3.9 CULTURAL RESOURCES

This section assesses the effects of the proposed action on cultural resources. The analysis considers the historic and prehistoric cultural resources of the potential treatment areas and vicinity. The Region of Influence considered in this section is the intertidal area of the San Francisco Estuary.

3.9.1 Environmental Setting

The earliest archaeological sites in the Bay region are from about 7,000 to 4,000 years before present (BP), a time when sparse populations of hunter-gatherers began to exploit a wider range of habitats. The presence of large projectile points, milling stones, and a lack of high density shell deposits typical of later time periods suggests that these early inhabitants relied heavily on the hunting and gathering of terrestrial foods (Moratto 1984:277).

By 4,000 years BP, populations established numerous villages throughout the San Francisco Bay Area. Village sites were commonly situated near a stream adjacent to resource-rich bayshore and marsh habitats (Moratto 1984:277) and often had deep, stratified deposits of shellfish and other remains from repeated occupations over time.

Beginning around 1,700 BP there was an increasing complexity in artifact assemblages that seems to reflect an intensified hunting, gathering, and fishing adaptation. The introduction of the bow and arrow, harpoon, and the use of clam disk beads as currency for trade are just a few indications that populations were larger and more densely settled.

The prehistoric inhabitants of the San Francisco Bay area were collectively known as the Costanoans, which is a linguistic designation that covered approximately 50 separate and politically autonomous nations or tribelets (Levy 1978). They hunted large and small game, collected berries and acorns, and fished the local waters. Native American groups are known to have heavily utilized marshlands for a wide variety of natural resources, and prehistoric habitation sites have been recorded in or adjacent to marshland settings.

The Spanish explored northern California as early as 1769, beginning with the expedition of Gaspar de Portola. As part of their expansion into the area, the Spanish established a fort, Castillo de San Joaquin, and presidio in the Golden Gate area between 1776 and 1794. The U.S. Army took over this Spanish settlement in 1846.

San Francisco Bay has a long history of maritime activities that undoubtedly left material remains along the water's edge. The California Gold Rush of 1849 greatly stimulated San Francisco's development as the primary port on the West Coast. Thousands of vessels took advantage of the Bay's calm waters and the rivers that provided easy access to the Sierra foothills where gold fever was rampant. Hundreds of vessels anchored in the Bay. The importance of maritime shipping continued throughout all succeeding historic periods and areas near major watercourses, estuaries, and nearby mudflats. Early population centers could be expected to have historic remains associated with these maritime activities.

The integrity and visibility of historic and prehistoric cultural resources along the perimeter of the Bay have been greatly affected over the last 150 years. Nearly all of the prehistoric tidal marsh in the San Francisco Estuary was diked between 1853 and the 1950s. Dikes were constructed along

the edges of the prehistoric salt marshes, following the edges of tidal sloughs too large to dam, and enclosing all small sloughs (Ver Planck 1958). Thus, almost all prehistoric marsh surfaces in the Estuary are located in the interior side of dikes. Nearly all existing tidal marshes formed in sediments deposited after dikes were constructed. These tidal "fringing" or "strip" marshes outboard of dikes established in the positions of previously unvegetated historic tidal channel beds or mudflats (Atwater *et al.* 1979). These modern marshes have been, or will likely be, invaded by Atlantic smooth cordgrass.

Within the modern San Francisco Estuary, prehistoric tidal marsh surface with the potential for shallow-buried cultural resources are restricted to locations within (a) diked bayland interiors, and (b) rare, locally preserved, undiked, prehistoric tidal marshes (e.g., upper Newark Slough, inner Dumbarton Marsh). Because non-native cordgrasses do not establish in the diked bayland interiors (where there is no tidal flow), these areas are not of concern for Control Program treatment activities. Areas of greatest concern are those areas where non-native cordgrass has invaded, or threatens to invade, preserved, prehistoric, tidal marshes.

Some tidal marshes that re-emerged after brief, failed periods of diking, such as Greco Island, may have near-surface archaeological resources, even though they are not pristine prehistoric tidal marshes. Tidal marshes that re-emerged in the 20th Century after many decades of diking and salt pond management, such as Ideal Marsh and Whale's Tail marsh, probably have prehistoric marsh surfaces buried at depths greater than one foot below contemporary surfaces. Burial of these prehistoric marsh surfaces is due to subsidence during past diked conditions, followed by vertical accretion of sediment with rising sea level since the mid-19th Century. Both Ideal Marsh and Whale's Tail Marsh are heavily invaded by Atlantic smooth cordgrass today. No site-specific sediment core data are currently available to determine the depth of prehistoric marsh surfaces in relation to modern marsh surfaces invaded by nonnative cordgrass.

Arrowhead Marsh in San Leandro Bay (Oakland) is a naturally formed tidal marsh. Although Arrowhead Marsh developed in historic times, it has the appearance of a prehistoric tidal marsh. Roberts Landing (San Leandro) salt marshes occur within a highly altered diked bayland that has been restored to restricted tidal circulation. These may also have some prehistoric marsh surfaces at an unknown depth below the modern surface where Atlantic smooth cordgrass colonies occur. Triangle Marsh on Coyote Creek was not diked historically, but the marsh today is essentially a modern deposit built over the original (prehistoric) one. Strong subsidence due to groundwater withdrawal in the Santa Clara Valley converted the original marsh to mudflat and low marsh, which rebounded to modern high tide elevation range after groundwater pumping and subsidence ceased. The tidal marshes of outer Bair Island have also rebounded after less extreme subsidence due to salt pond management and subsequent drainage. Bair Island currently has limited infestations of Atlantic smooth cordgrass, mostly near the adjacent sloughs.

In the North Bay and Suisun Subregions are also a few ancient tidal marshes that have infestations of non-native cordgrasses. The interior portions of Southhampton Marsh, Benicia, are prehistoric tidal marsh, and these have become invaded by saltmeadow cordgrass. Whittell Marsh, Point Pinole, is a prehistoric tidal marsh, now rapidly eroding. It has remnants of an invasion by Chilean cordgrass, which was previously treated. Heerdt (Greenbrae) Marsh has limited infestations near its edges. Other known prehistoric tidal marshes of San Pablo and Suisun Bays (i.e., China Camp Marsh, Petaluma Marsh, Fagan Marsh, Rush Ranch) have not yet been invaded by non-native cordgrasses.

Historic remains associated with maritime or fishery activities could be located where mudflat harbors and anchorages once existed, although the likelihood of discovering such remains has been reduced by infilling, diking, land reclamation, and other large-scale modifications of the bayshore landscape. Moreover, subsidence and sea-level rises have continued to accrete sediments in the project area, and areas infested with non-native cordgrass are likely to experience high rates of sedimentation (see Section 3.1, *Hydrology and Geomorphology*) that could bury historic resources.

3.9.2 Analysis of Potential Effects

Project activities have the potential to directly affect cultural resources from ground disturbance during treatment and implementation of erosion control measures. Indirect impacts may occur as a result of increased compaction and erosion of landforms that may contain archaeological deposits.

Descriptions of the specific setting, removal techniques, equipment and workforce requirements, timing and effectiveness of individual treatment methods are provided in Chapter 2, *Program Alternatives*. Project impacts are summarized in **Table 3.9-1**. A more detailed discussion of impacts and their potential significance is presented below.

Significance Criteria

Implementation of the proposed action or an alternative would require compliance with Section 106 of the National Historic Preservation Act (NHPA) and CEQA. The significance of project impacts on cultural resources is related to the following factors: the presence, nature, and importance of any cultural resources that may be present in the treatment area; the location, size, and access requirements of the treatment areas; and need for heavy equipment.

CEQA Guidelines Section 15064.5 indicate a project may have a significant environmental effect if it causes "substantial adverse change" in the significance of an "historical resource" or a "unique archaeological resource," as defined or referenced in CEQA Guidelines Section 15064.5[b, c] (1998). Such changes include "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of a historical resource would be materially impaired" (CEQA Guidelines 1998 Section 15064.5 [b]). This EIS/R uses these general criteria for both CEQA and NEPA impact assessment.

ALTERNATIVE 1: Proposed Action/Proposed Project - Regional Eradication Using All Available Control Methods

IMPACT CUL-1: Disturbance or Destruction of Cultural Resources from Access and Treatment

Any treatment method that involves excavation, dredging, or disturbance of marsh sediments has the potential to destroy, damage, or otherwise disturb undetected prehistoric or historic cultural resources. The potential for project impacts depends on the presence of invasive nonnative cordgrass in contemporary tidal marsh locations where prehistoric marsh sediments (or other prehistoric sediments) are present at or within approximately a foot below the current marsh surface. Comparison of early historic (1850s) and modern tidal marsh locations (Nichols and Wright 1971; Goals Project 1999) indicates that this potential is highly restricted in the San Francisco Estuary because diking has isolated nearly all early historic tidal marsh surfaces from modern tidal settings. Potential for disturbance of cultural resources in marshes with current non-native invasive cordgrass colonies is greatest in: Southhampton Marsh, Heerdt (Greenbrae) Marsh, Arrowhead Marsh, Roberts Landing (inside dikes), Whales Tail Marsh, Ideal Marsh, Dumbarton

Marsh, outer Bair Island, and Greco Island. Potential for disturbance of these resources in other possible treatment areas is unlikely, but not impossible.

Sea-level rise since the mid-19th Century has caused marsh sedimentation (peat accumulation, deposition of bay mud) to bury prehistoric marsh surfaces with variable depths of historic substrate. This lessens the potential for disturbance. Burial is greatest where prehistoric marshes were subject to diking or groundwater withdrawal that caused subsidence of the marsh prior to renewed tidal sedimentation and marsh growth after dikes failed. The stratigraphic "signature" of tidal marsh renewal after dike failure is detectible in marsh core samples, which allows estimation of the depth of ancient marsh surface burial. Rare near-"pristine" prehistoric tidal marshes are likely to have the shallowest burial of early historic or prehistoric surfaces, and the greatest potential for impact, but few such tidal marshes (upper Southhampton Marsh, outer Heerdt Marsh) so far have become invaded by nonnative cordgrasses. The most disturbing potential impact, dredging or excavation of cordgrass, is generally not suitable for treatment of ancient tidal marsh sites; it is most applicable to large tidal channels or outboard of dikes. The deepest dredging or excavation would be 18 inches below the current marsh surface.

Individual treatment methods differ in the potential magnitude of their impacts. Treatment methods using manual or mechanical methods could potentially disturb the ground. Chemical treatment itself would not affect cultural resources, but use of ground-disturbing vehicles during application of chemicals could disturb the ground surface and impact subsurface deposits.

Landforms such as mudflats and intertidal marshes could contain deeply buried archaeological deposits, but they have a relatively low potential to contain intact cultural remains at or near the present ground surface where most ground disturbance during access and treatment would occur. However, it is possible that remnants of maritime-related historic structures or, less likely, Native American archaeological sites could still occur in some areas. If present, such resources could be disturbed during access and treatment. For example, ground-based treatment may require accessing and traversing treatment sites with tracked-vehicles, or by boat or hovercraft. Use of tracked vehicles could compact and otherwise disturb the ground surface because soils colonized by non-native cordgrass are soft silts, muds, and clays. Any surface or near-surface archaeological materials in such soft soils could be damaged or disturbed, particularly by tracked vehicles. Such impacts could be significant at Heerdt (Greenbrae) Marsh, Roberts Landing, Whittell Marsh, or Southhampton Marsh.

In addition, accessing some treatment sites may involve vehicle travel along diked bayland interiors. These areas may contain historic or prehistoric sites that could be disturbed or destroyed by traffic if vehicle travel routes exceeded established levee roads or paths.

Any treatment that involves removal of root masses in prehistoric sediments could affect historic or prehistoric cultural resources, and methods that utilize heavy machinery to mow, cut, rip, or shred root masses also have potential to affect these resources. However, as noted above, few intact cultural resources are expected at or near the ground surface in most areas of treatment, because the vast majority of infested modern mudflats, intertidal marshes, and tidal channels are recent (20th Century) in origin. In addition, in places such as restored marshes, cultural resources may already have been removed, recorded, or covered. In such locales, it is unlikely that the project would further affect those resources.

MITIGATION CUL-1:

a. For all sites proposed for ground-disturbing control methods and ground-disturbing accsss (other than manual removal and smothering) a qualified archaeologist shall conduct a Phase I prehistoric and historical resource site record and literature search to assess the site's cultural resource sensitivity and the potential for project-related impacts. The literature search shall include a review of historic maps to determine whether the site is located on construction fill and whether historic buildings or structures are or were located within its boundaries. The record search shall identify all recorded prehistoric and historic sites in the site and identify previous cultural resource studies conducted in or adjacent to the site. The Phase 1 report shall assess potential impacts and, if needed, recommend site-specific measures to avoid or reduce potential impacts to less than significant levels. If evaluation requires excavations at any prehistoric or historic cultural resource sites, then excavations will be monitored by local Native American representatives identified by the Native American Heritage Commission. If the Phase 1 report finds that there are significant cultural resources, then an alternative treatment method that does not disturb the cultural resources (i.e. herbicide treatment) must be used. Otherwise, if the resource is determined significant and impacts cannot be avoided, then the lead Federal agency shall consult with the California Office of Historic Preservation (OHP) to identify appropriate mitigation measures (e.g. data recovery, recordation) to reduce impacts to less than significant levels.

b. For sites involving manual removal or smothering of invasive cordgrass and not requiring ground-disturbing access, if prehistoric or historic cultural resources are discovered during digging, the project sponsor will suspend all work in the immediate vicinity of the find pending site investigation by a qualified archaeologist or historic resources consultant to assess the materials and determine their significance. If the qualified archaeologist/historic resource consultant determines that the find is an important resource, the project sponsor will provide funding and time to allow recovering an archaeological sample or to implement avoidance measures. Work could continue at other locations while archaeological mitigation takes place.

IMPACT CUL-2: Loss of Cultural Resources from Erosion

Project-generated erosion, as described in Section 3.1, *Hydrology and Geomorphology*, could indirectly disturb or destroy cultural resources sites. This condition would be limited to a few sites within the Estuary (see impact CUL-1, above). Use of mechanical smothering, ripping, cutting, and shredding at the base of steep creek banks at such locations could induce erosion that could disturb or destroy archaeological resources. Methods that leave root masses in-place would slow erosional processes and result in a lower potential for impacts when compared to manual and mechanical treatment methods. Implementation of erosion control measures in Section 3.1, *Hydrology and Geomorphology,* would reduce the potential for erosion-related impacts. However, installation of some erosion control treatments using vehicles or heavy equipment has a potential to directly disturb or destroy archaeological deposits if applied to sensitive sites within remnant prehistoric marshes. Circumstances for such impacts would be very rare, but may be potentially significant.

MITIGATION CUL-2: The potential for erosion impacts to archaeological sites may be minimized by implementing the following:

Project implementation and erosion control measures shall be designed to avoid damaging potentially significant cultural resource sites. Priority shall be placed on (1) early screening to detect

the locations of sensitive prehistoric marsh remnants or near-surface buried prehistoric marsh surfaces (see mitigation measure CUL-1); (2) selecting non-native cordgrass control methods that minimize and avoid the potential for damage to such sites. If this is not feasible, then relevant portions of mitigation measure CUL-1 shall be implemented to reduce impacts to less than significant levels.

Implementation of mitigation measures CUL-1 and CUL-2 in combination with mitigation measures in Section 3.1, *Hydrology and Geomorphology* would reduce residual impacts to cultural resources from project-generated ground disturbance and erosion to less than significant levels. Collectively, these measures would ensure that archaeologically sensitive areas are identified and surveyed prior to ground disturbance. They also would ensure that any cultural resource located within the area of potential effect is recorded and avoided if feasible.

ALTERNATIVE 2: Regional Eradication Using Only Non-Chemical Control Methods

Impacts

The exclusion of herbicide treatment from Alternative 2 would require a proportional increase in ground-disturbing eradication methods, such as manual or mechanical excavation, disking or maceration, dredging, temporary diking, etc. This would reduce opportunities to avoid or minimize impacts to prehistoric and historic cultural resources s. In the absence of combined mechanical/herbicide treatment methods, the need for repeated mechanical treatment also would increase. This would increase the risk of disturbance of cultural resources compared with Alternative 1.

Mitigation Measures

Mitigation measures recommended for Alternative 1 would be implemented under Alternative 2. The measures would reduce potential impacts to less than significant levels.

ALTERNATIVE 3: No Action – Continued Limited, Regionally Uncoordinated Treatment

Impacts

Under this alternative, there would be a continued limited uncoordinated program to eradicate non-native cordgrass. Therefore, less cultural impact would occur than under Alternative 1. Local control programs would likely use similar treatment measures described under Alternative 1, with similar potential impacts and feasible mitigation measures.

Mitigation Measures

Mitigation measures recommended for Alternative 1 would be implemented under Alternative 3. The measures would reduce potential impacts to less than significant levels. Residual impacts would be the same as described under Alternative 1 (i.e. less than significant).

Table 3.9-1: Summary of Potential Cultural Resources Effects

Impact	*Manual Removal (Hand pulling and manual excavation)*	*Mechanical Removal (Excavation, dredging, and shredding)*	*Pruning, Hand-mowing, and Smothering*	*Flooding (Diking, drowning, salinity variation)*	*Burning*	*Herbicide Application*	*Beneficial Effects*
CUL-1: Disturbance or Destruction of Cultural Resources from Access and Treatment.	All Alternatives: Potentially significant impact from access and ground disturbance.	All Alternatives: Potentially significant impact from access and ground disturbance.	All Alternatives: Potentially significant impact from access.	All Alternatives: Potentially significant impact from access and ground disturbance.	All Alternatives: Potentially significant impact from access and burning.	Alternatives 1, 3: Potentially significant impact from access. Alternative 2: No impact.	N/A
CUL-2: Loss of Cultural Resources from Erosion.	All Alternatives: Less than significant impact from erosion and erosion control.	All Alternatives: Potentially significant impact from erosion and erosion control..	All Alternatives: Less than significant impact from access and ground disturbance. Root masses would be retained.	All Alternatives: Less than significant impact from erosion and erosion control.	All Alternatives: Less than significant impact from access and ground disturbance.	Alternatives 1 & 3: Less than significant impact from access and ground disturbance. Alternative 2: No impact.	N/A

Table 3.9-2: Summary of Mitigation Measures for Cultural Resources

Mitigation	*Manual Removal (Hand pulling and manual excavation)*	*Mechanical Removal (Excavation , dredging, and shredding)*	*Pruning, Hand-mowing, and Smothering*	*Flooding (Diking, drowning, and salinity variation)*	*Burning*	*Herbicide Application*
Mitigation CUL-1: a. For all sites proposed for ground-disturbing cortnol methods and ground-disturbing accsss (other than manual removal and smothering) a qualified archaeologist shall conduct a Phase I prehistoric and historical resource site record and literature search to assess the siteês cultural resource sensitivity and the potential for project-related impacts. The literature search shall include a review of historic maps to determine whether the site is located on construction fill and whether historic buildings or structures are or were located within its boundaries. The record search shall identify all recorded prehistoric and historic sites in the site and identify previous cultural resource studies conducted in or adjacent to the site. The Phase 1 report shall assess potential impacts and, if needed, recommend site-specific measures to avoid or reduce potential impacts to less than significant levels. If evaluation requires excavations at any prehistoric or historic cultural resource sites, then excavations will be monitored by local Native American representatives identified by the Native American Heritage Commission. If the Phase 1 report finds that there are significant cultural resources, then an alternative treatment method that does not disturb the cultural resources (i.e. herbicide treatment) must be used. Otherwise, if the resource is determined significant and impacts cannot be avoided, then the lead Federal agency shall consult with the California Office of Historic Preservation (OHP) to identify appropriate mitigation measures (e.g. data recovery, recordation) to reduce impacts to less than significant levels. **b. For sites involving manual removal or smothering of invasive cordgrass and not requiring ground-disturbing access, if prehistoric or historic cultural resources are discovered during digging, the project sponsor will suspend all work in the immediate vicinity of the find pending site investigation by a qualified archaeologist or historic resources consultant to assess the materials and determine their significance. If the qualified archaeologist/historic resource consultant determines that the find is an important resource, the project sponsor will provide funding and time to allow recovering an archaeological sample or to implement avoidance measures. Work could continue at other locations while archaeological mitigation takes place.**	**Applicable**	Applicable	Applicable	Applicable	Applicable	Applicable (ground access only)

Table 3.9-2: Summary of Mitigation Measures for Cultural Resources

Mitigation	*Manual Removal (Hand pulling and manual excavation)*	*Mechanical Removal (Excavation , dredging, and shredding)*	*Pruning, Hand-mowing, and Smothering*	*Flooding (Diking, drowning, and salinity variation)*	*Burning*	*Herbicide Application*
Mitigation CUL-2: Loss of Cultural Resources from Erosion. Project implementation and erosion control measures shall be designed to avoid damaging potentially significant cultural resource sites, as specified in Mitigation CUL-1, above.	Not Applicable	Applicable	Not Applicable	Applicable	Applicable	Not Applicable

Note: There may be textual differences between the measures in this summary table and the text in the section. The actual mitigation measure is in the text.

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