

Beacon's Beach Coastal Bluff Restoration Plan

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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	Introduction	4
1.1	Restoration Plan Elements	4
2	Existing Conditions	5
2.1	Land Use	5
2.2	Property Ownership.....	5
2.3	Regulatory Context.....	5
2.4	Coastal Bluff Characteristics	6
2.4.1	Geology and Soils.....	6
2.4.2	Groundwater.....	7
2.4.3	Vegetation Communities and Land Cover Types	7
2.4.4	Wildlife	9
2.4.5	Special-Status Species	10
3	Site Opportunities and Constraints	10
4	Restoration Project Descriptions	13
4.1	Goals and Objectives	13
4.2	Planting Program.....	13
4.2.1	Plant Palette.....	13
4.2.2	Planting Layout.....	15
4.2.3	Hydroseeding.....	15
4.2.4	Irrigation/Watering	16
4.2.5	Erosion Control and Water Quality Protection.....	16
4.3	Installation Methods	17
4.3.1	Mobilization and Vegetation Removal.....	17
4.3.2	Access Routes.....	17

4.3.3	Installation Activity Timelines and Environmental Constraints.....	17
4.4	Management and Maintenance Requirements.....	18
4.4.1	Non-native and Invasive Species Control.....	18
5.0	Project Success.....	20
6.0	References.....	22
Appendix A	27

Figures

1.	Vicinity Map.....	24
2.	Vegetation Community Map.....	25
3.	Conceptual Restoration Map.....	26

Beacon's Beach Coastal Bluff Restoration Plan

1 INTRODUCTION

The primary purpose of restoring Beacon's Beach coastal bluff is to preserve the Beacon's Beach access trail through lessening surface erosion and stabilizing soil by establishing native plants on plantable areas of the bluff. Native plant communities along coastal bluffs play a major role in stabilizing coastal bluffs and counteracting erosive forces. Low-growing plants catch and slow rainfall and reduce surface water runoff velocity. Plants draw water up through their stems or trunks and branches to their leaves and into the air by the mechanism of transpiration, thereby removing water from the soil. Plant roots provide a fibrous web that stabilize and anchor soil. The roots of many woody native brush species penetrate deeply across soil layers, thus increasing the soil's shear strength and reducing risk of shallow landslides. Native bluff species are adapted to maritime environments and persist in the face of changing coastal conditions, continuing to minimize surface erosion and provide soil stabilization. This Beacon's Beach Coastal Bluff Restoration Plan (Restoration Plan) serves as the implementation guide to accomplishing these goals.

Beacon's Beach is located at Leucadia State Beach at the west end of Leucadia Boulevard, with access off Neptune Avenue in Encinitas (Figure 1). The existing beach access at Beacon's Beach consists of a dirt trail beginning at a public parking lot off Neptune Avenue and leading down across the face of the coastal bluff.

Beacon's Beach and the access to the sand was historically created by a series of massive landslides between faults that run through the Beacon's Beach access path (Stroh 2001). In 1982 and 1983, previous stairway structures were damaged by additional landslide movement during winter storms. Since 1982/83, the landslide areas have experienced additional instability, with the most recent bluff sloughing occurring in April 2020.

To enhance the beach access at Beacon's Beach, the City of Encinitas (City) sought to install a stairwell from the more stable sections of the existing public parking lot on Neptune Avenue. The City held two public workshops to discuss the design of a new staircase. During the October 8th and October 15th, 2018 Beacon's Beach Workshop I and II (Agendas & Webcasts; City of Encinitas 2018), the public voiced a strong desire to see the bluff planted with California native material. Thus, the development and implementation of this Restoration Plan accomplishes a secondary goal: responding to stakeholder requests for native plant improvements along the Beacon's Beach access trail.

1.1 Restoration Plan Elements

The restoration elements included in this Restoration Plan include:

1. Summary of existing coastal bluff conditions present on the site, as well as

Beacon's Beach Coastal Bluff Restoration Plan

ownership and regulatory context

2. Specific restoration goals
3. Evaluation of steps for implementation
4. Identification of site constraints
5. Restoration design elements:
 - a. Planting programs, including removal of exotic species, sources of plants and/or seeds (local, if possible), protection of existing native plants, methods for preserving top soil and augmenting soils with nitrogen and other necessary soil amendments before planting, timing of planting, plans for irrigation until establishment, and general planting locations;
 - b. Proposed stormwater control measures, staging and access areas.
 - c. Identified management and maintenance requirements.
 - d. Specifications for continual public access.
 - e. Conceptual restoration plan map at 1"-100' scale.

2 EXISTING CONDITIONS

2.1 Land Use

Land uses surrounding the Project site include beaches, open space, and neighborhood residential. This site is under public agency use by the City and is owned by the California Department of Parks and Recreation. The site is bounded to the north and south by residential properties, and to the east by Neptune Avenue and an adjacent public parking lot.

2.2 Property Ownership

The California Department of Parks and Recreation owns Leucadia State Beach (Beacon's Beach) and authorizes the City to develop, operate, control, and maintain premises. The City agreed to accept premises in "AS-IS" condition and is tasked to maintain the beach in a safe and tenable condition, under the direction of the Operating Agreement (Appendix A; State of California 2008). Upon written permission of the State, the City may improve the premises by constructing and operating public facilities, concessions, or other general improvements in accord with the General Plan.

2.3 Regulatory Context

The California Coastal Act was enacted to protect the California coastline by managing the conservation and development of coastal resources through land use planning and regulation.

Beacon's Beach Coastal Bluff Restoration Plan

Under the California Coastal Act, the Coastal Commission regulates impacts to environmentally sensitive habitat areas in the “coastal zone” and requires a coastal development permit for almost all development within this zone. An environmentally sensitive habitat areas (ESHA) is defined in Section 30107.5 of the California Coastal Act 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 easily be disturbed or degraded by human activities and development.”

The entire Project site is within the Coastal Zone as defined by the Coastal Act. Section 30240 of the California Coastal Act requires that ESHA be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas. The restoration described herein has been designed to limit land disturbance and enhance the habitat value of the entire site, including areas considered ESHA.

2.4 Coastal Bluff Characteristics

2.4.1 Geology and Soils

The coastal bluffs along Beacon's Beach are underlain by Pleistocene and Eocene sedimentary formations (Woodward Clyde 1990). The base of the bluffs is composed of Eocene siltstone and claystone with interbedded sandstone assigned to the Ardath Shale. The relatively resistant formations create near vertical sea cliffs along the lower portion of the coastal bluffs bordering the slide area. Pleistocene terrace deposits comprise the upper portion of the bluff. The terrace sands are relatively homogeneous, medium dense to dense, silty fine sands that are typically friable and prone to erosional gullies.

Per Natural Resources Conservation Service Web Soil Survey, the Project site is comprised of soil type B, which has a moderate infiltration rate when thoroughly wet, and soil type D which has a very slow infiltration rate. The transition between the bottom of the bluffs and the beach define this soil divide (RRM 2020).

The Beacon's Beach bluff has experienced historic and continuing slope instability that is associated with a major coastal landslide (Woodward Clyde 1990). Previous stairway structures were damaged by landslide movement during winter storms in 1982/83. Since then, the landslide has experienced additional instability, including recent bluff face collapses under the trail along the upper bluff from high rain events in April 2020. This upper bluff area was repaired in May 2020 with a wood lagging retaining wall, under an emergency coastal development permit.

The historic landslide encompasses virtually all the bluff below the Beacon's Beach parking lot. The slide is approximately 400 feet long (measured parallel to the beach) and about 120 feet wide. The upper bluff is the headscarp of the landslide (which did not translate seaward when the

Beacon’s Beach Coastal Bluff Restoration Plan

landslide occurred). Portions of the upper bluff along the parking lot are nearly vertical, devoid of vegetation and appear over steepened. The body of the landslide is at the flatter slopes and consists of landslide debris. The middle to lower portions of the Project site are the areas proposed for planting, seeding and maintenance.

2.4.2 Groundwater

Groundwater levels have been monitored near the toe of the historic landslide area and where the terrace deposits meet the weathered Ardath Shale. Groundwater elevations have been recorded at about 25 feet above mean sea level height, 12 feet above mean sea level height and 8 feet above mean sea level height (AECOM 2018). The source of the groundwater within the bluff areas is from inland areas. Test pits near the southern margin of the historic landslide at Beacon’s Beach showed a flow of several gallons per minute, which was consistent with the release of naturally perched groundwater, combined with free draining low tide backflow to the beach.

2.4.3 Vegetation Communities and Land Cover Types

Vegetation communities were recently mapped by field surveys in winter 2019/20 using nomenclature to match the current “California Natural Community List” (Figure 2; CDFW 2020). Vegetation communities were classified based on site factors, descriptions, distribution, and characteristic species present. Information such as dominant species and associated cover classes, aspect, and visible disturbance factors were also recorded. Vegetation classifications followed Holland, as modified by Oberbauer (2005) and Sawyer and Keeler Wolf (1995).

In general, the predominant native vegetation communities associated with the coastal bluff are adjacent to the trail, in areas that have been planted with the supported species that include bladderpod (*Cleome isomeris*) and California sunflower (*Encelia californica*). Results of the surveys are presented in the Table 1 and Figure 2.

Table 1
Vegetation Community and Land Cover Types

Vegetation or Land Cover Type	Acreage
Diegan Coastal Sage Scrub: Coastal Form	0.02
Maritime Succulent Scrub	0.005
Southern Coastal Bluff Scrub (Disturbed)	0.29
Disturbed Habitat - Ice plant	0.27
Disturbed Habitat - Acacia	0.06
Disturbed Habitat – Russian thistle	0.07
Beach/Sand	0.30
Unvegetated Bluff/Trail	0.29
Totals	1.30

Beacon's Beach Coastal Bluff Restoration Plan

Diegan Coastal Sage Scrub (Coastal Form)

Coastal sage scrub consists predominantly of low-growing, aromatic, and generally soft-leaved shrubs. Diegan coastal sage scrub is a native plant community characterized by soft, low, aromatic, shrubs and subshrubs characteristically dominated by drought-deciduous species (Oberbauer 2005). This community typically occurs on sites with low moisture availability, such as dry slopes and clay-rich soils that are slow to release stored water. The representative species in this habitat type are California sage (*Artemisia californica*), flat-topped buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), saw-tooth goldenbush (*Hazardia squarrosa*), and laurel sumac (*Malosma laurina*).

Within the Project site, flat-topped buckwheat is present in small amounts.

Maritime Succulent Scrub

This vegetation community consists of low (knee to waist high), open (25-75% cover) scrub dominated by drought deciduous shrubs. The ground is generally bare between the shrubs. Maritime succulent scrub species are found on thin rocky or sandy soils, often on steep slopes of coastal headlands and bluffs. Characteristic species include Shaw's agave (*Agave shawii*), California sage, bush sunflower (*Encelia californica*), San Diego barrel cactus (*Ferocactus viridescens*), California box thorn (*Lycium californicum*), and coastal prickly pear (*Opuntia littoralis*).

Within the mapped maritime succulent scrub area in the Project site, bush sunflower and, to a lesser extent, California box thorn are present.

Southern Coastal Bluff Scrub (disturbed)

Southern coastal bluff scrub is generally dominated by bush sunflower, bladderpod, flat-topped buckwheat, coastal cholla (*Cylindropuntia prolifera*), coastal prickly pear, and at some locations, locally dense areas of California boxthorn.

Southern coastal bluff scrub occurs throughout much of the trail portion of the Project site. Onsite, this vegetation type is dominated by bush sunflower (*Encelia californica*); it occurs as a monoculture in many of the southern coastal bluff scrub patches. In areas where other southern coastal bluff species are present, such as bladderpod (*Isomeris arborea*), non-native species are also present. The most common non-native species making this a disturbed vegetation community are hottentot fig (*Carpobrotus edulis*), garland chrysanthemum (*Glebionus coronaria*) and sea rocket (*Cakile maritima*). Removal and maintenance of these non-native species is proposed herein in this Restoration Plan. With persistent maintenance, native plant species are expected to fill in areas of disturbance.

Beacon's Beach Coastal Bluff Restoration Plan

Disturbed Habitat

Disturbed habitat refers to areas that are not developed yet lack vegetation or support non-native species, and generally are the result of severe or repeated perturbation.

The disturbed habitat onsite includes an area that was graded following a landslide and planted in the past. The disturbed areas onsite are dominated by hottentot fig, acacia (*Acacia* sp.) and a mix of non-forbs and shrubs that include sea rocket and garland chrysanthemum.

Beach/Sand

Beach refers to areas that are subject to tidal inundation and are generally composed of sand. Beach areas are infrequently tidally inundated, whereas tidal flat or mudflat areas are inundated daily.

Though no beach areas are slated for planting in this Project, the adjacency is noted. Areas that are mapped as beach are lacking vegetation.

Unvegetated Bluff/Trail

The bare portion of the Project site refers to the parking lot at the top of the bluff that provides for day-use parking. The trail section of the Project site refers to the dirt switchback trail that allows for coastal access to the beach.

2.4.4 Wildlife

The habitat within the Project area supports a minimal number of common wildlife species found in coastal locations and within disturbed and/or urbanized areas. This is expected, as the habitat within the Project site lacks cover and structural diversity and is dominated by non-native species providing relatively few resources for wildlife. Typical wildlife species commonly observed on site include California gull (*Larus californicus*), American crow (*Corvus brachyrhynchos*), black phoebe (*Sayornis nigricans*), and house finch (*Carpodacus mexicanus*). Reptile species that are likely to occur include western fence lizard (*Sceloporus occidentalis*), side-blotched lizard (*Uta stansburiana*), and potentially gopher snake (*Pituophis melanoleucus*). Common species of mammal have been observed in upland parts of the site including brush rabbit (*Sylvilagus bachmanii*) and California ground squirrel (*Spermophilus beecheyi*). Other mammals adapted to living in areas near human disturbance, such as striped skunk (*Mephitis mephitis*) and Virginia opossum (*Didelphis virginica*), may also occur on the site.

Several bird species use the adjacent intertidal areas. Within the shorebird group, the most common species include California gull, western sandpiper (*Calidris mauri*), willet (*Tringa semipalmatus*), and whimbrel (*Numenius phaeopus*), and in offshore areas California brown pelican (*Pelecanus occidentalis*), Caspian tern (*Hydroprogne caspia*), California least tern (*Sterna antillarum browni*), and double-crested cormorant (*Phalacrocorax auritus*) are often

Beacon’s Beach Coastal Bluff Restoration Plan

observed.

2.4.5 Special-Status Species

Special-status species are those species that have been afforded special recognition by Federal, State, or local resource agencies or organizations. Special-status species are defined as meeting one or more of the following criteria: listed as threatened or endangered or candidates for future listing as threatened or endangered under the federal Endangered Species Act (FESA) or California Endangered Species Act (CESA); listed as species of concern by CDFW; bird species identified by the Service as Birds of Conservation Concern (USFWS 2008) plant species considered by the CNPS to be “rare, threatened, or endangered in California” (California Rare Plant Rank 1A, 1B, and 2, as well as CRPR 3 and 4 plant species); a plant listed as rare under the California Native Plant Protection Act; or a plant considered a locally significant species, that is, a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region or is so designated in local or regional plans, policies, or ordinances including Multiple Species Conservation Program (MSCP).

No special-status species were observed in or adjacent to the Project site. There is potentially suitable habitat on or near the Project that could support California least tern (*Sternula antillarum browni*) or western snowy plover (*Charadrius nivosus nivosus*), which are both special status species found to nest, roost or forage on an Encinitas beach in the southern portion of the City (USFWS 2012). However, with high tides, consistent human presence and the potential for birds of prey to roost along the adjacent bluff, nesting and roosting of these special status species is highly unlikely.

3 SITE OPPORTUNITIES AND CONSTRAINTS

Installation of the Project shall be conducted by hand and in areas that are heavily disturbed with non-native species, therefore only a handful of constraints challenge the successful implementation of the Project. Table 2 discusses various potential constraints and how they may relate to the success of the proposed restoration activities.

Table 2
Opportunities and Constraints Related to the Installation of the Restoration Plan

Category	Specific Issue	Design Consideration
Hydrology/Groundwater	Location suitable for habitat restoration	Once established, native species adapted to maritime conditions will be supported by natural rainfall, fog and mild climactic conditions that are present on the coast. Additionally, the presence of perched groundwater will significantly contribute to the development of the planted/seeded species once plants are established in the first two years.

Beacon’s Beach Coastal Bluff Restoration Plan

Unstable Geology	Weeding and planting could result in increased erosion on already unstable bluffs.	Planting and weeding are to be completed in phases to minimize disturbance. Erosion control and BMPs will be used to reduce erosion until restoration is complete and the native vegetation is fully established.
Existing Conditions	Existing conditions can be categorized as largely degraded due to slides and the presence of non-native species	Currently the site supports primarily non-native annual plant species. Once restored, the native species should be able to develop within several months with maintenance and professional restoration techniques. The site shall remain relatively undisturbed due to existing trails leading to the beach and difficult public access outside of the trail. The Beach Ambassador Program will work to utilize volunteers to deter folks from accessing the beach outside of the trail. .
Accessibility	Constructability is feasible without new construction access	The site has suitable access for installation, staging, and transport of materials and workers.
Native plant establishment	Native plants will be outcompeted by non-natives	The planting program is designed to be adaptive by splitting the installation of the restoration site into two years. Container plant selection, seeded species and watering schedules can be adjusted to account for the best tactic in establishing the native plants.
Long term maintenance and management	Site is located within City leased areas, owned by the California Department of Parks and Recreation	A coastal bluff vegetation management guide is currently being developed to aid in directing the management of coastal bluffs in Encinitas. Long-term management shall be the responsibility of the City and shall be guided by the vegetation management guide. A Coastal Conservancy grant may enable a long-term monitoring program at the Project site.
Special-status species	Special-status species may be disturbed during Project installation	No special status species are known to occur in the Project area. Special status species may occasionally use the nearshore for foraging and could eventually use the beach for roosting and nesting, if supplemental sand is placed in the future. The Project will be installed by hand, using hand tools, thereby minimizing noise or accidental disturbance to any wildlife. The Project will have beneficial effects for special-status species after construction.

Currently, non-native annual herbaceous plants dominate the Project site (Table 3), leaving the loose topsoil susceptible to erosion from storm water and wind desiccation. Annual plant material provides very little erosion control as the vegetation is only available a short period of the year and the shallow roots decay rapidly. Thus, the Project seeks to enhance the function of the existing foliage onsite with perennial container plantings and seeds from native southern coastal bluff scrub species that are often both long-lived and deep rooted.

The southern coastal bluff scrub vegetation community is comprised of plant species that are specially adapted to exist in the difficult onsite conditions and falls within the General Plan planting requirements. Some plants go dormant during the dry period to avoid desiccation, which after establishment will be advantageous since the Project does not support permanent irrigation. Other southern coastal bluff scrub species have adaptations that include sclerophyll and/or small foliage that efficiently shed heat. The reduced surface area and fewer stomata reduce the evapotranspiration rate.

The plants in the southern coastal sage scrub plant palette (Section 4.2.1) have been selected to account for the extreme conditions of the site. As the Project site is west facing with no shade, plants with light colored or gray leaves will have an advantage since light colors reflect heat and absorb less

Beacon's Beach Coastal Bluff Restoration Plan

light energy. Additionally, long-lived, woody shrubs that develop long tap roots will have an advantage in their ability to obtain water from deep sources. Deep rooted species are especially ideal to this site due to consistent groundwater flow. These species are anticipated to improve the perched groundwater flows, by utilizing the available water through uptake and transpiration (Acharya et al 2018). Less woody species, such as deerweed or black sage, have vast lateral root systems nearer to the surface. This adaptation allows plants to capitalize on dense fog or light precipitation events. These long-lived lateral roots are advantageous as they help retain soil and reduce erosion. Even during drought, many native shrubs and plants will be able to maintain relatively high-water potential through roots that extend a dozen feet below the surface.

Table 3
Photos (Existing Conditions)



Beacon's Beach Coastal Bluff and Trail (January 2020).



The yellow flowering plants, California sunflower are native and shall remain in place and be avoided during restoration activities (April 2020).



Plantable and potential dune location, south end of Beacon's Trail (April 2020)

Beacon's Beach Coastal Bluff Restoration Plan

4 RESTORATION PROJECT DESCRIPTION

4.1 Goals and Objectives

The overall goal of the restoration program is to create self-sustaining native southern coastal bluff scrub habitat that will stabilize soils, lessen erosion along the bluff and trail, and enable continued access to Beacon's Beach along the existing trail. To achieve this goal, a series of restoration activities described herein and depicted in Figure 3 are planned and include:

- Planting and establishment of native plant species in place of non-native species.
- Planting and/or seeding of bare coastal bluff areas to minimize surface erosion from wind, rain, and groundwater leaching.
- Beautification of the coastal bluff with native, flowering plant species.
- Increase carbon sequestration through increasing habitat.
 - Contributes to Section 3.1.6 Strategy 7 of the Climate Action Plan (CAP)
- Complies with CAP Adaptation efforts (Section 5.3.5, Prepare for Coastal Erosion and Predicted Sea-Level Rise) through Strategy 4 which requires coastal bluff improvements.

4.2 Planting Program

The planting program is designed to be adaptive. In Year One, the proposed container plants shall be planted, hydroseeded, weeded and maintained. In Year Two, the approach will be consistent with that of Year One, but additional restoration activities will be performed according to the results of monitoring the Project throughout Year One. In Year Two of the restoration install, container plants and seed palettes will be modified based on what was most successful during the first year. An evaluation of the hydroseeded areas will also be done between the completion of Year One and remedial planting in Year Two, to determine if additional hydroseeding in portions of the site is warranted.

4.2.1 Plant Palette

Given the highly challenging conditions of the Project site, selection of plant material required careful consideration. A detailed planting list was created and based on the following criteria:

- Native to San Diego County or southern California, preferably species known to occur naturally on coastal bluff environments.
- Species that will tolerate the hot, windy, dry, and sandy conditions on the bluff and that will survive with no supplemental watering after establishment.
- Species that will tolerate alkaline soils.
- Species with spreading, dense vegetative structure that will protect against raindrop impact and interrupt the overland flow of water down the slope.

Beacon's Beach Coastal Bluff Restoration Plan

- Species with extensive root systems that will help stabilize soil conditions.
- Species that would improve the aesthetic character of the slope.

Table 4 details the selected plants and seed for restoration of the bluffs. The selected species are commonly supported in southern coastal bluff scrub vegetation communities (Oberbauer 2005).

Table 4
Southern Coastal Bluff Scrub Planting and Seed Palette

Botanical Name	Common Name	Minimum PLS	Pounds per Acre	
<i>Acmispon glaber</i>	deerweed	65.67%	2	
<i>Artemisia californica</i>	California sagebrush	10%	2	
<i>Deinandra fasciculata</i>	tarweed	7.20%	2	
<i>Encelia californica</i>	bush sunflower	31.97%	3	
<i>Eschscholzia californica</i>	California poppy	73.72%	2	
<i>Frankenia salina</i>	Alkali heath	1.46%	1	
<i>Lasthenia californica</i>	goldfields	55.11%	2	
<i>Lupinus arboreus</i>	bush lupine	74.62%	1	
<i>Lupinus bicolor</i>	miniature lupine	92.44%	2	
<i>Plantago erecta</i>	dot-seed plantain	85.70%	1	
<i>Salvia apiana</i>	white sage	11.16%	2	
<i>Salvia mellifera</i>	black sage	66.84%	2	
		Total Pounds per Acre	20	
Botanical Name	Common Name	Container Plants	Average Spacing (feet on center)	Percent of Planted Area
<i>Acmispon glaber</i>	deerweed	1 gallon	4	3%
<i>Agave shawii</i>	Shaw's agave	1 gallon	3	1%
<i>Artemisia californica</i>	California sagebrush	1 gallon	4	3%
<i>Atriplex canescens</i>	four-wing saltbush	1 gallon	6	7%
<i>Baccharis pilularis</i>	coyote bush	1 gallon	4	2%
<i>Elymus condensatus</i>	giant wild rye	1 gallon	4	4%
<i>Encelia californica</i>	bush sunflower	1 gallon	5	4%
<i>Eriogonum fasciculatum</i>	buckwheat	1 gallon	3	2%
<i>Eriogonum parviflorum</i>	coastal buckwheat	1 gallon	3	4%
<i>Euphorbia misera</i>	cliff spurge	1 gallon	3	1%
<i>Isocoma menziesii</i>	coast goldenbush	1 gallon	5	3%
<i>Leptosyne maritima</i>	sea dahlia	1 gallon	3	2%
<i>Lycium californicum</i>	box thorn	1 gallon	5	5%
<i>Peritoma arborea</i>	bladder pod	1 gallon	6	6%

Beacon's Beach Coastal Bluff Restoration Plan

<i>Rhus integrifolia</i>	lemonade berry	1 gallon	6	6%
<i>Salvia apiana</i>	white sage	1 gallon	4	3%
<i>Yucca schidigera</i>	Mojave yucca	1 gallon	4	1%

4.2.2 Planting Technique

To ensure adequate establishment and balanced representation of each species within each habitat, plantings will occur in groupings. Specifically, each species will be planted in groupings of three-to-four individuals in a reasonably random grouping pattern within the planting zones. To ensure that large monoculture plant groupings do not result in this design, each species grouping cannot occur immediately adjacent to another grouping of the same species. This method should result in a random patchwork of each species across each habitat zone, mimicking natural growth patterns. Initially, these plantings will appear sparse, but plantings are expected to establish quickly and naturalize within two to three years to form cover typical of the coastal bluff habitats.

Most of the plant material will be provided in one-gallon pots, which have been successfully used before in bluff restoration projects. All plants will be planted according to industry standards, in holes of sufficient depth to accommodate the root mass and any attached soil. Holes will then be backfilled with native soil and humus. Care will be taken to ensure that the entire root mass is buried and not exposed to air and sunlight. The site is highly infested with California ground squirrel so herbivory control will be implemented in the form of cages.

A total of 700 container plants is proposed for installation. The container plants will be one-gallon size and have the appropriate organic soil amendments (i.e. compost humus) installed in the backfill. All container plant locations will have pin flags installed with a different color representing each species to track survivability over the course of the Project.

4.2.3 Hydroseeding

Hydroseeding is a planting process which utilizes a slurry of seed and mulch and is sprayed over prepared ground in a uniform layer. It promotes quick germination and inhibits soil erosion. The mulch in the hydroseed mixture helps maintain the moisture level of the seed and seedlings. All seeds will be clearly labeled showing type of seed, test date, the name of the supplier, and percentage of the following: pure seed, crop seed, inert matter, weed seed, noxious weeds, and total germination content. Labels for each seed delivered to the site will be inspected and approved by the contractor Project Manager and/or City Project Manager prior to mixing and application. All mixes are to include the specified seed mix at the prescribed rates per acre; wood fiber hydromulch at 2,500 pounds per acre; and a commercial binder (Az-Tac or equivalent) at 150 pounds per acre. All material will be delivered to the site in original, unopened containers

Beacon's Beach Coastal Bluff Restoration Plan

bearing the manufacturer's guaranteed analysis. All seed mixes will be stored in a dark, cool place and not be allowed to become damp. Installation between the months of October to January are necessary for allowing establishment during the cooler and wetter time of the year. While the initial seed application is proposed to consist of hydroseeding, additional seed may be hand broadcast, should the seed not be available at the time of initial hydroseed installation. The contractor shall consult the City if a given species on the plant palette will not be available for inclusion into the initial hydroseed mix. If seeding is successful as determined by the observance of seed sprouts, the same seed mix shall be applied for any remedial seeding needed. If specific species are unsuccessful onsite, the hydroseed mix shall be adjusted.

4.2.4 Irrigation/Watering

Irrigation will be provided by a pressurized water truck. The water truck will be used to provide supplemental water to the restoration sites until plantings have become established in Year One and Year Two. The irrigation schedules will depend on the natural rainfall and will mimic normal climate conditions to the maximum extent practical (i.e. no watering in the summer). Irrigation will be phased out gradually depending on the local weather conditions during the establishment period (e.g., after the first one or two growing seasons).

All container plants will be irrigated immediately after planting. All hydroseed will be reliant on natural rainfall to supplement germination and growth; watering will only be applied in container plant basins. The amount of water and duration of irrigation will be determined by the contractor and approved by the City geologist. Each watering episode will allow for deep penetration of the water into the soil. Deep soaking of the soil will promote good root development and will enhance survivorship of container stock. Irrigation will be provided on an as-needed basis for a minimum of the first two years after planting. The need for irrigation to continue beyond the first two years will be evaluated by the City in consultation with the contractor and based on the overall survival and vigor of the planted material.

4.2.5 Erosion Control and Water Quality Protection

The hydroseed mix shall include bonder fiber matrix, which utilizes a continuous layer of elongated fiber strands held together by a water-resistant bonding agent. It eliminates direct rain drop impact on soil. Bonded fiber matrix will biodegrade completely into a mulch layer that is beneficial to plant growth.

Soil disturbance will be avoided to the greatest extent possible during all weed controls efforts. The contractor shall implement best management practices (BMPs) to protect water quality, air quality, and biological/wildlife resources. Additionally, BMPs will be installed as needed to

Beacon's Beach Coastal Bluff Restoration Plan

stabilize steep and bare areas of the bluff. Only hand tools will be used to remove and/or plant container species. The Construction General Permit does not apply to this Project site and a stormwater pollution prevention plan (SWPPP) will not need to be prepared.

4.3 Installation Methods

This section describes the installation methods and hand-held tools and equipment that could be used for the restoration.

4.3.1 Mobilization and Vegetation Removal

Prior to any site preparation, the project site will be professionally surveyed and demarcated to ensure all restoration activities will occur within City-leased areas only. All areas to be planted will be prepped for container plant installation, as well as hydroseed application. Preparation activities primarily involve removing dead plants and controlling non-natives. Non-native species control will be accomplished using a combination of manual removals, weed whipping and targeted herbicide applications, with the resulting brush, trash and debris disposed of in a safe and legal manner. These maintenance areas shall also be demarcated with colored pin flags, which will indicate the corresponding non-native species control method (i.e. hand-pulling, weed whipping, etc.). To the maximum extent practicable, a weed whipper will be used to treat non-native plants; this will occur in designated areas of the bluff to allow roots from the non-native species to be left intact to provide soil stabilization while still enabling space for planting and hydroseeding. Thinning of the plants will be required to enable direct application of hydroseed onto bare soil. Non-native plants shall be removed by hand when possible by the Maintenance Contractor, with a maximum of five – six crew members working on the bluff at a time.

4.3.2 Access Routes

Water trucks, crew vehicles and other equipment transporting material to the Project site would utilize Leucadia Blvd and Neptune Avenue. Staging areas would be in the southern portion of the parking lot, eight parking spots will be fenced off for staging purposes. A nearby fire hydrant will be used to fill the water truck for watering events which will reduce surface street traffic.

4.3.3 Installation Activity Timelines and Environmental Constraints

The timing and phasing of the various installation activities are important considerations in restoration planning. Installation between the months of October to January are ideal for allowing establishment during the cooler and wetter time of the year. The site would be cleared of targeted non-native species first. Stormwater BMPs such as biodegradable jute netting, seed-free straw wattle, and biodegradable gravel bags will be installed to stabilize steep and bare areas

Beacon's Beach Coastal Bluff Restoration Plan

of the bluff. A combination of hydroseeding and planting would begin upon completion of preparation work. The hydroseed will act as another form of erosion control in both the short and long term, as seedlings begin to grow and become established (see Section 4.2.5).

The contractor would follow local jurisdiction time restrictions for hand-held equipment operation. It is anticipated that installation activities would take place Monday through Friday from 7AM to 5 PM. Work may not occur on holidays, depending on the contractor and local jurisdiction restrictions. Plant installation activities will be scheduled ahead of the rainy season and with consideration for the bird nesting season (approximately February 1 to September 15). If plant installation activities coincided with bird nesting season in any given year, a pre-construction nesting bird survey would be conducted prior to any installation/preparation activities, with any active nesting areas avoided. The beach and trail will remain open throughout the project duration with minimal disturbance to public access.

4.4 Management and Maintenance Requirements

4.4.1 Non-native and Invasive Species Control

Following installation of container plants and seed, the contractor will perform regular maintenance and watering at the Project site for two years. Maintenance will occur monthly to control non-native species, repair/replace BMPs, and remove trash/debris. Watering via a water truck and hose will occur on an as-needed basis until the vegetation is established. Watering will be conducted in the early morning to maximize absorption and reduce any impact on beach access.

The method of control of non-native, invasive plant species is species-specific and dependent upon the level of invasiveness. Table 5 details the observed and documented non-native and invasive species present onsite (Calflora 2020). Due to the small size of the Project site, all non-native species will be targeted for removal in Year One. As the Project progresses and native plants begin to establish in Year Two, targeted removal will be reduced to non-native, invasive species.

Weeds will be controlled prior to seed set if possible. For more robust non-native species and those on steep slopes, herbicide application, as appropriate and per City herbicide application guidelines, may be utilized. Herbicide application is most effective during the summer and fall, when plants are actively translocating nutrients downward. Foliar spraying is most effective when there is no wind (5 mph or less), and rain is not expected for 8 to 12 hours. All herbicide applications will be conducted with a 1 to 2-person crew on foot using backpack sprayers. These non-native species control tactics are intended to limit disturbance to soil during site preparation activities. Throughout all site preparation activities, existing native species will be avoided to the maximum extent possible.

Beacon’s Beach Coastal Bluff Restoration Plan

Table 5
Weed Species

Plant species	Non-native	Invasive
<i>Atriplex semibaccata</i>	Yes	Yes
<i>Cakile maritima</i>	Yes	Yes
<i>Carpobrotus edulis</i>	Yes	Yes
<i>Chenopodium murale</i>	Yes	No
<i>Glebionis coronaria</i>	Yes	Yes
<i>Limonium ramosissimum</i>	Yes	No
<i>Limonium sinuatum</i>	Yes	No
<i>Nicotiana glauca</i>	Yes	Yes
<i>Raphanus sativus</i>	Yes	Yes
<i>Salsola australis</i>	Yes	Yes
<i>Salsola tragus</i>	Yes	Yes
<i>Tetragonia teragonoides</i>	Yes	No
<i>Tropaeolum majus</i>	Yes	Yes

4.4.2 Kelp Wracking Bluff Back Dune – Pilot Restoration Project

Kelp is a brown alga that is a common site on the beaches in Encinitas because the City does not maintain or bury kelp as done in other jurisdictions. Though historically the City’s nearshore reef supported giant kelp (*Macrocystis pyrifera*), an invasive brown alga (*Sargassum muticum*) has developed offshore and occasionally comes in as large mats that fill up the beach area of Beacon’s Beach.

As a pilot project, the City of Encinitas is interested in supporting natural dune development at the toe of the Beacon’s Beach bluff that would utilize this washed up kelp. Washed up kelp would be periodically brought up to the toe of the slope of the bluff and then allowed to naturally decompose. The pile of wracked kelp would assist in the natural development of a dune by suspending sand and stabilizing cobble. Kelp wrack piles enhance the formation of hummocks and larger dunes by catching and holding windblown sand (Dugan 2011). Kelp wracks have assisted in the development of larger hummocks at the Cardiff State Beach Living Shoreline Program (2019). The City is interested in the development of a small, naturally forming sand dune at the toe of slope of Beacon’s Beach to enhance the stability of the toe of slope, limit the wave run-up on the trail and trail toe, and potentially steer beach goers away from being up against the naturally eroding bluffs. Though the dunes would not be planted or seeded, native plants that will be planted through the Beacon’s Bluff Restoration Program are expected to naturally recruit into these dune areas.

Beacon's Beach Coastal Bluff Restoration Plan

4.4.3 Long-term Site Stewardship and Maintenance

The City is in the process of creating a Beach Ambassador Program, organized by a program lead at the City and supported by community members through established partnerships with local non-governmental organizations (NGOs). The Beach Ambassador Program is currently in the design and planning phase. The City envisions the Program will entail various stewardship activities associated with specific beaches. At Beacon's Beach, for instance, the Beacon's Beach Ambassador Program may be involved in the following stewardship activities: community outreach (i.e. education about native plants and wildlife, tides, bluff safety, etc.), trash pick-up, trail maintenance, kelp wrack piling (see Section 4.4.2), and potentially non-native plant maintenance. The Beach Ambassador Program shall be discussed in future Parks and Recreation public meetings once the program is further developed.

Following the successful installation of the Restoration Program and the establishment of plant species, long-term maintenance is expected and shall be the responsibility of the City to implement. Though the Restoration Program is designed to be self-sufficient, the Project Site will likely require periodic checks and maintenance (i.e. weeding and plant replacement). Local NGOs will assist the City with this endeavor. The selected NGO shall manage maintenance crews that will hand-pull non-native and invasive species as the primary means of control. Foliar herbicide to control highly invasive species may be applied by a licensed herbicide applicator, and according to herbicide labels, City and California State Park's standards as a secondary means of control. Foliar applications involve spraying the leaves invasive species (including *Carpobrotus edulis*, *Cakile maritima*, and *Limonium* spp.) with a low concentration mixture of herbicide in accordance with label instructions. Only herbicide approved by the EPA, for use near water will be utilized. Herbicide shall only be utilized if invasive species proliferate at a rate beyond control by manual removal.

5.0 PROJECT SUCCESS

To evaluate performance, the City will monitor the Project area on a quarterly basis over the first three years of plant establishment, and biannually after that for the lifetime of trail system. Monitoring shall be conducted by visual inspection and shall be qualitative in nature. The success of the Project shall be evaluated on the following objectives:

- Native plant community is self-sustaining (supports itself with natural water and nutrient sources) and self-maintaining (successfully produces seedlings).
- Provides bluff stability based on visual observation of erosion (ruts and rivulets).
- Improves the Project site visually by adding long-lived woody and perennial native plant material to the site that will provide coverage and bloom opportunities throughout the year.

Beacon’s Beach Coastal Bluff Restoration Plan

- Provide an example to coastal bluff owners, encouraging the use of native plants for private bluff enhancements.
- Restoration accomplished in a reasonably timely fashion without restricting access.
- Provides maximum overall ecosystem benefits, providing regionally scarce habitat and potential for local ecosystem diversity.
- Meets or exceeds requests made by the public through public workshops to beautify and restore the site with native, visually stimulating species.
- Accomplishes natural carbon sequestration, per strategies identified in the City’s CAP.
- Improves coastal erosion, addressing risks related to sea-level rise, and implements coastal bluff improvements per strategies identified in the City’s CAP.

To measure how well the Project is meeting these objectives, a list of evaluation metrics have been designed and are listed in Table 6. These evaluation metrics will provide interim guidelines to help assure success of the restoration program and inform any adaptive management of the site that may be needed.

**Table 6
Performance Standards**

Year	% Survival of Plantings*	% Minimum Native Cover	% Max Allowable Non-native Weed Cover**
Year 1	90%	40	25
Year 2	90%	50	25
Year 3	80%	60	20

* Percent survival may include recruited plant species

** Percent non-native weeds are for annual non-native species. No perennial invasive species shall be allowed to persist.

Beacon's Beach Coastal Bluff Restoration Plan

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Beacon's Beach Coastal Bluff Restoration Plan

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Beacon's Beach Coastal Bluff Restoration Plan

Figure 1 (Placeholder)

Beacon's Beach Coastal Bluff Restoration Plan

Figure 2 (Placeholder)

Beacon's Beach Coastal Bluff Restoration Plan

Figure 3 (Placeholder)

Beacon's Beach Coastal Bluff Restoration Plan

APPENDIX A

**Operating Agreement for Moonlight and Leucadia State Beaches
California State Parks 2008**