Delta Risk Management Strategy (DRMS) Phase 1
Response to Comments: Subsidence

Comments	Responses
Reviewer: Victor Pacheco, DWR	
1. Page 5-9 from the Draft Risk Analysis Report states that subsidence rates of about 0.5 inches per year were common in the marsh and some areas appear to have experienced 1.0 inch per year. However, the location of points in Suisun Marsh used to estimate subsidence rates identified by Figure 7 on Page 16 from the February 2007 Subsidence Technical Memorandum appear to be primarily on levees that are known to settle over time. In fact, the negative subsidence rates in Table 2 on Page 17 from the Subsidence Technical Memorandum may actually reflect the work done on these levees to increase their height over time or settlement rather than subsidence. There appears to be a lack of data from areas within Suisun Marsh where subsidence may potentially occur. Several areas of the marsh are managed wetlands that are flooded year-round or existing tidal marsh that are unlikely to subside and may over time actually accumulate vegetation/sediment.	We recognize the large uncertainty in the Suisun Marsh subsidence estimates based on the only available data. However, the correlation of subsidence rates in highly organic soils with subsidence rates indicates similar processes to the Sacramento-San Joaquin Delta. Also, subsidence during the large period of time (over 50 years) between surveys probably reflects longer-term soil processes and not shorter-term changes in levees. We described a large uncertainty associated with our subsidence estimates (over 100%). We added additional text to this section of the report to better address this comment.

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2. While the uncertainty analysis from Section 4.2 on Page 42 in the Subsidence Technical Memorandum addresses the uncertainty of elevation data, it fails to address the lack of data from areas within Suisun Marsh where subsidence is more likely to occur as illustrated by Figure 22C on Page 29 in the Subsidence Technical Memorandum.	We attempted to address the uncertainty in Suisun Marsh subsidence estimates based on the uncertainty in the past elevation measurements. Also, we attempted to account for the spatial variability in subsidence rates using soil maps and the correlation of subsidence rates with soil organic matter content. Therefore, for those areas most likely to subside, we developed high and low estimates based on the error in elevation data. The estimates of about 2.9 to 3.6 feet during the next 50 years for the areas of highly organic soils are consistent with what we know about organic soil subsidence from the Delta and estimated subsidence of about 5 feet for soils with similar organic matter content there. Lower subsidence rates are expected due to wetter conditions.
3. Similarly, on Page 15-2 a bullet states that "For comparable soil organic matter contents, Suisun Marsh subsidence rates are similar to the Delta rates." However, it is known (and the report previously acknowledged) that management in Suisun Marsh is significantly different than the Delta and that while the marsh may subside 1 to 2 feet by 2050 the Delta would subside by 1 to 5 feet in the same time period. Some additional context is needed to clarify the bulleted statement.	Thank you for pointing this out. The text has been changed to read as follows. "Rates were generally lower than historic rates for Sacramento-San Joaquin Delta soils with similar organic matter content. This is probably the result or wetter conditions under different management practices."

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Reviewer: Patricia Quickert, Environmental Scientist Environmental Compliance and Evaluation Branch Division of Environmental Services	
4. Risk Analysis Report Page 2-2, 3rd paragraph. This paragraph should include the word 'subsidence', and tell the full story-subsidence in the Delta is anthropogenic and due to much more than simple oxidation and wind loss, i.e. a large volume of peat soil was used for levee construction. Also, a little more information about soil burning should be included since it was a regular agricultural practice.	While it is true that significant volumes of organic soil were used to build levees in the late 1800s and early 1900s, it was small relative to the volume lost since reclamation to oxidation, consolidation, wind erosion and burning. Moreover, this is not a relevant process in the Delta today. The Subsidence Technical Memorandum provides a summary of burning practices that were prevalent in the Delta before 1960.

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Reviewer: Michael Ramsbotham, COE	
5. Subsidence is still being popularized as a major threat to the Delta without sufficient supporting documentation. Consequences and risk do increase with increased by interior island subsidence, but there is little substantiating data to support the position that interior island subsidence significantly impacts seepage, stability, or seismic vulnerability. The old cartoon showing significant ground surface elevation loss at the toe of the levee because of subsidence is no longer true for much of the Delta.	Subsidence will increase volumes below sea level on the order of one-half. million acre feet during the next 50 years. Interior island subsidence will affect seepage through levees due to increased hydraulic gradients across levees. This has been demonstrated through groundwater flow modeling on Twitchell Island. Subsidence is still occurring near levees as demonstrated by leveling surveys and extensometer data. For example, the extensometer on Twtichell Island within 500 feet of the levee currently records about 0.5 inch per year. Elevation determinations near levees on Bacon Island indicated 1 to 2.5 feet of subsidence from 1978 to 2006.