

Vegetation Analysis and Management Plan For  
The Sutro Baths Site  
Golden Gate National Recreation Area



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LA 224- Vegetation Management  
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May 9, 1996


# Sutro Baths Location Map




## Golden Gate National Recreation Area

This map shows Golden Gate National Recreation Area and the status of lands within its authorized boundary. Also shown are neighboring public lands managed by a variety of local and federal authorities.

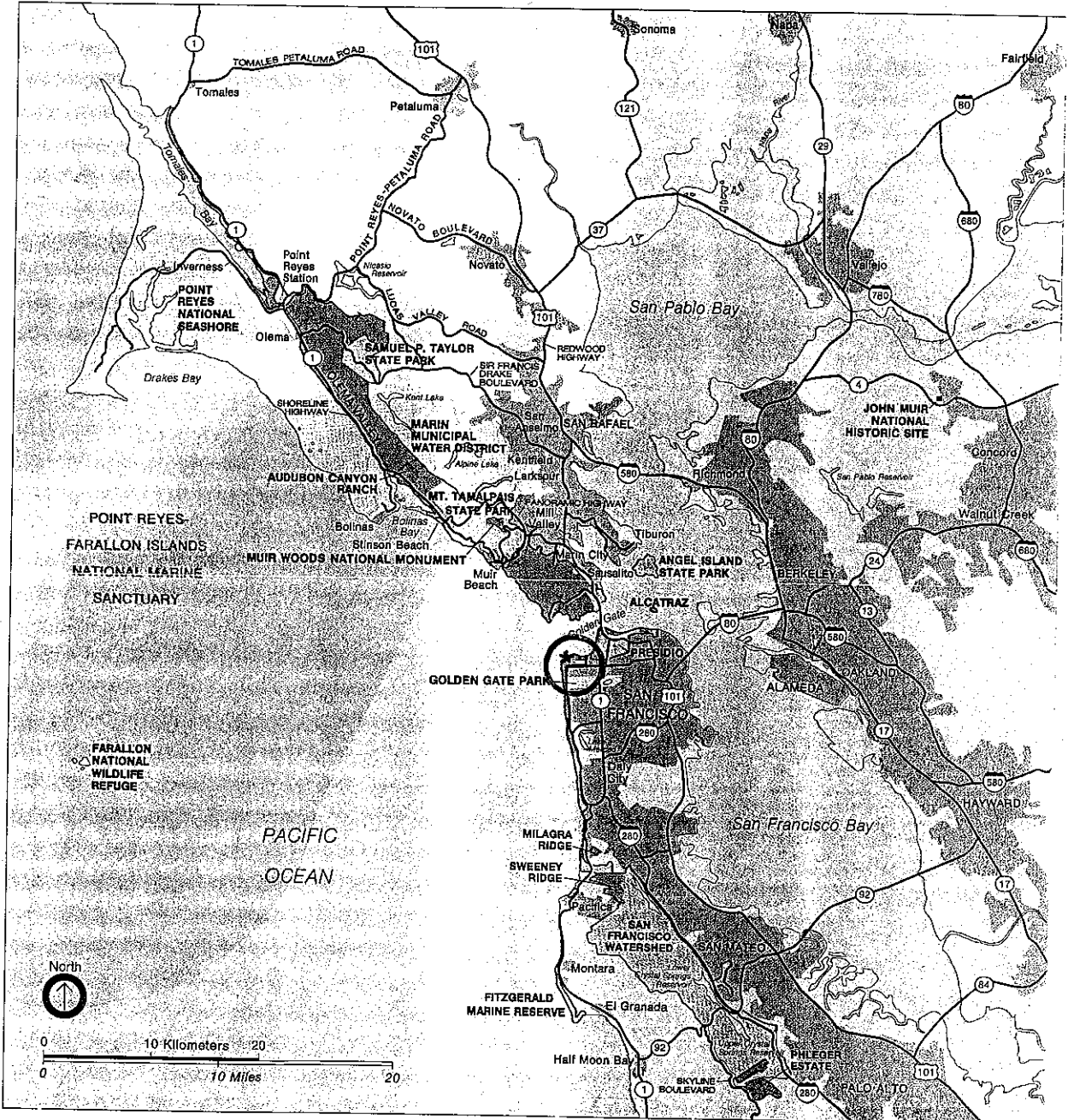
### Lands within authorized GGNRA boundary

-  Managed by National Park Service
-  Managed by other public agencies

 Private land  
 Various private lands within GGNRA's authorized boundary are in the process of acquisition. Check with park headquarters for current status of public lands.

- ### Other areas
-  Adjacent public area
  -  Urban area
  -  Point Reyes—Farallon Islands National Marine Sanctuary

The Point Reyes—Farallon Islands National Marine Sanctuary has been designated for the national significance of its biological resources. It is managed by the Sanctuary Programs Division of the National Oceanic and Atmospheric Administration in cooperation with the National Park Service.



Source: National Park Service, Golden Gate National Recreation Area map and informational leaflet

## *History of the Site*

The Sutro Baths ruins site is located in the Golden Gate National Recreation Area, in an area known as Lands End. This area is located on the northwestern tip of the city of San Francisco. In the late 1800s, after making his fortune mining the Nevada silver lode, engineering innovator Adolph Sutro had a vision for this area. He instructed workmen to blast out a catch basin for sea water and to build tunnels that would drain excess water in order to house a salt water aquarium. Shortly thereafter, he commissioned architects to build an ostentatious bathhouse by the sea. "A small place would not satisfy me," he said. "I must have it large, pretentious, in keeping with the environment, with the (Sutro) Heights, with the great ocean itself..."<sup>1</sup>

At a total cost of over a million dollars, the Sutro Baths were officially opened to the public in 1896. After purchasing a ticket, a visitor could walk down "...a noble staircase, wide, gradual of descent, bordered with broad-leafed palms, the flowering pomegranate, fragrant magnolias and the lance-like arms of the reaching maguey."<sup>2</sup> With this vision in mind, Sutro began the introduction of exotic plant species onto the Sutro bath site.

## *General Ecology of the Site*

The geological complex that underlies Lands End is known as the Franciscan complex. The complex, which is exposed at Lands End, includes seafloor scrapings of basalt and chert, and sedimentary sandstone and mudstone. In addition, sands from the Colma formation were added as dunes on top of the geologic base.

The flora of this exposed edge of the continent must be adapted to contend with harsher conditions than those inland. The dunes closest to shore are characterized by scarce moisture, high winds, and shifting sand. All species that live on the dunes themselves share certain characteristics, such as thick leaves to hold water, low growth to stay out of the wind, and extensive root systems that enable them to survive recurring burial under sand drifts. The rear dunes have a small amount of accumulating organic matter that forms enough soil and water to support taller, woodier, and more deeply rooted flora. The coastal bluffs contain more soil and water and can support heartier shrubs. In addition to the coastal scrub on site, runoff from the bluffs and water gathered in the ruins of the baths form two wetland areas in the bowl formed by the site.

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<sup>1</sup> Blaisdell, Marilyn, San Francisciana Photographs of Sutro Baths, 1987.

<sup>2</sup> Ibid.

### ***Vegetation Types Currently on Site***

The vegetation of the Sutro Baths site consists of a patchwork of units that are principally dominated by non-native species. The individual species in these units include those that were planted for erosion control and recreation, in addition to invasion and domination by weeds<sup>3</sup> and exotics from nearby residential gardens.

The "Existing Vegetation" figure on the following page shows the mosaic of vegetation units currently on the Sutro Baths site. The following section explains the species present in each vegetation unit. The letter "n" following the species indicates it is a native to this site, and the letter "e" following the species indicates it is exotic to the site.<sup>4</sup>

- **Marsh 1:**

Watercress	<i>Rorippa nasturtium-aquatica</i>	(n)
Sedge	<i>Carex spp.</i>	(n)
Silverweed	<i>Potentilla anserina</i>	(n)
Unknown		(e)
- **Marsh 2:**

Monkey flower	<i>Mimulus guttatus</i>	(n)
Horsetail	<i>Equisetum arvense</i>	(n)
Rush	<i>Juncus spp.</i>	(n)
Cala lily	<i>Zantedeschia aethiopica</i>	(e)
Iris	<i>Iris spp.</i>	(e)
Mattress vine	<i>Muehlenbeckia complexa</i>	(e)
Unknown		(e)
- **Herbaceous Mix:**

California blackberry	<i>Rubus vitifolius</i>	(n)
Coastal bush lupine	<i>Lupinus arboreus</i>	(n)
Cala lily	<i>Zantedeschia aethiopica</i>	(e)
Nasturtium	<i>Tropaeolum majus</i>	(e)
Wild radish	<i>Raphanis sativus</i>	(e)
Plume albizia	<i>Albizia distachya</i>	(e)
Unknown sapling		(e)
Unknown composite flower A		(e)
- **German Ivy Mix:**

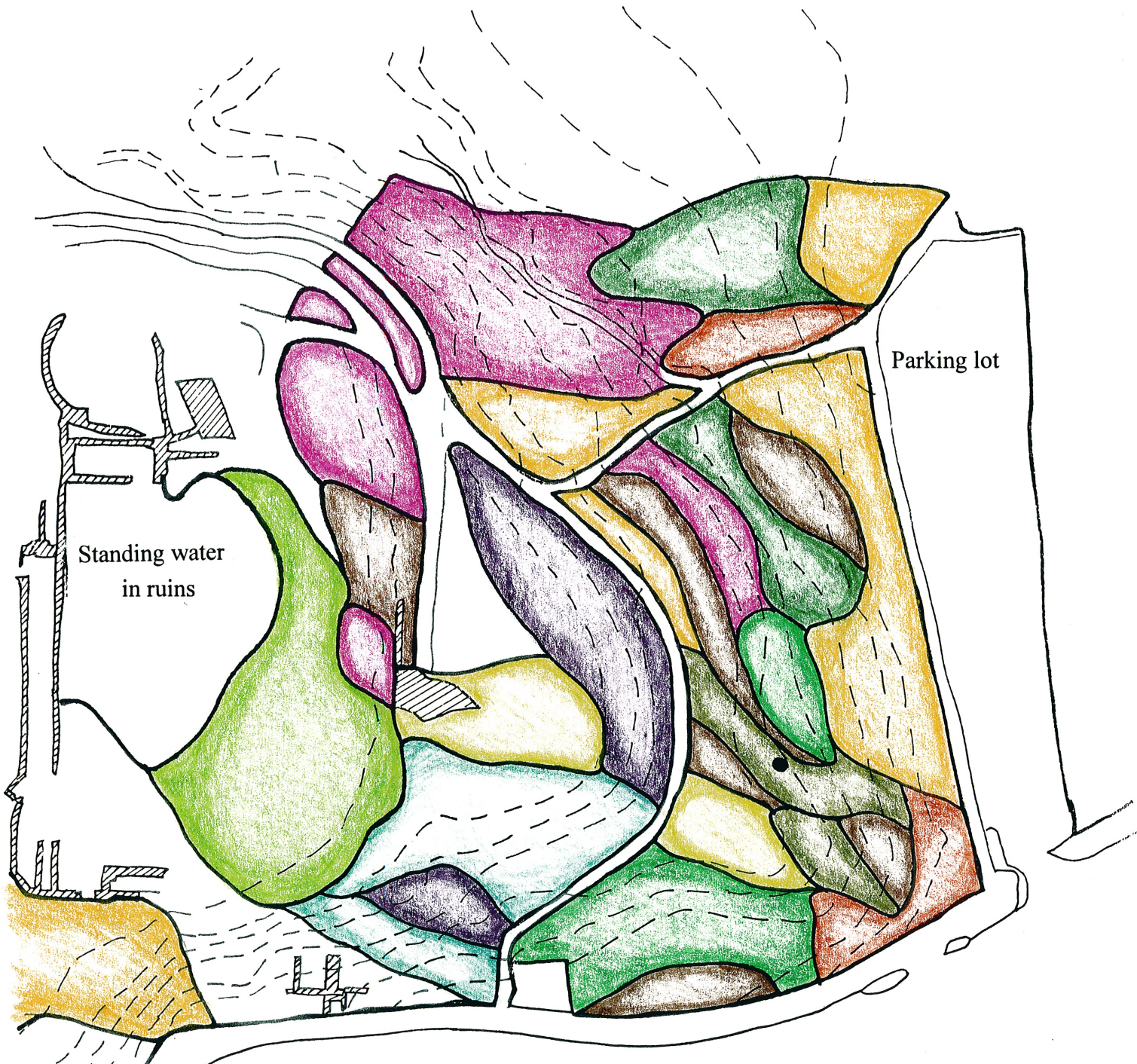
California blackberry	<i>Rubus vitifolius</i>	(n)
German ivy	<i>Senecio mikanioides</i>	(e)
Wild radish	<i>Raphanis sativus</i>	(e)
Plume albizia	<i>Albizia distachya</i>	(e)
- **Iceplant Mix:**

Iceplant	<i>Carpobrotus chilensis</i>	(e)
Sweet allyssum	<i>Lobularia martina</i>	(e)















<sup>3</sup> McBride, J. and Gerhard, D., Sutro Baths Vegetation Analysis, 1992, p. 1.

<sup>4</sup> Some species, such as Monterey cypress, may be native to California, but are marked (e) because they are not native to the site.





### Existing Vegetation

- |   |                              |   |                                |
|---|------------------------------|---|--------------------------------|
|  | Barren areas-includes paths. |  | Iceplant mix                   |
|  | Marsh 1                      |  | Forb/Grass mix                 |
|  | Marsh 2                      |  | Monterey cypress plantation    |
|  | Herbaceous mix               |  | Mattress vine                  |
|  | German ivy mix               |  | Plume Albizia mix              |
|  | Snag                         |  | Plume Albizia/Mirror plant mix |
|  | Sutro baths structural ruins |  | Mirror plant                   |



- Cheeseweed *Malva parviflora* (e)
  - Unknown composite flower A (e)
- Forb/Grass Mix:
  - California blackberry *Rubus vitifolius* (n)
  - Coastal bush lupine *Lupinus arboreus* (n)
  - Iceplant *Carpobrotus chilensis* (e)
  - Wild radish *Raphanis sativus* (e)
  - Wild oat *Avina fatula* (e)
  - Unknown composite flower A (e)
  - Unknown forb (e)
- Monterey Cypress Plantation:
  - Monterey cypress *Cupressus macrocarpa* (e)
- Mattress Vine: Mattress vine *Muehlenbeckia complexa* (e)
- Plume Albizia Mix:
  - Plume albizia *Albizia distachya* (e)
  - Sweet alyssum *Lobularia martina* (e)
  - Iceplant *Carpobrotus chilensis* (e)
  - Unknown composite flower A (e)
- Plume Albizia/Mirror Plant Mix:
  - Plume albizia *Albizia distachya* (e)
  - Mirror plant *Coprosma coronipifolia* (e)
- Mirror Plant: Mirror plant *Coprosma coronipifolia* (e)

## ***Historical Vegetation Analysis***

The vegetation of the area surrounding and including the Sutro Baths site has been subject to significant changes since pre-settlement times. These ongoing vegetative changes include the elimination of Native American controlled burns, introduction of grazing livestock and exotic plants, landscaping for recreation, tree planting for erosion control, and recreational use of the site.<sup>5</sup>

### ***Pre-Settlement Vegetation***

The pre-settlement vegetation on site consisted of Northern Coastal Bluff Scrub, Northern Foredune, and Central Coast Riparian Scrub. These communities were segregated along environmental gradients controlled by soil type, proximity to the sea and moisture availability. Local habitation by Native Americans may have also resulted in the clearing of some portions of scrub, but impacts from these activities were limited.<sup>6</sup>

### ***1888-1910 Vegetation***

Sutro's goals for the site included not only maximizing the extraordinary ocean vistas from the bathhouse grounds, but also creating a sheltered environment for the many beautiful flowers and trees he hoped to grow. He ordered species tolerant of drought and seaside conditions from as far away as the Black Sea coast and North Africa, hired gardeners and laborers to prepare the site, and installed a watering system powered by windmills. He also planted windbreaks of eucalyptus, cypress, and pine and built a glass conservatory for sensitive tropical plants.<sup>7</sup>

Sutro planted a cluster of trees called the Old Grove to act as a shady canopy over a lawn. Eight axial walkways radiated from the grove, surrounded by floral tapestries and sculpted hedges. One reporter of the time said that the garden at Sutro Baths would "...put to the blush many a site where the owner had naturally rich soil and natural shelter for his allies."<sup>8</sup>

In Sutro's day, native dune vegetation was seen as barren and undesirable. One visitor to the baths wrote, "The wilderness of sand has bloomed and blossomed into a scene of fairylike beauty. The air is redolent with fragrant shrubs and flowers, peace and calm and sunshine seem to reign perennially...Winding walks, fringed with beds of exquisite flowers, show bright and

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<sup>5</sup> McBride and Gerhard, p. 12.

<sup>6</sup> McBride and Gerhard, p. 13.

<sup>7</sup> Rubissow, Ariel, *Cliff House and Lands End: San Francisco's Seaside Retreat*, Golden Gate National Park Association, 1993, p. 29.

<sup>8</sup> Rubissow, p. 29.

sunny against the green of trees of every shade from the darkest to the lightest...Lawns whose tender and delicate green can compare with that of England..."<sup>9</sup> This quotation exemplifies the prevailing lack of respect or admiration for the local native vegetation, and the associated worship of imported exotics. Because of this attitude, exotics were encouraged to establish on the site, with eleven gardeners helping the exotic species to take a firm foothold.

Development of the gardens resulted in an overall area decrease in Northern Coastal Bluff Scrub and Northern Foredune Community. Areas of North Coast Riparian Scrub were eliminated east of the Baths. The combination of the establishment of Monterey Cypress communities, dominance of exotic species, and invasion of exotics as residential areas were built up resulted in major changes in vegetation on this site. Many of the common weeds currently on the site are common garden-variety weeds throughout the city. Additional species were planted for erosion control. The destruction of the Baths and the abandonment of the freshwater ponds led to the establishment of wetland vegetation types.<sup>10</sup> Much of the area that was once inhabited by the Northern Foredunes Community is in the wetlands area created by the ruins of the Baths. Under California and Federal law, all wetland communities must be protected.

### *Existing Vegetation*

Existing on site vegetation demonstrates the legacy of the site's colorful history. The site is almost exclusively inhabited by exotics at this time.

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<sup>9</sup> Rubissow, p. 29.

<sup>10</sup> McBride and Gerhard, p. 16.



## ***Recommendations for Management***

Because the site has been almost completely taken over by exotics, the best management prescription will be to remove all existing exotic vegetation and replace with native species. Re-establishment of native plant communities will allow for greater overall plant species diversity as well as providing habitat for native wildlife species. Indigenous endangered and threatened wildlife species, such as the California red legged frog and the bumble bee scarab beetle, will have a greater chance of survival once the native communities are re-established. The following sections detail the methods for removal of exotics and replanting of natives.

### ***Vegetation Removal and Erosion Control***

All exotic species should be removed from the *non-marsh areas* of the site following prescriptions stated in the Bradley method. The Bradley method is designed to minimize soil disturbance by removing exotics without the use of power equipment and only treating small areas at a time. Native species replanting should occur at the time of exotic removal. Following this method, the transition from exotics to natives should take approximately five years to complete. One fifth of each of the plant units that appear on the existing vegetation map should be treated each spring for five years. After the five year time period has elapsed and restoration has been completed, the site will be revegetated by native species. The Bradley method for removal and revegetation includes the following steps:<sup>11</sup>

- Remove one fifth of the exotic vegetation from each vegetation unit that appears on the existing vegetation map.
- Pick up the removed species and carry out of the site without dragging on the ground.
- Paint stumps of woody plants with herbicide to prevent root resprouting.
- Replant area of exotic removal with native species, as prescribed in the native vegetation restoration section of this document.
- Cover shrub seedlings with polyethylene plastic to control erosion and protect shrubs during early stages of growth. One mm black polyethylene should be cut in 3 foot squares with a 3 inch opening cut over the seedling hole. This method of erosion control will also reduce evaporation and soil temperature. Life expectancy of polyethylene squares is one year.<sup>12</sup>
- Repeat every spring for five years.

Removal of exotic vegetation from the marsh areas should be done by hand. All native species should be left in place. The native vegetation restoration section outlines the species that should be found after the restoration is complete.

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<sup>11</sup> McBride, Joe, personal communication, May 8, 1996; method taken from Bradley, J., *Bringing Back the Bush*, Landsdowne Press, 1988.

<sup>12</sup> US Environmental Protection Agency, *Erosion and Sediment Control Handbook*, California Department of Conservation, 1978.

### ***Native Vegetation Restoration***

The following paragraphs describe the native plant communities that will be recreated on the site. The following figure called "Native Plant Community Revegetation Plan" shows an overall site plan for the revegetation of the site, indicating plant community boundaries. Detailed planting plans for each plant community follow the site plan.

*Northern Foredune Community:* Conditions on the dunes closest to shore include a scarcity of moisture, high winds, and shifting sand, indicating an environment characterized by extremes in temperature, moisture availability, and wind velocity.<sup>13</sup> The species that find ways to flourish here share certain characteristics essential to their survival that include thick leaves to hold water, low growth to stay out of the wind, and extensive root systems that enable them to survive recurring burial under sand drifts.<sup>14</sup> Although these hardy pioneer species are well adapted to these harsh conditions, the species common to this vegetation type are not well adapted to competition with other plants. These dune species are generally replaced by other species in locations that offer some protection from the wind and more available moisture.<sup>15</sup> Periodic natural disturbance is necessary to maintain this plant community.<sup>16</sup>

The figure called "Typical Detail: Northern Foredune" outlines a typical planting plan and species composition for this plant community. The following list outlines the species that will be found in this community after restoration.

Coastal bush lupine	<i>Lupinus arboreus</i>
Beach sagebrush	<i>Artemisia pycnocephala</i>
Lizard tail	<i>Eriophyllum staechadifolium</i>
Sand verbena	<i>Abronia latifolia</i>
Beach primrose	<i>Primula</i>
Coastal strawberry	<i>Fragaria chiloensis</i>
Dune sedge	<i>Carex pansa</i>
Seaside daisy	<i>Erigeron glaucus</i>
Dune tansy	<i>Tanacetum camphoratum</i>
Mock heather	<i>Haplopappus ericoides</i>

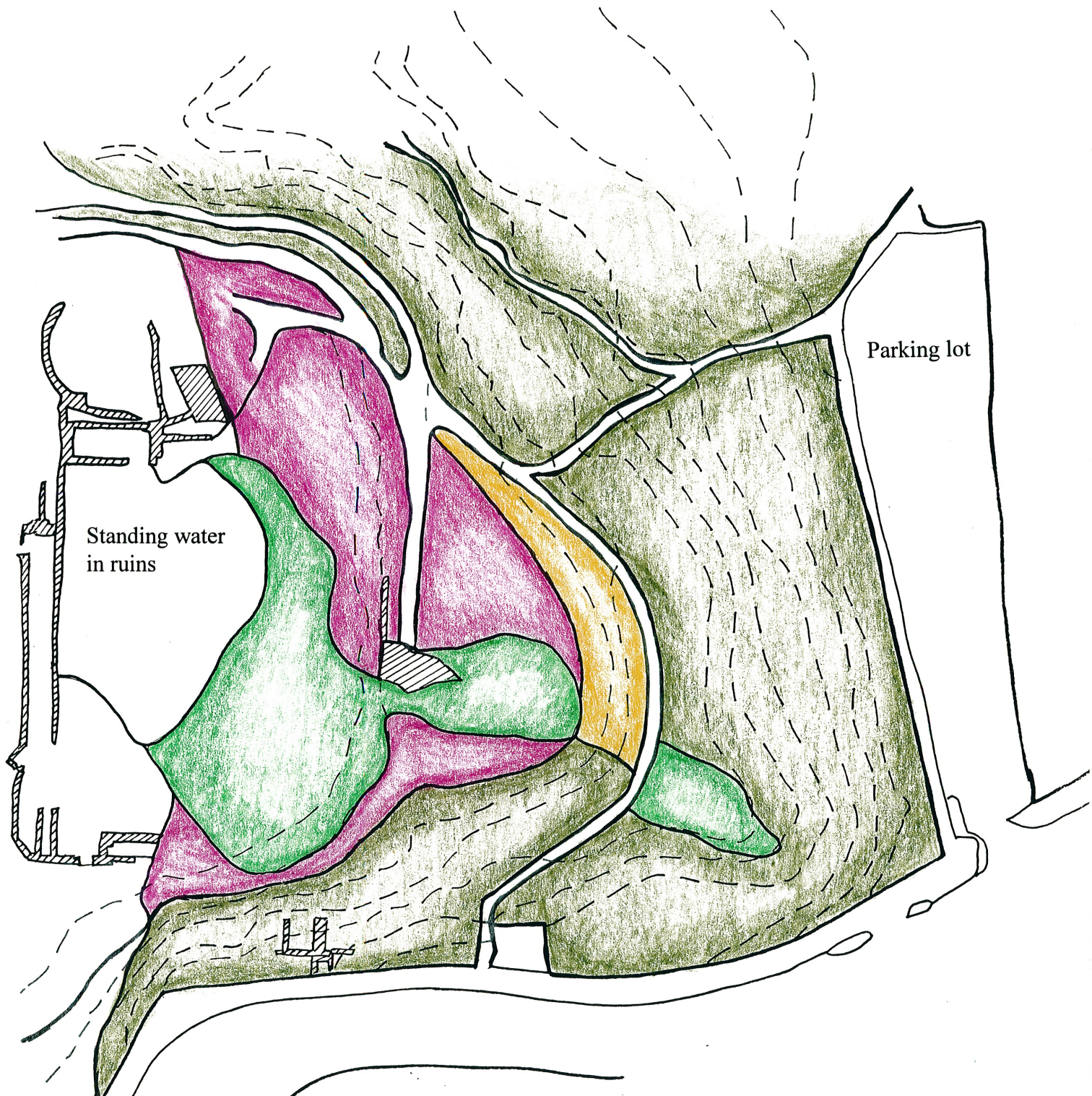
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<sup>13</sup> McBride and Gerhard, p. 2.






<sup>14</sup> Rubissow, p. 9.

<sup>15</sup> McBride and Gerhard, p. 2.

<sup>16</sup> Ibid.



## Native Plant Community Revegetation Plan

-  Northern Foredune
-  Northern Coastal Bluff Scrub- Sandy Soil
-  Northern Coastal Bluff Scrub- Clayey Soil
-  Coastal Marsh
-  Barren areas-includes paths





The planting recommendations for the Northern Foredune community as outlined in the detail figure are as follows:

- Total shrub cover should be approximately 20 percent.
- Total ground cover should be a *maximum* of 40 percent.
- Assumed mortality rate is 50 percent due to harsh conditions.
- Coastal bush lupine seedlings should be planted 2 feet on center, for a crown cover diameter of four feet. Seedlings should be at least 12 inches high.
- Beach sagebrush and lizard tail should be planted one foot on center. Seedlings should be at least 12 inches high.
- All other non-shrub species will be planted either individually or in small clusters of no more than 6 plants to account for the natural spreading of these species.

*Northern Coastal Bluff Scrub:* Dune scrub communities are generally located inland from pioneer dune communities and are successional older and more integrated. Because of their well-developed vegetative cover, dune scrub communities have more organic matter, retain more water, are more fertile, and have a lower salt content than soils of pioneer dune communities. Shade and litter from the vegetation also reduces the reflectivity and temperature fluctuation of the soil. Dune scrub communities have greater species diversity than pioneer dune communities, with taller and denser vegetation. Subshrubs and shrubs predominate the community.<sup>17</sup> This habitat is characterized by exposure to high velocity winds and salt spray.<sup>18</sup>

The substrate for this community can vary considerably.<sup>19</sup> The flatter areas and terraces of this site are characterized by sandier soils, and will host a different composition of species than the steeper, more clayey areas of the site. The origin of the sand substrate may be either former beaches or sand dunes deposited during the Flandrian transgression.<sup>20</sup> These areas will be dominated by bush lupine (80%), and about 10% each coyote brush and California sagebrush. Sedge will comprise the wet margins adjacent to drainage areas. The following is a list of characteristic species for this vegetation type. The following figure called "Typical Detail: Northern Coastal Bluff Scrub- Sandy Soil" shows a planting plan and species composition for this vegetation unit.

Coastal bush lupine	<i>Lupinus arboreus</i>
California sagebrush	<i>Artemisia californica</i>
Dwarf coyote brush	<i>Baccharis pilularis</i>
Sedge	<i>Carex spp.</i>

The planting recommendations for the Northern Coastal Bluff Scrub-Sandy soil community as outlined in the detail figure are as follows:

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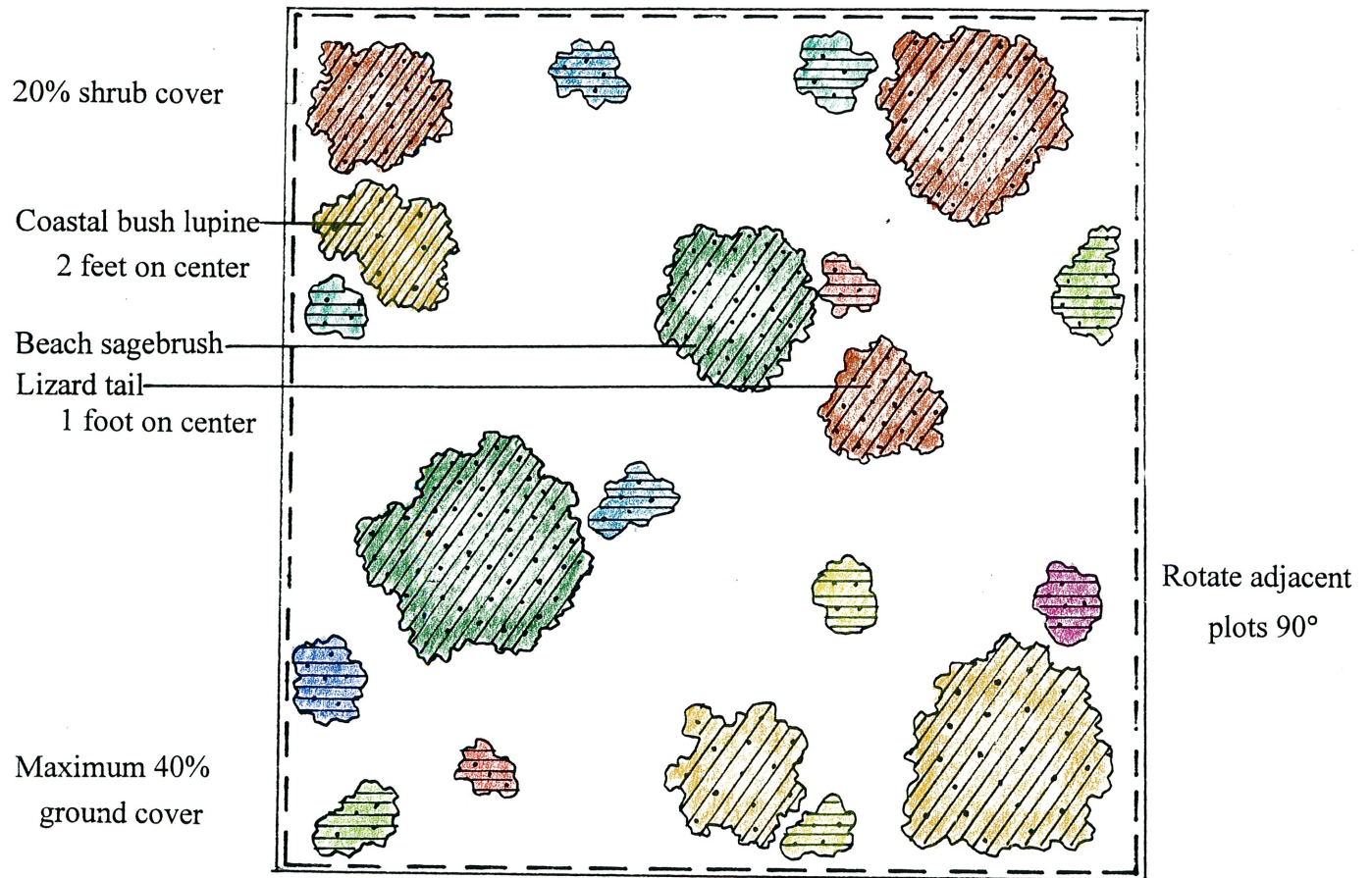
<sup>17</sup> Holland and Keil, p. 147.

<sup>18</sup> McBride and Gerhard, p. 4.

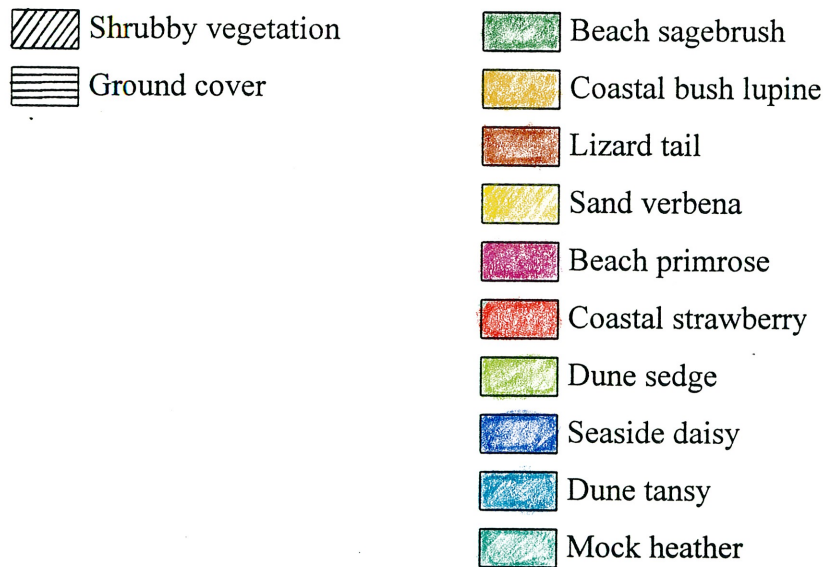
<sup>19</sup> McBride and Gerhard, p. 4.

<sup>20</sup> Ibid.





## Typical Detail: Northern Foredune



- Total canopy cover should be approximately 100 percent.
- *Salix spp.* should be planted in wet margins adjacent to wetland areas. Current year whips should be collected in January, and be at least 1/2 inch at the base and over 18 inches long. Planting depth should be 9-12 inches.<sup>21</sup>
- Assumed mortality rate is 50 percent due to harsh conditions.
- Coastal bush lupine, California sagebrush, and dwarf coyote brush should be planted 2 feet on center. Seedlings should be at least 12 inches high.

The steeper slopes, escarpments, and tops of bluffs on the site are characterized by a shallow mantle of clay texture soils.<sup>22</sup> Vegetation in these areas will be comprised of about 40% coyote brush, with the remainder comprised of equal parts coffeeberry, monkeyflower, and California sagebrush. To aid in poison oak suppression, California blackberry will comprise the wet margins adjacent to drainage areas. The following figure called "Typical Detail: Northern Coastal Bluff Scrub- Clayey Soil" shows the composition and planting plan for the areas of this vegetation unit as indicated in the revegetation plan. The following is a list of species that will be found in this vegetation unit after revegetation.

Dwarf coyote brush	<i>Baccharis pilularis</i>
Coffeeberry	<i>Rhamnus californica</i>
Monkeyflower	<i>Mimulus guttatus</i>
California sagebrush	<i>Artemisia californica</i>
California blackberry	<i>Rubus vitifolius</i>

The planting recommendations for the Northern Coastal Bluff Scrub-clayey soil community as outlined in the detail figure are as follows:

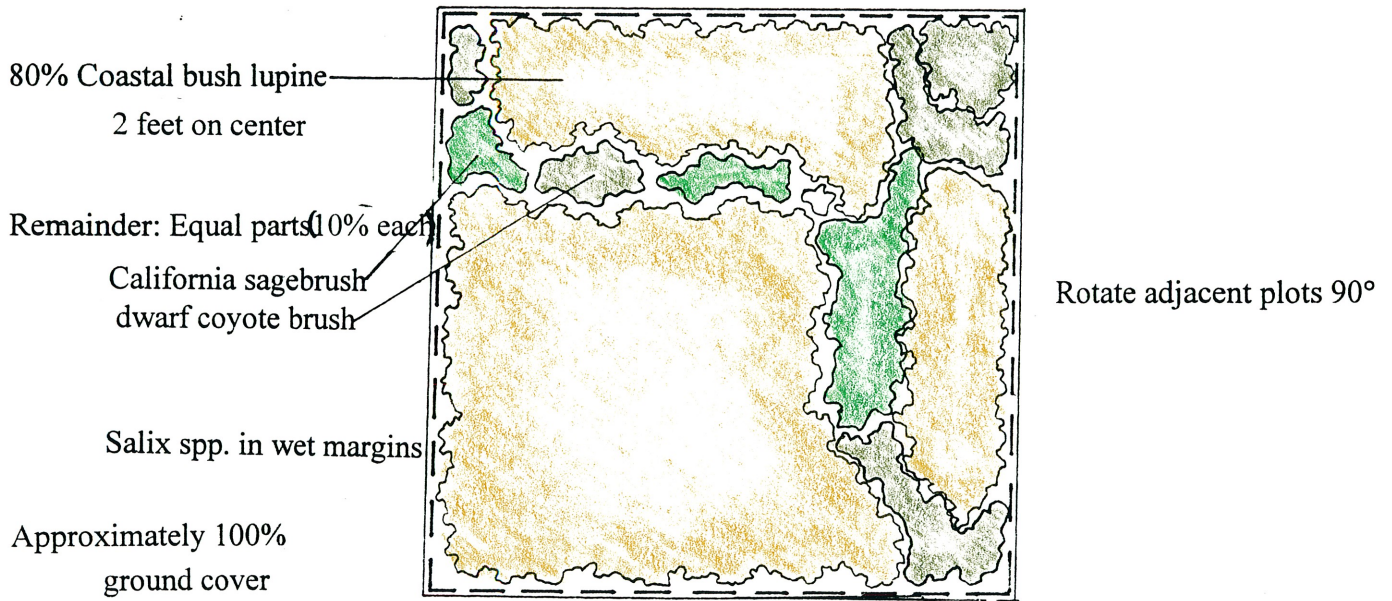
- Total canopy cover should be approximately 100 percent.
- California blackberry should be planted 4 feet on center in the wet margins adjacent to wetland areas to inhibit establishment of poison oak.
- Assumed mortality rate is 50 percent due to harsh conditions.
- Dwarf coyote brush, coffeeberry, California sagebrush, and California blackberry should be planted 2 feet on center. Coffeeberry seedlings should be at least 18 inches high. All other seedling should be at least 12 inches high.
- Monkeyflower seedlings should be planted 1 foot on center, with a minimum seedling height of 12 inches.

***Freshwater Marshes:*** Marshes occur in nutrient-rich mineral soils that are saturated through most or all of the year. These communities are best developed in locations with slow-moving or stagnant shallow water. As is the case with the Sutro Baths site, small marsh communities can occur on hillsides where seepage from springs has dampened the slopes. Marsh soils are often anaerobic, or nearly so. The low oxygen supply results from the presence of water in the soil that

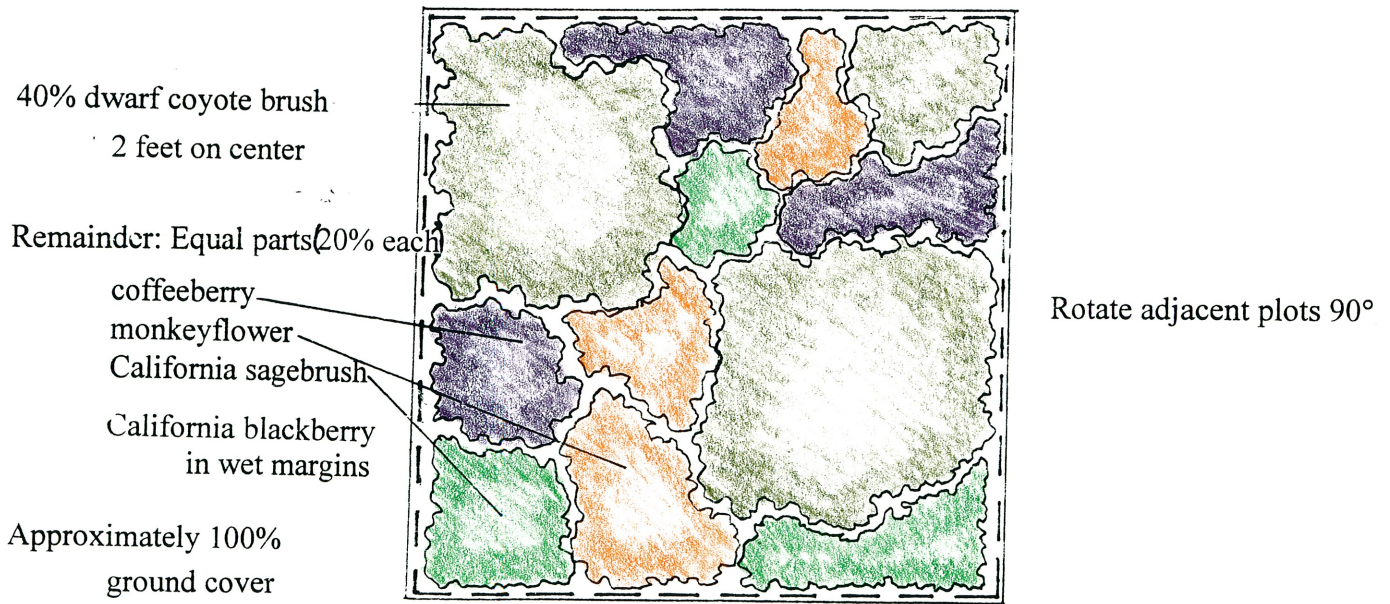
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<sup>21</sup> McBride, Joe, lecture notes, Landscape Architecture 224, March 12, 1996.

<sup>22</sup> Ibid.



### Typical Detail: Northern Coastal Bluff Scrub- Sandy Soil



### Typical Detail: Northern Coastal Bluff Scrub- Clayey Soil



fill the spaces among the soil particles, as well as the presence of organic debris that promotes the growth of bacteria and other microorganisms. Respiration of these decomposers greatly reduces the oxygen supply available to the roots and rhizomes of higher plants, and results in the production of toxic by-products and methane and hydrogen sulfide gasses.<sup>23</sup>

The dominant plants of freshwater marshes are mostly perennial monocots that can reproduce vegetatively by underground rhizomes. The stems of these plants are generally hollow or filled by aerenchyma, a porous tissue that allows gas exchange to occur between the exposed parts of the plants and their roots. In addition to the dominant monocots, some dicots are also commonly found in marsh communities.<sup>24</sup>

Characteristic plants to be found in this vegetation unit include:

Sedge	<i>Carex spp.</i>
Rush	<i>Juncus</i>
Monkeyflower	<i>Mimulus guttatus</i>
Watercress	<i>Rorippa nasturtium-aquaticum</i>
Silverweed	<i>Potnetilla anserina</i>
Horsetail	<i>Equisetum arvense</i>

The following outlines the management prescriptions for the coastal marsh community.

- One fifth of all exotics should be hand removed each spring for five years and should be hand carried without dragging.
- Only these listed native species should be allowed to remain in the marsh areas.
- There are no planting recommendations for the marsh communities. The natural revegetation process will determine the species composition on this site.

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<sup>23</sup> Holland and Keil, p. 440.

<sup>24</sup> Ibid.



## ***Long Term Monitoring and Maintenance***

The following section outlines techniques necessary for monitoring and maintenance of the re-established native plant communities on this site.

### ***Northern Foredune Community***

The plant species of this community have a low, often prostrate structure and succulent tissue that make them particularly vulnerable to trampling. Trampling by visitors to the site will damage the plants of this community.<sup>25</sup>

- Restored dune areas should be accessible only by boardwalks or pathways that are roped on both sides to ensure that visitors do not leave the path and trample the delicate plants.

Because the characteristic plants of this community are unable to compete with other plant species, attention should be given to eliminating exotics from this community.

- Each spring, all species exotic to *this community* should be removed by hand.
- If necessary, species native to the community should be thinned so that a maximum of 40% ground cover is maintained.

### ***Northern Coastal Bluff Scrub-Sandy Soil***

- Each spring, all exotics that have invaded should be hand weeded using prescriptions described in the Bradley method.
- Yearly exotic removal from revegetated areas should begin the first year following revegetation, including during the first five years when revegetation is still occurring.

### ***Northern Coastal Bluff Scrub-Clayey Soil***

- Each spring, all exotics that have invaded should be hand weeded using prescriptions described in the Bradley method.
- Yearly exotic removal from revegetated areas should begin the first year following revegetation, including during the first five years when revegetation is still occurring.
- California blackberry in the wet margins should be thinned so that it remains solely along the edges of the wetland areas.

### ***Coastal Marsh***

- Exotics should be removed as per the Bradley method over a period of five years.
- Each spring, all exotics that have invaded previously cleaned areas of this community should be hand weeded using prescriptions described in the Bradley method.

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<sup>25</sup> McBride and Gerhard, p. 2.

### ***References***

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11. National Park Service, Golden Gate National Recreation Area map and leaflet, United States Department of the Interior, 1995.
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