Hamilton Wetland Restoration Project

DRAFT CONCEPTUAL MAINTENANCE, MONITORING, AND ADAPTIVE MANAGEMENT PLAN

October 19, 1998

INTRODUCTION

This plan provides a general framework for maintaining and monitoring the success of the Hamilton Wetlands Restoration Project. Included is guidance for monitoring levee performance, site hydraulics, biological success, and water quality. This conceptual plan will be greatly expanded and quantified in the detailed design phase of the study.

This plan covers the period after the completion of construction. At the beginning of this period, dredged material will have been placed and the bayward levee breached. Maintenance and monitoring during construction will be described in the plans and specifications for construction. Monitoring of sediments for contaminants will be completed prior to levee breaching.

The Corps of Engineers will participate in the monitoring program for 13 years after the end of construction. Subsequent monitoring under the detailed plan will be the responsibility of the non-federal sponsor.

Monitoring of biological, hydrological, topographic, bathymetric, and chemical conditions will track the evolution of the site after breaching of the bayward levee. Periodic comparisons of measured conditions with expected conditions will determine whether the development of the site is progressing as planned.

Restoration goals and objectives for the project are qualitative statements in the EIR/EIS regarding expected future conditions. Quantitative standards intended to measure progress towards these goals and objectives will be developed later for the detailed maintenance, monitoring, and adaptive management plan.

LEVEES

Monitoring

SETTLEMENT. Monitoring of settlement of the levees due to foundation consolidation should be performed annually by means of precision level surveys of settlement monuments installed during construction. The greatest rate of settlement is expected to occur during the first ten years after the levees are constructed. The data should be reduced, plotted, and compared with the expected design rate. Settlement monitoring of the levees should continue annually until the analyses of the survey data shows that the rate and amount of settlement are within design expectations. At that time

the frequency of settlement monitoring may be adjusted to longer intervals of time. If the rates and amount of settlement are unacceptable, then corrective measures should be recommended and action taken.

ANNUAL INSPECTIONS. During the first few years after breaching of the bayward levee, a walkover inspection of the levees should be performed twice annually for pre- and post-winter conditions. Subsequently, the frequency of inspection can be reduced to one annual post-winter inspection. The reduced frequency would be based upon determining that the performance of the levee features, and of the site in general, are in accordance with design expectations.

The inspection should look for erosion problems such as rills, gullies, and other evidence of erosion on the newly constructed levees, and for evidence of burrowing mammals. Burrowing mammals, when present in large enough numbers, are detrimental to the overall stability of a levee. Burrowing mammals should be eradicated when infestations endanger the perimeter levee system, and the damage repaired. The breach openings should also be inspected for any obstructions or debris that would limit tidal flows. The walk over inspection should document the implementation of previously recommended corrective actions (or the lack thereof) and the effectiveness of that action.

The annual inspections may be supplemented as necessary following a major storm event or an earthquake of magnitude 5 or greater located within 50 miles of the project, or a smaller magnitude event if specific reports of local damage are received.

CROSS SECTIONS. Surveyed cross-sections of the perimeter levees and any water-side, wave-erosion protection berms should be performed annually until they have stabilized, but no less than five years after the breaching of the bayward levee. Supplemental surveys should be made after a severe storm event or a major El Nino winter.

INSPECTION REPORT. An inspection report should be written for each inspection documenting the observations and finding, recommended maintenance action items, and actions taken. In general, the monitoring and inspection report should include but not be limited to the following:

A. A site map indicating the areas of significant findings and/or observations.

B. Condition of the breaches, once they are created, noting obstructions and debris.

C. Condition of the levees and any recent repairs, noting any unusual, abnormal, or unexpected conditions or occurrences that could bear on the effectiveness of the structure.

D. Results of the settlement monitoring and interpretation of the data.

E. Condition of hard structures, culverts, and pipelines.

F. Condition of access and service roads, especially areas where problems are likely to develop.

G. Availability of emergency supplies necessary for immediate repairs of major storm related damages.

H. An emergency action plan that includes phone numbers and means of contacting operating personnel.

I. Maintenance measures taken (date, temporary measures taken, permanent repairs, ect.) and the cost of maintenance an operations for the report period.

J. A summary of findings, proposed corrective actions, and a maintenance plan to implement those actions.

Maintenance

Maintenance will consist of corrective action in response to problems identified when monitoring levee conditions as described in the section on monitoring above. Actions could include adding material to compensate for excessive settling or erosion, repair of earthquake damage, reinforcing the levee surface to withstand erosion in problem areas (to the minimum extent necessary), repair of drainage structures, or control of burrowing rodents. Any rodent-control efforts will need to be carefully planned and executed to avoid negative impacts on adjacent habitats and wildlife. Such efforts would be confined to levees; rodent populations in other habitat areas including berms would not be controlled except under unusual conditions.

HYDRAULICS

Monitoring

DREDGED MATERIAL FILL ELEVATION AND TIDAL SEDIMENTATION. The surface elevation of the dredged material fill after consolidation will be an important determinant of the success of the project. Proper development of the tidal marsh requires that the fill elevation be low enough to allow additional sedimentation and development of tidal channels on the site after breaching of the bayward levee. If significant portions of the fill are above the intended elevation, formation of small marsh channels will be inhibited and the eventual quality of the marsh habitat will be reduced. In contrast, if the fill elevation is lower than intended, the only negative impact would be a delay in marsh development while additional sedimentation raises the grade level to the intended elevation.

Dredged material deposited on the site will consolidate over time, with the fastest consolidation occurring initially. The degree of consolidation and its duration will depend upon the texture and depth of the dredged material. By the time that the bayward levee is breached, most consolidation will have already occurred. During the next

several years, some additional consolidation may occur and could counteract tidal sediment deposition during that period.

While monitoring the surface elevation of the fill material during and immediately after completion of disposal is important, this is part of the construction process and is not part of post-construction monitoring. Measurement of the fill elevation as part of the post-construction monitoring of the site will commence upon the breaching of the bayward levee, and will continue thereafter primarily to measure ongoing sedimentation on the site. These elevation data will also provide the baseline for measuring the physical development of the marsh plain and channels following the introduction of tidal action.

Monitoring of sediment deposition rates and patterns will provide useful information regarding the accuracy of predictive sedimentation models and will help to quantify the acceleration of marsh restoration achieved by using dredged material. This information will be important in future decisions regarding the use of dredged material in marsh restoration projects. Information regarding sediment deposition patterns will also assist in understanding changes in vegetation patterns as the marsh develops and will provide a basis for evaluating the effectiveness of the interior peninsulas in accelerating sediment deposition. The techniques to be used in monitoring site elevations will be determined during the detailed design stage, but could include transects across the site and/or resistivity staffs as used at the Sonoma Baylands project.

EXTERIOR TIDAL CHANNELS. To provide initial tidal access to the site, channels will be excavated to connect the site to the waters of San Pablo Bay. These channels will be large enough to provide substantial tidal circulation, but will be smaller than the initial equilibrium size. As the tidal hydrology of the site and its connecting channels evolves, the channels are expected to increase in size until they are in equilibrium with the tidal prism of the site. As the tidal prism eventually decreases due to sedimentation on the site, the channels will decrease in size in response.

To ensure that the site is developing properly, the geometry of these channels will be monitored periodically and will be compared to expected conditions.

TIDAL REGIME. The intent of the project is to create a tidal marsh with physical and biological conditions similar to natural marshes in the general area. The creation and maintenance of a normal tidal regime is a very important component of restoration, as tidal action and suspended sediment circulation are essential to the creation and maintenance of tidal marsh topography and vegetation.

The progress of the site's tidal regime towards reference conditions will be monitored using appropriate recording equipment. Measurements of tide elevations will be recorded periodically or continuously at locations within the site and at a nearby reference location. The tidal regime and tidal prism will be determined from these measurements.

PENINSULA CREST ELEVATIONS. The peninsulas are intended as temporary features to reduce wind and wave fetch, direct tidal flows away from levees, and encourage sedimentation. They are expected to gradually erode away and eventually disappear. The elevation of the peninsula crests will be periodically measured to monitor their progress towards specified standards.

INTERNAL CHANNEL DEVELOPMENT. Tidal channels are the most important physical feature of a tidal salt marsh. The extent, pattern, and density of the channel system determines many other attributes of the marsh, including hydrology, vegetation distribution, and habitat values. It is therefore important to document these attributes of channel development in the Hamilton restoration project for use in the design of future wetland restoration projects.

Channel development will be mapped from aerial photographs taken during appropriate tidal conditions. Transects may also be useful in measuring the development of these channels.

Maintenance

Maintenance will consist of removal of any debris that obstructs tidal flows, and maintenance of any monitoring equipment in the area. Corrective action to ensure the proper physical development of tidal habitats is covered under *Adaptive Management*, below.

WATER QUALITY

Monitoring and Maintenance

Water quality parameters to be monitored will include salinity, temperature, and dissolved oxygen. Measurements will be taken at several locations within the site and in the connecting channels. Due to the substantial tidal exchange that should exist immediately after breaching, water quality should be comparable to that in adjacent parts of the bay. If water quality deficiencies are substantial and persistent, remedial actions will be developed and implemented if practicable.

BIOLOGICAL RESOURCES

Monitoring

MARSH DEVELOPMENT. Marsh development will be determined by measuring physical parameters (hydrology and topography/bathymetry) and biological parameters (plant and animal life). Monitoring of physical parameters is discussed under hydraulics, above.

Monitoring of vegetation will include periodic measurements of the extent, location, composition, and density of marsh vegetation. Measurement techniques are

expected to include aerial photography and field surveys. Actual conditions will be compared to predicted conditions. Monitoring data will be analyzed to identify possible reasons for differences between observed and predicted conditions.

After five years of monitoring, the development rate of tidal marsh will be analyzed to determine whether the standard of 6 acres of new tidal marsh within the first 10 years is likely to be achieved. Similar reviews of tidal marsh development will be conducted in years 10 and 15 if it appears that further action is needed to meet tidal marsh restoration standards.

USE BY BIRDS. As intertidal mudflat and marsh habitats develop along with associated invertebrate fauna, use of these habitats by birds should gradually become similar to usage occurring on nearby intertidal habitats. As seasonal wetlands develop, winter use by waterfowl and shorebirds should become similar to such use on nearby seasonal wetlands. Periodic bird surveys will document trends in use of the site by birds in comparison to a nearby reference site and will provide an indication of the success of habitat restoration.

USE BY FISHES. Fish surveys early in the restoration process will document the initial suitability of the site for fishes. Ongoing surveys will document continued use of the site by fishes as marsh and channel formation occur.

USE BY ENDANGERED SPECIES (CALIFORNIA CLAPPER RAIL AND SALT MARSH HARVEST MOUSE). As marsh and channel development progress, habitats for the California clapper rail and the salt marsh harvest mouse are expected to gradually develop. After suitable habitat has developed over a portion of the site, periodic surveys will document the extent of these habitats and the presence of these species. Surveys will be coordinated with the U.S. Fish and Wildlife Service and the California Department of Fish and Game to ensure compliance with endangered species laws and regulations.

BENTHIC MACROINVERTEBRATES. Development of a benthic macroinvertebrate community should occur rapidly after the initial establishment of tidal action on the site. The presence of a thriving benthic macroinvertebrate community (together with abundant fish and bird populations) will indicate that the site is ecologically healthy even if it has not yet developed substantial tidal marsh habitat. However, the composition of this community can be expected to change rapidly and unpredictably due to normal natural fluctuations, which would lessen the value of monitoring trends in these species.

Surveys of benthic macroinvertebrates will be conducted during the first year after breaching to document the colonization of the site by these species. Additional surveys may be conducted later if site deficiencies arise.

VEGETATION IN SEASONAL WETLAND AND UPLAND AREAS. Development of appropriate vegetation in these areas will be monitored through field surveys. Success

criteria will be based upon the establishment of appropriate native species and vegetative cover.

Maintenance

Maintenance in non-tidal areas will be directed towards encouraging appropriate native plant species and minimizing the presence of exotic plant species of particular concern such as pampas grass, broom, and yellow star thistle. Management techniques may include mowing, burning, manual removal of unwanted plants, and herbicides if needed. Mowing and manual removal have been effective so far at suppressing unwanted upland plant species at the Sonoma Baylands project, and herbicides have not been necessary. Control of non-native predators (feral cats and/or red foxes) may also be needed.

Biological maintenance in tidal areas will primarily be passive, with natural processes allowed to gradually restore habitats. However, tidal areas (and uplands) may be invaded by the non-native perennial pepperweed *Lepidium latifolium*. Control of this plant is uncertain and can not be guaranteed. Herbicides would most likely be required in any attempt to control this species, should it invade the site.

ADAPTIVE MANAGEMENT

Adaptive management is a term which has been used to mean various things. As used here, it is an approach to resource management in which management goals remain the same, but management objectives and techniques may be modified in response to feedback (such as monitoring results) from the system being managed. Adaptive management recognizes that human knowledge regarding biological and physical systems is limited and that these systems may not always behave as expected. When a management or restoration project is to be implemented but there is some uncertainty regarding the response of the system to particular actions, adaptive management provides a way for management actions to respond to feedback from the system being managed.

Adaptive management will be implemented if specific restoration standards are not met or if it appears that actual conditions will diverge sufficiently far from intended conditions to threaten the achievement of overall project goals. Funding for adaptive management will be included in the project cost estimates so that this option will be available in the future if needed.

Should the development of the site fail to meet quantitative standards to be stated in the detailed monitoring plan, action to correct these shortfalls will be undertaken if such action could reasonably be expected to assist in the achievement of these standards. Corrective action could include vegetation management, predator management, topographic modifications such as creation of or enlargement of channels, or levee repairs or modifications.