

**SEISMIC STABILITY EVALUATIONS OF CHESBRO,  
LENIHAN, STEVENS CREEK, AND UVAS DAMS  
(SSE2)**

**PHASE A: STEVENS CREEK AND LENIHAN DAMS**

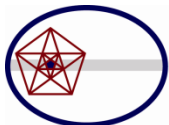
**SITE INVESTIGATIONS AND  
LABORATORY TESTING  
AT STEVENS CREEK DAM**

**ADDENDUM II TO WORK PLAN**

Prepared for

**SANTA CLARA VALLEY WATER DISTRICT**  
5750 Almaden Expressway  
San Jose, CA 95118

September 2011



**TERRA / GeoPentech**  
a Joint Venture

# ADDENDUM II TO WORK PLAN FOR SITE INVESTIGATIONS AND LABORATORY TESTING AT STEVENS CREEK DAM

---

## TABLE OF CONTENTS

1.0	Introduction.....	1
2.0	Purpose and Scope of Phase 3 Investigations .....	1
3.0	Procedures .....	2

## Figure

1	Plan Locations of Existing SSE2 Field Investigations – Stevens Creek Dam
---	--

# ADDENDUM II TO WORK PLAN FOR SITE INVESTIGATIONS AND LABORATORY TESTING AT STEVENS CREEK DAM

---

## 1.0 INTRODUCTION

The scope of the Phase 2 site investigations and laboratory testing at Stevens Creek Dam, that were recently completed as part of the SSE2 project, is described in the Work Plan dated November 2010<sup>1</sup> and the addendum thereto dated January 2011<sup>2</sup>. With exception of the CPTs described in the addendum, all the investigations described in these documents were performed.

Addendum II to the Work Plan describes the scope of additional (Phase 3) investigations deemed appropriate to improve the characterization of the alluvium under the dam. These investigations were discussed at a review meeting with the District and DSOD on August 15, 2011 when a consensus was reached on the purpose and scope of the additional investigations.

It should be noted that Addendum II to the Work Plan is intended to be used in conjunction with the original Work Plan and addendum thereto. Relevant procedures contained in these two documents are included herein by reference. Only modifications and/or additions to these procedures are discussed herein.

## 2.0 PURPOSE AND SCOPE OF PHASE 3 INVESTIGATIONS

The recent site investigations at Stevens Creek Dam indicate that the density of the alluvium is greater under the dam than at the toe. However, these data are limited and some confirmation of this observation appears warranted to allow the use of higher values of  $(N_1)_{60}$  under the embankment than at the toe in the seismic evaluation of the dam. The proposed additional Phase 3 investigations are aimed at confirming the higher density of the alluvium under the dam.

The proposed program agreed upon at the above-referenced meeting with DSOD is in two sub-phases:

- 3A. One mud rotary boring with shear wave velocity measurements using OYO suspension logging at the lower access road (SC-103) and three CPTs with seismic cone: one each at the crest (SC-101), at the lower access road (SC-103), and at the toe (SC-104);
- 3B. One instrumented BPT boring at SC-103, and possibly a second instrumented BPT at SC-104, if sufficient funds are available.

Figure 1 is a plan view of the dam showing the locations of the investigations performed to date and is included herein to illustrate the general locations of the proposed Phase 3 investigations. The actual locations of these additional investigations will be selected in the field to be about 10 feet away from completed borings/CPT probes.

The purpose of the mud rotary boring is to obtain OYO measurements of the shear wave velocity in the alluvium under the downstream slope of the dam along the maximum section that will be used in the analyses. The normalized OYO shear wave velocity,  $V_{s1}$ , under the slope will be

---

<sup>1</sup> TERRA/GeoPentech, a Joint Venture, 2010 (November), Seismic Stability Evaluations of Chesbro, Lenihan, Stevens Creek, and Uvas Dams, Phase A: Stevens Creek and Lenihan Dams, Site Investigations and Laboratory Testing at Stevens Creek Dam, Work Plan, prepared for Santa Clara Valley Water District.

<sup>2</sup> TERRA/GeoPentech, a Joint Venture, 2011 (January), Seismic Stability Evaluations of Chesbro, Lenihan, Stevens Creek, and Uvas Dams, Phase A: Stevens Creek and Lenihan Dams, Site Investigations and Laboratory Testing at Stevens Creek Dam, Addendum to Work Plan, prepared for Santa Clara Valley Water District.

## **ADDENDUM II TO WORK PLAN FOR SITE INVESTIGATIONS AND LABORATORY TESTING AT STEVENS CREEK DAM**

---

compared to that measured under the crest during the recently completed investigations to check that  $V_{s1}$  (and thus, the density) of the alluvium improves with confining pressure. Additional data, in the form of SPT blow counts, will also be collected in the alluvium in this boring, even though DSOD will not use them in their evaluation.

The purpose of the CPTs is two-fold:

1. Provide additional measurements of downhole shear wave velocity on the alluvium at three locations along the maximum section;
2. Allow pore pressure dissipation tests in the saturated portion of the alluvium to confirm the dilative nature of the material as indicated by the one test performed during the recent investigations.

DSOD requested additional shear wave velocity measurements be made in the alluvium at the toe to further corroborate the belief that  $V_{s1}$  (and the density) of the alluvium improves with confining pressure. OYO suspension logging in a boring at the toe was not successful during the recent investigations because caving in the hole required the use of casing. Therefore, it was agreed that the seismic cone could be used to provide these measurements as long as it was calibrated against the OYO logging. The calibration will be accomplished at the crest and at the lower access road by performing a CPT at each of these locations where OYO measurements will be available. A third CPT with seismic cone measurements will then be performed at the toe.

The CPTs will also include pore pressure dissipation tests in the saturated portions of the alluvium, as both we and DSOD believe that the information provided by these tests is very valuable in assessing the potential behavior of the material during shaking.

The second phase (Phase 3B) of the proposed investigation program includes one or two instrumented BPT borings to be performed in the spring of 2012 using instrumentation being currently developed by the University of California at Davis (UC Davis). The timing of these borings is dependent on the availability of funds from studies on Lenihan Dam that may not be required and on the availability of the instrumentation from UC Davis. BPT borings will be performed using the instrumentation from UC Davis so that additional information (beyond blow counts and PDA measurements) can be obtained. An instrumented BPT boring will be performed on the lower access road first to supplement the information available at this location; and then, if sufficient funds are available, a second instrumented BPT boring will be completed at the toe of the dam.

### **3.0 PROCEDURES**

The procedures for the mud rotary boring and OYO suspension logging will be as described in the original Work Plan<sup>1</sup>. The procedures for the CPTs and the Becker borings will be as described in the Addendum to the Work Plan<sup>2</sup> with some modifications/additions to the Becker borings.

The UC Davis instrumentation consists of two instrumented modules: one at the bottom of the Becker casing and one at the top under the hammer. These modules will be installed as the BPTs are performed in the alluvium. Based on the difficulty encountered penetrating through the embankment in the Becker boring already completed at the lower access road, the Becker casing

## **ADDENDUM II TO WORK PLAN FOR SITE INVESTIGATIONS AND LABORATORY TESTING AT STEVENS CREEK DAM**

---

will be pre-driven several times (open- and closed-ended) as necessary to penetrate through the embankment material to within 5 feet above the alluvium. Thereafter, all the rods will be pulled out, the instrumented modules installed, and the instrumented BPT completed in the alluvium. Pre-driving of the Becker casing is not anticipated to be required for the Becker boring at the toe of the dam where the alluvium is overlain by fill.

The energy transmitted to the top of the Becker drill string will also be measured using a model PAX Pile Driving Analyzer (PDA). Several representative hammer blows will then be analyzed using the CAPWAP computer program to develop an estimate of the split in resistance to driving between side friction and tip resistance. This information will be used for comparison with the Becker borings already done at the dam as well as with the data provided by the UC Davis instrumentation. Abe Construction Services, Inc. will perform the PDA measurements and CAPWAP analyses as they did for the recently completed Becker borings.

There will be no additional index property testing on samples from the mud-rotary boring. We will rely on the grain sizes and Atterberg limits determined on samples from the sonic boring at SC-103. Neither sealed observation wells nor piezometers will be installed in the Becker borings.



Rev. 3 08/25/2011 SSE2-WP-1BSC

SC-104 S/MR/BPT

**RECENTLY COMPLETED EXPLORATION LOCATION AND NUMBER**

**S = Sonic Boring**

1 Casagrande Piezometer in Alluvium at all S Borings

**MR = Mud-Rotary Boring**

Downhole Geophysical Logging at all MR Borings

Cone Penetrometer Probes at all MR Boring Locations

**BPT = Becker Penetration Test**

4 Vibrating Wire Piezometers at SC-102 BPT

Standpipe Piezometers at SC-106 BPT and SC-107 BPT



**PLAN LOCATIONS OF EXISTING SSE2 FIELD EXPLORATIONS - STEVENS CREEK DAM SEISMIC STABILITY EVALUATIONS (SSE2)**

**Figure 1**