APPENDIX D

Implications of Pond 3 Breaches

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M E M O R A N D U M

DATE: November 1, 2002

TO: Amy Hutzel

FROM: Michelle Orr

CC: Susanne von Rosenberg, Bob Battalio, Don Danmeier

RE: PWA Ref. 1591 – **Napa River Marsh Restoration Project**
Implications of Pond 3 Breaches

INTRODUCTION

On August 12, 2002 personnel from the California Department of Fish and Game (DFG) discovered a small hand-dug breach along the Pond 3 levee to South Slough. A second small breach was constructed under emergency conditions by DFG on September 9, 2002 in order to reduce the potential for unintentional releases of hypersaline water from the siphon that connects Ponds 3 and 4. This memorandum discusses how these recent breaches affect the analysis and recommendations contained in our Phase 2 Stage 2 report.

Overall, the Pond 3 breaches change the description of the "no project" alternative and have the potential to affect the restoration design. Additionally, the unexpected introduction of tidal action to Pond 3 accelerates the need for monitoring and adaptive management, as discussed below.

THE NO PROJECT ALTERNATIVE

The “no project” alternative now includes two small breaches to Pond 3, changing the definition of this alternative and its expected habitat evolution. The two hand-dug breaches include a small ditch in the perimeter levee immediately west of the Pond 3 – Pond 4 siphon to South Slough, and a second small ditch near the mouth of Dutchman Slough. Both breaches were less than 1 m wide, and although downcutting has been observed there has not been any significant widening of either breach.

In our Phase 2 Stage 2 report, we assumed that Pond 3 would remain managed pond habitat over the 50-yr planning horizon. With the new breaches, the existing habitat in Pond 3 is primarily subtidal and expected to change over time. The following sections describe these expected changes qualitatively and quantitatively.

Description of Habitat Evolution

Water depths in Pond 3 increased soon after breaching, creating subtidal habitat over most of Pond 3. Tidal action in the pond is very limited due to the under-sized breaches. Monitoring by USGS showed that the first breach to South Slough raised water levels in the pond by about 0.6 ft, but that the tidal range was limited to approximately 0.1 ft.

Over time the Pond 3 breaches are expected to enlarge due to scour caused by tidal exchange through the breaches. This enlargement is expected to begin gradually, accelerate to rapid rates once flow increases to a critical threshold, then continue more slowly until the breaches reach their respective equilibrium sizes. The period of rapid expansion will have a noticeable effect on habitat evolution, but the timing of this expansion is difficult to predict precisely. We expect that it will occur sometime during the next 7 years, with the breaches substantially scoured to equilibrium sizes within the next 12 years. Our estimates of Pond 3 habitat evolution are based on rates of breach enlargement at other sites with initially small, usually unintentional, breaches. These sites include the Greenpoint/Toy property at the mouth of Petaluma River, Slaughterhouse Point and White Slough along the east side of lower Napa River. It is important to note that breach evolution can be affected by extreme environmental events which may or may not occur during the next few years, resulting in conditions different than those observed at other locations over different time periods. Estimates provided here can be updated based on actual observed conditions at the site.

For the first few years, the years before "Year 0" in our restoration tracking (referred to here as Years -2 to 0), we predict only minor changes in habitat compared to existing conditions. By Year 0, we predict that the breaches will be slightly larger, though still small in size, allowing a tide range of several decimeters. The site will remain mainly sub-tidal, with small areas of intertidal mudflat and emergent vegetation along the perimeter. By Year 5, we predict that the breaches will be moderate in size and that pond interior channels will begin to scour. The majority of the site will be sub-tidal and intertidal mudflat. By Year 10, we predict that the breaches will be fully scoured and the interior channels more developed, with full drainage throughout the site. For Years 20 to 50, Pond 3 evolution is similar to that in Restoration Options 1-3 delayed by approximately 10 years. Scour of existing tidal marsh is expected to occur along lower South Slough and the mouth of Dutchman Slough after the breaches enlarge significantly.

Habitat Evolution Acreage Estimates and Discussion

The new No Action Alternative is expected to result in the following tidal habitats in Pond 3 by year 50: 60 acres of subtidal, 60 ac intertidal mudflat, 70 ac low marsh, and 1060 ac of mid marsh (Table 1 and

Figure 1). Expected scour in South Slough results in the following changes by year 50: 10 ac increase in subtidal habitat and 10 ac decrease in mid marsh habitat. Scour in Dutchman Slough is expected to be negligible within the precision of these estimates.

Pond 3 tidal habitats under the new No Action Alternative are expected to lag those of the four restoration options by approximately 10 years during the first 40 years of the project, then approximately equal those of the restoration options by Year 50 (Figure 2). Because significant low and mid marsh development in ponds other than Pond 3 (i.e., Ponds 4, 5, and 6/6A) occurs only after Year 50, differences between the No Action Alternative and Restoration Options are small during the first fifty years for these habitat types. These differences will increase, however, between years 50 and 100 as habitats develop in the other ponds.

RESTORATION DESIGN

It is still the intent of the NRSMR project to implement the preliminary design as shown in Figures 10 through 13 of our Phase 2 Stage 2 report. For the purpose of restoration planning, we assume that it will be feasible to implement all the features specified in the design. However, it is possible that conditions in Pond 3 may change such that some restoration features in this pond may not be cost-effectively constructed or environmentally permitted. If this is the case, the restoration plan can be modified at a later date to incorporate any necessary changes. These possible changes are expected to be limited to certain design features within Pond 3 and are discussed below.

The new Pond 3 breaches have the potential to affect the construction methods used in Pond 3 and possibly the types of design features ultimately constructed. Depending on the extent of tidal exchange to Pond 3 at the time of construction, it may be necessary to temporarily close the two breaches during construction of the starter channels and berms. Construction of these features using floating dredge or dry land techniques may require management of the pond water levels. Also, construction of the starter channels and berms may mobilize large amounts of sediment that should be allowed to settle and consolidate somewhat before tidal action is re-introduced. Construction of the other design features – additional breaches, ditch blocks and levee lowering – is not expected to be significantly affected.

The new Pond 3 breaches may affect the types of design features ultimately constructed depending on environmental permitting issues. Construction of the temporary breach closures discussed above may depend on obtaining relevant environmental permits. It is also possible that environmental permitting complications could arise if wetland habitat values develop within the pond by the time of construction. It is possible that permit requirements could limit the type and extent of grading to avoid or mitigate impacts to newly developed habitat.

If it becomes necessary to modify the restoration design to accommodate the above considerations, the habitat evolution estimates for Pond 3 will be affected. For example, if berms are not included in Pond 3,

there will be no early marsh habitat created by berm construction and site evolution in Option 4 will be slowed because of the absence of wind wave protection provided by the berms. If the starter channels are not included in Pond 3, development of the interior channels will rely exclusively on tidal scour and will occur more slowly. This in turn is expected to result in initially poor pond drainage and may result in less extensive long term channel development in Pond 3 if the delay in channel development allows vegetation to establish in the small channels furthest from the breaches before they can scour.

MONITORING AND ADAPTIVE MANAGEMENT

In essence (if not by design), the limited breaching at Pond 3 is an early partial implementation of the restoration plan. Consistent with the plan's adaptive management framework, this is the time to begin relevant monitoring to guide later phases of planning and restoration. In addition, information collected during the monitoring could support the discharge permitting process and increase our understanding of how the physical system functions.

PWA and USGS have developed an integrated monitoring plan for the Conservancy to provide data needed for adaptive management and to assist in subsequent project planning. Monitoring objectives are briefly summarized below. Complete descriptions of the proposed monitoring plans can be found in the proposals submitted to the Conservancy.

Salinity Monitoring Objectives

High salinity in the sloughs has the potential to negatively impact water quality and wildlife uses. We recommend data collection for the following uses:

- *Support the discharge permit application*. Field data collected as part of this monitoring effort would add credibility to the discharge permit application, which largely relies upon numerical model simulations to demonstrate likely impacts to receiving waters.

- *Interpret model results*. Monitoring of the pond waters could be used to improve the interpretation of salinity reduction simulations carried out in previous tasks, particularly the breach options. Salinity measurements taken from inside Pond 3 could be used to characterize mixing and to compare observed with simulated results. Key technical issues that could be clarified with monitoring data are the degree of mixing (lateral and vertical), the potential for 'by-passing' of freshwater from one breach to another, and the time required to effectively desalinate the pond.

- *Understand near-field mixing*. Although analysis of near-field mixing will be carried out as part of the Phase 2 Stage 2 scope of work, the methodology to be used will not address the potential effect of the bottom plumes that may develop when discharging dense saline waters

into the relatively brackish sloughs. Salinity data collected from the Pond 3 breaches could be used to characterize the strength, size, and persistence of such a dense bottom plume, if one exists and is detectable.

Geomorphic Monitoring Objectives

The objective of the geomorphic monitoring is to implement the adaptive management plan at the time of the first Pond 3 breaches, as the site begins to evolve. As described in the restoration plan, adaptive management will be used to improve project performance by adapting later phases of the project implementation based on lessons learned from the early phases. Adaptive management may also be used in design optimization to reduce construction costs of the later phases, as appropriate. For example, data collected in this monitoring effort could help to evaluate key design elements with strong cost and performance implications. Geomorphic monitoring should focus on the following key issues:

- *Interior pond channels.* Monitoring the evolution of channels inside Pond 3 may help determine the extent of starter channel excavation desired to achieve the project goals.

- *Slough erosion.* Erosion of the major sloughs downstream of the breaches is of particular interest to this project due to the potential impact to existing fringe marsh, levee failure, and undermining of infrastructure such as the Pond 3 – Pond 4 siphon. Monitoring data would help improve previous estimates of the rate and magnitude of slough expansion, potentially affecting breach locations and other design features.

Infrastructure Protection/Offsite impacts

The new breaches have the potential to affect infrastructure or off-site habitats. We recommend monitoring the Pond 3 / 4 siphon for structural integrity, the Pond 3, 4, and 5 levees for erosion, and the mouth of Dutchman Slough for any erosion of Pritchett Marsh. Infrastructure protection may be more of a property management issue, which we understand is being addressed by DFG as part of ongoing site maintenance and permitting for the emergency breaches.

ATTACHMENTS

Table 1. Habitat evolution table for the No Action Alternative
Figure 1. Habitat areas for the No Action Alternative
Figure 2. Habitat areas for the No Action Alternative and four Restoration Options

Table 1. No Action Alternative (areas in acres)

Year:	Present	0	5	10	20	30	40	50
Pond Interiors								
Subtidal	1,250	1,220	800	60	60	60	60	60
Intertidal mudflat	0	10	380	1,060	880	360	60	60
Low marsh	0	0	50	100	250	770	670	70
Mid marsh	0	20	30	30	60	60	450	1,060
Managed ponds	5,200	5,200	5,200	5,200	5,200	5,200	5,200	5,200
Upland/transition	220	220	210	210	210	210	210	210
SUBTOTAL	6,660	6,660	6,660	6,660	6,660	6,660	6,660	6,660
Sloughs								
Subtidal	430	430	430	440	440	440	440	440
Intertidal mudflat	80	80	80	80	80	80	80	80
Low marsh	30	30	30	30	30	30	30	30
Mid marsh	1,210	1,210	1,200	1,200	1,200	1,200	1,200	1,200
SUBTOTAL	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750
Ponds & Sloughs								
Subtidal	1,680	1,650	1,230	500	500	500	500	500
Intertidal mudflat	80	90	460	1,140	960	440	140	140
Low marsh	30	30	80	130	280	800	700	100
Mid marsh	1,210	1,230	1,230	1,230	1,260	1,260	1,650	2,260
Managed Ponds	5,200	5,200	5,200	5,200	5,200	5,200	5,200	5,200
Upland/transition	220	220	210	210	210	210	210	210
SUB TOTAL	8,410	8,410	8,410	8,410	8,410	8,410	8,410	8,410
OTHER*	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050
PROJECT TOTAL	9,460	9,460	9,460	9,460	9,460	9,460	9,460	9,460

*Other category includes non-evolving marsh (fringing marsh and Pond 2A) and sloughs and upland habitat areas.

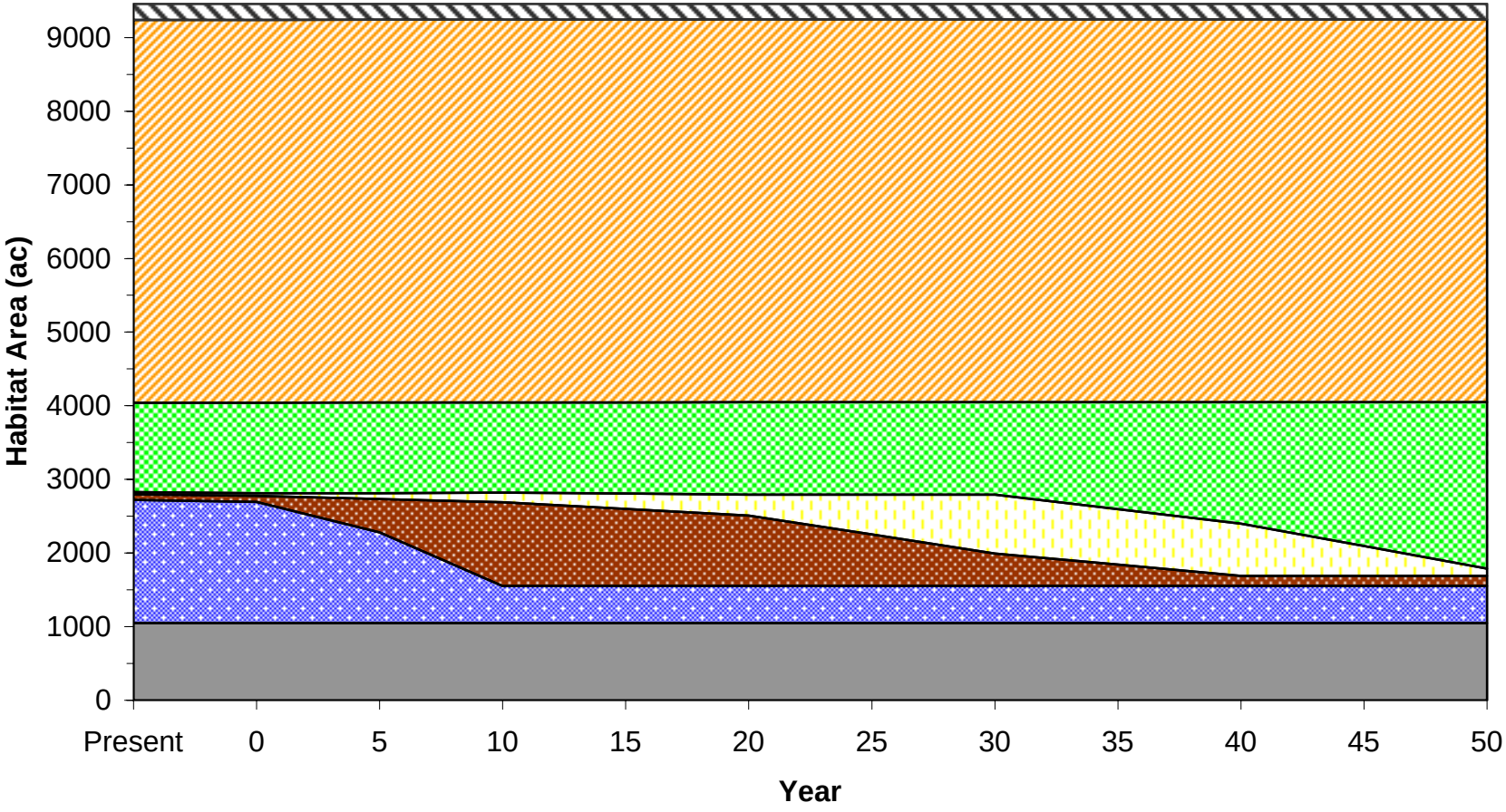
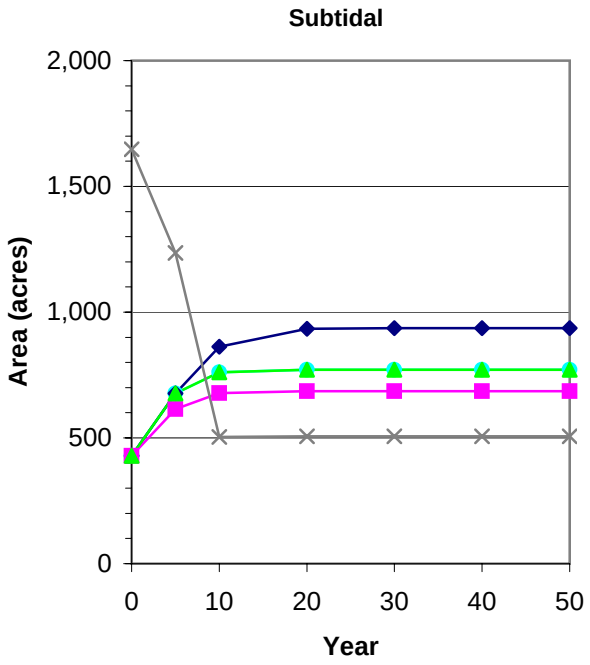


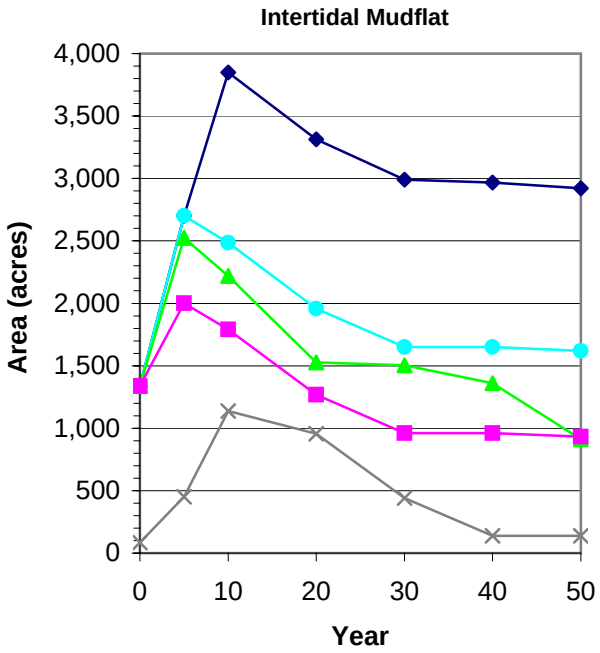
figure 1

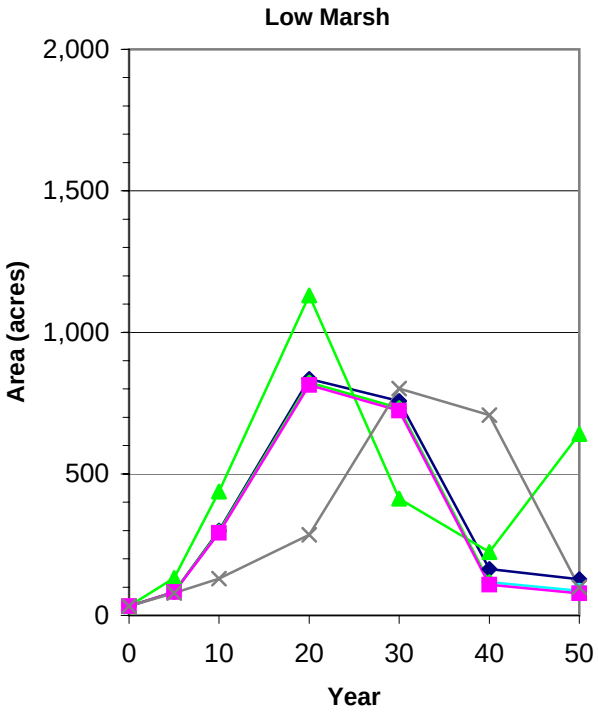
NSMR Phase 2

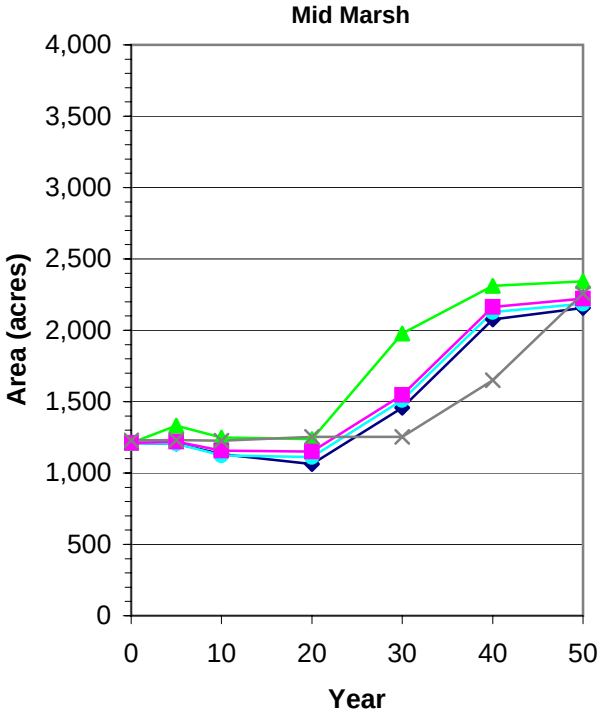
Habitat Areas, No Action Alternative

PWA









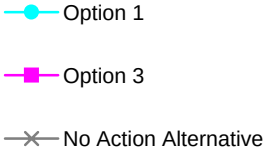


figure 2

Napa River Salt Marsh Restoration Feasibility Study

Habitat Evolution by Option

PWA