

U.S. Fish & Wildlife Service

Recovery Outline for the
Streaked Horned Lark
(*Eremophila alpestris strigata*)



Photo: D. Leonard, USFWS

Common Name Streaked horned lark
Scientific Name *Eremophila alpestris strigata*

Listing Status and Date Threatened; October 3, 2013 (78 FR 61452)
Critical Habitat and Date Designated; October 3, 2013 (78 FR 61506)

Lead Agency/Region U.S. Fish and Wildlife Service, Region 1

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Purpose of the Recovery Outline: This document lays out a preliminary course of action for the survival and recovery of the streaked horned lark. It is meant to serve as interim guidance to direct recovery efforts and inform consultation and permitting activities until a comprehensive draft recovery plan has been completed. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service (Service), and formal public participation will be invited upon the release of the draft recovery plan. However, we will consider any new information or comments that members of the public may wish to offer in response to this outline during the recovery planning process. For more information on Federal survival and recovery efforts for the streaked horned lark, or to provide additional comments, interested parties may contact

the lead biologist for this species, Cat Brown, at the above address, telephone number, or e-mail.

Scope of Recovery and Available Information: The scope of this effort is for a single species, the streaked horned lark. It provides a general overview of the available information concerning the streaked horned lark, presents interim recovery goals and objectives, and identifies immediate and longer-term actions, along with a tentative timeline for the recovery actions.

Some uncertainty and information gaps exist for this species. For example, estimating the abundance and trend of the streaked horned lark over time is complicated by the difficulty of gaining access for surveys on private lands in the Willamette Valley in Oregon, and on restricted military lands (e.g., the Artillery Impact Area) at Joint Base Lewis-McChord (JBLM) in Washington. A key recovery task will be to develop and implement a rangewide population survey protocol that will allow us to track the abundance and trend of the lark throughout its range. Other key recovery needs for the species include identifying limiting factors to population growth, effective methods to manage habitat, and effective methods to attract larks to suitable but unoccupied habitat.

Uncertainties and information gaps associated with this species will be clarified to the extent possible through the course of the recovery process as information is gathered or new information is generated through research. Modifications to the recovery plan will likely occur over time as any new information to inform recovery strategies becomes available.

I. Overview

A. BIOLOGICAL ASSESSMENT

1. Species Description and Life History

The streaked horned lark is endemic to the Pacific Northwest (historically found in British Columbia, Washington, and Oregon; Altman 2011, p. 196) and is a subspecies of the wide-ranging horned lark (*Eremophila alpestris*). Horned larks are small, ground-dwelling birds, approximately 6 to 8 inches in length (Beason 1995, p. 2). Adults are pale brown, but shades of brown vary geographically among the subspecies. The male's face has a yellow wash in most subspecies. Adults have a black bib, black whisker marks, black "horns" (feather tufts that can be raised or lowered), and black tail feathers with white margins (Beason 1995, p. 2). Juveniles lack the black face pattern and are varying shades of gray, from almost white to almost black (Beason 1995, p. 2). The streaked horned lark has a dark brown back, yellowish underparts, a walnut brown nape, and yellow eyebrow stripe and throat (Beason 1995, p. 4). This subspecies is conspicuously more yellow beneath and darker on the back than almost all other subspecies of horned lark. The combination of small size, dark brown back, and yellow underparts distinguishes this subspecies from all adjacent forms.

Horned larks forage on the ground in low vegetation or on bare ground (Beason 1995, p. 6); adults feed mainly on grass and forb seeds, but feed insects to their young (Beason 1995, p. 6). Horned larks form pairs in the spring; they create nests in shallow depressions in the ground and line them with soft vegetation (Beason 1995, p. 12). Streaked horned larks establish their nests in areas of extensive bare ground, and nests are almost always placed on the north side of a clump of vegetation or another object such as root balls or soil clumps (Pearson and Hopey 2005, p. 23; Moore and Kotaich 2010, p. 18).

Streaked horned larks are currently known to breed in the Puget lowlands of southwest Washington, on the outer coast of Washington, on islands and mainland sites along the lower Columbia River that forms the boundary between Washington and Oregon, and in the Willamette Valley of Oregon. Streaked horned larks have strong natal fidelity to nesting sites, returning each year to the place they were born (Pearson *et al.* 2008, p. 11). The nesting season for streaked horned larks begins in mid-April and ends in late August (Pearson and Hopey 2004, p. 11; Moore 2011, p. 32; Wolf 2011, p. 5). Clutches range from one to five eggs, with a mean of three eggs (Pearson and Hopey 2004, p. 12). After the first nesting attempt in April, streaked horned larks will often re-nest in late June or early July (Pearson and Hopey 2004, p. 11); Beason (1995, p. 12) reported that horned larks in most locations produce two or more successful clutches each year. Young horned larks leave the nest 8 to 10 days after hatching, and are cared for by the parents until they are about 4 weeks old, when they become independent (Beason 1995, p. 15). Nest success studies (i.e., the proportion of nests that result in at least one fledged chick) in streaked horned larks reported highly variable results. Recent studies on the Puget lowlands of Washington at JBLM found nest success varied from 30 to 64 percent between 2011 and 2015 (Wolf *et al.* 2016, p. 48). According to reports from sites in the Willamette Valley, Oregon, nest success has varied from 23 to 60 percent depending on the site (Altman 1999, p. 1; Moore and Kotaich 2010, p. 23). At one site (Rivergate Industrial Complex) in Portland, Oregon, Moore (2011, p. 11) found 100 percent nest success among eight nests monitored.

Pearson *et al.* (2005, p. 2) found that the majority of streaked horned larks winter in the Willamette Valley (72 percent) and on the islands in the lower Columbia River (20 percent); the rest winter on the Washington coast (8 percent) or in the south Puget Sound (1 percent). In the winter, most streaked horned larks that breed in the south Puget Sound migrate south to the Willamette Valley or west to the Washington coast; streaked horned larks that breed on the Washington coast either remain on the coast or migrate south to the Willamette Valley; birds that breed on the lower Columbia River islands remain on the islands or migrate to the Washington coast; and birds that breed in the Willamette Valley remain there over the winter (Pearson *et al.* 2005, pp. 5–6). Streaked horned larks spend the winter in large groups of mixed subspecies of horned larks in the Willamette Valley, and in smaller flocks along the lower Columbia River and Washington Coast (Pearson *et al.* 2005, p. 7; Pearson and Altman 2005, p. 7).

There are four other breeding subspecies of horned larks in Washington and Oregon: pallid horned lark (*E. a. alpina*), dusky horned lark (*E. a. merrilli*), Warner horned lark (*E. a. lamprochroma*), and Arctic horned lark (*E. a. arcticola*) (Marshall *et al.* 2003, p. 426; Wahl *et al.* 2005, p. 268). None of these other subspecies breed within the range of the streaked horned lark, but all four subspecies are frequently found in mixed species flocks during the winter in the Willamette Valley (Marshall *et al.* 2003, pp. 425– 427).

2. Historical and Current Population Status

Historical records indicate that the streaked horned lark was found west of the Cascade Range from the Georgia Depression (southern British Columbia, Canada), south through the Puget lowlands and outer coast of Washington, along the lower Columbia River, through the Willamette Valley, the Oregon coast, and into the Umpqua and Rogue River Valleys of southwestern Oregon (Altman 2011, p. 201). Currently, the lark is known to occur at scattered sites in the south Puget lowlands, the outer coast of Washington, the lower Columbia River, and the Willamette Valley in Oregon. An analysis of recent data from a variety of sources concluded that the streaked horned lark has been extirpated from the Georgia Depression (British Columbia), the Oregon coast, and the Rogue and Umpqua Valleys of Oregon (Altman 2011, p. 213), although a flock of wintering streaked horned larks was detected in the Rogue Valley in winter 2015-2016 (Randy Moore, Oregon State University, Corvallis, Oregon, pers. comm., 2016a) (Figure 1).

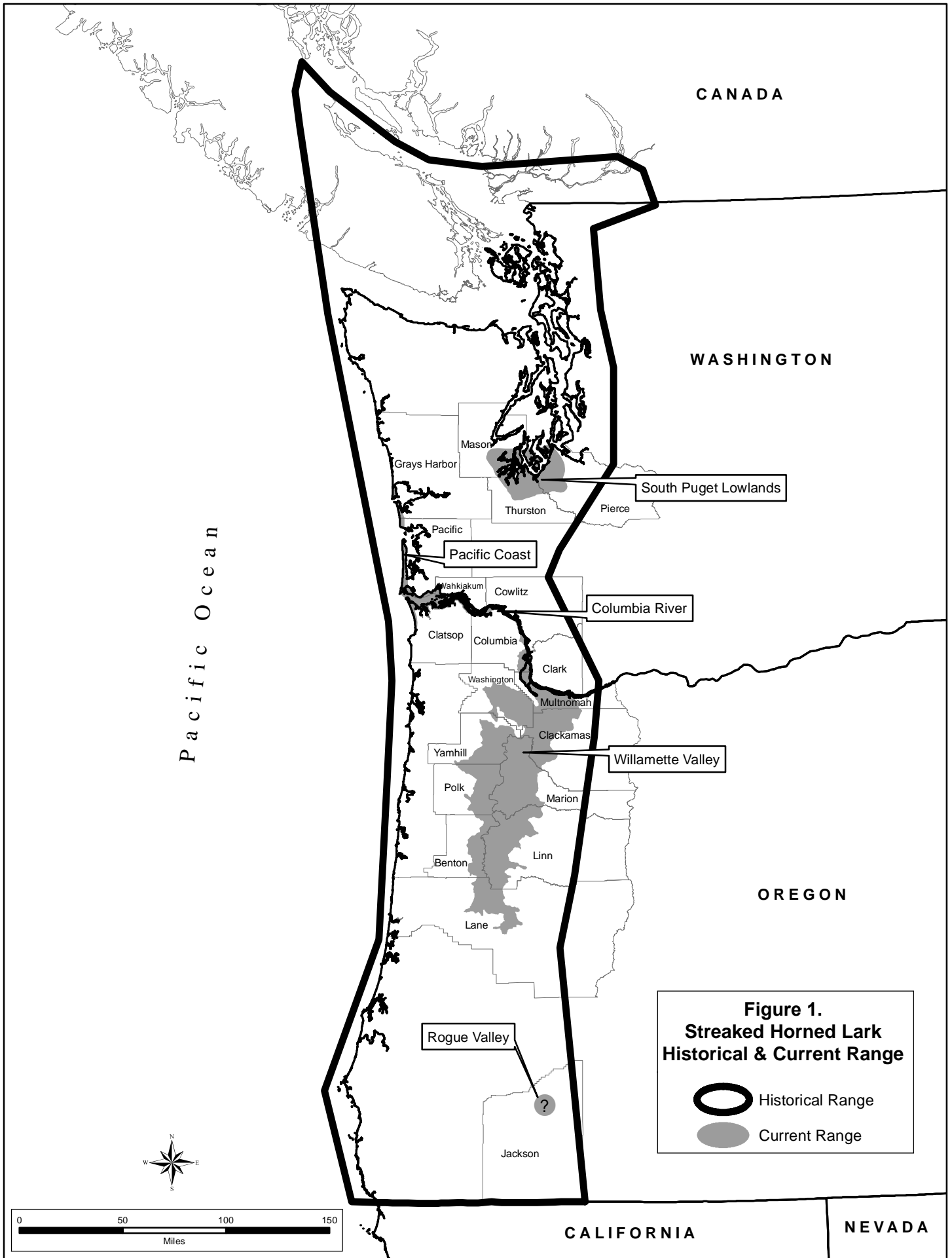
Historical Status

Estimates of historical abundance of the streaked horned lark throughout its range are largely anecdotal in nature.

British Columbia and San Juan Islands

The streaked horned lark was never considered common in British Columbia, but small breeding populations were known on Vancouver Island, in the Fraser River Valley, and near Vancouver International Airport (Campbell *et al.* 1997, p. 120; COSEWIC 2003, p. 5). The population declined throughout the 20th century (COSEWIC 2003, pp. 13–14); breeding has not been confirmed since 1978, and the streaked horned lark population is considered to be extirpated in British Columbia (COSEWIC 2003, p. 15), although a single streaked horned lark was sighted on Vancouver Island in 2002 (COSEWIC 2003, p. 16). The streaked horned lark was listed as endangered under Canada’s Species at Risk Act in 2005 (Environment Canada 2014, p. iii).

The first report of the streaked horned lark in the San Juan Islands, Washington, was in 1948 from Cattle Point on San Juan Island (Goodge 1950, p. 28). There are breeding season records of streaked horned larks from San Juan and Lopez Islands in the 1950s and early 1960s (Retfalvi 1963, p. 13; Lewis and Sharpe 1987, pp. 148, 204), but the last record dates from 1962, when seven individuals were seen in July at Cattle Point



(Retfalvi 1963, p. 13). The Washington Department of Fish and Wildlife (WDFW) conducted surveys in the San Juan Islands in 1999 (Rogers 1999, pp. 3–4). Suitable nesting habitat was visually searched and a tape recording of streaked horned lark calls was used to elicit responses and increase the chance of detections (Rogers 1999, p. 4). In 2000, MacLaren and Cummins (in Stinson 2005, p. 63) surveyed several sites recommended by Rogers (1999), including Cattle Point and Lime Kiln Point on San Juan Island. No larks were detected in the San Juan Islands during either survey effort (Rogers 1999, p. 4; Stinson 2005, p. 63).

Puget Lowlands

There are scattered records of streaked horned larks in the northern Puget Trough, including sightings in Skagit and Whatcom Counties in the mid-20th century (Altman 2011, p. 201). The last recorded sighting of a streaked horned lark in the northern Puget Trough was at the Bellingham Airport in 1962 (Stinson 2005, p. 52).

Over a century ago, the streaked horned lark was described as a common summer resident in the prairies of the Puget Sound region in Washington (Bowles 1898, p. 53; Altman 2011, p. 201). Larks were considered common in the early 1950s ‘in the prairie country south of Tacoma’ and had been observed on the tide flats south of Seattle (Jewett *et al.* 1953, p. 438). By the mid-1990s, only a few scattered breeding populations existed on the south Puget Sound on remnant prairies and airports (Altman 2011, p. 201).

Washington Coast and Lower Columbia River

There are a few historical records of streaked horned larks on the outer coast of Washington near Lake Quinault, the Quinault River, and the Humptulips River in the 1890s (Jewett *et al.* 1953, p. 438; Rogers 2000, p. 26). More recent records reported larks at Leadbetter Point and Graveyard Spit in Pacific County in the 1960s and 1970s (Rogers 2000, p. 26). Surveys conducted between 1999 and 2004 found larks at Leadbetter Point, Graveyard Spit, Damon Point, and Midway Beach on the outer coast (Stinson 2005, p. 63).

There are sporadic records of streaked horned larks along the Columbia River. Sightings on islands near Portland, Oregon, date back to the early 1900s (Rogers 2000, p. 27). On the lower Columbia River, it is probable that streaked horned larks bred only as far east as Clark County, Washington, and Multnomah County, Oregon (Rogers 2000, p. 27; Stinson 2005, p. 51).

Willamette Valley

The streaked horned lark’s historical range extends south throughout the Willamette Valley of Oregon, where it was considered abundant and a common summer resident over a hundred years ago (Johnson 1880, p. 636; Anthony 1886, p. 166). In the 1940s, the streaked horned lark was described as a common permanent resident in the southern Willamette Valley (Gullion 1951, p. 141). By the 1990s, the streaked horned lark was

called uncommon in the Willamette Valley, nesting locally in small numbers in large open fields (Gilligan *et al.* 1994, p. 205; Altman 1999, p. 18). In the early 2000s, a population of more than 75 breeding pairs was found at the Corvallis Municipal Airport, making this the largest population of streaked horned larks known (Moore 2008a, p. 15).

Oregon Coast

The streaked horned lark, while occasionally present, was never reported to be more than uncommon on the Oregon coast. The streaked horned lark was described as an uncommon and local summer resident all along the coast on sand spits (Gilligan *et al.* 1994, p. 205); a few nonbreeding season records exist for the coastal counties of Clatsop, Tillamook, Coos, and Curry (Gabrielson and Jewett 1940, p. 403). Small numbers of streaked horned larks were known to breed at the South Jetty of the Columbia River in Clatsop County, but the site was abandoned in the 1980s (Gilligan *et al.* 1994, p. 205). There are no recent occurrence records from the Oregon coast.

Umpqua and Rogue River Valleys

In the early 1900s, the streaked horned lark was considered a common permanent resident of the Umpqua and Rogue River Valleys (Gabrielson and Jewett 1940, p. 402). The last confirmed breeding record in the Rogue Valley was in 1976 (Marshall *et al.* 2003, p. 425). There are no recent reports of breeding streaked horned larks in the Umpqua or Rogue River Valleys (Gilligan *et al.* 1994, p. 205; Marshall *et al.* 2003, p. 425, Robinson 2016, p. 1).

Current Status

The most recent rangewide population estimate for streaked horned larks is about 1,170 to 1,610 individuals (Altman 2011, p. 213); this analysis was based on 2008 to 2010 data collected at all known breeding sites in Washington and all accessible breeding sites and roadside point counts in Oregon (Altman 2011, p. 213).

Puget Lowlands

In the south Puget lowlands, the streaked horned lark is currently known to occur at eight sites; three of these sites are municipal airports (Olympia Airport, Shelton Airport, and Tacoma Narrows Airport), and five sites are on JBLM (13th Division Prairie, Gray Army Airfield, 91st Division Prairie – Range 76, 91st Division Prairie – Range 50, and McChord Air Force Base). Approximately 119 breeding pairs of streaked horned larks were detected at these 8 sites in 2015 (Stinson 2016, p. 5) (Table 1).

Washington Coast and Lower Columbia River

In the past decade, streaked horned larks have been found at six sites on the outer coast of Washington (Leadbetter Point, Graveyard Spit, Midway Beach, Damon Point, Oyhut Spit, and Johns River Island). Lark populations appear to have been declining at all of

these sites recently, and in 2015, larks were found at only 1 site, Leadbetter Point, with just 11 pairs detected (Stinson 2016, p. 5) (Table 1). In 2016, two pairs of breeding larks were detected at Graveyard Spit, after several years of no detections (Cyndie Sundstrom, WDFW, Montesano, Washington, pers. comm., 2016).

Along the lower Columbia River, streaked horned larks are found on islands and at mainland sites adjacent to the river. In the last several years, surveys have detected breeding larks on 12 islands and 6 mainland sites; most of the Lower Columbia River sites with lark detections are active dredge material disposal sites, although the 2 sites farthest upriver (at the Port of Portland's Rivergate Industrial Complex and Portland International Airport's Southwest Quad) are old fill sites that retain suitable habitat characteristics (Stinson 2016, p. 5). Surveys in May 2016 detected larks at Howard Island for the first time, at a site being prepared for dredge material placement by the U.S. Army Corps of Engineers (USACE) (Slater and Treadwell 2016, p. 3). The most recent data indicate that there are at least 66 pairs of larks in the Lower Columbia River region (Table 1).

When the lark was listed as threatened in 2013, a recently published analysis predicted a rapid decline in the Washington populations, including breeding sites on the Puget Lowlands, outer coast, and Columbia River islands (Camfield *et al.* 2011, p. 8). One study of the lark population at 13th Division Prairie at JBLM speculated that small population size, high nest site fidelity, and low egg hatching rates indicated that the population is suffering from inbreeding depression (Anderson 2010, p. 33). Recent efforts at JBLM to manage habitat and reduce the adverse effects of airfield maintenance and military training, however, have resulted in an increased population of streaked horned larks and improved productivity (Wolf *et al.* 2015, p. 48). Recent data also indicate that the Puget Lowlands and Columbia River breeding sites have relatively stable or increasing lark populations (Stinson 2016, p.6). A new concern has emerged in the south Puget Lowlands population, however; counts of males are increasing, but counts of females are declining (Stinson 2016, p. 6). The reason for the skewed sex ratios is not yet apparent. However, a skewed sex ratio affects the effective population size (the portion of the population reproducing), and bird species identified by the International Union for Conservation of Nature as Globally Threatened more often exhibit male-biased sex ratios; the skew toward males tends to increase with increasing threat status (Donald 2007, p, 675).

Willamette Valley

In Oregon, lark populations have not been surveyed as regularly or intensively as the populations in Washington due to the lack of access to habitat on private agricultural lands. The most recent estimate of the streaked horned lark population in Oregon is about 900 to 1,300 breeding streaked horned larks in the Willamette Valley (Altman 2011, p. 213).

Recovery Outline for the Streaked Horned Lark

Table 1. Estimated Number of Breeding Pairs of Streaked Horned Larks in the South Puget Lowlands, Washington Coast, and Lower Columbia River Regions, 2010 – 2015. (“-“ indicates no survey in that year).							
Site	Ownership	Estimated Number of Breeding Pairs of Larks					
		2010	2011	2012	2013	2014	2015
South Puget Lowlands							
Olympia Airport	Port of Olympia	36	26	31	30	37	48
Shelton Airport	Port of Shelton	9	7	11	12	13	13
13th Division Prairie, JBLM	Federal (JBLM)	1	4	11	9	10	9
Gray Army Airfield, JBLM	Federal (JBLM)	15	15	12	11	10-13	19-21
91st Div. Prairie, Range 76, JBLM	Federal (JBLM)	10	5	-	5	8	6
91st Div. Prairie, Range 50, JBLM	Federal (JBLM)	-	-	-	-	9	3
McChord Air Force Base, JBLM	Federal (JBLM)	13	11	8	8-9	8-9	16-18
Tacoma Narrows Airport	Pierce County	-	-	-	-	2	2
Washington Coast							
Leadbetter Point	Federal (Willapa NWR)	-	17	12	6	11	11
Graveyard Spit	Tribe (Shoalwater Bay Indian Tribe) & Private	-	-	-	1	0	0
Midway Beach	State (WSP)	-	-	2	1	1	0
Damon Point	State (WDNR)	-	2	3	2	0	0
Oyhut Spit	State (WDFW)	-	0	2	0	0	0
Johns River Island	State (WDFW)	-	-	2	0	0	0
Lower Columbia River							
Rice Island	State (ODSL, WDSL)	7	22	14	23	18	14
Miller Sands	State (ODSL)	3	4	2	5	8	12
Pillar Rock	State (ODSL)	3	4	3	2	4	2
Welch Island	State (ODSL)	1	0	-	-	-	0
Tenasillahe Island	State (ODSL)	-	2	2	0	2	2
Brown Island	State (WDFW)	15	14	18	23	21	17
Wallace	State (ODSL)	-	-	1	-	1	0
Crims	State (ODSL)	0	7	4	2	5	6
Dibblee	State (ODSL)	-	-	-	-	1	1
North Port (Kalama)	Port of Kalama	-	-	1	3	2	-
Sandy	State (ODSL)	1	1	1	4	6	3
Lower Deer	State (ODSL)	-	-	-	-	1	0
Sand Island	State (ODSL)	-	-	-	-	3	2
Port of Longview (Wasser and Winters)	Port of Longview	-	-	-	1	2	-
Columbia Gateway	Port of Vancouver	-	-	-	-	1-2	-
Rivergate	Port of Portland	5	6	3	6	6	5
PDX Southwest Quad	Port of Portland	3	2	2	3	2	2
JBLM Joint Base Lewis-McChord NWR National Wildlife Refuge ODSL Oregon Dept of State Lands ODA Oregon Dept of Aviation	WDNR Washington Dept of Natural Resources WDSL Washington Dept of State Lands WSP Washington State Parks WDFW Washington Dept of Fish and Wildlife						
Sources: Washington and Columbia River summary in Stinson 2016, except for JBLM data for 2013-2015, which is from Wolf <i>et al.</i> 2016. Port of Portland data from Dana Green, Port of Portland, Portland, Oregon, pers. comm., 2016.							

Data from the North American Breeding Bird Survey (BBS) indicate that most grassland-associated birds, including the horned lark species, have declined across their ranges in the past three decades (Sauer *et al.* 2014, pp. 7-9). The BBS can provide population trend data only for those species with sufficient sample sizes for analyses. There are insufficient data in the BBS for a rangewide analysis of the streaked horned lark population trend (Altman 2011, p. 214). However, data from the BBS may provide additional insight into the trend of the streaked horned lark population in the Willamette Valley. Although the BBS does not track bird counts by subspecies, the streaked horned lark is the only subspecies of horned lark that breeds in the Oregon portion of the Northern Pacific Rainforest Bird Conservation Region, therefore it is reasonable to assume that counts of horned larks from the breeding season in the Willamette Valley are actually counts of the streaked horned lark. The BBS data regularly detect horned larks on several routes in the Willamette Valley, and counts from these routes show that horned larks in this Bird Conservation Region have been declining since the 1960s, with an estimated annual trend of -5.41 percent (95 percent confidence interval from -7.60 to -3.35) (Sauer *et al.* 2014, p. 4). The U.S. Geological Survey, which manages the BBS data, recommends caution when analyzing these data due to the small sample size, high variance, and potential for observer bias in the raw BBS data.

The best information on trends throughout the Willamette Valley comes from surveys by the Oregon Department of Fish and Wildlife (ODFW); the agency conducted surveys for grassland-associated birds, including the streaked horned lark, in 1996 and again in 2008 (Altman 1999, p. 2; Myers and Kreager 2010, p. 2). Point count surveys were conducted at 544 stations in the Willamette Valley (Myers and Kreager 2010, p. 2); over the 12-year period between the surveys, measures of relative abundance of streaked horned larks increased slightly from 1996 to 2008, according to this report. Both detections at point count stations and within regions showed moderate increases (3 percent and 6 percent, respectively) (Myers and Kreager 2010, p. 11). Population numbers decreased slightly in the northern Willamette Valley and increased slightly in the middle and southern portions of the valley (Myers and Kreager 2010, p. 11). This is the best information currently available on the trend of the lark population in the Willamette Valley; additional studies are needed to understand the valley-wide and subregional trends of the lark in Oregon.

The largest known population of streaked horned larks breeds at the Corvallis Municipal Airport; depending on the management conducted at the airport and the surrounding grass fields each year, the population has been as high as 100 breeding pairs (Moore and Kotaich 2010, pp. 13-15). Surveys from 2007 to 2013 found 80 to 100 pairs in most years during the breeding season (Moore 2008a, Moore and Kotaich 2010, Moore 2013); the population dropped precipitously in 2014 when deep snow in the southern Willamette Valley apparently depressed the lark population. In June 2014, Moore detected only 23 mated pairs of larks and 16 unmated males (Moore 2015a, p. 18). However, the population may have begun to rebound; in 2015, Moore detected 30 mated pairs at the Corvallis Airport, and early season counts in 2016 indicate that the number of nests has increased to more than 65 pairs (Randy Moore, Oregon State University, Corvallis, Oregon, pers. comm., 2016b.). It is unclear whether the troubling issue of declining female numbers that has been detected in Washington may also be occurring in Oregon.

Outside of the breeding season, the resident breeding population at the Corvallis Airport is augmented by mixed flocks of wintering streaked horned larks and other subspecies of horned larks (Moore 2008a, p. 9).

Streaked horned larks have been detected at four other airports in the Willamette Valley (Eugene Airport, Salem Municipal Airport, McMinnville Municipal Airport, and Independence State Airport). None of these airports have been comprehensively surveyed; our knowledge of the lark population at each site is the result of focused surveys done for pre-project clearances.

The Eugene Airport contracted surveys for the Taxiway A rehabilitation project in June and July 2015; 11 territories were detected in the project areas, and at least 9 of these territories were occupied by mated pairs of larks (Moore 2015b, p. 2). The Eugene Airport is a large commercial airport, and there are likely many more larks on the airfield beyond the bounds of the 2015 survey.

Surveys of the Salem Municipal Airport during the breeding seasons of 2005 to 2008 detected up to four pairs of breeding streaked horned larks at the southern end of the airport (Moore 2008a, p. 15). In 2012, surveys were conducted for the Salem Airport Runway Extension Project; only the area within the defined boundaries of the proposed project was surveyed, and one male horned lark was detected (ESA Vigil-Agrimis 2014, p.17). In 2014, surveys were conducted for streaked horned larks for the Airfield Electrical and Runway Safety Area Team Improvement Project; surveys in the project area did not detect any larks (ESA Vigil-Agrimis 2014, p.17).

The McMinnville Municipal Airport was surveyed in 2014 and 2015; streaked horned larks on territories were detected on Runways 4-22 and 17-35 (Moore 2015c, p. 2; ESA Vigil-Agrimis 2015, p. 15). Current information indicates that there are about 12 resident streaked horned larks at the McMinnville Airport (ESA Vigil-Agrimis 2015, p. 15).

The Independence State Airport was surveyed in 2103 for a pavement maintenance project. The consultant detected “small flocks” of streaked horned larks on the airfield but outside of the proposed project boundary (Thompson 2013, p. 1). Additional information about the size and distribution of larks on this airport is needed.

Streaked horned larks can be found on three units of the Willamette Valley National Wildlife Refuge Complex (Ankeny, Baskett Slough and William L. Finley). Larks mainly use the refuge’s agricultural fields, during both the breeding and winter seasons (U.S. Fish and Wildlife Service 2016, p. 3). Portions of each of the three refuges have been designated as Critical Habitat for the lark (78 FR 61506); most of the Critical Habitat designations are on agricultural lands that produce green forage for wintering Canada geese (U.S. Fish and Wildlife Service 2016, p. 3).

On Ankeny National Wildlife Refuge (NWR), streaked horned larks primarily use the central farm fields. Of the three units, Ankeny consistently appears to have the smallest breeding population, generally from one to five pairs (Moore 2008a, p. 8). Refuge staff

have been conducting surveys in the last couple of years. The count for Ankeny in 2015 was six breeding pairs of larks (Brian Root, U.S. Fish and Wildlife Service, Willamette Valley NWR Complex, Corvallis, Oregon, pers. comm., 2016). The consistently low lark numbers at Ankeny may reflect the landscape setting of this refuge unit; the farm fields are bordered by rows of tall trees, which limit the extent of suitable habitat for the lark (Moore 2008a, p. 8).

At Baskett Slough NWR, larks use a wider range of the refuge's fields, including both agricultural fields and wetland edges (Moore 2008a, p. 8). Surveys from 2006 to 2008 consistently found 18 to 20 pairs at Baskett Slough (Moore 2008a, p. 8). In 2015, the count for Baskett Slough was about 15 breeding pairs of larks (Brian Root, U.S. Fish and Wildlife Service, Willamette Valley NWR Complex, Corvallis, Oregon, pers. comm., 2016).

At William L. Finley NWR, larks inhabit portions of the southern and eastern agricultural fields (Moore 2008a, p. 8). The number of territorial male larks at William L. Finley NWR varied from 15 to 22 pairs over the 2006 to 2008 surveys (Moore 2008a, p. 8). In 2015, Refuge staff detected six breeding pairs (Brian Root, U.S. Fish and Wildlife Service, Willamette Valley NWR Complex, Corvallis, Oregon, pers. comm., 2016).

We have limited data on other sites in the Willamette Valley. M-DAC Farms, a privately owned prairie and wetland restoration project in Linn County, illustrates the pattern of streaked horned lark colonization of ephemeral habitats. Early in the breeding season in 2007, Moore (2008a, p. 10) detected a single pair of larks on the gravel road at the site; a controlled burn in June 2007 attracted 30 pairs of larks to the site during that breeding season. In 2008, the breeding population of larks grew to about 75 pairs (Moore 2008a, p. 11). As the vegetation at the site matured in the following years, the site became less suitable for larks, and the population declined to just two to three pairs in 2012 (Randy Moore, Oregon State University, Corvallis, Oregon, pers. comm., 2012). This is likely a common pattern, as breeding streaked horned larks opportunistically shift sites as habitat becomes available among private agricultural lands in the Willamette Valley (Moore 2008a, pp. 9-11).

The Mill Creek Corporate Center in Salem is owned by the Oregon Department of Administrative Services. The site is being developed for industrial, commercial, and service uses through a series of construction phases over an estimated 20-year period (Galen and van Staveren 2016, p. 1). The site was originally prepared for development in 2005, but only a portion of the property attracted tenants; the rest of the site sat fallow, and weedy vegetation colonized the site. A survey by Moore at the site detected as many as 20 pairs of larks in 2012 (Randy Moore, Oregon State University, Corvallis, Oregon, pers. comm., 2012). In 2015, a portion of the site was proposed for development; surveys by the Department of Administrative Services' consultant detected two to three pairs of streaked horned lark on the site (Galen and van Staveren 2016, p. 7). The vegetation over most of the site has succeeded to dense cover of grasses and forbs, no longer providing suitable habitat for the lark (Galen and van Staveren 2016, p. 6).

The Herbert Farm and Natural Area is a grass seed farm in Benton County that has been acquired by the City of Corvallis for restoration to native prairie and oak habitat. A portion of the site remains in grass seed production, and a few pairs of streaked horned larks have been detected along the road margins of the farmed parcels (Institute for Applied Ecology 2015, p. 9). This is the site of an ongoing research project to evaluate different methods of treating agricultural road margins to benefit streaked horned larks during the breeding season on active farm lands (Institute for Applied Ecology 2015, p. 6).

Much of the Willamette Valley is private agricultural land, and has not been surveyed for streaked horned larks, except along public road margins (Altman 1999, p. 2; Myers and Kreager 2010, pp. 2-3). There are numerous locations on private agricultural lands on which streaked horned larks have been observed in the Willamette Valley, particularly in the southern valley on grass seed fields. These lands may contain a large percentage of the population of streaked horned larks in Oregon, but no comprehensive survey has been conducted to date.

Umpqua and Rogue River Valleys

In the winter of 2015 to 2016, streaked horned larks were detected at the Lost Creek Lake reservoir in Jackson County, in the Rogue River Valley; other subspecies of horned larks have been detected at this location in the past, but this appears to be the first confirmed report of the *strigata* subspecies in about 40 years (Randy Moore, Oregon State University, Corvallis, Oregon, pers. comm., 2016a). Surveys the following spring did not find any breeding streaked horned larks in the Rogue Valley (Robinson 2016, p. 1).

3. Habitat Description and Landownership

Horned larks are birds of wide open spaces. Habitat used by streaked horned larks is generally flat with substantial areas of bare ground and sparse low-stature vegetation, mainly grasses and forbs (Pearson and Hopey 2005, p. 27). Suitable habitat is generally 16 to 17 percent bare ground, and may be even more open at sites selected for nesting (Altman 1999, p. 18; Pearson and Hopey 2005, p. 27). Vegetation height is generally less than 13 inches (Altman 1999, p. 18; Pearson and Hopey 2005, p. 27). Larks eat a wide variety of seeds and insects (Beason 1995, p. 6) and appear to select habitats based on the structure of the vegetation rather than the presence of any specific food plants (Moore 2008b, p. 19). A key attribute of habitat used by larks is open landscape context. Our data indicate that sites used by larks are generally found in open (i.e., flat, treeless) landscapes of 300 acres or more (Converse *et al.* 2010, p. 21). Some patches with the appropriate characteristics (i.e., bare ground, low stature vegetation) may be smaller in size if the adjacent areas provide the required open landscape context; this situation is common in agricultural habitats and on sites next to water. For example, many of the sites used by streaked horned larks on the islands in the Columbia River are small (less than 100 acres), but are adjacent to open water, which provides the open landscape context needed. Streaked horned lark populations are found at many airports within the

subspecies' range, since airfields typically have the ideal landscape context, and the wildlife hazard management regime provides the appropriate vegetation structure.

Historically, streaked horned larks nested in flat, open areas in grasslands, estuaries, and sandy beaches in British Columbia; in dune habitats along the coast of Washington; in prairies of western Washington and western Oregon; and on the sandy beaches and islands along the Columbia and Willamette Rivers. Habitat at these sites was created by natural processes of flooding, fire and coastal sediment transport dynamics. Today, these processes no longer operate (due to flood control dams, control of wildfires, and interruption of sediment transport by dams). Currently, the streaked horned lark nests in a broad range of habitats, including native prairies, coastal dunes, fallow and active agricultural fields, wetland mudflats, sparsely vegetated edges of grass fields, recently planted Christmas tree farms with extensive bare ground, fields denuded by overwintering Canada geese, gravel roads or gravel shoulders of lightly traveled roads, airports, and dredge material deposition sites in the lower Columbia River (Altman 1999, p. 18; Pearson and Altman 2005, p. 5; Pearson and Hopey 2005, p. 15; Moore 2008a, pp. 9-10, 12-14, 16). Streaked horned larks exhibit high nest site fidelity (Pearson *et al.* 2008, p. 11), generally returning to a breeding site until it becomes too densely vegetated to be suitable. Wintering streaked horned larks use habitats that are very similar to breeding habitats (Pearson *et al.* 2005, p. 8).

Although streaked horned larks use a wide variety of habitats, populations are vulnerable because the habitats used are often ephemeral or subject to frequent human disturbance. Ephemeral habitats include bare ground in agricultural fields and wetland mudflats; habitats subject to frequent human disturbance include mowed fields at airports, managed road margins, agricultural crop fields, and disposal sites for dredge material (Altman 1999, p. 19). It is important to note the key role of anthropogenically maintained landscapes in providing habitat for the streaked horned lark; without large-scale, manmade disturbance (e.g., burning, mowing, cropping, and deposition of dredge spoils), available habitat would decrease rapidly, but these same activities can kill or injure individuals, especially when they occur during the breeding season.

Land Ownership

In Washington, most of the currently known streaked horned lark populations occur on publicly-owned lands (Table 1). In the South Puget Lowlands, most of the lark habitat occurs on Federal lands at JBLM. The only other populations in that region are found on municipal airports in Olympia, Shelton, and Tacoma. On the Washington Coast, larks nest on Federal land at Leadbetter Point on the Willapa Bay NWR. Recent sightings of larks have also occurred on State lands at Damon Point and Midway Beach, and at Graveyard Spit, which is owned by the Shoalwater Bay Indian Tribe and private individuals.

On the lower Columbia River, which divides Oregon and Washington, streaked horned larks are found on a mix of public and private lands (Table 1). Most of the sites with documented breeding are on dredge material disposal sites owned by the Oregon and

Washington Departments of State Land. Breeding and foraging larks have also been detected on sites owned by the Ports of Longview, Kalama, Vancouver and Portland.

In the Willamette Valley, streaked horned larks occur on Federal lands at the Willamette Valley NWR Complex, on the William L. Finley, Ankeny, and Baskett Slough units. Populations of larks are also found on municipal and State lands at several airports in the Valley (Corvallis Municipal Airport, Eugene Airport, Salem Municipal Airport, McMinnville Municipal Airport and Independence State Airport) and at the Mill Creek Corporate Center in Salem and Herbert Farm and Natural Area in Corvallis. The largest area of potential habitat for the lark is on private agricultural lands throughout the Willamette Valley, with the most suitable habitat concentrated in the southeastern portion of the valley on grass seed farms.

4. Summary Biological Assessment

The decline of the streaked horned lark is mainly due to the loss of habitat, which is associated with development, agriculture, and the loss of the natural disturbance processes of fire and flooding throughout the bird's range. The streaked horned lark now occurs mainly on sites that are maintained by commercial and industrial processes (mowing on airfields, dredge material deposition, farming activities, and military training); these activities may create suitable habitat, but the methods and frequency of disturbance are generally incompatible with successful breeding. As a result, the rangewide population remains depressed and continues to decline.

The current trend is declining, but at sites where management has been altered to protect larks, especially during the breeding season, populations have stabilized or increased. This has been documented on the lower Columbia River sites, JBLM, and the Olympia Airport.

B. THREATS ASSESSMENT

1. Listing Factors/Primary Threats to the Species

As identified in the final listing rule (78 FR 61452), the main threats to the streaked horned lark are: loss of habitat and natural disturbance processes; incompatible habitat management; the adverse effects of military training, aircraft operation, and agricultural activities; small population issues and potential inbreeding depression; and predation pressure on small populations. In addition to the threats identified in 2013 when the lark was listed, three new potential threats have been identified: male-skewed sex ratio, avian pox in the Puget Lowlands, and rodenticide poisoning.

A summary of threats is provided below, together with a brief discussion of the newly identified threats; each is classified according to the five listing/delisting factors identified in section 4 of the Endangered Species Act ("Act"; 16 USC 1531 *et seq.*). The

final listing rule (78 FR 61452) provides a more detailed discussion of the threats and is incorporated herein by reference.

Factor A. The Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range

In the final rule to list the streaked horned lark as a threatened species, we identified the following habitat-related threats:

- Loss, conversion, and degradation of habitat, particularly as a consequence of agricultural, industrial and urban development.
- Loss of natural ecological disturbance processes.
- Successional changes in grassland habitats and encroachment of woody vegetation.
- Spread of invasive beach grasses.
- Incompatible management activities at occupied sites, including:
 - Mowing on airports;
 - Military training and associated activities; and
 - Dredge material deposition on Columbia River islands.
- Transient agricultural habitat, including:
 - Conversion to incompatible crops; and
 - Ephemeral habitats.

Summary of Factor A

There are many ongoing threats to the streaked horned lark's habitat throughout its range, many of which stem from the loss of natural disturbance processes that created habitat in the past. The loss of these natural disturbance processes has resulted in the lark's dependence on artificially maintained habitats, including agricultural lands, airports, and dredge material deposition sites; use of these artificial habitats exposes larks to disturbances, particularly during the breeding season, which may kill or injure all life stages of the bird. The continued loss and degradation of streaked horned lark habitat may result in smaller, more isolated habitats available to the subspecies, which could further depress the rangewide population or reduce the geographic distribution of the streaked horned lark. We conclude that the current and ongoing threats to streaked horned lark habitat result in a significant impact to the subspecies and its habitat, and will continue into the future.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

We have no data indicating that overutilization for commercial, recreational, scientific, or educational purposes is a threat to the streaked horned lark.

Factor C. Disease or Predation

In the final rule to list the streaked horned lark as a threatened species, we identified predation as an ongoing threat to streaked horned lark populations. In 2013, disease had not been documented as a threat; however, recent observations have identified disease concerns in the Puget Lowlands. We provide a brief discussion of the disease threat here.

In fall 2015, five streaked horned larks with pox-like lesions were observed at JBLM on McChord Airfield (Stinson 2016, p. 11). The lesions appear to be caused by avian pox. Avian pox is a common viral disease of wild birds; it causes wart-like lesions that may cause weakness and starvation if the lesions are extensive enough to interfere with feeding (Hansen 1999, p. 163). Although the course of this disease can be prolonged, birds with extensive lesions are known to completely recover if they are able to feed (Hansen 1999, p. 165). The magnitude of this threat has not been assessed. Population monitoring at JBLM will track the progress of the disease.

Summary of Factor C

Predation on adult streaked horned larks has not been identified as a threat, but it is the most frequently documented source of mortality for eggs and young larks. In most studies of streaked horned lark nesting ecology, predation has been the primary documented source of nest failure. Predation is a natural occurrence, but its effects are likely magnified for populations of streaked horned larks that are already declining and small. We believe that predation may be having a significant impact on the subspecies. The recently identified outbreak of avian pox in the Puget Lowlands may have population-level impacts if it spreads widely. Further study and monitoring is needed to assess and respond to this threat.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

In the final rule to list the streaked horned lark as a threatened species, we identified the following existing regulatory mechanisms that may offer some protection for the streaked horned lark:

- Canadian Laws and Regulations:
 - Species At Risk Act (SARA);
 - British Columbia Conservation Data Centre Red List; and
 - Migratory Birds Convention Act.

- U.S. Federal Laws and Regulations:
 - Migratory Bird Treaty Act;
 - Sikes Act; and
 - National Wildlife Refuge System Improvement Act.

- State Laws and Regulations:
 - Endangered species listing in Washington; and
 - Inclusion as a state strategy species in Oregon.

- Local Laws and Regulations:
 - County Area Ordinances in Washington; and
 - Oregon’s Land Conservation and Development Commission Goal 5.

Summary of Factor D

Canadian laws and regulations provide many potential protections for streaked horned larks in Canada. However, as the species is thought to be extirpated from Canada, these protections are unlikely to result in a change in the streaked horned lark’s downward trend across its range.

At the Federal level in the United States, three laws provide some protections for the streaked horned lark: the Migratory Bird Treaty Act, the Sikes Act Improvement Act of 1997, and the National Wildlife Refuge System Improvement Act of 1997. Each of these laws provides some specific protections for individuals or their habitats, but they do not provide for a program of habitat protection and population enhancement across the range of the streaked horned lark that would be sufficient to halt the documented declines of the subspecies.

State and local laws and regulations direct attention to the conservation needs of the species, but generally do not protect it from take or loss of habitat. Inadequate protections at the state and local levels leave the streaked horned lark at continued risk of habitat loss and degradation in Washington and Oregon.

We conclude that the existing regulatory mechanisms listed above are not sufficient to significantly reduce or remove the existing threats to the streaked horned lark, and we believe that the protections of the Endangered Species Act are needed to provide essential protections across the range of the subspecies.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

In the final rule to list the streaked horned lark as a threatened species, we identified the following threats under this factor:

- Small rangewide population.
- Low genetic diversity, small and isolated populations, and low reproductive success.
- Climate change.
- Stochastic weather events.
- Aircraft strikes and other activities at military and civilian airports.
- Recreation.

Two new threats in Factor E have been identified recently: male-skewed sex ratios in some populations and potential rodenticide poisoning. We provide a brief discussion of these new threats here.

Recent population monitoring at JBLM and Corvallis Airport have indicated a male-skewed adult sex ratio in those populations. Earlier monitoring at these sites appeared to indicate that all territorial males were mated, but in the last couple of years, substantial numbers of unpaired territorial males have been observed (Stinson 2016, p. 6; Randy Moore, Oregon State University, Corvallis, Oregon, pers. comm., 2016b). Further monitoring is needed to understand the magnitude of the issue, whether the trend in males and females continues to diverge, and the ultimate effect on the trend of the local and rangewide populations.

In 2014, seven streaked horned lark carcasses were collected at Corvallis Airport and were submitted for analysis to the National Wildlife Health Center in Madison, Wisconsin. All of the individuals apparently died after the application of the rodenticide zinc phosphide at the site. Testing could not be performed on three of the carcasses (all very young birds) as the condition of the carcasses was too poor. Gizzard contents from four birds (one adult female, one male fledging, and two immature birds) containing seeds (adult female) and insect parts (remaining birds) were pooled into one sample for analysis of phosphine gas (residual from exposure to zinc phosphide). The pooled specimens tested positive for phosphine gas, indicating exposure to the rodenticide zinc phosphide in at least one of the four birds (National Wildlife Health Center 2015, pp. 1-2). Given the pooled nature of the specimens, it is only possible to say that at least one of the individuals had contact with zinc phosphide before it died. Further study is needed to determine the magnitude of this threat, and to develop methods to reduce the potential for exposure to streaked horned larks.

Summary of Factor E

Based upon our analysis of the available data, the loss, degradation, and fragmentation of open habitats has resulted in smaller population sizes, loss of genetic diversity, and reduced gene flow among streaked horned lark populations, resulting in increased susceptibility to local population extirpation. Streaked horned larks are also at risk from threats including crushing and trampling from recreational activities, and aircraft strikes

and collisions. Recreational activities can cause the degradation of streaked horned lark habitat and direct mortality to nests and young. Death of individual larks caused by aircraft strikes is a threat to the small populations at airports, as the loss of even a single breeding individual can have an adverse effect on the population.

Genetic analysis has shown that streaked horned larks have suffered a loss of genetic diversity due to a bottleneck in population size, the effect of which may be exacerbated by continued small total population size. The loss of genetic diversity in small populations has been linked to increased chances of inbreeding depression, reduced disease resistance, and reduced adaptability to environmental change, leading to reduced reproductive success. These effects may be apparent in the small breeding population in the south Puget Sound, which exhibits low reproductive success.

Streaked horned lark habitat may be affected by climate change, which may reduce the availability of habitat at the Washington Coast. Stochastic weather events pose a threat to wintering flocks in the Willamette Valley.

We consider the impacts from the loss of genetic diversity, low reproductive success, climate change, stochastic weather events, aircraft strikes, and recreation to pose a threat to the streaked horned lark in combination with the other threat factors identified here, particularly given the inherent vulnerability of the streaked horned lark due to small population sizes and isolation of small populations.

2. Summary Threats Assessment

The streaked horned lark continues to be vulnerable to a variety of threats including loss of habitat and natural disturbance processes, incompatible habitat management, small population issues and potential inbreeding depression, and predation pressure on small populations. However, we believe that the threats to the streaked horned lark are largely tractable. In the last several years, lark populations have increased in response to improved habitat management and minimization of threats associated with dredge spoil deposition, military training, altered mowing schedules at military airports, and airport construction projects at several sites. This suggests that acquisition and management of additional habitat could ameliorate many of the threats currently operating on the populations of larks across its range. New threats that have emerged since listing (i.e., male-skewed sex ratio, avian pox in the Puget Lowlands, and potential rodenticide poisoning) need additional study to understand the magnitude of the threats, and to develop effective measures to reduce the threats.

C. CONSERVATION ASSESSMENT

1. Conservation Efforts

The streaked horned lark is benefiting from conservation efforts throughout its range.

Coordination and Partnerships

- The lark has an active conservation constituency. The Streaked Horned Lark Working Group formed in 2007, and consists of the participants from the Service, JBLM, USACE, Federal Aviation Administration, Natural Resources Conservation Service, WDFW, ODFW, municipal governments, airports and river ports, non-governmental organizations, academic researchers, and others. The working group meets regularly to review progress on lark conservation and to strategize on needed research, monitoring, and habitat protection.
- The Federal Aviation Administration has established Airports Working Groups in Oregon and Washington to focus on issues associated with larks and safety concerns at airports.
- The Natural Resources Conservation Service, the Service and American Bird Conservancy have signed an interagency agreement to fund a lark conservationist position. This staff position will likely be filled in late 2016 and will work with agricultural landowners in the Willamette Valley to promote and implement farming practices that support lark conservation during the breeding season. This staff position will also work closely with Natural Resources Conservation Service and local Soil and Water Conservation Districts to assist landowners with enrolling in Federal incentive programs. This position will be funded for a minimum of 3 years.

Research and Population Monitoring

- Population monitoring is ongoing at JBLM, all of the municipal airports in Washington, most of the Washington coastal sites, all occupied sites in the lower Columbia River, the Willamette Valley National Wildlife Refuge Complex, and at the Corvallis Airport.
- Extensive research on lark ecology, vital rates, predation, and limiting factors to population increase has been conducted in Washington at sites in the Puget Lowlands and coastal sites, and in Oregon at the Corvallis Airport and Willamette Valley National Wildlife Refuge Complex;
- The Center for Natural Lands Management conducted a conspecific attraction study to evaluate the efficacy of decoys and recorded song playback to attract larks to newly created habitats.
- The Institute for Applied Ecology is working with the Service's Partners for Fish and Wildlife program on a research project at Benton County's Herbert Farm Natural Area. This project is evaluating various techniques for modifying management of farm road margins to benefit breeding larks.

- The WDFW and its collaborators have published survey protocols for determining occupancy, population abundance, and trends at sites occupied by breeding larks (Pearson *et al.* 2016, entire).
- Scientists with the Center for Natural Lands Management and the WDFW worked with biologists throughout the range of the lark to prepare a guide to assessing streaked horned lark habitat characteristics (Anderson and Pearson 2015, entire).

Habitat Management and Threats Reduction

- Modification of the lower Columbia River navigation channel dredging and dredged material disposal program has been achieved through a section 7 consultation with the USACE. Under this consultation, the USACE modelled projected habitat succession associated with disposal of dredged material and adapted the placement of materials to protect larks during the breeding season and to increase suitable habitat over the 5-year course of the consultation. Preliminary findings indicate that lark numbers are increasing on the USACE's network of placement sites as a result of the modified dredge material placement plan.
- In 2015, the Willapa NWR submitted a proposal under the Service's Cooperative Recovery Initiative. The proposal is focused on habitat restoration at Leadbetter Point on the Washington coast that will benefit both western snowy plover (*Charadrius alexandrinus nivosus*) and streaked horned larks; the objective is to increase populations of both species by 50 percent over the course of the project. The project was selected for full funding (\$500,000) in 2016, and will be implemented over the next 5 years.
- JBLM prepared an Endangered Species Management Plan in 2013 to comply with U.S. Army regulation (AR) 200-1, 4-3 (5a); the plan includes the following conservation measures to benefit the streaked horned lark.

On-base Conservation

- Monitoring
 - JBLM contracts with the Center for Natural Lands Management to perform annual surveys of all suitable lark habitat on JBLM. Weekly nest searches occur at McChord Air Force Base, Gray Army Airfield, and 13th Division Prairie. Nest locations are provided to mowers and other personnel to maintain protective buffers around active nests and prevent disturbance and/or mortality of young.
- Avoiding Disturbance, Mortality, and Habitat Impacts
 - JBLM restricts off-road vehicle activity, digging, bivouacking, parking, recreation, and air operations (hovering, landing, sling loads, drops, paratroops, heavy lifts, etc.), dismounted maneuvers, Reserve Officers' Training Corps training, and airfield

maintenance activities within occupied lark habitat from April 15-August 31.

- JBLM will notify all entities using priority habitat areas to ensure timely and complete training and information regarding the types, locations, and timing of activities that are allowed or disallowed; including maps and written and verbal instructions.
- JBLM Fish and Wildlife personnel attend range walks with appropriate persons to coordinate environmental restrictions specific to Range 74/76, Range 50, and other areas where nesting by larks is known to occur.
- Increase Population and Distribution
 - JBLM manages lark habitat to improve, restore and increase habitat via prescribed ecological burning, small-scale planting enhancement plots, and invasive species control. Since 2009 JBLM Fish and Wildlife has conducted 704 acres of prescribed ecological burns in lark habitat. Other methods include herbicide application, invasive plant removal, and mowing.
 - In 2011, a genetic rescue program was initiated to increase genetic diversity of lark populations in the Puget trough (see details under “Population Augmentation,” below).

Off-base Conservation

- JBLM will improve and restore habitat conditions for larks and increase the overall amount of suitable habitat off-base through the Army Compatible Use Buffer program. The Army Compatible Use Buffer program helps fund regional efforts to establish and support populations of larks off base through land acquisition, restoring degraded prairie habitat, and increasing lark population abundance and distribution.
- JBLM will facilitate, fund, and implement regional recovery efforts and research intended to prevent further decline of the species, increase population numbers distribution on and off-base, and restoring degraded habitat.
- JBLM will fund management actions, habitat restoration, and seed bed nursery programs on and off the base.
- Section 7 consultations with Federal Aviation Administration on airports throughout the range of the lark have resulted in minimization of impacts to larks from construction, maintenance projects and airshows. Consultations have been completed for projects at Olympia, Tacoma Narrows, and Shelton Airports in

Washington, and for Corvallis, Salem, Eugene, and McMinnville Airports in Oregon.

- The Willamette Valley National Wildlife Refuge Complex has initiated consultation on the on-refuge farming practices. This consultation is in progress, and will guide management and pesticide use with a goal of improving the status of the lark for the next 5 years.
- Several habitat conservation plans (HCPs) are in development or have been completed recently; these conservation plans are part of permit application packages for incidental take of streaked horned larks that would occur as a result of an activity that has no Federal involvement.
 - The Kaufman Properties HCP was recently completed; it covers impacts to the streaked horned lark, Yelm pocket gopher (*Thomomys mazama yelmensis*), Olympia pocket gopher (*T. m. pugetensis*), and Taylor's checkerspot butterfly (*Euphydryas editha taylori*). The covered activities are development of former native prairie sites, and the conservation measures to be implemented include restoration of about 50 acres of potential foraging habitat for the lark adjacent to the Olympia Airport.
 - The Port of Portland is preparing an HCP for long-term management of Sandy Island (a designated Critical Habitat unit) in the lower Columbia River as a reserve site for larks, in exchange for take of existing breeding individuals at the Port's Rivergate and Portland International Airport properties.
 - Thurston County, Washington is preparing an HCP that covers impacts to the streaked horned lark, Taylor's checkerspot butterfly, three subspecies of pocket gopher, and nine other species that are currently listed, proposed for listing, or are considered species of concern. A draft HCP is currently in review by the Service. The covered activities are county-wide construction and development of occupied and potentially occupied habitat over the next 30 years. Proposed conservation measures to be implemented include conserving 3,800 acres of new conservation lands, adding function to 1,800 acres of existing legacy conservation lands, securing temporary-term conservation agreements on 650 acres of working lands, securing permanent-term conservation agreement on 1,800 acres working lands, and minimizing or avoiding impacts to 3,115 acres of conservation lands.
 - The Port of Olympia and the City of Tumwater, Washington, are currently coordinating and will likely join together and draft a joint HCP that would cover the streaked horned lark, Olympia pocket gopher, and Taylor's checkerspot butterfly, in addition to other species to be determined depending on covered activities and long-term mitigation activities that

may create suitable habitat. Covered activities will likely include construction and development in the City of Tumwater and on the Olympia Airport, and other Port-related activities, including airshows and airport maintenance.

Population Augmentation

- Streaked horned larks in the Puget Lowlands exhibit low egg hatchability, which may be a symptom of inbreeding depression. In 2011, a “genetic rescue” project was initiated to move lark eggs from a site in the Willamette Valley with high egg hatchability to nests at JBLM; a total of 20 eggs from 7 clutches were moved in 2011 and 2013 (Wolf *et al.* 2016, p. 28-30). Of the 20 eggs transferred, 1 translocated nestling from Oregon returned to JBLM as an adult male in 2012 and bred successfully with a female in 2013 and 2014, and returned again in 2015 (Wolf *et al.* 2016, p. 28-30). The Oregon male produced two young that successfully fledged in 2015. After 5 years, this project has met its stated success criteria, and the successful translocation and breeding by individuals from Oregon may result in improved fitness and reduced extinction risk for the Puget Lowlands lark population (Wolf *et al.* 2016, p. 28-30).

2. Summary Conservation Assessment

Substantial progress has been made towards the conservation of the streaked horned lark since its listing in 2013. Partnerships have formed, important research has been completed, and conservation measures have been implemented throughout the range of the subspecies. In almost every case, larks have responded positively to habitat management, and local populations have increased. Much remains to be done to ensure a viable rangewide population, but the conservation status of the streaked horned lark has clearly improved as a result of Federal listing.

D. SUMMARY ASSESSMENT OF RECOVERY STATUS

We believe that the streaked horned lark is highly recoverable. In the last 15 years, the bird’s basic ecology has been well-researched and habitat management techniques have been developed. Key questions remain, including the reason for the apparent declining trend in females, understanding how new sites are colonized, and predator-prey dynamics. The main requirement for recovery is increasing the number and size of lark populations by increasing available habitat at sites that are managed for larks in dedicated conservation areas without competing commercial and industrial uses. In Oregon, there is abundant potential habitat that could be restored for larks with acquisitions or easements; in Washington, potentially suitable habitat appears to be much more limited.

II. Preliminary Recovery Strategy

A. RECOVERY PRIORITY NUMBER

The streaked horned lark is assigned a recovery priority number of 9C on a scale of 1C (highest) to 18 (lowest; the “C” indicates the potential for conflict with human economic activities), based on the moderate degree of threat, a high potential for recovery as stated above, and its status as a subspecies (U.S. Fish and Wildlife Service 1983a,b). As discussed above, there is the potential for a high degree of conflict with existing land uses that create habitat for the lark throughout its range (e.g., military training, dredge material deposition, airport maintenance, and agriculture).

B. RECOVERY GOAL AND OBJECTIVES

Recovery of the streaked horned lark will require restoration of a self-sustaining rangewide population; the rangewide population must have stable or increasing numbers, of a size sufficient to withstand foreseeable long-term threats. The rangewide population should be well-distributed throughout most of its historical range where suitable habitat can be managed, with breeding sites that are protected and managed to control threats. Lark populations must be present in at least three geographic regions (i.e., south Puget lowlands, lower Columbia River and Washington Coast, and the Willamette Valley) within the subspecies’ historical range.

Recovery Zones

The streaked horned lark’s historical range can be logically divided into five regions; within these five regions, we have identified eight preliminary recovery zones (Table 2).

Region	Recovery Zone
North Puget Lowlands	North Puget Lowlands
South Puget Lowlands	South Puget Lowlands
Coast and River	Pacific Coast
	Columbia River
Willamette Valley	North Willamette Valley
	Southwest Willamette Valley
	Southeast Willamette Valley
Rogue and Umpqua Valleys	Rogue and Umpqua Valleys

Preliminary Recovery Objectives

We have developed preliminary recovery objectives for the streaked horned lark with input from relevant experts and the members of the Streaked Horned Lark Working Group.

1. The abundance of streaked horned lark in a self-sustaining rangewide population is of sufficient size to counteract small population issues;
2. Sufficient habitat is protected and managed to support a well-distributed rangewide population within the historical range of the subspecies;
3. Key threats (*e.g.*, human-caused disturbance during the breeding season, inappropriate habitat management activities, predation pressure exacerbated by small population issues) are ameliorated sufficient to achieve objectives 1 and 2.

As the Service works with its partners to prepare a recovery plan for the streaked horned lark, we will refine these objectives and develop criteria that provide specific targets for recovery of the species. Some of the relevant considerations we will address in establishing recovery criteria are discussed below.

Population-based Criteria

Preliminary recovery objective #1 (a self-sustaining rangewide population that is of sufficient size to counteract small population issues) deals with demographic attributes of a recovered population. The criteria for this objective must address both population size and growth rate.

Population size

Recovery objectives for listed species are often expressed in terms of a “minimum viable population” (MVP) that would be expected to persist for a given time period and remain resilient to existing threats. The size of an MVP may be determined through a population viability analysis (PVA) that models extinction risk by incorporating demographic, stochastic, and genetic factors. Such an analysis requires substantial data, which are not currently available for much of the range of the streaked horned lark. In order to set preliminary population recovery objectives, we will likely rely on expert opinion and recent published meta-analyses of MVPs.

The conservation biology literature of the last several decades indicates that population objectives for conservation should number in the thousands of individuals. A recent meta-analysis of MVPs concluded that conservation planning targets should include a minimum habitat area sufficient to support at least 7,000 sexually mature individuals (Reed *et al.* 2003); they defined an MVP as one with a 99 percent probability of persistence over 40 generations. Traill *et al.* (2007, p. 164) conducted a meta-analysis of

MVPs from 30 years of published data and found that the median size for an MVP was 4,169 individuals (95 percent CI = 3,577 – 5,129). Even though Traill *et al.* (2007, p. 165) did not find support for life history predictors of MVP size, they made available a taxa-specific MVP dataset to allow conservation practitioners to search for MVPs based on taxon as a preliminary guide. Using their data set, Anderson (2015, p. 2) calculated that the average MVP for the groups Aves and Passerines was 5,269 and 6,415 individuals respectively.

These general strategies for setting population targets for recovery do not consider the specific threats facing the streaked horned lark, however we believe that adopting a population-based recovery objective in the recovery plan for the streaked horned lark that is consistent with these recent meta-analyses will provide a reasonable starting point for a recovery program for the subspecies. The rangewide and regional population targets may be further refined in the future when more data are available to conduct a PVA for the streaked horned lark.

Growth rate

In addition to recovery criteria that establish target population sizes, it is essential to know that demographic variables are consistent with stable populations. To achieve this aim, the recovery plan will likely specify criteria for population growth rate, which will indicate if populations are stable and self-sustaining. A draft population growth rate criterion may specify that regular population monitoring in each region must demonstrate an average population growth rate (λ) is stable or increasing in each recovery zone over a 5-year period (i.e., $\lambda \geq 1$). If the population is declining (i.e., $\lambda < 1$), then we would implement more intensive monitoring to assess fecundity, nest success or other demographic variables to identify the cause of population decline, and to implement specific actions to reduce the downward trend.

Habitat-based criteria

Preliminary recovery objective # 2 (sufficient habitat is protected and managed to support a well-distributed rangewide population) deals with the habitat requirements for a sustainable population.

Streaked horned larks currently or potentially exist in one of three habitat protection categories:

- **Reserves.** Reserves are protected, funded, and managed in perpetuity with conservation as the goal and larks as a focus of that management. These could include portions of wildlife refuges, State parks, mitigation banks, agricultural easements that support larks, etc.
- **Mixed use sites.** Mixed use sites have some level of management that supports larks. These could include dredge material placement sites on the lower

Columbia River, Army training areas at JBLM, and perhaps portions of some airports.

- **Matrix.** The matrix is everywhere else where larks occur, but where there is no management consideration to conserve them. These areas likely include agricultural lands, some airports, and other scattered areas with suitable habitat.

As we develop the recovery plan for the streaked horned lark, we will develop specific habitat-based criteria to ensure that sufficient habitat is protected and managed to support a stable, well-distributed rangewide population of larks. Specific targets for number of sites and acreage in Reserves and Mixed Use sites will be established for each recovery zone.

Threat-based Criteria

Preliminary recovery objective #3 (key threats are ameliorated) deals with the need to control specific threats that reduce lark survival and reproduction. Examples for a few key threats are addressed here, but the recovery plan may identify additional threats that need specific recovery criteria.

- 1) **Manage human-caused disturbance.** Reduce mortality resulting from human disturbance (e.g., hunters, recreation, mowing, driving, dogs) at occupied sites by restricting activities where appropriate and during key periods (e.g., post signage, implement closures during the breeding season).
- 2) **Maintain suitable habitat structure.** Maintain suitable habitat conditions at occupied sites by controlling structure-modifying vegetation such as shrubs, trees, and dense ground cover.
- 3) **Reduce mortality from pesticide applications.** If warranted, reduce mortality associated with pesticide application by modifying State policies regarding application of specific pesticides in occupied areas.
- 4) **Improve lark survival and productivity on agricultural lands.** Work with agricultural producers to reduce mortality and increase productivity on agricultural lands by adjusting the timing or methods of agricultural operations. Approaches may include developing recommended farming practices that protect larks on portions of active farms. Delivery may be through incentive-based Federal programs (i.e., Farm Bill).

C. INITIAL ACTION PLAN

The Streaked Horned Lark Working Group meets annually to review the status of the lark, and to discuss the results of on-going research and the implementation of conservation actions; at the annual meeting, the group updates an action plan that focuses on the highest priority actions that need to be taken to advance the conservation of the streaked horned lark. The action plan includes tasks in four categories:

- 1) Determine population status, current distribution, and limiting factors;
- 2) Protect existing populations and habitats;
- 3) Enhance viability of extant populations and habitats; and
- 4) Coordination, education, and outreach.

The top priority actions in the current action plan focus on protecting existing breeding sites, acquiring new reserves, critical research, and outreach to landowners and partners. The most recent version of the action plan was completed in September 2015 (see Appendix A).

III. Preplanning Elements

A. PLANNING APPROACH

The Recovery Plan will be developed by U.S. Fish and Wildlife Service biologists with input from stakeholders, and academic and agency experts on the streaked horned lark.

B. INFORMATION MANAGEMENT

Information will be gathered and managed by U.S. Fish and Wildlife Service biologists and GIS staff. The administrative record will be housed at the Oregon Fish and Wildlife Office.

C. RECOVERY PLAN SCHEDULE

Regional Office Review Draft	WAG (Work Activity Guidance) due date to RO.
Public Review Draft	Anticipated release of draft (3 months after WAG date).
Public Comment Period	60 days following release of draft plan.
Final Recovery Plan	1 year after release of public review draft.

D. STAKEHOLDER INVOLVEMENT

Key stakeholders:

Federal

- U.S. Fish and Wildlife Service National Wildlife Refuges (Willamette Valley NWR Complex, Willapa Bay NWR, Lewis and Clark NWR, Julia Butler Hansen NWR, Ridgefield NWR)
- Department of the Army, Joint Base Lewis-McChord

- U.S. Army Corps of Engineers, Portland District
- Federal Aviation Administration
- Natural Resources Conservation Service
- Farm Service Agency

State

- Washington Department of Fish and Wildlife
- Oregon Department of Fish and Wildlife
- Oregon Department of Aviation

Municipal

- Metro
- Port of Portland
- Port of Olympia
- Port of Shelton
- Port of Vancouver
- Port of Longview
- Port of Kalama
- Pierce County
- Thurston County
- City of Eugene
- City of Corvallis
- City of Salem
- City of McMinnville
- City of Portland

Non-Governmental Organizations

- American Bird Conservancy
- Center for Natural Lands Management
- Oregon Farm Bureau
- The Nature Conservancy
- Audubon Society of Portland

Academic


- Oregon State University

E. STAKEHOLDER INVOLVEMENT STRATEGY

The primary mechanism for interacting with the stakeholders will be through the Streaked Horned Lark Working Group at the group's annual meetings. We will conduct additional outreach directly with key partners through meetings with their management and biological staff.

Recovery Outline for the Streaked Horned Lark

Approved:



12/9/2016

Acting

Regional Director, Region 1
U.S. Fish and Wildlife Service

Date

Citation

U.S. Fish and Wildlife Service. 2016. Recovery Outline for the Streaked Horned Lark (*Eremophila alpestris strigata*). Portland, Oregon. 42 pp.

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Appendix A. Streaked Horned Lark Action Plan developed by the Streaked Horned Lark Working Group.

Implementing Party Abbreviations:

ACOE	U.S. Army Corps of Engineers
CNLM	Center for Natural Lands Management
DSL	Oregon Department of State Lands
FAA	Federal Aviation Administration
FWS	U.S. Fish and Wildlife Service
JBLM	Joint Base Lewis-McChord
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge System
ODFW	Oregon Department of Fish and Wildlife
OSU	Oregon State University
PDX	Portland International Airport
POP	Port of Portland
Smithsonian	Smithsonian Institution
TNC	The Nature Conservancy
WSP	Washington State Parks
WDFW	Washington Department of Fish and Wildlife