

# **Specific Resource Plan**

## **Phase 2**

### **Enhancement and Protection of Terrace Lands at Younger Lagoon Reserve**

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This document was a collaborative effort among UCSC Staff and the Younger Lagoon Reserve  
Scientific Advisory Committee.

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## **INTRODUCTION**

On January 7, 2009 the California Coastal Commission (CCC) certified UCSC's Coastal Long Range Development Plan (CLRDP) for its Coastal Sciences Campus (CSC). The CLRDP is a comprehensive physical development and land use plan that governs development, land use and resource protection at the CSC, including Younger Lagoon Reserve (YLR).

The CLRDP states that all "natural areas" outside of the Campus Development Zone on the CSC are to be incorporated into Younger Lagoon Reserve, restored, and preserved in perpetuity (CLRDP 2009). On July 24, 2008 the University of California Natural Reserve System (UCNRS) and UCSC Campus Administration signed an agreement incorporating the approximately 47 ac (19 ha) of natural areas (CLRDP 2009) into the University of California Natural Reserve System (UCNRS) as part of UCSC's Younger Lagoon Reserve (YLR now encompasses approximately 72 ac [29 ha]). These additional natural areas are collectively referred to as the Terrace Lands. The agreement outlines the commitment by the NRS and campus to comply with restoration, management, and research on all YLR lands.

The Resource Management Plan (RMP) within the CLRDP provides a broad outline with general recommendations and specific guidelines for resource protection, enhancement, and management of all areas outside of the mixed-use research and education zones on the CSC site (areas that will remain undeveloped). A critical component of the CLRDP is the creation of a Specific Resource Plan (SRP) for each phase of restoration guided by a Scientific Advisory Committee (SAC). Thus, the intent of the RMP is for the SAC to use it as an initial framework for development of a more detailed SRP for implementation. The subsequent SRP's may be adapted to address current physical and ecological conditions, current understanding of biological and ecological processes, and current approaches to habitat re-vegetation, restoration, and enhancement. Although the SRP's are meant to be consistent with the performance standards set forth in the RMP, they may be adapted periodically based on findings from ongoing restoration work or input from the SAC. As such, the RMP goals and performance standards are not static requirements per se so much as initial guidelines that may be refined during the SAC process so long as such refinement is consistent with current professional restoration, enhancement, and management goals and standards, and with achieving high quality open space and natural habitat in perpetuity and consistent with the CLRDP.

Although the SRP's provide specific methodology and criteria for restoration and enhancement of the Terrace Lands within YLR it is important to note that other education and research endeavors will occur throughout YLR. These education, research, and outreach projects are concurrent with UCNRS's mission to "*contribute to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California.*" Interpretive signs have been placed throughout the Terrace Lands and student and faculty users conduct a wide range of projects ranging from observational studies of vertebrates to manipulative experiments focused on evaluating various restoration strategies and techniques to studies of wetland hydrology on coastal wetland species. These educational and research endeavors help train students, inform the public, provide insight into the natural world, and guide future restoration and management efforts at YLR and other similar habitats. In fact, undergraduate student investigators contributed greatly to this SRP both through research and restoration efforts. Thus, restoration efforts outlined below in the SRP, combined with future uses consistent with the UCNRS mission, will provide a unique opportunity for researchers, students, and the public to participate in, and observe, restoration and to use the reserve as an outdoor classroom and living laboratory.

The following document provides the SRP for Phase 2 (years 7-14) of the restoration of the Terrace Lands within YLR. There are approximately 36 ac (15 ha) outside of the development zone that will be restored over 20 years; thus, approximately 12 ac (5 ha) will be restored during each of the three phases. Phase 1 (years 1-7) is now complete (See SRP Phase 1 Summary Report). At the conclusion of Year 14 the final SRP will be written for Phase 3 (years 14-21).

Complete SRP guidelines are included as Appendix 1.



## **BASELINE ASSESSMENT (SRP 1)**

This SRP applies to Phase 2 restoration of the Younger Lagoon Reserve Terrace Lands, located on UCSC's Coastal Science Campus. The CSC is located on the coast at the western edge of the City of Santa Cruz. It encompasses the laboratory complex known as Joseph M. Long Marine Laboratory (LML), a flat, gently southward-sloping coastal terrace that ends at a bluff approximately 35 ft (10.5 m) above the waters of the Monterey Bay National Marine Sanctuary, and the University of California's Younger Lagoon Reserve. The site is located within the coastal zone of the City of Santa Cruz.

The CSC is bordered by a variety of land uses. Agricultural land lies to the west of the site along the western boundary of YLR. The northern boundary of the campus is formed by the Union Pacific Railroad tracks beyond which is an industrial area. Shaffer Road runs along the eastern boundary of the site north of Delaware Avenue. East of Shaffer Road is undeveloped land that is currently vacant except for a community garden. Antonelli Pond lies to the east of this area. South of Delaware Avenue the CSC is bounded on the east by the De Anza Mobile Home Park. The Pacific Ocean forms the site's southern boundary.

The 93-acre (37.5 hectare) Coastal Science Campus site brings together the Campus Development Zones (approximately 29 ac [12 ha]), including the original 15.7 acre (6.3 hectare) LML site, the original YLR (approximately 25 ac [10 ha]), and YLR Terrace Lands (approximately 47 ac [19 ha]). The upland terrace, which encompasses both the Campus Development Zone and the YLR Terrace Lands, stretches from the coastal bluff area northward to the Union Pacific Railroad tracks at the site's northern boundary. The majority of the site was used for agriculture and produced Brussels sprouts until 1987. Since 1987 the area has remained fallow. As described more fully below, the coastal bluff and terrace support a mix of native and non-native vegetation, most of which is characterized as coastal prairie and coyote brush scrub. Seasonal freshwater wetlands are also present on the terrace. A narrow intertidal rock shelf exists at the base of the bluff. Younger Lagoon lies along the western edge of the site. The reserve includes the lagoon itself as well as portions of tributary drainages and adjacent upland habitats. YLR contains known and potential habitat for several special-status wildlife species. No special-status plant species are known to occur on the reserve.

Several areas in YLR meet the definition of environmentally sensitive habitat area (ESHA) under the California Coastal Act. An ESHA is defined as any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments. At the time of CLRDP certification portions of the original YLR qualified as ESHA, as did seasonal wetlands on the Terrace and the rocky intertidal zone.

The terrace and bluff are part of the lowest and southernmost of a series of marine terraces along the Santa Cruz coastline. The terrace is essentially flat, with a 1-2% slope to the south. Its elevation ranges from 51 ft (15.5 m) above sea level at the northern edge to 37 ft (11 m) above sea level at the bluff top; its southern boundary. The southwestern edge of the terrace, between the Conservation Annex and Younger Lagoon, is partially edged by an artificial berm approximately 10 to 12 ft (3 to 3.5 m) high and 40 to 50 ft (12 to 15 m) wide.

The site is subject to a Mediterranean climate with wet cool winters and dry warm summers with little rainfall. This pattern helps to account for the mostly seasonal nature of the site's wetlands. Summer fog is present on 30% to 40% of the days. Prevailing winds are from the northwest in the summer and winter storm winds are generally from the south. Total rainfall averages approximately 30 inches (76 cm) per year. The site is exposed and subject to relatively high wind velocities, coastal fog, and salt spray compared to more protected areas to the east.

Soils on the terrace exhibit generally poor drainage, with portions of the site experiencing saturated soil conditions and temporary shallow inundation during the wet season (November through March). Soils fall into three soil series, Elkhorn Sandy Loam, 0-2% slope; Elkhorn Sandy Loam, 2-9% slope; and Watsonville Loam, thick surface, 0-2% slope (Soil Conservation Service 1980). These soils were formed from alluvial fans and marine deposits and tend to be deep with loamy textures and slow runoff. The 0-2% slope soils are categorized by the Natural Resource Conservation Service as hydric soils for Santa Cruz County (Natural Resource Conservation Service 1992). The soils are underlain by Santa Cruz Mudstone, with the water table generally 2 to 10 ft (0.6 to 3 m) below the surface depending on time of year (Philip Williams and Associates 1995).

Surface water primarily enters the property from a culvert at the railroad tracks near the northwest corner of the site, through on-site precipitation and by site runoff (Huffman-Broadway Group, Inc. 2004). The watershed above the Terrace Lands is significantly restricted by HWY 1 which diverts potential (and likely historical) runoff that would have ended up in Younger Lagoon, Wilder (West), or Antonelli Pond (East). Thus, the approximate size of the watershed that flows into the upper Terrace area is only approximately 50 ac (20 ha). Water leaves the site through evaporation and evapotranspiration, as well as drainage to Younger Lagoon, De Anza Mobile Home Park, and the ocean. Natural drainage patterns have been altered by LML and related Campus development as well as ditches and surface re-conveyance from past farming activities. Seasonal subsurface seeps on the coastal bluff and YLR slopes also indicate that near surface perched groundwater exits on the site at the/se locations. Extensive burrowing activity by rodents is evident throughout the Terrace and may have loosened the upper portions of the soil profile and aerated the soils. This may be improving soil drainage characteristics and increasing vertical and horizontal water movement through the site (Huffman-Broadway Group, Inc. 2004).

### ***Development zones***

The built environment is organized into four primary zones of development, one each in the lower (approximately 7 ac [3 ha]), middle (approximately 20 ac [8 ha]), and upper portions of the site (approximately 1.4 ac [0.6 ha]), and one at the Campus entrance (approximately 0.5 ac [0.2 ha]), referred to in the CLRDP as Lower Terrace, Middle Terrace, Upper Terrace, and Campus Entrance development zones (Figure 1). Each development zone is intended to include a mix of marine research and education uses, except for the Campus Entrance zone, which is intended for more general support facilities such as parking and an entrance kiosk (University of California Santa Cruz 2008).



**Figure 1. Coastal Science Campus Land Use Designations.**

## ***Natural areas outside of the CSC Development Zones (YLR Terrace Lands)***

Below, the current conditions of YLR Terrace Lands is described.

### ***Coastal Prairie***

Coastal Prairie is one of two dominant vegetation types, along with coyote brush (*Baccharis pilularis*) scrub on the terrace.

Non-native coastal prairie became firmly established after farming ceased in 1987 and when the Terrace Lands were incorporated into YLR, these areas were composed almost entirely of weedy non-native and mostly annual species. The dominant non-native species include ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), rattail sixweeks grass (*Festuca myuros*), brome fescue (*Festuca bromoides*), slender wild oat (*Avena barbata*), hare barley (*Hordeum murinum* ssp. *leporinum*), and Italian ryegrass (*Festuca perenne*). Herbs include wild radish (*Raphanus sativus*), cut-leaved geranium (*Geranium dissectum*), bristly ox-tongue (*Helminthotheca echioides*), and Bermuda-buttercup (*Oxalis pes-caprae*). The abundance of Bermuda-buttercup, which reproduces by vegetative bulblets, likely results from past cultivation and tilling activities.

During Phase 1 of restoration, approximately 5.6 ac (2.26 ha) were planted with native coastal prairie species. Nearly all of these plantings are meeting or exceeding their restoration goals; however, two plantings have fallen below their restoration targets, illustrating the difficulty of maintaining restored native coastal prairie (See SRP Phase 1 Summary Report). The dominant native species include purple needlegrass (*Stipa pulchra*), meadow barley (*Hordeum brachyantherum*), creeping wild rye (*Elymus triticoides*), blue wildrye (*Elymus glaucus*), yarrow (*Achillea millefolium*), gum plant (*Grindelia stricta*), and California aster (*Symphyotrichum chilense*).

### ***Coyote-brush scrub***

Coyote-brush scrub is the second dominant vegetation community on the terrace. It is characterized by patches of coyote brush of various sizes interspersed with native coastal scrub

species and non-native grassland. It also includes scattered patches of Douglas' baccharis (*Baccharis glutinosa*). Many coyote brush individuals are very tall, reaching 10 ft (3 m) or more. Bermuda-buttercup (*Oxalis pes-caprae*) is generally abundant under the coyote brush.

During Phase 1 of restoration, approximately 4 ac (1.62 ha) were planted with native coastal scrub species. All of these plantings are meeting or exceeding their restoration targets (See SRP Phase 1 Summary Report). The dominant native species include California sagebrush (*Artemisia californica*), lizard tail (*Eriophyllum staechadifolium*), California bee plant (*Scrophularia californica*), and coffee berry (*Frangula californica*).

### ***Ruderal***

Areas identified as 'ruderal' in the CLRDP are included in this SRP as either part of the coastal prairie or coyote-brush scrub categories. Restoration activities in "ruderal" areas will be the same as in the adjacent coastal prairie and coyote-brush scrub areas. The ruderal designation included an area that supports a linear (north-south) underground utility corridor (University of California Santa Cruz 2008). All vegetation was removed during construction and the area is now colonized by a dense cover of the weedy, non-native herb bur-clover (*Medicago polymorpha*). Other species include non-native weeds such as white-stemmed filaree (*Erodium moschatum*), Cretan mallow (*Malva pseudolavatera*), Jubata grass (*Cortaderia jubata*), poison hemlock (*Conium maculatum*), and non-native annual grasses.

### ***Coastal bluffs***

Current coastal bluff vegetation can be classified into two groups: native coastal bluff and ice plant (*Carpobrotus edulis*). The coastal bluff area is exposed to salt spray and ocean winds and is represented as a narrow zone along the top of bluff at the Terrace's southern end just south of LML (Figure 2).

During Phase 1 of restoration, nearly all of the ice plant was removed from the bluff top, and native coastal bluff species planted in its place. All of these plantings are meeting or exceeding their restoration targets (See SRP Phase 1 Summary Report). The dominant native species

include creeping wild rye (*Elymus triticoides*), lizard tail (*Eriophyllum staechadifolium*), coast buckwheat (*Eriogonum latifolium*), seaside daisy (*Erigeron glaucus*), yarrow (*Achillea millefolium*) and sand lettuce (*Dudleya caespitosa*).

Ice plant currently extends along portions of the cliff face. Other non-native species include wild radish (*Raphanus sativus*), ripgut brome (*Bromus diandrus*), Bermuda-buttercup (*Oxalis pes-caprae*), and Italian thistle (*Carduus pycnocephalus*).



**Figure 2.** Coastal bluff area.



## ***Wetlands***

The CLRDP cites 12 wetlands (W) on the Terrace Lands (Figure 4; Huffman-Broadway Group, Inc. 2004). These wetlands support six vegetation types: seasonal ponds, freshwater marsh-coastal terrace, willow herb-Douglas' baccharis, moist meadow, willow riparian forest, and annual coastal prairie (University of California Santa Cruz 2008, EcoSystems West 2002). In addition, some wetland indicator species (e.g. Italian ryegrass and Douglas' baccharis) are patchily distributed outside of the 12 delineated wetlands (Huffman-Broadway Group, Inc. 2004).

W1 is the drainage channel along the northwestern boundary of the property (approximately 0.14 ac [0.05 ha]). W2 is a flatter wetland swale in the northwestern portion of the property (it connects with W1 at its northern and southern ends). W3 is a large ponded area adjacent to the intersection of Delaware Avenue and Shaffer Road. W2 and W3 combined are approximately 4.57 ac (1.85 ha). W4 is a seasonal wetland swale in the eastern portion of the site (approximately 0.42 ac [0.17 ha]). W5 is a seasonal pond in the depressional area immediately south of the NOAA building (approximately 2.21 ac [0.89 ha]). W6 is an isolated wetland complex just north of the California Department of Fish and Game (CDFG) building (approximately 0.09 ac [0.036 ha]). W8 is an isolated wetland immediately south of Delaware Avenue Extension (approximately 0.01 ac [0.004 ha]). W9 is an isolated wetland approximately 200 ft<sup>2</sup> (61 m<sup>2</sup>) south southeast of the road bend where Delaware Avenue Extension turns south to become McAllister Way (87 ft<sup>2</sup>, 8 m<sup>2</sup>). W10 is an isolated wetland south of the DeAnza drainage adjacent to the eastern property boundary (four ft<sup>2</sup>, 0.37 m<sup>2</sup>). W11 is a drainage channel that extends westward from McAllister Way (115 ft<sup>2</sup>, 10.6 m<sup>2</sup>). W12 is a complex of wetlands south and east of the W5 (approximately 0.21 ac [0.085 ha]). Other than wetland W7, all wetlands qualify as ESHAs and together total approximately 7.65 ac. Each of these is described in more detail below.



**Figure 3.** Wetlands.

In addition to delineating wetlands that qualified as ESHA on the Coastal Science Campus, the Huffman-Broadway Group (2004) found one area that qualified as wetland but not as ESHA. This is designated as Wetland W7. Wetland W7 was determined to have no plant or animal life or habitat that was either rare or especially valuable because of its role in the ecosystem. Wetland W7 is approximately 43 ft<sup>2</sup> (4 m<sup>2</sup>) and is located in the northeast corner of the site approximately 150 ft (46 m) south of the northern property line.

### *Wetland Vegetation Types*

EcoSystems West (2002) described five wetland vegetation types on the Terrace Lands based on vegetation characteristics. These include seasonal pond, freshwater marsh-coastal terrace, herb community dominated by willow-herb and Douglas' baccharis, moist meadow, and central coast arroyo willow riparian forest. EcoSystems West (2002) characterized Italian ryegrass (*Lolium multiflorum*) as an upland vegetation type. However, at the time that the U.S. Fish and Wildlife Service (USFWS) issued its 1988 list of species that grow in wetlands, Italian ryegrass was considered synonymous with perennial ryegrass (*L. perenne*), a hydrophyte with a wetland designation of "FAC" (equally likely to occur in uplands or wetlands). Although the 1996 USFWS list does not include Italian ryegrass (the perennial ryegrass is now considered by many to be a separate species), in California it occurs in the same habitat conditions as its congener. On the Terrace Lands Italian ryegrass grows in locations that are continuously inundated for months as well as in areas with upland hydrology. As such, the species is considered a FAC species and a sixth wetland vegetation type (Coastal Prairie dominated by Italian ryegrass) is suggested to be included on the Terrace Lands (Huffman-Broadway Group, Inc. 2004). The following six wetland vegetation types exist on the Terrace Lands:

1. Seasonal ponds—Located within the grasslands south of the NOAA building in the southwestern portion of the terrace (Wetland W5). Patches of alkali bulrush (*Bolboschoenus maritimus*) dominate the central pond, along with smaller dense patches of pale spike-rush (*Eleocharis macrostachya*). Scattered on the pond bed are patches of the coastal salt marsh species such as pickleweed (*Salicornia pacifica*) and non-native

brass buttons (*Cotula coronopifolia*), swamp grass (*Crypsis schoenoides*), and biennial sagewort (*Artemisia biennis*). An annual native herb, water starwort (*Callitriche marginata*), is abundant along the pond margins where the vegetation is not otherwise sharply distinct from that of the adjacent non-native grassland. Douglas' baccharis and Italian ryegrass also grow in the transitional areas.

2. Freshwater marsh—Found in three areas throughout the Terrace. The first area is near the western boundary of the site just north of the sharp curve where Delaware Avenue Extension curves to the south near the southwest corner of Wetland W2. The marsh is in a small topographic depression, dominated by a dense patch of California bulrush (*Schoenoplectus californicus*). Dotted smartweed (*Persicaria punctatum*) and willow-herb (*Epilobium* spp.) occur around the edges along with a small arroyo willow (*Salix lasiolepis*).

The second area of freshwater marsh-coastal terrace is just south of the railroad tracks in the northwestern corner of the property at the northwest end of Wetland W2 at its intersection with W1. Dominated by a large arroyo willow in the center, the marsh also supports a dense colony of broad-leaved cattail, (*Typha latifolia*), floating marsh-pennywort (*Hydrocotyle ranunculoides*), dotted smartweed, willow-herb, and alkali bulrush. Saltgrass (*Distichlis spicata*) occurs in dense patches along the marsh margins.

The third location of freshwater marsh-coastal terrace is in the small wetland complex in the northwestern area of the terrace north of the CDFG building. This marsh drains into the eastern arm of Younger Lagoon. Alkali bulrush and willow-herb grow along the margins of the marsh, which can have open water as late as May. Willow-herb, alkali bulrush, and tall cyperus (*Cyperus eragrostis*) are the dominant species in the drainage way.

3. Herb community—This type is dominated by willow-herb and Douglas' baccharis as well as non-native cut-leaved geranium and bristly ox-tongue. Although these species occur elsewhere on the property, only a small area in the east-portion of W4 supports this vegetation type.

4. Moist meadow habitat—Occurs at the northern end of the W6 wetland complex and to the north of the freshwater marsh-coastal terrace from which it is separated by an area of non-native grassland. The moist meadow intergrades with the non-coastal prairie habitat, but is floristically distinct and its soil retains moisture until relatively late in the season. It is dominated by the non-native velvet grass (*Holcus lanatus*) which is a perennial that indicates at least seasonally moist conditions. The native Pacific silverweed (*Potentilla anserina* ssp. *pacifica*) is an associate. Other species include willow-herb, cut-leaved geranium, wild radish (*Raphanus sativa*), Spiny sow-thistle (*Sonchus asper*), and bristly ox-tongue.
5. Central coast arroyo willow riparian forest—Although abundant in Younger Lagoon, this habitat is found in only one location on the Terrace. Beyond the freshwater marsh-coastal terrace and moist meadow habitats, arroyo willow riparian forest also occurs near W6 and in one small patch at the southeast end of the freshwater marsh-coastal terrace. It is dominated by arroyo willow with no other arborescent species present and little understory.
6. Coastal Prairie dominated by Italian ryegrass—This habitat is a significant part of the vegetation in wetlands W2, W3, W4, W5, W8, W9, W10, and W12.

Dense patches of Douglas' baccharis (*Baccharis glutinosa*) are found throughout the Terrace Lands both within and outside of delineated wetlands.

At the time of the Huffman-Broadway Group wetland delineation for the Coastal Science Campus, the U.S. Fish and Wildlife Service considered Douglas' baccharis in California to be an Obligate Wetland species meaning that under natural conditions it occurs almost always (estimated probability 99%) in wetlands (U.S. Fish and Wildlife Service 1988). The U.S. Fish and Wildlife Service now considers Douglas' baccharis in California to be a Facultative Wetland species meaning that under natural conditions it usually occurs in wetlands (estimated probability 67% – 99%), but is occasionally found in non-wetlands (estimated probability 1% – 33%) (U.S. Fish and Wildlife Service 1988, Lichvar, 2016).

### *Description of wetlands*

Below are more detailed descriptions of specific characteristics of each wetland that occurs on the Terrace Lands.

#### *Wetland W1*

W1 and W2 both receive water from the culvert beneath the berm at the railroad tracks near the northwestern corner of the Terrace Lands. A small bermed area separates the wetland from adjacent agricultural lands to the west. Water flows in a north to south direction along the northwestern property boundary, then veers to the southwest before discharging to the eastern arm of Younger Lagoon. W1 was originally a drainage channel constructed to prevent inundation and allow agricultural cultivation in the northern portion of property. At present, it provides a major source of freshwater to Younger Lagoon. Sediment accumulation along portions of the channel has caused small ponds to form in some areas.

W1 is dominated by arroyo willow (*Salix lasiolepis*), willow-herb (*Epilobium ciliatum* ssp. *watsonii*), and the non-native curly dock (*Rumex crispus*). A non-native weeping willow (*Salix babylonica*) and the weedy invasive Jubata grass (*Cortaderia jubata*) also grow in W1. Poison hemlock (*Conium maculatum*) grows along its upper banks.

Wetland W1 and adjacent upland habitat provide an opportunity for wildlife to travel between Younger Lagoon and Antonelli Pond/Moore Creek (and along the railroad tracks to the west more generally).

During the final year of Phase 1 of restoration, a series of 5 brush packs were placed in the W1 channel in order to hydrologically reconnect W1 and W2. Although only recently installed, these brush packs are currently meeting performance criteria (See SRP Phase 1 Summary Report).

#### *Wetland W2*

W2 shares a water source with W1 and also receives sheet flow from upland areas to the east. Historical aerial photographs show that W2 previously included a man-made drainage ditch

feature but active management of the ditch apparently stopped in the early 1980s. The channel gradually filled in with sediment and W2 no longer contains a clearly defined bed and bank, making it difficult to define its lateral boundaries. As delineated in 2001, it diverges from its origin near the culvert into two narrow bands, one extending south to just north of Delaware Avenue Extension and the other extending west and east along the northern Campus boundary. The Delaware Avenue Extension road grade promotes flooding, ponding, and surface soil saturation during the wet season and through early spring. This results in some recharge of the shallow water table as well as settling of suspended solids and associated pollutants.

Wetland W2 supports both Italian ryegrass and two locations of freshwater marsh-coastal Terrace habitat (one in the southwest corner and the other in the northwest corner). This habitat contains California bulrush, dotted smartweed, willow-herb, and arroyo willow. The non-native dominated coastal prairie in W2 is not sharply distinct in species composition from the adjacent upland. The lowest portion of the area is overwhelmingly dominated by Italian ryegrass (*Festuca perenne*) and curly dock (*Rumex crispus*). Several large patches of the non-native herb green dock (*Rumex conglomeratus*) occur in the northern portion of the site, along with two patches of Douglas' baccharis at the margin of the wetland.

Wildlife habitat in W2 includes seasonal aquatic habitat in areas of ponded water and California Red-legged Frogs have been sighted in a small pond in the northwest corner of W2 in 1997 (Mori 1997, EcoSystems West 2002). Pacific tree frogs also use the seasonal wetland habitat for breeding as do many aquatic invertebrates which serve as prey for amphibians, reptiles, birds, and small mammals.

### *Wetland W3*

W3 is located just north of Delaware Avenue Extension and east of the southern boundary of W2. It is slightly lower in elevation than its surroundings and as a result water ponds after significant rainfall events. W3 receives overland flow from adjacent areas to the north and west; historical aerial photos indicate it was once part of a larger drainage that flowed from west to east and eventually discharged into Antonelli Pond. This drainage pattern was altered by

agricultural activities and installation of the Campus access road that extends from the end of Delaware Ave Extension.

Mapped as non-native grassland, W3 is not sharply distinct in species composition from the surrounding areas except that it contains algal mats, reflecting the seasonally flooded condition. Two large patches of the native creeping wild rye occur at the south-east corner of W3. The vegetation is otherwise overwhelmingly dominated by Italian ryegrass with scattered patches of curly dock.

#### *Wetland W4*

W4 is a seasonal drainage swale that originates in the central part of the Terrace Lands (approximately 300 ft [91.5 m] northeast of the NOAA parking lot). During rainfall events water accumulates in the upper portion of the swale and then flows eastward to a corrugated metal pipe culvert near the eastern Campus boundary. Historical aerial photos indicate this was once part of a continuous drainage that flowed to Natural Bridges Lagoon until an underground culvert was installed to accommodate construction of De Anza Mobile Home Park. The upper portion of the remnant swale has been disturbed by agricultural plowing, leaving no clearly defined channel, but a clearly defined drainage way does exist in the lower portion of the swale. The wetland likely functions to improve water quality through settling of suspended solids and associated pollutants while ponded.

The upper portion of the swale is dominated by hydrophytic species, such as willow-herb, Douglas' baccharis, non-native annual rabbit's foot grass (*Polypogon monspeliensis*) and curly dock. The central portion is not sharply distinct in species composition from the adjacent upland non-native grassland. The lower portion of the drainage is dominated by Italian ryegrass with scattered curly dock and wild radish. Patches of brown-headed rush (*Juncus phaeocephalus*), Common rush (*Juncus patens*), Harford's sedge (*Carex harfordii*), and Douglas' baccharis also occur in the lower portion.

#### *Wetland W5*



This wetland is a seasonal pond that forms in a small topographic depression in the southern portion of the Terrace immediately south of the NOAA building and is the wettest portion of the Terrace Lands. Historical aerial photos show this wetland has been a persistent feature on the terrace since at least the 1950s. The hydroperiod and depth of ponding depends on rainfall and ranges from two to five months and up to approximately 16 inches (40.5 cm) deep. In the early 1900s, a small channel was excavated to drain water from the pond to the ocean bluffs; however, after this ditch ceased to be maintained it rapidly filled in with sediment, limiting drainage to the ocean from the ponded area. The channel exhibited wetland characteristics in 1993 but by 2002 the channel had disappeared except for a linear wetland corridor extending south approximately 200 ft (61 m). A storm drain outlet was constructed from the NOAA site near the pond's northern end to allow water to flow into the pond when the NOAA underground detention/percolation system reaches capacity. A pre-existing outlet near McAllister Way functions as a hydrologic control and limits lateral expansion of surface water within the pond.

W5 is characterized by the seasonal pond vegetation type. Sedges, broad-leaved cattail, curly dock, pale spikerush, and pickleweed occur in the wetter areas with Douglas' baccharis and Italian ryegrass dominating the transitional areas that merge with the surrounding non-native coastal prairie habitat.

The pond supports many aquatic and benthic invertebrate species which provide a food source for amphibians, reptiles, and birds. Pacific tree frogs have been observed at W5 and likely breed at this site. The open water area provides habitat for migratory waterfowl and shorebirds to rest and forage. The pond is used recreationally by bird watchers.

During Phase 1 of restoration, extensive weed removal was conducted in W5, including seasonal mowing and hand pulling of curly dock.

#### *Wetland W6*

W6 is a small isolated wetland complex, occupying a low-lying area in the northwestern portion of the site north of the CDFG building along the western edge of McAllister Way. This area may have been used to retain irrigation water when the area was farmed. A partial berm that prevents the area from draining into the adjacent stream habitat of Younger Lagoon is still

visible. Although the area mapped as W6 includes only moist meadow habitat, other wetland vegetation types (e.g. freshwater marsh-coastal terrace and central coast arroyo willow riparian forest) occur nearby separated by non-native grassland. These areas are treated together in this SRP. The marsh can contain open water through mid-May or later, and the moist meadow retains moisture much later in the season than the non-native coastal prairie habitat.

W6 and the adjacent upland habitat likely facilitate wildlife movement between YLR and Antonelli Pond/Moore Creek (as well as up the coast along the railroad track corridor) and the relatively dense arroyo willow stand offers screening and escape cover.

During Phase 1 of restoration, W6 was planted with native wetland species. All of these plantings are meeting or exceeding their restoration targets (See SRP Phase 1 Summary Report). The dominant native species include common rush (*Juncus patens*), meadow barley, and Pacific silverweed (*Potentilla anserina* ssp. *pacifica*).

#### *Wetland W7*

W7 is a small isolated wetland located in the northeast corner of the Campus approximately 150 ft (45.72 m) south of the northern Campus property line at the railroad right-of-way.

#### *Wetland W8*

This seasonal wetland just south of Delaware Avenue Extension occupies a low-lying area immediately adjacent to the former roadbed. Vegetation primarily consists of non-native grassland, and is subject to (and probably formed by) periodic disturbance by passing vehicles whose tires leave the paved trail. The depression area supports wetland hydrologic conditions during the rainy season (particularly within the tire ruts) but is hydrologically isolated from other wetlands on the site due to the presence of Delaware Avenue Extension.

#### *Wetland W9*

W9 is a small isolated wetland located northeast of the CDFG facility approximately 200 ft (61 m) south southeast of the road bend where the Ocean Shore Railroad Trail (the former Shaffer Road Extension) turns south to join McAllister Way.

#### *Wetland W10*

W10 is a small isolated wetland located south of the DeAnza drainage adjacent to the Campus's eastern boundary.

#### *Wetland W11*

W11 is a small drainage extending west from McAllister Way into YLR.

#### *Wetland W12*

W12 is a complex of wetlands immediately south and east of W5 and is similar in characteristics to the southern reaches of W5 which formed around the small channel that was dug long ago to drain water from W5.

#### ***Wetland buffers***

Wetland Buffers do not constitute a specific habitat type in themselves and include mostly native and non-native coastal prairie, coyote brush scrub, and ruderal vegetation types (Figure 5). The "Buffer" designation and creation was applied with the goal of providing a buffer for wildlife from potential anthropogenic disturbances.

During Phase 1 of restoration, native planting occurred in W4, W5, W6, W10, and W12 buffers. All of these plantings are meeting or exceeding their restoration targets (See SRP Phase 1 Summary Report).



**Figure 4.** Wetland buffer areas.

### *Non-Native weeds*

Non-native weeds on the Terrace Lands are categorized into four categories for removal according to life-history characteristics, current distribution on the Terrace Lands, feasibility of control, and potential for spread (Table 1). The highest removal rating (Priority one) is given to large stature, slow moving exotic plants that are capable of invading and out-competing native plants in established plant communities. These plants are typically perennial or biennial and are generally straightforward to eliminate from an area. The distribution of Priority one weeds on YLR Terrace Lands is shown in Figure 6. Equal (if not greater) importance is given to the prevention of the introduction of new weeds that are known or suspected to be invasive but do not currently exist on the Terrace Lands (Watch List weeds). These classifications reflect current research on exotic invasives and concur with the California Native Plants Society's definition of an exotic invasive plant: "*a plant which is able to proliferate and aggressively alter or displace indigenous biological communities*" (California Native Plant Society 1996).

During Phase 1 of restoration, all Priority 1 weeds – with the exception of ice plant on the cliff faces of the bluffs, a few blackberry patches, and a few Monterey pine trees, were eliminated from the Terrace Lands. Follow-up monitoring and removal of re-emergent Priority 1 weeds was conducted annually (See SRP Phase 1 Summary Report).

**Table 1. Known non-native weeds on YLR Terrace and adjacent lands.**

<i>Common Name</i>	<i>Scientific Name</i>	<i>Priority Rating* for Removal</i>
Blackwood acacia	<i>Acacia melanoxydon</i>	W
Everblooming acacia	<i>Acacia retinodes</i>	W
Thoroughwort	<i>Ageratina adenophora</i>	W
European beachgrass	<i>Ammophila arenaria</i>	W
Giant reed	<i>Arundo donax</i>	W
Mediterranean Linseed	<i>Bellardia trixago</i>	W
Red valerian	<i>Centranthus ruber</i>	W
Portuguese Broom	<i>Cytisus striatus</i>	W
Scotch broom	<i>Cytisus scoparius</i>	W

<i>Common Name</i>	<i>Scientific Name</i>	<i>Priority Rating* for Removal</i>
Purple awned wallaby grass	<i>Rytidosperma penicillatum</i>	W
Pepperweed	<i>Lepidium latifolium</i>	W
Yellow parentucellia	<i>Parentucellia viscosa</i>	W
Fountain grass	<i>Pennisetum setaceum</i>	W
Spanish broom	<i>Spartium junceum</i>	W
Ice plant	<i>Carpobrotus edulis</i>	1
Jubata grass	<i>Cortaderia jubata</i>	1
Monterey cypress	<i>Hesperocyparis macrocarpa</i>	1
Cape ivy	<i>Delairea odorata</i>	1
Panic veldgrass	<i>Ehrharta erecta</i>	1
Fennel	<i>Foeniculum vulgare</i>	1
French broom	<i>Genista monspessulana</i>	1
Harding grass	<i>Phalaris aquatica</i>	1
Monterey pine	<i>Pinus radiata</i>	1
Himalayan blackberry	<i>Rubus armeniacus</i>	1
Slender oat	<i>Avena barbata</i>	2
Wild oat	<i>Avena fatua</i>	2
Common mustard	<i>Brassica rapa</i>	2
Rescue grass	<i>Bromus catharticus</i>	2
Ripgut brome	<i>Bromus diandrus</i>	2
Soft chess	<i>Bromus hordeaceus</i>	2
Italian thistle	<i>Carduus pycnocephalus</i>	2
Bull thistle	<i>Cirsium vulgare</i>	2
Bermuda grass	<i>Cynodon dactylon</i>	2
Poison hemlock	<i>Conium maculatum</i>	2
Black mustard	<i>Brassica nigra</i>	2
Velvet grass	<i>Holcus lanatus</i>	2
Farmer's foxtail	<i>Hordeum murinum</i> ssp. <i>Leporinum</i>	2
Prickly lettuce	<i>Lactuca serriola</i>	2
Poison wild lettuce	<i>Lactuca virosa</i>	2
Italian ryegrass	<i>Festuca perennis</i>	2
Cheeseweed mallow	<i>Malva parviflora</i>	2
Sourgrass	<i>Oxalis pes-caprae</i>	2

<i>Common Name</i>	<i>Scientific Name</i>	<i>Priority Rating* for Removal</i>
Bristly ox-tongue	<i>Helminthotheca echioides</i>	2
Rabbitsfoot grass	<i>Polypogon monspeliensis</i>	2
Wild radish	<i>Raphanus sativus</i>	2
Curly dock	<i>Rumex crispus</i>	2
Spiny sow thistle	<i>Sonchus asper</i>	2
Sow thistle	<i>Sonchus oleraceus</i>	2
Scarlet pimpernel	<i>Lysimachia arvensis</i>	3
Pineapple weed	<i>Matricaria discoidea</i>	3
Lambs quarters	<i>Chenopodium album</i>	3
Nettle-leaved goosefoot	<i>Chenopodium murale</i>	3
Brass buttons	<i>Cotula coronopifolia</i>	3
Filaree	<i>Erodium spp.</i>	3
Cut-leaved geranium	<i>Geranium dissectum</i>	3
Rough cat's ear	<i>Hypochaeris radicata</i>	3
Loosestrife	<i>Lythrum hyssopifolium</i>	3
Bur clover	<i>Medicago polymorpha</i>	3
Cut-leaved plantain	<i>Plantago coronopus</i>	3
English plantain	<i>Plantago lanceolate</i>	3
Annual bluegrass	<i>Poa annua</i>	3
Prostrate knotweed	<i>Polygonum aviculare ssp. Depressum</i>	3
Sheep sorrel	<i>Rumex acetosella</i>	3
Common groundsel	<i>Senecio vulgaris</i>	3
Chickweed	<i>Stellaria media</i>	3
Rattail sixweeks grass	<i>Festuca myuros</i>	3

Notes: \*Priority rating:

W. Watch List. These weeds are currently undetected at YLR Terrace Lands but are known to exist on nearby lands. Reserve staff will actively patrol for these weeds and eliminate them as soon as they are detected as part of YLR's Early Detection Rapid Response (EDRR) program (outlined in SRP 3).

1. High priority. These weeds are capable of invading and out-competing native plants in established plant communities. They are typically large stature, slow spreading perennial or biennials. Effective removal techniques for these weeds are generally well documented, and reserve staff will actively work to eliminate these weeds from YLR Terrace Lands. Once eliminated, on-going monitoring for reemergence of these weeds will take place in conjunction with patrols for Watch List weeds.
2. Medium priority. These weeds are mostly biennial or annual and are ubiquitous on YLR Terrace Lands. They are typically smaller in stature than Priority 1 weeds and more difficult to control. Weed control efforts for Priority 2 weeds will take place in conjunction with active restoration projects (e.g. planting), but P2 weeds are not expected to be eliminated from YLR Terrace Lands.

3. Low priority. These weeds are mostly annuals and are ubiquitous on YLR Terrace Lands. They are typically smaller in stature than Priority 1 weeds and more difficult to control. While many can effectively compete with native plants once they are established, they typically do not aggressively push out native plants. Most are commonly associated with native and non-native grasses and forbs in grasslands. Incidental weed control efforts for Priority 3 weeds may take place in conjunction with active restoration projects (e.g. planting), but P3 weeds are not expected to be eliminated from YLR Terrace Lands.

Source: Modified from John Gilcrest and Associates and Environmental Hydrology 1998.





**Figure 5.** Distribution of priority one weeds.

### *Phase two restoration areas*

The CLRDP states that 2/3 of the Terrace Lands (~24 ac [10 ha]) need to meet the criteria outlined in section SRP 7 (Tables 3-6) after 14 years (end of Phase 2). Conceptual goals for habitat restoration for the entire project area over the 20-year restoration period are discussed in detail below in SRP 2. Spatial localities for the various target vegetation communities may change based on site conditions, hydrology, etc. overtime if adaptations are deemed necessary/appropriate by the SAC. Phase 2 of the enhancement effort (this SRP) will focus on three areas in the middle terrace: grasslands, and wetlands 4 and 5 (Figure 6), as well as maintenance of Phase 1 restoration sites and continued monitoring and removal of re-emergent priority one weeds. These restoration areas total approximately 8.45 ac (3.42 ha). Existing vegetation is dominated primarily by non-native grasses.

Although efforts will primarily focus on the middle terrace during Phase 2, enhancement and protection of other areas will also take place. One potential project outside of the middle terrace that may occur during Phase 2 of restoration is the creation of a breeding pond for the federally protected California Red-Legged Frog (CRLF) in the upper terrace. This project would be a collaborative effort between UCSC, the US Fish and Wildlife Service (USFWS), the Resource Conservation District (RCD), the Natural Resources Conservation Service (NRCS), and would require additional coordination and permitting. The SAC has discussed and approved the creation of a breeding pond for CRLF in the upper terrace (See 2014-2015, 2015-2016 and 2016-2017 Younger Lagoon Reserve Annual Reports).

This section describes the locations and baseline conditions of the enhancement areas for Phase 2.



**Figure 6.** Primary Restoration Areas for Phase 1, 2 and 3.

### *Coastal Prairie*

Native grasses and forbs will be planted in relatively dense patches throughout approximately 5.45 ac (2.20 ha) of wetland buffer regions for W4 and W5, and the area around the generator yard. Although these areas will comprise the most intensive coastal prairie restoration for Phase 2, native grasses will also be planted throughout the Terrace Lands.

### *Wetland Buffers (Figure 5)*

Wetland buffers represent prescribed distances from wetland edges (100 ft [30.5 m] for all wetlands with the exception of W5 which has a 150 ft [45.7 m] buffer). During Phase 2, primary restoration efforts in wetland buffers will focus on approximately 1 acre (0.4 ha) of buffer area in buffers 4 and 5; however, other buffer areas will also be planted. Soil conditions within and among wetland buffer areas differ greatly and thus significantly influence the potential plant species that can inhabit a particular location. As such, wetland buffer areas are currently composed primarily of non-native grasses, coyote brush, Douglas' baccharis, and willow.

### *Central Areas of Wetlands 4 and 5*

#### *Wetland 4 (Figure 4)*

The central area of W4 is approximately 0.5 ac (0.2 ha). Phase 2 restoration activities in W4 will include weed control, enhancement of existing native vegetation with small-scale plantings and collection of seeds and cuttings for propagation. Small scale experiments investigating best practices for wetland restoration may also be conducted in this area.

#### *Wetland 5 (Figure 4)*

The central area of W5 is approximately 2.5 ac (1 ha). Phase 2 restoration activities in W5 will include weed control, enhancement of existing native vegetation with small-scale plantings and collection of seeds and cuttings for propagation. Small scale experiments investigating best practices for wetland restoration may also be conducted in this area.

### *Priority One Weed Patches*

During Phase 1 of restoration, all Priority 1 weeds – with the exception of ice plant on the cliff faces of the bluffs and two Monterey pine trees, were eliminated from the Terrace Lands.

During Phase 2, the remaining Priority 1 weeds will be eliminated from the terrace. Removal of re-emergent Priority 1 weeds will be conducted annually.

### **DESCRIPTION OF PLAN GOALS (SRP 2)**

The goal of the restoration project is to create and protect a mosaic of rare habitats that provide substantial ecosystem services including the preservation of biodiversity, habitat for special status species, and buffering of stormwater runoff. These habitats include coastal bluff, coastal prairie, seasonal wetlands, forested wetlands and grasslands. Additionally, because the site is a UC Natural Reserve, research focused on restoration and native flora and fauna will provide opportunities to guide future restoration in similar habitats and provide educational and outreach material for Reserve users. This section of the SRP defines restoration goals for Phase 2 of the restoration effort and conceptual goals for the entire 20-year restoration plan (Figure 8).

Phase 2 activities will primarily focus on the three distinct restoration projects discussed above: native coastal prairie establishment, and central wetland habitat in wetlands 4 and 5.

Maintenance of Phase 1 restoration sites and control of priority one weeds will also occur.

The overarching goal for Phase 2 is to meet success criteria for 2/3 of the Terrace Lands natural habitats. Success criteria for Phase 2 restoration activities are described in detail below in SRP 2. Specific success criteria were established based on setting goals that are achievable within the context of the site and are realistic objectives that will enhance ecological functions of the area.

Although restoration efforts during Phase 2 will be primarily focused on areas identified in Figure 6, planting and weed control will be conducted throughout the entire site (following specific guidelines outlined below), including testing methodologies to be used in Phase 3.

Below, the restoration goals for each habitat type are outlined in greater detail.

### ***Coastal Prairie restoration goals***

Restoration within coastal prairie areas will focus on increasing native grass species (see Table 2 for restoration palate) and decreasing non-native plant cover. Species richness and percent cover goals are outlined in Table 3. Although the primary effort will be to increase native grass cover and species richness, other native shrubs will be scattered throughout these areas through natural recruitment. There will be no change in topography and/or hydrology.

### ***Central areas of wetlands 4 and 5 restoration goals***

Restoration within the central areas of wetlands 4 and 5 will focus on increasing native plant species richness and percent cover (see Table 2 for restoration palate) and decreasing non-native plant cover. Species richness and percent cover goals are outlined in Table 5. There will be no change in topography and/or hydrology.

### ***Wetland buffer restoration goals***

Restoration efforts in wetland buffers will focus on increasing native plant species richness and percent cover (see Table 2 for restoration palate) and decreasing non-native plant cover. Plants used in the wetland buffers will vary depending upon soil conditions. Buffer areas throughout the Terrace Lands differ drastically depending upon the distance from each particular wetland and moisture content of the soil. As such, species richness and percent cover goals will vary (e.g. some areas will likely be dominated by grasses while others will be dominated by shrubs). Table 6 provides an overview of success criteria for wetland buffer areas. There will be no change in topography and/or hydrology.

### ***Priority one weed removal goals (for all P1 weeds)***

All priority-one weeds (see Table 2) will be controlled as they are detected throughout the Terrace Lands. Elimination of reproductive individuals is the goal, however YLR is surrounded

by priority-one weed seed sources and it is likely that there will always be some level of priority-one weeds persisting on the terrace.

### **SITE AREA PREPARATION AND INVASIVE PLANT REMOVAL (SRP 3)**

#### ***Early Detection Rapid Response (EDRR)***

Preventing the introduction of new invasive species is the first line of defense against new invasions. However, even the best prevention efforts will not stop all invasive species introductions, particularly at a small urban reserve like YLR which is surrounded by potential weed sources. Besides prevention, the most time and cost-effective way to manage the potential negative impacts of new invasive plants is through EDRR efforts.

EDDR focuses on surveying and monitoring at-risk areas to find infestations at their earliest stages of invasion and then rapidly beginning the control of these species. These efforts greatly increase the likelihood that new invasions will be addressed successfully and new weeds will be prevented from becoming established and widespread in a given area. Along with prevention this method is the most successful, cost effective, and least environmentally damaging means of control (National Invasive Species Council 2008).

After initial introduction of a new invasive plant there is a short period of opportunity for eradication or containment. Once permanently established a new invader becomes a long-term management problem. The costs associated with catching weeds before they become established are also drastically less than those of long-term invasive species management for noxious weeds that have already become widespread. Therefore, any low incidence weed known or suspected to be invasive (and feasible to control) will be removed when detected.

Weeds that are currently undetected on YLR Terrace Lands, but known to exist nearby (W – see Table 1) will be actively patrolled for and eliminated as soon as they are detected. High priority (P1 – see Table 1) weeds have been or will be eliminated from YLR Terrace Lands. Once eliminated, on-going monitoring for reemergence of these weeds will take place in conjunction

with patrols for watch-listed weeds. Control efforts for medium priority (P2 – see Table 1) weeds will take place in conjunction with active restoration projects (e.g. planting), but P2 weeds are not expected to be eliminated from YLR Terrace Lands. Incidental control efforts for low priority (P3 – see Table 1) weeds may take place in conjunction with active restoration projects (e.g. planting), but P3 weeds are not expected to be eliminated from YLR Terrace Lands.

Site area preparation and invasive plant removal techniques will vary from site to site as needed, but will draw from a set of standard methods for weed control, outlined below.

### ***Priority one weed control***

Removal techniques for priority one weeds may include one or more of the following: hand pulling / mechanical control, clipping / weed whacking, flaming, solarization, burning, grazing, and herbicide application. Due to their potential harmful impact to human health, wildlife, waterways, as well as negative public perception and neighbor concerns, herbicide use will be avoided whenever possible. When herbicide is applied all UC policies and listed safety instructions will be followed to protect surrounding biological resources. Due to their potential to re-invade, all priority one weeds with viable propagules will either be solarized and composted on site or bagged after removal and disposed of offsite. Some priority one weed control activities will be ongoing throughout the year. Other activities will be restricted to the winter and spring months (exact timing will be dependent on soil moisture conditions and seed-set).

The distribution of priority-one weed species on YLR Terrace Lands and possible weed control methods for each is described below.

*Ice plant* (*Carpobrotus edulis*). *Family: Aizoaceae*

*Extent of Ice plant on YLR Terrace Lands*—Nearly all of the Ice plant on the coastal bluff tops was removed during Phase 1 of Restoration. Ice plant is currently found primarily along the faces of the coastal bluffs. (Figure 5).



*Methods of Control for Ice plant on YLR Terrace Lands* —Ice plant on the coastal bluff tops can be controlled by manual methods, solarization, and herbicide application (Bossard et al. 2000). When hand removal is employed all above-ground plant material will be removed and the soil will be raked in order to expose and remove any remaining roots or stolons. When solarization is employed, black agricultural plastic held in place by sandbags will be used to tarp Ice plant patches for 3-6 months. After solarization or herbicide application, dead ice plant may be left in place to prevent erosion and control weeds; dead ice plant can serve as ‘mulch’ that can be planted into. For patches on the coastal bluff cliff faces, spraying may be preferred in order to minimize erosion.

*Jubata grass (Cortaderia jubata). Family: Poaceae.*

*Extent of Jubata grass on YLR Terrace Lands*—Jubata grass has been eliminated from the Terrace Lands, and is restricted to new recruits on the upper Terrace primarily along the northern and western property lines. The jubata grass on YLR Terrace Lands is part of a population that extends beyond the northern and western property lines, thus, effective control of jubata grass will require cooperation between adjacent land owners and reserve staff.

*Methods of Control for Jubata grass on YLR Terrace Lands* —Jubata grass is effectively controlled by mechanical means (hand pulling / grubbing), and herbicide application (Bossard et al. 2000). Hand removal is most effective for new recruits. When hand removal is employed, all above ground jubata grass material will be removed before seed set, and then the root mass will be removed. When winching is employed the root mass will be removed from the ground.

*Monterey cypress (Hesperocyparis macrocarpa). Family: Cupressaceae.*

Monterey cypress is native to the Monterey coast area, but is considered moderately invasive in other parts of California (including Santa Cruz County) where it spreads via seed from planted windbreaks or hedgerows.

*Extent of Monterey cypress on YLR Terrace Lands*—All of the Monterey cypress trees that currently exist on YLR Terrace Lands are ‘volunteers’ that have grown from seeds that were either brought to the site in landscaping mulch or that blew into the reserve from CSC landscaping plantings. All but one Monterey cypress tree has been eliminated from the reserve and the population is primarily restricted to new recruits (Figure 5).

*Methods of Control for Monterey cypress on YLR Terrace Lands*—Seedlings will be controlled by hand pulling/digging. In addition to removal efforts on Terrace Lands, collaborative efforts among UCSC staff and other CSC groups (e.g. NOAA/NMFS and CDFW) will continue to limit the transport of Monterey cypress to the site.

*Cape ivy (Delairea odorata). Family: Asteraceae.*

*Extent of Cape ivy on YLR Terrace Lands*—Cape ivy is not present on the Terrace Lands; however, it was established in a patch on the northwest border of Younger Lagoon at the beginning of Phase 1 (Figure 5). The patch was located on a shady west facing slope and had overrun the herbaceous understory of the area and was beginning to climb into the Arroyo willow canopy. During Phase 1 of restoration, Cape Ivy was eliminated from the reserve; however, it is notoriously difficult to control. Thus, regular monitoring and removal of any re-emergent Cape Ivy will continue during Phase 2.

*Methods of Control for Cape ivy on YLR Terrace Lands* —Cape ivy is difficult to eliminate for two reasons: stolons and underground parts readily fragment while being removed and plants will grow from almost any remaining fragment. Therefore, frequent post removal monitoring and maintenance is necessary if removal efforts are to be successful. Cape ivy can be controlled through mechanical means or herbicide application (Bossard et al. 2000). When hand removal is employed, all above ground plant material (both native and non-native plants, except native trees) will be removed in the infested area. After the removal of above ground material soil will be raked to expose and remove any remaining roots or stolons.

*Panic veldtgrass (Ehrharta erecta). Family: Poaceae.*

*Extent of Panic veldtgrass on YLR Terrace Lands* – During Phase 1 of restoration, Panic veldtgrass was eliminated from the YLR Terrace Lands. Monitoring and removal of any re-emergent Panic veldtgrass will continue during Phase 2.

*Methods of Control for Panic veldt grass on YLR Terrace Lands* —Once established panic veldtgrass is extremely difficult to control / eliminate. Mechanical means of control (hand pulling / grubbing), and herbicide application have had mixed results (Bossard et al. 2000). Therefore, the highest priority must be given to preventing the further spread of this weed and eliminating it while it is still at a low incidence. When hand removal is employed, the entire plant will be removed from the ground (including the root mass).

*Fennel (Foeniculum vulgare). Family: Apiaceae.*

*Extent Fennel on YLR Terrace Lands* – During Phase 1 of restoration, Fennel was eliminated from the Terrace Lands. One small patch remains in the Original Younger Lagoon Reserve. Removal of this patch, and monitoring and removal of any re-emergent Fennel will continue during Phase 2.

*Methods of Control for Fennel on YLR Terrace Lands* —Fennel is effectively controlled by mechanical means (hand pulling / grubbing), and herbicide application (Bossard et al. 2000). When hand removal is employed all above ground fennel material will be removed before seed set (root mass will also be removed).

*French broom (Genista monspessulana). Family: Fabaceae.*

*Extent of French broom on YLR Terrace Lands*—French broom was not detected on YLR During Phase 1 of restoration. However, it has previously been sighted in the middle terrace Development Zone near the greenhouses. In addition, an extremely large French broom population is located north of the reserve in the City of Santa Cruz Moore Creek Preserve making future re-infestations likely. Monitoring and removal of any re-emergent French broom will continue during Phase 2.

*Methods of Control for French broom on YLR Terrace Lands* —French broom is effectively controlled by hand pulling (weed wrenching), prescribed burning, flaming of seedlings, grazing by goats, herbicide application, or a combination (Bossard et al. 2000). Weed wrenches will be used to remove entire plants before seed set. Seedlings will be removed by flaming or manual methods.

*Harding grass (Phalaris aquatica). Family: Poaceae*

*Extent of Harding grass on YLR Terrace Lands* – During Phase 1 of restoration, Harding grass was eliminated from the Terrace Lands. Monitoring and removal of any re-emergent Harding grass will continue during Phase 2.

*Methods of Control for Harding grass on YLR Terrace Lands* —Harding grass is effectively controlled by mechanical means (hand pulling / grubbing), and herbicide application (glyphosate) (Bossard et al. 2000). When hand removal is employed all above-ground material will be removed before seed set (the root will also be removed).

*Monterey pine (Pinus radiata). Family: Pinaceae.*

Monterey pine is the most widely planted commercial timber tree in the world (Bossard et al, 2000). However, in its native range, consisting of five populations in California and Baja California, Mexico, the species is threatened by development, human-dispersed plant pathogens, non-native herbivores, etc (Bossard et al, 2000). Our classification of Monterey pine as a Priority one weed on the YLR Terrace Lands is specifically based on the fact that the Monterey pines on the YLR Terrace Lands became established on the site due to human introduction. Once established, Monterey pines can displace and shade out native vegetation and alter fire regimes. Monterey pines produce thousands of light winged seeds that are easily wind dispersed.

*Extent of Monterey pine on the YLR Terrace Lands* – Monterey pine on the YLR Terrace Lands is currently limited to one individual (Figure 5).

*Methods of Control for Monterey pine on YLR Terrace Lands*—Mature Monterey pine trees will be controlled by cutting the trunk at ground level. Seedlings will be controlled by hand pulling/digging. In addition to removal efforts on Terrace Lands, collaborative efforts among UCSC staff and other CSC groups (e.g. NOAA/NMFS and CDFG) will be initiated to limit the transport of Monterey pines to the site.

*Himalayan blackberry (Rubus armeniacus). Family: Roseaceae.*

*Extent of Himalayan blackberry on YLR Terrace Lands* – Himalayan blackberry is found at low incidence throughout YLR Terrace Lands. Two large patches remain at the northern end and eastern edge of the site (Figure 5).

*Methods of Control for Himalayan blackberry on YLR Terrace Lands* — Himalayan blackberry is effectively controlled by mechanical means (hand digging /weed wrenching). All above ground Himalayan blackberry material will be removed before seed set (roots will also be removed).

### ***Medium and low priority coastal prairie weed control***

Although mowing, grazing, herbicide application, scraping, and burning are effective methods for reducing annual seed set and thatch in non-native grasslands, managing to reduce exotic grasses without seeding or planting natives is relatively ineffective in restoring natives because it simply shifts the species composition to low stature exotic forbs (DiTomasso 2000, Hayes and Holl 2003a, Hayes and Holl 2003b, Stromberg et al. 2007). Therefore, medium and low priority weeds will not be controlled until active restoration projects (e.g. planting) are taking place in a site. Once active restoration has begun, a combination of weed control techniques will be implemented. Additionally, an experimental approach to non-native grass control may be used to evaluate emerging techniques with the goal of incorporating promising methodologies into management activities.

Some non-native coastal prairie control activities will be ongoing throughout the year. Other activities will be restricted to the winter and spring months (their exact timing dependent on soil moisture conditions and seed-set).

**PLANTING PLAN (SRP 4)**

The planting plan is composed of the following key components for successful restoration, plant palette and selection, planting design (plant mix and spacing), local plant material source, plant installation, erosion control, irrigation, and remediation. The planting palette is made up exclusively of native taxa that are appropriate to the habitat and region. Seed and/or vegetative propagules will be obtained from local natural habitats so as to protect the genetic makeup of natural populations. Horticultural varieties will not be used.

The use of locally collected seeds and cuttings in restoration projects reduces the risks of introducing non-local genes into the population; potentially decreasing species fitness. In order to maintain the genetic integrity of the rich assemblage of plants found along the central coast of California, all seeds and cuttings will be collected from coastal Santa Cruz and San Mateo Counties.

The restoration planting palate (Table 2) is comprised of possible revegetation species for each habitat type. If other species appropriate for restoration are identified they will be added to the restoration palate.

**Table 2. Possible revegetation species.**

<i>Common Name</i>	<i>Scientific Name</i>	<i>Coastal Prairie/ Erosion Control</i>	<i>Coastal Bluff</i>	<i>Wetland/ Riparian</i>	<i>Wildlife Corridor</i>	<i>Upland Buffer</i>	<i>Coastal Scrub</i>
<b>Trees</b>							
California box elder	<i>Acer negundo</i>			x	x		
California buckeye	<i>Aesculus californica</i>				x	x	
Coast live oak	<i>Quercus agrifolia</i>				x	x	
Wax myrtle	<i>Morella californica</i>			x	X		
Arroyo willow	<i>Salix lasiolepis</i>			x	X		

<i>Common Name</i>	<i>Scientific Name</i>	<i>Coastal Prairie/ Erosion Control</i>	<i>Coastal Bluff</i>	<i>Wetland/ Riparian</i>	<i>Wildlife Corridor</i>	<i>Upland Buffer</i>	<i>Coastal Scrub</i>
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**Shrubs and Subshrubs**

California sagebrush	<i>Artemisia californica</i>		x		X	x	X
Mugwort	<i>Artemisia douglasiana</i>		x	x			
Douglas' baccharis	<i>Baccharis glutinosa</i>			x			
Coyote brush	<i>Baccharis pilularis</i>		x		X	x	X
Blue blossom ceanothus	<i>Ceanothus thyrsiflorus</i>				X		
California goldenbush	<i>Ericameria ericoides</i>		x				X
Seaside daisy	<i>Erigeron glaucus</i>		x			x	
Coast buckwheat	<i>Eriogonum latifolium</i>		x			x	X
Lizardtail	<i>Eriophyllum staechadifolium</i>		x			x	X
Oceanspray	<i>Holodiscus discolor</i>				x	x	X
Deerweed	<i>Acmispon glaber</i>	X					X
Yellow bush lupine	<i>Lupinus arboreus</i>		x		x	x	
Bush monkeyflower	<i>Diplacus aurantiacus</i>		x		x	x	X
Wax myrtle	<i>Morella californica</i>				x		X
Coffeeberry	<i>Frangula californica</i>				x		X
California wild rose	<i>Rosa californica</i>	X		x		x	X
California blackberry	<i>Rubus ursinus</i>			x		x	X
Red elderberry	<i>Sambucus racemosa</i> var. <i>racemosa</i>			x	x	x	X

**Forbs**

Yarrow	<i>Achillea millefolium</i>		x	x		x	X
Sea pink	<i>Armeria maritima</i>		x				
California aster	<i>Symphotrichum chilense</i>	X	x	x			
Fat hen	<i>Atriplex prostrata</i>			x			
Beach saltbush	<i>Atriplex leucophylla</i>			x			

<i>Common Name</i>	<i>Scientific Name</i>	<i>Coastal Prairie/ Erosion Control</i>	<i>Coastal Bluff</i>	<i>Wetland/ Riparian</i>	<i>Wildlife Corridor</i>	<i>Upland Buffer</i>	<i>Coastal Scrub</i>
Sun cup	<i>Taraxia ovata</i>	X					
Wight's indian paintbrush	<i>Castilleja affinis ssp. affinis</i>		x				X
Soap plant	<i>Chlorogalum pomeridianum</i>	X					X
Brownie thistle	<i>Cirsium quercetorum</i>	X	x				
American wild carrot	<i>Daucus pusillus</i>	X	x				
Sand lettuce	<i>Dudleya caespitosa</i>		x				
Sea lettuce	<i>Dudleya farinosa</i>		x				
Western goldenrod	<i>Euthamia occidentalis</i>		x				
Beach strawberry	<i>Fragaria chiloensis</i>		x				
Gum plant	<i>Grindelia stricta</i>		x	x			X
Cow parsnip	<i>Heracleum maximum</i>		x			x	
Douglas' iris	<i>Iris douglasiana</i>	X	x				
Harlequin lotus	<i>Hosackia gracilis</i>	X					
Sky lupine	<i>Lupinus nanus</i>	X	x		x	x	
Varied lupine	<i>Lupinus variicolor</i>	X	x		x	x	
Wild cucumber	<i>Marah fabacea</i>					x	
Pacific oenanthe	<i>Oenanthe sarmentosa</i>			x			
California polypody	<i>Polypodium californicum</i>					x	X
Pacific silverweed	<i>Potentilla anserina ssp. pacifica</i>			x			
Self heal	<i>Prunella vulgaris</i>	X	x				
California buttercup, coastal form	<i>Ranunculus californicus</i>	X		x		x	
Pacific sanicle	<i>Sanicula crassicaulis</i>				x		X
California bee plant	<i>Scrophularia californica</i>			x			X
Blue-eyed grass	<i>Sisyrinchium bellum</i>	X		x			
Coast hedge nettle	<i>Stachys bullata</i>			x			

**Rushes/Sedges**



<i>Common Name</i>	<i>Scientific Name</i>	<i>Coastal Prairie/ Erosion Control</i>	<i>Coastal Bluff</i>	<i>Wetland/ Riparian</i>	<i>Wildlife Corridor</i>	<i>Upland Buffer</i>	<i>Coastal Scrub</i>
Baltic rush	<i>Juncus balticus</i>			x			
Western rush	<i>Juncus occidentalis</i>			x			
Common rush	<i>Juncus patens</i>			x			
Brown-headed rush	<i>Juncus phaeocephalus</i>			x			
Three-square	<i>Schoenoplectus pungens</i>			x			
California bulrush	<i>Schoenoplectus californicus</i>			x			
Low bulrush	<i>Isolepis cernua</i>			x			

**Grasses**

Bent grass	<i>Agrostis pallens</i>	X	x	x	x	x	
California brome	<i>Bromus carinatus</i>	X		x	x	x	x
California oatgrass	<i>Danthonia californica</i>	X		x			x
Tufted hairgrass	<i>Deschampsia cespitosa</i>	X		x			
Saltgrass	<i>Distichlis spicata</i>		x				
Western ryegrass	<i>Elymus glaucus</i>				x		
Meadow barley	<i>Hordeum brachyantherum</i>			x			
Creeping wildrye	<i>Elymus triticoides</i>			x	x	x	
Foothill needlegrass	<i>Stipa lepida</i>	X			x	x	
Purple needlegrass	<i>Stipa pulchra</i>	X	x		x	x	x

Plants will be installed approximately 12 to 36 inches (30 to 90 cm) on center, depending on species. Smaller stature plants will be grouped and spaced closer together, while larger stature plants will be spaced further apart. In general, plants will be placed in non-linear arrangements to mimic plant distribution patterns observed in nature.

Seeds will be collected from local sources and grown by UCSC staff and students at the UCSC Arboretum, UCSC Teaching Greenhouses, and YLR. Some species may be grown by local restoration contractors.

With the exception of trees, all plants will be grown in Ray Leach ‘Conetainers’ or similar sized pots. Trees will be grown in ‘tree pots’. These containers will maximize utilization of greenhouse space and minimize per plant costs while producing relatively large plants with well developed root systems. Installation will begin after the first winter rains.

#### *Erosion control*

Because the Terrace Lands are essentially flat erosion is not likely to be a concern. If following planting or weeding efforts erosion control is required, appropriate materials (e.g. wood-chip mulch, jute netting, wattles, etc.) will be installed.

#### *Irrigation*

Ideally, plant installation will commence after the first winter rain and end well before the rains stop, ensuring that plants are naturally watered in and established before the summer drought. However, if supplemental irrigation is needed, plants will be watered using one or all of the following methods: hand application, vehicle application, drip hose, and/or overhead sprinkling. Water will be obtained from CSC infrastructure.

#### *Remediation (maintenance / replacement plantings)*

It is anticipated that plant mortality will likely be in the 10-40% range due to herbivory, desiccation, and/or trampling (by volunteers during planting and monitoring). Thus, plants will be installed at relatively high densities. If mortality is lower than anticipated, plants will be removed as necessary to ensure successful growth and reproduction and future planting densities will be adjusted. If a particular planting effort fails, plants will either be replanted that season or the following year if failure occurs after the rainy / planting season. Additionally, an alternative planting palette may be considered.

### **REPORTING ON IMPLEMENTATION ACTIVITIES (SRP 5)**

A plan for documenting and reporting the physical and biological “as built” condition of the site will be prepared at the completion of the initial plan implementation activities. This report will describe the field implementation of the approved resource plan in narrative and photographs and report any problems in the implementation and their resolution.

The YLR manager will be on-site during restoration activities to take notes, photos, and to direct crews. After the end of the busy spring/summer restoration project season, she/he will compile notes and photos into a simple report describing the physical and biological “as built” condition of the site areas. This report will be submitted annually as part of the YLR annual report.

### **INTERIM MONITORING AND MAINTENANCE (SRP 6)**

Monitoring of restored areas on the Terrace Lands will provide data on coverage and richness of native species and thus gauge the “success” of restoration efforts. Specific monitoring methodologies, timing, and discussion of performance standards are included below in sections SRP 7 and SRP 8. Timing and methods for planting and weeding (maintenance) are detailed in sections SRP 4 and SRP 5 above. Data from annual monitoring efforts will be used to assess whether restoration efforts are proceeding in the desired trajectory (e.g. increased coverage and richness of natives and decreased coverage of non-natives). Interim success criteria and remediation measures are specified in Tables 3-6 for each habitat type. A report on the progress towards both interim and final success criteria (as per SRP 7 below) will be compiled.

Data compiled from monitoring and maintenance activities will be included in an annual report that will be provided to the UC Santa Cruz Planning Director and the SAC by December 31<sup>st</sup> of each year following year one of the project period in which monitoring has been conducted. Each report will be cumulative (building upon previous efforts), will summarize monitoring results, and include a “Performance Evaluation” section where data will be summarized and used to evaluate restoration efforts. In order to remedy potential deficiencies in meeting success criteria each report will also include a “Recommendations” section that will discuss solutions and/or adaptive strategies to tackle unforeseen circumstances or new findings that require a change in restoration practices, maintenance, monitoring, or success criteria.

### **SUCCESS CRITERIA FOR HABITAT TYPES (SRP 7)**

The SAC has defined final success criteria for species richness and coverage as well as remediation actions if criteria are not met. Success criteria will be evaluated by the SAC and may be changed if need be. Final success criteria will be evaluated only after a period of at least 3 years wherein the study site has been subject to no remediation or maintenance activities other than weeding. This section provides information on success criteria for each habitat type and a general overview of methods used to achieve these goals. Specific details regarding planting, site preparation, and weeding are included in sections SRP 2 (restoration and weeding goals), SRP 3 (site preparation), and SRP 4 (planting plan) above.

#### ***Ruderal, coyote brush scrub, and coastal prairie areas***

Enhancement and protection goals for ruderal, coyote brush scrub, and coastal prairie are to maintain open space areas, protect and enhance the ruderal, coyote brush scrub and coastal prairie areas through eliminating priority one weeds, controlling to the extent possible lower priority weeds, promoting the abundance and diversity of native plant species (through weed abatement and phased revegetation), and preventing unauthorized trail development. Interim and long-term goals for restoration of ruderal, coyote brush scrub, and coastal prairie are included in Table 3.

**Table 3. Summary of restoration activities, success criteria, and implementation actions for ruderal, coyote brush scrub, and coastal prairie areas.**

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 1</b> Priority 1 weeds	Eliminate on Terrace Lands	Year 3 and annually thereafter	No priority 1 weeds surviving to reproduction each year	Continue weed monitoring and control
			Priority 1 weeds reproducing on site	Increase frequency of monitoring and weed control; consider alternative control methods
<b>RMP PS 2</b> Priority 2 Weeds	Reduce weedy seed set after planting efforts are initiated.	Timed to correspond with planting efforts.	Planted plants are established	Continue weeding program
			Annual weeds out-competing native plants.	Change weeding schedule or evaluate alternative methods.
<b>RMP PS 3</b> Native plant species richness in Phase 1 ruderal, coyote brush scrub, and coastal prairie areas	8 native plant species appropriate for habitat established in restoration areas.  40% cover of shrubs in ruderal and coyote brush scrub where coyote brush scrub is the primary target.  25% cover of non-shrubs (grasses, herbs, etc.) in coastal	2 years after planting	6 or more native plant species established.  <i>and</i> ≥10% cover (shrubs), ≥5% cover (non-shrubs), and evidence of natural recruitment present.	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
	prairie areas where coastal prairie restoration is the primary target.		<p>Fewer than 6 native plant species present.</p> <p><i>or</i></p> <p>&lt; 10% cover (shrubs), &lt; 5% (non-shrubs) or no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods</p> <p>Monitor annually until success criteria are met</p>
		4 years after planting	<p>6 or more native plant species established.</p> <p><i>and</i></p> <p>≥ 25% cover (shrubs)          ≥15% cover (non-shrubs)          and evidence of natural recruitment present</p>	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			Fewer than 6 native plant species <i>or</i> < 25% cover (shrubs) and <15% cover (non-shrubs) <i>or</i> no evidence of natural recruitment present	Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods Monitor annually until success criteria are met
		6 years post planting and every 5 years thereafter	8 or more native plant species present comprising $\geq$ 40% cover (shrubs) and $\geq$ 25% cover (non-shrubs) <i>and</i> evidence of natural recruitment present	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			Fewer than 8 native plant species or < 40% cover (shrubs) and <25% cover (non-shrubs) of native species  <i>or</i>  no evidence of natural recruitment present	Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods.  Monitor annually until success criteria are met  Consult SAC.
<b>RMP PS 4</b>  Native plant richness in Phase 2 and Phase 3 ruderal, coyote brush scrub, and coastal prairie areas	Same criteria as for Phase 1 as adjusted by SAC.	Same criteria as for Phase 1.	Same criteria as for Phase 1.	Same criteria as for Phase 1 as adjusted by SAC: Monitor sites falling below performance standards annually until success criteria are met
<b>RMP PS 5</b>  Protection of revegetation in progress	No disturbance to revegetation plantings	Ongoing until revegetation is successful	Plantings undisturbed	Continue monitoring until revegetation is successful



<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			Plantings disturbed (plants broken, trampled, dislodged, removed)	Install signs or low fencing as appropriate and consistent with the CLRDP.

### ***Coastal bluff***

Enhancement and protection of coastal bluff habitat will be achieved by eliminating priority one weeds, promoting the abundance and diversity of native plant species through plantings, preventing unauthorized trail development, and increasing the extent of coastal bluff vegetation. Interim and long-term goals for restoration of coastal bluff habitats are provided in Table 4.

**Table 4. Summary of restoration activities, success criteria, and implementation actions for coastal bluff habitat.**

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 6</b> Priority 1 weeds except iceplant	Eliminate on coastal bluff	Year 3 and annually thereafter	No priority 1 weeds surviving to reproduction	Continue weed monitoring and control
			Priority 1 weeds reproducing on site	Use different species weed abatement methods or frequency
<b>RMP PS 7</b> Iceplant	Eliminate on coastal bluff	Prior to first rainy season following	No iceplant on coastal bluff	Continue monitoring and control

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
removal		initiation of construction for first development project in Lower Terrace development zone	Iceplant growing on coastal bluff	Use different species, weed abatement methods or frequency
<b>RMP PS 8</b> Native plant revegetation	8 native plant species appropriate for coastal bluff habitat.  40% cover of native species.	2 years after planting	4 or more native plant species established comprising $\geq$ 20% cover within bluff areas  <i>and</i>  evidence of natural recruitment present	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			<p>Fewer than 4 native plant species or &lt; 20% cover of native species in bluff areas</p> <p><i>or</i></p> <p>no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods</p> <p>Monitor annually until success criteria are met</p>
		4 years after planting	<p>8 or more native plant species established comprising <math>\geq</math> 30% cover within bluff areas</p> <p><i>and</i></p> <p>evidence of natural recruitment present</p>	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			<p>Fewer than 8 native plant species or &lt; 30% cover of native species in bluff areas</p> <p><i>or</i></p> <p>no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods</p> <p>Monitor annually until success criteria are met</p>
		6 years after planting and every 5 years thereafter	<p>8 or more native plant species established comprising <math>\geq</math> 40% cover within bluff areas</p> <p><i>and</i></p> <p>evidence of natural recruitment present</p>	Continue monitoring
			<p>Fewer than 8 native plant species or &lt; 40% cover of native species in bluff areas</p> <p><i>or</i></p>	Perform supplemental planting using different species, propagule type, soil

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			no evidence of natural recruitment present	preparation methods, irrigation, and/or weed abatement methods.  Monitor annually until success criteria are met.  Consult SAC.
<b>RMP PS 9</b> Protection of coastal bluff vegetation	No disturbance to coastal bluff vegetation	Ongoing	Vegetation undisturbed	Continue monitoring
			Vegetation disturbed (plants broken, trampled, dislodged, removed)	Install additional signs or low fencing as appropriate

***Wetlands***

Enhancement and protection goals for wetlands include increasing surface water flow, controlling weeds, promoting the abundance and diversity of native plant species, creating buffers, and controlling access by humans and non-native animals. Table 5 highlights the performance standards and enhancement activities for wetlands across the entire project area and for the 20-year duration. The primary focal areas for wetland restoration during Phase 2 of the project will include PS 12, 13, 14, 15, 16, and 17 (as per Table 5) as well as planting in the core areas of wetlands 4 and 5.

**Table 5.** Summary of restoration activities, success criteria, and implementation actions for wetland areas.

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 10.</b> Wetland 2 - flow diversion from Wetland 1	Wetland functioning as expected per design	1, 2, and 3 years after diversion completed	Structure remains intact  Water diversion functioning as expected	Continue monitoring
			Structure fails  Water diversion not functioning as expected	Fix with better structure  Develop and implement plans to correct functioning; continue monitoring
<b>RMP PS 11.</b> Combined Wetland W1/W2 – creation of willow riparian corridor and restoration plantings west and east of the	3 native plant species appropriate for habitat established in planted areas to comprise 30% cover (e.g. Coyote brush, willow, etc.).	2 years after planting	3 or more native plant species established comprising $\geq$ 10% cover within planted areas  <i>and</i>  evidence of natural recruitment present	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
combined W1/W2 hydrologic corridor			<p>Fewer than 3 native plant species</p> <p><i>or</i></p> <p>&lt; 10% cover of native species established within planted areas or no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods</p> <p>Monitor annually until success criteria are met.</p>
		4 years after planting	<p>3 or more native plant species established comprising <math>\geq</math> 20% cover within planted areas</p> <p><i>and</i></p> <p>evidence of natural recruitment present</p>	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			<p>Fewer than 3 native plant species</p> <p><i>or</i></p> <p>&lt; 20% cover of native species established within planted areas or no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods</p> <p>Monitor annually until success criteria are met.</p>
		6 years after planting** and every 5 years thereafter	<p>3 or more native plant species established comprising <math>\geq</math> 30% cover within planted areas</p> <p><i>and</i></p> <p>evidence of natural recruitment present</p>	Continue monitoring



<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			<p>Fewer than 3 native plant species</p> <p><i>or</i></p> <p>&lt; 30% cover of native species established within planted areas</p> <p><i>or</i></p> <p>no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods.</p> <p>Monitor annually until success criteria are met</p> <p>Consult SAC.</p>
<b>RMP PS 12.</b> Priority 1 weeds	Eliminate in wetlands	Year 3 and annually thereafter	No priority 1 weeds surviving to reproduction	Continue weed monitoring and removal as necessary
			Priority 1 weeds reproducing on site	Increase frequency of monitoring and weed removal efforts; consider alternative control methods

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 13</b> Priority 2 Weeds	Reduce weedy seed set after planting efforts are initiated.	Timed to correspond with planting efforts.	Planted plants are not established	Continue weeding program
			Annual weeds out-competing native plants.	Change weeding schedule or evaluate alternative methods.
<b>RMP PS 14.</b> Native plant revegetation	4 native plant species appropriate for habitat established in planted areas to comprise 30% cover within selected areas	2 years after planting	4 or more native plant species established comprising $\geq$ 10% cover within planted areas <i>and</i> evidence of natural recruitment present	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			Fewer than 4 native plant species <i>or</i> <20% cover of native species established in planted areas <i>or</i> no evidence of natural recruitment present	Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods  Monitor annually until success criteria are met
		4 years after planting	4 or more native plant species established comprising $\geq$ 20% cover within planted areas <i>and</i> evidence of natural recruitment present	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			Fewer than 4 native plant species <i>or</i> <20% cover of native species established in planted areas <i>or</i> no evidence of natural recruitment present	Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods  Monitor annually until success criteria are met
		6 years after planting** and every 5 years thereafter	4 or more native plant species established comprising $\geq$ 30% cover within planted areas <i>and</i> evidence of natural recruitment present	Continue monitoring

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
			<p>Fewer than 4 native plant species</p> <p><i>or</i></p> <p>&lt; 25% cover of native species established in planted areas</p> <p><i>or</i></p> <p>no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, soil preparation methods, irrigation, and/or weed abatement methods.</p> <p>Monitor annually until success criteria are met</p> <p>Consult SAC.</p>
<b>RMP PS 15.</b> Protection of revegetation in progress	No disturbance to revegetation plantings	Ongoing until revegetation is successful	Plantings undisturbed	Continue monitoring until revegetation is successful
			Plantings disturbed (plants broken, trampled, dislodged, removed)	Determine cause; develop appropriate solution

<i>Feature</i>	<i>Goal</i>	<i>Time Period</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 16.</b> Protection of wetlands	No unauthorized human disturbance to wetlands	Ongoing	Wetlands undisturbed	Continue monitoring
			Vegetation disturbed (plants broken, dislodged, trampled, removed); soils disturbed or compacted; other signs of trespass present	Install additional signs or low fencing as appropriate and per CLRDP specifications
<b>RMP PS 17.</b> Minimize anthropogenic changes to existing surface drainage patterns in open space areas (except for W1/W2 hydrologic integration)	Minimal changes to surface topography from management activities; no changes to surface topography due to unauthorized activities	Ongoing	Wetlands undisturbed	Continue monitoring
			Substantial changes to surface topography and/or drainage patterns evident	Determine cause; correct as necessary

***Wetland buffers***

Enhancement and protection goals for wetland buffer areas (Figure 5 and 7) are to protect wetlands from adverse impacts due to weeds, noise, human and non-native animal intrusion, lighting, predation, and sedimentation. During Phase 2, restoration of wetland buffer habitat will be conducted primarily in the Wetlands 4 and 5 buffers, but will also occur throughout other wetland buffer areas at a less intensive effort. Wetland buffers are delineated as 100 ft (30.5 m) beyond classified wetland habitat (with the exception of Wetland 5 which has a 150 ft [45.7 m] buffer area). Because conditions within wetland buffer areas vary, within and among wetlands,

plant species used in revegetation efforts will be largely dependent upon soil conditions. In order to achieve the goal of “insulating” wetland habitat from noise and intrusion (both physical and visual) by people, planting efforts will include shrubs near the outer edge of the wetland buffer areas and adhere to interim and long-term goals for restoration of ruderal, coyote brush scrub, and coastal prairie (see Tables 3 and 6).

**Table 6. Summary of restoration activities, success criteria, and implementation actions for wetland buffer areas.**

<i>Feature</i>	<i>Goal</i>	<i>Time Period*</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 18.</b> Reduce disturbance from automobile traffic	Construct new campus access road that diverts traffic between the Delaware Avenue/Shaffer Road intersection and the CDFG facility and abandon former access road (see management measures above)	See Table A.12 of CLRDP.	Roadway realigned and former roadway improved/restored	Maintain new roadway and trail/restoration areas of former roadway thereafter. Breaking up and removing pavement and then planting with native shrubs will enhance corridor along wetland 1.
<b>RMP PS 19.</b> Priority 1 weeds	Eliminate in buffer areas	Year 3 and annually thereafter	No priority 1 weeds surviving to reproduction	Continue weed monitoring and removal as necessary
			Priority 1 weeds reproducing on site	Increase frequency of monitoring and weed removal efforts; consider alternative control methods



<i>Feature</i>	<i>Goal</i>	<i>Time Period*</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 20</b> Priority 2 Weeds	Reduce weedy seed set after planting efforts are initiated.	Timed to correspond with planting efforts.	Planted plants are not established	Continue weeding program
			Annual weeds out-competing native plants.	Change weeding schedule or evaluate alternative methods.
<b>RMP PS 21.</b> Creation of vegetated berm at periphery of the buffer for wetland W5 (seasonal pond); see also management measures above	Establish vegetated berm (note: weed removal and planting requirements for the berm shall be the same as for the remainder of the weed removal and planting performance standards specified in this table)	See Table A.12 of CLRDP.	Vegetated berm established <i>and</i> weed control/planting successful per this table	Monitor and maintain in its design state thereafter
			Vegetated berm not established <i>and/or</i> weed control/planting not successful per this table)	Establish berm, and pursue remedial planting actions per this table.

<i>Feature</i>	<i>Goal</i>	<i>Time Period*</i>	<i>Result</i>	<i>Action</i>
<b>RMP PS 22.</b> Native plant revegetation	8 native plant species appropriate for habitat established in restoration areas.  40% cover within buffer areas that will be planted with shrubs.  25% cover within buffer areas that will be planted with grasses and herbaceous plants.	2 years after planting	6 or more native plant species established.  <i>and</i> ≥ 10% cover (shrubs), ≥ 5% cover (non-shrubs)  <i>and</i> evidence of natural recruitment present.	Continue monitoring
			Fewer than 6 native plant species present.  <i>or</i> < 10% cover (shrubs), < 5% cover (non-shrubs)  <i>or</i> no evidence of natural recruitment present	Perform supplemental planting using different species, propagule type, and/or soil preparation methods  Monitor annually until success criteria are met

<i>Feature</i>	<i>Goal</i>	<i>Time Period*</i>	<i>Result</i>	<i>Action</i>
		4 years after planting	<p>6 or more native plant species established.</p> <p><i>and</i></p> <p>≥ 25% cover (shrubs), ≥ 15% cover (non-shrubs)</p> <p><i>and</i></p> <p>evidence of natural recruitment present.</p>	Continue monitoring
			<p>Fewer than 6 native plant species present.</p> <p><i>or</i></p> <p>&lt; 25% cover (shrubs), &lt; 15% cover (non-shrubs)</p> <p><i>or</i></p> <p>no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, and/or soil preparation methods</p> <p>Monitor annually until success criteria are met.</p>

<i>Feature</i>	<i>Goal</i>	<i>Time Period*</i>	<i>Result</i>	<i>Action</i>
		6 years after planting and every 5 years thereafter	<p>8 or more native plant species established.</p> <p><i>and</i></p> <p>≥ 40% cover (shrubs), ≥ 25% cover (non-shrubs)</p> <p><i>and</i></p> <p>evidence of natural recruitment present.</p>	Continue monitoring
			<p>Fewer than 6 native plant species present.</p> <p><i>or</i></p> <p>&lt; 40% cover (shrubs), &lt; 25% cover (non-shrubs)</p> <p><i>or</i></p> <p>no evidence of natural recruitment present</p>	<p>Perform supplemental planting using different species, propagule type, and/or soil preparation methods</p> <p>Monitor annually until success criteria are met.</p> <p>Consult SAC.</p>
<b>RMP PS 23.</b> Protection of revegetation in progress	No human disturbance to revegetation plantings	Ongoing until revegetation is successful	Plantings undisturbed	Continue monitoring until revegetation is successful

<i>Feature</i>	<i>Goal</i>	<i>Time Period*</i>	<i>Result</i>	<i>Action</i>
			Plantings disturbed (plants broken, trampled, dislodged, removed)	Install signs or low fencing as appropriate
<b>RMP PS 24.</b> Protection of buffer areas	No unauthorized human disturbance to buffer areas	Ongoing	Buffer areas undisturbed	Continue monitoring
			Buffer areas disturbed (plants broken, dislodged, trampled, removed); soils disturbed or compacted; other signs of damage present	Install additional signs or low fencing as appropriate and per the CLRDP requirements .
<b>RMP PS 25.</b> Minimize anthropogenic changes to existing surface drainage patterns (except for those contemplated by and consistent with the CLRDP, including the Drainage Concept Plan (Appendix B)).	Minimal changes to surface topography from management activities; no changes to surface topography due to unauthorized activities	Ongoing	Wetlands/buffers undisturbed	Continue monitoring and work with Campus Planning, Development and Operations to ensure potential temporary impacts from construction are not having long-term impacts on wetland buffer habitats.

### **SUCCESS CRITERIA (SRP 8)**

Detailed success criteria for each habitat type are described in SRP 7 above. These criteria set an initial threshold of species richness and cover for specific habitat types throughout the restoration area. These criteria are based on CLRDP recommendations, and have been further refined by the SAC based on: 1) species richness and cover data that were collected for coastal prairie, scrub, and wetland habitats at “Reference Sites,” and 2) results from Phase 1 of Restoration. The criteria are the same as for Phase 1, except for the addition of an annual monitoring requirement for sites that fall below success criteria in order to allow for more responsive, adaptive management. If success criteria are not achieved, the SAC will discuss potential causes for the lack of success and recommend future adaptive management strategies to obtain desired goals.

### **MONITORING (SRP 9)**

This section of the SRP defines the monitoring approach that will be used to evaluate whether success criteria for native plant cover and richness is being met. In order to assess the progress towards meeting defined success criteria, monitoring efforts will focus on Phase 1 and Phase 2 target restoration/enhancement areas. The ultimate goal of Phase 2 is to meet success criteria for 2/3 of the Terrace Lands (approximately 24 ac [10 ha]). Monitoring will occur in the spring when species are blooming and readily identifiable. Percent cover and species richness will be calculated as described below; data will be compared to success criteria outlined in Tables 3-6.

#### ***Hydrological monitoring***

Water levels in each major wetland (1, 2, 4, and 5) will be recorded weekly throughout the rainy season at a series of staff plates (1, 2, 4, and 5) and piezometers (4 and 5) positioned strategically throughout the wetlands. Rainfall data will be collected at the Younger Lagoon Reserve weather station, located at the Long Marine Laboratory.

### *Coyote brush scrub, coastal bluff, willow riparian, and ruderal areas*

These areas are dominated by shrub species. The line intercept method will be used to assess cover in Coyote brush scrub, coastal bluff, willow riparian, and ruderal areas. Each transect will be 164 ft (50 m) in length and distributed throughout the restoration areas within each habitat type. The first starting point will be randomly selected within each specific habitat type and additional transects will be established at fixed intervals of 246 ft (75 m) in a north south direction. Specific start locations of each transect will be permanently established; however, orientation of every transect will be randomly selected each time a transect is surveyed (i.e. in different years). This method establishes random transect points while ensuring adequate coverage of the entire restoration area. If transects extend beyond the target habitat type into either developed areas or different habitats, the random orientation or starting point will be reselected in order to ensure sampling occurs within the target habitat. Shrub cover will be quantified by recording the length each shrub species is observed under the transect tape to the nearest 2 in (5 cm); herbaceous and grass cover will not be quantified in areas where shrubs intersect with the transect.

For areas within Coyote brush scrub, coastal bluff, willow riparian, and ruderal areas that lack shrubs (i.e. interstitial open areas), herbaceous plants and grasses will be quantified using 2.69 ft<sup>2</sup> (0.25 m<sup>2</sup>) rectangular quadrats 0.82 x 3.28 ft (0.25 m x 1.0 m). Quadrats will be placed every 16.4 ft (5 m) perpendicular to the transect with the first quadrat placed randomly between (0-5 m). Quadrats will alternate between the right and left side of the transect (first placement selected randomly) unless only one side contains an open grassy area, in those cases the open area will be chosen. Percent cover of native and non-native species will be determined by estimating total cover of each guild within each quadrat.

To adequately survey species richness, all native species that are observed in a 13 ft (4 m) wide belt transect along the line transect (6.5 ft [2 m] to either side of the line) will be recorded. Natural recruitment of native species will be noted in the line intercept and quadrat surveys by noting the presence or absence of recruits along the belt transect.

### ***Coastal Prairie Areas***

These areas are dominated by grasses and forbs. Transects will be established as per methodologies described above in Coyote-brush scrub, coastal bluff, willow riparian, and ruderal areas and serve as a backbone for quadrat surveys. Grasses and herbaceous cover will be quantified using 2.69 ft<sup>2</sup> (0.25 m<sup>2</sup>) rectangular quadrats (0.82 x 3.28 ft [0.25 m x 1.0 m]). Quadrats will be placed every 16.4 ft (5 m) perpendicular to the transect with the first quadrat placed randomly between (0-5 m). Quadrats will alternate between the right and left side of the transect (first placement selected randomly) unless only one side contains an open grassy area, in those cases the open area will be chosen. Percent cover of native and non-native guilds will be determined by estimating total cover of each species within each quadrat.

To adequately survey species richness, all native species that are observed in a 13 ft (4 m) wide belt transect along the line transect (6.5 ft [2 m] to either side of the line) will be recorded. Natural recruitment of native species will be noted in the line intercept and quadrat surveys by noting the presence or absence of recruits along the belt transect.

### ***Wetland Vegetation***

Rectangular quadrats 2.69 ft<sup>2</sup> (0.25 m<sup>2</sup>) will be used to evaluate cover of grass, forb, sedge, and rush species in the wetland areas. Quadrat size will be 0.82 x 3.28 ft (0.25 m x 1.0 m). A series of sampling locations will be determined by randomly assigning starting points at the edge of each wetland (determined by vegetation). At each starting point a transect tape will be extended across the wetland at a randomly chosen orientation to the opposite edge of the wetland. If the random orientation results in the transect being outside of the wetland area another orientation will be randomly selected. Quadrats will alternate between the right and left side of the transect (first placement selected randomly) falls within the wetland, in those cases the wetland area will be chosen. Percent cover of native and non-native species will be determined by estimating total cover of each species within each quadrat.

To adequately survey species richness, all native species that are observed in a 13 ft (4 m) wide belt transect along the line transect (6.5 ft [2 m] to either side of the line) will be recorded.



Natural recruitment of native species will be noted in the line intercept and quadrat surveys by noting the presence or absence of recruits along the belt transect.

### ***GIS and GPS Vegetation Surveys***

Beyond on-the-ground transect and quadrat surveys described above, percent cover of select species across the entire site will be calculated by digitizing the perimeters of identifiable species occurring throughout the Terrace Lands using GIS of recent aerial imagery. Once plants are digitized, area and percent coverage can be calculated using spatial analysis, thus providing an additional measure of cover for some species. Aerial imagery analysis and on-the-ground GPS mapping will provide a thorough estimate of total coverage of patchily distributed species such as coyote brush, creeping wild rye, Douglas' baccharis, and wetland species (rushes, and sedges) that can be accurately identified from aerial imagery. Aerial imagery will be digitized when orthoimagery is updated and available (likely every 2-5 years).

### ***Photo monitoring***

On-the-ground photo monitoring will be conducted annually and be timed to correspond when plants are blooming and more easily identified (spring/early summer). Photos will be oriented to capture large scale changes over time and taken at permanent photo points established throughout the project area. Figure 12 identifies several photo points; however, additional points will likely be created over time in order to capture specific areas within the restoration site and ensure growing vegetation does not preclude adequate coverage. Each point has a coordinate and bearing in order to ensure repeatability over time. Monitoring information collected for each photo point will include:

1. Photo point number
2. Date
3. Name of photographer
4. Bearing

5. Camera and lens size
6. Coordinates
7. Other comments

All on-the-ground photos will be included in the monitoring reports.



**Figure 7.** Photo monitoring points.

### ***Monitoring study report and schedule***

Results from monitoring efforts will be included in the reports (as per SRP 6) that will be submitted by December 31<sup>st</sup> of each year to UCSC, CCC, and the SAC. Reports will include a summary of restoration activities as well as an evaluation of whether success criteria are being achieved. The report will also discuss any corrective actions or adjusted protocols that may be required.

### **FINAL MONITORING REPORT (SRP 10)**

The final monitoring report will be submitted to the UCSC Planning Director, Scientific Advisory Committee, and California Coastal Commission at the end of the final monitoring period of Phase 2. The report will evaluate whether the site area conforms to the goals and success criteria set forth in the approved final resource plan.

### **PROVISION FOR POSSIBLE FURTHER ACTION (SRP 11)**

If the final report (SRP 10) indicates that the project has been unsuccessful, in part or in whole, based on the approved success criteria, then the final report shall identify remediation measures to be implemented to compensate for those portions of the original plan that did not meet the approved success criteria.

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## **APPENDICES**

### Appendix 1. CLRDP A.6.1: Specific Resource Plan Requirements

#### **A.6.1 Specific Resource Plans Required**

The RMP provides a fairly broad outline with general recommendations and specific guidelines for resource protection, enhancement, and management on the Coastal Science Campus site. The intent is that the Scientific Advisory Committee (SAC) uses the RMP as the initial framework for development of more detailed and specific resource plans for RMP implementation. These may be adapted to address the current physical and ecological conditions, current understanding of biological and ecological processes, and current approaches to habitat revegetation, restoration, and enhancement, provided that the overall intent of the RMP is carried out, including the level of resource protection and the timing guidelines. For example, the RMP performance standards provide suggestions for standards of biodiversity and vegetative cover, but these might be altered in a detailed plan based on new research or revegetation experience at this site. Adjustments to the performance standards that are more protective of the resources and more responsive to the site conditions based on management experience over time are encouraged.

Therefore, implementation of the requirements of this RMP shall be based on more detailed resource plans. Some of these more detailed resource plans will be developed during the course of projects that emanate from the CLRDP building program that require certain mitigations and capital improvements as part of them, but others may be developed irrespective of the building program (see also Approvals section below). Implementation of the RMP shall be guided by the SAC composed of three to four native restoration professionals and academicians appointed by the UCSC Chancellor and selected in consultation with the Executive Director of the California Coastal Commission. This committee shall meet on an annual basis at a minimum (more frequently as needed), and provide overall direction for resource plan preparation, revegetation installation, long-term maintenance and monitoring.

## Appendix 1: Specific Resource Plan Requirements

Specific Resource Plans shall be prepared per 1M 3.2.10 by a qualified restoration ecologist under the guidance of the SAC, and will follow the guidelines below, as appropriate:

1. A baseline assessment, including photographs, of the current physical and ecological condition of the proposed restoration, enhancement, and/or management site area. As appropriate, this may be based on available historical information or include current surveys addressing wetland delineation (conducted according to the definitions in the Coastal Act and the Coastal Commission's Regulations), a description and map showing the area and distribution of vegetation types, and a map showing the distribution and abundance of sensitive species, if any. Existing vegetation, wetlands, and sensitive species shall be depicted on a map that includes the footprint of the proposed site area.
2. A description of the goals of the resource plan, including, as appropriate, topography, hydrology, vegetation, sensitive species, and wildlife usage.
3. A description of planned site area preparation and invasive plant removal.
4. A planting plan including the planting palette (seed mix and container plants), planting design, source of plant material, plant installation, erosion control, irrigation, and remediation. Except for the planting of Monterey cypress, the planting palette shall be made up exclusively of native taxa that are appropriate to the habitat and region. Seed and/or vegetative propagules shall be obtained from local natural habitats so as to protect the genetic makeup of natural populations. Horticultural varieties shall not be used. Materials should be collected from coastal habitats that are located within approximately one mile of the Coastal Science Campus and seaward of Highway 1 (Morgan 2002).
5. A plan for documenting and reporting the physical and biological "as built" condition of the site area within 30 days of completion of the initial plan implementation activities. This simple report will describe the field implementation of the approved resource plan in narrative and photographs, and report any problems in the implementation and their resolution.
6. A plan for interim monitoring and maintenance, including:
  - a. A schedule.
  - b. Interim performance standards keyed to final success criteria (#7, below).
  - c. A description of field activities, including monitoring studies (#8, below).
  - d. The monitoring period.
  - e. Provision for submission of annual reports of monitoring results to the Planning Director for the duration of the required monitoring period, beginning the first



## Appendix 1: Specific Resource Plan Requirements

year after submission of the “as-built” report. Each report shall be cumulative and shall summarize all previous results. Each report shall document the condition of the site area with photographs taken from the same fixed points in the same directions. Each report shall also include a “Performance Evaluation” section where information and results from the monitoring program are used to evaluate the status of the project in relation to the interim performance standards and final success criteria. To allow for an adaptive approach to management, each report shall also include a “Recommendations” section to address changes that may be necessary in light of study results or other new findings.

7. Final success criteria for each habitat type, including, as appropriate:
  - a. Species diversity, including total number of taxa, number of native taxa, and number of invasive non-native taxa.
  - b. Vegetation coverage, including total vegetation, native vegetation, invasive non-native taxa, and dominant species.
  - c. Wildlife usage.
  - d. Erosion control and functional hydrology.
  - e. Control of invasive non-native plant taxa.
  - f. Maintenance of suitable habitat, and presence/abundance, for sensitive species or other individual “target” species.
  - g. A requirement that success be determined after a period of at least three years wherein the study site has been subject to no remediation or maintenance activities other than weeding.
8. The method by which “success” will be judged, including, as appropriate:
  - a. Type of comparison. Possibilities include comparing a census of the site area to a fixed standard derived from literature or observations of natural habitats, comparing a census of the site area to a sample from a reference site, comparing a sample from the site area to a fixed standard, or comparing a sample from the site area to a sample from a reference site.
  - b. Identification and description, including photographs, of any reference sites that will be used.
  - c. Test of similarity. This could simply be determining whether the result of a census was above a predetermined threshold. Generally, it will entail a one- or two-sample t-test.
  - d. The field sampling design to be employed, including a description of the randomized placement of sampling units and the planned sample size.

## Appendix 1: Specific Resource Plan Requirements

- e. Detailed field methods; not simply a citation of a publication or standard methodology.
  - f. Specification of the maximum allowable difference between the restoration value and the reference value for each success criterion.
  - g. Where a statistical test will be employed, a statistical power analysis to document that the planned sample size will provide adequate statistical power to detect the maximum allowable difference. Generally, sampling should be conducted with sufficient replication to provide 90% power with  $\alpha=0.10$  to detect the maximum allowable difference. This analysis will require an estimate of the sample variance based on the literature or a preliminary sample of a reference site.
  - h. A statement that final monitoring for success will occur after at least 3 years with no remediation or maintenance activities other than weeding.
9. Monitoring study design for each habitat type, including, as appropriate:
- a. Goals and objectives of the study.
  - b. Field sampling design.
  - c. Study sites, including experimental/revegetation sites and reference sites.
  - d. Field methods, including specific field sampling techniques to be employed. Photomonitoring of experimental/revegetation sites and reference sites shall be included.
  - e. Data analysis methods, including descriptive and inferential statistics with specified acceptable variance and significance levels to examine sample size, univariate and multivariate comparisons, and/or other param as appropriate and necessary to assess progress toward and meeting of success criteria.
  - f. Presentation of results.
  - g. Assessment of progress toward meeting success criteria.
  - h. Recommendations.
  - i. Monitoring study report content and schedule.
10. Provision for submission of a final monitoring report to the UCSC Planning Director and Scientific Advisory Committee at the end of the final monitoring period. The final report must be prepared by a qualified restoration ecologist. The report must evaluate whether the site area conforms to the goals and success criteria set forth in the approved final resource plan.
11. Provision for possible further action. If the final report indicates that the project has been unsuccessful, in part or in whole, based on the approved success criteria, then

## Appendix 1: Specific Resource Plan Requirements

the final report shall identify remediation measures to be implemented to compensate for those portions of the original plan that did not meet the approved success criteria.

