WETLANDS SCIENCE PROGRAM

Third Summary Report Montezuma Wetlands Restoration Project Technical Review Team

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Executive Summary

This is the third report of the Technical Review Team (TRT) for the Montezuma Wetlands Restoration Project (Montezuma). The TRT provides expert and objective analysis and recommendations on environmental monitoring and assessment of project operations and performance. It also conducts special studies relating to adaptive changes in project operation and design. It regularly reviews monitoring results and adaptive management planning for the project. The last report was issued in December 2006. This report reflects findings from all reviews conducted since that time.

Although intended to be an annual report, the length of time since the last report stems from Project slow-downs due to a lack of available dredged sediment for placement at the project site. Despite the fact that this is the only restoration project in the Bay and Delta that is permitted to accept noncover sediment, no sediment has been placed since 2006. This situation has halted progress toward breaching of Phase I of the project and forced drastic restriction of project expenditures, and TRT activities have been scaled back accordingly. Nevertheless, limited revenue from lease of the Liberty offloader allowed the project to continue basic site maintenance and monitoring.

Several planning meetings were held by Montezuma to review status and recommend management changes as warranted, in additional to the Annual and Subteam meetings. In 2007 the project Management Team proposed to modify several elements at Montezuma based on knowledge gained during previous years of operations and monitoring. These design modifications were proposed to improve the chances of restoration success at the project site. The TRT reviewed the project Management Team's "Adaptive Management Restoration Plan for Phase I of the Montezuma Wetlands Project" (originally drafted in July 2007) and provided comments on the proposed changes. Additional elements were amended to the Plan in subsequent years (2009) resulting in five main adaptive management modifications proposed for Montezuma:

- Restoration of tidal action to completed Phase 1 cells;
- Creation of California Least Tern/Snow Plover habitat;
- Modification of High Marsh Design for salt marsh harvest mouse (SMHM);
- Pumping water directly from the Sacramento River/Suisun Bay using approved fish screens;
- An increase in use of noncover sediment in Phase 1 up to the permitted 20% threshold.

The highlight of this reporting period is the Adaptive Management Restoration Plan for Phase I. This report contains the individual meeting summaries, final TRT review comments, and the Montezuma Management Team responses to the Plan. Other project milestones include the 2007 Annual Meeting, two meetings of the Contaminants sub-team in 2009, and several monitoring reports submitted by the project Management Team, which the TRT reviewed.

Dredged sediment has begun to receive more attention recently. The Army Corps of Engineers has renewed efforts to determine how dredged material management practices can be implemented in a manner that is sustainable for the Bay. They have convened a Placement Options Assessment Working Group (POAWG) in support of the San Francisco Bay Regional Dredged Material Management Plan (DMMP). In April 2010, the USGS and BCDC hosted a regional Sediment Science Workshop. The 2009 Pulse of the Estuary documented the status of sediments throughout the Estuary. A feature article titled "Dredged Sediment: From "Spoils" to Valued Resource" highlighted how critical beneficial reuse of dredged sediments is for restoration projects like Montezuma, Hamilton, and Bair Island. In addition, dredge sediments can reduce risk from flood damage.

As sea level continues to rise, it is becoming more imperative to manage the sediment supplied by local watersheds to restore and conserve intertidal habitats. Clearly, the long-term value of sediment as the building material for mudflats and tidal marshes can far exceed the short-term costs for dredging and re-use. To the fullest extent feasible, dredged sediment should be used to reduce the risk of rising sea levels drowning tidal marshland. Montezuma remains unique in its location at the mouth of the Delta, which gives it the potential to restore extensive brackish wetland habitat necessary for the endangered Delta smelt, threatened longfin smelt, and other species of special concern. Montezuma is one possible location for placement of sediments from Brooklyn Basin channel dredging. If it receives this or other sediment, it is poised to complete construction of Phase I and realize its first tidal breach. The TRT will continue to advise the Project through this critical next stage in order to ensure that the project is adequately monitored and successfully completed.

Project Milestones

January 17, 2007: **Least Tern/Snowy Plover Breeding Habitat Meeting** is held to review restoration issues that should be considered due to the occurrence of least terns and snowy plovers.
An update was provided on the occurrence of least tern and snowy plover nesting at the site on sand mounds that occurred due to the unanticipated delivery of large amounts of sand to the site. The TRT discussed construction of a sand island in Cell 8/9 to provide permanent habitat for tern breeding. The TRT discussed proposed plans for incorporating sustainable nesting habitat into the Phase I restoration design considerations such as predator management and surrounding habitat .

January 29, 2007**: Annual Meeting** is held. The TRT report and the project's adaptive management of the design and operations were reviewed. The following Restoration Design topics were discussed:

- Reconsidered high marsh elevations and "mouse farm"
- Tern habitat in cell 8/9
- Staged tidal restoration
- Earlier restoration of Phase III

The Operations discussion addressed water management considerations and the Levin Richmond Terminal sediment placement A field trip to the site was also conducted.

March 5, 2007: **Salt Marsh Harvest Mouse (SMHM) Conference Call** is held to discuss revision of the vegetation and elevation design criteria for SMHM habitat. Appropriate available datasets (CDFG, IRMW, DWR, etc.) on which to base the design were identified. The TRT concluded that an iterative approach to finalizing the elevation and vegetation design could begin with data gaps being filled in as they are identified during the adaptive management process.

June 1, 2007: **Project Team Meeting** to review the main Phase I adaptive management design features. TRT discussions focused on channel densities in the high marsh, updating tidal reckoning, revising the high marsh design elevation, early breach of completed portions of Phase I, and consideration of suitable bird nesting habitat for Least Tern bird islands.

September 19, 2007: **Restoration Plan Meeting** is held with the primary goal to review the July 2007 *Adaptive Management Restoration Plan for Phase I.* TRT discussion focused on high marsh design elevation changes, vegetation criteria for SMHM habitat, least tern habitat design and management, and ability of the tidal channel network to support a partial breach of Phase I.

2008: The TRT did not meet, but did review several monitoring reports submitted by the Project team.

January 28, 2009: **TRT Contaminants Subteam Meeting** is held to review Sediment and Water Quality results, reference site monitoring and pertinent adaptive management questions.

December 17 2009: **Contaminants subteam meeting** is held to present a data comparison of cover and noncover cells and discuss whether the TRT is comfortable with the proposal to increase the Phase I noncover capacity to 20%.

April 27 2010: **TRT summarizes the final comments on the *Adaptive Management Plan for Phase I***. The comment letter was sent to all involved agencies.

TRT Report Reviews and Recommendations

Sediment and Water Quality Monitoring Report Reviews

January 29, 2009: Contaminants Subteam comments on Montezuma Sediment and Water Quality Monitoring, Q3&Q4, 2004.

Montezuma Technical Review Team
Contaminants Subteam comments on Montezuma Sediment and Water Quality Monitoring, Q3&Q4, 2004.
January 29, 2009

The monitoring of incoming sediments and project cells for sediment and water in large part appear to meet the project's monitoring needs. The concentrations of chemicals of concern (COCs) mostly met the project's operational limits and the cover or noncover criteria for the project, as appropriate, with some exceptions for mercury (Hg) noted below.

Some pre-dredge testing indicated in situ Hg concentrations above the cover criterion. However, post-placement testing of that material indicated maximum and mean Hg concentrations at or below the cover criterion. However, the post-placement monitoring report also indicates that Hg concentrations in the non-cover cells were in some cases above both the 1992 criterion (0.35mg/kg) and the RWQCB 2000 proposed criterion (0.43 mg/kg). The report suggests that partitioning of fine sediments within cells leads to uneven distribution of Hg, with some places in some cells having elevated Hg levels relative to other places in the same cells. This is a likely process. The TRT should point out that the lower hydraulic conductivity of fine-grained sediments combined with their higher Hg concentrations raises some risks of increased Hg bio-availability, as reduced conductivity may inhibit drainage and encourage anoxic conditions and thus methylation, particularly in spots where Hg concentrations are highest. If the RWQCB chooses to base its assessment on the mean Hg concentration and to discount the few exceedences, then the monitoring effort for Hg does not need to be adjusted. If the RWQCB does not choose to discount the exceedences, then some adjustments in monitoring will be needed to assure that it meets the RWQCB's needs. If necessary, the TRT can identify and assess the scientific merits of alternative adjustments.

Once vegetated, the marsh sediments will contain plant detritus, which likely will effect the measurements of Hg concentration. One way to account for these effects is to standardize the measurements by adjusting them for their grain size and total organic carbon content.

Once the measurements of Hg concentration are adjusted to account for grain size and organic carbon content, they can be compared to measurements from reference sites and from other projects in the region. This will enable the agencies to compare this project to other projects and to overall regional conditions, which will further inform any decision about adjusting the monitoring program.

Exceedances of operational action levels for various trace elements other than Hg were recorded for surface waters. This could be due to evapo-concentration of the pooled surface water sampled. This speaks to the limited water supply for on-site sediment management.

The exceedances for zinc (Zn) appear to have been due to laboratory error, since the re-analysis of these samples yielded non-detects. This kind of imprecision of laboratory analyses appear to be a recurrent problem (also seen in 2004 Q1&Q2 report), and the project team should consider using another analytical laboratory if such inconsistency persists. Excursions in other COC concentrations were less severe.

Montezuma Management Team Response:

The mercury exceedances were encountered only in sediment dredged from an area of the Port of Oakland referred to as "cells 3 through 6". Approximately 150,000 cy of this material was placed in the noncover area of Cell 3/4 between December 12 and 26, 2004; approximately 350,000 cy of this material was placed in Cell 8/9 between December 26, 2004 and February 9, 2005. Cell 8/9 is a cover-only cell and does not have interior separation levees, but the material was placed at sufficient depth to be covered by at least three feet of additional sediment. (Please note that a full sampling and placement plan for this material was presented to the agencies (October 12, 2004, Lipton Environmental Group), before it was accepted at the Montezuma site).

In response to the question of whether placement of material with elevated mercury concentrations at Montezuma was acceptable to the RWQCB, it is important to note that exceedances of the 1992 and 2000 cover criteria for mercury were expected in this material based on pre-dredge testing. The material was designated as cover material by the DMMO despite these exceedances and approved by the agencies for placement at Montezuma (with additional monitoring) as described in the report.

As noted in the comments, generally higher concentrations of mercury were observed in samples collected from Cell 8/9 in comparison to samples collected from barges that were offloaded to Cell 8/9. Upon revisiting the data, we found that the difference between the Cell 8/9 and barge sample means was exaggerated by the inclusion of a large proportion of data points from Cell 8/9 representing reanalyses of composite samples and analyses of individual discrete samples. Since reanalysis and analysis of discretes was done for the samples showing the highest concentrations, giving all of these results equal weight in calculation of the mean resulted in that mean being biased somewhat high. It also happened that the two highest samples were paired with field duplicates that also showed high concentrations, which pushed the mean still higher. In order to reduce the high bias, we recalculated the Cell 8/9 mean with the original composite sample results averaged together with their associated field duplicates, reanalysis results, and discrete sample results. The recalculated Cell mean (0.45 mg/kg), while still above the barge sample mean, is substantially lower than the original Cell 8/9 mean (0.54 mg/kg).

A comparison of pre-dredge testing results with onsite confirmation sampling results for the Port cell 3 – 6 material, using the recalculated Cell 8/9 mean, is provided below:

	Range	Mean	n
Pre-dredge testing	0.39 - 0.53	0.46	5
Barges offloaded to Cell 3/4	0.21 - 0.42	0.34	8
Samples collected from Cell 3/4	0.21 - 0.35	0.28	6
Barges offloaded to Cell 8/9	0.044 - 0.59	0.34	9
Samples collected from Cell 8/9	0.09 - 0.83	0.45	14
All onsite samples	0.044 – 0.83	0.44	42

We have always thought that samples collected in the sediment cells after placement characterize material better than samples collected from barges because of the substantial mixing of large volumes of material during the hydraulic offloading and placement operations, and barge sampling only reflects discreet grabs from the upper portions of the barge that are accessible. Grain size offers a possible reason why generally higher concentrations were found in samples collected from Cell 8/9 than in samples collected from barges that were offloaded to Cell 8/9. Certainly, the lowest mercury concentrations observed (0.044 and 0.09 mg/kg) were grain size-related; concentrations in that range have only been observed at the site in sandy material. Those two samples were taken two days apart and represented a small amount (one or two barges worth) of sandy material (approximately 71% sand) that was received in the last few days of placement of Port cell 3 through 6 material. Those concentrations were an order of magnitude lower than the next lowest concentrations detected in Cell 8/9 (0.24 mg/kg) and in barges offloaded to Cell 8/9 (0.29

mg/kg). The rest of the port cell 3 through 6 material was fine-grained according to operational logs and the two other Cell 8/9 samples that were analyzed for grain size distribution were found to contain 100% silt and clay.

In response to the question of whether operational changes are needed to account for particle sorting, it is important to note that it is not clear that magnification of sediment COC concentrations due to grain size sorting is consistently occurring. As noted in the report, this phenomenon was not observed in Cell 3/4 (where lower concentrations were observed in comparison with barge samples) or in monitoring of other cells and barges. Nor is it clear that samples collected from surface sediments in the cells are generally finer-grained than samples collected from the barges. Direct comparison of grain size in barge vs. cell samples during the same time period is not possible because grain size was analyzed only in barge samples during 2004 in accordance with the QAPP. In 2005 monitoring protocols were changed to assess grain size in the cell samples and not in the barge samples. However, grain size measurements of barge samples from 2004 can be compared to grain size in cell samples from 2005. Both data sets show predominantly fine-grained sediment. Barge samples had an average of 84.83% silt and clay, and cell samples had an average of 74.12% silt and clay. The cell sample average is likely biased slightly low because about 12% of the volume of sediment received in 2005 was sandy material, which was not the case in 2004.

Regarding the concern about higher mercury concentrations in association with fine-grained sediment, the concentrations of mercury in Port cell 3 through 6 material were well below noncover criteria and that material was essentially treated as noncover sediment. It was placed into either the noncover area of Cell 3/4 or in the bottom of Cell 8/9 where it was subsequently covered by at least three feet of additional cover sediment.

Normalization of post-restoration monitoring results on the basis of TOC and grain size is a good suggestion regardless of concerns about exceedances of criteria. It should be noted, however, that the Port cell 3 through 6 material was placed below what (after tidal restoration) will be the mean tide line and will therefore not be accessible for sampling. It should also be noted that the current post-restoration monitoring plan does not include sediment sampling for COCs.

Concerns about lower hydraulic conductivity combined with higher mercury concentrations seem more applicable to material placed at or near the surface of the restored marsh than to material such as the Port cell 3 through 6 sediment that was placed below the mean tide line and buried under at least three feet of sediment where it is expected to remain anoxic. Consequently, the slightly elevated total mercury in this subsurface material is likely to contribute far less to methylation potential than surface sediment in all the cells that are subject to more wetting/drying cycles, due to limited water supplies and high evaporation in the summer months. This issue is one of the reasons why agency approvals have been requested for staged tidal restoration (so that breached cells will no longer need to be supplied with water to keep sediment saturated) and for a supplemental pump to withdraw water through a fish screen from the River/Bay to make up for shortfalls in supply from the well system before tides are returned to the site.

The precision of water quality results has improved since the time period covered by the subject report. Unexplained outliers are still occasionally encountered, but they represent a small minority of the results. The improvement appears to be related to newer and better equipment at the laboratory, enhancing their ability to separate inorganic COCs from interfering matrices. We have also worked with the laboratory to develop procedures to deal with salinity interferences, which are commonly encountered in water samples collected from the sediment cells. The lab uses the most saline of our water samples for MS/MSD analyses and uses dilution as needed to control the interference. Since mid-2006, we have also been sending split samples to another laboratory on a frequency of about 25% of water samples for inorganics. Results of these analyses are typically comparable to the main laboratory's results.

June 9, 2009: Contaminants Subteam comments on Montezuma Sediment and Water Quality Monitoring, 2005

Montezuma Technical Review Team
Contaminants Subteam comments on Montezuma Sediment and Water Quality Monitoring, 2005
Prepared by Don Yee
June 9, 2008

The monitoring of incoming sediments and project cells for sediment and water in large part appear to meet the project's monitoring needs. The concentrations of chemicals of concern (COCs) mostly met the project's operational limits and the cover or noncover criteria for the project, as appropriate, with some exceptions for mercury noted below.

Pre dredge testing indicated mercury, lead, and zinc concentrations above the cover criterion for some incoming barges. Although some measurements of material in Cell 8/9 showed mean concentrations above the target of 0.35 mg/kg, the final measurements taken had a mean of 0.33 mg/kg, as well as a plan to be covered by 3 ft of additional cover sediment. As long as the final cover sediment is more predictably below the criterion there should be no problems.

The report again suggests partitioning of fine sediments within cells leading to uneven Hg distribution mentioned in 2004. In review of the 2004 report I previously mentioned the lower hydraulic conductivity of fine grained sediment combined with higher mercury concentrations raises a bit of concern, as reduced conductivity may inhibit drainage and encourage anoxic conditions and thus methylation particularly in spots where Hg concentrations are highest. Although this review comes a bit late to do much about the cells in question, one option if sediments are continually at or above criterion due to sorting is to examine concentrations on normalized basis, adjusting so that like concentrations (i.e. mercury in the inorganic part of fine grained sediments) are compared to reference conditions. If the normalized concentrations are comparable, then there should be less concern.

Although there was one exceedance each for lead and zinc in Cell 8/9 cover material, average concentrations were well within limits and thus not a problem.

A few DDT exceedances were generally associated with samples with QC issues, either matrix interference or low (<reporting limit) concentrations. Results regularly <RL but still above criterion suggests that the lab should be investigating means of improving sensitivity to get better certainty on results, by increasing sample sizes and/or taking steps to reduce interferences.

There were a few PCB detects > the cover criterion, and similar to the DDTs where a criterion exceedance is still below RL, the lab's analytical methods could perhaps stand to increase sensitivity somewhat, as detects for 2 of the 7 aroclors (MDLs often around 25ug/kg) is often enough to result in a sum PCBs greater than the criterion. This might be accomplished simply by slightly increasing the sediment volume extracted by the lab.

There were frequent exceedances of action levels for trace elements in monitored groundwater and surface water, in large part due to evapoconcentration during periods of limited water supply, but nothing that persisted during wet periods suggesting leaching from placed sediments.

Montezuma Management Team Response:
Regarding the mercury exceedances, please see our response to comments on the Q3/Q4 2004 report.

Regarding reporting limits, it has been difficult for the laboratory to consistently achieve low RLs for DDTs and PCBs. This is largely due to the high moisture content in the samples (typically 60-70% for recently placed sediment). We have not discussed RLs with the laboratory for two years, since no sediment placement (and therefore no sediment sampling) has occurred during that time. Prior to future sediment placement at the site, we will revisit this issue to explore options for improving RLs for DDTs and PCBs.

June 4, 2008: Contaminants Subteam comments on Montezuma Sediment Confirmation Sampling Plan (2006)

Montezuma Technical Review Team
Contaminants Subteam comments on Montezuma Sediment Confirmation Sampling Plan (2006)
Prepared by Don Yee
June 4, 2008

The document outlines a sampling approach for assuring that sediment received from the Levin Richmond Terminal Corporation meets the project sediment acceptance criteria.

The underlying statistics described are sound, although their application may be a bit inaccurate or jumbled. For the trace elements, PAH, and PCB data, the mean, sample standard deviation, and t values are derived from data using n=2 (df= n-1 = 2-1 =1 degree of freedom), so the upper confidence limit:

$$UCL = Xbar + t_{(0.05,\ df=n-1)}\ S / sqrt(n)$$

Can be found. If we require this UCL to be at or below the regulatory threshold (RT), we will have 95% confidence that the true mean is below the threshold. Although fixing the other values (Xbar, T, S, with UCL=RT) you can hypothetically solve for n, all it will tell you is whether the n you used in deriving the mean, stdev, and t is too small for the sampled population, not what a hypothetical minimum number of samples to achieve that confidence level is. Even if the calculated n were <1, we could not then analyze a single sample from an unknown population and have any confidence that its mean were below the RT, because t and S for n=1 (df=0) are undefined. We would require an assumption the sample was part of an already measured population with a known mean and standard deviation, and the additional sample's utility would then only be in refining the confidence interval of the already measured population by increasing the total number of measurements by +1.

We might make a guess that an unmeasured population is similar to the already measured one, and given n=2 was sufficient to establish the UCL below RT for most of the trace elements, guess that n=2 samples for the new population would also give a UCL < RT, which may be acceptable given that the previous Xbar, t, and S were derived from n=2. The risk of a UCL higher than RT, though possible, would not be large (depending on how near the previously calculated UCL was to the RT).

Similarly applied to the DDT data, the same assumptions cannot be used. In the latter case, the mean, the sample standard deviation, and the t values are derived from n=10 samples. Thus the calculated n of <2 (suggesting a minimum sample size of n=2 for an unknown sample) is meaningless in this case. If n=2 random subsamples truly had been taken from the dredge composites analyzed (e.g. arbitrarily the first subsample from each), we would find Xbar = 256, Sxbar=39.5, $t_{(0.05,\ df=n-1)}$=12.71, and UCL = 610.6 which is above the RT. In fact, this first pair gives the lowest UCL, with all other UCLs pairs (i.e. LRTSO1-02 with LRTSO2-02, etc) higher, because although the other pair weighted means are often lower, their resultant weighted stdevs are larger due to larger differences in concentration.

The UCL equation above thus is primarily good for evaluating *post facto* whether you have sampled enough to have a certain confidence that your mean concentration is below some threshold. If the UCL is above the RT, the choices then would be 1) to accept that the mean concentration may truly be above the RT and choose another disposal method or 2) to sample more in an attempt to reduce the uncertainty in the mean concentration. If the mean concentration is near the RT or the measured concentration is highly variable, additional sampling may not appreciably alter the estimated UCL to a sufficient degree to change the conclusion.

In this specific case for comparison to RT, we may be OK despite a misapplication to derive a hypothetical minimum n (which would have in turn required a recursive adjustment of the t used, since df=n-1 would be lower than =10-1), because here we have actually analyzed n=10 samples, the subsequently derived UCL is already below the RT, with any additional samples measured only serving to refine the UCL estimate by increasing n. As long as the sediments composited used for the previous n=10 analyses were fully representative of the sediment population dredged and disposed, then we are likely truly below the RT with a greater than 95% confidence.

If other sediment populations are to be disposed (i.e. not within the sediment population/area already measured), they are likely to require n>2 samples measured to establish the same confidence that they are below RT, even if we were to assume *a priori* that their mean concentrations and stdevs are likely going to be similar. This is not a safe assumption given the variability seen in the previous samples; the means and stdevs for n<10 could vary quite a bit if only a subset of the previous subsamples were used.
However, even assuming we know the mean and stdev perfectly from the n=10 samples measured previously, at the very least, to derive minimum n, we would need to make UCL calculations with paired $t_{(0.05,\, df=n-1)}$ and sqrt(n) values for the same n. This would represent a starting point, although using a small sample number and a highly variable underlying population, the uncertainty in a comparison of UCL to RT may be high.

Montezuma Management Team Response:
We appreciate your detailed knowledge and comments on the statistics and believe that our future confirmation sampling plan statistics would benefit from TRT review and input prior to finalizing. In the case of the Levin Richmond Terminal (LRT) sediment, the primary chemical of concern (COC) was DDTs and the actual monitoring implemented in the field included more monitoring of all COCs, including PAHs, PCBs, and DDTs. In total, six samples of the LRT material were analyzed for DDTs, four samples were analyzed for inorganic COCs, and one sample was analyzed for PAHs, PCBs, and pesticides other than DDTs. Actual monitoring implemented in the field when the LRT sediment came to Montezuma, showed that all COCs were within their respective sediment acceptance criterion (report in preparation).

July 27, 2007: Report Review Comments of "Water and Sediment Monitoring Report 2006-2007"

Montezuma Technical Review Team
Water and Sediment Monitoring Report 2006-2007 Review Comments
Prepared by Don Yee
July 27, 2009

Page 18, July 18 sample – analytical problems were found in both the analysis and reanalysis. Generally the point of reanalysis is to correct problems in the original. If the reanalysis also has problems, an investigation of alternative analytical procedures (different preparation methods, additional clean up to reduce interferences, using different ions to quantify, sample dilution, preconcentration or larger sample size) is warranted. Analysis of samples with seemingly odd results by a second lab may also be helpful; e.g. if the second laboratory uses the same/similar method (e.g. ICP-MS) yet obtains very different results, there may be details of sample prep and analysis that are causing the differences. If about 25% of samples are budgeted for analysis at an alternate laboratory, it may be wise to reserve a percentage (e.g. 5-10%) for use on samples with demonstrated QC issues, as opposed to random or systematic distribution among analyzed samples. Between two labs, it may be difficult to know which result is "right", but professional judgment can be applied to determine which is more likely correct. If a decision is made not to switch labs, modifications to their analytical methods to avoid future problems should be implemented.

Page 19- Different concentrations between incoming barges and placed sediment are not wholly unexpected; sources and thus contaminant deposits in sediment are not homogeneously distributed. The more important results are those in place within the cells, as that most directly affects biotic exposure. To the extent possible, collection of composite samples (created from multiple grabs within a cell or barge) are better representative of average conditions, less variable, and more similar in spatial scale to the habitat ranges of biota of concern (generally higher trophic levels for bioaccumulative chemicals of concern). Discrete grab samples may be more appropriate for acutely toxic chemicals of concern and lower trophid/less mobile species, e.g. where a localized kill zone would be unacceptable.

Page 21 - The report correctly notes that TEQ-2 calculations are higher than TEQ-1 numbers, but it is not a given that TEQ-2s are overestimates, which depends on whether actual (unmeasureable/unreported) concentrations are above or below half the detection or reporting limit. When detection limits are higher than in measurements for reference sites, whether values are higher or lower than the reference values is indeterminate and thus it is uncertain whether TEQ-1s are "below Suisun Marsh background levels". For example, if the reference site sample were reanalyzed as a blind sample for comparison, with detection/reporting limits 10-100x higher, all congeners would be reported as non detect with a TEQ-1 of zero, despite actual concentrations being the same as in the initial analysis. If detection and reporting limits are not essentially identical among samples being compared, including congeners reported only for both samples for TEQ-1 comparisons would at least make for a better "apples to apples" comparison between sites and samples.

Montezuma Management Team Response:
Page 18, July 18 sample – *We routinely reanalyze samples with seemingly odd results or analytical problems, and we have had samples analyzed by alternate labs or methods. In the case of the July 18 sample, analysis a third time by another lab or by other methods was not possible because insufficient sample mass remained after the first two analyses. It is important to note that the incidence of problematic samples is low; we are talking here about one questionable sample out of 377 sediment and water samples that were collected for inorganics over the reporting period. At times when we have had samples analyzed by other labs for comparison, for example water samples from Cell 6/7 that were analyzed by both STL and Frontier Geosciences (see pages 30-31), the results have typically been similar to the main lab's. Our routine split*

samples also typically replicate the main lab's results, so we have not seen evidence of systematic problems that would prompt us to switch labs.

Page 19- All samples collected from barges and cells are composites, typically of four grab samples. We archive a portion of each grab sample and analyze those separately if the composites show elevated or unexpected concentrations. We also typically collect four or five discrete samples to get a more fine-grained characterization of the final surface of each cell once sediment has been placed to the design elevation and no more sediment placement is anticipated in that cell.

Page 21 - *This is a good point. To investigate this question we recalculated the background TEQ-1s using only congeners detected in both the onsite samples and the background sample that represents the Suisun Marsh maximum value. This exercise resulted in a range of background TEQ-1s depending on which congener detections were common to each sample pair. A comparison shows one onsite TEQ-1 (in a field duplicate) marginally higher than its corresponding background TEQ-1. The others were below the background TEQ-1s, including the paired sample of the field duplicate that showed the exceedance. The onsite values and recalculated background values can be seen below:*

Sample ID	TEQ-1	Background TEQ-1
SS-P1C8/9-012506	0.08	0.34
SS-P1C3/4-012506	0.13	0.34
SS-P1C8/9-030806	0.093	0.34
SS-P1C2-040606	0.0016	0.022
SS-P1C3/4-040606	0.0016	0.022
SS-P1C8/9-040606	0.0030	0.022
SS-P1C3/4-050406	0.063	0.34
SS-P1C8/9-050406	0.10	0.34
SS-P1C1-061306	0.41	0.83
SS-P1C1-061306-0	0.53	0.96
SS-P1C10-061406	0.0026	0.022
SS-P1C3/4-061406	0.16	0.34
SS-P1C8/9-061406	0.45	0.96
SS-P1C10-071306	0.0024	0.022
SS-P1C2-071306	0.0019	0.022
SS-P1C8/9-071306	0.0020	0.022
SS-5ASB-080806	0.0017	0.022
SS-P1C3/4-080806	0.030	0.83
SS-P1C6/7-080806	0.15	0.34
SS-P1C11-NC-112006B	0.32	0.34
SS-P1C11S-C-121306	0.90	0.96
SS-P1C11S-C-121306-0	**1.07**	0.96
SS-P1C11N-C-121906	0.51	0.96
SS-P1C11-010907	0.43	0.96

Biological Survey Review

February 4, 2009: Report Review Comments of "2005 Report on Biological Surveys"

Montezuma Technical Review Team

Reviewed of "2005 Report on Biological Surveys" for the Montezuma Wetlands Project (MWP)
Prepared by Letitia Grenier
February 4, 2009

I have reviewed the "2005 Report on Biological Surveys" for the Montezuma Wetlands Project (MWP) and have the following comments.

Overall, I continue to be impressed by the efforts of the MWP to alter their monitoring to respond to changes in the biological communities and requests from the TRT. This ability to adaptively manage is important when dealing with a long-term project of large spatial scale that includes a great deal of habitat change.

The upland grass monitoring produced interesting results. Given the replication within the sampling areas, the resulting data would support statistical tests to compare the grazing treatments to each other. Statements made about differences between grazing treatments would be strengthened by statistical testing.

The vernal pool figures are very helpful to summarize and visualize the results of the pool monitoring. The addition of error bars and statistical tests would strengthen the statements made about comparisons among pool groups or change over time. At a minimum, the addition of 95% confidence intervals would allow the reader to determine if differences between pool groups or time periods were significant.

The summary of western pond turtle (WPT) sightings in Phase 1 on page 15 does not seem to include the observations of WPT made by Avocet Research Associates on May 4. This seems like useful information to include, to know where turtles are inhabiting future construction areas.

I was unclear on how sediment placement in Phase 1 would not harm WPT residing in the affected cells (page 16, first paragraph). A more detailed description of this logic would be helpful.

On page 17, 3rd paragraph, the report states that pre-construction surveys for California red-legged frogs (CRLF) will not be conducted in areas where protocol surveys have already been conducted in previous years and the frogs have not been detected. The appearance of WPT in Phase 1 where they were not previously observed shows that the distribution of wildlife species will change as the habitats within the MWP change. Therefore, are the project biologists convinced that the habitat change within the MWP will not attract CRLF where there were none before? More detail on this line of thinking would be helpful.

It should be noted that the habitat quality categories mapped in Figure 16 as red and green are for saltmarsh harvest mouse.

Montezuma Management Team Responses:

We will discuss statistical testing of the grassland monitoring and vernal pool data with the monitoring biologists. Certainly, 95% confidence intervals can easily be incorporated into the graphs comparing means among the pool groups.

Page 15 of the report includes one of the WPT sightings on May 4, 2005 (on a levee near Cell 3/4), but the second sighting (in the return water channel near Cell 8/9) was mistakenly omitted from the summary. These two sightings may represent two different turtles or two sightings of the same turtle. There is appropriate habitat for WPT in Montezuma Slough adjacent to Phase I, and there is also a ditch in northern Phase II that retains water year-round via a subsurface connection with the adjacent slough and supports a population of

WPT. It appears most likely that WPT venture north from Phase II or over the levee from Montezuma Slough when salinity in the cells and ditches of Phase I is within the range they tolerate. To date, they have not been observed in Phase I during the summer or fall when salinity rises in the cells and ditches. This pattern is typical of Phases II through IV also: WPT have been observed in disparate areas of the site during the wet season, but during the dry season they appear to retreat to the few areas onsite that provide year-round relatively fresh water.

When WPT were first observed in Phase I, we evaluated the possible risks that Phase I construction and operations might pose to WPT and conferred with biologists with extensive experience with the species. The potential risks to WPT in Phase I were identified as 1) being struck by vehicles or construction equipment; and 2) burial by sediment placement if WPT aestivate in the dry season by burying themselves in mud.

The logic behind our conclusion that protective measures (beyond our normal monitoring and construction/operations oversight) are not needed is as follows:

1) The risk of being struck by vehicles and construction equipment is lessened by the fact that construction takes place in the dry season when salinities are higher. Construction areas need to be dry for work to take place and this further lessens the likelihood of WPT presence near construction areas; construction also generally occurs in locations that are away from the constructed and filled (or partially filled) cells that contain water in the dry season. In addition, strict control over contractor activities is maintained during construction; construction work areas (including haul routes) are laid out and biological avoidance measures are identified (verbally and in writing) with the contractor prior to the start of work. Adherence to these procedures is strictly enforced via daily oversight by project staff. Preconstruction surveys are conducted immediately prior to the start of work in or near any areas containing water (these are typically small sections of ditches that cross levee footprints). If necessary, drift fences can be placed in high traffic areas during construction if necessary to limit movement of WPT onto haul routes.

   Outside of construction areas, vehicle traffic is very light, limited to a pickup truck used for water quality and biological monitoring. During active sediment placement, another pickup truck or two are in use by staff conducting monitoring and managing sediment placement operations. ATVs are used in the winter when the levees are impassible by trucks. Vehicle speeds are slow by necessity (the levees are not much wider than a pickup truck). Monitoring and operations staff are few in number and are routinely briefed on biological avoidance measures.

2) Burial of aestivating turtles during sediment placement was determined to be highly unlikely; WPT experts we conferred with advised that WPT are not known to aestivate in mud during the dry season, but typically move overland if water bodies they are inhabiting dry up. They have been documented to move 1.5 miles in two weeks and up to half a mile in a day.

   Sediment placement when turtles are active is also unlikely to affect WPT if they are in the cells. The cells are large relative to the zone of immediate sediment placement effects (e.g., turbulence). Sediment placement effects also occur over a limited period of time; offloading times are typically 1.5 to 3 hours per barge and 1 to 3 barges per day is a typical rate of sediment delivery to the site. WPT are mobile and capable of moving away from the incoming sediment plume, which is comprised of 75-85% water and is further diluted by the cell water it is placed into.

Regarding CRLF, the habitat conditions in Phase I are not appropriate for the species. CRLF have a low tolerance for salinity. The maximum salinity tolerance has been documented as 9 ppt for adults and 6 ppt for embryos (Jennings and Hayes 1990). CRLF also require dense vegetation that is in contact with or close to deep water (at least 70cm). These conditions are not met in the Phase I cells or in the existing ditches and seasonal wetlands in Phases II through IV that have been surveyed to date. As noted in the report, we will continue to conduct surveys for CRLF prior to work in potential habitat that has not previously been surveyed.

We will clarify Figure 16 as you suggest in the next report.

Reference:

Jennings, M.R. and M.P. Hayes (1990). Final Report of the status of the California red-legged frog (*Rana aurora draytonii*) in the Pescadero Marsh Natural Preserve. Prepared for the California Department of Parks and Recreation under contract NO. 4-823-9081 with the California Academy of Sciences. 30 pp.

December, 17 2010: Report Review Comments of "2006-2007 Report on Biological Surveys"

Montezuma Technical Review Team

Reviewed of "Report on Biological Surveys, 2006/2007, Montezuma Wetlands Project?
Prepared by J. Letitia Grenier, Ph.D.
Conservation Biology Program Manager / Senior Scientist
San Francisco Estuary Institute
December, 17 2010

Review of Montezuma Wetlands Project Biological Surveys 2006-2007

At the request of the head of the Technical Advisory Team, Josh Collins, I have completed a review of the *Report on Biological Surveys, 2006/2007, Montezuma Wetlands Project* (Acta Environmental, Inc.).

As in previous years, I continue to be pleased at the efforts of the Montezuma restoration team to monitor not just according to the letter of their permits, but to also go beyond those measures to protect biological resources as conditions in the project change.

Burrowing Owls

Given the lack of success in getting burrowing owls to use the constructed nests, which may be related to regional population declines, are there other measures that might be more effective at aiding Burrowing Owl reproduction? Perhaps the Montezuma team could explore other options with DFG and Avocet Research Associates (ARA). One idea that comes to mind, based on this report, would be to protect natural owl burrows from being trampled by cattle. Is there a way to put up cattle barriers prior to nesting or in a way that doesn't disturb prospecting and nesting pairs? Also the suggestion from ARA of moving constructed burrows closer to areas with owl and ground squirrel activity seems like a good one to follow up.

Vernal Pools

I commend the Montezuma team for monitoring Pool 17, although it is not required under the permit. This pool supports listed branchiopods, so documenting the impact of adjacent tidal restoration will be interesting from a scientific point of view to inform future restoration projects.

The flooding of Pool A-1 due to construction activities was corrected after two winters. While it would seem better to have corrected this drainage issue somewhat faster, it's difficult to say how this flooding impacted vernal pool fauna. The greatest number of listed branchiopods (2 spp) was found in the pool in the first winter of flooding, while none were found in the second winter. In any case, it seems positive that more typical hydrology has been restored.

The greater resiliency of the natural preserved pools in supporting native biota during a dry year was an interesting outcome of this monitoring.

The figures indicate possible declines in some vernal pool flora metrics since 2005. It will be important to see results from 2008 and 2009 to determine if this represents a longer-term trend.

The results from these two years of monitoring Residual Dry Matter have interesting implications for grazing management. Does the Montezuma restoration team have a mechanism for controlling grazing or for working with those who manage grazing?

Finally, the first observed occurrence of a listed branchiopod occurred in the constructed pools in 2006, which was a great sign of improving habitat. Are there performance standards for these pools, or is the only mitigation requirement the number of acres?

Salt Marsh Harvest Mice (SMHM)
It was a very positive sign that the SMHM continued to reproduce despite significant flooding. The termination of the house mouse eruption may provide a long-term benefit to the SMHM from the flooding.

Western Pond Turtles (WPT)
It was unfortunate that a ditch was filled in without the opportunity to monitor it for WPT. This kind of construction communication issue is common in restoration projects, and this instance underscores the need to keep up constant efforts to communicate about biological impacts. Nevertheless, it seems unlikely that any turtles were harmed, as the ditch was poor turtle habitat.

Salinity in the return channel pond was a challenge during the years covered by this report. In general for the whole project, water management has turned out to be a significant effort and sometimes an obstacle to meeting requirements. I encourage the Montezuma team to continue working with DFG and other turtle experts to brainstorm ideas for how to provide low salinity turtle habitat either through changing the hydrological connections in the return channel pond area, creating an adjacent pond, etc. Given that turtles can tolerate higher salinities for unknown time periods, it might be informative to conduct simple monitoring (e.g., counts of visible turtles) each time water quality is sampled, to see whether or not the salinity seems to affect turtle presence. The results might show that salinity in not affecting turtle behavior.

Shorebirds and Waterfowl
This monitoring, which is not required, is an example of the efforts of the Montezuma team to protect biological resources on their own initiative.

Least Terns
The Least Terns now have an established nesting colony at the Montezuma project. As this monitoring continues, the Montezuma team and their subcontractors should have in their minds a goal of gathering data and ideas now, based on the current nesting behavior of the birds, that might help make the future constructed nesting habitat more successful. Knowledge and ideas from those in the field could be helpful for making important tweaks to the constructed habitat design and management. Outside experts could be invited to attend monitoring trips to contribute their thoughts.

Plant Monitoring
Rare plant and invasive plant monitoring and protection and *Phragmites* and thistle control seemed to go well. This relatively early control of some of the more problematic invasive species is good, economical biological management.

Interim Habitat Enhancement Monitoring
The flooding documented by this monitoring was outside the control of the project managers and may have had the positive effect of reducing house mouse populations. I would appreciate some discussion with the Montezuma team about the enhancement aspect of this effort. It seems the habitat was monitored but not enhanced, and I am interested to learn what type of enhancement was envisioned by the permitting agency or is feasible on such large land areas.

Overall Comment
In general, the report is well written. The important information is easily accessible to the reader. I appreciate the changes to the figures that have been made in response to previous reviews.

An enhancement that would make the report even better would be to add brief captions to the figures. This could both add information (What do the error bars represent: 1 SD or 1 SE?) and add interpretive value (Were photos like 34a and 34b taken in early or late spring? Note which photos are taken from the same vantage point.) Flipping back and forth from figures to the text can be cumbersome, so having brief captions would improve the report

Montezuma Management Team Responses:

Burrowing Owls
Construction of additional burrows near the Phase I/Phase III border, near where a single owl has been observed in recent years, is planned for this fall. Additional burrows are also planned for the area near the

existing mititation burrows where ground squirrel activity has increased in recent years. It is unfortunate that burrowing owl populations continue to decline regionally. However, habitat in the vicinity of the mitigation burrows appears to be ideal for nesting owls, and there is reason to hope that a successful nesting pair (and their offspring) could establish a new colony over a relatively short time period.

Vernal Pools

Vernal pool fauna in Pool A-1 appear to have recovered from flooding in that pool. No large branchiopod species were observed there in 2006 or 2007, but three listed species, *Lepidurus packardi*, *Branchinecta lynchi*, and *B. conservatio* were found there in 2008 and 2009. This is the largest number of listed branchiopod species observed to date and includes two species that had not previously been documented in that pool. It is possible that these species found their way into Pool A-1 as a result of high water levels that increased its connectivity other vernal pools via swales that run nearby. We will continue to monitor developments in this pool.

Floristic parameters (with the notable exception of non-vernal pool species abundance) showed sharp declines in the very dry winter of 2007. Most of these parameters increased in 2008 and 2009, but many have remained below 2005 levels. Interestingly, the number of vernal pool-affiliated plant taxa in the preserved pools and railroad site pools (which were relatively less affected by dry conditions in 2007) rebounded in 2008 but in 2009 showed the lowest levels to date. The created and avoided pools, many of which held no standing water at all in 2007, continued to recover in 2009. So we continue to see fluctuations in diversity and abundance of vernal pool flora over the short-term, likely owing to complex interactions of multiple variables, and the effects of an event such as a particularly wet or dry year can take a number of years to play out.

The project has some ability to control grazing on the site, and continues to work with the grazing lessee to protect and enhance conditions for vernal pools and native grasses. So far, the intensity and type of grazing has been suitable and no changes in grazing regime have been warranted.

The performance standards for the created vernal pools can be found in the project's MMRP (Appendix H). The created pools must meet or exceed the biological conditions documented in baseline surveys of the listed branchiopod habitat that was impacted by Phase I construction. These surveys identified the branchiopod species present, species diversity and abundance, and the ratio of opportunistic species to endemic vernal pool fauna. Vegetation in the created pools must be composed of native hydrophytes, with vernal pool-affiliated flora comprising approximately 10% relative cover.

Western Pond Turtles (WPT)

Salinity in the return water channel pond continues to be a challenge, although improved water management techniques adopted in 2008 have shortened the period when salinities exceed 15 ppt to about four to six weeks out of the year. Alternatives such as creating a replacement pond or enhancing conditions in the makeup water pond with the addition of bank vegetation have proved infeasible either due to cost, impracticability, or regulatory requirements that apply to the makeup water pond. WPT continue to be found in the makeup water pond, in the return water channel upstream of the return channel pond, and elsewhere onsite, but they are now rarely seen in the return channel pond even during the majority of the year when salinities are low (3 to 4 ppt). The reason for their current rarity in the return channel pond even under suitable conditions is unclear, but the presence of a family of otters in the pond since approximately 2006 may be a contributing factor; river otters are a potential predator on WPT and are known to harass WPT and displace them from habitat. However, surveys indicate that the site continues to support a population of turtles that we hope will be able to colonize the restored marsh in future.

Least Terns

We would welcome participation in monitoring by outside experts and are receptive to any ideas that may make the constructed nesting habitat more successful. We continue to communicate with least tern biologists and will be attending the annual CDFG/USFWS least tern coordination meeting again this year, where we hope to further benefit from the experience of least tern colony managers from around the state.

Interim Habitat Enhancement Monitoring

It is true that the project's efforts in this area consist mainly of monitoring. As discussed in the Interim Habitat Enhancement Plan for Unfilled Phases (LEG 2002) the site infrastructure of pumps and ditches is not equal to the task of making large-scale alterations in patterns of seasonal ponding in unfilled phases, and there are also other species whose habitat could be adversely affected by large-scale changes, even if they could be

accomplished. One thing that can be done is running the return water channel pump to draw down excessive flooding of SMHM habitat in Phase IV, and this has been done when inundation exceeded normal high water levels. However, it takes weeks or months of pumping to achieve a noticeable effect, and even this action has been precluded at times when no water storage capacity remains in the makeup water pond and Phase I cells. As for what type of enhancement was envisioned by the agencies, we don't know the answer that question. Interim habitat enhancement was a mitigation measure from the EIR/S that was subsequently adopted as a condition in the County and Corps permits, and the project was tasked with figuring out how to make it a reality. As you observed, the reality is that there is not a lot we can do beyond monitoring. But we would be happy to discuss this aspect of the project further with you in the interests of maximizing the benefit that can be gained from this effort.

Overall Comment

We will add more descriptive captions and footnotes to figures in future reports.

Adaptive Management Plan and Design Modification Reviews

April 27, 2010: Final Summary of Review Comments of the Requested Adaptive Management Modifications as outlined in the "Adaptive Management Restoration Plan for Phase I of the Montezuma Wetlands Project" (July 2007) and additional amendments

MONTEZUMA TECHNICAL REVIEW TEAM MEMORANDUM

TO: DOUG LIPTON, PH.D., LIPTON ENVIRONMENTAL GROUP, MONTEZUMA TECHNICAL ADVISOR

FROM: MEREDITH WILLIAMS, PH.D., SAN FRANCISCO ESTUARY INSTITUTE

SUBJECT: TRT REVIEW OF REQUESTED ADAPTIVE MANAGEMENT MODIFICATIONS

DATE: 4/27/2010

CC: RACHEL BONNEFIL, ACTA ENVIRONMENTAL, MONTEZUMA ECOLOGIST

This letter summarizes the review by the Technical Review Team (TRT) of the proposed adaptive management modifications to Phase I of the Montezuma Wetlands Project. These proposed modifications are described in the Phase I Adaptive Management Restoration Plan (AMP) (Adaptive Management Restoration Plan, Montezuma Wetlands LLC, July, 2007), in memos dated January 29, 2008 and March 19, 2008, and in letters to the SFRWQCB (dated December 15, 2009), Solano County (dated December 2, 2009), BCDC (dated November 30, 2009), and USACE (dated December 3, 2009), and supplemental information regarding least tern habitat design provided to the TRT (emails dated January 13, 2010, March 10, 2010, March 25, 2010). This memo reports TRT recommendations and findings on the each of the requested adaptive management modifications.

1. Staged Restoration of Tidal Action to Completed Areas of Phase I

The TRT concluded that the proposed "early restoration" of completed Phase 1 cells is a good idea. Support for this approach was documented in the July 7, 2008 review of Section 3.0 – 3.3.4 (Staged Tidal Restoration [the "early breach"]) of the 2007 Adaptive Management Plan. This support was based on the following conclusions:

- The modular design of the Project can support the kinds of design changes that are being proposed. The project footprint is subdivided into four large "Phases" that consist of "sediment cells." Each cell is larger than needed to contain a tidal drainage network that will tend to maintain itself through the usual ebb and flood of tidal water, based on studies of nearby natural analogue marsh systems. The restoration of full tidal action to cells and the increase in elevation of high marsh cells are unlikely to reduce their ability to serve as physical templates for self-maintaining tidal marshland.
- Of all the tidal marsh restoration projects around San Francisco Bay, only this one includes a significant amount of uplands that can become tidal wetlands as sea level rises. This is especially important if the rate of sea level rise is fast enough to drown the existing tidal wetlands.
- The threat of drowning tidal marshes gives the Project new urgency. Under natural conditions, high marshes keep up with sea level rise by the accumulation of plant matter produced on-site, plus the deposition of inorganic sediments delivered by the tides. Most opportunities to restore tidal marshes are in subsided areas. To restore them to tidal marsh that has a chance to keep up with sea level rise, they must be raised high enough with imported sediment to be colonized by tidal marsh vegetation. As time passes, sea level rises, and the elevation to which the subsided areas have to be raised, and therefore the amount of sediment needed to offset sea level rise, increases.

Thus, speeding the rate of restoration (as the staged tidal restoration would do) decreases the cost and uncertainty of the restoration of sustainable tidal marsh.

- The goal of the Project is to use sediment dredged from the San Francisco Estuary to restore tidal wetlands, as called for by every regional ecological plan to date. The project has been constrained by water availability for managing unfinished cells. The need to mix dredged sediment with water to move it onto the site, plus the need to keep dredged sediments wet after they have been moved into cells, plus the need to decant the cells and reuse the water, necessitates an expensive plumbing and water management system that has proved unable to provide enough water to keep all the Phase I cells ponded in the dry months of the year. The sooner completed cells can be restored to tidal action the better for sustaining the ability of the Project to supply water to unfinished cells in a phase.

- The Project has been delayed by a lack of dredged sediment coming to the site. The schedule of dredging and the choices on disposal or reuse sites has been, and will probably continue to be uncertain. Steady, uninterrupted progress in sediment placement leading to whole-Phase breaching seems improbable. Therefore, in order to realize the benefits of the Project, its Phases need to be implemented in stages by breaching selected cells.

  It should be noted that the increasing rate of sea level rise puts a premium on managing the sediment supplied by local watersheds to restore and conserve intertidal habitats. Dredged sediments are a critical part of the sediment supply for restoration projects like Montezuma, Hamilton, and others around the SF Estuary. Clearly, their long-term value as the building material for mudflats and marshes far exceeds their short-term cost for removal and disposal. To the fullest extent feasible, dredged sediment should be used to reduce the risk that rising sea levels will drown tidal marshland.

2. Creation of Least Tern/Snowy Plover Habitat

In 2006, The TRT began advising the Project on design changes to support the Least Tern and Snowy Plover that occurred at the Project for the first time in 2005. Providing stable habitat for these species has become an important concern in the design and planning for completion of Phase I. A proposed design was described in the July 2007 Adaptive Management Plan, and revisions to this design were outlined in emails and drawings in emails from Rachel Bonnefil on January, 12, 2010, March 10, 2010, and March 25, 2010. These revisions are good refinements to the restoration design.

These changes allow the constructed nesting habitat to be more easily maintained over time. It is likely that maintenance of the substrate will be needed if it blows away or if the area becomes overly vegetated. The proposed changes will place the habitat in a place where it can be more easily accessed by vehicles, which will reduce the costs and increase the feasibility of maintenance.

At the same time, leaving a land connection for vehicle access will provide terrestrial predators with easier access as well. Therefore, the proposed fencing is an important design element to help reduce predation on eggs and young. The placement of the fence at the bottom of the slope to the nesting area should help reduce perching by raptors.

Edge effects can also reduce reproductive success, so it is preferable to minimize edge. The planned shape and size of the nesting areas are optimized to be large enough (≥1 acre) to house a colony, and yet have as little edge as is feasible, given the constraints of the current elevations and costs of construction.

The interaction between the Montezuma staff (R. Bonnefil) and the California Least Tern coordination group was an excellent way to get ideas for and review of the change in design. Continued input from this group, as planned, is an important part of the ongoing planning and monitoring. Equally important is the planned adaptive management of the nesting areas and evolution of the habitat design.

An additional design element that perhaps should be added is an initial sparse planting of native plants in the nesting area. This idea is based on observations of high nesting success at up to 30% vegetative cover from the Venice Beach Least Tern colony. In addition to providing cover for chicks, would sparse

native plant cover decrease wind erosion and provide some competition against invasive plants? If so, it might be a cost-saving measure that would reduce maintenance in the long run.

Other considerations to keep in mind as the Montezuma team moves forward with constructing the nesting areas are as follows:

- Adaptive management of predation, such as by controlling predators, placing material on top of the fences to reduce perching by raptors, or constructing more nesting areas in future phases of the project, may be necessary for the terns to nest successfully.
- Monitoring tern use and nesting success will be important to know how greatly predation, wind, and other factors are impacting the colony. In the absence of monitoring reproductive success, it may be hard to know if these further actions are needed.
- Providing more nesting habitat may be warranted if tern populations increase in the Bay Area over time, as is predicted due to climate change.

Accommodation of Least Tern nesting colonies is a valuable, unforeseen benefit of the Montezuma project and should continue to be a high priority. The TRT requests regular communication on this topic as this restoration design element moves forward.

3. Modification of High Marsh Design for SMHM

In 2003, the TRT began advising the Project on proposed design changes for high tidal marsh, based on the best available scientific information about the natural history and habitat characteristics of the salt marsh harvest mouse (SMHM), *Reithrodontomys raviventris,* which is a primary design concern for the high marsh portion of the Project. In recent years, since the original designs were developed, data have been accumulating through publicly funded studies that are relevant to high marsh design for the project. The TRT reviewed recent advances in scientific understanding relevant to SMHM habitat associations. Several studies combined to provide important new information on correlations between tidal marsh elevation, plant community structure, and the distribution and abundance of SMHM in the brackish regions of the San Francisco Bay-Delta ecosystem. A report reviewing this work was completed in December 2004 and was included in the December 2006 TRT report review. This set of studies suggests that, in the region of the system that includes this project, the natural, sustainable SMHM habitat is characterized by a mixture of salt-tolerant and other tidal marsh vegetation at elevations above Mean Higher High Water. These elevations can develop slowly under natural sedimentary regimes because the associated plant species are not especially productive and the deposition of inorganic sediment is limited by relatively infrequent tidal inundations. It seems clear that creating SMHM habitat for this project within the timeframe prescribed by the project plans and permits will require creating high marsh plains that are higher than originally designed. The revised high marsh design, which includes raising the design elevation and eliminating of the diked managed pickleweed marsh, reflects this new information. The raised high marsh elevation also reflects updated tidal reckoning that was performed in 2007. This updated tidal reckoning showed that tidal datums are now higher than when the original design work for the project was done, so all tide height-based design elevations have been raised accordingly .

The vegetation plan for the high marsh areas of the project calls for a mixture of vegetation types, including mixed halophytes with a lower percentage of pickleweed (*Sarcocornia pacifica*) than originally planned. The proposed plant community structure is characteristic of brackish portions of the Delta.

More extensive discussion of issues related to high marsh design, salt marsh harvest mouse habitat, and tidal reckoning can be found in the Second Annual Report, Montezuma Wetlands Restoration Project Technical Review Team, December 2006

4. Pumping Water Directly from the Sacramento River/Suisun Bay Using Approved Fish Screens

The TRT provided input to the Project Management Team to assist in the development of the management strategy for changes in pumping at the site. The requested pumping plan is consistent with the TRT input.

The presence of delta smelt (*Hypomesus transpacificus*) and longfin smelt (*Spirinchus thaleichthys*) is well-documented in the Delta. Larvae from both species may be present in the same portion of the Estuary as the pumping station. The majority of delta smelt spawning occurs between early April and mid-May with larval abundance peaking from April to June(Baxter 1999, Moyle 2002). There are two critical periods for risk of longfin smelt entrainment due to diversion. The first is from spring through summer, when larvae and juveniles travel downstream after being spawned. The second is in winter through spring, when adults move back upstream to spawn (The Bay Institute et al. 2007).

In addition to seasonal variation, spawning levels vary interannually, depending on rainfall, outflow, and adult movements. We would anticipate that both species of fish could be entrained in small numbers, but through proper management this risk can be minimized.

The fact that the sediment delivery schedule will dictate non-continuous operation is a mitigating consideration to pumping risks for both species. The expected pumping duration during active sediment placement is 3 to 9 hours on placement days, and there will be frequent non-operational days. These factors greatly reduce the potential for entrainment or other negative impacts. The fact that the project will use fish screens constitutes a second important mitigation measure. The Management Team has selected appropriate fish screens according to current best practices for both the Liberty offloader and the groundwater extraction system.

Review of DFG summer and fall distributional data is recommended, particularly if there is pumping outside of the August 1 to December 15 timeframe specified by the 1602 Lake and Streambed Alteration Agreement (#1600-2009-0053-3, dated September 23, 2009). Given that smelt populations are extremely low, near-site monitoring for smelt to assess the impact of pumping is not expected to be a very effective tool given that the intensive sampling of DFG catches very few fish. Three more effective tools to moderate impact are as follows:

1. The DFG summer sampling concludes before August 1. These sampling results will indicate where the juveniles last were. If these results indicate that peak abundance in July lies within one tidal excursion of the intakes, concern about entrainment is more warranted.
2. The DFG fall sampling starts in September. By October 1, there would be some indication as to whether the peak smelt abundance lies within one tidal excursion of the pump. Again, if it is, concern about entrainment is more warranted. If both the summer and fall data suggest that pumps are being operated away from where smelt are actually known to be, there is considerable reason to expect that the likelihood of entrainment is low.
3. Also note that almost always, delta smelt are upstream of the 2 ppt isohaline, therefore as long as 2 ppt or higher water is drawn, it is likely that few smelt are being exposed to the screens.

Should the project consider pumping outside of the August 1 and December 15 timeframe, there should be regular interaction with regional fish experts (e.g., Randy Baxter) to consider current distribution of the fish and appropriate mitigation and monitoring measures.

5. Allowing up to 20% Noncover Sediment in Phase 1

Contaminant levels for water and sediment in Phase 1 cover-over-noncover areas are well within the permit limits for the full range of constituents being monitored. These include a wide range of inorganic and organic contaminants per the project's Mitigation, Monitoring and Reporting Plan. Based on data collected to date, concentrations of inorganic COCs and PAHs in water and sediment are similar in cover-only and cover-over-noncover sediment cells. During its review of the request to increase the amount of noncover sediment in Phase I to 20%, the TRT gave special attention to those contaminants with the potential to enter and bioaccumulate in the food web, notably organic contaminants (DDTs and PCBs) and mercury. The majority of pesticide and PCB results for both cover and cover-over-noncover sediment are below the detection limits established in the 2000 Mitigation, Monitoring, and Reporting Plan which is at least one order of magnitude lower than the permit limits – depending on the organic analyte. Cover-over-noncover levels of these COCs are not detectably different from cover sediment results using currently applied methods. In fact, most pesticide and PCB results for both cover and cover-over-noncover sediment (>99%) are below the method detection limit of the analytical methods currently being used and all are below permitted levels. Organic method

detection limits meet permit requirements for cover, so with respect to the proposed increase of the Phase I noncover limit, the cover-over-noncover cells are fully compliant with the permit.

Effluent Limitations and Sediment Screening Criteria for Selected Chemicals,
Table B-5 QAPP Methods-final-032393.xls, MMRP

Parameter	Noncover (mg/kg)	Cover (mg/kg)	RWQCB Permit Limits (μg/*l*)
PCBs	<0.4	<0.05	-
Total DDTs	<0.1	<0.003	-
Mercury	<1.3	<0.35	0.25

During its review of this request to revise the project permit, the TRT began to consider the degree to which the science of contaminant monitoring has advanced since the project's monitoring plan was developed. Also, the TRT is beginning to consider how to monitor Phase 1 after it is restored to tidal action, perhaps in 2011 or 2012. The TRT intends to more comprehensively address these considerations through one or more dedicated TRT meetings with project managers and responsible agencies. The meetings should be conducted this year, soon after the annual report of the TRT is completed. The TRT will work with the project management team to plan these meetings. Again, the TRT concludes that based on monitoring results to date, the project will meet permit requirements even if cover-over-noncover sediment placement is increased to 20%.

References

Baxter, R. D. 1999. Osmeridae. Pages 501 *in* J. J. Orsi, editor. Report on the 1980-1995 Fish, Shrimp, and Crab Sampling in the San Francisco Estuary, California. The Interagency Ecological Program for the Sacramento-San Joaquin Estuary (IEP), Sacramento, CA.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press, Berkeley.

The Bay Institute, Center for Biological Diversity, and Natural Resources Defense Council. 2007. Petition to list the San Francisco Bay Delta population of longfin smelt (*Spirinchus thaleichthys*) as endangered under the Endangered Species Act. Petition to U.S. Fish and Wildlife Service.

March 30, 2010: Review Comments of Proposed Changes to the Least Tern Habitat and Supporting Email Discussion

MONTEZUMA TECHNICAL REVIEW TEAM MEMORANDUM

TO: DOUG LIPTON

FROM: LETITIA GRENIER, SAN FRANCISCO ESTUARY INSTITUTE

SUBJECT: TRT RESPONSE TO LEAST TERN NESTING HABITAT DESIGN FOR MONTEZUMA RESTORATION

DATE: 3/30/2010

CC: RACHEL BONNEFIL

The proposed changes to the Least Tern nesting habitat as outlined in an email from Rachel Bonnefil on 25 March 2010 (see below) are a good refinement to the restoration design.

These changes allow the nesting habitat to be more easily maintained over time. It is likely that maintenance of the substrate will be needed if it blows away or if the area becomes overly vegetated. The proposed changes will place the habitat in a place where it can be more easily accessed by vehicles, which will reduce the costs and increase the feasibility of maintenance.

At the same time, leaving a land connection for vehicle access will provide terrestrial predators with easier access as well. Therefore, the proposed fencing is an important design element to help reduce predation on eggs and young. The placement of the fence at the bottom of the slope to the nesting area should help reduce perching by raptors.

Edge effects can also reduce reproductive success, so it is preferable to minimize edge. The planned shape and size of the nesting areas are optimized to be large enough (≥1 acre) to house a colony, and yet have as little edge as is feasible, given the constraints of the current elevations and costs of construction.

The interaction between the Montezuma staff (R. Bonnefil) and the California Least Tern coordination group was an excellent way to get ideas for and review of the change in design. Continued input from this group, as planned, is an important part of the ongoing planning and monitoring. Equally important is the planned adaptive management of the nesting areas and evolution of the habitat design.

An additional design element that perhaps should be added is an initial sparse planting of native plants in the nesting area. This idea is based on observations of high nesting success at up to 30% vegetative cover from the Venice Beach Least Tern colony. In addition to providing cover for chicks, would sparse native plant cover decrease wind erosion and provide some competition against invasive plants? If so, it might be a cost-saving measure that would reduce maintenance in the long run.

Other considerations to keep in mind as the Montezuma team moves forward with constructing the nesting areas are as follows:

- Adaptive management of predation, such as by controlling predators, placing material on top of the fences to reduce perching by raptors, or constructing more nesting areas in future phases of the project, may be necessary for the terns to nest successfully.

- Monitoring tern use and nesting success will be important to know how greatly predation, wind, and other factors are impacting the colony. In the absence of monitoring reproductive success, it may be hard to know if these further actions are needed.
- Providing more nesting habitat may be warranted if tern populations increase in the Bay Area over time, as is predicted due to climate change.

Accommodation of Least Tern nesting colonies is a valuable, unforeseen benefit of the Montezuma project and should continue to be a high priority. The TRT requests regular communication on this topic as this restoration design element moves forward.

Supporting Emails Related to the Least Tern Habitat Design (January to March 2010)

From: "Rachel Bonnefil" <bonnefil@sbcglobal.net>
To: "Letitia Grenier" <letitia@sfei.org>
Cc: "Meredith Williams" <meredith@sfei.org>
Sent: Thursday, March 25, 2010 12:36:17 PM
Subject: Re: Updated Montezuma least tern habitat plan

Hi Letitia,

A revised figure showing the proposed least tern nesting areas is attached. Roger and I pored over the survey again on Monday and found what we think is a better option than that long section of raised levee just north of Cell 11. That area was shaping up to be too narrow (there seems to be an edge effect with tern colonies, with more predation on nests that are within 20' or so of the colony edge) so we found a spot in the future seasonal wetland that we think will work a lot better. Both of the areas shown on this figure take advantage of existing high ground, and will be raised to about +9' NGVD and graded more or less flat, with fairly steep slopes (~2:1) from the top surface down to the adjacent high marsh or seasonal wetland elevation. This figure is not perfect in that it doesn't show those slopes but instead shows water (lt. blue) right next to the top surface of the tern areas. I'll have them change that, but meanwhile I wanted to get this to you w/out further delay.

The northern tern area (to the left on the figure) is about 1.5 acres, the southern one is about 1 acre. That's the area of the flat surfaces and doesn't count the slopes down to adjacent marsh/seasonal wetland elevations. As we discussed, each area would have a low berm along part or all of the upland sides (towards the top on this figure) to provide some visual blocking from a tern's eye view.

The lines with dots around the tern areas represent fencing. The fence details are not determined yet (we'll consult with the tern group on materials and design), but it would likely be either electric fencing or chain link fencing. The fencing would be installed at the bottom of the slopes surrounding the tern areas so the tops of the fences will be below the surface of the tern areas, in order to make the fences less effective hunting perches for avian predators.

The maintenance plan for the substrate is to replace it once it blows away or gets too thin to deter weeds. Our plan is to buy oyster shells from the Jerico facility next to the site. We may also use sand from onsite that we have stockpiled in a couple of areas. The goal is to maintain it at less than 30% vegetative cover, and we hope a thick and mobile layer of sand and/or shell will accomplish that. If needed we can do mechanical weed control, but what we've seen in other sandy areas of the site is that they stay weed-free or close to it until underlying soil/sediment becomes exposed.

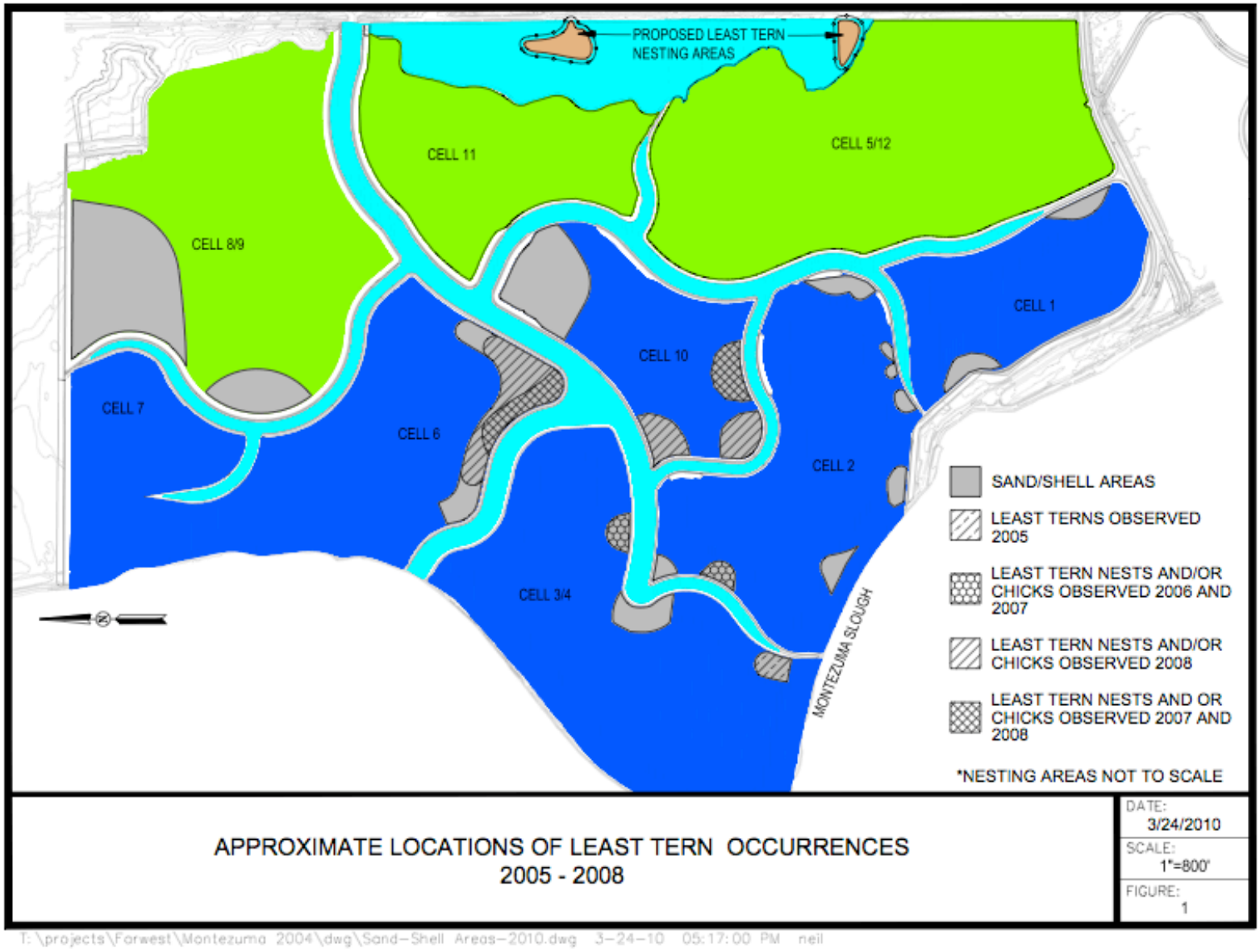
As far as adaptive management, both of these areas will be accessible after tidal restoration so we have flexibility to modify them if needed (e.g. raise them, resurface them, recontour them, add windbreaks or chick shelters, etc.). If the sand/shell surface does not work we can cover them with some hard surface (like gunnite) but our preference would be to stick with natural materials. We'll continue to assess habitat conditions before the start of

the nesting season so we can do weed control, fix fences, or do other maintenance work, and then monitor the areas through the nesting season. We'll also continue to coordinate with the tern group to get feedback on things that don't seem to be working and identify possible corrective measures.

Let me know if you have any questions or would like to discuss it further.

Best Regards,

Rachel


PROPOSED LEAST TERN NESTING AREAS
CELL 11
CELL 5/12
CELL 8/9
CELL 1
CELL 10
CELL 7
CELL 6
CELL 2
CELL 3/4
MONTEZUMA SLOUGH
SAND/SHELL AREAS
LEAST TERNS OBSERVED 2005
LEAST TERN NESTS AND/OR CHICKS OBSERVED 2006 AND 2007
LEAST TERN NESTS AND/OR CHICKS OBSERVED 2008
LEAST TERN NESTS AND OR CHICKS OBSERVED 2007 AND 2008
*NESTING AREAS NOT TO SCALE
APPROXIMATE LOCATIONS OF LEAST TERN OCCURRENCES
2005 - 2008
DATE: 3/24/2010
SCALE: 1"=800'
FIGURE: 1
T:\projects\Forwest\Montezuma 2004\dwg\Sand-Shell Areas-2010.dwg 3-24-10 05:17:00 PM neil

From: Letitia Grenier

To: bonnefil@sbcglobal.net

Cc: Meredith Williams

Sent: Friday, March 19, 2010 3:13 PM

Subject: Re: Updated Montezuma least tern habitat plan

Hi Rachel,

Thanks for your time yesterday on the phone explaining the map figure and discussing the tern habitat plans. I look forward to seeing the revised map and list of attendees to the tern meeting that we discussed you would to send to me

Also, it would help to have a brief text description of some of the other aspects of the tern habitat that we discussed on the phone, specifically the actual shape and size of the habitat areas, the fencing arrangement, the maintenance plan for the substrate, and the strategy for adaptive management over time. That brief description would give me something written down to respond to in our letter.

Thank you.

Regards,

Letitia

----- Original Message -----

From: "Letitia Grenier" <letitia@sfei.org>

To: bonnefil@sbcglobal.net

Cc: "Meredith Williams" <meredith@sfei.org>

Sent: Thursday, March 18, 2010 3:55:13 PM

Subject: Re: Updated Montezuma least tern habitat plan

Hi Rachel,

I'm working on reviewing the Montezuma LETE habitat design, and I need a little help interpreting your map figure. The two proposed LETE areas don't look like peninsulas to me, especially the one in cell 11. Could you maybe explain the colors on the map a bit more or give me a call on my cell phone at your convenience to walk me through it? 510 875 5723

Thanks,
Letitia
----- Original Message -----
From: "Meredith Williams" <meredith@sfei.org>
To: "Josh Collins" <josh@sfei.org>, "Letitia Grenier" <letitia@sfei.org>, "Don Yee" <don@sfei.org>, "Ben Greenfield" <ben@sfei.org>
Sent: Thursday, March 11, 2010 8:22:05 AM
Subject: Fwd: Updated Montezuma least tern habitat plan

Hello all,

This is one of the elements of the permit change request that we will need to review and respond to. I'll schedule a meeting to discuss this sometime late next week.

Regards,
Meredith

----- Forwarded Message -----
From: "Rachel Bonnefil" <bonnefil@sbcglobal.net>
To: "Meredith Williams" <meredith@sfei.org>
Sent: Wednesday, March 10, 2010 6:52:52 PM
Subject: Updated Montezuma least tern habitat plan

Hi Meredith,

As promised, here's an updated description of our proposed approach for constructing CA least tern habitat in Phase I. As you know, we've been looking for the best way to incorporate permanent stable least tern nesting habitat into the tidal restoration design ever since terns began nesting in Phase I in 2006. As I mentioned at our December meeting, we have come to the conclusion that a constructed sand island located in the restored high marsh, which we proposed in 2007 to replace the sandy areas in the future low marsh where terns are currently nesting, would provide suitable tern habitat but has some practical difficulties that make it undesirable over the long term. The first is that once tidal action is restored to Phase I, the island would be too difficult to access for the ongoing monitoring and management (e.g. weed control) that will be necessary to maintain habitat values. In addition, a sand island would be too prone to wind erosion unless it is covered with a hard man-made surface.

Our current plan is to construct two higher-elevation peninsulas at the upper edge of the restored high marsh. Like the previously proposed sand island, these peninsulas would be raised to approximately +8 to +9' NGVD to keep them well above the line of highest tidal action. The ends of these peninsulas, each comprising a 1 to 2 acre nesting area, would be topped with sand, shell, or a combination of both to provide suitable nesting substrate. The nesting areas would be connected to the uplands by narrow levee roads to facilitate access for management and monitoring after tidal restoration. The sandy "topping" on the nesting areas will be just as prone to wind erosion as a sand island would, but since the peninsulas will be accessible to equipment the surface can be replaced with more sand/shell as needed. This will also help keep the weeds down since they have a hard time getting established in a loose mobile sandy substrate. One peninsula is planned for construction atop an existing high area adjacent to Cell 5/12. The other is proposed for the top of one of the main tidal channel levees adjacent to Cell 11. These locations are shown on the attached figure.

I sought comments on this approach from a group of least tern specialists at the CDFG/FWS California Least Tern Coordination Meeting on January 7 of this year. The approach was favorably received by the group and the design was refined in some respects based on their comments, for example, the addition of a second nesting area was one of the group's recommendations (I sent you and Josh an email a couple of months ago (on Jan 13) that summarized the feedback I got from them).

Let me know if you have any questions about any of this.

Best regards,
Rachel

Hi Letitia,

Here is the attendance list from the January 2010 least tern meeting. They were pretty much all southern CA people, which could limit their ability to attend TRT meetings. That may not matter much though since we don't have in-person meetings very often. The one Bay Area person there was Susan Euing of FWS, who manages the Alameda tern colony. I think she would be a good addition to the TRT if she's able and interested. A couple of other people that I talked to at the meeting who seemed very knowledgeable (and who may have a wider base of knowledge about different least tern sites than Susan does) are Eric Kershner of FWS and Dan Robinette of PRBO.

Also attached are Dan Marschalek's notes from the meeting.

It was nice to talk with you again!
Best, R.

From: "Rachel Bonnefil" <bonnefil@sbcglobal.net>
To: "Meredith Williams" <meredith@sfei.org>, "Josh Collins" <josh@sfei.org>
Sent: Wednesday, January 13, 2010 4:47:03 PM
Subject: Fw: Annual Least Tern Mtg.

Hi Josh and Meredith,

I recently went to the CDFG/FWS Annual Least Tern Coordination Meeting and talked with them about our Montezuma tern situation. I got some good information at that meeting that I wanted to share with the TRT.

As I mentioned briefly to Meredith at our Dec 17th subteam meeting, we've realized that the sand island we were planning to build in Cell 8/9 for least terns has some practical difficulties - inaccessbility and instability - that are too big to overcome. We need to be able to get to the tern habitat to manage weeds, monitor, etc., and a sand island in the middle of the high marsh will be practically inaccessible. The instability problem is related to wind erosion - we underestimated the effect of the constant winds out there and based on what we've seen happen to the sand in Cell 10 we'd have to pave the sand island to keep it from blowing away over time. So we've gone back to the drawing board and come up with a new conceptual design that consists of a sand-topped peninsula connected to the uplands via a narrow levee. Based on feedback received at the tern meeting, we want to add a second tern nesting area atop the main channel levee near Clank Hollow.

Below is a summary of the Montezuma-related information I took away from the meeting. I've attached a figure showing the tern peninsula in Cell 5A/5B/12, as well as a list of discussion questions that I sent to the tern group prior to the meeting at the request of CDFG's meeting leader. Also attached is the meeting agenda in case you're interested in what else was discussed. We'd like to hear any thoughts or comments the TRT has on any of this, so please forward to other TRT members as you see fit. And as always, feel free to email or call me with any questions.

Best,
Rachel

----- Original Message -----
From: Rachel Bonnefil
To: Doug Lipton ; Roger Leventhal ; Anne Wallace
Sent: Monday, January 11, 2010 1:30 PM
Subject: Annual Least Tern Mtg.

Hi all, just wanted to share some good information I got from DFG/FWS's Annual Least Tern Coordination Mtg last Thursday. This is a meeting of people managing least tern colonies around the state, so mostly agency people and a few consultants and academics. It is mostly southern CA people since that's where most of the terns are. The focus

is very pragmatic - mainly nuts and bolts aspects of least tern habitat creation and management and some population biology research.

I gave a brief (10 min) presentation on Montezuma's existing tern situation and our current thinking on how best to incorporate tern nesting habitat into Phase I - not the Cell 8/9 sand island but the most recent conceptual design of a sand/shell topped "peninsula" in cell 5A/5B/12. I had Cadmasters add it to the cell drawing (attached) along with some colors showing low/high marsh areas. There was ~15 minutes of group discussion about the merits of this conceptual design and what we can do to give it the best chance of success. Here's a summary of the main points:

- The group thought the basic idea is sound. I specifically asked them if tern habitat surrounded by vegetated marsh (as opposed to open water or bare ground) can work, and they said it definitely can as long as the vegetation is low-growing (they cited several so. cal. tern colonies surrounded by vegetated high marsh).
- 1-2 acres is an appropriate size for the nesting habitat.
- There was strong agreement that accessibility for management (i.e., connection to uplands) is critical, even if it provides better access to predators as well.
- The main limiting factor is likely to be predation, and consensus was that while fencing doesn't keep out all of them, our chances of success are low over the long run without a fence.
- Placing the fence at the bottom of the slope around the peninsula reduces its value as a raptor perch by lessening the height advantage.
- Nixolite (that spiky stuff they use to keep pigeons off buildings) can also be used along the top of the fence to deter raptor perching. However, many at the meeting were skeptical that any fence design can effectively deter raptor perching.
- Active predator management was also felt to be a necessity by most people - DFG and FWS both do very intensive predation monitoring and control at their sites. This level of effort is probably more than we can afford to devote, and the situation at a lot of tern colonies is different than at Montezuma (most of the sites are surrounded by urban/suburban development so they are easier to get to and also support fewer predators. Some of our predators (e.g. northern harriers) are also protected species so that complicates things. There was some divergence of opinion on this, with some saying that as long as food resources are sufficient and the density of nesting terns is high enough they are able to withstand predation pretty well. This is an issue that bears looking into.
- More than one nesting location is highly advisable. The trend we've seen of the terns shifting from spot to spot w/in Phase I is typical for a new colony, and in older established colonies the terns tend to move from spot to spot in response to predation. Having more than one nesting location, even if they are fairly close together, was felt to be very important for long-term success. Having 2-3 spots is no guarantee against predators but it gives the terns a better chance, and since their typical response to predation is to move somewhere else nearby they are less likely to abandon the whole site if there's another spot to go to.
- As I discussed w/Roger on Friday, I think it would be very feasible to make another nesting site in Phase I by raising one of the levees along the main tidal channel (just north of Cell 11) and topping it with sand/shell. I talked to a FWS guy at the meeting about this - he said it would be a good approach and levee sites can work well for least terns.
- As far as attracting terns to the new habitat, tern decoys and recorded tern calls were said to work well.

Some other non-Montezuma related things I heard about:

- Least terns seem to be moving north, maybe due to climate change. Several people said that they expect to see increased tern nesting in the Bay Area. The San Diego Bay colonies are in decline over the past 5 years, probably due to a combination of predation and fishery declines.
- There was study of nesting success at one colony under different configurations of topography and vegetative cover. The most successful in terms of hatching rates and avoiding predation were in dune habitat with about 30% vegetative cover (native dune plants ~5-10cm high). The dunes were about 2-3m high and about 5-10m apart. The terns nested mostly on the seaward dune faces.
- Gull-billed terns have become a huge problem for the San Diego Bay least tern and snowy plover colonies over the past 5 years or so. The gull-billed tern is not yet listed but is rarer than the least tern (there are only ~1,000 known pairs of the western subspecies of gull-billed terns) and they eat the chicks of other seabirds and shorebirds. They are typically found only in southern CA but two were recently seen in San Mateo.

- A study of least tern foraging behavior showed that terns forage in different locations at different stages of nesting (eggs vs. chicks vs. fledglings). When feeding chicks they tend to forage right near the nesting areas to minimize the time they spend away from the nest. Thus proximity to foraging habitat is critical to nesting success in terms of just finding enough food and because more time spent away from the nest = more predation on chicks.

May 4, 2009: Response to information request regarding potential impacts of seasonal pumping on fish

Montezuma Wetlands Technical Review Team

Response to information request regarding impact of seasonal pumping on fish

Prepared by Ben Greenfield, SFEI; Montezuma TRT Member

May 4, 2009

- At what times of the year are larval delta smelt and longfin smelt likely to be present in the project area?

Moyle (2002) indicates that delta smelt spawning occurs between February and July, with the majority of spawning between early April and mid-May. Consequently, larval abundance peaks from April to June (Baxter, 1999). Spawning predominantly occurs in sloughs and shallow edgewaters of channels in the upper Delta and Sacramento River above Rio Vista (i.e., not in proximity to the pumping stations). However, larvae (16 – 18 mm) that develop several weeks later are washed downstream into the estuarine mixing zone (Moyle, 2002). After this downstream movement, delta smelt larvae could be in the same portion of the Estuary as the pumping station.

It is not terribly surprising that the different agencies reported different dates of longfin smelt larval presence. This is because actual spawning dates are somewhat uncertain and vary from year to year (The Bay Institute *et al.*, 2007). Actual spawning activity has never been documented, but is instead inferred from larval presence (California Department of Fish and Game, 2009). In their petition to list longfin smelt, The Bay Institute et al. (2007) indicate that there are two critical periods for risk of entrainment due to diversion. The first is from spring through summer, when larvae and juveniles travel downstream after being spawned. The second is in winter through spring, when adults move back upstream to spawn.

Despite interannual variability, examining all CDFG monitoring data, general agreement exists regarding the peak months of longfin smelt spawning and larval abundance.
Based on long-term monitoring data on larval abundance, longfin smelt spawning occurs between November and June (Baxter, 1999; California Department of Fish and Game, 2009; Moyle, 2002). Most spawning occurs in late winter to early spring, with larvae most abundant between January and April (Baxter, 1999). From 1981 to 1988, catch per unit effort of larvae peaked in February and March (Baxter, 1999; California Department of Fish and Game, 2009). Larvae metamorphose into juveniles (>22 mm) one to two months after hatching (Emmett *et al.*, 1991). Consequently, abundance of Age 0 smelt (> 40 mm) begins to increase in April and remains high through the end of the year. Age 0 and Age 1 smelt are typically more abundant in Central and San Pablo Bays than Suisun Bay (Baxter, 1999).

The DWR California State Water Project Incidental Take Permit for longfin smelt indicates potential entrainment risk for longfin smelt from January through June, depending on flow conditions.

- What is the likelihood that larval fish would be entrained?

This is a difficult question to answer directly. From a risk perspective, the likelihood is definitely greater than zero – there is a risk of potential take. Pumping would occur in locations within the general habitat and spawning area for both delta smelt and longfin smelt. According to Moyle (2002), delta smelt spawn throughout Suisun Bay and sloughs of Suisun marsh. Abundance tends to focus in the Northwestern Delta within the Sacramento River channel (i.e., the project area) during periods of drought. Delta smelt larvae are captured almost exclusively in the western Delta and Suisun Bay (Baxter, 1999).

The longfin smelt spawning range extends down to Suisun Bay and Montezuma Slough, with larvae transported down to San Pablo and Central Bay in high outflow years, and the Delta and Suisun Bay in low outflow years

(Moyle, 2002). Consequently, larvae, juveniles (Age 0) and adults (Ages 1 and 2) all occur in Suisun Bay at various times of the year (Baxter, 1999).

- What seasonal restrictions on pumping, if any, are appropriate to protect listed species?

To have no chance of entraining larval delta smelt or longfin smelt, pumping activity without restrictions should only occur during the August through November window identified by CDFG. However, spawning and consequent larval distribution vary considerably from year to year. Hence, additional water pumping should be permitted during a portion of the remaining months, in consultation with designated biologists at DFG or USFWS. When this may occur will vary from year to year, depending on rainfall, outflow, and documented adult movements. A potential drawback of relying on best professional judgment of designated scientists is that it would rely on clear communication and subjective opinion of selected individuals.

Pumping rates may also be reduced to a fixed amount (or shut off) during fixed dates, based on findings of ongoing monitoring surveys. This would have the advantage over a "best professional judgement" approach of including a standardized approach with more predictable outcomes. CDFG (2009) describe an example of a standardized approach in the management of duck hunting water diversions to protect chinook salmon and delta smelt:

> *Water diversions from main sloughs within Suisun Marsh and from Suisun Bay are subject to restrictions when Chinook salmon or delta smelt might be present (U.S. Army Corps of Engineers 2008). These restrictions include: (1) restricting water diversion pipes to 25% of capacity from November 1 through the end of duck season (date varies by year from December through March), (2) complete prohibition of diversion February 21-March 31, (3) use only 35% capacity from April 1-May 31, and (4) if two of three 20mm Survey station's 'catch per 10000 cubic meters' surpasses 20 from April 1-May 31, then diversions are restricted to 20% capacity.*

- What is the likely severity of impacts on listed species from the proposed pumping?

Export pumping clearly exhibits lethal impacts on the species considered, as fish entrainment has been documented in numerous monitoring programs (California Department of Fish and Game, 2009). Nevertheless, the amount of pumping proposed in this project (68 to 5600 acre-ft annually) is relatively small, compared to the overall pumping rate from the combined Central Valley Project and State Water Project exports. Using CDWR Dayflow model data, The Bay Institute et al. (2007) estimated annual average CVP and SWP exports at 5,900,000 acre-ft annually from 2002 – 2006. This is 1,000 to 100,000 times the proposed Montezuma Project annual high and low end export rates, respectively.

CDFG (2009) describe entrainment of longfin smelt in power plant cooling water intakes and water diversions in Suisun Bay and the Delta. The pumping rates and conditions (e.g., presence vs. absence of fish screen; location of intake) vary considerably among these projects. Nevertheless, for most of the projects, recent (i.e., post 2000) recorded capture of longfin smelt and delta smelt is typically on the order of several individuals. Based on this finding and conservative application of a hazard factor, I would estimate that total take of larval, juvenile and adult longfin smelt and delta smelt for continuous operation of the Montezuma pumping project would be less than 200 individuals for each species per year.

- What mitigation measures might be appropriate to compensate for these impacts?

The placement of fish screens to government specifications on both pumping operations would constitute an important mitigation measure. In their review of current information, The Bay Institute et al. (2007) note that over 1,800 unscreened or inadequately screened diversions currently operate in the upper Estuary and Delta.

Experts on ongoing conditions affecting longfin smelt and other species of concern (e.g., delta smelt) may be identified to provide guidance to project managers regarding operation of pumping facilities. This could occur on a biweekly or weekly basis to incorporate latest available information on adult distribution and spawning status, as well as environmental parameters associated with spawning (e.g., temperature and salinity). In

instances when larvae are expected to occur near the project operations, pumping may be reduced or discontinued. The DFG has established a Smelt Working Group to provide this guidance to State Water Project personnel. The permit also included a "stop work order" provision.

CDFG issued to the DWR California State Water Project an Incidental Take Permit for longfin smelt. The State Water Project entails pumping of large volumes of water from several locations for water use and flood control. Several mitigation measures were described in the Incidental Take Permit. If deemed necessary, some of these may be considered, on a smaller scale, for mitigation of incidental take by the Montezuma Project.

As mitigation action, the permit also required that DWR fund the "acquisition, initial enhancement, restoration, long-term management, and long-term monitoring of 800 acres of inter-tidal and associated subtidal wetland habitat in a mesohaline part of the estuary." The permit estimates the cost of land acquisition and enhancement at $1200/acre and $250/acre respectively. Restoration of tidal marsh habitats may increase food production for larval/juvenile longfin smelt, and maintenance of reduced salinity at the Montezuma pre-breach ponds may serve to accelerate the rate of project success. Since habitat restoration is a primary objective of the Montezuma project, the potential benefits of this activity should be considered if mitigation activities are needed. However, a conservation easement or transfer of the fee title of the lands may be needed.

Following the DWR permit, funds may be provided by the Project towards ongoing monitoring for longfin and delta smelt. This would presumably focus on monitoring spawning adult and larval abundance at or adjacent to Montezuma Slough. Monitoring of the intake operation may also be undertaken to determine fish entrainment. This could include establishment of a salvage operation, or direct monitoring of the fish screen. However, to have real benefit, such monitoring would have to occur on a routine basis during months of concern, and could therefore be costly.

- Are there any measures other than seasonal restrictions, such as adjustment of pumping rates or volumes, that could be enacted to reduce the likelihood of impacts to listed species?

I'm not totally clear on the location or use of the salinity control gates established on Montezuma Slough, in comparison to the Montezuma project location. I wonder if perhaps the 3000 gpm pump currently slated for the Sacramento River could be placed on Montezuma Slough, itself. If this was the case, it is possible that the pumping would occur from waters with salinity conditions that are too low for the species of concern, resulting in reduced chances of entrainment. Also, pumping of water lower in salinity would improve the desired effects of salinity reduction for the project, thereby requiring less pumping.

References:

Baxter, R.D., (1999) Osmeridae. In: J.J. Orsi (Ed.), *Report on the 1980-1995 Fish, Shrimp, and Crab Sampling in the San Francisco Estuary, California*, pp. 501. The Interagency Ecological Program for the Sacramento-San Joaquin Estuary (IEP), Sacramento, CA.

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February 19, 2009: Report Review Comments of "Montezuma Wetlands Project Reference Site Monitoring: Evaluation of Sediment and Tissue Contaminant Concentrations in the Vicinity of Montezuma Wetlands" (October 2007)

REVIEW COMMENTS

Report titled: "Montezuma Wetlands Project Reference Site Monitoring:
Evaluation of Sediment and Tissue Contaminant Concentrations
in the Vicinity of Montezuma Wetlands," dated October 2007

Aroon Melwani and Ben Greenfield
San Francisco Estuary Institute
February 19, 2009

This report presents the results from the February 2006 sampling and analysis of three reference sites for surface sediment and tissue contamination. The objective of the project was to evaluate current sediment and tissue characteristics in the vicinity of the proposed wetland restoration area. This report is well written and conveys the methods and results coherently. The graphical presentation of study site locations and other illustrations were also well developed – facilitating a thorough review of the study design and findings. Below, some concerns regarding the tissue collections and analytical procedures are discussed. In addition, several inconsistencies and typographical errors are reviewed. We focus on the tissue results because we feel that these constitute the largest and most important data gap that needs to be addressed by the present and future studies. We hope these comments are helpful and would be happy to provide additional feedback, as needed.

1. Tissue Collection

Given the goal of documenting the tissue contamination at the reference sites, we suggest the further detail should be added to the tissue collection methods section.

- Methods for tissue collection should refer back to Table 2 as limited information on sampling sites is provided in Chapter 2.2
- Sample sizes were not given
- Sample methods – individuals or composites not stated. Perhaps results are in Table 13?
- Specify how specimens were cleaned
- Specify if samples analyzed whole body or guts removed, etc.
- If compositing was performed, were samples stratified by size?

Montezuma Management Team Response: We agree that methods for tissue sample collection and preparation could have been more clearly presented. However, most of the information you request is provided in the report. Methods for net type, size, speed and duration of trawls are provided in Section 2.2. Start and stop coordinates are provided in Table 2 and the approximate location of trawls are presented in Figure 4 (this is a small area and individual lines indicating trawl locations would not be useful in this figure). Sample sizes for clams and shrimp are provided in Table 12. Sample sizes for fish are provided in Table 13. Tissue samples were composited by species (one composite sample per species). Clams were rinsed with deionized water and scrubbed with a brush to remove sediment or debris. Clams were then shucked, with all soft tissues being submitted for analysis. Fish and shrimp were rinsed with deionized water to remove any sediment or debris and submitted as whole body samples.

2. Detection Limits

We ask the authors and project managers to consider obtaining lower detection limits for future PCB analyses in sediments and tissue and for selenium (Se) in tissue. Commonly available laboratory methods result in PCB congener detection limits of 0.2 ppb. In the present study, the detection limit was 1.0 ppb. Available detection limits for Se are typically on the order of 0.02 ppm, compared to 1.0 in the present study.

Had analysis been performed at lower detection limits, PCB results may have been more informative. For example, it may have been possible to determine congener profiles for PCBs to determine whether changes occur after breach.

Montezuma Management Team Response: The target detection limit in sediment for Se was 0.25 ppm and 1 ppb in tissues. The target detection limit for PCB congeners was 1.0 ppb. In early 2006, lower detection limits were attainable, but with a significant increase in analytical costs. Future programs can target lower detection limits for both PCB congeners and Se. As the reviewers comment, the lower limits are more commonly available at this time.

3. Limitations of Hg analysis

It appears that analytical methods for Hg in sediments and fish were inappropriate for this study. Based on Appendix A, it appears that sediments and tissues were analyzed for Hg in combination with other metals by inductively coupled plasma - atomic emission spectroscopy (ICP-AES). This method is not typically sensitive enough to discern biologically significant patterns in Hg. Hg analysis in sediments and tissue is typically performed by atomic absorption spectrophotometry or cold vapor atomic fluorescence spectroscopy. For example, EPA Method 7473 "Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry." Prior to analysis, tissue samples are often digested in a heated solution of H_2SO_4 and HNO_3 followed by digestion with BrCl.

Future Hg analyses in sediments and tissues should be performed separately from other metals, using current state of the science analytical methods (and a laboratory that routinely performs these methods).

Montezuma Management Team Response: Mercury analysis in sediment and tissue was conducted by EPA Method 7471A that uses techniques similar to those suggested above. Method 7471A was also used for mercury in previous reference sampling efforts. Please let us know if you prefer Method 7473 to be used instead.

Our concern regarding the Hg methods raises doubts concerning the putative differences between Hg in fish tissue reported in this study and Hg results from similar species in separate locations. Table 14 indicates total Hg concentrations of 0.082 ppm wet in Shimofuri goby. Our data for 12 composite samples of Shimofuri goby indicate average concentrations of 0.04 ppm wet (±0.015 SD). These samples, obtained as part of the RMP Hg in Small Fish pilot study (B. Greenfield, *unpublished data*), had similar body size and were relatively similar among three collection locations. This two fold difference in tissue Hg is biologically meaningful and also significant from a risk point of view. It could be attributed to seasonal variation, as our sampling is typically performed in summer, as compared to February for these samples. Nonetheless, the inappropriate methods for Hg analysis bring into doubt the elevated findings in the reference site study.

Montezuma Management Team Response: That is an interesting observation, and as noted above an appropriate method was used for Hg analysis so there is no apparent reason to consider the results invalid. The difference between Montezuma's 2006 sample and the RMP's Small Fish Pilot Study average result suggests that further tissue sampling in Montezuma Slough in both summer and winter may be warranted to confirm the initial results. However, mercury concentrations and the factors causing its bioaccumulation are known to vary widely between different regions in the Estuary and Delta, so it is plausible that mercury concentrations in fish tissue may also vary between different locations.

Another limitation is the lack of methylmercury (MeHg) analyses in sediments. For Hg studies, methylmercury analysis is an important parameter for biological uptake from sediments. In future studies, MeHg in sediments should be analyzed, using appropriate analytical methods and a lab that routinely performs these analyses. As MeHg is a difficult analysis to perform, selection of appropriate analytical laboratory is imperative.

Montezuma Management Team Response: The question of MeHg sampling in sediment has been discussed at TRT meetings and in TRT comments in the past with no clear resolution. For example, see pg. 18 of the TRT's Second Annual Report. As we stated in the response to that comment, "*…at every instance of discussing [the possibility of MeHg analysis in sediment] with RWQCB, TRT members, or*

scientists working in the Bay-Delta, we have received a similar answer: no one is sure how it would be interpreted or if it is even meaningful beyond a research perspective given the very high variability of Me-Hg concentrations in sediments and the myriad of factors effecting its levels and uptake into the food web (e.g., salinity, pH, redox conditions, organic carbon, sulfides, biota present, food web interactions, etc.)." We continue to feel that it is a wiser use of the project's limited funds to focus on Hg sampling in tissue, which the TRT and others have made clear is a much better measure of food web effects than sediment MeHg concentrations would be. However, we are open to discussion of this point if the TRT feels there is a clear reason why MeHg analysis in sediment would further the objectives of the reference site monitoring effort.

Incidentally, a much larger data set exists for Hg in Mississippi silverside (*Menidia audens*), than for the species sampled in the Reference Site Monitoring study. In particular, Mississippi silverside have been monitored in multiple locations for the RMP Small Fish Pilot Study (Greenfield et al. 2006), and as part of the Calfed Fish Mercury Project (Slotton et al. 2007), including some monitoring in Montezuma Slough. Additional analyses are also being performed on this species. This species is most effectively monitored using shoreline beach seine placement. In the future, it may be appropriate to include collection and analysis of this species for Hg and other contaminants.

Montezuma Management Team Response: We agree that *Menidia* data would be useful; we simply have not caught any in past sampling efforts. Our tissue sampling efforts are by necessity limited in scope, and it is not always possible to catch what we want. However, we can conduct beach seining along the slough banks and will certainly analyze *Menidia* if they are caught in future sampling events. At our January 28th 2009 contaminants subteam meeting, Ben Greenfield also recommended including Darrell Slotton's Montezuma Slough tissue data in a reference data summary, and suggested that the TRT could provide these data. We agree that this combined data summary would be useful.

4. Unnecessary analyses.

A full metals suite is typically not very informative in finfish, as these species typically do not accumulate any toxic metals but Hg and Se. This is evident in Table 14, in that most concentrations are at or below detection for the finfish samples. Future efforts would be better focused on obtaining additional replication and better methodology in Hg analysis.

Montezuma Management Team Response: We disagree that analyses other than Hg and Se in fish tissue are unnecessary. While a sole focus on mercury and selenium may be ample for assessment of bioaccumulation in fish, development of a reference data set for analytes other than mercury remains a requirement of the project's permits and EIR/S. Secondly, if there are few detections that is still useful information from the point of view of comparing tissue concentrations in the restored site with reference conditions, which is the objective of the reference monitoring effort (and the permit requirement). Thirdly, while it is technically accurate to say that most concentrations other than Hg and Se were below detection limits, Table 14 shows that four of these "other" metals (chromium, copper, nickel and zinc) were detected in fish. Finally, analysis for only Hg and Se in fish tissue would not free up significant resources for other efforts, such as additional replication, as the comment suggests. The cost of sample collection would not change and the analytical cost reduction would be negligible because of the way analytical pricing is typically structured. Analysis for the full suite of metals therefore adds some information without appreciably adding to the cost of the monitoring or taking resources away from other efforts.

5. Replication.

It appears that only a single composite sample was analyzed for each animal species collected from Montezuma Slough in 2006. Typically, in studies of Hg in tissue, analyses are performed on several replicate individual or composite samples per species/site combination. These are often stratified by size, given the strong influence of size on Hg.

Note, replicate sampling and analysis is particularly helpful for Hg analysis because of the strong length vs. Hg relationship, and because of variability in biota Hg at a site. Although replicate analyses would also be

beneficial for organic pollutant analysis, the cost of organics analysis is much higher than for Hg analysis. Therefore, we only recommend replicate sampling for organics analysis, if sufficient funding is available.

For Hg analysis, there should be at least three composites per species per sampling event (date and location). There could be up to fifteen samples for Hg. There is no need to analyze more than fifteen samples per species/date/location. Composites should be stratified by size (i.e. length), if a wide range of sizes are collected. Individuals could also be run, but for individuals there should be 5 to 15 samples.

To summarize: 3 to 15 composites or 5 to 15 individuals per species/site/date

Montezuma Management Team Response: We appreciate your recommendations on sample size and replication, and will implement them to the extent possible. We agree that replicate analysis for some or all species would be desirable, but the scope of tissue analyses was limited due to budget constraints. As this was the first effort to establish tissue concentrations for the area, the decision was to include more species and not increase replicate numbers. Future efforts can increase the number of replicates in the area for some species.

3. Typographical Errors/Specific Comments

- Introduction, p. 3, "This report presents the results of sampling and analysis conducted at three additional reference sites in February 2006." Sites P1 and OB will likely be impacted by the breach. Thus it appears to be inaccurate to refer to them as reference sites.
- Insert space or semicolon between "limit" and "J" in footnote to Table 7
- Inconsistent reporting of wet weight - reported as both "ww" and "wet wt" throughout document
- Chapter 3.2.2 (PAHs, PCBs, Organochlorine Pesticides, and Dioxins/Furans) should be "3.3.3"
- Chapter 4.0 (Summary) range in DDTs incorrect should be 2.7 to 3.6 ug/kg
- Summary pg. 26: "The Suisun Marsh system has sediment that ***contains of*** chromium and nickel."
- Table 13, and elsewhere: the correct common name for *P. macrolepidotus* is "Sacramento splittail" , not "splittail sucker"
- Appendix A indicates "Sediment/Soil Analytical Procedures." Are these the procedures for tissue also? If so, modify. If not, should add separate table.
- Appendix B missing
- Abstract needed
- Summary section incorporated data from the Rush Ranch area. Authors should indicate the relevance of this site to the comparison (i.e. that it was also a Reference site in the vicinity of the restoration area – refer to Figure 1)
- Summary section does not indicate whether the reference site meets expectations or how results relate to the objectives of the project

Montezuma Management Team Response: Regarding the description of locations P1 and OB as reference sites, these locations were chosen largely in response to TRT recommendations to establish reference conditions in the immediate vicinity of the restoration area to allow assessment of conditions before and after tidal breaching (see the TRT's Second Annual Report, pg. 17). The analytical information in Appendix A applies to tissue as well as soil/sediment. Appendix B was mistakenly omitted; we will forward the TRT a complete copy of the report. We will consider your editorial comments during preparation of the next report on reference site sampling; however, we do not plan to resubmit this report.

References

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July 7, 2008: Initial Report Review Comments of the "Adaptive Management Restoration Plan for Phase I of the Montezuma Wetlands Project" (July 2007)

Memorandum

To: Doug Lipton, Ph.D., Lipton Environmental Group, Montezuma Wetlands Project Manager
From: Joshua N. Collins, Ph.D., Chair, Montezuma Project Technical Review Team
Date: July 7, 2008
Subject: Review of the Adaptive Management Plan for Montezuma Wetlands Project

This document summarizes the review by the Technical Review Team (TRT) of the Adaptive Management Plan (AMP) for Phase 1 of the Montezuma Wetlands Project (Adaptive Management Restoration Plan, Montezuma Wetlands LLC, July, 2007), excluding the proposal to increase the capacity of the Project for "non-cover" sediment, which the TRT has not yet reviewed.

The TRT was established in accordance with Special Condition #1 in the U.S. Army Corp of Engineer's Permit No.19405N to assure the scientific credibility of the Project's monitoring efforts and to review any habitat design changes that the Project might propose (TRT Charter Agreement, September 2002). This review by the TRT is consistent with its Charter.

In 2003, the TRT began advising the Project on proposed design changes for high tidal marsh based on new scientific information about the natural history and habitat characteristics of the Salt Marsh Harvest Mouse, a primary design concern for the high marsh portion of the Project. In 2006, The TRT began advising the Project on design changes to support the Least Tern and Snowy Plover that occurred at the Project for the first time in 2005, and have since become important design concerns. The proposed changes in habitat design involve reconfigurations of planned levees and channels within the Project boundary that were also reviewed by the TRT. In January 2007, the Project began to incorporate these proposed design changes into the AMP. The TRT began its review of the AMP in September 2007, and has developed the following comments. As stated above, these comments only pertain to the Project design changes described in the AMP of July 2007, excluding the proposal to increase the capacity of the Project for "non-cover" sediment, which the TRT has not yet reviewed.

General Comments

This Project is an important part of the regional initiative to restore tidal marsh and manage dredging. The AMP is useful because it has the potential to enhance the ecological and societal values of the Project.

- While there is a need to balance tidal marsh restoration with the conservation of diked baylands for their own ecological services, all the existing planned and ongoing tidal marsh restoration projects around the San Francisco Estuary are important because they have significant net benefits for fish and wildlife, pollution control, flood control, and navigation. The AMP increases the rate at which these values are achieved by increasing the rate at which this Project is implemented.
- This Project is by far the largest project in the brackish area of the Estuary, where the greatest losses in tidal wetlands have occurred. The brackish marshes tend to have the greatest native bio-diversity of all the tidal marshes in the Estuary, and their restoration is therefore essential to maintain the Estuary's overall bio-diversity. Furthermore, the restoration of brackish marshes near the western edge of the Delta, where the Project is located, can provide much-needed feeding habitat for young salmon coming out of the Sacramento River Watershed, and therefore benefits the many efforts to restore California's commercial salmon fishery. The AMP advances the schedule for the Project to begin achieving these values.
- Since the Project is located in the brackish area of the Estuary, it provides an opportunity for the evolution of salt marshland as sea level rises and saline conditions extend upstream. This is especially important for resident species of fish and wildlife that are restricted to salt marshes and will therefore have to move with them during estuarine transgression. The AMP increases the likelihood that the Project will help reduce the threat of tidal wetland loss due to climate change and rapid sea level rise by increasing the rate at which the Project is implemented.

The revised designs for high marsh, including the designs for Least Tern and Snowy Plover habitats, reflect recent advances in science and enhance the Project.

- The original and revised designs for the high tidal marsh for this project have been driven by the best available scientific understanding of the habitat requirements of the Salt Marsh Harvest Mouse (SMHM). In recent years, since the original designs were developed, data have been accumulating through publically funded studies that are relevant to high marsh design for this project. These studies in combination provide important new information on correlations between tidal marsh elevation, plant community structure, and the distribution and abundance of the SMHM in the brackish regions of the San Francisco Bay-Delta ecosystem. The fundamental message coming through these studies is that, in the region of the system that includes this project, the natural, sustainable SMHM habitat is characterized by a mixture of salt-tolerant and other tidal marsh vegetation at elevation above Mean Higher High Water. These elevations develop slowly under natural sedimentary regimes because the associate plant species are not especially productive and the deposition of inorganic sediment is limited by relatively infrequent tidal inundations. It seems quite clear that creating SMHM habitat for this project within the timeframe prescribed by the project plans and permits will require creating high marsh plains that are higher than originally designed. The revised high marsh designs reflect this new information.
- Since the Least Tern and Snowy Plover first colonized the site, there has been enough input from specialists for these species to design integrate nesting habitat into the project designs. As noted in the specific comments below, the designs are experimental, although appropriate.

The proposed "early restoration" of ready Phase 1 cells is a good idea.

- The modular design of the Project can support the kinds of design changes that are being proposed. The project footprint is subdivided into four large "Phases" that consist of "sediment cells." Each cell is larger than needed to contain a tidal drainage network that will tend to maintain itself through the usual ebb and flood of tidal water, based on studies of nearby natural analogue marsh systems. The proposed changes to restore tides to smaller groups of cells and increase the constructed elevation of high marsh cells are unlikely to reduce their ability to serve as physical templates for self-maintaining tidal marshland.
- Of all the tidal marsh restoration projects around San Francisco Bay, only this one includes a significant amount of uplands that can become tidal wetlands as sea level rises. This is especially important if the rate of sea level rise is fast enough to drown the existing tidal wetlands.
- The threat of drowning tidal marshes gives the Project new urgency. Under natural conditions, high marshes keep up with sea level rise by the accumulation of plant matter produced on-site, plus the deposition of inorganic sediments delivered by the tides. Most opportunities to restore tidal marshes are in subsided areas. To restore them to tidal marsh that has a chance to keep up with sea level rise, they must be raised high enough with imported sediment to be colonized by tidal marsh vegetation. As time passes, sea level rises, and the elevation to which the subsided areas have to be raised, and therefore the amount of sediment needed to offset sea level rise, increases. Thus, speeding the rate of restoration (as the staged tidal restoration would do) decreases the cost and uncertainty of the restoration of sustainable tidal marsh.
- The goal of the Project is to use sediment dredged from the San Francisco Estuary to restore tidal wetlands, as called for by every regional ecological plan to date. But, in a practical sense, the Project is as much about moving water as it is about moving sediment. The need to mix dredged sediment with water to move it onto the site, plus the need to keep dredged sediments wet after they have been moved into cells, plus the need to decant the cells and reuse the water, necessitates an expensive plumbing and water management system that has proved unable to provide enough water to keep all the Phase I cells ponded in the dry months of the year. The sooner completed cells can be restored to tidal action the better for sustaining the ability of the Project to supply water to unfinished cells in a phase.
- The Project has been delayed by a lack of dredged sediment coming to the site. The schedule of dredging and the choices on disposal or reuse sites has been, and will probably continue to be uncertain. Steady, uninterrupted progress in sediment placement leading to whole-Phase breaching

seems improbable. Therefore, in order to realize the benefits of the Project, its Phases need to be implemented in stages by breaching selected cells.

It should be noted that the increasing rate of sea level rise puts a premium on managing the sediment supplied by local watersheds to restore and conserve intertidal habitats. Dredged sediments are a critical part of the sediment supply for restoration projects like Montezuma, Hamilton, and others around the SF Estuary. Clearly, their long-term value as the building material for mudflats and marshes far exceeds their short-term cost for removal and disposal. Reconsidering the continued ocean disposal of dredged sediment that could be used to protect the Estuary from sea level rise seems wise and patently desirable.

Specific Comments

AMP Sections 1 and 2 (Introduction and Background)

This is background material that the TRT has previously reviewed and that adequately reflects previous TRT commentary.

AMP Section 3.0 – 3.3.4 (Staged Tidal Restoration [the "early breach"])

The TRT has little to add to these Sections of the AMP beyond the commentary it has already provided. However, the TRT decided that portions of levees left intact after a cell is breached should be termed "levee remnants" rather than "bird islands." The term "bird islands" should be changed to "levee remnants" whenever it refers to parts of a levee.

Section 3.4 (Updated Tidal Reckoning)

The TRT is comfortable with the revised high tide datums developed from the local DWR data. However, the TRT disagrees with the statement made in the first paragraph of Section 3.4 that the differences between the LF estimates of high tide datums (ca 1995) and the DWR estimates (ca 2007) are due to sea level rise. The differences are at least 0.5 ft., and there has not been that much sea level rise in the last dozen years.

AMP Section 3.5 (Sediment Cell Elevations)

The TRT has nothing to add to thus Section of the AMP beyond the commentary it has already provided, which is reflected in this version of the AMP.

AMP Section 3.6 (Post-Breach Monitoring)

The proposed monitoring is consistent with existing efforts for the Project. However, the TRT reiterates its recommendation to produce a GIS of all sampling efforts. The TRT continues to look for opportunities to coordinate the Project's monitoring with other efforts in the region, and one easy way to see new opportunities is by comparing various monitoring sites and schedules. The Project should consider using the Bay Area Wetland Tracker to display monitoring locations and to report monitoring results.

The TRT recommends that the Project continue to review new monitoring methods for possible adoption. For example, since the TRT last reviewed the AMP in September 2007, new protocols have been developed for using tidal marsh wildlife to assess bioaccumulation of pollutants, mapping tidal marsh vegetation, and assessing the overall health of tidal wetlands. The TRT suggests that it work with the Project to review the proposed pre-and post breach monitoring plans for "early restoration" Stages 1 and 2 in the context of new monitoring methods and opportunities for coordination with other monitoring efforts.

AMP Section 4 (Tern/Plover Habitat)

The TRT has little to add to this Section of the AMP beyond the commentary it has already provided, which is reflected in this version of the AMP. However, the TRT suggests that the AMP explicitly state that the concept of tern and plover "nesting islands" that are surrounded by high marsh is unproven and that the design is therefore experimental. Although these species are known to prefer nesting areas that are essentially surrounded by water, they are also known to nest in places near water that are surrounded by broad areas of bare ground. Whether or not these species will accept broad areas of very low-growing high marsh vegetation

as surrogate for water or bare ground remains to be seen. However, as indicated by the TRT reviews and by additional specialists for these species, the design for nesting habitat seem optimal for this Project.

AMP Section 5 (Other High Marsh Design Modifications)

The TRT suggests that the Project adjust its target plant species composition for SMHM habitat to reflect the local, brackish flora that supports the SMHM. The current list of target plant species reflects more saline, or down-estuary models of SMHM habitat. The TRT is willing to work with the Project to develop the appropriate description of the plant community structure of high brackish.

AMP Section 6 (Schedule)

The Project is heading toward an important milestone: the initial restoration of tidal action and the start of monitoring to assess Project performance. This is likely to require some adjustments in the monitoring efforts to distinguish Project effects from ambient change, and to assess the relevance of Project objectives.

The TRT suggests that the Project regard its AMP as the framework for such assessment. However, for the AMP to better serve as the needed framework, it should be further developed with a matrix indicating exactly what indicators are needed to track progress toward each objective, and what off-site or reference data are needed for those indicators to characterize their ambient conditions. The matrix will be an essential tool for knowing what data define progress and success, and how the Project might coordinate with other monitoring efforts to acquire such data. This need not be a large development effort; most of what is needed to create the matrix already exists.

Appendices

Appendix 1: TRT and Project Team Members (December 2006 to December 2010).

Last Name	First Name	Role/Area of Expertise	Organization	Active
TRT				
Batha	Bob	Operations	SF Bay Conservation and Development Commission	Active
Greenberg	Andree	Vegetation/Wildlife	San Francisco Bay Regional Water Quality Control Board	Active
Collins	Josh	Monitoring Design/TRT Project Manager	San Francisco Estuary Institute	Active
Davis	Jay	Contaminants	San Francisco Estuary Institute	Active
Didonato	Joe	Wildlife	East Bay Regional Parks District	Resigned 12/2008
Greenfield	Ben	Contaminants	San Francisco Estuary Institute	Active
Grenier	Letitia	Contaminants/Wildlife	San Francisco Estuary Institute	Active
Grosso	Cristina	Data Management	San Francisco Estuary Institute	Active
Herbold	Bruce	Aquatic Wildlife	US Environmental Protection Agency	Active
Jones	Paul	TRT Facilitator	US Environmental Protection Agency	Active
Koutsoftas	Demetrious	Geotechnology/ Engineering	Arup	Active
Lowe	Sarah	TRT Project Assistant	San Francisco Estuary Institute	Active
Malamud-Roam	Karl	Physical Processes/Vector Control	Contra Costa Mosquito and Vector Control District	Active
Polson	Eric	Operations/ Engineering	Consulting Civil Engineer	Active
Shellhammer	Howard	Terrestrial Wildlife	Independent Consultant	Active
Thompson	Bruce	Benthic Ecology	San Francisco Estuary Institute	Resigned 8/2007
Williams	Meredith	TRT Project Assistant	San Francisco Estuary Institute	Resigned 9/2010
Yee	Donald	Contaminants	San Francisco Estuary Institute	Active
Project Management Team				
Bonnefil	Rachel	Montezuma Project Ecologist	Acta Environmental	
Leventhal	Roger	Montezuma Project Chief Engineer	FarWest Engineering	
Levine	Jim	Montezuma Wetlands Project Owner	Montezuma Wetlands LLC	
Lipton	Doug	Montezuma Project Manager	Lipton Environmental Group	

Appendix 2: TRT Meeting Minutes

January 17, 2007: Least Tern/Snowy Plover Breeding Habitat Meeting Minutes

January 29, 2007: Annual Meeting Minutes

March 5, 2007: Salt Marsh Harvest Mouse Conference Call Minutes

June 1, 2007: Project Team Meeting Minutes (internal coordination meeting - no formal minutes documented)

September 19, 2007: Restoration Plan Meeting Minutes

January 28 2009: Contaminants Subteam Meeting Minutes

December 17, 2009: Contaminants Subteam Meeting Minutes

Montezuma Wetlands Project

Least Tern/Snowy Plover Breeding Habitat
January 17, 2007 (10:30am – 12:30pm)
Project Site

Subteam Meeting Summary

Attendees

Terry Adelsbach, USFWS	Letitia Grenier, SFEI
Rachel Bonnefil, Project Team	Cristina Grosso, SFEI
Josh Collins, SFEI	Roger Leventhal, Project Team
Joe Didonato, East Bay Parks	Doug Lipton, Project Team
	Howard Shellhammer, HT Harvey & Assoc.

Materials Distributed

- Diagram of proposed Cell 8/9 least tern habitat

Meeting Objectives

- To review the recent occurrence of least tern and snowy plover nesting at the site
- To discuss proposed plans for incorporating sustainable nesting habitat into the Phase I restoration design
- To provide feedback on the Restoration Plan currently being prepared by the Project Team

Project Status

- Doug Lipton briefly updated the group on the Phase I construction and sediment placement progress and the proposed early breach to Cells 1-4 in 2007 and explained that sediment targeted for the open ocean was redirected to the project site because of large ocean swells in December 2006.The group discussed documentation of the project's activities. Doug noted that timely subteam reports were more useful to the Project Team than the Annual Report. However, documentation of the thought process provided in the Annual Report is also useful. Since the tern habitat has raised interest in the project, it is important to appropriately document findings of the high marsh/tern habitat for a larger audience.
- Doug Lipton explained that the restoration plan for the tern habitat and adjustments of the high marsh area would be available in March for the TRT to review. (This plan will be made available in June 2007). The TRT will provide a written summary of their comments and recommendations to the Project Team.
- **Action Item #1:** Josh Collins suggested writing a summary on lessons learned and including that the project received unwanted sand, which unexpectedly brought terns to the site.

Site Visit: Existing Tern Nesting Area

- Rachel Bonnefil noted that the first terns (approximately 20) appeared in 2005 but no breeding was observed. In 2006 up to 100 nesting adults, up to 28 fledglings and up to 20 chicks were observed . The plovers were only observed in the sandy areas and not in the tern nesting area.
- Doug Lipton explained that it is important to retain the existing habitat until the tern island is completed. Once the tern island is completed the current nesting area will no longer be maintained and vegetation will be allowed to encroach to encourage terns to colonize the constructed habitat.
- Josh Collins commented that during the TRT's review of the Tern Restoration Plan, they should briefly address existing conditions, but focus on future habitat.
- Joe Didonato recommended using recorded tern calls played over a solar-powered sound system to attract the birds when they return in April/May to breed. Decoys also work and he has information on birds' responses to decoy positioning from another project.
- Terry Adelsbach noted that plovers nest in low densities over large areas.
- Joe Didonato explained that vegetation and substrate are the main issues to consider when creating habitat and noted that sometime plovers and terns will nest next to each other.

Site Visit: Proposed Habitat in Cell 8/9

- The Project Team provided an overview of the preliminary design for the new nesting habitat in Cell 8/9 and discussed raising the high marsh elevation in Cell 8/9 based on data collected at Brown's Island and Rush Ranch by Stuart Siegel.
- Howard Shellhammer presented the problem that CDFG collected mouse data with no vegetation analysis, and Brown's Island has vegetation data, but no mouse data were collected.
- The group discussed the need to obtain the mouse data since it will be awhile before the project obtains its own data. Also, the project has CE criteria, so it would be useful to have this information. Rachel Bonnefil added that another option is to collect vegetation data at the trap locations.
- Doug Lipton discussed the possibility of connecting their northern Phase III area with DWR's Mein's Landing project, which could provide DWR some mitigation for their SMHM impacts on Suisun Marsh levees and within their Mein's property.
- **Action Item #2:** Howard Shellhammer will follow-up with CDFG and report back to the group.
- Roger Leventhal noted that he wants to put tide gauges out this summer. Josh Collins agreed with collecting long-term tide gauge data due to the importance of sediment elevation. He emphasized the need to get as close as possible to the realistic high tide datum, for which a year of data would be better to use. (Tidal datums have since been undated based on tide height data collected at a nearby tide station by DWR between 1998 and 2007).

Predator Management

- Joe Didonato stressed the importance of having a predator management plan. While a moat will deter predators, it will not stop predation. A 300-500 ft buffer would be easier to construct. He noted that at other sites, they trap regularly for terrestrial predators. However, the main predation concern is by avian predators[1].
- Howard Shellhammer suggested that if the tern model is successful, it could be used in other phases or cells.
- Rachel Bonnefil commented that even if the terns do not use the site every year, it is still important to create additional tern habitat because problems at the other regional sites (e.g. excessive predation) can cause nesting failure in any given year and terns are known to re-nest elsewhere under those conditions. The lack of expansion in Bay Area tern habitats is also cited by CDFG as a key factor currently limiting recovery of the species.
- Joe Didonato explained that the terns are attracted to the shells and prefer bigger pieces of shells to crushed up pieces. However, this requires a fair amount of maintenance.
- Rachel Bonnefil noted that while the tern island in Cell 8/9 needs to be completed before the existing tern habitat area in Cells 2 and 3/4 is restored to tidal action. The high marsh habitat in Cell 8/9 does not need to be completed as soon since Cell 8/9 is part of the second tidal breach stage, which is planned for tidal restoration in 2009.
- Rachel explained that last winter was a bad year for mice at the site due to unusually extensive and prolonged ponding due to levee overtopping and heavy rainfall during the '05/'06 wet season. Low capture rates for salt marsh harvest mice were observed in fall 2006 surveys. CDFG/DWR trappers have said that, following major flooding events in Suisun diked marshes, they have observed initial depression of SMHM numbers followed by a rebound over the next year or two. They also have observed that the proportion of house mice to SMHM will sometimes be reduced after such events. Trapping will be conducted again in 2007.

Options to Creating a Tern Island

- Joe Didonato and Terry Adelsbach commented that the nesting of terns was unanticipated.
- Rachel Bonnefil reported that the Project Team is looking into partnerships for funding. They can potentially get some financial help from the Port of Oakland since they have mitigation needs for planned berth work where tern foraging habitat exists.
- Letitia Grenier questioned if the terns would nest in the middle of a vegetated marsh. Terry Adelsbach noted the project could create habitat not used by the terns or unmanageable by the project.
- Joe Didonato suggested cutting levees and creating habitat on top of the levees instead of one island habitat at risk to predation. Rachel confirmed that this is part of the restoration design.
- Howard Shellhammer commented that successful nesting by terns on the constructed habitat may not occur, and the project should consider this when changing habitat goals to support the species.

[1] Note from RB: At Alameda, with ~400 nesting pairs, they do very intensive predator management (including trapping and "deporting" raptors) and they still had almost complete mortality of chicks in 2006.

- The group discussed the possibility that the terns nesting at Montezuma in 2006 were re-nesters from the Alameda colony, which suffered extensive predation and was largely abandoned by the terns in mid-summer 2006.

Meeting adjourned at 1:00 pm.

Montezuma Wetlands Project
Technical Review Team
Annual Meeting Summary
January 29, 2007 (9:00am – 2:30pm)
Birds Landing Hunting Reserve Clubhouse

Attendees

Victor Chan, Solano County	Misty Kaltreider, Solano County
Josh Collins, SFEI	Roger Leventhal, Project Team
Joe Didonato, East Bay Parks	Doug Lipton, Project Team
Beth Dyer, USACE	Eric Polson, Polson Engineering
Letitia Grenier, SFEI	Howard Shellhammer, HT Harvey & Assoc.
Cristina Grosso, SFEI	Donald Yee, SFEI

Materials Distributed

- Second Annual TRT Report

Introductions and Purpose of Meeting

- The meeting began with a field trip to the project site.
- The objectives of the meeting were to (1) provide an update on the TRT's progress and the project's status, (2) discuss the project's adaptive management of the design and operations, and (3) outline upcoming TRT tasks.

SITE visit and Project Status

- Doug Lipton updated the group on project progress through 2006. The major highlights included: successful placement of about 3 million cubic yards (cy) of sediment since 2003, including about 300,000cy of noncover; construction and placement of sediment into Cells 1, 2, 3/4, 6/7, 8/9, 10, and 11 (only Cells 5a, 5b and 12 remain unconstructed in Phase I); Cells 1-4 are near completion to target elevations and planned for early tidal restoration within the next year or two.
- Doug discussed difficulties the project continues to have with the Corps for obtaining and scheduling sediment deliveries. He noted that the recent Corps contract for 50-foot sediment (i.e., the $115 million 3E contract) left Montezuma out as a disposal option. With the only other beneficial reuse project (Hamilton) not ready until October 2007, this has allowed the Dutra-Manson Joint Venture (JV) to be in a sole source (and non-competitive) position when they provide costs to bring material to Montezuma versus ocean disposal (that was an option in Contract 3E); the EPA is the only agency that has any power over restricting ocean disposal and has no control over Corps contracting.

TRT Progress

- Cristina Grosso updated the group on the TRT's progress. The major highlights included the Contaminants and High Marsh/Tern subteam meetings and the completion of the Second TRT Annual Report.
- Josh Collins noted the importance of the Operations Monitoring and Design Modifications section in the Annual Report and the Project Team's ability to adaptively manage the project and address emerging concerns in a timely manner. He suggested publishing a paper as a case study on the adaptive management of a large-scale project.
- Doug Lipton noted that the TRT provides a tremendous benefit to the Project Team by providing feedback, which enables them to adaptively respond to what is happening at the site (e.g., least tern habitat, Levin-Richmond Terminal DDT-affected sediments).
- Beth Dyer agreed that the role and progress of the TRT is on the right track.
- Josh Collins commented on the delayed sediment delivery to the project site, which causes delays in the receipt of data and reports and TRT participation.

TRT Progress (cont'd)

- Doug Lipton briefly reviewed the areas of future TRT focus. These included creating the best high marsh habitat possible, reviewing the proposal for creating tern habitat, discussing reference site monitoring and establishing benchmarks for comparison after the breach, and discussing restoration economics, including the costs of beneficially restoring habitat using dredged sediment.

- **Action Item #1:** Distribute a TRT quarterly email progress update, including outstanding action items and subteam findings. Agency staff should be included to keep them informed of TRT proceedings and as a way to respond to the project throughout the year.

- **Action Item #2:** Post the 2nd Annual Report on the project's website using a new cover photo.

- **Action Item #3:** Doug Lipton and Josh Collins will develop an outline for a manuscript discussing the real costs of restoration and send it to the TRT for comment. The group agreed that the Project has valuable information to disseminate to the public and agencies.

- **Action Item #4:** The group discussed the need to have an overall map of reference sites for contaminants and biology to assist in the coordination with other efforts. The Contaminants Subteam will meet in February or March to outline efforts for future monitoring and reference site work and identify target performance criteria. The Project Team has a reference database containing tissue samples from Rush Ranch, Hill Slough, and Montezuma Slough. Josh Collins noted the importance of including the high marsh designs in the reference site work to help in determining target performance criteria.

Project Adaptive Management – Restoration Design
Reconsidered High Marsh Elevations and "Mouse Farm"

- Howard Shellhammer provided an overview to TRT on CDFG's monitoring efforts and the evolving knowledge that vegetation depth and complexity of habitat are more important than species type, especially noting that pickleweed dominance should not be the essential criteria for SMHM success at Montezuma. Therefore, there is more flexibility for the SMHM than first outlined for the Project. His database contains 741 projects around the Bay with an average CE of 2.48. An aggregation of 252 Suisun projects performed by Shellhammer, CDFG, DWR, et al., yields a CE of 4.43. Studies carried out by Barthman-Thompson (CFG) and Patty Quicket (DWR) in a variety of marshes in the Suisun Bay in 2002 - 2004 resulted in CE's ranging from 4.9 to 19.3.
- Howard explained that he was not concerned with the Project meeting its vegetation criteria that is currently focused on pickleweed and noted that it takes a long time for high marsh vegetation (of mixed halophytes) to reach the thickness and age to support animals. He suggested expanding the vegetation criteria to include a greater variety of brackish and saline species, but would not change the mouse capture efficiencies required.
- Howard commented that the managed "mouse farm" was designed with the assumption that the Project would proceed quickly into Phase II so the "mouse farm" needed to function early on supporting the SMHM. However, based on information collected over the last decade he suggested removing the "mouse farm" and including this area as part of the high marsh design that relies on natural tidal inundation versus tide gates and culverts.
- Josh recommended changing trapping procedures in the restored marsh to include the gradient from the channels in the high marsh from brackish to more saline areas, since all should be considered SMHM habitat.
- The group noted the need to have estimates of elevation ranges relative to MHHW for these various plant communities. These may be available through data from IRWM or CDFG.
- Beth Dyer questioned the Project site's location at the edge of the range for SMHM. Howard explained that he would not expect population densities to be as high as in the central/south bay since Montezuma is in a transitional zone at the edge of the species range.
- Roger Leventhal suggested reviewing the salinity regime at vegetation reference sites since it may be fresher at the Project site. He also recommended including narrative text explaining target plant communities for the high marsh in the Annual Report's Appendix 4 – Photographs of Vegetation Communities. The group decided that this could be part of the next report that the High Marsh Subteam produces. Josh noted that this appendix should also include the target elevations for high marsh at the Project site.

- **Action Item #5:** There is a need to assemble a picture of SMHM habitat characteristics at this edge of the estuary and recommend some adjustments to the performance criteria in terms of vegetation.
- **Action Item #6:** The Project Team requested feedback on the high marsh target elevation for their upcoming restoration plan. They may need help with taking transects to obtain elevation to confirm suggestions from Brown's Island.

Tern Habitat in Cell 8/9

- Roger Leventhal presented the preliminary plans for creating tern habitat in Cell 8/9 and noted that the restoration plan is being prepared. There is a good possibility of receiving some funding from the Port of Oakland as mitigation for one of their berth projects that would impact tern foraging habitat.
- The island will consist of 5 acres and include a wide buffer area that encompasses all of Cell 8/9. Plans include refuge from the wind and a sound system per Joe Didonato's recommendation.
- Roger noted the last tidal reckoning was done in 2004 and suggested doing another study this summer. He estimated 3.5 – 3.7 NGVD (~0.5 feet above MHHW) as the new high marsh elevation.
- Joe Didonato questioned how the island would be managed. Roger explained that long-term management would include active vegetation removal. Howard Shellhammer also noted that once the area becomes a marsh, long-term terrestrial predator management would be needed.
- Josh Collins explained that the Subteam expressed concern that creating tern habitat may not be worth the effort since once high marsh vegetation begins to grow, the birds will leave. Letitia Grenier commented that an island surrounded by high marsh is not typical tern habitat and most likely the birds would not use it. Roger and Doug commented that they had been hearing much more positive predictions of potential success of the proposed island from other tern experts, including staff from USFWS.
- Roger and Doug emphasized that the area currently used by the terns would be inundated by most high tides once the breach occurs, and that the habitat is an accidental artifact of past sediment placement and current water management, which is not tidal.
- The TRT recognized that this is a valuable species that would be a great addition to the project if the created habitat were successful. The group briefly discussed where the terns may be coming from and if the tern habitat would remove terns from one area to another.
- **Action Item #7:** The TRT will review and comment on the tern restoration design proposal and provide scientific advice and recommendations on monitoring. The proposal is expected to the TRT in early March.

Staged Tidal Restoration

- Roger Leventhal presented the proposed staged tidal restoration plan for Phase I. The first stage would comprise Cells 1, 2, and 3/4. If Cell 6/7 and 8/9 can be finished in time, those cells could also be included in the first stage tidal. Including Cell 8/9 would offer the opportunity to restore tidal action to Clank Hollow. Since sediment deliveries for completing Cells 6/7 and 8/9 are unknown and uncertain, the Project Team will proceed with the initial sequencing plan.

- A staged tidal breach would decrease water pumping costs, but increase construction costs for raising certain levees to become new temporary perimeter levees to p. The construction process always includes constant surveying and adapting to subsiding soils.

- Joe Didonato questioned if the ungraded section of the levee east of Cell 3/4 could be used for the tern island. The project team clarified that the Cell 3/4 levee will ultimately be surrounded by high-growing low marsh vegetation, which makes it an unsuitable area for tern nesting. Josh Collins noted that the Subteam suggested building a tern island that would evolve into high marsh and also create sections of breaks in the levees that could be used for tern habitat. Joe suggested that the tern habitat could be phased to have a multitude of habitats throughout the Project site.

Earlier Restoration of Phase III

- Doug Lipton updated the group that the Project Team has participated in discussions with DWR and USFWS about ways to connect Montezuma with DWR's Meins Landing project that proposes to restore tides to a diked seasonal wetland. Meins Landing is adjacent to the northern tip of the project site in Phase III, and DWR appears to need additional SMHM mitigation In addition, DWR has approached the project team about creating smelt habitat. Both SMHM and Delta smelt habitats could be created in

Phase III without the use of dredged sediment, by scraping down adjacent uplands to appropriate high marsh and tidal channel elevations.

- By eliminating the levee between the projects and making the area contiguous, there is the possibility of restoring special status species habitat and restoring habitat in an area (Phase III) that was not slated for restoration so soon (given the relatively slow rates of sediment delivery to Monteuzma). If needed, additional upland habitat can potentially be purchased at the northeastern tip.

- Although Phase III provides the opportunity to restore habitat without using dredge sediments, permits and/or permit amendments will be needed for changing the design, impacting an existing habitat, and carving out upland habitat.

- Beth Dyer expressed the need to establish the permitting process for redesign elements that cut across agencies.

- **Action Item #8:** Josh Collins suggested adding Steve Culberson to the TRT, since he is the Lead Scientist at DWR and has expertise in sediment plant interactions and tidal marsh evolution.

- **Action Item #9:** Doug Lipton will meet with DWR staff (about the adjacent Mein's Landing project) and provide the TRT an update. Beth Dyer also suggested working with the Suisun Marsh Charter Group.

Project Adaptive Management – Operations

Water management

- Roger Leventhal explained that they are restructuring the groundwater well system due to biological fouling and the "pumping" of fine sands that have significantly reduced the production rate.

- The Project has hired Geomatrix to assess and repair the groundwater well system that involves 15 wells in Phase IV near the river.

- **Action Item #10:** Add more specific details on updating the well system to the Adaptive Management List.

- **Action Item #11:** Roger explained that they have submitted a proposal to the Water Board to cut-off the diffuser on the discharge pipe, since the project's infrequent and intermittent discharges over the years have allowed sediment to accumulate and block the end of pipe. He will send the proposal to the TRT for review.

Levine Richmond Terminal Sediment Placement

- Roger Leventhal explained that the Project received 23,000 cubic yards of sediment from the Levine Richmond Terminal that contained elevated levels of DDTs. These sediments were buried in the deepest part of Cell 11 in accordance with DMMO and agency approvals. Roger explained that more extensive monitoring is planned, for example monitoring of DDT in Cell 11 surface water for more than a year (one of the success criteria for placement of the LRTC sediment is non-detectable levels of DDT in the cell's surface water). The sediment also was consolidated before placement of cover sediment and monitored to confirm there was no mixing of LRTC sediment with overlying cover sediment.

- **Action Item #12:** Misty Kaltrieder requested a summary of the handling of the Levin Richmond Terminal sediment. Doug noted it will be presented in future project monitoring and operations reports.

- The group suggested that if the Project was planning on accepting noncover sediment for other cells, it would be useful to have a summary of these actions as background information. Because three years of monitoring data have shown no impacts to water quality from placing noncover sediment at the site, the Project Team indicated they would be submitting a proposal to the County for receiving noncover sediment beyond the current Phase I maximum level of 400,000 cy. Roger mentioned that there is

capacity for several hundred thousand more cubic yards of noncover, since cells are being dug deeper in order to provide material for building the levees.

- Doug Lipton concluded the discussion by noting that Montezuma is the only project that can accept noncover sediments for wetland beneficial reuse purposes.

Project Monitoring

Engineering Update

- Roger Leventhal provided the group with an engineering update. He presented a summary of the total amount of sediment received in 2006 (1.5 mcy) and showed a map of the settlement pole locations in Cells 1-4.

- The group questioned the significant figures presented in the table. Roger explained that the numbers reflected exact amounts calculated by the Corps and were for documentation purposes to Solano County and for tracking the amounts received with the amounts specified in Corps contracts.

- Roger Leventhal summarized the current cell elevations based on the January 2007 surveys and noted that the sediment is still settling. He commented on the usefulness of seeing how sediment settlement will be affected by the early breach and restoring of tidal action.

Chemistry and Biology Update

- Doug Lipton explained that the Project conducts water quality monitoring every two weeks in cells with exposed noncover sediment, and monthly in completed noncover and cover cells. Doug summarized that water quality was not being driven by the sediment quality , but instead by water management and evaporation. He noted that contaminant levels tend to reflect the amount of water added to the cells to keep them wet (e.g., inorganics increase as ponds dry out in the summer, similar to seasonal wetlands and salt ponds throughout the SF Estuary).
- Victor Chan questioned the mercury concentrations found at the site and the Port of Oakland sediment that contained elevated levels. Doug Lipton explained that Port of Oakland sediments with elevated mercury levels were approved as cover by the DMMO and that the project team developed an additional confirmation and placement plan to deal with this material that came from Oakland dredging polygons 3-6. He reminded the TRT that this material was dealt with effectively in 2004 and provided in 2005 monitoring reports. Doug also noted there were non-detects in cell water for mercury, and methylmercury is not being analyzed in accordance with TRT suggestions.
- Letitia Grenier suggested reconsidering monitoring for methylmercury in the water column in association with tissue sampling. It would be useful to have both collected at the same time and suggested sampling blood in birds or sampling what the avocets and stilts are eating.
- Don Yee cautioned that methylmercury sampling requires appropriate temporal and spatial coverage to address the high variability in results (i.e., how to evaluate high concentrations).
- Doug Lipton noted that there were some copper and nickel cell water concentrations over the action levels (which are one-half of the WDR criteria)in some cells. Due to the shortage of water, the Project Team prioritizes which cells to keep wet and the noncover cells receive water preferentially.
- The group questioned if the SMHM monitoring would be conducted this year. Due to the flooding last year, Doug thought that the monitoring would occur, but he needed to verify this with Rachel, who was unable to attend the meeting.

Meeting Wrap-up Comments

- Beth Dyer commented that the Project is doing interesting work and suggested developing a strategy for disseminating this knowledge. This information would be useful to the environmental community and relevant at the state and national level. She recommended finding a spokesperson and noted that the regulators are watching the Project for SMHM and hydrology achievements.

- Josh Collins suggested that the high marsh design could be presented at conferences and discussed in articles (e.g., *Estuary* magazine and IEP newsletter).

- Victor Chan questioned if the Project had solicited the Sacramento Corpsfor dredged materials. Doug indicated that they had not, but are open to discussing disposal opportunities anytime.

- **Action Item #13:** Due to the delay in the issuance of the monitoring data reports, the group requested that the Project Team provide summary figures and tables of available data every 4 months or so.

TRT Tasks for Upcoming Year

- In addition to participation in the TRT annual meeting and review of the annual report, individual TRT assignments will depend on individual involvement in the smaller, focused subteams. Meeting summaries and reviews from the subteams will be distributed to the entire TRT.

- Josh Collins noted that there is a backlog of report reviews due and requested that these be submitted by March 2007.

- Upcoming subteam assignments include:
  - High Marsh/Tern Subteam: review of the Staged Tidal Restoration Proposal (estimated due date: March 2007). When reviewing the tern habitat proposal, the TRT should also address the monitoring needed for terns in regards to the revised Phase I restoration (e.g., monitoring PCBs and Hg in tern food species).

  - Contaminants Subteam: meet in February or March to discuss monitoring and reference site monitoring.
    - Victor Chan requested to be notified of this subteam meeting.
    - Josh Collins requested that the Project Team provide the raw data for the subteam to review and suggested preparing a map of reference sites outside of the project area to assist in coordination.

Meeting adjourned at 2:30 pm.

Montezuma Wetlands Project

Technical Review Team
Salt Marsh Harvest Mouse Conference Call
March 5, 2007 (3:00pm – 4:00pm)

Participants: Rachel Bonnefil, Josh Collins, Cristina Grosso, Howard Shellhammer

Meeting Objectives:

(1) Clarify immediate and long-term needs for the high marsh and elevation criteria
(2) Discuss CDFG data reviewed by Howard Shellhammer and elevation data from Stuart Siegel
(3) Identify how to determine elevation and vegetation criteria

Preparation of the Restoration Plan and Revision of SMHM Habitat Criteria:

- The group discussed the data and next steps needed to help the Project Team complete a draft Phase I Adaptive Management Restoration Plan for the TRT to review.
- Howard provided a brief summary of the CDFG data. Most species of halophytes will support mice, and mouse densities appear to be positively correlated with vegetation depth and density. He noted that mature stands of Scirpus can support mice.
- Howard and Josh suggested that elevation, plant composition/architecture, and distance from channels are the key elements that need to be addressed in determining mouse habitat goals.
- Howard explained that the restoration design is going to produce a broader spectrum of plants than what the original criteria stated for the project, which were dominated by pickleweed. Therefore, he suggested discussing these changes with the agencies soon, since the Restoration Plan is proposing a different vegetation community, and it will likely take many years before the project site will support mice at CDFG's trapping levels.
- **Action Item #1**: The group agreed to take an iterative approach to finalizing the draft Adaptive Management Restoration Plan and have the TRT review and provide comments on working drafts of the Plan. There are enough data and information to begin this process, and gaps can be filled in as they are identified.
- The group briefly discussed several ancillary recommendations that could be addressed in the Plan, including farming halophytes for one growing season, grading to provide topography at different heights, and breaching during the summer when the salinity is higher.

Possible Data Sources:

- SFEI has the IRMW plant data for Brown's Island, but would need to obtain confirmation from Stuart Siegel to use the data. If necessary, Josh can contact Steve Culberson regarding the DWR data.
- Josh also noted that SFEI has historical data, and additional data can be obtained from several dissertations.
- The group discussed the lack of tidal datum data for Hill Slough. Josh explained that there is a tide gauge near the Hill Slough Bridge, which is approximately one mile from one of CDFG's trapping sites, and an approximate relationship between that station's tidal datums and Hill Slough's could be established with a relatively limited field effort.
- Rachel mentioned that documentation and references to support the Restoration Plan's recommendations on mouse habitat are needed, and this is somewhat problematic because CDFG has not yet published their data. Howard suggested that it would be ideal to use the statistical data from CDFG to support that a mixed plant community provides higher capture rates should that data become readily available.

- **Action Item #2**: Howard and Josh will produce the following two graphs to help support the revised SMHM habitat design (estimated deliverable date: April):
  (1) Percent halophytic vegetation v. tidal elevation (Josh)
  (2) Percent halophytic vegetation v. number of mice/capture efficiency (Howard)

  - Howard noted that a persuasive case could be built with the existing data and that the general categories of high, medium, and low could be used for any missing data
  - Rachel commented that numerical percent cover criteria will be needed eventually for the permit. Howard suggested running transects at a selected number of grids to produce these data.

- Josh recommended stating up front in the Phase I Adaptive Management Restoration Plan that the diked marsh pickleweed marsh is no longer an appropriate design because more recent trapping data indicating that a pickleweed-dominated habitat is not needed to support SMHM,
- Howard also explained that it is important to note that no place in the estuary has been trapped as extensively in recent years as in Suisun Marsh, and therefore the CDFG data set represents a large proportion of available data on the species.
- Josh suggested stating that new data have been obtained since the original project design was proposed and that the majority of the trapping work in the Bay has been performed by Howard and CDFG.

- **Action Item #3**: Rachel will discuss with Doug when a draft Restoration Plan can be distributed to the TRT for review.

Montezuma Wetlands Project
Technical Review Team
September 19, 2007 (10:30am – 1:30pm)

Attendees:

Bob Batha, BCDC	Letitia Grenier, SFEI
Rachel Bonnefil, Project Team	Cristina Grosso, SFEI
Andree Breaux, RWCQB	Roger Leventhal, Project Team
Josh Collins, SFEI	Doug Lipton, Project Team
Ben Greenfield, SFEI	Eric Polson, Polson Engineering
	Donald Yee, SFEI

Meeting Objectives:

- To review the *Adaptive Management Restoration Plan for Phase I Report*
- To answer questions and gain TRT insights

Summary of Action Items:

- TRT drafts letter on the need for a guaranteed supply of sediment to ensure that marsh restoration at Montezuma can progress on a reasonable timeframe that is in accordance with the project's permits.
- TRT recommends running elevation transects at Upper Nurse Slough and eastern Rush Ranch to confirm high marsh elevations at those sites. Josh to identify optimal locations to conduct elevation surveys at these sites. .
- Josh to obtain BREACH II elevation data for Browns Island
- TRT review topics:
    - Project Team prepares technical memo on tern island design, providing a list of advisors and personal contacts, and outlining the challenges and constraints of tern habitat construction/management.
    - Project Team characterizes vegetation on outboard levees in the same elevation range as the cell levees to assess what vegetation is likely to colonize the "remnant levees" (i.e., those sections of cell levees proposed to be left at existing elevations) so that the TRT can assess their potential habitat value and possible habitat design.
    - Project Team prepares technical memo on data used to determine the elevation range for the high marsh modifications.
    - TRT review will also include looking at monitoring elements of the draft adaptive management restoration plan.
- SFEI will issue draft minutes. The TRT is encouraged to address monitoring elements within a turnaround time of two weeks.

Project Status:

- Doug Lipton provided an overview of the 2007 construction and site activities, ongoing battles with the Corps over sediment they continue to waste in the ocean instead of beneficially reusing at Montezuma, and plans for 2007-2008.
    - No sediment has been delivered to the Project site in 2007. The last delivery was in December 2006. Therefore, the focus of 2007 has been on monitoring and management of the site and keeping the cells wet.
    - The Liberty offloader is also going to be used at Hamilton. It takes about a week to move the offloader between the sites. Doug Lipton explained that there is a possibility of getting sediment in October since the JV has alerted them that Hamilton will not be ready until November.
    - Josh Collins noted that it does not make sense to dump mud in the ocean with the threat of sea level rise. However, Doug explained this is often the Corps' preferred disposal option since it is cheaper in comparison with beneficial reuse.
    - Josh Collins recommended that the Annual Report should note that evaluating the stressors on the system should also be part of monitoring*?? Cristina, can you clarify?*. It is difficult for the TRT to do their job with indeterminate project schedules. *Was this really a major point that needs to be stated?*

- **Action Item 1:** Bob Batha suggested that the TRT issue a statement that beneficial reuse of the sediment resource should be prioritized over ocean disposal, especially in light of sea level rise. SFEI will draft a statement addressing the necessity of having guaranteed sediment delivery for the Project to progress in a reasonable timeframe that is in accordance with the project's permits. The TRT will review this and then distribute the statement to some of the agencies.

Discussion of July 2007 Adaptive Management Restoration Plan for Phase I:
Summary of Phase I Design Modifications

- Doug Lipton presented a summary of proposed Phase I adaptive management design modifications. He discussed the major components of the landscape restoration plan and the updated Phase I habitat acres for low marsh, high marsh, channels, and remnant levees (i.e., levee sections proposed to be left at existing elevations, which in the past have been referred to as "bird islands").
- The proposed major adaptive management design changes to Phase I discussed were: staged tidal restoration to completed sediment cells, creating least tern/snowy plover habitat (depending on the availability of sand), and modifying the high marsh design for the salt marsh harvest mouse (SMHM), including raising target elevations and eliminating the managed "mouse farm."
- Rachel Bonnefil provided an update on DFG's SMHM/vegetation data. We have preliminary data summaries for 2002-2004, but Howard Shellhammer is still trying to get the unpublished data, which they are reluctant to release until the paper is published. Another factor is that detailed vegetation data were not collected at all of the SMHM trap sites concurrently with SMHM monitoring. However, the DFG data indicate that there are higher SMHM densities in mixed halophyte habitat than in pickleweed-dominated habitat. DFG's preliminary findings have informed Project team and TRT discussions over the past several years, the consensus being that a pickleweed-dominated landscape is not necessary to support SMHM, and that the diked pickleweed marsh is not necessary to ensure success of the project's SMHM mitigation. For these reasons, and also because a less management-dependent landscape is preferable, the Project team proposes to eliminate the diked pickleweed marsh from the design and instead restore that portion of Phase I to fully tidal high marsh.
- Andree asked about increasing house mouse captures at the site in recent years and their effect on SMHM populations. Rachel noted that Tom Kucera's data shows large increases in house mouse captures since 2002 and that SMHM capture rates have fluctuated over that time showing an overall slight decrease. Tom's assessment is that this may reflect a reduced SMHM population but it could also be that large numbers of house mice make the SMHM harder to detect, whether or not their populations have in actuality decreased. The level of monitoring that would be needed to determine population size is beyond the project's monitoring scope and budget.
- **Action Item 2:** Josh Collins suggested removing the quotes around the phrase/words adaptive management, experts, and outside in the PowerPoint slides.

Staged Tidal Restoration in Phase I

- Doug Lipton presented the benefits and challenges of staged tidal restoration.
- Bob Batha expressed concern that the channel network would accrete sediment due to being oversized for the smaller tidal prism of the first few restored cells; Bob noted that dredging of the channels may be needed in future..
- Andree Breaux suggested including dredging in any permit changes needed to implement the adaptive management modifications.
- Bob suggested that the project develop an estimate of the amount of sediment that might need to be dredged, based on the estimated timing of the tidal breach stages.
- Roger Leventhal explained to the group the proposed notching of the interior cell levees, if possible to below the marsh plain elevation, to promote formation of channels that will convey adequate tidal prism to the restored cells. Roger expects that the cell levees will resist erosion and that notching is needed to allow the channels to incise below the marsh surface. (Noncover separation cell levees would not be notched).
- Letitia Grenier raised the issue of high marsh slivers forming quickly at the edges of cells and the possibility of mice colonizing these habitats from adjacent areas that support mice. This is something to be aware of ahead of time in case operations will need to be adjusted.
- Roger Leventhal and Eric Polson agreed that once tidal action is introduced, they do not expect rebounding of the peat and compacted sediments.

- Bob Batha questioned using the term "bird islands" for the sections of cell levees proposed to be left at existing elevations approximately 0.5' to 2' above MHHW. Bob noted that these areas will likely remain unvegetated for a short period of time and may not provide appropriate nesting habitat for shorebirds and waterfowl. He recommended making an estimated guess on what the remnant levee habitat will look like in the future (e.g., in one year, in 1-3 years, in 5 years, etc.). In addition, this will also assist with planning for weed management for these areas. Bob noted that the target habitat for bird nesting areas should be unvegetated.
- Letitia noted that an elevation 1' above MHHW may be low enough to discourage weedy vegetation, but 2' above MHHW may be too high. Monitoring may be able to show what elevations are optimal.
- Letitia also noted that higher elevation areas within the marsh can become upland high tide refugia for terrestrial predators.
- The feasibility of various approaches to grading down the cell levees was discussed, including side-casting material into the marsh. It was generally discussed that side-casting levee material would create localized areas of elevations slightly above the marsh plain, but they could likely be made low enough not to foster upland vegetation and serve as refugia for predators.
- Letitia suggested that high marsh refugial habitat should be the goal for the remnant levees.
- **Action Item 3:** The group agreed to rename "bird islands" to "remnant levees".

- Andree Breaux commented that the "peninsulas" at Sonoma Baylands did not subside and they appear to be acting as predator corridors.
- The TRT agreed that notching the levees to foster channel development is a good idea, but are not sure if the remnant levees will create predator corridors. Therefore, the group recommended running several experimental treatments on remnant levees by grading them down to various elevations marsh plain and monitoring vegetation parameters, bird density and predator use.
- Josh Collins proposed decoupling the remnant levees from the project's bird nesting habitat requirements and evaluating how that habitat function can be met elsewhere on site based on the expected habitat. While we do not want to upland predators to have access, we do want to provide refugia for birds.
- Doug Lipton suggested using the existing range of levee elevations and the plan to grade some of the levees down be used to evaluate what vegetation and wildlife use occur; emphasizing the experimental nature of this to assist with the design in other areas. Bob Batha agreed that knowing what habitat will likely be on these remnant levees will enable the Project Team to better estimate the second tidal restoration stage of Phase I.
- **Action Item 4:** The TRT suggested the following approach:
  - Decouple the bird islands from nesting shorebird habitat and draft a proposed treatment of these areas that grades a section down to marsh plain and focuses on bird refugia.
  - Identify performance indicator species (marsh bird diversity/density, tracks for upland mammalian species, e.g., fox, coyote, skunk, rat) and areas for monitoring for these.

- **Action Item 5:** Rachel Bonnefil will characterize vegetation on outboard levees in the same elevation range as the existing stage 1 cell levees to assess what vegetation is likely to colonize the remnant levees..

Updated Tidal Reckoning

- Roger explained that local tidal datums were recalculated using tide data obtained from a nearby DWR tide gauge. DWR also performed the tidal reckoning as described in Appendix B of the report.
- Roger presented the updated tidal datums, which are generally about 0.5' higher than the old datums, most likely due to sea level rise.
- The design elevations for those habitat elements that are based on tidal elevations (e.g., intertidal marsh, channel inverts) have also been updated based on the tidal reckoning. A further change to the high marsh elevation (raising it MHHW+0.5') is also proposed (see discussion below).
- **Action Item 7:** Josh Collins recommended that the TRT send a memo to DWR on how useful their data were to ensure that they maintain the gauge in the future.

Create Least Tern/Snowy Plover Habitat

- Doug explained the basic design for the tern island. Rachel Bonnefil explained that unlike what is generally thought of as typical tern habitat, the proposed island will be surrounded by high tidal marsh and not by water. The project has conferred with a several biologists experienced with management of tern colonies, and the overall consensus is that the proposed island is a reasonable idea and that terns will colonize a lot of atypical habitats as long as their basic needs are provided, mainly unobstructed sightlines, proximity to good foraging habitat, and some protection from predators (e.g., distance from upland areas, fencing, ditching. However, there is no guarantee that the terns will use this area.
- Doug Lipton noted that delays in construction of the tern island might delay the first stage of tidal breaching because of the existing tern habitat in the future low marsh area. Letitia Grenier suggested creating temporary habitat in other areas on the site but the project team noted other potential areas of the site were evaluated and concluded the island in Cell 8/9 was still the best site. Bob Batha recommended that available sand should be placed at the proposed Cell 8/9 island site instead of creating habitat somewhere else.
- Bob Batha commented that he thought creating tern/snowy plover habitat was a good idea, but is concerned about vegetation growth and weed control. In addition, he thought that high marsh vegetation may still be too high to maintain good sightlines. Bob suggested reviewing the tern habitat management efforts at Albany mudflats and Charleston Slough for more information.
- **Action Item 6:** Josh Collins requested that Rachel Bonnefil write a short technical memo (similar to Appendix B in the report) summarizing the rationale of the tern island design, the people contacted regarding this matter, and outlining the main constraints and uncertainties that may affect successful colonization of the habitat by terns.

High Marsh Modifications

- Doug Lipton explained the proposal to raise the high marsh design elevation to 0.5' above MHHW, and to eliminate the diked pickleweed marsh from the design and restore that area of Phase I to fully tidal high marsh.
- **Action Item 8:** Josh suggested providing the TRT with a technical memo summarizing the field data that were considered in the decision to raise the high marsh elevation. The memo should describe vegetation composition at different elevations within the high marsh range in reference tidal marshes.
- Bob Batha expressed concern that there is not much room for error in meeting the elevation targets and stressed the importance of identifying the optimal elevation based on reference site data.
- Josh Collins suggested running elevation transects at eastern Rush Ranch, upper Nurse Slough, and obtaining BREACH II data from Browns Island.
- Bob Batha questioned the different salinities at Rush Ranch and Montezuma.
- Doug Lipton proposed constructing Cell 8/9 to the proposed new high marsh elevation and evaluating habitat development at this target elevation through post-breach monitoring. Additional data could be collected to confirm the target elevation .
- **Action Item 9:** Josh to obtain Breach II Brown's Island data.

Other Phase I Modifications

- Doug Lipton briefly explained additional Phase I modifications proposed in the report, including removal of fish point bars, enlargement of Cell 12, and possible expansion of noncover capacity. The post-breach monitoring program (as outlined in the MMRP and presented in the report) was discussed briefly. However, due to the lack of time, the TRT did not discuss these items.

Clarify TRT Review Process for July 2007 Report

- Bob Batha recommended expanding the discussion on Page 3 of the report under "Dredged Sediment Types" to clarify statements about comparative water quality between cover and noncover cells.
- Josh Collins requested that the TRT closely review sections on monitoring when commenting on the report and to send any additional comments by the first week in October.
- Doug Lipton explained that the Project Team will be meeting with agency staff over the next month or two to present the proposed adaptive management changes, and will update and refine the proposal based on the TRT's input.

Next TRT Meetings

- Contaminants Subteam Meeting in October or November 2007.
- Annual Meeting in January 2008.

Meeting adjourned at 2pm.

Montezuma TRT Contaminants Subteam
January 28, 2009

Present: Doug Lipton, Beth Christian, Rachel Bonnefil, Ben Greenfield, Don Yee, Meredith Williams, Josh Collins, Cristina Grosso

Main objectives: *1) review sediment and water data summary, 2006-2008; 2) discuss 2006 reference site work. Other issues discussed included seasonal timing for proposed surface water pumping and implications of cell water salinity for the seasonal timing of tidal breaches.*

Project Status & Issues Regarding Lack of Sediment
Status:

- The Project has 150 acres of completed sediment cells ready for restoration to tides.
- No sediment has been received since Dec 2006. The primary cash flow for the project has been unavailable due to the lack of sediment.
- The lack of sediment has a significant impact on the Project's ability to cover cells and fulfill permit requirements.
- Other than Hamilton, very few restoration projects are being selected for beneficial reuse of sediment.
- The need for a new holistic approach to beneficial reuse and restoration in SF estuary is beginning to be recognized.

Water and Sediment Data Summary, 2006-2008
Rachel Bonnefil presented summary graphs and tables of sediment and water quality results for the years 2006 through 2008. The main points of this summary are described below.

Sediment results:

- Arsenic, cadmium, chromium, copper, nickel, silver, PAHs, and PCBs were below criteria
- Lead, mercury, selenium, and zinc were detected above cover criteria in a few sediment samples, some of which were questionable results due to analytical problems
- DDTs were detected at elevated levels (98 to 439 µg/kg; mean = 242 µg/kg) in sediment from Levin-Richmond Terminal
    - These results were consistent with pre-dredge testing that showed DDT concentrations of 140 to 462 µg/kg with a mean of 279 µg/kg
    - Lower concentrations were detected in samples collected from Cell 11 (98 to 286 µg/kg; mean = 173 µg/kg) than from incoming barges (203 to 439 µg/kg; mean = 356 µg/kg)
    - In accordance with TRT recommendations and agency approvals, LRTC material was placed in a deep portion of Cell 11 and covered with approximately 6 feet of cover material.
    - Approximately 3 more feet of cover material will be placed on the cell to achieve the design elevation

Surface water results:

- Zinc exceeded the WDR discharge limit in one sample from the makeup water pond; TSS and turbidity exceeded discharge limits in several samples. No discharge of water occurred during the reporting period.
- Cadmium, chromium, lead, selenium, silver were below operational action levels (half the WDR discharge limits) in the makeup water pond and sediment cells.
- Arsenic, copper, mercury, nickel, and zinc were detected above operational action levels in the makeup water pond and/or sediment placement cells.
- Exceedances of action levels occurred in both cover-only and noncover cells.
- Mean concentrations were generally lower in noncover cells
- Significant ongoing nickel and zinc exceedances occurred in Cell 6/7; nickel concentrations between 21 and 12,000 µg/L, zinc concentrations between non-detect (<20 µg/L) and 2,600 µg/L zinc.
- Only minor amounts of material (mostly sand) has been placed in Cell 6/7
- DI WET testing in Cell 6/7 leached relatively high levels of Ni and Zn from low-concentration soil/sediment samples; low pH related to exposed peat soils appears to be driving elevated water concentrations
- In general there were fewer exceedances in the cells in 2006 and 2007 than in 2005, likely due to improvements in the well system that increased well production.

- Some reductions in exceedances compared with previous years may also be due to improved analytical equipment obtained by the laboratory (fewer false positives)
- No discernable trend in inorganics concentrations in cell water over time; salinity levels appear to be rising over time in some cells.
- Limited water supplies still preclude keeping cells continuously ponded during the dry season; cells containing little sediment (Cell 6/7) and cells containing large amounts of sand (Cell 10) are lowest priority and are dry through much of the summer/fall.

Groundwater results:

- Arsenic, lead, and mercury exceeded their background maximums in some Phase I monitoring wells
- Exceedances for these COCs are often followed by a steep reduction in concentration during the next quarterly sampling event
- Intermittent high detections of mercury were detected in two deeper wells, consistent with previous years' results
- No discernable trends in groundwater concentrations since the start of monitoring in 2003

Group discussion followed this presentation of results. Ben Greenfield questioned whether the project's permitted screening criteria need to be re-evaluated. He noted that the current Sediment Quality Object (SQO) approach is based on a triad that considers multiple lines of evidence, and in general the SQO approach indicates that bulk chemistry levels alone are not the best indicators; need to consider matrix effects and toxicity (where available). The SQO approach doesn't apply to dredged materials. Doug Lipton suggested that SQOs could be presented along with the project's screening criteria. Beth Christian noted that the water discharge criteria in the project's Waste Discharge Requirements (WDR) are outdated; the WDR is due for renewal in 2010 and criteria will likely be updated.

Ben Greenfield noted that the reporting limits for mercury in water are slightly higher than the permit limit. Doug Lipton and Rachel Bonnefil said that lower reporting limits are not commonly available on the relatively short turnaround times that the project needs in order to respond to exceedances in a timely way. Don Yee recommended occasional analysis of surface water by low-level methods for comparison with conventional results for mercury.

The question was raised as to whether MeHg should be part of Montezuma monitoring. Doug Lipton noted that this question had come up in past TRT discussions, and the benefit of measuring MeHg in sediment or water has never been made clear in light of the wide temporal and spatial variation in MeHg concentrations in wetland environments that are known to correlate poorly with sediment Hg concentrations.

Josh Collins suggested that the TRT write up recommendations about what role of bulk chemistry data should play in monitoring at the site. Ben Greenfield questioned whether bulk chemistry monitoring should be replaced with sublethal toxicity testing.

Regarding the Cell 6/7 water results, Josh Collins noted that high levels of metals could be related to a salmon canning operation that was located there in the late 1800s. Montezuma was the site of industrial use due to its deep water location. Stockyards were also there. Russ Flegal and Jim Hunt are familiar with this history.

The Project Team would like TRT help with figuring out an approach to treat or manage Cell 6/7 nickel and zinc concentrations. Don Yee suggested a bench-scale study or pilot test to determine if additions such as limestone could reduce Ni and Zn concentrations. Doug Lipton noted that addition of sediment to the cell appears to be the most feasible way to buffer low pHs in the cell to reduce leachability. Soft soils in the cell make it infeasible to get equipment out there to move sediment from adjacent cells. Given the large area, most options are quite costly.

Salinity in cell water was discussed. Rachel Bonnefil presented graphs showing that salinity levels appear to be rising over time in the older cells (Cells 1, 2, and 3/4). Josh Collins noted that cell water salinity is a consideration in the timing of tidal breaching; breaching should occur at times when cell water salinity is not too much higher than adjacent water bodies (Montezuma Slough and/or Sacramento River, depending on which Phase is being breached). High salinity levels in summer/fall may preclude breaching in those seasons. Rising

cell salinity levels due to water supply shortfalls gives greater urgency to the need to breach at least a portion of Phase I, which would help alleviate the water supply problems.

Josh suggested adding Slough and River salinity to the graphs of cell salinity to compare relative levels and assess optimal seasonal timing for tidal breaches.

Surface Water Pumping from Sacramento River
The timing of proposed surface water pumping to supply onsite water was discussed. Rachel Bonnefil noted that there are some discrepancies in guidance provided by CDFG vs. USFWS with regard to seasonal pumping windows for protection of larval Delta smelt. Rachel will send an email to Josh summarizing the guidance received to date from CDFG and USFWS and requesting TRT input the question.

2006 Reference site work
The group discussed the report on 2006 reference sampling of sediment and tissue samples from the Sacramento River and Montezuma Slough adjacent to the site. This report was submitted to the TRT on xx.

Ben Greenfield noted that Darrell Slotton's mercury biosentinel small fish data from Montezuma Slough are available in-house at SFEI. The project team should summarize the existing reference data for tissue and include Slotton's data. SFEI is collaborating on a North Bay biosentinel study; Montezuma could be included in this study. The study is currently on hold due to budget cuts.

Ben Greenfield commented that the sample size in the 2006 reference work was too small. The TRT will make recommendations regarding sample size.

Ben also commented that mercury and selenium are the only metals worth analyzing in tissue.

Cristina Grosso recommended including the reference data in the Montezuma database; an excel table of reference data is needed to upload to the database.

Action Items
1. Rachel to send a summary of river pumping timing guidance received from DFG & FWS
2. Josh will send this summary to Bruce Herbold (EPA) and other relevant TRT members for feedback
3. Low level mercury analysis (method 1631) of surface water may provide more information. Rachel will request this for comparison
4. Consider an interagency meeting for presentation of the report (Josh)
5. Contact Steve Culvertson (DWR) about salinity results and coordinating efforts (Josh)
6. Add ambient slough salinity values to the chart, also include River by Phase 4 (Rachel)
7. Consider using Wetland Tracker for sediment locations (Meredith)
8. Send Darrell's data to Rachel (Cristina)
9. Summarize recommendations on minimum sample size for fish sampling (Ben)
10. Draft new contracts(Cristina and Meredith)
11. Include review of adaptive management plan in the TRT annual report (appendix)
12. Construct a response to Cell 6/7 data. Outline a bench study on sediment additions (Don, Ben)

Montezuma Contaminants TRT Sub Team
12/17/09
Doug Lipton, Rachel Bonnefil, Ben Greenfield, Don Yee, Meredith Williams

The primary question under consideration is whether or not the Contaminants sub team is comfortable with the proposal to expand noncover capacity in Phase 1 up to 20%, the amount authorized by the permits in Phases II, III, and IV. The project's permits currently limit noncover capacity in Phase I to 400,000 cy (~10%). This limitation was intended to allow time for monitoring to evaluate whether noncover sediment showed greater water quality impacts than cover sediment. The project has requested permit amendments to allow placement of up to 20% noncover in Phase I.

General Updates

Doug Lipton provided an update on the most recent LTMS Management Meeting

- An outline of the Corps' new Dredged Material Management Plan (DMMP) was presented: it places a high priority on beneficial reuse of dredged sediment; calls for better coordination between dredging projects and beneficial reuse sites, and emphasized the importance of reducing ocean disposal of sediment.
- Mark Wishman is the Corps project manager for the DMMP

Status update on regional dredging and prospects for receiving sediment at Montezuma:

- The last stage of the 50' deepening project at the Port of Oakland (Contract 3E) contract is near completion and expected to end mid-January 2010.
  - The Liberty offloader, which has been leased to the Hamilton Wetlands Restoration Project for the past 3 years under contract 3E, will be available for use at Montezuma in 2010.
  - The Corps appears to be no longer pursuing development of the Aquatic Transfer Facility
  - A planned federal deepening project from Oakland Inner Harbor to Coast Guard Island will generate approximately 800,000 cy of sediment, a significant portion of which is expected to be noncover sediment

Data Review

Rachel Bonnefil and Doug Lipton presented a summary of water and sediment data collected since the start of sediment placement in late 2003. The following primary findings were presented:

- Few detections of organic COCs were observed in water, and when detected they were typically close to or below reporting limits
- Mean concentrations of most inorganic COCs in water were similar between cover-only cells, cells with exposed noncover, and "completed" noncover cells (i.e., those in which at least 3' of cover sediment has been placed atop noncover mud)
- Mean noncover water concentrations for nickel, selenium, and zinc were elevated relative to means for cover and completed noncover when data from the entire monitoring period (2004-2009) was used in the comparison
- Mean cover and noncover concentrations were similar for all inorganic COCs for the period of 2006-2009
- High salinity in water samples was associated with analytical interferences during summer/fall dry periods of 2004 and 2005, resulting in apparent false positives for nickel, selenium and zinc
- Improved analytical methods implemented in 2006 resulted in more accurate detections, particularly of nickel, selenium, and zinc
- Groundwater monitoring data 2004-2009 show no detections of organic COCs

- Groundwater results 2004-2009 show detections of inorganic COCs above and below pre-project background levels at the site. Chromium, copper, selenium, and zinc were typically below background levels in all wells
- Elevated arsenic and nickel were detected in one of the shallow groundwater wells, but low concentrations were detected in all other wells and sediment quality (both cover and noncover) was similar across Phase I, suggesting that sediment was not the source of the spatial variation in groundwater As and Ni concentrations.
- Elevated mercury was consistently detected in two of the deeper groundwater wells (but not in shallow groundwater), suggesting that dredged sediment was not a source of mercury to groundwater.
- Selenium and zinc detections in groundwater became rare beginning in 2006, likely due to better analytical equipment
- Mean sediment concentrations were similar for cover vs. noncover
- Cadmium, mercury, lead, and silver noncover sediment means were higher than cover sediment means
- Cover sediment means for other inorganic COCs were similar to or higher than noncover means
- Overall, comparison of cover and noncover water results indicates that differences among the data sets likely reflect operational and analytical factors
- Operational factors include water management, differences in cell distribution among data sets, seasonal variation (i.e., evaporation and concentration of dissolved COCs). Therefore, each data set reflects events in time in addition to any inherent differences between cover and noncover sediment.
- Concentrations of sediment inorganics do not appear to be a good predictor of water concentrations
- Organic COCs do not appear to impact water quality
- Noncover sediment does not appear to pose a greater threat than cover sediment to surface or groundwater resources

Ben Greenfield noted that detection limits for organics may be below biological impact thresholds, so the absence of detections in water does not demonstrate that cover and noncover are similar in terms of wildlife impacts. Food web modeling and/or lower detection limits for organics may be needed to answer this question.

Don Yee noted that detection limits for PCBs used in RMP water sampling are 0.1 ng/L, 1,000x lower than the project's detection limits. Doug and Rachel noted that the detection limits achieved at the site met permit requirements and that routine analysis using RMP's detection limits would be cost prohibitive.

Ben noted that ambient water quality in the Bay may also be above biological impact thresholds. Doug noted that one project objective is to be no worse than ambient conditions in the Suisun Marsh.

Ben and Don discussed the relative importance of biotic uptake through the water column vs. benthic uptake. Ben stated that water column exposure is a significant pathway for food web uptake, and that monitoring of biota in the cells is needed to assess food-web impacts of organics in cover vs. noncover sediment.

Don questioned why biotic monitoring would be needed to evaluate differences between cover and noncover impacts if a comparison of surface sediment in cover cells vs. "completed" noncover cells shows similar concentrations and the exposure pathways are the same for both.

Ben suggested that a comparison between all 5 categories of water inorganics data may be helpful (i.e., comparison of samples collected from 1]cover only cells, 2]cover areas prior to notching of separation levees, 3] noncover areas before notching of separation levees, 4] cover/noncover areas after notching of separation levees but before ≥3' of cover sediment placed, and 5] "completed" noncover cells).

Ben suggested that box/whisker plots may also be helpful in presenting water inorganics means.

Ben suggested summarizing barge and cell sample data separately.

Ben suggested pairing sediment and water inorganics results for each cell to see if they show similar trends in concentrations.

Don suggested normalizing water inorganics results to salinity.

Ben suggested that the organics detection limits and absence of MeHg data warrant biotic monitoring.
Don suggested that surrogate measurements may be possible (e.g., SPMDs, SPMEs, DGTs), but noted that these methods will not work if the cells dry out, so all variables (e.g. water management) must be controlled to get apples-to-apples comparisons. Don said that an RMP Special Study used DGTs for Hg in water, but results are still pending

Rachel noted that it may be hard to find biota to sample in the current cell conditions (prior to tidal restoration) because of wide fluctuations in salinity and low water levels in the dry season.

Other possible options suggested for evaluation of organics were:

- Comparison of detection limits with effects thresholds for target wildlife
- Enter the project's organics detection limits into a food web model
- Analysis of a limited number of water samples at very low detection limits

Modeling of organics was discussed:

- Organics models based on equilibrium partitioning
- Can organics leach from noncover sediment into pore water?
- Organics have low solubility in pore water; it seems unlikely that organics in subsurface sediment (3' or more bgs) will affect surface sediment porewater
- Could model subsurface hydrologic flow for the site (SFEI has the capacity to do this modeling)

The potential for noncover sediment to mix into the cover layer was discussed. Doug and Rachel pointed out that the placement of cover over the noncover sediment is implemented in a manner to minimize mixing: cover is placed after settling and dewatering of the noncover sediment; and cover sediment is placed in an outer ring of cover-only material that then flows over a berm so fine-grained materials are distributed in a non-disruptive manner over the noncover layer. Finally, sediment sampling is performed in the top layer to confirm all COC concentrations in surface sediments meet the cover criteria.

Main Conclusions and Recommendations:
SFEI should give further consideration to possible modeling of the uptake to see if there are any pathways through which uptake could reasonably occur.

Ways of resolving uncertainties related to organics detection limits and MeHg data should be considered, including:

- Use of surrogate measurements (e.g., SPMDs , DGTs, SPMEs)
- Comparison of organics detection limits with effects thresholds for target wildlife
- Entering organics detection limits into a food web model
- Biotic assessment
- Analysis of some samples for organics at very low detection limits

The contaminants subteam did not reach consensus that the information provided indicates beyond all possible doubt that noncover vs. cover sites will have the same impact on wildlife. Project proponents' information

provided was convincing for most metals but not convincing for organics or Hg, due to elevated organics detection limits relative to wildlife thresholds and the absence of MeHg data.

Action Items:

1. Send tern habitats contact from Wetlands Monitoring Group- Meredith
2. SFEI should have an additional internal discussion about the potential for uptake – particularly for organics in the water column – and whether or not the absence of detections of organics in water is sufficient to infer low levels in the food web. Include Josh, Letitia, possibly Aroon
3. Project team should determine whether or not SFEI should model uptake pathways. If this is desired, what is an appropriate budget for this task?