

City of Mountain View
Public Works and Community Services Departments



**2012 SHORELINE BURROWING OWL
PRESERVATION PLAN**



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**DRAFT BURROWING OWL PRESERVATION PLAN
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EXECUTIVE SUMMARY

The City of Mountain View has long recognized the importance of having burrowing owls at Shoreline at Mountain View (hereafter, Shoreline or the Park) and over the years has implemented numerous measures to protect birds. Prior to 1998, when landfill maintenance projects were implemented near nesting burrowing owls, the City contacted the California Department of Fish and Game (CDFG) to obtain a mitigation permit for each project. At the time, the City recognized not all projects could be planned with adequate time to obtain a CDFG mitigation permit and that each request could consume City and CDFG staff time. In 1998, the City developed the Burrowing Owl Management Plan for Shoreline at Mountain View, Vista Slope and Crittenden sites to promote burrowing owl protection by meeting regulatory requirements and avoiding impacts to birds when performing maintenance activities.

In the past 12 years, since the 1998 Burrowing Owl Management Plan, burrowing owl populations in the Bay Area, including the Park, have dropped to such low levels that the Bay Area population is at risk of completely disappearing (Albion Environmental, 2010). Monitoring of burrowing owls over the years indicates two primary problems for the owls at the Park: (1) poor foraging habitat quality; and (2) frequent, large-scale ground disturbances related to landfill maintenance to comply with stringent closed landfill regulations. Data from numerous studies at the Park indicate the number of chicks produced per successful nest is at a level adequate to sustain the population, but the number of nests in the Park is too low given the available area. Two key approaches to increasing the number of successful nests are to: (1) improve the quality of nesting habitat so that more birds nest and more nests survive disturbances; and (2) improve the quality of foraging habitat, especially during the nesting season, so that there is enough food to rear large numbers of healthy fledglings.

Central to improving nesting and foraging conditions is to ensure ground disturbances are kept to a minimum to protect nests and foraging habitat. Monitoring shows that large areas of the Park are disturbed every year for required landfill maintenance. While maintenance is essential, project planning can significantly reduce the impacts of these operations and enhance burrowing owl habitat quality in the Park. Habitat protection and landfill operations are to be coordinated for the benefit of both.

Given the changes since 1998, the Mountain View City Council voted to update the 1998 Burrowing Owl Management Plan and change the name to "Burrowing Owl Preservation Plan" (the Plan). In the past, owl management at Shoreline has focused on avoiding impacts to nesting owls from the Park operations and meeting the requirements of wildlife laws. Such management is important to ensure no wildlife laws are violated and for providing a way for the Park projects to proceed without constant intervention by the CDFG. However, it is clear that preserving the owl population requires a holistic, proactive approach to understand the population trends and meet population needs.

The Plan describes an adaptive management approach to preserving burrowing owls based on setting goals, implementing actions to achieve those goals and monitoring the results of actions and then, if goals are not met, revising actions based on consultation with burrowing owl experts and Park managers to determine what actions could be taken to improve conditions for burrowing owls. As with the previous plan, this document also provides procedures for meeting wildlife laws and regulations without the City having to consult CDFG on every action taken at the Park that has the potential to harm burrowing owls. The Park is a 750-acre regional park with 442 acres of landfill cells and approximately 438 acres of suitable owl habitat. Based on the ecology of owls and research on the population parameters of owls in Shoreline and the region, the following are measurable Burrowing Owl Population Goals that, if met, indicate a healthy population:

Population Goal 1. An average breeding season population of at least 10 pairs of owls. This measure is based on the assumption that approximately 30 acres of habitat will support a pair of owls. This is a target with a goal of more pairs, if possible. Achieving greater numbers would demonstrate greater success.

Population Goal 2. Nest success is approximately 50 percent to 75 percent. This measure is based on research indicating that low nest success is contributing to population declines in the region.

Population Goal 3. Pairs fledge an average of three chicks per pair each year. This measure is based on the estimate that only one chick of three survive to the next year. In a five-year life span, a pair would produce five surviving chicks.

Habitat Goals to promote high-quality habitat for burrowing owls include:

- Habitat Goal 1. Manage and maintain at least 300 acres of medium- to high-quality habitat throughout the Park:
- a. Approximately 100 acres should be high-quality nesting habitat managed to keep grasses low, to keep predators under control and to provide "foraging islands" within nesting habitat.
 - b. Approximately 100 acres should be managed for high-quality foraging habitat, promoting populations of large insects and small rodents sufficient to support at least 10 pairs of owls during the breeding season.

- c. Approximately 100 acres should be managed for medium-quality nesting and/or foraging habitat.

Habitat Goal 2. Maintain healthy populations of ground squirrels throughout the Park, in both nesting and foraging habitat.

Habitat Goal 3. Successfully protect and manage a burrowing owl preserve.

The Plan describes 10 Owl Management Actions designed to achieve these population and habitat goals (Section IV). A central theme of these actions is to actively manage nesting and foraging habitat throughout the Park. One key component is that land disturbances required to meet landfill regulations should be performed such that these preventive maintenance operations result in extending the life of the repair to minimize the frequency of corrective actions needed in the repair. Specific Owl Management Protocols given in Section V are referenced when more detailed instructions are needed. The Actions are:

Action 1. Officially delineate and manage a burrowing owl preserve in Shoreline.

Action 2. Manage other areas for burrowing owls outside of the preserve, in accordance with the Shoreline Burrowing Owl Preservation Plan.

Action 3. Protect burrowing owls from project impacts.

Action 4. Actively control predators, especially nonnative and nuisance species.

Action 5. Develop a volunteer program with Santa Clara Valley Audubon Society (SCVAS).

Action 6. Monitor population and habitat conditions to assess progress toward goals to make changes, as appropriate to achieve population and habitat goals.

Action 7. Review implementation effectiveness of burrowing owl management action with SCVAS.

Action 8. Submit an annual report to CDFG on progress in implementing the actions and achieving the goals.

Action 9. Employ a full-time biologist with owl expertise.

Action 10. Encourage local universities and/or other researchers to conduct research that helps Shoreline staff preserve the burrowing owl population at the Park.

These 10 Owl Management Actions are designed to help preserve the burrowing owl population at the Park by addressing problems with low-quality nesting and foraging

habitat, regular/large-scale ground disturbance, human intrusion, lack of adequate burrows and an abundance of predators.

The Plan begins by giving background information about the Park and the purpose of the Plan. Section II gives an overview of the regulatory framework that applies to burrowing owls. Section III summarizes burrowing owl ecology, especially nesting and foraging requirements, and gives a thorough summary of burrowing owl population numbers at the Park over the years. This section also describes in detail conditions at all terrestrial areas of the Park, the extent to which burrowing owls have used those areas over time and the factors degrading those habitat areas. Given the information in these sections, the adaptive management plan for preserving the owl population at the Park is laid out in Section IV, including population and habitat goals and actions for achieving the goals. Section V gives protocols; i.e., more specific implementation direction/recommendations, on issues such as managing owl habitats and protecting squirrels and owls from project impacts. A list of these recommendations is found in Appendix A. Appendix B summarizes the Plan's measures for burrowing owl protection specific to landfill maintenance and to golf course maintenance, two major land uses in the Park.

I. INTRODUCTION

A. Need and Purpose for this Plan

This document provides a guide to the long-term preservation of burrowing owls (*Athenecunicularia*) at Shoreline at Mountain View in the City of Mountain View in the context of the other uses at Shoreline.

Shoreline at Mountain View is a 750-acre wildlife and recreation area owned and operated by the City of Mountain View. According to the 1996 Shoreline/Vista Slope Land Use Master Plan, "Shoreline at Mountain View is a distinctive regional wildlife and recreation area which focuses on wildlife habitat preservation, open spaces and passive uses for the public, to the degree that it is economically feasible to do so." The 1996 Shoreline/Vista Slope Land Use Master Plan envisioned future uses of the Park would focus on native plants, facilities to support passive recreation and the "peaceful, restful spirit of the Park," and circulation that is not "disruptive to wildlife." The Specific Natural Resources Goals in the 1996 Shoreline/Vista Slope Land Use Master Plan include:

- "Develop and maintain buffer zones between natural habitat and public use areas and a system of wildlife corridors which link various habitat.
- Create management and educational guidelines to focus enhancement on "target species" and to preserve wildlife habitat value while optimizing public use.
- Develop and provide periodic review of current habitat enhancement and related park management policies, practices, rules and regulations."

The vision and goals for Shoreline show the City's commitment to maintaining and improving wildlife habitat for the long term.

Shoreline has a variety of habitats supporting a large number of species. Approximately 220 acres are wetlands, ponds and a small boat sailing lake. These wetlands support dozens of waterbird species and have helped to make Shoreline one of the best birding sites in the Bay Area. Approximately 530 acres is upland habitat, much of which is located over closed landfill. This terrestrial habitat is dominated by nonnative grasses and plants, but has been attractive to the burrowing owl, a Special Status Species, and a "target species" at Shoreline for over 20 years. Approximately 438 upland acres are high-to moderate-use owl habitat, especially the unirrigated grassland and golf course. Miles of trails and other recreational opportunities allow people wildlife viewing and passive recreation. These features and the wildlife

attract over 1 million visitors a year to the Park. Human uses adjacent to Shoreline include office parks and the Shoreline Amphitheatre, a 20,000-seat entertainment venue.

While landfill at Shoreline was officially closed and closure was certified in 1996 by the regulatory agencies, closed landfill operations and maintenance operations are one of the major activities in the Park to keep the closed landfill in compliance with Federal, State and local regulations. Sections of landfill regularly settle, creating cracks and depressions which fill with water in the landfill's soil cap that can release landfill gas. Both conditions—standing water and cracks in the landfill cap—violate regulatory requirements and must be rectified. Landfill regulations require continuous operation of landfill gas collection system consisting of 271 landfill gas collection wells and miles of pipes underlying the site to avoid release of harmful gases to the environment. Maintenance and corrective action often requires dirt moving, filling, vehicular traffic and other associated disturbances which degrade and destroy habitat. Required landfill maintenance activities are a primary factor degrading upland habitat at Shoreline for species such as the burrowing owl. The protection of burrowing owls in the context of landfill maintenance has been a major, long-term challenge.

For over 20 years, burrowing owls (*Athene cunicularia*) have been year-round residents at Shoreline. Burrowing owls, a unique and appealing species of owl, live and nest underground. They are active during the day and forage both day and night. They often live in close proximity to people in areas such as golf courses, airports and open parklands (Trulio and Chromczak, 2007). The burrowing owl is a State Species of Special Concern (SSC) and a national Bird of Conservation Concern (USFWS 2008). The owl population in Santa Clara County has been declining for the past 30 years and now fewer than 70 birds are estimated to reside in the entire County (Albion Environmental, 2010). Shoreline at Mountain View is one of the last areas in the County supporting burrowing owls and, as such, is an extremely important habitat for this bird.

The City of Mountain View has long recognized the importance of having burrowing owls at Shoreline and over the years has implemented numerous measures to protect birds in the Park, including employing a part-time burrowing owl expert and developing artificial burrows. In 1998, the City developed the Burrowing Owl Management Plan for Shoreline at Mountain View, Vista Slope and Crittenden sites to promote burrowing owl protection during maintenance activities by focusing on meeting regulatory requirements and avoiding impacts to birds. Knowledge about the owls in the Park has advanced and operations, such as landfill maintenance, have

increased due to stringent new regulations, which should allow habitat protection and operations to be coordinated for the benefit of both.

Recognizing the need to update the 1998 Burrowing Owl Management Plan for Shoreline, on May 18, 2010, the Mountain View City Council directed staff to update the management plan and change the name from "Burrowing Owl Management Plan" to "Burrowing Owl Preservation Plan." A proactive preservation approach will result in a plan that takes a longer, more holistic view and will be more likely to maintain owls in the Park for the long term. This Burrowing Owl Preservation Plan offers goals and actions that the City can implement which, in the context of Shoreline's mission and uses, as well as the Bay Area context, will have the greatest possible potential for maintaining a population of burrowing owls at Shoreline at Mountain View for the foreseeable future. As with the previous plan, this document provides a guide for meeting wildlife laws and regulations without the City having to consult the CDFG on every action taken at the Park that has the potential to harm burrowing owls. By including procedures that ensure, to the satisfaction of the CDFG, that wildlife regulations are followed without agency interaction on each project, this plan saves the City and the CDFG the time and expenses involved in agency negotiations.

B. Habitat Needs of the Western Burrowing Owl

General

The Western Burrowing Owl (*Athene cuniculariahypugaea*) is a native of open grassland habitats west of the Mississippi, north into the prairie provinces of Canada and south into northern Mexico (Haug, *et al.*, 1993). This small owl, only 9" tall, is migratory throughout much of its range, although many birds stay in California year round. This unique owl does not hoot, is active day and night, and is the only species of owl that lives and nests underground. Owls in our region do not dig their own burrows but depend on California ground squirrels to dig burrows for them. Owls and squirrels often live in the same colonies together—although not in the same burrows. Burrowing owls are well known for their site tenacity, the behavior of staying at chosen nesting burrows even in the face of nearby disturbances to those burrows. They also exhibit site fidelity, returning to the same nesting burrows year after year (Zarn, 1974).

Burrowing owls reproduce in the spring and summer. In our region, birds pair up beginning in February and lay their eggs underground; chicks begin emerging in late May. Young stay with their parents into the fall, when they molt and begin to disperse. Young burrowing owls are reproductive by the next year. Pairs typically have one clutch per season.

The Western burrowing owl is migratory throughout much of its range, but birds will reside in parts of California, including Santa Clara County, year round. Resident birds will move from nesting burrows used in spring and summer, to other nearby burrows in fall and winter. Birds often return to nesting burrows used in previous years. Birds live an estimated five years.

Nesting

Important elements of high-quality nesting habitat are availability of burrows, short vegetation and perches. Burrow availability is crucial for burrowing owl survival as owls are dependent on semifossorial mammals to dig their burrows, and owls are seldom found in areas unoccupied by burrowing mammals (Zarn, 1974; Haug, *et al.*, 1993). The California ground squirrel (*Spermophilus beecheyi*) is the main burrowing mammal in Santa Clara County providing burrows for owls; thus, maintaining a healthy population of ground squirrels is essential for providing sufficient burrows for owls. Burrows are used by squirrels and owls to escape predators, hide during inclement weather and as nests for raising young. California ground squirrels are a keystone species in California grassland habitats due to the fact that they play a crucial role in the functioning and survival of grassland ecosystems and species survival. Their burrows aerate the soil and any organic material they take into the burrows provides nutrients for plant growth. Many species other than burrowing owls use the burrows of California ground squirrels, including tiger salamanders, frogs, lizards, snakes, spiders, insects and rodents. Ground squirrels, in turn, are important prey species for coyotes, foxes, hawks and eagles, although they are not typical prey for burrowing owls. Burrowing owls and California ground squirrels have a weak mutualistic relationship in which each species benefits the other. Thus, these two species easily cohabit in colonies, but use separate burrows.

Burrow availability can be increased by installing dirt mounds that will attract ground squirrels or by the use of artificial burrows (Trulio, 1997). Smith and Belthoff (2000) recommend artificial burrows include a nesting chamber with a floor space greater than 900 cm² and 10 cm diameter tunnels. Areas with higher densities of burrows are usually preferred by owls. Trulio (1999) found that in fields in northern Santa Clara County, California, not occupied by owls, there was an average of 7 burrows per acre, while the average number of burrows within a 24' radius of an occupied owl burrow was 197.5 burrows per acre.

Short vegetation and open terrain afford the owls a good view and are also essential nesting habitat qualities. Green and Anthony (1997) reported that

owls select burrows that have approximately 55 percent bare ground and less than 15 percent shrub cover. Trulio (1997) concluded that owls at Shoreline at Mountain View and Moffett Airfield used short-grass habitat in proportion to its availability and, when owls nested in burrows in tall grass, it was usually on a mound or levee. At Moffett Airfield the average vegetation height around owl burrows was 5.6" and the average vegetation cover was 44 percent compared to areas with no owls, where the average vegetation height and cover was 10.4" and 85 percent. Short vegetation is crucial during the start of the breeding season, which extends from March to September in Northern California. A sufficient population of ground squirrels can be effective at keeping vegetation low. In areas without enough grazers or regular fire, mowing is a common mode of vegetation control, either via tractor mowers or hand-held weed whackers (Trulio, 1997).

Burrowing owls frequently use short perches near their burrows to search for danger and food (Green and Anthony, 1997). Artificial perches have been a successful management tool in attracting burrowing owls to areas and helping them detect predators and also increase hunting ability (Sheffield, 1997). Green and Anthony (1997) found that when the average vegetation height was 2" to 6", owls choose burrows near an elevated perch. They recommend the installation of artificial perches between 2' to 6' tall at active burrows when natural perches are absent.

Predation is a major factor in adult and juvenile survival. Burrowing owls have many predators, both on the land and in the air (Haug, *et al.*, 1993). Tall perches attract large birds of prey, such as hawks and larger owls, and tall vegetation hides terrestrial predators such as snakes, cats and foxes. In areas where owls use burrows, short vegetation, no tall trees/perches and short perches for owls will help owls evade predators year-round.

Foraging

Burrowing owls are opportunistic and generalists when it comes to their dietary requirements (Haug, *et al.*, 1993), with local conditions such as floral and faunal composition affecting both the relative proportion and diversity of species that are preyed upon (Zarn, 1974). Most owls forage relatively near their burrows (Haug, *et al.*, 1993). Insects and rodents make up the bulk of most burrowing owls' diets. Many researchers have documented the importance of rodents in the burrowing owl diet, especially with respect to successful reproduction (York, *et al.*, 2001).

For avian species, resource availability is especially important in the breeding season (Strong, Rimme and McFarland, 2004). Several studies have confirmed the importance of rodents in the diet of burrowing owls, especially

in increasing the rates of breeding success (Wellicome, 1994; York, *et al.*, 2001; Haley, 2002).

Rodent habitat requirements vary from species to species, but the main consensus among researchers that habitat heterogeneity is essential to healthy rodent populations (Ostfeld and Klosterman, 1985). Fragmented habitats, in general, support fewer species of rodents (Bolger, *et al.*, 1997). Unmowed/ ungrazed habitat had the highest density of small mammals compared to mowed/ grazed areas (Adams, 1984; Jones, Bock and Bock, 2003). Bolger, *et al.* (1997), found that over half of the urban fragmented habitats they assessed supported fewer populations of native rodents than unfragmented habitat. Adams (1984) found very low small mammal densities in mowed areas, while Moulton, Brady and Belthoff (2006) found that rodent prey species at owl burrows near irrigated sites was greater than around burrows in nonirrigated agricultural sites. Jones, *et al.* (2003), found small rodents in significantly greater abundance in areas with the most cover and tallest vegetation. Small mammal density is very low in mowed vegetation versus tall vegetation and, in one study, the author concluded that the small mammal density in a mowed area was one-half the density of an unmowed area (Adams, 1984).

Invertebrates are the other major portion of burrowing owl diets. The availability of invertebrates is based on habitat qualities such as habitat size, vegetation cover and vegetation type. Bolger, *et al.* (1999), found a decline in arthropod diversity and abundance over time in fragmented urban habitats in California. They also found that *Dermaptera* (earwigs) increased in abundance in smaller, older fragments. *Dermaptera* were the most common prey species numerically in the owl's diet at the Park. However, urban areas with irrigation and a diversity of vegetation can increase invertebrate abundance, thus increasing owl numbers that feed on the invertebrates (Wesemann and Rowe 1987; Millsap, 1999). Intensive management practices on golf courses maintain the vegetation very short and this practice will lower invertebrate richness and biomass. Giulio, Edwards and Meister (2001) found that insect diversity was greater in meadows mowed once or twice per year as opposed to meadows mowed more than two times per year.

C. Status of the Western Burrowing Owl

The western burrowing owl is declining throughout much of its range (Sheffield, 1997). In Canada, it is an endangered species and is state-listed as endangered in Minnesota. The bird has no official status under the Endangered Species Act, but is a national Bird of Conservation Concern (USFWS, 2008) because of population declines; the burrowing owl nests and birds are protected under the Federal Migratory Bird Treaty Act. In California, it is a State Species of Special Concern. In addition to CDFG codes

that safeguard birds of prey such as burrowing owls, Species of Special Concern status legally protects burrowing owls and their nests. In California, burrowing owl populations are threatened by destruction of burrowing mammals, especially California ground squirrels, that are essential for providing nest sites for burrowing owls (Haug, *et al.*, 1993), as well as habitat loss due to development by humans (Trulio and Chromzak, 2007). Lack of prey is also a key factor in low population and reproduction numbers (Wellicome, 1994; Haley, 2002).

The burrowing owl has been designated a California Species of Special Concern due to diminishing habitats and population declines (CDFG, 1995). DeSante, *et al.* (2007), estimated the population of owls in California at 9,266 pairs in the early 1990s, 71 percent (6,571 pairs) of which lived in the Imperial Valley. The Bay Area supports approximately 2 percent to 3 percent of the State population.

II. REGULATORY FRAMEWORK

The 1998 Burrowing Owl Management Plan focused on meeting wildlife agency regulatory requirements as a way to protect burrowing owls while also meeting the proscriptions of regulations governing landfill maintenance.

The regulations, agreements and policies that protect burrowing owls and, in some instances, their habitat, are briefly summarized below. In general, any action that could harm burrowing owls or disturb nests during the breeding season is illegal unless permitted by the appropriate regulatory agency.

A. Federal Regulations

The burrowing owl is protected under the Federal Migratory Bird Treaty Act (16 USC, Sections 703 to 711), which prohibits the "taking" of any migratory bird or body parts, nests, eggs or products. The species has no official Federal status under the Federal Endangered Species Act, although it is a national Bird of Conservation Concern (USFWS, 2008), due to declining populations.

B. State of California Regulations

Under the California Endangered Species Act, the burrowing owl is a State Species of Special Concern based on both localized and State-wide population declines as well as losses of suitable habitat (CDFG, 1995). Under California Fish and Game Code, Section 1802, the CDFG is the agency manager and trustee of fish and wildlife resources and their habitat.

Burrowing owls, as birds of prey, are protected by California Fish and Game Code Section 3503.5, which prohibits the taking, possession or destruction of birds of prey, their nests or eggs. For this reason, any impacts to burrowing owls during the breeding season (February 1 to August 31) are in violation of this code, unless approved by the CDFG. Any disturbance that results in nest abandonment and/or loss of reproductive efforts (e.g., killing or abandonment of eggs or young), or the loss of habitat is considered a "taking" and is potentially punishable by fines and/or imprisonment.

The California Environmental Quality Act (Guidelines, Section 15380, Subsections b and d) requires evaluation of project impacts to Species of Special Concern, such as burrowing owls. Specifically, California Environmental Quality Act (CEQA) requires a "mandatory finding of significance" if impacts to rare, threatened or endangered species are likely to occur. Mitigation must be provided to offset any impacts to the species or its habitat. To be legally adequate, mitigation measures must be capable of "avoiding the impact altogether by not taking a certain action or parts of an

action"; "minimizing impacts by limiting the degree of magnitude of the action or its implementation"; "rectifying the impact by repairing, rehabilitating or restoring the impacted environment"; "reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action"; or "compensating for the impact by replacing or providing substitute resources or environments" (Guidelines, Section 15370).

Impacts to burrowing owls that require mitigation include the loss/ degradation of burrowing owl breeding and/or foraging habitat and potential "take" of individual burrowing owls and their nest sites. Thus, all projects in Shoreline that impact owl nesting or foraging habitat are subject to CEQA. The Burrowing Owl Survey Protocol and Mitigation Guidelines (Burrowing Owl Consortium, 1993) provide habitat survey protocols for assessing whether burrowing owls are living in a project area. If burrowing owls are observed during surveys, the extent of burrowing owl habitat on-site should be delineated by a qualified burrowing owl biologist. The acreage ratio for habitat mitigation to offset permanent impacts to burrowing owl habitat will be determined in consultation with the CDFG. Land identified to offset impacts to burrowing owls must be protected in perpetuity, either by a conservation easement or fee title acquisition. Ideally, burrowing owl mitigation lands should be identified in the general vicinity of the project site. Short-term habitat impacts may be mitigated by restoring the area to burrowing owl habitat when the project is complete.

If it is determined that burrowing owls occur on a project site, a burrowing owl habitat mitigation plan must be prepared to avoid "take" and this plan will be subject to the review and approval of the CDFG. A Mitigation Agreement that will legally bind the applicant to the conditions of the plan will be executed between the CDFG and the applicant before the CDFG will issue authorization for mitigation activities.

C. Shoreline Mitigation Agreements

The City has participated in three Mitigation Agreements approved by the CDFG that permit burrowing owl mitigation within the boundaries of Shoreline. In each case, mitigation required lands be designated and managed for burrowing owl nesting or foraging habitat or both. In the first agreement, Alza Corporation mitigated for impacts to burrowing owls on a parcel adjacent to the Park. The 1998 Alza Mitigation Agreement designated 6.5 acres of nesting habitat with mounds and artificial burrows along the edge of the golf course, and 12 acres foraging habitat on Vista Slope. In the second agreement, in 2008, the City mitigated for 1 acre of nesting habitat located on City-owned property, referred to as Charleston East, with new mounds on Vista and by improving 6.5 acres for "owl habitat" next to Mountain View

Tidal Marsh. Finally, a Mitigated Negative Declaration was approved in October 2011 for the Shoreline Athletic Fields project which included requirements to mitigate for the loss of 6 acres of burrowing owl foraging habitat. In the fall of 2011, the City converted 7.2 acres of golf course ponds (Ponds 1 and 2) to owl habitat as part of the mitigation for the project. Another 2 acres has been enhanced north of E-Lot and approximately 0.6 acre on the athletic field project site will be set aside for owl habitat, including improvements to land between Pond 1 and the athletic fields site. The total mitigation land for the proposed athletic fields project is 9.8 acres. See Figure 1—Existing Burrowing Owl Mitigation.

D. Mountain View General Plan Policies

The City of Mountain View adopted the 2012 General Plan on July 10, 2012, which includes the following policy, "Protect and enhance nesting, foraging and other habitat for special-status species and other wildlife." The General Plan also includes an action which states, "Evaluate and maintain burrowing owl habitat through the Burrowing Owl Preservation Plan." This plan addresses this action, in part, by focusing on one special status species that occurs in Mountain View, the burrowing owl.

This Burrowing Owl Preservation Plan recommends establishing specific areas of Shoreline as a burrowing owl preserve that requires actions detrimental to burrowing owls proposed for the preserve area, such as land disturbances, be permitted only through an emergency action procedure or consultation process with City managers, the burrowing owl biologist and, if needed, CDFG.

E. Shoreline at Mountain View Vision/Goals

The 1996 Shoreline Park/Vista Slope Land Use Master Plan (Land Use Plan) established a vision and goals for Shoreline and the Vista Slope. The vision statement recognized that both sites were distinctive regional wildlife and recreation areas which focus on wildlife habitat preservation, "target species" protection, open space and passive uses for the public. Because they have occupied grassland habitat at Shoreline, burrowing owls have for many years been one of the key "target species" for management. Relevant goals from the 1996 Land Use Plan include:

- Provide periodic review of balance of wildlife habitat versus people intensity.

- Create management and education guidelines to focus on "target species" and to preserve wildlife habitat value while optimizing public use.
- Develop and provide periodic review of current habitat enhancement and related park maintenance policies, practices, rules and regulations.
- Promote utility locations which are easily accessible, consider landfill and habitat constraints that are unobtrusive.

The vision and goals of the Land Use Plan are an important basis for the recommendations for action to protect burrowing owls given in this Preservation Plan.

F. Landfill Maintenance Regulation Basics

The Shoreline Landfill is a closed landfill owned and operated by the City which must remain in compliance with an approved Postclosure Maintenance Plan. The closed landfill consists of three distinct and separate parcels: the 544-acre site, containing approximately 350 acres of waste; the Vista Slope, containing approximately 65 acres of waste; and the Crittenden Hill, containing approximately 27 acres of waste. Refuse decomposition produces landfill gas, leachate and surface settlement which is expected to continue over 30 years following landfill closure. Landfill gas and leachate are harmful to the environment and human health. Landfill gas is explosive and leachate can contaminate groundwater if not controlled and abated properly. Closed landfills are regulated by strict Federal, State and local regulations to protect the environment and human health until the landfill is deemed inert.

The closed Shoreline landfill must conform to permit requirements by the Federal NSPS and EG, Bay Area Air Quality Management District, the Regional Water Quality Control Board, the California Air Resources Board, the Local Enforcement Agency and the Department of Resources Recycling and Recovery (CalRecycle). These agencies require the City to monitor, operate landfill gas collection systems continuously, maintain the gas collection system, perform routine maintenance and repairs of the landfill cap, landfill gas, leachate removal systems and monitor groundwater. The City is required to submit reports demonstrating regular testing of these systems and verification regulatory limits is not exceeded to remain in compliance with these agencies. Exceedance of the permit limits is a violation of Federal, State and local laws and is enforceable with severe penalties.

The landfill control systems operation, repair and maintenance are temporary projects and are exempted from CEQA requirements under Section 15301—

Existing Facilities. Class 1 exemption under Section 15301 consists of the operation, repair, maintenance, permitting, leasing, licensing or minor alteration of existing public or private structures, facilities, mechanical equipment or topographical features, involving negligible or no expansion of use beyond that existing.

The City must maintain the landfill and its systems due to constantly decomposing, compacting and settling refuse—50 miles of LFG piping and stringent regulatory requirements from multiple agencies. It is necessary to replace soil in most areas and disturbances will occur due to repairing the cap, piping and well systems to keep in regulatory compliance and maintain public safety.

Postclosure landfill maintenance is governed by several regulatory agencies. These include the Bay Area Air Quality Management District (BAAQMD), Local Enforcement Agency (LEA), Regional Water Quality Control Board, CalRecycle (formerly CIWMB) and the California Air Resources Board (CARB). Each of the above agencies has unique requirements to maintain compliance. Below is a summary of the monitoring requirements:

1. **Landfill Emission Control System**—Landfills must have an emission control system to collect and process landfill gas (created by decomposing refuse). If gas is destroyed by a flare, a destruction efficiency of at least 98 percent by weight must be achieved (*Rule 8:34 301-304*).
2. **Repairing the Landfill Cap**—The landfill cap consists of 1' of dirt, 1' to 2' of clay and 1' of vegetative soil over refuse. Refuse is constantly decomposing and causing surface distress. Many areas are found with cracking in the soil cover or subsidence over entire areas. The refuse is from 5' to 90' in depth, depending on the area, which covers approximately 440 acres. Cap material is meant to stop migration of gases (methane being the greatest constituent, along with carbon dioxide, oxygen, nitrogen and several trace constituents). Cap material keeps contaminated liquids (leachate or condensate) from going off-site. Repairing the landfill cap must take place within five calendar days (or immediately depending on the surface problem) upon discovery of a problem. Disturbances of soil, such as trenching, dozer work, truck, piping and vault repair may or will take place (*Rule 8:34 303 and 414*).
3. **Monitoring Surface Emissions**—Monitoring is performed utilizing specialized monitoring equipment (Organic Vapor Analyzers) to check for gases coming through the cap in a prescribed manner. If LFG is found to exceed regulatory thresholds, a number of repair scenarios may

take place (cap repair, well repair, lateral repair, pneumatic pump repairs, etc.). Disturbances of soil, such as trenching, dozer work, truck, piping and vault repair may or will take place (*Rule 8:34 303,607*).

4. **Monitoring System Components (Leak Testing)**—There are well over 1,000 components (which includes vaults, piping, flanges, wells, etc.) checked on the site using specialized monitoring equipment (Organic Vapor Analyzers) to check for gas leaks at a specified distance from the component. If components are found to exceed regulatory thresholds, various repair scenarios take place depending on the component. This could include disturbance of soil, such as trenching, dozer work, trucks, piping and vault repair (*Rule 8:34 301,415, 416, 602*).
5. **Cover Integrity Monitoring (Cap Inspections)**—Cap Inspections are completed on a monthly basis. This is in accordance with 40 CFR 60755(c)(5) and Rule 8-34-510. This is used as a preventative maintenance tool for the City to maintain cover integrity before surface monitoring takes place. City personnel must constantly keep the cap repaired due to decomposing refuse. The surface must be kept stable for compliance and safety. Disturbances of soil, such as trenching, dozer work, truck, piping and vault repair will take place. This is described in **Repairing the Landfill Cap** above.
6. **Wellhead Monitoring**—(Two-hundred seventy-one (271) wells as of January 2012.) Wells may be 12' to 75' in depth vertically or horizontally wells up to 100'. Monitoring of landfill gas wells is accomplished on a monthly basis in accordance with 40 CFR 60.756(a) and Rule 8-34-505 1, 2, 3 and 4.
7. **Troubleshooting Gas Systems**—The landfill consists of over 50 miles of LFG, condensate and compressed air HDPE piping. Decomposing refuse will always put more stress on piping systems as it compacts and settles. Leaks, distresses in system components such as valves, test ports and pneumatic pumps are found by isolating the system, checking levels of liquid, observation and testing gas, and a number of other techniques. If leaks or components have to be repaired, it is with a sense of urgency to avoid public safety, regulatory and other LFG system problems. Repairs will likely require heavy equipment and disturbances in soil over small to large areas depending on the problems associated with the repair.
8. **California Air Resources Board (CARB) Regulations**—In recent years, new regulations have been implemented affecting landfills. These regulations are at least four times more restrictive than previous

regulations. For example, the **Final Regulation Order 95465** by CARB for Surface Methane Emissions Standards requires performing quarterly instantaneous and integrated surface emissions monitoring on a 25' serpentine walking pattern. The City must achieve a 25 ppm average emission rate or less over each 50,000 square foot grid to be in compliance. If results show an exceedance, the City must place soil cover over a minimum area, currently 50,000 square feet (CARB Order 95465 and Rule 8-34)

III. BURROWING OWLS AT SHORELINE

A. Bay Area Population

Once numerous, today perhaps fewer than 70 burrowing owls reside in Silicon Valley and nearly all of them are found at three locations: NASA Ames/Moffett Federal Airfield, San Jose International Airport and Shoreline. These birds require valley grasslands which are prime development sites. Much of this habitat was converted to urban uses in the Bay Area over the last 30 years, resulting in large population declines. Between the 1980s and 1990s, the number of pairs was cut in half, to an estimated 150 pairs (DeSante, *et al.*, 2007). A survey of 111 sites occupied by owls on private or city-owned development lands showed 66 percent of patches occupied by owls in 1998 were lost to development or other major disturbance by 2002 (Trulio, 2010). In the last decade, populations in our region have continued to decline steadily. By 2010, owl numbers at the three largest habitat patches in Santa Clara County dropped to 50 percent of 1999 levels (Figure 2—Numbers of Pairs, Successful Pairs and Chicks by Year at Shoreline, 1998-2010) (Albion Environmental, Inc., 2010; Chromczak, pers. comm. Trulio and Chromczak, 2007). At this rate, burrowing owls could be gone from our region in 10 years.

Chelgren, *et al.* (in press.), conducted an analysis of the population dynamics of the South Bay burrowing owl population. They found that adult survivorship and chicks per nest were highest in the Shoreline-Moffett region and lowest in the Mission College-Tasman region. However, nest success, which is the number of nests producing chicks, was lower in the Shoreline-Moffett area than Mission-Tasman. The combination of these demographic rates in the region is resulting in a declining population. One recommendation for improving population persistence is to improve nest success, especially in the Shoreline-Moffett area. Trulio and Higgins (in press.) found the numbers of rodents in the diets of South Bay birds were very low compared to other populations. The lack of sufficient rodents in the diet, especially during the breeding season, can result in poor reproductive success (York, *et al.*, 2001).

B. Shoreline Owl Management

Shoreline provides one of the last remaining protected, low-lying grassland sites in the South San Francisco Bay Area and one of the last subpopulations of burrowing owls in Santa Clara County. The City of Mountain View's actions have contributed to a continuous population of breeding burrowing owls while other parks close by (Byxbee Park and Sunnyvale Park, for instance) have experienced a loss of breeding burrowing owl populations.

Mountain View has implemented a number of actions and programs that have helped to maintain the burrowing owl population at the Park. Some of those actions are:

- Maintaining habitat for burrowing owls at Shoreline since the 1980s.
- Having a Burrowing Owl Management Plan for the Park since 1998.
- Having policies in the General Plan and Land Use Plan for Shoreline and Vista Slope to protect owls.
- Providing extensive mowing throughout the Park to enhance suitability of the park for nesting burrowing owls.
- Installing artificial burrows in strategic locations to attract burrowing owls.
- Hiring a part-time biologist to monitor and enhance habitat for burrowing owls.
- Requiring project evaluations for all projects within the Park that could potentially impact burrowing owls.
- Providing monthly maps of burrowing owl locations to the Park personnel to inform all employees of exact owl locations to prevent accidental disturbance of active owl burrows.
- Producing quarterly and annual reports on burrowing owl demographics to provide information on the success and failure of the Park management in maintaining owls.
- Providing educational signage and information to visitors on the ecology and importance of burrowing owls.
- Working with students and residents on burrowing owl studies to enhance awareness of burrowing owl issues.

C. Population History

The history of burrowing owls at Shoreline begins in the late 1970s, when employees of the active landfill reported observations of burrowing owls at Shoreline. When the Park opened in 1983, Shoreline Rangers also reported seeing owls. A complete census of Shoreline was first conducted in 1989 by Elaine Harding as part of her senior thesis in biology at San Jose State

University. Harding observed 14 owls and found 26 active burrows in the approximately 0.5-square mile study area. In 1992, 1993 and 1994, Lynne Trulio conducted systematic surveys of Shoreline and recorded a total of 23, 20 and 13 adult owls, respectively; there were 11, 9 and 5 breeding pairs these years (Trulio, 1997) (Table 1—Burrowing Owl Population and Breeding Success at Shoreline at Mountain View).

Four pairs of owls and two unpaired birds were observed during a survey of Shoreline during April 1997 by H. T. Harvey & Associates, and owls were observed at several different locations during the fall and winter months of 1997-98. Five pairs of owls were observed during late winter/early spring, 1998.

Beginning in 1998, systematic surveys of burrowing owls have been conducted on a monthly basis and the data recorded for annual reports that are submitted to the California Department of Fish and Game. These reports were originally prepared to meet the mitigation requirements for the Alza property to track the burrowing owl population (burrow locations, breeding pairs, success, mortality and migration), as well as potential impacts to burrowing owls and their habitats throughout the Park. Data from these surveys show the burrowing owl population has fluctuated over the past 13 years, with periodic increases and declines (Figure 3—Numbers of Pairs, Successful Pairs and Chicks by Year at Shoreline, 1998-2010).

The total number of pairs of burrowing owls has been as low as 3 pairs (1998, 2009 and 2010) and as high as 13 pairs (2003), with the average being approximately 7.25 pairs. The number of pairs producing chicks versus total number of pairs has averaged 47 percent and has not varied much (range, 2 to 7 pairs), even during years of high numbers of burrowing owl pairs at the Park. The relatively low percent of successful nests may be due to a limiting factor such as prey quality/availability, predator pressure or negative impacts to nest burrows. A total of 205 burrowing owl chicks were produced in the Park since 1992 (excluding 1995 to 1997). The average number of chicks was 12.8 chicks per year and 3.6 chicks per nest. The minimum number of chicks per year was 4 in 1998, while the maximum number of chicks per year was 22 in 2003. The largest brood size at the Park was a total of 7 chicks, occurring once in 2005 and again in 2010.

Data from banded burrowing owls at Shoreline and other sites in Santa Clara County confirm that burrowing owls move between Shoreline, NASA Ames/Moffett Federal Airfield, Byxbee Park (Palo Alto) and Mission College (Santa Clara). The vast majority of movements are between Shoreline and NASA/Ames Federal Airfield (Chromczak, pers. comm.).

For populations to grow, survivorship and reproduction must outpace death and emigration. Currently, data on these demographic factors show the population in Silicon Valley is declining in number (Albion Environmental, 2010; Chelgren, *et al.*, in prep.). Chelgren, *et al.* (in prep), indicate the number of successful nests (nests producing chicks) should be increased as one important measure to stop the region's population decline. Two key approaches to increasing the number of successful nests are to: (1) improve the quality of nesting habitat so that more birds will nest in an area and more nests will survive disturbances; and (2) improve the quality of foraging habitat, especially during the nesting season, so that there is enough food to rear large numbers of healthy fledglings.

D. Nesting and Foraging at Shoreline

Habitat Size

Many burrowing owls in our region are nonmigratory and, therefore, require habitat year-round. Key year-round requirements are adequate burrows and good foraging. Burrows in open grassland habitat are central to the burrowing owl's life, allowing birds to avoid predators and provide nests for producing chicks. Adequate foraging habitat year-round near owl burrows, especially in the breeding season, is also critical to supporting owl populations.

Although habitat size is a major factor in sustaining populations, the amount of habitat a pair of burrowing owls requires to survive and successfully reproduce is unknown. In many species, required habitat size is linked to habitat quality. It is likely that owls do best in colonies with multiple owl pairs, although the number of pairs that may be optimum is unknown. Certainly, the larger the habitat is, the more owls can be supported and more likely population persistence will be. At Shoreline, there is an estimated 426 acres of potential owl habitat (see Table 4—Burrowing Owl Habitat Use in Shoreline (acres)). Even at a 30-acre-per-pair estimate, it seems likely that Shoreline can support 10 pairs of owls if beneficial conditions exist. In the Silicon Valley, 10 owls at any location would be a significant population.

Habitat size can be increased either through land acquisitions or changes in uses to benefit burrowing owls, both of which can be difficult. At Shoreline, changes in land uses are possible occasionally, but the most feasible way to increase the population size is through increasing both nesting and foraging habitat quality so that more birds can be supported.

Nesting Habitat

When nest burrow locations over time are mapped, key areas used by owls include the Meadowlands and the golf course. Burrow use by burrowing owls during the peak of the breeding season (May to July) from 1999 to 2010 show that 48 percent of nests occurred in the Meadowlands, with 45 percent of nests occurring on the golf course, 5 percent occurring in E-Lot and 1 percent at the Charleston Road site and Crittenden Hill. Figure 4—Burrowing Owl Successful Nest Locations and Figure 5—Burrowing Owl Unsuccessful Nest Locations, show approximately 95 percent of the spatial distribution of nests during the breeding seasons from 1999 to 2010. Not shown on the maps are sites with multiple nests occurring at the same location or sites for which the nest location was not recorded, but was known to exist.

Data for successful nests show the golf course had an estimated 51 percent of all successful nests, the Meadowlands had approximately 34 percent of successful nests and the E-Lot had 10 percent. The data for unsuccessful nests indicate approximately 61 percent of unsuccessful nests occurred in the Meadowlands and approximately 39 percent of unsuccessful nests occurred on the golf course. The large number of nest attempts in the Meadowlands shows this area is very attractive to nesting birds but the high failure rate of these nests shows birds are not succeeding in that area. By improving the management of the Meadowlands area of Shoreline, the breeding success rate for burrowing owls should increase greatly.

Outside of the breeding season, Vista Slope, Crittenden Hill and the North Shore area of Shoreline provide fall and winter burrows for burrowing owls. Vista Slope, in particular, provides a key area for burrowing owls. It is believed that Vista Slope, and Crittenden Hill to a lesser degree, may attract migratory burrowing owls. Both sites are often well used from September through February, which coincides with migratory patterns for burrowing owls.

The spatial distributions overall show all areas of Shoreline at Mountain View are used by burrowing owls, but some areas more so than others. Factors at different areas throughout the Park that could limit the use by burrowing owls include:

- Golf Course: Burrow availability is a major limiting factor on the golf course as ground squirrels are discouraged from using fairways and greens. Thus, ground squirrel burrows are limited to areas in between fairways and along the rough areas surrounding the golf course. Frequent mowing of the golf course attracts burrowing owls for nesting,

but the availability of quality prey species is limited as most invertebrates and rodents do not find short manicured grass areas appealing. The golf course is surrounded by rough areas and other habitats that can provide quality habitat for burrowing owl prey.

- Meadowlands: This area has the potential to provide prime habitat for both nesting burrowing owls and their prey. However, the site is above landfill cells and has required frequent earthwork activities that destroy ground squirrel habitat, including burrows for burrowing owls and vegetation for owl prey. Both of these factors reduce the overall suitability of this area for burrowing owls and can result in lower nest success.
- Vista Slope and Crittenden Hill: Both sites are over a closed landfill but do not have the need for frequent earthwork operations as the Meadowlands area. The relatively tall hills at these sites reduce the appeal for nesting burrowing owls, but these sites have been used by birds in fall and winter, outside of the breeding season. Less steep areas of these sites have excellent potential to be improved as foraging habitat and nesting habitat. However, these "flat" areas are likely to settle and accumulate with water, requiring earthwork activities. Social trails and trails in mitigation habitat may also limit owl use.

Foraging Habitat

Without adequate foraging habitat, burrowing owls cannot survive and reproduce. They will not stay at burrows long if prey availability is too low. A study conducted by Trulio and Higgins (in press.) analyzed the burrowing owl pellets collected in 2005 to 2006 at five locations in Santa Clara County, including Shoreline at Mountain View, confirmed that rodents were more important than insects in the diet based on biomass. Invertebrates represented 17.5 percent and the vertebrates were 82.5 percent of total biomass of the eight dominant prey taxa. Compared to other western burrowing owl populations, birds in Santa Clara County have very low numbers of vertebrates in their diets Trulio and Higgins (in press.). Several studies have confirmed the importance of rodents in the diet of burrowing owls, especially in increasing the rates of breeding success (Wellicome, 1994; York, *et al.*, 2001; Haley, 2002). Factors that are unfavorable to rodents, such as small habitat patches (Bolger, *et al.*, 1997) and frequent mowing (Adams, 1984), limit the rodent prey at Shoreline that is available to burrowing owls.

In Santa Clara County, Trulio and Higgins (in press.) found pocket gophers dominated the biomass in the owls' diets. Because of the importance of rodents in successful reproduction, we review the basic habitat requirements

of the five most common rodent prey species Trulio and Higgins (in press.) found in the diets of Silicon Valley owls below and in Table 2—Statistics for Five Dominant Rodent Species in the Bay Area.

California Vole (*Microtus californicus*)

Habitat: Found in grasslands, especially wet meadows and irrigated pastures.

Diet: Eats many kinds of forbs and grasses, especially the fresh, tender new growth and developing seeds. Mature seeds are less favored and insects are avoided. *Microtus* prefer grasslands with *Bromus*, *Lolium* and *Avena* grass species (Batzli and Pitelka, 1970).

Reproduction: Breeds year-round provided fresh green vegetation is available, or else only breeds when fresh vegetation is growing, especially during the rainy season. Females become sexually mature between 3 to 4 weeks of age and usually produce 3 to 8 young per litter in a burrow.

Comments: *Microtus* populations regularly exhibit population irruptions whereby the population reaches an extremely high density only to collapse in following years (Batzli and Pitelka, 1970). These irruptions generally occur every 3 to 4 years (Garsd and Howard, 1982).

House Mouse (*Mus musculus*)

Habitat: Usually found around human habitations and in fields and brushy areas.

Diet: Capable of eating a very large variety of food items: seeds, leaves, berries, fruit, insects and an assortment of human foods.

Reproduction: Capable of rapid population increases as breeding can occur throughout the year depending on food availability. Litter size varies from 4 to 8 young after a gestation period of 3 weeks with up to 5 litters per year. Females become sexually mature between 7 to 8 weeks of age.

Pocket Gopher (*Thomomys bottae*)

Habitat: A subterranean species that prefers friable soils where it can burrow extensively in farmland, grasslands and lawns. *Thomomys* are limited in their distribution by several factors, including climate, vegetative structure and especially hard soils (Jones and Baxter, 2004).

Diet: Roots, bulbs and tender bases of growing plants.

Reproduction: Young are born from late winter to summer; however, the breeding season is extended on irrigated land. Litters can vary from 1 to 4 with 2 to 12 young each time.

Comments: *Thomomys* often experience periodic population fluctuations (Aldous, 1957) and these fluctuations often occur as a result of an extended abundance of green forage in summer which is directly correlated with precipitation levels (Dixon, 1929).

Western Harvest Mouse (*Reithrodontomys megalotis*)

Habitat: Common in grasslands and open oak woodlands.

Diet: Eats a variety of seeds of grasses and weeds along with some insects and especially cutworms. *Reithrodontomys* show a preference for *Avena* grass species (Batzli, 1968).

Reproduction: Breeds in spring and sometimes again in fall in a ball-shaped nest made of grass on the surface of the ground and sometimes in a dense bush. Litters of 3 to 9 young, the young are weaned in 3-1/2 weeks and will often reproduce themselves in the same year of birth.

Comments: *Reithrodontomys* abundance severely declines with *Microtus* population irruptions and increases during periods of *Microtus* declines (Heske, Ostfeld and Lidicker, 1983).

Deer Mouse (*Peromyscus maniculatus*)

Habitat: Found in a variety of habitats, including grasslands, chaparral, forests and brush.

Diet: Includes a variety of seeds and grasses, insects—especially grasshoppers and crickets—and insect larvae and fungi. *Peromyscus* show a preference for *Avena* grass species (Batzli, 1968).

Reproduction: A litter of 2 to 8 young is produced from April through November, depending on the availability of food.

Invertebrates are the other major portion of burrowing owl diets. Trulio and Higgins (in press.) found that 87 percent of the insects in diets of burrowing owls in Silicon Valley was composed of three taxa: beetles, grasshoppers/crickets and earwigs (Table 3—Results of Pellet Analysis of Burrowing Owls at Shoreline). These results are supported by other studies that show insect

diversity decreases and earwig abundance increases in small fragments (Bolger, *et al.*, 1999) and insect diversity decreased when vegetation mowing increased (Giulio, Edwards and Meister, 2001). While burrowing owl nesting habitat requires short grass and even bare ground conditions, high-quality foraging habitat supporting a diversity and abundance of insects and rodents requires tall vegetation, heterogeneity in vegetation structure and a diversity of cover conditions.

E. Use by Area

Approximately 530 acres of Shoreline at Mountain View are upland. This entire terrestrial area is burrowing owl habitat, used by owls to nest in spring, roost in winter or forage year-round. At any time of the year, birds may be found at any location in the park and projects anywhere in the park have the potential to impact burrowing owls. However, the frequency with which owls use different areas is strongly influenced by Shoreline's terrestrial land uses. Table 4 shows the amount of area at Shoreline that receives the highest use, moderate use and little to no use by burrowing owls. Currently, approximately 321 acres receive the highest use by burrowing owls, 105 acres are moderately used and 104 acres are low- to no-use areas.

The golf course is one of the primary land uses at Shoreline, comprising 194 acres (Figure 6—Existing Burrowing Owl Mitigation Areas and Shoreline Burrowing Owl Preserve Areas). Current management of the golf course is conducive to nesting and year-round burrow use by owls (Figures 5 and 6); in fact, over the last 20 years, owls have almost continuously nested in burrows on the golf course. These conditions on the golf course support nesting: grasses are kept short; squirrels are allowed to populate rough areas; there are few trees; and there is little dirt movement, soil piling or other land disturbance. Most owls nest in squirrel-dug burrows, but some nest in artificial burrows constructed as part of the 6.5 acres of mitigation habitat along the south golf course edge (Figure 4). In addition, when squirrel control is needed, methods and locations for eliminating the squirrels are overseen by the Park's burrowing owl biologist. This important measure ensures owls are not harmed and a population of squirrels, at a level that can be tolerated by golfers, remains. The golf course is not high-quality foraging habitat due to the uniform management for short grass and the use of herbicides and other pesticides. However, the City is in the process of converting approximately 7.2 acres of golf course ponds into high-quality foraging habitat managed under a mitigation agreement to promote owl prey, especially rodents. Other opportunities to enhance foraging on or near the golf course may exist.

More nesting habitat, approximately 12 acres of mitigation area, is designated on Vista Slope (Figure 1). Although this is nesting habitat mitigation for development impacts to burrowing owls outside Shoreline, owls have never nested in this area until 2012 (Figure 4); they regularly forage and winter there. Possible factors keeping owls from nesting more often in this area are trails that fragment the site and the hilly topography of Vista Slope. Burrowing owls in our region typically do not nest on hills and that has been true for Vista Slope, although owls have nested on Crittenden Hill. Currently, Vista Slope and Crittenden Hill primarily function as wintering habitat and low- to moderate-quality foraging areas (Figure 6); a predominance of nonnative grasses, lack of habitat complexity and fragmentation due to trails reduce the quality of the area for burrowing owls.

Approximately half of the 86-acre Meadowlands is high-use owl habitat. This area has potential to provide good-quality nesting and foraging habitat (Table 4; Figure 5) as landfill maintenance and other ground disturbances in this area are relatively low. Burrowing owls have used the Meadowlands during breeding and nonbreeding seasons; they have nested in natural and artificial burrows (Figure 5).

The other half of the Meadowlands (Figure 5) provides only moderate-use habitat for owls due to regular disturbance by landfill operations/activities. These land disturbance activities, driven by regulatory obligations, result in surface excavation, compaction by vehicles and 15 to 30 acres per year of soil regrading. These activities remove vegetation, harm squirrels and their burrows. Despite this activity, burrowing owls still use the site for nesting, winter burrows and foraging; indeed, they are often attracted to newly disturbed sites. Thus, preconstruction surveys, construction phase protection and postconstruction mitigation for owls are essential for any project in this area. The entire Meadowlands area is rife with social trails and informal roads that are significant factors in reducing habitat quality and the presence of owls, as they result in habitat fragmentation and human intrusion. Despite the regular land disturbances, these 44 acres of Meadowlands can easily be enhanced each year to promote insects and rodents and, thereby, function as higher-quality foraging habitat.

Nine acres adjacent to Shoreline Boulevard and the Meadowlands (Figure 3) are stable engineered fill and not underlain by landfill material. This site is especially important for owls as it is not subject to landfill subsidence and subsequent landfill maintenance such as filling and land disturbances to address subsidence. A key to improving owl nesting and foraging habitat is to avoid ground disturbance. These 9 acres are suitable for owl habitat because it is ensured that landfill subsidence will not occur—making this area ideal habitat for owls.

The 28-acre E-Lot, adjacent to the Meadowlands, is a grassy/gravelly area which is an overflow parking lot for the Shoreline Amphitheatre. This area rarely experiences land disturbances and functions as foraging habitat and occasionally owls will nest within the site.

The 33-acre North Lake (Figure 5) is classified as low-use due to poor suitability for nesting habitat. Numerous trails in this part of Shoreline result in heavy human activity and a large number of trees attract burrowing owl predators. Owls have not been recorded nesting or wintering in this area (Figures 3 and 6), but the site could be enhanced for improved foraging, especially in areas farthest from trees.

Low- to no-use owl areas at Shoreline are those that are urbanized, such as the Boat House complex, Golf Links Clubhouse, both with parking lots; the proposed athletic field complex; and the Amphitheatre and Crittenden developments. Although these areas are developed, it is important to know owls will nest in burrows even at very urbanized sites in the Park. Thus, projects in these areas should be surveyed for burrowing owls before beginning the work.

F. Factors Degrading Habitat

Approximately 438 acres of Shoreline's 542 acres of terrestrial area are high- to moderate-use burrowing owl habitat. Despite this large area and the management practices implemented at Shoreline for burrowing owl conservation, the overall trend has been a declining population. This decline may be due to a number of activities at Shoreline that are reducing habitat availability, reducing habitat quality, and limiting prey, burrows and ground squirrels. Two key factors limiting owl numbers appear to be regular disturbance of large areas and lack of high-quality foraging habitat; both are limiting the burrowing owl population in Shoreline. In fact, lack of adequate foraging habitat appears to be a key limiting factor for owl population growth at Shoreline. There are other factors too, some of which degrade sections of Park habitat and others which are Park-wide disturbances. Key activities that are significantly impacting the burrowing owl population include:

- Systematic and regular grading on a large scale destroys prime foraging and nesting habitat, and limits the prey base and the ground squirrel populations in these areas.
- Insufficient high-quality foraging habitat, especially during the breeding season. No lands are currently managed for foraging and only an estimated 83 of 426 acres may be unmowed in the summer and,

therefore, provide sources of insect and rodent prey in the breeding season. In particular, an increase in rodent prey is needed.

- Insufficient mowing during the breeding season to maintain nesting habitat, especially during years of high precipitation levels.
- Disturbance by vehicles going off-road, leading to erosion, collapse of burrows and direct disturbance of burrowing owls. Many unofficial trails and roads degrade owl habitat throughout the Park by fragmenting habitat and promoting human intrusion.
- Formal and informal trails and unofficial roads in owl habitat that increase human approach and disturbance. Shoreline has only one paved road (Shoreline Boulevard) and approximately seven miles of paved paths (Figure 5), most of which are on the edges of owl habitat.
- Predation by nonnative and/or nuisance species. Predators, such as nonnative cats, dogs and foxes, as well as native crows and ravens, that are thriving in human-altered environments. The City policy of removing cats and foxes has been effective and beneficial for the burrowing owls. Crows and ravens should be discouraged by eliminating human food sources and by not planting nesting trees near habitat.
- Future impacts are expected from the new athletic fields, including more food available to predators and more nighttime lighting. Food, which attracts burrowing owl predators, both aerial and terrestrial, and can boost their populations, is a threat that may increase near the new athletic fields. Shoreline has limited night lighting and activity. The proposed athletic fields complex is programmed to include lighted fields and lighted parking lots. Mitigations to reduce and eliminate lighting impacts must be implemented aggressively throughout the life cycle of this facility.

In the past, impacts were addressed on a case-by-case basis using regulatory tools through the 1998 Burrowing Owl Management Plan. While protecting owls from project impacts is important, this approach to burrowing owl protection alone has not been successful at preventing large-scale impacts to the birds and their habitat. It is also important to realize the Shoreline population may be declining due to regional factors and this information is not currently included in Park management decisions. A holistic approach that includes and acts on all available information is the most reliable route to preserve the burrowing owl population in Shoreline, regardless of whether the problems are internal or external.

IV. PLAN FOR PRESERVING THE POPULATION

A. Adaptive Management Process

Owl management at Shoreline has typically focused on avoiding impacts to owls from Shoreline projects and operations. While management to comply with laws and regulations is essential, preserving the owl population requires more holistic, proactive management to meet population needs. The purpose of this document is to provide a guide to the long-term preservation of burrowing owls at Shoreline at Mountain View. An objective such as this must be based on the best information in conjunction with regular evaluation of progress. Such a process is called adaptive management, which is a method of learning by doing. Adaptive management is widely considered one of the most successful approaches to achieving long-term habitat protection and management objectives in uncertain environments.

Elements for ensuring a successful adaptive management process include:

- Goals that are based on the best available scientific and management information.
- Actions to achieve the goals.
- Effective monitoring to assess progress toward goals.
- Studies to understand uncertainties.
- Regular evaluation of progress toward goals, and of goals and actions themselves, in consultation with burrowing owl experts, stakeholders and Shoreline managers.
- Changes to management actions based on the progress evaluation to more effectively reach goals.
- Regular reporting of progress to the City and stakeholders.

Much of the adaptive management structure given here is already in place at Shoreline. A complete adaptive management approach will allow efficient, coordinated organization of existing activities to not only meet regulatory requirements, but to achieve population objectives. Adaptive management will also result in improved understanding of problems, if population objectives are not achieved. Because adaptive management requires a thorough understanding of the species and context, regular availability of a burrowing owl biologist is recommended in this plan. This biologist will

oversee the implementation of the adaptive management plan, as well as ensure the City complies with wildlife regulations protecting the burrowing owl and other wildlife species.

B. Goals for Population Preservation

To implement adaptive management, managers must set goals, take actions to meet those goals based on the best available knowledge, monitor response to those goals and initiate additional actions, including conducting research, if the goals are not being met. This subsection lists goals for the burrowing owl population and habitat at Shoreline; the next subsection provides actions for managers to take to achieve these goals. It is important to realize managers may revise preservation goals and actions over time in response to changing conditions. However, changes to goals and/or actions should be the result of a consultative process, including Shoreline managers, stakeholders (including the Santa Clara Valley Audubon Society), agencies (especially the CDFG) and burrowing owl biologists familiar with conditions at Shoreline and burrowing owls in the region.

The size of the burrowing owl population at Shoreline is determined by both internal conditions at Shoreline and the external regional context. Coordinating Shoreline owl preservation goals and actions within the regional burrowing owl population context is essential to understanding population changes in the Park, adapting goals and actions to meet changing conditions and understanding the role of Shoreline in the greater region.

Based on the estimated 426-acre size of the Park's owl habitat, the ecology of burrowing owls and research on owls in Shoreline and the region, the following are measurable population goals that, if met, indicate a healthy population:

Population Goal 1. An average breeding season population of at least 10 pairs of owls. This measure is based on the assumption that approximately 30 acres of habitat will support a pair of owls. This is a target with a goal of more pairs, if possible. Achieving greater numbers would demonstrate greater success.

Population Goal 2. Nest success is approximately 50 percent to 75 percent. This measure is based on research indicating that low nest success is contributing to population declines in the region.

Population Goal 3. Pairs fledge an average of three chicks per pair each year. This measure is based on the estimate that only one chick of three survive to the next year. In a five-year life span, a pair would produce five surviving chicks.

The following are habitat goals indicating good-quality habitat for burrowing owls:

- Habitat Goal 1. Manage and maintain at least 300 acres of medium- to high-quality habitat throughout the Park as follows:
 - a. Approximately 100 acres should be high-quality nesting habitat managed to keep grasses low, to keep predators under control and to provide "foraging islands" within nesting habitat.
 - b. Approximately 100 acres should be managed for high-quality foraging habitat, promoting populations of large insects and small rodents sufficient to support at least 10 pairs of owls in the Park during the breeding season.
 - c. Approximately 100 acres should be managed for medium-quality nesting and/or foraging habitat.
- Habitat Goal 2. Maintain healthy populations of ground squirrels throughout the Park, in both nesting and foraging habitat.
- Habitat Goal 3. Successfully protect and manage a burrowing owl nesting preserve.

C. Owl Management Actions for Achieving the Goals

The following 10 Owl Management Actions are designed to achieve the population and habitat goals listed above. A central theme of these actions is to actively manage good-quality nesting and foraging habitat throughout the Park. The key to ensuring good habitat is that land disturbances required to meet landfill regulations should be implemented in a manner that better protect owls and, to the extent possible, achieve a minimum of five years before returning to the area for further corrective action. Specific Protocols given in Section V are referenced as appropriate for each Action.

Action 1. Officially delineate and manage a burrowing owl preserve in Shoreline.

Setting aside and protecting preserves managed for rare species is an essential tool in promoting species recovery. The areas recommended for the

burrowing owl nesting preserve are those expected to need the least amount of land disturbance or management for nonowl uses. The preserve areas are mitigation lands (which are protected for owls by law), 42 acres of habitat at the Meadowlands that are low landfill maintenance areas and 83 acres of habitat at Vista Slope/Crittenden actively managed for high-quality foraging (see Figure 7). The nonlandfill 9-acre site in the Meadowlands adjacent to Shoreline Boulevard is especially important to include as this area is not subject to land disturbances due to landfill maintenance. The recommended preserve totals approximately 103 acres. The management of the burrowing owl nesting preserve will be focused exclusively on burrowing owls and the habitat they require. Specific management in the burrowing owl preserve should include the following:

- a. Manage for high-quality nesting habitat, especially in the Meadowlands and flatter areas of Vista and Crittenden slopes. Specific management will include proper mowing, ensuring abundant squirrel populations, providing nearby foraging opportunities, eliminating trails and roads, and controlling predators. Specific Protocols A through E give detailed guidelines.
- b. Manage steeper slopes and other appropriate areas, such as the golf course pond mitigation area, for high-quality foraging habitat (see Specific Protocol C).
- c. Delimit the preserve with a low, attractive fence or other markers so that boundaries of the preserve are unambiguous to visitors and staff in the field; add additional features or barriers to prevent entry into the preserve where needed.
- d. Include the preserve on all Shoreline maps.
- e. Provide signage in the field showing the preserve and educating the public.
- f. Remove all informal trails, from the preserve and maintain formal trails along the edge of the preserve and key trails outside nesting habitat for accessing the tops of Vista Slope and Crittenden Hill (see Specific Protocol E).
- g. Remove all informal roads and prohibit all vehicles from entering (except as absolutely needed for City-related maintenance and emergency response because no other access options are available) (see Specific Protocol E).

- h. Maintain mitigation agreements, ensuring mitigation zones are not impacted by land disturbance and maintaining artificial burrows as appropriate.
- i. Allow only owl supportive land uses directly adjacent to the preserve, whenever possible.
- j. Minimize land disturbance activities, unless emergency actions are required (see Specific Protocol F. iii.).
- k. Allow landfill management activities that are necessary to fulfill regulatory requirements; when possible, conduct landfill well readings by golf cart or other small, low-impact vehicle; complete a Project Evaluation (PE) (see Specific Protocol F) for any activity more intrusive than surveillance; remediate land disturbances as determined by the burrowing owl biologist within two weeks to three months of completing the disturbance activity.
- l. In the event of a landfill management emergency in the preserve that is an immediate threat to human health or essential to meet regulatory requirements, landfill staff will contact the Community Services Director or his/her designee; a burrowing owl survey will be conducted before action is taken, if possible. After the emergency action is completed, a full report on the activities taken, reason for the actions and remediation implemented. Remediate land disturbances as determined by the burrowing owl biologist within two weeks of completing the disturbance activity. If owls or burrows are impacted by the activity, the report will be provided by the Community Services Director or his/her designee to CDFG.

All eight of these Specific Protocols (Section V) apply to this Action.

Action 2. Manage other areas for burrowing owls outside of the preserve, in accordance with the Shoreline Burrowing Owl Preservation Plan.

In addition to the areas in the nesting preserve, burrowing owls regularly use the golf course, the remainder of the Meadowlands and the North Shore Area. Owls can be found anywhere in the Park, even in developed areas. Whenever land disturbance activities or other actions that could affect owls are planned, conduct a consultation with Shoreline managers and the burrowing owl biologist and prepare a PE (see Specific Protocol F) that states the need for the project, provides the regulatory code requiring the project action and addresses burrowing owl regulatory requirements. Actions needing consultations and PEs include: land disturbances such as moving,

placing, digging or scraping soil; disturbance by pedestrian access (marathons or other recreational activities); planting trees near the burrowing owl preserve; herbicide use; use of new poisons; poisons used in new areas; and rodent control. PEs for land disturbance activities will include required remediation actions, including revegetation, foraging structures and ground squirrel protection/restoration measures, to return the site to quality burrowing owl habitat. See Specific Protocols for Quality Nesting Habitat (Protocol A), Burrows (Protocol B), and Quality Foraging Habitat (Protocol C). Remediation will begin within 30 days of the completion of the disturbance action. Notify the CDFG of impacts to owls or owl habitat. Recognizing that these areas have other land uses and needs apart from owl habitat, these areas should be managed for owls as follows:

a. Golf Course:

- Conduct PEs for projects that could impact burrowing owls, their habitat, or ground squirrels and prey species.
- Continue golf course management actions beneficial to owls.
- Limit the use of all pesticides and herbicides.
- Consult with the burrowing owl specialist on rodent killing.
- Protect nesting birds from disturbance by golfers.
- Conduct regular staff education, at least once a year.
- Enhance areas in or near the golf course for foraging, as appropriate.

b. Regular Landfill Maintenance Areas (outside the nesting preserve):

- PEs for each land disturbance activity will include required remediation actions to return the site to burrowing owl habitat. In particular, all disturbed areas will be enhanced for foraging by revegetating with native species and placing structures for burrowing owl prey. Based on the type of disturbance and recommendations of the burrowing owl biologist, remediation will occur within two weeks to three months of the completion of the land disturbance action (see Specific Protocols F and G).
- Priority or emergency landfill maintenance actions, when required, will follow procedures in Specific Protocol G.

- Notify the CDFG of impacts to owls or owl habitat, whether for emergency or nonemergency projects.
 - At appropriate places, install "foraging islands" to improve the foraging quality of the area. See Specific Protocols for Quality Foraging Habitat (Protocol C).
 - Whenever foraging enhancements are disturbed or destroyed, they will be replaced within two weeks to three months, as determined appropriate by the burrowing owl biologist and Shoreline managers.
 - Conduct regular staff education, at least once a year (see Specific Protocol G).
 - Provide training/education session to outside contractors performing services for the City in wildlife areas, unless outside contractors are accompanied by Park staff (see Action 3, below, and Specific Protocol F).
- c. North Shore Area:
- Conduct a consultation with Shoreline managers and the burrowing owl biologist whenever land disturbance actions in the area are planned. Land disturbance actions include disturbing burrows, removing vegetation, piling or moving dirt, digging or removing dirt, overcovering land, discing or other soil disturbance. If burrowing owls or owl habitat will be impacted, prepare a PE (see Specific Protocol F). Notify the CDFG of impacts to owls or owl habitat.
 - Especially in areas away from trees, install "foraging islands" to improve the foraging quality of the area. See Specific Protocols for Quality Foraging Habitat (see Specific Protocol C).
- d. Low- to No-Use Owl Areas (Developed):
- Conduct a consultation with Shoreline managers and the burrowing owl biologist whenever land disturbance actions in the area are planned. Land disturbance actions include disturbing burrows, removing vegetation, piling or moving dirt, digging or removing dirt, overcovering land, discing or other soil disturbance. If burrowing owls or owl habitat will be impacted, prepare a PE

(see Specific Protocol F). Notify the CDFG of impacts to owls or owl habitat.

Action 3. Protect burrowing owls from project impacts.

These measures will be implemented to protect owls and habitat from potentially harmful actions:

- a. Write PEs whenever land disturbance activities, rodent control, tree plantings or unique events in burrowing owl habitat are planned. PEs will ensure the project area is surveyed for owls, regulations are followed, CDFG is informed if needed, owls are protected and areas are returned to habitat, including restoring ground squirrels. See Specific Protocols for Project Evaluations (Protocol F).
- b. Conduct yearly educational workshops for Shoreline staff and relevant City staff to educate them about avoiding impacts to owls and habitat and on procedures required in Shoreline. Include a joint City-Santa Clara Valley Audubon Society presentation in the workshop (see Specific Protocol H).
- c. Prohibit unsupervised/uninformed contractors into Shoreline. All contractors hired to complete work within burrowing owl habitat shall be accompanied by a Shoreline staff member who has been educated about avoiding impacts to owls and habitat. Alternatively, contractors can take an educational workshop provided by the City to learn about protecting burrowing owls. These contractors shall also complete a project walk-through with the biologist and may receive approval, to work in Shoreline unaccompanied by staff (see Specific Protocol F).
- d. Have coordination meetings at least two times per year between Shoreline staff, Public Works staff, Public Services staff and the burrowing owl specialist to review upcoming projects and measures to be taken to avoid impacts to owls and their habitats (see Specific Protocol F).

Action 4. Actively control predators, especially nonnative and nuisance species.

Measures to ensure predators are kept in check include: not planting trees near nesting habitat, keeping trash away from wildlife, ensuring wildlife cannot access outdoor food at the restaurants and prohibiting barbecues in or adjacent to the Park. See Specific Protocols for Predators (Protocol D).

Action 5. Develop a volunteer program with Santa Clara Valley Audubon Society (SCVAS).

SCVAS volunteers should regularly participate in activities that help the City maintain habitat and support owl populations. Volunteers should be integrated into monitoring, foraging and nesting habitat improvement projects, and programs for educating Shoreline staff, contractors and visitors. SCVAS can coordinate with the burrowing owl specialist to participate in projects (see Specific Protocol H).

Action 6. Monitor population and habitat conditions to assess progress toward goals and make changes, as appropriate, to meet population and habitat goals.

In addition to monitoring, the burrowing owl biologist will be responsible for designing and implementing a monitoring plan that will directly assess progress toward population and habitat goals, and will collect data that could be used to determine why goals are not being met, if that is the case. Monitoring will include tracking the implementation of the Actions, PEs and impacts to owls (see Specific Protocols H and I).

Monitoring information, as well as information from yearly reviews, research conducted in the area and literature, will be used by Shoreline managers to change owl management actions if population and/or habitat goals are not being met or to improve conditions at Shoreline.

Action 7. Review implementation effectiveness of burrowing owl management actions with SCVAS.

Adaptive management requires regular review of goals, actions and monitoring to determine if progress toward goals is adequate and/or if changes in the process are needed. Each year, the Shoreline managers, burrowing owl biologist and a representative from SCVAS will meet to determine if changes in actions, monitoring, research or the goals themselves are needed. CDFG should be informed of the meeting, allowing them to attend if they wish (see Specific Protocol H).

Action 8. Submit an annual report to CDFG on progress in implementing the actions and achieving the goals.

Each year, the Community Services Director or his/her designee will submit a report to CDFG written by or reviewed by the burrowing owl biologist that describes: (1) implementation of actions and progress toward population and habitat goals; (2) how the City complied with wildlife laws and regulations; (3) monitoring and research activities of the past year; and (4) changes to

burrowing owl management undertaken. If needed, the Community Services Director or his/her designee will present owl management changes recommended by staff to achieve habitat and population goals.

The burrowing owl specialist will continue with the quarterly reports to Park personnel and will also include the updates on the Burrowing Owl Preservation Plan in the quarterly reports.

Action 9. Employ a full-time biologist with owl expertise.

Implementing this preservation plan can only succeed if the City continues to work with a burrowing owl biologist. This person must have experience with burrowing owl preservation and relevant laws, and should have a demonstrated ability to conduct monitoring and research. The burrowing owl biologist will be responsible for implementing the Burrowing Owl Preservation Plan (including monitoring and reporting), coordinating with staff on projects, working with burrowing owl volunteers, implementing changes as appropriate, and coordinating with researchers and managers working on burrowing owl issues in the region and the State. The burrowing owl biologist will assist City staff in complying with legal requirements and in contacting and working with the CDFG when projects impact or may impact burrowing owls. The biologist will also stay current on burrowing owl literature. The biologist will actively participate in regional plans relevant to burrowing owls, such as the Santa Clara County Habitat Conservation Plan, participate in/attend burrowing owl consortium meetings, and CDFG meetings on regional and State-wide burrowing owl preservation. This biologist can also handle other wildlife issues at Shoreline.

Action 10. Encourage local universities and/or other researchers to conduct research that helps Shoreline staff preserve the burrowing owl population at Shoreline.

Research that is focused on assisting managers can be invaluable in understanding population changes and finding management that could improve conditions. The burrowing owl biologist would be responsible for coordinating and assisting researchers (Protocol H).

V. SPECIFIC PROTOCOLS

The actions listed in the previous section are designed to reduce the factors that threaten the burrowing owl population at Shoreline, including low nesting and foraging habitat quality, regular/large-scale ground disturbance, human intrusion, lack of adequate burrows and predators. The specific protocols given here provide background on the issues and give detailed direction/recommendations for addressing each of these issues. Included in this Plan is Appendix A—*List of Specific Protocol Recommendations*, for easy reference by City staff and intended to be a working document in day-to-day operations.

A. Quality Nesting Habitat

Nesting burrowing owls require habitat with short grass and no trees around their burrows. They also need adequate foraging habitat nearby. Implement these measures to manage for high-quality nesting habitat.

- i. *Mowing.* Mowing is critical for providing burrowing owl habitat. The habitat requirements of burrowing owls are very specific. Near their burrows, owls need short vegetation, open terrain and abundant burrows (Thomson, 1971; Zarn, 1974; and Green and Anthony, 1997). However, foraging areas require more varied habitat conditions such as long grass, brush piles and native shrubs to provide habitat for burrowing owl prey.

Burrowing owls at Shoreline have shown a strong tendency to nest on the golf course, due in part to the short, regularly mowed vegetation. Short vegetation in and around nesting burrows cannot be emphasized enough to maintain a population of burrowing owls.

Short vegetation, less than 6" in height, or even bare ground is of prime importance to burrowing owl reproduction and survivorship; burrowing owls will abandon nest burrows when the vegetation grows too tall. Maintaining short vegetation in nesting burrowing owl habitats by mowing or grazing is a standard procedure for successful burrowing owl survival. Several studies conducted at the Park and nearby NASA Ames/Moffett Federal Airfield confirmed the importance of short vegetation around burrowing owl nests (Trulio, 1997, 1999; Fisher, *et al.*, 2007).

Two standard mowings per year are presently conducted at Shoreline. The first mowing usually occurs around the end of March/start of April (depending on vegetation height and the availability of the mowing contractor). The second mowing occurs just before July 4, usually the

last week of June. This mowing is also designed to reduce biomass for fire suppression during the July 4 fireworks display at the nearby Shoreline Amphitheatre. Targeted mowing of active burrowing owl burrows/mounds and artificial burrows is done on a regular basis, especially during the grass growing season, with a hand-held weed/grass trimmer by the burrowing owl specialist.

Additional mowing of prime burrowing owl nesting habitat during the breeding season would greatly enhance the suitability of the Park for burrowing owl use, thus increasing burrowing owl productivity. Instead of two large-scale mowings per year, four small-scale mowings targeting high-density areas of ground squirrel burrows would attract more burrowing owls and increase burrow use.

To ensure adequate foraging habitat, the burrowing owl biologist, working with Landfill and Park staff, will designate large areas near nesting habitat that will be allowed to grow long. Areas of tall grass would be rotated such that large areas of grassland are always short and some are always long. Other areas in nesting habitat should be planted with native shrubs and groundcover perennials and/or have other features such as debris piles to create "foraging islands" (see Quality Foraging Habitat below). The location of these features will be determined by the burrowing owl specialist to ensure that birds at nesting burrows have an unobstructed view.

For effective nest habitat management, the burrowing owl specialist must be allowed to mow areas when needed. The City should purchase a small, seated mower and have the burrowing owl specialist or park maintenance worker mow specific flat areas of high ground squirrel burrow densities on an as-needed basis to maintain suitable vegetation height. A hand-push mower would also be useful, allowing cutting of areas beyond the sites presently mowed with the hand-held weed/grass whacker.

Mowing becomes more important due to landfill grading projects which increase the quantity of nonnative weeds. Soil imported from outside the Park for grading projects contains vast amounts of seeds of pioneer weed species that often grow up to 4' to 6' tall and reduce the suitability of the Park, not just for burrowing owls, but for nearly every species inhabiting the Park. Mowing later in the season has been added to the mowing schedule to address these aggressive weeds. However, with each additional grading project, a surge of weedy species occurs and often new weed species are introduced.

Recommendations for mowing include:

- Each year, the burrowing owl biologist, in conjunction with Shoreline staff, will develop a plan for mowing/nonmowing areas in the Park.
 - Mow specified nesting and high burrow density areas a minimum of four times a year. Time mowing in appropriate areas to reduce nonnative, invasive weeds.
 - Provide a small riding mower for Park staff and the burrowing owl biologist to mow nesting areas.
 - Have contractors mow nonowl habitat areas or areas as specified by the mowing plan developed by the burrowing owl biologist/the Park staff.
 - In all contractor mowing, include financial penalties in the contract if the contractor mows unauthorized areas or does not complete the job in the specified time line.
- ii. *Landscaping/Seeding.* Landscape projects should not include tall trees in areas adjacent to burrowing owl nesting or foraging habitat. Tall trees provide perches for other raptors that can easily prey upon the burrowing owls, reducing the suitability of several areas for owls. Landscaping of the Park, especially with tall trees, should include participation from the burrowing owl specialist to reduce impacts to burrowing owls.

Review areas that have been planted with tall trees adjacent to burrowing owl nesting areas and prune them to an acceptable height.

Currently, upon completion of grading projects, areas are seeded with a variety of native grass and annual species to reduce erosion and enhance the habitat for a diversity of animal species. Hydroseeding has been the preferred method of seed dispersal whereby the native seeds are spread on the soil in a mixture of fertilizer and water. Timing hydroseeding to take advantage of precipitation is crucial as no irrigation is provided for the plants. Hydroseeding has often resulted in limited or no plants establishing themselves due to low rainfall or ineffective timing of hydroseeding. Research should also be conducted on other methods of native plant enhancement. For example, in fall 2010, an experimental plot was set up in the Meadowlands where native seeds were broadcast

into a recently disked area and then compacted to determine if this method would optimize seed-to-soil contact.

For effective results, schedule seed dispersal for the beginning of the winter rainy season in November/December. If planting is implemented during the dry months, irrigation will be necessary. Also, irrigation is usually necessary during the dry season for the first two years after native perennials are planted. After that, they do not need water.

At present, there are two distinct seed mixtures used for grassland revegetation at Shoreline (Tables A-1 and A-2). Additional research, conducted by qualified researchers from consulting firms, nonprofit groups or local universities, should be implemented to determine whether these species are the most suitable in terms of long-term establishment and what, if any, other species would be best suited to the site. Purple needle grass has established itself successfully at numerous locations in Shoreline and California poppies have regularly reseeded themselves. To reduce cost and effort, focus on species that do well under Shoreline's conditions.

Table A-1. Plant Mix A—Burrowing owl mix for owl habitat.

Species	Scientific Name	Pounds/Acre
California Meadow Barley	<i>Hordeumbrachyantherum</i>	9
Purple Needlegrass South Bay	<i>Nassella pulchra</i>	9
California Poppy	<i>Eschscholzia californica</i>	1.5
California Brome	<i>Bromus carinatus</i>	2
Red Fescue Native	<i>Festuca rubra (Molate)</i>	5
Clarkia	<i>Clarkia elegans</i>	.25

Table A-2. Plant Mix B—Nonburrowing owl areas.

Species	Scientific Name	Pounds/Acre
Clover	<i>Trifolium tridentatum</i>	4
California Brome	<i>Bromus carinatus</i> (annual)	35
Small fescue	<i>Vulpia microstachys</i>	6

- iii. **Nonnative Invasive Weeds.** Nonnative, highly invasive species such as tumbleweed, stinkweed, mustard, yellow star thistle and many others are a major problem in Shoreline. Since they are not native, these species do not support the great diversity and abundance of native species, especially burrowing owl prey, that native plants support. These species are primarily imported into the Park in soil for fill projects; control should be stepped-up to limit introductions and reduce the impact from these species. They are spreading at a rapid rate, degrading the habitat

of the Park and potentially providing a fire hazard. Measures to limit this problem include:

- Limiting fill to only work necessary.
 - Allowing clean fill with no seeds whenever possible.
 - Instituting a mowing or succession regime to reduce/eliminate nonnatives.
- iv. *Owl Perches.* Short perches (under 3' tall) should be provided near nesting burrows to provide the birds a good view of the habitat as part of artificial burrow installations. Use natural materials such as sticks and large rocks.
- v. *Poisons.* Since poisons used to kill other organisms can secondarily poison burrowing owls:
- a. Never use pesticides, rodenticides or herbicides in the nesting preserve.
 - b. If poisons such as rodenticides are absolutely essential in other parts of Shoreline, work with the burrowing owl specialist on use of the poisons to avoid impacts to burrowing owls.

B. Burrow Availability

- i. *Ground Squirrels.* Burrow availability is crucial for burrowing owl survival as burrowing owls, despite their name, do not dig their own burrows; they are heavily dependent on ground squirrel burrows for their survival. Areas within Shoreline that have experienced minimal land disturbances have healthy ground squirrel populations while areas experiencing more frequent land disturbances experience fewer ground squirrels. Recolonization of areas by ground squirrels after landfill grading may be slowed or prevented by substrate conditions and locations of source populations of squirrels.

To improve and preserve owl populations, grading projects must evaluate their impacts on California ground squirrels and be managed to reduce or mitigate impacts on prime foraging habitat. Grading projects are to be tightly restricted to only those areas needed and dirt fill placed in a manner such that regrading is not required for five to seven years. This will allow ground squirrels and burrowing owls to recolonize and use the site for a number of years before the next land disturbance.

If projects will destroy squirrel burrows, mitigations for this impact should include some or all of these measures (all conducted by the burrowing owl biologist):

- a. The burrowing owl biologist will evaluate the area surrounding the project for burrows. If sufficient natural burrows are available adjacent to the proposed site, then evict ground squirrels in the project area using one-way trap doors. This work will be conducted by the burrowing owl biologist.
 - b. If insufficient burrows exist, employ passive relocation of ground squirrels by installing artificial burrows within close proximity of the project site and evicting the squirrels in the project area.
 - c. Repopulate impacted areas with ground squirrels by capturing squirrels and releasing them into artificial burrows.
 - d. Mitigation measures should be included in PEs, as should all habitat restoration and mitigation actions. These measures are especially important in all high-owl-use areas such as the Meadowlands, Vista Slope and all mitigation areas. In summary, maintaining squirrel populations should include these measures:
 - Limit landfill disturbance of burrowing owl habitat to as small a footprint as possible.
 - Protect areas of high ground squirrel activity.
 - Where impacts will occur, evaluate the extent of the impact and sufficiency of burrows nearby.
 - Evict ground squirrels from landfill disturbance sites and provide artificial burrows nearby as refuge.
 - Passively relocate squirrels back into recently disturbed areas.
- ii. *Artificial Burrows.* Artificial burrows are regularly installed at Shoreline as part of ongoing passive relocation projects. They have been successfully used by burrowing owls, some more than others. Artificial burrows could be used in some locations where natural burrow availability is low or nonexistent, usually where landfill activities have significantly reduced or impacted ground squirrel populations. Where projects will impact burrowing owl burrows and impacts are approved

by the CDFG, artificial burrows can be installed to provide new burrows and passively relocate owls in consultation with CDFG and the burrowing owl specialist. Several different designs have been used such as artificial burrows in mounds or in the ground with the entrance flush with the ground surface. The burrowing owl specialist can determine which burrow design is best given the site conditions. The Meadowlands is an ideal location for artificial burrows to attract burrowing owls, including the nonlandfill area next to Shoreline Boulevard; several clusters of between four and six artificial burrows would greatly enhance this area. Another ideal location would be the northeast portion of the Meadowlands which was just recently graded and has no source of ground squirrels close by for recolonization. Locate artificial burrows where no underground landfill piping exists; thus, disturbance from landfill activities would be at a minimum at these locations.

C. Quality Foraging Habitat

While the vegetation close to nesting burrows must be short, foraging habitat that supports a good abundance of insects and rodents must include a diversity of plant species and structural heterogeneity. Use these measures to ensure high-quality foraging habitat near nesting birds.

- i. *Vegetation.* Landscaping with native perennial plants would enhance the prey base of burrowing owls (Moulton, *et al.*, 2006) by providing an additional year-round source of cover, especially for small rodents which occur in greater abundance in a mixture of high-density, and diversity of shrubs and mixed-grass (Windberg, 1998). The nonnative annual grasses in California have a short but rapid growing period during the wet season and then dry out shortly afterwards. Native perennials can provide a year-round supply of seeds, berries and fruit for burrowing owl prey. Native perennials adjacent to active owls' burrows should be low-growing species, while taller perennials could be planted further away from active owl colonies or along the peripheral of owl habitat. Some suitable plant species could include the following: *Arctostaphylos ssp.*, *Atriplex ssp.*, *Ceanothus ssp.*, *Eriogonum ssp.*, *Lupinus ssp.*, *Mimulus ssp.*, *Monardella ssp.*, *Ribes ssp.*, *Rosa ssp.* and *Salvia ssp.*

After completing grading projects, reconstruct foraging habitat features and replant areas with a variety of native grasses, annual forbs and perennial species to reduce erosion and enhance the habitat for a diversity of animal species.

ii. *Foraging Habitat Features.* Features to create and enhance habitat for prey species of burrowing owls include the following:

- Berms/Mounds: Construct berms or mounds approximately 4' high with a gradual slope on both sides (3:1 ratio), with native grasses and annuals and allow to grow unmowed in a natural state. Rodents burrowing into the berms are less likely to experience flooded burrows during the rainy season, which will increase their survival rates. Ground squirrels prefer elevated areas for burrow construction, possibly to scan for predators. Ground squirrel burrows provide ideal habitat for an array of burrowing owl prey species, including lizards, spiders, earwigs, pill bugs, beetles, snails, slugs, mice and flies.
- Brush Piles: Brush piles consist of large logs loosely spaced in a crisscrossed pattern. Smaller branches and twigs create the next layer and dead vegetation placed on top creates the final layer. The damp, warm interior of the brush piles attract many animal species, providing an ideal habitat for birds, reptiles, amphibians and rodents.
- Rock Piles: Rock piles should be several feet in diameter and 2' to 3' in height. The foundation consists of large boulders with hiding places in between with smaller rocks placed on top. Reptiles and amphibians are attracted to the thermal heat provided by the surface rocks and the moist environment under the rocks.
- Logs: Place large branches or small tree trunks around the sites to provide ideal habitat for invertebrates such as beetles and grubs as the wood decomposes.
- Pipe Piles: Place terra cotta pipe of various pipe diameters and lengths in piles above and below ground. Pipe above ground may have both ends open while below ground pipe is to have one end buried into the soil. Some pipe piles may be covered with vegetation. Rodents, amphibians and invertebrates are attracted to the moist conditions within the pipes, which also provide cover and protection.
- Mulch: Place mulch or leaf matter in small heaps and spread out to attract ground-living invertebrates that inhabit this type of environment.

- Native Plants: Based on the advice of the burrowing owl specialist, grow native perennial ground cover plants in dense plantings. Hydroseed flat areas with native grasses to be left unmowed to provide cover and food for rodents and invertebrates.
- "Foraging Islands": "Foraging islands" are compact features composed of brush, rocks, pipe piles and native species to increase prey abundance. In places far from nesting burrows, tall grasses and shrubs can be included. These islands can be easily replaced with more brush, rocks and pipes, if damaged. Foraging islands can also be placed in nesting habitat to provide nearby prey, but far enough from nests not to obstruct the birds' views; avoid using grasses or plants that grow tall and would require mowing.

iii. *Poisons*. Since poisons used to kill other organisms can secondarily poison burrowing owls:

- a. Avoid using pesticides, rodenticides or herbicides in the foraging areas.
- b. If poisons such as rodenticides are absolutely essential, work with the burrowing owl specialist on use of the poisons to avoid impacts to burrowing owls.

In summary, to ensure high-quality foraging habitat, recommendations include:

- The burrowing owl biologist will develop a plan each year for mowing and otherwise improving or maintaining high-quality foraging habitat.
- Allowing longer grass and perennial native plants in areas that do not obstruct the view of nesting owls.
- Place brush piles, debris piles (with terra cotta pipes and other rodent-friendly materials) and other physical features to attract insects and rodents throughout foraging habitat, but away from nests and areas that will be mowed.
- Restore damaged areas using native species and habitat features to attract native insects and rodents.

- Develop "foraging islands" composed of brush, rocks, pipe piles and native species which provide good habitat for burrowing owl prey.
- Avoid use of all pesticides, rodenticides or herbicides. If use is absolutely necessary, work with the burrowing owl specialist on avoiding impacts to owls.

D. **Predators**

While predation is natural, humans have altered the owl's environment in a way that attracts native and nonnative predators and, thereby, reduces the owl's population. Follow these measures to reduce the threat of predation for burrowing owls.

- i. *Barbecuing and Trash Containers.* Corvid (crow and raven) populations have been experiencing exponential growth rates in urban areas because of access to anthropogenic foods. Marzluff and Neatherlin (2005) found that corvids had smaller home ranges and higher rates of reproduction, with annual survival rates positively associated with proximity to human settlements and campgrounds where the corvids spent 75 percent of their foraging on human foods. Other species, especially generalist omnivores, such as feral cats, dogs, skunks, raccoons and opossums that benefit from human-provided food sources, are prime predators of burrowing owls. An increase in these species increases mortality rates of already diminishing burrowing owl populations.

To prevent increases in populations of these predators due to access to trash and human food:

- Trash containers should be provided at all events and all locations where food is served and/or consumed. Containers must be designed in such a way that birds and other animals cannot remove the food contained within.
 - Portable barbecues are discouraged and permanent barbecue facilities within or adjacent to Shoreline should not be permitted. If, on occasions, Shoreline permits a barbecue, it will occur during business hours (9:00 a.m. to 5:00 p.m.) at permitted locations. After a barbecue event, a Ranger will visit the site to ensure no food is available to predators.
- ii. *Cats.* Feral cats are supreme predators and actively prey upon burrowing owls. One study in Florida found owl mortality by cats

accounted for 30 percent of deaths (Millsap and Bear, 1988). Cats also impact burrowing owls indirectly by decimating small bird and rodent populations, reducing the available food supply for burrowing owls. Lepczyk and Mertig (2004) estimated that cats in southeastern Michigan were killing about 47,000 birds during the breeding season.

- Continue the cat trapping program in operation at Shoreline.
- Proactively discourage all feeding of cats in Shoreline, especially at Michaels Restaurant and at the Shoreline Amphitheatre.

iii. *Dogs.* Dogs were the cause of 20 percent of damage to burrowing owl burrows at Oakland airport (Thomsen, 1971) and the mere presence of dogs causes a frenzied defense from burrowing owls. Dogs are known predators of young burrowing owls and eggs (Haug, 1985). Procedures to reduce the impact of dogs within Shoreline should be implemented, including:

- Increase signage and educational programs; and
- Institute fines or a written warning as a deterrent.

iv. *Other Predators.* Burrowing owls have many predators, both native and nonnative. Diurnal predators observed at Shoreline attempting to kill or successfully killing owls on a regular basis include: crows, golden eagles and red-tailed hawks. Recently, there has been a significant increase in crows and red-tailed hawks at the Park. Some simple, humane ways to reduce the impact of these predators are to:

- Reduce the availability of perching sites adjacent to prime burrowing owl habitats and install antipredator perches on lampposts near owl habitat.
- Do not plant trees near burrowing owl habitat, especially nesting sites.
- Reduce anthropogenic food availability with animal-resistant trash containers to prevent wildlife access and by having rangers or other staff patrol food service and preparation areas each day and after each event.

E. Human Intrusion

Human intrusion, either on foot or by vehicle, can be very disruptive to burrowing owls and the paths and roads fragment habitat, reducing its nesting and foraging quality.

- i. *Human Approach.* Many studies have found birds respond to human approach as they would to a predator. Thus, humans approaching burrowing owls is very disruptive; owls expend energy escaping and may expose themselves or their young to predation. In addition, Thomsen (1971) found that 65 percent of damage to owl burrows was caused by humans. At Shoreline, human approaches include teenage golfers throwing golf balls at birds, photographers disturbing burrowing owls by advancing too close to the burrow, and walkers/joggers going off pathways and trampling over active burrows. Several solutions to this problem are:
 - Develop a dedicated burrowing owl preserve, which has no or very limited trails in nesting habitat. Preserve areas should have fencing (split-rail or other attractive fencing) as needed and/or feasible to prevent people from entering.
 - Have signs on the golf course that all animals are protected.
- ii. *Trail and Road Removal.* Trails through habitat can significantly degrade habitat quality. Trails through owl habitat facilitate human and dog approach to birds and burrows and, if vehicles go off trails, they can destroy burrows and kill birds and squirrels. Trails also fragment habitat, reducing its ability to support nests or owl prey.

There are many miles of official and unofficial trails and roads at Shoreline and removal of some of these could significantly increase the suitability of habitat for burrowing owls. Specifically, social trails and unofficial roads in nesting habitat should be closed off and replanted. Also, official trails in owl mitigation areas and burrowing owl preserve nesting habitat should be reviewed and considered for removal if feasible. Installing a split rail fence or other barrier to restrict human intrusion in owl habitat should be considered.

Millsap and Bear (1988) found 25 percent of known mortality of burrowing owls was attributed to vehicle collisions, while Haug and Oliphant (1987) found vehicle collisions responsible for 37 percent of mortality. In addition, roads fragment and degrade habitat, reducing the amount of prey and nesting areas available to owls. A large number

of unofficial roads have been formed by Shoreline staff conducting maintenance activities. Maintenance staff should establish a plan to provide access roads that minimize intrusion and impacts into wildlife habitat areas. All such roads in the burrowing owl preserve deemed unnecessary should be blocked off and revegetated. Landfill monitoring and surveillance activities should be conducted by driving on the designated routes or by golf cart. Unofficial roads throughout all parts of Shoreline should be removed to the greatest extent possible. Fencing around the burrowing owl preserve would greatly reduce human and vehicular trespass. Fencing can also limit access of people with dogs, for instance, along the Back 5 section of the golf course where the fence line of the Google property ends. This area has constant foot traffic and regular access with dogs directly adjacent to the burrowing owl mitigation area.

Recommendations include:

- Remove unofficial trails from burrowing owl nesting and foraging habitat.
- Fence the preserve and other high-owl-use areas when feasible.
- Evaluate the location of informal roads and remove those that are unnecessary and redundant. Relocate others in a way that avoids impacts to owl habitat but meets the needs of landfill maintenance staff.

Lights. Lighting can cause alteration in behavioral patterns of some species, especially nocturnal species. Burrowing owl foraging normally occurs at dusk and dawn; thus, lighting adjacent to burrowing owl nesting and prime foraging areas could severely impact both the owls and their prey species. Lampposts also provide ideal perching posts for hawks and eagles. To reduce impacts:

- Lampposts adjacent to active burrowing owl nesting areas should have antiperching deterrents installed to discourage these predators of burrowing owls.
- Lighting will be turned off as soon as not needed.
- Lighting will be directed away from burrowing owl and other habitats. Lights will be designed to illuminate only the necessary activities.

F. **Project Impacts**

A wide range of projects from tree planting to rodent eradication to landfill maintenance have had negative impacts on owls at Shoreline. Because much of Shoreline is located over a landfill, required landfill maintenance and repair operations have taken a major toll on burrowing owl nest survival and habitat quality. Measures to reduce impacts to owls begin with a PE for any activity from tree planting to large-scale earth moving, as these can all affect burrowing owl survival and reproduction.

- i. *Project Evaluations.* To reduce project impacts, Shoreline instituted PEs, which are required during soil disturbance/digging projects to reduce any negative impact to burrowing owls. A PE is generated from the originator of the project and the form is completed by the burrowing owl specialist.
 - PEs should be required for all projects that could possibly impact burrowing owls or their habitat. To ensure this, the Community Services Director or his/her designee and burrowing owl biologist must be informed of all projects—large or small—in Shoreline. Impacts to burrowing owls are not just limited to destruction of burrows and grading soil, but also include physical disturbance by foot traffic, automobile collisions, helicopter activity and destruction and collapse of burrows from vehicular traffic.
 - A PE Form should be standard for all projects and this form should include the following:
 1. A detailed description of the project, including a clear justification of the need for the project that cites the regulations or laws that require the action, its location, start date, completion date and contact person. In addition to quantifying the exact acreage of the project (including proposed haul routes, staging area, fill zone, etc.), the description will explain the need for the size of the project impact.
 2. A map of the location of the project showing the boundary of the project site.
 3. This boundary will be marked by both the originator of the PE and the burrowing owl biologist.

4. All outside contractors, including truck drivers, will be accompanied or will take a workshop providing information as to the sensitivity of the site, the location of nearby active burrowing owl burrows and the routes to be taken at all times (as required by Action 3.)
 5. A list of vegetation, foraging habitat, nesting habitat and ground squirrel restoration mitigations to be implemented when the project is completed.
 6. The PE will be signed by both the originator and the biologist after the site has been marked.
- For large dirt fill projects directly adjacent to high-density ground squirrel burrows, before dumping occurs, several artificial burrows should be constructed on the periphery of the project site and one-way trap doors placed on the active squirrel burrows to encourage squirrels to locate to artificial burrows during project. This will facilitate rapid recolonization of the project site upon completion. See Specific Protocols for *Burrow Availability—Artificial Burrows* (Protocol B).
 - All trash and construction debris will be removed from the project site after completion.
 - When finished, the site will be graded to a level suitable for mowing and seeding (removing any compacted soil after dirt dumping).
 - All projects will be kept as small as possible, including limiting haul roads, staging areas and fill zones to only the area required to treat the problem.
- ii. *Passive Relocation of Burrowing Owls.* Any project or activity that will impact burrowing owls or their nesting, or permanently impact foraging impact must be approved by the CDFG (see requirements under "Regulatory Framework"). Avoiding impacts to birds or their habitat is the first mitigation approach to consider. If avoidance is not possible, the CDFG may allow burrowing owls to be passively relocated outside of the breeding season (September to January). Passive relocation is a procedure that includes developing artificial burrows near the impact area and evicting owls before impacts occur. For passive relocation to occur, four to six artificial burrows for each natal and satellite burrow would need to be constructed in advance of the passive relocation; then,

upon completion, one-way trap doors would be put in place for about seven days prior to eviction. Upon completion of the project, the site would need to be restored to its original state, with vegetation and original burrows replaced with artificial burrows as burrowing owls have burrow fidelity. The plan for passive relocation must be developed by the Community Services Director or his/her designee or other appropriate City staff and the burrowing owl biologist with the CDFG. Only when the plan is approved by the CDGF can it be implemented.

- iii. *Long-Term, Large-Scale Coordination.* Because PEs are project-specific, they are not good tools for coordinating among projects, setting goals for limiting impacts or evaluating cumulative impacts of projects. Long-term, large-scale projects require coordination meetings at least several times per year, between the Shoreline managers, staff and the burrowing owl specialist. At an initial meeting early in the year, likely projects should be brought forward and reviewed. This will allow discussion of projects that staff might not have thought could harm owls. Managers will also have the opportunity to limit footprints of projects or negotiate project timing, as appropriate, and the chance to evaluate and reduce the cumulative impact of projects on owls.

As part of long-term planning, Shoreline managers should set a conservative area limit for the amount of land disturbance and covering that is allowed each year, apart from emergency operations required by agencies or human safety. This target should be put into the yearly report evaluating progress toward habitat and population goals. Having such a target, while it may not always be achievable, will help limit land disturbances. In addition, long-term planning should include designs for landfill repairs that will ensure, to the greatest extent possible, that another repair in that area will not be needed for at least five years. Increasing the slope of the finish grades for dirt filling projects are implemented should be considered. Also consider replacing extraction well laterals at the same time.

G. Landfill Project Procedures

The nature of landfill maintenance allows for most work to be planned in advance using the Project Evaluation and Long-Term, Large-Scale Coordination procedures given in Specific Protocol F. Thus, the great majority of landfill repair/maintenance projects encompassing most of the area disturbed each year for these projects will fall under Specific Protocol F. However, at times, actions that were not envisioned during coordination meetings will be necessary to meet regulatory requirements; these "Priority Actions" will allow some planning and coordination, but must be completed

within a few days. On still other occasions, "Emergency Actions," which permit no prior planning, must be taken to protect public health. Procedures for these two infrequent classes of action are given below.

i. *Routine Maintenance Projects*

Routine maintenance items are planned nonurgent regulatory and nonregulatory work items that can be planned for and are not required to be done on a priority or emergency basis as described below. Be aware that avoidance or habitat mitigation measures may be changed by requirements of the CDFG.

If the City plans an earth-moving or construction project in suitable or occupied burrowing owl habitat at Shoreline at any time during the year, the following protocol will be followed. The protocol will be used to avoid accidental injury or mortality of owls or to prevent owls from moving into areas where construction may occur.

The City department originating the project will submit a Project Evaluation Form to the Community Services Director or his/her designee and burrowing owl biologist/specialist, including a description of the project, a map illustrating the site location at Shoreline, vehicle and equipment travel routes, the starting and ending dates of the project (if known), and the name and telephone number of a contact person at that department at least one week prior to the proposed project starting date. See Protocol F for full Project Evaluation elements.

The City's qualified owl biologist/specialist will conduct a preconstruction survey of the project site to determine if there is any evidence of owls or owl use. The survey will follow the CDFG Staff Report on Burrowing Owl Mitigation (1995) and the City's owl biologist's recommendations for survey methodology. An initial survey will be conducted to determine if there is any owl use (nesting, roosting, foraging) on the project site. If no owls or ground squirrel burrows are observed on the site, then the Project Evaluation Form will be completed and sent to the appropriate City department(s) and landfill crews. If ground squirrel burrows are found on the project site, then at least three additional surveys will be conducted on different dates. The initial survey and three additional surveys should include two morning surveys and two evening surveys. The morning surveys should include the period between one hour before sunrise to one hour after sunrise; evening surveys should include the period between one hour before sunrise to one hour after sunrise; evening surveys should include the

period between two hours before sunset to one hour after sunset. Surveys should not be done during heavy rain, high winds (over 20 mph) or if there is dense fog over the site. If the project does not begin within five days of the last survey, another preconstruction survey will be required prior to starting construction.

The qualified owl biologist/specialist will determine the potential impacts of the project on burrowing owls or their habitat. To avoid impacts to burrows, the CDFG (March 7, 2012) requires that project disturbance remain within the distances as per the following table:

Location	Time of Year	Low Disturbance	Medium Disturbance	High Disturbance
Nesting sites	April 1- August 15	200 m/650'	500 m/1,625'	500m/1,625'
Nesting sites	August 16- October 15	200 m/650'	200 m/650'	500m/1,625'
Nesting sites	October 16- March 31	50 m/162'	100 m/325'	500 m/1,625'

Impacts to foraging habitat will also be determined. The City's qualified burrowing owl biologist/specialist will then fill out the Project Evaluation Form, indicating whether the project is "approved with avoidance measures" or "postponed for further study," which may include postponing the project until the nonbreeding season. The qualified owl biologist/specialist will also list avoidance and habitat mitigation measures and, if necessary, consult with the CDFG.

If owls are found during the survey and are within the buffer zone as defined in the CDFG Staff Report (2012) during the breeding season, the project will be postponed unless it is deemed an emergency or priority repair. The qualified owl biologist/specialist will list avoidance measures to be followed by the City during project construction to avoid harming or harassing owls. A routine project which is postponed may become a priority project if delayed too long, such as for annual cap repair projects that must be done with sufficient time to hydroseed before winter rains begin.

If the project is approved with avoidance and/or habitat mitigation measures or requires further study, the Community Services Director or his/her designee or burrowing owl biologist/specialist will contact the CDFG by telephone, facsimile or letter to relate the survey results and suggested avoidance measures. If no owls or evidence of owls are

observed on the site, and with CDFG approval, one-way doors may be installed in all ground squirrel burrows in the project area for a period of at least 72 hours (three days). Thereafter, all ground squirrel burrows which will be destroyed by project construction activities will be blocked or filled with dirt.

Prior to project excavation and/or grading, all active owl burrows within the project site will be identified by the City's qualified burrowing owl biologist/specialist. The qualified owl biologist/specialist will place flagged wooden stakes, traffic cones or barricades between the active owl burrow(s) and the construction boundaries to delineate a buffer zone of protection for the active burrow(s). Although the CDFG recommends that the projects remain at least 50 meters (160') from active burrows during the nonbreeding season, it may be necessary to place stakes, cones or barricades closer than 50 meters (160') from an active burrow, depending on the project and equipment necessary to make the repair.

Although the CDFG Staff Report (1995) does not specify work hours, the CDFG strongly suggests that any work to be performed within owl habitat be scheduled between the hours of 9:00 a.m. and 3:00 p.m. to reduce the disturbance to owls during their foraging periods.

A vehicle and equipment travel route will be marked on the site map and on the ground at the project site prior to beginning the project. Cones or flags may be used to mark the vehicle travel route within 100' of the project location.

The City's qualified burrowing owl biologist/specialist will monitor the project site during, and following project work to ensure that no owls are harmed and to monitor owl behavior during project work. The owl biologist/specialist will then write a report summarizing the project and monitoring results, which will be included as an attachment to the City's annual report.

- ii. *Priority Repair Projects.* A priority repair is any repair associated with maintaining the integrity of the landfill cap or landfill gas and leachate extraction systems that must be completed within five (5) calendar days. Requirements for gas collection and leachate operations and conditions are set by the San Francisco Bay Area Air Quality Management District. Priority Projects will follow this protocol:

1. Landfill Maintenance Coordinator will contact the Community Services Director or his/her designee and burrowing owl biologist/specialist and discuss the need for the project.
2. A Project Evaluation will be completed.
3. Burrowing owl biologist/specialist will conduct a preconstruction survey following the CDFG Staff Report on Burrowing Owl Mitigation (1995).
4. If no owls are found in the project area, the burrowing owl biologist will use one-way doors to evict squirrels from the area.
5. If owls are found occupying the site within 50 meters during the nonnesting season, or 75 meters during the nesting season, the Community Services Director or his/her designee and burrowing owl biologist/specialist will contact the CDFG to determine feasible protection measures for the owls, given the requirements for meeting landfill regulations.
6. The burrowing owl biologist/specialist will monitor the project and provide a report on the project's impacts to burrowing owls to the Community Services Director or his/her designee and the CDFG.

iii. *Emergency Repair Projects.* An emergency repair is any repair that must be done immediately to meet health and safety and or regulatory requirements. Emergency repair projects include: (1) any repair necessary to control or extinguish a landfill fire or breach in the earthen cap which poses an imminent threat to safety; (2) any repair to the landfill cap which is necessary to prevent the seepage or flow of leachate from the landfill cell; or (3) a major break in the landfill gas collection system that could result in shutdown of the City's landfill flare station or serious public health impact. Emergency projects are only those in which there is an imminent threat to public health or which require repair within 24 hours per BAAQMD regulations.

If an emergency repair is needed, these procedures will be followed:

1. Landfill Maintenance coordinator will contact the Community Services Director or his/her designee and burrowing owl biologist/specialist to discuss the need for the project.
2. A Project Evaluation will be completed before the project, if there is time, or after the project if there is not time.

3. Burrowing owl biologist/specialist will survey the project area and, if there is time, evict ground squirrels from the project area.
4. If owls are found in the project area, the burrowing owl biologist/specialist will work with the crew to implement measures to protect owls from the project activity or, in the case of extreme emergency, evict owls from burrows in the project area after consulting with the CDFG.
5. If possible, set up a meeting prior to the emergency repair work with the Community Services Director or his/her designee, burrowing owl biologist/specialist, and Street and Landfill Closure Manager. Participants will discuss the need for the project and feasible owl avoidance measures such as using cones or barricades to protect active owl burrows from project activities and mapping out vehicle and equipment travel routes.
6. If an emergency occurs on a weekend and City landfill crews are unable to contact the Community Services Director or his/her designee or burrowing owl biologist/specialist, the landfill crew will follow these procedures:
 - a. Leave a voice mail message for the Community Services Director or his/her designee describing the emergency and the necessity for immediate repair to the landfill gas collection system. The crew should state the reason(s) why an emergency repair is necessary.
 - b. Using a copy of the most recent burrowing owl monthly report to identify the locations of active owl burrows in the vicinity of the emergency work, set up a line of barricades between the emergency work site (e.g., gas well) and the active owl burrow, if one is within 160' of the emergency work. The barricades should extend out 100' to either side of the work site to keep trucks and equipment from damaging active owl burrows.
 - c. Trucks and equipment must stay on service roads whenever possible. When they must leave service roads, the crew will delineate a travel route that avoids ground squirrel burrows when possible and stays at least 100' from owl burrows.

- d. Following the repair, the landfill crew and/or other appropriate City staff will send an e-mail followed by the PE to the Community Services Director or his/her designee and burrowing owl biologist/specialist that describes the work done and the avoidance measures taken. If impacts to burrowing owls occurred as determined by the burrowing owl biologist/specialist, the Community Services Director or his/her designee or burrowing owl biologist/specialist will contact CDFG by phone.

H. **Volunteers**

The Burrowing Owl Preservation Plan requires significant habitat enhancement and maintenance, as well as monitoring and staff/contractor education. Some of this work can be accomplished by volunteers. In particular, the Santa Clara Valley Audubon Society has, for many years, been a leader in burrowing owl conservation and preservation in our area. This organization has a large base of volunteers who are highly motivated to preserve burrowing owls in our area. SCVAS volunteers are a great resource for helping Shoreline with a range of activities, including:

- Collecting data on numbers of owls, breeding pairs and chicks.
- Monitoring for predators.
- Planting native species in foraging habitat.
- Building habitat islands.
- Maintaining foraging habitat once established.
- Cutting grass in nesting habitat.
- Educating staff and contractors.

The burrowing owl specialist would be responsible for directing the activities of volunteers.

I. **Research**

Additional research would greatly increase our knowledge of some aspects of burrowing owl ecology that at present eludes us, most notably the following:

1. What is the limiting factor for our low reproductive rate? The average number of potential breeding pairs is 7, yet the average number of successful breeding pairs is only 3.3. Burrowing owls can actually have up to 12 eggs, yet our average number of chicks per nest is only 3.6 chicks. We need to find out if the nests with no chicks do produce eggs and if they fail, is it predation or infertile eggs? Maybe a camera inserted into the nests would provide us with some of this information.
2. Cause of adult and chick mortality. Diurnal predators such as hawks, crows and eagles have been observed attempting to kill and killing burrowing owls; however, little is known of the exact cause of mortality. Burrowing owl feathers and parts of carcasses are often found on-site; however, limited knowledge is available as to the main cause of death. Maybe motion-detection cameras adjacent to burrows could provide us with some of this information.
3. What native grass species and annuals are best suited for seed mixes after grading projects, and what species are successfully surviving at present?
4. What parts of the Park are sources of rodent populations and how long does it take for rodents to colonize new areas after seeding?
5. What are the best methods for monitoring owls and habitat to assess progress toward Shoreline's population and habitat goals?
6. And other possible research to be contemplated.

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APPENDIX A.

LIST OF SPECIFIC PROTOCOL RECOMMENDATIONS

A. Quality Nesting Habitat Recommendations

i. *Mowing*

- a. Each year, the burrowing owl biologist, in conjunction with Shoreline staff, will develop a plan for areas to be mowed (for nesting) and areas not to be mowed, to provide foraging habitat.
- b. Mow specified nesting and high burrow density areas four times a year. Time mowing in appropriate areas to reduce nonnative, invasive weeds.
- c. If possible, provide a small riding mower to the Park staff and burrowing owl biologist to mow nesting areas.
- d. Have contractors mow nonowl habitat areas or areas as specified by the mowing plan developed by the burrowing owl biologist/Park staff.
- e. In all contractor mowing, include financial penalties in the contract if the contractor mows unauthorized areas or does not complete the job in the specified time line.
- f. Vegetation around nests must be less than 6" in height for a distance of at least 25'—bare ground is acceptable—to provide an unobstructed view for the birds.

ii. *Landscaping/Seeding*

- a. Landscape projects should not include tall trees in areas adjacent to prime burrowing owl habitat.
- b. Upon completion of grading projects, seed area with a variety of native grass and annual species during the rainy season to take advantage of precipitation, even if hydroseeding.
- c. Conduct research on other methods of native plant enhancement.

- d. Use the seed mixtures for grassland revegetation at Shoreline (Tables 5 and 6). Focus on species that do well under Shoreline's conditions.
- e. Conduct research (by qualified researchers from consulting firms, nonprofit groups or local universities) on which species do best and whether others would be suitable.

Table 5. Plant Mix A—Burrowing owl mix for owl habitat.

Species	Scientific Name	Pounds/acre
California Meadow Barley	<i>Hordeumbrachyantherum</i>	9
Purple Needlegrass South Bay	<i>Nassellapulchra</i>	9
California Poppy	<i>Eschscholziacalifornica</i>	1.5
California Brome	<i>Bromuscarinatus</i>	2
Red Fescue Native	<i>Festucarubra (Molate)</i>	5
Clarkia	<i>Clarkia elegans</i>	.25

Table 6. Plant Mix B—Nonburrowing owl areas.

Species	Scientific Name	Pounds/acre
Clover	<i>Trifoliumtridentatum</i>	4
California Brome	<i>Bromuscarinatus(annual)</i>	35
Small Fescue	<i>Vulpiamicrostachy's</i>	6

iii. *Nonnative Invasive Weeds*

- a. Limit fill to only work necessary.
- b. Allow clean fill with no seeds, especially nonnative weeds, whenever possible.
- c. Institute a mowing or succession regime to reduce/eliminate nonnatives.

iv. *Owl Perches*

- a. Place short perches (under 3' tall) near nesting burrows to provide the birds a good view of the habitat.
- b. Use natural materials such as sticks and large rocks.

v. *Poisons*

- a. Never use pesticides or herbicides in the nesting preserve.

- b. If poisons such as pesticides are absolutely essential in other parts of Shoreline, work with the burrowing owl specialist on use of the poisons to avoid impacts to burrowing owls.

B. Burrow Availability

i. *Ground Squirrels*

- a. For proposed projects, the burrowing owl specialist will evaluate the area surrounding the project for burrows. If sufficient natural burrows are available adjacent to the proposed site, then evict ground squirrels in the project area using one-way trap doors. This work will be conducted by the burrowing owl biologist.
- b. If insufficient burrows exist, employ passive relocation of ground squirrels by installing artificial burrows within close proximity of the project site and evicting the squirrels in the project area.
- c. Repopulate impacted areas with ground squirrels by capturing squirrels and releasing them into artificial burrows.
- d. Include ground squirrel protection and mitigation measures in PEs. Mitigations for squirrel populations should include:
 - Limit landfill disturbance of burrowing owl habitat to as small a footprint as possible.
 - Protect areas of high ground squirrel activity, whenever possible.
 - Where impacts will occur, evaluate the extent of the impact and sufficiency of burrows nearby.
 - Evict ground squirrels from landfill disturbance sites and provide artificial burrows nearby as refuge.
 - Passively relocate squirrels back into recently disturbed areas.

ii. *Artificial Burrows*

- a. Where projects will impact burrowing owl burrows and impacts are approved by the CDFG, install artificial burrows to provide new burrows and passively relocate owls in consultation with the CDFG and the burrowing owl specialist.

- b. Install artificial burrows in locations where natural burrow availability is low or nonexistent, as in where landfill activities have significantly reduced or impacted ground squirrel populations.
- c. The burrowing owl specialist can determine which burrow design is best given the site conditions.
- d. Install burrows in the Meadowlands to attract burrowing owls, including the nonlandfill area next to Shoreline Boulevard; several clusters of between four and six artificial burrows would greatly enhance this area.
- e. Install burrows in the northeast portion of the Meadowlands, which was just recently graded and has no source of ground squirrels close by for recolonization.
- f. Locate artificial burrows where no underground landfill piping exists; thus, disturbance from landfill activities would be at a minimum at these locations.

C. Quality Foraging Habitat

i. *Vegetation*

- a. Landscape with native perennial plants to enhance the prey base of burrowing owls by providing an additional year-round source of cover and food such as seeds, berries and fruit for burrowing owl prey.
- b. Use suitable plant species such as: *Arctostaphylos spp.*, *Atriplex spp.*, *Ceanothus spp.*, *Eriogonum spp.*, *Lupinus spp.*, *Mimulus spp.*, *Monardella spp.*, *Ribes spp.*, *Rosa spp.* and *Salvia spp.*
- c. After completing grading projects, reconstruct foraging habitat features and replant areas with a variety of native grasses (Tables 5 and 6), annual forbs and perennial species, as in "b." above.

ii. *Foraging Habitat Features*

- a. Install these features in foraging areas and in nesting areas as directed by the burrowing owl specialist to create and enhance habitat for burrowing owl prey species:

Berms/Mounds: Construct berms or mounds approximately 4' high with a gradual slope on both sides (3:1 ratio), with native grasses and annuals and allowed to grow unmowed in a natural state. Rodents burrowing into the berms are less likely to experience flooded burrows during the rainy season, which will increase their survival rates. Ground squirrels prefer elevated areas for burrow construction, possibly to scan for predators. Ground squirrel burrows provide ideal habitat for an array of burrowing owl prey species, including lizards, spiders, earwigs, pill bugs, beetles, snails, slugs, mice and flies.

Brush Piles: Brush piles consist of large logs loosely spaced in a crisscrossed pattern. Smaller branches and twigs create the next layer and dead vegetation placed on top creates the final layer. The damp, warm interior of the brush piles attract many animal species, providing an ideal habitat for birds, reptiles, amphibians and rodents.

Rock Piles: Rock piles should be several feet in diameter and 2' to 3' in height. The foundation consists of large boulders with hiding places in between with smaller rocks placed on top. Reptiles and amphibians are attracted to the thermal heat provided by the surface rocks and the moist environment under the rocks.

Logs: Place large branches or small tree trunks around the sites to provide ideal habitat for invertebrates such as beetles and grubs as the wood decomposes.

Pipe Piles: Place terra cotta pipe of various pipe diameters and lengths in piles above and below ground. Pipe above ground may have both ends open while below-ground pipe is to have one end buried into the soil. Some pipe piles may be covered with vegetation. Rodents, amphibians and invertebrates are attracted to the moist conditions within the pipes, which also provide cover and protection.

Mulch: Place mulch or leaf matter in small heaps and spread out to attract ground-living invertebrates that inhabit this type of environment.

Native Plants: Based on the advice of the burrowing owl specialist, grow native perennial ground-cover plants in dense plantings. Hydroseed flat areas with native grasses to be left unmowed to provide cover and food for rodents and invertebrates.

"Foraging Islands": "Foraging islands" are compact features composed of brush, rocks, pipe piles and native species to increase prey abundance. In places far from nesting burrows, tall grasses and shrubs can be included. These islands can be easily replaced with more brush, rocks and pipes, if damaged. Foraging islands can also be placed in nesting habitat to provide nearby prey, but far enough from nests not to obstruct the birds' views; avoid using grasses or plants that grow tall and would require mowing.

1. Work with the burrowing owl biologist to develop a plan each year for mowing and otherwise improving or maintaining high-quality foraging habitat.
2. Allow longer grass and perennial native plants in areas that do not obstruct the view of nesting owls.
3. Restore damaged areas using native species and habitat features to attract native insects and rodents.

iii. *Poisons*

- a. Avoid using pesticides or herbicides in the foraging areas.
- b. If poisons such as pesticides are absolutely essential, work with the burrowing owl specialist on use of the poisons to avoid impacts to burrowing owls.

D. **Predators**

i. *Barbecuing and Trash Containers*

- a. Trash containers should be provided at all events and all locations where food is served and/or consumed. Containers must be designed in such a way that birds and other animals cannot remove

the food contained within. Discuss designs with SCVAS and the CDFG.

- b. Barbecues are discouraged and permanent barbecue facilities within or adjacent to Shoreline should not be permitted. If, on occasions, Shoreline permits a barbecue, it will occur during business hours (9:00 a.m. to 5:00 p.m.) at specifically designated locations. After the barbecue event, a ranger will visit the site to ensure no food is available to predators.

ii. *Cats*

- a. Continue the cat trapping program in operation at Shoreline.
- b. Proactively discourage all feeding of cats in Shoreline, especially at Michaels Restaurant and at the Shoreline Amphitheatre.

iii. *Dogs*

- a. Increase signage and educational programs, which have been somewhat effective.

iv. *Other Predators*

- a. Reduce or eliminate all perching sites that could attract large predators to areas adjacent to prime burrowing owl habitats and install antipredator perches on lampposts near owl habitat.
- b. Do not plant trees near burrowing owl habitat, especially nesting sites.
- c. Reduce anthropogenic food availability with animal-resistant trash containers to prevent wildlife access and by having rangers or other staff patrol food service and preparation areas each day and after each event.

E. Human Intrusion

i. *Human Approach*

- a. Develop a dedicated burrowing owl nesting preserve, which has no or very limited trails. Preserve areas should have fencing (split-rail or other attractive fencing) to prevent people from entering.

- b. Install signs on the golf course stating that all animals are protected.
- ii. *Trail and Road Removal.*
 - a. Remove informal trails from burrowing owl foraging habitat.
 - b. Fence the nesting preserve and other high-owl-use areas.
 - c. Evaluate the location of informal roads and remove those that are unnecessary and redundant. Relocate others to avoid impacts to owl habitat while meeting the needs of landfill maintenance staff.
- iii. *Lights*
 - a. Lampposts adjacent to active burrowing owl nesting areas should have antiperching deterrents installed to discourage burrowing owl predators.
 - b. Turn off lighting as soon as not needed.
 - c. Lighting will be directed away from burrowing owl and other habitats. Lights will be designed to illuminate only the necessary activities.

F. Project Impacts

- i. *Project Evaluations*
 - a. PEs should be required for all projects that could possibly impact burrowing owls or their habitat. To ensure this, the Community Services Director or his/her designee and burrowing owl biologist must be informed of all projects—large or small—in Shoreline. Impacts to burrowing owls are not just limited to destruction of burrows and grading soil, but also include physical disturbance by foot traffic, automobile collisions, helicopter activity, and destruction and collapse of burrows from vehicular traffic.
 - b. A PE Form should be standard for all projects and this form should include the following:
 - 1. A detailed description of the project including the need for the project, its location, start date, completion date and contact person. In addition to quantifying the exact acreage of the

project (including proposed haul routes, staging area, fill zone, etc.), the description will explain the need for the size of the project impact.

2. A map of the location of the project, showing the boundary of the project site. This boundary will be marked by both the originator of the PE and the burrowing owl specialist.
 3. An agreement all contractors, including truck drivers, will sign acknowledging that they understand the sensitivity of the site, the location of nearby active burrowing owl burrows and the routes to be taken at all times.
 4. Fines for contractors that violate the conditions of the contract for protecting owls and habitat. Include fine information in the agreement.
 5. A list of vegetation, owl foraging habitat, owl nesting habitat and ground squirrel restoration mitigations to be implemented when the project is completed.
 6. Signatures required by both the PE originator and the burrowing owl specialist after the site has been marked.
- c. For large dirt fill projects directly adjacent to areas of high-density ground squirrel burrows, before dumping occurs, several artificial burrows should be constructed on the periphery of the project site and one-way trap doors placed on the active squirrel burrows to encourage squirrels to locate to artificial burrows during project. This will facilitate rapid recolonization of the project site upon completion. See Specific Protocols for Burrow Availability—Ground Squirrels (Protocol B).
 - d. All trash and construction debris will be removed from the project site after completion.
 - e. When finished, the site will be graded to a level suitable for mowing and seeding (removing any compacted soil after dirt dumping).
 - f. All projects will be kept as small as possible, including limiting haul roads, staging areas and fill zones to only the area required to treat the problem.

ii. *Passive Relocation of Burrowing Owls*

- a. Any project or activity that will impact burrowing owls or their nesting, or permanently impact foraging impact must be approved by the CDFG (see requirements under "Regulatory Framework").
- b. For passive relocation to occur, four to six artificial burrows for each natal and satellite burrow would need to be constructed in advance of the passive relocation; then, upon completion, one-way trap doors would be put in place for about seven days prior to eviction.
- c. Upon completion of the project, restore the site to its original state, with vegetation and original burrows replaced with artificial burrows.

iii. *Long-Term, Large-Scale Coordination*

- a. The Shoreline managers, staff and the burrowing owl specialist should meet early in the year to review the likely projects for the year.
- b. Limit all projects to as small as possible, including limiting haul roads, staging areas and fill zones to only the area required to treat the problem.

G. Volunteers

- a. Engage volunteers from the Santa Clara Valley Audubon Society burrowing owl conservation and preservation in the Park.
- b. Have them conduct tasks such as:
 - Collecting data on numbers of owls, breeding pairs and chicks.
 - Monitoring for predators.
 - Planting native species in foraging habitat.
 - Building habitat islands.
 - Maintaining foraging habitat once established.
 - Cutting grass in nesting habitat.

- Educating staff and contractors.
- c. The burrowing owl specialist will direct the activities of volunteers.

H. **Research**

- a. Engage local universities or other sources of qualified researchers to address important questions about burrowing owls.
- b. Research questions should include:
1. What factors are limiting our low reproductive rate? For example, how often do birds produce eggs that do not result, cause of adult and chick mortality? What are the major factors in adult and chick mortality?
 2. What native grass species and annuals are best suited for seed mixes after grading projects, and what species are successfully surviving at present?
 3. What parts of the Park are sources of rodent populations and how long does it take for rodents to colonize new areas after seeding?
 4. What are the best methods for monitoring owls and habitat to assess progress toward Shoreline's population and habitat goals?

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Figure 1. Existing Burrowing Owl Mitigation Areas.

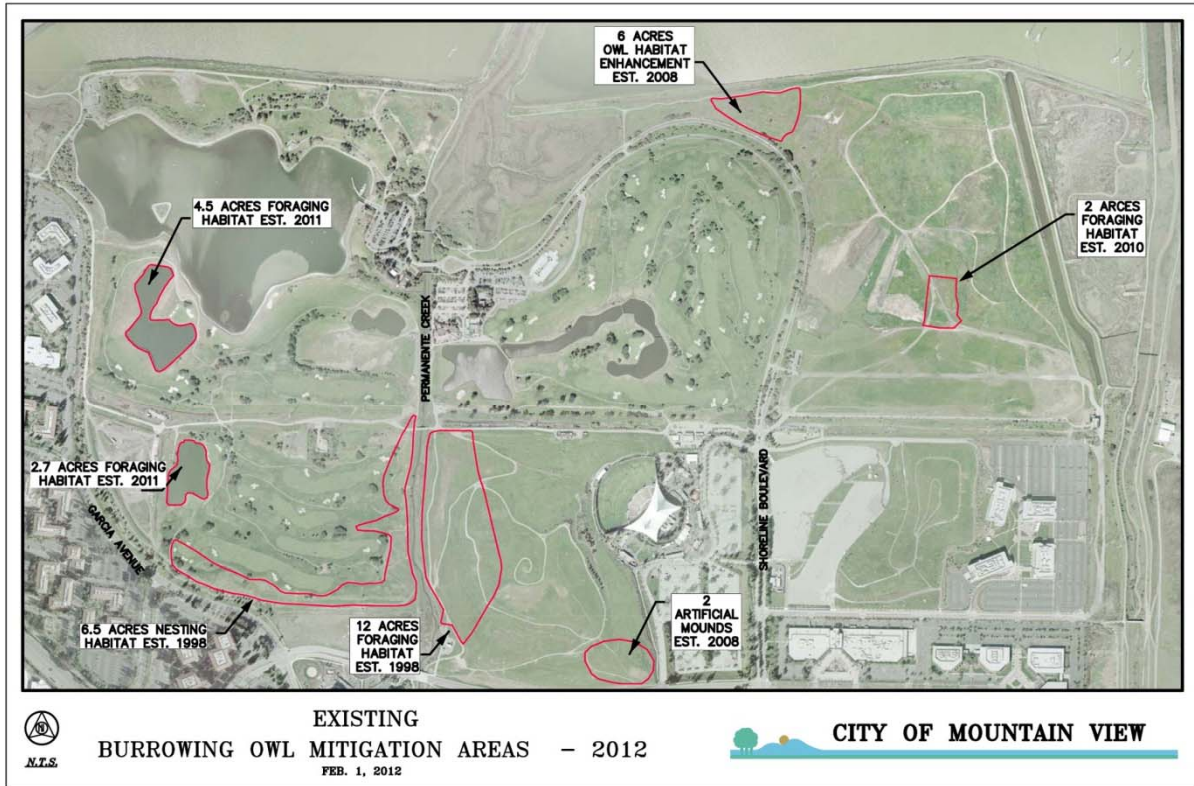
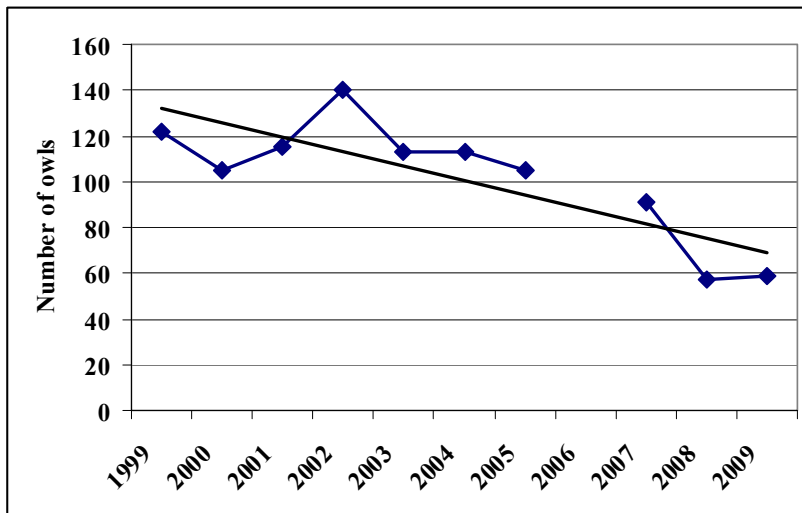


Figure 2. Santa Clara County Burrowing Owl Population, 1999 to 2009.



The combined number of burrowing owls at the three largest habitat sites in Santa Clara Valley (Moffett Federal Airfield, Shoreline at Mountain View and San Jose International Airport) shows a steady decline over the past 10 years (data from Albion Environmental, Inc., 2010; and Chromczak, pers. comm.)

Figure 3. Numbers of Pairs, Successful Pairs and Chicks by Year at Shoreline, 1998-2012

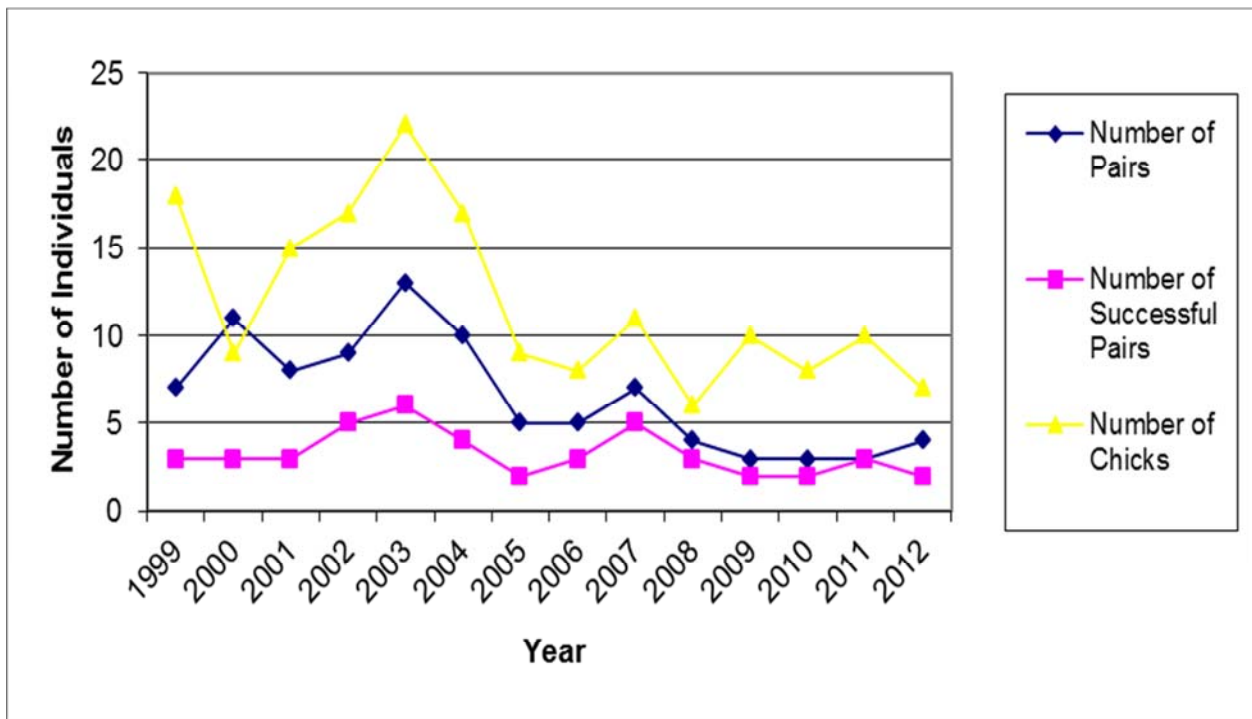


Figure 4. Burrowing Owl Successful Nest Locations, 1999-2012

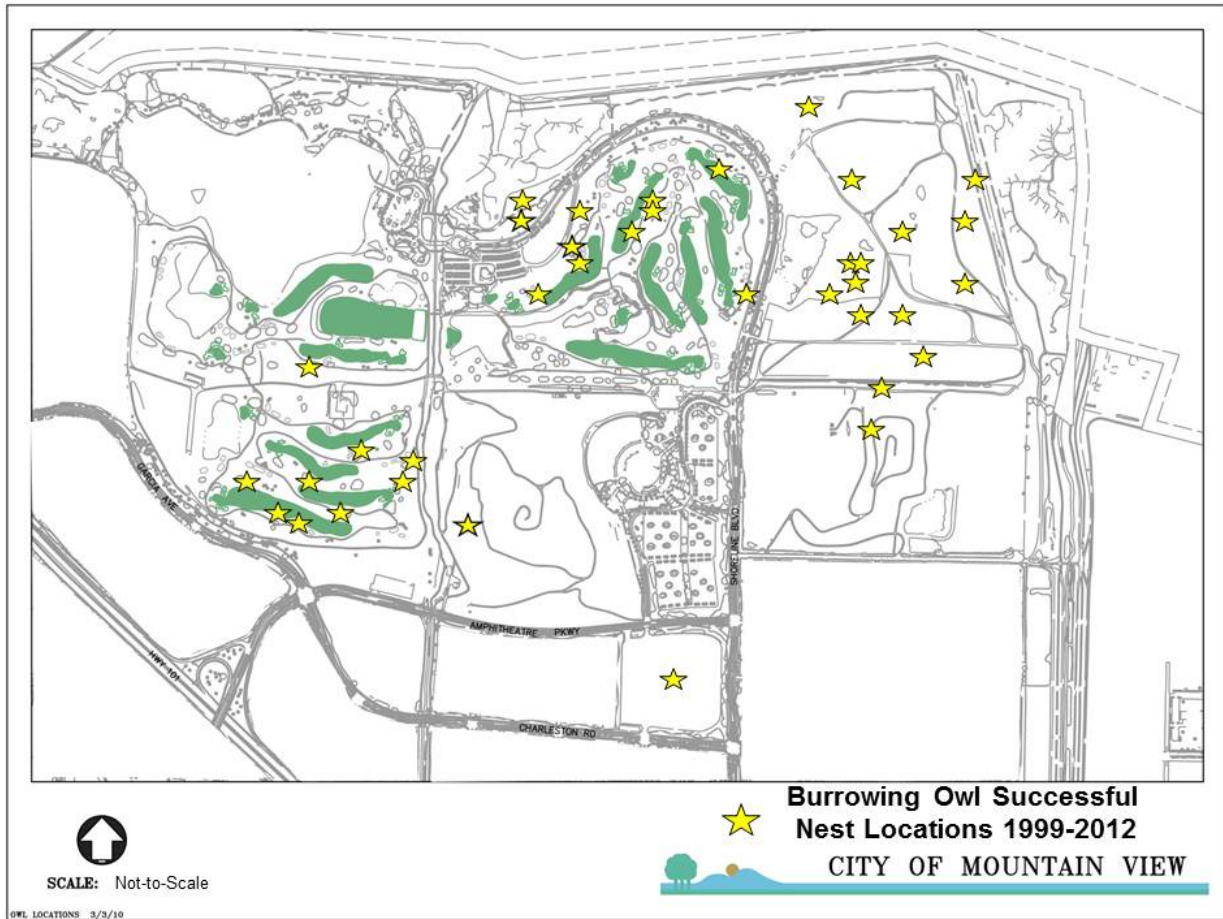


Figure 5. Unsuccessful Burrowing Owl Breeding Locations, 1999-2012

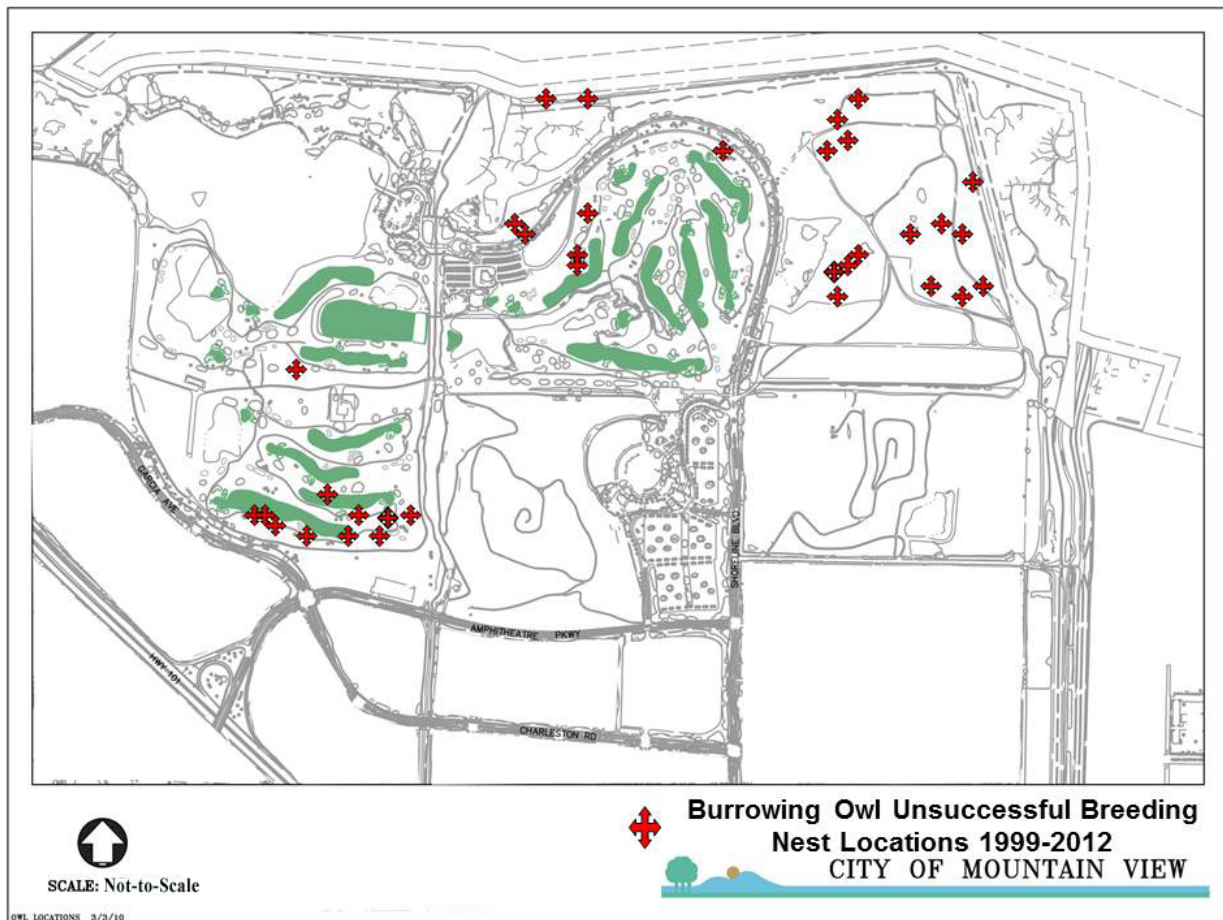


Figure 6. Existing Burrowing Owl Mitigation Areas and Proposed Burrowing Owl Preserves.

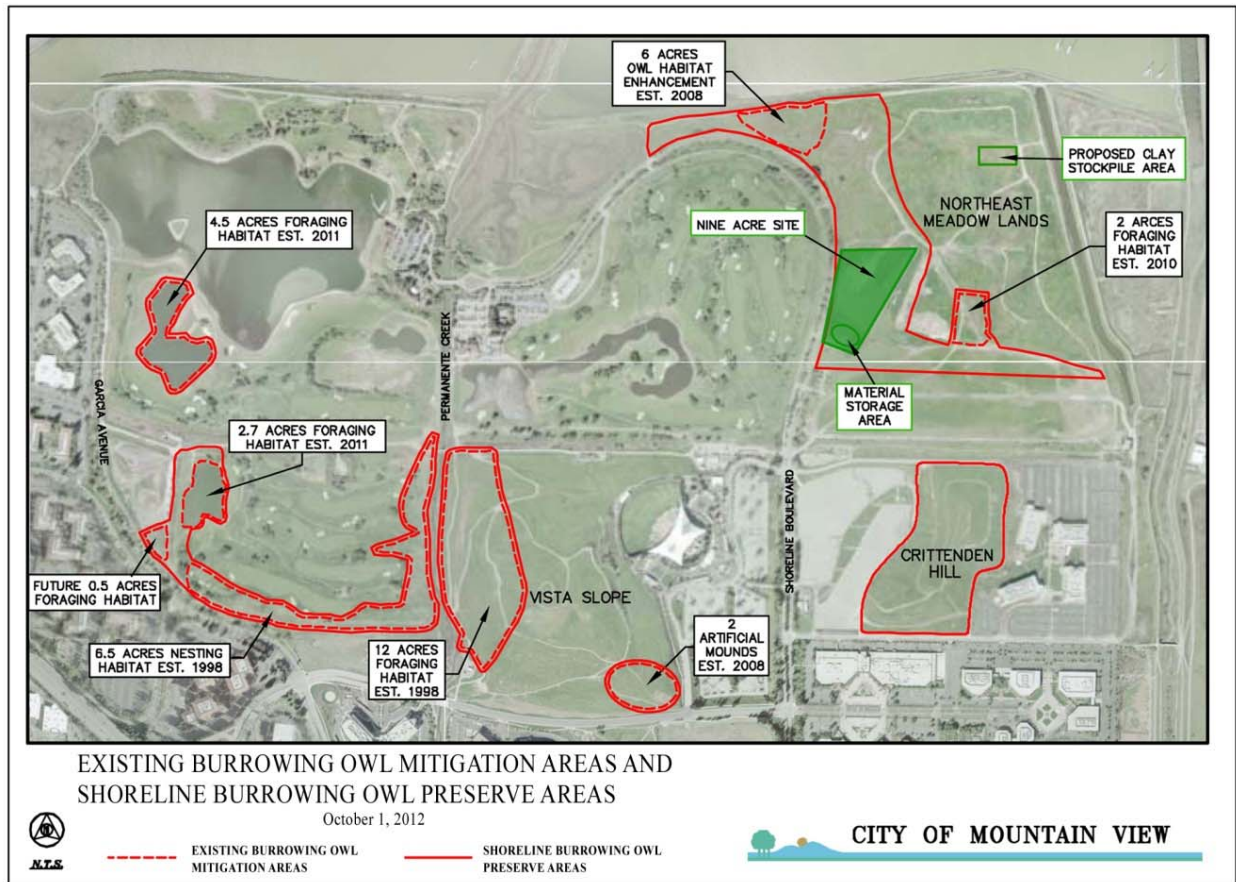


Table 1. Burrowing Owl Population and Breeding Success at Shoreline at Mountain View

	1992	1993	1994	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	Mean
Estimated no. of pairs	11	9	5	3	7	11-12	8-9	9-10	13	10	5	5	7	4	3	3	91	7.25
No. and percentage of successful pairs	7 64%	7 78%	3 60%	2 66%	3 43%	3 27%	3 37%	5 56%	6 46%	4 40%	2 40%	3 60%	5 71%	3 75%	2 66%	2 66%	43 47%	3.75
Total chicks produced	21	15	14	4	18	9	15	17	22	17	9	8	11	6	10	9	205	12.8
Chicks/nest	--	--	--	2, 2	5, 6, 7	1, 4, 4	4, 5, 6	2, 2, 3, 5, 5	3, 3, 4, 4, 4, 4	5, 4, 4, 4	2, 7	5, 2, 1	1, 1, 1, 4, 4	3, 2, 1	5, 5	7, 2	155	3.6
Mean Brood Size	3.0	2.5	4.7	2	6	3	5	3.4	3.6	4.2	4.5	2.6	2.2	2	5	4.5		3.6

Table 2. Statistics for Five Dominant Rodent Species in the Bay Area

Species	Home Range	Density	Average Adult Mass
California Vole	0.37 per acre Varying from 0.25-2.5 ac (Fisler, 1962)	5 to 618 per 2.5 acres (Salvioni and Lidicker, 1995)	53.3g
House Mouse	1,500' (Lidicker, 1966)	1 to 700 per 2.5 acres (Pearson, 1963)	18.0g
Pocket Gopher	2,700' (males) Varying from 900' to 4,800' (Howard and Childs, 1959)	10 to 62 per acre (Howard and Childs, 1959)	155.5g
Western Harvest Mouse	1.0 to 1.38 per acre (Brant, 1962)	1 to 50 per acre (Fisler, 1966)	11.5g
Deer Mouse	0.25 to 0.50 per acre (Storer, <i>et al.</i> , 1944)	4 to 10 per acre (Verner and Boss, 1980)	44.0g

Table 3. Results of pellet analysis of burrowing owls at Shoreline (Trulio and Higgins in press.)

Scientific Name	Common Name	Number of Individuals	Percentage
<i>Coleoptera</i>	Beetles	581	32.55
<i>Orthoptera</i>	Grasshoppers and crickets	463	25.94
<i>Dermaptera</i>	Earwigs	504	28.24
Larvae (various species)		9	0.50
Isopoda	Pillbugs	4	0.22
<i>Sceloporus occidentalis</i>	Western fence lizard	10	0.56
Aves	Birds	9	0.50
Araneae	Spiders	6	0.34
<i>Stylommatophora</i>	Snails	17	0.95
UnID rodents		31	1.57
<i>Microtus californicus</i>	California vole	60	3.36
<i>Mus musculus</i>	House mouse	42	2.35
<i>Reithrodontomys megalotis</i>	Western harvest mouse	7	0.39
<i>Peromyscus maniculatus</i>	Deer mouse	2	0.11
<i>Thomomys bottae</i>	Pocket gopher	25	1.40
<i>Spermophilus beecheyi</i>	Ground squirrels	9	0.50
<i>Lepus</i>	Hares	4	0.22
<i>Hylaregilla</i>	Pacific tree frog	1	0.06
Hymenoptera	Wasps and bees	1	0.06
<i>Opisthoptera</i>	Worms	0	0.00
<i>Lepidoptera</i>	Butterflies and moths	0	0.00
Decapoda	Crustaceans	0	0.00
Totals		1,785	100

Table 4. Burrowing Owl Use in Shoreline (acres).

Location	High- to Moderate-Use Areas (445 acres in total)				Low- to No-Use Areas	Total Area
	Primarily Nesting	Nesting/Foraging	Primarily Foraging	Nesting or Foraging		
<i>Golf Course</i>	192 ¹	7 ²	10			209
<i>Vista Slope</i>		12	52			64
<i>Crittenden Hill</i>			20			20
<i>Meadowlands</i>		42 ⁴		44		86
<i>North Lake</i>				30		30
<i>E-Lot and Kite Flying Area</i>				28		28
<i>Boathouse and Clubhouse</i>					15	15
<i>Athletic Fields</i>			0.5 ³		6	6.5
<i>Shoreline Amphitheatre</i>					43	43
<i>Crittenden Development</i>					40	40
TOTAL	192	461	82.5	102	104	541.5

¹ Includes fairways which are not likely to provide nesting sites but creates high visibility area.

² Converted ponds from wet habitat to dry habitat for burrowing owls in fall 2011.

³ Approved mitigation land to be created with construction of Athletic Fields.

⁴ Includes Nine-Acre Site.

Table 5. Plant Mix A—Burrowing owl mix for owl habitat.

Species	Scientific Name	Pounds/acre
California Meadow Barley	<i>Hordeumbrachyantherum</i>	9
Purple Needlegrass South Bay	<i>Nassellapulchra</i>	9
California Poppy	<i>Eschscholziacalifornica</i>	1.5
California Brome	<i>Bromuscarinatus</i>	2
Red Fescue Native	<i>Festucarubra (Molate)</i>	5
Clarkia	<i>Clarkia elegans</i>	.25

Table 6. Plant Mix B—Nonburrowing owl areas.

Species	Scientific Name	Pounds/acre
Clover	<i>Trifoliumtridentatum</i>	4
California Brome	<i>Bromuscarinatus(annual)</i>	35
Small Fescue	<i>Vulpiamicrostachy's</i>	6

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