

Chapter 5. Birds

Review Conducted by:

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SUMMARY

This review identifies the potential impacts associated with the proposed Phase II Landfill Expansion on birds and their habitats (primarily grasslands and wetlands), and assesses the adequacy of the mitigation plan in addressing these impacts. Primary impacts include the direct loss of habitat for several special-status species and potential indirect impacts, both onsite and offsite, of “subsidized” predators (crows and ravens). The latter have increased greatly in California and the San Francisco Bay Area, in part in response to concentrated food sources at landfills, and are implicated in declines of several threatened or endangered species. Such impacts are of greatest concern for open-nesting species in Suisun Marsh and particularly for a newly discovered colony of the California Least Tern.

Mitigation measures are weighted too heavily toward wetland habitats, focusing mainly on the California Tiger Salamander, and too little toward grassland habitats and birds. Grassland mitigations could be improved by fencing to enhance concealment habitat for known nesters or to attract new nesting species, and by planting densely foliated native trees or shrubs as nest sites for Loggerhead Shrikes. Details of grassland enhancement measures for native grasses and forbs are needed. The mitigation plan needs to include a corvid abatement program to reduce the numbers of ravens and crows using the landfill, to thereby lessen the impact of these subsidized predators on birds in adjacent habitats.

The mitigation plan fails to address the likely long-term effects of sea-level rise from global warming, particularly as this factor could affect the ecological integrity of sensitive habitats on low-lying parcels north of the Potrero Hills. Consideration should be given to mitigation sites much farther from the landfill than those proposed, given that the impacts of corvids likely would be greatest proximate to the landfill. If this concern of local effects of corvid concentrations is not considered too great, consideration should be given to use of the Eastern Valley as an alternative mitigation site, as its habitat is most similar to that of the expansion parcel and it may benefit the Burrowing Owl, which appears currently to have no suitable habitat on other mitigation lands.

INTRODUCTION

Background

This review is part of a multi-disciplinary effort by a panel of experts to evaluate the potential environmental impacts of the landfill expansion on habitat and associated wildlife at the project site, and to review the appropriateness and adequacy of proposed mitigation measures. This written assessment is one of several means to aid the BCDC staff and the Commission in evaluating whether the proposed project complies with the relevant Solano County LPP policies and meets the standards for approval of a BCDC marsh development permit.

Scope of Review

Resources Addressed. This portion of the assessment addresses the potential impacts, at various scales, of the proposed landfill expansion on birds and their habitats. The dominant habitat at the site of the proposed landfill expansion is grassland, which is among the most threatened habitats in California (CPIF 2000). Within the grassland, there is an ephemeral creek, a few diked ponds, scattered swales and seeps, and a few clumps of or isolated trees and shrubs. A variety of resident, breeding, migratory, and wintering birds uses the site, including a number of special-status species. In general, the bird species that use the site are those that forage or nest in relatively open habitats, such as raptors (owls and hawks), curlews, corvids (ravens and crows), swallows, blackbirds and meadowlarks, finches, and sparrows. Small numbers of waterbirds use the ponds and swales.

Review Objectives. This review describes the potential impacts on existing habitat values and associated biological and wetland resources for birds. As applicable, it considers the effects on birds and their habitats both onsite and offsite, and evaluates the magnitude of impacts on a local, regional, and range-wide basis. In assessing the impacts of habitat conversion, the review characterizes impacts to species based on the numbers of individuals affected, changes in quality of habitats for species, and how the importance of the habitat to species' life history strategies (migration routes, seasonal ranges) might affect populations offsite.

The specific objectives of this review are to:

- Identify key resources and habitat values for resident, breeding, wintering, and migratory birds at the site;
- Evaluate the potential effects of the proposed project on these birds and their habitats;
- Evaluate the effectiveness of the proposed mitigation program for these birds and their habitats;
- Identify potential modifications or implementation measures for incorporation into the landfill expansion plan; and

- Identify potential modifications to the mitigation program to more effectively mitigate potential effects of the project.

Review Limitations. This review is hampered in part by limited information on the use of the Landfill properties by birds and by a lack of specific studies of the potential impact of “subsidized” predators, particularly corvids (American Crows [*Corvus brachyrhynchos*] and Common Ravens [*Corvus corax*]), on nesting birds both onsite and offsite. See further discussion of limitations below under “Methods.”

METHODS

Field Surveys

Field surveys conducted for this review were limited by the required schedule to a period between late May and mid-July 2006. Field surveys for birds in 2006 as part of this review included:

- A half day of incidental observations during a group site visit and orientation on May 23, 2006.
- Two full days of area searches of the Phase II site and adjacent mitigation (and other) properties for all species of birds on May 26 and June 14, 2006.
- Focal surveys of corvid use of the active face of the landfill proper from 0640-1000 on the morning of June 29, 2006. These counts were taken from a hillside in the southwestern corner of the Phase II expansion area, looking northwest to the active landfill, and hence are minimal counts. The goal was to obtain information on the extent of use of this food source by corvids to aid in assessment of potential impacts of these predators on other nesting birds and to gauge if any actions would be feasible to reduce use of the landfill by corvids.

Impact and Mitigation Evaluation and Recommendations

The methods to evaluate impacts, assess the value of proposed mitigations, and produce recommendations included:

- A review of bird use data of the Landfill properties and adjacent lands from field surveys in May and June and additional data included in environmental documents pertaining to the proposed landfill expansion;
- A review of published literature pertaining to the bird species (and their habitats) known or expected to occur on the Landfill properties; and
- Evaluation of the potential impacts of the landfill expansion on birds and their habitat, and measures that might be taken to mitigate such impacts, on the basis of knowledge gained from environmental documents provided by BCDC and the Landfill,

published and unpublished sources, and my own >30 years of field experience with birds in California.

Constraints to the analysis of impacts and mitigations for the proposed landfill expansion centered mainly on the limited prior information on bird use of the Landfill properties and the very limited surveys conducted in 2006 as part of this review. Surveys for birds in 2006 were conducted for only a few days in the late breeding season and thus did not encompass prime periods for migratory or wintering birds. Further, because they were conducted in only 1 year, surveys did not encompass the natural range of climatic factors contributing to inter-annual variation in bird numbers, species richness, or patterns of use.

In particular, the limited survey of corvids at the active face of the landfill did not provide adequate data to fully assess either corvid use of the landfill or impacts of corvids on other birds nesting in the vicinity of the landfill (see “Impact Evaluation”). The single morning survey in late June provided documentation of high counts of at least 14 Common Ravens and 20 American Ravens foraging at or roosting proximate to the active working face of the landfill. These limited data are considered inadequate to assess numbers of corvids using the landfill because their numbers likely vary substantially by time of day, season, and year and because peak counts at a particular time do not account for turnover of corvids coming and going from the landfill. Further, without detailed studies of color-marked or radio-tagged corvids, it was not possible to determine exactly how far these predators range from the landfill and what impacts they are having on other species in the vicinity.

IMPACT EVALUATION

Survey Results

During surveys in May and June 2006, a total of 32 bird species were seen or heard on, or foraging over, the Landfill properties; two additional species were seen flying over the properties apparently in transit to nearby wetlands (Table 5-1). Species of particular conservation concern are discussed in more detail in the following section.

**Table 5-1. Bird Species Observed at the Potrero Hills Properties
on Limited Surveys during May–June 2006^a**

Gadwall	Loggerhead Shrike
Mallard	American Crow
Great Blue Heron	Common Raven
Turkey Vulture	Tree Swallow
Northern Harrier	Cliff Swallow
Red-tailed Hawk	Barn Swallow
Golden Eagle	European Starling
American Kestrel	Blue Grosbeak
Killdeer	Red-winged Blackbird
Black-necked Stilt	Tricolored Blackbird
American Avocet	Western Meadowlark
Rock Pigeon	Brewer's Blackbird
Mourning Dove	Brown-headed Cowbird
Great Horned Owl	Bullock's Oriole
Anna's Hummingbird	House Finch
Western Kingbird	

^a In addition, individuals of the Double-crested Cormorant and Snowy Egret were seen flying over the properties.

Overview of Potentially Affected Species

Special-Status Species. A number of special-status bird species occur at or in the vicinity of the Landfill (Table 5-2). Areas of focused concern include the active landfill, Phase II expansion area, adjacent proposed Landfill Phase II mitigation areas, and other adjacent properties within the primary and secondary management areas of Suisun Marsh. The following special-status species are known or expected to occur in the project area:

Table 5-2. Special-Status Species of Potential Concern with Potential to Occur within the Potrero Hills Landfill Phase II Expansion Area and Associated Mitigation Lands

Species	Federal T&E	State T&E	USFWS BCC	California		Conservation Plans
				BSSC	FP	
Species Potentially Affected Onsite^a						
White-tailed Kite (b)					x	
Northern Harrier (B?)				X		
Swainson's Hawk (b?)		x	x			
Golden Eagle (b)					X	
Long-billed Curlew			X			X
Burrowing Owl (b)			X	X		
Short-eared Owl (b)				x		
Loggerhead Shrike (B)			X	X		
Tricolored Blackbird (b)			X	X		
Peregrine Falcon (b)		x	x		x	
Prairie Falcon (b)			x			
Grasshopper Sparrow				x		
Breeding Species in Primary Management Area of Suisun Marsh Potentially Affected by Onsite Activities^b						
Snowy Plover (coastal) (B?)	X?			X?		X
Snowy Plover (interior) (B?)				X?		X
California Black Rail (B)		X	X		X	
California Clapper Rail (B)	X	X			X	
California Least Tern (B)	X	X			X	
Suisun Song Sparrow (B)			X	X		

(b) = Known to breed in broader region.

(B) = Known to breed in specific area.

(b?) = May breed in broader region.

(B?) = May breed in specific area.

California BSSC = California Bird Species of Special Concern.

California FP = California Fully Protected.

Conservation Plans = Designated of conservation or focal concern under national or regional conservation plans such as Partners in Flight, U.S. Shorebird Conservation Plan, North American Waterbird Conservation Plan.

T&E = Listed as threatened or endangered.

USFWS BCC = U.S. Fish and Wildlife Service Birds of Conservation Concern.

^a Includes species that are known to occur (X) or may occur (x) within the Phase II expansion area.

^b Includes species or subspecies that breed in Suisun Marsh that potentially may be affected by populations of "subsidized" predators (corvids: Common Raven, American Crow) augmented by concentrated food resources at Potrero Hills Landfill.

White-Tailed Kite (Elanus leucurus)

Status: The Phase II expansion area provides potential nesting and foraging habitat for this species. Because the species responds to cyclic populations of small rodents, particularly the California Vole (*Microtus californicus*) (Dunk 1995), presence or absence of kites at any one time does not serve as a good indicator of the long-term suitability of this site for this species.

Concerns: Nomadic habits make it difficult to assess the effects of potential habitat loss from the proposed Phase II expansion. Management of habitat on mitigation lands to favor vole populations (e.g., moderate or lighter grazing intensity) likely would benefit White-tailed Kites.

Northern Harrier (Circus cyaneus)

Status: Small numbers (2–3+ per day) have been seen repeatedly foraging in the Phase II expansion area and on other adjacent properties in spring and summer 2006; they are undoubtedly breeding somewhere on these or adjacent properties.

Concerns: Although the Project EIR indicates that there is no suitable nesting habitat, regular presence of the species in breeding season suggests otherwise. Phase II expansion definitely would reduce foraging habitat and likely nesting habitat. Proper management could enhance potential nesting habitat by fencing swales/seeps and thereby promoting growth of hydrophytic plants and tall grass for nest concealment.

Swainson's Hawk (Buteo swainsoni)

Status: The Phase II expansion area and adjacent properties provide at least potential foraging habitat for migrant Swainson's Hawks passing through the area.

Concerns: More information is needed on the potential use of this site by this species, but its overall population in the region or in California is not likely to be affected much by the proposed project.

Golden Eagle (Aquila chrysaetos)

Status: The species is known to nest nearby offsite; adults were seen in 2006 foraging or flying over the Phase II expansion area, Eastern Valley, and Southern Hills.

Concerns: Although eagles have large home ranges (20–33 square kilometers [km]² during breeding and smaller or larger in winter), they generally focus most of their activity within core areas, which may include <15 percent of the extent of the home range; on average, adults may range only 1 km (0.6 mile [mi]) from the nest during breeding (Kochert et al. 2002). Because Golden Eagles were seen on each of the three visits that covered most of the Landfill properties in 2006, it is likely that the Landfill properties are within the core area of the pair nesting nearby offsite. Hence, the Phase II expansion likely would reduce the core area of the resident pair, although it is unclear if this would degrade the home range enough to either eliminate the nesting territory or cause the pair to relocate elsewhere. The California ground squirrels (*Spermophilus beecheyi*) that are prevalent in the Phase II expansion area and Eastern Valley are likely important prey for the eagles. Collisions with wires, fences, and other structures cause substantial mortality to eagles in some areas and should be of concern with respect to the Phase

II expansion. Eagles would benefit most by burial of any new (or old) power lines at the landfill site; if above-ground lines are installed, they should meet raptor-safe construction standards (Avian Power Line Interaction Committee 1996 in Kochert et al. 2002).

Peregrine Falcon (*Falco peregrinus*)

Status: The species likely occurs at least irregularly in the Potrero Hills, particularly given the proximity of large waterbird populations in adjacent Suisun Marsh. Populations of this falcon in California are increasing after prior declines from reproductive impairment by pesticides.

Concerns: No major concerns are associated with the species, as the proposed Phase II expansion is likely to result in minimal effects on habitat for this species in the general area.

Prairie Falcon (*Falco mexicanus*)

Status: Numbers in California currently appear to be relatively stable. The species likely occurs at least irregularly in the Potrero Hills, given the suitable foraging habitat and abundant prey such as meadowlarks. The species could nest in the general region, but rock outcrops and cliffs in the Potrero Hills do not appear to be adequate for nesting onsite.

Concerns: No major concerns are associated with the species, as the proposed Phase II expansion is likely to result in minimal effects on the overall availability of habitat for this species in the general area.

Long-Billed Curlew (*Numenius americanus*)

Status: The species is known to occur in the Potrero Hills Valley in the non-breeding season. California's Central Valley as a whole is one of the most important wintering areas for this species in North America (Dugger and Dugger 2002). In this region, central and eastern Solano County is a particularly important area for this upland-foraging shorebird (PRBO Conservation Science unpublished data).

Concerns: This species has a conservation concern ranking of "highly imperiled" in the United States because of a relatively small overall population, which historically has declined substantially (Brown et al. 2001). Ongoing development pressures are already eliminating potential habitat as urban areas expand into agricultural areas of Solano County. Because habitats vary in their suitability to curlews across the non-breeding season, a mix of grassland and irrigated fields are needed over a broad landscape to provide for the species' overwintering needs. Some foraging habitat would be lost by the landfill expansion. The species prefers flatter areas and therefore likely would not benefit from protection of the proposed mitigation lands that contain hills and slopes above the floor of the Potrero Hills Valley.

Burrowing Owl (*Athene cunicularia*)

Status: The species is known to occur in the non-breeding season in the Potrero Hills Valley, which has potential nesting habitat for this declining species.

Concerns: The species continues to decline in California, particularly from habitat loss from urban expansion and shifting agricultural practices. It is currently extirpated or nearly extirpated in many San Francisco Bay Area counties. The habitat in the Potrero Hills would be lost with

the Phase II expansion. The species might be more inclined to breed and winter in some of the mitigation areas if they were heavily grazed, protected from ground squirrel control, and, perhaps, enhanced by installation of artificial burrows.

Short-Eared Owl (Asio flammeus)

Status: Potentially suitable habitat occurs in the flatter grasslands of the Potrero Hills Valley. Because the species also responds to cyclic rodent prey, absence of this owl in certain years is not a good indicator of the long-term suitability of this site for this species. It is perhaps most likely to occur in the Potrero Hills in the non-breeding season, although nearby Suisun Marsh appears to be the most reliable breeding site for this species in central California.

Concerns: The species is now very local as a breeder in central California, and winter habitat also is being lost to urban expansion. As with the White-tailed Kite, this species likely would benefit from management of habitat to favor vole populations.

Loggerhead Shrike (Lanius ludovicianus)

Status: The species is declining continent-wide and in California (Sauer et al. 2006). Breeding densities in central and eastern Solano County currently appear to be among the highest in California (D. Shuford pers. obs.). Two active nests were found on the Phase II expansion area in spring-summer 2006, another nest was almost certain in trees at Griffith Ranch, and additional birds (nesting areas uncertain) were seen in Southern Hills and Director's Guild.

Concerns: The Phase II expansion would remove most of the trees in the area and extensive foraging areas, as most foraging occurs in flatter lowland valleys rather than on slopes of hills; trees are few and appear to limit the number of breeding territories. Two nesting territories would be lost to the landfill expansion, and shrikes would be at risk of heightened mortality from vehicle collisions if vehicular activity increases on the road(s) to the proposed sedimentation ponds on the Griffith Ranch property, particularly if sited where a dirt road now runs along the edge of the eucalyptus grove on the west side of the property. Vehicle collisions are an important mortality factor that may have contributed to population declines (Yosef 1996). Mitigation and monitoring do not adequately address this species. The species likely would benefit from planting of isolated densely foliated trees or shrubs in protected areas.

Grasshopper Sparrow (Ammodramus savannarum)

Status: The species has declined greatly in California and currently is extirpated as a breeder from much of the Central Valley. It is not known to occur in the Potrero Hills based on recent surveys; drastic alteration of native grasslands by the introduction of exotic annual grasses may have eliminated suitable habitat.

Concerns: Mitigation and monitoring does not address this species or how long-term management potentially could provide viable native grassland habitat for the species. This sparrow might be affected by nest parasitism offsite if it breeds within a 6.7-km (4-mi) radius of the Landfill, the expected commuting distance from the Landfill of Brown-headed Cowbirds (*Molothrus ater*) attracted there by abundant food. Thus, any mitigation actions for the Grasshopper Sparrow would best be conducted beyond this commute radius of cowbirds using the Landfill.

Tricolored Blackbird (Agelaius tricolor)

Status: Small numbers (<30) were seen foraging in the Phase II expansion area in spring-summer 2006. The species presumably breeds offsite within several miles, as no suitable breeding habitat is present in the Phase II expansion area or on proposed mitigation lands. This nearly endemic California species continues to decline range-wide.

Concerns: Foraging habitat for this species would be lost by the proposed Phase II expansion; the Potrero Hills Valley appears to provide the best habitat for this species in the Potrero Hills. Mitigation and monitoring do not adequately address this species. Management potentially could enhance Phase II or other properties to provide nesting habitat by fencing off swales and perhaps planting dense or armored native plants preferred for nesting. Because of the species' near-endemic status in California and the relatively few breeding sites in the state in any given year, effective mitigation efforts could result in range-wide benefits to this species. Conversely, the species' specialized foraging needs during breeding might make it difficult to enhance such habitat, particularly if this were offsite.

Additional Special-Status Species in Suisun Marsh Potentially Affected by Landfill Activities. The following special-status species that breed in Suisun Marsh could be affected by increasing numbers of “subsidized” predators (ravens and crows) whose populations likely are augmented by the availability of concentrated food resources at the Potrero Hills Landfill. See the discussion elsewhere in this report regarding increasing populations of corvids, the role of landfills in augmenting populations, and the known and potential impact of these predators on special-status species.

California Black Rail (Laterallus jamaicensis coturniculus)

This diminutive rail is known to breed in the tidal marshes of Suisun Marsh. Because of its secretive habits, little is known about its nest predators. Hence it is unclear if corvids might affect its already declining population.

California Clapper Rail (Rallus longirostris obsoletus)

This tidal marsh rail reaches the eastern limit of its range in the San Francisco Bay estuary in Suisun Marsh. Little is known of predators at the nest, but Common Ravens are known to prey on adult Clapper Rails.

Snowy Plover (Charadris alexandrinus)

In 2006, Snowy Plovers were documented breeding for the first time (estimated 15–20 birds) in Suisun Marsh. Because this is a transition area between the tidal areas of the greater San Francisco Bay estuary and the landlocked wetlands of the Central Valley, it is unclear if these birds belong to the “coastal” (federally threatened) or “interior” (special concern) population of the species. The plover breeding site, in the vicinity of Montezuma Slough (Birds Landing across from the Montezuma Slough tidal gates [R. Leong pers. comm.]), is about 15 km (9 mi) from the Landfill and hence well within the maximum distance (65 km or 40 mi) that Common Ravens are known to fly in a day. Crows and ravens are known to be important predators of Snowy Plovers and appear to be responsible for plover declines in some areas of California.

California Least Tern (Sternula antillarum browni)

In 2006, a breeding colony of this species (about 17–42 pairs) (Marschalek 2007) was found in Suisun Marsh near Montezuma Slough, specifically at Birds Landing across from the Montezuma Slough tidal gates (R. Leong pers. comm.). The colony site is about 15 km (9 mi) from the Landfill, and hence well within the maximum distance (65 km or 40 mi) that Common Ravens are known to fly in a day. Corvids are important predators of Least Terns in California, and crows and ravens have been known to cause these terns to abandon their colonies for a season.

Suisun Song Sparrow (Melospiza melodia maxillaris)

This endemic resident subspecies of the Song Sparrow is restricted to tidal marshes in the Suisun Marsh area. Crows and ravens are known predators of these sparrows, which have the lowest reproductive success of the three subspecies of tidal marsh Song Sparrows endemic to the San Francisco Bay estuary (H. Spautz pers. comm.).

Other Declining Species. Additional species that breed at the landfill expansion site that have shown long-term declines in numbers in California from 1968 to 2005 (Sauer et al. 2006), but are still relatively abundant and have not yet been singled out as being of particular conservation concern, include the Killdeer (*Charadrius vociferus*), Mourning Dove (*Zenaida macroura*), Western Meadowlark (*Sturnella neglecta*), Brewer's Blackbird (*Euphagus cyanocephalus*), Bullock's Oriole (*Icterus bullockii*), and House Finch (*Carpodacus mexicanus*).

Direct Project Effects

Habitat Loss. The Phase II expansion will reduce nesting and foraging habitat for a number of special-status species. It will permanently eliminate nesting territories (nest sites and foraging habitat) for at least two pairs of Loggerhead Shrikes, at least part of the nesting territory of at least one pair of Northern Harriers, and part of the home range and (more importantly) the apparent core area of one pair of Golden Eagles nesting offsite. It also will eliminate winter foraging habitat for resident individuals and additional individuals of these species that may occupy the area in winter. The expansion will eliminate foraging habitat for wintering Long-billed Curlews, for breeding and wintering Tricolored Blackbirds, and for wintering and (potentially) breeding Burrowing Owls. Habitat lost to the expansion also might result in limited effects on migrant Swainson's Hawks and migrant or wintering Peregrine Falcons, Prairie Falcons, and Short-eared Owls. Habitat loss also will displace some other declining breeding species: several pairs of Western Meadowlarks and Brewer's Blackbirds and perhaps some individuals of the Killdeer, Mourning Dove, Bullock's Oriole, and House Finch.

Direct Mortality. If power lines from the proposed power plant (now slated for construction on the Phase I site) are placed aboveground, they have the potential, depending on their design, length, and placement, to cause directly mortality of Golden Eagles and other raptors from collisions with these lines. A similar concern was expressed for potential bird collisions with a (now-defunct) ridge-top wind turbine project nearby, particularly given the substantial flight of waterfowl crossing over the Potrero Hills in transit between Suisun Marsh and vernal pools and agricultural areas north of these hills (Jones & Stokes 1987). Frequent

winter fog in this overall area would exacerbate this problem because of reduced visibility and the likelihood of lower flight paths by raptors and waterfowl under such conditions.

If the proposed sedimentation ponds on the Griffith Ranch property are serviced by a paved road, the likelihood of collisions with Loggerhead Shrikes that nest in the eucalyptus grove on the edge of this property would be increased.

Impacts from Lighting for Night Operations. The proposed increased lighting for nighttime operation at the landfill could cause disorientation of passerines attracted to the lights when descending to land after nocturnal migration and disorientation of waterfowl or other waterbirds moving locally at night in winter, particularly during foggy weather. Most of the literature on this issue pertains to mortality of migrant passerine birds from collisions with lighted buildings, towers, and lighthouses, particularly during overcast or foggy weather (Cochran and Graber 1958, Avery et al. 1976, Evans and Manville 2000, Crawford and Engstrom 2001, Jones and Francis 2003). Because passerines are migrating at considerable heights over a broad front, it is unclear whether potential impacts to passerine birds might be greater in a scenario where they are attracted to an “island of light” at the Landfill, surrounded by a relatively dark landscape, or whether the problem would be greater for the much more extensive and continuous nighttime lighting in the urbanized Suisun City-Fairfield-Travis Air Force Base area nearby.

Disorientation by landfill lights might have a greater effect on waterfowl and other waterbirds moving locally at night between wetlands to the north and south of the Landfill. These birds generally would be flying relatively low, and they may already tend to avoid flight paths toward nearby urban areas, which mostly lack wetland habitat in their immediate vicinities. Thus, their flight paths may naturally be concentrated close to the Landfill, where disorientation from lights might cause confusion and collision with structures. This may be particularly the case during foggy weather, which is prevalent in winter when overall numbers of waterfowl and waterbirds reach their annual peak abundance locally. As most structures at the Landfill currently are relatively low in height, potential collisions by birds may be a limited problem. In this regard, it would be valuable to know the height and location of any buildings (including the power plant), wires, or other structures that would be added as part of the proposed Landfill expansion.

Impacts from Noise, Dust, or Vehicular Activity. It seems unlikely that noise, dust, or movement of equipment on and around the working face of the landfill would cause a substantial adverse impact on birds in the immediate vicinity. Noise in the immediate vicinity of the working face of the landfill likely has a limited adverse impact on birds in the area. Some additional noise in the form of pyrotechnics (blank pistols, propane canisters) used, in combination with other methods, to control gulls numbers may have a beneficial effect in reducing the numbers of gulls and perhaps other undesirable species such as ravens and crows.

If adequate dust control measures around the working face of the landfill are maintained or implemented, it seems unlikely that dust would substantially affect birds in the vicinity. It is possible that wind-blown dust might degrade the quality of some grassland habitat downwind, although this likely would be a negligible effect if adequate dust control measures were consistently implemented.

Bird collisions with equipment in the immediate vicinity of the working face of the Landfill would likely be minimal because of the slow speeds at which vehicles are operating in this area. Vehicle collisions with birds would likely be more frequent on Highway 12 and the paved access road to the dump, where vehicle speeds are greater, although the magnitude of such mortality is unknown. Nevertheless, bird collisions likely would increase with the increased truck traffic anticipated with the Phase II expansion and projected increase in tonnage of garbage delivered to the Landfill. With increased truck traffic after dark associated with nighttime operation at the Landfill, mortality from collisions might increase for owls foraging along roadsides.

Indirect Project Effects

Impacts of Subsidized Predators. Numbers of American Crows and Common Ravens – members of the family Corvidae (or corvids) – have increased dramatically in recent decades throughout the West, including California and the San Francisco Bay region (Liebezeit and George 2002, Kelly et al. 2002). These generalist foragers thrive in highly disturbed habitats, including agricultural, suburban, and urban areas. The availability of concentrated human food resources, including garbage at landfills, that “subsidize” corvids is considered a key factor in their increasing populations. These resources augment corvids’ reproductive success, leading to increases in their numbers, expansion of their ranges, and heightened impacts on other species—particularly those with small and vulnerable populations. Crows and ravens are both known to be important predators on threatened and endangered species in California. Ravens are also particularly adept at using telephone poles, electrical power towers, buildings, and other human structures as nest substrates. Because ravens are known to fly up to 65 km (40 mi) in a day and range over several hundred kilometers throughout the year, any given landfill could influence raven populations over a broad area (Boarman 2003). Crows also are known to forage or fly to roost sites up to 18 km (11 mi) from daytime territories or activity centers (Liebezeit and George 2002).

Given the proximity of the Landfill to breeding populations of a variety of bird species (including several that are threatened or endangered) in the important wetland habitats of Suisun Marsh, the potential impact of augmented corvid populations should be an important concern with respect to expansion of the Landfill. Of particular concern is the breeding colony of California Least Terns and associated Snowy Plovers nesting about 15 km (9 mi) from the Potrero Hills Landfill, thus well within the maximum distance of 65 km (40 mi) that Common Ravens are known to fly in a day. At this distance, it might take corvids a while to locate the tern colony. If located, they likely would remain or return to exploit this concentration of eggs and chicks.

The concern over the potential effects of corvids is heightened given that expansion of the landfill will greatly increase its lifetime and capacity and thus likely will further increase, both in the short and long term, corvid numbers and their impact on other species. Table 3-3 in the Project EIR projects a 156-percent increase in tonnage of garbage delivered to the landfill from the years 2000–2049, which underestimates the increase in food available to corvids because tonnage limits would not be imposed for organic compostibles that include additional food wastes. The availability of this increased amount of food would be offset to some degree by expansion of the operating hours from 20 to 24 hours (Monday through Friday), such that more delivery would occur during nighttime hours when corvids typically do not forage.

Nevertheless, to accommodate the projected increase in delivery of garbage to the landfill, it seems that a larger working face of the landfill would be necessary, which should attract more corvids.

Of the special-status species, those nesting in the open are the ones most likely to be affected by predation from corvids. Hence, it is possible that, by subsidizing populations of corvids, the Landfill could indirectly contribute to the loss of the entire nesting effort in some years of as many as 35–80 California Least Terns and 15–20 Snowy Plovers (or more if populations increase in subsequent years). Although ravens and crows generally move less than 3–7 km (2–4 mi) in a day (references cited in Kelly et al. 2002), this does not take into account non-breeders, which are not tied to nest sites and can occur in large numbers in areas of concentrated food (e.g., low hundreds of non-breeding ravens occur on Pt. Reyes peninsula; J. Roth pers. comm.). Although harder to quantify, the Landfill likewise could also indirectly depress populations or reproductive success of these special-status species nesting in concealing vegetation: California Black Rail, California Clapper Rail, and Suisun Song Sparrow. As noted above, ravens are known predators of adult Clapper Rails; and both crows and ravens are known predators of Suisun Song Sparrows, which have the lowest reproductive success of the three subspecies of tidal marsh Song Sparrows endemic to the San Francisco Bay estuary (H. Spautz pers. comm.).

To document the levels of corvid use of the Landfill and the impacts of these “subsidized” predators on other birds in the vicinity, it would be valuable to conduct scientific studies to determine peak numbers of corvids at the landfill, turnover rates needed to estimate total numbers of corvids, daily and seasonal patterns of corvid use, numbers of nesting corvid pairs in the vicinity, extent of movements of corvids between the Landfill and Suisun Marsh, and whether there is any interchange of corvids between the Potrero Hills and Hay Road Landfills. In concert with the above studies, it would be valuable to initiate monitoring and research on California Least Terns and Snowy Plovers nesting in Suisun Marsh to determine whether corvids are important predators at their colonies. Likewise, if feasible, it would be valuable to coordinate with any ongoing studies of other species, such as the California Clapper Rail, California Black Rail, or Suisun Song Sparrow, to evaluate the extent of predation of corvids on the full suite of special-status species in Suisun Marsh.

Cowbird Parasitism. Brown-headed Cowbirds are widely known to depress reproductive success of various cup-nesting passerine landbirds by parasitizing the nests (i.e., by laying their eggs in nests of other species for hosts to rear). Cowbird parasitism rates are known to be higher near landfills and other sources of abundant anthropogenic foods elsewhere in California (Airola 1985), and cowbirds can “commute” daily up to 6.7 km (4 mi) from key foraging sites to areas with abundant host populations (Rothstein et al. 1984). Cowbirds are known to forage in the active face of the Landfill, and hence their numbers and effects on other nesting birds likely are augmented by this food source. The extent and magnitude of parasitism is unstudied and hence unknown, but of potential special-status species in question, only the Song Sparrow and Grasshopper Sparrow are particularly susceptible to cowbird parasitism.

Cumulative Effects

The Phase II expansion would contribute to the cumulative effects of habitat loss and degradation from ongoing development in Solano County. This habitat loss creates a feedback loop, as increasing population growth in Solano County and in the surrounding counties served by the landfill collectively contributes to the need to expand the capacity and life expectancy of the landfill. Effects of development on special-status species in Solano County are being addressed through the ongoing development of the County's Habitat Conservation Plan (LSA Associates 2005).

The Potrero Hills Landfill and the Hay Road Landfill (about 16 km [10 mi] to the northwest) together likely add to the cumulative impact of subsidized predators on other nesting birds, as the distance between these landfills is such that corvids likely can move between them, and the areas affected in this manner by each landfill likely overlap. Although some of the land in this area is protected, increases in subsidized predators can still degrade its value to some species of wildlife. By mid-century, at about the end of the life span of the Phase II expansion, the potential effect of the landfill from subsidized predators could increase if sea-level rise causes marshes in Suisun Marsh to migrate inland and hence closer to the landfill or to be reduced in extent, thereby concentrating predation effects in a smaller area or on a smaller prey population (see discussion below).

The direct loss of habitat to birds by the Phase II expansion would mainly result in localized effects, although even with mitigation there would be a net loss to some special-status species, such as the Loggerhead Shrike and Long-billed Curlew, with regionally important populations in the Solano County area. The indirect consequences of expansion, via augmentation of subsidized predators (corvids), could result in regional or statewide effects on populations of some listed species, particularly the California Least Tern, nesting nearby in Suisun Marsh.

MITIGATION EVALUATION

Key Elements of the Mitigation Program

Mitigation Goals, Objectives, and Actions. The overall goals of the mitigation program are to avoid impacts to sensitive habitats if possible and to replace the functions and values of sensitive habitats lost to project development. Mitigation actions for birds are almost entirely passive, as the main enhancement activities proposed are for wetlands and are directed mainly at the California Tiger Salamander. A few species of waterbirds are expected to benefit secondarily by creation of wetlands for the salamander, and some upland species of birds are expected to benefit from preservation and management of almost 600 acres of grasslands. A few waterbirds – none with special status – may show a net gain of wetland habitat with the loss of some wetlands from Phase II expansion and creation of more wetlands from mitigation actions. Upland birds should show a net loss of habitat, as no additional habitat is created for them and some will be lost to the Phase II footprint. The MMP suggests that management of grasslands will enhance their value to birds, but it is unclear what values will be enhanced and by what methods.

Evaluation of the Mitigation Program

Critique of the Mitigation Program. The primary focus of the recommendations in the MMP for Phase II expansion is on wetland habitat and species. Although this level of concern for wetlands is warranted, conservation recommendations for upland grasslands are minimal. For example, there is little recognition of the importance of onsite habitats for various special-status grassland birds that use the site in relatively high densities (e.g., Northern Harrier, Loggerhead Shrike), there is little or no discussion of how to enhance habitats for species (e.g., Tricolored Blackbird) that now occur in low numbers or do not breed (but might if conditions were improved). The revised grassland management plan (GMP) (LSA Associates and ESP 2007) addresses some of these issues with respect to removing, or reducing the abundance of, invasive plants; but it provides little specific guidance on how grazing and grazing management will directly benefit birds. The GMP would benefit from a more explicit explanation of what the current grazing management practices are on the mitigation parcels, exactly what new practices will be implemented, and how specifically these new practices are expected to benefit birds.

Also, there seems to be a discrepancy between how the environmental documents characterize cumulative impacts versus mitigation. The Project EIR indicates that, because of zoning and other factors, areas immediately around the Landfill likely will change little in the future and hence cumulative impacts will be “less than significant.” In such a scenario, it is unclear why purchase and protection of such lands qualifies as mitigation when they are unlikely to be affected in the future. Also, as discussed elsewhere in this review, it is not clear if the key mitigation parcels of the Director’s Guild and Griffith Ranch will in fact be protected “in perpetuity,” given the likely long-term effects of sea-level rise.

In cases, such as the Griffith Ranch, where it is proposed to create new wetlands by impounding water upslope from existing wetlands, there is not an adequate analysis of whether such impoundments would provide a net gain of wetland habitat or if they would rob wetlands downslope of water that would otherwise make these wetlands larger or remain for longer durations seasonally. The MMP does discuss the size of the watershed in which the new wetlands would be constructed and whether, given projected runoff and precipitation, the created ponds would hold adequate water; but the plans do not address directly whether this would have any substantial effect on downslope wetlands already on or adjacent to the property.

Despite the recognized concern in the literature of impacts by subsidized predators (corvids) on other species in proximity to landfills, the Project EIR does not mention this potentially important problem. No mitigation is proposed for the potential impacts of corvid predation on other species breeding in either the primary or secondary management areas of Suisun Marsh, which is of concern because the LPP states that the habitats of Suisun Marsh “deserve special protection.” The greatest effect is likely to be from ravens, which were rare or absent in the area in past decades. Crows have long been common in Solano County, given their long-exhibited ability to exploit food sources in agricultural areas. In recent years, crows in the San Francisco Bay area have increased in urban areas, such as those near the landfill.

Effects of Sea Level Rise. The Project EIR and MMP fail to take into account the potential effects of future sea-level rise from global warming. Plausible projections of the magnitude of future sea-level rise from this source range from 0.5 to over 3.0 meters (20 to

120 inches) by 2100 (Gleick and Maurer 1990). The rate of rise will increase progressively, leading to more rapidly rising sea level toward the middle of the 21st century. Under some scenarios, a 1-meter rise may result by the year 2050; the rise in the Suisun Marsh area may occur more rapidly because of concurrent land subsidence. With a 1-meter rise in sea level, during very extreme high tides Potrero Hills is projected to be an island surrounded by tidal waters, which would inundate parts of Highway 12 to the north (Figure 8 in Gleick and Maurer 1990). Hence, it is possible that without corrective action the Director's Guild and part of the Griffith Ranch mitigation properties may be degraded near the end of the life of the Phase II Landfill and may no longer support the plant and wildlife communities for which they are slated to be protected "in perpetuity." Also, there appears to be no analysis of other effects, such as whether by the end of, or after, the life of the Phase II landfill there will be any problems with contamination from a rising water table with the rise in sea level.

Mitigation Goals, Objectives, and Actions: Adequacy in Avoiding, Mitigating, and Compensating for Project Impacts

Proposed mitigation measures are not fully adequate to offset the impacts of the Phase II expansion. Discussion of proposed mitigation actions that are valuable, those that need improvement, and new measures that warrant consideration are described in the following sections.

MITIGATION RECOMMENDATIONS

Recommendations for Improvements to Management of Grazed Grasslands

Fence Wetter Areas to Enhance Nesting Habitat. Fencing of some marshes, swales, and pond edges to allow the growth of tall marsh plants or grasses would provide for better nest concealment for some known nesting species, such as the Northern Harrier, and might induce others, such as the Tricolored Blackbird, to begin nesting on the site.

Plant Isolated Trees and Shrubs. It also would be valuable to plant some isolated dense-foliaged trees or tall bushes within some of the grassland parcels to compensate for nest sites of the Loggerhead Shrike that would be lost to the Phase II expansion. The best trees to plant include natives such as willows, elderberry, or poison oak that are already located on the Phase II site. The size and spacing of such trees should be given careful consideration, as large trees or groves of trees also might attract nesting crows and ravens.

Enhance Grassland Habitat Value. It is good that the MMP proposes to reduce invasive non-native plants, such as thistles in grasslands, but it does not go far enough in proposing measures to improve the value of grasslands to birds. These measures may include enhancement of grasslands by managing the timing and intensity of grazing to benefit native grasses and forbs, and to investigate the use of fire, if feasible, for similar purposes. If extensive stands of native-dominated grasslands could be established, they might prove suitable for Grasshopper Sparrows, which currently are not known from the site. The sparrows would be most likely to benefit if native grasslands were restored on mitigation lands far from the Landfill

to lessen the potential impact of nest parasitism on the sparrows by Brown-headed Cowbirds foraging at the Landfill. In short, efforts should be made to enhance the value of the grassland mitigation parcels rather than just to protect them from development for other uses.

Remove Artificial Predator Perches in Wetland Areas. The creation of additional wetland habitat on mitigation parcels should benefit some common species of migrant and breeding waterbirds. The value of such wetlands would be enhanced by removal of any unnecessary artificial structures that might serve as predator perches. If, prior to the erection of these structures, there were no comparable natural perches or roosting sites (such as large trees), the structures may have increased both diurnal and nocturnal predator pressure on birds and mammals in an area where it previously may have been slight. An option to explore would be installation of plastic spikes on the tops of signs or other structures that are placed (or kept) in areas where sensitive bird species are present, which can make these potential perches inhospitable to raptors.

Recommended Mitigation for Potential Corvid Impacts

Liebezeit and George (2002) summarized management recommendations for reducing corvid predation overall, and Boarman (2003) discussed recommendations for reducing access of ravens to anthropogenic food sources at landfills. It is recommended that mitigation for the potential impact of corvids augmented by the Landfill should include an integrated corvid abatement program that expands on the current abatement program targeted at gulls. This program uses a combination of pyrotechnics (blank pistols, propane canisters), falcons, and dogs (S. Vasconcellos pers. comm.). It would be valuable to extend the abatement program to cover the entire year (not only winter as currently is done for gulls), particularly as corvid food demands can be higher in the breeding season when feeding young; hence, the breeding season is the period of greatest concern with respect to predation of corvids on other species.

It would be important to monitor corvid numbers to document that the expanded abatement program is reducing their numbers and specifically that the methods used for harassing gulls are effective for corvids. This is particularly important because corvids are known to habituate over time to some types of hazing (Liebezeit and George 2002). Any abatement measures should be adaptive to changing conditions or learned behaviors by corvids so that abatement remains effective over time. Likewise, it would be valuable to coordinate this abatement program with monitoring of corvid use of the Hay Road Landfill to evaluate whether corvids displaced from the Potrero Hills Landfill are relocating to another comparable site nearby. If this were found to be the case, additional actions would need to be taken to ensure that the impacts of corvids on other birds are actually abated and not simply shifted to other areas (such as the Jepson Prairie Preserve).

Additional operational measures to minimize the availability of foods to corvids (e.g., reducing the size of the active working face of the landfill or more quickly covering deposited refuse) also should be investigated, particularly as annual tonnage of refuse delivered to the landfill is projected to rise substantially over the life of the project.

Additional Wetland Mitigation

Depending on the outcome of further analysis of the watershed effects of some proposed mitigation impoundments on downslope wetlands, some additional mitigation for Phase II project effects on wetlands may be needed.

Recommendations for Additions or Alternative Approaches to Mitigate Project Impacts

Serious consideration should be given to whether it is appropriate for any of the proposed mitigation sites to be located immediately next to the landfill, knowing that nesting birds at these sites likely would be at greater risk to predation from corvids concentrated at the landfill than would birds at mitigation sites at a much greater distance.

If this concern of local effects of corvid concentrations is not considered too great, consideration should be given to the use of the Eastern Valley (eastern Potrero Hills Valley) as one component of the mitigation for the Phase II expansion because the Eastern Valley is the most similar habitat in the area to that which would be lost to the proposed current landfill expansion. Likewise, the Eastern Valley would be at risk to future landfill expansion. The Eastern Valley supports some trees that might be suitable for nesting Loggerhead Shrikes, and this relatively broad low valley is much better foraging habitat for breeding shrikes, Tricolored Blackbirds, Western Meadowlarks, and other blackbirds (Brewer's and Red-winged) as well as wintering hawks and Long-billed Curlews than are the narrower valley and steeper slopes of the Southern Hills. Similarly, the Project EIR reports wintering Burrowing Owls for the Phase II portion of the Potrero Valley, but these were very close to the Eastern Valley lands, which would be more likely on the basis of comparable habitat to support wintering Burrowing Owls than the other mitigation parcels. Also, the Eastern Valley is much less likely than the Director's Guild and Griffith Ranch parcels to be affected by the long-term impacts of sea-level rise.

Even though locating the power plant on the Phase I site, rather than on Griffith Ranch as previously proposed, would reduce impacts from direct loss of habitat and potentially increased bird mortality from collisions with aboveground power lines or with vehicles using a paved access road, the power plant and associated infrastructure should be designed to minimize these or other impacts. Also, efforts should be taken to reduce or eliminate any carbon dioxide (CO₂) emissions from this plant, as CO₂ is known to be a major contributor to greenhouse gases responsible for global warming.

As nighttime lighting at the Landfill may cause disorientation and collisions with structures by migrant passerines or locally moving waterfowl and other waterbirds, design features of lighting that minimize such impacts should be incorporated. Even simple changes in light signatures may reduce avian light attraction and mortality (Jones and Francis 2003). Information gained from consultation of both published literature and experts in the field will likely increase the likelihood that nighttime lighting can be designed to minimize avian attraction and mortality from collisions. Some considerations should include the type and height of lights, the intensity and nature of light beams, and shields on lights to focus their beams downward onto the Landfill and away from adjacent areas.