. Preparation of preliminary program-level budget and schedule for the expansion of Lopez Reservoir. Work involved preparation of a pre-planning assessment memorandum for the concept of installation of Obermeyer Gates at the Lopez Dam spillway providing additional storage. Includes yield analysis and preliminary evaluation based on other water supply projects in the US.

South Gippsland Water Authority, Wilkur / Wild Dog Creek Conceptual Dam & Pipeline Study, Leongatha, VIC, Australia. Served as Task Manager for feasibility investigations of 2,000ML dam location options and 50km pipeline networks for water supply distribution to rural areas. Evaluated multiple dam location options and used 12D design package to size and assess embankment alternatives. Cost estimates were provided for each option. Evaluated multiple pipeline alternatives, performed hydraulic analysis to determine piping sizes and provided cost estimates for each alternative. Prepared final report for South Gippsland Water Authority including recommendation of preferred options for further investigation.

EXHIBIT 2-A

AECOM

Roy Watts

Cost Estimation

Areas of Expertise

Program and Cost Schedules
Conceptual, Design Level, and Hard Dollar Construction Cost Estimates and Schedules
Constructability Analysis

Education

BS, Finance, University of Colorado

Years of Experience

With AECOM	22
With Other Firms	25

Professional Associations

International Commission on Large Dams

Training and Certifications

MSHA 24 Hour New Miner Training
OSHA 40 Hour Health and safety Training

Roy Watts is an experienced professional in construction project controls, construction cost estimating/scheduling and claims management and avoidance. In the past 47 with AECOM, he has acquired diversified experience in design and construction of projects involving transportation, water resources, energy and environment. His previous and present responsibilities include construction implementation and quality control, scheduling all levels of project development, construction conceptual and final design cost estimates and contract document development. He is proficient in the use of electronic cost estimating and scheduling.

Experience

Ventura County Public Works Agency, Matilija Dam - Removal Plans, Sediment Transport Analysis & Robles Diversion Mit, Ventura, CA. Participated in engineering services for the Matilija Dam removal, as part of a larger ecosystem restoration project. Removing the dam will, among other things, open up steelhead trout habitat on Matilija Creek and restore sediment transport functions down the river to the Pacific Ocean.

US Department of Interior - Bureau of Reclamation - Central California, Auburn-Folsom South Unit - Special Report Technical Support, Auburn, CA. Provided cost estimating for the preparation of a special report of the Central Valley project. As authorized, the Auburn-Folsom South Unit, which was to be located on the North Fork of the American River, included the Auburn Dam and Reservoir to elevation 1,140 feet; an 800 MW power plant; the Folsom South Canal; the Sugar Pine dam, reservoir, and conveyance; and the County Line dam, reservoir, and conveyance.

Contra Costa Water District, Los Vaqueros Dam Raise, Brentwood, CA. Cost Estimator. Feasibility Analysis, Alternative Selection, Design Construction Schedule, and Cost Estimates. Roller Compacted Concrete Abutment and Earth-fill Raise, Concrete Spillway, Outlet works Improvements.

US Bureau of Reclamation and National Park Service, Elwha Surface Water Intake, Port Angeles, WA. Construction Issues and Cost. Feasibility Analysis, Alternative Selection, Construction Schedule and Cost Estimates. Elwha River Washington; Hydro Plant Removal, River Diversion and Sediment Management, Port Angles Washington New Water Treatment.

San Diego County Water Authority, San Vicente Dam Raise, Lakeside, CA. Estimating Construction Cost, Schedule and Issues.

Feasibility Analysis, Alternative Selection, Design Construction Schedule and Cost Estimates. Roller Compacted Concrete Raise, Tunnels, Concrete Intake Tower, Outlet Pipe.

Northern Colorado Water Conservancy District, Carter Lake Dam No. 1 Outlet Works; Larimer County, CO. Cost Estimator. Constructability review and cost estimating for a new outlet work constructed in the abutment of a 200-foot high earthfill dam that serves as the terminal reservoir for the Colorado-Big Thompson Project. Design involved a 100-foot high intake structure, 1000-foot long tunnel conduit, and a control structure containing a 48-inch diameter sleeve valve.

City of Loveland, Green Ridge Glade Reservoir, Loveland, CO. Construction Manager and Project Controls. 1,500,000 CY embankment and hydraulic structures.

Fort Collins Utilities, Dry Creek Drainage Improvement Project; Larimer County, CO. Cost Estimator. Constructability review and cost estimating for an $8.1 million flood control project. Project features included a fuse plug spillway on an existing irrigation reservoir, 2 new flood control dams, a SCADA system and new diversion channels.

Colorado River Water Conservation District, Elkhead Reservoir Enlargement, Craig, CO. Cost Estimator. Constructability review and cost estimating for new outlet works and spillway. The spillway consisted of a 16-foot high labyrinth weir with a capacity of approximately 28,000 cfs.

Denver Water, Strontia Springs Reservoir Sediment Removal, Kassler, CO. Cost Estimator. Feasibility Analysis, Alternative Selection, Construction Schedule and Cost Estimates. Feasibility of Sediment Removal in Upper Reaches of Strontia Springs Reservoir.

Denver Water, Ralston Reservoir Downstream Buttress and Spillway Improvements Feasibility Analysis, Denver, CO. Construction Issues and Cost. Alternative Selection, Construction Schedule and Cost Estimates. Rock Buttress From On Site Quarry and Concrete Spillway Liner Repair.

Queensland Water and Infrastructure, Hinze Dam Raise, Brisbane, Australia. Construction Issues and Cost. Constructability review and cost estimating for raise of Hinze Dam approximate 50 km South of Brisbane. The project involved the 15 meter raise of a 200 meter high rockfill dam and the raise of a concrete gravity spillway structure. Other project features included raising two intake towers and the construction of a new Fish Facility.

AECOM

Keith Wright

Landscape Architecture

Areas of Expertise

Environmental Restoration
Environmental Permitting

Education

BS, Landscape Architecture, University of California, Davis

Years of Experience

With AECOM	5
With Other Firms	3

Professional Associations

American Society of Landscape Architects

Training and Certifications

ISA Certified Arborist
Field Safety Training
HEC-RAS River Analysis System Course
Biotechnical Soil Stabilization Workshop
Surface Mining and Reclamation Act: Preparation and Review of Reclamation Plans Workshop

Keith Wright has over 8 years of experience in the field of landscape architecture and ecology. His experience includes environmental permitting, riparian and wetland habitat restoration, restoration plans, details and specifications, land use studies, and open space planning. Keith has worked in the public sector where he has coordinated with various groups including landowners, corporations, small businesses and non-profits. He has also worked with county, state, and federal agencies and is familiar with the permitting process pertaining to sensitive riparian and wetland habitats.

Experience

San Francisco Public Utilities Commission (SFPUC) Calaveras Dam Replacement Project Mitigation Site Design, PCO44, Alameda and Santa Clara County, CA. Coordinated production of construction documents for habitat restoration of three sites. Deliverables included planting plans, detail drawings, and specification. Review of construction submittals and construction support. Challenges included design of irrigation system in a remote area away from municipal water and power sources. Solar design, water tanks, and booster pumps were included in the design.

SFPUC, Peninsula Pipelines Seismic Upgrade, San Mateo County, CA. Produced construction documents detailing site restoration for five separate construction sites. Riparian sites were designed to provide refuge for red-legged frog while conforming to long-term maintenance practices applied in an urban setting. Final landscape design incorporated permit requirements, long-term maintenance requirements, and land-owner requests due to the right-of-way crossing multiple types of land use, such as a condo development, Caltrans right-of-way landscaping, school parking lot, and a SFPUC storage lot. Deliverables included GIS maps, AutoCAD drawings, and site vegetation surveys.

SFPUC, Peninsula Vegetation Removal Project, San Mateo, California. Provided contractor oversite for seed collection activities. Collected seed used to restore degraded sites in local watershed. Prior to seed collection, scouted and identified suitable collection sites. Returned to collection sites and identified species for collection crew to harvest. Recommended collation dates based on seed maturity and annual seed production. Assured SFPUC collection and pathogen avoidance protocols were followed.

Pacific Gas and Electric Company (PG&E), Putah Creek R-188 Pipeline Removal, Yolo County, CA. Wrote site revegetation plan which described enhancement and revegetation areas based on permit requirements. Provided plant list containing species and quantities to be planted, described planting techniques and suitable plant spacing. Hydroseed, container installation, willow pole installation, and erosion control methods are described in the plan.

State Coastal Conservancy, South Bay Salt Ponds Restoration - Phase II, Southern San Francisco Bay, CA. Assisted in preparing conceptual (10%) designs for restoration of former Cargill salt ponds in three pond complexes around southern San Francisco Bay: Eden Landing, Alviso, and Ravenswood. Produced drawings in GIS and AutoCAD showing phased design process and alternative design concepts. Conceptual placement of trails, levee breaches, habitat types, and built infrastructure such as wildlife viewing platforms, interpretive signage, access points, and other facilities. Produced conceptual drawings for nesting island design based on habitat needs of specific species. Island design was improved based on information from extensive studies of islands installed during Phase I of the project.

PG&E, Pit 3 Tunnel Rock Creek Crossing Structure Seismic Retrofit Design, Shasta, CA. Designed habitat restoration plan for impacts related to the seismic retrofitting the crossing structure for water transfer at Rock Creek, a tributary to the Pit River. The planting plan followed the guidelines set forth in specialized FERC use permits. Determined monitoring frequency and long term performance criteria. Coordinated progress meetings and site visits with the client and lead agency. Developed scope and budget for the project. Deliverables included technical specifications, AutoCAD plan and detail sheets, and the FERC required written revegetation plan. Managed streambed restoration design process. Produced streambed restoration drawings.

SFPUC, Bioregional Habitat Reserve Program, Sunol, CA. Assisted in production of construction documents detailing stream channel design and vegetation habitat plantings. Worked on planting plans, technical specifications, irrigation requirements, and cost estimates for multiple. A major channel design project was on two miles of San Antonio Creek and included bio-engineered bank stabilization and habitat creation. The project included stream, oak woodland, savannah, riparian, and native grassland rehabilitation, establishment, and enhancement on over 200 acres.

AECOM

About AECOM

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM companies have annual revenue of approximately US$18 billion. See how we deliver what others can only imagine at aecom.com and @AECOM.

Contact
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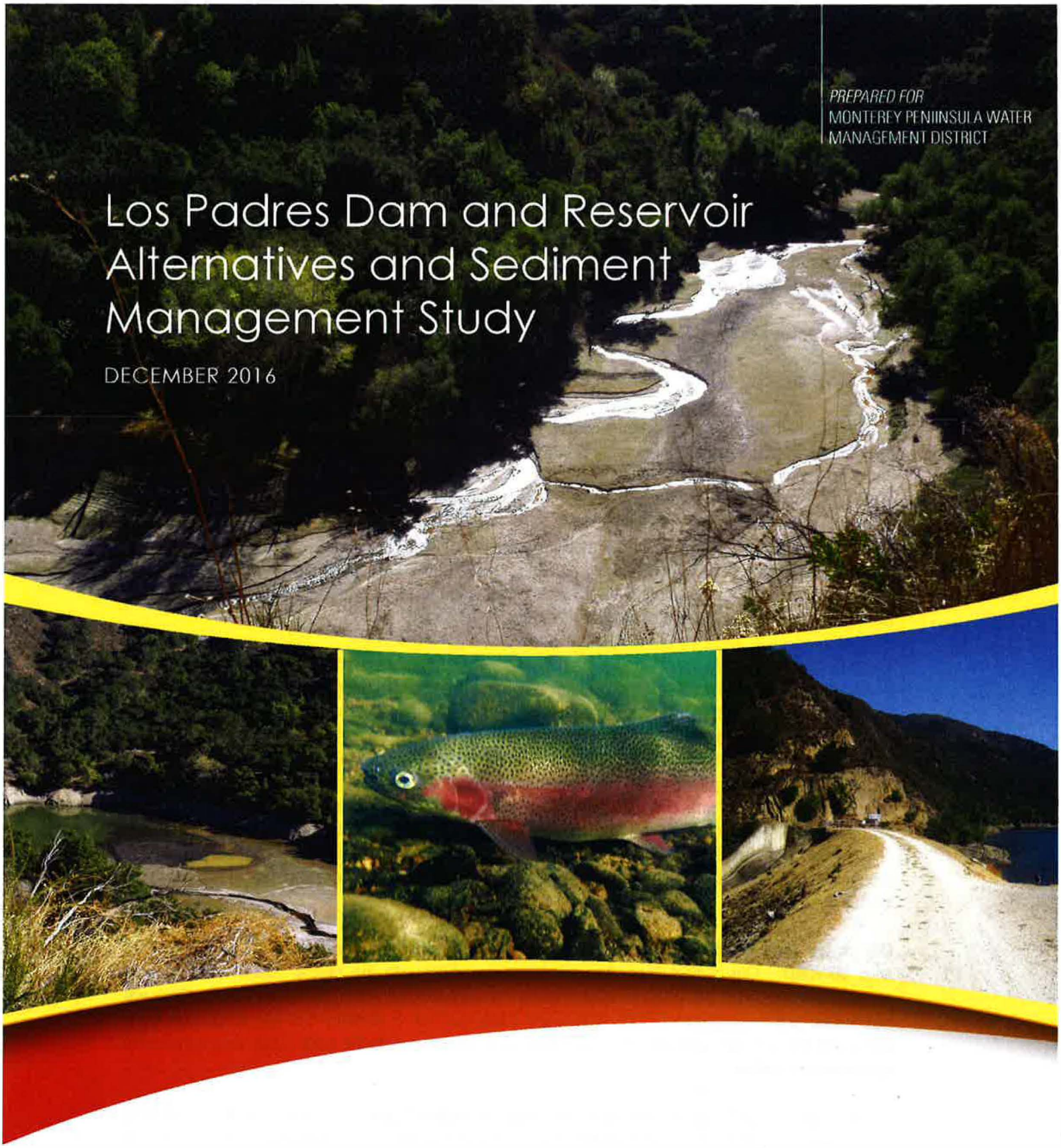

PREPARED FOR
MONTEREY PENIINSULA WATER MANAGEMENT DISTRICT

Los Padres Dam and Reservoir Alternatives and Sediment Management Study

DECEMBER 2016

PROPOSAL

MWH® now part of Stantec

MWH now part of Stantec

December 28, 2016

Mr. Larry Hampson
Monterey Peninsula Water Management District
5 Harris Court, Bldg. G
Monterey, CA 93940

Re: Los Padres Dam and Reservoir Alternatives and Sediment Management Study

Dear Mr. Hampson:

We are happy to submit our proposal for services needed for the Los Padres Dam (LPD) and Reservoir Alternatives and Sediment Management Study. As one of the leading water resources, hydraulics, and dams engineering companies in California and the United States, MWH, now part of Stantec brings worldwide experience in dams and sediment removal projects that will support services that are effective, relevant, and will ultimately drive your project to success. Further, our overall team's experience in Carmel Valley and the Carmel River watershed for the previous Los Padres Dam sediment removal study, as well as support during multiple phases of the San Clemente Dam (SCD) Removal Project, provide us with the unparalleled working knowledge to provide efficient in-depth evaluation of alternatives and facilitation of stakeholder meetings for the project.

Team Experience. MWH is offering a team of experienced engineers and professionals, well versed in all aspects required for the development of alternatives, engineering, geomorphology, fisheries biology and construction planning, cost estimating, and environmental assessment for this project. We are assigning some of our most experienced engineering staff who are familiar and worked on the 2013 MWH Los Padres Dam Sediment Removal Study and the 2007 MWH EIR/EIS alternatives development and Basis of Engineering for the San Clemente Dam Removal Project, so that their knowledge, including knowing "what works & what doesn't", will be directly applied to the Los Padres Dam study. In addition, we have partnered with an industry-leading geomorphologist, Bob. Mussetter, from Tetra Tech, as well as key steelhead experts from Cramer Fish Sciences to complement our in-house MWH staff. We have brought together this team in order to leverage the full complement of recent and direct local expertise for this project.

Our project team has local area knowledge and project history working on the Carmel River and with MPWMD. Our project team has experience working with the critical issues, policies, and procedures associated with projects located along the Carmel River and in Monterey County. They are well known and respected by DSOD, NMFS and California Fish & Wildlife. Our key leads have been active with the San Clemente Dam and Los Padres Dam dating back to the early 2000s; their experience is summarized below:

- Our Project Manager, Vik Iso-Ahola, was the Project Manager for the prior LPD and SCD sediment and dam removal studies for MWH, and has extensive experience with the DSOD on these projects as well as numerous other dam modification projects throughout the State.

2121 N. California Blvd.
Walnut Creek, CA
94596 USA

Tel: 925-627-4500
Fax: 925-627-4501

- Dr. Bob Mussetter, our team's lead geomorphologist, is responsible for development of the most extensive sediment transport models on the Carmel River known to date as part of his work on SCD under MWH.
- Dr. Michael Beakes, our lead fisheries biologist, is an expert on the central California coast steelhead, performing extensive research and published papers on steelhead life history.

Mr. Iso-Ahola is our proposed Project Manager and primary contact and is authorized to represent MWH's interest on this project.

Vik Iso-Ahola, PE, PMP
2121 N. California Blvd.
Walnut Creek, CA 94596
Phone: (925) 627-4619
Fax: (925) 627-4501
Vik.Iso-Ahola@mwhglobal.com

Upon selection, we are prepared to work with MPWMD to develop mutually acceptable terms and conditions for the project. Thank you for the opportunity to submit this proposal to MPWMD. Should you have any questions or if you require additional information, please call Vik Iso-Ahola, Project Manager, at (925) 627-4619.

Sincerely,
MWH, now a part of Stantec

Craig Harris
U.S. West Business Center Management Leader

Vik Iso-Ahola, P.E., PMP
Project Manager

Enclosed
Original + 3 copies and 1 copy emailed to: larry@mpwmd.net

SIGNATURE PAGE

ISSUE DATE: November 2016

RFP EXTENSION DATE:_____

RFP: Los Padres Dam Sediment Management Study

PROPOSALS ARE DUE IN
THE DISTRICT OFFICE BY
3:00 P.M., LOCAL TIME, ON: December 28, 2016

MAILING ADDRESS:
Monterey Peninsula Water Management District
5 Harris Court, Building G
Monterey, CA 93940

QUESTIONS ABOUT THIS RFP #10340 SHOULD BE DIRECTED TO
Larry Hampson, larry@mpwmd.net, (831) 658-5620 or (831) 238-2543

Consultant MUST INCLUDE THE FOLLOWING IN EACH PROPOSAL:
1 original plus 3 copies = total of 4 copies plus one CD or DVD (no USB sticks)

[X] ALL REQUIRED CONTENT AS DEFINED PER SECTION 7.1 HEREIN

This Signature Page must be included with your submittal in order to validate your proposal.
Proposals submitted without this page will be deemed non-responsive.

[X] **CHECK HERE IF YOU HAVE ANY EXCEPTIONS TO THIS SOLICITATION.**

Consultant MUST COMPLETE THE FOLLOWING TO VALIDATE PROPOSAL

I hereby agree to furnish the articles and/or services stipulated in my proposal at the price quoted, subject to the instructions and conditions in the Request for Proposal package and the identified exceptions. I further attest that I am an official officer representing my organization and authorized with signatory authority to present this proposal package.

Company Name: MWH now a part of Stantec Date December 22, 2016

Signature: Craig Harris Printed Name: Craig Harris

Street Address: 2121 N. California Blvd., Suite 600

City: Walnut Creek State: CA Zip: 94596

Phone: (925) 627-4619 Fax: (925) 627-4501 Email: Vik-Iso-Ahola@mwhglobal.com

Registered California Civil Engineer Name and License No.

Vik Iso-Ahola, PE #62772

RECEIPT OF ADDENDA

MWH acknowledges receipt of one addenda dated 12/27/16.

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SECTION 2 - PRE-QUALIFCATIONS/LICENSING REQUIREMENTS

MWH acknowledges that it meets all of the prequalification and licensing requirements to perform the Scope of Work as outlined within the RFP.

MWH and its core sub-consultants possess and maintain all permits, licenses, and professional credentials necessary to provide services as specified under the RFP. Our key proposed team members that will have responsible charge of the listed applicable discipline include the following. Other members of the team maintain required licenses and certifications for the work to be performed under this contract.

Licensed Professional Civil Engineer and DSOD Coordinator

Vik Iso-Ahola, PE, PMP

Licensed Professional Civil Engineer

Recent DSOD Project References (Project Name – DSOD Contact(s)):

- San Clemente Dam – Dave Gutierrez & Y-Nhi Enzler
- LL Anderson Dam – Melissa Collord
- Santa Anita Dam – Harpreet Hansra
- Big Tujunga Dam - Dave Gutierrez & Y-Nhi Enzler

Expertise in Reservoir Operations, Hydrology, Flood Control and Mapping

- Los Padres Dam Spillway Capacity Study – the project review of LPD hydrology, bathymetry, and determined the maximum spillway capacity as compared to maximum flood.
- LL Anderson Dam – reviewed Probable Maximum Flood (PMF), routed flood hydrograph through existing spillway, and developed spillway modification alternatives.
- Santa Anita Dam – included PMF determination, routing of flood hydrograph through existing spillway, and development of spillway rehabilitation alternatives
- Big Tujunga Dam - included PMF determination , routing of flood hydrograph through existing spillway, and development of spillway rehabilitation alternatives

Expertise in Reservoir Operations, Hydrology, Flood Control and Mapping

Eric Clyde, PE, WRE (MWH)

Certified Fisheries Biologist with Steelhead Experience

Michael Beakes, PhD (Cramer Fish Sciences)
Joseph Merz, PhD (Cramer Fish Sciences)
Stephanie Theis (MWH)

Qualified Geomorphologist with Experience in Fluvial Processes, Mass Wasting, Sediment Transport Analysis, and Floodplain Development

Bob Mussetter, PhD, PE (Tetra Tech)
Stu Trabant, PE (Tetra Tech)

Although MWH is a large company we focus our project teams with specialists having direct knowledge of the work and maintain the size of the team to most efficiently complete the work. We have additional depth of highly qualified, local and national expertise to draw upon if necessary.

SECTION 3 - PROJECT EXPERIENCE AND REFERENCES

PROJECT EXPERIENCE

The MWH team has extensive experience on similar projects that will be utilized to support this project. A summary of our specific areas of expertise are provided below. Summary descriptions for specific and applicable projects are found at the end of this section, and include several projects on the Carmel River, such as the San Clemente Dam Removal, Los Padres Dam Sediment Removal Study, and Sleepy Hollow Steelhead Rearing Facility Intake.

Sediment Studies

MWH provides a full range of sediment management and remediation services. Through a legacy of hundreds of sediment project assignments conducted over the past 80 years, MWH has the expertise to address sediments from a structural perspective, as well as on an environmental and ecological basis. In addition, MWH has extensive worldwide contaminated sediment investigation and remediation experience in numerous distinct geologic and climatic zones. We have hydrologic, hydraulic, geotechnical, and civil engineering specialists who are dedicated to providing solutions for sediment management issues under multiple environmental conditions.

MWH staff can perform focused studies that provide optimal solutions during project planning, design, and operation phases in the management of sediment impacting structures or the natural environment. Our capabilities encompass the collection of samples, laboratory analyses (quantity, physical characteristics and contaminant levels), modeling, risk assessment, evaluation of removal and placement alternatives, and estimation of sediment yield. MWH can provide experienced staff to conduct detailed sampling programs that fully characterize sediment conditions. Program support includes recommendation and procurement of necessary instrumentation and sampling equipment.

The volume and rate of sediment transported by streams is determined by both empirical methods and direct measurement. Suspended sediments can be measured over a range of stream discharges at many river stations, and numerous sediment loading curves can be constructed from the data. Transport rates from those curves are combined with discharge as indicated by streamflow-duration curves to determine total suspended sediment transport. Estimates of total sediment transport or yield have been developed for a number of client projects using the Modified Einstein or Colby methods. These empirically derived formulas are applied to hydraulic, suspended sediment, and geometric characteristics of a particular stream reach under study.

Sediment Management (Reuse/Disposal)

MWH has extensive experience in managing large soil/sediment excavation, reuse and disposal projects. The focus of these projects has been to maximize beneficial onsite reuse of excavated material for site grading and earthworks. Beneficial reuse of soil/ sediment expedites construction projects, minimizes off-site disposal of excavated material, decreases the volume of truck traffic through local communities, and results in significant cost savings to MWH's clients.

MWH has successfully used the results of focused sampling and analyses, fate and transport, and risk assessment programs to guide the development of excavation plans and strategies for segregating reusable soil/sediment from material requiring offsite disposal. These segregation plans and strategies have maximized on-site reuse and lowered project costs. Projects where MWH evaluated or managed the

soil excavation, reuse, and disposal of soil/sediment have included the San Clemente Dam Removal Project, and the Los Padres Dam Sediment Removal Study in the Carmel River watershed, as well as for Englebright Dam as part of the Yuba Salmon Forum. Utilizing this comprehensive approach to sediment management projects has resulted in millions of dollars of savings to MWH's clients. These projects and MWH's involvement are further described in the Highlighted Projects section.

Dredge Spoils Experience

MWH has managed and conducted dredge materials surveys for many years. We have conducted or provided oversight management of detailed sampling and analyses programs required for the permitting of offshore and upland disposal of dredge materials. MWH has conducted in-situ bioassays of material to assess its potential toxicity and suitability for offsite disposal.

We have worked with numerous dredge spoils contractors in the region and have intimate knowledge of the means and methods of dredge spoil dewatering, treatment, and processing that can make the material more suitable for disposal or re-use. We use this knowledge and experience to help guide our clients in dredge project planning to find the most cost-effective solution for dredge spoils placement.

Sediment Sampling/Site Characterization

MWH technical specialists have extensive experience in conducting environmental and ecological assessments of terrestrial, aquatic, and marine ecosystems to address a wide range of issues associated with sediment management. We have successfully applied cost-effective and innovative approaches to streamline the site investigation process and tailor our site investigations toward meeting the project's exit strategy goals. Our staff is sensitive to the importance of collecting the appropriate amount of data to support removal alternatives analysis and satisfy fate and transport and risk assessment data quality objectives. Our data-quality objectives are designed to ensure that data of known and appropriate quality are obtained to support remedy selection.

In support of sediment assessments, MWH staff have designed and implemented sediment sampling and analysis plans and applied rational and statistical methods to determine the appropriate amount of data required to meet assessment goals. MWH co-authored USEPA's Monitoring Guidance for the National Estuary Program that describes approaches and methods for characterizing sediment quality.

Dams and Reservoirs

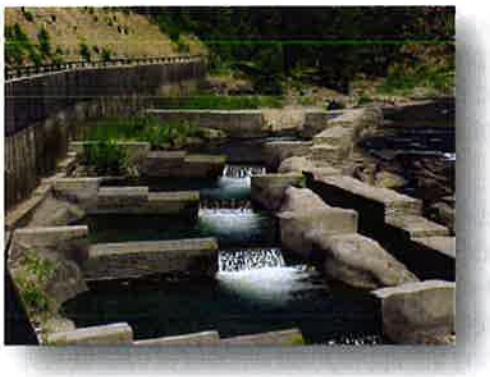
Since 1920, MWH has specialized in wet infrastructure, including major water resource projects that have included the planning, design and construction management of dams both in the U.S. and around the world. MWH has experience in all types of dam design and construction and has built a reputation for innovation and quality engineering. MWH has the in-house expertise and experience necessary to handle all aspects of project development, including the capability of assessing and addressing any potential environmental impacts. MWH can draw on the skills and experience of a staff of engineers and scientists, many of whom have 20 or more years of continuous service with the firm in the planning and implementation of dam and water resource projects.

Over the years, MWH has led the industry in the design of earth and rockfill dams and concrete dams. The company possesses the capabilities and experience for any dam related project. Our experience includes dam projects on every continent.

Fish Passage Planning and Design Experience

MWH has been a leading provider of both fish biology and fish passage engineering services to most of the major hydroelectric projects and water supply dams on the west coast of the US encompassing work on most major river systems.

MWH has completed in excess of 50 fisheries projects in the last 25 years. In the last 15 years our fisheries engineers have designed more than 25 fish screens ranging in size from 30 cfs to over 2,500 cfs that are now in operation. Many of these are for fish protection at auxiliary water intakes for fish ladder systems. We offer an industry leading team of specialized fisheries engineers that have worked on fisheries projects across the continent, with our primary focus in the West Coast.



MWH has creative fisheries engineers with comprehensive experience in developing value-based solutions to all types of fish facilities. In addition, MWH has specialized expertise in fisheries science and bioengineering and has applied this expertise at dozens of major dam and hydro projects, many of which must protect fish species covered by the Endangered Species Act (ESA) of 1973. MWH's expertise covers all aspects of fish passage engineering including barrier assessment, conceptual plan development, hydraulic modeling with both mathematical and physical models, hydraulic design of flow structures, structural, mechanical and electrical design of fish screens and fish ladders, design and evaluation of debris removal devices for fish screens, and regulatory requirements for fish passage and screening projects. We also offer technical expertise in fisheries research including fish behavior, fish predator concerns, fish tagging and monitoring, and regulatory requirements for protected and endangered fish.

MWH has been retained by utilities, irrigation districts, and water districts to provide fish passage at their dams, and intake facilities. For fish passage services, our clients include public utilities, power companies, irrigation districts, federal agencies, state agencies, and water districts primarily in California, Washington, Oregon, and Idaho. During development of fish passage projects, close interaction with state and federal government fishery agencies such as California DFG, NMFS and USFWS, is necessary to develop facilities that successfully pass fish to meet the requirements of both the owner and fishery agencies. During the course of developing over 50 successful fish passage facilities, MWH has earned the respect of state and federal fishery agencies. An indication of this is that we have even been hired by these agencies to provide fish passage designs, serve on expert panels and to advise them on designs by others.

Specific Carmel River Experience

Since several of our team member's initial involvement in 2001, we have played a key role in the evaluation of alternatives and the associated potential impacts for the San Clemente Dam Seismic Retrofit Project. Dr. Mussetter performed the initial sediment-transport studies for the San Clemente Dam retrofit study for the California Department of Water Resources (CDWR). After completion of that study, California American Water Company (Cal-Am) contracted with Dr. Mussetter to perform a more detailed evaluation of the potential flood hazards in the river downstream from the dam associated with the alternatives that were analyzed in the CDWR study. In the initial modeling that was performed for CDWR, the sediment loading

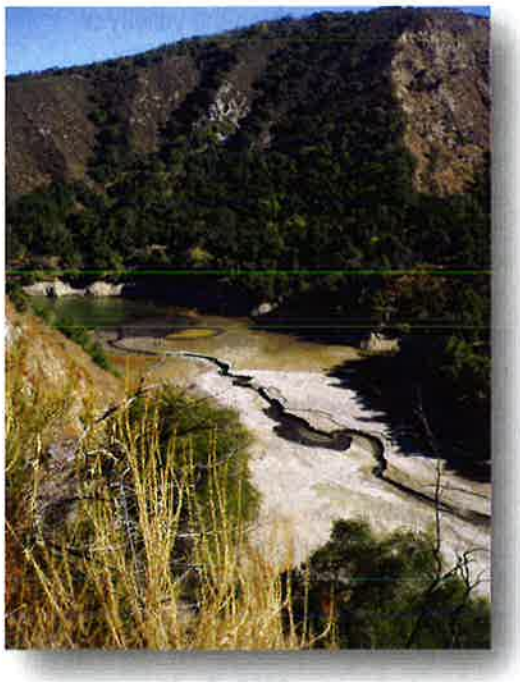
under baseline conditions was assumed to be the same as the upstream watershed sediment yield, under the assumption that the existing reservoir will have minimal sediment trap efficiency, and the sediment loading to the downstream river associated with the dam-notching and -removal alternatives was approximated based on the transport capacity of the upstream reach of the river.

Due to uncertainty about the validity of these assumptions, and uncertainty about the gradation of the existing reservoir deposits, Cal-Am subsequently retained Dr. Mussetter to perform additional analyses that included collection of detailed topographic, bathymetric, and sediment data in San Clemente Reservoir, and development of a sediment-transport model of the reservoir that could be used to directly evaluate the existing trap efficiency and rate of erosion after notching or removal of the dam. Subsequent to these initial studies, MWH and Dr. Mussetter were involved throughout the planning phases of the project through completion, including:

- In January 2005, Dr. Mussetter was retained by Cal-Am to perform hydraulic and sediment-transport analyses on the Carmel River Reroute and Dam Removal (CRRDR) Option for the San Clemente Dam Seismic Retrofit Project. A sediment-transport analysis was performed for three scenarios, including baseline conditions with no dam (i.e., pre-dam conditions), baseline conditions with the existing dam configuration, and conditions representing the CRRDR option.
- From 2005 to 2007, under the leadership or our current Project Manager, Vik Iso-Ahola, MWH supported the San Clemente Dam Seismic Retrofit EIS Team by developing conceptual designs and detailed cost estimates for dam removal, sediment removal, no action, and CRRDR alternatives. The effort included support to CalAM during public outreach and TRC reviews and discussions.
- From 2007 to 2008, MWH prepared the Draft Basis of Design Report for the CRRDR, including performing geotechnical investigation for the bypass under contract to the State Coastal Conservancy. Under contract to MWH, Dr. Mussetter summarized an evaluation of flood hazards and an analysis of the downstream impacts associated with the CRRDR option. The downstream impact analysis included an evaluation of the effects of the CRRDR option on suspended sediment concentrations, fish passage conditions (i.e. a critical riffle analysis), and changes in the bed material gradation.
- In 2007, Dr. Mussetter assisted the California State Coastal Conservancy (SCC) and its consultants in further evaluating the CRRDR option. During this phase of the project, Dr. Mussetter reviewed the technical analysis and preliminary designs, and provided input on the viability of those designs.

- Most recently, Dr. Mussetter and TetraTech staff served as the lead design engineers on the Design-Build (DB) team for the recently constructed CRRDR Project, which is billed as the largest dam removal project in California history. Tetra Tech also provided post-design services and engineer of record inspections during construction.

In 2013, building upon the experience and knowledge gained supporting the San Clemente Dam Removal project, MWH developed an initial conceptual assessment on the general feasibility of sediment removal at Los Padres Dam and Reservoir, including development of cost estimates for each feasible alternative.



The results of the study highlighted the differences between the San Clemente Dam Removal and Los Padres Dam (LPD) Sediment Removal, where a similar "re-route" alternative could not be developed for LPD due to the lack of adjacent drainages and steeper terrain in the upper Carmel River watershed. The challenges for removing sediment from LPD was identified to be similar or even more difficult as compared to San Clemente Dam. While several removal alternatives were studied and identified to be feasible for extending the useful life of the reservoir, it was ultimately recommended that additional studies are required to develop an alternative that balances environmental impacts and costs against gained benefits.

MWH PROJECT REFERENCES

The following project descriptions have specific application to the Los Padres Dam and Reservoir Alternatives and Sediment Management Study. These projects demonstrate the team's experience and expertise with DSOD, reservoir operations, sediment management, fisheries biology, and fluvial geomorphology.

Los Padres Reservoir Sediment Removal Feasibility Study

Location
Monterey County, California

Client
California American Water Company (Cal-Am)

Services
Initial Conceptual Assessment
Evaluation of Sediment Removal Methods
Identification of Disposal Sites
Cost Estimating for Alternatives

Completion Date
Study: 2012 – 2013

Contact
Douglas A. Fraser, PE
831-236-4494
douglas.fraser@amwater.com

California American Water Company (Cal-Am) is the owner and operator of the **Los Padres Dam and Reservoir** located on the Carmel River in Monterey County, California with an original reservoir storage capacity of 3,070 af. The storage capacity has been reduced by over 1,284 acre-feet (af), or about 40 percent, as a result of sediment deposition over its 60 years of operation. Cal-Am retained MWH Global (MWH) to perform a study on the **feasibility of removing an estimated 2 million cubic yards of sediments** from the Los Padres Reservoir in order to restore the original storage capacity.

The scope of this study was intended to provide an initial conceptual **assessment** on the general feasibility of sediment removal at Los Padres Dam and Reservoir. MWH's assessment served to facilitate the long-term planning for **management of the reservoir and sediments**. The scope of work for this study included the following.

1. **Assessment** of existing reservoir conditions and data;
2. Conceptual evaluation of methods for **reservoir sediment** removal, transport and disposal;
3. Identification of potential commercial use and preliminary selection of disposal sites for the removed sediment
4. Identification of potential environmental issues and permitting requirements for removal and disposal of the sediment;
5. Description and cost estimate for three conceptual **alternatives** based on feasible methods removal, transportation and disposal of the sediment.

This study researched the recommended reservoir sediment management practices by the USBR, USSD and Heinz Center. Typically applied **sediment management strategies,** such as sediment re-routing, drawdown flushing, reservoir emptying, and siphoning, were considered, but deemed not practical based on the dam configuration and design, and the reservoir operation constraints. MWH's study outlined possible dredging or dry excavation methods and transport to proposed nearby upstream or downstream

storage locations. A detailed evaluation of preferred **alternatives** and permitting requirements was performed and further environmental study and benefit-cost comparison was recommended prior to selection of a feasible **alternative**.

Los Padres Dam Spillway Capacity Study

Location
Monterey County, California

Client
Douglas A. Fraser, P.E.
Senior Project Manager
California American Water,
Central Division
511 Forest Lodge Rd., #100
Pacific Grove, CA 93950
831-236-4494

Services

- CFD Modeling
- Flood Routing
- Rating curve development

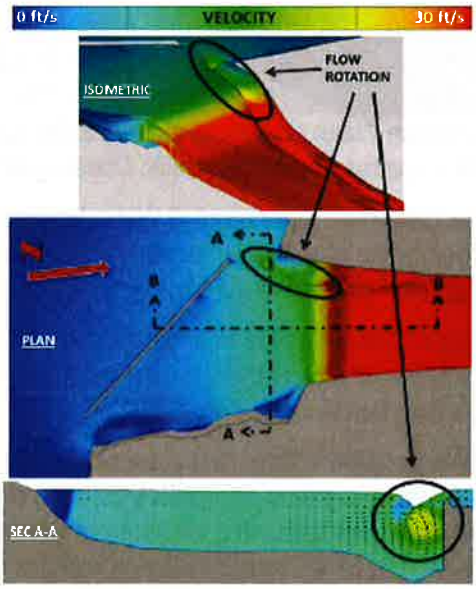
Completion Date
2012 – 2013

California American Water Company (Cal-Am) is the owner and operator of the Los Padres Dam and Reservoir located on the Carmel River in Monterey County, California with an original reservoir storage capacity of 3,070 af.

Spillway Capacity Study Computational Fluid Dynamics (CFD) Modeling

Cal-Am had previously conducted an investigation using a 2-dimensional (2D) numerical hydraulic model to compare the estimated peak reservoir surface elevations and flow velocities near the spillway both with and without a new fish collector installation. The study results suggested that the existing spillway capacity of the Los Padres Dam was significantly lower than the original rating curve developed by the California Division of Safety of Dams (**DSOD**) in 1980.

In order to confirm the spillway capacity, Cal-Am engaged MWH to conduct an independent three dimensional (3D) Computational Fluid Dynamics (CFD) analysis. The CFD was performed on the existing spillway and reservoir.



Results of the analyses found the following:

- There was a significant rotational component to the spillway flow, which led to continual scour along the toe of the west retaining wall.
- The discharge coefficients computed by the CFD showed a 6% reduction in the discharge capacity from the original DSOD rating curve due to 3D effects not previously identified.

Because the spillway capacity reduction was shown to be not as severe as predicted, MWH's study results allowed Cal-Am to negotiate a delay to necessary spillway changes with DSOD and revisit the use of the fish collector, saving Cal-Am substantial unbudgeted expenditure.

Carmel River Reroute and San Clemente Dam Removal Project

Location
Monterey County, CA

Client
California-American Water Company (initial and ongoing phases of project)
State Coastal Conservancy (separate phase)

Services
- Sediment Removal Feasibility Study
- Identification of Environmental Compliance Requirements
- Soil, Groundwater, and Other Media Sampling
- CEQA/NEPA
- Restoration
- Hydraulics/Hydrologic
- Civil & Geotechnical

Completion Date
2015, monitoring through 2021

Contacts
(CalAm)
Douglas A. Fraser, PE
831-236-4494
douglas.fraser@amwater.com

(State Coastal Conservancy)
Trish Chapman, Project Manager,
(510) 286-0749

MWH supported the California American Water Company (Cal-Am) in the **San Clemente Dam Removal Study**. MWH provided a conceptual **alternatives development,** preliminary engineering, construction cost estimating, and support of the ongoing EIS/R process for San Clemente Dam. The San Clemente Dam was a 106-foot-high, concrete-arch dam, built in 1921 on the Carmel River. This dam was owned by California-American Water Company, located at the confluence of the Carmel River and San Clemente Creek, 18.5 miles upstream from the Pacific Ocean in Monterey County.

The California Department of Water Resources – Division of the Safety of Dams (DSOD) issued a safety order for the structure in the early 1990s. This order required the San Clemente Dam meet dam safety criteria relative to the maximum credible earthquake (MCE) and probable maximum flood (PMF).

Studies concluded the PMF would overtop the dam and subject the foundation to erosion, or the MCE would cause severe overstressing of the dam structure. Findings determined standards could be achieved by either notching the dam to a level where DSOD requirements are met, or by removing the dam.

MWH assisted in formulating measures and alternative plans and evaluating and comparing alternative plans including **dam rehabilitation, dam notching, dam removal**, and re-route of the river with **dam removal.** We calculated **volumes of dredged material and developed dredged material placement plans.** The MWH team developed benefits and cost estimates to evaluate **alternative** plans for all dam modification and/or removal alternatives.

During the interactive EIS/EIR process, we coordinated an interdisciplinary team and **held stakeholder workshops and meetings**, and provided engineering support and guidance to the NEPA/CEQA team. MWH worked closely with CAW, USACE, **DSOD**, and other stakeholders throughout the project.

MWH performed **geotechnical investigation** surveys and analyses, providing supporting data for the evaluated alternatives, and developed dredging and **sediment placement plans** for each alternative. The team applied GIS to develop flood (hydrologic & hydraulic) and **sediment transport (geomorphic) analyses** (MWH subconsultant Dr. Mussetter) of each alternative. MWH also provided preliminary design of structural measures required for each alternative (e.g., dam penetrations, notching, channel and disposal site stabilization, pipelines, etc.).

Options for addressing the safety deficiency included **strengthening the existing dam** (the owner's initial preference) and **complete dam removal**. Various options for **managing the sediment** with complete **dam removal** were studied, and the Carmel River Reroute and San Clemente Dam Removal (CRRDR) option was ultimately selected.

As a follow up to the EIR/EIS support and under contract to the State Coastal Conservancy, MWH prepared the Draft Basis of Design Report for the CRRDR, including performing geotechnical investigation for the bypass.

Subconsultant Experience

The CRRDR option was recently completed by a Design-Build team and Dr. Mussetter and Tetra Tech is part of that team performing Channel Reconstruction Design.

Project features include:

- Access roads, staging areas, and stream diversions for the three-year construction project.
- Construction of a diversion dike and a channel through the bedrock ridge between the Carmel River and San Clemente Creek that reroutes the Carmel River around the majority of the **reservoir sediment deposits**.
- Removal of the **reservoir sediment** deposits in the San Clemente arm of the reservoir.
- Reconstruction of a natural channel to provide fish passage and riparian habitat.
- Stabilization of the accumulated sediment in the bypassed, Carmel River arm of the reservoir.
- Wetland and upland habitat restoration throughout the site.
- Removal of San Clemente Dam and the smaller (the Old Carmel River Dam 0.4 miles downstream.

For the past 15 years members of the Tetra Tech design team have been involved in the development of the project characterized by the three phases. The most recent is the completed Design Build Effort. Team

members performed two earlier efforts that helped develop the approach and important information for the CRRDR Design Build Effort. These were initial **Sediment Transport and Modeling Studies and Technical Review Team Management.**

Design Build Effort (2013 to present). Tetra Tech recently completed its role as part of a design-build team for the CRRDR, led by Granite Construction, which is under contract to California American Water, the owner of the dam. Tetra Tech is a subconsultant to the Lead Designer and is responsible for hydrologic and hydraulic analyses, and design of the approximately 4,500-foot-long, reconstructed stream channel corridor that provides upstream and downstream passage for **steelhead** in the rerouted section of the Carmel River. The California State Coastal Conservancy (Conservancy) is the lead agency who coordinated engineering and environmental services for the preliminary design phase, and they continue to be the lead agency for implementation of the CRRDR option.

Sediment Transport and Hydraulic Modeling Studies (2001-2008). Mussetter Engineering, Inc. (now part of Tetra Tech after being acquired in May 2009) performed detailed sediment transport modeling for a wide range of potential **dam removal** or retrofit options for the California Department of Water Resources, California-American Water, and the Conservancy to assist with the feasibility and environmental studies leading up to selection of the CRRDR option. These studies included **data collection** related to both the topography and bathymetry of the river and reservoir, and a drilling program to provide detailed characterization of the reservoir sediment deposits. The work also included use of the **sediment modeling** results to assess potential impacts to channel capacity, flooding and channel stability in the 18.5-mile reach of the Carmel River downstream from the dam.

Technical Review Team Management (2009-2011). Tetra Tech managed a Technical Review Team that included federal agencies (U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, U.S. Bureau of Reclamation); state agencies (California Department of Fish and Game, California Department of Water Resources); local agencies (Monterey County Water Resource Agency, Monterey Peninsula Water Management District); and private consultants. Tetra Tech maintained the contacts list, distributed draft documents for review, collected and organized review comments, and maintained communications throughout the process. Tetra Tech also assisted in organizing and facilitating Technical Review Team meetings that took place at the Conservancy's offices in Oakland, California.

Specific aspects of the effort related to the project elements from the RFQ include:

Complex Dam Removal
Tetra Tech analyzed the system response to nearly 20 **alternatives for removal** of the San Clemente Dam. This involved 1-D **sediment transport modeling** of sediment deposited behind the dam to establish the rate at which flows could remove deposited sediments. Downstream **sediment transport modeling** was performed to determine potential changes in channel **morphology** and flooding.

Ecosystem Restoration – Accumulated Sediment Management Plan
Prior to the current Design-Build project, Tetra Tech performed **geomorphic, hydraulic and sediment transport analyses for a wide range of potential alternatives** for removing or retrofitting San Clemente Dam to bring it to an appropriate seismic safety condition. These studies involved **geomorphic** analysis of conditions in the 18.5-mile reach of the Carmel and **hydraulic and sediment transport modeling** to quantify the likely effects of releasing stored sediment. Initially, thirteen scenarios with sediment releases ranging from 300 ac-ft to 1,500 ac-ft were investigated. After it became clear that the downstream impacts of releasing the stored sediment would be unacceptable, additional **alternatives** for reducing the downstream impacts were modeled. The effects of these **alternatives** on downstream **sediment** loads

ranged from only minor changes from existing (i.e., with-dam) conditions to release of large quantities of **sediment** over a period of a few decades followed by return to the natural background sediment loads.

To understand potential effects, additional analyses were performed to quantify the effects of bed changes on downstream flooding, fish passage, instream habitat and channel stability. The local effects depended on varying **geomorphic** character of the river over the 18.5-mile study reach that flows through a narrow, boulder-bed and bedrock-confined canyon in the upstream portions of the reach, becomes a mobile, gravel/cobble bed river over the middle portion of the reach, and then abruptly transitions to a sand bed system in the downstream approximately 4 miles of the reach. **Sediment deposition** in the approximately 1-mile-long lagoon between the Pacific Coast Highway and the coast was of significant concern. Based on the high cost, potential for unacceptable downstream impacts and significant challenges associated with finding a suitable repository to place excavated reservoir sediment, the Reroute Project was identified as a means of isolating the majority of the reservoir deposits.

Ecosystem Restoration – Habitat, Channel, Floodplain and Revegetation Aspects

The purpose of the Channel Restoration is to provide naturally-functioning stream channels that will evolve over time through **fluvial processes** and exhibit resiliency to major floods and **sediment** events, such that long-term sustainability is maximized and maintenance requirements for the channels are minimized. The Channel Restoration Design uses natural, and where necessary, biodegradable materials; concrete, metal cabling or metal anchors are not used in the design. The restored channel was designed to meet the four specific design criteria: fish passage for upstream migration of adult **steelhead** and downstream migration of kelts, smolts and juvenile **steelhead** during the historical migration period, long-term sustainability and resiliency to the full range of floods and **sediment-transporting events**, provide high quality aquatic and riparian habitat, and develop a channel that emulates the natural variability in channel conditions.

The San Clemente Creek Valley in which the reconstructed channel being built is relatively steep and confined compared to the historical main river valley, presenting significant design challenges to criteria. The 3,000-foot-long Combined Flow Reach (CFR) has an average gradient of 2.7 percent, and consists of a series of boulder step-pool sequences separated by resting pools. Channel substrate consists of a well-graded mixture of cobbles, gravel and sand that remains stable up to a 5-year peak discharge but will adjust and sort during higher flows. The channel banks are being constructed from a combination of boulder toe protection and fabric encapsulated soil lifts containing live willow stakes to promote rapid development of a robust riparian corridor. The approximately 600-foot long, 0.8 percent Reroute Channel that connects the upstream river to the CFR is being constructed with a riffle-pool morphology. The upstream 1,000 feet of the project reach are being re-constructed to provide a transition from the Reroute Reach to the undisturbed Upper Carmel River. The Tetra Tech design team is coordinating with the ecological design team to develop and implement a robust re-vegetation and habitat restoration plan for the overbanks and other disturbed areas.

Hydraulics, Hydrologic, River Engineering and Wetland Restoration

Besides the extensive **hydraulic and sediment transport modeling** previous described to support development of the **sediment management plan and dam removal scheme**, Tetra Tech performed 1-dimensional (1-D) and **2-D hydraulic modeling** for the final channel and floodplain design. The 1-D modeling was executed using the Corps of Engineers HEC-RAS software and the 2-D modeling was performed using the Bureau of Reclamation SRH-2D software. The 1-D model was used to establish the initial design configuration because of the ease with which the channel configuration can be iteratively modified. A 2-D model was then developed for the initial configuration that met most of the rigorous engineering design requirements established by the Owner and agencies, and this model was then used to refine the design and assess the detailed performance requirements for fish passage and channel stability.

The 2-D model was also used to develop hydraulic data for design of the diversion dike that routes the Carmel River through the bedrock cut into the former San Clemente Creek valley and the Stabilized **Sediment** Slope that buttresses the downstream end of the bypassed **sediment** deposits. These features must be stable for the Probable Maximum Flood. As a result, the model was run for a wide range of flows from the low end of the fish passage range (about 15 cfs) to the PMF (~100,000 cfs). Specific flows between these values that were used to design various aspects of the project included the 5-year through the 100-year peaks.

Civil Engineering

To control erosion in the overbanks, approaches were designed to address two types of erosion. The re-vegetation plan being prepared by Rana Creek, in cooperation with Tetra Tech, was designed to prevent near-term surface erosion on the overbank surfaces. The overbank restoration plan calls for LWD to create immediate overbank roughness with Manning's n-values of 0.08 to 0.12 to prevent channel avulsion. Tetra Tech also assisted the geotechnical engineers with the design of a small tributary channel that crosses over the top of the stabilized **sediment** (i.e., **sediment** that is being isolated in the Carmel Arm of the reservoir), and then down the steep face of the Stabilized **Sediment** Slope into the reconstructed river.

Geotechnical Engineering

Throughout the various phases of the project, Tetra Tech coordinated with and used information supplied by geotechnical engineers to determine likely subsurface conditions (depth to bedrock, size distribution of alluvium, bank characteristics and of deposited reservoir sediments). Tetra Tech worked with the geotechnical engineers to develop the Stabilized **Sediment** Slope that buttresses the downstream end of the bypassed sediment deposits.

Life History Variation in Steelhead Trout

Location
Central Valley, California

Client Reference
Lindsay E. Correa, Delta Science Program, Delta Stewardship Council
Lindsay.Correa@deltacouncil.ca.gov

Date of Services
2011

Total Fees
$40,000 (CFS Component)

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DOI: 10.1577/T08-164.1

[Article]

Steelhead Life History on California's Central Coast: Insights from a State-Dependent Model

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Abstract.—Steelhead *Oncorhynchus mykiss* display a dizzying array of life history variation (including the purely resident form, rainbow trout). We developed a model for female steelhead in coastal California (close to the southern boundary of their range) in small coastal streams. We combined proximate (physiological) and ultimate (expected reproductive success) considerations to generalize the notion of a threshold size for emigration or maturity through the development of a state-dependent life history theory. The model involves strategies that depend on age, size or condition, and recent rates of change in size or condition during specific periods (decision windows) in advance of the actual smolting or spawning event. This is the first study in which such a model is fully parameterized based on data collected entirely from California steelhead populations, the majority of data coming from two watersheds the mouths of whose rivers are separated by less than 8 km along the coast of Santa Cruz County. We predicted the occurrence of resident life histories and the distribution of sizes and ages at smolting for steelhead rearing in the upstream habitats of these streams. We compared these predictions with empirical results and show that the theory can explain the observed pattern and variation.

Cramer Fish Sciences (CFS) staff Dr. Joseph Merz and Dr. Michael Beakes participated in a multi-year program project evaluating and modeling factors influencing **steelhead** trout anadromy. The project lead to the publication of several papers, two are shown here.

Steelhead *Oncorhynchus mykiss* display a dizzying array of **life history variation** (including the purely resident form, rainbow trout). Dr. Merz & Beakes developed a model for female steelhead in coastal California (close to the southern boundary of their range) in small coastal streams. They combined proximate (physiological) and ultimate (expected reproductive success) considerations to generalize the notion of a threshold size for emigration or maturity through the development of a state-dependent **life history theory.** The model involved strategies that depend on age, size or condition, and recent rates of change in size or condition during specific periods (decision windows) in advance of the actual smolting or spawning event. This was the first study in which such a model is fully parameterized based on data collected entirely from California steelhead populations, the majority of data coming from two watersheds the mouths of whose rivers are separated by less than 8 km along the coast of Santa Cruz County. They predicted the occurrence of resident **life histories** and the distribution of sizes and ages at smolting for steelhead rearing in the upstream habitats of these streams. The predictions were compared with empirical results and show that the theory could explain the observed pattern and variation.

Dr. Beakes and Merz tested the effect of temporal patterns in food supply on **life history** decisions in coastal steelhead *Oncorhynchus mykiss irideus* from a Central California coastal (CCC) population (Scott Creek) and a Northern California Central Valley (NCCV) population (upper Sacramento River basin). They manipulated growth through feeding experiments conducted from May to the following March using warm (2006 cohort) and cool (2007 cohort) temperature regimes. Survival in seawater challenges just before the time of typical juvenile emigration provided an index of steelhead smolt versus nonsmolt **life history** pathways. Survival varied significantly with fish size (with larger fish being more likely to survive than smaller fish) and by source population (with CCC steelhead being more likely to survive than NCCV steelhead of the same size). The timing of increased food supply (treatment group) did not significantly affect seawater survival rates in either NCCV or CCC steelhead. For both strains, the eventual survivors of seawater challenges (putative smolts) diverged from the eventual mortalities (putative nonsmolts) in both size and growth rate by June in both years, suggesting that the initial growth advantages were maintained throughout the experiments. A significant divergence in condition factor between smolts and nonsmolts by December matched the expected morphological transition of smolts, which showed faster growth in length than weight compared with nonsmolts. The apparent timing of the decision window, several months before the typical period of smolt emigration, matched the patterns observed for other salmonids. In coastal California, this decision must occur before fish have had the opportunity to take advantage of improved winter–early spring feeding conditions. The results support the role of early growth opportunity in **life history** decisions and provide insight into the applicability of **life history** models for managing California steelhead.

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[Article]

Smolt Transformation in Two California Steelhead Populations: Effects of Temporal Variability in Growth

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Yuba River Fish Passage and Salmon Forum and Englebright Lake Dam Removal Evaluation

Location
Yuba River, CA

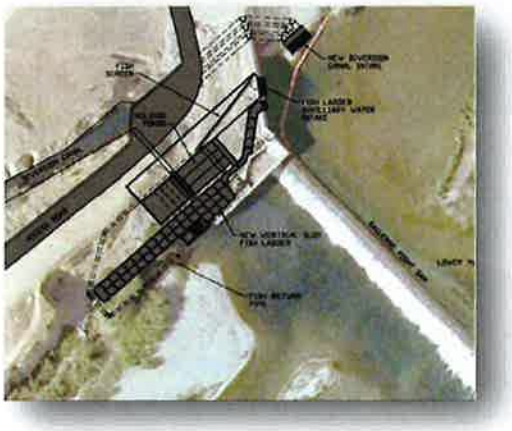
Client
Yuba County Water Agency,
National Marine Fisheries Service
Geoff Rabone (YCWA contract)
(530) 741-3000
grabone@ycwa.com
Rick Wantuck (NMFS contract)

Services
- Fish Passage Feasibility Study
- Sediment Removal Feasibility Study
- Identification of Environmental Compliance Requirements
- AACE Cost Estimates

Dates of Service
2011 - 2014

Yuba River Fish Passage and Salmon Forum

MWH was retained initially by NMFS and then by Yuba Water County Agency to perform a **feasibility investigations of alternatives** for anadromous salmon passage past dams and obstructions in the upper Yuba River. The Yuba River Basin supports a number of anadromous fish species including Central Valley spring-run Chinook, California Central Valley steelhead, and the Southern DPS of the North American green sturgeon. The upper Yuba River has been identified in a NMFS Draft Recovery Plan as a prime candidate for reintroduction of spring-run Chinook salmon and **steelhead**. Dams in the upper river include Englebright Dam, New Bullards Bar Dam, and Our House Dam. Englebright Dam and New Bullards Bar dams are both very tall arch dams, 260-ft and 645-ft tall respectively, that currently present complete barrier to fish movement into the upper watershed. Daguerre Point Dam, in the lower Yuba River, also currently provides a barrer to fish passage into the upper Yuba River below Englebright.



For the initial NMFS study, MWH evaluated upstream and downstream passage **alternatives** included a new trap and haul system over Daguerre Point Dam, a fish ladder over Englebright Dam, and a tramway over Englebright Dam. Downstream passage **alternatives** included a fish screen in the Englebright Dam reservoir, fish screens along the upper tributaries of the Yuba River, and a trap and floating surface collector in the Englebright reservoir. Subsequent to the study for

NMFS, MWH was contracted by Yuba County Water Agency to participate in the Yuba River Salmon Forum (YSF), providing engineering assessment of fish passage facilities and associated appurtenances, costs, permitting issues, and operations. The process included participation in the YSF Technical Working Group (TWG) meetings Passage concepts developed are intended to support the TWG's examination and deliberation on information and sound science to identify a path to a preferred **alternatives** for reintroduction of anadromous salmonids into the upper Yuba River. MWH's scope for this project included formulating a matrix of potential **alternative** project elements, developing and gathering information on the **alternatives** and appurtenances and refine/revise the matrix, developing screening process/criteria, conducting **alternative** screening, and preparing technical memoranda documenting the results of the study. MWH also signed another contract to be a member of the Technical Advisory Committee for YWCA's development on the North Yuba.

For **History & Data Compliation,** MWH reviewed and prepared a technical memorandum summarizing existing information and **data gaps, including history** of Yuba River fisheries, barriers to passage, and regulatory considerations. MWH performed **civil engineering design and cost estmating** to a AACE Class 5 level for each of the conceptual design **alternatives**. For **Fisheries Biology**, our team reviewed previous studies on Chinook Salmon and Steelhead and surveyed potential available habitat upstream of the passage barriers.

Englebright Lake Dame Removal Evaluation

In an effort to **restore riverine ecosystems and historical fish populations**, such as salmon to the Yuba River, evaluation of the **removal or notching** of the Englebright Lake and Daguerre Point Dams was conducted. MWH was retained to provide a high level engineering assessment of **dam removal** or notching options for the Englebright Dam, including AACE Level 5 cost estimates. The 280 ft (85 m) high variable radius concrete arch dam was constructed in 1941 by the Army Corps of Engineers for the primary purpose of **trapping sediment** derived from anticipated hydraulic mining operations in the Yuba River watershed. Extensive hydraulic and hard rock mining occurred upstream in the Sierra Nevada prior to 1884 and resumed on a limited basis until the 1930s during the great depression under the regulation of the California Debris Commission. Although no hydraulic mining in the upper Yuba River watershed resumed after construction of the Englebright Lake Dam, abandoned mine sites and tailings continue to contribute impacted **sediments** to the upper Yuba River, Englebright Lake, and the reach of Yuba River located between the Englebright Lake and Daguerre Point Dams.

MWH provided advice on regulatory requirements for **dam removal and impacted sediment disposal** or discharge. MWH identified and

defined critical parameters for **dam removal and/or notching options** (e.g., max. fish ladder height, required downstream or upstream mitigations, **sediment placement** sites, etc.). MWH engineers also developed high level breakdown of each **Dam Removal**/Notching option, listing major construction work items, planning and design requirements, and regulatory requirements. **Each item was evaluated** in regard to additional study and overall information gathering that would be required during subsequent development phases of each option.

MWH developed cost estimates for each removal/notching option using AACE cost estimation methodology for a Level V cost estimate.

Shasta Dam Fish Passage Evaluation

Location
Shasta Lake, CA

Client
U.S. Bureau of Reclamation

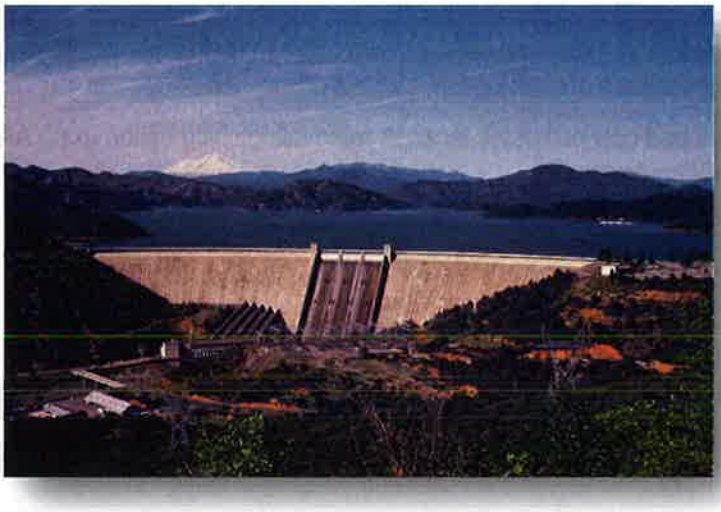
Services
Feasibility Study
Predesign Drawings

Completion Date
2014

Contact
John Hannon, USBR
(916) 414-2413
jhannon@usbr.gov

Project Features Similar to the Los Padres RFP

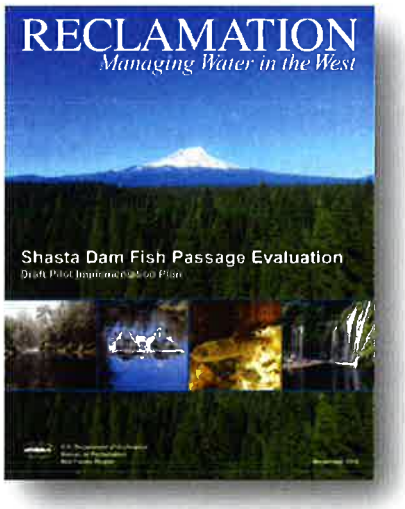
Fish Passage Feasibility at high head dams



The Shasta Dam Fish Passage Evaluation is an effort by the U.S. Bureau of Reclamation to evaluate the feasibility of reintroducing Sacramento River winter-run Chinook salmon to tributaries above Shasta Lake. At the inception of this work MWH participated in a **multi agency** working group to brainstorm and review upstream and downstream concepts for fish passage.

The Fish Passage Pilot Implementation Plan was developed for a Pilot Program collaboratively with representatives from Federal and State agencies. The Pilot Program is an adaptive management approach identifying **biological, management, and engineering evaluations** designed to determine the feasibility of a long-term reintroduction. Successful delivery of these documents was supported by development of a Stakeholder and Public Outreach Plan that was informed by a results of a situation assessment of the stakeholder community.

This outreach plan was used to guide the conduct of public meetings and landowner meetings throughout the period of performance. Additional technical actions include captive broodstock juveniles and eggs, and natural adult transport, and release and evaluation of **life-stage** specific survival rates.



Key challenges facing the implementation of the Pilot Program include: (1) landowner acceptance and cooperation; (2) Endangered Species Act compliance, permits and rules to authorize pilot-level and long-term reintroductions; (3) design of collection facilities to provide for juvenile passage; and (5) public concerns about the interaction between reintroduced Chinook salmon and the world-class wild trout fishery. The Pilot Plan provides an assessment strategy and protocols for investigation of critical biological performance criteria and fish passage engineering options to evaluate the potential for success of re-establishing a viable population of Sacramento River winter-run Chinook salmon upstream from Shasta Dam.

For **history & data compilation,** MWH developed environmental sections of the EIS summarizing field investigations, habitat surveys, permitting challenges, and project impacts. MWH performed **civil engineering design** for the proposed pilot program and conceptual adult upstream and downstream passage facilities. For **Fisheries Biology,** MWH performed a habitat assessment upstream of Shasta Dam to support reintroduction of a reasonable number of Chinook Salmon and biological feasibility of conceptual passage options . Subsequent to the plan developments MWH assisted the TWG with the review and concept selection for interim passage options that could be implemented as part of the pilot program.

Vern Freeman Dam Fish Passage

Location
Ventura County, CA

Client
United Water Conservation District

Services
Expert Review
Alternatives Assessment
Feasibility Analysis
Predesign Drawings
Cost Estimating

Completion Date
2011

Contact
Michael Solomon
(805)525-4431

Project Features Similar to the Los Padres RFP
Fish Passage Feasibility at high head dams
High Sediment Transport

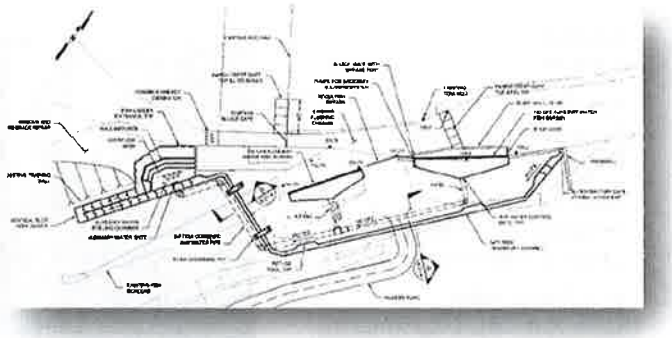
United Water Conservation District (UWCD) operates Vern Freeman Diversion Dam (VFDD) on the Santa Clara River, Ventura County, California. In October 2008, the National Marine Fisheries Service and the United Water Conservation District approved the appointment of six engineers and biologists to an independent panel that would evaluate the upstream passage of steelhead rainbow trout at the dam. Adequate fish passage past the dam is important for recovery of **steelhead** in the upper reaches of the river. The mission of the fish panel was to **review existing information,** evaluate performance of the existing fish ladder, identify improvements to the existing fish passage facilities, and to perform predesign drawings and prepare cost estimates for proposed fish passage improvements .

The Panel began by **collecting and evaluating available information** for the project. This primarily included reviewing existing fish passage facilities, current diversion operations, hydrology and hydraulic information. This review helped Panel members to understand the current fish passage performance of the facility, as a basis to develop ideas to improve fish passage. The Panel brainstormed potential fish passage solutions, narrowing the list to five **alternative** solutions: a vertical slot fishway, a nature-like fishway, a rock ramp, a hardened ramp, and **dam removal**.

Dennis Dorratcague from MWH participated in the expert review panel. MWH staff led the development of several alternative concepts for a vertical-slot fishway to provide volitional passage along the left abutment of the dam. The fishways consisted of an entrance structure, fish ladder, exit structure, and auxiliary water provided through two intake screens and a buried pipeline. Variations in the fishway design involved the design capacity of the flow through the fish ladder. A concepts for a nature-like fishway along the left abutment was also prepared. Conceptual-level opinions of probable construction costs were prepared for all alternatives.

For **history & data compilation,** MWH reviewed historical hydrology studies, ladder operations, **sediment papers, and flow data**. We provided **civil engineering design and cost estimating** for the fish ladder and nature-like fishway alternatives. Throughout the study, the Panel used typical fish passage

characteristics to **develop and compare alternatives**. A Pugh scoring matrix was used to compare these characteristics among alternatives and to refine the designs; estimated cost was not considered when comparing alternatives. The effectiveness of fish attraction to the fishway entrance was a critical characteristic. To distinguish the differences of this characteristic among alternatives, the Panel developed and used a method of comparing the attraction of the alternatives based on flow near the fishway entrance.



Sleepy Hollow Steelhead Rearing Facility Intake

Location
California

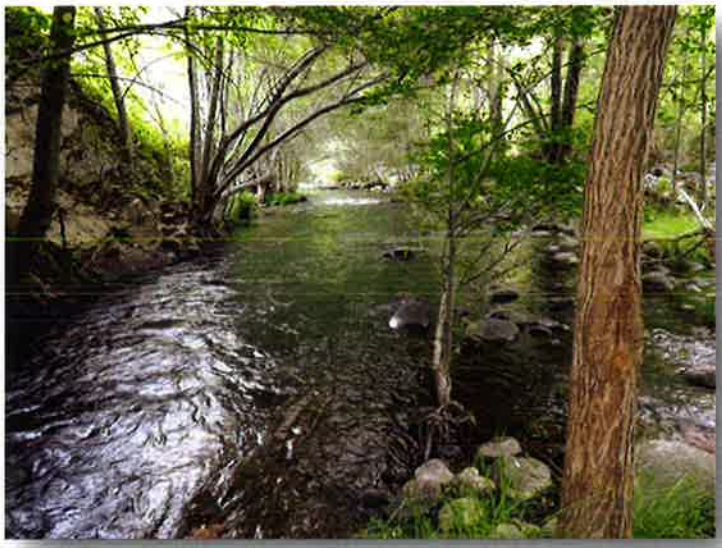
Client
Monterey Peninsula Water Management District

Services
Assessment of infrastructure
Design of screen/intake system,

Completion Date
March 2015 – November 2016

Contact
Larry Hampson, MPWMD
831-658-5620
larry@mpwmd.dis.ca.us

Proposed and Actual Engineering Costs:
$401,000 / $152,000 (to date)



The Sleepy Hollow **Steelhead** Rearing Facility relies on a water supply from the **Carmel River** that is subject to frequent **sediment loading issues**. Tetra Tech worked with the Freshwater Institute to evaluate options for recirculating tank systems that would allow the facility to reduce reliance on the surface water source and susceptibility to surface water quality issues. Tetra Tech performed an **assessment** of the aging infrastructure at the facility and designed a new river screen/intake system, new wet well and pump system, water reuse system, water treatment system and operation and maintenance improvements. The new pump system integrates with existing pipes, cold well, quarantine tanks, cooling tower, rearing channel and outlet. Tetra Tech proposed disease control dosing for recirculation, and integrated the recirculation system with existing drain systems for the rearing channel and quarantine tanks and with office facilities using non-potable water. Existing water quality controls were integrated with the recirculation system and new water quality controls systems. New facilities also were integrated with the existing electrical system, with backup systems, alarms and a protocol for alerts.

As part of this project, Tetra Tech performed hydraulic and **sediment-transport modeling** to inform the design. A **hydraulic model** of the project reach of the Carmel River that was previously developed by Tetra Tech was updated with **new survey data that was collected** for this study, and used to assess water-surface elevations and hydraulic conditions at the proposed intake structure. An existing 1-dimensional (1-D) **sediment-transport model of the Carmel River**, also developed by Tetra Tech, was also updated to reflect the new survey

data and revised to include a range of anticipated **sediment loadings** associated with the recently constructed Carmel River Reroute and **Dam Removal** (CRRDR) Project. Results from this model were used to assess **sediment loading** to the structure, and in particular suspended sediments that could affect the performance of the intake. Results from the modeling were also used to **design sediment-control features** and scour countermeasures for the intake structure.

Lagunitas Creek Lifecycle Monitoring

Location
Lagunitas Creek, California

Client Reference
Greg Andrew
Marin Municipal Water District
415-945-1191

Scope of Services
- Design of a statistically rigorous sampling design.
- Sampling juvenile coho salmon populations with electrofishing and snorkeling according to established protocols.
- Estimation of juvenile abundance and population spatial structure.
- Estimation of juvenile coho over-winter survival using PIT tags and mark recapture models.

Date of Services
2012 – Ongoing

Total Fees
$160,000

Cramer Fish Sciences (CFS) was contracted by the Marin Municipal Water District to implement the Coastal Monitoring Plan (CMP); a comprehensive sampling program created by state and federal resource agencies to monitor coastal populations of coho and steelhead in California. Lagunitas Creek is considered a stronghold of coho salmon and as such has been designated a **life cycle** monitoring station where all freshwater salmonid **life stages** are monitored. The sampling program is designed to monitor trends in abundance and habitat occupancy while maximizing the spatial extent of fish sampling.

Cramer staff used a generalized random tessellation (GRTS) to create a rotating panel of sample sites in the watershed and coordinated with the National Park Service to provide them with sample sites from the selection procedure. Snorkel surveys and electrofishing were performed by CFS staff at the selected sites each year to collect fishes and relevant habitat data. During these surveys, both half and full-duplex PIT tags were surgically implanted into coho salmon of appropriate size for detection during the spring outmigration.

Each year, data collected by CFS was integrated with the data collected by the Park Service to provide MMWD with estimates of coho and steelhead population sizes in the watershed. Additionally, habitat occupancy rates for each species were estimated for three major tributaries. Following the spring out migration period, tag detections were combined in a mark-recapture model to estimate overwinter survival of coho. Models were constructed to test different hypotheses of overwinter survival including: 1) survival is a function of the tributary where the fish was tagged, and 2) survival is a function of fish size at tagging.

Each season, CFS staff collaborated with the MMWD to construct a joint report on the CMP monitoring and other monitoring performed in the watershed. Additionally, CFS constructed and maintained a relational database containing all the CMP data and provided it to the MMWD.

Battle Creek Passage and Steelhead Life Cycle Modeling

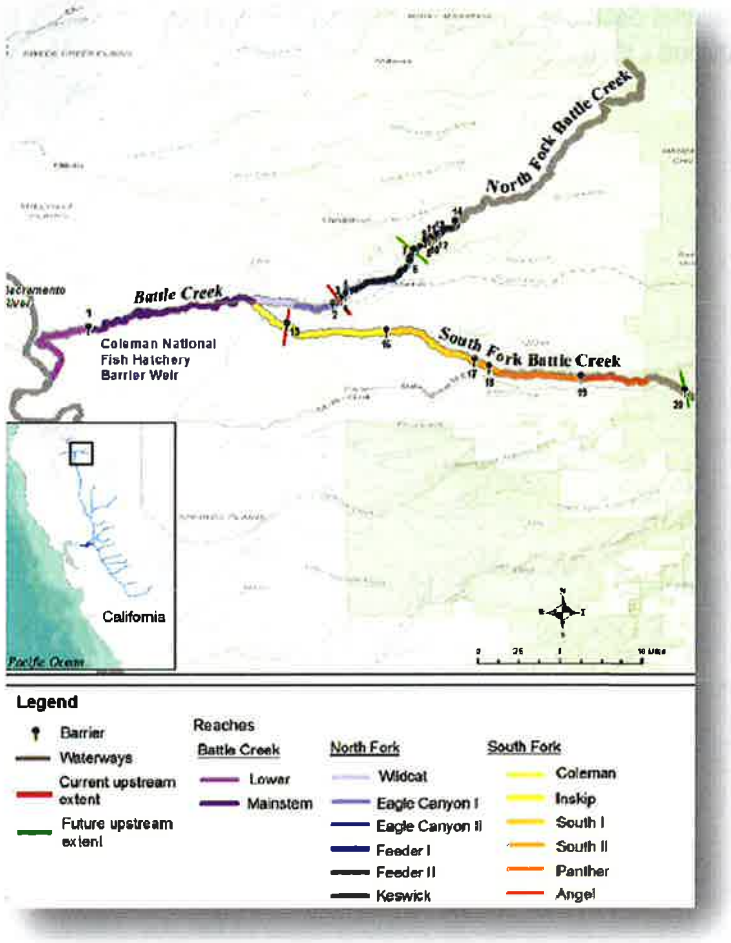
Location
Red Bluff, California

Client Reference
Mary Marshall
U.S. Bureau of Reclamation, Mid-Pacific Region
916-978-5248

Scope of Services
- Developing a **steelhead** life cycle model to represent consequences of fish passage, hatchery introgression, and habitat productivity
- Experience modeling complex steelhead life histories and passage issues
- Expert knowledge of fish habitat and passage behavior

Date of Services
2016

Total Fees
$350,000



The Battle Creek watershed, like many in the west, is a complex environment, providing important opportunities for both the natural and man-made environments. Agency and stakeholder representatives with interests in the Battle Creek watershed have worked over the last two decades to reconcile the conflicts between ecological functions and human services. These efforts have mainly focused on conserving and restoring aquatic habitats for native salmonid reproduction and growth, while preserving the use of water resources for hydropower production and water diversions. Mandated fish hatchery operations at the Coleman National Fish Hatchery (CNFH) is another longstanding use that increases the complexity of these reconciliation efforts.

Restoration of the upper Battle Creek watershed, motivated through FERC relicensing of PG&E hydropower facilities, focuses on providing fish access to historical habitat for the re-establishment of naturally occurring salmonid populations. The Battle Creek watershed is considered a highly important watershed that historically supported large numbers and a broad diversity of anadromous salmonids. Infrastructure modifications associated with the Battle Creek Salmon and Steelhead Restoration Project (BCRP) began in early 2010. The goal of the BCRP is to provide high quality habitat and improve fish passage throughout 48 miles of stream habitat. Once completed, the BCRP will be adaptively managed as described in a project-specific adaptive management plan (BCRP-AMP).

Cramer Fish Sciences was contracted to develop **steelhead** and Chinook salmon **life cycle** models for the Battle Creek watershed in order to assess effectiveness of restoration efforts and passage enhancements. Cramer Fish Sciences led technical discussions, conducted analyses, completed population models and drafted an Adaptive Management Plan to guide further investigations, particularly as related to potential conflicts between operation of Coleman National Fish Hatchery and the Battle Creek Restoration Program.

Battle Creek includes numerous man-made and natural passage barriers. A central component of our quantitative modeling effort was to represent how each of the barriers could influence the success of **steelhead** and Chinook salmon recovery. Expected improvements in barrier passage were assessed in this project to guide future enhancement activities.

SECTION 4 – FIRM AND KEY PERSONNEL

This proposal and qualifications package to provide engineering services for the Los Padres Dam and Reservoir Alternatives and Sediment Management Study is being submitted by MWH, now a part of Stantec in association with our subconsultant firms. This team was formed to provide the Monterey Peninsula Water Management District (MPWMD) with a highly experienced team with relevant project experience and local expertise to accomplish the objectives of the Study.

The MWH team offers the following advantages to MPWMD for this project:

Team Experience. MWH is offering a team of experienced engineers and professionals, well versed in all aspects required for the development of alternatives, engineering, geomorphology, fisheries biology and construction planning, cost estimating, and environmental assessment for this project. We are assigning some of our most experienced engineering staff who are familiar and worked on the 2013 MWH Los Padres Dam Sediment Removal Study and the 2007 MWH EIR/EIS alternatives development and Basis of Design for the San Clemente Dam Removal Project, so that their knowledge, including knowing "what works & what doesn't", will be directly applied to the Los Padres Dam study. In addition, we have partnered with an industry-leading geomorphologist, Bob Mussetter, from Tetra Tech, as well as key steelhead experts from Cramer Fish Sciences to complement our in-house MWH staff. We have brought together this team in order to leverage the full complement of recent and direct local expertise for this project.

Our project team has local area knowledge and project history working on the Carmel River and with MPWMD. Our project team has experience working with the critical issues, policies, and procedures associated with projects located along the Carmel River and in Monterey County. They are well known and respected by DSOD, NMFS and California Fish & Wildlife. Our key leads have been active with the San Clemente Dam and Los Padres Dam dating back to the early 2000s; their experience is summarized below:

- Our Project Manager, Vik Iso-Ahola, was the Project Manager for the prior LPD and SCD sediment and dam removal studies for MWH, and has extensive experience with the DSOD on these projects as well as numerous other dam modification projects throughout the State.
- Bob Mussetter, our team's lead geomorphologist, is responsible for development of the most extensive sediment transport models on the Carmel River known to date as part of his work on SCD under MWH.
- Dr. Beakes, our lead fisheries biologist, is an expert on the central California coast steelhead, performing extensive research and published papers on steelhead life history.
- Eric Clyde, our reservoir operations and mapping specialist, has an over 40-year background in hydrology, hydraulic modeling, mapping, and reservoir operations planning primarily in California.

MWH OVERVIEW

MWH, now a part of Stantec, specializes in water and natural resources. MWH employees use innovative ideas and technology to help solve complex infrastructure and environmental challenges. This work is built on a nearly 200-year history during which MWH has delivered services from initial planning and design through construction, start-up and operations.

Since its founding, MWH has specialized in major water resource projects that have included the planning, design, and construction management of dams both in the United States and around the world. MWH has experience in all types of dam design and construction techniques and has built a reputation for innovation and quality engineering. MWH has the in-house expertise and experience necessary to handle all aspects of project development including the capability of assessing and addressing any potential environmental impacts associated with these developments. MWH can draw on the skills and experience of a staff of engineers and scientists many of whom have 20 or more years of continuous service with the firm in the planning and implementation of dam and water resource projects.

MWH's fisheries capabilities are centered in the San Francisco Bay area and the Pacific Northwest; however, we have completed fish engineering projects throughout the country and around the world. Our engineers and fisheries scientists collaborate using their knowledge of fish behavior, regulations and engineering criteria related to fish facilities design. MWH's fisheries experts are familiar with the biological requirements and engineering criteria for recirculating aquaculture systems, fish screening, passage, holding, and capture for both juvenile and adult fish. MWH staff engineers work daily with biologists and fishery agency engineers in developing innovative, efficient and reliable designs that are proven through years of successful operation that match the Owners expectations.

SUBCONSULTANT TEAM MEMBERS

Although MWH routinely provides the majority of the technical skills necessary to complete our projects, we frequently retain the services of "Best-in-Class" specialty subcontractors to provide local expertise in specific areas. It has been our experience that utilizing the services of locally based subcontractors is beneficial to the project through the unique expertise that they bring to the project and the socio-economic benefits that they provide to the greater community. For this project we wanted to supplement MWH's expertise in the Carmel Valley with two firms that bring specific Carmel River knowledge and expertise in steelhead biology that has been requested for the Study.

CRAMER FISH SCIENCES®

CRAMER FISH SCIENCES (CFS) is a team of experts at assessing the productivity and limiting factors of fish populations and their habitats. Cramer has a staff of more than 40 fisheries biologists, ecologists, and geneticists at six locations throughout the West Coast. For more than 27 years, their focus has been to empower natural resource managers and stakeholders with cutting-edge science and practical solutions to environmental issues. CFS has a history of achieving firsts in introducing new field study methods, synthesizing fisheries information across regions and agencies, developing new analytical methods that encompass the full life-cycle of fish, and creating ESA Recovery Plans. CFS is well-known for their expertise in the planning and implementation of research studies and for our advanced quantitative methods. CFS staff has expertise in a wide range of methodologies and tools for investigating fish population dynamics, fish habitat and restoration and fish movement and behavior. CFS staff includes biologists and technicians with expertise in a wide breadth of methodologies and equipped with boats, fish sampling gear, and habitat survey instruments. Their scientific credibility across a wide spectrum of natural resource regulators, developers, and conservationists, combined with their advanced capabilities for research and quantitative analysis, have enabled Cramer Fish Sciences to move clients past imposing hurdles with environmental issues.

TETRA TECH is a full service company and has been involved since 2001 and played a key role in evaluating sediment transport, river hydraulics and hydrology, and fish passage alternatives design and construction in the Carmel River. Their project focus has been on the San Clemente Dam and studies have extended upstream to include the Los Padres Dam vicinity and surrounding watershed. Tetra Tech performed the initial sediment-transport studies for the California Department of Water Resources (CDWR) DSOD. Follow on work was performed for California American Water Company (CalAm) and the California Coastal Conservancy to evaluate potential flood hazards and sediment loading in the river downstream from San Clemente Dam associated with fish passage and dam removal alternatives. Tetra Tech also performed analyses that included collection of detailed topographic, bathymetric, and sediment data and development of a sediment-transport model of the reservoir that could be used to directly evaluate the existing trap efficiency and rate of erosion for dam removal. Tetra Tech served as the lead stream design engineer on the CRRDR Project, which included reconstruction of a 4,300-foot-long natural channel to provide fish passage and instream and riparian habitat in the affected reaches. Tetra Tech is currently working with MPWMD to support the design and construction of the Sleepy Hollow Steelhead Rearing Facility Intake.

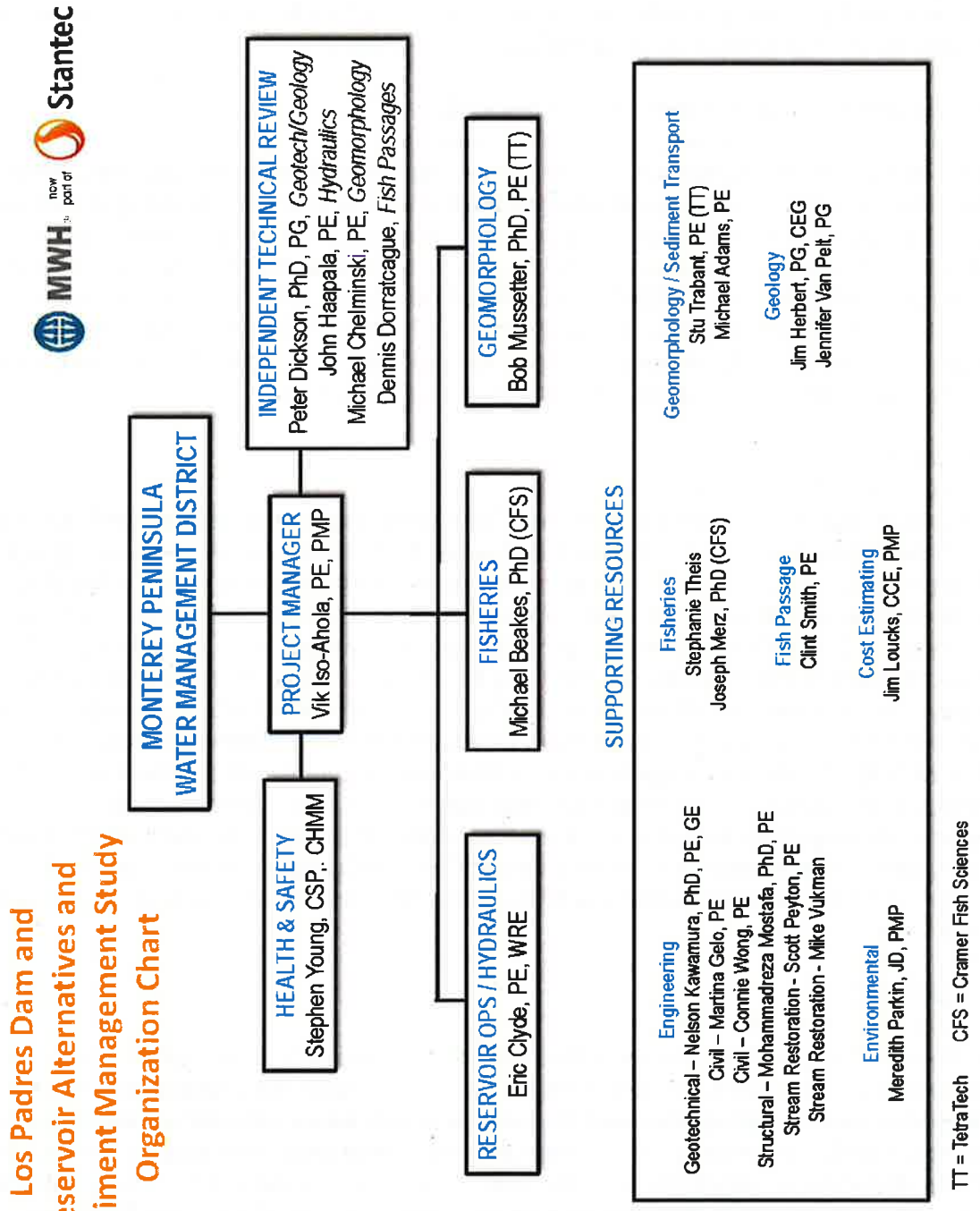
PROJECT TEAM ORGANIZATION

One of the keys to project success is bringing the right people to the project and assigning them to the right roles. We have brought some of our best talent to this project, and have structured our team to align reporting and delivery responsibilities with the overall project objectives. Our team is results-oriented. They can envision a successful project end point, then drive the work products to get there and arrive on time and on budget.

The strength of our team begins with our selection of a project manager. Our team will be led by Vik Iso-Ahola, who as our Project Manager, brings 19 years of experience working with water-resources related projects involving civil, geotechnical, structural, and construction engineering, cost estimating, and planning. Vik Iso-Ahola not only has worked extensively in the Carmel River watershed, but also is an experienced civil engineer and certified project management professional whose breadth of knowledge and experience with dams and dam removal, DSOD, and other regulators will allow him to effectively manage the diversity of work tasks to be completed by the project team. He has facilitated risk evaluation workshops for a number of PG&E dams as a FERC Part 12 Independent Consultant, soliciting input from Owner and Regulatory personnel that resulted in concise and coherent updates to the dam probable failure modes analysis documents. Mr. Iso-Ahola's project experience has provided him with a regular and ongoing working relationship with Federal Energy Regulatory Commission and the California DSOD, providing him a depth of experience and excellent reputation in addressing stakeholder requirements and understanding of regulatory compliance issues. In addition, he has published papers on spillway modification, dam removal issues, concrete thermal analysis, liquefaction evaluation, dam rehabilitation, and structural design optimization for dam raising and dam retrofit using FEM analysis.

Vik will oversee the technical team and provide local insight based on his previous work on similar projects throughout the western US. The organization chart of the team supporting Mr. Iso-Ahola presented below, followed by summaries of key staff who provide the expertise in sediment transport, flood risk evaluation, water supply, steelhead biology and lifecycle dynamics, and cost estimating.

Project Team Organization Chart



KEY STAFF AND ROLES

Short biographies for our key Team members are included in the following pages along with descriptions of their specific role or expertise. In addition to our senior resources, we have included core mid-level engineers with highly relevant experience that will allow us to perform the work in a cost-effective and efficient manner. Full resumes are presented in Section 9 – Appendix.

RESERVOIR OPERATIONS / MAPPING / HYDROLOGY

Eric Clyde, PE, WRE, *Reservoir Operations/Hydraulics*

Mr. Clyde is a Principal Engineer with **over 39 years of experience in water resources engineering**, storm drainage and flood control, **reservoir operations modeling, computer modeling of hydrology,** storm drainage, reservoir operations, and open channel **hydraulics**. He has supervised and participated in hydrologic and water resources projects throughout the United States. His computer modeling experience includes HEC-HMS, HEC-RAS, RESSIM, DSS, SWMM, InfoWorks, UNET, HEC-FDA, and many other hydraulic, and hydrologic programs. Mr. Clyde served on the Board of Directors of the Floodplain Management Association for 14 years, including 2 years as Chair, and is currently serving as Chair of the Professional Development Committee and as Senior Advisor to the Board.

FISHERIES

Michael Beakes, PhD - Cramer Fish Sciences

Dr. Beakes brings over 13 years of research experience and a strong combination of field-based and quantitative research experience to the team. By coupling field data with quantitative modelling techniques Michael enhances the team's ability to advance fisheries science by improving understanding of how stream and river ecosystems function and providing insight into how best to manage them. Michael's primary role at Cramer Fish Sciences as a senior biologist is to develop, coordinate, and implement a broad range of habitat restoration projects and monitoring throughout California. Michael received a BSc in Biology with an emphasis in Fish and Wildlife Management from Northern Arizona University in 2002, and received his Ph.D. in Biology from Simon Fraser University in Vancouver, British Columbia, Canada in 2014. While at SFU Michael's research was focused on examining the dynamics of large-scale natural and anthropogenic disturbance in stream and river ecosystems across large spatiotemporal scales. His research experience includes studies on the effects of wildfire on stream temperatures and food webs in a small California coastal watershed, flow regulation on California Central Valley rivers, salmon life-cycle models and habitat capacity in California and Washington State, and climate change on the Fraser River in British Columbia, Canada.

GEOMORPHOLOGY

Bob Mussetter, PhD, PE – TetraTech

Dr. Mussetter has over 35 years of experience in analysis and design for a broad range of water-resource and civil engineering projects, including numerous hydraulic and **sediment transport** projects on the Carmel River over the past approximately 15 years. His primary area of expertise involves integration of hydrology, hydraulic engineering, and river mechanics with **fluvial geomorphology** to solve river stability, flooding, and environmental problems. Dr. Mussetter is nationally recognized as an expert in hydraulic and **sediment-transport** analysis. His experience includes projects throughout the United States and internationally involving a broad range of stream types and physical environments, varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate sediment transport in both sand- and gravel-bed systems. He has extensive experience with the full suite of hydrologic, hydraulic and **sediment- transport** models, including HEC-HMS, HEC-RAS, HEC-6

and HEC-6T, RMA-2V, FLO-2D, and SRH-2D, and many other similar models.

Dr. Mussetter has particular experience in analyzing and predicting **sediment transport and fluvial processes** in natural streams, including the effects of human-induced and natural disturbances such as reservoirs, diversions, landslides and rare floods on channel stability and instream aquatic habitat. He also has considerable experience in developing measures to mitigate the potential adverse impacts of these disturbances, including channel stabilization measures using natural materials, **sediment flushing flows, and sediment augmentation**. His experience includes collection and analysis of substrate data, analysis of aerial photographs, flood inundation studies, and preparation of **sediment budgets**. Dr. Mussetter has authored or co-authored several manuals and design guides relating to river stability, erosion control and surface erosion. In addition, he has been an instructor for the National Highway Institute-sponsored "Stream Stability and Scour at Highway Bridges" training course and was involved in preparation of the Federal Highway Administration documents HEC-18, "Evaluating Scour at Bridges" and HEC-20, "Stream Stability at Highway Structures." This training course and the related documents describe the current standard of engineering practice for evaluating stream stability and scour in the riverine environment.

TECHNICAL REVIEWERS

Our team's independent technical reviewers will be utilized to provide insight and review of our deliverables prior to delivery to the District and TRC. Also, as necessary and as requested, these independent experts may be called upon to supplement our core team presented above to provide input into TRC reviews and discussions.

Peter Dickson, PhD, PG, *Geotechnical/Geology*

Dr. Dickson has **40-years of broad experience on a large variety of water resource projects** in many parts of the world including **dams for water supply** and hydroelectric projects, power plants, penstocks, tunnels, caverns, pumping stations, and **flood control structures.** His experience includes project screening and ranking; design and supervision of **geological, geotechnical, and hydrogeologic** investigations; siting of project features and developing layouts and arrangements; dam type selection (fill dams, CFRD, RCC, gravity, arch dams), slope stability evaluations and slope design; landslide studies; technical training and technology transfer; determining criteria for planning, design and construction of tunnels, caverns, and dams; detailed design and contract document preparation. His work includes assessment of risk, identification and evaluation of mitigation options and alternative project arrangements, development of project cost parameters, independent technical review, and constructability review.

John Haapala, PE, *Hydraulics*

Mr. Haapala has **42 years of specialized experience in hydrology, hydraulics, flood studies, dam-break inundation studies, reservoir operation** and power studies, engineering economics, and fisheries issues with an emphasis on computer applications. He is adept at the usage and adaptation of many existing standard **hydrologic and hydraulic** computer programs, and has developed a number of new application programs. He has been the hydrology lead on numerous hydrology and hydraulics studies for hydroelectric power developments worldwide. Throughout his career, he has performed Probable Maximum Flood studies and other floods studies in diverse locations including Alaska, Florida, California, Washington, and Indiana. He has performed **power and operation studies of more than 100 reservoirs** and power plants including complex multi-reservoir, multi-use systems. The studies were performed to determine firm water supply yield, hydroelectric generation, benefits of component sizing and the effects of alternative instream flow requirements. A normal part of the **reservoir operation studies** has been to determine the hydraulic losses in the penstock and tunnel conduit system. His hydrologic and hydraulic

analysis experience also includes reservoir and channel flood routing, spillway sizing, gated spillway flood operations, freeboard analysis and riprap sizing for shore protection. Hydraulics experience includes the design of hydraulic structures such as spillways, energy dissipaters, developing spillway rating curves, and the static and hydraulic transient analysis of pipelines and tunnels. He has performed dam-break studies to develop inundation maps and inflow design floods for several projects including using HEC-RAS as the dam-break model with multiple downstream dams from the failed dam.

Michael Chelminski, PE, *Restoration and Dam Removal*

Mr. Chelminski is responsible for technical aspects of ecological evaluation, mitigation, and restoration analyses and designs. His work includes the development of hydrologic and hydraulic studies for integration with Stantec's skills in the ecological and biological sciences. A licensed engineer, his project experience includes ecological restoration design and monitoring, **fish passage assessments, effluent mixing analyses, and dam safety evaluations**, and is the **engineer-of-record for more than a dozen completed small dam removal projects**. He has worked on watersheds including the Allegheny, Connecticut, Deerfield, Delaware, Housatonic, Hudson, Ohio, Potomac, and Penobscot Rivers in the United States; and projects in Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, and Saskatchewan, Canada.

Dennis Dorratcague, *Fisheries*

Mr. Dorratcague has **over 40 years of specialized experience in fish passage projects** on the west coast for irrigation, power, and municipal projects. Mr. Dorratcague was the key developer of the Vee-type fish screen for screening large canal diversions. Working with Milo Bell in the mid-1980's, he developed the concept and led the design of the first two Vee-shaped structures that were constructed in the early 1990's. He is past president of the Bioengineering Section of the American Fisheries Society. Mr. Dorratcague has been working in the field of hydrology and hydraulics since 1972. His main areas of concentration have been hydraulic structures, fisheries engineering, computer modeling of hydrology and hydrodynamics.

SUPPORTING RESOURCES

Our team's supporting staff have been selected for their skills and abilities in the varied knowledge areas required to develop the Study alternatives and gather additional data. We have included a range of experience and skill on the team to allow for economical yet effective execution of the proposed tasks.

Engineering

Nelson Kawamura, PhD, PE, GE, *Geotechnical Engineering*

Dr. Kawamura has **38 years of experience** as a geotechnical engineer in civil, mining and geo-environmental engineering projects in the U.S. and abroad, including 30 years of experience in **dams** and appurtenant structures, hydropower facilities and tunnels; possesses experience in subsurface investigations, analysis and design, and construction QA/QC; worked on all design phases of dam, spillway, powerhouse and tunnel rehabilitation projects; is experienced in dynamic analysis of tunnels and dams. Has expertise in dam safety engineering in conformance with FERC and **DSOD** requirements.

Martina Gelo, PE, *Civil Engineering*

Martina Gelo is civil/structural engineer with **15 years of experience** in structural design and analysis for **water resources,** mining, and natural gas engineering projects. She is proficient in civil/structural analysis, calculations, design; drafting, material take offs and cost estimating. Her experience includes design and analysis of variety concrete foundations (equipment foundations, building foundations, pipe support foundations), concrete retaining walls, culverts, bridges, concrete boxes, pump intake structures,

structural steel platforms and support structures. Martina also has experience with open channel and pipe hydraulics, hydrology analysis, grading design, and piping design.

Connie Wong, PE, *Civil Engineering*
Ms. Wong is a civil engineer with over five years of project experience. She assists in the civil design of wet infrastructure projects involving dams, powerhouses, and canals. Ms. Wong also has a focus in geotechnical engineering and assists in the geotechnical and slope stability analyses of projects involving landslide mitigation, water treatment pond design, reservoir evaluation, and **sediment storage facilities**.

Mohammadreza Mostafa, PhD, PE, *Structural Design*
Dr. Mostafa has more than 15 years of consulting experience in seismic analysis and design of various steel, concrete, and masonry structures. He has experience managing a design team working on appurtenant structures to dams, such as underground and surface hydropower plants, dry and pressurized tunnels and shafts, intake, outlet structures and residential and industrial buildings. He is experienced in seismic evaluation of existing structures, as well as in structural design of Water/Wastewater facilities. He has extensive knowledge of current design codes: CBC, IBC, ACI 318, ASCE 7, ACI 350, AISC 360, AISC 341, AISC 358, API, USACE, AWWA D10 and PTI.

He is skilled in dynamic analysis (response spectrum and nonlinear time history) of building and hydraulic structures using relevant commercial software and design codes (US Army Corps of Engineers' engineering manuals and FERC publications). He has also experience on seismic analysis and design of different concrete and steel bridges based on AASHTO LRFD design code.

Scott D. Peyton, PE, *Stream Restoration*
Mr. Peyton is an engineer with experience in a variety of water resource and design projects. He has direct project experience with ecosystem and stream restoration and enhancement projects including conceptual level planning, preliminary and final design, permitting, assistance during construction, and post construction monitoring. Mr. Peyton also has experience in **hydrologic and hydraulic modeling**, performing floodplain analysis and delineation, water quality studies, and a variety of storm water and water resources projects including watershed management and planning. He is a proficient user of many hydrologic, hydraulic, and GIS applications, including RIVERMorph, HEC-HMS, HEC-RAS, ArcView, and ArcInfo. In addition, he has experience in water resources planning projects including EPA NPDES Phase II programs and permit applications, hazard mitigation planning, and watershed planning and improvement projects.

Mike Vukman, *Stream Restoration* – Stantec
Over his career, Mr. Vukman has been able to compile a diverse set of skills as a project manager, including skills obtained while facilitating large stakeholder groups in an effort to restore greenways along riparian corridors. Experienced in stream restoration, Natural Channel Design, **fluvial geomorphology,** biotechnical streambank erosion control methods, and trail alignment, design, construction, and maintenance, Mr. Vukman's involvement within these projects has included management of subcontractors, budget tracking, grant writing, facilitation of community meetings, preparation of required permits, data gathering and processing, construction, post-project maintenance and monitoring, and final report writing. His interpersonal skills have allowed him to successfully manage several diverse stakeholder groups whose goals were based on prevention of private property loss through the design and implementation of comprehensive stream restoration projects. Furthermore, Mr. Vukman is trained as a **fluvial geomorphologist,** having completed Levels I-IV of Dr. David Rosgen's Wildland Hydrology short

courses. With approximately 17 years of experience designing and implementing numerous biotechnical streambank erosion control projects, he is an expert practitioner of soil bioengineering and other biotechnical erosion control methods and is often called upon by local agencies for advice and guidance. His expertise also includes long-term maintenance and monitoring of riparian restoration and trail construction projects. Additionally, he draws on leadership skills honed by years of experience managing conservation corps crews and serving as a Sergeant in the US Army.

Environmental

Meredith Parkin, JD, PMP, *Environmental*

Ms. Parkin has over **21 years of experience** in policy, regulatory and environmental compliance, permitting, planning, and land use for various **dam and reservoir, water-related**, and infrastructure projects, including previous studies for Los Padres Dam and San Clemente Dam Removal. She has assisted both public agencies and private interests in addressing regulatory challenges, with a focus on identifying challenges early through the integration of policy and compliance during all phases of project development, from planning through construction. Her experience includes environmental compliance and permitting for multi-purpose local, State and Federal projects and programs. Ms. Parkin is currently managing the CEQA and/or NEPA compliance on a variety of dam and reservoir and water-related and infrastructure projects and has managed the permitting effort for 160 infrastructure facilities in 60 different jurisdictions in CA and NV. She is also managing the acquisition of environmental permits from regulatory agencies such as the NMFS, USACE, USFWS, Regional Water Quality Control Boards, and the California Department of Fish and Wildlife.

Fisheries

Stephanie Theis, *Fisheries Biologist*

Ms. Theis is a lead **fisheries biologist** with over 25 years of professional experience, in both freshwater and estuarine environments, emphasizing fish ecology, Endangered Species Act (ESA) compliance, fisheries monitoring, fish passage, habitat restoration design and monitoring, and environmental impact assessment. Her experience includes a comprehensive knowledge of **life history** and habitat needs of anadromous and resident fishes. Ms. Theis is an expert in adaptive management as well as ESA and EFH compliance procedures and has successfully conducted numerous Section 7 consultations with NMFS and USFWS. She has led plans for fish passage in multiple watersheds and monitoring programs for habitat restoration programs.

Joseph Merz, Ph.D. – *Fish Biologist* – Cramer Fish Sciences

Over the past 23 years, Dr. Joseph Merz has worked as a **fisheries ecologist**, preforming studies and monitoring of fish populations, on coastal and Central Valley **steelhead** and Chinook salmon populations. Joe teaches professional courses in salmonid ecology, habitat assessment, and fish passage. Dr. Merz has coauthored a variety of peer-reviewed publications, focusing on river rehabilitation, fish movement and reproductive success, invasive species, woody debris/redd associations, and evaluation of salmonid spawning and rearing habitat enhancement. Personally, he has been honored with multiple awards and scholarships for his performance, and has initiated numerous interagency and multidisciplinary grants totaling over US $15 million for California salmonid restoration, **life cycle modeling** and habitat assessment projects. Joe has performed numerous assessments of habitat manipulation on aquatic resources including habitat enhancement, flow manipulation, invasive species, and regulation implementation, including Chinook salmon and **steelhead** spawning. One of Joe's unique strengths is his public outreach skills and ability to collaborate with a variety of constituents. He has taught at university and

public education levels, worked with federal and state representatives, and partnered with local entities (i.e., outreach groups, planners, volunteer organizations, etc.). Recently, Dr. Merz has been part of a multiagency technical teams developing strategies for Chinook Salmon re-introduction on the Upper Columbia River watershed and providing guidance for resource management on the Lower American River during the most recent drought. He is a member of American Fisheries Society and the Southwestern Association of Naturalists, and the Ecological Society of America.

Fish Passage

Clint Smith, PE, *Fish Passage*

Mr. Smith has **31-years-of-experience** in civil, environmental and water resource engineering. His background includes the planning, analysis and design of **water intake facilities; fish transport, passage and screening facilities; municipal water**, wastewater and storm drainage conveyance and treatment systems; hydrologic and meteorological instrumentation **data collection** systems.

Cost Estimating

James Loucks, CCP, PMP, *Cost Estimating*

Mr. Loucks has over 30 years of constructability, cost estimating/project management experience in civil works and process infrastructure of water treatment plants, water conveyance pipelines, **water storage facilities** and industrial process plants. During his career, Mr. Loucks has gained experience in multiple project delivery methods including design-build, engineer-procure-construct (EPC) and traditional design-bid-build (DBB) or hard dollar contracting. He has been associated with some of the most respected self-performing contractors in the country as well as leading international consulting engineering firms. Mr. Loucks has gained significant domestic and international experience with specific international exposure in Asia, Latin America and the United Kingdom. As Cost Management Practice Leader for MWH Americas, Mr. Loucks leads a group dedicated to total cost management which is a systematic approach to managing cost and constructability throughout a project's lifecycle. His tasks include systems integration, staff recruiting, workload resourcing, detailed and conceptual estimating, third party estimate reviews, client presentations, and quality control. Prior to joining MWH, Mr. Loucks held key estimating, project management and project engineering positions for Arizona and California based general engineering contractors.

Geomorphology/Sediment Transport

Stuart C. Trabant, PE, *Sediment-Transport* - TetraTech

Mr. Trabant has over 20 years of experience in hydrologic, hydraulic, water-resources and civil engineering. He has completed projects throughout the United States and internationally involving a broad range of stream types and physical environments, and varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate **hydrologic, hydraulic and sediment-transport conditions** for both sand-bed and gravel-bed systems. His primary areas of expertise are in hydraulics, hydrology, **fluvial geomorphology,** and erosion and **sedimentation**. **Mr. Trabant has significant experience in performing analyses to support the planning and design phases of water-resources and sediment management projects**, as well as preparation of design plans and specifications. He also has extensive field experience in topographic and bathymetric (GPS and total station) surveying, **sediment sampling, stream gaging and geomorphic mapping and interpretation**.

Mr. Trabant has served as the lead design engineer or project manager for numerous stream and river restoration design projects that have focused on habitat improvement, municipal development, flood conveyance, irrigation and agriculture, recreation, flood damage recovery, and water quality, among other

things. He was the primary **sediment-transport modeler** for a number of studies that were carried out to assess **alternatives** for **removal of San Clemente Dam** on Carmel River. Mr. Trabant was also the project manager and design engineer for a stream restoration design of an approximately 1-mile long reach of North Fork Clear Creek, near Blackhawk, CO that was undertaken to accommodate highway widening, improve the mining affected water quality, and restore salmonid habitat. He recently instructed a course on engineering geomorphology that was conducted for the Northeast Ohio Regional Sewerage District that was conducted as part of the Districts Master Planning Standards Development Program. He has extensive experience with the full suite of industry-standard hydrologic models, 1-D and 2-D hydraulic models and **sediment transport models,** (HEC-RAS, HEC-6, HEC-6T, SAM, HEC2-SR, SED2D and CH3D-SED), as well as GIS (ArcGIS), AutoCAD and MicroStation.

Michael F. Adams, Jr. PE, *Geomorphology/Sediment Transport*

Michael is a Civil Engineer experienced in stream restoration, natural channel design, **water resources, fluvial geomorphology**, and underwater inspection. Michael's responsibilities include project management, technical review, design, project scoping, **geomorphic assessments**, stream and watershed studies, development of restoration **alternatives**, and natural channel design. He has been involved in all phases of a stream restoration design project including developing project goals and objectives, scoping, field data collection, design calculations, development of plans and specifications, permitting, construction oversight and monitoring. Michael is a registered Professional Engineer and has attended all four levels of stream restoration courses taught by Dave Rosgen and he currently assists with the Level 3 courses as an instructor. He is especially familiar with **sediment transport** and early in his career worked on Stantec's dive crew inspecting **scour problems** at bridge sites. Michael is also well versed at writing and public speaking, and won the 2001 Daniel Terrell Award for outstanding paper presented by the District 9 Council of ASCE. He also helps teach stream restoration related short courses across the country and frequently presents at stream restoration conferences.

Geology

Jim Herbert, PG, CEG, *Geologist*

Mr. Herbert has 34 years of extensive and varied experience in the engineering geology, geotechnical assessments, and associated construction fields. He has spent considerable time effectively managing quality control programs for significant earthwork construction, structural distress, rock excavation, groundwater assessment, dam instrumentation, and rock/soil slope stability assessments and stabilizations. Mr. Herbert is adept at evaluating existing site conditions with respect to design plans/construction specifications, distress indicators, geotechnical documentation, geological maps and literature, and aerial imagery to develop comprehensive models of subsurface conditions in support of site development, rehabilitation and forensic investigations. Given his wide- ranging experience, Mr. Herbert is capable of working easily with the project managers, design and construction professionals, environmental consultants, and local/state/federal regulators to develop implementable geotechnical, geologic, and **hydrogeologic** investigations within the confines of budget and schedule. During the course of his career, he has provided detailed plans for investigations into deep foundations, landslides and soil creep, rock slope stability, channel erosion, embankment and structural settlements, bridge and dam foundations, and aggregate resources.

Jennifer Van Pelt, PG, *Field Investigation*

Ms. Van Pelt has worked on a wide variety of projects, developing a range of capabilities involving geological and geotechnical skills. She has participated in project teams in several phases including proposal writing, field investigation, data analysis, and reporting. Ms. Van Pelt's project experience includes

field mapping (traditional and rope access techniques), geotechnical drill core logging and sampling, soils logging and sampling, photogrammetric evaluation, slope stability analyses and evaluation, fracture and kinematic analysis, foundation preparation inspection, consolidation grouting implementation and inspection, groundwater and surface water sampling, report preparation, and laboratory experience.

SECTION 5 – LITIGATION HISTORY

MWH AMERICAS, INC.

The Office of Corporate Counsel of MWH Americas, Inc. (MWH) treats information concerning pending litigation and claims as proprietary and confidential. Despite the scope and volume of MWH's business as well as the increased litigious environment, the company is involved in relatively few legal proceedings. Some proceedings may be confidential or involve the privacy rights of individuals; however, MWH currently has no significant pending litigation which would adversely impact MWH's financial stability or capability to provide quality services. If Monterey Peninsula Water Management District would like to receive more specific information about MWH's claims or litigation history, MWH's Associate General Counsel, John D. Wood, would be available at (303) 410 – 4147 to respond to any further inquiries.

This information is not to be used for any other purpose without the written permission of the General Counsel of MWH Americas, Inc.

CRAMER FISH SCIENCES

No history of litigation in the past 5 years.

TETRA TECH

No history of litigation in the past 5 years.

SECTION 6 – TECHNICAL ASPECTS

As outlined in the RFP, this section summarizes MWH's technical project approach to the work, divided into the following areas:

- Project Understanding and Approach – A high level description of MWH's understanding and general approach to successfully completing this project.
- Scope of Work – A description of the detailed scope of work, supplementing and expanding upon the scope breakdown and outline provided in the RFP.
- Optional Tasks – Additional services to be added to the project at a later time at MPWMD's discretion.
- Confirmation Statement

MWH APPROACH TO DELIVER THIS PROJECT

MWH will undertake this project with a team of professionals with extensive qualifications and experience in dams and relevant reservoir sediment removal, construction, estimating, and permitting expertise. In addition to the Los Padres Dam (LPD) sediment removal study in 2013 for CAW, MWH performed a similar sediment removal study and prepared EIR/EIS documents for CAW's San Clemente Dam (SCD) Removal Project from 2005 to 2008. Several of the MWH designated team members were part of both the LPD and SCD project team and will provide valuable insights and transfer of knowledge on related tasks from these projects. MWH will incorporate information, research, database, and experience from the extensive study efforts at both projects to the next phase of evaluation for LPD. The appropriate level of effort and resources will be committed to complete the project efficiently.

The focus of this study will be to identify and evaluate no action, dam and sediment removal alternatives, reservoir capacity increase, and sediment management alternatives for the Los Padres Dam (LPD) reservoir. Each alternative will be analyzed with respect to anticipated environmental impacts, permitting, constructability, cost and schedule impacts associated with removing the dam and restoring the river, or increasing reservoir storage by removing sediments or raising the dam, or combinations thereof. We are excited and well qualified to highlight and recommend potential solutions to this fish habitat, regional water supply, and environmental issue. Information and results from the feasibility study will facilitate MPWMD and CAW's planning and future actions for the Los Padres Dam reservoir. MWH will work closely with MPDWMD, CAW, and the TRC to gain a clear understanding of CAW's needs and expectations for this analysis.

SCOPE OF WORK

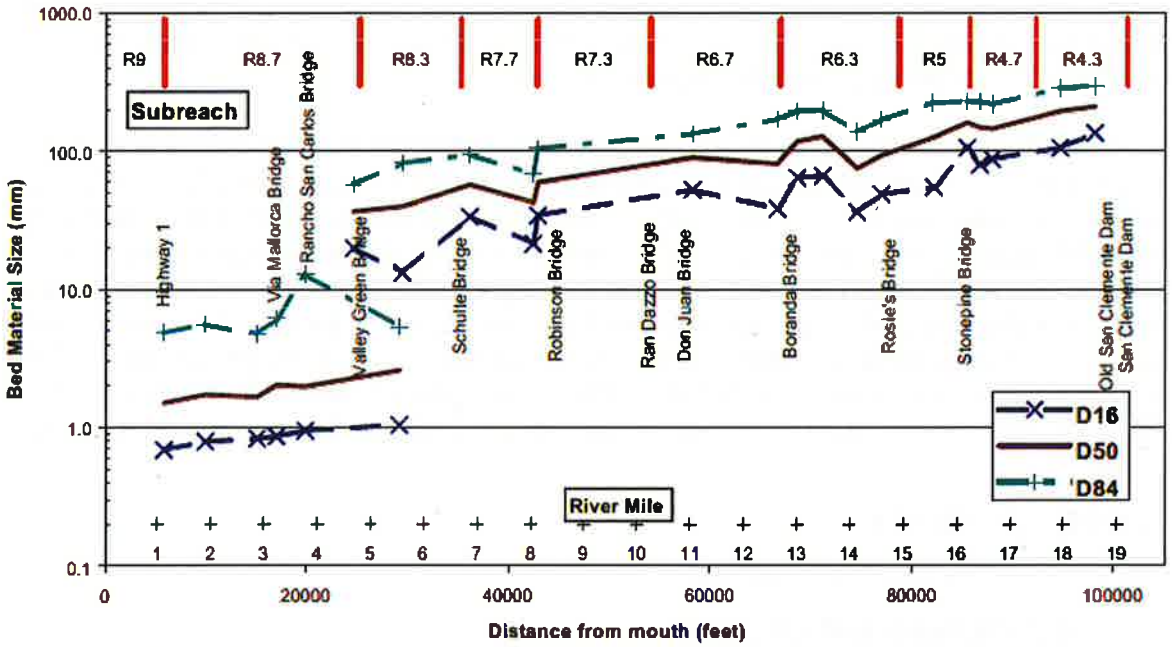
Task 1 Feasibility Study Preparation

Task 1-1 Compile Background Information

As part of this task, the MWH team will compile and summarize relevant data and findings from reservoir operations, biological design criteria, and previous geomorphic analyses at Los Padres Dam and the Carmel River. In addition, cost data will be gathered from other similar projects for use in comparison and baseline against alternatives developed for LPD. Given our team's history and intimate knowledge of Los Padres Dam and the Carmel River watershed, our data gathering efforts will be executed efficiently, yet with diligence to provide a thorough reference data set.

In addition to the information we gathered during our prior evaluation of the Los Padres Dam sediment removal alternatives study, key members of MWH's project team were responsible for the geomorphic analysis and a wide range of modeling to assess key elements and the potential downstream effects of various alternatives during the planning phases of the San Clemente Dam Seismic Retrofit and Carmel River Reroute and Dam Removal (CRRDR) projects. In performing this work, we obtained, reviewed and used the bulk of the relevant information from studies that had been completed by others at that time (i.e., prior to about 2008), and we also participated in collection of a significant amount of additional geomorphic data on the river.

Since completion of those studies, members of our team have continued to obtain, review and use new data being collected by the MPWMD, U.S. Geological Survey (USGS) and the California State University Monterey Bay (CSUMB), among others, to support work on the CRRDR Design-Build and Sleepy Hollow Raw Water Intake and Supply System Upgrade projects. Through the cumulative experience from the above work, conducted more or less continuously over the past approximately 15 years, the project team has obtained, synthesized and directly used most, if not all, of the relevant geomorphic data for the Carmel River, providing us with unparalleled understanding of the conditions in the river, the available data with which to quantitatively evaluate those conditions, and the factors that drive the behavior of the river. In completing this task, we will revisit the reports and data to review that all relevant information has been considered and will provide a concise summary of the information that can be used to meet the objectives of this study.



Carmel River bed material gradations downstream from San Clemente Dam (as of April 2001).

Bridge pier at Rancho Canada Golf Course Cart Path (~RM 2.7) showing scour and typical gravel bed material (photo by R. Mussetter, November 7, 2007). Contrast with sand/fine gravel gradation from 2001 samples in Figure 1.

Deliverables: Summary Memorandum of Data Compilation, including electronic submittal of compiled data files

Task 1-2 Evaluation Criteria

The MWH project team will develop appropriate technical evaluation criteria to be used to assess impacts of the sediment management alternatives to water quality, geomorphology, and water rights, as well as economic feasibility criteria that define acceptable cost-benefit ratios. If available, the impacts of climate change effects on long-term water availability will be included as a criterion. The criteria will include identification of "fatal flaws" that would eliminate alternatives from consideration. In addition to the criteria provided in Appendix A-2 of the RFP (e.g., effects of alternative on fish passage, potential for monitoring, adaptability of alternatives, etc.), below are some initial thoughts on each general criterion category and potential "fatal flaws":

- Water quality – Utilizing the available water quality data for LPD and downstream as baseline, quantitative criteria will be established as a measure to compare relative (i.e., qualitative, or high level quantitative estimates) impacts of each alternative to water quality. While utilizing a clear quantitative "bright line" criterion may not be practical during the initial alternatives evaluation phases, the baseline data can be used as reference points for evaluation of relative impacts of alternatives. As alternatives are refined, the baseline water quality data can used as a reference that cannot be exceeded by a given factor. For example, an alternative must not significantly increase turbidity from the baseline average, where if it is estimated that turbidity will increase by a factor of X, the alternative will be eliminated (i.e., not to exceed values and durations for each water quality measurement will be defined as fatal flaws that eliminate alternatives).

- Geomorphology – The data gathering phase will establish the current "as-built" snapshot of the Carmel River downstream of LPD, as well as upstream conditions, where it is expected that the sediment sampling and field reconnaissance in the reservoir will provide ample baseline data. This compiled snapshot will establish the baseline criterion to compare alternatives against with qualitative expert evaluation of impacts to the river geomorphology. It is expected that future alternative evaluation phases will require computer modeling of candidate alternatives which will be compared against the established baseline. Fatal flaws may include excessive increase in

downstream flooding, significant increase in suspended sediments, notable or costly increases required of structural or stream features downstream, etc.

- Water Rights – The current water rights in Los Padres Reservoir (2,179 AF) will be used as the baseline against which alternatives are compared, where it is expected that each alternative will have an impact on this right, which will be rated against the relative impact (loss) imposed by other alternatives. Fatal flaw criteria would likely include the complete loss of water right with no, or costly mitigation.

- Economic Feasibility – MWH's prior sediment removal study at LPD identified technically feasible scenarios for managing sediments; however, these were estimated at high economic as well as potentially unacceptable environmental cost. This stage of the project's feasibility evaluation will further refine the prior, as well as new, alternatives to provide a clearer picture on economic feasibility of each. The economic feasibility evaluation will be balanced with the gained benefits; therefore this criterion may be defined in terms of a cost-benefit ratio, or qualitative cost-benefit measure that is influenced by the other criteria such as water rights, water quality, etc. It's envisioned that an economic fatal flaw will be defined by an upper limit cost that makes implementation of an alternative untenable.

Deliverables: Draft Evaluation Criteria Memorandum (Final to be incorporated into Task 1-4 deliverables)

Task 1-3 Critical Data Gaps

Upon completion of Task 1-1, critical data gaps will be identified and presented to the TRC for review. Also, depending on the results of the evaluation criteria definition in Task 1-2, additional data needs may be identified to help provide baseline information for defining evaluation criteria (e.g., if certain water quality is found to be scarce, additional data gathering may be recommended to establish baseline evaluation criteria). Further, the gaps identified will be considered and incorporated where applicable into the investigation plan in Task 2-1, which should be completed prior to TRC Meeting #1 (Task 1-4).

We note that there are a significant amount of data and information available for the reach of the Carmel River downstream from the head of the former San Clemente Reservoir, but a paucity of data for the reach between Los Padres Dam (LPD) and San Clemente Reservoir. Based on our current understanding of the available data, critical data gaps for the geomorphic analysis likely include representative river cross sections and bed material sediment data in the Los Padres to San Clemente Reservoir reach that can be used to quantify sediment transport rates and related river responses. The bed material sampling can be performed during a field reconnaissance by the project team that is proposed as part of the basic scope of work. This reconnaissance will be key to understanding the current status of the reach, and in addition to the sampling, will provide site-specific observations that will be invaluable in evaluating the alternatives.

While detailed hydraulic and sediment transport modeling is not envisioned for this alternatives evaluation, sufficient cross sections that are representative of key portions of the reach will be necessary to facilitate quantification of hydraulic, bed mobilization and sediment transport under existing and alternative conditions at a level of detail sufficient to understand likely effects and relative merits of the alternatives. The cross section surveys are proposed as an additional task in the optional tasks section below.

Deliverables: Memorandum identifying data gaps and proposal for additional data acquisition needs and activities

Task 1-4 TRC Meeting #1

Subsequent to completion of the tasks above, a technical memorandum summarizing the tasks will be developed and submitted six weeks prior to the TRC meeting to be held at a MPWMD office (or other location). The objective of the meeting will be to present the background and setting of the project, which will lead into a discussion and establishment of the evaluation criteria for the alternatives. The meeting protocols and preparation requirements defined in the RFP will be followed. Given that it is expected that the workshop will require approximately ½ day or more to review the baseline information, discuss and agree upon criteria, the MWH key leads (PM and DSOD engineer, Reservoir Operations expert, Fisheries Biologist, and Geomorphologist) are proposed to attend in person. In addition, a staff level professional will be in attendance to take notes and support the team.

Deliverables: Technical Memorandum summarizing Tasks 1-1 to 1-3, Draft and Final Meeting Minutes, Final Evaluation Criteria (revision to Draft Evaluation Criteria from Task 1-2)

Task 2 Sediment Management Options

Task 2-1 Obtain and Analyze Reservoir Sediment Samples

The primary goal of this task will be to characterize the depth, type, and size of material deposited in the reservoir starting at the dam and to the tail of the reservoir. The proposed program is designed to gather sufficient information to develop a stratigraphic map of the deposits within the reservoir that can be used as a credible basis for developing and comparing sediment management alternatives. Our most experienced Engineering Geologist, Jim Herbert, will lead the effort along with support from our field geologist, Jennifer Van Pelt, both of whom have experience with prior investigations along the Carmel River for the CRRDR Basis of Design geotechnical investigation as well as Jim's field reconnaissance and aggregate resource investigation conducted as part of the preliminary design of New Los Padres Dam in the late 1990s.

Development of the sediment investigation will include:

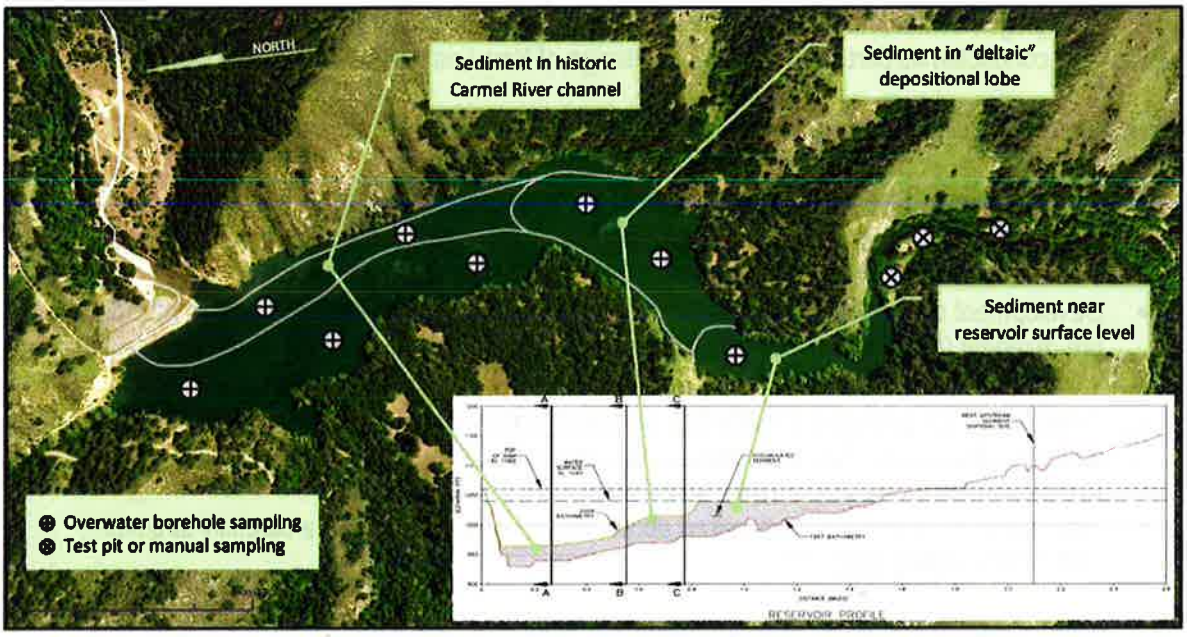
- Review of available background information, focusing on sediment types and deposition patterns.
- Evaluation of 2008 and 2016 bathymetric data and (if needed) development of a bathymetric elevation contour map to identify reservoir sediment depositional patterns.
- Development of an isopach (i.e., equal thickness) map comparing the 2008 bathymetric data to the pre-reservoir (1948) topography, illustrating the pattern of sediment deposition and sediment volumes.
- Geomorphic interpretation of bathymetric contour map and isopach map to identify areas of similar sediment deposition. This interpretation will identify the fewest number of sampling points needed to characterize the sediment types and volumes.
- Information reviewed and synthesized above will be used as input into a carefully targeted sediment sampling program.

The preliminary plan, which will be further detailed in a Work Plan developed for MPWMD and other regulatory approvals, proposes to sample sediments along the main stem channel down to the pre-1948 topography at an approximate spacing of 400 to 750 feet from the dam through the reservoir to its tail,

resulting in approximately 8 borings with samples collected with California Modified sample barrel, Pitcher barrel or Shelby tube depending upon the granularity of the materials encountered. Samples will be taken approximately every five feet from barge-mounted borehole set ups. In addition, given that the sediments at the tail of the reservoir are largely exposed in dry point bars and are expected to be primarily coarse grained, we propose to collect samples from three (3) test pits or manually-excavated pits. However, if determined necessary and sufficient budget is available, a limited access drill rig may be mobilized from the barge at the tail of the reservoir and used for additional borings to confirm soil types near the base of the deposits.

Upon completion of the sampling phase, select samples from each boring will be sent to the laboratory for characterization, including particle size distribution with hydrometer (ASTM D422), Atterberg limits (ASTM D4318) and visual classification (ASTM D2487). Results of the sampling (boring logs) and sample testing will be used to develop a stratigraphic profile of the sediments in the reservoir, as well as provide a basis to estimate the volume and distribution of organics, fines, sands, gravel, and cobble. This information along with a summary of the investigation will be provided in a draft sediment investigation report submitted within two weeks of completion of the laboratory testing.

If additional characterization of the sediments within the reservoir is desired, Cone Penetration Test (CPT) soundings may be used as an inexpensive method to split between borings along portions of the reservoir where it is expected that sediments and stratigraphy will be of similar composition. While CPTs do not typically extract samples for use in characterization, they provide quick, yet fairly accurate representations of soils/sediments along a soil column when calibrated with adjacent borings and samples. This method is not included in our investigation estimate, but can be discussed with MPWMD if there is a desire to accumulate additional data for the overall study.



Illustrated are proposed overwater and on-land sediment sampling locations based our understanding of reservoir sedimentation through comparison of the original reservoir pool topography and the findings of a 2008 bathymetric study (Watershed Institute).

Our sediment sampling plan and budget is based on the assumptions stated herein. However, the proposed investigation is subject to discussion with MPWMD and CalAm and may be modified depending on budgetary limitations and permitting requirements/difficulty, as well as MPWMD's objectives for the investigation.

Deliverables: Draft and Final Work Plan, Draft and Final Sediment Investigation Report

Task 2-2 Describe Alternatives

This task will describe each alternative provided in the RFP, including details of potential effects to the river and within the watershed, conceptual layouts that provide a visual and physical depiction, and discussion of longevity and benefits of each. High level order of magnitude estimated costs will be provided for comparison purposes relative to other alternatives (e.g., cost classified as "high" above $50M, "extremely high" above $100M, etc.), but will not be detailed in a formal cost estimate (to be provided later in Task 5). The considerations for each alternative described in the RFP will be included as a minimum, but additional ideas, impacts, variations on alternatives, etc. will be discussed. Some additional thoughts for each alternative are provided below:

1. No Action Alternative – Utilizing input from our geomorphologic experts, we will re-visit, summarize, and update as necessary our prior estimates for complete reservoir sedimentation. This revision will drive how long-term impacts of no action will be quantified and estimated, such as the eventual and complete loss of water rights in the reservoir, feasibility of fish passage, etc.

2. Dam Removal – Detailing how a feasible dam removal could be executed will be important to describe, as each sub-alternative (e.g., phased removal, partial removal, complete removal) within this category will have its unique requirements, challenges, and potentially high economic and environmental cost. For example, a phased removal may be favorable for providing a managed release of sediments from the reservoir, but each phase may require notable engineering and construction to allow the lowered dam at each phase to safely pass the maximum flood, which may be costly. On the contrary, a single, complete dam and sediment removal may provide less risk from a dam overtopping perspective, but would require substantial construction activity in one or two seasons that could have significant short term environmental impacts in the river as well as to local communities.

3. a. & b. Dredge and Place Sediment Downstream, on or off Cal-Am Property – Our 2013 report will be revisited and additional disposal sites investigated, where consideration could be given to the bypassed reservoir at the former San Clemente Dam site downstream. Also, expanding the sediment placement sites along the river immediately downstream of the previously proposed sites as well as conveyance to a previously unidentified property could be considered. Given the expanded footprint for these alternatives, the team will have to consider the additional and wider impacts to the riparian and overall watershed habitat. Also, the long-term sustainability of this option(s) will be described and provided as an evaluation criterion.

4. Reservoir Storage Expansion – Similar to the detailing required for the dam removal alternative, each reservoir expansion sub-alternative will be developed and described in sufficient detail to characterize their relative costs, impacts, and long-term viability. Each alternative will have unique challenges for implementation, especially the dam replacement alternative, which would require creative ideas and planning to obtain and bring construction materials onsite while minimizing impacts to the environment and local communities.

5. Sediment Management Program – Given that it is expected that sedimentation in LPD reservoir will continue, a sediment management program could be implemented as a stand-alone alternative that utilizes dredging or other removal method to maintain the current reservoir capacity. Or, as indicated in the RFP, sediment management will be described as part of the other alternatives that maintain LPD in place. While it is expected that dredging or mechanical excavation are the likely feasible alternatives for managing sediments, our 2013 evaluation of feasible sediment management techniques will be re-visited, considered, and adapted for each alternative that may have unique requirements and challenges for sediment management. For example, a dam raise or replacement could inundate areas that were previously considered feasible for sediment disposal, which would require identification of new sediment disposal areas that may impact the overall feasibility of a dam raise alternative.

Further, as part of the evaluation and description for all alternatives, we will prepare initial, qualitative descriptions of the range of potential effects of each alternative on the geomorphic behavior of the downstream channel. Specific issues that will be addressed include:

1. Anticipated short- and long-term changes in the overall sediment balance in both the canyon-bound, upper reach of the Carmel River downstream from LPD and the alluvial, lower reach,
2. Anticipated changes in the riparian vegetation, if any, associated with the various water management alternatives,
3. Potential effects of the above changes on vertical and lateral stability of the river channel,
4. Potential effects of the above changes on the flood carrying capacity of the lower river, particularly in the alluvial, lower reach where flood capacity is already limited, and
5. Likely changes in the bed material gradations, particularly as they could impact instream habitat and fish passage.

Deliverables: Alternatives Description Technical Memorandum, includes conceptual drawings and figures (approx. 2-3 figures per alternative)

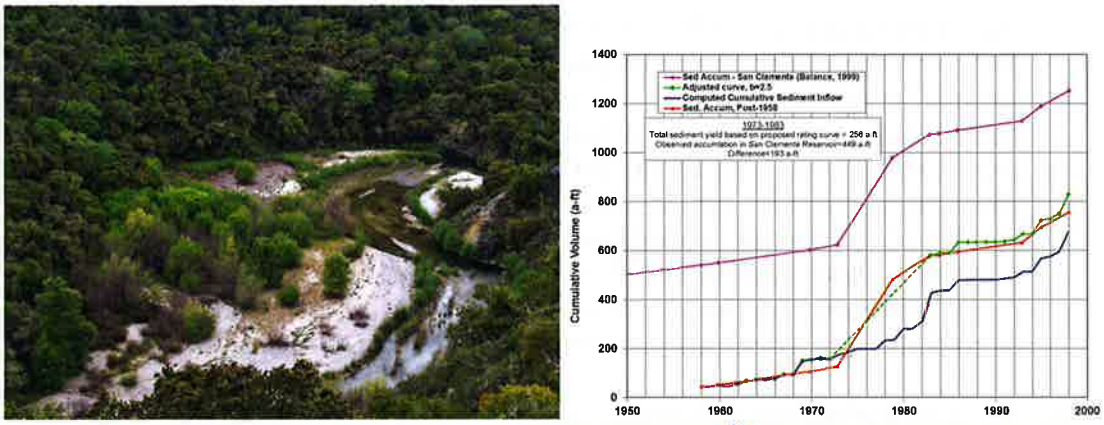
Task 2-3 Evaluate Geomorphic Effects of Changes in Sediment Load

Following development of the qualitative descriptions of potential effects from Task 2-2, we will quantify the effects at a sufficient level of detail to facilitate comparison of the alternatives. The analyses will include at least the following:

1. Development of a bed material (i.e., sand and coarser) sediment supply rating curve for the inflows to LPD. This curve will be developed based on the historic sediment storage in the reservoir and the bulk gradation of the reservoir deposits that will be determined from the sampling program to be completed under Task 2-1. The trap efficiency of Los Padres Reservoir will be considered in the analysis; however, it is believed that the vast majority of the sand and coarser load that has been delivered from the upstream watershed since closure of the dam is currently stored in the reservoir. A similar approach was used to develop the inflowing sediment load rating curve for San Clemente Reservoir for the dam removal planning studies [Mussetter Engineering, Inc. (MEI), 2003]. MWH (2013) estimated that the rate of sediment deposition in Los Padres Reservoir over the 69-year period between closure of LPD in 1949 and the 2008 bathymetric surveys was about 21 ac-ft/yr, including episodic events such as the intense period of rainfall after the 1977 Marble Cone Fire. For comparison, MEI (2005) estimated that the sediment supply to San Clemente

Reservoir between the late-1940s and early-2000s was about 17.5 ac-ft/yr including episodic input such as the Marble Cone fire and the Dormody landslide, and about 16.5 ac-ft/yr in the absence of those inputs. Accordingly, sensitivity evaluation of the deposition rate will be incorporated into bed material supply analyses.

Data from the reservoir sediment characterization that was conducted for MEI (2003) indicated that about 65 percent of the material deposited in the Carmel Branch of San Clemente Reservoir was sand, about 22 percent was gravel and cobbles and 13 percent was silt and clay. The gradation of the material in Los Padres Reservoir is likely similar (but will be verified through the Task 2-1 sediment characterization study); thus, the bulk of the supply is in the sand and finer size-ranges, release of which is not necessarily favorable for instream fisheries habitat. The results of this task will represent the natural (i.e., unimpaired) sediment supply to the reach downstream from LPD.



Reservoir deposits at head of San Clemente Reservoir (April 9, 2001) and sediment accumulation in San Clemente Reservoir (1950-1999) used as part of basis for sediment supply rating curve.

2. Estimates of the portion of the natural sediment supply that will pass into the downstream reach, including both the volume and gradation, for each of the alternatives. Under the No Action alternative, the sediment supply to the downstream reach will be similar to the historic supply, at least under near-term conditions. If no action is taken to remove sediment from the reservoir, the trap efficiency will eventually decrease, with an increasing quantity of primarily sand and finer material passing through the reservoir. Delivery of significant quantities of gravel- and cobble-sized material through the reservoir is unlikely without direct mechanical intervention, even under the extreme condition in which the reservoir is essentially full of sediment.
   Under the Dam Removal alternative(s), the near-term sediment supply to the downstream river will likely be elevated above the natural supply due to erosion of the residual reservoir deposits. The magnitude of this supply will, of course, depend on the extent to which the existing deposits are removed and/or stabilized in conjunction with removing the dam. Over the long-term, the downstream supply should approach natural conditions. The effects of the Dredging, Reservoir Expansion, and Sediment Management alternatives on the near- and long-term sediment supply to the downstream reach will range from essentially no change from existing conditions to effects similar to the Dam Removal alternative, depending on how each alternative is implemented, including changes to the storage capacity of the reservoir and the disposition of sediment removed from the reservoir. Quantification of the volume, timing and gradation of the altered sediment

supply will be critical to evaluating the relative effects of these alternatives on downstream channel behavior, including both aggradation/degradation response and instream habitat.

3. Incipient motion calculations to quantify the range of discharges over which the existing bed material in key portions of the Los Padres to San Clemente Reservoir reach is being mobilized. Knowledge of the frequency and duration of bed mobilizing flows is key to understanding both channel stability and instream habitat dynamics.

4. Transport capacity calculations for the reach between Los Padres Reservoir and the head of the former San Clemente Reservoir using appropriate relationships for the existing, coarse-grained material (most likely either Parker, 1990 or Wilcock-Crowe, 2003 for the bed load, coupled with the Einstein procedure for quantifying suspended bed material load). These calculations will provide a basis for determining the likely bed response (both aggradation/degradation and changes in bed material characteristics) for those alternatives that would significantly alter the downstream sediment supply. Given the coarse-grained nature of the bed material, this portion of the river is probably strongly supply-limited in at least the sand and finer size-ranges; thus, the transport capacity relationships will provide estimates of the potential amount that could be moved by the river assuming an unlimited supply, and this is likely an order of magnitude or more higher than the actual supply, even if the dam were to be removed. The extent to which individual subreaches of the LPD to San Clemente Reservoir reach is supply-limited or hydraulically-controlled with respect to spawning-sized gravel is a function of the local hydraulic conditions and bed material gradations. Similar relationships are available, or can be developed from the available information, for the portion of the reach downstream from the head of the former San Clemente Reservoir.

5. Continuity and bed material evolution analysis on a subreach-basis [minimum of four subreaches: LPD to head of former San Clemente Reservoir, San Clemente Reservoir to Camp Stephani, Camp Stephani to the Narrows (RM 9.8), and the Narrows to the coast]. This analysis will consist of a comparison of the upstream supply for each alternative with the transport capacity within each subreach to assess how the overall sediment balance would change. Because of the supply-limited nature of most of the reach, it is not anticipated that changes in the sediment supply will have a significant effect on the overall stability of the channel; however, increases in the both the sand and gravel supply under some alternatives could alter the gradation of the bed material, particularly on gravel bars that are key instream (primarily spawning) habitat. The bed load transport relationships will be used to assess how the bed gradations are likely to change and the potential implication to spawning gravel quality under these conditions. The analytical techniques and results from this task can also be used to inform sediment disposal options for alternatives that involve mechanical removal and downstream placement of sediment to restore the sediment supply in an effort to correct the sediment imbalance and improve instream habitat. The suspended sediment estimates for each alternative can also be used to assess the potential

deleterious effects of increased suspended sediment loads on native fish using criteria specified by the fishery biologists (e.g., Newcombe and Jensen, 1996).

6. Channel geometry and flood elevation analyses to estimate the potential effects of the alternatives on channel capacity and stability. In general, unless an alternative involves release of a large sediment pulse, such as would occur if the dam is removed without moving or stabilizing the stored sediment, downstream impacts to overall channel stability and channel capacity are likely to be relatively subtle. Nonetheless, it will be important to critically evaluate any potential effects to insure that unintended consequences do not occur. The analysis will primarily focus on the portions of the reach where even modest decreases in flood capacity could impact developed properties (i.e., downstream from Camp Stephani). Because detailed modeling is not envisioned for this analysis, locations where channel aggradation could be significant will be identified and the implications of such aggradation qualitatively evaluated based on the likely magnitude of the aggradation on channel capacity.

Deliverables: Technical Memorandum summarizing the methods, assumptions and findings from the analysis, and includes appropriate graphics and drawings to illustrate the key features of each of the alternatives that was evaluated.

Incision at in the Upper Carmel Reach of the CRRDR project.

Task 3 Evaluate Effects on Steelhead

The overall technical team will coordinate closely with our fishery biologists' scope regarding potential effects of the alternatives on fish passage and instream habitat (i.e., spawning gravels and suspended sediment loads), based on results from Task 2. Cramer Fish Sciences (CFS) staff will analyze available information to assess how each alternative is likely to affect S-CCC steelhead and steelhead habitat. An important aspect of the Task 3 analysis will be to provide a quantitative accounting of tradeoffs between alternative in their net benefit to Carmel River S-CCC. For example, dam removal may improve access to upstream habitats, but could degrade the quality of habitats downstream due to sedimentation or warmer water temperatures. CFS work on Task 3 will provide objective, quantitative basis for prioritizing alternatives in terms of net benefits to S-CCC steelhead. This task will include an evaluation of the impact of changes in the water supply and sediment transport associated with alternative water supply options to be provided by MPWMD, including results from the climate change study being performed by the U.S. Geological Survey and Bureau of Reclamation, if available during the time-frame of this study.

Deliverables: Technical Memorandum that summarizes the effects to steelhead of varying water supply and sediment transport.

Task 4 Identify Feasible Alternatives

This task will summarize and expand upon the data gathering, conceptual evaluation, and alternative development efforts completed to this point. The goal during this task will be to work with the TRC to further evaluate and rank alternatives via a series of workshops and a "break-out" in between to consolidate the input received. The MWH team key staff will participate in each meeting and provide input into the alternatives development, as well as provide staff support for meeting records and summarization.

Task 4-1 TRC Meeting #2

Utilizing the evaluation criteria developed during the first TRC meeting, the second meeting will review the draft evaluation matrix of alternatives submitted prior to the workshop, resulting in selection, elimination, and identification of additional analysis or development needs. The agenda outline and protocols defined in the RFP will be followed. Similar to the first workshop, this meeting is expected to be interactive and require at least ½ day for the summarization and discussion efforts.

Deliverables: Draft Evaluation Matrix of Alternatives; Workshop Agenda; and Meeting Report summarizing the selection and elimination of alternatives, conclusions, and additional analysis recommendations, as well as meeting notes

Task 4-2 Alternative Development

Task 4-3 Meeting #3

This third TRC meeting will be a continuation of the discussions held at the prior meeting, where the additional analysis and development of alternatives or criteria will first be presented along with an updated evaluation matrix. The meeting outline and protocols defined in the RFP will be followed. The meeting objective will be to reach consensus on a final list of alternatives.

Deliverables: Draft and Final Meeting Summary with content as defined in the RFP

Task 5 Final Report

This task will summarize the information developed throughout the alternatives evaluation process, develop AACEI level 5 cost estimates for alternatives that have not been eliminated, provides a final evaluation and ranking of alternatives, and presents conclusions and recommendations for further action.

Task 5-1 Prepare Draft and Final Report

It is understood that a draft outline for the final report will be developed for TRC review, where the sample outline in the RFP is provided as a guide to be developed further as information gathered during the evaluation process is incorporated. While it is not anticipated given that TRC meeting #3 will have occurred prior to development of the final report, our team will meet with the TRC or with individual commenters prior to finalization of alternatives and before the Final Report is issued. Budget is reserved for one additional meeting prior to issuance of the Final Report. Overall, the guidance for completion of the Final Report provided in the RFP will be followed.

Deliverables: Draft and Final Report

Task 6 Project Management

As defined in the RFP, this task will consist of the standard project management tasks, including scheduling, budget tracking, invoicing, progress reporting, and general project communications including agency staff. The progress reporting and invoicing effort will follow the requirements in the RFP. This task reserves budget for up to four meetings in-person by the Project Manager and up to two staff: 1) Kickoff meeting; 2) Review of proposed operations in the field; 3) Up to two meetings with regulatory agencies. Additional meetings may be held as requested where budget is available or appropriate budget adjustments or increases provided.

Deliverables: Invoices; progress reports; electronic copies of communications (i.e., email or memoranda) among agencies and consultants (if/where appropriate); meeting minutes.

OPTIONAL TASKS

Task 7 - Field Survey

In order to fill the lack of topographic and cross section data in the reach between Los Padres Dam and the former San Clemente Dam site, we propose that a limited survey to obtain representative cross sections is performed by surveyors. This task will allow for estimation of the geomorphology along this reach during the initial alternatives evaluation, as well as provide credible data for future hydraulic modeling and sediment transport evaluations. We have reserved a budget of $10,000 for a surveying firm to conduct cross section surveys, which will be refined upon discussion and approval by the District.

Deliverables: Cross section survey data

CONFIRMATION STATEMENT

Our proposal is inclusive of all elements necessary to complete all goals, tasks, and project deliverables within 18 months of the execution of the Agreement, per the Addenda No. 1 to the RFP dated 12/27/16.

Vik Iso-Ahola

Vik Iso-Ahola
Project Manager

SECTION 7 – PRICING AND SCHEDULE

PROJECT BUDGET

MWH proposes to complete the work for the amount shown on the attached table and billing rates to be billed monthly based on progress at hourly rates. Our budget is based on the requirements stated in the RFP and the details and assumptions provided within this proposal. Our budget includes $165,000 for driller mobilization and sampling, and a total of approximately $273,000 for the sampling Task 2-1. This effort will be refined with MPWMD as goals for the sampling program is discussed. TRC meetings are assumed to be approximately 1/2 day in duration and include MWH PM and 4 other staff in attendance in person. In general, our stated deliverables and number of meetings provide the basis for our effort, where added revisions or iterations are not budgeted unless specifically indicated for "draft" and "final" submission (i.e., finalization of memoranda after receipt of substantial comments where no "draft" and "final" versions are indicated will incur additional effort that is not budgeted). Understanding that project requirements change, we will remain flexible and regularly discuss our budget with the District, making adjustments as necessary and where possible to meet the project's goals.

SCHEDULE

Our schedule provided at the end of this section is based on the assumptions herein and the draft schedule proposed in the RFP. Given the duration required to gather and develop the project background information, including the field sampling in the reservoir which is dependent on unknown permitting durations and requirements, we propose to complete the project within 18 months from execution of the agreement. Our schedule in fact shows about a 15 month duration, but this may extend depending on the investigation duration (e.g., permitting issues), TRC requirements for additional study, general scheduling conflicts/issues for meetings, etc. As the project develops, we will remain flexible with our schedule and revise as necessary as information is made available and requirements updated. In order to allow for sufficient time to complete the initial data gathering, criteria development, and field sampling, our first TRC meeting is proposed for early June 2017. Upon completion of the first phase of work and TRC meeting, the remaining schedule and level of effort will be clarified and our schedule updated accordingly. In general, we would expect the last two TRC meetings to occur in the second half of 2017 and the Final Report completed in early 2018.

CONFIRMATION STATEMENT

Our proposal is inclusive of all elements necessary to complete all goals, tasks, and project deliverables within 18 months of the execution of the Agreement, per the Addenda No. 1 to the RFP dated 12/27/16.

Vik Iso-Ahola

Vik Iso-Ahola
Project Manager

2017 HOURLY RATE SCHEDULE

The basis of payment will be the CONSULTANT's rate schedule as set forth below. The rates provided below shall be in effect from January 1, 2017 to December 31, 2017. Rates will be escalated January 1 of each year utilizing CPI or other agreed upon index.

Hourly Personnel Charges

TECHNICAL/ADMINISTRATIVE STAFF	Hourly Rate
Junior Technician or Drafter	$ 111
Technician or Drafter	126
Designer	142
Clerk Typist/Data Processor	95
Project Administrator	101
PROFESSIONAL STAFF (Engineer, Geologist, Scientist, etc.)	
Assistant Professional (Intern)	$113
Associate Professional	127
Professional	137
Senior Professional I	149
Senior Professional II	170
Supervising Professional I	184
Supervising Professional II	204
Principal Professional I	237
Principal Professional II	268
Senior Company Officer	319

All personnel time involving expert or witness testimony, or other participation in a judicial proceeding involving the Client, as requested by Client, or compelled by subpoena or otherwise, during or after completion of the scope of services, will be charged at 1.5 times the hourly rates stated herein. Compilation of data and documents, review and preparation time will be charged at the normal hourly rates in effect at time such services are rendered.

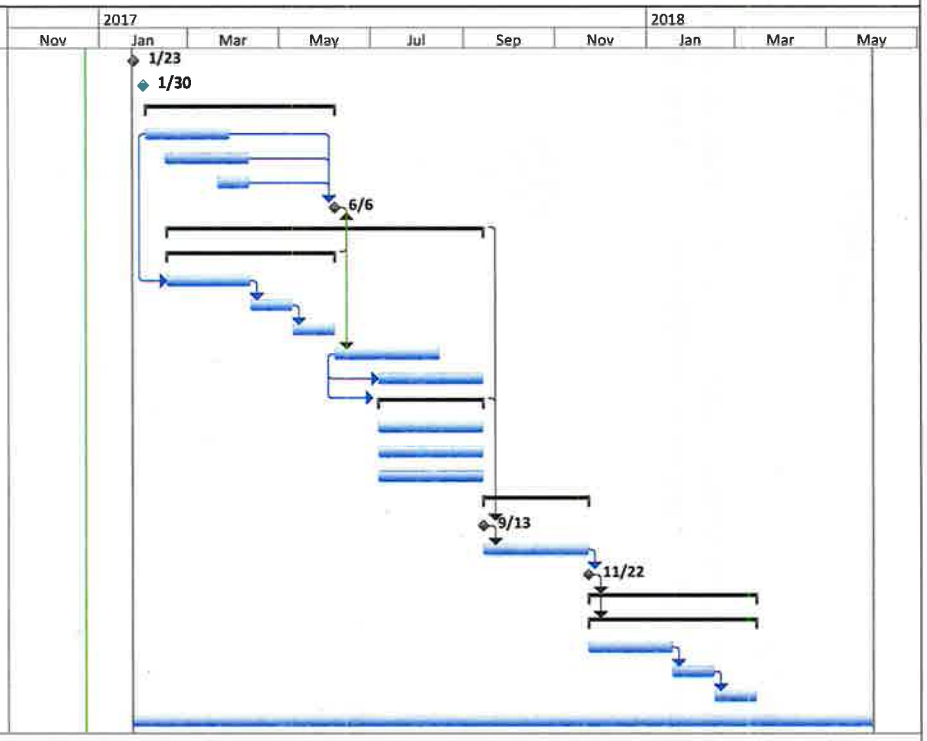
Charges for contract personnel using Stantec facilities will be made according to the hourly rate corresponding to their classification. Special project accounting report and financial services, including submission of invoice support documentation, which are not normally provided to Client, will be charged at the rate of $60 per hour.

Expenses

1. Project related expenses are charged at cost plus 10 percent.
2. Project subcontracts are charged at cost plus 10 percent.
3. Other expenses directly identifiable to the project, including but not limited to the following examples, will be charged at cost plus 10 percent: equipment or sample shipping; special supplies (drafting and printing, photos, reference materials, expendable materials such as containers and chemicals); personal expenses (such as travel, personal vehicle mileage, subsistence and vehicle rental costs incurred on project activities); outside report reproduction; and licenses, permits, insurance, special fees, etc.
4. Field or specially equipped vehicles are charged at an hourly rate of $12.00.
5. Associated Project Costs (including general computer equipment, word processing equipment and software, telephone, telex, facsimile, general photocopying, and postage) will be charged at $11.50 per labor hour.
6. When required, per diem will be charged at the prevailing geographic rate.
7. Use of computer and Computer Aided Drafting/Design (CADD), Geographic Information Systems (GIS), and similar specialty modeling and computer applications for engineering and scientific analyses will be charged at $18.00 per hour.

Los Padres Dam and Reservoir Alternatives and Sediment Management Study - Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	Notice to Proceed	1 day	Mon 1/23/17	Mon 1/23/17	
2	Kickoff Meeting	1 day	Mon 1/30/17	Mon 1/30/17	
3	**1.0 Feasibility Study Preparation**	**90 days**	**Wed 2/1/17**	**Tue 6/6/17**	
4	1.1 Compile Background Information	2 mons	Wed 2/1/17	Tue 3/28/17	
5	1.2 Prepare Evaluation Criteria	2 mons	Tue 2/14/17	Mon 4/10/17	
6	1.3 Identify Critical Data Gaps	3 wks	Tue 3/21/17	Mon 4/10/17	
7	1.4 TRC Meeting 1	0 days	Tue 6/6/17	Tue 6/6/17	4,5,6,9
8	**2.0 Sediment Management Options**	**151 days**	**Wed 2/15/17**	**Wed 9/13/17**	
9	**2.1 Obtain Reservoir Sediment Samples**	**80 days**	**Wed 2/15/17**	**Tue 6/6/17**	
10	2.1.1 Permitting/Work Plan	2 mons	Wed 2/15/17	Tue 4/11/17	4SS+10 days
11	2.1.2 Investigation	1 mon	Wed 4/12/17	Tue 5/9/17	10
12	2.1.3 Lab Testing & Report	1 mon	Wed 5/10/17	Tue 6/6/17	11
13	2.2 Describe Alternatives	2.5 mons	Wed 6/7/17	Tue 8/15/17	7
14	2.3 Evaluate Geomorphic Effects of Changes in Sediment Load	2.5 mons	Thu 7/6/17	Wed 9/13/17	13SS+21 days
15	**3.0 Evaluate Effects on Steelhead**	**50 days**	**Thu 7/6/17**	**Wed 9/13/17**	**13SS+21 days**
16	3.1 Increased Sediment Transport	2.5 mons	Thu 7/6/17	Wed 9/13/17	
17	3.2 No Increase in Sediment Transport	2.5 mons	Thu 7/6/17	Wed 9/13/17	
18	3.3 Incorporate Data from Alternative Water Supply Options	2.5 mons	Thu 7/6/17	Wed 9/13/17	
19	**4.0 Identify Feasible Alternatives**	**50 days**	**Wed 9/13/17**	**Wed 11/22/17**	
20	4.1 TRC Meeting 2	0 days	Wed 9/13/17	Wed 9/13/17	8,15
21	4.2 Alternative Development	2.5 mons	Thu 9/14/17	Wed 11/22/17	20
22	4.3 Meeting 3	0 days	Wed 11/22/17	Wed 11/22/17	21
23	**5.0 Final Report**	**80 days**	**Thu 11/23/17**	**Wed 3/14/18**	**22**
24	**5.1 Prepare Draft and Final Report**	**80 days**	**Thu 11/23/17**	**Wed 3/14/18**	**22**
25	5.1.1 Draft Report	2 mons	Thu 11/23/17	Wed 1/17/18	
26	5.1.2 TRC Review	1 mon	Thu 1/18/18	Wed 2/14/18	25
27	5.1.3 Final Report	1 mon	Thu 2/15/18	Wed 3/14/18	26
28	**6.0 Project Management**	**354 days**	**Mon 1/23/17**	**Thu 5/31/18**	



Project: LPD Schedule
Date: Fri 12/23/16

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	Manual Progress
Summary	Inactive Task	Duration-only	Finish-only	

Los Padres Dam and Reservoir Alternatives and Sediment Management Study - Cost Estimate

	Senior Company Officer	Principal Professional III	Principal Professional I	Supervising Professional II	Supervising Professional I	Senior Professional II	Senior Professional I	Designer	Professional	Associate Professional	Technician or Drafter	Assistant Professional (Intern)	Junior Technician or Drafter	Project Administrator	Clerk Typist/Data Processor	Labor Cost	Subcontractor (TT)	Subcontractor (CFS)	Subcontractor (Drilling)	Subcontractor (Lab Testing)	Direct Costs	Total by Task
	$319	$268	$237	$204	$184	$170	$149	$142	$137	$127	$126	$113	$111	$101	$95							
1.0 Feasibility Study Preparation																						
1.1 Compile Background Information		7	14		6				24							$9,586	$21,039	$1,130				$31,755
1.2 Prepare Evaluation Criteria		25	18	4	18				32							$19,478	$4,037	$1,930			$330	$25,775
1.3 Identify Critical Data Gaps		4	6		4				18							$5,696	$1,914	$1,130				$8,740
1.4 TRC Meeting 1		24	16		8	4			16					2		$14,770	$8,106	$2,565			$825	$26,266
Subtotal Task 1	**0**	**60**	**54**	**4**	**36**	**4**	**0**	**0**	**90**	**0**	**0**	**0**	**0**	**2**	**0**	**$49,530**	**$35,096**	**$6,755**	**$0**	**$0**	**$1,155**	**$92,535**
2.0 Sediment Management Options																						
2.1 Obtain Reservoir Sediment Samples																						
2.1.1 Permitting		7	24						36							$12,496						$12,496
2.1.2 Investigation		8	40	8					244							$46,684			$165,000		$3,850	$215,534
2.1.3 Lab Testing & Report		14	56						104							$31,272	$620			$11,000	$550	$43,442
2.2 Describe Alternatives		17	36	4	22	8			48				40			$30,328	$7,986	$565				$38,879
2.3 Evaluate Geomorphic Effects of Changes in Sediment Load		4	6		4	16										$5,950	$41,589	$2,965				$50,504
Subtotal Task 2	**0**	**50**	**162**	**12**	**26**	**24**	**0**	**0**	**432**	**0**	**0**	**0**	**40**	**0**	**0**	**$126,730**	**$50,195**	**$3,530**	**$165,000**	**$11,000**	**$4,400**	**$360,855**
3.0 Evaluate Effects on Steelhead																						
3.1 Increased Sediment Transport		4	5		6											$3,361	$4,114	$8,650				$16,125
3.2 No Increase in Sediment Transport		4	5		6											$3,361	$4,114	$8,650				$16,125
3.3 Incorporate Data from Alternative Water Supply Options		4	5		6											$3,361	$21,696	$8,650				$33,707
Subtotal Task 3	**0**	**12**	**15**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$10,083**	**$29,924**	**$25,949**	**$0**	**$0**	**$0**	**$65,957**
4.0 Identify Feasible Alternatives																						
4.1 TRC Meeting 2		28			4				24					2		$11,730	$3,155	$2,895			$825	$18,605
4.2 Alternative Development		33	23	8	28	8			88				40			$38,935	$3,828	$2,095				$44,858
4.3 Meeting 3		40			4				40					2		$17,138	$3,155	$2,895			$825	$24,013
Subtotal Task 4	**0**	**101**	**23**	**8**	**36**	**8**	**0**	**0**	**152**	**0**	**0**	**0**	**40**	**4**	**0**	**$67,803**	**$10,138**	**$7,885**	**$0**	**$0**	**$1,650**	**$87,475**
5.0 Final Report																						
5.1 Prepare Draft and Final Report		44	200	8	84	16			132				80			$105,964	$14,969	$6,780			$550	$128,263
Subtotal Task 5	**0**	**44**	**200**	**8**	**84**	**16**	**0**	**0**	**132**	**0**	**0**	**0**	**80**	**0**	**0**	**$105,964**	**$14,969**	**$6,780**	**$0**	**$0**	**$550**	**$128,263**
6.0 Project Management		160			56									100		$63,284						$63,284
Subtotal Task 6	**0**	**160**	**0**	**0**	**56**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**0**	**$63,284**	**$0**	**$0**	**$0**	**$0**	**$0**	**$63,284**
TOTAL HOURS (2,233)	**0**	**427**	**454**	**32**	**256**	**52**	**0**	**0**	**806**	**0**	**0**	**0**	**160**	**106**	**0**							
TOTAL COST	**$0**	**$114,436**	**$107,598**	**$6,528**	**$47,104**	**$8,840**	**$0**	**$0**	**$110,422**	**$0**	**$0**	**$0**	**$17,760**	**$10,706**	**$0**	**$423,394**	**$140,322**	**$50,899**	**$165,000**	**$11,000**	**$7,755**	**$798,369**

7.0 Optional Task	**$11,000**

SECTION 8 - EXCEPTIONS

MWH requests the consideration of the proposed revisions to the MPMWD, Agreement for the execution of this work. In accordance with the RFP our Exceptions will be included on the following pages.

Changes to the Sample Agreement included in the RFP beginning on Page 62 of 71.

1. In Section II.B second paragraph, strike the first sentence.

2. Strike all of Section II.D

3. In Section V strike "and late performance shall result in a waiver of part of the fees payable to pursuant to the terms of this Agreement."

4. In Section VI.F replace "who may be" with "to the extent" and strike the note at the end of the section.

MWH requests that the following four provisions be added to the Agreement based on the nature of the work included under the Agreement:

A. MPWMD shall furnish to Consultant all applicable information and technical data in MPWMD's possession or control reasonably required for the proper performance of the Services. Consultant shall be entitled to reasonably rely upon the information and data provided by MPWMD or obtained from generally acceptable sources within the industry without independent verification except to the extent such verification is expressly included in the Services.

B. The standard of care applicable to Consultant's Services will be the degree of skill and diligence normally employed by professional consultants performing the same or similar services at the time and location said Services are performed.

C. Consultant's opinions, recommendations and assessments are limited by a) the accuracy and completeness of information upon which it may reasonably rely, b) schedule constraints or scope limitations, c) unknown or variable site or other conditions, d) other factors beyond Consultant's control. Any estimates as to construction costs are limited by a lack of control over financial and/or market conditions, including the future price of labor, materials, and prospective bidding environments and procedures. Consultant does not warrant or guarantee the accuracy or completeness of its Services to the extent impacted by these limitations and MPWMD should limit its reliance on the Services in like manner.

D. To the fullest extent permitted by law, the Parties agree to limit the aggregate liability of Consultant to the amount of fees paid to them under the Agreement. In no event shall either party be liable for any indirect, incidental, special or consequential damages whatsoever (including but not limited to lost profits or interruption of business).

SECTION 9 - APPENDIX

PROJECT TEAM RESUMES

Team Resumes are presented in the following order:

PROJECT MANAGER & DSOD COORDINATOR

Vik Iso-Ahola, PE, PMP – Project Manager and DSOD Coordinator

RESERVOIR OPERATIONS / HYDRAULICS

Eric Clyde, PE, WRE, *Reservoir Operations/Hydraulics*

FISHERIES

Michael Beakes, PhD - Cramer Fish Sciences

GEOMORPHOLOGY

Bob Mussetter, PhD, PE – TetraTech

HEALTH & SAFETY

Stephen Young, *Health & Safety*

TECHNICAL REVIEWERS

Peter Dickson, PhD, PG, *Geotechnical/Geology*
John Haapala, PE, *Hydraulics*
Michael Chelminski, PE, *Geomorphology* - Stantec
Dennis Dorratcague, *Fish Passages*

SUPPORTING RESOURCES

Engineering

Nelson Kawamura, PhD, PE, GE, *Geotechnical Engineering*
Martina Gelo, PE, *Civil Engineering*
Connie Wong, PE, *Civil Engineering*
Mohammadreza Mostafa, PhD, PE, *Structural Design*
Scott D. Peyton, PE, *Stream Restoration* - Stantec
Mike Vukman, *Stream Restoration* – Stantec

Environmental

Meredith Parkin, JD, PMP, *Environmental*

Fisheries

Stephanie Theis, *Fisheries Biologist*
Joseph Merz, Ph.D. – *Fish Biologist* – Cramer Fish Sciences

Fish Passage

Clint Smith, PE, *Fish Passage*

Cost Estimating

James Loucks, CCP, PMP, *Cost Estimating*

Geomorphology/Sediment Transport

Stuart C. Trabant, PE, *Sediment-Transport* - TetraTech
Michael F. Adams, Jr. PE, *Geomorphology/Sediment Transport* - Stantec

Geology

Jim Herbert, PG, CEG, *Geologist*
Jennifer Van Pelt, PG, *Field Investigation*

Vik Iso-Ahola, PE, PMP

Project Manager – DSOD Coordinator

EDUCATION

MBA, Finance and Accounting, University of California at Davis

BS, Civil Engineering, University of Maryland

LICENSES/ REGISTRATIONS

Professional Engineer – Civil: California No. 62772

Certified Project Management Professional, Project Management Institute

In 19 years of professional experience, Mr. Iso-Ahola has developed a range of capabilities in water-resources and dam projects involving geotechnical, civil, structural, and construction engineering & planning. He is adept at leading large multi-disciplinary teams to deliver complex engineering designs and has led project teams in all phases, including field investigations, inspections and studies of facilities, in-depth stability analyses, preparation of plans and specifications, scheduling, cost estimating, and design report preparation. Mr. Iso-Ahola's project experience includes rehabilitation and design for dams and spillways, including managing multiple disciplines for gate structures, outlet works, valve and electrical rehabilitation design, slope stability analyses; hydraulic modeling; foundation grouting; three dimensional finite element analyses; groundwater seepage modeling; seismic analyses; logging, sampling, field testing; and laboratory testing of soils, rock, grout, and concrete. He has published papers on spillway modification, dam removal issues, concrete thermal analysis, liquefaction evaluation, dam rehabilitation, and structural design optimization for dam raising and dam retrofit using FEM analysis.

Relevant Project Experience

Los Padres Dam Sediment Removal Feasibility Study, ***California America Water Company***
Project Manager for the initial conceptual assessment and feasibility evaluation of sediment removal at Los Padres Dam and Reservoir. The objective of the study was to facilitate the long-term planning for management of the reservoir and sediments. The scope of work for the study included assessment of existing reservoir conditions and data; conceptual evaluation of methods for reservoir sediment removal, transport and disposal; identification of potential commercial use and preliminary selection of disposal sites for the removed sediment; identification of potential environmental issues and permitting requirements for removal and disposal of the sediment; description and cost estimate for three conceptual alternatives based on feasible methods removal, transportation and disposal of the sediment.

Los Padres Dam Spillway Capacity Study, ***California America Water Company***
Project Manager for an independent three dimensional (3D) Computational Fluid Dynamics (CFD) analysis for the Los Padres Dam Spillway located on the Carmel River in Monterey County, California. The CFD was performed on the existing spillway and reservoir. MWH's study results allowed Cal-Am to negotiate a delay to necessary spillway changes with **DSOD** and revisit the use of the fish collector, saving Cal-Am substantial unbudgeted expenditure.

San Clemente Dam Removal Study, *California America Water Company*
Project Manager for the dam removal/modification feasibility study and EIR/EIS engineering support of San Clemente Dam, a 100-foot-high concrete arch dam. Project involved feasibility of dam strengthening, dam removal, sediment removal and disposal concepts (slurry, conveyor, and trucking), including preparation of conceptual plans and drawings, cost estimating, scheduling, and description of alternatives report preparation. The scope of feasibility study involved identifying problems, constraints, and formulating the dam/sediment removal and dam strengthening alternatives, including performing seepage and slope stability analyses to evaluate feasibility of conceptual design components. The feasibility report established qualitative and quantitative benefits of each alternative and cost estimates to implement each alternative. Cost estimating for each alternative included inventorying, forecasting, analyzing future project conditions (e.g., operating costs, escalation, etc.) and conducting comparative cost analyses. The effort also included engineering support for the project draft and final environmental impact review/statement (EIR/EIS).

Carmel River Re-Route and Dam Removal Basis of Design, San Clemente Dam, *California State Coastal Conservancy*
Project Manager for development of the initial basis of design for the Carmel River Re-route and Removal (CRRDR) of San Clemente Dam, a 100-foot-high concrete arch dam. The basis of design document was developed to

establish criteria to be utilized in the CRRDR design effort, and included a geotechnical investigation and analysis of the bypass cut between the Carmel River and San Clemente Creek.

Englebright Dam Removal Studies, *Yuba Salmon Forum/Yuba County Water Agency*
Lead engineer providing engineering assessment of dam removal or notching options for the Englebright Dam, including AACE Level 5 cost estimates. Mr. Iso-Ahola's role was to advise on engineering feasibility of alternatives, regulatory requirements for dam removal, and impacts of sediment disposal or discharge. Identified and defined critical parameters for dam removal and/or notching options (e.g., construction methodologies, max. fish ladder height, required downstream or upstream mitigations, sediment placement sites, etc.) Work culminated in a high level breakdown of each Dam Removal or Notching option, listing major construction work items, planning and design requirements, and regulatory requirements. Each item was evaluated in regard to additional study and overall information gathering that would be required during subsequent development phases of each option. Provided presentations of alternatives and cost estimates to the Yuba Salmon Forum which consisted of numerous stakeholders such as CA Dept. of Fish and Game, NOAA National Marine Fisheries Service, CA Regional Water Quality Control Board, and several NGOs.

L. L. Anderson Dam Spillway Modifications, ***Placer County Water Agency***
Project Manager for design modifications to the spillway of the 251-foot high rockfill dam. The spillway modification project required an upgrade to spillway capacity due to increased PMF. He managed initial studies, geotechnical investigation, physical model, and final design process for widening rock channel spillway. His team optimized rock slope stability and excavation design to eliminate benches in the granitic bedrock structure, saving approximately $900 K in excavation costs; used digital photogrammetry to map and evaluate the spillway channel rock slopes. Other design components included grout curtain design, hydraulic modeling (HEC-RAS HEC-1), 1:20 scale physical model, and structural, electrical, mechanical design of new radial gate structure. Design features included a nominal dam raise, new concrete parapet wall, and rock spoils disposal. Work included cost estimating using MCACES, and development of plans, specifications, and design report. The foundation design included consolidation grouting, rock bolts and anchors, shotcrete-reinforced rock fill bank protection, natural slope embankment protection, rock excavation and blasting, flow containment structures, and hydraulic energy dissipation steps and riprap. All work was reviewed and accepted by regulatory agencies including FERC, **DSOD**, USFS, USFW, USCOE, CDFG, SWRCB, and SHPO.

Big Tujunga Dam Stability Evaluation and Rehabilitation Design, *LA County Department of Public Works*
Project Manager and Engineer for stability evaluation and rehabilitation design of the Big Tujunga Dam, a 251-foot high concrete arch dam. Included a $1M geotechnical and geophysical investigation for siting of the new dam buttress foundation, new overtopping spillway, and replacement of all outlet valves with fixed cone, jet flow, butterfly, and ball valves. Performed seismic dynamic finite element analyses (3-D FEM) of the dam using ground motion records modified to match a target spectrum. Performed Rock Mass Rating and liquefaction evaluation utilizing the investigation results from the $1M geotechnical investigation. Involved in all stages of rehabilitation design, such as, estimating, mix design, general civil design, preliminary and detailed plans, structural design, permitting, project controls, scheduling, and CADD, which was reviewed and approved by **DSOD**. Project Manager for Engineering Services during Construction (ESDC), coordinating overall engineering support for the $100 million dollar construction project. The Big Tujunga Dam Seismic and Flood Rehabilitation Project was awarded the 2011 National Dam Rehabilitation Project of the Year by the ASDSO (Association of State Dam Safety Officials) and the U.S. Society of Dams (USSD) Award of Excellence – Constructed Project in 2012, which is an award presented to project designers for outstanding design and innovation in the dam industry.

Santa Anita Dam Spillway Modification Project, ***LA County Department of Public Works***
Project Manager for re-analysis of Santa Anita Dam, a 225-foot high concrete arch dam built in 1924-27. The primary issues of concern include Alkali-Silica Reaction (ASR) within the dam concrete, seismic stability to withstand the current Maximum Credible Earthquake (MCE), and hydraulic adequacy of the existing spillway to handle updated Probable Maximum Flood (PMF). Performed linear-elastic finite element analyses (3-D FEM) to assess the seismic stability of the dam and to develop rehabilitation concepts. Currently leading design for the preferred rehabilitation concept, which includes a stepped spillway notch, spillway extensions, and modified risers. The project rehabilitation design also includes valve replacement, helipad, generator building, shotcrete armoring, new lighting and electrical, remote operation and sensing of valves, CCTV, replacement cableway hoist, water system upgrade, and new bridge across notch cut into dam. All rehabilitation design work was reviewed and approved by **DSOD**.

San Vicente Dam Raise Structural Evaluation, *San Diego County Water Authority*
The San Vicente Dam (concrete gravity dam) was raised by 117 feet to about 337 feet high, creating an approximately 242,200 acre-foot reservoir. Project included design of raised dam, new spillway, modified intake tower, and new valves. Involved as senior structural engineer on team performing staged construction thermal and structural FEM analyses to predict concrete temperatures in the dam and to estimate the stress state along the interface of the existing concrete and the new RCC during and after construction, including under maximum credible earthquake (MCE) loading. The normal and shear stress at the interface of the existing concrete and new RCC were investigated at several stages of construction and after the dam has reached steady state temperatures.

Spaulding Dams No. 1, 2, & 3 FERC Part 12D Inspection, *PG&E*
Project Manager and FERC-approved Co-Independent Consultant for FERC 5-year Part 12 Inspection of the Spaulding Dams, which include a thick arch dam, concrete gravity dam with radial gates, and rockfill dam with concrete core. Also included inspection of two powerhouses and associated penstocks. Scope included site inspection, STID update, and development of the FERC Part 12 Inspection Report. Inspection required review of site geotech/geology, updated hydrology, structural stability, gates and valve condition, instrumentation performance and readings, and current seismic loading assumptions.

Olivenhain Dam, *San Diego County Water Authority*
Engineer for analysis review team for new $140M, 318-foot-high RCC dam that creates a 24,000-acre-foot reservoir, providing 90,100 acre-feet of emergency water storage. Performed 2-D finite element analyses to evaluate foundation shear feature, optimizing design of the dam foundation concrete shaping block used to bridge the foundation shear feature. The project received numerous awards including 2004 Outstanding Civil Engineering Project, 2004 Project of the Year, Environmental Category for project over $10M, 2004 Outstanding Engineering Project and the Charles Pankow Award.

Panama Canal Third Set of Locks Project, *Panama Canal Authority*
Lead for structural engineering services for 2-D FEM thermal analysis of 100+ feet high lock wall and lock head structures for the $3B Panama Canal expansion. Thermal analysis evaluated varied mix designs, where analysis results were used to optimize mass concrete placement temperatures and perform cracking evaluation using strain calculations. Utilized ACI 207 guidelines and finite element analysis to predict peak temperatures and potential for cracking.

Eric Clyde, PE, WRE

Reservoir Operations and Hydraulics Lead

Mr. Clyde is a Principal Engineer with over 39 years of experience in water resources engineering, storm drainage and flood control, reservoir operations modeling, computer modeling of hydrology, storm drainage, reservoir operations, and open channel hydraulics. He has supervised and participated in hydrologic and water resources projects throughout the United States. His computer modeling experience includes HEC-HMS, HEC-RAS, RESSIM, DSS, SWMM, InfoWorks, UNET, HEC-FDA, and many other hydraulic, and hydrologic programs. Mr. Clyde served on the Board of Directors of the Floodplain Management Association for 14 years, including 2 years as Chair, and is currently serving as Chair of the Professional Development Committee and as Senior Advisor to the Board.

EDUCATION

MS, Civil Engineering, Colorado State University, 1977

BS, Civil and Environmental Engineering, Utah State University, 1975

LICENSES/ REGISTRATIONS

Professional Engineer (Civil) in California, Virginia, and Texas

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers

Diplomate, Water Resources Engineer, American Academy of Water Resources Engineers

Floodplain Management Association – Past Chair

American Water Resources Association

Tau Beta Pi Engineering Honor Society

Relevant Project Experience

PG&E Dambreak Analysis and Mapping, Camanche Dam, 2016
Mr. Clyde was the project technical lead for the extension of the existing Upper and Lower Bear River and Salt Springs Dambreak Analyses and Inundation Mapping for the PG&E. This study extended the previous studies that developed theoretical dambreaks at the dams impounding Upper and Lower Bear River and Salt Springs lakes, which are power generation facilities for PG&E. The hydrographs from the previous HEC-RAS models were passed to a HEC-RAS 5.0 two-dimensional model of Camanche Reservoir, the downstream Mokelumne River, and the valley (nearly 600 square miles), including Lodi and Stockton, to determine the limits of inundation resulting from the potential breaching of Camanche Dam. Inundation mapping and other data were displayed using RAS Mapper and GIS software.

USACE Joint Base Elmendorf-Richardson (JBER) Upper South Fork Chester Creek Hydrology, AK, 2015
Mr. Clyde was the project technical lead for the JBER Upper South Fork Chester Creek Hydrology Study for the Alaska District of the U.S. Army Corps of Engineers. This study developed HEC-HMS hydrologic models and HEC-RAS hydraulic models of the Upper South Fork of Chester Creek watershed using available LiDAR and GIS data to develop models that describe the current conditions including the quantity and distribution of surface water, geologic and topographic conditions, soil and vegetation characteristics, and other information pertinent to watershed hydrology. The models were then used to simulate the watershed with the addition of a proposed road from the Geronimo Drop Zone to the Bulldog Trail Road. Based on the results of the modeling, it was concluded that the new road would have less than significant impacts on downstream areas.

PG&E Dambreak Analysis and Mapping, Fordyce and Spaulding Dams, 2014
Mr. Clyde was the project technical lead for the Fordyce and Spaulding Dambreak Analysis and Inundation Mapping for PG&E, which developed theoretical dambreaks at the dams impounding Fordyce and Spaulding lakes. An HEC-RAS hydraulic model of the dams and downstream channels of Fordyce Creek and the South Yuba and Yuba rivers simulated the sequential dambreaks and routed the flows through Englebright Reservoir and down the Yuba River. The hydrographs from the HEC-RAS model were passed to a FLO-2D two-dimensional model of the valley, including Marysville and Yuba City, to determine the limits of inundation resulting from the dambreaks. Inundation mapping and other data were be displayed using GIS software.

USACE Joint Base Elmendorf-Richardson Floodplain Mapping, AK, 2014
Mr. Clyde was the project technical lead for the JBER Floodplain Mapping for the Alaska District of the U.S. Army Corps of Engineers. This study developed HEC-RAS hydraulic models of the portions of Eagle River and Ship Creek that flow through JBER. LiDAR data collected by JBER in 2009 was used to define the floodplain areas, and field surveys were made at each of the bridges crossing Eagle River and Ship Creek to define the stream channels. Based on the results of the HEC-RAS modeling, mapping showing the 100-year floodplains for Eagle River and Ship Creek was developed using ArcGIS.

California DWR, Central Valley Flood Management Planning Program (CVFMP), CA, 2013
Mr. Clyde managed multiple tasks in the CVFMP for DWR. The tasks included: the State Plan of Flood Control (SPFC) Descriptive Document, program management and support services, and Supporting Technical Analyses. He was the technical lead for the CVFPP, and as such lead the hydrologic and hydraulic evaluations, including reservoir operations, flow and stage modeling for all major rivers and tributaries (more than 700 rivermiles), Paradise Cut Bypass assessment, economic modeling, life safety analysis, and development of levee performance curves. He was instrumental in development of the CVFPP and technical attachments for approval in June 2012.

Oroville Dam River Valve Outlet System (RVOS) Rehabilitation and Operation for California Department of Water Resources, CA, 2015
Mr. Clyde was the Project Technical Lead for the development of three Technical Memoranda for DWR on Rehabilitation and Operation of the RVOS at Oroville Dam. The RVOS is the low-level outlet for Oroville Dam and was in need of rehabilitation after an operational incident in 2009. TM-9 provided Hydraulic Modeling Results and 2014 Drought Emergency RVOS Operation Considerations that allowed DWR to get approval from Division of Safety of Dams and OSHA to operate the RVOS for the 2014 Drought Emergency. TM-10 documented the 2014 RVOS Validation Testing and Operational Commissioning. TM-11, RVOS Capacity Restoration Re-Evaluation, looked at alternative modifications to the RVOS to allow operation at design discharges and recommended a preferred alternative for design and construction. TM-12 documented the 2016 RVOS Baffle Ring Testing and Operation Commissioning.

USACE and California DWR, Sacramento-San Joaquin River Basins Comprehensive Study, CA, 2002
Mr. Clyde was a project manager for task orders from the U.S. Army Corps of Engineers as part of the Sacramento – San Joaquin River Basins Comprehensive Study. This study is the largest of its kind in the world – involving flood management planning for a combined watershed of nearly 60,000 square miles and including hydraulic modeling of hundreds of rivermiles. He led many of the hydraulic and hydrologic engineering tasks including the UNET Modeling of the Sacramento River and Tributaries (500 rivermiles); Hydraulic Analysis of Concept Plans; Hydrodynamic Analysis of Lower Sacramento and San Joaquin Rivers; Channel Capacity Analysis for the Sacramento River and Tributaries; UNET Model Documentation for the Sacramento River; and Hydraulic and Hydrologic Documentation Support. Flows from the dams on the Sacramento River and major tributaries were developed using HEC-5 reservoir operations modeling software.

Joint Use Fish Screen Project River Hydrology and Hydraulic Study for West Stanislaus Irrigation District, CA, 2015
Mr. Clyde was the technical lead for hydrology and hydraulic analysis to determine design water surface elevations at a proposed West Stanislaus Irrigation District (WSID) diversion and fish screen on the San Joaquin River at the existing site. The hydrology at the diversion site is complicated by the fact that it is located 1 mile upstream from the Tuolumne River confluence. He developed a HEC-RAS hydraulic model of the San Joaquin River for the reach from the Newman gage to the Stanislaus River and coupled that with the hydrology to determine water surface elevations at the proposed intake site. He also developed the statistics needed to determine 10% and 90% exceedence and 100-year flood flows to evaluate operation of the intake.

Friant-Kern and Madera Canals Capacity and Reverse-Flow Assessment for U.S. Bureau of Reclamation, CA, 2011
Mr. Clyde was the MWH project manager for the analysis of modifications required for the Friant-Kern (151 miles) and Madera Canals (36 miles) Capacity and Reverse-Flow Assessment, being conducted for U.S. Bureau of Reclamation. Since the two canals were built nearly 60 years ago, changes have occurred that have reduced the capacity of the canal below the designed capacity, by as much as 10 percent. As part of the San Joaquin River Restoration Program, these capacity deficiencies are to be removed. The purpose of this analysis was to determine where the flow deficiencies exist and then develop appraisal-level designs for their removal and return of the canals to original design capacity. The study included hydraulic modeling (led by Mr. Clyde); development of designs, and preparation of a design report including conclusions, drawings, and costs; and preparation of an Environmental Assessment. In addition, the use of pumps to provide reverse flow of up to 500 cfs in the lowest 4 reaches of the canal was modeled.

California DWR, Analysis of Modifications Required for Enlargement of East Branch of the California Aqueduct, CA, 2008
Mr. Clyde was the MWH project manager for the analysis of modifications required for the Phase II enlargement of the East Branch of the California Aqueduct, conducted for DWR. In order to meet projected future delivery needs, the East Branch canal must be enlarged, and one or more existing flow constrictions must be removed. The purpose of this analysis was to determine where and why the flow constrictions exist and then develop feasibility-level designs for their removal and enlargement of the canal. This analysis involved both reconnaissance studies and feasibility studies. The reconnaissance study included data review, field investigations, and development of a detailed work plan for the feasibility study. For the feasibility study Mr. Clyde was technical lead for HEC-RAS hydraulic modeling of 95 miles of the canal, development of alternative designs, and preparation of a feasibility report including conclusions, drawings, costs, and schedules for subsequent work.

Coachella Canal Lining Project for U.S. Bureau of Reclamation, CA, 2005
Mr. Clyde conducted the hydraulic computer modeling for the Coachella Canal Lining Project for the Coachella Valley Water District. Much of the Coachella Canal had been lined previously, but 33.2 miles remained unlined. The project involved the design of the lined replacement for the unlined section of the canal. This section of canal included 26 siphons and six check structures. The computer modeling helped determine the most efficient section for the two alternatives for the new concrete lined canal. One alternative was to construct the lined canal in the existing canal alignment, requiring the new canal section to function with the existing canal siphons that go under major drainage features along the canal. The second alternative, that was ultimately selected, was to construct the new lined canal adjacent to the existing canal, with all new canal siphons at the major drainage features.

CRAMER FISH SCIENCES®
An Employee Owned Consulting Company

MICHAEL BEAKES, PH.D.

Fisheries Lead

3300 Industrial Blvd, Suite 100
West Sacramento, CA 95691
V 916.231.1681
michael.beakes@fishsciences.net

Years of Experience

- 13 years. Professional start date: June 2003

Education

- PhD, Biology, Simon Fraser University, Burnaby, British Columbia, Canada. 2014.
- BSc, Biology – Fish & Wildlife Management Emphasis, Northern Arizona University, Flagstaff, AZ. 2002.

Dr. Beakes joined Cramer Fish Sciences in April, 2016 and brings over 13 years of research experience and a strong combination of field-based and quantitative research experience to the team. By coupling field data with quantitative modelling techniques Michael enhances the Cramer Fish Sciences team's ability to advance fisheries science by improving understanding of how stream and river ecosystems function and providing insight into how best to manage them. Michael's primary role at Cramer Fish Sciences as a senior biologist out of the West Sacramento office is to develop, coordinate, and implement a broad range of habitat restoration projects and monitoring throughout the California Central Valley. Michael received a BSc in Biology with an emphasis in Fish and Wildlife Management from Northern Arizona University in 2002, and received his Ph.D. in Biology from Simon Fraser University in Vancouver, British Columbia, Canada in 2014. While at SFU Michael's research was focused on examining the dynamics of large-scale natural and anthropogenic disturbance in stream and river ecosystems across large spatiotemporal scales. His research experience includes studies on the effects of wildfire on stream temperatures and food webs in a small California coastal watershed, flow regulation on California Central Valley rivers, salmon life-cycle models and habitat capacity in California and Washington State, and climate change on the Fraser River in British Columbia, Canada.

Employment History

Senior Biologist, Cramer Fish Sciences, West Sacramento, CA. 2016 - present.

Postdoctoral Scholar, NOAA Southwest Fisheries Science Center, Santa Cruz, CA. 2015 - 2016.

National Research Council Research Associate, NOAA Northwest Fisheries Science Center, Seattle, WA. 2014 - 2015.

Doctoral Candidate, Simon Fraser University, Burnaby, British Columbia, Canada. 2011 - 2014.

Doctoral Student, University of California, Santa Cruz, CA. 2009 - 2010.

Lab Assistant III, NOAA Southwest Fisheries Science Center, Santa Cruz, CA. 2006 - 2009.

Biologist, Pacific States Marine Fisheries Commission, Umatilla, OR. 2005.

Biologist, Washington Department of Fish and Wildlife, Pasco, WA. 2005.

Field Research Assistant, Pacific States Marine Fisheries Commission, Portland, OR. 2004.

Field Research Assistant, U.S. Fish & Wildlife Service, Flagstaff, AZ. 2003.

Field Research Assistant, Arizona Game & Fish Department, Flagstaff, AZ. 2003.

Selected Publications

Jonathan W. Moore, **M.P. Beakes**, H.K. Nesbitt, J. Yeakel, D.A. Patterson, L.A. Thompson, C. Phillis, D. Braun, C. Favaro, D. Scott, C. Carr-Harris, W. Atlas. 2015. Emergent stability in a large free-flowing watershed. *Ecology* 96: 340-347.

Corinna Favaro, J.W. Moore, J.D. Reynolds, **M.P. Beakes**. 2014. Potential loss and rehabilitation of stream longitudinal connectivity: fish populations in urban streams with culverts. *Canadian Journal of Fisheries and Aquatic Sciences* 71: 1805-1817.

Michael P. Beakes, J.W. Moore, S.H. Hayes, and S.M. Sogard. 2014. Wildfire and the effects of shifting stream temperature on salmonids. *Ecosphere* 5: 63.

Michael P. Beakes, S. Sharron, R. Charish, J.W. Moore, W.H. Satterthwaite, E. Sturm, B.K. Wells, S.M. Sogard, and M. Mangel. 2014. Using scale characteristics and water temperature to reconstruct growth rates of juvenile steelhead (*Oncorhynchus mykiss*). *Journal of Fish Biology* 84: 58-72.

Michael P. Beakes, J.W. Moore, N. Retford, R. Brown, J.E. Merz, and S.M. Sogard. 2014. Evaluating statistical approaches to quantifying juvenile Chinook salmon habitat in a regulated California river. *River Research and Applications* 30: 180-191.

Brett Favaro, D.C. Braun, and **Earth2Ocean Research Derby**. 2013. The 'Research Derby': a pressure cooker for creativity and collaborative science. *Ideas in Ecology and Evolution* 6 (1).

Andrew O. Shelton, W.H. Satterthwaite, **M.P. Beakes**, S.P. Munch, S.M. Sogard, M. Mangel. 2013. Separating intrinsic and environmental contributions to growth and their population consequences. *American Naturalist* 181: 799-814.

Corey C. Phillis, S.M. O'Regan, S.J. Green, J.E.B. Bruce, S.C. Anderson, J.N. Linton, **Earth2Ocean Research Derby**, and B. Favaro. 2013. Multiple pathways to conservation success. *Conservation Letters* 6: 98-106.

Susan M. Sogard, J.E. Merz, W.H. Satterthwaite, **M.P. Beakes**, D.R. Swank, E.M. Collins, R.G. Titus, and M. Mangel. 2012. Contrasts in habitat characteristics and life history patterns of steelhead in California's central coast and Central Valley. *Transactions of the American Fisheries Society* 141: 747-760.

Michael P. Beakes, W.H. Satterthwaite, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel. 2010. Smolt transformation in two California steelhead populations: Effects of temporal variability in growth. *Transactions of the American Fisheries Society.* 139: 1263-1275.

William H. Satterthwaite, **M.P. Beakes**, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel. 2010. State-dependent life history models in a changing (and regulated) environment: Steelhead in the California Central Valley. *Evolutionary Applications.* 3: 221-318.

William H. Satterthwaite, **M.P. Beakes**, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel. 2009. Steelhead life history on California's central coast: Insights from a state dependent model. *Transactions of the American Fisheries Society.* 138: 532-548.

TETRA TECH

Bob Mussetter, PhD, PE

Geomorphology Lead

Dr. Mussetter has over 35 years of experience in analysis and design for a broad range of water-resource and civil engineering projects, including numerous hydraulic and sediment transport projects on the Carmel River over the past approximately 15 years. His primary area of expertise involves integration of hydrology, hydraulic engineering, and river mechanics with fluvial geomorphology to solve river stability, flooding, and environmental problems. Dr. Mussetter is nationally recognized as an expert in hydraulic and sediment-transport analysis. His experience includes projects throughout the United States and internationally involving a broad range of stream types and physical environments, varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate sediment transport in both sand- and gravel-bed systems. He has extensive experience with the full suite of hydrologic, hydraulic and sediment- transport models, including HEC-HMS, HEC-RAS, HEC-6 and HEC-6T, RMA-2V, FLO-2D, and SRH-2D, and many other similar models.

Dr. Mussetter has particular experience in analyzing and predicting sediment transport and fluvial processes in natural streams, including the effects of human-induced and natural disturbances such as reservoirs, diversions, landslides and rare floods on channel stability and instream aquatic habitat. He also has considerable experience in developing measures to mitigate the potential adverse impacts of these disturbances, including channel stabilization measures using natural materials, sediment flushing flows, and sediment augmentation. His experience includes collection and analysis of substrate data, analysis of aerial photographs, flood inundation studies, and preparation of sediment budgets. Dr. Mussetter has authored or co-authored several manuals and design guides relating to river stability, erosion control and surface erosion. In addition, he has been an instructor for the National Highway Institute-sponsored "Stream Stability and Scour at Highway Bridges" training course and was involved in preparation of the Federal Highway Administration documents HEC-18, "Evaluating Scour at Bridges" and HEC-20, "Stream Stability at Highway Structures." This training course and the related documents describe the current standard of engineering practice for evaluating stream stability and scour in the riverine environment.

Education:

Ph.D./1989/Civil Engineering
M.S./1982/Civil Engineering
B.S./1976/Civil Engineering

Registrations/Certifications:

Registered Professional Engineer: 1983/Colorado, 1984/Arizona, 1984/Montana, 1994/New Mexico, 1998/Idaho, 1995/South Dakota, 1999/ California, 2002/Texas, 2005/Wisconsin, 2014/Nevada

Professional Affiliations:

American Society of Civil Engineer

American Water Resources Association

American Academy of Water Resources Engineers (Diplomate)

American Geophysical Union

Office:
Fort Collins, Colorado

Years of Experience:
39

Years with Tetra Tech:
21

RELEVANT EXPERIENCE

San Clemente Dam Retrofit Study, Carmel River, Carmel, California, 2007 - Principal Engineer and Project Manager for a detailed study of the potential impacts on flooding, river stability and instream habitat in an 18-mile reach of the Carmel River associated with various options for retrofitting San Clemente Dam to meet seismic safety standards. Project responsibilities included study plan development, supervision of subcontractors for topographic and bathymetric surveys and reservoir sediment sampling, collection of sediment and other physical data, hydraulic (HEC-RAS) and sediment transport (HEC-6T) modeling, and interpretation of model results. His responsibilities also included extensive coordination and communication with agencies and interest groups concerned with public safety, water supply, instream habitat and endangered species issues. The study was performed for the California Department of Water Resources and American Waterworks Company.

Carmel River Reroute and Dam Removal Design-Build Project, California, 2016 - Principal Engineer and Project Manager for a detailed study of the potential impacts on flooding, river stability and instream habitat in an 18-mile reach of the Carmel River associated with various options for retrofitting San Clemente Dam to meet seismic safety standards. Project responsibilities included study plan development, supervision of subcontractors for topographic and bathymetric surveys and reservoir sediment sampling, collection of sediment and other physical data, hydraulic (HEC-RAS) and sediment transport (HEC-6T) modeling, and interpretation of model results. His responsibilities also included extensive coordination and communication with agencies and interest groups concerned with public safety, water supply, instream habitat and endangered species issues. Tetra Tech is

currently part of a design-build team for the CRRDR, led by Granite Construction, which is under contract to California American Water, the owner of the dam. Tetra Tech is a subconsultant to Kleinfelder (Lead Designer) and is responsible for hydrologic and hydraulic analyses, and design of the stable stream channel that provides upstream and downstream passage for steelhead in the rerouted section of the Carmel River. Tetra Tech recently completed 2-dimensional hydraulic flow analyses for the proposed confluence of the reroute channel and the Carmel River at the current dam site and is coordinating with the California Division of Safety of Dams (DSOD) on the results. The modeling was performed using Bureau of Reclamation SRH-2D software for the 100- and 1,000-year frequency events, and the Probable Maximum Flood.

Sleepy Hollow Raw Water Intake and Water Supply System Upgrade, Monterey Peninsula Water Management District (MPWMD), Ongoing – Technical Manager for hydraulic, geomorphic and sediment transport analysis to support design of a new raw water intake on the Carmel River for the Sleepy Hollow Steelhead Rearing Facility, a key objective for which is to minimize sedimentation issues at the fish screen. The work involved coordination with MPWMD staff, field reconnaissance to assess conditions in the river adjacent to the site, management of hydraulic and sediment transport analysis to identify an appropriate location to limit sedimentation issues, and ongoing discussions and assistance to the design team.

River Restoration Engineering Services for the San Joaquin River Restoration Program, California, Ongoing - Project Manager and Principal Engineer for a multi-year series of water resources, river restoration, and geomorphic analyses to support the San Joaquin River Restoration Project between Friant Dam and the confluence with the Merced River for the California Department of Water Resources (DWR) in accordance with an existing multi-jurisdictional Settlement Agreement. Project responsibilities include hydrologic analysis, geomorphic analysis, steady and unsteady one-dimensional and two-dimensional hydraulic modeling (HEC-RAS, SRH-2D), sediment transport modeling, restoration design for the improvement of riparian and aquatic habitat and fish passage, and development of appraisal-level cost estimates for 150 miles of river and up to 60 miles of the flood bypass system.

Two-dimensional Hydrodynamic, Bank Erosion and Sediment-transport Analysis of the Sacramento River in the Vicinity of the M&T Pump Intake and Fish Screens at RM192.5 (CALFED and Ducks Unlimited), Ongoing - Principal Hydraulic Engineer for a study to evaluate bank erosion processes and sediment transport processes and identify alternative for protecting the pumping plant, located at RM 192.5 on the Sacramento River near Chico, CA, that are acceptable to both the plants owners and the resource agencies charged with protecting instream and riparian habitat and water quality. The study included 2-dimensional hydraulic and sediment transport analysis, oversight of a physical modeling study, and design of habitat-friendly bank protection measures. Bank protection measures modeled and designed included spur dikes to change sediment deposition patterns at the pumps, and a rock toe and vegetation revetment to prevent further bank erosion and channel migration.

Windy Gap Reservoir Modification Study, Grand County, CO, 2015 – Principal Engineer for a study was to assess alternatives for improving the health of the river by constructing a river bypass, or providing some means of connectivity through or around the reservoir. Dr. Mussetter provided river engineering and fluvial geomorphology analyses and review of the detailed hydraulic and sediment-transport assessment, habitat assessments, review and assessment of the reservoir, pumps and operational procedures, preparation of conceptual plans and construction cost estimates.

Platte River Recovery Implementation Program, Kearney, Nebraska, Ongoing – Project Manager and Principal Engineer for a multi-year study for field data collection and analysis, including: bathymetric surveying, stream gaging, bar and vegetation mapping, and sediment sampling. The analysis is for the recovery of pallid sturgeon, piping plover, least tern and whooping crane by giving recommendations for the management of flows, sediment augmentation and mechanical changes to the river channel. The study has included development of 2-D models for the purpose of sediment augmentation, quantifying sand bars and vegetation and predicting how they respond to short-duration-high-flow events in tandem with mechanical removal of bars and vegetation.

Stephen Young, CSP, CHMM

Health & Safety

Mr. Young has more than 28 years of experience in industrial hygiene, safety, environmental and construction. He has done various short courses and certifications: 30 Hour OSHA Construction Safety and Health, Rocky Mountain Education Center, OSHA Region VIII Training Institute, Red Rocks Community College, Lakewood, Colorado. He has worked with various MNCs like Groundwater Technology, Inc., Maecorp Environmental, Roux Associates, Inc., Apex Environmental, Inc., Apex Companies, LLC (Apex Environmental, Inc.) and MWH.

Relevant Project Experience

Safety and Health Manager, Price Pit Superfund Site, Pleasantville, NJ
Provided direction and oversight for remedial Operations & Maintenance (O&M) activities which included groundwater sampling, confined space entry, groundwater extraction and treatment of 300 gallons per minute (gpm) of contaminated groundwater and landfill leachate at the onsite waste water treatment plant (WWTP). Prepared Activity Hazard Analyses (AHAs), developed and provided Confined Space Entry / Rescue training and annual 8-hour OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) refresher training. Conducted a site health and safety audit against OSHA and U.S. Army Corps of Engineers (USACE) Safety and Health (EM 385-1-1) requirements.

Safety and Health Manager, Silresim Superfund Site, Lowell, MA
Developed, maintained, and implemented an Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) following OSHA and USACE Safety and Health (EM 385-1-1) requirements. Remedial activities included operation of a groundwater extraction system and O&M of a waste water treatment plant and air pollution controls. Conducted seven quarterly health and safety audits to assess the effectiveness of the SSHP. Provided annual HAZWOPER refresher training to project personnel.

Safety and Health Manager, Formerly Used Defense Site (FUDS), Birdsboro, PA
Developed, maintained, and implemented an Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) following OSHA and USACE Safety and Health (EM 385-1-1) requirements. Remedial activities included the removal of USTs, ASTs, product piping, impacted soil and 50 aged drums of calcium carbide.

Program Manager, EHS Resident Consultant, Lockheed Martin, NJ, PA
Provided 14 years of onsite support with the EHS Departments at the following Lockheed Martin facilities: IS&GS / Space Systems, Valley Forge, PA , Commercial Space Systems, Newtown, PA and Missiles and Space, East Windsor, NJ. Primarily responsible for integrating EHS programs into production areas, laboratories, clean rooms, testing facilities, warehouses, data centers and office environments. Provided safety engineering and compliance reviews for operations involving high and low explosives, thermal batteries and other power systems, cryogenics and compressed gases, flammable liquids, vapor degreasers, RF radiation, fire protection systems, scaffolding, fall protection, confined spaces, powered industrial trucks, aerial lifts, cranes and rigging, machine guarding, and use of various toxic chemicals.

Health and Safety Assessments at Hydroelectric Power Plant Sites
Completed Health and Safety assessments at four run-of-the-river hydroelectric power plants under various phases on construction at existing dams along the Ohio River in Ohio, Kentucky and West Virginia. Completed a Health and Safety assessment at a hydropower site on the Columbia River in Washington.

EHS Trainer, Various Locations
Over 1300 contact hours of EHS training in a variety of topics including hazardous waste management, HAZWOPER, confined space entry, chemical hygiene/lab safety, hazard communication, bloodborne pathogens, excavation and trenching, lock-out / tag-out, hot work, fire extinguishers, compressed gases, PPE, asbestos awareness, construction safety, ladder safety, overhead crane operation, aerial lift operation, forklift operation, explosives handling, first aid/CPR/AED and USDOT Hazardous Materials Transportation regulations.

EDUCATION

MS/MSc, Environmental Protection & Safety Management, Saint Josephs University, Pennsylvania

BS/BSc, Natural Resource Management, The University of Maryland, Maryland

LICENSES/ REGISTRATIONS

Certified Safety Professional (CSP), No. 18553 (since 2005)

Certified Hazardous Materials Manager (CHMM), No. 3582 (since 1992)

SPECIALIZED TRAINING

OSHA 30-hour Construction Safety

OSHA 40-hour initial Hazardous Waste Operations and Emergency Response (HAZWOPER) and 8-hour Supervisor

Fall Protection Competent Person, Competent Equipment Inspector (3M)

Confined Space Entry and Operations (MSA)

Mine Safety and Health Administration (MSHA) 32-hour New Miner training

Medic First Aid, CPR and AED Instructor (HSI)

Tunneling/Underground Construction Safety r

EHS Auditor, Various Locations
Completed EHS audits at dozens of facilities in a variety of sectors including electronics, pharmaceutical, aerospace, specialty chemical, network television stations, secondary lead recycling, hazardous waste treatment facilities, active remediation sites, metal pipe and bar manufacturing, foundries, wastewater treatment plants, oil and gas equipment servicing, warehousing, R&D facilities, decontamination and demolition sites and large office complexes.

Health and Safety Plan Preparation and Implementation, Various Locations
Prepared and implemented OSHA HAZWOPER Health and Safety Plans (HASPs) for:

- The decontamination of a metallo-organic pesticide manufacturing facility in northern New Jersey. Contaminants of concern included elemental mercury, benzene, acetic acid and phenylmercuric acetate. Health and safety activities included a PPE assessment; preliminary lockout/tagout survey; confined space entry procedures; air monitoring using mercury vapor analyzers, photoionization detectors, dust/particulate monitors and colorimetric tubes; operation of a personnel decontamination trailer; and hazardous waste handling. All work was performed in Level C or B protection.
- Site-wide investigation activities at a 1,200-acre explosives manufacturing plant in northern New Jersey. The Health and Safety Plan was developed to ensure safe collection, handling and transport of energetic and reactive sediment and soil samples. Contaminants of concern included TNT, nitroglycerin, nitrocellulose, HMX, RDX and smokeless powder. Served as site safety officer during field activities.
- On-site and off-site investigation activities at heavily contaminated wetland and upland areas at a former waste disposal facility in southern New Jersey (Superfund NPL site). Drilling activities were performed in Level B PPE. Contaminants of concern included PCBs, chlorinated solvents, benzene and vinyl chloride.
- The US Army Corps of Engineers (USACE) using OSHA and USACE Safety and Health (EM-385) requirements at the New Bedford/Fairhaven Hurricane Barrier in Massachusetts. This project included repairs to sector gates and rehabilitation (sand-blasting and re-painting) of barrier structures over/in water of the New Bedford Harbor. Also prepared Safety Plans for excavation and drilling at sites along the Delaware River in Philadelphia and Pennsville, NJ for evaluation of potential dredge material disposal facilities.
- Remediation activities at petroleum refineries, terminals, pipeline release sites, and other industrial sites.

Site Manager/Site Health and Safety Officer, Various Locations
Prepared plans and specifications, procured required permits, coordinated bidding process, and served as Site Manager/Site Health and Safety Officer on the following remedial construction projects:

- Excavation of 4,300 tons of metals-impacted wetland soils at a battery manufacturing facility (CERCLA site) in southern New York. Project activities included dewatering of the wetlands, operation of a batch flocculation/sedimentation wastewater treatment system, and sediment drying/bulking.
- Excavation of 4,500 tons of PCB-contaminated soils from residential and industrial properties adjacent to an active electric rail car maintenance facility (CERCLA site) in southeastern Pennsylvania.
- Excavation of 5,900 tons of PCB-contaminated soil to a depth of 27 feet below grade at a former chemical plant (ISRA site) in northern New Jersey. The project required the installation of steel-sheet piling to 55 feet, localized dewatering of two aquifers, operation of a 100 GPM groundwater treatment system, and installation of a 3-acre asphalt cap.
- Excavation of 3,600 tons of petroleum-impacted soils at a lubrication oil processing facility in central Connecticut. Impacted soils were excavated from beneath building floors and foundations and vactored from drainage structures.
- Processing of 8,100 tons of petroleum-contaminated soils at an active union refinery in Montreal, Quebec. Processing included amending the soils with drying agents, bulking agents and nutrients; pugmill blending; and particle sizing. Processed soils were loaded into aerated treatment cells to enhance bioremediation.
- Excavation of 4,600 tons of pesticide and metals-impacted soils from a former agrochemical research facility in northern Delaware. Project activities included decontamination, demolition and removal of PCB-impacted floors and drainage structures, and disposal of hazardous and non-hazardous wastes.
- Excavation of 1,000 tons of petroleum-impacted soils to a depth of 20 feet below grade at a former chemical plant in Southern New Jersey. This was a fast-tracked project that was completed in 8 weeks.

Peter Dickson, PhD, PG

Technical Reviewer

EDUCATION

PhD, Geology, University of Pittsburgh

MS, Geology, University of Manchester

BS, Geology, University of Leeds

LICENSES/ REGISTRATIONS

Professional Geologist: Virginia, Wyoming, Indiana, Georgia

Dr. Dickson has 40-years of broad experience on a large variety of water resource projects in many parts of the world including dams for water supply and hydroelectric projects, power plants, penstocks, tunnels, caverns, pumping stations, and flood control structures. His experience includes project screening and ranking; design and supervision of geological, geotechnical, and hydrogeologic investigations; siting of project features and developing layouts and arrangements; dam type selection (fill dams, CFRD, RCC, gravity, arch dams), slope stability evaluations and slope design; landslide studies; technical training and technology transfer; determining criteria for planning, design and construction of tunnels, caverns, and dams; detailed design and contract document preparation. His work includes assessment of risk, identification and evaluation of mitigation options and alternative project arrangements, development of project cost parameters, independent technical review, and constructability review.

Relevant Project Experience

Neelum-Jhelum Hydroelectric Project, *Water and Power Development Authority (WAPDA) of Pakistan*
Member of senior technical review team during detailed design and construction of 960-MW hydroelectric project scheme in Himalaya foothills, Jammu-Kashmir northern Pakistan. Responsible for site visits, value engineering and technical advice to design team, technical review of underground works (28-km-long headrace and 3.5 km tail tunnels, underground powerstation complex, 300-m-high surge shaft, access tunnels), and concrete gravity dam, de-sanding chambers. Severe project challenges include major earthquake hazard (within zone of catastrophic 2005 earthquake, M=7.6), weak foundation materials, active fault crossings for tunnels, highly deformed and complex tunnel geology. Technical lead in evaluation of earthquake hazard using DSHA and PSHA methods for project including evaluation of reservoir triggered seismicity (RTS). Results used for development of seismic design parameters for final design including ground motion estimates, response spectra and time histories. Lead in rock stress testing, design of concrete-lined high-pressure manifold, foundation treatment and design for active fault at dam site, headrace tunnel crossing of active fault, powerhouse 3-D modeling and stress analysis.

Cerro Corona, Goldfields, *Cajamarca, Peru*
Member of independent technical review panel responsible for review of design, plans, and specifications for construction of 225-m-high tailings dam and related works located in high seismic hazard region in Andes. Visited project site to conduct field inspections, participated in technical review meetings with client and design team, participated in Failure Modes and Effects Analysis (similar to PFMA) of project as part of on-going Risk Analysis and Management.

Susitna Watana, ***Alaska Energy Authority***
Advisory Input to and Review of Seismicity and Seismic Hazard, Geotechnical Investigations and Site Characterization, Reservoir Slope Stability, Geological Engineering, Rock Mechanics, and Development of Site Arrangements.

Panama Canal Third Set of Locks Projects, *Panama Canal Authority (ACP)*
The project consists of construction of two new lock complexes on either side of the Panama Canal (Atlantic and Pacific complexes), consisting of three new lock chambers plus an innovative water saving basin system to reduce water consumption for lock operations. The Pacific complex entrance from Gatun Lake will be formed by the construction of four zoned earth and rockfill embankment dams, each approximately 25 m high. Dr. Dickson serves as member of Independent Technical Review Board, participating in review of foundations and seismic aspects, design criteria, design procedures and analytical approaches, and submittals. From 2009-2010, Peter served as Quality Lead for Chicago Design Centre. He helped write and establish quality management procedures and processes for the design team. Prior to construction he served as the Owner's independent consultant and peer reviewer in the development of seismic criteria and assessment of risk for the project, participating in risk workshops and discussions.

Curibamba Hydroelectric Project, *EDEGEL and Endesa*
Served on Board of Consultants as technical expert on foundations and underground structures. Assignment involved review of hydroelectric project in final stage of design and soon entering into tender stage. Project involves two dams and intakes, combined headrace tunnel system totaling 9.6 km (either TBM or drill-blast), underground powerhouse cavern with 195-MW installed capacity. Reviewed and advised on design, construction approach and methodology. Review activities included site visit and detailed inspection of investigations and design review with Owner and its design team.

Iowa Hill Pumped Storage Project, ***Sacramento Municipal Utilities District (SMUD)***
Lead geological engineer in re-examination of project layouts and construction costs. Prepared new revised layouts for underground works including powerstation complex, high pressure and low pressure waterways, power shaft, and upper reservoir. Participated in preparation of estimates of construction costs, constructability analysis, and scheduling. Advised on development of scope of additional site investigations. Previous work included serving as lead geologist studying the Iowa Hill Pumped-Storage scheme using existing Slab Creek Reservoir, American River, as lower reservoir. Also lead geologist studying the expansion of Icehouse Reservoir and pumped-storage development in connection with Union Valley Reservoir. Conducted field reconnaissance, developed geologic investigation program, and assisted in developing preliminary layouts and strategies for minimizing environmental impact.

Tekeze Dam, ***Ethiopian Electric Power Corporation***
Responsible for technical review and field inspection of project works and seismic hazard on 190-high thin-arch concrete dam under construction, special focus on foundation and rock slope stability assessment, rock mechanics evaluations (including 3-D rigid block and kinematic analyses, block theory, 2-D and 3-D FEM stress and deformation analysis), rock fall simulation, rock reinforcement and anchor design, including participation in thrust-block design and left abutment remedial works (abutment replacement), review of underground works (power tunnel system and powerhouse cavern); QA of site engineering.

Dasu Hydroelectric Project, ***Water and Power Development Authority (WAPDA) of Pakistan***
Lead geological engineer in feasibility study and design of major hydroelectric project on Indus River (4000-MW installed capacity powerhouse, 200-m-high dam). Responsible for geotechnical investigations, development of design criteria for dam, and design of underground facilities. Also responsible for direction and review of seismic hazard and geotectonics investigations and determination of seismic parameters for design, including reservoir triggered seismicity (RTS). Supervised evaluation of rock fall onto Karakoram Highway under various loading conditions including earthquake using various rock slope stability methods and rock fall simulation programs. Lead risk assessment workshop during constructability evaluation and cost estimation.

Shandong Taian Pumped-Storage Project, ***Shandong Taian Pumped-Storage Power Station Co. Ltd.***
Consultant responsible for review and technical advice on design and construction of underground features including powerhouse cavern, transformer hall, water conveyance tunnels, power shafts, and surge chambers. Responsible for review of geology, tunnel design, assessment of stability of caverns and tunnels, and shafts; numerical analysis, excavation and support design of caverns, overall review of cavern design and construction methods; review and advise construction design of underground works, including review construction procedures and specifications; check of project construction schedule, implementation plan, and construction cost estimates. Also responsible for technical advice and review of geomembrane lining system for upper reservoir.

John C. Haapala, PE

Technical Reviewer

EDUCATION

MS, Civil Engineering
University of Washington

BS, Civil Engineering
University of Washington

LICENSES/ REGISTRATIONS

Professional Engineer
California No. 27907

Professional Engineer
Washington No. 19661

YEARS OF EXPERIENCE

42

Mr. Haapala has 42 years of specialized experience in hydrology, hydraulics, flood studies, dam-break inundation studies, reservoir operation and power studies, engineering economics, and fisheries issues with an emphasis on computer applications. He is adept at the usage and adaptation of many existing standard hydrologic and hydraulic computer programs, and has developed a number of new application programs. He has been the hydrology lead on numerous hydrology and hydraulics studies for hydroelectric power developments worldwide. Throughout his career, he has performed Probable Maximum Flood studies and other floods studies in diverse locations including Alaska, Florida, California, Washington, and Indiana. He has performed power and operation studies of more than 100 reservoirs and power plants including complex multi-reservoir, multi-use systems. The studies were performed to determine firm water supply yield, hydroelectric generation, benefits of component sizing and the effects of alternative instream flow requirements. A normal part of the reservoir operation studies has been to determine the hydraulic losses in the penstock and tunnel conduit system. His hydrologic and hydraulic analysis experience also includes reservoir and channel flood routing, spillway sizing, gated spillway flood operations, freeboard analysis and riprap sizing for shore protection. Hydraulics experience includes the design of hydraulic structures such as spillways, energy dissipaters, developing spillway rating curves, and the static and hydraulic transient analysis of pipelines and tunnels. He has performed dam-break studies to develop inundation maps and inflow design floods for several projects including using HEC-RAS as the dam-break model with multiple downstream dams from the failed dam.

While at MWH, he has authored or co-authored 15 professional papers on hydrology, hydraulics, dam safety, and hydroelectric development topics. His broad experience in hydrology and hydraulics has been recognized at MWH with his selection as the dams and hydropower technical practice lead for hydrology and hydraulics. He has recently contributed to writing best practice guidelines for the flood hydrology dams and the hydraulic design of spillways.

Relevant Project Experience

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification Project, *Los Angeles Department of Public Works*
Performed flood routings with HEC-1 modeling to determine the maximum reservoir level during PMF passage for this $88M project. Performed detailed hydraulic analysis of the proposed emergency spillway including both stepped spillway and flip bucket alternatives. Estimated erosion potential below the spillway for the spillway alternatives. The final design met client needs, was accepted by the California Division of Safety of Dams and is under construction.

San Vicente Dam Design, *San Diego County Water Authority*
The existing 220-ft high concrete dam will be raised by 117-ft. Hydraulic design of a new stepped spillway with ogee crest and flip bucket terminus was performed. Riprap sizing and plunge pool erosion was determined. Inundation maps were developed with HEC-RAS for the 100-year flood and the PMF. Construction flood analysis was performed.

Santa Anita Dam, *Los Angeles Department of Public Works*
Santa Anita Dam is a 225-foot high concrete arch dam near Los Angeles built in the 1920's for flood control. Investigations were conducted to determine the adequacy of the existing spillways. Rating curves were developed for the existing spillways and routing of flood hydrographs through the reservoir was performed. The trajectory of spill and the downstream impact points were determined.

Susitna-Watana Hydroelectric Project PMF Study, *Alaska Energy Authority*
Watana Dam is a proposed new 700-ft-high dam on the Susitna River in Alaska that would also include a 600 MW new powerhouse. Because of the large size of the watershed (5,180 sq. mi.), a site-specific PMP was necessary

and a Board of Consultants and FERC representatives reviewed the study. Because of the cold weather climate, development of the 100-year snowpack with seasonal and areal variations was necessary. A probable maximum snowpack case was also considered for the PMF. The all-season PMP included variable glacier melt contributions based on variations in temperature and wind. Unit hydrograph calibration and verification was performed. The PMF resulted from the most critical combination of the PMP and snowmelt. Hydraulic analysis of the gated spillway and outlet structures was performed. The spillway was sized to pass the most critical of all PMF cases. A climate change analysis of hydroelectric generation was performed using historic data and stochastic analysis techniques.

White Rock Penstock and Tunnel Capacity Analysis, *Sacramento Municipal Utility District*
This study involved performing a detailed hydraulic analysis of the White Rock power conduit system for the Sacramento Municipal Utility District. The White Rock power conduit includes 25,000 feet of both unlined and lined tunnel and about 1,500 feet of penstock of varying diameter and several other hydraulic elements including a wye branch, reducers, and valves. The hydraulic analysis resulted in a determination of the loss in full load output on the powerhouse under revised flow conditions.

Crow Dam Rehabilitation Project, *Confederated Salish and Kootenai Tribes*
Crow Dam is a 90-ft high embankment dam administered by the Bureau of Indian Affairs. Dam safety evaluations for this high hazard dam determined that the low-level outlet and the spillway required rehabilitation. Seasonal construction diversion floods were routed for various cofferdam heights and pumping capacities. Using risk assessment methods, the spillway design flood was selected as the 10,000-year flood. A reservoir inflow volume frequency analysis and flood routing was used to determine the risk of hazardous spillway operation prior to repairs.

Big Creek Expansion Project (BICEP), *Southern California Edison*
An assessment was performed of several concepts for expansion of the existing Big Creek Project. The expansion would provide additional hydroelectric generation capacity that could be used for peaking energy during peak periods of high flows and/or electrical demands. The hydraulic capacities and conduit sizes were estimated for alternative configurations that would provide additional generation. A site visit to the Big Creek facilities was also performed.

Lake Dorothy Hydroelectric Project, *Alaska Electric Light and Power*
The available hydrologic data was reviewed and extended by correlation after an evaluation of alternative methods of data extension. A reservoir operation model was developed to simulate operation of the storage reservoir, the tunnel and conduit system, and the powerhouse for a period of 65 years. A series of operation model runs were performed to determine the effects of alternative installed capacities and alternative reservoir operation modes.

Oroville to 39-01, *Harza/Edaw Joint Venture*
Hydroelectric power studies were performed at a feasibility level for five alternatives that would add new units to an existing hydroelectric project.

Upper San Joaquin River Basin Storage Investigation Feasibility Study and Environmental Impact Study/Report, *USBR - Mid-Pacific Region*
Reviewed model development and provided alternative ideas for model development based on extensive modeling experience. Additional improved methods were incorporated into the model. IDIQ for Water Resources Planning and Engineering - Bureau of Reclamation, Mid-Pacific Region (01CS20210B and BRPS/06CS204097B)

Snettisham Hydroelectric Project Surplus Study, *Alaska Electric Light and Power, Alaska*
The Snettisham Hydroelectric Project supplies a majority of the electric energy used by Juneau. The firm energy generation capability of Juneau's hydroelectric resources is about equal to the electric load. The city wanted to consider supplying various substantial amounts of electricity to a new mining operation. A power study model of the city's electric loads and hydroelectric resources was developed. The hydraulics of the two power tunnels, each over 6,000 feet long, was determined for each of the two powerhouses. The effects of supplying different amounts of electricity in different months to the mine on firm and average hydroelectric energy availability to the city were analyzed.

New Spicer Meadow and McKays Point Dam PMF Study, *Northern California Power Agency*
The Probable Maximum Flood (PMF) was developed at New Spicer Meadow Dam on Highland Creek, and at McKays Point Dam on the North Fork Stanislaus River. The 72-hr PMP was developed for each month at each dam using HMRs 58 and 59. The 100-yr snow water equivalent available by 1,000-ft elevation band for each month was developed based on data from several snowpack stations and a probability analysis. Unit hydrographs were

developed that resulted in excellent calibration and verification between simulated and recorded flood hydrographs. Spillway rating curves were determined for each dam. The Probable Maximum Flood was developed for all potentially critical months and routed through the reservoirs with the HEC-1 Flood Hydrograph Package.

Susitna-Watana Hydroelectric Project Operation Studies, *Alaska Energy Authority*
Susitna-Watana is a proposed hydroelectric project in Alaska that is currently in the project optimization and FERC licensing stage. It would include a 700-ft to 800-ft high dam, a 600 MW to 800 MW powerhouse and a reservoir with 4 to 6 million acre-feet of storage. A power study and reservoir operation model was developed in support of FERC Pre-Application Document (PAD) and project optimization and environmental studies. The model included development of 61-years of natural inflows and reservoir operations on an hourly basis to include the potential for a load-following operation. Power studies included integration of Susitna-Watana with other resources to maximize usable generation in the Anchorage to Fairbanks Railbelt area. Stochastic hydrology was used to show the range of values that is possible for firm energy and to include the potential impacts of climate change.

Selected Publications

Haapala, John C., and Bryan Carey. "Susitna-Watana Hydroelectric Project Firm Energy Analysis Under Historic and Climate Change Scenarios", HydroVision 2012 Conference Proceedings, Louisville, Kentucky, July 2012.

Haapala, John C., and Gregory L. Tate. "Conjunctive Use of Florida's Ground & Surface Waters Solves Source Water Cost Issues", *Florida Water Resources Journal*, Vol. 62, No. 2, February 2010.

Haapala, John C., and Hayes, Stan J. "Streamflow Trends and Hydropower Production in the Ohio River Basin", Waterpower XII Conference Proceedings, 2001.

Haapala, John C., and van Donkelaar, Catrin. "Long-Term Hourly Simulation of a Peaking Hydropower Project with Application to Federal Relicensing", HydroVision 2008 Conference Proceedings, Sacramento, California, July 2008.

Haapala, John C., "Forest Cover, Wind Speed, Snowmelt, and Overestimation of the Probable Maximum Flood", Association of State Dam Safety Officials Dam Safety 2004 Conference Proceedings, Phoenix, September 2004.

Haapala, John C., and Finis, Mario, "The Neglected Cool Season PMF", Association of State Dam Safety Officials Dam Safety 2006 Conference Proceedings, Boston, September 2006.

Iso-Ahola, Vik, Haapala, John C., and Lindell, James. "Physical Model Confirms Spillway Modification for Passing Increased PMF", Association of State Dam Safety Officials, Dam Safety 2008 Conference Proceedings, Indian Wells, California, September 2008.

Bernedo, Carmen E., Haapala, John C. and Arnold, Terrence A. "1-D or 2-D? That's the Dam-Break Question!", Association of State Dam Safety Officials Dam Safety 2007 Conference Proceedings, Austin, Texas, September 2007.

Michael R. Chelminski PE

Technical Reviewer

Stantec

Mr. Chelminski is responsible for technical aspects of ecological evaluation, mitigation, and restoration analyses and designs. His work includes the development of hydrologic and hydraulic studies for integration with Stantec's skills in the ecological and biological sciences. A licensed engineer, his project experience includes ecological restoration design and monitoring, fish passage assessments, effluent mixing analyses, and dam safety evaluations, and is the engineer-of-record for more than a dozen completed small dam removal projects. He has worked on watersheds including the Allegheny, Connecticut, Deerfield, Delaware, Housatonic, Hudson, Ohio, Potomac, and Penobscot Rivers in the United States; and projects in Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, and Saskatchewan, Canada.

PROFESSIONAL EXPERIENCE

- Stantec. 2007-present. Principal, Ecological Restoration Services; Restoration Engineer
- Woodlot Alternatives, Inc. 2002-2007. Division Director, Ecological Restoration Services; Restoration Engineer
- Earth Tech. 1999-2002. Water Resources Engineer
- US Army Corps of Engineers, Fairbanks, Alaska. 1995-1997. Construction Management Engineer

EDUCATION

MS, Civil Engineering, Utah State University, Logan, Utah, 1999

BS, Civil Engineering, University of Connecticut, Storrs, Connecticut, 1994

REGISTRATIONS

Professional Engineer #47167, Commonwealth of Massachusetts

Professional Engineer #PEN 0026319, State of Connecticut

Professional Engineer #10320, State of Maine

Professional Engineer #10677, State of New Hampshire

PROJECT EXPERIENCE

Dam Removal and Related Projects

Third-Party Peer Review for Pond Lily Dam Removal Project, West River, New Haven, Connecticut

Performed third-party review and owner-consultant consultation for proposed removal of Pond Lily Dam on the West River in New Haven, Connecticut. Project work included review and reporting on design and bid documents and coordination with owner, design consultant, and others to identify potential means to reduce project costs.

Third-Party Peer Review for Dam Removal Studies, Saranac River, New York

Technical lead for a peer review of sediment transport evaluations and proposed sediment management plans for removal of Imperial Dam on the Saranac River in Plattsburg, New York. Work was contracted to the State of New York.

Preparation of White Paper on Dam Removal, Confidential

Technical lead for development of a white paper presenting opportunities and constraints for dam removal as part of ongoing work on a CERCLA site.

Development of Dam Removal and Bypass Channel Fact Sheets and Construction BMPs, Fisheries and Oceans, Canada

Contributor for development of fact sheets and construction best management practices for dam removal and bypass channels at small dams in Ontario, Alberta, Saskatchewan, and Manitoba.

Peer Review and Comment for Downstream Fish Passage as Part of Proposed Hydroelectric Development, South Fork Skykomish River, Washington

Peer review and comment on evaluation of downstream fish passage at proposed Sunset Fish Passage and Energy Project. Services were performed under contract to a stakeholder and included review, evaluation, and commenting on three-dimensional, computational fluid dynamics model developed by others.

Michael R. Chelminski PE

Technical Reviewer

Dam Removal Evaluation and Design, CFB, Gagetown, New Brunswick

Performed evaluations and developed preliminary design for removal of a dam in the Canadian Forces Base Gagetown in New Brunswick. Work included a site visit, participation in dam owner meetings, and development of preliminary design materials and reporting.

Roughbark Dam Removal Evaluation, Saskatchewan

Technical lead for evaluation for removal of Roughbark Dam in Saskatchewan, Canada. Project work included site visit, owner consultation, and reporting.

Third-Party Review for Post-Dam Removal Evaluation of Impact to Infrastructure, Quinnipiac River, Connecticut

Technical lead for third-part review of potential impacts to a utility crossing following a dam removal and development and evaluation of conceptual alternatives to mitigate impacts.

Ballville Dam Removal, Ohio

Responsible for study scoping, field assessment, sediment transport and hydraulic evaluations, and support for preparation of an environmental impact statement for the proposed removal of Ballville Dam on the Sandusky River.

Phillipston Reservoir Dam Removal Project, Phillipston, Massachusetts

Engineer of record and technical lead for dam removal as part of fish habitat restoration project. Project work included design, permitting, and construction-phase services for dam removal completed in 2012.

Milbournie Dam Removal, North Carolina

Performed field assessment, preliminary assessment, and preliminary design review for the proposed removal of Milbournie Dam on the Neuse River near Durham, North Carolina.

Sackett Brook Restoration Project / Gravesleigh Pond Dam Removal, Pittsfield, Massachusetts

Technical lead for for design, permitting, and construction-phase support for aquatic and riparian habitat restoration project involving the removal of a dam and bridge. Dam removal was completed in 2013.

Due Diligence Evaluation of Fish Passage at Hydroelectric Generating Facilities, Canada

Technical consultant for due diligence evaluation of technical and regulatory evaluation of upstream and downstream fish passage and associated regulatory issues at multiple existing hydroelectric facilities.

Bartlett Rod Shop Company Dam Removal, Pelham, Massachusetts

Lead engineer for scoping and design for removal of a 20-ft tall dam on Amethyst Brook. The project dam is privately owned an in poor condition; removal was selected by the dam owner. Project work included development of detailed engineering plans, specifications, bid documents, and bidding services. Project dam removed in 2012. Performed post-action monitoring and construction contract close-out through 2014.

Penobscot River Dam Removals: Great Works Dam Removal Fish Passage Study, Maine

Project manager and technical lead for numerical modeling and fish passage evaluation during and after staged (multi-year) removal of Great Works Dam. Project work included development of two-dimensional hydraulic models of nine removal scenarios.

Penobscot River Dam Removals: Howland Dam Bypass Channel Fish Passage Study, Maine

Project manager and technical lead for evaluation of upstream fish passage at a proposed bypass channel. Project work included development of two-dimensional hydraulic model, bathymetric surveys, tidal and riverine stage data acquisition, and wetland impacts assessment.

Penobscot River Wetland Resources Restoration Assessment, Maine

Project manager and technical lead for evaluation of post-action restoration of wetland resources in two former impoundments following dam removal and a third impoundment where a hydroelectric generating facility will be decommissioned, thereby altering impoundment hydrologic regime.

Michael R. Chelminski PE

Technical Reviewer

Reconnaissance Surveys and Reporting for Dam Removal, Massachusetts Division of Ecological Restoration, 2006-2015, Massachusetts

Performed reconnaissance surveys and associated reporting at over 50 dams to evaluated potential for dam removal under contract to the Massachusetts Division of Ecological Restoration.

Peer Review of Fish Passage Design, New Brunswick

Performed peer review and site visits for a fish passage facility that was constructed as HADD compensation on a tributary to the Magaquidavic River in New Brunswick.

Royal River Restoration Studies, Yarmouth, Maine

Project manager and technical lead for multiple studies evaluating the potential for restoration of aquatic resources and potential impacts to infrastructure associated with two dams on the Royal River in Yarmouth, Maine. Study components included delineation of natural resources, assessment and review of existing infrastructure, sediment sampling, hydraulic modeling, reporting, and stakeholder engagement, including presentations at multiple public meetings. Evaluated alternatives to date have included no action, improved technical fish passes, and dam removal.

Montsweag Brook Restoration Project, Wiscasset, Maine

Project manager and technical lead for dam removal and native diadromous fish species habitat restoration project as part of Natural Resource Damage Restoration Plan and Settlement Agreement for closure of the Maine Yankee nuclear power facility. Project work included preparation of a feasibility study incorporating a full range of biological and engineering evaluations, public participation, impact assessments, restoration options, fish pass studies, hydraulic modeling, and permit planning. Dam removal construction was initiated in September 2010.

Rattlesnake Brook Dam Removal Study, Freetown, Massachusetts

Project manager and technical lead for preliminary dam removal design study for removal of a dam on Rattlesnake Brook in Freetown, Massachusetts. Project work included field studies to evaluate existing conditions, collection of tidal stage data seaward from the dam, and development of preliminary design materials for removal of the dam and integration of a new stream channel with downstream infrastructure constraints.

Orland Village Dam Alternatives Feasibility Study, Orlando, Maine

Project manager and technical lead for feasibility study for evaluation of potential actions related to a deteriorated dam in Orland, Maine. Project work included field assessment, desktop studies including hydrodynamic analyses, preliminary regulatory agency coordination, reporting, and stakeholder coordination. Evaluated alternatives included no action, reconstruction of the dam, modifications to existing fish passage systems, and preliminary design of improved fish passage systems.

Thunder Brook Restoration Project, Cheshire, Massachusetts

Project manager and technical lead for dam removal and culvert replacement for fish habitat restoration project. Project work included a full range of biological and engineering evaluations, public participation, impact assessments, restoration options, fish pass evaluations, hydraulic modeling, permit planning, and construction observation. Project completed in 2012.

Little River Dam Removal, Lisbon Falls and Topsham, Maine

Responsible for conceptual design through final design and permitting for removal of a remnant industrial water supply diversion dam, allowing native fish species access to historical spawning and rearing habitat. This work included coordination of a site survey and the preparation of a Phase 1 environmental site assessment. Dam was removed in 2009.

Ox Pasture Brook Dam Removal, Rowley, Massachusetts

Project manager and technical lead for dam removal feasibility study including development and analysis of proposed conditions using unsteady-state HEC-RAS model. Work included scoping and execution of all components of study. Dam removal was complete in 2009.

Sediment Capping and Dam Removal Design, Massachusetts

Project hydraulic engineer for development and evaluation of riverine sediment cap design and conceptual dam removal scenario for a contaminated site restoration. Performed hydraulic analysis to determine riprap sizing, channel morphology, and dam breach size using Flow-3D.

Michael R. Chelminski PE

Technical Reviewer

PUBLICATIONS

Presentation: Interpretation and Analysis of Tidal Stage Data for Tidal Restriction Project. *Restore America's Estuaries Conference*, 2009.

Presentation: Hydraulic and Fish Passage Modeling of a Proposed bypass Channel on the Piscataqua River at Howland Dam. *Diadromous Species Restoration Research Network Symposium, University of Maine, Orono, Maine*, 2009.

Presentation: Integration of CAD Design with Mulit-Dimensional Hydraulic Modeling for Stream Restoration. *Southeast Regional Stream Restoration Conference*, 2009.

Dennis E. Dorratcague, PE

Technical Review

Mr. Dorratcague has over 40 years of specialized experience in fish passage projects on the west coast for irrigation, power, and municipal projects. Mr. Dorratcague was the key developer of the Vee-type fish screen for screening large canal diversions. Working with Milo Bell in the mid-1980's, he developed the concept and led the design of the first two Vee-shaped structures that were constructed in the early 1990's. He is past president of the Bioengineering Section of the American Fisheries Society. Mr. Dorratcague has been working in the field of hydrology and hydraulics since 1972. His main areas of concentration have been hydraulic structures, fisheries engineering, computer modeling of hydrology and hydrodynamics.

EDUCATION

MS/MSc, Civil Engineering, Colorado State University

BS/BSc, Aerospace Engineering, University of Notre Dame

LICENSES/ REGISTRATIONS

Professional Engineer – (Civil) CA, WA

MEMBERSHIPS/ AFFILIATIONS

American Fisheries Society

American Society of Civil Engineers

Relevant Project Experience

Steelhead Fish Passage Study, United Water Conservation District, Santa Paula, CA
The United Water Conservation District was sued by California Trout concerning passage of endangered steelhead at Freeman Dam on the Santa Clara River near Ventura. As part of the litigation agreement, a group of independent experts was convened to provide fish passage concepts at the dam. Mr Dorratcague was a member of the panel of experts. Through deliberations and meetings with the District and NMFS, a series of possible solutions were proposed and was a report writtren. The report and its findings were adopted by both parties.

California Delta Fish Facilities, California Department of Water Resources. Mr. Dorratcague served as a member of the Clifton Court Forebay Fish Facilities Technical Advisory Team (CCFTAT) since 1997 and the North Delta Cross-Channel Technical Team. In these positions he worked with other experts to advise DWR in the design of the up to 15,000 cfs fish intakes on the Sacramento River for the Delta Conveyance project. He also provided concept designs for a Low-Flow Fish Screen at Clifton Court Forebay for California DWR and a group of state water contractors.

Los Padres Dam Sediment Removal Study, CalAm
Mr. Dorratcague provided input to the study team concerning fish passage issues and facilities during the study.

Banta Carbona Fish Screen Project, Banta Carbona Irrigation District. Technical Manager for the fish screen feasibility study for a 250 cfs Vee-shaped fish screening installation on a diversion off the San Joaquin River near Tracy, California. In addition to screening for chinook juvenile salmon, other endangered or proposed for listing species were considered. In addition to three screening alternatives, the study included consideration of obtaining water from other sources during critical fish migration periods. Meetings were held with federal and state fisheries agencies to discuss criteria and design specifics. The project was designed and built taking into account the special designs to alleviate the sedimentation problem at the screens. The project was tested with juvenile salmon and delta smelt with no effects on these fish. The facilities have been operating successfully and protecting migtrating fish for the last six years.

Technical Reviewer, Intakes for the City of Sacramento, CA. Mr. Dorratcague provided technical review for the two intakes for the City of Sacramento. One is an expansion of an existing 310 cfs intake on the American River to meet new fish protection criteria. The second intake is on the Sacramento River and has a 280 cfs capacity. Both intakes are towers built in the rivers containing pumps and their controls.

Glenn-Colusa Fish Screen Project, Glenn-Colusa Irrigation District. Glenn-Colusa Irrigation District (GCID) representative on the Constructability Committee for the design and construction of the 3,000 cfs GCID fish screens on the Sacramento River in California. This three-member committee was charged with reviewing the design and construction of the $70 million project. He also wrote the initial fish screen evaluation plan for the project.

White River Fish Screen Project, Puget Sound Energy. Project Manager for the hydraulic modeling, preliminary and final designs, and construction services of a 2,000 cfs fish screen on a power canal on the White River in Western Washington. The project consists of a Vee screen structure 250-feet long 70-feet wide and 20-feet high. The bypass system incorporates a chute and a high-density polyethylene bypass pipeline to carry fish back to the White River. The White River drains the White Glacier on Mt Rainier and carries large quantities of sediment. In addition to the sedimentation basins, the design included a sediment re-suspension system in the fish screen area.

Lake Cushman Floating Surface Collector, Tacoma Power. Project Manager. MWH was responsible for design of the guide nets, net transition structure (NTS), and 244 cfs floating surface collector (FSC). The full-depth guide net is over 200 feet deep and 1,400 feet long. It is designed to guide fish to the entrance of the NTS. The NTS accelerates flow to capture the fish at full flow in the NTS and is over 100 feet long and 34 feet wide. The FSC is 91 feet long and 48 feet wide and weighs about 350 tons. Mr. Dorratcague led the team that produced plans and specifications for these facilities and worked with Tacoma Power who designed some mechanical equipment and shore-side facilities.

Cowlitz Falls Fish Passage Concept Design Report, Tacoma Power. Member of an expert panel led by Tacoma Power to develop concept designs and a Concept Design Report for new downstream fish passage at Cowlitz Falls Dam in Washington. Working with Tacoma Power, he developed fish passage concepts including vertical plate screens, floor screens, and a weir box fish attraction concept. He managed the design of two experimental weir boxes for installation in spillways on the dam, attended meetings and negotiations with the resource agencies for final passage concepts.

Landsburg Fish Passage Project, Seattle Public Utilities. Technical manager for the preliminary and final designs of the fish passage facilities at the Landsburg dam and intake on the Cedar River. This work for Seattle Public Utilities included a 425 cfs automated Vee fish screen facility, a fish ladder over Landsburg Dam, an adult sorting and holding facility, and a rock weir passage over the aqueduct crossing. Design features included intake improvements with sediment exclusion, dam stability upgrades and seismic strengthening of the aqueduct crossing. An overflow tilting weir gate was also designed to pass juvenile salmonids over the 14-foot high Landsburg Dam. Passage facilities were designed for coho, sockeye, steelhead and endangered Chinook salmon and bull trout.

Clallam-Cline Intake and Fish Screen, Jamestown-S'Klallam Tribe. Project Manager for the design and construction of a new intake and fish screen structure on the Dungeness River in Washington replacing an infiltration type intake. The project was sponsored by the Jamestown S'Klallam Tribe, local irrigation companies and the Washington Department of Fish and Wildlife, who designed and furnished two belt screens. Services included the design of the river intake and pipeline modifications and construction support services.

Wapatox Canal (Naches) Fish Screen, PacifiCorp. Project Manager for the preliminary and final design of a fish screen facility for Pacific Power and Light Company. The 500 cfs capacity screen is located in the Wapatox Canal on the Naches River in Washington. The facilities included vertical wedgewire screens, automatic cleaning systems, trashrack and automatic rake, fish bypass system, and an expanded river intake. Unique design features include special cold weather protection and mining a new tunnel conduit under a State highway embankment.

A-Canal Fish Screen, Klamath Irrigation District. Project Manager for the feasibility study, design and construction support services of a 1,100-cfs vee-shaped fish screen on the A-canal diversion for Klamath Irrigation District in Southern Oregon. The screen design consisted of primary and secondary screens, automated cleaning systems and two fish bypasses. One bypass included a fish friendly pump and bypass back to Upper Klamath Lake. The other bypass required a 2400-foot long gravity flow pipeline carrying the fish to below Link River Dam. A fish evaluation station was incorporated into the pumped bypass line. An automated headgate system for the canal was also designed to automatically control flows into the irrigation canal. The screen and bypass system was tested and found to keep fish out of the canal and have no effect on fish transiting the screen and bypass system.

Walterville Fish Screen and Tailrace Barrier, Leaburg Ladder, Eugene Water and Electric Board
Technical Manager for the design of a new fish screen, ladder, and tailrace barrier in Western Oregon. The screens were designed in a three-Vee layout to screen salmonid fry from a 2,575 cfs flow in a power canal. The ladder project involved replacement of a non-functioning ladder over the dam with a vertical slot fish ladder. The tailrace barrier work involved studying a number of options to prevent migrating adults from traveling up a 2-mile long

tailrace to the power plant. Fixed, floating, and movable pickets and a velocity barrier were studied as well as auxiliary water facilities to attract the fish back to the river. The fish screen and bypass have been tested and found safe for juvenile salmonids passing through them.

Cabinet Gorge Fish Passage Facility, AVISTA Energy
Project Manager for the preliminary and final design of the adult fish passage trapping and collection facility at Cabinet Gorge Dam on the Clark Fork River in Idaho. The facility is design to trap endangered bull trout and other species, separate the species, and transport bull trout to their native streams upstream. The structure is located near the spillway and specifically designed to withstand the turbulence and wave action during flood conditions. The works that were designed included a fish ladder and trap structure, 35 by 80 feet by 28 feet high, a crane and bucket system for transferring fish to a tanker truck, and a holding and sorting facility located at an exsisting hatchery a mile away.

Quality Control Reviews at Fish Hatcheries, Washington Department of Fish and Wildlife and US Fish and Wildlife Service
Mr Dorratcague provided the quality control reviews for the designs at three fish hatcheries. These were Keta Crisp Creek Hatchery, Devils Pupfish Refugium, and Voights Creek Fish Hatchery Replacement

Nelson Kawamura, PhD, PE, GE

Geotechnical Engineering

Dr. Kawamura has 39 years of experience as a geotechnical engineer in civil, mining and geo-environmental engineering projects in the U.S. and abroad, including 30 years of experience in dams and appurtenant structures, hydropower facilities and tunnels; possesses experience in subsurface investigations, analysis and design, and construction QA/QC; worked on all design phases of dam, spillway, powerhouse and tunnel rehabilitation projects; is experienced in dynamic analysis of tunnels and dams; led design and quality control of earthwork projects including compaction control of embankment fill materials. Has expertise in dam safety engineering in conformance with FERC and DSOD requirements.

EDUCATION

PhD, Civil Engineering, University of Illinois, 1998

MS, Civil Engineering, University of Illinois, 1991

BE, Civil Engineering, University of Sao Paulo, 1977

LICENSES/ REGISTRATIONS

Professional Engineer, Civil, California No. CE 65685, 2003

Professional Engineer, Civil, Michigan No. 6201048591, 2002

Professional Engineer – Geotechnical, California No. GE 2868, 2010

Relevant Project Experience

Priest Rapids Dam Project – *Grant County Public Utility District, WA*
Lead Geotechnical Engineer/Project Technical Lead – Reviewed scope of geotechnical services for Phase IV liquefaction potential and post-earthquake stability and deformation analyses of a zoned earth embankment composed of a central vertical impervious core flanked by pervious shells founded on potentially liquefiable granular alluvial deposits located on the right abutment. Developed guidelines for dynamic FLAC 2D analysis on the 25-foot tall right embankment dam to estimate seismic displacements at the end of ground shaking and post-liquefaction reconsolidation settlement. Supervised and reviewed liquefaction potential analysis, numerical modeling and geotechnical report. Reviewed pre-conceptual level alternatives proposed for seismic mitigation. Led the feasibility study of six seismic mitigation alternatives for the right embankment dam, including design criteria, seepage analysis, static and seismic analyses, drawings and feasibility report in conformance with the requirements by the owner, owner's Board of Consultants and FERC (Board members are Ross Boulanger, Lee Harder and Lelio Mejia). Currently is developing alternatives of connection details of the existing and new embankment dams in consultation with specialty contractors and cofferdam alternatives.

Wanapum Dam Project – *Grant County Public Utility District, WA*
Geotechnical Reviewer/Lead Geotechnical Engineer – Reviewed scope of geotechnical services for Phase IV liquefaction potential and post-earthquake stability and deformation analyses of a 100-foot tall zoned earth embankment composed of a central vertical impervious core founded on basalt flanked by pervious shells founded on potentially liquefiable granular alluvial deposits located in the river-closure section. Reviewed liquefaction potential analysis, dynamic FLAC 2D seismic deformation analysis and geotechnical report. Evaluated spillway foundation conditions using available borings and reviewed geological and geotechnical investigation program.

L. L. Anderson Dam - Spillway Modification, *Placer County Water Agency, CA*
Geotechnical Reviewer - Assessed and performed internal technical review of geotechnical data report, geotechnical interpretive report, geotechnical baseline report, and slope stability analysis for $2.9M of engineering services. Checked if documents met or exceeded the scope of work and design criteria approved by the client. Work met project schedule and budget. Dr. Kawamura reviewed geotechnical design of spillway modification on granodiorite. He provided technical oversight for rock excavation design, development of geotechnical parameters, slope stability analysis, nominal dam raise, parapet wall design along the 2,700-foot long dam crest, compaction requirements, and grout curtain design.

Power Tunnels, Ruskin Powerhouse Improvements – *BC Hydro, Canada*
Geotechnical Task Leader - Dr. Kawamura developed guidelines for dynamic FLAC 2D analysis on transverse sections of power tunnels and uncoupled FLAC 2D and SAP2000 3D analyses on longitudinal section. He supervised numerical modeling of 21-foot ID concrete lined sections in massive diorite and 19-foot ID steel lined sections in highly fractured diorite and glacial deposits. He prepared technical memorandum on liner leakage analysis and leakage repair with fiber reinforced polymer sheets and sub-drainage. He prepared technical memorandum on permanent seismic deformations in concrete and steel liners, and seismic liner retrofitting. He prepared drawings for tunnel liner leakage repair, and reviewed seismic stability analysis of cut slope and intake structure, and geotechnical specifications including earthworks and compaction requirements. Is currently providing technical support for the BC Hydro representative on-site for soil excavations and compaction of drainage blanket materials.

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification – *Los Angeles County Department of Public Works, CA*
Geotechnical Reviewer - Dr. Kawamura reviewed seismic rehabilitation design of a 250-foot-high arch dam for flood control founded on jointed granite. The project included concrete buttress on downstream face of the existing dam, new spillway at the dam crest, and downstream slope stabilization. He reviewed optimization of rock anchor design based on geological mapping of the exposed rock surfaces, assessed dam foundation capacity, and evaluated consolidation grouting program within the footprint of concrete buttress. He also reviewed geotechnical reports and memoranda.

Shasta Dam Raise Impacts on PG&E's Pit 7 Development – *USBR, CA*
Lead Geotechnical Engineer - Evaluated potential adverse effects of the Shasta reservoir raise between 8.5 and 20.5 feet on PG&E Pit 7 project using available drawings, boring logs, photographs and publications. Evaluated at conceptual level 3 possible impacts of the reservoir raise on Afterbay reservoir shoreline between Pit 7 Dam and Afterbay Dam located some 1.8 miles downstream of Pit 7 Dam, i.e., surface erosion along the Afterbay reservoir shoreline; slope instability over the Afterbay reservoir shoreline due to rapid drawdown of Shasta reservoir; and instability of Pit 7 powerhouse due to increase in uplift pressure.

Wanapum Spillway Repair Project – *GCPUD, WA*
Lead Geotechnical Engineer - Dr. Kawamura evaluated spillway foundation conditions using available borings and reviewed geological and geotechnical investigation program. He reviewed new boring logs in rock and concrete, results of laboratory tests in rock cores and water samples, and geotechnical report. He prepared technical memoranda on post-tensioned 2,144-kip multi-strand anchors and 581-kip bar anchors grouted in basalt for spillway monolith stabilization. He evaluated potential grout curtain deterioration, analyzed geotechnical instrumentation data, and reviewed drawings. The work was done working closely with FERC and owner's Board of Consultants.

Santa Anita Dam Spillway Modification Project – *Los Angeles County Department of Public Works, CA*
Geotechnical Reviewer - Reviewed geotechnical design criteria, geotechnical investigation program, geotechnical investigation report, geotechnical engineering calculations, drawings and specifications for the proposed generator, fuel and garage building. Reviewed site reconnaissance memorandum, surface erosion mitigation alternatives and geotechnical engineering calculations for high water tank erosion evaluation.

Calaveras Dam Replacement – *San Francisco Public Utilities Commission, Sunol, CA*
Senior Geotechnical Engineer - Dr. Kawamura designed initial ground support systems consisting of steel plates, shotcrete layer, and dowels for a 22-foot-diameter inlet/outlet shaft and 10-foot-diameter adits in Temblor sandstone and underlying Franciscan Melange formation. He supervised and reviewed analysis and design of a 26-foot-high shotcrete-faced retaining structure anchored in Franciscan formation. He also supervised and reviewed dynamic (FLAC 2D) analysis and foundation design of a 46-foot-high spillway gravity wall anchored in rock to resist seismic effects. He reviewed dynamic FLAC analysis of 200-foot deep permanent spillway excavation. He prepared technical memoranda and supervised preparation of civil design drawings.

Rio Blanco Dam – *Puerto Rico Aqueduct and Sewer Authority, PR*
Senior Geotechnical Engineer/Geotechnical Resident Engineer – Supervised subsurface investigation program consisting of borings, field and laboratory tests, and piezometer installation. Analyzed slope stability of a 115-foot deep excavation in weathered granodiorite for construction of spillway. Performed independent technical review of off-stream reservoir project (layout and cross-section optimizations) consisting of a compacted earth dam of 4,300 feet in crest length and 65 feet in maximum height founded on alluvial deposits with artesian groundwater sitting on residual soil of granodiorite. Reviewed design of intake tower on weathered volcaniclastic rocks. Assessed geologic faults crossing the reservoir area. Performed finite element dynamic deformation analysis to evaluate the benefits of stone columns to minimize liquefaction and reduce permanent seismic deformations. Conducted finite element seepage analysis to evaluate the benefits of cutoff slurry trench to reduce flow rates through alluvial sand. Served as a geotechnical resident engineer during foundation treatment and embankment dam construction.

Australia Pacific Liquefied Natural Gas (APLNG) Upstream Phase 1 – *Origin Energy, Australia*
Geotechnical Reviewer – Reviewed boring and laboratory test program for embankment foundations, bottom of reservoir and borrow areas at the Reedy Creek site. Directed and reviewed limit equilibrium slope stability and finite element seepage analyses of 30-foot tall pond earthfill embankments at the end of construction, maximum normal operation, rapid drawdown and during design earthquake in Condabri, Reedy Creek, Talinga and Spring Gully sites including development of geotechnical input parameters. Supervised and reviewed preparation of technical memoranda on geotechnical data and analysis. Performed technical review of earthwork specifications, geotechnical

drawings and technical memorandum on stabilization of dispersive soils derived from residual soils of sandstone/siltstone/mudstone/claystone, and alluvial deposits. Reviewed text for geotechnical sections of design plan reports.

RS-STA 1W Expansion #1 Project – *South Florida Water Management District, FL*
Geotechnical Reviewer – Provided guidance to the technical staff on seepage analysis and limit equilibrium stability analysis of 15-foot deep canal slopes and 10-foot tall pond embankment slopes in peat, loose sand and limestone totaling 60,000 feet in length each at the end of construction, normal operation, maximum flood with hurricane, and rapid drawdown. Reviewed calculations of seepage rates, exit hydraulic gradients, and uplift pressures, liquefaction potential analysis, and settlement calculations. Reviewed seepage and stability analyses technical memoranda.

Thornton Composite Reservoir – *MWDGC, Chicago, IL*
Senior Geotechnical Engineer - Dr. Kawamura supervised finite element transient seepage analysis to characterize the seepage regime in a 2,700-foot long dam comprised of a wall of in-situ dolomitic limestone during cyclic reservoir operation. He assessed piezometric heads on upstream face of the dam to be used in stability analyses of individual joint-bound rock blocks identified by geologic mapping. He evaluated the effect of reservoir drawdown downstream of the drainage curtain.

Los Padres Dam Sediment Removal Feasibility Study – *California American Water, CA*
Geotechnical Reviewer – Provided geotechnical support for earthworks including soil properties and required embankment slopes.

Martina Gelo, PE

Civil Engineering

Martina Gelo is civil/structural engineer with 15 years of experience in structural design and analysis for water resources, mining, and natural gas engineering projects. She is proficient in civil/structural analysis, calculations, design; drafting, material take offs and cost estimating. Her experience includes design and analysis of variety concrete foundations (equipment foundations, building foundations, pipe support foundations), concrete retaining walls, culverts, bridges, concrete boxes, pump intake structures, structural steel platforms and support structures. Martina also has experience with open channel and pipe hydraulics, hydrology analysis, grading design, and piping design.

EDUCATION

MEng, Civil, University of Zagreb, Faculty of Civil Engineering, Croatia

LICENSES/ REGISTRATIONS

P.E. California (C 83278)

ISO 9001:2000 Quality System Auditing

YEARS OF EXPERIENCE

15

Relevant Project Experience

WATER RESOURCES ENGINEERING

Moccasin Penstock Rehabilitation Project, *Tuolumne County, California*
Client Name: San Francisco Public Utilities Commission
Engineer responsible for existing concrete saddles and coating rehabilitation as well as project constructability assessment.

Don Pedro Project, Stanislaus *County, California*
Client Name: Turlock Irrigation District
Structural engineer for stability evaluation of existing Powerhouse.

Santa Anita Dam Spillway Modification Project, *Los Angeles County, California*
Client Name: Los Angeles County Department of Public Works
Structural engineer for detail design and retrofit of dam outlet platform, retaining wall, and building foundations in high seismic area.

River Intake Structure, *Sweeny, Texas*
Client Name: Phillips 66
Structural engineer for preliminary and detail design of 60 ft high concrete pump intake structure on the bank of Saint Bernard River, Sweeny, Texas.

Burdelj Reservoir Project– Basic Engineering, *Croatia*
Client Name: Country of Croatia
Responsible for design of dam structures (body of dam, spillway, drop inlet spillway, conduit, chute spillway, stilling basin and other structures).
Developed similar project in 2004. Slanac Reservoir and Lipovacka Gradna Reservoir and Rudarska Gradna Reservoir in 2005.

Londza Reservoir – Phase 2– Detailed Engineering, *Croatia*
Client Name: Country of Croatia
Responsible for structural analysis of dam reinforced concrete parts, as well as for designing and drafting of all structures, made all quantity calculations and cost estimates in project, also worked on phase 1 of this project in 2004.

CIVIL/STRUCTURAL MINING ENGINEERING

Homestake-McLaughlin Mine, Water Management, Pump-back System, Trade off Study, *Lake County, Northern California*
Client Name: Barrick Gold
Responsible for developing trade off study of feasible options for retrofitting pump back system from existing mine pit, over existing dam to tailings lake in high seismic area.

Homestake-McLaughlin Mine, Mine Closure Water Management, Barker Pump-back System Design, *Lake County, Northern California*
Client Name: Barrick Gold
Responsible for detail design and retrofitting of pump back system in high seismic area. Project involved seismic evaluation and retrofitting of existing structures (tank, access bridge, pump station) as per current California seismic code requirements.

Quebrada Blanca Phase 2 Tailings - Detailed Engineering, *Chile*
Client Name: Teck
Structural discipline lead for tailings disposal and reclaim systems design in high seismic area. The project involved the structural design and analysis of tank foundation, tailings distribution boxes, pump intake structures, pump foundations, pipe supports, and structural steel platforms.

Relincho Project Feasibility Study, *Chile*
Client Name: Teck
Structural discipline lead for tailings disposal and seepage water reclaim systems design in high seismic area. Also responsible for tailings disposal and seepage water reclaim systems process area drawings. The project involved the structural design of tank foundation, tailings distribution box, pump intake structure, pump foundations, pipe supports, structural steel platforms and cyclone support structure.

Barrick Cortez Hills Tailings Pumping and Piping Project– Detailed Engineering, *Nevada, USA*
Client Name: Barrick Gold
Civil/Structural engineer for civil and structural detail design of pump station, tailings and reclaim water pipelines. The project involved the structural design of pump foundations and pipe supports, building foundations, procurement of structural steel pump building, pipelines design.

Khouribga Phosphate Ore Pipeline System– Basic Engineering, *Morocco*
Client Name: OCP Group
Civil/Structural engineer for civil and structural design of pump stations, head stations, valve Stations and terminal station.

Connie Wong, PE

Civil Engineering

Ms. Wong is a civil engineer with over five years of project experience. She assists in the civil design of wet infrastructure projects involving dams, powerhouses, and canals. Ms. Wong also has a focus in geotechnical engineering and assists in the geotechnical and slope stability analyses of projects involving landslide mitigation, water treatment pond design, reservoir evaluation, and sediment storage facilities.

EDUCATION

BS, Civil Engineering, University of California, Berkeley

LICENSES/ REGISTRATIONS

Professional Engineer (PE) - California – C83417

Relevant Project Experience

Santa Anita Dam Spillway Modification Project, Los Angeles County Department of Public Works, California
Civil/Geotechnical Engineer - This project features the augmentation of the spillway capacity of Santa Anita Dam to meet the requirements of the upgraded Probable Maximum Flood, valve replacement, water system replacement, and a new garage, generator, and fuel supply tank. Ms. Wong assisted in the civil design of various features including the hoist tail tower platform, construction vehicle ramps, spillway notch, spillway impact area armoring, access road drainage and expansion and prepared design drawings in AutoCAD. Ms. Wong also helped develop the geotechnical report for the new garage, generator, and fuel supply buildings and performed geotechnical calculations for the scarp repair gabion wall design.

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification, Los Angeles County Department of Public Works, California
Civil Engineer - This project features the seismic retrofit of an existing concrete arch dam including placement of mass concrete to thick arch section, construction of a new valve, and installation of new outlet penstocks and valves. Ms. Wong redesigned the drainage grading plan for the powerhouse patio, reviewed project submittals, assisted in the analysis and design of drill holes, revised design drawings in AutoCAD and MicroStation to incorporate as-built details, and developed the construction summary report. Ms. Wong also performed civil design for the underground utility improvement, including the design of the new water routing system and the alignment of the trench for the electrical and water lines. Ms. Wong developed the civil drawings in AutoCAD and Civil3D for the underground utility improvement, assisted in writing specifications, and developed the bill of materials for the civil work.

Tulloch Hydroelectric Project 3rd Unit Addition, Tri-Dam Project, California
Civil Engineer - The project at Tulloch Dam features a new powerhouse with a 7-MW turbine-generator, penstock bifurcation at the existing outlet valves and access road which includes the installation of 3 culverts. The powerhouse covers an area of 32 ft. by 48 ft. and a depth of 73 ft. into the rock. Ms. Wong assisted with writing weekly reports, performing tests, analyzing monthly pH data, reviewing and processing submittals and RFIs, crack mapping of the access road, and revised design drawings to incorporate as-built details.

Waste Management Unit 32 Closure Studies and Interim Corrective Action, Avon Remediation Team, Tesoro Golden Eagle Refinery, California
Civil/Geotechnical Engineer - MWH performed investigations to collect soil and groundwater treatability information to support closure of Waste Management Unit 32 (WMU 32) in order to evaluate the feasibility of closure alternatives, develop a design basis and process design report for the most cost-effective approach, and finalize the closure design. MWH also developed a corrective action approach to treat the contaminated soil underneath the site. Ms. Wong helped developed general, civil, and mechanical design drawings in AutoCAD and helped design the final grading plan for the project. Ms. Wong assisted in the geotechnical investigation, analyzed boring logs, CPTs, and laboratory tests to determine material properties, and performed calculations for primary and secondary consolidation for the waste management unit.

Willow Island Hydroelectric Project, American Municipal Power, West Virginia
Civil/Geotechnical Engineer - Willow Island is one of four hydroelectric plants along the Ohio River that MWH has designed for American Municipal Power. A cofferdam was constructed to allow dry excavation and construction of the Willow Island powerhouse. Ms. Wong helped perform the slope stability computations for the rock anchor load analysis for excavation support to determine the difference in required rock anchor force due to the difference in rock strengths assumed by MWH and the design-build contractor.

Moccasin Penstock Rehabilitation Project, San Francisco Public Utilities District, California
Civil Engineer – This project consists of rehabilitation work to an existing penstock for the Moccasin Hydroelectric Project. Ms. Wong assisted with the design of civil drawings, analyzed the material property analysis results for the existing penstock and determined the feasibility of using a helicopter to bring the new penstock bifurcation up to the site.

Hell Hole Dam Outlet Works Upgrade, Placer County Water Agency, California
Civil Engineer – This project consists of upgrading the outlet works at Hell Hole Dam to be able to meet the daily instream flow, spring time pulse flow, and down ramp of spill flow goals and license conditions mandated by FERC, as well as other requirements stated by PCWA. Ms. Wong performed a HEC-RAS hydraulics analysis for the downstream channel to determine the discharge rate and other conditions that lead to backwater and fixed cone valve inundation, in order to determine the flow limitations of the existing channel and to determine the channel recontouring required to discharge the FERC license target flow and keep the backwater curve below the finished floor elevation of the existing powerhouse.

Ruskin Powerhouse Improvements Project, BC Hydro, Canada
Civil Engineer – This hydropower plant was built in 1930. MWH is to evaluate if the powerhouse structure and 3 power tunnels meet the current seismic design criteria and to detail seismic retrofitting solutions as needed. Ms. Wong assisted with the review of dynamic stress and displacement calculations.

Pine Flat Dam Slope Failure Design Investigation and Mitigation Design, U.S. Army Corps of Engineers (USACE), California
Civil/Geotechnical Engineer - This project involves the investigation and mitigation of a slow-moving landslide sliding onto Pine Flat Dam in Fresno, CA and blocking access to a gallery adit. Mitigation involves drainage of the sliding mass and the design of a structure allowing year-round access into the adit. Ms. Wong assisted with the geotechnical investigation, performed slope stability and parametric sensitivity analyses on SLOPE/W, analyzed the inoperable drainage pipes previously built into the sliding mass, developed design drawings, and reviewed RFIs.

Tank 1002 Liner System Design, Phillips 66, San Francisco Refinery, California
Civil Engineer - This project involves the design of an HDPE liner system to prevent future leakage from a fuel tank storage containment site, which had been leaking pooled rainwater. Ms. Wong assisted in the design of the liner system, including the anchor trench into the berm and ground surface, anchorage onto wing walls and stairs, liner protection, and site drainage. Ms. Wong also developed all design drawings.

APLNG Pond Design, Origin Energy, Australia
Civil/Geotechnical Engineer - MWH designed the feed, brine, effluent, and permeate ponds associated with the existing and planned water treatment facilities for the water discharge from coal seam gas extraction in Queensland. Ms. Wong assisted in the development of the geotechnical analysis and detailed design report. Ms. Wong performed seepage and slope stability analysis on SEEP/W and SLOPE/W and assisted in the analysis of the geotechnical investigation and soil properties.

Priest Rapids Right Embankment Mitigation Design, Grant County Public Utility District, Washington
Civil/Geotechnical Engineer – This project consists of providing engineering services related to the design of mitigation measures associated with liquefaction potential, foundation seepage and embankment stability for the Priest Rapids Dam right earth embankment. Ms. Wong assisted with the preliminary design of the new cofferdam required for excavation of the existing embankment, back-calculated the friction angle of the existing soil using SLOPE/W, and assisted with developing soil profiles of the existing site.

Stormwater Treatment Area STA-1W Expansion Area No. 1, South Florida Water Management District, Florida
Civil/Geotechnical Engineer - This project is a component of the Restoration Strategies projects identified to work in conjunction with the existing Everglades Stormwater Treatment Areas to meet the Water Quality Based Effluent Limit that would achieve compliance with Florida's phosphorus criterion in the Everglades Protection Area. Ms. Wong assisted with the geotechnical investigation, performed uplift calculations, and performed seepage and slope stability analyses of the embankments and canals using SEEP/W and SLOPE/W.

DeSabla Powerhouse ARV and De-Excitation System, Pacific Gas & Electric Company (PG&E), California
Civil Engineer - This project at the DeSabla powerhouse features the replacement of an existing voltage regulator system with a new automatic voltage regulator and the installation of a new exciter contactor and an outdoor power

transformer. Ms. Wong designed the concrete pad for the new transformer box and designed the lateral seismic support structure for the bus duct. She also developed design drawings in MicroStation.

Los Padres Dam Sediment Removal Study, California American Water
Civil Engineer - MWH performed a feasibility study for the removal of 2 million cubic yards of sediment from the Los Padres Reservoir. The study includes the investigation of alternative methods for sediment removal, transportation, and disposal, identifying potential commercial uses or disposal sites for the sediment, and preparing conclusions and recommendations. Ms. Wong compared sediment disposal site location alternatives, calculated their sediment volume capacities, assisted in the preliminary design of the disposal sites, analyzed and compared 1947 and 2008 reservoir bathymetry data, identified potential access roads, determined quantities for project cost estimation, developed drawings and figures for the final report, and assisted in preparing the project execution plan.

L.L. Anderson Dam Spillway Modification Project, Placer County Water Agency, California
Civil Engineer – Prior to modification, studies indicated that the LL Anderson Dam spillway did not have enough capacity and the dam would fail under extreme flood conditions. MWH modified the rock channel spillway to bring the dam into compliance with current standards. Modifications include widening the upper spillway channel, adding a new gate structure downstream of the existing structure, adding new gate controls and adding a parapet wall along the dam crest. Ms. Wong revised design drawings to incorporate as-built details.

Lake Eleanor Dam Condition Assessment, San Francisco Public Utilities Commission, California
Civil Engineer – Lake Eleanor Dam in Yosemite National Park shows signs of cracking and deterioration. MWH inspected the dam and developed a Needs Assessment Report to evaluate the condition of the existing dam and facilities, define the gap between the current condition and operations and maintenances' requirements, and provide recommendations on the rehabilitation necessary to meet requirements and extend the service life of the facility. Ms. Wong helped to write, edit, and compile photos for the Inspection Report that summarizes the findings and conclusions of the inspection, which was later used to develop the Needs Assessment Report.

Helms Sewage Treatment Plant Overflow Tank Improvements, PG&E, California
Civil Engineer - This project features a tank to capture and quantify the overflow from the water treatment plant. Ms. Wong assisted with the design of the overflow tank system and details, prepared design drawings, and assisted in overseeing the construction process.

Lyons Dam Instream Flow Release and Canal Flow Automation, PG&E, California
Civil Engineer - MWH designed a system to automate instream flow releases, as well as canal flows to Phoenix Powerhouse and Columbia Canal on the Stanislaus River. Ms. Wong updated civil drawings in MicroStation and assisted in the design of an outdoor stairway configuration near the generator building.

Mohammadreza Mostafa, PhD, PE

Structural Design

Dr. Mostafa has more than 15 years of consulting experience in seismic analysis and design of various steel, concrete, and masonry structures. He has experience managing a design team working on appurtenant structures to dams, such as underground and surface hydropower plants, dry and pressurized tunnels and shafts, intake, outlet structures and residential and industrial buildings. He is experienced in seismic evaluation of existing structures, as well as in structural design of Water/Wastewater facilities. He has extensive knowledge of current design codes: CBC, IBC, ACI 318, ASCE 7, ACI 350, AISC 360, AISC 341, AISC 358, API, USACE, AWWA D10 and PTI.

He is skilled in dynamic analysis (response spectrum and nonlinear time history) of building and hydraulic structures using relevant commercial software and design codes (US Army Corps of Engineers' engineering manuals and FERC publications). He has also experience on seismic analysis and design of different concrete and steel bridges based on AASHTO LRFD design code.

Software Experience:
Structural Analysis: ANSYS, ADINA, ABAQUS, SAP2000, ETABS, SAFE, Sigma/W and PLAXIS.
Structural Design: SP Column, ENERCALC, WIND SIMPLE, HILTI AND SIMPSONS Anchor Design software.

Relevant Project Experience

Rio Bravo Hydro Electric Project, *Catalyst Energy Development*
Served as structural engineer performing the stress analysis of the Diversion Dam due to the proposed modifications to the dam. These modifications include adding two piers on the crest of the dam to support the access bridge and adding two holes through the dam for sluicing the sediments

Lake Eleanor Needs Assessment, *San Francisco Public Utilities commission*
Served as lead structural engnieer performing the Finite Element Analysis of the Lake Eleanor multiple arch dam, preparing the inspection report and the Needs Assessment Report. The project include updatring the seismicity and PMP/PMF of the project.

Santa Anita Dam, *LA Department of Public Works*
Served as structural engineer performing complementary Time-History Finite Element Analysis of the dam considering the effect of the spillway notch. The main goal was to compute the reponse of the slender block next to the spillway notch.

Monticello Dam Blind Prediction, *United States Society on Dams,*
Served as structural engineer performing Time-History Finite Element Analysis of the dam and comparing the results with the accelerometer recordings from a recent earthquake with PGA=0.01g.

North Fork Dam Spillway, *Pacific Corps Energy*
Served as structural engineer performing the earthquake and post-earthquake analyses of the North Fork spillway using nonlinear FE methods. Performed the stability check of the structure for the operational, earthquake flood and post-earthquake load cases.

Tulloch Dam Spillway, *TRI-DAM*
Served as structural engineer performing the earthquake and post-earthquake analyses of the Tulloch spillway using nonlinear FE methods. Performed the stability check of the structure for the operational, earthquake and post-earthquake load cases. Moreover, served as the assistant project manger on this job.

EDUCATION

Ph.D., Structures, University of Colorado, Boulder, 2011

M.S., Structures, University of Colorado, Boulder, 2010

M.S., Hydraulic Structures, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran, 2003

B.S., Civil Engineering, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran, 2001

LICENSES/ REGISTRATIONS

Registered Professional Civil Engineer: California, Washington and Oregon

Registered Structural Engineer, Iran (Since 2003)

Member of USSD Committee of Concrete Dams Chapter as of 2016

Member of ASDSO

Poe Dam Project, Radial Gate Replacement, *Pacific Gas & Electric*
Served as structural engineer for performing the nonlinear stress analysis of the existing trunnion yoke and hub using Finite Element Methods (ADINA software). The analysis also included designing new yoke and hub assemblies that comply with the relevant design codes for trunnion structure (USACE engineering manuals). The analysis results were published in USSD 2014.

Kelly Ridge Powerhouse TSV Replacement, *South Feather Water and Power Agency*
Served as structural engineer for the stress analysis of the existing reducer spool of the penstock, connected to the butterfly valve.

Hadly Dam, *Holyoke Gas and Energy*
Performed the independent analysis and design for the plunge pool and the anchorage system. Also checked the adequacy of the dowels that were used to stabilize the slopes of the plunge pool

Robbs Peak Weir, *Sacramento Municipal Utility District*
Served as structural engineer designing a weir on the downstream of the dam. The design involved the stability analysis of the structure and nonlinear Finite Element analysis to design the reinforcement

Don Pedro Dam and Appurtenant Structures, *Turlock Irrigation District*
Prepared a condition assessment report on the dam and all appurtenant structures. This report included the assessment of the bulkheads, radial gates, powerhouse structure, power intake structure and etc.

Bowman Penstock, *Nevada Irrigation District*
Served as structural engineer for the analysis and design of the reinforced concrete encasement around the existing penstock bifurcation which was broken. It also included designing a thrust block and Prestressed anchors per PTI code.

Kwoiek Penstock Design, *Kwoiek Creek Resources Limited Partnership (CANADA)*
Served as structural engineer conducting the analysis and design for the KWOIEK penstock. The analysis was done using nonlinear Finite Element method to model the 3D alignment of the penstock as well as the Soil-Structure interaction.

Linville Dam project, Penstock Encasement, *Duke Energy Corporation*
Served as structural engineer for the analysis and design of the concrete encasement for the existing penstock that will be exposed to the increased overburden pressures associated with placement of the downstream earthen stability berm.

Coleman-Asbury Penstock, *Pacific Gas & Electric*
Served as structural engineer designing the 36" diameter steel penstock for the project using the ASCE Manual 79 for steel penstocks

Hyatt Powerhouse, *Department of Water Resources (DWR)*
Served as the structural engineer designing the egress structure inside the powerhouse as well as checking the existing powerhouse structure against the new loads per the relevant codes.

Davis-Woodland project, *Woodland-Davis Clean Water Agency*
Served as the structural engineer designing the operation building as well as the pump station building.

Scott D. Peyton PE

Stream Restoration

Stantec

Mr. Peyton is a project manager with experience in a variety of water resource and design projects. He has direct project experience with ecosystem and stream restoration and enhancement projects including conceptual level planning, preliminary and final design, permitting, assistance during construction, and post construction monitoring. Mr. Peyton also has experience in hydrologic and hydraulic modeling, performing floodplain analysis and delineation, water quality studies, and a variety of storm water and water resources projects including watershed management and planning. He is a proficient user of many hydrologic, hydraulic, and GIS applications, including RIVERMorph, HEC-HMS, HEC-RAS, ArcView, and ArcInfo. In addition, he has experience in water resources planning projects including EPA NPDES Phase II programs and permit applications, hazard mitigation planning, and watershed planning and improvement projects.

EDUCATION

BS, Civil Engineering, University of Dayton, Dayton, Ohio, 2002

River Restoration and Natural Channel Design, Wildland Hydrology, Gunnison, Colorado, 2007

River Morphology and Applications, Wildland Hydrology, Davis, West Virginia, 2006

Applied Fluvial Geomorphology for Engineers, Wildland Hydrology, Davis, West Virginia, 2006

Wetland Delineation and Management, Richard Chinn Environmental Training, Columbus, Ohio, 2005

River Assessment and Monitoring, Wildland Hydrology, Missoula, Montana, 2007

REGISTRATIONS

Professional Engineer #27304, Commonwealth of Kentucky

Professional Engineer #71790, State of Ohio

PROJECT EXPERIENCE

Geomorphologic Assessments

Whitewater Canal Rehabilitation, Metamora, Indiana (Senior Project Engineer)

The Town and IDNR propose to rehabilitate the Whitewater Canal to improve water delivery into the town's historic district and create a hiker/biker trail along the rail/canal route. As Senior Project Engineer, Mr. Peyton conducted a field review of the project site in October 2004 to identify the watershed sedimentation problems, examine historic structures, characterize the sedimentation in the existing canal, and to propose alternatives at the West Fork of the Whitewater River diversion dam to manage flows and sediment. The project went into the study phase in May 2006, when Mr. Peyton lead the fieldwork in the watershed to qualify sediment sources, classify the streams, and examine alternatives for their effectiveness at solving the sediment source problems to the canal. The EPA WARSS based study report was provided to IDNR in August 2006.

Little Miami River Geomorphic Assessment, Hamilton & Clermont Counties, Ohio

Hamilton and Clermont counties conducted feasibility studies to introduce a multi-modal transportation network through the Eastern corridor to the City of Cincinnati. As part of this study, alternative alignments over the state and national scenic Little Miami River and the adjacent farm lands were investigated. The unique designation and quality of this stream presented an added intricacy to the project. Stantec was charged with providing geomorphic analyses of several reaches of the Little Miami River associated with the transportation alignment alternatives as well as providing findings and recommendations. Mr. Peyton performed field work including field reconnaissance, surveying profile and cross sections of the stream, installing erosion and scour monitoring devices, and collecting particle data from the stream bed and banks.

Scott D. Peyton PE

Stream Restoration

County-wide Geomorphic Study, Harris County, Texas (Project Manager)
Stream channels in Harris County are subject to extensive erosion which is filling in shipping channels at the Port of Houston. To address this problem, Harris County is developing the tools to make natural channel design a more commonly used design approach. The work conducted for this study included developing regional curves, collecting reference reach data, developing dimensionless ratios, developing BEHI and NBS erosion rate curves, and developing suspended sediment rating curves.

Stream Restoration

Buffalo Bayou Stream Restoration, Houston, Texas (Project Manager)
Mr. Peyton is the Project Manager for the largest stream restoration and natural channel design project ever undertaken in Houston. Buffalo Bayou is a special stream – one of the last left unchannelized by past flood control efforts. Many banks along the bayou were eroding badly, threatening millions of dollars in public and private infrastructure. Stantec is working with the Bayou Preservation Association and the Harris County Flood Control District to development the design for the project. The project is scheduled for construction in 2013 at a capital cost of approximately $6,000,000.

Chevron Facility on the Great Miami River Hydraulic Modeling and Scour Remediation, Cincinnati, Ohio
Stantec performed hydraulic modeling from river mile 7.0 to river mile 16.1 above the confluence with the Ohio River to determine the impacts the remedial measures might have on 100-year flood elevations and performed scour depth calculations on the exposed riverbank to support sheet pile wall design. Stantec also proposed alternatives for bank and floodplain restoration and re-vegetation following construction of the cut-off wall. The project addressed the erosion of the bank and potential impacts on the floodplain and scour from the proposed conditions. Lowering the floodplain next to the river and the vegetation restoration will place riparian forest, and their protective roots, close to the waterline. Placement of silty soil behind the proposed sheet pile wall will help seal the sand & gravel layer under the proposed riparian planting zone.

AMPGS Stream Relocation, Racine, Ohio (Project Engineer)
In anticipation of the construction of a new power plant, an existing stream needed to be relocated and reconstructed as a natural channel. As Project Engineer, surveyed the typical channel characteristics of the stream, obtained sediment samples, and located a reference reach that was intensively surveyed using Rosgen methods.

Seltzer Park Riparian Restoration, Shelby, Ohio (Project Engineer)
Served as a Project Engineer providing construction assistance to the contractor. The project involved the restoration of an existing stream using natural channel design techniques while maintaining the aesthetics of the park setting.

Gilmers Creek Stream Restoration Project, Madison County, Tennessee (Assistant Project Manager)
Gilmers Creek, a sandbed stream, located near Jackson, Tennessee, has been channelized to accommodate agricultural fields in the vicinity of the stream. The stream is incised and levees have been constructed on both sides of the creek, preventing access to the floodplain. Stantec was retained by White Lake Waterfowl to perform stream restoration of 8,000 feet of Gilmers Creek for the purpose of a mitigation bank. The natural channel design included restoring Gilmers Creek to a natural meandering pattern through an adjacent farm field. Because the sediment being transported by the stream is highly erosive, an important aspect of the design was to ensure that sediment stability was achieved. A FLOWSED/POWERSED analysis was performed to determine if the design would adequately transport the sand load. Mr. Peyton performed the geomorphic surveying of the impacted and reference reaches for the project. He also completed the natural channel design of Gilmers Creek.

* denotes projects completed with other firms

Scott D. Peyton PE

Stream Restoration

Cypress Creek Stream Restoration, Houston, Texas (Project Engineer)

The Harris County Flood Control District proposes a second phase of stream restoration on Cypress Creek in western Houston, with Stantec being a subconsultant to Geomatrix, Inc. As Project Engineer, Mr. Peyton proposed to concentrate on grade stabilization for the Creek, while restoring an open floodplain. He led to the effective discharge analysis that was used to size the channel. Additional surveying lead by Alan identified the downstream channel constraints for the design. A HEC-RAS model was created by Geomatrix, with the preliminary design from the RiverMorph analysis conducted by Stantec. Mr. Peyton directed the modification of the design in the model for the purpose of identifying flow conditions necessary for the sizing of the rock for the control structures.

Furnace Branch Stream Mitigation, Wayne County, Tennessee (Sr. Water Resources Engineer and QA/QC)

On site stream mitigation was required as part of the widening of SR-15 and subsequent encapsulation of a "Tennessee Exceptional Waterway." Mr. Peyton assisted with geomorphic assessment of the impaired stream for the restoration of an entrenched reach of Furnace branch. Completed the design of a priority three incised stream restoration for a total of 1200 feet of channel. A sediment transport model was developed using the Flowsed/Powersed module of the RIVERMorph© Natural Stream Design software to evaluate bed stability. Additional tasks included: the identification and geomorphic survey of a reference reach, sediment samples and sieve analysis, construction quantity calculations, and hydraulic calculations. Further challenges included the channel design through bedrock constraints.

Willows Branch Stream Enhancement, Warren County, Tennessee (Sr. Water Resources Engineer and QA/QC)

This project included the relocation of 1,100 feet of Willows Branch as on-site mitigation for stream impacts at SR-1 highway. Mr. Peyton performed conceptual design and then reviewed the detailed stream design and geomorphic assessment of the impaired reach, sediment transport calculations, construction quantity calculations, and channel design using RIVERMorph© Natural Stream Design software. This stream enhancement was one of the first restoration designs bid through the roadway contract and demonstrates a turning point in the management of stream relocations in Tennessee. Mr. Peyton also reviewed the monitoring of Willows Branch for two successful years of the monitoring reports to comply with 401 and 404 water quality permits.

Tributaries to the Hatchie River Watershed Assessment, Various Counties, West Tennessee (Project Manager)

Stantec was contracted by the Nature Conservancy to conduct an abbreviated watershed assessment and prepare three conceptual designs for the Clover, Richland Creek and Bear Creek watersheds in West Tennessee, located within the Hatchie Watershed. The main purpose of this project was to assess the watershed for potential stream restoration projects, identify potential funding and prepare conceptual designs and cost estimates. Mr. Peyton was responsible for field assessments, project sites selection, report preparation, and development of conceptual and final designs.

Unnamed Tributary to the Wolf River Stream Restoration, La Grange, Tennessee (Project Manager)

The UT Wolf stream restoration project included the restoration of approximately 10,000 feet of stream. The project was completed by the design/build team of Stantec and Mid Tennessee Sediment and Erosion Control and was initiated by the Tennessee Stream Mitigation Program (TSMP). The project included Priority I and II restoration techniques and the re-meandering of UT Wolf. Mr. Peyton provided final design assistance and managed construction oversight of the project.

* denotes projects completed with other firms

Scott D. Peyton PE

Stream Restoration

Tributary to Mill Creek Stream Restoration, Cleveland, Ohio (Project Manager)

The Tributary to Mill Creek was a degraded headwater stream on the Highland Hills Golf Course. Mr. Peyton performed stream assessments and prepared a conceptual design. Mr. Peyton then led an effort to educate more than a dozen stakeholders to gain project support and held multiple public education field days for the high profile project. Final design and construction services were also Mr. Peyton's responsibility for this design-build project. Approximately 2,300 feet of stream was restored and enhanced using Priority I, II and III natural channel design techniques. The City of Cleveland, the North East Ohio Regional Sewer District, and the Cuyahoga County Board of Health now have a stream restoration showpiece for northeast Ohio.

Dry Fork Creek Bank Stabilization and Stream Restoration, Whitewater Township, Ohio (Principal-in-Charge)

Mr. Peyton was the design engineer and Principal-in-charge for bank stabilization and stream restoration work in Dry Fork Creek within the Miami-Whitewater Forest. The restoration reach was approximately 2,200 feet long and included the use of j-hooks to reduce lateral erosion and promote pool formation and the use of toe wood and live brush layering along steep erosional stream banks. Permitting activities included preparation of NWP 27 under Section 404 of the Clean Water Act, correspondence with the Ohio Historic Preservation Office on issues related to Section 106 of the National Historic Preservation Act, and agency coordination as required under Section 7 of the Endangered Species Act. The federally threatened running buffalo clover is known to occur in the Miami-Whitewater Forest and the endangered Indiana bat had been captured within two miles of the project area. Field surveys concluded that these species were not present within the project area and consequently formal consultation with USFWS was not necessary. The project was built on-time and within budget and withstood the third wettest month on record (April 2011) without damage despite having been constructed only months five months earlier.

East Fork Avey's Run Stream Restoration, Cincinnati, Ohio (Project Manager)

Mr. Peyton was responsible for all aspects of this design-build stream restoration project. He assisted the Clermont Soil and Water Conservation District and the East Fork Little Miami River Watershed Collaborative in restoring the reach using 319 Grant funds. Mr. Peyton collected and reviewed available GIS data and performed geomorphic and sediment data collection for the impacted reach and reference reach. He then prepared a conceptual design for 1,700 feet of East Fork Avey's Run including 500 feet a Priority I restoration and 1,200 feet of Priority III restoration using natural channel design techniques. The Priority I restoration included relocating the channel to and reconnecting the channel with the historical floodplain. The Priority III restoration included adding in channel grade control and habitat structures to raise the channel bottom to decrease the degree of incision. In-situ, native materials were used in the design to reduce construction costs and improve aesthetics of the completed project. He worked with the design-build contractor throughout the project on constructibility and budget issues to deliver an innovative and stable stream system.

* *denotes projects completed with other firms*

Scott D. Peyton PE

Stream Restoration

Muddy Creek Stream Restoration, Mason, Ohio
(Senior Project Engineer)

Muddy Creek was threatening homes, driveways and sanitary sewer infrastructure in the City of Mason, Ohio due to scour and lateral stream migration. The City of Mason's primary concerns were an exposed length of 21" sanitary sewer and scour at a concrete encased sewer crossing. Mr. Peyton was responsible for stream restoration and stabilization of 1,600 feet of stream. Mr. Peyton defined a clear picture of existing stream conditions utilizing RIVERMorph, photographs, GPS, survey data and a GIS. He then implemented the appropriate design based on the collected data. The key project components were identifying problems caused by existing drainage system conditions and recommending natural channel design solutions. Specific tasks included geomorphic survey and analysis, stream walk and analysis, interviewing and educating residents, analyzing model results, GIS data collection and mapping, and cost analysis. After design alternatives were analyzed, Mr. Peyton executed the preferred design option. He created construction plans suitable for bidding, including plans, profiles, cross sections, specifications, details and an engineer's estimate. As part of this project, Stantec also designed a replacement of approximately 1,800 linear feet of replacement sanitary sewer. Mr. Peyton played a key role in project management and coordination to deliver both stream and sewer construction drawings on time. Mr. Peyton assisted the City with construction administrative tasks and was on site during stream construction and structure installation.

Mike Vukman

Stream Restoration

Over his career, Mr. Vukman has been able to compile a diverse set of skills as a project manager, including skills obtained while facilitating large stakeholder groups in an effort to restore greenways along riparian corridors. Experienced in stream restoration, Natural Channel Design, fluvial geomorphology, biotechnical streambank erosion control methods, and trail alignment, design, construction, and maintenance, Mr. Vukman's involvement within these projects has included management of subcontractors, budget tracking, grant writing, facilitation of community meetings, preparation of required permits, data gathering and processing, construction, post-project maintenance and monitoring, and final report writing. His interpersonal skills have allowed him to successfully manage several diverse stakeholder groups whose goals were based on prevention of private property loss through the design and implementation of comprehensive stream restoration projects. Furthermore, Mr. Vukman is trained as a fluvial geomorphologist, having completed Levels I-IV of Dr. David Rosgen's Wildland Hydrology short courses. With approximately 17 years of experience designing and implementing numerous biotechnical streambank erosion control projects, he is an expert practitioner of soil bioengineering and other biotechnical erosion control methods and is often called upon by local agencies for advice and guidance. His expertise also includes long-term maintenance and monitoring of riparian restoration and trail construction projects. Additionally, he draws on leadership skills honed by years of experience managing conservation corps crews and serving as a Sergeant in the US Army.

EDUCATION

BA, Environmental Studies, California State University, East Bay, California, 1995

Applied Fluvial Geomorphology, Wildland Hydrology, Pagosa Springs, Colorado, 2004

River Morphology and Applications, Wildland Hydrology, Pagosa Springs, Colorado, 2006

River Assessment and Monitoring, Wildland Hydrology, Pagosa Springs, Colorado, 2009

River Restoration and Natural Channel Design, Wildland Hydrology, Pagosa Springs, Colorado, 2009

MEMBERSHIPS

Member Representative, Society of American Military Engineers, Sacramento Post

Point of Contact, Society of American Military Engineers, San Francisco Post

PROJECT EXPERIENCE

Soil Bioengineering Erosion Protection

Willow Brush Mattress Project, Codornices Creek*, Berkeley, California (Project Manager)

Mr. Vukman successfully designed and constructed a willow brush mattress on a spring-fed stream that contains a State and Federally- listed threatened Steelhead Trout Distinct Population Segment (DPS). Set within a completely engineered concrete reach, he pushed the known slope ratios (horizontal to vertical) of this soil bioengineering technique.

Biotechnical Streambank Stabilization*, Martinez, California (Project Manager)

After numerous traditional engineering attempts were made to protect an outside bend of Alhambra Creek from eroding (i.e., gabions, riprap), Mr. Vukman successfully stabilized this piece of property by designing and installing a biotechnical streambank erosion control project that utilized soil brush layering and other soil bioengineering techniques. He managed this project in a timely and cost-effective manner without the use of more traditional engineering approaches.

Mike Vukman

Stream Restoration

Biotechnical Streambank Erosion Control Projects*, Multiple Locations, California (Project Manager)
Funded through the US EPA, Mr. Vukman led the design of two biotechnical streambank erosion control projects along private property within the San Francisco Bay Area. As project manager, he was responsible for data gathering and processing, design, and composition of the final report. Geared towards providing a cost-effective and ecologically-based solution, each design used various soil bioengineering techniques in an effort to reduce existing erosion rates while increasing the habitat for local flora and fauna.

Stream/River Restoration

Pipeline Stream Crossings*, Various Locations, California (Project Manager)
Working for Kinder Morgan, Mike led the geomorphic assessments and survey on more than 15 stream channels, determining the potential for channel downcutting, headcutting, and lateral streambank migration. Assessments were all in the areas of currently exposed pipelines. Led the effort to quantify and document risks to the pipeline due to channel instability.

Pipeline Stabilization/Stream Restoration Project, Tahoe National Forest, Placer County, California (Construction Oversight)
Mike provided construction oversight during the restoration of approximately 150-linear feet of stream bed in the Tahoe National Forest. The stream had re-aligned itself to follow parallel a pipeline corridor that was constructed prior to 1960. As a result, the creek ran parallel/directly over the pipeline for a distance and its original natural drainage is merely a side channel. Mike provided oversight for the construction of grade control structures in the natural stream channel which were designed to direct the flow of the stream down-valley and away from the pipeline alignment. Mike was also responsible for coordinating with the construction contractor and onsite pipeline inspector to ensure that the project was completed following appropriate health and safety protocols.

Pipeline Stream Crossings, Various Locations, Minnesota (Project Manager)
Working for Magellan Midstream Partners, Mike managed the development of two pipeline stability projects after they had become exposed along their respective streams. Mike and his team determined the potential for channel downcutting, headcutting, and lateral streambank migration, helping the client to choose a cost-effective and ecologically-based long-term repair solution.

Pipeline Stream Crossings: Sandpiper / Line 3 Pipeline Geomorphic Surveys, Various Locations, Minnesota (Environmental Scientist)
Pipeline Stream Crossings: Sandpiper / Line 3 Pipeline Geomorphic Surveys, Various Locations, Minnesota (Environmental Scientist)
Assisted with the field data collection for comprehensive survey and geomorphic assessment on 61 pipeline stream crossings throughout the state of Minnesota. Effort covered around 40,000 LF streams and rivers ranging in size from bankfull width (Wbkf) less than 10 feet to the Red River of the North (Wbkf > 200 feet). Performed benchmark establishment, longitudinal profile survey, cross section survey, bed materials sampling, and particle size classification. Performed Pfankuch in-stream habitat assessment and Bank Erosion Hazard Index/Near Bank Stress (BEHI/NBS) surveys to supplement interpretation of field measurements. Results of survey and assessment used to document baseline conditions in support of an environmental permit application. Recommendations to minimize future construction disturbance and potential negative river adjustments were made based on existing conditions and stream type identified at each site.

McCosker Stream Daylighting Project, Canyon, California (Project Manager)
Led the team helping the East Bay Regional Parks District determine best options to develop an acquired tract of land into a multiple-use property. Currently, a perennial stream flows below ground through a series of culverts. Stantec explored the feasibility of removing the culverts, which total approximately 1,600 linear feet, and reconstructing a steppool stream in its place that provided fish passage for Rainbow Trout. Stantec's Team conducted a site assessment, developed a conceptual plan and related report and created a preliminary cost estimate for the project.

** denotes projects completed with other firms*

Mike Vukman

Stream Restoration

Redwood Creek Stream Restoration Project, Oakland, California ((Project Manager)
Served as project manager for this East Bay Regional Parks District effort. The District is actively attempting to restore and stabilize of Redwood Creek, located within Redwood Regional Park, to protect the public and existing infrastructure, to reduce sediment inputs from bank erosion, and to increase instream habitat values for Rainbow Trout. Working closely with EBRPD staff, Stantec conducted a site assessment and developed 30% and 60% conceptual plans for the project.

Yampa River Restoration, Chuck Lewis Area, Steamboat Springs, Colorado (Project Manager)
Led the assessment and design of over 25000 LF of restoration along the Yampa River. Project goals included improvement of trout habitat and bank stability.

Wildcat Creek Restoration Project*, San Pablo, California (Project Manager)
Identified by the City of San Pablo and the Wildcat Watershed Council as a high priority restoration project, Mr. Vukman led the design and implementation of a publicly-funded multi-objective stream restoration project that utilized natural channel design principles. This project included the design and construction of an instream grade control structure as well as several soil bioengineering techniques.

Alhambra Creek Restoration*, Martinez, California (Project Manager)
Mr. Vukman led a team that assessed restoration opportunities using Natural Channel Design principles for a 1-mile stretch of Alhambra Creek. By working with the Alhambra Creek Watershed Planning Group, he elicited the support of all adjacent private landowners. Specifically requested by the Alhambra Valley Creeks Coalition (AVCC), a group that Mr. Vukman helped to form, this project focused on addressing erosion along this stretch of Alhambra Creek. Several restoration options were presented to citizens in an open forum meeting.

Peralta Creek Restoration*, Oakland, California (Project Manager)
While working with the City of Oakland, Mr. Vukman led efforts to design and build a multi-objective stream restoration project within a recreational park. He successfully led this effort that was aimed at flood damage reduction and increased habitat for terrestrial and instream flora and fauna, while providing safe access for local environmental education efforts.

Geomorphic-based Pipeline Stabilization*, Tahoe National Forest (Project Manager)
Design and implementation of a geomorphic-based step pool project along a tributary to the North Fork of the Yuba River to protect an 8-inch section of pipeline that had become exposed at two separate locations within the stream bed. The stream had altered its path and was running parallel along the pipeline alignment. Stantec was able to increase the long-term stability of this section of pipeline and reduce its risk of exposure, while still allowing for safe fish passage and proper sediment transportation rates in a balanced manner.

Wildcat Creek Restoration and Realignment Project*, San Pablo, California (Project Manager)
Funded by a public grant, with a goal of addressing flood capacity issues caused by decreased sediment transportation rates, Mr. Vukman successfully led efforts to design and build a properly functioning bankfull channel by realigning the existing channel configuration. He submitted all required permits and served as project manager through the entire project.

Williamson River and Wetland Conceptual Restoration Design, Klamath Marsh National Wildlife Refuge, Oregon (Project Manager)
Using Natural Channel Design principles in a high meadow while working with the USF&WS staff, Stantec completed a Concept Design and Report for a restoration project in the heart of the Refuge. When implemented, the project will restore more than 8,000 acres of various types of wetlands. In addition, it will restore 3-5 miles of a single thread river channel along with approximately 70 miles of small tributaries throughout the Klamath Marsh.

** denotes projects completed with other firms*

Mike Vukman

Stream Restoration

Feasibility Study

Antonio Mountain Ranch and Conservation Area Mitigation Bank Feasibility Report, Lincoln, California (Project Manager)

Served as the project manager to determine the potential to restore historic hydrologic and hydraulic functions to various stream types. The goal of the project was to restore a variety of wetland types to a property that comprises approximately 808 acres as part of a wetland mitigation bank. With the information Stantec's investigation generated, the client was able to strategically allocate resources for the Mitigation Bank where the maximum credits could be generated while at the same time minimizing the costs associated with earthwork.

Feasibility/Opportunity and Constraint Assessment for the Proposed San Leandro Creek Greenway Trail Project, Oakland, California (Project Manager)

Mike is currently working for the City of Oakland to generate a feasibility report that will assess existing conditions and opportunities/constraints as the first step in the City's planning for the proposed San Leandro Creek Greenway. The project is situated along San Leandro Creek bordering the cities of Oakland and San Leandro and is defined by the upstream limits of Lake Chabot Dam and the downstream limits of San Leandro Creek's confluence with the SF Bay at Arrowhead Marsh in Oakland. The project requires Stantec to engage with a diverse stakeholder group, including the City of San Leandro and Oakland, EBRPD, EBMUD, Alameda County Flood Control District, Friend of San Leandro Creek, and other private and public landowners within the watershed.

Arroyo Mocho Feasibility Study*, Livermore, California (Project Manager)

In an effort to determine the feasibility of modifying existing trapezoidal flood control channels to be more ecologically beneficial, Mike led a team that analyzed potential solutions throughout a 7,200-foot-long reach of Arroyo Mocho. Solutions included the modification of the stream's dimension, pattern, and profile, installation of riparian vegetation without raising flood stages, and replacement of existing grade control structures that act as fish passage barriers with more natural grade control structures.

Wildcat Creek Conceptual Restoration Plan*, Berkeley, Project Manager

Funded through an emergency FEMA Grant, Mr. Vukman led efforts to provide the East Bay Regional Park District with a conceptual restoration plan for a step pool system within an existing golf course. He met with FEMA subcontracted biological consultants to make sure this concept plan was approved.

Fish Passage Design

Codornices Creek Step Pool Project*, Berkeley, California (Project Manager)

Mr. Vukman successfully led a team that designed and implemented a publicly-funded step pool project in the heart of Berkeley. In an effort to improve and restore fish passage for Oncorhynchus mykiss to a severely scoured section of Codornices Creek, he worked with local watershed groups. Additionally, Mr. Vukman also managed subcontractors whose job was to gather various hydraulic and hydrologic data. These efforts led to the successful implementation of a step pool project that eliminated the fish passage barrier adjacent to a bridge without increasing localized flooding conditions. This project was designed to be in accordance with the California Salmonid Stream Habitat Restoration Manual.

Remedial Design and Construction

SF Bay Area, Sierra Nevada Mountains, and beyond*, California

Mr. Vukman supervised multiple trail crews who were charges with designing, building, and/or maintaining trails throughout the SF Bay Area and the Sierra Nevada Mountains, allowing him to work with numerous local, state, and federal agencies up and down the state of CA.

Naturalized Wetlands / Channels

Pipeline Stability Analysis, Various Locations, California (Project Manager)

Led the geomorphic assessments and survey on more than 15 stream channels, determining the potential for channel downcutting, headcutting, and lateral streambank migration. Assessments were all in the areas of currently exposed pipelines. Led the effort to quantify and document risks to the pipeline due to channel instability.

** denotes projects completed with other firms*

Mike Vukman

Stream Restoration

Riparian Restoration

Geomorphic-based Pipeline Stabilization, Tahoe National Forest, California (Project Manager)

Design and implementation of a geomorphic-based step pool project along a tributary to the North Fork of the Yuba River to protect an 8-inch section of pipeline that had become exposed at two separate locations within the stream bed. The stream had altered its path and was running parallel along the pipeline alignment. Stantec was able to increase the long-term stability of this section of pipeline and reduce its risk of exposure, while still allowing for safe fish passage and proper sediment transportation rates in a balanced manner.

Ecosystem Restoration

Williamson River and Wetland Conceptual Restoration Design, Klamath Marsh National Wildlife Refuge, Oregon (Project Manager)

Using Natural Channel Design principles in a high meadow while working with the USF&WS staff, Stantec completed a Concept Design and Report for a restoration project in the heart of the Refuge. When implemented, the project will restore more than 8,000 acres of various types of wetlands. In addition, it will restore 3-5 miles of a single thread river channel along with approximately 70 miles of small tributaries throughout the Klamath Marsh.

Creek Rechannelization

Wildcat Creek Restoration and Realignment Project*, San Pablo, California (Project Manager)

Funded by a public grant, with a goal of addressing flood capacity issues caused by decreased sediment transportation rates, Mr. Vukman successfully led efforts to design and build a properly functioning bankfull channel by realigning the existing channel configuration. He submitted all required permits and served as project manager through the entire project.

Erosion Control Planning

Biotechnical Streambank Erosion Control Projects*, Pleasant Hill and Fairfax, California (Project Manager)

Funded through the US EPA, Mr. Vukman led the design of two biotechnical streambank erosion control projects along private property within the San Francisco Bay Area. As project manager, he was responsible for data gathering and processing, design, and composition of the final report. Geared towards providing a cost-effective and ecologically-based solution, each design used various soil bioengineering techniques in an effort to reduce existing erosion rates while increasing the habitat for local flora and fauna.

Site Assessment

San Leandro Creek Trail Feasibility Study, San Leandro, Oakland, California (Technical Advisor)

Mike served as Stantec's technical advisor to determine the feasibility of creating a multi-use trail along a riparian corridor. Mike's preliminary analysis included the following disciplines: fluvial geomorphology, geotechnical analysis, hydrology/hydraulics, in-stream fish habitat, native and non-native vegetation, recreation, environmental education, and community development.

Arroyo [MV2] de la Laguna (ADLL) Conceptual Restoration Plan*, Pleasanton, California (Project Manager)

As an extension of the Urban Creeks Council's Streamside Management Program for Landowners (SMPL) with Zone 7 Water Agency, Mike performed initial site assessments of 28 contiguous pieces of privately held streamside properties along a potential steelhead (Oncorhynchus mykiss) stream named Arroyo de la Laguna. Through these transparent initial site assessments, he assisted in galvanizing a group whose shared vision includes the restoration of a 1-mile stretch of Arroyo de la Laguna. As a direct result of this group's collective efforts, Mike has worked with a team to produce a 30 percent concept design for this 1-mile of deeply incised stream. Following EPA's Watershed Assessment of River Stability & Sediment supply (WARSSS), Mike worked on a report that included the Predicted Level Assessment (PLA) and post winter flow monitoring components.

* *denotes projects completed with other firms*

Mike Vukman

Stream Restoration

Site Restoration

Wildcat Creek Conceptual Restoration Plan*, Berkeley, California (Project Manager)

Funded through an emergency FEMA Grant, Mr. Vukman led efforts to provide the East Bay Regional Park District with a conceptual restoration plan for a step pool system within an existing golf course. He met with FEMA subcontracted biological consultants to make sure this concept plan was approved.

Water Resources Management (Environmental Remediation)

Codornices Creek Step Pool Project*, Berkeley, California (Project Manager)

Mike successfully led a team that designed and implemented a publicly-funded step pool project in the heart of Berkeley. In an effort to improve and restore fish passage for Oncorhynchus mykiss to a severely scoured section of Codornices Creek, he worked with local watershed groups. Additionally, Mike also managed subcontractors whose job was to gather various hydraulic and hydrologic data. These efforts led to the successful implementation of a step pool project that eliminated the fish passage barrier adjacent to a bridge without increasing localized flooding conditions. This project was designed to be in accordance with the California Salmonid Stream Habitat Restoration Manual.

** denotes projects completed with other firms*

Meredith Parkin, JD, PMP

Environmental

EDUCATION

JD, Lincoln Law School of Sacramento

BS, Human Nutrition and Food Science, New Mexico State University

LICENSES/ REGISTRATIONS

Certified Project Management Professional, Project Management Institute

Ms. Parkin has over 21 years of experience in policy, regulatory and environmental compliance, permitting, planning, and land use for various dam and reservoir, water-related, and infrastructure projects. She has assisted both public agencies and private interests in addressing regulatory challenges, with a focus on identifying challenges early through the integration of policy and compliance during all phases of project development, from planning through construction. Her experience includes environmental compliance and permitting for multi-purpose local, State and Federal projects and programs. Ms. Parkin is currently managing the CEQA and/or NEPA compliance on a variety of dam and reservoir and water-related and infrastructure projects and has managed the permitting effort for 160 infrastructure facilities in 60 different jurisdictions in CA and NV. She is also managing the acquisition of environmental permits from regulatory agencies such as the NMFS, USACE, USFWS, Regional Water Quality Control Boards, and the California Department of Fish and Wildlife.

Relevant Project Experience

Environmental Lead, Los Padres Reservoir Sediment Removal Feasibility Study, *California American Water Company (Cal-Am), Monterey County, CA.*
Ms. Parkin provided Cal-Am with an environmental compliance and permitting strategy with an overview of the possible environmental and permitting requirements, challenges, and strategies associated with sediment removal from the Los Padres Reservoir. As one component of a successful project implementation approach, the TM provided a blueprint to guide the acquisition of permits, agreements and authorizations, minimize permitting surprises and delays, and maximize the timeliness of permit acquisition with acceptable permit terms.

Environmental and Permitting Specialist, Sediment Removal Project, *Pleasant Grove Verona Mutual Water Company, Pleasant Grove, CA*
Ms. Parkin provided the client with overall compliance and permitting strategy development for removal of sediment in the Natomas Cross Canal. She obtained the Section 404 permit, Section 401 Water Quality Certification, National Pollutant Discharge Elimination System permits, and the DFG 1600 Agreement through USACE, RWQCB, and DFW.

Environmental and Permitting Specialist, Shasta Lake Water Resources Investigation (SLWRI), *US Department of the Interior Bureau of Reclamation, Central CA.*
The SLWRI Environmental Impact Statement (EIS) is being prepared to evaluate the potential environmental, cultural, and socioeconomic effects of implementing the proposed action to modify the existing Shasta Dam and Reservoir. Ms. Parkin is developing the Section 404(b)(1) Alternatives Evaluation in support of Clean Water Act compliance for an USACE Individual Permit. In addition, Ms. Parkin is managing the coordination with multiple agencies to develop and implement a strategy for compliance with Federal and California Engendered Species Acts and NEPA.

Project Manager, Central Valley Flood Protection Plan, *California Department of Water Resources, Central Valley, CA*
Ms. Parkin was the project manager for the Program Environmental Impact Report (PEIR), a multi-million dollar effort that analyzed the broad, potential impacts associated with implementing the 2012 Central Valley Flood Protection Plan (CVFPP) at a program level of detail. The CVFPP outlines a broad range of physical improvements, policies, and institutional changes encompassing $14 to $16 billion in investments over the next 25 years. This PEIR effort was novel in that the geographic scope was comparable to that of the Eastern Seaboard. Ms. Parkin led a team of 50 people, providing guidance and direction to MWH and subcontractor staff on the scope of environmental resources and ensuring completeness and consistency across the over 10,000 page PEIR. She led an Environmental Coordination Team, which refined the compliance approach and discussed and resolved high-level program environmental issues, and regularly interfaced with DWR legal staff. The PEIR was developed within

an extremely compressed timeframe to meet a legislative deadline. Despite the contentious nature of the CVFPP and the aggressive timeframe, the PEIR was certified on-time and under-budget, and was unchallenged in court.

Environmental Technical Lead, Upper San Joaquin River Basin Storage Investigation, *US Department of the Interior, Bureau of Reclamation, CA*
MWH is the lead planning and environmental compliance consultant to Reclamation for conducting the USJRBSI, a feasibility study to formulate and evaluate alternatives that develop up to 1.3 million acre-feet of additional San Joaquin River water supply. Ms. Parkin was the CWA and NEPA specialist and providing strategy for the development of the EIS and Section 404(b)(1) Alternatives Evaluation. In addition, Ms. Parkin also coordinated with multiple agencies for compliance with CWA, NEPA, ESA, and Section 106 Consultation.

Environmental and Permitting Specialist, Waterman Water Treatment Plant (WTP), *City of Fairfield, CA*
Ms. Parkin assisted the City of Fairfield in obtaining (1) NPDES permits from the San Francisco RWQCB and the State Water Board, and (2) CEQA compliance to dispose of solids from the Waterman WTP processes as fill on the WTP property.

Environmental & Permitting Coordinator, Sacramento River Joint Intake, *Reclamation District (RD) 2035 and Woodland Davis Clean Water Agency, Yolo County, CA*
Ms. Parkin is the environmental compliance lead for construction monitoring and MMRP/environmental permit compliance the $44 million RD2035 Joint Intake Project. She is managing the CEQA MMRP/environmental permit compliance and is coordinating with construction managers, federal and state agencies, and biologists to provide required monitoring and documentation of compliance, and provide final reporting on environmental permits.

Environmental & Permitting Lead, Oroville FERC Implementation Program, *State of California Department of Water Resources, Butte County, CA*
Ms. Parkin is providing the client with the overall compliance and permitting strategy for the Oroville Facility Implementation Program. In addition, she is managing environmental studies for NEPA/CEQA compliance and permits for implementation.

NEPA Specialist, Long-Term Plan for Protecting Adult Salmon in the Lower Klamath River EIS, *Bureau of Reclamation, Northern California*
The Bureau of Reclamation is preparing an EIS to address flow augmentation releases to prevent potential fish die-off in the lower Klamath River. Ms. Parkin is providing the NEPA strategy for the EIS. She is providing direction on the project description, alternative analysis, impact methodology and is leading the cumulative effects analysis, environmental justice resource section, and other EIS chapters. In addition, she is also providing strategic support on development of the Biological Assessment.

Environmental and Permitting Specialist, Positive Barrier Fish Screen Project Phase 1, *Meridian Farms Water Company, Meridian, CA*
Ms. Parkin was the project manager for development of the CEQA/NEPA and biological assessment and compliance documents for the $25 million Meridian Farms fish screen project, being implemented in two phases. She obtained the necessary Federal and state permits, including the Section 404 permit, Section 401 Water Quality Certification, NPDES permits, and the Streambed Alteration Agreement through the USACE, RWQCB and DFW. While obtaining the Section 404 permit, Ms. Parkin worked with the USFWS, NMFS and USACE to negotiate and finalize required mitigation for the project. In addition, she prepared and submitted Water Right Petitions for a Change of Diversion and Place of Use through the State Water Resources Control Board.

Environmental and Permitting Specialist, Positive Barrier Fish Screen Project, *Patterson Irrigation District, CA*
Ms. Parkin prepared, submitted and obtaining the Section 404 USACE permit, Section 410 Water Quality Certification, and the DFG 1600 applications through USACE, RWQCB, and DFW.

Stephanie Theis

Fisheries Biologist

Ms. Theis is a lead fisheries biologist with over 26 years of professional experience, in both freshwater and estuarine environments, emphasizing fish ecology, Endangered Species Act (ESA) compliance, fisheries monitoring, fish passage, habitat restoration design and monitoring, and environmental impact assessment. Her experience includes a comprehensive knowledge of life history and habitat needs of anadromous and resident fishes. Ms. Theis is an expert in adaptive management as well as ESA and EFH compliance procedures and has successfully conducted numerous Section 7 consultations with NMFS and USFWS. She has led plans for fish passage in multiple watersheds and monitoring programs for habitat restoration programs.

EDUCATION

BS/BSc, Fisheries Ecology, Humboldt State University

Graduate studies, Applied Ecology and Conservation Biology - Fish, Frostburg State University

PROFESSIONAL AFFILIATIONS

National, Western Division, Cal-Neva Chapter, Oregon Chapter, and Idaho Chapter of the American Fisheries Society

Secretary for the Cal-Neva Chapter of the American Fisheries Society

YEARS OF EXPERIENCE

26

Software Experience:

Technical Lead Shasta Dam Fish Passage Evaluation, Bureau of Reclamation.
Ms. Theis led the development of an adaptive management-focus Pilot Implementation Plan for a pilot reintroduction of winter-run Chinook Salmon in the upper Sacramento and McCloud rivers as part of the NMFS BO reasonable and prudent alternative for the CVP/SWP operations. She developed metrics for program success; options for adult, egg, and juvenile transportation and collection studies; and monitoring programs for tracking all life stages to evaluate the success. The Pilot Implementation Plan also included discussions on the overall reintroduction strategy, genetics and passage options, structural options, donor stock selection, and a description of the adaptive management approach for the program. Stephanie was responsible for reviewing agency documents, such as the Hatchery and Genetics Management Plans for Livingston Stone Hatchery, which would have implications for the Pilot Program. She worked collaboratively with multi-agency workgroups in key topic areas of public outreach, planning and policy, fish health, technology, and habitat. She actively engaged with stakeholders and landowners to gain trust and support for the program. She was responsible for the quality control and consistency for the habitat assessment report and Environmental Assessment which evaluated the impacts of implementing the Pilot Plan.

Project Manager and Fisheries Biologist, Yuba River Fish Passage Project, USACE.
Ms. Theis identified key issues and potential complications for fish passage into historic fish habitat in the Upper Yuba River watershed. She prepared a preliminary planning report describing the history of the Yuba River fisheries, the current fish passage issues, and conceptual designs for upstream adult and downstream juvenile fish passage to the Upper Yuba River watershed. This report included engineering designs as well as passage routes and potential complicating factors for reintroduced fish. This report is the first step by NMFS to determine the feasibility of fish reintroduction into the upper watershed Independent Technical Review Team.

Lead Aquatic Specialist, Stibnite Gold Project, Midas Gold Inc.
Ms. Theis is leading a long-term multi-year study to evaluate the baseline conditions of the fish abundance and distribution, stream habitat conditions, and benthic macroinvertebrate abundance and diversity. She continues to work closely with the U.S. Forest Service to establish or modify the survey protocols as needed. She conducts snorkel surveys with periodic electrofishing efficiency surveys, PIBO habitat and substrate surveys, and macroinvertebrate surveys using a Hess sampler, macroinvertebrate and soil samples for metals testing, and E-DNA sampling. She conducts the statistical analyses and prepares annual reports. Stephanie regularly coordinates with NMFS, USFWS, IDFG, EPA, IDEQ, and the Nez Perce Tribe. She also advised engineers on preliminary designs for a restored channel which would facilitate fish passage into the upper watershed.

Lead Fisheries Biologist, San Joaquin River Restoration Program, Bureau of Reclamation.
Ms. Theis was one of two fisheries consultants selected to work collaboratively with resource agency technical specialists to develop an Adaptive Management Approach and Fisheries Management Plan, and Implementation Plans, and the development of the quantitative Ecosystem Diagnosis and Treatment (EDT) model, specific for the San Joaquin River. With a very rapid program schedule, she led multiple subconsultants in the development of the fisheries impact assessments for both riverine and Delta fisheries resources at a both a program level and an interim

flows level. She prepared BAs for consultation for both the program and interim flows. She assisted engineers and water planners to identify key habitat needs for successful reintroduction. She also coordinated with NMFS and USFWS to establish the reintroduced Chinook salmon as an experimental population following the Endangered Species Act (ESA) Section 10(a)(1)(A) permit application and 10(j) rule.

Lead Fisheries Biologist, Shasta Lake Water Resources Investigation, Bureau of Reclamation.
Ms. Theis was responsible for evaluating the survivorship and mortality rates of anadromous fishes in the Sacramento River between Keswick Dam and Red Bluff Diversion Dam. She prepared technical sections for the aquatic resource sections of a Plan Formulation Report, and Environmental Impact Statement and numerous technical white papers. She quantified the survival and mortality rates of anadromous salmonids in the Sacramento River between Keswick Dam and Red Bluff resulting from changes in flow and water temperature. In this technical evaluation, she used the salmon production model SALMOD, and assisted the US Geological Service in modifying the model design to be specific to the SLWRI. Results from SALMOD were used to identify fisheries benefits under the different alternatives, and present recommendations for improving alternatives. Ms. Theis identified fish habitat restoration options and locations in the upper Sacramento River (below Keswick Dam) and prepared technical papers on the fisheries effects resulting from: 1) gravel augmentation; 2) side channel, floodplain habitat, and riparian habitat restoration; 3) adaptive management; 4) climate change; and 5) varied water operations to compare flow benefits versus water temperature benefits. She was the lead author of the riverine fisheries evaluation and assisted and updated the Delta fisheries discussions and assessments.

Panel Member, Senior Fisheries Biologist, Operations Criteria and Plan (OCAP) Biological Assessment Review, Bureau of Reclamation.
Member of a review panel consisting of eight external reviewers selected for their technical expertise to assess the effect of proposed Central Valley Project/State Water Project (CVP/SWP) operations on the special status fish species identified in the draft OCAP BA. Reviewed and evaluated the validity of assessments and soundness of the logic used for the conclusions reached in the draft OCAP BA based on the data and documentation presented in the chapters and technical appendices. Reviewed the draft OCAP BA for thoroughness, use of the best available scientific information, technical accuracy, compliance with the requirements of the ESA and its implementing regulations, and compliance with the Magnuson-Stevens Fishery Conservation and Management Act with respect to Essential Fish Habitat (EFH).

Central Valley Project Improvement Act Science Integration Team, Independent Member.
Ms. Theis is a current member of the CVPIA ~~Science Integration~~ Team (SIT) tasked with establishing biological objectives, predicting consequences, evaluating trade-offs, and ultimately recommending priorities to guide fish habitat restoration projects or studies that work towards achieving the CVPIA doubling goals. Ms. Theis, as a member of the SIT, is helping refine and utilize decision support models to predict the outcome of alternative actions and identify the watersheds, including the Delta, in which habitat restoration priorities should be established. The recommendations are based on system needs; water quality conditions; fish life stage needs; and whether or not benefiting a specific life stage will likely result in the highest abundance, natural productivity, and life history and genetic diversity. The SIT works in a collaborative and transparent manner to ensure defensibility in their recommendations.

CRAMER FISH SCIENCES®

JOSEPH E. MERZ

Education and Training

Ph.D. Conservation Ecology. University of California, Davis. 2004.
M.S. Biological Conservation. California State University Sacramento. 1994.
Cal Poly San Luis Obispo, CA. B.S. Environmental and Systematic Biology. 1991.

Employment History

Vice-President/Principal Scientist in Restoration Ecology, Cramer Fish Sciences. 2007–present.
Adjunct Professor/Lecturer, UC Santa Cruz, Institute of Marine Sciences. 2008–present.
Lecturer, California State University, Sacramento. 2001-2008.
Fisheries Biologist II, East Bay Municipal Utility District. 1996–2007.
Aquatic Ecologist, ENTRIX INC. 1993–1996.
Contract Biologist, California Department of Fish and Game. 1991–1994.

Expertise

Over the past 23 years, Dr. Joseph Merz has worked as a fisheries ecologist, preforming studies and monitoring of fish populations, on coastal and Central Valley steelhead and Chinook salmon populations. Joe teaches professional courses in salmonid ecology, habitat assessment, and fish passage. Dr. Merz has coauthored a variety of peer-reviewed publications, focusing on river rehabilitation, fish movement and reproductive success, invasive species, woody debris/redd associations, and evaluation of salmonid spawning and rearing habitat enhancement. Personally, he has been honored with multiple awards and scholarships for his performance, and has initiated numerous interagency and multidisciplinary grants totaling over US $15 million for California salmonid restoration, life cycle modeling and habitat assessment projects. Joe has performed numerous assessments of habitat manipulation on aquatic resources including habitat enhancement, flow manipulation, invasive species, and regulation implementation, including Chinook salmon and steelhead spawning. One of Joe's unique strengths is his public outreach skills and ability to collaborate with a variety of constituents. He has taught at university and public education levels, worked with federal and state representatives, and partnered with local entities (i.e., outreach groups, planners, volunteer organizations, etc.). Recently, Dr. Merz has been part of a multiagency technical teams developing strategies for Chinook Salmon re-introduction on the Upper Columbia River watershed and providing guidance for resource management on the Lower American River during the most recent drought. He is a member of American Fisheries Society and the Southwestern Association of Naturalists, and the Ecological Society of America.

SELECTED PUBLICATIONS

Author	Publications/Reports
Merz, Joseph	Del Real, S., M. Workman, J. Merz. 2011. Migration characteristics of hatchery and natural-origin Oncorhynchus mykiss from the lower Mokelumne River, California. Environmental Biology of Fishes. 94:363-375. Merz, J.E. 2002. Seasonal feeding habits of steelhead trout in the lower Mokelumne River, California. California Fish and Game 88(3) 95-111. Merz, J.E. 2001. Association of fall-run Chinook salmon redds and woody debris in the lower Mokelumne River, California. California Fish and Game 87(2):1-15. Merz, J.E., and L.K. Chan. 2005. Effects of gravel augmentation on macroinvertebrate assemblages in a regulated California river. River Research and Applications 21:61-74. Merz, J.E., and P. B. Moyle. 2006. Salmon, wildlife, and wine: Marine-derived nutrients in human dominated ecosystems of Central California. Ecological Applications 16(3):999-1009. Merz, J.E., G.B. Pasternack and J.M. Wheaton. 2006. Sediment budget for salmonid spawning habitat rehabilitation in a regulated river. Geomorphology 76:207-228. Merz, J.E., and J. D. Setka. 2004. Evaluation of a spawning habitat enhancement site for Chinook salmon in a regulated California river. North American Journal of Fisheries Management 24:397-407. Merz, J.E., J. D. Setka, G.B. Pasternack and J.M. Wheaton. 2004. Predicting benefits of spawning habitat rehabilitation to salmonid (Oncorhynchus spp.) fry production in a regulated California river. Canadian Journal of Fisheries and Aquatic Sciences. 24:397–407. Merz, J.E., P. Skvorc, S. Sogard, C. Watry, S. Blankenship, and E. Van Nieuwenhuyse. 2012. Onset of melanophore patterns in the head region of Chinook salmon- A Natural marker for the reidentification of individual fish. North American Journal of Fisheries Management. Merz, J. E., Workman, M., Threloff, D., & Cavallo, B. 2013. Salmon Lifecycle Considerations to Guide Stream Management: Examples from California's Central Valley. San Francisco Estuary and Watershed Science, 11(2). Miller, J.A., A. Gray, and J. Merz. 2010. Quantifying the contribution of juvenile migratory phenotypes in a population of Chinook salmon Oncorhynchus tshawytscha. Marine Ecology Progress Series. 408:227-240. Satterthwaite, W.H., S.A. Hayes, J.E. Merz, S.M. Sogard, D.M. Frechette and M. Mangel. 2012. State-Dependent Migration Timing and Use of Multiple Habitat Types in Anadromous Salmonids, Transactions of the American Fisheries Society, 141:3, 781-794. Satterthwaite, W. H., Beakes, M.P., Collins, E., Swank, D.R., Merz, J.E., Titus, R.G., Sogard, S.M., Mangel, M. 2009. Steelhead life history on California's central coast: insights from a state dependent model. Transactions of the American Fisheries Society 138: 532-548. Satterthwaite, W. H., Beakes, M.P., Collins, E., Swank, D.R., Merz, J.E., Titus, R.G., Sogard, S.M., Mangel, M. 2009. State-dependent life history models in a changing (and regulated) environment: steelhead in the California Central Valley. Evolutionary Applications. Published Online: Nov 20 2009. Sogard, S.M., J.E. Merz, W.H. Satterthwaite, M.P. Beakes, D.R. Swank, E.M. Collins, R.G. Titus, M. Mangel. 2012. Contrasts in habitat characteristics and Life history patterns of Oncorhynchus mykiss in California's Central Coast and Central Valley. Transactions of the American Fisheries Society 141:747–760. Wheaton, J.M., J. Brasington, S.E. Darby, J.E. Merz, G.B. Pasternack, D. Sear, and D. Vericat. 2009. Linking geomorphic changes to salmonid habitat at a scale relevant to fish. River Research and Applications DOI: 10.1002/rra.1305. Wheaton, J.M., G. B. Pasternack and J. E. Merz. 2004. Spawning habitat rehabilitation – I. Conceptual approach and methods. International Journal of River Basin Management 2(1):3–20. Wheaton, J.M., G. B. Pasternack, and J. E. Merz. 2004. Including Habitat Heterogeneity In Salmonid Spawning Habitat Rehabilitation Design. In: Fifth International Symposium on Ecohydraulics in Madrid, September 12-17, 2004. Zeug, S. C., K. Sellheim, C. Watry, B. Rook, J. Hannon, J. Zimmerman, D. Cox, and J. Merz. 2013. Gravel augmentation increases spawning utilization by anadromous salmonids: A case study from California, USA. River Research and Applications. Zeug, S., K . Sellheim, C. Watry, J . D . Wikert, J. Merz. 2014. Response of juvenile Chinook salmon to managed flow: lessons learned from a population at the southern extent of their range in North America. Fisheries Management and Ecology.

Clint Smith, PE

Fish Passage

Mr. Smith has 31-years-of-experienced in civil, environmental and water resource engineering. His background includes the planning, analysis and design of water intake facilities; fish transport, passage and screening facilities; municipal water, wastewater and storm drainage conveyance and treatment systems; hydrologic and meteorological instrumentation data collection systems.

EDUCATION

BS/BSc, Civil Engineering
Washington State

LICENSES/ REGISTRATIONS

Professional Engineer – (Civil) WA, Or, ID

Manage The Project (MTP), MWHU

Relevant Project Experience

Project Manager, Soda Springs Fish Passage Design, PacifiCorp, Project Manager for the design of new fish passage facilities at Soda Springs Dam on the North Umpqua River, Oregon. Soda Springs dam is a 77-foot high concrete arch dam that presented a complete blockage to upstream migrating anadromous salmon, trout, and lamprey. The project features include: construction of a 1,875-cfs fish screen and fish bypass system; a half ice-harbor fish ladder; spillway modifications and appurtenant electrical and control systems. MWH provided full engineering support during construction, and startup. Fish passage facilities went online in 2014.

Project Manager, Walterville Fish Screen Facility, Eugene, OR, Eugene Water & Electric Board. This, 2,575 cfs facility is a vertical fixed-plate vee screen designed to meet current screening criteria for salmon fry and trout. Project features include 2,200 ft of 54-inch diameter pipe, development of a new river outfall, extensive analysis and design of an environmentally friendly rock weir diversion and channel stabilization system and monitoring and control systems. Designs include provisions for monitoring and enumeration equipment. Construction of the project was completed in November 2002.

Project Manager, Landsburg Fish Passage Facilities, Cedar River, WA, Seattle Public Utilities. This project included two upstream fish passage structures, a new 426 cfs fish screening facility, fish collection and sorting facility, downstream juvenile fish passage system, dam stability upgrades, automation and other appurtenant facilities. These facilities are the cornerstone of Seattle Public Utilities Habitat Conservation Plan for the Cedar River Watershed. Design development and permitting of this project required close coordination with resource agencies, tribes and special interest groups. Construction of the Landsburg Project was completed in October 2003.

Project Engineer, Clallam-Cline Intake and Fish Screen, Jamestown-S'Klallam Tribe. Project Engineer for the design and construction of a new intake and fish screen structure on the Dungeness River in Washington replacing a infiltration type intake. The project was sponsored by the Jamestown S'Klallam Tribe local irrigation companies and the WDFW who designed and furnished two belt screens. Included the design of the river intake, pipeline modifications and construction support services. The project was completed in 1995.

Task Lead, Cache County Water Restoration Project, Cache County Utah. Mr. Smith was the lead for planning and design of a new screened river diversion structure along the Logan River near Logan, UT. Work included assessment of the existing intake and development and evaluation of options to bring the facility into compliance with current fish passage requirements and with USDA Forest Service requirements. The facility included construction of fish screens, a bypass flume for downstream passage around an existing diversion dam, a new canal head gate, channel modifications, and bank stabilization and reinforcement. The intake was part of a larger project to consolidate river diversions and to restore irrigation flows to areas left isolated when the canal was destroyed by a landslide.

Project Engineer, Banta-Carbona Fish Screen Project, Tracy, CA, Banta-Carbona Irrigation District
This project was designed for a diversion of 250 cfs from the San Joaquin River and was required to meet stringent approach velocity criteria suitable for Delta Smelt. The project features were designed to operate from extreme low river flows to high flows with water depths from 2ft to nearly 30 ft. The hydraulic characteristics required the use of a fish friendly bypass system to return fish to the river. Construction was completed in 2002.

Project Engineer, Naches Fish Screen Facilities Project, Naches, WA, PacifiCorp. Work included the preparation of design and construction documents for a 500 cfs fish screening facility. Screens were designed to current criteria for salmonid fry. Vertical flat plate screens in a chevron pattern 150 feet long on each side and 5 feet high were selected as the preferred design. Special consideration was given to the accumulation of sediment and debris and to operation of the screens during severe icing conditions. The work included preliminary designs of modifications to the diversion dam and intake including: construction of an inflatable dam or bascule gates, installation of a trashrack with a cleaning rake, hydraulic improvements, and bedload handling structures.

Project Engineer, White River Fish Screen Project. The project duties for this 2,000 cfs vee screen included design of the pumping and mechanical systems for a spray backwash system and design of the panel screens and other mechanical systems. Mr. Smiths designed a pressure backwash screen cleaning system with two 75-hp vertical turbine pumps, an automated screen sweeping system for the fish screens and an automatic trash rake for cleaning the trashracks. A sediment management system was included to pass significant sediment loads coming from Mt. Rainier through the White River.

Project Manager, Leaburg Fish Screen Project, McKenzie River, OR, Eugene Water & Electric Board. This 2,500 cfs screening facility, constructed the 1970's was one of the first flat panel fish screens in the United States. Although the screens have been highly effective at passing fish the Owner is required under a hydropower re-licensing agreement to make improvements to the facility. Mr. Smith worked with the Owner and several resource agencies to develop numerous improvement options to improve operations and passage efficiencies. Designs were initiated and construction is scheduled for completion spring 2004.

Project Manager, Little Walla Walla Fish Screen Project, Walla Walla River ID and Hudson Bay ID
Consolidation of several unscreened irrigation intakes to the Little Walla Walla diversion and constructed a new 250 cfs fish screen, automated diversion and fish ladder. Designs were developed in close coordination resource agencies, tribal representatives and irrigation districts. The dam included both a rubber dam and adjustable crest gate for winter flood protection and summer water level control.

Project Manager, Prospect No. 3 Fish Passage Project, PacifiCorp. The work included selection and design of an inclined screening system for the 150 cfs diversion, design of the new fish screens, intake trash rack and raking system, fish ladder modifications, fish bypass pipeline, forebay dredging, new communication and control system and site restoration.

Elwha Tribal Fish Hatchery Replacement, Elwha Klallam Tribe. Project Engineer for the site planning and predesign phases for replacement of a coho and steelhead salmon hatchery owned and operated by the Lower Elwha Klallam Tribe. Duties included hydraulic design of gravity and re-use systems, site development, adult fish collection systems, mechanical system development for life support and thermal marking.

Merwin Fish Hatchery, PacifiCorp
Design Engineer for the chlorine disinfection system and water supply intake for the new hatchery facility.

James Loucks, CCP, PMP

Cost Estimating

EDUCATION

BS, Construction Engineering, Arizona State University

LICENSES/ REGISTRATIONS

Certified Cost Professional (CCP) – Association for the Advancement of Cost Engineering

Project Management Professional (PMP) – Project Management Institute (PMI)

Mr. Loucks has over 30 years of constructability, cost estimating/project management experience in civil works and process infrastructure of water treatment plants, water conveyance pipelines, water storage facilities and industrial process plants. During his career, Mr. Loucks has gained experience in multiple project delivery methods including design-build, engineer-procure-construct (EPC) and traditional design-bid-build (DBB) or hard dollar contracting. He has been associated with some of the most respected self-performing contractors in the country as well as leading international consulting engineering firms. Mr. Loucks has gained significant domestic and international experience with specific international exposure in Asia, Latin America and the United Kingdom. As Cost Management Practice Leader for MWH Americas, Mr. Loucks leads a group dedicated to total cost management which is a systematic approach to managing cost and constructability throughout a project's lifecycle. His tasks include systems integration, staff recruiting, workload resourcing, detailed and conceptual estimating, third party estimate reviews, client presentations, and quality control. Prior to joining MWH, Mr. Loucks held key estimating, project management and project engineering positions for Arizona and California based general engineering contractors.

Relevant Project Experience

San Clemente Dam Removal, *Coastal Conservancy, Carmel Valley, CA.*
Principal Estimator, Mr. Loucks prepared detailed Class 3 and Class 2 cost estimates were to support alternative analysis for the removal of a thin arch dam and upstream sediment deposits in the Carmel River including a river re-route bypass option.

Calaveras Small Hydro, *San Francisco Public Utilities Commission*
Mr. Loucks analyzed constructability impacts and provided construction cost estimates and schedules for a 1MW small hydro study for a project near Calaveras Dam.

Alameda Creek Fish Passage Facility, *San Francisco Public Utilities Commission*
Mr. Loucks provided Class 2 construction cost estimates and schedules for a $35M fish ladder on Alameda Creek near Calaveras Dam. Mr. Loucks also prepared a comprehensive constructability report.

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification Project, *LA County Dept. of Public Works*
Principal Estimator – a detailed Class 2 cost estimate was developed for the LA County Dept. of Public Works project that involves a mass concrete thickening section with related spillway modifications. In addition, significant upgrades to site infrastructure and support facilities were estimated.

Bennett Dam Riprap Upgrade Project, *BC Hydro*
Mr. Loucks served as proposal manger and project manager for a independent third party review of a multi-year riprap upgrade project located in northern British Columbina.

San Vicente Dam Raise, *San Diego County Water Authority, CA.*
QC Team Lead - As a member of the QA/QC team, Mr. Loucks is reviewing all cost opinion deliverables from MWH's teaming partner, prior to submission to the client. The $200 M project scope consists of a major roller compacted concrete (RCC) dam raise plus related site infrastructure.

Big Creek Expansion Project, *Southern California Edison, Shaver Lake, CA.*
Senior Estimator, Mr. Loucks delivered appraisal level Class 4 cost estimates to support project feasibility studies for various water chain management systems associated with a 700 MW, $1 B hydropower expansion project. Facilities included dams, tunnels, reservoirs, penstocks, and powerhouses.

Upper San Joaquin River Basin Storage Investigation, *U.S. Bureau of Reclamation, Millerton Lake, Fresno, CA.*
Principal Estimator - As part of the California Association for Local Economic Development (CALFED) Bay-Delta program, the feasibility study evaluated several Class 4 alternatives to develop water supplies from the San Joaquin River. Mr. Loucks developed conceptual and detailed level costs for several dam raise options at Friant Dam including associated outlet works and power generating features.

Site C Cost Estimate Validation Report, *BC Hydro, British Columbia, Canada.*
Project Manager, Mr. Loucks is currently leading a Project Validation Team (PVT) to review and validate the appraisal level facility costs for a major $6 B CDN Greenfields hydroelectric project on the Peace River in northern British Columbia. The scope consists of a major new earth filled dam, 900-megawatt (MW) power house, penstocks and consequential site infrastructure. BC Hydro needs to have their internal cost opinion certified by an outside expert in order to gain support from the provincial government for approval of the business case financial objectives.

Folsom Dam Joint Federal Project (JFP) Construction Phasing Analysis, *U.S. Bureau of Reclamation/U.S. Army Corps of Engineers (USACE)/Department of Water Resources, Sacramento, CA.*
Project Manager/Head Technical Lead - The JFP is a $1 B six gated auxiliary spillway element being designed for dam safety and flood damage reduction purposes at Folsom Dam in California. The phasing study was undertaken to develop a logical and defensible approach for determining the optimum construction packaging and sequencing scheme for the USACE's work package. The overriding objective was to decompose the USACE's work package into a series of discrete construction packages and suggest an optimized phasing sequence that accounts for known and theorized constructability constraints.

Shasta Dam Water Resources Investigation, *U.S. Bureau of Reclamation, Redding, CA.*
Principal Estimator - Mr. Loucks developed appraisal level Class 4 cost estimates were to support feasibility level designs of dam raise alternatives including main dam and wing dam (embankment) modifications, spillway improvements, river outlet upgrades, temperature control device (TCD) installation, and miscellaneous civil infrastructure improvements.

Los Vaqueros Energy Recovery Project, *Contra Costa Water District*
Mr. Loucks developed Class 5 and Class 4 cost opinions in support of a small hydropower addition that converts water flows in the Multi-Purpose Pipeline to electrical generation revenue for the district. Total costs: $10M.

TETRA TECH

Stuart C. Trabant, PE
Sediment Transport

Mr. Trabant has over 20 years of experience in hydrologic, hydraulic, water-resources and civil engineering. He has completed projects throughout the United States and internationally involving a broad range of stream types and physical environments, and varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate hydrologic, hydraulic and sediment-transport conditions for both sand-bed and gravel-bed systems. His primary areas of expertise are in hydraulics, hydrology, fluvial geomorphology, and erosion and sedimentation. Mr. Trabant has significant experience in performing analyses to support the planning and design phases of water-resources and sediment management projects, as well as preparation of design plans and specifications. He also has extensive field experience in topographic and bathymetric (GPS and total station) surveying, sediment sampling, stream gaging and geomorphic mapping and interpretation.

Mr. Trabant has served as the lead design engineer or project manager for numerous stream and river restoration design projects that have focused on habitat improvement, municipal development, flood conveyance, irrigation and agriculture, recreation, flood damage recovery, and water quality, among other things. He was the primary sediment-transport modeler for a number of studies that were carried out to assess alternatives for removal of San Clemente Dam on Carmel River. Mr. Trabant was also the project manager and design engineer for a stream restoration design of an approximately 1-mile long reach of North Fork Clear Creek, near Blackhawk, CO that was undertaken to accommodate highway widening, improve the mining affected water quality, and restore salmonid habitat. He recently instructed a course on engineering geomorphology that was conducted for the Northeast Ohio Regional Sewerage District that was conducted as part of the Districts Master Planning Standards Development Program. He has extensive experience with the full suite of industry-standard hydrologic models, 1-D and 2-D hydraulic models and sediment transport models, (HEC-RAS, HEC-6, HEC-6T, SAM, HEC2-SR, SED2D and CH3D-SED), as well as GIS (ArcGIS), AutoCAD and MicroStation.

Education:
M.S., Civil Engineering (Hydraulics), Colorado State Univ., 1996

B.S., Civil Engineering, Colorado State Univ., 1994

Registrations/Certifications:
Registered Professional Engineer, Colorado, #34764, 2000

Professional Affiliations:
American Society of Civil Engineers, Member

Office:
Fort Collins, Colorado

Years of Experience:
21

Years with Tetra Tech:
20

RELEVANT EXPERIENCE

San Clemente Dam Removal Project, California Coastal Conservancy, CA, Ongoing – Provided technical review of hydrologic, hydraulic, and sediment analyses prepared during the design phase of the recently constructed Carmel River Reroute and Dam Removal Project.

Sediment-Transport Modeling to Evaluate Potential Impacts of San Clemente Dam Retrofit Options, Carmel, CA, 2007 - Project Engineer for a detailed study of the potential impacts on flooding, river stability and instream habitat in an 18-mile reach of the Carmel River associated with various options for retrofitting San Clemente Dam to meet seismic safety standards. Sediment-transport modeling was also performed in the existing reservoir to evaluate sediment-trapping effects associated with the various options. Project responsibilities included study plan development, collection of sediment and other physical data, hydrologic (HEC-FFA), hydraulic (HEC-RAS) and sediment transport (HEC-6T) modeling, and interpretation of model results. Specifically, the model results were used to evaluate the effects of the various options on sediment storage in the downstream river and the associated potential for increased flood hazards, as well as the effects to salmonid habitat (suspended sediment concentrations, bed material size requirements for spawning and fish passage limitations). His responsibilities also included preparation of a flood damage analysis and flood inundation mapping for selected alternatives. The hydraulic and sediment-transport modeling for the recently constructed Carmel River Reroute and Dam Removal Option required development of a preliminary design of the diversion channel and rerouted channel. The study was initially performed for the California Department of Water Resources and American Waterworks Company, and recently for the California State Coastal Conservancy.

Evaluation of Sediment Sluicing Operations for Pacoima Dam, CA, 2011 - As part of LACDPWs Sediment Management Feasibility Study, Mr. Trabant is currently performing hydraulic and sediment-transport modeling

to evaluate potential sluicing operation options to evacuate accumulated sediments in Pacoima Reservoir. For this study, he carried out a geomorphic field evaluation of the reach upstream from the reservoir to evaluate the sediment supply, the reach downstream of Pacoima Dam to assess sediment-transport characteristics between the dam and the location where the sluiced sediment will ultimately deposit in Lopez Flood Control Basin, the outlet works at the dam and the reservoir itself. A sediment-transport model is currently being developed of the 1983 sluicing operation, and will be validated using pre- and post-sluicing topographic information. Once validated, this model may be used to assess the effectiveness of sluicing the existing reservoir deposits.

Sleepy Hollow Raw Water Intake and Water Supply System Upgrade, Monterey Peninsula Water Management District (MPWMD), CA, Ongoing – Project Engineer for hydraulic, geomorphic and sediment-transport analysis to support design of a new raw water intake on the Carmel River for the Sleepy Hollow Steelhead Rearing Facility, a key objective for which is to minimize sedimentation issues at the fish screen. Work included field reconnaissance to assess conditions in the river adjacent to the site, management of hydraulic and sediment-transport analysis to identify an appropriate location to limit sedimentation issues, and ongoing discussions and assistance to the design team.

Flood Risk Management, Baseline Sediment-Transport and Hydraulic Analysis of the Upper Yuba River, CA, 2008 - Project Engineer for a feasibility study of modifications to Englebright Dam on the Yuba River to provide fish passage to upstream reaches. Project responsibilities included statistical analyses of flood frequency (HEC-FFA) and mean daily flow durations and development of a hydraulic (HEC-RAS) model of the Yuba River from the dam to the confluence with the Feather River, and the Feather River between the confluence with the Yuba River and the Bear River. A sediment-transport (HEC-6T) model of the project reach was also developed and executed to evaluate the stability of the rivers under existing and historical conditions.

Big Thompson River Flood Recovery Services. Loveland, CO, Ongoing – Project Manager and Lead Hydraulic Engineer for two City of Loveland projects on the Big Thompson River, including the Denver Avenue Outfall Bank Stabilization Project and the Development of a Conceptual Design for Viestenz-Smith Mountain Park (VSMP). The Denver Avenue Outfall project included hydraulic modeling, alternatives analysis and design of cost-effective and integrated bank stabilization measures to project the recently reconstructed outfall that was damaged by the September 2013 flood. The VSMP project also initially included development of a hydraulic model and preparation of conceptual design plans and associated cost estimates for channel and overbank stabilization measures to mitigate future damages to park infrastructure. Mr. Trabant is currently serving as co-designer of the final VSMP restoration design, and is responsible for the hydrologic and hydraulic analyses, sediment-transport evaluations, and design of the channel and stream stability and infrastructure protection measures.

Stream Restoration Design for State Highway 119/Main Street South Project, CO, 2012 (Const. 2012) - Project Manager for a the State Highway 119/Main Street South project which is a collaborative effort organized by the Colorado Department of Transportation (CDOT) to develop a multidisciplinary design for the highway corridor along the approximately 1-mile long reach of the North Clear Creek valley bottom downstream (southeast) of the City of Blackhawk, CO. His responsibilities included coordination with numerous state and federal agencies and a variety of local interest groups, hydraulic and sediment-transport modeling, and participation at public meetings. Because the reach is an EPA Superfund Site along a narrow valley corridor, the project goals were varied and involved mine-waste disposal, treatment of toxic runoff, widening of the highway, and a stream restoration design that provides vertical and lateral stability, improved fish habitat, flood protection and wetland mitigation. In addition to developing the stream restoration design and specifications, Mr. Trabant also provided construction management services during the construction phase.

Sediment Augmentation Feasibility Study for the Platte River, NE, 2013 - Project Engineer and Task Order Manager for developing hydraulic and sediment-transport models of an approximately 28-mile reach of the Platte River to assess the feasibility of sediment augmentation program to improve habitat for ESA-listed species. Developed hydraulic and sediment-transport models using HEC-RAS (Version 4.1) that were calibrated and verified using available information. Model development included innovative techniques to address the numerous flow- and sediment splits along the project reach.

Michael F. Adams, Jr. PE

Geomorphology/Sediment Transport

Stantec

Michael is a Civil Engineer experienced in stream restoration, natural channel design, water resources, fluvial geomorphology, and underwater inspection. Michael's responsibilities include project management, technical review, design, project scoping, geomorphic assessments, stream and watershed studies, development of restoration alternatives, and natural channel design. He has been involved in all phases of a stream restoration design project including developing project goals and objectives, scoping, field data collection, design calculations, development of plans and specifications, permitting, construction oversight and monitoring. Michael is a registered Professional Engineer and has attended all four levels of stream restoration courses taught by Dave Rosgen and he currently assists with the Level 3 courses as an instructor. He is especially familiar with sediment transport and early in his career worked on Stantec's dive crew inspecting scour problems at bridge sites. Michael is also well versed at writing and public speaking, and won the 2001 Daniel Terrell Award for outstanding paper presented by the District 9 Council of ASCE. He also helps teach stream restoration related short courses across the country and frequently presents at stream restoration conferences.

EDUCATION

MS, Civil Engineering, University of Kentucky, Lexington, Kentucky, 1998

BS, Civil Engineering, University of Kentucky, Lexington, Kentucky, 1996

BA, History, Vanderbilt University, Nashville, Tennessee, 1993

CERTIFICATIONS & TRAINING

Stream Functions Pyramid Framework, Will Harman, Raleigh, North Carolina, 2012

Ecological and Geomorphic Principles of Stream Restoration, Dr. Margaret Palmer and Dr. Peter Wilcock, Baltimore, Maryland, 2009

Advanced HEC-RAS, Dr. Arthur Miller, Gainesville, Virginia, 2008

HEC-RAS, Dr. Arthur Miller, Gainesville, Virginia, 2008

Comprehensive Project Management Training, PSMJ, Lexington, Kentucky, 2008

Leadership PE Program, Kentucky Society of Professional Engineers, Frankfort, Kentucky, 2006

Natural Channel Design and River Restoration, Wildland Hydrology, Steamboat Springs, Colorado, 2003

River Assessment and Monitoring, Wildland Hydrology, Pagosa Springs, Colorado, 2003

Fluvial Geomorphology for Engineers, Wildland Hydrology, Pagosa Springs, Colorado, 2002

Co-Instructor, NRCS Introduction to Fluvial Geomorphology, Morgantown, West Virginia, 2015

Co-Instructor (RIVERMorph Stream Restoration Software), River Morphology and Applications (Rosgen Level II), Multiple, Various Locations, 2015

Co-Instructor (RIVERMorph Stream Restoration Software), River Assessment and Monitoring (Rosgen Level III), Multiple, Various Locations, 2015

Co-Instructor, NRCS Applications and Planning with Fluvial Morphology, Bozeman, Montana, 2014

Team Leader, River Assessment and Monitoring (Rosgen Level III), Lubrecht, Montana, 2010

Team Leader, River Assessment and Monitoring (Rosgen Level III), Lubrecht, Montana, 2009

Michael F. Adams, Jr. PE

Geomorphology/Sediment Transport

Team Leader, River Morphology and Applications (Rosgen Level II), Meadows of Dan, North Carolina, 2005

REGISTRATIONS

Professional Engineer #90869PE, State of Oregon

Professional Engineer #45587, Commonwealth of Virginia

Professional Engineer #113494, State of Texas

Professional Engineer #50751, State of Minnesota

Professional Engineer #PE 080261, Commonwealth of Pennsylvania

Professional Engineer #36300, State of Maryland

Professional Engineer #034864, State of North Carolina

Professional Engineer #PE905134, Washington, D.C. (District of Columbia)

Professional Engineer #112832, State of Tennessee

Professional Engineer #17980, State of West Virginia

Professional Engineer #22025, Commonwealth of Kentucky

LEED Accredited Professional, U.S. Green Building Council

MEMBERSHIPS

Member, Maryland Stream Restoration Association

Member, Society for Ecological Restoration

Member, American Society of Civil Engineers

Member, River Restoration Northwest

PROJECT EXPERIENCE

Stream and River Restoration

Dewey Creek Stream Restoration Project, Prince William County, Virginia (Lead Designer)

This project was initiated by Prince William County as part of its overall Watershed Restoration Initiatives. The project, which is approximately 6,000LF, consists of four phases. Michael serves as lead designer for each of the four phases, two of which are currently at the Preliminary Design phase. The other two Phases will be taken to a Conceptual Design prior to generating Preliminary Design documents. It is anticipated that Michael will also participate in Construction Observation once the projects go to construction.

Hatchery Creek Design/Build Project (Design and QA/QC), Russell County, Kentucky

Hatchery Creek is Kentucky's first restored trout stream and involves the establishment of 6,000 feet of stream channel across the historic floodplain of the Cumberland River just below Wolf Creek Dam. The design receives flow from the Wolf Creek National Fish Hatchery and includes both single thread and braided sections of channel. Boulder and log structures, connected vernal pools/sloughs, and off channel pools/wetlands throughout the project create a variety of habitat features to serve every phase of the trout life cycle. The stream flow returns to the Cumberland River through 600 feet of designed step pool channel. Michael developed the initial concept plan for the project and served in subsequent QA/QC activities.

Chester Creek Stream Restoration Project, Duluth, Minnesota (Project Manager)

Chester Creek was severely damaged by flooding during the summer of 2012. Two low-head dams were damaged and a pedestrian bridge heavily utilized by snow mobiles and cross country skiers in the winter was washed away. Stantec delivered conceptual and preliminary design packages for the restoration of two reaches of stream including the removal of two low-head dams. Michael served as project manager and QC engineer for the project.

** denotes projects completed with other firms*

Michael F. Adams, Jr. PE

Geomorphology/Sediment Transport

Boulder Creek Confluence Stream Restoration Project, Boulder, Colorado (QA/QC)

Recent flooding and a history of flow diversions have significantly altered the landscape of Boulder Creek in it eponymous city. The local perturbations to the system have resulted in excessive sediment deposition in sections of channel that have had the cross section altered. As a consequence, flow has diverted into an adjacent pond thereby starving the downstream reach of water except in high flow events. Stantec is currently developing a design to correct the hydraulic deficiencies of the project to promote single channel flow and sediment transport throughout the project reach. Michael is leading the QA/QC activities for the project.

McCosker Stream Daylighting Project, Canyon, California (Lead Designer)

The East Bay Regional Parks District acquired a tract of land it would like to develop into a multiple-use property. Currently, a perennial stream flows below ground through a series of culverts. Stantec explored the feasibility of removing the culverts, which total approximately 1,200 linear feet, and reconstructing a step-pool stream in its place. Michael conducted a site assessment and developed a conceptual plan and preliminary cost estimate for the project.

TxDOT Grand Parkway Stream Mitigation Project/ Phase II Katy Prairie Umbrella Stream Mitigation Bank, Houston, Texas (Project Manager)

Stantec is currently providing stream restoration services to Restoration Systems, LLC for multiple streams within the Katy Prairie Conservancy in Northwest Harris County near Houston, Texas. The majority of this project is for Compensatory Mitigation associated with the Grand Parkway project in Houston. Stantec is providing assessment, design and construction management services. Michael is serving as project manager and lead designer for the project, which consists of over 16 miles of new stream construction, making it the largest known single-site mitigation bank in the United States.

Knowlton Creek Stream Restoration Project Final Design, Duluth, Minnesota (Project Manager)

Elevated sediment loads from bank erosion and bed degradation along Knowlton Creek have caused the filling of a downstream estuary. Following up on a Feasibility Study, Stantec produced Final design documents, assisted with bid preparation and will provide Construction Oversight Services. Michael served as project manager for the project.

Juniata Dam Removal and Stream Restoration Project, Philadelphia, Pennsylvania (Lead Designer, Project Manager)

As part of its Green City initiative, and utilizing a watershed plan developed by Stantec, the City of Philadelphia Water Department identified a number of projects to improve water quality within the city. It its current state, Juniata dam creates a stagnant pool that is believed to be a major contributor to decreased levels of Dissolved Oxygen (DO) within Tacony Creek. Stantec performed a feasibility study for the removal of the dam and the restoration of the channel upstream and downstream of the structure.

Middle Fork Stream Restoration Project, Henderson County, Tennessee (Project Manager; Lead Designer)

This project, located in West Tennessee, restored nearly two miles of perennial, spring-fed streams by raising them nearly fourteen feet in places to re-connect them with the historic flood plain. The design utilized hundreds of pieces of wood to stabilize the bottom as well as to create/enhance habitat value for in-stream and near-stream organisms. Dozens of oxbow and ephemeral pools were incorporated into the design to enhance near-stream habitat value for amphibians. Working closely with the Tennessee Stream Mitigation Program, Stantec provided assessment, design and construction management services. Michael managed the project and was the lead designer.

Phase I Katy Prairie Umbrella Stream Mitigation Bank, Houston, Texas (Project Manager, Lead Designer)

Stantec provided stream restoration assessment, design, construction observation and monitoring services to Restoration Systems, LLC for approximately three miles of stream on the Katy Prairie Conservancy property in Northwest Harris County near Houston, Texas. The project is being utilized in the first stream mitigation bank in Texas. Michael served as project manager and lead designer for the project, which consists of 3 miles of new stream construction.

** denotes projects completed with other firms*

Michael F. Adams, Jr. PE

Geomorphology/Sediment Transport

Beasley Creek Stream Restoration Project, Fayette County, Tennessee (Project Manager; Lead Designer)

This project, located in West Tennessee just outside of Memphis, restored over three miles of streams by removing a berm running parallel to the stream system and replacing it with an active floodplain. The design included thousands of trees and shrubs in addition to the engineering work on the stream itself. Working closely with the Tennessee Stream Mitigation Program, Stantec provided assessment, design and construction management services. Michael managed the project and was the lead designer.

Crooked Creek Restoration Project, Hardin County, Tennessee (Project Manager)

The Tennessee Stream Mitigation Program entered a partnership with the Tennessee Wildlife Resource Agency to restore a section of Crooked Creek, a tributary to Mud Creek in the White Oak Wildlife Management Area. Michael served as project manager and lead technical resource for design and construction for approximately 10,000 linear feet of channel and several acres of adjacent wetlands. Construction for the project was accomplished under budget including a number of additional habitat features added during the construction phase.

Kyles Fork Stream Mitigation, Hancock County, Tennessee (Project Manager, Lead Designer)

This project, located on the Clinch River in East Tennessee, was aimed at reducing sediment loads and protecting a shoal that provided habitat for dozens of threatened and endangered mussel species. The Tennessee Stream Mitigation Program entered into a partnership with the Tennessee Wildlife Resource Agency, with Stantec serving as the design consultant, to restore approximately 5,000 linear feet of a tributary to the Clinch, to repair a rapidly eroding section of bank along the Clinch River and to eliminate a breech along a levee that was contributing sediment to the system. Michael was responsible for managing the project and serving as the lead technical resource for the design and implementation.

Little Frozen Creek Stream Restoration, Jackson, Kentucky (Design Engineer)

The construction of KY 15 by the Kentucky Department of Transportation impacted several streams along the proposed highway corridor. As Project Engineer, Michael was responsible for the design of over 2,500 feet of gravel-bed stream in eastern Kentucky as mitigation for the highway improvements. This project included sediment transport analysis, natural channel design, hydraulic modeling, field assessments, constructed riffles, boulder vanes and habitat features in a C4 stream type.

Zack's Fork Stream Restoration, Lenoir, North Carolina (Lead Designer)

Zack's Fork is a highly impacted stream located near Lenoir, North Carolina. The restoration of Zack's Fork was initiated through the North Carolina Ecosystem Enhancement Program (EEP) as a full delivery project. The project included reconstruction of 3900 feet of a highly entrenched F4 stream type as a stable C4 stream. Michael was the Lead Designer for the geomorphic study and stream restoration design.

Four Mile Creek Stream Restoration, Mecklenburg County, North Carolina (Lead Designer)

Four Mile Creek is located in a highly urbanized area near Charlotte. The restoration of Four Mile Creek was initiated through North Carolina's Ecosystem Enhancement Program as a full delivery project. The project included restoration of 2,900 feet of a highly entrenched F4 stream type to a stable C4 stream type. Michael served as the Lead Designer for the geomorphic study and stream restoration design.

Upper Coldwater Fork Stream Restoration, Martin County, Kentucky (Lead Designer)

Michael served as the Lead Designer for the restoration design of approximately 6,000 feet of Coldwater Fork in eastern Kentucky. Coldwater Fork was the most severely impacted stream from the October 11, 2000 slurry spill at the Martin County Coal facility, one of the worst coal mining related environmental disasters in the eastern United States. This project included a geomorphic assessment and design based on a reference reach, preparation of 401 and 404 permits, development of monitoring/maintenance plans, construction oversight and three years of monitoring.

** denotes projects completed with other firms*

Jim Herbert, PG, CEG

Geologist

EDUCATION

BS, Geological Sciences, California State University at Long Beach

LICENSES/ REGISTRATIONS

Certified Engineering Geologist: California No. 1657

Professional Geologist: California, No 5213, Washington, No. 2394

Mr. Herbert has 34 years of extensive and varied experience in the engineering geology, geotechnical assessments, and associated construction fields. He has spent considerable time effectively managing quality control programs for significant earthwork construction, structural distress, rock excavation, groundwater assessment, dam instrumentation, and rock/soil slope stability assessments and stabilizations. Mr. Herbert is adept at evaluating existing site conditions with respect to design plans/construction specifications, distress indicators, geotechnical documentation, geological maps and literature, and aerial imagery to develop comprehensive models of subsurface conditions in support of site development, rehabilitation and forensic investigations. Given his wide-ranging experience, Mr. Herbert is capable of working easily with the project managers, design and construction professionals, environmental consultants, and local/state/federal regulators to develop implementable geotechnical, geologic, and hydrogeologic investigations within the confines of budget and schedule. During the course of his career, he has provided detailed plans for investigations into deep foundations, landslides and soil creep, rock slope stability, channel erosion, embankment and structural settlements, bridge and dam foundations, and aggregate resources.

Relevant Project Experience

New Los Padres Dam Feasibility Study and Aggregate Assessment, Monterey County, California, USA, Monterey Peninsula Water Management District
Project Engineering Geologist/Task Leader for the aggregate resources study for the proposed 282-foot high roller - compacted concrete dam on the upper Carmel River. Set up and performed field investigation of rock coring, water pressure and grout testing to evaluate the quantity and quality of rock resources in the area of the reservoir and dam. Supervised geophysical surveys and engineering geologic mapping conducted by others. He was also responsible for compilation of overall geologic/seismic evaluations of the project site, review/evaluation of preliminary design with respect to geologic conditions, and review/revision of construction cost estimate.

L. L. Anderson Dam - Spillway Outfall Modification Mapping & Construction Support, Placer County, California, USA, Placer County Water Agency
Project Engineering Geologist for the geologic mapping and evaluation of damage to the outfall area for the preliminary design, final design for construction of a new spillway outfall after record rainfall in 1996 caused reservoir overflow to leave the original spillway outfall channel. Modifications to the spillway outfall were performed under the jurisdiction of Federal and State agencies.

L. L. Anderson Dam - Spillway Modification Mapping, Investigations & Construction Support, Placer County, California, USA, Placer County Water Agency
Project engineering geologist responsible for developing work plan and project health and safety plan, and for implementation of subsurface exploration into granitic bedrock conditions associated with existing spillway for French Meadows Reservoir. Coreholes were advanced using wireline techniques on both sides of spillway for evaluation of widening, armoring, and new gate construction, and within the spillway for deepening the spillway and foundation conditions. Auger borings were advanced to evaluate foundation conditions for planned parapet wall on the crest of L.L. Anderson Dam, a 231-foot high rockfill structure.

Mokelumne Aqueducts Delta Tunnel Study, Sacramento-San Joaquin Delta, California, East Bay Municipal Utility District
Project Engineering Geologist responsible for data review and evaluation, evaluation of aerial imagery for regional conditions and access, alignment reconnaissance, permitting and contractor acquisition, development of work plan for subsurface exploration program along 16.6 mile long alignment through the Delta.

Big Tujunga Dam Seismic Rehabilitation Mapping, Investigations & Construction Support, Los Angeles County, California, USA, Los Angeles County Department of Public Works
Principal Engineering Geologist responsible for preparation and supervision of geotechnical investigations from a barge in the plunge pool and from cable-suspended platforms on near-vertical downstream abutment walls for evaluation of foundation conditions in planned concrete buttress. Becker Penetration Tests and seismic refraction surveys were conducted to evaluate liquefaction potential in an ancient stream channel

underlying the foundation area of the right abutment wing wall. Prepared a detailed geologic report that summarized the field program and geologic/geotechnical findings. Oversaw a subsequent detailed subsurface investigation into left abutment stability and consulted with DSOD regarding findings. Mapped vertical abutment foundation excavations along with DSOD staff using industrial rope access techniques during construction.

Lower Slab Creek Powerhouse, Task 7: Mapping, Feasibility Evaluations & Construction Planning, Camino, California, Sacramento Municipal Utility District
Project Engineering Geologist providing reconnaissance- and design-level geologic mapping, evaluation of aerial imagery for regional bedrock structure, review and summaries of geologic/geotechnical investigations into Slab Creek Arch Dam, White Rock Tunnel and the specific project.

San Luis Reservoir Low Point Improvement Project Alternatives Evaluation, Santa Clara County, California, USA, Santa Clara Valley Water District
Project Engineering Geologist for planning study that addressed over 75 alternatives including new dams and reservoirs, expansion of existing reservoirs, pipelines, tunnels, pump stations, hydroelectric facilities, water treatment facilities, and institutional agreements, and provided geotechnical evaluation of six feasible alternative dam sites.

Upper San Joaquin Storage Investigation Alternatives & Temperance Flat Dam Investigations, Sierra Nevada Foothills, California, USA, U. S. Bureau of Reclamation
Principal Engineering Geologist and Assistant Task Manager for alternative designs, conceptual design and cost estimating for selected alternatives of 15 potential storage measures intended to increase storage within the upper San Joaquin River Basin by 700,000 acre-feet. Dam types considered included concrete-faced rock fill, earth fill, concrete arch, concrete gravity, and RCC. Worked closely with Reclamation staff in site reconnaissance, mapping and geological/geotechnical investigation program development for the preferred Temperance Flat Dam alternative.

El Galeno Mine Tailings Dam & Borrow Resource Investigations, Cajamarca, Peru, Lumina Copper
Lead Engineering Geologist responsible for Bankable Feasibility-level geologic mapping of the 24 km^2 project site, located in the Andes Mountains at elevations over 3500 m. Provided detailed field mapping and analysis for a planned 10 million m^3 tailings dam and 1 million m^3 saddle dam, water supply dam, waste rock dump and processing plant facilities. Also provided support to the subsurface field investigation that advanced over 8000 m of diamond core drill hole.

La Pitarrilla Mine Tailings Dam & Borrow Resource Investigations, Casas Blancas, Mexico, Silver Standard
Engineering geologist for geologic mapping of proposed tailings storage facility dam and impoundment in volcanic ignimbrite terrain. Also mapped and assessed sources and quantities of potential fine-grained deposits for impoundment liner material and coarse-grained deposits for aggregate and filter materials.

American River Pump Station Foundation Mapping, Investigations & Construction Support, Auburn, California, USA, Placer County Water Agency
Project Engineering Geologist for the evaluation of potential pump station, intake structure, fish screen configurations and pipeline alignments within the construction area of the abandoned Auburn Dam project. Conducted reconnaissance-level geologic mapping of potential sites and detailed geologic mapping of selected site. Managed and evaluated findings of subsurface field investigation conditions with respect to slope stability, seismicity, and faulting. Provided conceptual design, preliminary design, and final design support and construction observations. During construction, blast-damaged slopes were assessed, slope inclinations were modified, and anchor bolts were installed to provide more stable tunnel portal and slopes.

Tulloch Hydroelectric Project, 3rd Unit Addition, Mapping, Investigations & Construction Support Oakdale, California, USA, Oakdale and South San Joaquin Irrigation Districts
Principal Engineering Geologist responsible for the initial reconnaissance-level mapping of the proposed powerhouse and access road. Provided QA/QC oversight for subsequent detailed mapping and subsurface field investigations consisting of three wireline rock coreholes advanced into the proposed powerhouse footprint. Provided oversight and review for in-construction rock excavation mapping and rock bolt placement.

Jennifer Van Pelt, PG

Geologist

EDUCATION

MS, Geological Sciences, University of California, Santa Barbara

REGISTRATIONS

Professional Geologist: California, 9174

Ms. Van Pelt provides field geological, geotechnical, and supervising services on a wide variety of hydroelectric and water resource projects, and is a licensed professional geologist in California. Ms. Van Pelt's 10 years of project experience includes field mapping (traditional and rope access techniques), geotechnical drill core logging and sampling, soils logging and sampling, well installation and development, slope stability analyses, evaluation, and instrumentation, fracture and kinematic analysis, photogrammetric evaluation, foundation preparation inspection, dam foundation curtain and consolidation grouting design, implementation, and inspection, groundwater and surface water sampling, report preparation, and laboratory experience.

Relevant Project Experience

San Clemente Dam Removal and Carmel River Re-route, California American Water, Carmel Valley, California
The San Clemente Dam has reached the end of its usable life due to heavy sediment buildup. The California State Coastal Conservancy plans to remove the dam and re-establish the natural flow of the Carmel River and San Clemente Creek. Ms. Van Pelt conducted geotechnical field services for a feasibility evaluation of the project which included mapping of geologic structures in the local area including stratigraphic, fracture, and fault identification, and oversaw the advancement of two 120 foot core holes and three sediment borings along the Carmel River, and San Clemente Creek. Produced a Technical Memo for the investigation including the analysis of field work and geotechnical data, kinematic analyses, and the creation of detailed drill core logs and geologic maps.

Preliminary Design: Mill Site Jetty Geotechnical Investigation, Confidential Client, New Mexico
Lead geologist for geotechnical exploration program to evaluate foundation conditions for the design of an arroyo jetty and stormwater channels to control erosion. Services included supervision and coordination of drilling, sample collection, detailed rock core and soils logging, geologic mapping, quality assurance, and training of staff.

White River Hydro Project – Construction and Commissioning Support, Regional Power OPCO Inc., Ontario Canada
Engineering geology inspector and project geologist for two Greenfield run-of-river hydroelectric facilities on the White River, in northwest Ontario, Canada. Provided on-call geotechnical support during excavation and construction, including foundation and abutment rock mapping, and rock slope stability recommendations. Served as technical lead geologist on site during curtain grouting operations, providing coordination, oversight, quality control, and preparation of final grouting report. Commissioning of both sites expected mid-2016. Total installed capacity of both sites is 18.9 MW.

Candelaria Mine New Tailings Storage Facility Dam Project – Phase 3 Geotechnical and Hydrogeological Subsurface Investigation, Freeport McMoran Inc. (FCX), Copiapo, Chile
Lead engineering geologist in the field, and site coordinator for a detailed geologic and geotechnical exploration program to evaluate the subsurface conditions and geohazards for a new tailings storage facility dam in Northern Chile. Services included supervision and coordination of multiple drilling teams and technicians for 24 hours drilling, permeability testing, piezometer installation, discontinuity mapping, detailed logging of samples as well as quality assurance and oversight of 1,500 m (4,900 feet) of soils and rock logging, and training of junior staff.

Wanapum Dam Spillway Repairs, USA, Grant County Public Utility District, Washington State
Engineering Geologist in quick response activities associated with repair of broken concrete monolith within the spillway gate structure for Wanapum Dam located on the Columbia River in central Washington. The designed repair involved installation of post-tensioned anchors (PTA) such that the concrete monoliths would satisfy Federal Energy Regulatory Commission dam stability criteria at an intermediate pool level. The PTAs consist of three 61-strand tendons in each of the 11 spillway piers, supplemented by bar anchors in the spillway ogee sections. Ms. Van Pelt provided drilling supervision and oversight for subsurface investigation crack logging of pilot holes drilled through structure for tendon installation.

Cerro Verde Mine Expansion Tailings Dam Project, Freeport McMoran Inc (FCX), Arequipa, Peru
The Cerro Verde Mine Expansion Tailings Storage Facility includes the construction of a 140 m (459 feet) tall zoned embankment starter dam to handle the start-up water pond and a 300 m (984 feet) tall ultimate cyclone sand embankment dam, to contain a total of 2.025 Gt of processed ore tailings. Ms. Van Pelt provided engineering geology services during the feasibility and design investigation, which included drilling and logging of over 1900 m (6200 feet) of rock core and soils, permeability testing, piezometer installation, field mapping, and training of associated staff.

Susitna-Watana Reservoir Slope Stability Evaluation, Alaska Energy Authority (AEA), Talkeetna Mountains, Alaska
Performed a desktop reservoir rim slope stability evaluation for the proposed 700 foot high Susitna dam which will impound a reservoir approximately 42 miles in length, and an annual drawdown of approximately 200 feet. The evaluation utilized LiDAR (Laser Detection and Ranging) and ISFAR (Interferometric Synthetic Aperture Radar) imagery, the results of previous field investigations and geologic mapping, and from aerial imagery interpretations to examine the landscape for evidence of active/recent and/or historical failures (e.g., slides, flows, solifluction) and to identify the likely dominant failure modes and mechanisms that may occur during reservoir operation, and considered geologic conditions, slope angle and aspect, and potential for permafrost was used to evaluate potential for future instability during reservoir operation.

New Croton Dam Spillway Modification, New York Department of Environmental Protection, New York
Conducted field investigations and kinematic analyses for the New Croton Dam Spillway Modification project, Croton-on-Hudson, New York. Development of 3D models of the spillway slope used ADAM-Tech Photogrammetric tools to create detailed maps, photo-geologic maps, and kinematic figures for slope stability analyses.

Dugway West Interceptor Sewer Expansion Tunnel Geotechnical Investigation, North East Ohio Regional Sewer District (NEORSD), Cleveland, Ohio
Provided engineering geology services during the investigation stage for the design of a 3 mile long sewer interceptor to be constructed beneath an urban area. Reaches include cut and cover pipeline, a 108 inch tunnel in hard rock transitioning to a 63 inch EPBM micro-tunnel in soft glacial deposits. Ms. Van Pelt oversaw soils and core drilling for the tunnel geotechnical investigation, including geotechnical core and soils logging, sampling, and piezometer installation.

La Pitarrilla Mine, Tailing Storage Facility Feasibility Investigation, Silver Standard, Casas Blancas, Mexico
Ms. Van Pelt produced detailed geotechnical logs for approximately 1000 m rock core in volcanic, volcaniclastic, altered, and sedimentary rocks as a field geologist in support of the geotechnical Investigation and feasibility geotechnical design of a plant site capable of producing 4,000tpd ore body, two alternative locations for a tailing storage facility (TSF) and a 15km long access road including a bridge crossing the Nazas River. Investigation was initiated for the site location and development of a tailings storage facility for daily mine operation of approximately 8000 tons/day for approximately 17 years.

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