CDM

Memorandum

To: *Shirin Tolle, U.S. Army Corps of Engineers*

From: *Carrie Metzger, CDM*

Date: *February 10, 2004*

Subject: *Responses to Comments*

CDM received comments from the U.S. Army Corps of Engineers related to a preliminary cost estimate on a conceptual bittern removal alternative. The sections below summarize the responses to these comments.

The cost estimate is general in scope due to the conceptual nature of the alternative. The research, analyses, and engineering specifications necessary to bring to the concept to a feasibility level have not been initiated or developed; therefore, the estimate must remain relatively general. Responses to the more detailed comments are below, and correspond to the letters in the original comment memorandum.

a. The sources were previously included at the bottom of the memorandum and in the cost estimate table. The memorandum has been revised to include the sources where referenced within the text.

b. A description of the alternative components is included in the revised memorandum. Markups to Figure 2-2 from the Draft EIR/EIS are also included.

c. The memorandum has been revised to consistently use an estimated duration of 9 years.

d. In our engineering judgment, a 40% contingency factor is appropriate given the level of uncertainty for the alternative concept. This contingency factor is consistent with other work on this project. The preliminary cost estimates performed by Brown and Caldwell (in Appendix D of the Draft Feasibility Report) also used a 40% contingency factor for most elements of the project. We also believe that a 40% contingency is consistent with Corps costing guidance. The Corps identifies a 25% contingency for a feasibility study level design. The memorandum only addresses a removal concept, with only the major elements of the concept identified. Therefore the 40% contingency is justifiable.

e. We contacted several landfills for rate quotes, daily acceptance capacity, and verification that the brine solids would be accepted. The landfills stated that it is likely the brine solids could be accepted; however, a soil profile would be necessary before they could definitively accept the brine solids. Depending on the size of the landfill, potential daily acceptance ranged from 100 tons to 1,000 tons. Delta Oil Transporters and the Hay Road Landfill provided an estimate of $45 million for transportation and disposal. This estimate is close to the estimate in the memorandum of $53 million.

f. The revised memorandum includes references with page numbers and chapters.

g. This estimate did not include an analysis of the hydrology/hydraulics of the ponds. That was not part of CDM's scope on this assignment. This assumption is based on the information that in spring 2002, Pond 7 had approximately 3 feet of bittern at 300 ppt. As the bittern concentrates, it is a reasonable assumption to include approximately 1 foot as the remaining liquid. These assumptions are based on the "Bittern Toxicity Testing Results, Ion Composition of Bittern, and Sediment Salinity Data" from GAIA, Inc. dated September 12, 2002 [Table 1 of the report (Anion/Cation and Salinity Concentrations in Water, Ponds 7 and 8, Napa Salt Marsh)]. Information was also used from a teleconference between Larry Wyckoff (Department of Fish and Game) and Susanne von Rosenberg (GAIA, Inc.) on June 18, 2002.

Please contact me if you have any questions.

Copies: Amy Hutzel, California Coastal Conservancy
Susanne von Rosenberg, GAIA, Inc.

TECHNICAL MEMORANDUM
Napa River Salt Marsh Restoration Project

Subject: *Alternative Bittern Removal for Pond 7 Salinity Reduction – Conceptual Cost Estimate*

Date: February 10, 2004

Prepared by: CDM

Purpose: This TM presents an "order-of-magnitude" cost estimate for the removal of bittern waste from Pond 7. The costs are based on a conceptual project with only the major elements of the "concept" being addressed. Assumptions related to the cost development are included in the text below. Cost bases are from readily available sources and are not developed from a specific project design. Further, the cost of the bittern removal alternative is compared to the current preferred concept that achieves salinity reduction by dilution with recycled water and discharge to the existing area waterways and sloughs.

Summary: The component for bittern waste removal, with an approximate cost of $210 million (attached detail), is nearly an order of magnitude greater (eight times more) than the cost of the preferred recycled water/dilution alternative component at $25.9 million (Napa Salt Marsh Restoration – Draft Feasibility Report, April 2003. Appendix D, Brown and Caldwell report dated May 31, 2002, *including "Final Cost Estimate of Napa Salt Marsh Salinity Reduction and Restoration Alternatives", page 14.*). The bittern removal alternative component considered in this evaluation is not cost effective.

Description of Alternative: Pond 7 salinity (created by bitterns/residuals from past evaporative salt pond operations) would be physically removed for disposal offsite at a local landfill. The alternative considers removal of accumulated bitterns in both solid and liquid phases using dredging/dragline-like construction operations for bitterns in the solid phase (as apparent during the dry season following liquid evaporation) in combination with construction and operation of brine concentration facilities for removal of bittern that exists in a liquid phase. Direct disposal of liquid bitterns would be avoided and resultant concentrated salt residues in a "dewatered" state would be trucked from the pond to a landfill for disposal as a non-hazardous waste (CDM did not verify the waste classification of the "solids" generated from the bittern treatment. If determined by California DTSC to be a designated waste because of groundwater threat, the waste would need to be disposed of a at a permitted hazardous waste facility.) Minimal remaining liquids would be properly discharged to existing sloughs within allowable dilution limits.

To facilitate construction of access to the ponds for equipment and for truck hauling of bittern salt residues, reconstruction of 2,500 feet of existing levee would be performed, including widening of the existing levee for truck access. The stretch of levee

reconstruction would occur from the access road parking lot (north of Pond 7A) south to the donut. Costs have not been included for upgrading of local access roads from the nearest highway to the ponds site. CDM does not have information on the roadways or the preferred route. Costs could be substantially greater depending on roadway upgrade requirements.

A work area of approximately 3 acres would be constructed straddling both ponds for equipment staging, access, material handling, and for the brine treatment facility. Construction would be conducted using imported fill, mud mats to support equipment, or equivalent means. Removal operations would be seasonal during the summer and fall months, lasting approximately 9 years as described below. Following completion of the project, imported soil material comprising the work area could be reused as borrow for levee repair and other restoration projects for the entire salt pond restoration area.

CDM has included a contingency of 40% to cover design, permitting and environmental documentation, construction management, and project details not addressed as part of the major project details. The number of years of operating a facility for this project is not known because required chemical engineering and mass balance studies have not be done. It is expected that as the concentration of brines diminishes after each season of solids/liquids removal, continuation of brines treatment would become neither cost effective nor warranted prior to completion of the solids removal.

The cost for the bittern concentration facility is based on costs for an actual Bureau of Reclamation project. (Zero Discharge Waste Brine Management for Desalination Plants – Final Report, U.S. Department of the Interior – Bureau of Reclamation, Desalination Research and Development Program Report No. 89, December 2002, *including Section 8.2 "Results of Cost Analysis", pages 31 – 38.*)

Under the assumption that six 20-ton trucks can be loaded an hour, an 8 hour work day, and a 120 day work season, it will take approximately 9 years to remove all sediment containing bitterns, assuming that there is no loss of salt in sediment due to liquids removal or dilution from subsequent rainy seasons (i.e., all of the current pond bottom sediments will need to be removed). The 9 years does provide an approximate time frame for the construction period.

CDM investigated local landfills for the likelihood that they could receive the solids from the ponds. Several landfills, including Hay Road Landfill in Vacaville and Keller Canyon Landfill in Pittsburgh, indicated they might be able to accept the brine solids based on the preliminary soil chemistry results. However, a soil profile would be necessary before the landfills could state definitively that they could accept the brine solids. Depending on size, landfills could accept 100 tons to 1,000 tons daily. CDM applied standard disposal rates for the estimate. Many disposal facilities apply surcharges in order to accept non-standard wastes. If the wastes are determined to be a California "designated" wastes, disposal costs will be substantially higher.

Assumptions: Pond 7 area – 300 acres;
Pond bittern phase liquid depth – 1 foot;
Pond bittern solids phase accumulation – 1 foot;
Pond salinity – 40% (400 ppt);
Bittern density – 118.4 lbs/ft3 (factored up from the density reported in Zero Discharge Waste Brine Management for Desalination Plants – Final Report, U.S. Department of the Interior – Bureau of Reclamation, Desalination Research and Development Program Report No. 89, December 2002, *including Section 8.2 "Results of Cost Analysis", pages 31 – 38* at 25% salinity);
Brine concentration facility construction cost - $21.6 million (Zero Discharge Waste Brine Management for Desalination Plants – Final Report, U.S. Department of the Interior – Bureau of Reclamation, Desalination Research and Development Program Report No. 89, December 2002, *including Section 8.2 "Results of Cost Analysis", pages 31 – 38.*, scaled up from a 25% salinity brine concentration facility ["cold evaporation" process]);
Brine concentration operations cost - $90 per 1,000 gallons treated (Zero Discharge Waste Brine Management for Desalination Plants – Final Report, U.S. Department of the Interior – Bureau of Reclamation, Desalination Research and Development Program Report No. 89, December 2002, *including Section 8.2 "Results of Cost Analysis", pages 31 – 38.*, scaled up from a 25% salinity brine concentration facility ["cold evaporation" process]);
Cost time basis - April 2003.

Estimated Cost: The estimated cost for the bittern removal alternative component is $210 million and includes fractional amounts for mobilization, indirect costs, and contingency (Napa Salt Marsh Restoration – Draft Feasibility Report, April 2003. Appendix D, Brown and Caldwell report dated May 31, 2002, *including "Final Cost Estimate of Napa Salt Marsh Salinity Reduction and Restoration Alternatives", page 14.*, Appendix D) costs as follows:
Mobilization – 11%
Indirect costs – 15%
Construction overhead, profit, bond – 17%
Contingency – 40%

References:

1. Napa River Salt Marsh Restoration Project – Discharge Permit Application, California State Coastal Conservancy, U.S. Army Corps of Engineers, and California Department of Fish & Game, June 2003, *including the Water Quality and Sediment Characterization Report, Table 3.*

2. Napa Salt Marsh Restoration – Draft Feasibility Report, April 2003. Appendix D, Brown and Caldwell report dated May 31, 2002, *including "Final Cost*

Estimate of Napa Salt Marsh Salinity Reduction and Restoration Alternatives", page 14.

3. Zero Discharge Waste Brine Management for Desalination Plants – Final Report, U.S. Department of the Interior – Bureau of Reclamation, Desalination Research and Development Program Report No. 89, December 2002, *including Section 8.2 "Results of Cost Analysis", pages 31 – 38.*

4. Building Construction Cost Data – Western Edition, RS Means, *12th Annual Edition, 1999, including Unit Price Section: Earthwork, 022 200 212 0200 & 0900, page 50, 022 200 222 0300, page 50, 022 200 238 1850, page 51, 022 200 266 1255, page 56; Railroad and Marine Work, 0222 520 824 1100 & 0100, page 65.*

5. Sandoval, Beverly. 10 February 2004. (Delta Oil Transporter) Telephone communication with Michelle Wilen with CDM, Sacramento, CA.

6. Boykins, Angela. 10 February 2004. (NorCal Waste System, Inc.) Telephone communication with Michelle Wilen with CDM, Sacramento, CA.

Napa Salt Marsh Salinity Reduction Alternative Cost Estimate

Dec-03 JP/JTW

CE Level: Conceptual, feasibility study/planning

References: Napa Salt Marsh Restoration - Draft Feasibility Report, April 2003
US Bureau of Reclamation - Desalination Research and Dev. Program Report No. 89, December 2002

Description of Alternative/Component Considered and Related Assumptions:

Achieve Pond 7 salinity reduction by removal of bittems with offsite disposal at a local landfill. Bittern is considered non-hazardous waste.
Bittems in two phases, liquid and solids. Remove salts from liquid phase with brine concentration facility; remove salts in solid phase with dredge-like removal operations. All salts removed to offsite disposal at local landfill as non-hazardous waste.
Pond liquid depth is 1 foot; assume solids depth is 1 foot.
Pond area: 300 acres
Pond 7 salinity is approximately 40% (400 ppt).
Facilities include new access road to Pond 7 to support construction and truck hauling activities.
Facilities include new brine concentration system in basic form without optimizations- See USBR Report No. 89 for facility construction and operations cost estimates (using cost for "Cold Evaporation" process)and assume facility size at 1 MGD capacity.
Density for 25% salinity reported = 1.185 kg/cubic meter
Scale up reported costing for 40% salinity from 25%; assume increase is directly proportional.
Brine concentration removes 99.9% salt

Property/Cost Factor		25 % Salinity	40 % Salinity (Pond 7)
Density	kg/meter3	1185	1896
Density	lbs/ft3	73.944	118.31
Cost per 1000 gallons processed		$56	$89.60
Construction cost for 1 mgd plant		$13,500,000	$21,600,000
Salt mass (TDS) per foot pond - tons			773040
Salt volume per foot depth pond - yd3			484000
Salt volume per foot depth pd liquid - gal			97748640

Summary Comment:

Estimated cost for salt/bittern removal (see estimate below) is approximately $216 million.
The bittern removal/landfill disposal alternative is about 8 times the cost of alternative salinity reduction involving installation of new recycled water pipelines (estimated cost of $25.9 million as shown in Draft FS, MACES project estimate of April 2003).

Bittern Removal/Landfill Disposal Cost Estimate

Alternative Component Item/ Assumptions	Means Reference	Quantity	UOM	Unit Cost April 2003	$$ Extensions	
Access roadway for truck hauling and equipment mobilizations						
"Levee" x-section: Top=24'; sides at 1v/2h; 15' height; 2,500 ft length		75000	C.Y.			
Import	022 200 212 0200	75000	C.Y.	9.10	$682,500	
Haul distance adder	022 200 212 0900	75000	C.Y.	7.86	$589,500	
Compaction	022 200 222 0300	75000	C.Y.	0.84	$63,000	
Facility Work Area Pad Construction (3 acres)						
Import	022 200 212 0200	9680	C.Y.	9.10	$88,088	
Haul distance adder	022 200 212 0900	9680	C.Y.	7.86	$76,085	
Compaction	022 200 222 0300	9680	C.Y.	0.84	$8,131	
Liquid Fraction Processing						
Brine concentration	USBR No. 89	97748640	Gal	0.09	$8,758,278	
Brine concentration facility	USBR No. 89	1	L.S.	21600000	$21,600,000	
Operations for removal of bittern in a "solids" form						
Assume dredging type operation with barge (or large track) mounted dragline or clamshell, hopper dumped, pumped 1000' to truck loading area	024 520 824 1100	484000	C.Y.	11.28	$5,457,100	
Handling equipment setup mobilization (dredging type operations)	024 520 824 0100	1	L.S.	49800.00	$49,800	
Disposal of solids to offsite landfill - 2 feet depth (salt from liquid and settled solids)						
Disposal mat'ls area management with dozers (2) - pusing and shaping	022 200 238 4000	968000	C.Y.	2.28	$2,204,668	
Truck Loading - Hydraulic excavator, plus 50% for wet excavation	022 200 238 1850	968000	C.Y.	7.34	$7,105,144	
Hauling Offsite and Disposal Fees						
Hauling 20 Yd, 50 mi rt, heavy traffic	022 200 266 1255	968000	C.Y.	34.71	$33,599,365	4.201389
Tipping Fees	CIWMB 2000 Survey Redwood San. Landfill, Novato	968000	C.Y	21.40	$20,715,200	8.402778
Alternative Component Base Cost - Subtotal $$					***$100,996,859***	
Mobilizaiton (fraction of base cost)			L.S.	0.11	$11,109,655	
Indirect Costs (fraction of base cost and mobilization)			L.S.	0.15	$16,815,977	
Construction Ovhd, Profit, Bond (fraction of base cost, mobilization, and indirect costs)			L.S.	0.17	$20,955,889	
Alternative Component Cost w/o contingency - Subtotal $$					$149,878,380	
Contingency			L.S.	0.40	$59,951,352	
Total Alternative Component Cost w/ contingency					***$209,829,732***	