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Mr. Phil Isenberg  
Chair, Delta Stewardship Council  
980 Ninth Street, Suite 1500  
Sacramento, California 95814

Dear Mr. Isenberg:

The U.S. Geological Survey (USGS) takes its reputation for objective science very seriously. In support of that reputation we investigated the issues outlined in the letter to the Delta Stewardship Council on February 2, 2011, from Dr. Salah-Mars and Dr. McCann (enclosed), and referred to by Dr. Tom Brocher, Director, USGS Earthquake Science Center, in his letter to the Council on February 4, 2011 (enclosed).

We agree that Dr. David Schwartz, USGS, erroneously commented on the earthquake assessment contained in the Delta Risk Management Study (DRMS). Dr. Schwartz was not aware of the Technical Memoranda included in the DRMS report and as a result misinterpreted Figures 6-19 and 6-21 of that report. These errors were not intentional and we sincerely apologize. As a result of these findings, we request the removal of that portion of the webcast related to Dr. Schwartz's presentation. The presentation on Seismic Risk in the Delta can be found at <http://cal-span.org/cgi-bin/archive.php?owner+DSC&date+2011-01-28>. In addition, I have sent a letter to Dr. McCann expressing my personal apologies. Dr. Brocher and Dr. Schwartz have also met with Dr. Ivan Wong of the URS Corporation to clarify these errors.

We continue our strong commitment to understanding the earthquake hazards in the Delta, and we applaud the excellent work contained in the DRMS report. This report is providing a critical framework for understanding the Delta and its management in the future.

Sincerely,

Marcia McNutt  
Director

Enclosures



February 2, 2011

Mr. Phil Eisenberg (Chairman)  
Mr. Randy Fiorini  
Ms. Gloria D. Gray  
Ms. Patrick Johnston  
Ms. Felicia Marcus  
Mr. Hank Nordhoff  
Mr. Don Nottoli  
Delta Stewardship Council  
980 Ninth Street, Suite 1500  
Sacramento, CA 95814

**Subject:** U.S. Geological Survey Presentation to the Delta Stewardship Council  
January 28, 2011 - Seismic Risk in the Delta

Dear Members of the Delta Stewardship Council:

At the recent Council meeting on Friday, January 28<sup>th</sup> Dr. David Schwartz of the U.S. Geological Survey (USGS) made a presentation regarding seismic risk in the Delta. In addition to presenting a tutorial on seismic hazards in the Bay Area and the Delta, Dr. Schwartz made a number of comments regarding the assessment of earthquake ground motions in the Delta with specific reference to the Delta Risk Management Strategy (DRMS) assessment of seismic hazards and the risk of levee failure.

We were surprised to hear definitive 'opinions' offered by Dr. Schwartz on the DRMS study, specifically his assessment of the estimation of earthquake ground motions in the Delta. Dr. Schwartz's opinions did not convey awareness or knowledge of the DRMS body of work.

For the record, we would like to clarify a number of erroneous but significant statements that were made during his presentation.

1. Dr. Schwartz commented on the estimation of ground motion and site response, and how DRMS used a model based on 'one type of material, a stiff soil'. This statement is not correct and represents neglect on the part of Dr. Schwartz to read the complete DRMS work.

In the DRMS study, a considerable effort was put into collecting existing geotechnical information on Delta soil properties to support site-specific evaluations. As such, site conditions were carefully modeled representing at each site the specific soil conditions including: clay, silt, loose sand (liquefiable), peat, etc that exist at each site. The detailed description of the ground motion and site-response assessment is provided in the

**Seismology and Levee Vulnerability Technical Memoranda (TM)** (among the 12 TMs produced in DRMS).

2. Dr. Schwartz also commented on the estimates of levee failure in the Delta. On this subject we found a number of statements are not consistent with what was done in the DRMS work. For instance, Dr. Schwartz referred to a map of 100-year ground motions in the Delta that was presented in the DRMS report. He indicated that modeling ground motions in terms of these 'uniform bands' is very unrealistic. We would certainly agree and simply point out these uniform hazard ground motion maps were not used in the DRMS risk analysis (they were used for display purpose only for the general public). Secondly, the vulnerability classes (representing the fragility functions of the various levee segments in the Delta) are intrinsic properties of the levees and their foundations. The seismic response of these levees is not affected by the 100-year ground motions only, but by a range of ground motions resulting from small and frequent to large and infrequent earthquakes as it is explained clearly in the **Risk Analysis Report** and the **Seismic Hazard TM**.
3. During this same part of his presentation, Dr. Schwartz then went on to draw a conclusion with respect to the use of the 'uniform-band' characterization of the ground motion and the prediction of levee failure. He concluded that 'one-half of the Delta is ok and the other half is failed' given the uniform band of ground motions, suggesting such a conclusion is 'very, very unrealistic.' This is an over-simplified and more importantly, erroneous characterization of the predicted performance of Delta levees and how the DRMS risk analysis modeled the probability of levee failures. Even if Dr. Schwartz's 'uniform-band theory of ground motions was correct', his characterization of how levee performance was modeled is not.

In listening to the presentation we are disappointed that representatives of the USGS failed to carefully review and correctly represent the large body of work done under the DRMS project (Two Main Reports and 12 Technical Memoranda). The DRMS work was reviewed by 8 different independent panels that are nationally recognized scientists and experts from various agencies; including USGS (independent review documents are available at anyone's request).

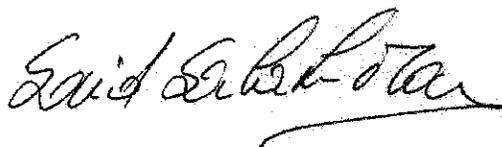
We have taken this opportunity to write to the Council to set the record straight with respect to erroneous statements made regarding the DRMS work and to caution the council with respect to what we will call the politics of science. The authors of DRMS stand behind their work; it is the most peer-reviewed work on the Delta, and we consider it to be the most comprehensive Delta risk study to date.

On a positive note, we have no doubt that ongoing and future research will improve our ability to estimate earthquake ground motions and assess the performance of Delta levees. We recall, for example, when the USGS visited URS during their review of the seismic

hazard work in 2007 (nearly 4 years ago) they presented their thoughts regarding basin effects. We certainly expect that in the years ahead, research and more earthquake ground motion recordings will give us a better understanding of the degree to which basin effects may be important and should be explicitly considered in seismic hazard studies. As Dr. Schwartz indicated, the assessment of earthquake ground motions is a complex problem and an area the USGS is actively working in.

We hope this clarifies some of the mis-information that was presented at the meeting last Friday.

Sincerely,  
**URS Corporation**



Said Salah-Mars, Ph.D.  
Vice President  
URS Corporation  
DRMS Program Manager



Martin W. McCann, Jr., Ph.D.  
President  
Jack R. Benjamin & Assoc., Inc.  
DRMS Technical Lead



## United States Department of the Interior

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February 4, 2011

Chairman Phil Isenberg  
Delta Stewardship Council  
650 Capitol Mall  
Sacramento, CA 95814

**Dear Chairman Isenberg:**

I am writing to thank you for the opportunity for the USGS to discuss seismic hazards to the Sacramento/San Joaquin Delta with the Delta Stewardship Council. I hope we will have future opportunities to further discuss the hazards and the research we are doing to better understand the hazards.

I want to take this opportunity to clarify some remarks that we made about the DRMS studies and our understanding of the seismic hazard. During our presentation we made comments that have been construed as indicating that the DRMS study underestimated the hazards (and risk) to the Delta from earthquakes. This was not our intent: we concur with the DRMS study that the seismic hazard in the Delta is high.

Beside informing the Council about earthquake hazards to the Delta, the main point we were trying to make is that there remains considerable uncertainty in any characterization of hazards due to our community's limited understanding of: (1) the potential seismic sources in the East Bay and beneath the Delta; (2) the effects that peat and soft soils will have on earthquake energy as it is transmitted to the ground surface; and (3) the deeper three-dimensional geology of this part of the Central Valley and the presence of thick, soft basin materials. We believe that it is critical to obtain more measurements of ground motions in the Delta to address these last two concerns. We further believe that the ongoing research at the USGS and elsewhere will help to reduce the uncertainty in hazard assessments.

Again, thank you for the opportunity to discuss seismic hazards with your group. We look forward to future collaborations with you and the Delta Stewardship Council.

Tom Brocher  
Director, Earthquake Science Center

cc. Said Salah-Mars, URS Corporation  
Marty McCann, Jack R. Benjamin & Assoc., Inc.