

AGENDA  
IRVINE RANCH WATER DISTRICT / SERRANO WATER DISTRICT  
COMMITTEE MEETING

IRWD Board Room, 15600 Sand Canyon Avenue, Irvine, CA

TUESDAY, APRIL 26, 2022

CALL TO ORDER     3:30 p.m.

ATTENDANCE     Committee Members:

|                     |       |              |       |
|---------------------|-------|--------------|-------|
| IRWD: Doug Reinhart | _____ | John Withers | _____ |
| SWD: Larry Pharris  | _____ | Frank Bryant | _____ |

|                     |                   |       |                  |       |
|---------------------|-------------------|-------|------------------|-------|
| <u>ALSO PRESENT</u> | Paul Cook         | _____ | Jerry Vilander   | _____ |
|                     | Wendy Chambers    | _____ | Kevin Burton     | _____ |
|                     | Cheryl Clary      | _____ | Paul Weghorst    | _____ |
|                     | Christine Compton | _____ | Rob Jacobson     | _____ |
|                     | Rich Mori         | _____ | Malcolm Cortez   | _____ |
|                     | Jacob Moeder      | _____ | Vittorio Roggero | _____ |
|                     | Jeremy Jungreis   | _____ |                  | _____ |

PUBLIC COMMENT NOTICE

Public comments are limited to three minutes per speaker on each subject. You may also submit a public comment in advance of the meeting by emailing comments@irwd.com before 9:00 a.m. on Tuesday, April 26, 2022.

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**COMMUNICATIONS**

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1. Notes: Burton
2. Public Comments
3. Determine the need to discuss and/or take action on item(s) introduced, which came to the attention of the District subsequent to the agenda being posted.
4. Determine which items may be approved without discussion.

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**ACTION**

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| 5. | <u>SANTIAGO RESERVOIR IMPROVEMENTS PROJECT UPDATE AND CONSULTANT VARIANCE – MOEDER / BURTON</u> |  |
|----|-------------------------------------------------------------------------------------------------|--|

|  |                                                                                                                                                                                                                                                                           |  |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | Recommendation: That the Irvine Ranch Water District and Serrano Water District Boards approve proceeding with Variance No. 2 with AECOM in the amount of \$2,618,959 for additional design phase services for the Santiago Reservoir Improvements (IRWD Project #01813). |  |
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**INFORMATION**

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| 6. | <u>UPDATE ON EFFORTS TO SEEK FEDERAL AND STATE FUNDING FOR THE SANTIAGO RESERVOIR IMPROVEMENTS PROJECT – COMPTON</u> |  |
|----|----------------------------------------------------------------------------------------------------------------------|--|

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|  | Recommendation: Receive and file |  |
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## OTHER BUSINESS

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7. Director Comments
8. Adjourn

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Availability of agenda materials: Agenda exhibits and other writings that are disclosable public records distributed to all or a majority of the members of the above-named Board in connection with a matter subject to discussion or consideration at an open meeting of the Board are available for public inspection in the District's office, 15600 Sand Canyon Avenue, Irvine, California ("District Office"). If such writings are distributed to members of the Board less than 72 hours prior to the meeting, they will be available from the District Secretary of the District Office at the same time as they are distributed to Board Members. Upon request, the District will provide for written agenda materials in appropriate alternative formats, and reasonable disability-related modification or accommodation to enable individuals with disabilities to participate in and provide comments at public meetings. Please submit a request, including your name, phone number and/or email address, and a description of the modification, accommodation, or alternative format requested at least two days before the meeting. Requests should be emailed to [comments@irwd.com](mailto:comments@irwd.com). Requests made by mail must be received at least two days before the meeting. Requests will be granted whenever possible and resolved in favor of accessibility.

April 26, 2022

Prepared by: J. Moeder

Submitted by: K. Burton

Approved by: Paul A. Cook 

IRWD / SWD COMMITTEE

**SANTIAGO RESERVOIR IMPROVEMENTS  
PROJECT UPDATE AND CONSULTANT VARIANCE**

**SUMMARY:**

The AECOM/GEI design team has completed the draft preliminary design report for the Santiago Reservoir Improvements project which includes several technical documents, results from the first phase of geotechnical field investigations, and hydraulic analysis of the new spillway. The design team and Division of Safety of Dams (DSOD) aligned on the hydraulic design criteria for the new spillway which has resulted in substantial changes to the spillway size and alignment. In parallel to advancing the preliminary design of the project, IRWD established Risk-Informed Decision Making (RIDM) as a core component of its Dam Safety Program which has potential impacts to the project. Staff recommends that the Board authorize the General Manager to execute a variance in the amount of \$2,618,959 with AECOM for additional engineering design services for the Santiago Reservoir Improvements project.

**BACKGROUND:**

In April 2020 IRWD, on behalf of IRWD and Serrano Water District (SWD), retained AECOM to design the Santiago Creek Dam Outlet Tower and Spillway Improvements project in the amount of \$4,989,380. AECOM has progressed on the preliminary design activities including the first phase of geotechnical investigations and computational fluid dynamics analysis using the original spillway design concept and Probable Maximum Flood (PMF) developed in 2020. The PMF analysis is the hydraulic design criteria used to design spillways that represents the most severe flood event. The original PMF analysis indicated that the spillway would need to pass a reservoir inflow of 59,000 cubic feet per second (cfs). Staff shared the PMF analysis with DSOD for its review and acceptance, and after nearly a year of review and collaboration, DSOD and AECOM aligned on an updated PMF analysis that resulted in a reservoir inflow of 68,000 cfs.

After aligning with DSOD on the revised hydraulic design criteria for the spillway, AECOM completed the computational fluid dynamics analysis that identified significant challenges with containing the flow rate with the original spillway concept. As a result, the design team generated an alternative spillway design that, based on computer modeling, could successfully pass the increased flow rate. The revised design includes a shifted alignment and an overall larger spillway structure. This shifted alignment and larger footprint is prompting the need for additional geotechnical investigations to characterize the materials and complete the design. In the coming months, AECOM will advance the physical model phase that will further refine the spillway design.

### RIDM and Impacts on the Project:

Traditionally, dam safety assessments, which are integral components of any Dam Safety Program, utilize a standards-based approach that follows established rules and guidelines for design events and loads, structural capacities, and defensive design measures. Historically, the standards-based approach to dam safety has proven to be good practice, but that approach omits consideration of other dam safety elements such as human factors and operational issues that could potentially expose dam owners to increased levels of risk.

Another approach to dam safety that has been used at the federal level is RIDM, which is a more rigorous, systematic, and thorough process to dam safety that focuses on identifying and reducing risks. In the late 1990s, the Bureau of Reclamation was the first agency to incorporate RIDM into its dam safety program. Since that time, RIDM is now used by several dam regulators and dam owners throughout the United States. In 2020, DSOD announced to California dam owners that it will be integrating RIDM into its regulatory oversight of dams under its jurisdiction.

In parallel to advancing the preliminary design activities for the Santiago Reservoir Improvements project, IRWD started integrating RIDM as a core component of its Dam Safety Program to enhance its program and align with DSOD's future state-wide RIDM-based dam safety program. As part RIDM, IRWD completed Semi-Quantitative Risk Analysis (SQRA) on all five of its dams including Santiago Creek Dam, which is owned by IRWD and SWD. The risk analysis identified areas of uncertainty and information that supports the risk estimates. To minimize the potential for revisiting areas of uncertainty in the future when major improvements at Santiago Creek Dam are complete, staff executed Variance No. 1 with AECOM in the amount of \$46,780 to study the areas of uncertainty.

### Design Variance No. 2:

AECOM submitted a variance in the amount of \$2,618,959 that includes items required to complete the design and optional RIDM related items. The additional scope of work required to complete the design amounts to \$1,585,820 and includes additional geotechnical investigations and engineering costs to successfully complete the design of the larger and more complex spillway and outlet structure. The additional RIDM-related scope of work amounts to \$1,033,139 and includes completing risk analysis on the spillway and outlet improvements and geotechnical investigations focused on reducing uncertainties. The revised design completion date is April 2024, one year past the original schedule. The scope of work and variance are attached as Exhibit "A".

Staff will provide a presentation during the Committee meeting that elaborates on the items presented herein. The presentation is attached as Exhibit "B".

### FISCAL IMPACTS:

The project will be funded 75% by IRWD and 25% by SWD in accordance with the Irvine Lake ownership agreements. IRWD will fund its portion using the Water Replacement Fund.

ENVIRONMENTAL COMPLIANCE:

This project is subject to the California Environmental Quality Act (CEQA). In conformance with the California Code of Regulations Title 14, Chapter 3, Section 15004, the appropriate environmental document will be prepared when "meaningful information" becomes available.

RECOMMENDATION:

That the Irvine Ranch Water District and Serrano Water District Boards approve proceeding with Variance No. 2 with AECOM in the amount of \$2,618,959 for additional design phase services for the Santiago Reservoir Improvements (IRWD Project #01813).

LIST OF EXHIBITS:

Exhibit "A" – Variance No. 2 Scope of Work and Fee

Exhibit "B" – Presentation for Santiago Reservoir Improvements Project Update and  
Variance No. 2

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April 15, 2022

Mr. Jacob Moeder P.E.  
Senior Engineer – Capital Projects  
Irvine Ranch Water District  
15600 Sand Canyon Avenue  
Irvine, California 92618

**Subject: Variance Request for Santiago Creek Dam Outlet Tower and  
Spillway Improvements Project, PR 01813**

Dear Jacob:

The purpose of this document is to provide our proposed scope of work and fee estimate for a variance for the Santiago Creek Dam Outlet Tower and Spillway Improvements Final Design Project. These services will be provided for Irvine Ranch Water District (IRWD) and Serrano Water District (SWD), referred to herein as the Districts.

This variance request follows over five years of studies and evaluations by the AECOM/GEI team of the existing spillway, starting with a comprehensive condition assessment followed by an alternatives analysis, and progressing to final design of a replacement spillway. The goal is to design a hydraulically efficient and constructable spillway meeting the regulatory requirements of the California Division of Safety of Dams (DSOD). We have now identified and begun to incorporate several changes to the final design of the spillway that were previously unforeseen. We are requesting additional design fees to successfully complete and deliver the project for the Districts. The major variance items include:

- A spillway alignment re-evaluation,
- Additional geotechnical investigation for the new spillway alignment,
- Additional effort to complete the preliminary and final design due to increased size and complexity of the replacement spillway,
- Relocation the Irvine Lake Pipeline (ILP) under the new spillway,
- Risk analysis for construction including a cofferdam, and
- Incorporation of quantitative risk analysis for long-term project reliability into the final design of the project.

### **Background for Variance Request**

After a comprehensive condition assessment of the existing spillway, GEI Consultants, Inc. (GEI) performed an Alternatives Analysis in April 2020, which became the basis for design of a new spillway at Santiago Creek Dam. The preferred alternative selected during the

Alternatives Analysis consisted of a 350 ft long L-shaped ogee weir leading to a 100-ft wide, 300-ft long curved chute that terminated in a stilling basin at the downstream end of the spillway. The selected alternative was located in the narrow canyon on the dam's left abutment with its footprint generally coinciding with the footprint of the existing spillway. This spillway alignment is shown in **Figure 1a**. The final design project was scoped to provide a detailed design of this selected preferred alternative. We describe the factors below that have contributed to the changes in alignment and design necessitating this request for a variance.

### Complicated Hydraulics

In Fall of 2020, work on the design project commenced with preliminary design of the new spillway. A range of tasks were performed including geologic explorations and hydraulic analyses to support the design of the spillway, which enabled the design team to gain a significantly increased understanding of the site and the proposed spillway. At this stage, key issues were identified as a result of the hydraulic Computational Fluid Dynamics (CFD) analyses, which indicated that the original alignment of the spillway from the Alternatives Analysis was untenable and would not sufficiently dissipate energy and contain flows around the sharp right-hand curve in the spillway. The CFD model included a detailed analysis of the hydraulic performance for various flow rates up to and including the Probable Maximum Flood (PMF) developed by GEI and submitted to DSOD. It is noteworthy that, at this time, DSOD had not yet reviewed or commented on the PMF study developed by GEI that had a peak inflow value of 54,000 cubic feet per second (cfs). It is also important to note that until the initial CFD modeling was performed there was no way of knowing that the selected alternative would be untenable.

### DSOD Review and Increase of PMF

Following the initial CFD modelling runs, DSOD provided their interpretation of the PMF study, which had a significantly higher peak inflow of over 75,000 cfs as compared to the PMF study performed by GEI. Multiple meetings were conducted with DSOD to discuss and debate appropriate parameters for use in arriving at a PMF that is sufficiently conservative for design of the spillway. While it would take a detailed discussion to fully explain the differences between the two PMF studies, in the end GEI agreed to change certain parameters, which resulted in an increase of the PMF inflow to 59,000 cfs for use in design. Conversely, DSOD agreed to reduce their PMF peak inflow to 68,000 cfs. DSOD agreed that GEI would use the 59,000 cfs peak inflow developed by GEI to meet standard design criteria for dam crest freeboard but requested that GEI show that the 68,000 cfs peak inflow developed by DSOD could also be safely routed through the spillway, although with reduced minimum freeboard requirements.

### Changes to Spillway Alignment and Components

As a result of the additional CFD modeling that was performed with the new agreed-upon PMF values, it became apparent that further alignment adjustments would be needed to the original alignment of the spillway for satisfactory hydraulic performance. The increased PMF values also had significant impact on the spillway and necessitated that the spillway weir, chute, and stilling basin would need to be enlarged and deepened to accommodate the higher flows due to the increase in PMF value. Most significantly, the proposed weir structure would need to be significantly longer and deeper than originally anticipated due to submergence issues with the increased flows. It also became clear that the geotechnical and topographic conditions in the vicinity of the new weir structure would present significant challenges that are magnified with the need for an enlarged weir structure. Because of the steep topographic drop of the slope of the rock line extending into the reservoir, this enlarged structure cannot be extended further into the reservoir as the structure would become significantly higher and wider, resulting in the need for significantly more excavation, benching, and concrete and encroachment into the existing dam embankment fill. Therefore, the only viable option is to fit the enlarged structure along the left edge of the reservoir, resulting in a much higher cut than originally anticipated in the slope on the left side of the weir structure.

### Alignment Development

During the drive to determine the appropriate alignment, a straightened intermediate alignment (**Figure 1b**) was developed that would address many of the challenges identified for the original curved alignment. However, this intermediate straightened alignment presented its own challenges and risk due to its proximity to the dam embankment. After consideration of the site topography, and hydraulic and geologic constraints, a layout with a further adjustment to the intermediate alignment has been developed, which minimizes the curve in the spillway chute while maintaining distance between the spillway and dam embankment. The plan of this revised spillway alignment is shown in the attached **Figure 1c**. This is the alignment that is now being carried to final design.

### Impacts on Left Slope Above Spillway

A major impact of the spillway realignment is on the slope on the left side of the spillway. The original alignment would have had a cut of about 10 feet, resulting in a relatively straightforward design without the need to understand the global stability of the 100-foot-plus tall slope above that supports the adjacent landfill. However, with the current design as shown in Figure 1c, the enlargement and deepening of the spillway will require significantly higher cut slopes of up to 40 feet that have the potential to destabilize the slope. As a result, there is a need to understand the geotechnical properties of the tall slope for design of slope reinforcement and a high tie-back retaining wall. Poor rock quality was identified in the first phase of investigation, and additional investigation is needed to reduce risk of over-design or

under-design, with the goal of providing an appropriately robust and cost-effective design for this slope.

#### Impact on Irvine Lake Pipeline

In addition to the above issues and considerations, the existing Irvine Lake Pipeline (ILP) that crosses over Santiago Creek downstream of the existing spillway was not designed to handle the discharge capacity of the larger PMF flows (e.g., hydrodynamic forces, scour) and will therefore need to be replaced for the project. The replacement will involve placing the new ILP inside a casing pipe that will be installed by open-cut trenching or tunnelling beneath the creek. The design work for the ILP will be performed by AECOM.

Our proposal for the variance includes the following scope of work items to address additional data collection needs and analyses to provide a robust and cost-effective design for the modified alignment of the enlarged spillway, driven mainly by the increase in PMF, DSOD review comments further increasing the PMF, hydraulic performance of the spillway, and geotechnical/geologic conditions of the high slope on the left side of the spillway side-channel control structure.

## **SCOPE OF WORK**

### **Phase 1: Preliminary Design**

Additional budget is required to complete the preliminary design including the modifications to the spillway design to move the spillway alignment from the existing channel to the straighter alignment down the left abutment, the additional hydraulic modeling needed to size the spillway for the larger PMF inflow, responses to DSOD comments and update to the PMF report, and relocation of the ILP pipeline.

#### **Tasks 1 through 22: Preliminary Design**

Tasks 1 through 22 include all tasks for preliminary design that were authorized under the original PSA contract for IRWD Purchase Order No. 619735. Task 22 includes Variance No. 1 to PSA 619735 for Evaluation of PFM 103 - Scour through embankment cracks due to Seismic Loading Deformations of Santiago Creek Dam. Additional work anticipated for the Preliminary Design Phase is captured in Task 23 that follows.

#### **Task 23: Additional Preliminary Design Services**

##### **Subtask 23a: Revised Spillway Alignment**

GEI evaluated the constructability and hydraulic feasibility of the intermediate and later spillway alignments. The structural feasibility of the spillway walls was evaluated with consideration to the required height of the spillway walls, geologic conditions at the site, and

relatively narrow rock abutment between the dam embankment and spillway canyon to determine if the dam embankment would be impacted during construction of the spillway. Various construction techniques for the spillway walls were evaluated to ensure the final proposed spillway configuration is constructable and cost effective.

A CFD model was developed to evaluate the hydraulic conditions within the intermediate alignment and support refinement of the spillway configuration to ensure the spillway is hydraulically feasible. This scope includes development of a revised alignment and up to five (5) modifications to the spillway weir alignment or stilling basin design.

#### **Subtask 23b: Update PMF Report**

The work under this subtask has been completed but has been included in the variance request for budget adjustment. DSOD provided comments on the Santiago Creek Dam PMF Report prepared by GEI, which required additional hydrologic modeling and analyses to address. The budget for this task covers the time spent on preparation, attendance, and follow-up discussions for the June 14<sup>th</sup>, 2021 meeting with DSOD. During this meeting, DSOD indicated conditional approval for the PMF hydrograph, provided dam crest freeboard requirements are met. Therefore, this task assumes no further work is needed to coordinate with DSOD and accounts for finalizing the PMF report based on the 59,000 cfs PMF hydrograph and the written comments received from DSOD in December 2020, which required that the spillway also safely route the 68,000 cfs.

#### **Subtask 23c: ILP Pipeline Relocation**

The ILP is a 36-inch diameter welded steel pipeline that is supported on concrete piers over the creek and spans approximately 300 feet. AECOM will design a relocation for the ILP that will include a new pipeline, related appurtenances, and a steel casing. The ILP will be routed under Santiago Creek, and the proposed spillway stilling basin, to protect it from spillway releases. Per discussions with the District, the relocated ILP will be upsized to a 54-inch diameter carrier pipe under the creek. The ILP and potential casing will be installed under the creek by open trench or tunneling methods. The construction method will be determined by AECOM during the preliminary design phase. Deliverables for this task will include an ILP relocation section in the Preliminary Design Report (PDR), preliminary design of the ILP relocation (30% drawings, estimate).

#### **Subtask 23d: Preliminary Design Report and Drawings**

Additional construction drawings are needed to represent the complex wall and chute construction in the revised spillway design. The original proposal included a total of 36 sheets in the drawing list related to the design of the spillway (sheets SP-1 to SP-36) and assumed 10 of those sheets would be prepared as part of the preliminary design. We are proposing to update the drawing list for the revised spillway design to a total of 51 sheets,

with 27 of those sheets prepared during preliminary design. Therefore, we have included cost to prepare these additional 17 sheets during the Preliminary Design phase.

### **Subtask 23e: Additional Project Management Effort**

As indicated in a later section on Design Schedule Impacts, there has been a delay of about a year in the completion of the Preliminary Design stage. This has had a significant impact on the allocated project management task budget. We are, therefore, requesting additional project management budget to satisfactorily complete the preliminary design stage.

## **Phase 2 – Final Design**

### **Task 1: Project Management**

Additional project management time has been added to the budget to conduct AECOM/GEI risk workshops during the preparation of each final design deliverable. AECOM's risk specialist will update the Risk Register and present it during the workshops, which can be attended by the Districts if interested. The Risk Register will be used to anticipate construction risks and coordinate risk management strategies.

### **Tasks 5 and 13: Constructability and Final Design Deliverables**

These tasks are included to request budget additional budget to complete Final Design for Santiago Creek Dam Outlet Tower and Spillway Improvements Project. A more thorough constructability review and construction sequence is necessary to address the complex interactions between the dam raise, the existing spillway and outlet tower demolition, and the new spillway and outlet works modifications. Additional technical specifications and other modifications to the Project Manual are also required to address the materials used for construction and Contractor responsibilities during construction. Additional construction drawings are also needed to represent the complex wall and chute construction in the revised spillway design. The original proposal included a total of 36 sheets in the drawing list related to the design of the spillway (sheets SP-1 to SP-36). We are proposing to update the drawing list for the revised spillway design to a total of 51 sheets. Task 13a also includes an additional five sheets for the ILP relocation. A summary list of the proposed sheets is provided in Attachment A.

### **Task 15: Additional Geotechnical Analysis and Design**

Based on changes to the replacement spillway design that have occurred during the 30-percent design phase, the spillway weir bathtub will be larger, will extend significantly into the reservoir, and will significantly impact the slopes on the left side of the spillway and require large cuts on the right side of the spillway. This has resulted in an increased scope including large retaining walls, slope stabilization, and deep excavations. The additional geotechnical

analyses and design tasks that are required to address this increased scope of the project are summarized below.

**Subtask 15a – Retaining wall design:** New retaining walls are proposed in the left and right sides of the spillway. The walls are anticipated to be ground anchor walls and will be designed for permanent use. Geotechnical analyses to be conducted include evaluations of anchor capacity, corrosion potential, global slope stability, and static and seismic wall loading. Seismic analysis for these retaining walls, and below described walls and slopes, will be conducted using simplified methods and evaluated using the existing Santiago Creek Dam seismic hazard analysis. We have assumed that static and seismic finite element analyses will not be required and have not budgeted for it. For the right wall, due to the close proximity to the existing dam, an evaluation will be conducted to ensure that installation of ground anchors will not negatively impact the stability of the existing dam.

At the stilling basin, a retaining wall will be designed to protect the outlet structure. An evaluation of anchor capacity and global stability will be performed.

Due to the weir extending significantly into the reservoir, return walls will need to be designed at the ends of the weir. Geotechnical evaluations of these return walls will be conducted, and an evaluation of the existing rock permeability will be performed.

**Subtask 15b – Slope stability:** Above the left ground anchor wall will be a retained slope. The slope is currently unstable and exhibits significant slaking, which has historically accumulated as detritus at the toe of the slope. The 30-percent design concept is to stabilize the retained slope with shotcrete and rock bolts where the existing slope cannot be cutback to a stable angle due to project constraints such as the existing landfill gas flare station. Where there is room, the slope will be cut back to a stable angle without shotcrete and rock bolts. In these areas, slope stability calculations will be performed to show that the permanent slope will be stable.

In the downstream chute, the excavation depth will decrease; however, differential conditions will develop where permanent cut slopes will be required on the right side of the spillway and fill below the chute with a descending slope will be required on the left side of the spillway. Geotechnical analyses to show that the right side cut slopes and descending left slopes are stable will be performed. Further, an evaluation of differential foundation conditions in this area will be performed, including over-excavation criteria. For evaluations of the retaining walls, differential foundation conditions, and other new project features, an evaluation of the onsite rock deformability parameters will be performed.

Due to the larger excavation anticipated by the 30-percent design, much larger disposal areas will need to be used to dispose of the material. Geotechnical analyses necessary for these disposal areas will be performed including slope stability and development of earthworks criteria.

**Subtask 15c – Foundation design:** Because the weir is now much larger than previously anticipated, and extends into the reservoir, a very tall concrete weir (up to approximately 37 feet) is anticipated in the 30-percent design, the weir will be founded on an existing rock slope and therefore will be subject to significant differential foundation conditions. The permanent stability of the weir will be evaluated geotechnically to show that global slope movement involving the weir does not occur. Foundation criteria for the rock slope will be developed.

**Subtask 15d – DSOD comment response:** As a result of the increased scope and complexity of the construction anticipated based on changes made during the 30-percent design, we anticipate that DSOD comment response will increase significantly in scope. We have, therefore, revised our budget to provide an additional allowance for geotechnical-related DSOD interaction during final design.

**Subtask 15e – Dynamic analysis of weir and walls:** It is anticipated that there is a potential for DSOD to request dynamic analysis of the weir and walls. As an optional task, GEI will perform dynamic analysis of the anchored walls, cantilever walls, RCC gravity wall at the stilling basin, and the weir, if so, requested by the DSOD. The dynamic analyses would be linear elastic, two-dimensional analyses. Three horizontal time histories would be developed based on the existing AECOM deterministic seismic hazard analysis for the site. Five cross sections would be analyzed, two at the weir (at the maximum section and minimum section), two at the anchored walls (one at the left wall, one at the right wall), two at the cantilever walls (at the maximum section and minimum section) and one at the stilling basin RCC gravity walls. At the weir, hydrostatic stresses from the reservoir would be included. For the anchored walls, construction sequencing of the top-down construction would be modeled. Damping would be modeled with assumed Rayleigh damping coefficients. The results of the cantilever wall analysis would be used to confirm the seismic loading is within acceptable limits of the wall design based on simplified analyses. The results of the anchored walls, RCC gravity wall, and the weir analyses would be used to confirm the design results in acceptable overturning and peak tensile and compressive stresses in the RCC gravity walls and weir. It would also confirm the peak dynamic stresses in the ground anchors are acceptable. These analyses would be performed once at a near-final design stage after the designs have already been iterated with simplified methods. The dynamic analyses would be documented in a draft TM. The time histories would be documented in a brief calculation package attached to the dynamic analysis TM. The draft TM would be submitted to DSOD and responses to DSOD comments, if any, would be provided, along with the final TM.

#### **Task 16: Supplemental Field Investigations**

The first phase of geotechnical field investigations occurred in Fall 2020 at the start of the preliminary design stage. The original scope also included an additional phase planned to be implemented around the 90% design when the environmental document and permitting phase is complete, which would allow vegetation clearing and work to occur in the creek. Due

to the modifications to the spillway design, additional supplemental field investigations are needed early in the final design phase to support the design of the new spillway.

Our proposed supplemental field investigations include additional borings, test pits, and geophysical surveys needed to support this updated spillway design. The majority of these investigations would occur in the near future under Phase 2 Investigation once DSOD approves the Geotechnical Work Plan, and Phase 3 of the geotechnical investigations would occur around the 90% design when the environmental document and permits are complete.

With the exception of the geophysical surveys, the supplemental boring and test pit investigations will be carried out using the methods and procedures for drilling and logging that are described in the Geotechnical Exploration Work Plan previously prepared by AECOM and GEI (2020). The drilling will be performed by Gregg Drilling using the same equipment utilized for the 2020 explorations: a small, light-weight track rig will be used in the spillway and a truck-mounted rig will be used for the other borings. The test pits will be small (~ 3 ft wide x 15 ft long x 10 ft deep) excavations made with a rubber-tired or track-mounted backhoe. The geophysical surveys are a surficial, non-invasive activity that require no drilling or excavation. The surveys are conducted by inserting (usually by pushing or hammering) small (~ ¼-inch diameter) geophones on steel rods into the ground in a linear array that are connected to a cable. The geophones are used to send or record signals through the ground using hand-held equipment to perform the various survey methods, which include seismic refraction, multichannel analysis of surface waves, and electrical resistivity.

The design team will prepare a Geotechnical Work Plan, support the IRWD submittal process to DSOD, and respond to DSOD's comments on the Geotechnical Work Plan.

The proposed field investigations are described below and shown in the attached Figure 2. Table 1 (attached) provides additional details of the proposed explorations.

#### Phase 2 Investigation (Not Needing Vegetation Removal)

As shown in Figure 2, the Phase 2 Investigation includes five borings (S-15 through S-19), one test pit (TP-4) and two geophysical lines (SR-1 and SR-2). The Phase 2 Investigation is located to be accessible without vegetation clearing and the locations shown in Figure 2 can be adjusted, as necessary, to minimize impacts. These investigations are described below roughly in an upstream to downstream direction.

Borings S-15 and S-16 are horizontal borings proposed at the left wall of the spillway approach, where large cuts and spillway walls are anticipated. The existing geotechnical investigation locations and the proposed boring locations are shown in Figures 2 and 3. The two proposed horizontal borings will be advanced in an area with ground conditions likely similar to the ground conditions where the ground anchors will be installed.

Boring S-19 will be an inclined boring drilled from the top of the slope above left side of the spillway. A downhole geophysical (televiewer) survey will be performed in the borehole to provide quantitative rock joint information necessary for stability analyses. Televiewer will also provide additional, detailed data on the in situ joint conditions at depth. Packer permeability testing also will be performed to provide information on the rock hydraulic conductivity.

SR-1 is a geophysical survey proposed along the shoreline upstream of the control structure, in the vicinity of the new left wall of the spillway. This geophysical survey will include seismic refraction, Multichannel Analysis of Surface Waves (MASW), and electrical resistivity, all of which are done using the same linear array of geophones.

Boring S-17 is proposed at the left abutment of the dam, in the existing spillway overlook area. This boring will evaluate the condition of the rock that will be retained by the right wall. The right wall will be significantly high and very close to the existing embankment. A downhole geophysical (televiewer) survey will be performed in the borehole to provide quantitative rock joint information necessary for stability analyses. Packer permeability testing also will be performed to provide information on the rock hydraulic conductivity.

Boring S-18 is proposed near the bottom of the proposed spillway chute. A downhole geophysical (televiewer) survey will be performed in the borehole to provide quantitative rock joint information necessary for stability analyses. Packer permeability testing is proposed at S-17 and S-19; however, if packer testing is unsuccessful at those locations due to low groundwater at the time of drilling, for example, packer testing may also be performed at S-18 to provide additional information on the rock hydraulic conductivity.

Test Pit TP-4 is intended to evaluate the 1969 fill and possibly the 1969 concrete rubble revetments anticipated to be encountered here and potentially retained. SR-2 is a geophysical survey proposed along the downstream end of the chute, near the stilling basin. This geophysical survey will include seismic refraction, MASW, and electrical resistivity, all of which are done using the same linear array of geophones.

#### Phase 3 Investigation (Needing Vegetation Removal)

The Phase 3 Investigation includes additional test pits and geophysical lines; however, due to the need for vegetation removal to perform these explorations, we understand they cannot be performed during the 2022 calendar year. Therefore, these investigations are anticipated to occur later, likely during the 90-percent design phase. These test pits and geophysical lines (note, vegetation clearing will be required along the proposed geophysical lines due to dense vegetation in the area) are proposed to evaluate the ground conditions along the existing steep slope at the proposed chute and stilling basin. Currently, there are no investigations that have been conducted here, other than the 1969 borings, which were not conducted to evaluate the proposed spillway. Borings are not proposed along the spillway

chute because the steep existing slope would make access impractical. Therefore, the ground conditions in this area will be evaluated by comparing the boring results at the top and bottom of this hill (S-17 and S-18, respectively), and interpolating using the proposed test pit and geophysics data along the slope of the hill.

#### **Task 17: Additional Hydraulic Modeling**

The increased complexity of the spillway and the higher flow will require that additional CFD analyses be performed between 30 percent and 60 percent design for the new spillway alignment to develop and fine tune the final design geometry. This will include refining the stilling basin to account for downstream conditions.

The hydraulics team, including Alden Labs, will coordinate to perform final CFD runs prior to construction of the physical model. These additional runs are needed prior to building the physical model and will be focused on the stilling basin and flows in the creek. The physical model will verify the CFD model and will be constructed to make further refinements to the inlet structure, chute and terminal stilling basin structure. Work for 60 percent design will include coordinating with other design teams and presentations to the Board of Consultants (BOC).

From 60 percent to 100 percent design the hydraulic team will need to coordinate with Alden Labs and address comments from the BOC, regulatory agencies and perform additional evaluations to address comments. It has been GEI's recent experience on a spillway design project that the BOC had asked for additional runs on the physical model. In anticipation of BOC requesting additional runs with the physical model we are requesting additional budget for Alden Labs also to cover effort that may be needed to address BOC questions. This additional budget request will cover half a week of additional runs with the physical model in addition to engineering support as required.

#### **Task 18: Construction Risk Evaluation TM and Workshops**

This task includes the evaluation of construction risk including hydrologic risk, geotechnical risk, and construction sequencing and preparing a TM summarizing the results of our evaluations. The TM effort will be led by GEI with thorough quality control reviews by AECOM.

**Subtask 18a: Workshops.** AECOM, GEI and our subconsultant, Integrated Engineering & Construction (IEC), will participate in one half-day and one full day workshop to discuss and strategize construction risks associated with the Project. The first workshop will be held with AECOM and GEI construction experts and members of the design team and the second workshop will be held with the Districts. The goal of the workshops will be to identify, prioritize, and determine strategies needed to mitigate the risks during construction and will also address construction sequencing.

**Subtask 18b: Input to Risk Register.** GEI and IEC will provide input to the risk register that is being compiled and maintained by AECOM throughout the life of the Project.

**Subtask 18c: Construction Hydrologic Risk.** GEI will evaluate the construction hydrologic risk for the planned construction period of the project while considering the construction sequencing. To this end GEI will perform a refined analysis, leveraging prior work for lower frequency events, of the Santiago Creek Dam watershed hydrology focused on supporting development of a water diversion and construction reservoir operations plan. The refined analysis will be based on evaluation of historical Irvine Lake storage and outflow information supplemented by stream gauge and precipitation data obtained from USGS and the Districts. The analysis will include estimating minimum, maximum, and mean monthly average inflows to the reservoir, as well as reservoir inflow, outflow, and reservoir rise for storms with annual exceedance probabilities of  $p=0.5$  (2 year),  $p=0.1$  (10 year), and  $p=0.01$  (100 year). This analysis will be especially focused on evaluating and addressing the risk related to the winterizing of the spillway construction to allow to safely pass the design flood during the winter. The construction hydrologic risk for the storm events will be included in the final Construction Risk Evaluation TM. The evaluation of construction hydrologic risk was not included in GEI's original scope because the construction sequencing hadn't been developed highlighting the need for evaluation of this risk.

**Subtask 18d: Geotechnical Risks for Diversion Berm.** GEI will assess the geotechnical risks for the construction of an upstream diversion berm associated with challenges and issues that may arise when placing a berm on the existing lake silt. The diversion berm has currently been designed by AECOM for a 4-year design storm. If needed, the diversion berm will be redesigned by AECOM for the appropriate design storm following the results of the hydrologic risk analysis in Subtask 19c.

**Subtask 18e: Construction Risk TM.** GEI and IEC will document our findings from Subtasks 19c and 19d and input from the workshops to develop a TM summarizing the results of our evaluations. This Construction Risk TM will become a part of the final Constructability TM that is being prepared by AECOM. It is anticipated that the risk will largely be related to repair and replacement cost of the construction facilities and equipment along with the potential need to build back the spillway foundation if the winterization scheme for the spillway construction is unable to pass the flood causing a massive erosion.

### **Task 19: Lake Aeration System Evaluation and Design**

The existing Irvine Lake aeration system is comprised of an air compressor and metallic aeration line that is routed over the dam embankment that bifurcates into an array of flexible hoses that discharge compressed air underwater into the bottom of the lake near the outlet tower. The existing air compressor is located at the downstream toe of the dam inside a wood-framed garage shed. The purpose of the aeration system is to improve water quality

through artificial aeration, which improves reservoir mixing and reduces thermal stratification and anoxia in the hypolimnion (bottom layer) of the reservoir. Anoxia can lead to severe water quality issues including elevated concentrations of trace metals, odor-producing compounds, and nutrients that fuel algae growth. Further, anoxia is detrimental to aquatic life and can cause fish kills. The current aeration system offers the Districts low efficiency transfer of oxygen from compressed ambient air into the reservoir water column.

AECOM will perform a water quality assessment for Irvine Lake and evaluate at least three modern and relevant aeration technologies to improve the water quality. The evaluation will consider, life cycle costs (including considerations for energy, labor, and capital), likelihood to achieve desired water quality, ease of operation, and IRWD/SWD experience and preferences. A preliminary design will be completed for the preferred option, to include sizing and system configuration needs based on modeling results, manufacturer specifications or other relevant documentation, identification of power requirements, equipment layout and associated control philosophy. AECOM's finding and recommendations will be presented in a Lake Aeration System TM.

AECOM will provide final design (drawings, technical specifications, and construction cost estimate) for the selected aeration system that will be added to the project construction documents.

#### **Task 20: Optional - QRA at 60% Design**

We have budgeted a level of effort commensurate with supporting the planned Quantitative Risk Assessment (QRA) at the 60% design stage to be facilitated by the Districts' consultant HDR, Inc. Following are brief descriptions of the breakdown items planned for this task.

**Subtask 20a: Meetings.** We have budgeted for a total of four meetings for this task. These include two separate meetings with HDR; the first to have an initial discussion on the project and HDR will be briefed by AECOM and GEI. It is anticipated that HDR will receive and review this design information and will develop PFMs to be used in the QRA workshops. We have budgeted for a second meeting with HDR to receive input from HDR on the PFMs developed for the QRA. In addition, we have budgeted for two additional meetings for subsequent discussions with the team and HDR.

**Subtask 20b: Analyses for selected critical PFMs.** We have budgeted for six critical PFMs to be evaluated with parametric sensitivity analyses for input to the QRA work. These potentially will be spillway PMF probability, excavation/wall stability, weir stability. Sensitivity analyses could potentially evaluate results for high, medium, and low estimates of parameters along with variations in loading conditions.

**Subtask 20c: Risk workshops.** We have budgeted for 2 “estimators” each from AECOM and GEI to prepare for and participate in a QRA Risk workshop to be facilitated by HDR. We have assumed that this workshop will be one week-long.

**Subtask 20d: Report.** We have budgeted for input to the QRA Report to be prepared by HDR. We have also budgeted for review of the report to be prepared by HDR.

### **Task 21: Optional - Additional Embankment Cracking Evaluation and Geotechnical Investigation**

3D Nonlinear Deformation Analyses. AECOM has been contracted by IRWD to evaluate PFM 103—Scour (Concentrated Leak) through Embankment Cracks due to Seismic Loading and Deformations using a 2D nonlinear analysis. A 3D nonlinear deformation analysis of the dam embankment may be required to further evaluate PFM 103. Under the current separate contract, AECOM will conduct a 2D sensitivity analyses that will be helpful in determining which parameters (if any) require more study or additional geotechnical data collection or field explorations. This task does not include any dam embankment remedial design for addressing cracking potential if an issue is discovered during these analyses.

**Subtask 21a:** Geotechnical Investigation to Update Materials Characterization. This task would involve updating or verifying the same materials characterization from the properties identified in the 2D analyses. AECOM will conduct a field exploration/geotechnical data collection effort that will involve two (2) borings on the right abutment to evaluate the foundation characterization, five (5) borings in the upstream impervious zone, five (5) borings along the crest and four (4) borings on the downstream previous zone to evaluate the strength of the embankment materials. Please note that the number of borings may vary depending on the results of 2D sensitivity analyses.

**Subtask 21b:** 3D geometry modeling and deformation analysis will be developed for the existing dam embankment with results from the geotechnical investigation. Not all the time histories would be run for each return period, only a worst-case or representative history based on the results of the 2D analysis that is currently underway. Up to three (3) sensitivity analyses on material properties or ground motions (not the geometry) will be performed.

A draft memorandum will be prepared describing the analysis approach, materials characterization, and results of the analyses. Evaluations of cracking potential will be made based on distribution of displacements strains within the embankment. After review of the draft memo, comments from IRWD, SWD, HDR or other stakeholders will be incorporated into a final report.

AECOM will conduct a total of one (1) workshop with IRWD, SWD, and HDR to review the results of the 3D analysis. The workshop includes a Power Point presentation and discussion.

### Design Schedule Impacts:

The additional preliminary design and final design phase tasks identified in this variance will impact the project schedule. The schedule variance for key project deliverables is as follows:

|                                      | <b>Original<br/>Completion Date</b> | <b>Updated<br/>Completion Date</b> | <b>Schedule Variance</b> |
|--------------------------------------|-------------------------------------|------------------------------------|--------------------------|
| Preliminary Design Report Completion | June 2021                           | June 2022                          | +12 months               |
| Bid Set Completion                   | April 2023                          | April 2024                         | +12 months               |
| Construction Completion              | June 2025                           | February 2027                      | +20 months               |

### Cost Estimate:

A summary of the estimated budget requests for the proposed variances by phase is provided below.

|                              | <b>Original Budget<br/>plus Approved<br/>Variance No. 1</b> | <b>Additional Budget<br/>Requested</b> | <b>Updated Budget<br/>Requested</b> |
|------------------------------|-------------------------------------------------------------|----------------------------------------|-------------------------------------|
| Phase 1 – Preliminary Design | \$2,956,400                                                 | \$200,470                              | \$3,156,870                         |
| Phase 2 – Final Design       | \$2,079,760                                                 | \$2,418,489                            | \$4,498,249                         |
| <b>Totals</b>                | <b>\$5,036,160</b>                                          | <b>\$2,618,959</b>                     | <b>\$7,655,119</b>                  |

Details of the proposed additional budgets requested for Phase 1 – Preliminary Design and Phase 2 – Final Design are provided in Table 2. Table 3 shows a detailed breakdown of labor hours and costs for GEI and Table 4 shows the detailed breakdown of subcontractor and direct costs.

Quotes from the drilling and geophysical subconsultants are provided as Attachment B.

Mr. Jacob Moeder P.E.  
Variance Request  
April 15, 2022

We propose performing professional engineering services for the tasks described above on a time-and-materials basis for a not-to-exceed variance amount of \$2,618,959.

If you have any questions or comments, please contact me at (714) 483-1354 or via e-mail at [bryan.paine@aecom.com](mailto:bryan.paine@aecom.com).

Sincerely,



Bryan C. Paine, PE, QSD, ENV SP  
Project Manager, Associate Vice President  
AECOM Technical Services, Inc.



Iqbal Ahmed, PhD, PE, GE  
Senior Project Manager  
GEI Consultants, Inc.

Attachments:

Table 1 – Summary Description of Supplemental Field Work  
Table 2 – Variance Fee Estimate for AECOM/GEI Team  
Table 3 – Detailed Labor Estimate Breakdown for GEI Subconsultant  
Table 4 – Detailed Breakdown of Subcontractor and Soils Laboratory Costs  
Figure 1 – Plan of Updated Spillway Designs  
Figure 2 – Proposed Supplemental Investigation Plan  
Figure 3 – Cross Section of Left Slope  
Attachment A – List of Proposed Design Drawings  
Attachment B – Subconsultant Quotes

**Table 1. Summary Description of Supplemental Geotechnical Investigation Field Work**

| Exploration ID          | Location - Purpose                               | Boring Inclination (from horizontal) | Length (ft)                     | Downhole Testing               | Piezometer (Y/N) | Notes                                            |
|-------------------------|--------------------------------------------------|--------------------------------------|---------------------------------|--------------------------------|------------------|--------------------------------------------------|
| Boring S-15             | Left Retaining Wall - Foundation Conditions      | -5                                   | 100<br>[30 additional optional] | NA                             | N                | In Spillway; No Vegetation Clearing              |
| Boring S-16             | Left Retaining Wall - Foundation Conditions      | -5                                   | 100<br>[30 additional optional] | NA                             | N                | In Spillway; No Vegetation Clearing              |
| Boring S-17             | Right Retaining Wall - Foundation Conditions     | -90                                  | 115                             | Packer Permeability; Televiwer | Y                | On Dam Crest; No Vegetation Clearing             |
| Boring S-18             | Stilling Basin - Foundation Conditions           | -90                                  | 75                              | Televiwer                      | Y                | Near DS Control Building; No Vegetation Clearing |
| Boring S-19             | Left Retaining Wall - Foundation Conditions      | -50                                  | 310                             | Packer Permeability; Televiwer | N                | From Flare Station; No Vegetation Clearing       |
| Test Pits TP-4 to TP-14 | Chute and Stilling Basin - Foundation Conditions | NA                                   | 5 to 12 ft                      | NA                             | N                | Heavy Vegetation Clearing Required               |
| SR-1                    | Left Retaining Wall - Foundation Conditions      | NA                                   | 240                             | NA                             | N                | Spillway Shoreline; Minor Vegetation Clearing    |
| SR-2                    | Chute and Stilling Basin - Foundation Conditions | NA                                   | 180                             | NA                             | N                | Near DS Control Building; No Vegetation Clearing |
| SR-3 to SR-6            | Chute - Foundation Conditions                    | NA                                   | 180 (x3)<br>600 (x1)            | NA                             | N                | Heavy Vegetation Clearing Required               |

| Table 2 - Variance Fee Breakdown for AECOM/GEI Team                                      |                                                                                   |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------|-----------------------------------|-------------------------------------------------|------------------------------------------|-----------------------------------------------|----------------------------------------------------|---------------|-------------------|-------------------|------------------------------|--------------------------------------------------------|-----------------------------------------|----------------------------------------------------------|-------------|
| Irvine Ranch Water District and Serrano Water District                                   |                                                                                   |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
| Santiago Creek Dam Outlet Tower and Spillway Improvements Project - Engineering Services |                                                                                   |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
| April 15, 2022                                                                           |                                                                                   |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
| Task No.                                                                                 | Task Description                                                                  | AECOM Labor Hours <sup>1</sup> |                                   |                                                 |                                          |                                               |                                                    |               | AECOM TOTAL HOURS | AECOM LABOR COSTS | GEI LABOR COSTS (no mark-up) | GEI DIRECT COSTS & MATERIALS <sup>2</sup> (no mark-up) | AECOM SUB-CONTRACTOR COSTS (no mark-up) | AECOM DIRECT COSTS & MATERIALS <sup>2</sup> (no mark-up) | TOTAL       |
|                                                                                          |                                                                                   | Principal Engineer             | Project Manager / Senior Engineer | Senior Project Engineer / Geologist / Scientist | Project Engineer / Geologist / Scientist | Senior Staff Engineer / Geologist / Scientist | Staff Engineer / Geologist / Scientist / CAD / GIS | Project Admin |                   |                   |                              |                                                        |                                         |                                                          |             |
|                                                                                          |                                                                                   | \$290                          | \$250                             | \$190                                           | \$160                                    | \$130                                         | \$110                                              | \$100         |                   |                   |                              |                                                        |                                         |                                                          |             |
| Phase 1 - Preliminary Design                                                             |                                                                                   |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
| 23.                                                                                      | Additional Preliminary Design Services                                            |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
|                                                                                          | a. Revised Spillway Alignment                                                     |                                | 2                                 |                                                 |                                          |                                               | 4                                                  |               | 6                 | \$940             | \$42,150                     | \$15,000                                               | \$11,960                                |                                                          | \$70,050    |
|                                                                                          | b. Update PMF Report                                                              |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   | \$12,990                     |                                                        |                                         |                                                          | \$12,990    |
|                                                                                          | c. 30% Design - ILP Pipeline Relocation                                           | 2                              | 4                                 | 2                                               | 16                                       |                                               | 16                                                 |               | 40                | \$6,280           |                              |                                                        |                                         |                                                          | \$6,280     |
|                                                                                          | d. Prepare Additional Spillway Plans (10 additional spillway sheets)              |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   | \$64,870                     |                                                        |                                         |                                                          | \$64,870    |
|                                                                                          | e. Project Management                                                             | 16                             | 80                                |                                                 |                                          |                                               |                                                    | 20            | 116               | \$26,640          | \$19,640                     |                                                        |                                         |                                                          | \$46,280    |
| SUBTOTAL PHASE 1                                                                         |                                                                                   | 18                             | 86                                | 2                                               | 16                                       |                                               | 20                                                 | 20            | 162               | \$33,860          | \$139,650                    | \$15,000                                               | \$11,960                                |                                                          | \$200,470   |
| Phase 2 - Final Design                                                                   |                                                                                   |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
| 1.                                                                                       | Project Management (Risk Register Meetings)                                       | 8                              | 16                                |                                                 | 24                                       |                                               |                                                    |               | 48                | \$10,160          | \$4,320                      |                                                        |                                         |                                                          | \$14,480    |
| 5.                                                                                       | Constructability and Access (includes considerations for Weir at El 796)          |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   | \$6,700                      |                                                        | \$27,220                                |                                                          | \$33,920    |
| 13.                                                                                      | Task Deliverables                                                                 |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
|                                                                                          | a. Improvements Plans (17 additional spillway sheets & 5 additional ILP sheets)   | 8                              | 16                                | 16                                              | 60                                       | 40                                            | 96                                                 | 8             | 244               | \$35,520          | \$68,760                     |                                                        |                                         |                                                          | \$104,280   |
|                                                                                          | b. Project Manual (Technical specifications for more complex spillway design)     | 4                              | 8                                 |                                                 |                                          |                                               |                                                    | 8             | 20                | \$3,960           | \$32,440                     |                                                        |                                         |                                                          | \$36,400    |
| 15.                                                                                      | Additional Geotechnical Tasks                                                     | 8                              | 16                                |                                                 |                                          |                                               |                                                    |               | 24                | \$6,320           | \$426,420                    |                                                        |                                         |                                                          | \$432,740   |
| 16.                                                                                      | Supplemental Geotechnical Investigations                                          | 8                              | 16                                | 60                                              | 12                                       |                                               |                                                    | 40            | 136               | \$23,640          | \$181,540                    | \$22,000                                               | \$348,760                               | \$33,830                                                 | \$609,770   |
| 17.                                                                                      | Additional Hydraulic Modeling                                                     |                                | 4                                 |                                                 |                                          |                                               |                                                    |               | 4                 | \$1,000           | \$35,520                     | \$15,000                                               |                                         |                                                          | \$51,520    |
| 18.                                                                                      | Construction Hydrologic and Geotechnical Risk Assessment TM                       | 4                              | 8                                 |                                                 |                                          |                                               |                                                    |               | 12                | \$3,160           | \$62,300                     |                                                        | \$7,280                                 |                                                          | \$72,740    |
| 19.                                                                                      | Lake Aeration System Design (Draft TM, Final TM, and 3 additional sheets)         | 2                              | 16                                | 8                                               | 40                                       | 60                                            | 80                                                 | 4             | 210               | \$29,500          |                              |                                                        |                                         |                                                          | \$29,500    |
| 20.                                                                                      | Optional - QRA at 60% Design                                                      |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
|                                                                                          | a. Meetings                                                                       | 8                              | 32                                |                                                 |                                          |                                               |                                                    |               | 40                | \$10,320          | \$10,320                     |                                                        |                                         |                                                          | \$20,640    |
|                                                                                          | b. Analyses for PFMs                                                              | 28                             | 68                                | 128                                             | 184                                      | 80                                            |                                                    | 8             | 496               | \$90,080          | \$90,080                     |                                                        |                                         |                                                          | \$180,160   |
|                                                                                          | c. Prepare and Participate in Workshop                                            | 56                             | 56                                |                                                 |                                          |                                               |                                                    | 4             | 116               | \$30,640          | \$30,640                     |                                                        |                                         |                                                          | \$61,280    |
|                                                                                          | d. Report                                                                         | 20                             | 32                                | 24                                              |                                          |                                               |                                                    | 4             | 80                | \$18,760          | \$18,760                     |                                                        |                                         |                                                          | \$37,520    |
| 21.                                                                                      | Optional - Additional Embankment Cracking Evaluation & Geotechnical Investigation |                                |                                   |                                                 |                                          |                                               |                                                    |               |                   |                   |                              |                                                        |                                         |                                                          |             |
|                                                                                          | a1. Geotechnical Investigation to Update Materials Characterization - Foundation  | 2                              | 5                                 | 13                                              | 19                                       | 75                                            | 12                                                 | 14            | 140               | \$19,810          |                              |                                                        | \$24,410                                | \$5,593                                                  | \$49,813    |
|                                                                                          | a2. Geotechnical Investigation to Update Materials Characterization - Embankment  | 2                              | 8                                 | 121                                             | 66                                       | 414                                           | 20                                                 | 22            | 653               | \$94,350          |                              |                                                        | \$396,320                               | \$70,576                                                 | \$561,246   |
|                                                                                          | b. 3D Nonlinear Deformation Analysis                                              | 10                             | 4                                 | 234                                             | 460                                      | 4                                             |                                                    |               | 712               | \$122,480         |                              |                                                        |                                         |                                                          | \$122,480   |
| SUBTOTAL PHASE 2                                                                         |                                                                                   | 168                            | 305                               | 604                                             | 865                                      | 673                                           | 208                                                | 112           | 2,935             | \$499,700         | \$967,800                    | \$37,000                                               | \$803,990                               | \$109,999                                                | \$2,418,489 |
| TOTAL                                                                                    |                                                                                   | 186                            | 391                               | 606                                             | 881                                      | 673                                           | 228                                                | 132           | 3,097             | \$533,560         | \$1,107,450                  | \$52,000                                               | \$815,950                               | \$109,999                                                | \$2,618,959 |

**Notes & Assumptions:**

- 1.) The billing rates for AECOM and GEI are being held to the same rates as the original contract.
- 2.) Direct Costs / Materials provided with no markup and include costs such as geotechnical borings, lab testing, mileage to meetings/site, courier fees, rental cars, airfare to DSOD offices, and document reproduction costs.

**Table 3 - Detailed Labor Estimate for GEI Subconsultant**  
Irvine Ranch Water District and Serrano Water District  
Santiago Creek Dam Outlet Tower and Spillway Improvements Project - Engineering Services  
April 15, 2022

| Task No.                     | Task Description                                                                    | GEI Labor Hours <sup>1</sup> |                                   |                                                 |                                          |                                               |                                                    |               | GEI TOTAL HOURS | GEI LABOR COSTS | GEI TOTAL   |
|------------------------------|-------------------------------------------------------------------------------------|------------------------------|-----------------------------------|-------------------------------------------------|------------------------------------------|-----------------------------------------------|----------------------------------------------------|---------------|-----------------|-----------------|-------------|
|                              |                                                                                     | Principal Engineer           | Project Manager / Senior Engineer | Senior Project Engineer / Geologist / Scientist | Project Engineer / Geologist / Scientist | Senior Staff Engineer / Geologist / Scientist | Staff Engineer / Geologist / Scientist / CAD / GIS | Project Admin |                 |                 |             |
|                              |                                                                                     | \$290                        | \$250                             | \$190                                           | \$160                                    | \$130                                         | \$110                                              | \$100         |                 |                 |             |
| Phase 1 - Preliminary Design |                                                                                     |                              |                                   |                                                 |                                          |                                               |                                                    |               |                 |                 |             |
| 23.                          | Additional Preliminary Design Services                                              |                              |                                   |                                                 |                                          |                                               |                                                    |               |                 |                 |             |
|                              | a. Revised Spillway Alignment                                                       | 46                           | 59                                | 74                                              |                                          |                                               |                                                    |               | 179             | \$42,150        | \$42,150    |
|                              | b. Update PMF Report                                                                | 6                            | 45                                |                                                 |                                          |                                               |                                                    |               | 51              | \$12,990        | \$12,990    |
|                              | c. 30% Design - ILP Pipeline Relocation                                             |                              |                                   |                                                 |                                          |                                               |                                                    |               | 0               | \$0             | \$0         |
|                              | d. Prepare Additional Spillway Plans (10 sheets)                                    | 8                            | 8                                 | 60                                              | 100                                      | 255                                           |                                                    |               | 431             | \$64,870        | \$64,870    |
|                              | e. Project Management                                                               | 16                           | 60                                |                                                 |                                          |                                               |                                                    |               | 76              | \$19,640        | \$19,640    |
| SUBTOTAL PHASE 1             |                                                                                     | 60                           | 112                               | 134                                             | 100                                      | 255                                           | 0                                                  | 0             | 737             | \$139,650       | \$139,650   |
| Phase 2 - Final Design       |                                                                                     |                              |                                   |                                                 |                                          |                                               |                                                    |               |                 |                 |             |
| 1.                           | Project Management (Risk Register Meetings)                                         | 8                            | 8                                 |                                                 |                                          |                                               |                                                    |               | 16              | \$4,320         | \$4,320     |
| 5.                           | Constructability and Access (includes considerations for Weir at EI 796)            | 4                            | 8                                 | 8                                               | 8                                        | 4                                             | 2                                                  |               | 34              | \$6,700         | \$6,700     |
| 13.                          | Task Deliverables                                                                   |                              |                                   |                                                 |                                          |                                               |                                                    |               | -               | -               | -           |
|                              | a. Improvements Plans (17 additional spillway sheets & 5 additional ILP sheets)     | 17                           | 51                                | 68                                              | 68                                       | 136                                           | 80                                                 | 8             | 428             | \$68,760        | \$68,760    |
|                              | b. Project Manual (includes considerations for Weir at EI 796)                      | 12                           | 20                                | 24                                              | 60                                       | 60                                            |                                                    | 20            | 196             | \$32,440        | \$32,440    |
| 15.                          | Additional Geotechnical Analysis/Design                                             |                              |                                   |                                                 |                                          |                                               |                                                    |               | -               | -               | -           |
|                              | a. Retaining wall design                                                            | 76                           | 92                                | 288                                             |                                          | 500                                           |                                                    |               | 956             | \$164,760       | \$164,760   |
|                              | b. Slope stability                                                                  | 32                           |                                   | 168                                             |                                          | 200                                           |                                                    |               | 400             | \$67,200        | \$67,200    |
|                              | c. Foundation design                                                                | 34                           |                                   | 152                                             |                                          | 164                                           |                                                    |               | 350             | \$60,060        | \$60,060    |
|                              | d. DSOD comment response                                                            | 40                           |                                   | 120                                             |                                          | 120                                           |                                                    |               | 280             | \$50,000        | \$50,000    |
|                              | e. Dynamic analyses for weir and walls                                              | 30                           | 60                                | 110                                             | 200                                      | 60                                            |                                                    |               | 460             | \$84,400        | \$84,400    |
| 16.                          | Supplemental Geotechnical Investigations                                            |                              |                                   |                                                 |                                          |                                               |                                                    |               | -               | -               | -           |
|                              | Phase 2 Investigation (No Vegetation Clearing)                                      |                              |                                   |                                                 |                                          |                                               |                                                    |               | -               | -               | -           |
|                              | a. Develop Workplan and DSOD approval, Field Prep                                   |                              | 16                                |                                                 | 16                                       |                                               |                                                    |               | 32              | \$6,560         | \$6,560     |
|                              | b. Field Investigation                                                              | 2                            | 102                               | 4                                               | 284                                      |                                               |                                                    |               | 392             | \$72,280        | \$72,280    |
|                              | c. Update GDR                                                                       | 4                            | 24                                | 8                                               | 160                                      |                                               |                                                    |               | 196             | \$34,280        | \$34,280    |
|                              | d. Update GIR                                                                       | 6                            | 32                                | 16                                              | 56                                       |                                               |                                                    |               | 110             | \$21,740        | \$21,740    |
|                              | Phase 3 Investigation (Vegetation Clearing Required)                                |                              |                                   |                                                 |                                          |                                               |                                                    |               | -               | -               | -           |
|                              | e. Field Prep                                                                       |                              | 4                                 |                                                 | 24                                       |                                               |                                                    |               | 28              | \$4,840         | \$4,840     |
|                              | f. Brush Clearing                                                                   |                              | 4                                 |                                                 | 16                                       |                                               |                                                    |               | 20              | \$3,560         | \$3,560     |
|                              | g. Test Pits (11 pits, machine dug)                                                 |                              | 8                                 |                                                 | 50                                       |                                               |                                                    |               | 58              | \$10,000        | \$10,000    |
|                              | h. Geophysical Surveys                                                              |                              | 8                                 |                                                 | 24                                       |                                               |                                                    |               | 32              | \$5,840         | \$5,840     |
|                              | i. Update Design/Reports                                                            | 4                            | 24                                | 40                                              | 48                                       |                                               |                                                    |               | 116             | \$22,440        | \$22,440    |
| 17.                          | Additional Hydraulic Modeling                                                       | 64                           |                                   |                                                 | 106                                      |                                               |                                                    |               | 170             | \$35,520        | \$35,520    |
| 18.                          | Construction Hydrologic and Geotechnical Risk Assessment TM & Workshops             |                              |                                   |                                                 |                                          |                                               |                                                    |               | -               | -               | -           |
|                              | a. Workshops                                                                        | 24                           | 16                                | 8                                               |                                          |                                               |                                                    |               | 48              | \$12,480        | \$12,480    |
|                              | b. Input to Risk Register                                                           | 10                           | 16                                | 8                                               |                                          |                                               |                                                    |               | 34              | \$8,420         | \$8,420     |
|                              | c. Hydrologic and Water Diversion Risk Assessment                                   | 14                           | 12                                | 10                                              | 40                                       |                                               |                                                    |               | 76              | \$15,360        | \$15,360    |
|                              | d. Geotechnical Risk and Cofferdam Assessment                                       | 12                           | 12                                | 20                                              |                                          | 28                                            | 8                                                  |               | 80              | \$14,800        | \$14,800    |
|                              | e. Input to Final Constructability TM                                               | 14                           | 14                                | 8                                               | 8                                        |                                               | 8                                                  |               | 52              | \$11,240        | \$11,240    |
| 19.                          | Lake Aeration System Design                                                         |                              |                                   |                                                 |                                          |                                               |                                                    |               | 0               | \$0             | \$0         |
| 20.                          | Optional - QRA at 60 Percent                                                        |                              |                                   |                                                 |                                          |                                               |                                                    |               | -               | -               | -           |
|                              | a. Meetings                                                                         | 8                            | 32                                |                                                 |                                          |                                               |                                                    |               | 40              | \$10,320        | \$10,320    |
|                              | b. Analyses for PFMs                                                                | 28                           | 68                                | 128                                             | 184                                      | 80                                            |                                                    | 8             | 496             | \$90,080        | \$90,080    |
|                              | c. Prepare and Participate in Workshop                                              | 56                           | 56                                |                                                 |                                          |                                               |                                                    | 4             | 116             | \$30,640        | \$30,640    |
|                              | d. Report                                                                           | 20                           | 32                                | 24                                              |                                          |                                               |                                                    | 4             | 80              | \$18,760        | \$18,760    |
| 21.                          | Optional - Additional Embankment Cracking Evaluation and Geotechnical Investigation |                              |                                   |                                                 |                                          |                                               |                                                    |               | 0               | \$0             | \$0         |
| SUBTOTAL PHASE 2             |                                                                                     | 519                          | 719                               | 1212                                            | 1352                                     | 1352                                          | 98                                                 | 44            | 5,296           | \$967,800       | \$967,800   |
| TOTAL                        |                                                                                     | 579                          | 831                               | 1,346                                           | 1,452                                    | 1,607                                         | 98                                                 | 44            | 5,957           | \$1,107,450     | \$1,107,450 |

**Notes & Assumptions:**

- 1.) The billing rates for AECOM and GEI are being held to the same rates as the original contract.
- 2.) Direct Costs / Materials provided with no markup and include costs such as geotechnical borings, lab testing, mileage to meetings/site, courier fees, rental cars, airfare to DSOD offices, and document reproduction costs.

**Table 4 - Detailed Breakdown of Subcontractor and Direct Costs**  
Irvine Ranch Water District and Serrano Water District  
Santiago Creek Dam Outlet Tower and Spillway Improvements Project - Engineering Services  
April 15, 2022

**Subcontractor Costs<sup>1</sup>**

| Task No.             | Subcontractor                                       | Task Description                                                                               | Quantity | Unit | Unit Cost    | Total Cost   |
|----------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------|----------|------|--------------|--------------|
| Ph 1, Task 23a       | Alden Labs                                          | CFD hydraulic modeling computing services                                                      | 1        | LS   | \$15,000.00  | \$15,000.00  |
| Ph 1, Task 23a       | Integrated Engineering & Construction (Phil Martin) | Spillway constructibility technical support                                                    | 1        | LS   | \$11,960.00  | \$11,960.00  |
| Ph 2, Task 5         | Integrated Engineering & Construction (Phil Martin) | 3rd party constructibility review, cost estimating review, and construction scheduling support | 1        | LS   | \$27,220.00  | \$27,220.00  |
| Ph 2, Task 16b & 16h | Geovision                                           | Geophysical Surveys (2 mobilizations)                                                          | 1        | LS   | \$50,900.00  | \$50,900.00  |
| Ph 2, Task 16b       | Gregg Drilling                                      | 5 borings totaling 755 feet, including environmental testing and disposal of drill cuttings    | 1        | LS   | \$243,495.00 | \$243,495.00 |
| Ph 2, Task 16b       | Geovision                                           | Downhole geophysics                                                                            | 1        | LS   | \$11,475.00  | \$11,475.00  |
| Ph 2, Task 16f & 16g | Innovative Services Group                           | Brush clearing & Test pits (11 pits, machine dug)                                              | 1        | LS   | \$42,890.00  | \$42,890.00  |
| Ph 2, Task 17        | Alden Labs                                          | Post completion Physical Model Support and CFD hydraulic modeling computing services           | 1        | LS   | \$15,000.00  | \$15,000.00  |
| Ph 2, Task 18        | Integrated Engineering & Construction (Phil Martin) | Engineering services for Construction Hydrologic and Geotechnical Risk Assessment TM           | 1        | LS   | \$7,280.00   | \$7,280.00   |
| Ph 2, Task 21a1      | ABC Liovin Drilling                                 | Optional sonic borings on right abutment for materials characterization (2 borings)            | 1        | LS   | \$16,335.00  | \$16,335.00  |
| Ph 2, Task 21a1      | Geovision                                           | Optional borings - Downhole geophysics                                                         | 1        | LS   | \$8,075.00   | \$8,075.00   |
| Ph 2, Task 21a2      | ABC Liovin Drilling                                 | Optional borings on dam embankment for materials characterization (9 borings)                  | 1        | LS   | \$135,024.50 | \$135,024.50 |
| Ph 2, Task 21a2      | Gregg Drilling                                      | Option barge borings on dam embankment for materials characterization (5 borings)              | 1        | LS   | \$216,250.00 | \$216,250.00 |
| Ph 2, Task 21a2      | Geovision                                           | Optional borings - Downhole geophysics                                                         | 1        | LS   | \$21,000.00  | \$21,000.00  |
| Ph 2, Task 21a2      | American Integrated Services                        | Optional borings - Disposal of drilling cuttings                                               | 1        | LS   | \$24,045.00  | \$24,045.00  |

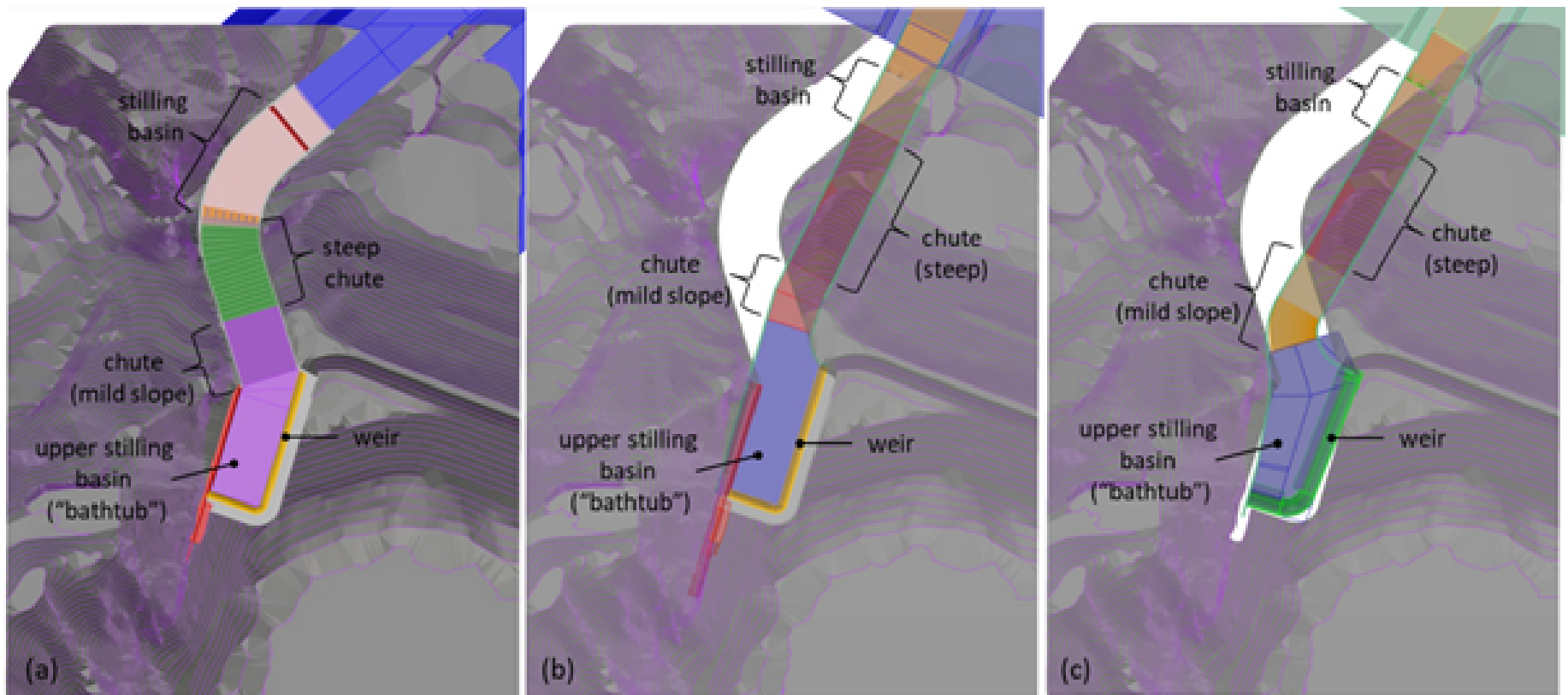
| Task No.        | Subcontractor   | Task Description                              | Quantity | Unit | Unit Cost | Total Cost         |
|-----------------|-----------------|-----------------------------------------------|----------|------|-----------|--------------------|
| Ph 2, Task 16e3 | AECOM Soils Lab | Water content tests                           | 60       | EA   | \$20.00   | \$1,200.00         |
| Ph 2, Task 16e3 | AECOM Soils Lab | Dry density tests                             | 40       | EA   | \$36.00   | \$1,440.00         |
| Ph 2, Task 16e3 | AECOM Soils Lab | Particle-size distribution tests              | 24       | EA   | \$150.00  | \$3,600.00         |
| Ph 2, Task 16e3 | AECOM Soils Lab | Corrosivity suites                            | 10       | EA   | \$260.00  | \$2,600.00         |
| Ph 2, Task 16e3 | AECOM Soils Lab | Liquid limit and plastic limit tests          | 24       | EA   | \$160.00  | \$3,840.00         |
| Ph 2, Task 16e3 | AECOM Soils Lab | Direct shear tests                            | 0        | EA   | \$290.00  | \$0.00             |
| Ph 2, Task 16e3 | AECOM Soils Lab | Triaxial shear tests - consolidated undrained | 15       | EA   | \$410.00  | \$6,150.00         |
| Ph 2, Task 16e3 | AECOM Soils Lab | Unconfined compressive strength tests on rock | 40       | EA   | \$300.00  | \$12,000.00        |
| Ph 2, Task 16e3 | AECOM Soils Lab | Modified Proctor                              | 5        | 2    | \$520.00  | \$2,600.00         |
| Ph 2, Task 16e3 | AECOM Soils Lab | Point load strength tests on rock             | 0        | EA   | \$140.00  | \$0.00             |
| <b>Total</b>    |                 |                                               |          |      |           | <b>\$33,430.00</b> |

| Task No.        | Subcontractor   | Task Description                     | Quantity | Unit | Unit Cost | Total Cost        |
|-----------------|-----------------|--------------------------------------|----------|------|-----------|-------------------|
| Ph 2, Task 21a1 | AECOM Soils Lab | Particle-size distribution tests     | 16       | EA   | \$150.00  | \$2,400.00        |
| Ph 2, Task 21a1 | AECOM Soils Lab | Liquid limit and plastic limit tests | 16       | EA   | \$160.00  | \$2,560.00        |
| <b>Total</b>    |                 |                                      |          |      |           | <b>\$4,960.00</b> |

| Task No.        | Subcontractor   | Task Description                                                | Quantity | Unit | Unit Cost  | Total Cost         |
|-----------------|-----------------|-----------------------------------------------------------------|----------|------|------------|--------------------|
| Ph 2, Task 21a2 | AECOM Soils Lab | Moisture density tests                                          | 50       | EA   | \$36.00    | \$1,800.00         |
| Ph 2, Task 21a2 | AECOM Soils Lab | Particle-size distribution tests                                | 50       | EA   | \$150.00   | \$7,500.00         |
| Ph 2, Task 21a2 | AECOM Soils Lab | Liquid limit and plastic limit tests                            | 50       | EA   | \$160.00   | \$8,000.00         |
| Ph 2, Task 21a2 | AECOM Soils Lab | Pinhole                                                         | 5        | EA   | \$290.00   | \$1,450.00         |
| Ph 2, Task 21a2 | AECOM Soils Lab | Triaxial shear tests - consolidated undrained                   | 20       | EA   | \$410.00   | \$8,200.00         |
| Ph 2, Task 21a2 | AECOM Soils Lab | Triaxial shear tests - unconsolidated undrained                 | 35       | EA   | \$160.00   | \$5,600.00         |
| Ph 2, Task 21a2 | AECOM Soils Lab | Triaxial shear tests - Cyclic (additional \$1,000 for shipping) | 10       | EA   | \$2,000.00 | \$21,000.00        |
| Ph 2, Task 21a2 | AECOM Soils Lab | Consolidation                                                   | 20       | EA   | \$560.00   | \$11,200.00        |
| <b>Total</b>    |                 |                                                                 |          |      |            | <b>\$64,750.00</b> |

Notes:

1. All subcontractor and laboratory costs shown in the tables above include payment of prevailing wages.
2. Assumes AECOM Geotechnical Lab in Anaheim, CA will perform geotechnical laboratory testing.



Spillway Alternatives  
Santiago Creek Dam  
Irvine, California

Irvine Ranch Water District / Serrano Water District  
Irvine, California

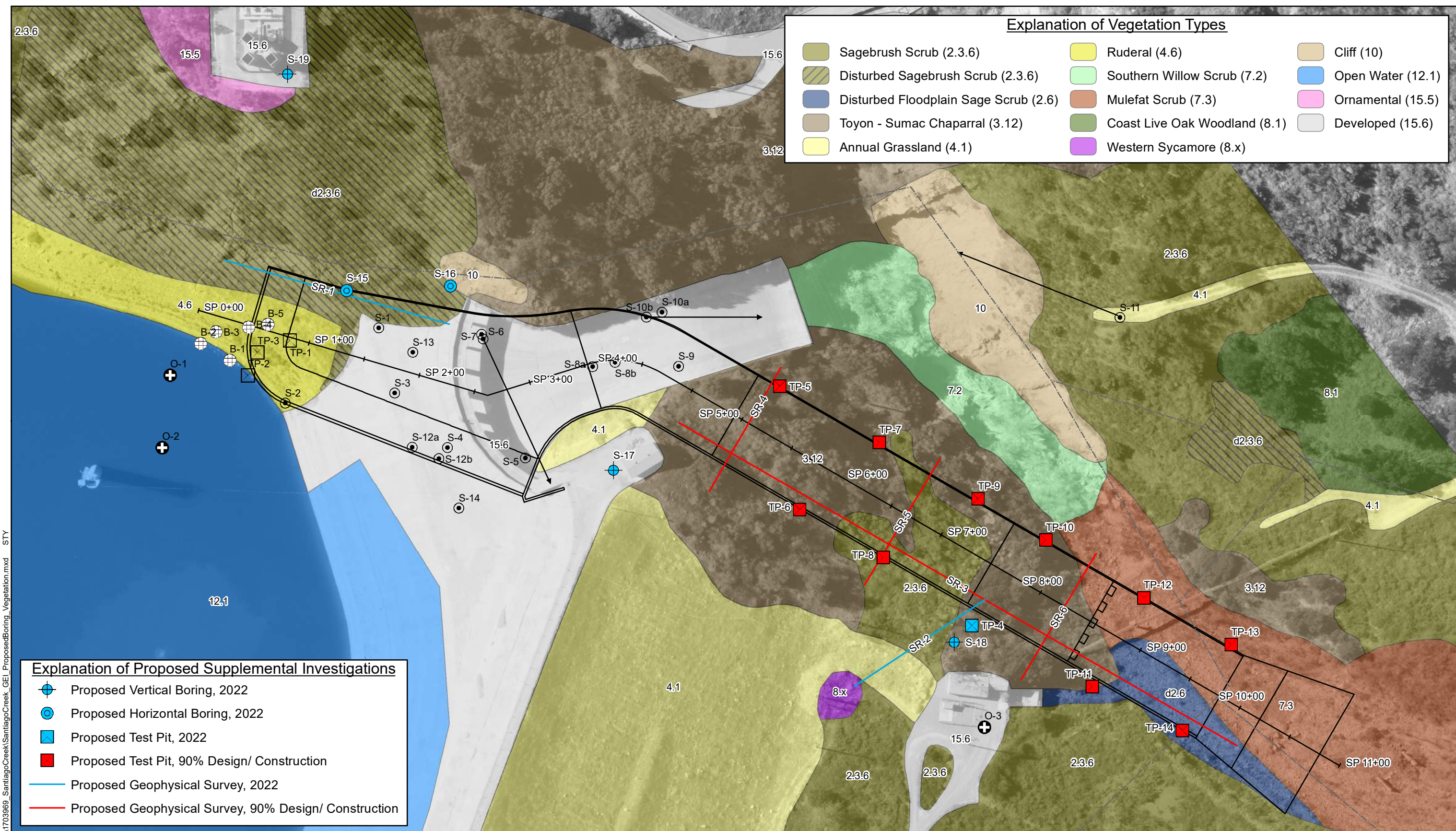


Project 2002748

SPILLWAY ALTERNATIVES

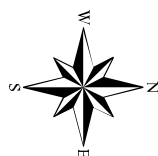
February 2022

Fig. 1



19-Jan-2022 Z:\Projects\1703969 SantiagoCreek\GIS\ProposedBoring\_Vegetation.mxd STY

0 40 80 160 Feet



Santiago Creek Dam Outlet and  
Spillway Improvements  
Orange County, California

Serrano and Irvine Ranch Water District

**AECOM**



PROPOSED SUPPLEMENTAL INVESTIGATION PLAN

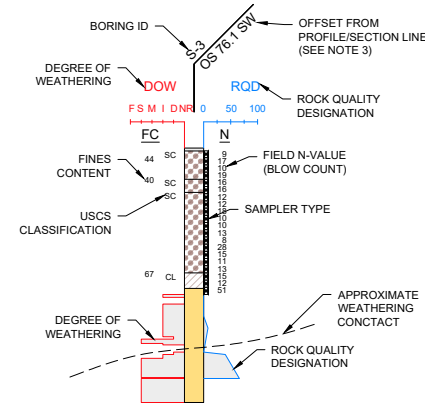
January 2022

**DRAFT**

Figure 2

K:\2024\4.8 Santiago Dam Spillway\00 CAD\Figures\Geologic Profile And Sections\Santiago-Geologic Sections\proposedExplorations.dwg, File date: 2/25/2022 1:51 PM, Print date: 2/25/2022 1:58 PM by: Yehi, Scott

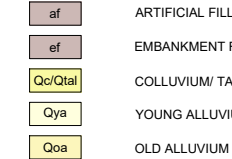
**BORING EXPLANATION**



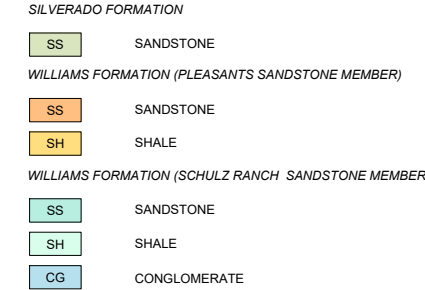
**SOIL LOG EXPLANATION**



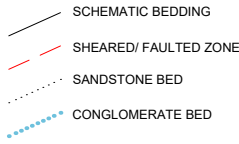
**SURFICIAL DEPOSITS**



**GEOLOGIC UNITS**

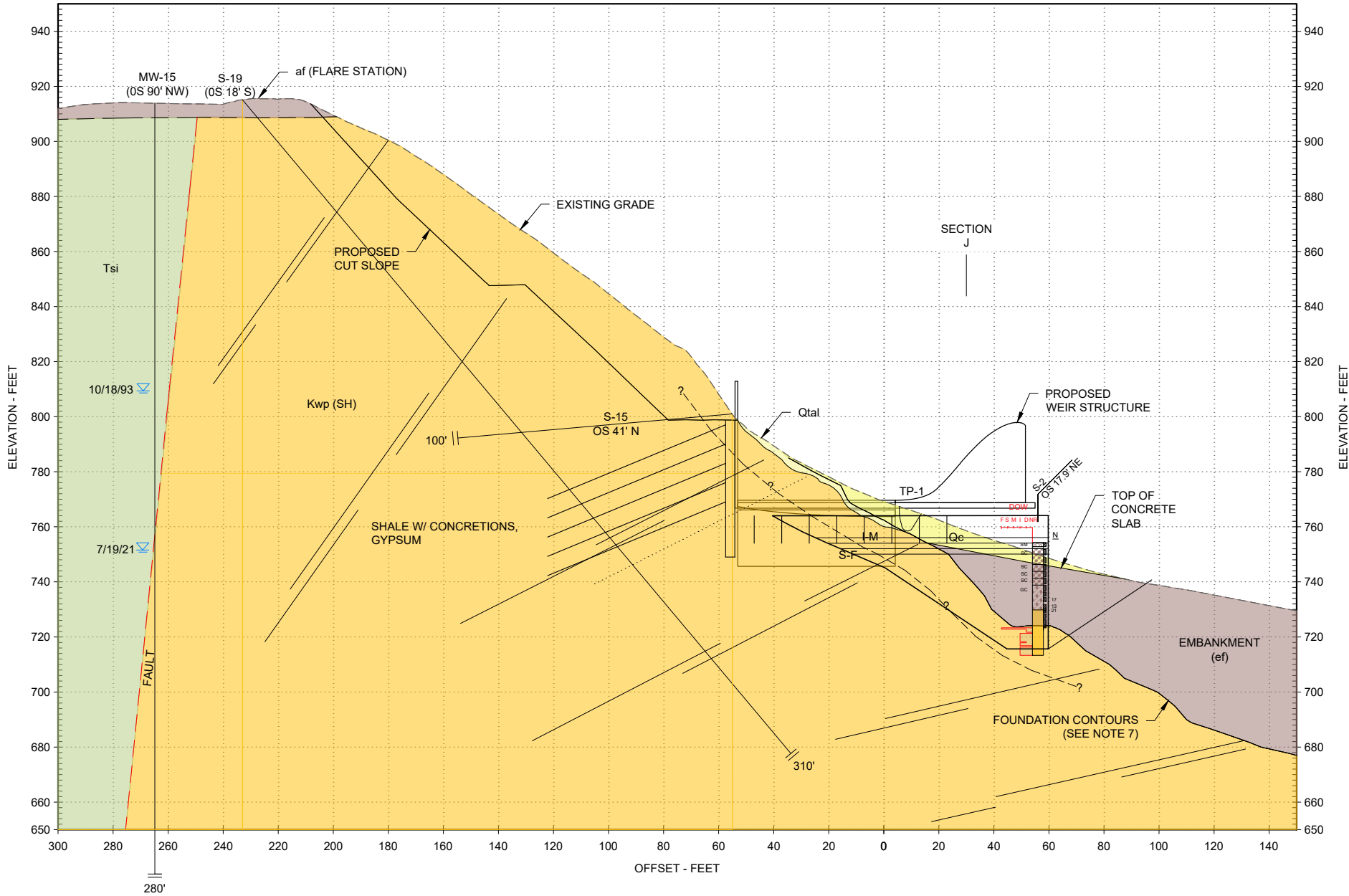


**DEGREE OF WEATHERING**

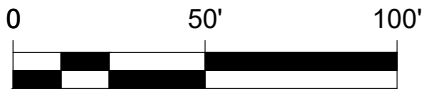


**NOTES**

- SEE PLATE 1 FOR PROFILE AND SECTION LOCATIONS.
- THE BORINGS REPRESENT THE SUBSURFACE CONDITIONS AT THOSE SPECIFIC LOCATIONS AT THE TIME THE BORING WAS COMPLETED. SUBSURFACE CONDITIONS MAY CHANGE OVER TIME.
- OFFSET DISTANCES SHOWN FOR EACH BORING REPRESENTS THE DISTANCE OF THE BORING TO THE PROFILE OR SECTION LINE. BORINGS ENTIRELY WITHIN BEDROCK ARE TYPICALLY PROJECTED ALONG STRIKE OF NEARBY BEDDING (SHOWN ON PLATE 1); OTHERS ARE PROJECTED PERPENDICULAR TO THE SECTION.
- THE PROFILE AND SECTIONS ARE HIGHLY INTERPRETIVE AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS. ALL GEOLOGIC FEATURES AND CONTACTS SHOULD BE CONSIDERED APPROXIMATE.
- THE SCHEMATIC BEDDING SHOWN ON THE SECTIONS REFLECTS THE APPARENT DIP OF A NEARBY BEDDING MEASUREMENT (SHOWN ON PLATE 1) THAT IS PROJECTED ONTO THE LINE OF SECTION.
- THE PROFILE AND SECTIONS WERE DEVELOPED USING STANDARD METHODS THAT ARE COMMONLY USED BY PROFESSIONALS THROUGHOUT THE GEOLOGIC INDUSTRY.
- FOUNDATION SURFACE DIGITIZED FROM CONSTRUCTION DRAWING NO. 35 "BEDROCK CONTOUR MAP", DATED NOVEMBER 1931. DRAWING WAS MODIFIED BY HAND WRITTEN NOTES IN NOVEMBER 1933 TO READ "FOUNDATION CONTOUR MAP".
- VERTICAL DATUM IS NAVD88.



A SECTION  
Scale 1" = 50'



**AECOM** | **GEI** Consultants

IRVINE RANCH WATER DISTRICT AND  
SERRANO WATER DISTRICT

**SECTION A  
SPILLWAY WEIR**

|                                                                                  |                     |
|----------------------------------------------------------------------------------|---------------------|
| Proj. No.: 60633802                                                              | Date: FEBRUARY 2022 |
| Project: SANTIAGO CREEK DAM<br>SPILLWAY AND OUTLET WORKS<br>IMPROVEMENTS PROJECT | Figure: 3           |

Attachment A: Updated Drawing List

| Sheet No. | Drawing No. | Sheet Title                                                                |
|-----------|-------------|----------------------------------------------------------------------------|
| 1         | G-1         | Title Sheet                                                                |
| 2         | G-2         | Location Map, Vicinity Map, and Sheet Index                                |
| 3         | G-3         | Construction Notes, Symbols, Agency Index & Abbreviations                  |
| 4         | G-4         | General Notes and Hydrologic Information                                   |
| 5         | G-5         | Site Access Plan                                                           |
| 6         | G-6         | Construction Storage and Laydown Plan                                      |
| 7         | G-7         | Overall Site Plan                                                          |
| 8         | C-1         | Site Demolition and Salvage Plan                                           |
| 9         | C-2         | Site Demolition and Salvage Plan                                           |
| 10        | C-3         | Site Demolition and Salvage Details                                        |
| 11        | C-4         | Tower Abandonment Plan, Section, and Details                               |
| 12        | C-5         | Spillway Demolition Plan                                                   |
| 13        | C-6         | Temporary Spillway Slope Shoring Plan                                      |
| 14        | C-7         | Horizontal Control Plan                                                    |
| 15        | C-8         | Inclined Outlet Access Road and Retaining Wall Plan                        |
| 16        | C-9         | Dam Access Safety Improvement Plan, Sections, and Details                  |
| 17        | C-10        | Temporary Bypass Pumping System Plan                                       |
| 18        | C-11        | Temporary Stormwater/Creek Diversion Plan and Details                      |
| 19        | C-12        | Irvine Lake Pipeline Relocation Notes                                      |
| 20        | C-13        | Irvine Lake Pipeline Relocation Plan and Profile                           |
| 21        | C-14        | Irvine Lake Pipeline Relocation Connection Plans                           |
| 22        | C-15        | Irvine Lake Pipeline Relocation Details (Sheet 1 of 2)                     |
| 23        | C-16        | Irvine Lake Pipeline Relocation Details (Sheet 2 of 2)                     |
| 24        | OW-1        | Outlet Works General Plan                                                  |
| 25        | OW-2        | Inclined Outlet Structure Cofferdam Notes and Arrangement                  |
| 26        | OW-3        | Inclined Outlet Structure Cofferdam Sections and Details                   |
| 27        | OW-4        | Inclined Outlet Structure Cofferdam Details                                |
| 28        | OW-5        | Inclined Outlet Structure Excavation Plan and Profile                      |
| 29        | OW-6        | Inclined Outlet Structure Plan and Profile                                 |
| 30        | OW-7        | Inclined Outlet Structure Point of Connection Details                      |
| 31        | OW-8        | Inclined Outlet Structure Mechanical Details - 1                           |
| 32        | OW-9        | Inclined Outlet Structure Mechanical Details - 2                           |
| 33        | OW-10       | Inclined Outlet Structure Platform and Stairway Plan, Profile, and Details |
| 34        | OW-11       | Inclined Outlet Structure Structural Notes, Legend, Abbreviations          |
| 35        | OW-12       | Inclined Outlet Structure Structural Plan, Sections, and Details           |
| 36        | OW-13       | Inclined Outlet Structure Structural Details - 1                           |
| 37        | OW-14       | Inclined Outlet Structure Structural Details - 2                           |
| 38        | OW-15       | Inclined Outlet Structure Structural Details - 3                           |
| 39        | OW-16       | Inclined Outlet Structure Structural Details - 4                           |
| 40        | OW-17       | Outlet Works Control Building Site Plan                                    |
| 41        | OW-18       | Outlet Works Control Building Sections                                     |
| 42        | OW-19       | Outlet Works Control Building Mechanical Plan                              |
| 43        | OW-20       | Outlet Works Control Building Structural Notes                             |
| 44        | OW-21       | Outlet Works Control Building Foundation Plan                              |
| 45        | OW-22       | Outlet Works Control Building Roof Framing Plan                            |
| 46        | OW-23       | Outlet Works Control Building Roof Framing Details                         |
| 47        | OW-24       | Outlet Works Control Building Sections and Elevations                      |
| 48        | OW-25       | Outlet Works Control Building Structural Details - 1                       |
| 49        | OW-26       | Outlet Works Control Building Structural Details - 2                       |
| 50        | OW-27       | Valve House Plan                                                           |
| 51        | OW-28       | Valve House Sections                                                       |
| 52        | OW-29       | Valve House Mechanical Plan                                                |
| 53        | OW-30       | Valve House Excavation Plan                                                |
| 54        | OW-31       | Valve House Structural Notes                                               |
| 55        | OW-32       | Valve House Foundation Plan                                                |
| 56        | OW-33       | Valve House Roof Framing Plan                                              |
| 57        | OW-34       | Valve House Roof Framing Details                                           |
| 58        | OW-35       | Valve House Sections and Elevations                                        |

| Sheet No. | Drawing No. | Sheet Title                                                 |
|-----------|-------------|-------------------------------------------------------------|
| 59        | OW-36       | Valve House Structural Details - 1                          |
| 60        | OW-37       | Valve House Structural Details - 2                          |
| 61        | OW-38       | Emergency Outlet Structure Plan                             |
| 62        | OW-39       | Emergency Outlet Structure Excavation Plan                  |
| 63        | OW-40       | Emergency Outlet Structure Section                          |
| 64        | OW-41       | Emergency Outlet Structure Details                          |
| 65        | OW-42       | Stilling Basin Plan and Profile                             |
| 66        | OW-43       | Stilling Basin Sections and Details                         |
| 67        | WQ-1        | Reservoir Water Quality System - General Plan               |
| 68        | WQ-1        | Reservoir Water Quality System - Aeration Equipment Details |
| 69        | SP-1        | Spillway General Arrangement                                |
| 70        | SP-2        | Spillway Plan and Profile Sta 0+00 to Sta 5+50              |
| 71        | SP-3        | Spillway Plan and Profile Sta 5+50 to Sta 11+00             |
| 72        | SP-4        | Spillway Subsurface Investigation Plan                      |
| 73        | SP-5        | Spillway Construction Sequence - Stage 1                    |
| 74        | SP-6        | Spillway Construction Sequence - Stage 2                    |
| 75        | SP-7        | Spillway Construction Sequence - Stage 3                    |
| 76        | SP-8        | Spillway Demolition Plan                                    |
| 77        | SP-9        | Spillway Excavation Plan (Sheet 1 of 2)                     |
| 78        | SP-10       | Spillway Excavation Plan (Sheet 2 of 2)                     |
| 79        | SP-11       | Spillway Excavation Sections (Sheet 1 of 3)                 |
| 80        | SP-12       | Spillway Excavation Sections (Sheet 2 of 3)                 |
| 81        | SP-13       | Spillway Excavation Sections (Sheet 3 of 3)                 |
| 82        | SP-14       | Spillway Anchor and Drainage Plan (Sheet 1 of 2)            |
| 83        | SP-15       | Spillway Anchor and Drainage Plan (Sheet 2 of 2)            |
| 84        | SP-16       | Spillway Drainage Details                                   |
| 85        | SP-17       | Spillway Final Grading Plan (Sheet 1 of 2)                  |
| 86        | SP-18       | Spillway Final Grading Plan (Sheet 2 of 2)                  |
| 87        | SP-19       | Spillway Sections (Sheet 1 of 3)                            |
| 88        | SP-20       | Spillway Sections (Sheet 2 of 3)                            |
| 89        | SP-21       | Spillway Sections (Sheet 3 of 3)                            |
| 90        | SP-22       | Spoils Disposal Plan and Sections                           |
| 91        | SP-23       | Slope Stabilization Plan                                    |
| 92        | SP-24       | Slope Stabilization Details                                 |
| 93        | SP-25       | Structural Standard Notes                                   |
| 94        | SP-26       | Structural Design Criteria                                  |
| 95        | SP-27       | Structural Standard Details (Sheet 1 of 2)                  |
| 96        | SP-28       | Structural Standard Details (Sheet 2 of 2)                  |
| 97        | SP-29       | Spillway Structural Layout Plan                             |
| 98        | SP-30       | Spillway Joint Layout Plan (Sheet 1 of 2)                   |
| 99        | SP-31       | Spillway Joint Layout Plan (Sheet 2 of 2)                   |
| 100       | SP-32       | Side Channel Weir Layout Plan                               |
| 101       | SP-33       | Side Channel Weir Cross Sections                            |
| 102       | SP-34       | Side Channel Weir Details                                   |
| 103       | SP-35       | Wall Type I Plan                                            |
| 104       | SP-36       | Wall Type I Elevation                                       |
| 105       | SP-37       | Wall Type I Cross Sections                                  |
| 106       | SP-38       | Wall Type II Plan                                           |
| 107       | SP-39       | Wall Type II Elevation                                      |
| 108       | SP-40       | Wall Type II Cross Sections                                 |
| 109       | SP-41       | Wall Type III Plan                                          |
| 110       | SP-42       | Wall Type III Elevation                                     |
| 111       | SP-43       | Wall Type III Cross Sections                                |
| 112       | SP-44       | Wall Details                                                |
| 113       | SP-45       | Stilling Basin Plan                                         |
| 114       | SP-46       | Stilling Basin Cross Sections                               |
| 115       | SP-47       | Stilling Basin Details                                      |
| 116       | SP-48       | Scour Protection Plan and Sections                          |

| Sheet No. | Drawing No. | Sheet Title                                                       |
|-----------|-------------|-------------------------------------------------------------------|
| 117       | SP-49       | Scour Protection Details                                          |
| 118       | SP-50       | Downstream Apron Plan                                             |
| 119       | SP-51       | Downstream Apron Cross Sections                                   |
| 120       | BR-1        | Pedestrian Bridge Structural Notes and Abbreviations              |
| 121       | BR-2        | Pedestrian Bridge General Arrangement Plan                        |
| 122       | BR-3        | Pedestrian Bridge Structural Observations and Special Inspections |
| 123       | BR-4        | Pedestrian Bridge Foundation Plan                                 |
| 124       | BR-5        | Pedestrian Bridge Elevations                                      |
| 125       | BR-6        | Pedestrian Bridge Abutment Sections                               |
| 126       | BR-7        | Pedestrian Bridge Sections                                        |
| 127       | BR-8        | Pedestrian Bridge Abutment Details                                |
| 128       | BR-9        | Pedestrian Bridge Details - 1                                     |
| 129       | BR-10       | Pedestrian Bridge Details - 2                                     |
| 130       | BR-11       | Pedestrian Bridge Miscellaneous Details - 3                       |
| 131       | SW-1        | Stairway Plan                                                     |
| 132       | SW-2        | Stairway Profile                                                  |
| 133       | SW-3        | Stairway Sections and Details                                     |
| 134       | SW-4        | Stairway Details                                                  |
| 135       | E-1         | Overall Electrical Site Plan, Legend & Abbreviations              |
| 136       | E-2         | Single Line Diagram                                               |
| 137       | E-3         | Control Building Electrical Plan                                  |
| 138       | E-4         | Valve Vault & EOS Electrical Plan                                 |
| 139       | E-5         | Control Building Conduit Plan                                     |
| 140       | E-6         | Outlet Works Valve Vault & EOS Conduit Plan                       |
| 141       | E-7         | Control Building Lighting Security, and Grounding Plan            |
| 142       | E-8         | Valve Vault & EOS Lighting Security, and Grounding Plan           |
| 143       | E-9         | Control Building Panel Elevations                                 |
| 144       | E-10        | Electrical Conduit – Sections and Details                         |
| 145       | E-11        | Electrical Service Plan and Details                               |
| 146       | E-12        | PLC and Telemetry Schematic                                       |
| 147       | E-13        | Security Camera and Telemetry Details                             |
| 148       | E-14        | Air Schematic Control Diagram                                     |
| 149       | E-15        | Emergency Outlet Valve Schematic Control Diagram                  |
| 150       | E-16        | Electrical Details - 1                                            |
| 151       | E-17        | Electrical Details - 2                                            |
| 152       | E-18        | Cable and Conduit Schedule                                        |
| 153       | I-1         | Instrumentation Legend and Symbols                                |
| 154       | I-2         | Outlet Works P&ID                                                 |
| 155       | I-3         | Instrumentation Details                                           |
| 156       | I-4         | SCADA System Architecture                                         |
| 157       | I-5         | Telemetry System Details - 1                                      |
| 158       | I-6         | Telemetry System Details - 2                                      |
| 159       | I-7         | Reservoir Aeration System P&ID                                    |
| 160       | EC-1        | SWPPP Index Map and Notes                                         |
| 161       | EC-2        | SWPPP Notes                                                       |
| 162       | EC-3        | SWPPP Excavation Area 1                                           |
| 163       | EC-4        | SWPPP Excavation Area 2                                           |
| 164       | EC-5        | SWPPP Excavation Area 3                                           |
| 165       | EC-6        | SWPPP Outlet Works Improvements Area 1                            |
| 166       | EC-7        | SWPPP Outlet Works Improvements Area 2                            |
| 167       | EC-8        | SWPPP Spillway Improvements Area 1                                |
| 168       | EC-9        | SWPPP Spillway Improvements Area 2                                |
| 169       | EC-10       | SWPPP Details - 1                                                 |
| 170       | EC-11       | SWPPP Details - 2                                                 |
| 171       | EC-12       | SWPPP Details - 3                                                 |
| 172       | EC-13       | SWPPP Details - 4                                                 |

Notes:

The original contract included 34 spillway drawings. This variance adds 17 spillway drawings, 5 ILP relocation drawings, and 3 reservoir aeration system drawings.

EOS = Emergency Outlet Structure

SCADA = supervisory control and data acquisition

SWPPP = Stormwater Pollution Prevention Plan

ILP=Irvine Lake Pipeline

## **Attachment B – Subconsultant and Subcontractor Quotes**

Date: March 24, 2022

To: Iqbal Ahmed, PE,  
Mark Fortner, PE

From: Dan Gessler, PE

Subject: **Change Order for additional CFD modeling during preliminary design of Santiago Dam Spillway**

Description of Additional Work:

The additional work for the preliminary design phase is to test an additional spillway alignment in the FLOW-3D model. The spillway alignment modification was provided by GEI. The need for the modification was discussed in a series of e-mails ending with an e-mail from Alden to GEI on Feb 26<sup>th</sup> 2021 providing the proposed budget.

Additional Budget

|                                     |               |
|-------------------------------------|---------------|
| Model setup:                        | 40 hrs        |
| Simulations:                        | 40 hrs        |
| <u>Post Processing and Analysis</u> | <u>16 hrs</u> |
| Total                               | 96 hrs        |

Billing rate for sr. CFD engineer is \$156.25/hr

Total budget for additional simulations is \$15,000

Date: March 24, 2022

To: Iqbal Ahmed, PE,  
Mark Fortner, PE

From: Dan Gessler, PE

Subject: **Change Order for Support with Final Design**

Description of Additional Work:

After completion of the physical model testing, a final model report will be prepared. The proposed budget did not include post model completion support to address additional questions that may be raised by the BOC or regulators. This change order is for additional funds for post model completion support.

Additional Budget

|                              |                    |                      |
|------------------------------|--------------------|----------------------|
| ½ week of additional testing |                    | \$5,000 <sup>1</sup> |
| SME support:                 | 8 hrs at \$275/hr  | \$2,200              |
| Principal Engineer support   | 40 hrs at \$195/hr | <u>\$7,800</u>       |
| Total                        |                    | \$15,000             |

<sup>1</sup> Testing costs are \$10,000 per week for all staff and data collection equipment

Total budget for post model completion support is \$15,000



## Integrated Engineering & Construction

22-Feb-22

### PROPOSAL

#### AECOM

#### Santiago Reservoir Improvements

#### Constructability, Estimate Review and Scheduling Support Services

| Task Description                                                    | Hours      | Hourly Rate<br>\$230 |
|---------------------------------------------------------------------|------------|----------------------|
| <b>Task 1—30 Percent Design</b>                                     |            |                      |
| 1.1 Review of existing drawings and information                     | 4          |                      |
| 1.2 Constructability Meetings                                       | 8          |                      |
| 1.3 Review 30% Cost Estimate (prepared by AECOM) & review comments  | 16         |                      |
| 1.4 Develop 30% Construction Schedule (P6) and schedule narrative   | 16         |                      |
| 1.5 Meetings                                                        | 8          |                      |
| <b>Task 1 Total Hours</b>                                           | <b>52</b>  | <b>\$11,960</b>      |
| <b>Task 2—60 Percent Design</b>                                     |            |                      |
| 2.1 Review of existing drawings and information                     | 8          |                      |
| 2.2 Constructability Meetings                                       | 16         |                      |
| 2.3 Review 60% Cost Estimate (prepared by AECOM) & review comments  | 24         |                      |
| 2.4 Update 60% Construction Schedule (P6) and schedule narrative    | 24         |                      |
| 2.5 Meetings                                                        | 8          |                      |
| <b>Task 2 Total Hours</b>                                           | <b>80</b>  | <b>\$18,400</b>      |
| <b>Task 3—90 Percent Design</b>                                     |            |                      |
| 3.1 Review of existing drawings and information                     | 4          |                      |
| 3.2 Constructability Meetings                                       | 8          |                      |
| 3.3 Review 90% Cost Estimate (prepared by AECOM) & review comments  | 16         |                      |
| 3.4 Update 90% Construction Schedule (P6) and schedule narrative    | 16         |                      |
| 3.5 Meetings                                                        | 8          |                      |
| <b>Task 3 Total Hours</b>                                           | <b>52</b>  | <b>\$11,960</b>      |
| <b>Task 4—100 Percent Design</b>                                    |            |                      |
| 4.1 Review of existing drawings and information                     | 2          |                      |
| 4.2 Review 100% Cost Estimate (prepared by AECOM) & review comments | 8          |                      |
| 4.3 Update 100% Construction Schedule (P6) and schedule narrative   | 4          |                      |
| 4.4 Meetings                                                        | 4          |                      |
| <b>Task 4 Total Hours</b>                                           | <b>18</b>  | <b>\$4,140</b>       |
| <b>Total Hours</b>                                                  | <b>202</b> | <b>\$46,460</b>      |

#### Assumptions:

Site visit or travel for meetings is not included



February 2, 2022  
Proposal No. P21-0776 Rev 3

Todd Crampton, CEG  
GEI  
180 Grand Avenue, Suite 1410  
Oakland, CA 94612  
510.350.2934  
cell: 510.759.9470

**Proposal for Borehole and Surface Geophysics  
Santiago Creek Dam, Irvine, California**

Dear Mr. Crampton:

**GEOVision** is pleased to present this revised proposal to conduct geophysics for your project in Irvine, California. The scope of the project includes:

**PHASE 1**

BHTV (Borehole Televiwer) – Three (3) borings

- a) One at 75 ft – Vertical
- b) One at 115 ft – Vertical
- c) One at 310 ft – Vertical

SRT + ERT (Seismic Refraction and Electrical Resistivity Tomography) - Two (2) 2D lines and MASW (2) 1D lines

- a) One at 180 ft
- b) One at 240 ft

**PHASE 2**

SRT + ERT Four (4) 2D lines and MASW (4) 1D lines

- c) Three at 180 ft
- d) One at 600 ft

We will require a written contract and work authorization before mobilization.

***Borehole Televiwer Geophysics***

***Acoustic Televiwer and Deviation (Verticality) Survey***

GEOVision proposes to provide borehole Televiwer surveys using one of our RG Borehole Televiwers, or equivalent. The Borehole Acoustic Televiwer utilizes acoustic waves to image the internal surface of the borehole. Because it is acoustic, and not optical, it does not require clear water to operate. The resulting images can be laid out vertically almost like a physical core. The instrument has a built-in fluxgate magnetometer to maintain orientation accuracy and triaxial

accelerometers to measure tilt throughout the measurement. Because of this, fractures that pass through the “core” (if you will) can not only be mapped, but oriented in space to provide an orientation angle relative to north, and a dip angle at a measured depth. This analysis is done after the data collection using specialized software tools. Here is a link to a description of the HRAT probe we will use:

<https://www.robertson-geo.com/wp-content/themes/robertson/downloadfiles/usermanual/1549561343.pdf>

### **Televiewer Environmental Conditions**

The acoustic televiewer requires a stable, fluid filled, uncased borehole between 67 and 150mm diameter.

### **OPTIONAL: Optical Televiewer Survey**

In the event that the borehole cannot hold fluid, GEOVision proposes to provide borehole Televiewer surveys using one of our Optical Televiewers, or equivalent. The Hi-OPTV provides a continuous high resolution oriented image of the borehole walls using a conventional light source. A unique optical system based on a fisheye lens allows the probe to survey 360 degrees simultaneously. This information is processed in real time to produce a complete ‘unwrapped’ image of the borehole oriented to magnetic north. While, unlike the HRAT, it can operate in air-filled boreholes, it is unsuitable for boreholes containing mud or cloudy fluids. The resulting images can be laid out vertically almost like a physical core, and in real color. The instrument has a built-in fluxgate magnetometer to maintain orientation accuracy and triaxial accelerometers to measure tilt throughout the measurement. Because of this, fractures that pass through the “core” (if you will) can not only be mapped, but oriented in space to provide an orientation angle relative to north, and a dip angle at a measured depth. This analysis is done after the data collection using specialized software tools. Here is a link to a description of the DOPTV probe we will use:

<https://www.robertson-geo.com/wp-content/themes/robertson/downloadfiles/usermanual/1558096925.pdf>

### **Televiewer Environmental Conditions**

The optical televiewer requires a stable, air or CLEAR fluid filled, uncased borehole between 67 and 150mm diameter.

### **Borehole Geophysics Fees**

We propose to complete the required borehole geophysical logging for four boreholes for the following fixed unit fee schedule:

| ITEM | DESCRIPTION                              | UNIT     | QTY | UNIT RATE | EXT COST |
|------|------------------------------------------|----------|-----|-----------|----------|
| 1    | Mobilization                             | EA       | 3   | 700.00    | 2,100.00 |
| 1.1  | Hand Carry / Loading pole                | EA       |     | 1,000.00  |          |
| 2    | Borehole PS Suspension Velocity Logging  |          |     |           |          |
| 2.1  | Each borehole, first 100 ft              | Borehole | 3   | 2,250.00  | 6,750.00 |
| 2.2  | Additional footage                       | Ft       | 225 | 5         | 1,125.00 |
| 3    | Report (\$500/borehole, minimum \$1,000) | Borehole | 3   | 500.00    | 1,500.00 |
| 4    | Standby fees per day                     | Day      |     | 1,900.00  |          |

**TOTAL****\$ 11,475.00****NOTES:**

1. Each borehole entry on a separate day is charged as a "first 100ft" log, even if it's the same borehole (unless its due to our delay or equipment). Multiple efforts on the same day are one entry. The most common reason to return to the same borehole on a subsequent day is because the borehole was obstructed.
2. The unit rates for logging include processing, as well as all expenses including per diem.
3. GEOVision will not charge you for standby if we can log a hole that day. This means that if we log a hole on Tuesday morning, and the next hole on Wednesday afternoon, we will not charge you for standby.
4. GEOVision reserves the right to NOT log a borehole if conditions indicate that there is a strong possibility that we will lose a logging tool. This is rare, but it can happen. For example, if there has been significant and continuing collapse in the borehole and attendant loss of circulation causing the drill string gets stuck, etc. This is why the method of drilling is so important. We strongly recommend rotary mud.

**Report**

A report will be provided describing the project, the methodology, the procedures and the results.

You will receive Televue images immediately at the site via flash drive; followed by Televue feature processed data with both wrapped (core) and unwrapped images, feature orientation and dip angles, with interpretive comments describing each feature, both in PDF (typically 1 foot per inch) and Excel formats; Deviation data in both ASCII and orthographic projection PDF formats; and Caliper (ATV only) in both PDF (typically 1 foot per inch) and ASCII formats.

**Borehole Schedule**

Generally, we can meet your required schedule provided we have three weeks advance notice. Faster mobilizations are certainly possible, depending on availability. **GEOVision** personnel will not be available during company scheduled holidays.

Due to present backlog, our final report will be produced within 30 days after completion of field work.

**Surface Geophysics****2D P-wave Refraction Tomography Survey (SRT)**

A geophysical survey using P-wave seismic refraction is proposed. The seismograph used during this investigation will consist of two to four Geometrics Geode 24-channel seismograph(s) (up to 96 channels), or equivalent. The seismic energy sources may consist of an accelerated weight drop (AWD), various sledgehammers and an aluminum plate. Receivers will consist of 4.5 to 10Hz vertical geophones aligned in single spreads of 24 to 48 geophones. Geophones will be spaced at from 5 to 10 ft, for spread lengths of up to 950 feet with multiple shot points occupied per spread including forward and reverse end shots, off end shots, and multiple interior shots. Overlapping spreads may be required for lines of length greater than 235 feet. Geophone spacing and total line lengths may change due to field conditions or data requirements. Seismic data will be stored on the laptop's hard disk and backed up to external hard disk at the end of the field day. Relative elevations of each geophone location will be measured with an engineer's transit and rod or DGPS. Seismic

refraction data will be processed using seismic tomography techniques and/or the generalized reciprocal method (GRM).

Following the first day's acquisition, data will be evaluated to determine if shallow water is encountered, in which case the methodology will be switched to S-wave refraction.

### ***Multi-Channel Analysis of Surface Wave Method (MASW)***

We propose to use active multi-channel analysis of surface waves (MASW) and passive (array or refraction microtremor) during this investigation, as necessary. The active techniques will be able to image the S-wave velocity of the upper 40 to 50 ft using hammer and weight drop sources and the passive techniques should extend depth of investigation to at least 80 ft or greater, depending on the level of passive background energy and the length of the lines.

The seismographs used during this investigation will consist of one or two Geometrics Geode signal enhancement seismograph with 24 channels, or equivalent. The seismic energy sources will consist of sledgehammers, an accelerated weight drop, and an aluminum plate. Receivers will consist of 4.5-Hz vertical geophones. If needed, passive microtremor data will be acquired using up to 48 geophones aligned in a "L" shaped array, nested triangle array, or a linear array depending upon site conditions.

Seismic lines will consist of 24 to 48 geophones spaced 5 to 10 ft apart. A minimum of thirteen (13) shot points will be occupied per line for the MASW collection. MASW data will be analyzed using the software packages WinSASW developed at University of Texas, Austin, software by Geogiga, Inc. and Geometrics, Inc., as necessary.

### ***2D Electrical Resistivity Tomography Survey (ERT)***

Resistivity data will be acquired on single-spread lines using as many as 112 electrodes extending up to 600 ft in length. Exact line locations and lengths will be determined in the field based on geologic information, site constraints, infrastructure and access.

An AGI Super Sting 112-electrode system, or equivalent, will be used for acquisition. Number of electrodes and ideal electrode spacing to be determined based on line placement. Line length can be up to 666 ft using 112 electrodes spaced 6 feet apart. This maximum spacing will provide exploration depth in excess of 130 feet with some loss of near-surface resolution. In contrast, we can deploy a line 550 feet in length consisting of 112 electrodes spaced 5 ft apart which will provide greater near surface resolution but a reduced exploration depth, likely to 100 feet or so.

Multiple array types will be acquired along each line, e.g., dipole-dipole, strong gradient, Wenner and/or inverse Schlumberger. Relative elevations of select electrode locations will be measured with an engineer's transit and rod or total stations system. The ends of each line will be surveyed with a submeter GPS system to tie the survey to the State Plane Coordinate System. The Super Sting will be programmed with the appropriate acquisition parameters and will automatically record potential differences between specified pairs of electrodes as determined by array type. Resistivity data will be run through a two-dimensional least squares or finite element modeling algorithm in the program EarthImager, also by AGI, to generate resistivity sections of the subsurface directly beneath each line.

### **Surface Geophysics Report**

A report will be provided for the geophysical investigation and will include a site map showing the location of the geophysical lines and a discussion of methodology, field procedures, data analysis and results. The report will be reviewed and approved by a California Professional Geophysicist.

### **Surface Schedule**

Generally, we can schedule projects provided we have four weeks advance notice. Faster mobilizations are certainly possible, depending on availability. We expect this work to require up to 5 field days. Preliminary results can be made available within three weeks following field work.

### **Refraction Geophysics Fees**

We propose to complete the requested seismic refraction work using the following fee schedule.

| ITEM     | DESCRIPTION                                                                            | UNIT         | QTY      | UNIT RATE    | TOTAL FEE        |
|----------|----------------------------------------------------------------------------------------|--------------|----------|--------------|------------------|
| <b>1</b> | <b>Phases 1 and 2 Geophysical Survey – Mobilization and Demobilization (crew of 3)</b> | <b>LS</b>    | <b>2</b> | <b>\$900</b> | <b>\$1,800</b>   |
| <b>2</b> | <b>P-wave Refraction with MASW lines</b>                                               |              |          |              |                  |
| 2.1      | Days, including expenses, equip fees (crew of 3)                                       | Day          | 4        | 4,300        | 17,200           |
| 2.3      | Processing per P-wave spread                                                           | Spreads      | 6        | 600          | 3,600            |
| 2.4      | Processing for 1D MASW                                                                 | Spreads      | 6        | 750          | 4,500            |
| <b>3</b> | <b>Resistivity lines (est 3 sprds per day)</b>                                         |              |          |              |                  |
| 3.1      | Days, including expenses, equip fees (crew of 3)                                       | Day          | 4        | 4,300        | 17,200           |
| 3.2      | Processing resistivity                                                                 | Spreads      | 6        | 600          | 3,600            |
| <b>4</b> | <b>Reporting, per line</b>                                                             | <b>Lines</b> | <b>6</b> | <b>500</b>   | <b>3,000</b>     |
| <b>5</b> | <b>Standby / Training Fees</b>                                                         | <b>Hour</b>  |          | <b>500</b>   | <b>-</b>         |
|          | <b>TOTAL ESTIMATED COST</b>                                                            |              |          |              | <b>\$ 50,900</b> |

#### **NOTES:**

1. We have assumed standard topography (workable slopes) and no line clearing.
2. Data will not be acquired in locations deemed unsafe to do so.
3. You will provide access to all locations at the time of the measurements. Standby time will be charged for time waiting for access.
4. You will provide traffic control and lane closure if needed.
5. We may use high visibility marking paint to mark our lines on the ground. This paint should erode within 8 weeks of completing the survey. However, some traces may remain until the next rain.
6. We assume depth of investigation to be less than 100 feet. If greater depths of investigation are required, then a larger energy source must be mobilized, and additional accessible line length will be required.
7. We assume the number and location of the survey lines will not change significantly.

**Terms**

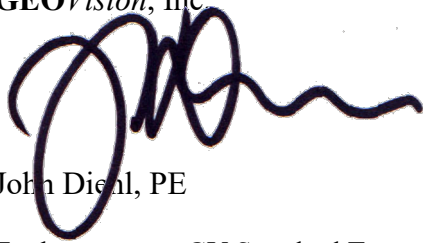
**GEOVision** requires a contract and written work authorization before mobilization. I have attached our standard terms. Please review, sign and return if acceptable.

We commit to using highly skilled personnel and state-of-the-art instrumentation for our work. However, it is the nature of geophysical measurements that some field conditions outside our control may result in poor quality data. Our work for this project will be done on a best effort basis.

Please call me at (951) 549-1234 if you have questions regarding this proposal or require additional information.

We look forward to working with you on this project.

Sincerely,  
**GEOVision, Inc.**

A handwritten signature in dark ink, appearing to read 'John Diehl', is written over the company name.

John Diehl, PE

Enclosures:   GV Standard Terms  
                  Technical Note – Seismic Refraction – Tomography  
                  Technical Note – Resistivity



# GREGG DRILLING, LLC.

Environmental, Geotechnical, and Marine Site Investigation Services  
2726 Walnut Ave., Signal Hill, CA 90755 Ph: (562)427-6899 Fax: (562)427-3314

Client: GEI Consultants Date: Thursday, March 10, 2022  
Contact: TODD CRAMPTON E-mail: [tcrampton@geiconsultants.com](mailto:tcrampton@geiconsultants.com)  
Phone: 510.350.2934 Cell: 510.759.9470  
Project: Santiago Creek Dam, Supplemental Investigation - Irvine, CA (IRWD) Proposal # 122-0235

**Scope:** Drill (5) borings in total with rotary & HQ3 coring: (2) Horizontal borings (-5deg) to ~100ft each inside spillway; [vertical borings] - (1) 75ft boring w/2" piezometer install & above grade monument w/packer testing & televiewer logging; (1) 115ft boring w/2" piezometer install & above grade monument w/packer testing & televiewer logging; & (1) 310ft boring w/packer testing & televiewer logging, backfill & patch surface to match

| Item | Description of Services                                             | Unit Cost    | Units | Est. Qty. | Total        |
|------|---------------------------------------------------------------------|--------------|-------|-----------|--------------|
| 1    | Mobilization / Demobilization -Spillway Rig, equipment and crew     | \$ 12,435.00 | Lump  | 1         | \$ 12,435.00 |
| 2    | Quality Control / Quality Assurance                                 | \$ 3,500.00  | Lump  | 1         | \$ 3,500.00  |
| 3    | 40 ton crane deposit/recover rig/equip/materials                    | \$ 4,250.00  | Day   | 3         | \$ 12,750.00 |
|      | Drilling Operations - Breakdown by location                         |              |       |           |              |
| 4    | S-15 (-5 Deg horizontal) ~100 ft                                    | \$ 34,965.00 | Each  | 1         | \$ 34,965.00 |
| 5    | S-16 (-5 Deg horizontal) ~100 ft                                    | \$ 34,965.00 | Each  | 1         | \$ 34,965.00 |
| 6    | Forklift and/or skid steer equipment                                | \$ 1,900.00  | Wk    | 2         | \$ 3,800.00  |
|      |                                                                     |              |       |           |              |
| 7    | S-17 vertical ~115ft w/ packer testing, televiewer & piezometer     | \$ 28,400.00 | Each  | 1         | \$ 28,400.00 |
| 8    | S-18 vertical ~75ft w/ piezometer                                   | \$ 19,045.00 | Each  | 1         | \$ 19,045.00 |
| 9    | S-19 vertical ~310ft w/ packer testing                              | \$ 71,810.00 | Each  | 1         | \$ 71,810.00 |
|      |                                                                     |              |       |           |              |
| 10   | IDW Analysis - VOCs via 8360, Title 22 metals & TPH Full Scan - STD | \$ 525.00    | Each  | 5         | \$ 2,625.00  |
| 11   | DOT drums, 55 gallon w/disposal of non-hazardous material           | \$ 300.00    | Each  | 44        | \$ 13,200.00 |
| 12   | Packer bladder replacement                                          | \$ 2,000.00  | Each  | 3         | \$ 6,000.00  |
|      |                                                                     |              |       |           |              |

**Estimated Total \$ 243,495.00**

## Assumptions:

- Work will be performed under OSHA 1910.120 "Level D" safety protection
- Daily Rate is based on Monday through Friday work days
- Site accessible for equipment, Site is secure-No security required
- All locations to be hand augered/cleared to 5ft below surface
- No third party billing
- Project is subject to California Prevailing wages
- Project is NOT subject to Davis-Bacon (DBA) or Service Contract Act (SCA) rates
- Project is NOT subject to any Project Labor Agreements (PLA)
- Gregg is a non-union specialty drilling contractor
- A \$5000.00 Cancellation fee will be charged for cancellations with 48-hrs of confirmed scheduled start

## Notes:

- Federal Projects - Gregg is a Small Disadvantaged Business (SDB)
- California Public Utilities Commission (CPUC) - Gregg is a Minority Business Enterprise (MBE)
- Gregg is an Alaska Native Corporation (ANC) owned business
- Gregg is also a Small Business for various local entities within the State of California

Gregg Drilling, LLC  
GEI Consultants  
Santiago Creek Dam, Supplemental Investigation - Irvine, CA

Thursday, March 10, 2022

The project will be billed at the unit rates presented in this proposal multiplied by the actual number of units required to complete the work. Client will be responsible for obtaining all permits and traffic control necessary to complete the work, providing access to the drill site, providing an on-site water source and for manifesting and disposal of all investigation derived waste. The above prices are valid for 60 days of date herein; after 60 days all proposals are subject to review/modification. A minimum callout will be charged for projects under and up to 5-hrs per day including travel + materials and sur-charges. A cancellation fee will be charged for cancellations within 48-hrs of confirmed start date, including delays due to weather or site access. Client will be charged repair or replacement cost for all equipment damaged or lost due to adverse site conditions. In the event of downhole tool loss (breakage of rods, samplers, instrumented tooling, etc.), client will be responsible for costs associated with recovery efforts.

**Utilities:**

Each client by the act of retaining Gregg Drilling to provide services described above, also accepts the responsibility for locating and marking all drilling locations and for contacting Underground Service Alert/DIG ALERT and opening a DIG ALERT TICKET a minimum of 3 and a maximum of 14 days prior to drilling. This number shall be submitted to Gregg Drilling in order for Gregg to obtain a ticket a minimum of 72 hours prior to work commencement. Gregg Drilling shall not be held liable for any damage to underground utilities.

**Payment Terms:**

The preceding costs represent our best estimate for the tasks as we understand them. Client will be invoiced following completion of the work; all bills are due and payable in full within 30 days of the date of the invoice. Invoices not paid within 30 days will be subject to a 1.5% per month finance charge. For clients with existing Master Service Agreements (MSA) payment terms will be in accordance with the MSA. Please note Gregg Drilling will not accept "Pay When Paid" payment terms. Please sign and e-mail back a copy of this proposal and the attached Work Agreement to indicate acceptance of the proposal and conditions. Please do not hesitate to call if you have any questions or need any additional information.

Gregg Drilling, LLC

GEI Consultants

Signature: \_\_\_\_\_

Gabriel Evans  
Project Manager

Name/Title: \_\_\_\_\_



# Proposal

## ADDRESS

CEG TODD CRAMPTON  
GEI Consultants  
180 Grand Avenue, Suite 1410  
Oakland, CA 94612

| PROPOSAL # | DATE       | EXPIRATION DATE |
|------------|------------|-----------------|
| 111823     | 03/16/2022 | 10/15/2023      |

## CONTACT

Todd Crampton

## PROJECT

Santiago Dam, Irvine - Spillwa

| DATE       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                            | HOURS | RATE | AMOUNT |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|--------|
| 03/16/2022 | <b>Services</b><br>Site Access,<br>Over growth/ Vegetation grubbing, brush clearing<br>Santiago Dam, Irvine-Spillway<br><br>Vegetation clearing: up to 1,000 lineal feet to create several 6- to 8-foot-wide paths.<br><br>Test pits: if accessible @2:1 slope or less 11 pits up to about 10-12 feet deep (or to top of bedrock). The pits will be 24" to 30" wide and 10-15 feet long and will utilize the paths created by the vegetation clearing. | 1     | 0.00 | 0.00   |
| 03/16/2022 | <b>Services</b><br>Innovative Service Group (ISG) appreciates the opportunity to provide you with a proposal for brush clearing at the subject site.<br>Based on the client provided information, ISG has developed the following scope of work and costing included in this response.                                                                                                                                                                 | 1     | 0.00 | 0.00   |
| 03/16/2022 | <b>Services</b><br>Preconstruction and Mobilization Activities:<br><br>ISG will provide project specific PPE, equipment safety,<br>site condition changes will be discussed daily. ISG will complete the following tasks:<br>• Conduct a site visit with the client to confirm and photo document current site conditions.<br>• Client will Make Underground Service Alert notifications 48-hours if necessary                                         | 0     |      | 0.00   |

| DATE       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HOURS | RATE     | AMOUNT    |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|-----------|
| 03/16/2022 | prior to mobilization.<br><b>Services</b><br>(Option A)<br>Excavator with thumb<br>ISG will complete the following tasks: 2 day<br>• Track and crush and a path to the location approx 1000' (estimated 2 day)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5     | 4,440.00 | 22,200.00 |
| 03/16/2022 | **1-Excavator @ 3 day @ \$385.00 per hr. operator included @ 8hr days not to exceed \$3,080.00<br><b>Services</b><br>(Option B)<br>LABOR<br>• Clear brush by hand tech/labor force (2 techs/1supervisor) approx not to exceed 48 man hrs @ \$155 p. hr. not to exceed \$7,440.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 48    | 155.00   | 7,440.00  |
| 03/16/2022 | <b>Services</b><br>SCHEDULE:<br>ISG can initiate pre-field activities within reasonable time upon acceptance of this proposal. ISG anticipated the work being completed as follows:<br>Preconstruction and Mobilization day 1<br>Mobilization 2 days plus<br>The supplied pricing is subject to the conditions, assumptions and exclusions listed herein.<br>- Due to terrain, dust control measures are excluded.<br>- Work hours of operation are between 7:00 AM to 5:00 PM five days a week. 8hr max and monitored by the engineer.<br>- Delays associated with the uncovering or encountering any unknown anomalies, underground utilities, piping, hardscape or foundation, inaccessible terrain that impede future scope will be addressed on a T&M bases. | 1     | 0.00     | 0.00      |
| 03/16/2022 | <b>Services</b><br>• Mobilize to the site with a tracked excavator up to a 30,000-pound excavator and personnel mobilization (2 events) @\$375.00 per event (2 events) @\$375.00 per event<br><br>total- \$1750.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2     | 875.00   | 1,750.00  |
| 03/16/2022 | <b>Services</b><br>• Mobilize to the site with labor, supervisor, crew truck (4 events) @\$375.00 per event<br><br>total- \$1500.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4     | 375.00   | 1,500.00  |

| DATE       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | HOURS | RATE | AMOUNT |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|--------|
| 03/16/2022 | <b>Services</b><br>Exclusions;<br>*digalert/underground service alert<br>*Any permitting<br>*Traffic control<br>*overtime beyond 8 hr day Monday thru Friday<br>*any work on Saturday or Sunday<br>*Additional time due to any anomalies or inaccessible terrain<br>*any license or permits , plan check, drawings, include being present for any city inspections.<br>*does not include any standby time for access or shutdowns beyond 8 hrs day, standby rate \$2500 day<br><br>**any components of proposal removed will deem proposal void | 1     | 0.00 | 0.00   |
| 03/16/2022 | <b>Services</b><br>***signed service agreement as follows, max 45 days commenced posted date invoice received net total +3% daily on past due invoicing***                                                                                                                                                                                                                                                                                                                                                                                      | 1     | 0.00 | 0.00   |
| 03/30/2022 | <b>Services</b><br>Subject to additional fuel surcharges beyond 30 days of this quote of 14% but not limited to.                                                                                                                                                                                                                                                                                                                                                                                                                                | 1     | 0.00 | 0.00   |

Santiago Dam Spillway

Irvine Ranch Water District

Orange County, CA

SUBTOTAL **\$32,890.00**

Allowance for field uncertainties and for delaying these services for approximately 18 months: **\$10,000.00**

TOTAL **\$42,890.00**

Accepted By

Accepted Date



## ABC Liovin Drilling, Inc.

1180 East Burnett Street, Signal Hill, CA 90755  
Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



CA SBE #22141

Quote # 43981

# FAX

Attn: Christopher Goetz

To: **AECOM Inc**

From Mario P Romero

Fax: 6 Pages Including This Page

Phone 714-567-2794

Date: Monday, March 7, 2022

Re: Quote - Santiago Creek Dam 1 Irvine Park Rd Orange, CA 92869

Dear Christopher,

Please review the attached quotation. If you have any questions please feel free to give me a call at (562) 981-8575. Please make sure to sign and date the bottom of every page and email or fax (562-981-9594) back to us. Our California SBE certification is included on the last page. I have also included some commonly requested license numbers below. Thank you for the opportunity to quote.

Mario P Romero

NAICS Code 237110

SIC Code 1781

CAGE (SAM.gov) Code 1MKD3

Dun Bradstreet (DUNS) # 113122436

C-57 CA Contractors License # 422904 (expires 9/30 of even numbered years)

C-23 NV Contractors License # 0081445 (expires 7/31 of even numbered years)

FEIN Federal Employer ID # 33-0498383

CA EIN California Employer ID # 427 4680 0

CA FTB Corporation # 1700939

CA DGS Small Business Enterprise SBE # 22141

CA DIR Public Works Contractor Registration # 1000002851

CA DMV Motor Carrier Permit (MCP) # 0102659

Riverside County Well Drillers Registration # PI0000009

San Bernardino County Well Drillers Registration # 145

City of Los Angeles Business License 0002117126-0001-3

City of San Diego Business License B2013050136

City of Oceanside Business License BL-1251621



ABC LIOVIN

## ABC Liovin Drilling, Inc.

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<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



CA SBE #22141

# QUOTE

Quote # 43981

### AECOM Inc

999 Town and Country Road  
Orange CA 92868

ATTENTION: Christopher Goetz

PHONE: 714-567-2794

PHONE 2

FAX

PAGER:

CELL: 949-374-4876

HOME PHONE:

FAX 2:

### JOB LOCATION:

Santiago Creek Dam  
1 Irvine Park Rd  
Orange CA 92869

### QUOTE DATE:

Monday, March 7, 2022

Revised:

| Qty: | Unit | Description or Item                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Unit Price: | TOTAL      |
|------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|
| 1    | Each | Mob/demob - Truck mounted sonic rig - per call out                                                                                                                                                                                                                                                                                                                                                                                                                   | \$2,000.00  | \$2,000.00 |
| 1    | Day  | Drill crew daily travel to and from the site                                                                                                                                                                                                                                                                                                                                                                                                                         | \$525.00    | \$525.00   |
| 2    | Days | Truck mounted sonic rig with 3 man crew<br>Daily Sonic rig setup, moving between holes, hand auger upper five feet, site clean up and decon. Sonic drill, continuously sample two borings, 1x125 and 1x60, borings will tag bedrock and then go an additional 10', backfill with neat cement and patch to match surface. Place drill cuttings into drums for transportation & disposal by client<br>*Cost includes drill rig and 3 man crew on site 8 hours or less* | \$4,500.00  | \$9,000.00 |
| 185  | Feet | Cement grout backfill                                                                                                                                                                                                                                                                                                                                                                                                                                                | \$8.00      | \$1,480.00 |
| 6    | Each | DOT drums for drill cuttings and decon                                                                                                                                                                                                                                                                                                                                                                                                                               | \$75.00     | \$450.00   |
| 48   | Hour | Prevailing wage surcharge - per man per hour.                                                                                                                                                                                                                                                                                                                                                                                                                        | \$60.00     | \$2,880.00 |
| ?    | Each | Forklift & hopper - delivery and pick up                                                                                                                                                                                                                                                                                                                                                                                                                             | \$350.00    | ?          |
| ?    | Day  | Forklift & hopper                                                                                                                                                                                                                                                                                                                                                                                                                                                    | \$300.00    | ?          |
| ?    | Lump | Portable restroom (If required)                                                                                                                                                                                                                                                                                                                                                                                                                                      | \$500.00    | ?          |
| ?    | Hour | Site security (16hrs per night no weekends)                                                                                                                                                                                                                                                                                                                                                                                                                          | \$38.00     | ?          |
| ?    | Hour | Premium time over 8 hrs on site - per man per hour                                                                                                                                                                                                                                                                                                                                                                                                                   | \$125.00    | ?          |
| ?    | Each | Cancellation fee                                                                                                                                                                                                                                                                                                                                                                                                                                                     | \$1,500.00  | ?          |
| ?    | Each | Damaged sonic bits due to hard drilling                                                                                                                                                                                                                                                                                                                                                                                                                              | \$350.00    | ?          |

Estimated total cost to complete this project:

\$16,335.00

Signature & Date of Acceptance

Estimated total time required to complete this project:

2- Days



ABC LIOVIN

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<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



CA SBE #22141

QUOTE

Quote # 43981

Thank you for the opportunity to quote. We look forward to working with you on this project. Please note that prices reflect the footage quoted. If for any reason the actual total footage drilled is less than the quantity originally quoted, then prices may change to reflect the decreased footage. If you have any questions concerning this quotation, please feel free to call.  
Sincerely,

Mario P Romero

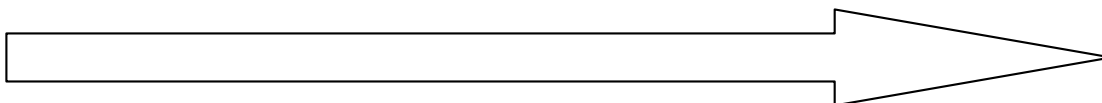
### Assumptions

- 1) Only 8 hours or less will be spent on site - cost provided for time over 8 if required
- 2) All drilling locations are at least 20 feet away from above ground utility lines
- 3) All borings and/or wells will be drilled off city streets therefore no traffic control will be required.
- 4) Drill site area is subject to hard drilling conditions and potential for refusal with Sonic core drilling
- 5) ABC will provide a Forklift/Hopper for moving well materials and spoils during drilling. - Upon request
- 6) There is a \$1500.00 cancellation fee for projects cancelled less than 48 hours from scheduled start time.
- 7) ABC is not responsible for damaging or repairing any sidewalk panels, sprinkler lines, grass, etc. while gaining access to and from drilling locations
- 8) Site security cost provided - Can provide upon request
- 9) Client will provide water for drilling/grouting operations when necessary for the duration of the project.
- 10) Client will survey and mark locations, call dig alert and add ABC Drilling to the Dig Alert Ticket at least 72 hours prior to start of field work
- 11) All changes to original scope will be subject to additional project costs
- 12) Site access for large truck mounted equipment - supplied by client
- 13) Equipment and material staging area supplied by client
- 14) Prevailing wages are included in the estimated project total.
- 15) Bit damage/replacement to be charged as shown on quote
- 16) Orange County well permits - supplied by client
- 17) Transportation and disposal of all drill cuttings and fluids - supplied by client
- 18) Proposal subject to rig and crew availability

I understand and agree to all of the above assumptions as well as the dollar amounts on the preceding page:

Signature and Date

**Please also read and sign the Terms and Conditions on the following page**





ABC LIOVIN

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QUOTE

Quote # 43981

### Terms And Conditions

- 1) There is no retainage.
- 2) The quoted prices are good for 30 days from the original quote date. The prices are no longer valid after 30 days. If the project is to start 30 days after the original quote then a new quote needs to be done.
- 3) If at anytime ABC Liovin Drilling is mobilized to a drill site, and for any reason, condition, or circumstance, we are at the job site for less than four hours there will be a four hour minimum charge portal to portal.
- 4) Standby time and refusal are billable items.
- 5) Your firm is responsible for damaged equipment due to adverse drilling conditions if the operator advises to stop due to encountering these conditions and is told to continue.
- 6) Before any job can be scheduled, this form must be signed and faxed back to ABC Liovin Drilling.
- 7) ABC Liovin Drilling's Terms are net 30 days with weekly invoicing, unless otherwise agreed to in advance in writing. Any Balances that are past due and will become subject to a finance Charge of up to 24.0% Per annum. If it becomes necessary to instigate collection proceedings, client will be responsible for all Collection costs, this may include attorney fees, court costs, process servers, or any other person or company ABC Liovin deems necessary to employ or contract in its efforts to collect. And secure payment. For all intents and purposes this will be considered a legal and binding contract between ABC Liovin Drilling and the company listed on the title page. It is also considered that this agreement was executed in the city of Signal Hill, State of California.
- 8) If bedrock, cobbles, flowing sands, or other adverse drilling conditions are encountered, drilling will be continued on a time and materials basis, or terminated at the discretion of ABC LIOVIN DRILLING.
- 9) Your firm is responsible for:
  - a) Obtaining any well or site specific permits
  - b) Locating and clearly marking any underground installations or utilities.
  - c) Obtaining access to the site for a normal truck mounted drill rig with no overhead wires within 20 Ft. of the holes. ABC LIOVIN DRILLING SHALL NOT BE RESPONSIBLE for any damages to underground improvements not clearly and accurately marked.
  - d) Your firm is responsible for providing a source of water on site.

Please indicate your acceptance of this quotation

\_\_\_\_\_  
*Signature and Date*

\_\_\_\_\_  
*Printed Name and Title of person signing above*

This project is to be scheduled for

\_\_\_\_\_  
*Date and Time*

Please Fax back prior to job start date so that the job can be scheduled.



ABC LIOVIN

**ABC Liovin Drilling, Inc.**

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Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



QUOTE

Quote # 43981

---

WAIVER OF HAND AUGERING/ AIR KNIFING REQUIREMENTS

It is ABC Liovin Drilling, Inc's policy to clear borings using either hand augers or air knifing to a depth of at least 5 feet below ground surface (bgs) prior to advancing the borings. By signing this document, Client specifically waives this requirement.

In addition, Client expressly agrees that, in the event any underground utilities or other structures, materials or items are encountered from 0 to 5 feet bgs, Client assumes all responsibility for any damage to such utilities, structures, materials or items.

Client further agrees to indemnify and save harmless ABC Liovin Drilling, Inc from any and all costs, expenses, damages, charges, claims, demands or liabilities whatsoever, arising from any damage to underground utilities, structure, materials or items occurring between 0 to 5 feet.

By signing this document, Client Representative warrants and represents that he or she has express authority to bind Client to this document.

Client: \_\_\_\_\_

Client Representative: \_\_\_\_\_

Project Location: \_\_\_\_\_

Project Dates: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_



ABC LIOVIN

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QUOTE

Quote # 43981

CA SBE #22141

12/28/21, 7:11 PM

Supplier Profile

Printed on: 12/28/2021 7:11:25 PM

To verify most current certification status go to: <https://www.caleprocure.ca.gov>



### Office of Small Business & DVBE Services

Certification ID: 22141

Legal Business Name:

ABC LIOVIN DRILLING INC

Doing Business As (DBA) Name 1:

Doing Business As (DBA) Name 2:

Address:

1180 EAST BURNETT ST  
 SIGNAL HILL  
 CA 90755

Email Address:

[eric@abcdrilling.com](mailto:eric@abcdrilling.com)

Business Web Page:

<http://www.abcdrilling.com>

Business Phone Number:

562/981-8575

Business Fax Number:

562/981-9594

Business Types:

Construction

| Certification Type | Status   | From       | To         |
|--------------------|----------|------------|------------|
| SB                 | Approved | 12/10/2021 | 12/31/2023 |

Stay informed! KEEP YOUR CERTIFICATION PROFILE UPDATED!

-LOG IN at [CaleProcure.CA.GOV](https://www.caleprocure.ca.gov)

Questions?

Email: [OSDSHELP@DGS.CA.GOV](mailto:OSDSHELP@DGS.CA.GOV)

Call OSDS Main Number: 916-375-4940

707 3rd Street, 1-400, West Sacramento, CA 95605

<https://caleprocure.ca.gov/pages/SupplierProfile/supplier-profile-print.html>

1/1

Monday, March 7, 2022 12:19 PM

Page 6 of 6

AECOM Inc: Santiago Creek Dam 1 Irvine Park Rd Orange, CA 92869

A - 45

**Leiva, Julie**

---

**From:** John Diehl <jdiehl@geovision.com>  
**Sent:** Tuesday, March 29, 2022 6:04 PM  
**To:** Leiva, Julie  
**Cc:** Glenn Goss; Emily Feldman  
**Subject:** [EXTERNAL] P22-0217 IRVINE LAKE PS SUSPENSION  
**Attachments:** Logging time in the hole.xls; App Note - P-S method.pdf; P-S Log Un-cased Borehole Preparation.pdf; GV STD TERMS 2018.pdf



March 29, 2022

Julie Leiva  
AECOM  
Staff Geologist, Geotechnical Group, Water  
M +1-925-753-1538  
[Julie.Leiva@aecom.com](mailto:Julie.Leiva@aecom.com)

## **PROPOSAL FOR BOREHOLE VELOCITY LOGGING**

### **Santiago Creek Dam, Irvine Lake, Irvine, CA**

Dear Ms. Leiva:

Following is our proposal P22-0217 for Borehole Suspension Velocity logging in seven (7) borings for your project at Irvine Lake in Irvine, CA. Following are the tasks outlined in your request:

Task A – Borings on R Abutment  
2 borings to 60 ft and 125 ft, respectively

Task B – Borings on Dam Embankment  
5 borings to 150 ft each

We will require a written Contract before mobilizing.

### ***P-S Suspension Logging***

GEOVision geophysical logging is performed with equipment that is NIST traceable, using Quality Assurance procedures approved by EPA, NRC, and the DOE. Velocity data will be collected at 1/2m intervals. At each measurement depth the digitally recorded data is checked, and recorded on digital media before moving to the next depth. Following completion of field work, the recorded digital records are processed by computer and interactively analyzed by an experienced geophysicist to produce plots and tables of P and S<sub>H</sub> wave velocity versus depth. Standard analysis is performed on receiver 1 to receiver 2 data, with separate analysis performed on source to receiver data as a quality assurance procedure. Data is presented in report format, with ASCII data files and digital records transmitted by email.

GEOVision will use our own procedure P-S Suspension Procedure V1.5. A detailed reference for the velocity measurement techniques used is:

Guidelines for Determining Design Basis Ground Motions, Report TR-102293, Electric Power Research Institute, Palo Alto, California, November 1993, Volume 1, Sections 7 and 8.

NOTE: A “rathole” of 15 ft is required to obtain data to the full depth desired. This is due to the construction of the OYO P-S suspension tool (see enclosed).

Here is a link to the manufacturer’s description of this tool:

<https://www.robertson-geo.com/wp-content/themes/robertson/downloadfiles/usermanual/1601899379.pdf>

### ***P-S Logging Environmental Conditions***

The OYO P-S Suspension Logging Method can be used in either cased or uncased boreholes. For best results, the borehole must be between 100 and 200 mm in diameter, or 4 to 8 inches. Uncased boreholes are preferred because the effects of the casing and grouting are removed. It is recommended that the borehole be drilled using the rotary mud method. This method does little damage to the borehole wall, and the drilling fluid (usually a bentonite mix) coats and seals the borehole wall reducing fluid loss and wall collapse. The borehole fluid is required for the logging, and must be well circulated prior to logging. If the borehole must be cased, the casing must be PVC and properly installed and grouted. The best method is using a tremie tube to pump grout from the bottom. Any voids in the grout will cause problems with the data. Likewise, large grout bulbs used to fill cavities will also cause problems. The grout must be set before testing. This means the grouting must take place at least 36 hours before testing. We have had good success specifying the ASTM Standard D4428/D4428M-91 Section 4.1 for borehole preparation (see ASTM website for copy). Everything must be followed. For example, if you think you would like to use some auger-type drilling method, consider how much damage this does to the borehole wall.

### ***Site Activities***

Here is a brief description of our activities at the site to you can plan.

1. We like to show up onsite a couple of hours ahead of when you expect to trip out after TD-ing the hole. If you completed the night before, we’ll ask the driller to trip back in to clean and circulate. It’s a little nerve-racking to drop a \$50,000 instrument into a hole that’s been sitting open for more than a few hours.
2. We will unpack and assemble our equipment and thoroughly test it while we’re waiting for you to finish.
3. When all the rods are out of the hole we’ll hand you our sheave with the logging cable already run. We’ll ask you to lift this sheave to the top of the drilling mast so we can log from your rig.
4. We’ll hoist the probe into vertical position and do some final checks
5. We’ll then lower the probe into position to log the first measurement. We will acquire usually starting from the surface or the bottom of the surface casing. We like to consult the drilling log before we start, to see if there are any sections we should be aware of.
6. We continue collecting data until we reach the bottom of the borehole. Attached is a “logging time in the hole” spreadsheet where you can calculate the total logging time.
7. Once we complete the logging, our probe is out of the hole, and we have verified the data, we’ll ask you to drop the sheave back to the ground. We’ll pack up and leave.

### ***Logging Fees***

We propose to complete the required borehole geophysical logging for this borehole for the following fee schedule.

#### **TASK A - R ABUTMENT**

| ITEM         | DESCRIPTION                                         | QTY | UNIT COST | EXT COST          |
|--------------|-----------------------------------------------------|-----|-----------|-------------------|
| 1            | Mobilization (one Geophysicist)                     | 2   | 750.00    | 1,500.00          |
| 2            | Borehole PS Suspension Logging                      |     |           |                   |
| 2.1          | Each borehole, first 100 ft (1)                     | 2   | 2700.00   | 5,400.00          |
| 2.2          | Additional footage                                  | 25  | 7.00      | 175.00            |
| 4            | Report, \$500 per borehole, min \$1000              | 1   | 1000.00   | 1,000.00          |
| 5            | Standby fees per hour for training, safety meetings |     | 235.00    |                   |
| <b>TOTAL</b> |                                                     |     |           | <b>\$8,075.00</b> |

## TASK B - EMBANKMENT

| ITEM         | DESCRIPTION                                         | QTY | UNIT<br>COST | EXT<br>COST        |
|--------------|-----------------------------------------------------|-----|--------------|--------------------|
| 1            | Mobilization (one Geophysicist)                     | 5   | 750.00       | 3,750.00           |
| 2            | Borehole PS Suspension Logging                      |     |              |                    |
| 2.1          | Each borehole, first 100 ft (1)                     | 5   | 2700.00      | 13,500.00          |
| 2.2          | Additional footage                                  | 250 | 7.00         | 1,750.00           |
| 4            | Report, \$500 per borehole, min \$1000              | 5   | 400.00       | 2,000.00           |
| 5            | Standby fees per hour for training, safety meetings |     | 235.00       |                    |
| <b>TOTAL</b> |                                                     |     |              | <b>\$21,000.00</b> |

### NOTES:

1. Each borehole entry on a separate day is charged as a "first 100ft" log, even if it's the same borehole (unless its due to our delay or equipment). Multiple efforts on the same day are one entry. The most common reason to return to the same borehole on a subsequent day is because the borehole was obstructed.
2. The unit rates for logging include processing, as well as all expenses including per diem.
3. You can adjust the quantities, such as anticipated depth, to see the new fees.
4. GEOVision reserves the right to NOT log a borehole if conditions indicate that there is a strong possibility that we will lose a logging tool. This is rare, but it can happen. An example is, if there has been significant and continuing collapse in the borehole and attendant loss of circulation. Then the drill string gets stuck, etc. etc. This is why the method of drilling is so important. We strongly recommend rotary mud.

### Report

A report will be provided describing the project, the methodology, the procedures and the results, including tables and charts of the velocity profiles obtained from the borehole data. You will receive data for both Receiver-to-Receiver (R1-R2) and Source-to-Receiver (S-R1). You will also receive this data in Microsoft Excel format, including our new Layer Modeling template which will allow you to develop your own layer model using the suspension data.

Provided each boring is logged to sufficient depth, you will also receive a spreadsheet that calculates V30 using the NEHRP method. Why do we interpolate to 1m increments? The PS logger measures directly the travel time over a 1 meter interval. So, the overlapped measurements (at nominal 0.5m intervals for your data) are overlapping travel times. It is not explicitly correct to use these as representing individual 0.5m interval velocities.

### Schedule

Generally, we can meet your required schedule provided we have two weeks advance notice. Faster mobilizations are certainly possible, depending on availability. However, we will need a written contract and authorization to proceed prior to mobilization. GEOVision personnel will not be available during company scheduled holidays.

Preliminary results can be made available within two weeks following field work. However, due to present backlog, our final report will be produced within 30 days after completion of field work.

### Terms

GEOVision requires a Work Authorization to proceed before mobilization. We already have a Master Service Agreement.

We commit to using highly skilled personnel and state-of-the-art instrumentation for our work. However, it is the nature of geophysical measurements that some field conditions outside our control may result in poor quality data. Our work for this project will be done on a best effort basis.

Please feel free call me if you have any questions.

Yours very truly,  
GEOVision Geophysical Services

John Diehl

GEOVision Inc.

1124 Olympic Drive  
Corona, CA 92881-3390  
(951) 549-1234  
<http://www.geovision.com/>

Reference: P22-0217

Attached:      Application Note – PS Suspension Logging  
                 Specification for Borehole Preparation  
                 Calculator for Logging Time

# SUSPENSION P-S VELOCITY LOGGING METHOD



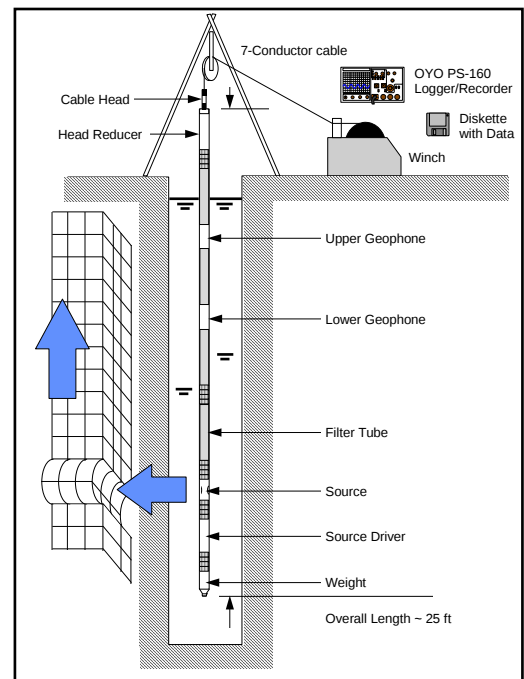
## Overview

Suspension P-S velocity logging is a relatively new method of measuring seismic wave velocity profiles. Developed in the mid-1970s to answer the need for a technique that could measure seismic shear-wave velocities in deep, uncased boreholes, it was originally used by researchers at the OYO Corporation of Japan. The method gained acceptance in Japan in the mid-1980s and was used with other velocity measurement methods to characterize earthquake site response. Since the early 1990s it has gained acceptance in the U.S., especially among earthquake engineering researchers. **GEOVision** personnel have logged over 1500 boreholes using this technique since 1991.

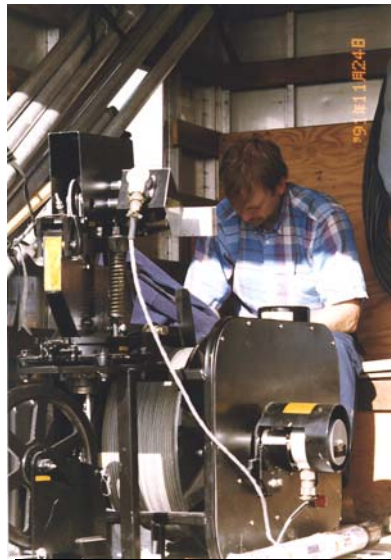
## Procedure

The OYO P-S Logging System uses a 7-meter probe, containing a source and two receivers spaced 1 meter apart, suspended by a cable. The armored 4- or 7-conductor cable serves both to support the probe and to convey data to and from a recording/control device on the surface. The probe is lowered into the borehole to a specified depth (a rotary encoder on the winch measures probe depth), where the source generates a pressure wave in the borehole fluid. The pressure wave is converted to seismic waves (P and S) at the borehole wall. Along the wall at each receiver location, the P and S waves are converted back to pressure waves in the fluid and received by the geophones, which send the data to the recorder on the surface.

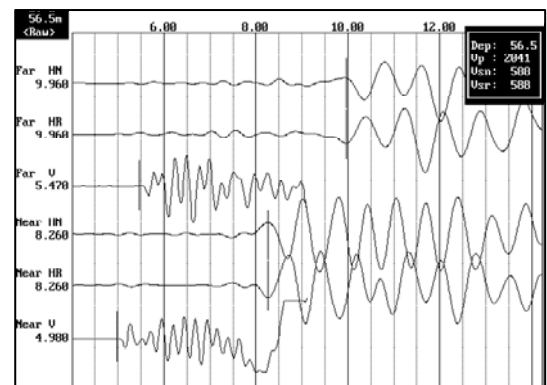
The elapsed time between arrivals of the waves at the receivers is used to determine the average velocity of a 1-meter-high column of soil around the borehole. Source to receiver analysis is also performed for quality assurance.



**Oyo PS Suspension Logger Setup**



**Oyo PS Suspension Logging System**



**Waveform Data for a Single Measurement**

## Applications

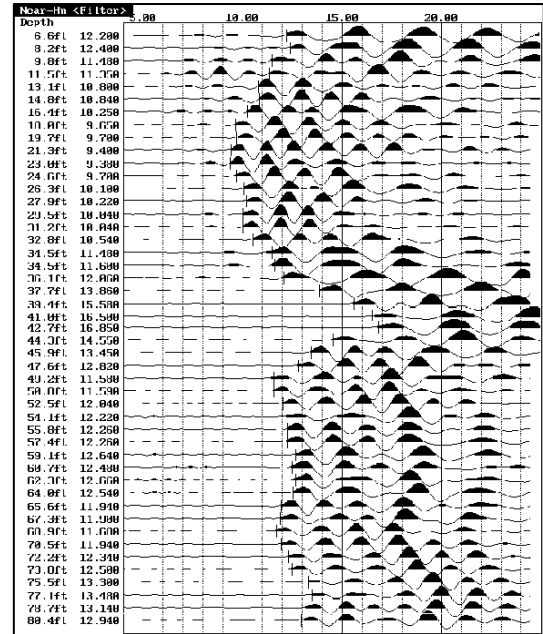
Typical applications of suspension P- and S-wave velocity logging include:

- Dam safety investigations
- Seismic site response studies for bridge abutments, dams, buildings, etc.
- Foundation studies
- Measurement of soil/rock properties (i.e. shear modulus, bulk modulus, compressibility, and Poisson's ratio)
- Characterization of strong motion sites
- Velocity control for seismic reflection surveys

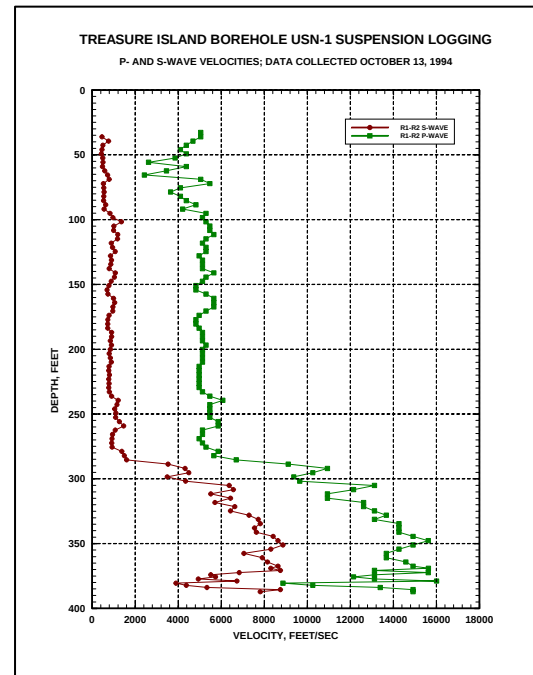
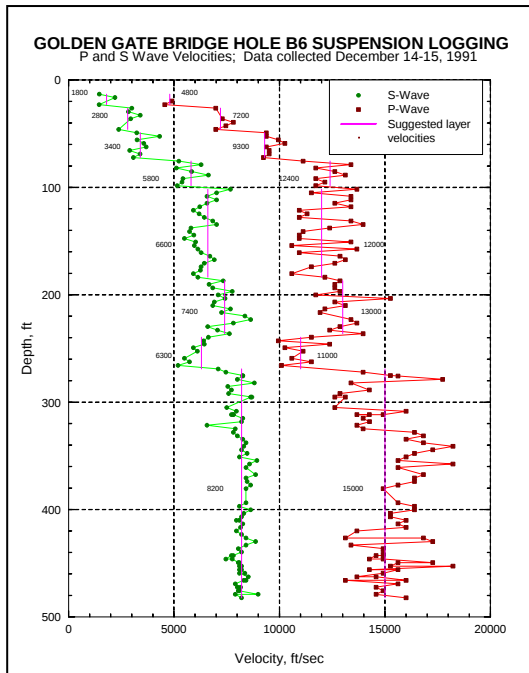
## Key Benefits

Suspension P- and S-wave velocity profiling using the OYO Suspension Logger has become the method of choice for obtaining high resolution borehole velocity measurements. The reasons are many:

- Only method that obtains both P- and S-wave velocity data reliably in a single hole at depths greater than 200 ft.
- Can be used in either uncased or cased (PVC) boreholes, although results are always better in uncased holes.
- Can be used in boreholes drilled from barges.
- Offers very high resolution (typically 1 meter) for resolving thin layers that can have a dramatic effect on surface response.
- Requires only 1 hole, as opposed to crosshole methods that require at least 2.
- Has been used to depths of 2,000 ft.



**Depth Sequential Waveform Arrivals**



- Specifically adapted to soils, whereas tools developed for oil exploration are optimized for rock.
- Permits measurement of soil and rock properties such as shear modulus, bulk modulus, compressibility, and Poisson's ratio.
- Not hindered by fast layers and lack of depth penetration like surface methods such as downhole.

## **SPECIFICATIONS FOR DRILLING UNCASSED BOREHOLES FOR P-S SUSPENSION LOGGING**

1. The OYO P-S Suspension Logging Method can be used in either cased or uncased boreholes. Uncased boreholes are preferred because the effects of the casing and grouting are removed. For best results, the borehole must be between 10 and 20 cm in diameter, or 4 to 8 inches.
2. It is recommended that the borehole be drilled using the rotary mud method. Drilling must be done with minimal sidewall disturbance. If you think you would like to use some auger-type drilling method, consider how much damage this does to the borehole wall. The rotary mud (also called rotary wash) method does little damage to the borehole wall, and the drilling fluid (usually a bentonite mix) coats and seals the borehole wall reducing fluid loss and wall collapse. The borehole fluid is required for the logging, and must be well circulated prior to logging.
3. NOTE: A "rathole" of 15 ft is required to obtain data to the full depth desired. This is due to the construction of the OYO P-S suspension tool (see enclosed).
4. GEOVision reserves the right to NOT log a borehole if conditions indicate that there is a strong possibility that we will lose the P-S Suspension logging tool. This is rare, but it can happen. An example is, if there has been significant and continuing collapse in the borehole and attendant loss of circulation. Then the drill string gets stuck, etc. etc. This is why the method of drilling is so important. We strongly recommend rotary mud.

## ABC Liovin Drilling, Inc.

1180 East Burnett Street, Signal Hill, CA 90755  
Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



Quote # 44194

CA SBE #22141

# FAX

Attn: Julie Leiva

To: **AECOM Inc**

From Rick Hastings

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Fax: 7 Pages Including This Page

Phone 714-567-2794

Date: Tuesday, March 29, 2022

---

Re: Revised Quote - Santiago Creek Dam TASK 2 1 Irvine Park Road Orange, CA 92869

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Dear Julie,

Please review the attached quotation. If you have any questions please feel free to give me a call at (562) 981-8575. Please make sure to sign and date the bottom of every page and email or fax (562-981-9594) back to us. Our California SBE certification is included on the last page. I have also included some commonly requested license numbers below. Thank you for the opportunity to quote.

Rick Hastings

NAICS Code 237110

SIC Code 1781

CAGE (SAM.gov) Code 1MKD3

Dun Bradstreet (DUNS) # 113122436

C-57 CA Contractors License # 422904 (expires 9/30 of even numbered years)

C-23 NV Contractors License # 0081445 (expires 7/31 of even numbered years)

FEIN Federal Employer ID # 33-0498383

CA EIN California Employer ID # 427 4680 0

CA FTB Corporation # 1700939

CA DGS Small Business Enterprise SBE # 22141

CA DIR Public Works Contractor Registration # 1000002851

CA DMV Motor Carrier Permit (MCP) # 0102659

Riverside County Well Drillers Registration # PI0000009

San Bernardino County Well Drillers Registration # 145

City of Los Angeles Business License 0002117126-0001-3

City of San Diego Business License B2013050136

City of Oceanside Business License BL-1251621

# ABC Liovin Drilling, Inc.

1180 East Burnett Street, Signal Hill, CA 90755  
Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



## QUOTE

Quote # 44194

CA SBE #22141

**AECOM Inc**  
999 Town and Country Road  
Orange CA 92868

ATTENTION: Julie Leiva  
PHONE: 714-567-2794  
PHONE 2  
FAX  
PAGER:  
CELL: 925-753-1538  
HOME PHONE:  
FAX 2:

### JOB LOCATION:

Santiago Creek Dam TASK 2  
1 Irvine Park Road  
Orange CA 92869

### QUOTE DATE:

Tuesday, March 29, 2022

### Revised:

Tuesday, March 29, 2022

| Qty: | Unit | Description or Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Unit Price: | TOTAL       |
|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| 2    | Each | PW-Mob/Demob Rig, Tools, Material and Crew * Qty assumes (1) "Full Size Rig/Mud Rotary Capable Rig and (1) "Limited Access Rig mobilization                                                                                                                                                                                                                                                                                                                                                                                                                                                   | \$700.00    | \$1,400.00  |
| 14   | Each | (AUTO HAMMER EQUIPPED CME-85/MUD ROTARY OR LIMITED ACCESS AUGER RIG SERVICE)<br>Drill, Sample and Backfill (5) 150 foot "crest" and (4) 85 foot "bench" Geo-Tech soil borings. The borings will be backfilled with a 5% Bentonite/Portland cement grout and be finished at the surface with a color matched concrete patch as needed * Cost includes Rig, Tools and 2 Man Crew onsite 8 hours or less on Prevailing Wage<br><br>note: Quantity assumes (10) days with a "Mud Rotary" capable rig at the crest locations and (4) days with the Limited Access Rig at the (4) "bench" locations | \$4,300.00  | \$60,200.00 |
| 10   | Day  | Mud Rotary Surcharge                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | \$1,500.00  | \$15,000.00 |
| ?    | Each | Geo-Tech Sample Rings (2.5" x 1.0")+Canister                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | \$28.00     | ?           |
| 1090 | Foot | 5% Bentonite/Portland cement grout backfill                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | \$7.00      | \$7,630.00  |
| 9    | Each | Color matched concrete patch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | \$40.00     | \$360.00    |
| 14   | Day  | Support Truck and Decon Trailer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | \$300.00    | \$4,200.00  |
| 1    | Each | Mobilization/Demobilization of Forklift                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | \$350.00    | \$350.00    |
| 14   | Day  | Forklift & Hopper Rental<br>* Pricing based on minimum (10) day rental                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | \$300.00    | \$4,200.00  |
| 75   | Each | 55 Gallon Drums<br>* Estimate assumes roughly (70) soil and (5) decon drums will be used in this effort                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | \$75.00     | \$5,625.00  |
| ?    | Each | Roll of Visquine to protect surface under equipment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | \$150.00    | ?           |
| 14   | Day  | Per Diem (2 man crew)<br>* For out of town work and to maintain DOT compliance as needed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | \$350.00    | \$4,900.00  |
| ?    | Week | Portable Restroom Rental                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | \$500.00    | ?           |
| ?    | Hour | PW-Standby Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | \$550.00    | ?           |

Tuesday, March 29, 2022 11:52 AM (Revised Quote)

Page 2 of 7

AECOM Inc: Santiago Creek Dam TASK 2 1 Irvine Park Road Orange, CA 92869

## ABC Liovin Drilling, Inc.

1180 East Burnett Street, Signal Hill, CA 90755  
Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



## QUOTE

Quote # 44194

|   |       |                                                                                                                                                                                                                                                                                           |            |        |
|---|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|
| ? | Hour  | PW-Per Man Overtime Rate after 8 hours on-site                                                                                                                                                                                                                                            | \$200.00   | ?      |
| ? | Each  | Cancellation fee                                                                                                                                                                                                                                                                          | \$1,500.00 | ?      |
| 1 | Cost+ | (PROJECT COST ESCALATOR) 30% projected cost increase for (1) year from time of bid + 30 days due to current worldwide fuel and market conditions. ABC Drilling reserves the right to re cost this project if estimated cost increase does not cover current costing at time of scheduling | \$0.00     | \$0.00 |

Estimated total cost to complete this project: \$103,865.00

Signature & Date of Acceptance

Estimated total time required to complete this project: 14-Days

**\$135,024.50 (including 30% potential escalation for 1-year delay)**

## ABC Liovin Drilling, Inc.

1180 East Burnett Street, Signal Hill, CA 90755  
Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



# QUOTE

Quote # 44194

Thank you for the opportunity to quote. We look forward to working with you on this project. Please note that prices reflect the footage quoted. If for any reason the actual total footage drilled is less than the quantity originally quoted, then prices may change to reflect the decreased footage. If you have any questions concerning this quotation, please feel free to call.  
Sincerely,

Rick Hastings

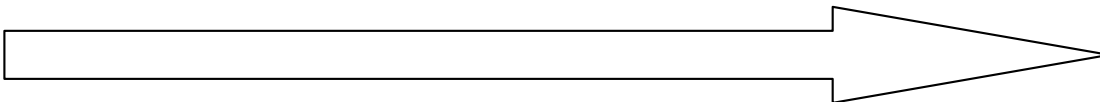
### Assumptions

- 1) This IS a prevailing wage job.
- 2) Traffic Control will be provided by client if required.
- 3) If refusal is encountered, the project may be continued on a time and material basis or at ABCs discretion.
- 4) If needed, Sampler Liners and Caps will be provided at an additional cost.
- 5) Client is responsible for site access.
- 6) Client will provide Porta Potty or restroom facilities. ABC can provide Portable Restrooms at an additional cost if need be.
- 7) Client will provide a Registered Geologist or Engineering Geologist during the drilling, if needed.
- 8) There is a \$1500.00 cancellation fee for projects cancelled less than 48 hours from scheduled start time.
- 9) Add an additional \$1500 per day per rig for drilling on the weekend or at night.
- 10) Water will be made available by Client
- 11) Soil cuttings will be spread onsite per clients direction.
- 12) All "Lump Sum Pricing" is for work described in the "CLIENT" provided RFQ any additional tasks or changes will be charged on a "T&M basis
- 13) All "Fixed Rate Pricing" (Each) is for work described in the "CLIENT" provided RFQ any additional tasks or changes will be charged on a T&M basis
- 14) Cost includes hand clearing top 5-6ft of boreholes
- 15) ABC can park equipment and stage all materials onsite during the duration of the project.
- 16) Client will survey and mark locations, call dig alert and add ABC to the Dig Alert Ticket at least 48 hours prior to ABC mobilizing onsite.
- 17) ABC is a non union drilling company. This bid does not include any additional union fees or costs necessary to enroll employees in the union. This would be done at an additional cost if needed.
- 18) Any site specific training will be billed at \$350 per hour if needed.
- 19) All changes to original scope will be subject to additional project costs
- 20) Borings will be backfilled with a 5% Bentonite/Portland Cement grout.
- 21) 48-hour cancellation fee applies

I understand and agree to all of the above assumptions as well as the dollar amounts on the preceding page:

\_\_\_\_\_  
Signature and Date

**Please also read and sign the Terms and Conditions on the following page**



## ABC Liovin Drilling, Inc.

1180 East Burnett Street, Signal Hill, CA 90755  
Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



# QUOTE

Quote # 44194

### Terms And Conditions

- 1) There is no retainage.
- 2) The quoted prices are good for 30 days from the original quote date. The prices are no longer valid after 30 days. If the project is to start 30 days after the original quote then a new quote needs to be done.
- 3) If at anytime ABC Liovin Drilling is mobilized to a drill site, and for any reason, condition, or circumstance, we are at the job site for less than four hours there will be a four hour minimum charge portal to portal.
- 4) Standby time and refusal are billable items.
- 5) Your firm is responsible for damaged equipment due to adverse drilling conditions if the operator advises to stop due to encountering these conditions and is told to continue.
- 6) Before any job can be scheduled, this form must be signed and faxed back to ABC Liovin Drilling.
- 7) ABC Liovin Drilling's Terms are net 30 days with weekly invoicing, unless otherwise agreed to in advance in writing. Any Balances that are past due and will become subject to a finance Charge of up to 24.0% Per annum. If it becomes necessary to instigate collection proceedings, client will be responsible for all Collection costs, this may include attorney fees, court costs, process servers, or any other person or company ABC Liovin deems necessary to employ or contract in its efforts to collect. And secure payment. For all intents and purposes this will be considered a legal and binding contract between ABC Liovin Drilling and the company listed on the title page. It is also considered that this agreement was executed in the city of Signal Hill, State of California.
- 8) If bedrock, cobbles, flowing sands, or other adverse drilling conditions are encountered, drilling will be continued on a time and materials basis, or terminated at the discretion of ABC LIOVIN DRILLING.
- 9) Your firm is responsible for:
  - a) Obtaining any well or site specific permits
  - b) Locating and clearly marking any underground installations or utilities.
  - c) Obtaining access to the site for a normal truck mounted drill rig with no overhead wires within 20 Ft. of the holes. ABC LIOVIN DRILLING SHALL NOT BE RESPONSIBLE for any damages to underground improvements not clearly and accurately marked.
  - d) Your firm is responsible for providing a source of water on site.

Please indicate your acceptance of this quotation

\_\_\_\_\_  
*Signature and Date*

\_\_\_\_\_  
*Printed Name and Title of person signing above*

This project is to be scheduled for

\_\_\_\_\_  
*Date and Time*

Please Fax back prior to job start date so that the job can be scheduled.

## ABC Liovin Drilling, Inc.

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Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



# QUOTE

Quote # 44194

---

### WAIVER OF HAND AUGERING/ AIR KNIFING REQUIREMENTS

It is ABC Liovin Drilling, Inc's policy to clear borings using either hand augers or air knifing to a depth of at least 5 feet below ground surface (bgs) prior to advancing the borings. By signing this document, Client specifically waives this requirement.

In addition, Client expressly agrees that, in the event any underground utilities or other structures, materials or items are encountered from 0 to 5 feet bgs, Client assumes all responsibility for any damage to such utilities, structures, materials or items.

Client further agrees to indemnify and save harmless ABC Liovin Drilling, Inc from any and all costs, expenses, damages, charges, claims, demands or liabilities whatsoever, arising from any damage to underground utilities, structure, materials or items occurring between 0 to 5 feet.

By signing this document, Client Representative warrants and represents that he or she has express authority to bind Client to this document.

Client: \_\_\_\_\_

Client Representative: \_\_\_\_\_

Project Location: \_\_\_\_\_

Project Dates: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## ABC Liovin Drilling, Inc.

1180 East Burnett Street, Signal Hill, CA 90755  
Phone: 562-981-8575 Fax: 562-981-9594  
<http://www.abcdrilling.com>  
California Contractor C-57 License No. 422904



# QUOTE

Quote # 44194

CA SBE #22141

12/28/21, 7:11 PM

Supplier Profile

Printed on: 12/28/2021 7:11:25 PM

To verify most current certification status go to: <https://www.caleprocure.ca.gov>



### Office of Small Business & DVBE Services

Certification ID: 22141

Legal Business Name:

ABC LIOVIN DRILLING INC

Doing Business As (DBA) Name 1:

Doing Business As (DBA) Name 2:

Address:

1180 EAST BURNETT ST  
SIGNAL HILL  
CA 90755

Email Address:

[eric@abcdrilling.com](mailto:eric@abcdrilling.com)

Business Web Page:

<http://www.abcdrilling.com>

Business Phone Number:

562/981-8575

Business Fax Number:

562/981-9594

Business Types:

Construction

| Certification Type | Status   | From       | To         |
|--------------------|----------|------------|------------|
| SB                 | Approved | 12/10/2021 | 12/31/2023 |

Stay informed! KEEP YOUR CERTIFICATION PROFILE UPDATED!

-LOG IN at [CaleProcure.CA.GOV](https://www.caleprocure.ca.gov)

Questions?

Email: [OSDSHELP@DGS.CA.GOV](mailto:OSDSHELP@DGS.CA.GOV)

Call OSDS Main Number: 916-375-4940

707 3rd Street, 1-400, West Sacramento, CA 95605

<https://caleprocure.ca.gov/pages/SupplierProfile/supplier-profile-print.html>

1/1

Tuesday, March 29, 2022 11:52 AM (Revised Quote)

Page 7 of 7

AECOM Inc: Santiago Creek Dam TASK 2 1 Irvine Park Road Orange, CA 92869



## GREGG DRILLING, LLC.

Environmental, Geotechnical, and Marine Site Investigation Services  
2726 Walnut Ave., Signal Hill, CA 90755 Ph: (562)427-6899 Fax: (562)427-3314

Client: AECOM Date: Tuesday, March 29, 2022  
Contact: Julie Leiva E-mail: [Julie.Leiva@aecom.com](mailto:Julie.Leiva@aecom.com)  
Phone: ### Cell: 925-753-1538  
Project: Irvine Ranch Water District Santiago Creek Dam - Silverado, CA Proposal # 122-0286

**Scope:** Using our spud barge drill (5) borings up to 90ft below mudline, with geotechnical sampling w/shelby tubes to bedrock and then upto 10ft into rock w/HQ3 coring, backfill with grout. Mean water level at 35ft or less.

| Item                                        | Description of Services                                    | Unit Cost    | Units | Est. Qty. | Total         |
|---------------------------------------------|------------------------------------------------------------|--------------|-------|-----------|---------------|
| 1                                           | Mobilize equipment, deploy barge, & rig w/ necessary labor | \$ 39,500.00 | Lump  | 1         | \$ 39,500.00  |
| 2                                           | Demobilize equipment, barge, & rig w/ necessary labor      | \$ 19,500.00 | Lump  | 1         | \$ 19,500.00  |
| Drilling Operations - Breakdown by location |                                                            |              |       |           |               |
| 3                                           | Overwater Borings ~90ft below mudline                      | \$ 28,950.00 | Each  | 5         | \$ 144,750.00 |
| 4                                           | Rate escalation surcharge (Jan 2023 and beyond)            | \$ 12,500.00 | Lump  | 1         | \$ 12,500.00  |

**Estimated Total** \$ 216,250.00

### Assumptions:

- Work will be performed under OSHA 1910.120 "Level D" safety protection
- Daily Rate is based on Monday through Friday work days
- Site accessible for equipment, Site is secure-No security required
- **We Estimate 12-14 days to mob, deploy, drill, demob and complete this project**
- Project is subject to California Prevailing wages
- Project is NOT subject to Davis-Bacon (DBA) or Service Contract Act (SCA) rates
- Project is NOT subject to any Project Labor Agreements (PLA)
- Gregg is a non-union specialty drilling contractor
- A \$5000.00 Cancellation fee will be charged for cancellations with 48-hrs of confirmed scheduled start

### Notes:

- Federal Projects - Gregg is a Small Disadvantaged Business (SDB)
- California Public Utilities Commission (CPUC) - Gregg is a Minority Business Enterprise (MBE)
- Gregg is an Alaska Native Corporation (ANC) owned business
- Gregg is also a Small Business for various local entities within the State of California

Gregg Drilling, LLC  
AECOM  
Irvine Ranch Water District Santiago Creek Dam - Silverado, CA

Tuesday, March 29, 2022

The project will be billed at the unit rates presented in this proposal multiplied by the actual number of units required to complete the work. Client will be responsible for obtaining all permits and traffic control necessary to complete the work, providing access to the drill site, providing an on-site water source and for manifesting and disposal of all investigation derived waste. The above prices are valid for 60 days of date herein; after 60 days all proposals are subject to review/modification. A minimum callout will be charged for projects under and up to 5-hrs per day including travel + materials and sur-charges. A cancellation fee will be charged for cancellations within 48-hrs of confirmed start date, including delays due to weather or site access. Client will be charged repair or replacement cost for all equipment damaged or lost due to adverse site conditions. In the event of downhole tool loss (breakage of rods, samplers, instrumented tooling, etc.), client will be responsible for costs associated with recovery efforts.

**Utilities:**

Each client by the act of retaining Gregg Drilling to provide services described above, also accepts the responsibility for locating and marking all drilling locations and for contacting Underground Service Alert/DIG ALERT and opening a DIG ALERT TICKET a minimum of 3 and a maximum of 14 days prior to drilling. This number shall be submitted to Gregg Drilling in order for Gregg to obtain a ticket a minimum of 72 hours prior to work commencement. Gregg Drilling shall not be held liable for any damage to underground utilities.

**Payment Terms:**

The preceding costs represent our best estimate for the tasks as we understand them. Client will be invoiced following completion of the work; all bills are due and payable in full within 30 days of the date of the invoice. Invoices not paid within 30 days will be subject to a 1.5% per month finance charge. For clients with existing Master Service Agreements (MSA) payment terms will be in accordance with the MSA. Please note Gregg Drilling will not accept "Pay When Paid" payment terms. Please sign and e-mail back a copy of this proposal and the attached Work Agreement to indicate acceptance of the proposal and conditions. Please do not hesitate to call if you have any questions or need any additional information.

Gregg Drilling, LLC

AECOM

Signature: \_\_\_\_\_

Gabriel Evans  
Project Manager

Name/Title: \_\_\_\_\_



March 30, 2022

AIS Proposal No. 4201425

Julie Leiva  
AECOM  
300 S Grand Avenue  
Los Angeles, CA. 90071

**RE: Transportation and disposal of drummed waste – Santiago Creek**

Dear Julie,

American Integrated Services, Inc. (AIS) appreciates the opportunity to provide AECOM with a proposal for disposal of drums. Based on the information provided in your email today, an estimate of costs is provided below.

AIS is a full-service, minority-owned environmental services company specializing in remediation, construction, emergency response, and specialized transportation services. Founded in 1998, AIS has become an industry leader in providing turn-key environmental services.

AIS has five office locations and equipment yards stationed strategically throughout California and a Gulf Coast office in Pasadena, Texas. Our staff of over 400 full-time employees includes a full spectrum of engineers, geologists, scientists, as well as experts in the fields of environmental construction, demolition, industrial cleaning, decontamination, and remediation. AIS employs a large field staff including hazardous waste certified drivers, construction and demolition specialists, emergency response personnel, confined space and rescue crews, heavy equipment operators and environmental technicians. Our in-house waste management specialists have extensive experience managing a variety of waste streams including both solid and liquid, non-hazardous, regulated wastes, RCRA hazardous land-banned/incinerator materials, and TSCA wastes.

AIS field personnel are trained in accordance with 29 CFR 1910.120. In addition, the majority of our staff are confined space trained and trench/excavation certified per OSHA requirements. Our staff also receives additional specialty training depending on our client's requirements.

AIS owns over \$30 million dollars in equipment and assets including excavators, loaders, dozers, backhoes, bob cats, shoring hammers and equipment, scissor lifts, gear trucks, multiple supervisor and support vehicles, hazardous certified transportation vehicles (vacuum trucks, roll-off trucks, bob-tails, ten wheelers, drum trucks, flat beds, end dumps) and over 450 hazardous

certified and specialized roll-off bins, emergency response trailers and emergency response vehicles.

Our highly trained and experienced staff, extensive list of in-house equipment, and service commitment make it possible for us to provide safe, high quality and cost-effective services.

Lastly, AIS also carries all required insurance for performing the complex and demanding services associated with the environmental industry. In addition to standard general liability of \$20,000,000, AIS also carries auto, workers compensation and contractor's pollution liability insurance. This specialized coverage ensures that both you our client and AIS are prepared for any unforeseen circumstances that may occur on your project.

#### **Scope of Work:**

Task B – Dam Embankment Drilling (U/S Slope, Dam Crest, D/S Slope)

- Stake bed transport – Assume up to 2 deliveries per upstream, crest, downstream – up to 6 deliveries
- Non-haz drum disposal – Assumed 85 drums
- Analytical testing – Assuming up to 2 tests per upstream, crest, downstream – up to 6 total

| Qty | Equipment                                        | U.O.M. | Rate     | Cost        |
|-----|--------------------------------------------------|--------|----------|-------------|
| 6   | Analytical                                       | Each   | \$770.00 | \$4,620.00  |
| 32  | Transport drums to disposal – 3 trips            | Hour   | \$140.00 | \$4,480.00  |
| 3   | Prevailing wage on site                          | Hour   | \$165.00 | \$495.00    |
| 85  | Disposal of Non-Hazardous drums                  | Each   | \$170.00 | \$14,450.00 |
|     | Total for this project based on quantities above | Total  |          | \$24,045.00 |

**Assumptions:**

- Prevailing wage rates included.
- Actual time and material will be charged.
- Disposal rate is based on non-hazardous results.
- Profiling, manifesting, and waste management is included in this bid.
- Non-Hazardous drum pricing is based on profile approval at Crosby & Overton, Inc.
- Pricing is valid until December 31, 2022.

**Terms and Conditions:**

This work will be performed in accordance with American Integrated Services, Inc. Client Service Agreement (attached).

- Should action be brought to collect any sums past due, prevailing party shall be entitled to recover court costs and reasonable attorney's fees.
- Jurisdiction and venue for legal action shall be in the state and county of: (a) where the agreement is signed; (b) where the materials, service, or equipment was purchased; or (c) as otherwise provided by law with the (Seller) having the right to choose among these jurisdictions and venues for any particular dispute.

AIS appreciates the opportunity to submit this proposal. For your convenience, this proposal is presented in a form that can be accepted as an agreement. To accept this proposal, please sign below and return a copy to me via email at [mborrego@americanintegrated.com](mailto:mborrego@americanintegrated.com). Should you have any questions or need additional information, please contact me directly at 310-864-2489.

Best Regards,  
**American Integrated Services, Inc.**

*Meriah Rangel*

Meriah Rangel  
Junior Project Manager

Please sign and date below and return via e-mail to my attention at  
[mhernandez@americanintegrated.com](mailto:mhernandez@americanintegrated.com)

Upon receipt of authorization to proceed we will schedule this work immediately.

Print Name: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_



  
Irvine Ranch  
Water District

## **SANTIAGO RESERVOIR IMPROVEMENTS PROJECT UPDATE AND VARIANCE NO. 2**

IRWD/SWD JOINT COMMITTEE  
APRIL 26, 2022

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### **AGENDA**

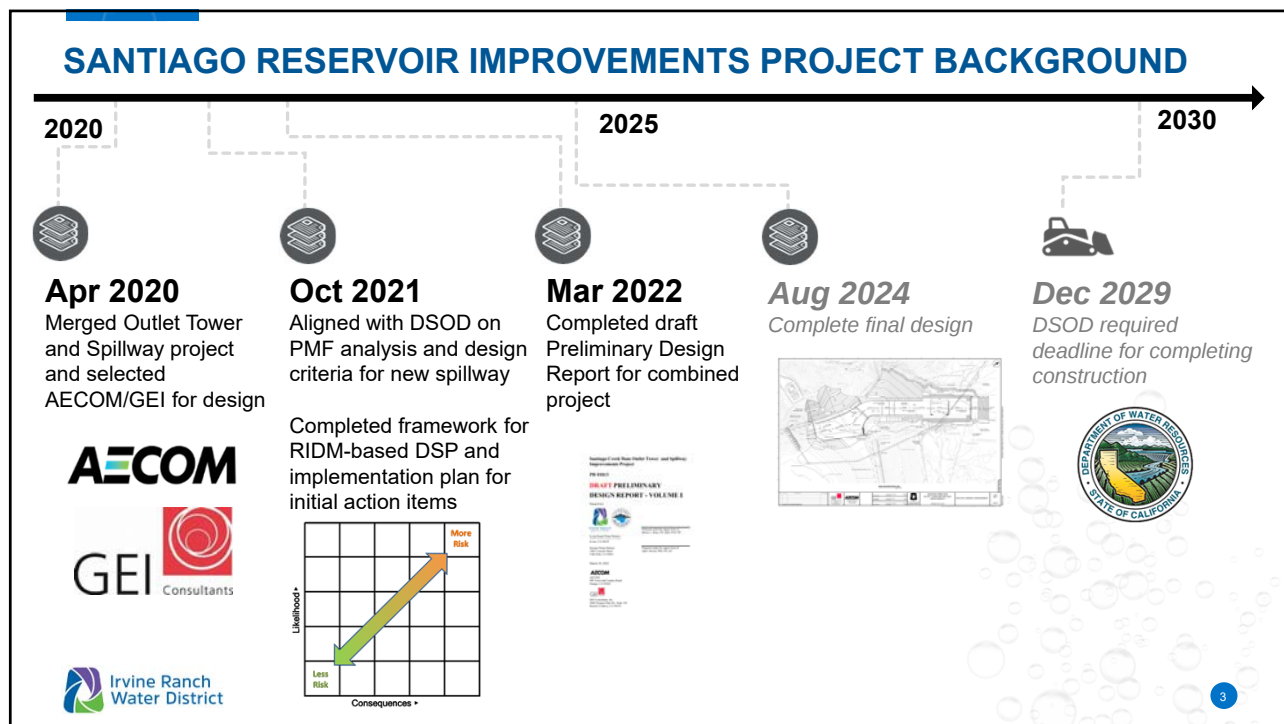
- Background
- Project Update
- Changes in Scope of Work
- Project Schedule & Next Steps
- Staff Recommendation



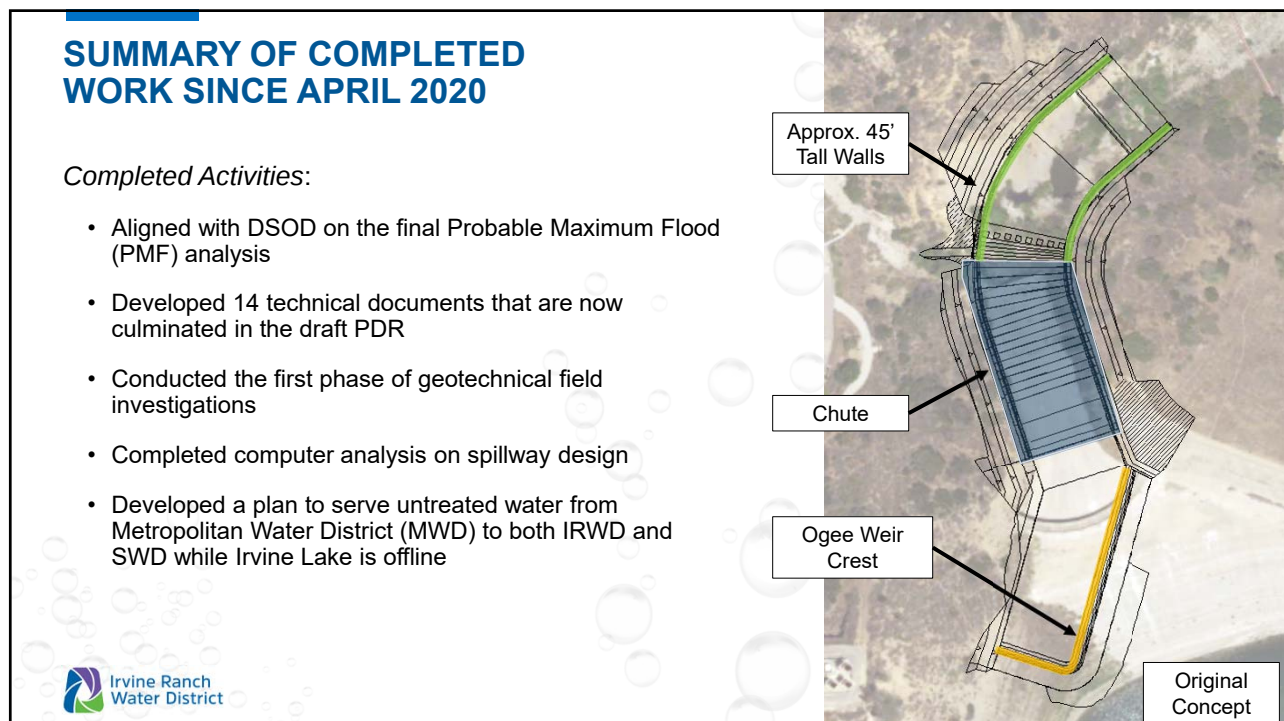
 Irvine Ranch  
Water District

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## SUMMARY OF ENVIRONMENTAL ACTIVITIES

### *Completed the following activities:*

- Jurisdictional Delineation
- Vegetation Mapping and Bio Tech Report

### *Upcoming activities (Fall 2022):*

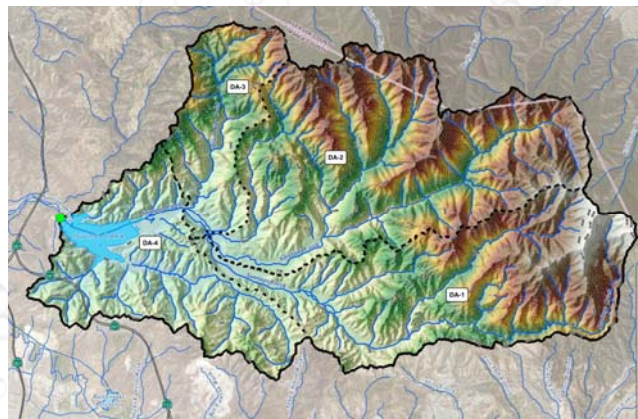
- Complete Focused Species Surveys
- Start permitting process
- Complete Initial Study and determine required CEQA document (MND or EIR)



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## CHANGED CONDITIONS SINCE 2020

- PMF analysis yielded higher hydraulic design criteria for new spillway.
- Computational Fluid Dynamics (CFD) analysis identified unfavorable hydraulic conditions and in conjunction with DSOD approved PMF prompted the need to realign the spillway.
- Semi-Quantitative Risk Analysis (SQRA) performed as part of transitioning to a Risk-Informed Decision Making (RIDM) based dam safety program identified concerns that warranted further evaluation.

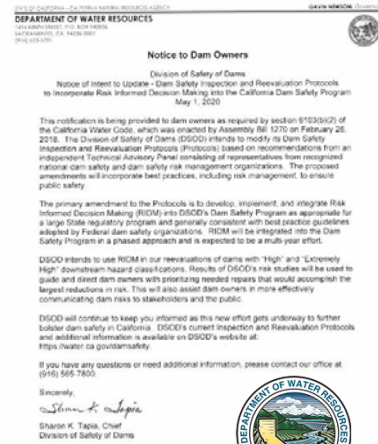


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## TRANSITION TO RIDM-BASED DAM SAFETY PROGRAMS

- Risk-Informed Decision Making (RIDM):
  - Process of making safety decisions by evaluating if existing risks are tolerable and present risk reduction measures are adequate
- In May 2020, DSOD announced transition to RIDM
  - Based upon "best practices" at the federal level
  - DSOD has 650 high and extremely high hazard dams within the state
  - DSOD plans on performing a comprehensive re-evaluation and identification of deficiencies for each dam
- IRWD enhanced its Dam Safety Program and now has a program that is RIDM-based
  - IRWD performed risk analysis on its dams including Santiago Creek Dam that is owned by both IRWD and SWD
    - DSOD staff attended the all-day risk analysis workshop for Santiago Creek Dam



Next steps include performing risk analysis of the outlet tower and spillway improvements



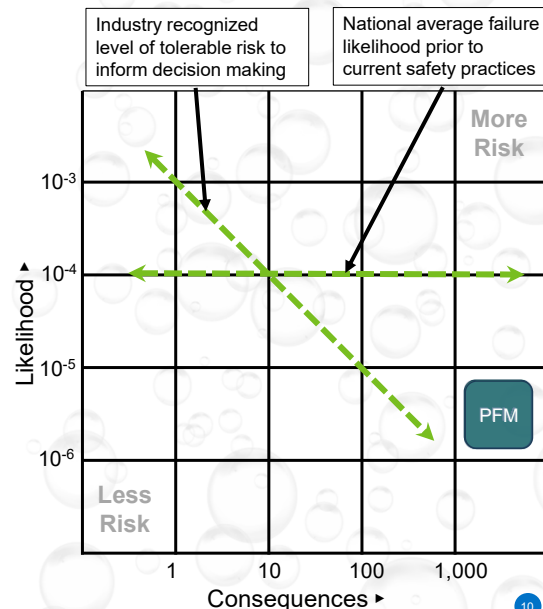
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## RIDM AND PROJECT IMPACTS

Evaluated several Potential Failure Modes (PFMs) for SQRA that identified the following:

- Areas of uncertainty and information that supports risk estimates
- Seismically induced cracking poses the highest risk for the dam
  - Completed first phase of cracking study since current project includes removing dam crest to widen road
  - Advancing second phase of cracking study that includes 2D analysis
  - Anticipate requiring additional geotechnical information to confirm potential for cracking and material strengths at specific areas of interest

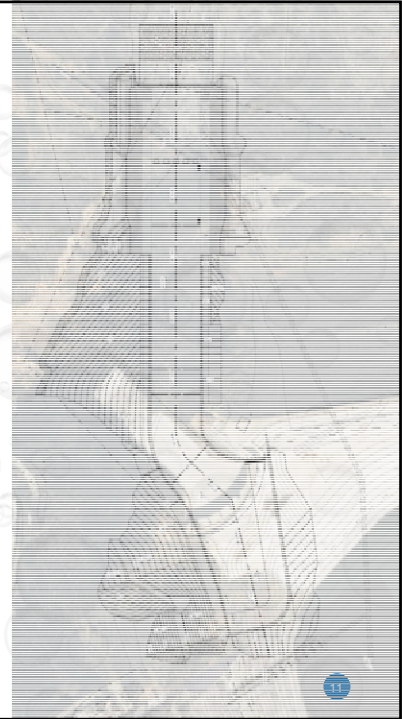


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## ADDITIONAL SCOPE OF WORK AND FEE

| Description                                    | Cost               | Percent of Total |
|------------------------------------------------|--------------------|------------------|
| Design costs                                   | \$976,050          | 37%              |
| RIDM related costs                             | \$422,080          | 16%              |
| Geotechnical investigations to complete design | \$609,770          | 24%              |
| Geotechnical investigations for RIDM           | \$611,059          | 23%              |
| <b>Total Additional Scope of Work</b>          | <b>\$2,618,959</b> | <b>100%</b>      |



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## UPDATED "ALL-IN" PROJECT COST

| Description                            | 2020 Estimate (\$ Million) | 2022 Estimate (\$ Million) |
|----------------------------------------|----------------------------|----------------------------|
| Outlet Works                           | 5                          | 11                         |
| Spillway                               | 78                         | 125                        |
| Inclined Outlet Structure              | 20                         | 30                         |
| Total Estimated Construction Cost      | 103 <sup>1</sup>           | 166 <sup>1</sup>           |
| Soft Costs                             |                            |                            |
| Design                                 | 5                          | 7.5                        |
| Environmental (CEQA & Mitigation)      |                            |                            |
| Construction Management and Inspection | 31 <sup>2</sup>            | 50.5 <sup>2</sup>          |
| Other (DSOD Fees, Legal, etc)          |                            |                            |
| Total Estimated Soft Costs             | 36                         | 58                         |
| <b>Estimated "All-In" Project Cost</b> | <b>139</b>                 | <b>224</b>                 |

- 1) Includes construction contingency of 45%.  
 2) This estimate results in a total 35% soft cost.



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## PROJECT SCHEDULE

- Complete Preliminary Design Report July 2022
- Start CEQA document and permitting process November 2022
- Complete Design (Lake is drained/offline) Summer 2024
- Start Construction Fall 2024
- Construction Completion Fall 2027<sup>1</sup>
- DSOD Required Construction Completion December 2029

1) Original estimate was Summer 2025



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## NEXT STEPS

- IRWD and SWD Boards approve Variance No. 2
- Proceed with final design
- Proceed with environmental compliance activities



Santiago Creek Dam Spillway  
December 2010



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## IRWD & SWD STAFF RECOMMENDATION

*That the IRWD and SWD Boards approve proceeding with  
Variance No. 2 with AECOM in the amount of \$2,618,959  
for additional design phase services.*



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## QUESTIONS



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April 26, 2022

Prepared and

submitted by: C. Compton

Approved by: Paul A. Cook 

## IRWD / SWD COMMITTEE

### UPDATE ON EFFORTS TO SEEK FEDERAL AND STATE FUNDING FOR THE SANTIAGO RESERVOIR IMPROVEMENTS PROJECT

#### SUMMARY:

Over the past four years, federal and state funding has been sought for the Santiago Reservoir Improvements Project. IRWD staff will provide an update on these funding request efforts, along with a summary of the existing emergency and disaster mitigation grant programs that have been considered for potential funding.

Although there are existing efforts underway to seek the establishment of a federal and state dam safety program to fund safety infrastructure improvements at high hazard dams, there is currently no federal or state dam safety program that provides funding exclusively for dam safety, outlet tower or spillway improvements outside of the Federal Emergency Management Agency's (FEMA) National Dam Safety Program High Hazard Potential Dam Grant Program (HHPD). The total funding available through the HHPD in Fiscal Year 2021 was \$12 million.

#### BACKGROUND:

According to the Association of State Dam Safety Officials, as of 2022, there are approximately 15,200 high-hazard potential dams in the United States, and \$24.04 billion in funding is needed to rehabilitate non-federal high-hazard dams like the Santiago Reservoir. With this large funding need, there have been efforts at the federal and state levels to seek greater investment into dam safety.

Currently, funding opportunities for dam safety improvements are generally limited to FEMA emergency and disaster mitigation grants. These varied grant programs have been reviewed to determine if the Santiago Reservoir Improvements Project is eligible for potential funding, and where the program is a good candidate for funding sought. The following is a summary of those programs:

- *2019 Pre-Disaster Mitigation (PDM), FEMA Hazard Mitigation Grant* – A grant application was submitted for the Project. The California Office of Emergency Services (CalOES), which administers this federal grant, denied the program for funding;
- *2020 Building Resilience Infrastructure and Communities (BRIC), FEMA Hazard Mitigation Grant* – A grant application was submitted for the Project. CalOES determined the project was ineligible for funding under the program. BRIC grants are usually capped at \$50 million;
- *2021 BRIC, FEMA Hazard Mitigation Grant* – A Notice of Intent grant application was submitted for the Project, but at CalOES's urging the notice was withdrawn due to the project not being a good fit for the grant program and so that Project could be considered under the Hazard Mitigation Grant Program (HMGP);

- *2022 –HMGP, FEMA Hazard Mitigation Grant* – The grant program was considered by IRWD, SWD and CalOES for the Project, but determined not to be a good fit. HGMP grants are usually given for less than \$10 million; and
- *2022 –HHPD, FEMA Hazard Mitigation Grant* – The grant application period is expected to open in late May. Submission of a grant application is being evaluated to determine if the level of possible funding justifies the submission. There is \$10,000,000 total funding available through the HHPD this year, and awards from the program have typically been capped around \$1,500,000 per project, though it may be higher this year.

Other funding opportunities are also being examined to determine if the Project could be eligible for funding. IRWD staff will discuss these with the Committee, and will update the Committee on:

- Efforts to establish a state dam safety grant program;
- Efforts to establish a new or larger federal dam safety grant program;
- Potential program funding from the Infrastructure Investment and Jobs Act (IIJA); and
- Other funding opportunities for the Project.

#### FISCAL IMPACTS:

As described above.

#### ENVIRONMENTAL COMPLIANCE:

This project is subject to the California Environmental Quality Act (CEQA). In conformance with the California Code of Regulations Title 14, Chapter 3, Section 15004, the appropriate environmental document will be prepared when "meaningful information" becomes available.

#### RECOMMENDATION:

Receive and file.

#### LIST OF EXHIBITS:

None.