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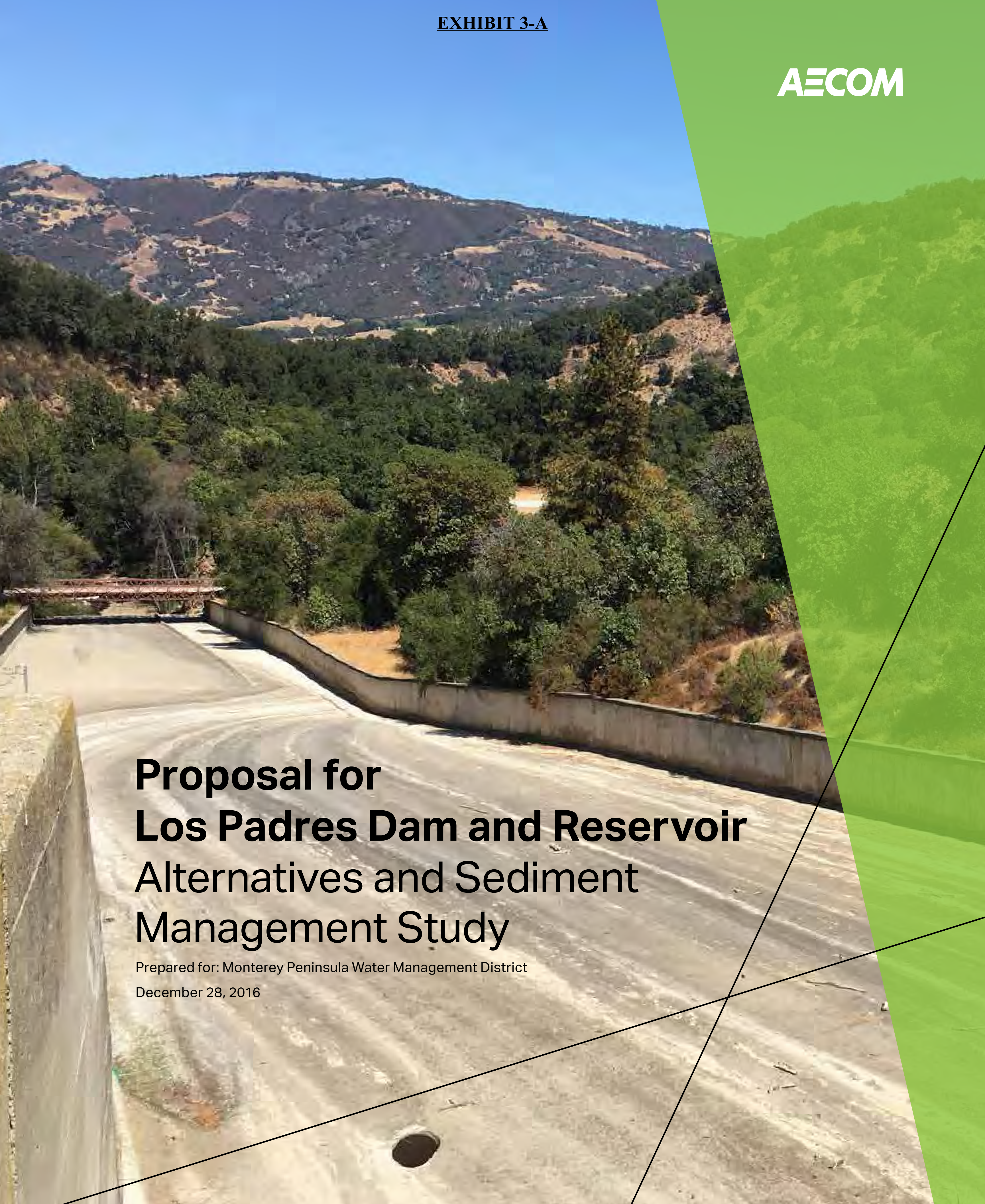

Proposal for Los Padres Dam and Reservoir

Alternatives and Sediment Management Study

Prepared for: Monterey Peninsula Water Management District

December 28, 2016

EXHIBIT 3-A

AECOM

AECOM
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Oakland, CA 94601
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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

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	Noel Wong
Project Manager	Vice President, Principal-in-Charge
(510) 874-3058 (direct)	(510) 874-3112 (direct)

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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

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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

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02 Prequalifications/ Licensing Requirements

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

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

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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

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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

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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

EXHIBIT 3-A

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.

EXHIBIT 3-A

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.

EXHIBIT 3-A

Searsville Dam and Reservoir Alternatives Study

San Mateo and Santa Clara Counties, California

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

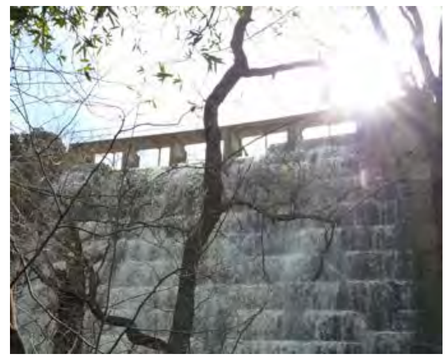
Key Subconsultants: Balance Hydrologics

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.

EXHIBIT 3-A

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.

EXHIBIT 3-A

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.

EXHIBIT 3-A

Assistance with IFIM characterization of the Carmel River

Carmel Valley, California

Balance Hydrologics, Inc.®

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 3-A

04
Key Staff Persons

EXHIBIT 3-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.

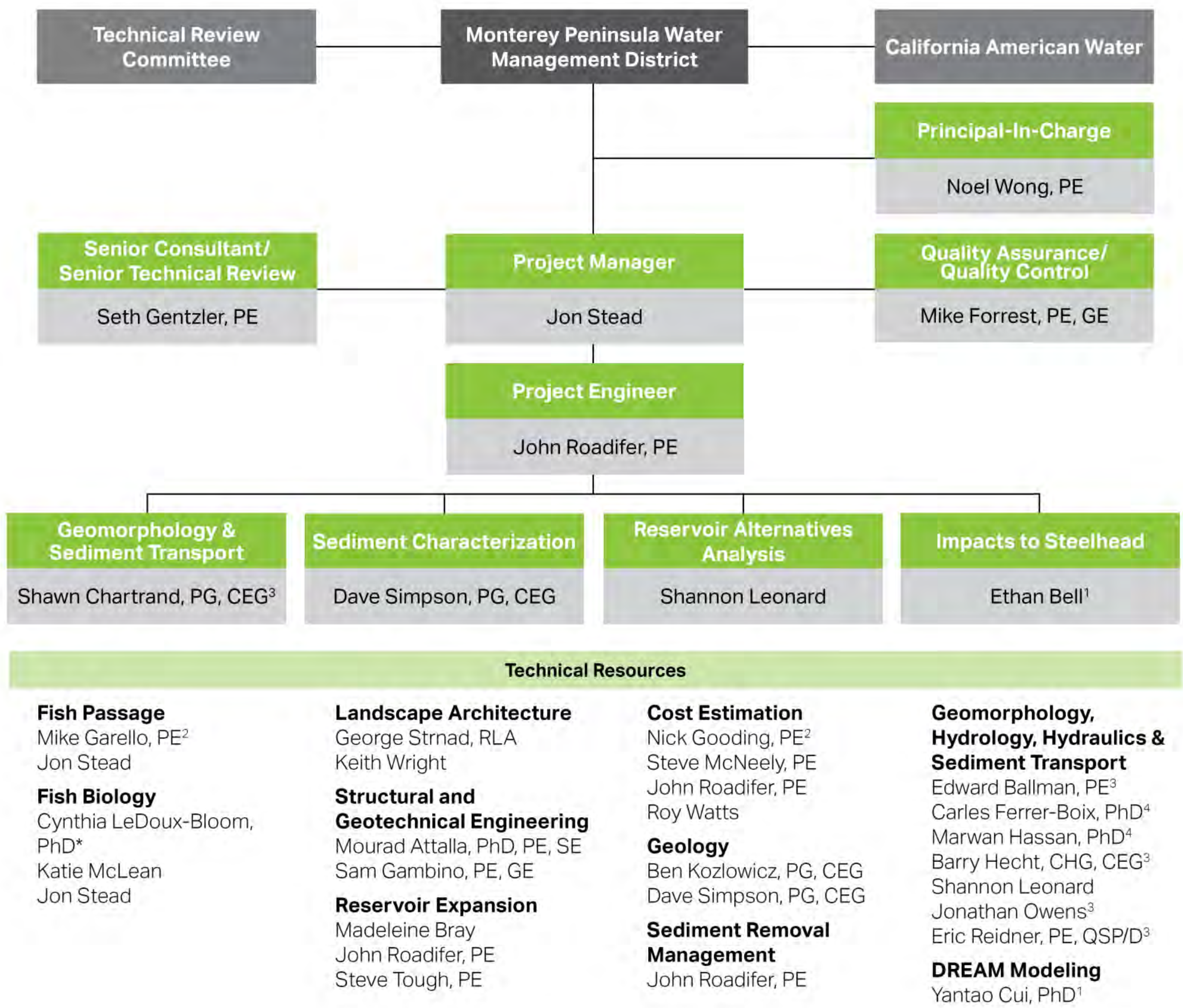
Stillwater has a long history of supporting sediment management and water diversion projects with great success. Stillwater has worked collaboratively or individually on nearly 40 dam removal or dam sediment management projects throughout the U.S.

EXHIBIT 3-A

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



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 3-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.

EXHIBIT 3-A

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.

EXHIBIT 3-A

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.*

EXHIBIT 3-A

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

EXHIBIT 3-A

06
Technical Aspects

EXHIBIT 3-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

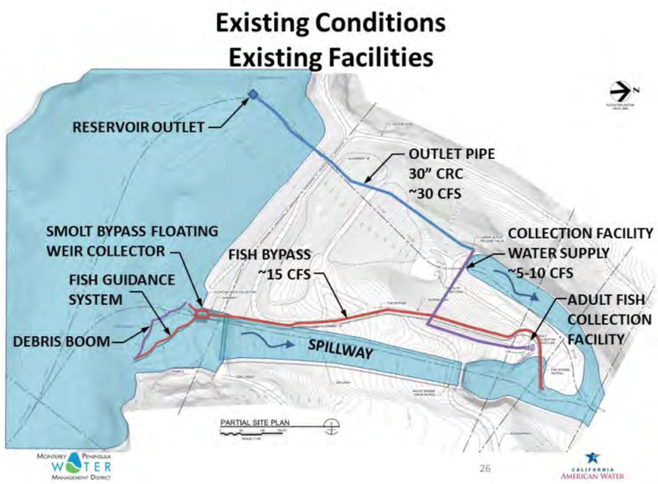
Task 1 is focused on the technical analyses and engineering required for concept development. The AECOM Team will compile and review available background information to prepare for a concept development workshop with the TRC, and will prepare workshop materials, including preliminary thoughts on alternative 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]

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.

[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.

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.

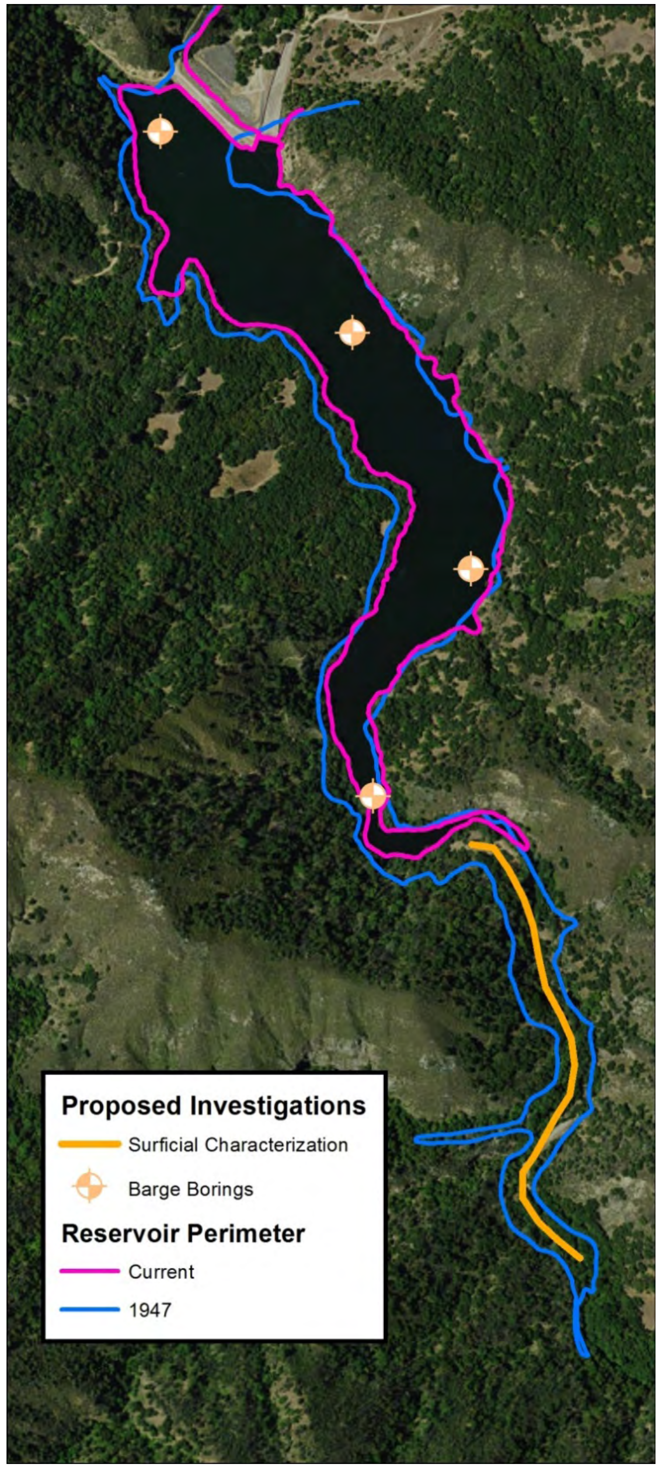


Figure 6.1 Reservoir Exploration Locations

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.

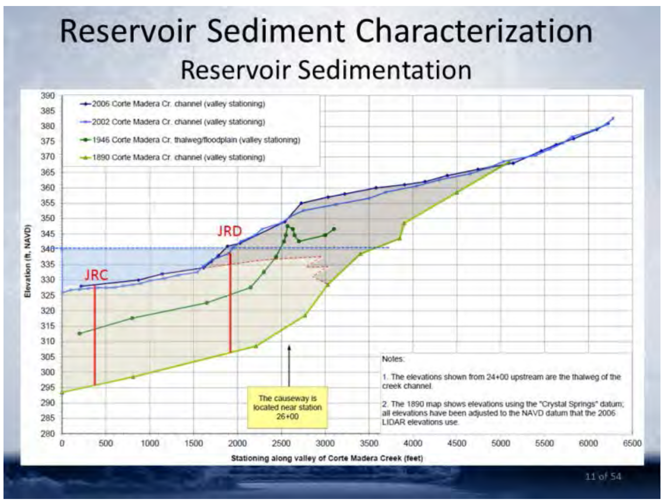
Deliverables, Schedule, and Assumptions

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;

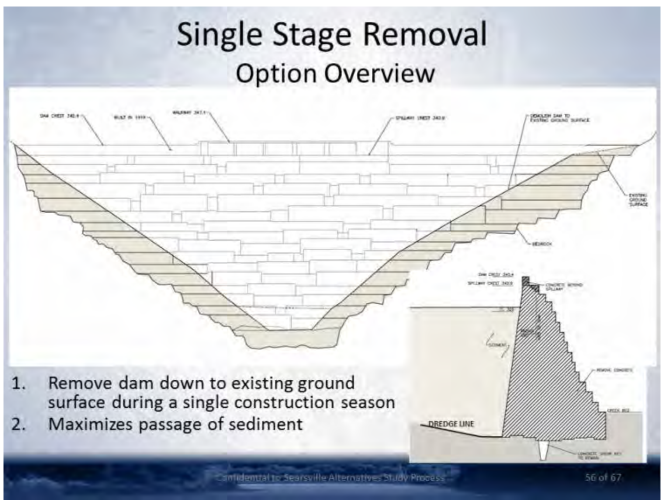
EXHIBIT 3-A

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;

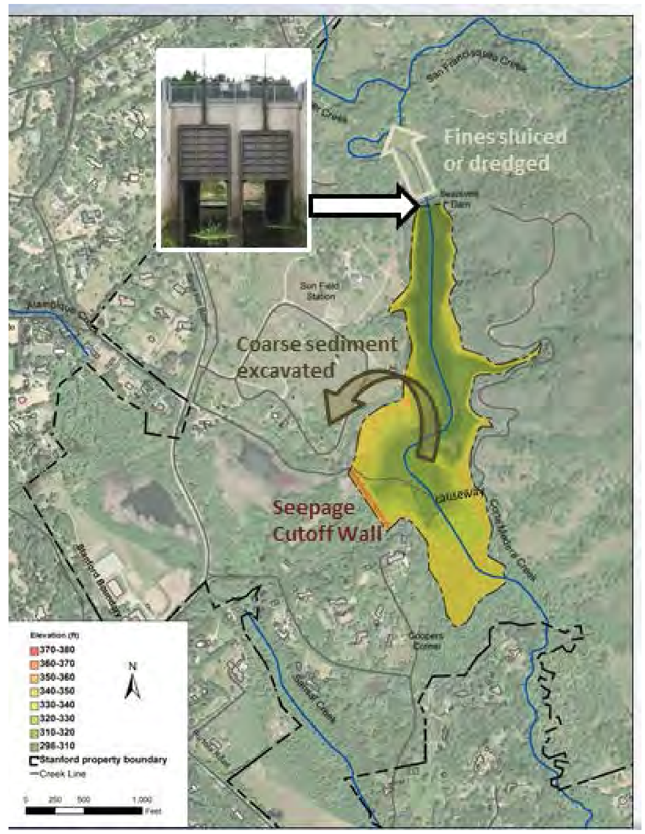
vi. water availability analysis (i.e., what effects would alternatives have on instream flows); and

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.

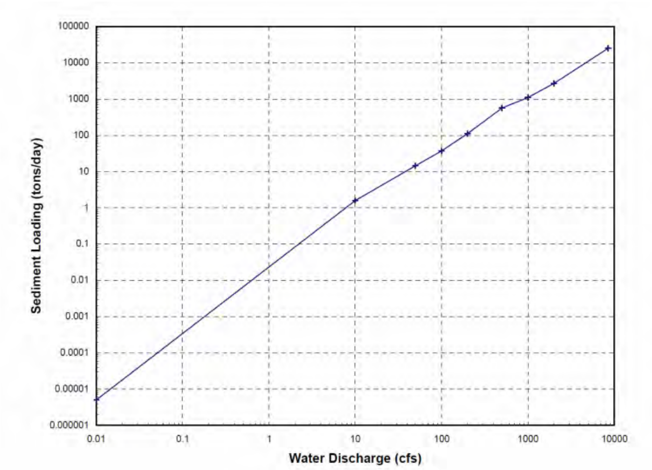
Our intent is for the level of effort of any modeling to be commensurate with the level of design detail available for the project. Our proposed approach, developed by leading researchers in the field of geomorphology and sediment transport, is robust, physically based, and allows for the analysis of 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.



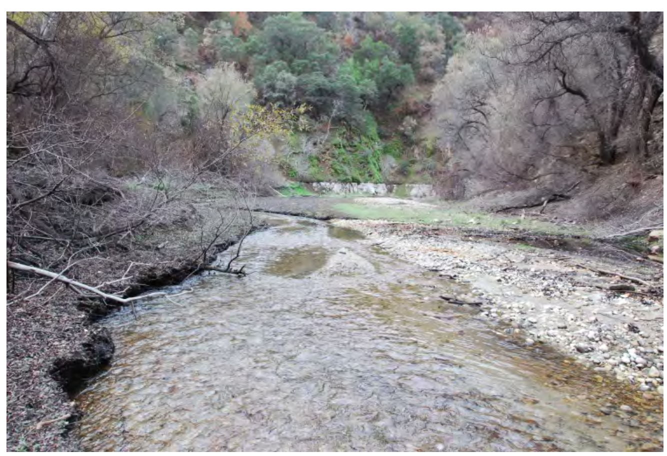
Example sediment rating curve from previous project

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.



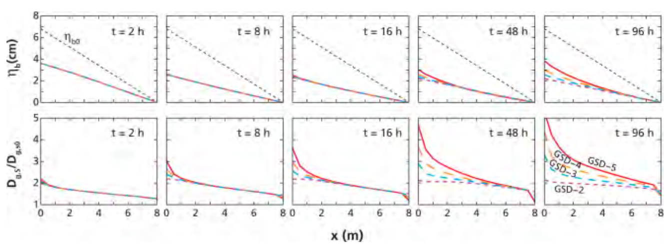
Sediment deposition at the head of Los Padres Reservoir, Dec. 2016

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.

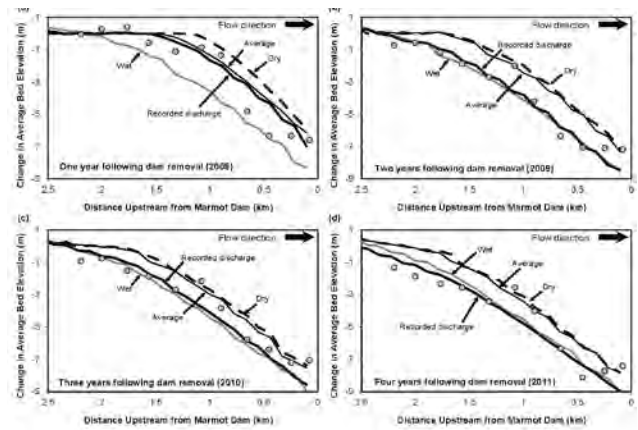
Optional Subtask 2-3.3 Qualitative Evaluation of Geomorphic Response to Changes in Sediment Supply

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.

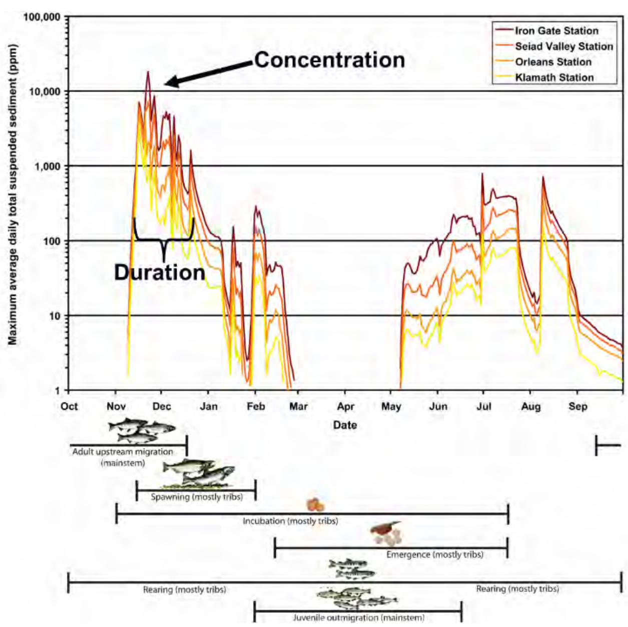
The analysis will focus on the response of steelhead and their habitat to increases in sediment in at least the following five response reaches: 1) the inter-dam reach between LPD and the upstream end of the inundation zone of the former San Clemente Reservoir; 2) San Clemente Reservoir to Camp Stephani 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.

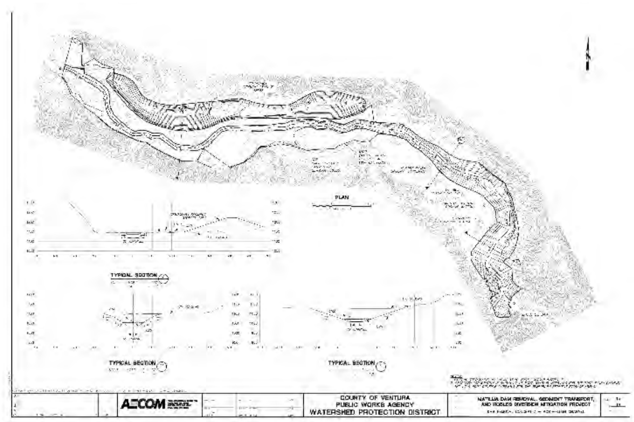
Deliverables, Schedule, and Assumptions (all Task 3)

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:

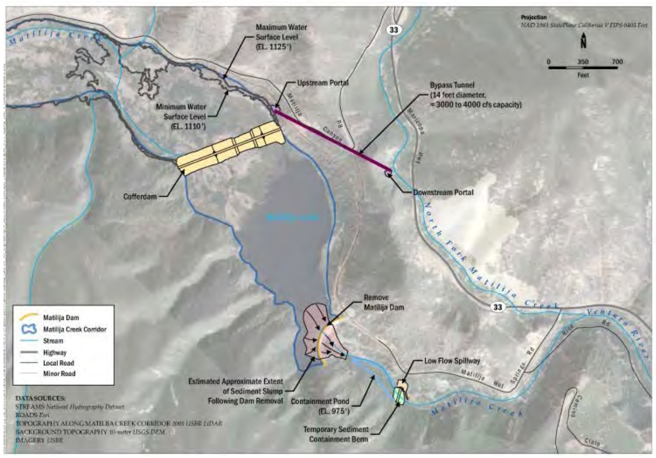
- Distribution of the final Task 1 (background information, evaluation criteria, and data gaps) and Task 2-1 (sediment characterization) TMs, and draft documents developed under Task 2-2 (preliminary alternatives descriptions), Task 2-3 geomorphic effects), and Task 3 (effects on steelhead) to the TRC 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:

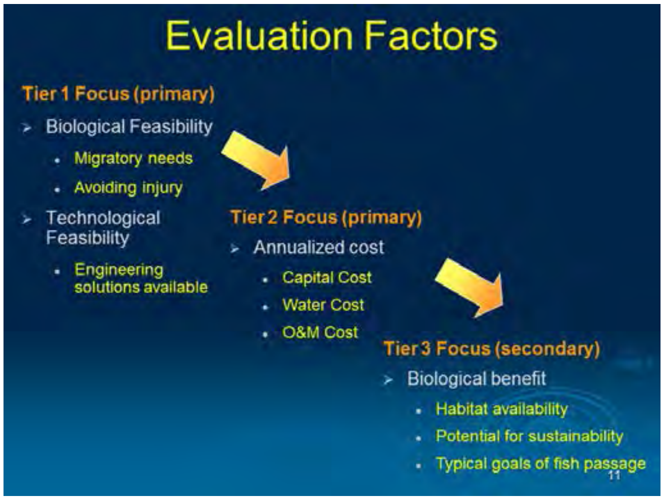
1. The AECOM Team will present an overview of the work completed to date, and will address any questions from the previously distributed meeting notes.
2. Discuss and refine evaluation criteria based on the current state of the alternatives.
3. Identify any criteria that would constitute a fatal flaw, 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 3-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.

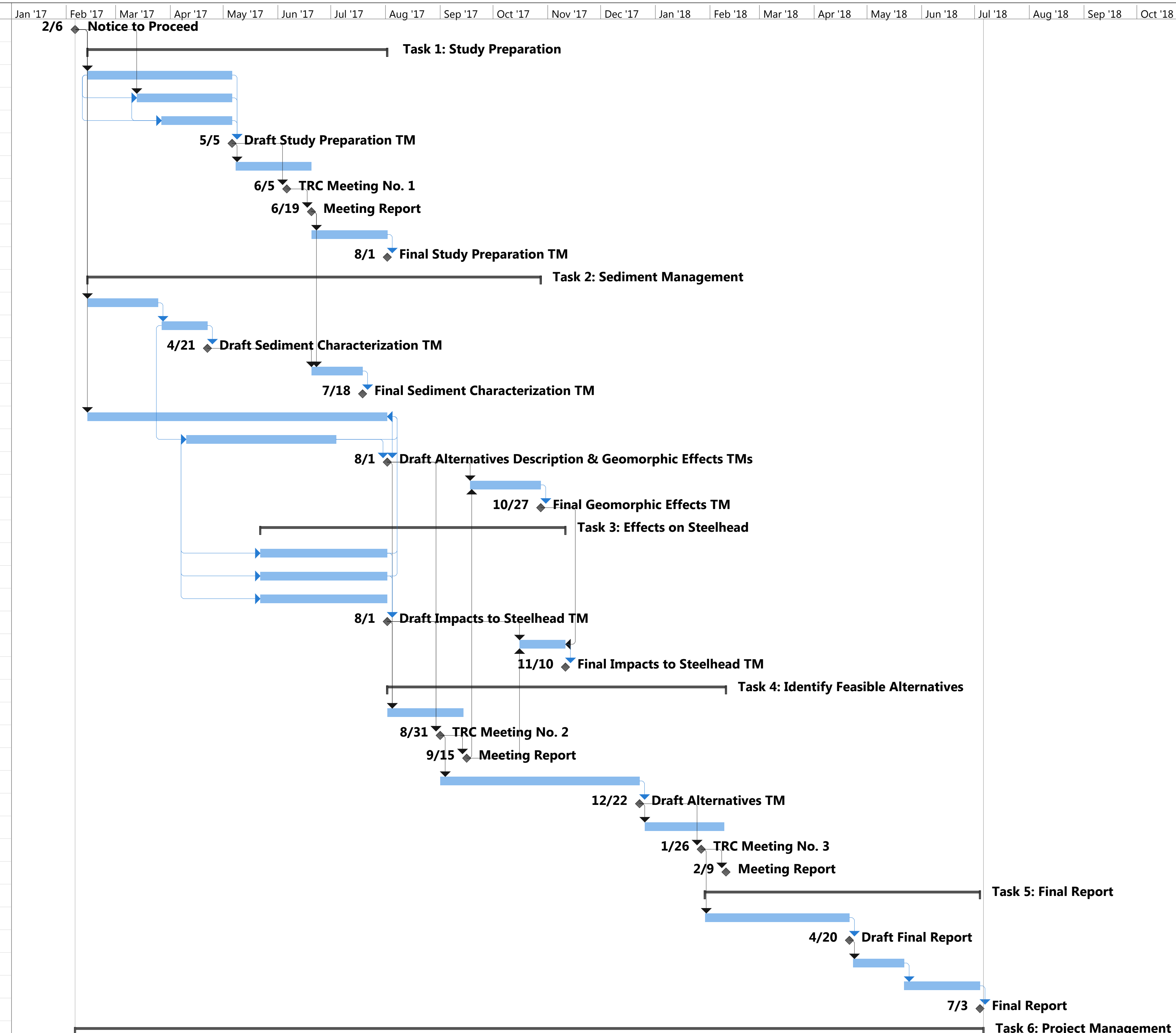
Task	Description	Hours	Budget
1	**Feasibility Study Preparation**	**250**	**$44,392**
1-1	Compile Background Information	75	$12,195
1-2	Prepare Evaluation Criteria	59	$10,225
1-3	Identify Critical Data Gaps	42	$7,158
1-4	TRC Meeting No. 1	74	$14,814
2	**Sediment Management Options**	**749**	**$210,500**
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 3-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 3-A

EXHIBIT 3-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.

Appendices

EXHIBIT 3-A

09 Appendices

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

EXHIBIT 3-A

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

EXHIBIT 3-A

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

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.

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 .

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.

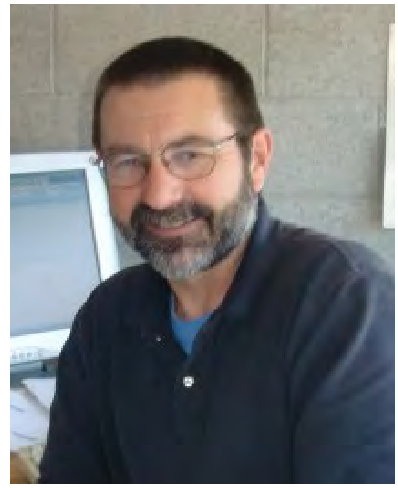
US Army Corps of Engineers, Lake Isabella Dam TO 17 – Outlet Works Structures Seismic Evaluation and Conceptual Retrofit Design, Kern County, CA. Led the technical team to perform seismic analysis and develop conceptual retrofits for 10 outlet works structures in the main and auxiliary dams. The structures 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.

<u>**EXHIBIT 3-A**</u>

EDWARD D. BALLMAN, P.E.

Geomorphology, Hydrology, Hydraulics & Sediment Transport



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

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

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 3-A

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.

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 3-A

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 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.

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).

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.

EXHIBIT 3-A

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.

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.

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.

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 3-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.

EXHIBIT 3-A

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.

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 3-A

BARRY HECHT, CHG, CEG

Geomorphology, Hydrology, Hydraulics & Sediment Transport

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.

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

EXHIBIT 3-A

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.

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.

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.

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.

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.

EXHIBIT 3-A

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.

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.

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 3-A

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 3-A

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.

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.

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.

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.

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.

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.

EXHIBIT 3-A

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.

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