

**FINAL REPORT**

May 5, 2020

**SAN DIEGO UNIFIED PORT DISTRICT**

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# THREATENED AND ENDANGERED SPECIES STEWARDSHIP AT D STREET FILL

San Diego Association of Governments  
*TransNet* Environmental Mitigation Program



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**SAN DIEGO ASSOCIATION OF GOVERNMENTS  
Transnet Environmental Mitigation Program  
Threatened and Endangered Species Stewardship at D Street Fill**

**Final Report**

Project Period: January 1, 2019 – May 29, 2020

SANDAG Contract Number: 5005505

**Executive Summary**

The California least tern (*Sternula antillarum browni*, least tern) is a federally endangered migratory seabird which nests on sandy beaches around San Diego Bay. Urbanization, habitat loss, and abundant predators have negatively impacted the population which now requires annual management and monitoring to protect the species from extinction. One of the largest remaining habitat areas for least terns is the D Street Fill, located in Chula Vista, California, which is an approximately 80-acre area of dredge spoils that provides sandy dune habitat with low-vegetation height for least terns to nest. The San Diego Unified Port District (Port) and the U.S. Fish and Wildlife Service (USFWS) jointly manage the site, which requires annual invasive plant removal, management and monitoring of the least tern seasonal breeding and nesting, and avian and predator control efforts.

In November 2018, the Port received a \$75,400.00 San Diego Association of Governments *Transnet* Environmental Mitigation Program grant to support site preparation, management and monitoring, and predator control at the D Street Fill for the 2019 and 2020 least tern nesting seasons. Site preparation efforts began in February 2019. The Port mechanically scraped invasive vegetation from the site to restore it to sandy dune habitat with minimal vegetation. The Port contracted an endangered species monitor with the required federal and state permits to conduct least tern monitoring, banding, and compliance reporting. The endangered species monitor routinely recorded the number of least tern adults, nests, eggs, chicks, and fledglings throughout the season. Chicks were also weighed and measured to provide data on overall health. The Port also contracted the U.S. Department of Agriculture Animal Plant Health Inspection Services - Wildlife Services (USDA APHIS), with the required federal and state permits to remove mammalian and avian predators from the D Street Fill. USDA APHIS conducted daily site visits to assess, trap, and remove predators from the nesting site.

For the 2019 nesting season, a total of 104 least tern nests were recorded at the D Street Fill and an estimated 12 fledglings survived to adulthood. Least terns are particularly susceptible to predators and human disturbance because they nest on the ground, so low survival rates for eggs, chicks, and fledglings is anticipated. The number of nests and fledgling survival for 2019 is consistent with previous years; therefore, the 2019 nesting season is considered successful since the season led to a positive gain for the least tern population. In addition, a total of 74 predators were removed from the site.

The *Transnet* Environmental Mitigation Program grant also supported site preparation for the 2020 nesting season with an application of herbicide to remove invasive Bermuda grass. Additional management and monitoring for the 2020 nesting season will be supported by the Port and USFWS. The Port appreciates SANDAG's support for endangered species management through the *Transnet* Environmental Mitigation Program. This contribution was critical to the continued support and recovery of the endangered California least tern.

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## 1.0 Project Background

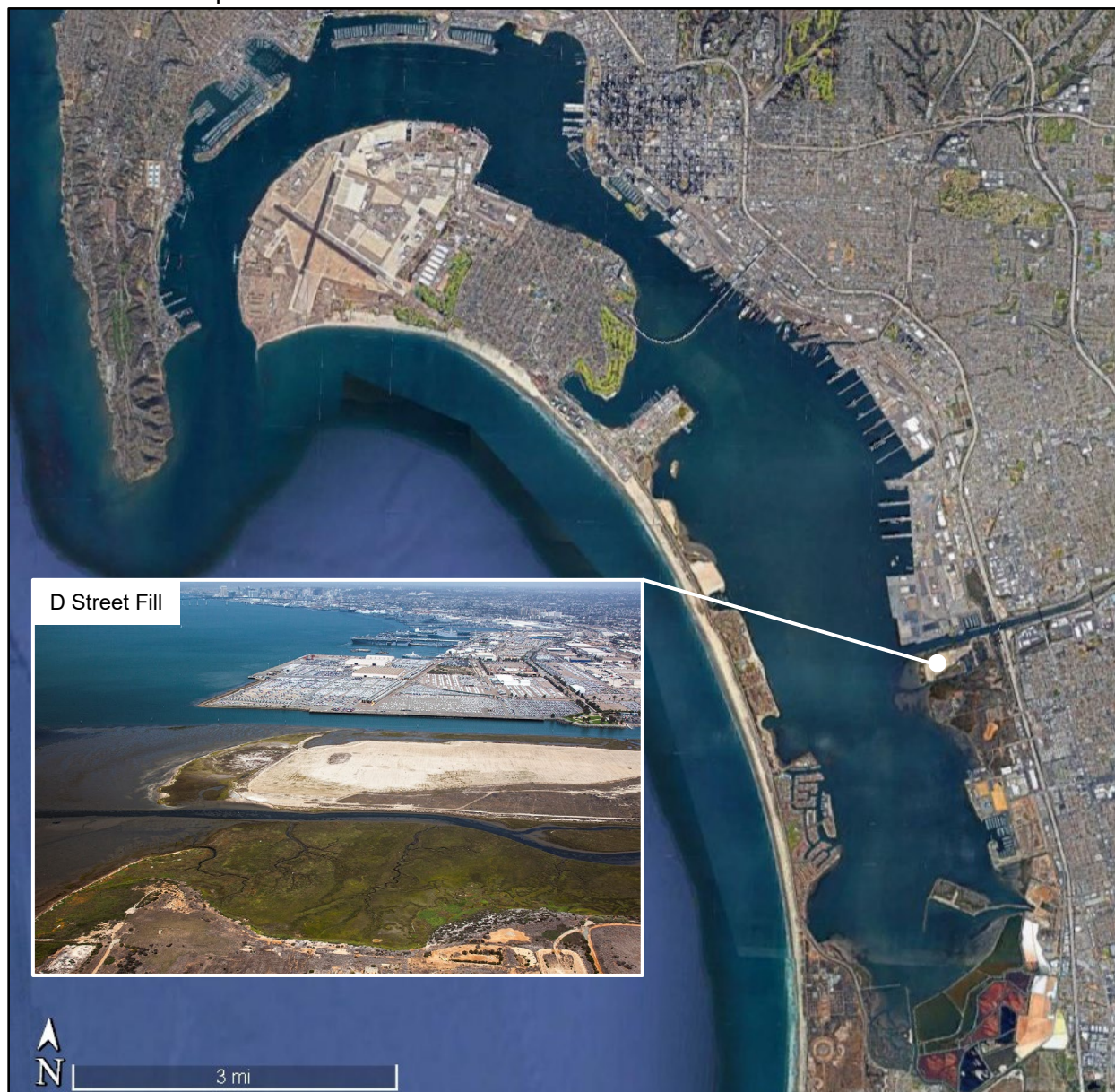
The California least tern (*Sternula antillarum browni*, least tern) is a federally endangered migratory seabird. Least terns are the smallest tern species found in the western Pacific Ocean and primarily nest on sandy beaches, mudflats, and dune habitats in the northern regions of Mexico, Southern California, and up to San Francisco Bay. They are identifiable from other birds and terns by their small size, distinct black cap, black stripes across the eyes, white forehead, light grey upper body, white under body, and orange beak and legs (Figure 1). The least terns feed on small-sized schooling fishes, including topsmelt, anchovy, silversides, and small perches, as well as small crustaceans, insects, mollusks, and marine worms.

California least terns once nested in large colonies on beaches throughout Southern and Central California; however, increased urbanization, permanent and long-term habitat loss, and abundant land predators led to a decrease in their habitat range, now limited to unknown areas of northern Mexico, Southern California, a few areas of San Francisco Bay, and a decline in the breeding population to less than 300 nesting pairs. In 1972, the species was subsequently listed under the Endangered Species Act (ESA, 16 U.S.C. § 1531 et seq.). Annual monitoring, site management, and predator control efforts helped increase the least tern population to over 7,000 nesting pairs by 2009. Since then, the breeding population and reproductive success has varied wildly from year to year but is generally declining. Reproductive success is dependent on multiple factors, including the availability of sandy beach habitat with low vegetation height and density for nesting, the presence of invasive vegetation, the availability and size of prey fish, close proximity of prey fish to nesting sites, predator presence and predation pressure, human disturbance, and climate change-influenced oceanographic conditions.



**Figure 1.** Two adult California least terns on a mudflat. These two birds were given identification bands as chicks, visible on their legs, that provides long-term data on the population status (San Diego Unified Port District).

Least terns migrate to San Diego Bay at the beginning of April and typically depart by mid-September. One of the largest nesting areas is at the D Street Fill, a roughly 80-acre rectangular peninsula of dredge spoils along the eastern shore of San Diego Bay (Figure 2). D Street Fill is located within the City of Chula Vista, just south of the Sweetwater Channel, and is jointly managed by the San Diego Unified Port District (Port), on Port tidelands, and by the U.S. Fish and Wildlife Service (USFWS), as part of the San Diego Bay National Wildlife Refuge, Sweetwater Marsh Unit. The D Street Fill is an existing California least tern nesting colony and was previously designated as a snowy plover critical habitat area. Other nesting sites around San Diego Bay include the San Diego International Airport; Chula Vista Wildlife Reserve; Naval Air Station North Island; San Diego Bay National Wildlife Refuge, South San Diego Bay Unit; and the Naval Amphibious Base beaches in Coronado.



**Figure 2.** The location of the D Street Fill within San Diego Bay. The inset shows the National City Marine Terminal (top), the Sweetwater Channel, the D Street Fill (the light tan area of dredge spoils with no vegetation), and the San Diego Bay National Wildlife Refuge, Sweetwater Marsh Unit (the wetland area at the bottom).



The Western snowy plover (*Charadrius nivosus nivosus*, snowy plover) is a small shorebird found along the Pacific coast from southern Baja California, Mexico to southern Washington. Snowy plovers are about six inches in length, have a brown head with a black patch above a white forehead, black patch behind the eye, pale brown or gray upper body, dark brown shoulder patches, white under body, and dark grey or black legs and beak (Figure 3). Their food consists of small invertebrates, such as mollusks, crustaceans, insects, and marine worms found in beach sand, beach wrack (dead seaweed), and low-growing dune vegetation. Snowy plovers nest above the high tide line on coastal beaches, dunes, and sparsely vegetated areas. Like least terns, snowy plovers have experienced significant habitat loss due to urbanization, human disturbance, and invasive plants, which has led to a decline in active nesting and their overall breeding population. In 1993, the Western snowy plover was listed as threatened under the Endangered Species Act.



**Figure 3.** Two Western snowy plovers on a sandy beach (Mike Baird, Audubon).

Snowy plovers forage and nest in several areas around San Diego Bay, specifically along the beaches at the Naval Air Station North Island, Naval Amphibious Base, and the Silver Strand Naval Training Complex and the South San Diego Bay National Wildlife Refuge. Snowy plovers have not nested at the D Street Fill since 2000 but are frequently observed foraging on the western shoreline at low tide.

Reproductive success for least terns and potential nesting and foraging for snowy plovers at the D Street Fill is dependent on two main factors, annual habitat management and predator control. Without site management to remove invasive species and predator control efforts to remove nuisance mammalian and avian predators, the least tern population at D Street Fill would likely suffer significant population decline in as little as one nesting season.

### *1.1 Habitat Management at the D Street Fill*

Beginning in 1969, the D Street Fill was created by placing dredge spoils from nearby development projects, including dredge spoils from Interstate 5 and State Route 54

construction, onto native marshland adjacent to San Diego Bay. These dredge spoils have simulated native coastal beach and dune habitat which least terns began to utilize after loss of their native habitat. To maintain appropriate nesting habitat for least terns and potential nesting habitat for snowy plovers, the D Street Fill requires significant preparation and management each year. Both least terns and snowy plovers are atypical nest builders and prepare their nesting site by finding a small depression in the sand. They may arrange shell pieces or bits of grass in and around the nest. Least terns and snowy plovers lay light brown or grey speckled eggs that blend in with the surrounding sand. Without annual site management, invasive plants would cover the nesting site with dense, tall vegetation that would inhibit nest building. Snowy plover adults and especially tiny chicks cannot cross dense vegetation to access their foraging grounds near the shoreline.

Annual preparation of the D Street Fill for nesting begins in January and includes mechanical scraping of approximately 30 acres to reduce invasive vegetation immediately prior to the nesting season. Application of pre-emergent herbicide to kill the invasive plant seed bank and/or a topical herbicide treatment is also considered when advised by the Port's endangered species monitor or USFWS. The D Street Fill also supports a rare, native plant species, the Nuttall's lotus (*Acmispon prostratus*), and other native birds, such as horned larks (*Eremophila alpestris*) and killdeer (*Charadrius vociferus*). Though not endangered or threatened, horned lark and killdeer are native birds that often nest with least terns, so efforts were made to protect their nests. Nuttall's lotus is a California protected species (Figure 4). USFWS staff and the Port's endangered species monitor survey the D Street Fill prior to any site disturbance or herbicide application to identify and flag any ground nesting birds and sensitive plants.



**Figure 4.** Nuttall's lotus is a rare, native coastal plant and a California protected species (San Diego Unified Port District).



After vegetation removal, the Port's endangered species monitor(s) places ceramic roofing tiles throughout the site in a 30-meter grid pattern. The tiles assist with mapping and relocating nests and provide additional shelter and shade for least tern chicks. The endangered species monitor also places ceramic and wooden least tern decoys across the site in scattered groupings. The decoys are used to encourage live terns to land and begin nesting in the area (Figure 5).



**Figure 5.** An adult least tern stands between two decoys (San Diego Unified Port District).

### *1.2 Monitoring for Endangered and Threatened Species*

A qualified endangered species monitor must have several federal and state permits to conduct least tern monitoring, banding, and compliance reporting and must comply with permits obtained from the USFWS and California Department of Fish and Wildlife (CDFW). Additionally, the monitor must have a valid federal Endangered and Threatened Species Incidental Take Permit in good standing (ESA Section 10(a)(1)(A)). The monitor must also have a California State Scientific Collection Permit (Fish and Game Code Section 1002 and Title 14 Sections 650 and 670.7) and a Memorandum of Understanding with CDFW.

In early April at the beginning of the nesting season, the Port's endangered species monitors survey the D Street Fill a minimum of one to three times per week, for approximately two hours each visit, to collect data and assess the status of the nesting site. During the height of the nesting season (May through July), monitors may survey the site up to twice per day. Weekly reports are compiled on least tern and snowy plover sightings, the total number of nests, new nests, active nests, abandoned nests, eggs, chicks, and fledglings, as well as any predators, animal tracks seen near nests, adults or chicks that appeared to be preyed on, and unauthorized human disturbance. When chicks are present, monitors will band the chick and record information on chick health by weighing and taking wing length measurements.

### 1.3 Predator Management

Nuisance mammalian and avian predators pose a significant threat to the recovery of least terns at the D Street Fill as well as other nesting sites. Predator control services provide trapping and/or removal of predators under a predator control program. For the past several years, predator management has been conducted by the U.S. Department of Agriculture Animal Plant Health Inspection Services - Wildlife Services (USDA APHIS). USDA APHIS has the necessary federal and state permits to use trapping devices and/or remove mammalian and avian predators in accordance with all applicable laws and regulations; including Title 14, section 465.5 of the California Code of Regulations; Wildlife Services Directive 2.450, sections 3a through 3d; and, two federal Migratory Bird Depredation permits issued to USDA APHIS by the San Diego National Wildlife Refuge Complex and by the USFWS Region 8 Migratory Bird Permit Office. The combination of these permits allows for lethal and non-lethal management of avian predators at the D Street Fill.

Annual predator management is critical to successful least tern nesting and reproduction. Since least terns nest directly on the sand, they are especially susceptible to land predators, such as feral cats, coyotes, opossums, racoons, and rats. Avian predators, such as Cooper's hawks, Northern harriers, peregrine falcons, and crows and ravens also easily prey on eggs, chicks, and adult birds. Without annual, active predator management, least tern adults and offspring at the D Street Fill would likely be eliminated in a single breeding season.

Each year, USDA APHIS begins surveying and animal trapping in March and continues services through the nesting season, typically ending by August. Management actions included routine predator surveys, discerning immediate and future predator impacts, and implementation of predator control measures. USDA APHIS works closely with endangered species monitors to identify predators and possible predation events by reporting missing eggs, owl pellets or other scat containing least tern feathers, footprints from human activity, and signs of raptor predation.



**Figure 6.** A peregrine falcon carries an adult least tern in its talons (San Diego Unified Port District).



## 2.0 Project Goals

The objective of the Threatened and Endangered Species Stewardship at D Street Fill project is to manage the recovery of federally endangered least terns and federally threatened snowy plovers, which occur at the D Street Fill during the 2019 and 2020 breeding and nesting season. The Port's goal is to "prepare" the D Street Fill by managing and maintaining the site as suitable breeding and nesting habitat. Preparation includes site grading, vegetation control, invasive plant management, endangered species monitoring, and predator management. The Port provided matching support in the form of direct and in-kind funds, including staff time, management of contractors to conduct predator control and endangered species monitoring, and organizing volunteer events. The Port organized two volunteer events to assist in site preparation and promote protection of San Diego Bay's natural resources.

### 2.1 Project Tasks

1. Site Preparation – Manually and mechanically scrape approximately 30 acres of the site to remove invasive plants, prune back, and reduce vegetation to enhance the quality and quantity of available nesting habitat with low vegetation height and density for use by least terns and snowy plovers during the nesting seasons. Remove washed up debris along the shoreline, as needed.
2. Management and Monitoring – Conduct a site assessment prior to the 2019/2020 nesting seasons to determine a vegetation removal strategy and potential herbicide treatment. Prior to the arrival of least terns, set out bird decoys to encourage live birds to nest and place grid markers across the site for mapping nests. During the nesting seasons, conduct nest monitoring, data collection, and reporting for least terns and snowy plovers. Prepare an annual report including least tern nest and egg data, documented incidences of predation, nest distribution, breeding chronology, and future management recommendations.
3. Predator Management – Manage avian and mammalian predators during the 2019 nesting season. Perform daily predator control, as required, to reduce predation of least terns and other sensitive species. Prepare an annual report on predator management activities, results, and future recommendations.
4. Invasive Plant Control – Apply herbicide treatment(s) to reduce or eliminate presence of new and existing invasive plant species as needed for the 2019/2020 growing seasons.
5. Volunteer Event(s) – Organize and supervise at least one volunteer event to assist in site preparation and promote protection of San Diego Bay's natural resources.
6. Administrative – Administration of the project and preparation of quarterly and final grant reports will be accomplished by Port staff.

Multiple factors impact the least tern population at the D Street Fill, as well as other nesting sites in Southern California, including factors beyond the Port and USFWS's immediate control. These factors include changing weather patterns, oceanographic conditions, and the availability of prey for adults and chicks. However, appropriate site preparation and predator management are two crucial factors the Port and USFWS can directly influence that have a positive impact on reproductive success. The expected results of the Threatened and Endangered Species Stewardship at D Street Fill project are to, at a minimum, maintain the current status of the least tern population and successfully assist with the survival of new birds (i.e. successful fledging of new chicks into the population).

### 3.0 Work Performed by Task

#### 3.1 Task 1 – Site Preparation

*Budget:* \$5,500.00

*Match:* \$11,144.49

*Spent:* \$16,644.49

##### *3.1.1 2019 Nesting Season Site Preparation*

In early March 2019, the Port's endangered species monitor surveyed the D Street Fill to determine the state of invasive plants, rare and sensitive plants, and ground nesting birds prior to site management efforts for the 2019 nesting season (Figure 7). Populations of Nuttall's lotus and two killdeer nests were demarcated to be avoided during site preparation activities. Between March 12 and April 3, 2019, the Port's General Services Department conducted mechanical scraping over approximately 30 acres of the D Street Fill to reduce invasive vegetation and enhance the site (Figure 8). Monitoring and inspection of the work was conducted by Port and USFWS staff and the Port's endangered species monitor. Once grading and removal of vegetation was completed in April, no further site preparation work was performed so the least terns were not disturbed during the 2019 nesting season (Figure 9).



**Figure 7.** The state of the D Street Fill prior to 2019 site preparation. The grass patches are primarily invasive Bermuda grass (San Diego Unified Port District, Photo taken January 22, 2019).





**Figure 8.** A motor grader scrapes and removes vegetation (San Diego Unified Port District, photo taken on April 3, 2019).



**Figure 9.** Completed grading of the site. The bare, sandy ground is ideal for nesting least terns. The vegetation patch with pink flags contains Nuttall's lotus, a rare plant species that was preserved during grading (San Diego Unified Port District, photo taken on April 3, 2019).



### 3.1.2 2020 Nesting Season Site Preparation

Preliminary work to prepare the D Street Fill for the 2020 nesting season began in early February. An assessment of the invasive plants and nuisance vegetation at the site was conducted by the Port's endangered species monitor. The site had significant amounts of invasive Bermuda grass (*Cynodon dactylon*) that has increased in its extent and coverage over the past few years. It appeared that annual vegetation scraping may “chop up” and spread the Bermuda grass seed, exacerbating the problem. Therefore, the Port and USFWS decided to apply an herbicide treatment to kill the Bermuda grass before vegetation removal and grading.

Prior to herbicide application, the endangered species monitor walked the site and flagged the Bermuda grass's extent. Nuttall's lotus, a horned lark nest, and killdeer nests were also flagged (Figure 10). Rain events caused temporary flooding of the site and delayed the herbicide application for two weeks, but it was eventually applied on March 21, 2020 (Figure 11).



**Figure 10.** Left: A horned lark nest with two eggs marked before herbicide application. Right: The same nest, with three eggs, after the herbicide application (San Diego Unified Port District).



**Figure 11.** Temporary flooding of the D Street Fill due to rain events in late March and early April 2020 (San Diego Unified Port District, photo taken April 9, 2020).





**Figure 12.** Significant rains caused saturated soils which slowed down the vegetation removal process (San Diego Unified Port District, photo taken April 21, 2020).

Rain also delayed the start of vegetation removal, which was conducted by USFWS for the 2020 season, and began the second week of April 2020 (Figure 12). Vegetation removal is normally completed before April 1, the start of then nesting season; however, it is rare for least terns to be spotted before mid-April or to begin nesting before the end of April or early May. Significant rain events, as was experienced in March and April 2020, may have also delayed the birds' migration north toward San Diego Bay.

All site preparation tasks for 2019 and 2020 were completed as originally planned and in accordance with the grant scope and budget. No significant issues were encountered during the site preparation for 2019 and 2020; however, the timing for vegetation removal is carefully considered from year to year. In 2019, vegetation removal occurred in early April and was followed by rain events. This caused significant growth of invasive plants before the least terns arrived and began nesting in mid-May. In 2020, extended periods of rain and temporary flooding of the site prevented vegetation removal until late April and overlapped with the arrival of the first least terns of the season. Port and USFWS staff and the Port's endangered species monitor agree that site preparation planning should occur early in January each year to accurately assess when vegetation removal should be performed. Site management, including annual vegetation removal, invasive species management, and regular pre-emergent and/or herbicide treatments must continue each year to maintain the D Street Fill as a suitable nesting site for least terns and potentially support foraging and nesting snowy plovers.

In addition, annual reports, such as the 2019 California Least Tern Status Report (prepared by the Port's endangered species monitor; Patton 2019, Appendix A), and the 2019 Predator Management Report for the San Diego International Airport, Chula Vista Wildlife Reserve, and D Street Fill (prepared by USDA APHIS; USDA APHIS 2019, Appendix B), recommend additional site preparation strategies to improve the status and recovery of the least tern population. These recommendations include:

- Continue site preparation and management into the future.
- Trimming the brush near the bike path, under power lines, along the D Street fence line, inside the gate, and along the east perimeter road to remove raptor perches.
- Remove piles of lumber, driftwood, trash, and other debris that has washed up onto the shoreline to prevent harboring rodents or other potential predators.

### 3.2 Task 2 – Management & Monitoring

*Original Budget:* \$38,000.00

*Amended Budget:* \$38,836.44 (\$836.44 redistributed from the Volunteer Event(s) budget)

*Match:* \$4,479.75

*Spent:* \$43,316.19

#### 3.2.1 2019 Nesting Season Management and Monitoring

After vegetation removal, the Port's endangered species monitors began management of the D Street Fill nesting site by placing a 30-meter system of ceramic roofing tiles in a grid pattern throughout the site to assist with GIS mapping of nest locations. These roofing tiles also provide shade and shelter from predators for least tern chicks. Ceramic and wooden least tern decoys were also placed across the site in scattered groupings to encourage live terns to land and nest in the area (Figure 13). The decoys also help assess the presence of predators since raptors will mistake the decoys for live birds and then strike and knock them over. endangered species monitors and USDA APHIS use this information to adapt predator control strategies.



**Figure 13.** Ceramic and wooden decoys that imitate adult nesting least terns are placed at the site to encourage live birds to land and begin nesting (San Diego Unified Port District).

Weekly monitoring for snowy plovers was conducted at D Street Fill beginning in early March 2019; however, no snowy plovers were observed during the 2019 nesting season. The first reported least tern was heard at Batiquitos Lagoon in Carlsbad on April 8, 2019. On the morning of April 10, 2019, endangered species monitors observed one least tern foraging off the D



Street Fill and Sweetwater Marsh. Two additional least terns were observed in flight over the Chula Vista Wildlife Reserve, and one least tern was observed over the South San Diego Bay saltworks. These sightings marked the beginning of the 2019 nesting season. The Port's endangered species monitor provided weekly reports on adult sightings and any issues, such as predators or human disturbances.

Throughout April 2019 as the nesting season progressed, the D Street Fill was monitored between one and three times per week. Least tern sightings remained low with most adult birds observed in the early morning and then moving offshore to forage for fish. No on-ground activity, which signals the birds are preparing to nest, was observed for most of the month. Upon arrival in San Diego Bay, least terns generally spend some time foraging offshore before selecting a spot to beginning breeding and nesting.

May 2019 began with low numbers of least tern sightings and by mid-May the number of nests observed marked a 72% reduction from the same date in 2018. However, the timing for when the least terns begin to nest often varies from year to year and is based on weather, oceanographic conditions, and prey availability. Least tern sightings and nests significantly increased in the second half of May 2019 and by the end of the month 41 nests were recorded at the D Street Fill (Figure 14). To accommodate the increased activity, monitors observed the site more frequently, up to once or twice per day, to collect data.



**Figure 14.** Left: Least terns nest in depressions in the sand and may use shell pieces to line the nest area. This egg has been marked by an endangered species monitor with a black line. If the egg is actively being cared for, the parents will rotate the egg regularly to ensure even incubation. If the mark remains in the upward position, it is a sign the egg is likely abandoned. Right: A least tern chick and an unhatched egg sit in a nest. Both are camouflaged to blend in with surroundings which makes their nests particularly vulnerable to human disturbance because they are difficult to spot and are easily tread on. (San Diego Unified Port District).



By the end of June 2019, the number of least tern nests increased to a total of 98. Adults were observed incubating eggs, chicks were beginning to hatch, and the oldest chicks began to fledge (i.e. grow their flight feathers). Endangered species monitors continued to count nests and determine which nests were active, had been abandoned, contained eggs, and had chicks. Monitors also recorded information on chick health by weighing chicks, which is a measure of whether they are receiving enough food from their parents, and measuring their wing length, a measure of overall size (Figure 15). Animal tracks seen near nests or other signs indicating predators in the area were also recorded.



**Figure 15.** Weight (left photo) and wing length (right photo) data are collected to assess chick growth, if it is receiving enough food, and general health (San Diego Unified Port District).



**Figure 16.** Two least tern chicks shelter under a roofing tile. The tiles help relocate and map nests and provide shade on hot, sunny days. (San Diego Unified Port District).

By July 2019, the nesting season had reached its peak with several active nests, nests containing eggs or chicks, and older chicks fledging and practicing flying. Least tern sightings remained consistent with the previous month. Once nests are built and eggs are laid, adult least tern activities shift to rearing of chicks. In the early morning, adult birds will leave chicks in the nest and fly offshore to forage for fish that are small enough to feed to tiny chicks. Fish that are too large cannot be swallowed and the chicks will choke or starve. To protect them from predators while adults are foraging, the chicks have mottled, downy feathers that blend in with the sand and provide camouflage. They may also utilize the roofing tiles placed by endangered species monitors as shelter from predators (Figure 16).

By the end of July 2019, the nesting season was nearly complete with a total of 104 nests observed at the D Street Fill (Patton 2019). The 2018 season recorded 109 nests which suggests the breeding population remained consistent during these two years (Patton 2018). Table 1 contains endangered species monitor observations of all adult birds, nests, and offspring recorded throughout the nesting season from April 1 to August 28, 2019.

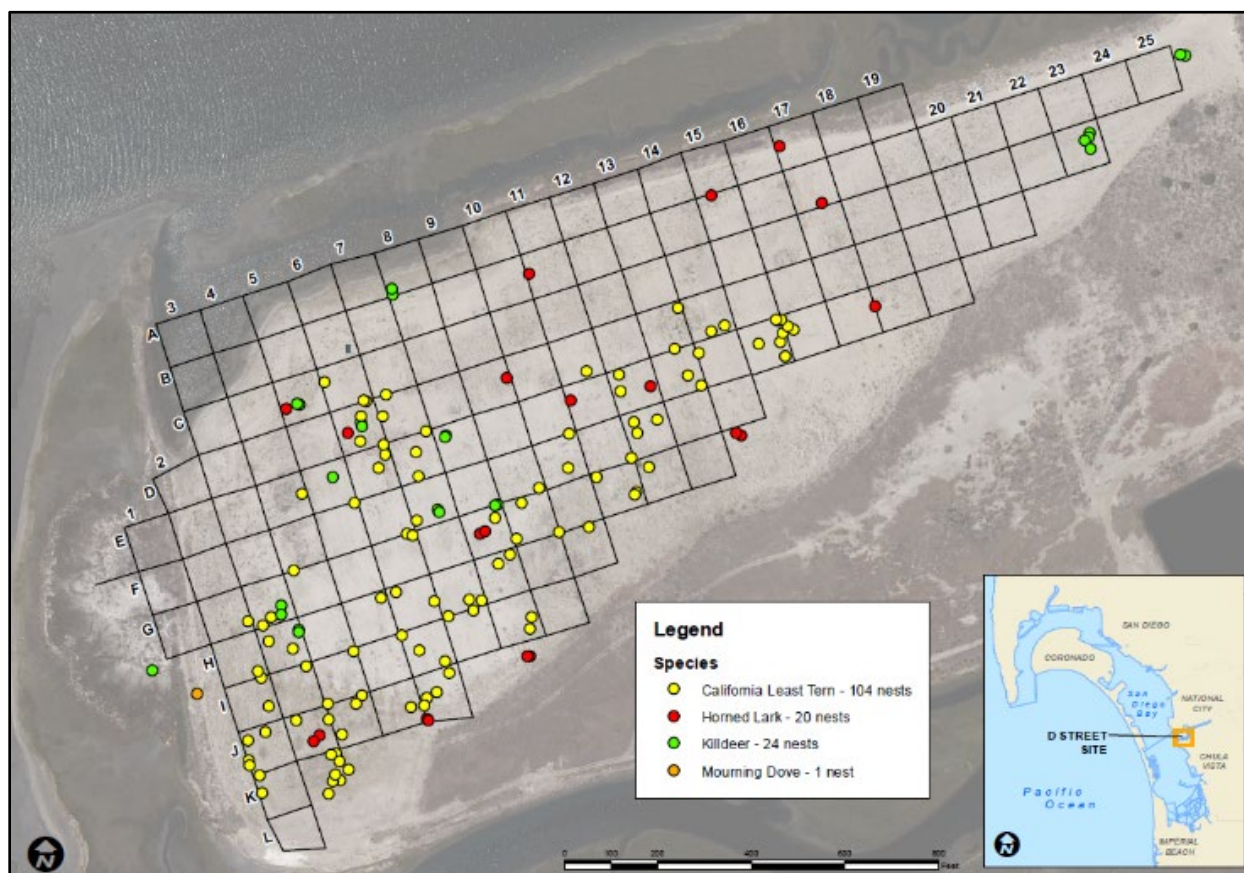
**Table 1.** Monitoring results for adult least terns and nests observed at the D Street Fill for the 2019 nesting season. The number of adult terns is the number of birds observed on-ground or flying back and forth from the site to San Diego Bay (i.e. foraging). Active nests are the number of nests that adults are in the process of building, contain eggs, have adults incubating eggs, contain chicks or fledglings, and/or are nests that have not been abandoned. New nests are the number of nests built within the past observation period (i.e. within the last 1-7 days). The number of chicks and fledglings is the total number on site during the observation period. Note that some chicks and fledglings may be lost to predation between observation periods. Data adapted from the 2019 California Least Tern Status Report (Appendix A).

Date	Adults	Total nests	Active nests	New nests	Chicks	Fledglings
04/17/2019	6	0	0	0	0	-
04/24/2019	20-23	0	0	0	0	-
04/27/2019	80-82	0	0	0	0	-
04/30/2019	20	0	0	0	0	-
05/03/2019	18	1	0	0	0	-
05/14/2019	60+	10	9	7	0	-
05/17/2019	45-50	17	16	-	0	-
05/21/2019	<20	36	34	19	0	-
05/28/2019	24	41	37	5	0	-
06/04/2019	35	46	41	4	3	-
06/11/2019	40	50	34	3	15	-
06/18/2019	40-50	77	38-41	16	9	-
06/22/2019	-	88	-	11	2	-
06/25/2019	40+	91	48	5	3	3
06/29/2019	-	98	7	-	0	3
07/02/2019	35+	102	52	4	1	5
07/09/2019	45+	103	30	1	15+	3+
07/16/2019	15	104	14	1	4	4
07/23/2019	23+	104	12	0	5-7	5
07/30/2019	10-14	104	1-4	0	2-4	3-5
08/09/2019	5-8	104	2	0	0	4-6
08/13/2019	1-3	104	0	0	0	2
08/17/2019	1	104	0	0	0	0
08/20/2019	0	104	0	0	0	0
08/28/2019	0	104	0	0	0	0



In August 2019, the Port's endangered species monitors continued to observe and report on adult bird sightings and nesting activities as the end of the nesting season approached. By mid-August a few parents were still moving back and forth from the D Street Fill to San Diego Bay to feed fledglings, but most birds had left the site and migrated south for winter. Monitors visited the site regularly until no more least tern activity was observed on at least three visits. This marked the end of the 2019 nesting season.

After the nesting season, monitors used pin flags to mark all the nests for GPS mapping and installed stakes for use as reference grid lines (Figure 17). These data generated a map of the distribution of nests across the site which will inform future site preparation and management. The ceramic tiles placed throughout the site at the beginning of the nesting season were removed and stored for the following season. Monitors compiled and analyzed the nesting and reproduction data into the 2019 California Least Tern Status Report (Patton 2019, Appendix A).



**Figure 17.** Least tern, horned lark, killdeer, and mourning dove (*Zenaida macroura*) nests at the D Street Fill for the 2019 nesting season (map modified from the 2019 California Least Tern Status Report available in Appendix A).

Despite the total number of nests observed, the Port's endangered species monitor estimated approximately 12 fledglings survived the 2019 nesting season at the D Street Fill. Several active nests with eggs and chicks were observed in early July followed by a notable lack of chicks. Predation events are suspected as the primary cause of the missing and dead chicks. As mentioned, least tern nests are particularly susceptible to predators and a low survival rate is not unexpected. The low number of fledglings is consistent with previous monitoring years and demonstrates the critical need for monitoring, management, and predator control at the site.

### 3.2.2 2020 Nesting Season Management and Monitoring

In preparation for the 2020 nesting season, Port and USFWS staff and the Port's endangered species monitor surveyed the D Street Fill and developed a plan for management and monitoring. The Port's endangered species monitor marked the invasive Bermuda grass extent in preparation for an herbicide treatment and flagged Nuttall's lotus and native bird nests to be avoided. The first adult least terns for the 2020 nesting season were observed on the mudflats at the D Street Fill on April 18, 2020 (Figure 18). No snowy plovers have been observed at the D Street Fill as of April 2020. All *Transnet* Environmental Mitigation Program funds for management and monitoring funds were utilized by April 21, 2020. The Port will provide funds for monitoring the remainder of the 2020 nesting season.



**Figure 18.** One of the first least tern adults of the 2020 nesting season was spotted at the D Street Fill on April 18, 2020.

All management and monitoring tasks were completed as originally planned and in accordance with the grant scope and budget. No significant issues were encountered during the 2019 season or the beginning of the 2020 season. Continued annual monitoring of the least tern breeding and nesting season is necessary to collect data to assess the overall status of the least tern population and determine factors inhibiting its recovery. Port and USFWS staff and the Port's endangered species monitors should continue to collaborate regularly and frequently to proactively plan and manage future nesting seasons. In addition, the 2019 California Least Tern Status Report (see Appendix A) outlines several management recommendations that could improve monitoring efforts and data collection for the recovery of least terns, as well as supporting the return of nesting plovers at the D Street Fill. These recommendations include:

- Continue annual monitoring and data collection each nesting season.
- Purchase of a portable tower blind to assist with monitoring.
- Colored leg bands for banding chicks.

- Perform vegetation removal in mid-February to support snowy plover foraging and nesting followed by additional scraping in April prior to the arrival of least terns.
- Mechanical scraping and vegetation removal in the off-nesting season.
- Herbicide treatments in the off-nesting season for Bermuda grass and pepperweed (*Lepidium latifolium*).
- Clearing pathways within the saltmarsh areas of the site to support snowy plover access between potential nesting and foraging areas.
- Interpretive signage at Pepper Park to inform kayakers and other recreators of the sensitive and protected habitat area at the D Street Fill.
- Predator management to begin as early as February.

### 3.3 Task 3 – Predator Management

*Budget:* \$29,900.00

*Match:* \$589.63

*Spent:* \$30,489.63

Predator control and management was conducted by USDA APHIS from March through September 2019. The principal equipment and techniques used for predator management included various sizes of cage traps, padded-jaw foothold traps, neck snares, raptor traps, Compound DRC-1339 avicide, shooting, calling/shooting, spotlighting/shooting, monitoring cameras, and night-vision/thermal imaging equipment. A combination of these methods, techniques, and tools were applied at or near the D Street Fill. Their placement and usage were primarily based on observations of predators in the area (either by USDA APHIS, endangered species monitors, or Port or USFWS staff), signs of predators in the area (i.e. animal tracks, scat, etc.), or signs of predation or predation threats (i.e. eaten eggs, dead chicks, scattered feathers, owl pellets containing feathers, etc.).

All trapping devices were strictly used in accordance with all applicable federal and state laws and regulations and within the guidelines for the permits specific to predator management of least tern nesting areas. Predator management activities for March through August, the end of the 2019 nesting season, included removal of 79 known or potential predators from the D Street Fill (Table 2). This included both mammalian and avian predators (Figure 19).

**Table 2.** Mammalian and avian species removed from the D Street Fill by predator control services during the 2019 least tern nesting season. For the full predator control efforts conducted during the 2019 season, see Appendix B).

Mammalian species	Number removed
Black rat ( <i>Rattus rattus</i> )	8
California ground squirrel ( <i>Otospermophilus beecheyi</i> )	18
Feral cat ( <i>Felis domesticus</i> )	5
Striped skunk ( <i>Mephitis mephitis</i> )	8
Virginia opossum ( <i>Didelphis virginiana</i> )	6
Avian species	
American crow ( <i>Corvus brachyrhynchos</i> )	24
Common raven ( <i>Corvus corax</i> )	5
Cooper's hawk ( <i>Accipiter cooperii</i> )	4
Red-tailed hawk ( <i>Buteo jamaicensis</i> )	1
<b>Total</b>	<b>79</b>





**Figure 19.** A Cooper's hawk watches for prey, which includes both adult least terns and chicks (San Diego Unified Port District).

USDA APHIS routinely surveyed the D Street Fill at least once per week, or once per day when traps are set (as required under permit guidelines), or up to several hours per day or at night when actively tracking predators. USDA APHIS coordinated closely with the Port's endangered species monitor to determine active predator threats. Missing eggs, owl pellets or other scat containing least tern feathers, signs of human activity including footprints, and signs of raptor predation, such as scattered least tern feathers on the ground and toppled least tern decoys, were also reported. USDA APHIS and endangered species monitors also noted at least one chick depredated by ants. After the nesting season's end, USDA APHIS prepared and submitted the 2019 Predator Management Report for the San Diego International Airport, Chula Vista Wildlife Reserve, and D Street Fill (see Appendix B). The report provides all the predator management data for the season along with recommendations to improve management and predator control success to assist with the recovery of least terns. These recommendations include:

- Maintaining predator management efforts into the future.
- Longer holding periods for raptors.
- Allow for preemptive removal of raptors.
- Improve crow, raven, and gull management strategies.
- Repair the D Street entrance to reduce gaps under the gates and around the south channel grating to prevent mammalian entry.
- Resolve permit issues regarding confusing and contradictory language, trap inspection intervals, restrictions on trap types and use conditions, and the length of time to negotiate permit conditions and amendments.

- Replace and improve USFWS Refuge boundary signs or install new signs to prevent trespassing.
- Relocate “Area Closed” and “Restricted Area” channel marker buoys to areas more frequently used by kayakers.
- A “Watch for Vehicles” sign at the bike path entrance and near the pedestrian bridge to warn bikers and pedestrians on-coming vehicles.
- Trim vegetation and clear brush along the bike path fence so drivers can see oncoming cyclers, pedestrians, and vehicle traffic.

All predator management tasks were completed as originally planned and in accordance with the grant scope and budget. No significant issues were encountered during the 2019 season. Falcons continue to be a substantial threat to adult birds, chicks, and fledglings. Crows and ravens are also a substantial threat to eggs and chicks. Increased funding to hire additional USDA APHIS or other predator management staff could help improve reproductive success and offspring survival.

### **3.4 Task 4 – Invasive Plant Control**

*Budget:* \$1,000.00

*Match:* \$2,000.00

*Spent:* \$3,000.00

Prior to the 2019 nesting season, the D Street Fill was surveyed by Port and USFWS staff, the Port’s endangered species monitor, and a Pest Control Advisor to assess the extent of invasive plants present. The Pest Control Advisor determined the best approach for management of the invasive plants specific to the D Street Fill that aligned with the Port’s Integrated Pest Management Policy, San Diego Bay National Wildlife Refuge management policies, and the State of California Proposition 65 List. At the time, the Port was in the process of aligning its Integrated Pest Management Policy with the state’s Proposition 65 list of naturally occurring and synthetic chemicals known to cause cancer or birth defects or other reproductive harm.

The Port’s change to its pesticide/herbicide policy, along with USFWS concerns on the timing and impact of an herbicide treatment on native and rare plant species found at the D Street Fill and the arrival of the least terns, prevented an herbicide treatment from being applied before the start of the 2019 nesting season. An herbicide treatment was instead planned for prior to the 2020 nesting season.

In February 2020, Port and USFWS staff and the Port’s endangered species monitor surveyed the site and observed that invasive Bermuda grass had achieved early 100% coverage over portions of the nesting site. It is likely that the vegetation removal process conducted each year is essentially “chopping up” the Bermuda grass and its seeds and spreading it around the site. Port and USFWS staff agreed that an herbicide treatment should be implemented to kill the Bermuda grass and prevent it from going to seed before the vegetation removal process.

Port staff selected an approved herbicide and planned for a contractor to apply the treatment the last week in February 2020. Significant rain events and temporary flooding of the D Street Fill delayed application until March 21, 2020. The herbicide was applied using a small off-road vehicle which could easily maneuver around rare plants and ground-nesting birds that the Port’s endangered species monitor had previously flagged and marked off as areas to avoid (Figure 20). On March 23, 2020, the monitor observed browning of portions of the Bermuda grass showing the treatment had an impact (Figure 21).





**Figure 20.** The Port's contractor applied an herbicide to invasive Bermuda grass, the grass-like vegetation in the photo, using a small off-road vehicle which provided maneuverability to avoid bird nests and rare plants (San Diego Unified Port District, photo taken March 21, 2020).



**Figure 21.** Notable browning of Bermuda grass and yellowing of invasive mustard (*Brassica nigra*) after the herbicide treatment applied on March 21, 2020 (San Diego Unified Port District, photo taken on April 3, 2020).



The invasive plant control task was not completed in 2019 due to changes in the state's Proposition 65 List and Port's Integrated Pest Management Policy, along with concerns from USFWS on timing and impacts to native plants and the arrival of least terns. Therefore, an herbicide treatment was instead implemented in early 2020 in accordance with the grant scope and budget. No significant issues were encountered during the 2020 herbicide treatment; however, significant rain events delayed application for approximately three weeks which gave less time for the herbicide to take effect before vegetation removal began. The herbicide did significantly brown the Bermuda grass but since vegetation removal, the Bermuda grass has begun to return. It is likely that several herbicide applications are required. Discussions with Port and USFWS staff and endangered species monitors resulted in the following recommendations:

- Continue funding for the implementation of an annual herbicide application.
- Herbicide application in the fall and a second application prior to vegetation removal.
- Multiple herbicide applications throughout the off-nesting season.
- Continue coordination between the Port and USFWS on herbicide application.

### 3.5 Task 5 – Volunteer Event(s)

*Original Budget:* \$1,000.00

*Amended Budget:* \$163.44 (\$836.44 redistributed to the Management and Monitoring budget)

*Match:* \$908.94

*Spent:* \$1,072.38

On September 21, 2019, the Port sponsored a cleanup site at the D Street Fill for Coastal Cleanup Day. Public volunteers participated in the cleanup of trash and invasive plants along the shoreline. The event is hosted annually by I Love A Clean San Diego, a local environmental non-profit organization focused on zero waste conservation in San Diego. The Port has sponsored a cleanup site at the D Street Fill since 2003. Large amounts of plastic trash wash up on the northern shoreline, adjacent to the nesting site and in the area where snowy plovers have been observed foraging in past years. Trash, specifically plastic, is of concern because birds are known to mistake small plastic pieces as food items. The D Street Fill is inaccessible during the nesting season to protect nests from human disturbance; therefore, it is critical to collect trash after the nesting season ends and before the next season begins.

Port staff also coordinated with the USFWS Refuge Manager for Coastal Cleanup Day. USFWS staff noted that there was an abundance of three species of invasive sea lavender (*Limonium raosissimum*, *L. duriusculum*, and *L. perezii*) growing onsite that was still small and had not yet gone to seed, which is the ideal time for removal. USFWS asked that Coastal Cleanup Day volunteers and Port staff pull the invasive plants during the event, if time permitted.

The Port's General Services Department provided cleanup supplies, including trash bags, gloves, trash pickers, a pop-up tent, and a table and chairs. On the day of the event, Port staff coordinated access and shuttled volunteers to the site and arranged for dumpsters and port-o-potties to be delivered to the site and picked up after the event. Port staff also briefed volunteers on safety, site logistics, and the environmental importance of the site to the endangered least terns and threatened snowy plovers. Seven public volunteers and three Port volunteers removed an estimated 315 pounds of debris from the D Street Fill (Figure 21). The volunteers did not have time to remove the invasive lavender, so a second cleanup event was scheduled for October 2, 2019 with Port volunteers and student volunteers from the Living Coast Discovery Center, a local non-profit environmental education facility located near the D Street Fill in Chula Vista.



**Figure 21.** A volunteer loads trash bags for disposal during Coastal Cleanup Day, an annual global cleanup event, at the Port-sponsored site at the D Street Fill (photo taken September 21, 2020, San Diego Unified Port District).

The USFWS Refuge Manager joined approximately 25 volunteers (nine Port volunteers and approximately 16 Living Coast Discovery Center volunteers) to provide training on how to identify the three invasive sea lavender species, compared to the one native sea lavender species (*Limonium californicum*), and remove them before they went to seed (Figure 22). These invasive species outcompete the native sea lavender and create habitat that is not suitable for nesting least terns or snowy plovers that may forage in the area. During the cleanup event, hundreds of small plants were pulled, bagged, and disposed of offsite to prevent and seeded plants from propagating (Figure 23). Several volunteers also collected an abundance of plastic trash along the shoreline.

A third volunteer event was planned for Creek to Bay, another annual cleanup event hosted by I Love A Clean San Diego that takes place during Earth Week (usually the third or fourth week in April and originally scheduled for April 25, 2020). However, Creek to Bay and future volunteer events were postponed until further notice due to the COVID-19 pandemic and state and county stay at home order and social distancing requirements. The Port expects the next cleanup event to take place at the D Street Fill will be Coastal Cleanup Day tentatively scheduled for September 26, 2020, pending further COVID-19 impacts and social distancing requirements.





**Figure 22.** The Refuge Manager for the San Diego Bay and Tijuana Slough National Wildlife Refuges teaches a Port volunteer about invasive and native sea lavender during a cleanup event on October 2, 2019 (San Diego Unified Port District).



**Figure 23.** Left: Volunteers from the Port and the Living Coast Discovery Center collected trash and removed invasive sea lavender from the D Street Fill during a cleanup event on October 2, 2019. Right: Invasive sea lavender.



Two volunteer events were completed under the Volunteer Event Task as originally planned and in accordance with the grant scope and budget. No significant issues were encountered during the 2019 season; however, the 2020 volunteer event was postponed to September 2020 due to COVID-19. The unused Volunteer Event Task funds were subsequently transferred to the Management and Monitoring Task. Volunteer events will continue at the D Street Fill since a significant amount of trash washes up onto the shoreline each year. Port staff have the following recommendations for future volunteer events at the D Street Fill:

- Improve signage directing volunteers to the site since it is difficult to find and may dissuade volunteers from attending.
- Purchasing 5-gallon buckets to collect trash and minimize the use of trash bags.
- Increase the number of Port and Living Coast Discovery Center volunteer events to at least two times per year to supplement I Love A Clean San Diego's Coastal Cleanup Day and Creek to Bay events.
- Coordinate with the Urban Corps of Engineers to perform large debris removal (i.e. logs and large trash items).

### **3.6 Task 6 – Administrative**

*Budget:* \$0.00

*Match:* \$10,031.61

*Spent:* \$10,031.61

For the Site Preparation Task, the Port and USFWS provided staff time to coordinate equipment and logistics for mechanical scraping, vegetation removal, and to supervise the work. The Port paid additional costs for the pest control advisor, equipment operators, equipment fuel, and a portion of the equipment rental that exceeded the grant budget.

For the Management and Monitoring Task, the Port provided staff time to coordinate and supervise the work, review weekly reports, and complete grant reporting documents. For the Predator Management Task, the Port provided staff time to coordinate and supervise the work, review monthly reports, and complete grant reporting documents. Additionally, costs for the Port's endangered species monitors and predator control services were paid by the Port for the beginning of the 2020 nesting season.

For the Invasive Plant Control Task, the Port provided staff time to coordinate and supervise the work. Additional costs for the herbicide application were paid by the Port. For the Volunteer Event(s) Task, the Port provided staff time to coordinate volunteer events with event partners, organize restroom facilities and dumpster services, and organize and train volunteers.

Administration of the SANDAG *TransNet* Environmental Mitigation Program grant, including reporting requirements and invoicing were accomplished by Port staff. The grant was completed before the grant expiration date and all grant funds were successfully utilized.

## **4.0 Conclusions**

The 2019 California least tern breeding and nesting season at the D Street Fill was considered successful with the survival of approximately 12 fledglings. As a ground-nesting bird, least terns are particularly susceptible to predators, human disturbance, and habitat loss; therefore, even a small, positive reproductive gain of 12 birds is critical to the survival of this species.

#### 4.1 General Project Recommendations

Active site preparation, monitoring, and predator management efforts should continue as implemented since 1997. To improve least tern reproductive success and to continue to support potential foraging and nesting by snowy plovers at the D Street Fill, the Port and USFWS should consider implementing the management recommendations mentioned above. Specifically, the following recommendations should be considered highest priority:

- Continue coordination between the Port and USFWS on the management of the least tern nesting site at the D Street Fill.
- Continue annual site preparation, monitoring, and predator management efforts .
- Perform vegetation removal in mid-February to support snowy plover foraging and nesting followed by additional scraping in April prior to the arrival of least terns.
- Mechanical scraping and vegetation removal in the off-nesting season.
- Herbicide applications throughout the off-nesting season.
- Interpretive signage at Pepper Park to inform kayakers and other recreators of the sensitive and protected habitat area at the D Street Fill.
- Predator management to begin as early as February.
- Allow for preemptive removal of raptors.
- Improve crow, raven, and gull management strategies.
- Resolve permit issues regarding confusing and contradictory language, trap inspection intervals, restrictions on trap types and use conditions, and the length of time to negotiate permit conditions and amendments.
- Replace and improve USFWS Refuge boundary signs or install new signs to prevent trespassing.

The Port appreciates SANDAG's support of endangered species management through its grant opportunities. The *Transnet* Environmental Mitigation Program grant for the Threatened and Endangered Species Stewardship at the D Street Fill project ensured the success of the 2019 nesting season and appropriate site preparation for the 2020 nesting season. This contribution was critical to the continued support and recovery of least terns.

The Port looks forward to applying for another SANDAG *Transnet* Environmental Mitigation Program grant if offered in the future. The Port is continually seeking grant funding to continue supporting monitoring and predator management for the endangered California least tern and threatened Western snowy plovers that nest and forage at the D Street Fill.

## 5.0 References

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- USDA APHIS 2019. Predator Management Report for San Diego International Airport, Chula Vista Wildlife Reserve, and D Street Fill. United States Department of Agriculture, Animal and Plant Health Inspection Services – Wildlife Services. March 2020. pp. 14.



## **6.0 Appendices**

### **Appendix A** 2019 California Least Tern Status Report

## **Appendix A**

# **THE STATUS OF THE CALIFORNIA LEAST TERN AT SAN DIEGO UNIFIED PORT DISTRICT PROPERTIES IN 2019**

Prepared under Contract

For

San Diego Unified Port District



Photo by M. Sadowski

By

Robert T. Patton  
Consulting Biologist

Final Report  
December 2019



## Appendix A

### SUMMARY

In preparation for the 2019 nesting season at D Street Fill, San Diego Unified Port District (Port) and U.S. Fish and Wildlife Service (USFWS) staff and contractors applied herbicide to invasive plant species; and in late March, Port staff completed mechanical grading of the site to reduce vegetation and enhance it for use by least terns and snowy plovers. Predator management was conducted by personnel of US Department of Agriculture, Wildlife Services, and is to be reported separately. Monitoring was conducted from mid-March through August one to three days per week.

Least terns were first observed at the D Street Fill on 10 April 2019. They were observed again on 24 April and each visit after that through 17 August. At least 104 nests were initiated by 55 to 72 estimated pairs between 1 May and 13 July. Average clutch size was 1.24 eggs per nest. The maximum number of concurrently active nests and broods was 51 nests and four broods of chicks on 2 July. At least 32 nests were suspected to have resulted from renesting by pairs that lost earlier clutches.

At least 59 chicks from 45 nests hatched successfully. It is estimated that only 12 chicks reached fledgling age and survived to fledge from the site. Forty-five nests with 50 eggs were abandoned pre-term, two nests with three eggs were non-viable and abandoned after prolonged incubation, and two eggs from two nests failed to hatch and were abandoned after the other egg in each clutch hatched successfully. At least four nests with four eggs were depredated with northern harrier suspected of being responsible. Additional abandoned eggs appeared to have been scavenged by harrier. The outcomes of nine nests with 11 eggs were uncertain, but lack of evidence of hatching or chick presence indicates probable depredation.

Sixteen chicks were found dead with no obvious causes of mortality. One chick was depredated by ants and the remains of one depredated fledgling suggested peregrine falcon as responsible. A peregrine was observed leaving the site with prey that appeared to be an adult least tern, but the monitor could not rule out the possibility that it could have been a small shorebird instead. Scattered feathers of another adult least tern suggested possible raptor predation. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that others were likely preyed on. The disappearance of up to 29 chicks coincided with documented depredation and/or daily disturbances to the colony by northern harrier and gull-billed tern, and visits by Cooper's hawk, red-tailed hawk, peregrine falcon, American kestrel, and American crow. Other potential predator species observed in the area included ant species, great blue heron, gulls, common raven, European starling, western meadowlark, opossum, rats, California ground squirrel, coyote, feral cat, and striped skunk.

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### **LIST OF TABLES**

1. Least tern nest and egg data, D Street Fill, 2019.
2. Documented causes of least tern mortality, D Street Fill, 2019.

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1. San Diego Unified Port District and San Diego County Regional Airport Authority least tern nesting sites, 2019.
2. Least tern nest distribution, D Street Fill, 2019.
3. Least tern breeding chronology, D Street Fill, 2019.
4. Least tern productivity chronology, D Street Fill, 2019.



## Appendix A

### INTRODUCTION

The California least tern (*Sternula antillarum browni*)(tern) once nested in large, loose colonies on beaches throughout Southern California. Increasing urbanization and habitat loss have led to the decline of its population and shifted much of the nesting to less traditional colony sites such as landfills and airports (California Least Tern Recovery Team 1977). The subspecies has been listed as endangered since 1972 (California Department of Fish and Game 1972, US Bureau of Sport Fisheries and Wildlife 1973). The population in California in 1973 was thought to be as low as 300 nesting pairs; by 2009, the population had grown to an estimated 7130 nesting pairs (Marschalek 2009). Since then, the breeding population has been declining, with preliminary estimates in 2018 of 3655 to 4352 pairs (CDFW unpublished data).

This report addresses monitoring and management of the least tern colony site at the "D Street Fill" on the eastern shore of San Diego Bay and south of the mouth of the Sweetwater River under contract with the San Diego Unified Port District (Port) during the 2019 breeding season. San Diego International Airport - Lindbergh Field and the Chula Vista Wildlife Reserve are two other nesting sites located on facilities and properties adjacent to San Diego Bay and within jurisdiction of the Port, but monitoring in recent years has been under separate contract through the San Diego County Regional Airport Authority (Figure 1).

Guidelines were established by the U.S. Fish and Wildlife Service (USFWS) through informal consultation conducted for the maintenance of the D Street Fill within the Sweetwater Marsh National Wildlife Refuge Planning Area. Work was conducted under Federal Fish & Wildlife Endangered & Threatened Species Permit number TE-789255, Federal Bird Marking & Salvage Permit number 20047-H, National Wildlife Refuge Special Use Permit, and State of California Department of Fish & Wildlife (CDFW) Memorandum of Understanding (MOU) regarding California least tern and western snowy plover (*Charadrius nivosus nivosus*).

### STUDY AREA

Least terns have nested on the sand-shell substrate of dredge spoil at the "D Street Fill", south of the mouth of the Sweetwater River, along the eastern shore of San Diego Bay, since 1973

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(WESTEC 1981). This site is owned and managed jointly by the Port and the USFWS as part of the Sweetwater Marsh National Wildlife Refuge. Colony size and reproductive success have varied widely from year to year depending on the availability of nesting habitat with low vegetation height and density, availability of prey fish, predation and predator presence, and human disturbance. Annual least tern productivity at D Street Fill is summarized in Appendix A. Notable events in the site's history included it being abandoned by nesting terns in 1981 and 1990 (Copper 1981, Obst and Johnston 1992), and the colony being re-established with up to 135 nests in 1992 (Caffrey 1993). At least 41 nests were established at D Street in 1997, but there were significant losses to predation, and only seven nests were established in 1998 (Patton 1998a & 1998b). Nest numbers increased to 36 in 1999, but remained relatively low through 2002 when 24 nests were initiated (Patton 1999, 2000, 2001, 2002). Numbers then increased with 91 nests in 2003 and 111 in 2004. Since 2005, annual nest numbers have ranged from 100 in 2006 to 148 in 2008 and 2014; and annual fledgling production has ranged from nine individuals in 2012 to 36 in 2014 (Patton 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017). Over the past 10 years, annual numbers of fledglings produced per nest have ranged from 0.08 to 0.29 and numbers of fledglings per pair from 0.10 to 0.33.

	1980	1981	1982	1983	1984	1988	1989	1990	1991	1992
Nests	12	0	1	1	41	19	2	0	59	135

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Nests	41	7	36	34	32	24	91	111	101	100	130

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Nests	148	132	119	116	114	144	148	123	118	127	109
Fledglings	17-24	19-29	15-27	25-32	9	23-32	28-36	21-34	21-22	25-27	12-15

The site consists of a roughly rectangular peninsula of dredge deposits with relatively even topography, bordered by saltmarsh, mudflats, and San Diego Bay to the west, the historic Sweetwater River channel and saltmarsh to the south, the Sweetwater River flood control channel and saltmarsh to the north, and channels and saltmarsh of Sweetwater and Paradise Marshes to the east. A vehicle bridge and railroad trestle provide access from the north, a second trestle provides access from the south, but chain-link fencing and bollards limit accessibility to the bridges. The area of historic use by terns is further protected by a six-foot-tall chain link fence running north-south across the eastern end of the site and is closed to unauthorized access. Vegetation is



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diminished by mechanical scraping, grading, and/or dragging prior to each nesting season and species assemblages altered to resemble coastal strand habitat. Ceramic tiles are laid out at grid intersections of 30-meter squares to assist in nest mapping and provide shade and shelter for chicks.



Aerial view of Sweetwater Marsh, D Street Fill, and Sweetwater River.

## METHODS

### Site Preparation

The eastern portion of the nesting area (grid rows 18 through 24) was again left heavily furrowed and vegetated this year. This initially had been intended as erosion control for a component of a wetland mitigation project completed by San Diego Gas and Electric in 2015 to 2016; but then was left in an effort to limit the spread of seeds following discovery of a highly invasive non-native weed, broad-leaved or perennial pepperweed (*Lepidium latifolium*), that had apparently been introduced to the site by equipment involved in the mitigation project. Monitors flagged individuals or patches of *Lepidium*, and contractors, staff of the Port, and staff of the San Diego National Wildlife Refuge Complex applied herbicide. Port and Refuge staff also applied herbicide to invasive non-native iceplant (*Carpobrotus* sp.) scattered around the site, and to recently established stands of Bermuda grass (*Cynodon dactylon*) in the western portion of the nesting area.

Prior to any site preparation efforts after mid-February, the site was surveyed for the

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presence, courting or nesting of western snowy plovers, and for nests of other species. In late March and into the first week of April, Port staff conducted mechanical scraping of the site to reduce vegetation and further enhance it for use by terns and snowy plovers. Additional new growth of vegetation in the nesting area was reduced by manual weeding, most notably mustard (*Brassica*) species. Vegetation around the periphery of the cleared area was pruned back to limit predator perches and cover, most notably *Baccharis* species. Manual weeding also targeted reducing invasive plant species, particularly iceplant, garland chrysanthemum (*Glebionis coronaria*), and Russian thistle (*Salsola* sp.).

Monitors surveyed a 30 m grid system and placed ceramic roofing tiles at each grid intersection to assist in nest mapping and provide shade and shelter for chicks. Existing perimeter signs indicating that the area is an endangered species nesting site were repaired or replaced. Ceramic, plastic, and papier-mache decoys were placed in three groups of 20 each in the central portion of the cleared site and in the western third where the majority of nests have occurred in the past. At least half of each decoy group was arranged to simulate single birds (spaced 1.0 to 2.0 m apart) and the remainder of each decoy group set as pairs of birds (spaced approximately 15.0 cm apart) according to Burger (1988).



Mechanical scraping to reduce vegetation and prepare the site for least tern nesting.



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### Monitoring

The site was monitored one to three times per week by one to six people for one to four hours. Each visit was supervised by at least one senior monitor with extensive experience in monitoring and managing nesting least terns, snowy plovers, and their young. Weekly monitoring for snowy plovers was conducted at D Street Fill beginning in early March. The site was monitored for terns and plovers for approximately two hours each visit from 15 through 30 April. During the peak season of May through July, monitoring time was increased to four hours per visit to accommodate nest location, marking, and chick banding and recapture. The time of day of the site visits varied, but efforts were made to conduct censuses during the cooler hours of the day (before 1300 or after 1600) to avoid causing heat stress to chicks. Monitoring was rescheduled in cases of precipitation or high winds. Monitoring continued twice per week through mid-August until the terns departed. Monitoring was discontinued when no least terns had been observed for three consecutive visits. The final monitoring visit for 2019 was on 27 August at D Street Fill.

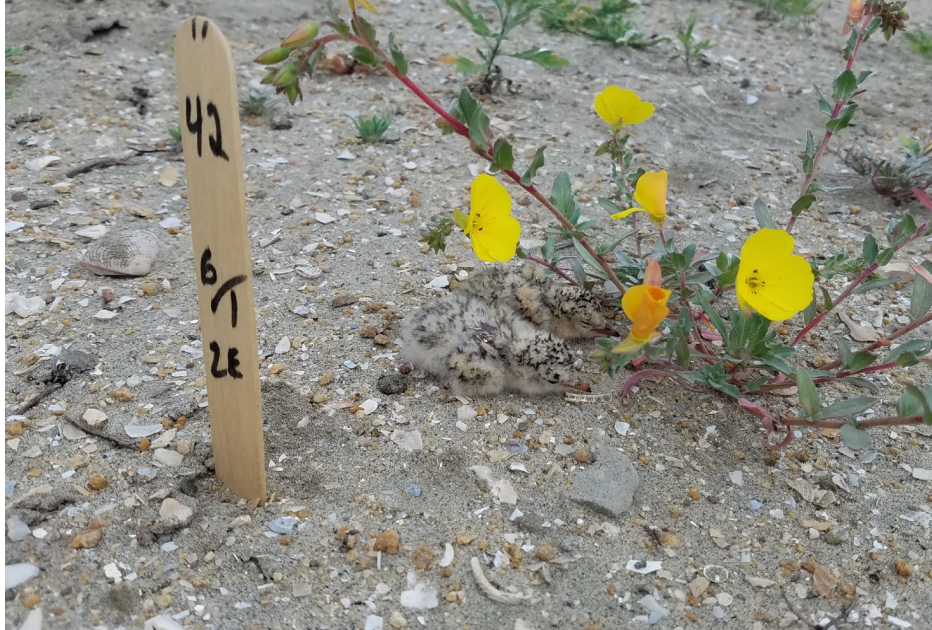
Monitoring methodology was adapted from that described by Foster, Hyde, and Patton (1982). Monitoring visits typically involved scanning the site from the perimeter with binoculars and/or spotting scope and recording observations in a site log book, on daily site maps, and on daily standardized data forms (Appendix B). Log books, master nest lists, maps, band lists, and specimen/mortality lists were maintained for each site. Log book entries were made for every visit, including the name(s) of the observer(s), the date and the times of the visit, and any significant observations. To minimize disturbance, additional observations were made from within a portable blind used within the colony and along the perimeter. Likewise, observations were made using the vehicle as a blind from along the perimeter road.

Each visit, transects were walked along the grid system to locate and record nests, chicks, or signs of disturbance. Monitors noted presence and location of predators on or in the vicinity of the site. Conditions of nests and decoys were checked, and any abandoned eggs, eggshell fragments, bone, feathers, carcasses, or damaged decoys were collected. If tracks or other signs of predator presence were noted, predator management personnel were notified. Egg abandonment or nonviability was determined by the eggs being present over 40 days or the eggs being cool and unturned with no attending adult observed at or near the nest for at least three consecutive visits.

Nests located at D Street Fill were marked by numbered wooden tongue depressors placed

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vertically in the sand one to two meters west of each nest. Nest numbers were assigned by order of discovery.



Brood of two least tern chicks near nest scrape and nest marker.

### Chick Banding

An attempt was made to band all chicks. Chicks were banded on the right leg with an individually numbered U.S. Geological Survey (USGS) metal band. Whenever feasible, the chicks were weighed with an Acculab 150 or Ohaus 320 gram electronic scale and a right wing chord measurement taken, both at initial banding and each recapture. One or both of these measurements were at times omitted to save time and reduce disturbance to the colony. The nest number from which the chick originated was noted if known. Band recapture data was used to estimate chick survival and fledging success, and band recovery data was used to quantify mortality and predation. In addition, banding of chicks provides for future recapture and recovery of bands to document longevity, dispersal, and to correlate age and colony of origin with breeding location, effort, success, and other factors.

### Fledgling Estimation

Estimates of fledgling numbers were derived from a combination of two approaches: the



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first being to assume that all chicks recaptured with a wing length of 67 to 84 millimeters (14 to 17 days of age; unpublished data, C. Collins, E. Copper) or greater will fledge; the second, to total the number of fledglings observed every two to three weeks, on the assumption that fledged birds stay approximately two weeks at the colony after fledging (Thompson and Slack 1984, Massey 1989). The resulting range was used to estimate of the number of juvenile terns surviving to fledging age. The number of documented dead or depredated fledglings was then subtracted for the estimate of young surviving to fledge from the site.

### **Predator Management**

Management of avian and mammalian predators was conducted by personnel of the U.S. Department of Agriculture, Wildlife Services (USDA WS) under a separate contract. Predator management activities were reported separately by that agency. Sick or injured birds were taken to Project Wildlife for veterinary treatment and possible rehabilitation and release. Abandoned egg, chick and adult carcass specimens were collected and frozen, pending direction from USFWS for isotope and/or contaminant analysis.

## **RESULTS AND DISCUSSION**

California least terns were observed from 10 April through 17 August 2019 at and adjacent to properties and facilities of the Port. At the three Port and San Diego County Regional Airport Authority sites, 189 nests were established from 1 May to 13 July (Appendix C). At least 20 to 22 tern young are estimated to have fledged from San Diego International Airport - Lindbergh Field, D Street Fill, and Chula Vista Wildlife Reserve.

### **Breeding Chronology**

California least terns were observed at the D Street Fill nesting site on 10 April and then from 24 April through 17 August. Approximately 55 to 72 pairs established 104 nests spread throughout the site but with most in the central western portion of the site (Figure 2). Observations of birds late in the season consisted of foraging along adjacent shoreline and loafing on the adjacent

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mudflats.

The pair estimation method used for the CDFW breeding pair index for tracking long-term trends is based on the total number of nests established before 15 June plus half the number of nests established 15 June and later. This two-tiered approach is an attempt to standardize pair estimates and by taking into account the possibility of renesting of pairs that had lost earlier clutches as well as young birds breeding for the first time and arriving late from wintering grounds (Massey and Atwood 1981). However, given the lack of productivity in recent seasons, particularly with significant predation around San Diego Bay, the question has been raised as to whether the maximum number of concurrently active nests may be a more accurate measure of the number of breeding pairs. The CDFW method results in a maximum index estimate of 77 breeding pairs this season. However, timing of nest losses and new nest initiations suggests that at least 32 nests likely resulted from renesting by pairs that had lost earlier clutches or broods, leading to a maximum number of 72 breeding pairs. The minimum number of breeding pairs was 55, based on the maximum number of concurrently active nests and broods (51 nests and four broods of chicks on 2 July).

Typically, nest initiation occurs in early May (Massey 1974), and this year's first nest was found on 1 May. Figure 3 depicts graphically the chronology of nesting events at the D Street Fill in 2019. The numbers of active nests plotted in Figure 3 were those nests being tended by an adult. Unlike most years, early season nest initiation was gradual and most nests were established in June rather than in May this season. This corresponded with reduced colony attendance by adults in the early part of the season both at D Street and at other sites in Southern California, leading to speculation of reduced availability of prey fish. Only one other new nest was established at D Street during the first week of nesting, eight in the second week, and 27 in the third week. In contrast, by that date in 2018, 89 nests had been established (Patton 2018). Nest initiation picked up in June and peaked in mid-June then tapered off with the last nests being initiated on 6 and 13 July.

The number of active nests plotted in Figure 3 diverged from the number of total nests in late May due to the abandonment of three nests. Divergence between numbers of active and total nests increased through June with hatching of chicks and additional nest abandonments and predation. Active nest numbers dropped rapidly through mid to late July with chicks hatching, cessation of nest initiation, and losses to nest abandonment and predation.

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### Nest Distribution

All nesting attempts occurred on the sparsely vegetated, mechanically cleared portion of the site, with light-colored sand-shell substrate (Figure 2 and Appendix C). Late spring rainfall resulted in significant vegetative cover in portions of the site. The majority of nests were located in the central western half of the site with the densest nesting in the southwest portion of this concentration of nests. Other nests were established radiating from this primary concentration of nests, with a secondary scattering of nests extending to the east. The advantages of group defense and/or adherence and the influence of colony formation/nest-site selection factors on nest distribution patterns within a colony have been previously demonstrated (Coulson 1968, Siegal-Causey and Hunt 1986, Patton and Foster 1984). Gaps in nesting between dense clusters of nests in the western site corresponded with dense cover of invasive Bermuda grass that has increased on the site in recent years.



Least tern nest distribution at D Street Fill in 2019.

This season, 17 nests were established farther east in the site than most nests in past years. Reasons for this expansion in nest distribution are speculative, but likely include vegetation



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reducing the area available for nesting elsewhere on the site (particularly the increasingly dense Bermuda grass in the western portion of the site), predator disturbance in the main colony nest cluster, and proximity to the restored tidal channels along the north northeast and east southeast edges of the site with their increased prey availability. Although most nests each year have been focused in the central western site, terns and plovers regularly nested farther east when the site had significantly more open area and less peripheral vegetation in the 1980s.

Appendix D lists nest numbers and distribution for the site over the past 20 years. Generally each season the site is cleared so that 30 m wide grid rows numbered 1 through 24 are established west to east on the site, although clearing in some years has not extended beyond row 18 (see Figure 2). From 1997 through 2003, no nests were documented east of grid row 12. Three nests were established in rows 13 and 14 in 2004, and one nest was in row 13 in 2005. Since 2006, eight to 20 nests have been established each season in rows 13 through 20. Each year from 1997 through 2015 this area had been cleared of vegetation, except in 2005 when miscommunication resulted in the eastern portion of the site not being cleared. In 2003, a portion of the northeastern fill north of rows 18 through 24 was excavated for saltmarsh and tidal channel restoration. In 2011, prior to the breeding season, a portion of the northwestern fill, grid rows 1 through 10, A through E, was excavated for the L-ditch mitigation project. A portion of the southeastern fill southeast of row 18 was excavated prior to the 2016 season as a component of a San Diego Gas and Electric wetland mitigation project (and the site east of grid row 18 not cleared of vegetation to minimize spreading invasive pepperweed). Terns have been observed foraging in the channels of each of these mitigation areas. No on-ground activity has been observed to date in the southeastern project area, but adults roost with their fledglings on the slope and shoreline of the northwestern project area.

### Clutch Size

Fifty-five to 72 estimated pairs of least terns established 104 nests with 129 eggs at the D Street Fill in 2019. The average clutch size was 1.24 eggs per nest with 25 two-egg clutches, and 79 single egg clutches (Table 1). This average clutch size was among the lowest recorded at this site, much lower than the 2.15 recorded by Massey in her initial study of least tern breeding biology (1974) and the 1.63 average recorded at this site over the ten previous years (Appendix C). Reduced average clutch sizes have been noted to indicate locally reduced food availability (Atwood

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and Kelly 1984).

### Hatching Success

Only 46 percent of the eggs at D Street Fill hatched successfully this season, resulting in an average of 0.57 chicks per nest and 1.31 chicks per nest that experienced hatching (Table 1). This was among the lowest hatching rates in recent years at this site, although higher than that of the 2012 season when nest predation and abandonment severely limited hatching success to 40 percent (Patton 2012). Nest abandonment was the primary known limiting factor to hatching success, with 43 percent of nests abandoned pre-term (45 nests). Two additional nests were abandoned after extended incubation periods, and two additional eggs were abandoned after the other egg in each clutch hatched. Four nests were documented to have been depredated; the outcomes of nine additional nests were unknown and predation likely, either of eggs or of recently hatched chicks. These undetermined nest outcomes coincided with documented predation of eggs and chicks. Nest abandonments were likely influenced both by predator presence and/or possible depredation of one or both adults, and by limited prey fish availability.



Least tern nest with egg and newly hatched chick.

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### **Chick Banding**

In 2019, 44 chicks from at least 33 nests were banded at D Street Fill. Chicks were banded on the right leg with USGS metal bands individually numbered 2421-50430 through -50473.

### **Fledging Success and Seasonal Production**

In 2019, only 12 chicks are estimated to have reached fledging age and to have survived to fledge from the colony. Productivity was thus 0.11 fledglings per nest, 0.17 to 0.22 per pair. Although low, this number of fledglings was higher than that of 2012 when fledgling success was severely limited by predation and mortality to only nine fledglings (Patton 2012), and the fledgling per pair ratio was higher than that of last year (Patton 2018).

Figure 4 depicts daily numbers of hatchings and observed numbers of fledglings. The temporal distribution of hatching reflected the bimodal waves of nest initiation common some seasons (Massey and Atwood 1981). The early pulse of nesting had corresponding hatching of 45 percent of the chicks from 1 to 25 June, and the later pulse of nesting resulted in 55 percent of the chicks hatching from 6 to 20 July. This pattern in hatching numbers is in turn reflected in the numbers of fledglings three weeks later. However, the contrast between the two curves is notable, with daily numbers of observed fledglings reduced from earlier hatching numbers due to mortality and predation limiting the number of chicks reaching fledging age. Fledglings generally remain at the colony site for two weeks after first flying, as reflected in the number of observed fledglings peaking later than three weeks after the peak of hatching. Fledgling numbers dropped as the young gained flight experience and dispersed from the colony with the adults. The late season variations in day-to-day observed numbers of fledglings indicated dispersal to foraging and roosting areas and return visits to the colony site.

Chick recovery for band recapture and growth measurement data was complicated at times by vegetative cover conditions, weather fluctuations, and predator presence. Fledgling survival estimates were complicated by fledgling mobility, the inability to collect recapture data to identify individuals, their tendency to shift to roost and forage along the shoreline of the bay, and possibly by the arrival of fledglings from other colonies. However, the consistency of twice-weekly counts of numbers of chicks observed, recaptures, and fledglings, with the corresponding observations of predator presence, depredation, and recovery of carcasses, supports the accuracy of this season's



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fledgling estimate.

### Mortality

Forty-three percent of nests (45 nests) with 50 eggs were abandoned after one to 29 days of incubation (Table 2). Two additional nests with three eggs failed to hatch and were abandoned after prolonged incubation of 48 to 59 days. Eggs of two additional two-egg clutches failed to hatch and were abandoned after the other in each clutch hatched. Chick mortality was higher than usual this season with 16 chicks found dead of undetermined causes (27 percent of those hatched).

	Hatched	Abandoned Pre-term	Abandoned Post-term (Failed to Hatch)	Uncertain Outcome	Predation	Non- predation Mortality
Nests	45	45	4	9	4	
Eggs	59	50	5	11	4	
Chicks					1	16
Fledglings					1	0
Adults					0-2	0

The majority of chick mortality and nest abandonment occurred through July when depredation and daily disturbances to the colony by predators were documented. Some nest abandonment and chick mortality were possibly related to depredation of one or both adults. The high number of chick deaths also coincided with high mortality rates reported at other colonies (M. Post, B. Bonesteel, pers. comm.), and with examples of delayed chick growth (R.P., unpubl. data). Such mortality may be related to localized decreases in prey fish availability during this critical period of the season, possibly due to shifting currents or sea surface temperatures. However, without regular sampling of the appropriate size fish, such conclusions as to fluctuations in prey availability are only speculative.

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Two least tern chicks under shelter of a ceramic tile.

### Predation

Four nests with four eggs were documented to have been depredated this season (Tables 1 and 2). Northern harriers (*Circus cyaneus*) were suspected to be responsible. Additional previously abandoned eggs also appeared to have been scavenged by harriers. The outcomes of nine other nests with 11 eggs were uncertain, but lack of evidence of hatching or chick presence indicated probable depredation. The presence of well-lined nest scrapes without eggs also raised the possibility of eggs having been depredated before monitors had documented the nests.

The carcass of one chick was found being depredated by ants. The depredated remains of one fledgling suggested peregrine falcon (*Falco peregrinus*) as responsible. A peregrine was observed leaving the site with prey that appeared to be an adult least tern, but the monitor could not rule out the possibility that it could have been a small shorebird instead. Scattered feathers of another adult least tern found on site suggested possible raptor predation. Additional chicks were suspected of being taken by each of these species.

No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that others were likely preyed on. The disappearance of up to 29 chicks coincided with documented depredation and/or daily disturbances to the colony by northern harrier and gull-billed tern (*Gelochelidon nilotica*), and visits by Cooper's

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hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), peregrine falcon, and American crow (*Corvus brachyrhynchos*). Other potential predator species observed in the area included ant species, great blue heron (*Ardea herodias*), gull species (*Larus* spp.), common raven (*Corvus corax*), European starling (*Sturnus vulgaris*), western meadowlark (*Sturnella neglecta*), opossum (*Didelphis virginiana*), rats (*Rattus* spp.), California ground squirrel (*Spermophilus beecheyi*), coyote (*Canis latrans*), feral cat (*Felis catus*), and striped skunk (*Mephitis mephitis*).

	Ants sp.	Northern Harrier	Peregrine Falcon	Raptor Species
Nests		4		
Eggs		4		
Chicks	1			
Fledglings				1
Adults			0-1	0-1

### Snowy Plovers and Other Species

Sightings of western snowy plovers at and adjacent to D Street Fill have declined in recent years and none were documented this year. Site suitability for nesting by snowy plovers had decreased due to encroaching saltmarsh vegetation and its increasing density where mudflats used to exist adjacent to the southwest and northwest fill so that plovers and young no longer have access between foraging and nesting habitats. The last documented nesting attempt by snowy plovers at D Street Fill was in 2000. The excavation of the northwest edge of the site to an unvegetated gentler slope adjacent to mudflats in 2011 increased the potential for plover use of the site and for nesting to be re-established. However, saltmarsh vegetation has filled in along this shoreline as well, and the expanding and increasingly dense Bermuda grass in the western portion of the site reduces the site's attractiveness to plovers.

No attempt was made to document all nests or all species nesting at D Street Fill. However, nests encountered during monitoring for terns and snowy plovers were marked, mapped, and contents recorded (Figure 2). Killdeer (*Charadrius vociferus*) established at least 13 nests within the interior and on the northwest and west slopes of the site. Mourning doves (*Zenaidura macroura*) established one nest along the western edge of the site. Horned larks (*Eremophila*



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*alpestris*) appeared to nest throughout the site, and at least 14 nests were found within the tern colony. Belding's savannah sparrows (*Passerculus sandwichensis beldingi*) and western meadowlarks were present and singing throughout the season, indicating probable nesting of both species adjacent to the prepared colony site. Other sensitive species observed on-site this season included San Diego black-tailed jackrabbit (*Lepus californicus bennettii*), and two low-growing coastal strand plant species considered endangered by the California Native Plant Society (CNPS): coast wooly-heads (*Nemacaulis denudata*) and Nuttall's lotus (*Lotus nuttallianus* = *Acmispon prostratus*). Seven pairs of osprey (*Pandion haliaetus*) established nests on platforms, lights, and utility poles to the north of the site at the adjacent National City Marine Terminal.



Two least tern chicks hiding at the base of vegetation.

## MANAGEMENT RECOMMENDATIONS

Site preparation, monitoring, and predator management efforts should continue as implemented in 1997 and modified each season since. Marking of permanent grid intersections with rebar or PVC would reduce site preparation time and cost. The use of a portable tower blind may enhance chick counting and recapture efforts. The use of color bands to identify least tern

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chicks by natal colony would enhance fledgling estimates and provide long-term data and insight on colony dynamics and recruitment.

Mechanical scraping of the site should continue and be planned for mid-February each season to precede potential snowy plover nest-site selection, with additional vegetation control done by early April if no plovers are nesting. If plovers are not present on-site in February, mechanical scraping should be delayed until late March to ensure clearing of seedlings following any late rains. Efforts should be made to secure appropriate staff, equipment, and budget prior to each season to ensure adequate site preparation. This would include experienced operator(s) communicating with monitors, agency, and Wildlife Services personnel, and access to a road grader or a four-wheel-drive tractor with Gannon box or equivalent box scraper. Additional mechanical scraping to reduce vegetation in the off-season has been recommended previously and should continue to be considered as an option.

A focused effort of multiple herbicide treatments in the off-season is needed to reduce the increasing cover of Bermuda grass in the western portion of the site. Continued monitoring and herbicide treatment of perennial pepperweed will be necessary, although the dramatic reduction this season and last suggests that eradication may be near. Additional herbicide treatment and physical clearing of vegetation in the eastern portion of the site will be needed once pepperweed eradication has been confirmed. The possibility of herbicide application should continue to be considered, particularly in light of the shift in abundance and distribution of mustard throughout the site in recent years. Non-native and peripheral scrub vegetation should continue to be removed to reduce encroachment of these species on the site as well as to reduce potential predator perches. Efforts in recent years have been successful in reducing non-native invasive plant species, including iceplant, mustard, sea-rocket (*Cakile maritima*), cocklebur (*Xanthium spinosum*), pampas grass (*Cortaderia* sp.), garland chrysanthemum, sweet fennel (*Foeniculum vulgare*), Russian thistle (*Salsola tragus*), Brazilian pepper tree (*Schinus terebinthifolius*), tamarisk and *Acacia* sp.. Coordination is needed in removal of any piles of vegetation or soil generated. Previous seasons, piles of manually removed iceplant had been deposited and left within the nesting site, creating small hummocks used by raptors and corvids, and creating the potential for the site-clearing equipment to spread the iceplant into the nesting area.

If snowy plover nesting is to be re-established, the access points between upland nesting

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habitat and tidal flat foraging habitat would need to be maintained and expanded. Encroachment of vegetation along the fill periphery and increasing density of saltmarsh vegetation between the fill and western tidal mudflats appears to have formed enough of a barrier to plover chicks that site-selecting adults have abandoned D Street as a nesting site. Non-vegetated pathways at least three to eight meters wide would need to be cleared through the saltmarsh to make the site again suitable for use by snowy plovers. However, current regulatory processes appear to not recognize the importance of non-vegetated tidal mudflat habitat for shorebirds and to prevent maintenance or creation of such pathways without mitigation for saltmarsh.

The signs installed in past seasons and replaced in recent years may have reduced human intrusion into nesting areas. Interpretive/informational signs or kiosks at entrances or adjacent focal points of public activity, recreation, viewing, or access would lessen the need for confrontation or law enforcement, lessen the likelihood of impacts such as colony disturbance, chick and egg losses, and increase public awareness, cooperation, understanding, and support. To limit use by perching raptors, all signs should be topped with anti-perching hardware such as Nixalite.

The level of predation each season, despite the prompt response by USDA WS staff to perceived predation problems or threats, illustrates the difficulty in management of endangered species on the periphery of urbanized areas. The difficulty in dealing with evasive predators justifies continued reliance on the experienced staff of USDA WS for predator management. In light of the continued decline in the local snowy plover population, proactive monitoring of potential predator species should begin at least by 1 March if not 1 February, and precautionary trapping efforts maintained at all sites throughout the season. The administrative difficulties experienced by USDA WS personnel in recent seasons in attempting to obtain permission to live-trap and relocate harriers and peregrines need to be addressed and protocol established before each season. Likewise, the ability to hold trapped raptors until late in the season to limit continued impacts if/when they return following release should be reinstated. The recent requirements to release raptors within 72 hours of trapping has been shown to have limited effectiveness in reducing predation and limited success in improving raptor health or survivability (USDA WS data; B. Shemai USMC data).

The populations of scavengers and potential predators such as corvids and gulls have increased dramatically in Southern California in recent years. An aggressive policy of corvid



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removal and deterrence to gull nesting should be incorporated at each site. Daily disturbance to gulls loitering at sites may be necessary, and if that is not sufficient, removal of nesting individuals and their eggs may be warranted. Control of other mammalian and avian predators should continue, and permits, personnel, and equipment secured for at least early March through September.

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## **Appendix A**

### **TABLES**

## Appendix A

Table 1. Least tern nest and egg data, D Street Fill, 2019.

	<u>nests</u> *	<u>eggs</u>
Total	104	129
1 egg clutch	79	79
2 eggs	25	150
Known Hatch		
Total	45*	59
1 egg	28	28
2 eggs	17*	31
Uncertain Outcome		
Total	9*	11
1 egg	6	6
2 eggs	3*	5
Failed to Hatch		
Total	53*	59
1 egg	45	45
2 eggs	8*	14
Depredated		
Total	4	4
1 egg	4	4
Abandoned (pre-term)		
Total	45	50
1 egg	40	40
2 eggs	5	10
Abandoned post-term/nonviable		
Total	4*	5
1 egg	1	1
2 eggs	3*	4

\* inclusion in more than one category: one egg each of two two-egg clutches was abandoned/failed to hatch after the other hatched; one egg of a two-egg clutch hatched after the outcome of the other egg was uncertain.

## Appendix A

Table 2. Documented causes of least tern mortality, D Street Fill, 2019.

Cause	Least Tern Age Class	<u>Total Losses</u> D Street Fill
Total:		
	egg	59
	chick	17
	fledgling	1
	adult	0-2*
Predation*:		
	Ant species	
	chick	1
	Northern Harrier	
	egg	4
	Peregrine Falcon	
	suspected adult	0-1
	Raptor species	
	fledgling	1
	suspected adult	0-1
Non-predation Mortality:		
	Abandonment (pre-term)	
	egg	50
	Unknown	
	Abandoned post-term/nonviable	
	egg	5
	No visible trauma	
	chick	16

\*daily-observed chick numbers and recapture data indicate additional losses of up to 29 chicks, species suspected as responsible for losses include northern harrier and gull-billed tern, with possible losses also to Cooper's hawk, red-tailed hawk, peregrine falcon, American kestrel, and American crow. 16 chicks were found with no obvious causes of death. One additional chick was found being depredated by ants. The remains of one fledgling suggested peregrine falcon as responsible. A peregrine falcon was observed carrying prey that appeared to be an adult least tern. Feathers of one other adult suggested possible predation by a raptor.

## **Appendix A**

### **FIGURES**



## Appendix A

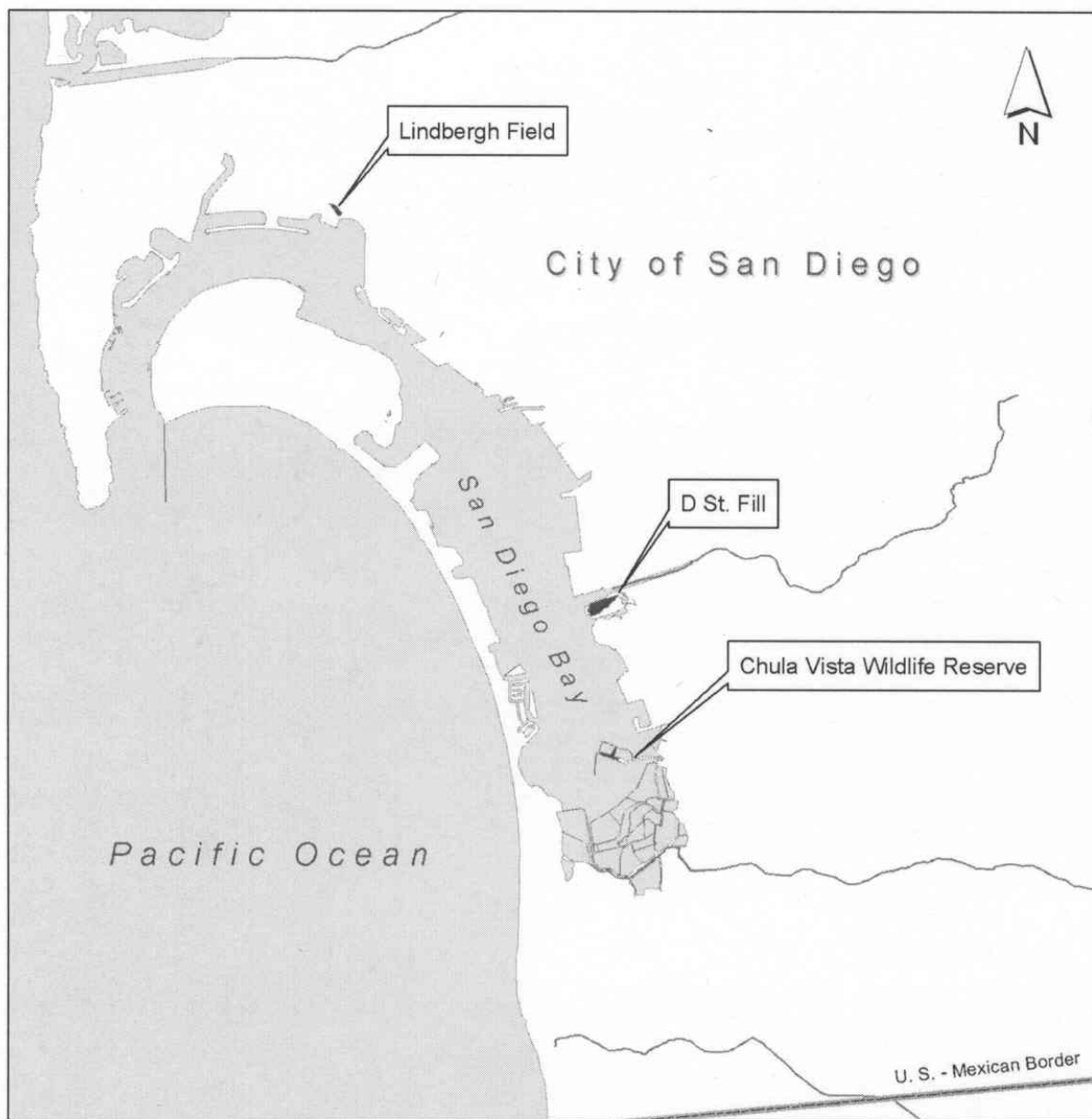


Figure 1. San Diego Unified Port District and San Diego County Regional Airport Authority least tern nesting sites, 2019.

## Appendix A

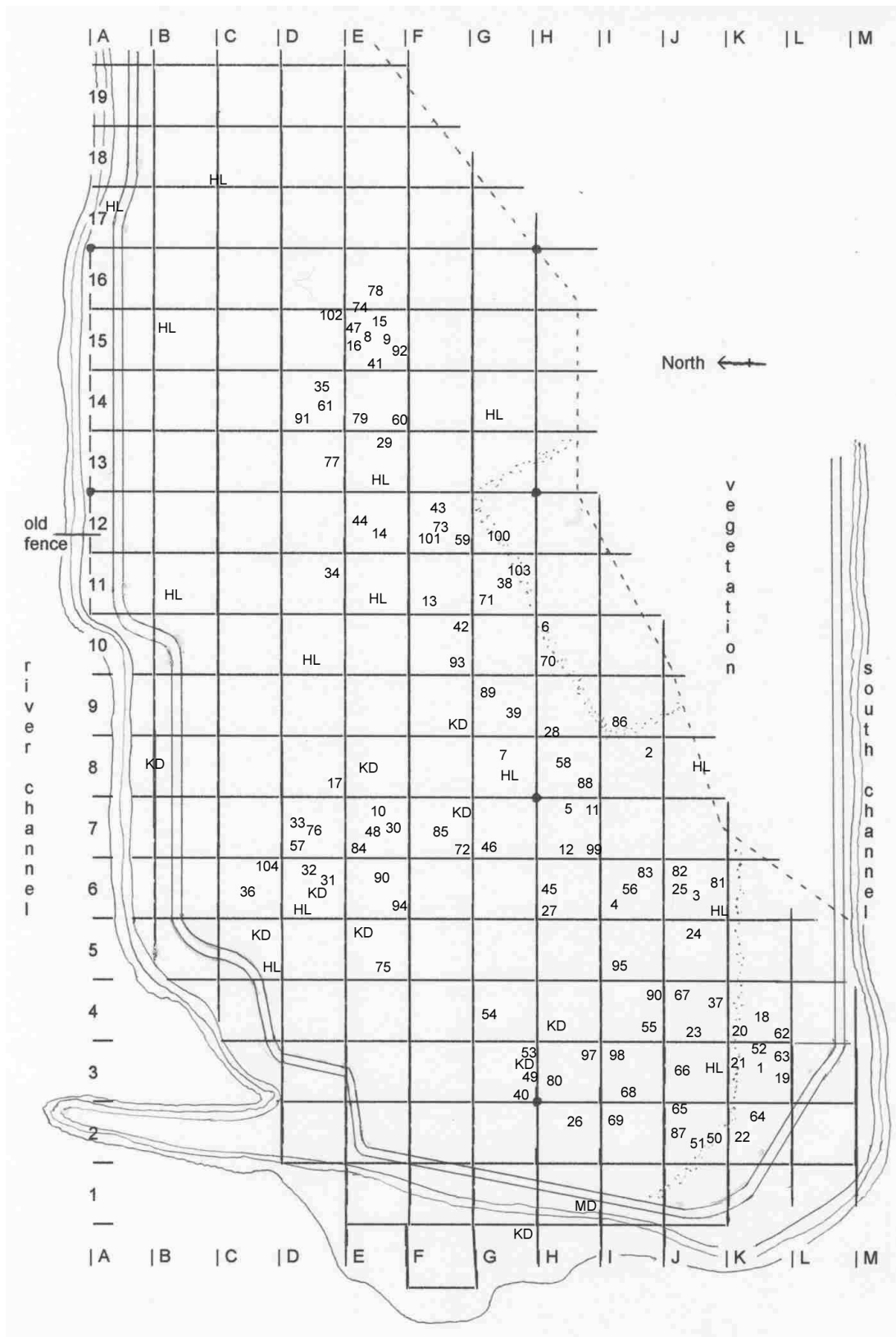
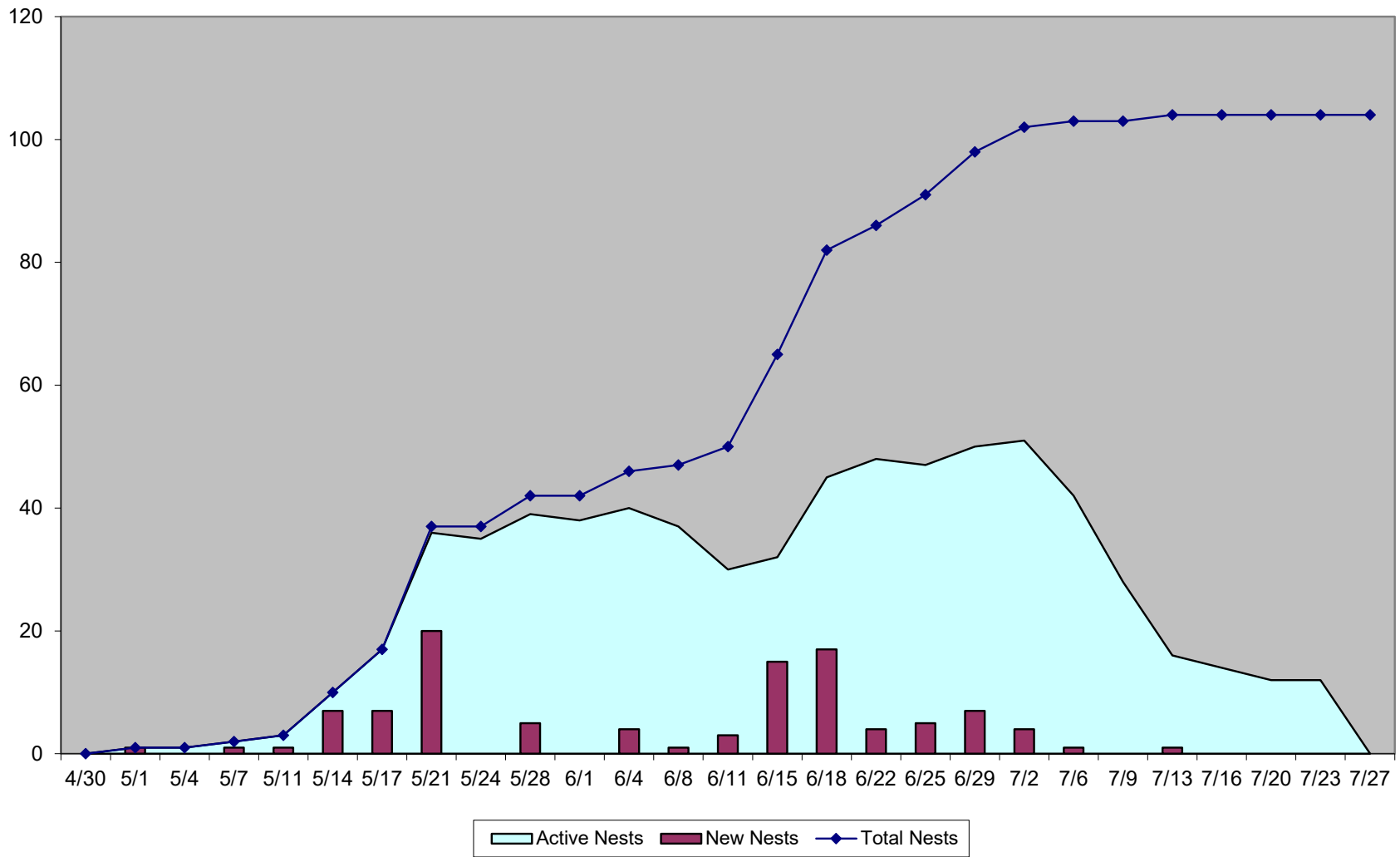


Figure 2. Least tern nest distribution, D Street Fill, 2019.

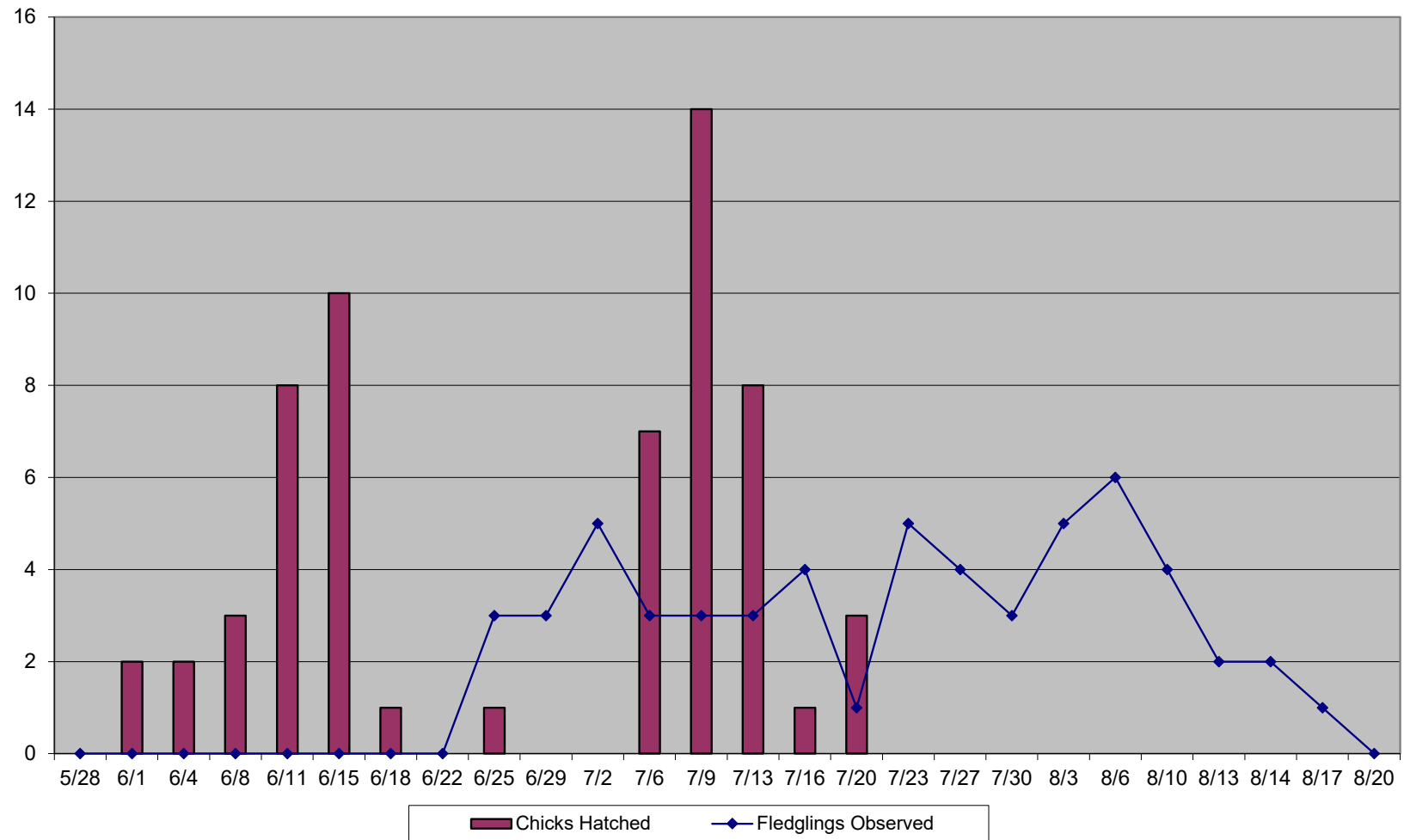
## Appendix A

Figure 3. Least tern breeding chronology, D Street Fill, 2019.



## Appendix A

Figure 4. Least tern productivity chronology, D Street Fill, 2019.





## **Appendix A**

### **APPENDICES**

## Appendix A

Appendix A. Summary of documented California least tern breeding, D Street Fill and Sweetwater Marsh.

Year	Estimated Number of Breeding Pairs		Number of Nests	Estimated Number of Fledglings	
	Minimum	Maximum		Minimum	Maximum
1973	4	20	4+	11	11
1974	36	36	36	0	0
1975	10	10	10	0	0
1976	24	24	33	0	0
1977	40	40	40	20	25
1978	47	47	47	15	15
1979	24	28	28	15	20
1980	12	15	15	0	0
1981	0	0	0	0	0
1982	1	1	1	2	2
1983	1	1	1	0	0
1984	16	29	41	15	15
1985	41	47	47	0	0
1986	5	6	10	7	7
1987	28	28	28	10	10
1988	19	19	19	0	0
1989	2	2	2	0	0
1990	0	0	0	0	0
1991	45	47	59	38	42
1992	135	135	135	14	24
1993	23	23	32	1	1
1994	8	8	9	3	3
1995	26	26	27	22	28
1996	25	25	28	15	35
1997	38	38	41	0	0
1998	5	7	7	8	10
1999	30	30	36	2	2
2000	28	31	34	27	30
2001	30	31	32	12	17
2002	23	23	24	8	8
2003	62	85	91	12	19
2004	77	94	111	4	11
2005	77	97	101	9	17
2006	88	94	100	18	29
2007	100	115	130	25	28
2008	133	135	148	17	24
2009	129	129	132	19	29
2010	117	117	119	15	27
2011	100	113	116	25	32
2012	78	93	114	9	9
2013	96	113	144	23	32
2014	125	129	148	28	36
2015	108	111	123	21	34
2016	91	106	118	21	22
2017	93	112	127	25	27
2018	94	100	109	12	15
2019	55	72	104	12 <sup>2</sup>	12

## Appendix A

Appendix B. Sample datasheet.

## Appendix A

Location:				Date:		Job:		Observer(s):					
Time start:				Time stop:				On site:					
Est/Measured		Time:		Temp:		Wind Spd/Dir:		Cloud cvr (%):		Precip. (Y/N):		Tide: H L In Out	
ADULTS		Total:		NESTS		Total:		New:					
CHICKS		Observed:		Est max:		New Chicks:		Fledglings Obs:		Est max:			
Mortality (Y/N):		Adult:		Fledgling:		Chick:		Egg:		Nest:			
Predation (Y/N):		Adult:		Fledgling:		Chick:		Egg:		Nest:			
Take (Y/N):		Adult:		Fledgling:		Chick:		Egg:		Nest:			
Col Live (Y/N):		Adult:		Fledgling:		Chick:		Egg:		Other:			
Col Dead (Y/N):		Adult:		Fledgling:		Chick:		Egg:		Fish:		Other:	

Nest No.	Grid No.	New/ Incub.	Status	Nest No.	Grid No.	New/ Incub.	Status	Nest No.	Grid No.	New/ Incub.	Status
1				31				61			
2				32				62			
3				33				63			
4				34				64			
5				35				65			
6				36				66			
7				37				67			
8				38				68			
9				39				69			
10				40				70			
11				41				71			
12				42				72			
13				43				73			
14				44				74			
15				45				75			
16				46				76			
17				47				77			
18				48				78			
19				49				79			
20				50				80			
21				51				81			
22				52				82			
23				53				83			
24				54				84			
25				55				85			
26				56				86			
27				57				87			
28				58				88			
29				59				89			
30				60				90			

Egg/Nest Codes: E=egg, CH=chick, NC=New Chick, H=hatched and no longer present, PH=probable hatch, FH=failed to hatch, A=abandoned  
P=Preyed on, DAM=damaged, F=flooded, B=buried, Col=collected, M=moved, Unk=unknown. Circle Nest Number if new or if status has changed.



## Appendix A

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## Appendix A

Appendix C. Summary of the status of the California least tern and western snowy plover at properties of the San Diego Unified Port District and San Diego County Regional Airport Authority in 2019.

Potential nesting sites of the endangered California least tern and western snowy plover were prepared prior to mid-April at Lindbergh Field - San Diego International Airport, D Street Fill, and Chula Vista Wildlife Reserve; and monitored from mid-March through August 2019, by Robert Patton, Elizabeth Copper, Jennifer Jackson, Lea Squires, Thomas Myers, and Matt Sadowski. Mayra Garcia and staff of SDIA Environmental Affairs assisted at Lindbergh Field, and Brian Collins and Edward Owens of Sweetwater Marsh NWR assisted at D Street Fill.

Least terns were observed from 10 April through 17 August 2019 at and adjacent to properties and facilities of the San Diego Unified Port District. At the three Port District and San Diego County Regional Airport Authority sites, 189 nests were established from 1 May to 13 July. At least 20 to 22 young are estimated to have fledged from the sites, with productivity limited primarily by predation but also by nest abandonment and by unexplained mortality suspected to be related to locally reduced prey availability. Average clutch size at each site was among the lowest recorded.

### **San Diego International Airport – Lindbergh Field & Former Naval Training Center**

Prior to the terns' arrival, San Diego County Regional Airport Authority personnel and contractors applied herbicide, manually removed vegetation, and repaired plastic mesh chick barriers and covers over stormdrains. Zoological Society of San Diego subcontract personnel established a 30 m grid system in the primary nesting oval (03-S) and assisted in repairs to chick barriers and manual removal of vegetation. Above average winter rainfall and continuing precipitation into May resulted in extensive weed growth and necessitated additional manual thinning. Monitoring was conducted April to mid-August one to three days per week. Predator management was conducted by personnel from USDA Wildlife Services.

Least terns were first observed foraging over the bay and in flight over the southeast end of Lindbergh Field on 17 April 2019. They were observed each visit after that through 15 August. Breeding pair and nest numbers decreased from those of 2016 and 2017 and remained significantly lower than those of 2014 and earlier, although they were higher than those of 2015 and nest numbers were the same as in 2018. At least 19 nests were initiated by 11 to 13 estimated pairs between 9 May and 3 July. Average clutch size was 1.42 eggs per nest. The maximum number of concurrently active nests and broods was 11 on 21 June (8 nests, 3 broods). Six nests appeared to be renesting of pairs that had lost their initial clutches. All nests were established in the main nesting oval 03-S except for three in oval 01-S.

At least 10 chicks from 12 nests hatched successfully. It is estimated that six chicks reached fledgling age and survived to fledge from the site. Three nests with four eggs were abandoned pre-term, and in two clutches one egg each failed to hatch and was abandoned after the other egg in the clutch hatched successfully. Seven eggs from five nests were depredated, with American crows suspected, although common ravens or western gulls could have possibly been responsible. The outcome of one nest with two eggs was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation either shortly before or shortly after hatching.

Three adults were lost to being struck by aircraft. One chick was depredated by ants and another was observed being taken by an American kestrel. Four additional chicks are suspected to

## Appendix A

have been depredated, with Cooper's hawk, red-tailed hawk, or American kestrel suspected as responsible; but corvids, gulls, and ants were also observed in the area during the period of losses. Other potential predators observed in the area included rats, great blue heron, and European starling.

### **D Street Fill & Sweetwater Marsh NWR**

In preparation for the 2019 nesting season at D Street Fill, San Diego Unified Port District and U.S. Fish and Wildlife Service staff and contractors applied herbicide to invasive plant species; and in late March, Port staff completed mechanical grading of the site to reduce vegetation and enhance it for use by least terns and snowy plovers. Biological monitors under contract with the Port manually removed non-native invasive plants from the site, pruned back vegetation to reduce cover and potential raptor perches, surveyed the grid system, and placed decoys and ceramic tiles for chick shelters. Predator management was conducted by personnel of US Department of Agriculture, Wildlife Services, and is to be reported separately. Monitoring was conducted from mid-March through August one to three days per week.

Least terns were first observed at the D Street Fill on 10 April 2019. They were observed again on 24 April and each visit after that through 17 August. At least 104 nests were initiated by 55 to 72 estimated pairs between 1 May and 13 July. Average clutch size was 1.24 eggs per nest. The maximum number of concurrently active nests and broods was 51 nests and four broods of chicks on 2 July. At least 32 nests were suspected to have resulted from renesting by pairs that lost earlier clutches.

At least 59 chicks from 45 nests hatched successfully. It is estimated that only 12 chicks reached fledgling age and survived to fledge from the site. Forty-five nests with 50 eggs were abandoned pre-term, two nests with three eggs were non-viable and abandoned after prolonged incubation, and two eggs from two nests failed to hatch and were abandoned after the other egg in each clutch hatched successfully. At least four nests with four eggs were depredated with northern harrier suspected of being responsible. Additional abandoned eggs appeared to have been scavenged by harrier. The outcomes of nine nests with 11 eggs were uncertain, but lack of evidence of hatching or chick presence indicates probable depredation.

Sixteen chicks were found dead with no obvious causes of mortality. One chick was depredated by ants and the remains of one depredated fledgling suggested peregrine falcon as responsible. A peregrine was observed leaving the site with prey that appeared to be an adult least tern, but the monitor could not rule out the possibility that it could have been a peep instead. Scattered feathers of another adult least tern suggested possible raptor predation. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that others were likely preyed on. The disappearance of up to 29 chicks coincided with documented depredation and/or daily disturbances to the colony by northern harrier and gull-billed tern, and visits by Cooper's hawk, red-tailed hawk, peregrine falcon, American kestrel, and American crow. Other potential predator species observed in the area included ant species, great blue heron, gulls, common raven, European starling, western meadowlark, opossum, rats, California ground squirrel, coyote, feral cat, and striped skunk.

Sightings of western snowy plovers at and adjacent to D Street Fill have declined in recent years and none were documented this year. Killdeer, horned lark, and mourning dove nested on-site this season, and seven pairs of osprey established nests on platforms, lights, and utility poles at the adjacent National City Marine Terminal.

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### Chula Vista Wildlife Reserve

Prior to mid-April 2019, Zoological Society of San Diego subcontract personnel coordinated herbicide application, mechanical scraping of the site, and weeded invasive non-native vegetation, surveyed the grid system and placed ceramic tiles for chick shelters, placed decoys, and repaired or replaced signs. Monitoring was conducted from mid-March through mid-August one to three days per week. Predator management was conducted by USDA Wildlife Services staff.

Two least terns were first observed at the Chula Vista Wildlife Reserve on 10 April. Terns were next seen on 17 April, 24 April, then on each visit through 13 July, and then one to two observed on 20 and 22 July. At least 66 nests were initiated by 31 to 45 estimated pairs between 7 May and 6 July with distribution throughout but concentrated in two clusters in the southwestern portion of the site and in the north-central site. Average clutch size was 1.38 eggs per nest. The maximum number of concurrently active nests and broods was 29 nests and two broods of chicks on 2 July. At least 21 nests were suspected to have resulted from renesting by pairs that lost earlier clutches.

At least 38 chicks from 26 nests hatched successfully. It is estimated that only two to four chicks reached fledgling age and survived to fledge from the site this season. Thirty nests with 41 eggs were abandoned pre-term. One egg was depredated by unknown species, one was found damaged with thin and incomplete eggshell, and one appeared to have been stepped on by a trespassing boater. The outcomes of seven nests with nine eggs were uncertain, but lack of evidence of hatching or chick presence indicates probable depredation.

The carcasses of four chicks were found dead of undetermined causes. Feathers of three depredated adults were found in owl pellets. The feather pile of another adult suggested predation by peregrine falcon. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that others were likely preyed on. Most chicks were not seen beyond the first few days of hatching. The disappearance of up to 30 chicks coincided with repeated hunting of the site by northern harrier, peregrine falcons, gull-billed terns, large owl species, and visits by great blue heron, red-tailed hawk, and American crow. Other potential predator species observed in the area included great egret, osprey, American kestrel, gulls, common raven, opossum, feral cat, striped skunk, and rats.

Snowy plovers were noted at CVWR on each of two dates this season, including a pair in the southwest site on 27 April and a male with a pre-nest scrape on 4 May. Other species nesting at the site this season included one pair of osprey on the platform to the east of the prepared least tern site and another pair on the jetty off the southwest corner of the site, each successfully fledging young. A pair of Canada geese appeared to incubate a nest on the northwest central dike island but eggs were not confirmed. Mallard and/or gadwall nested on the southwest jetty. Killdeer and horned lark nested within the prepared site and Belding's savannah sparrows nested along the periphery and in adjacent saltmarsh. Forster's terns established at least 103 to 118 nests with most on saltmarsh vegetation and/or eelgrass wrack on the southwest jetty, as well as some on the northwest central dike island and on the northeast dike.



## Appendix A

Appendix C. Summary of California least tern breeding at San Diego Unified Port District and San Diego County Regional Airport Authority sites, 2019.

	SDIA-LF	D St Fill	CVWR
Date terns first observed	4/17	4/10	4/10
Date terns last seen	8/15	8/17	7/22
Date of first nest	5/9	5/1	5/7
Date last nest found	7/3	7/13	7/6
Date last nest established	7/3	7/13	7/6
Date of first hatch	6/7	6/1	6/4
Date of last hatch	7/16	7/20	7/20
Date of first fledgling	6/29	6/25	6/25
Estimated number of pairs	11-13	55-72	31-45
Total number of nests	19	104	66
Total number of eggs	27	129	91
Clutch size:			
1 egg	11	79	42
2 egg	8	25	23
3 egg	0	0	1
4 egg	0	0	0
unknown (min. 1 egg)	0	0	0
Average clutch size	1.42	1.24	1.38
No. of nests hatching young*	10	45	26
Total number of eggs hatched	12	59	38
Estimated number of fledglings	6	12	2-4
Number of chicks banded	12	44	26
Number of adults banded	0	0	0
Uncertain outcome			
Nests*	1	9	7
Eggs	2	11	9
Documented Mortality			
Preyed upon			
Nests*	5	4	1
Eggs**	7	4	1
Chicks	2	1	0
Fledglings	0	1	0
Adults	0	0-2	4
Human disturbance			
Nests*	0	0	1
Eggs	0	0	1
Chicks	0	0	0
Fledglings	0	0	0
Adults	3	0	0
Other causes			
Nests*			
Abandoned (pre-term)	3	45	30
Failed to hatch (incubated to term)	2	4	0
Died hatching	0	0	0
Damaged (eggshell thinning)	0	0	1
Flooded	0	0	0
Eggs			
Abandoned (pre-term)	4	50	41
Failed to hatch (incubated to term)	2	5	0
Died hatching	0	0	0
Damaged (eggshell thinning)	0	0	1
Flooded	0	0	0
Chicks	0	16	4
Fledglings	0	0	0
Adults	0	0	0

\* may be included in more than one category

\*\* not including previously abandoned eggs that were depredated/scavenged

## Appendix A

Appendix C-1. Summary of California least tern breeding at San Diego International Airport - Lindbergh Field, 2005-2019.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Date terns first observed	4/21	4/19	4/23	4/22	4/21	4/20	4/19	4/16	4/22	4/15	4/15	4/13	4/16	4/19	4/17
Date terns last seen	8/3 (9/2 bay)	8/30	8/22	8/15	8/11	8/10	8/3	8/7	8/19	7/23	7/14	7/26	(8/19 bay)	7/19	8/15
Date of first nest	5/4	5/15	5/15	5/16	5/10	5/4	5/10	5/8	5/13	5/6	5/9	5/4	5/5	5/8	5/9
Date last nest found	7/5	8/1	7/11	7/18	8/11	7/20	7/19	7/3	8/6	6/17	6/6	6/20	6/8	6/5	7/3
Date last nest established	7/5	7/18	7/11	7/18	7/2	7/2	6/24	7/3	7/16?	6/17	6/3	6/20	6/8	6/5	7/3
Date of first hatch	5/31	6/13	6/10	6/6	6/2	6/2	5/31	5/31	6/7	5/29	6/2	5/26	5/30	5/29	6/7
Date of last hatch	7/19	8/1	7/18	7/21	7/7	7/15	7/5	7/6	7/16	6/24	6/26	6/25	6/18	6/12	7/16
Date of first fledgling	6/20	7/8	7/2	6/30	6/22	6/22	6/21	6/21	7/2	6/17	6/23	6/14	6/18	6/22	6/29
Estimated number of breeding pairs	121-150	114	120-127	122-124	136	110	66-76	96-124	90-95	90-99	9-10	31	20-21	16	11-13
Total number of nests	157	131	135	139	145	116	78	130	114	100	18	37	24	19	19
Total number of eggs	278	207	238	238	268	211	141	197	159-166	180	27	61	45	34	27
Clutch Size															
1 egg	39	55	33	43	26	23	15	63	64-71	20	9	13	3	4	11
2 egg	115	76	101	94	116	91	126	67	42-49	80	9	24	21	15	8
3 egg	3	0	1	1	2	2	0	0	0	0	0	0	0	0	0
4 egg	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0
Average clutch size	1.77	1.53	1.76	1.71	1.85	1.82	1.81	1.54	1.42-1.46	1.80	1.50	1.65	1.88	1.79	1.42
No. of nests hatching young*	128	81	93	112	103	88	66	84	80	65	8	25	18	13	10
Total number of eggs hatched	222	124	156	193	183	161	118	136	109	113	15	38	27	22	12
Estimated number of fledglings	45-85	54-65	34-42	115-128	36-38	29-38	11-15	36	34	34-46	8-9	10-17	13-17	13-14	6
Number of chicks banded	183	120	116	167	138	144	93	110	85	99	15	32	26	22	12
Number of adults banded	0	0	0	12	3	12	7	0	1	2	0	0	0	0	0
Uncertain outcome															
Nests*	2	4	3	3	9	3	1	9	3	10	0	2	1	1	1
Eggs	4	7	5	3	16	4	2	9	3-7	14	0	2	1	2	2
Documented Mortality															
Preyed upon:															
Eggs**	3	56	23	13	11	11	0	6	5	8	5	9	8	2	7
Chicks	15	8	15	2	0	5	23	3	8	9-10	1-4	4-5	0	1	2
Fledglings	11	13-14	3-4	1	3	3	7	0	1	3-4	0	1	0	0	0
Adults	1	4-8	1-2	2	2	3	1	1	6	2	1	0	1-2	1	0
Other than preyed upon:															
Eggs															
Human Damaged	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Failed to hatch (incubated to term)	15	8	13	19	12	10	9	2	4	18	2	5	7	1	2
Died hatching	0	0	1	0	0	1	0	1	0	3	0	0	0	0	0
Abandoned (pre-term)	34	12	40	9	46	23	12	42	38	24	3	7	2	7	4
Flooded	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chicks	21	1	12	19	46	36	10	47	13	18	0	5-6	1	5	0
Fledglings	10	1	3	5	2	6	0	3	4	1	1	1	0	0	0
Adults	1	0	1	0	0	2	1	1	0	0	0	0	0	0	0
Nests															
Human damaged*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Preyed upon*	2	37	17	11	7	8	0	5	7	4	7	5	1	5	
Failed to hatch*	15	8	13	16	11	9	8	2	4	15	1	5	7	1	2
Abandoned (pre-term)*	25	10	26	8	31	18	9	35	27	17	3	5	1	4	3
Flooded	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

\* included in more than one category

\*\* not including previously abandoned eggs that were depredated/scavenged

## Appendix A

Appendix C-2. Summary of California least tern breeding at D Street Fill, 2005-2019.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Date terns first observed	4/19	4/18	4/22	4/22	4/21	4/16	4/19	4/12	4/16	4/15	4/17	4/11	4/11	4/17	4/10
Date terns last seen	8/1	8/14	8/20	8/13	7/28	7/30	8/15	8/6	8/13	8/12	7/25	7/26	7/29	7/23	8/17
Date of first nest	5/10	5/16	5/15	5/10	5/8	5/4	5/6	5/5	5/7	5/6	5/5	4/29	4/28	5/8	5/1
Date last nest found	7/8	7/11	8/20	7/18	8/11	6/29	7/2	7/10	7/23	8/15	7/7	7/12	7/8	7/10	7/13
Date last nest established	7/8	7/11	7/17	7/16	6/27	6/29	7/2	7/10	7/22	7/8	7/3	7/11	7/3	7/3	7/13
Date of first hatch	6/4	6/9	6/8	6/3	5/29	5/25	5/27	5/26	6/1	5/27	6/2	5/27	5/19	5/29	6/1
Date of last hatch	6/28	7/25	7/24	7/22	7/14	7/2	7/8	7/3	7/19	7/12	7/9	7/5	7/1	6/26	7/20
Date of first fledgling	6/28	7/4	6/30	6/24	6/19	6/15	6/21	6/22	6/25	6/17	6/23	6/17	6/9	6/22	6/25
Estimated number of breeding pairs	77-97	88-94	100-115	133-135	129	117	100-113	78-93	96-113	125-129	108-111	91-106	93-112	94-100	55-72
Total number of nests	101	100	130	148	132	119	116	114	144	148	123	118	127	109	104
Total number of eggs	161	140	214	262	229	227	217	162	215	260	224	196	210	198	129
Clutch Size															
1 egg	42	60	47	34	35	11	15	66	73	36	22	40	44	21	79
2 egg	58	40	82	114	97	108	101	48	71	112	101	78	83	87	25
3 egg	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Average clutch size	1.59	1.40	1.65	1.77	1.73	1.91	1.87	1.42	1.49	1.76	1.82	1.66	1.65	1.82	1.24
No. of nests hatching young*	79	74	91	124	110	83	97	47	114	126	99	89	96	85	45
Total number of eggs hatched	122	98	160	223	189	158	174	65	174	224	184	149	162	155	59
Estimated number of fledglings	9-17	18-29	25-28	17-24	19-29	15-27	25-32	9	23-32	28-36	21-34	21-22	25-27	12-15	12
Number of chicks banded	79	52	83	129	122	86	112	41	108	145	128	80	103	92	44
Number of adults banded	0	0	0	5	0	4	2	7	1	3	0	0	0	0	0
Uncertain outcome															
Nests*	3	5	5	6	11	27	2	16	5	2	4	5	2	2	9
Eggs	5	7	9	8	16	51	4	20	7	2	7	7	2	4	11
Documented Mortality															
Preyed upon:															
Eggs**	11	14	14	2	0	5	14	21	1	3	4	7	6	13	4
Chicks	8	2	9-12	11	8-11	14	4-7	6	4-8	4-7	7	4	4-5	3-5	1
Fledglings	1	1	4	0	1	1	1	0	3	1	2	1	6	4	1
Adults	1	1	2	0	5	1	3-4	0	0	7-11	4	5	0	0-1	0-2
Other than preyed upon:															
Eggs															
Human Damaged	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Failed to hatch (incubated to term)	7	6	3	9	8	5	6	4	3	8	5	6	10	8	5
Died hatching	0	0	0	0	2	0	3	0	3	0	0	0	7	4	0
Abandoned (pre-term)	16	16	28	20	14	8	16	52	27	23	24	27	23	14	50
Flooded	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chicks	17	8	7	12	12	28	40	16	54-58	59-62	31	58	33	46	16
Fledglings	1	0	5	0	0	11	9	0	11	7	11	1	3	0	0
Adults	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Nests															
Human damaged*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Preyed upon*	7	10	11	2	0	3	9	14	1	3	2	5	6	10	4
Failed to hatch*	7	6	3	6	8	4	6	4	3	7	5	6	10	8	4
Abandoned (pre-term)*	12	13	24	16	11	5	11	40	22	16	19	21	18	12	45
Flooded	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

\* included in more than one category

\*\* not including previously abandoned eggs that were depredated/scavenged

## Appendix A

Appendix C-3. Summary of California least tern breeding at Chula Vista Wildlife Reserve, 2005-2019.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Date terns first observed	4/26	4/21	4/23	4/9	4/24	4/22	4/19	4/12	4/13	4/15	4/20	4/16	4/15	3/28	4/10
Date terns last seen	7/29	8/14	8/15	8/29	8/4	8/2	8/24	9/13	8/19	8/12	8/18	8/2	8/11	7/23	7/22
Date of first nest	5/17	5/30	5/15	5/16	5/12	5/11	5/13	5/12	5/13	5/10	5/10	5/9	5/9	5/12	5/7
Date last nest found	7/1	7/4	7/10	7/8	7/10	6/29	7/19	7/10	7/2	6/20	6/30	7/26	6/20	6/19	7/6
Date last nest established	7/1	7/4	7/3	7/8	7/10	6/29	7/16	7/10	7/2	6/20	6/30	7/12	6/20	6/19	7/6
Date of first hatch	6/10	6/20	6/8	6/6	6/2	6/1	6/3	6/2	6/4	5/31	5/31	5/31	5/30	6/2	6/4
Date of last hatch	7/1	7/22	7/20	7/26	7/24	7/2	7/18	7/31	7/16	6/28	7/6	7/16	7/4	6/22	7/20
Date of first fledgling	7/5	8/4	7/17	8/15	6/23	6/29	6/21	6/29	6/25	6/20	6/20	6/21	6/20	6/26	6/25
Estimated number of breeding pairs	44-53	12-13	33-39	28	37	32	34-47	29-37	58-66	80-86	65-71	56-63	78-86	77-81	31-45
Total number of nests	57	15	46	33	48	40	53	64	79	87	79	76	96	83	66
Total number of eggs	101	25	81	60	86	76	100	98	129	166	146	122	161	144	91
Clutch Size															
1 egg	13	5	11	7	11	4	6	30	29	8	13	30	31	23	42
2 egg	44	10	35	25	36	36	47	34	50	79	65	46	65	59	23
3 egg	0	0	0	1	1	0	0	0	0	0	1	0	0	1	1
Average clutch size	1.77	1.66	1.76	1.82	1.79	1.9	1.89	1.53	1.63	1.91	1.85	1.60	1.68	1.73	1.38
No. of nests hatching young*	40	9	24	18	22	21	39	36	66	75	70	63	72	59	26
Total number of eggs hatched	74	17	42	32	40	41	75	55	106	142	127	103	120	101	38
Estimated number of fledglings	2	2	0	2	4-5	2	12-19	18-20	32-39	23-27	33-37	15-18	17-23	7-10	2-4
Number of chicks banded	46	10	23	16	18	16	40	43	94	107	99	78	105	61	26
Number of adults banded	0	0	0	7	5	7	1	2	4	1	0	0	1	0	0
Uncertain outcome															
Nests*	3	2	0	11	16	5	10	9	0	1	0	1	8	2	7
Eggs	5	3	0	17	28	10	15	11	0	2	0	1	13	2	9
Documented Mortality															
Preyed upon:															
Eggs**	9	3	36	6	8	21	4	9	2	6	6	2	5	6	1
Chicks	1	0	2	2	2	8-9	5-7	5	1-2	2	15	5-6	7	1-3	0
Fledglings	0	0	0	1	0	0	1	2	2	9	3	0	5-6	0	0
Adults	0	1	0	0	0	0	3	2-3	3	6	8-13	2	1-2	2-3	4
Other than preyed upon:															
Eggs															
Human Damaged	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Failed to hatch (incubated to term)	5	0	1	4	3	0	1	1	9	3	3	2	4	5	0
Died hatching	0	0	0	1	2	0	0	0	0	0	0	0	0	2	0
Abandoned (pre-term)	8	2	2	0	5	2	5	22	12	13	10	14	19	28	41
Flooded	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chicks	5	0	0	0	2	1	2	3	28-29	35	16	26-27	25	26-28	4
Fledglings	0	0	0	0	0	1	0	0	3	2	4	1	2	0	0
Adults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nests															
Human damaged*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Preyed upon*	6	3	21	4	7	11	2	6	1	4	4	2	3	6	1
Failed to hatch*	5	0	1	4	5	0	1	1	8	3	3	2	4	5	0
Abandoned (pre-term)*	7	2	2	0	4	2	4	17	10	9	7	11	14	20	30
Flooded	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

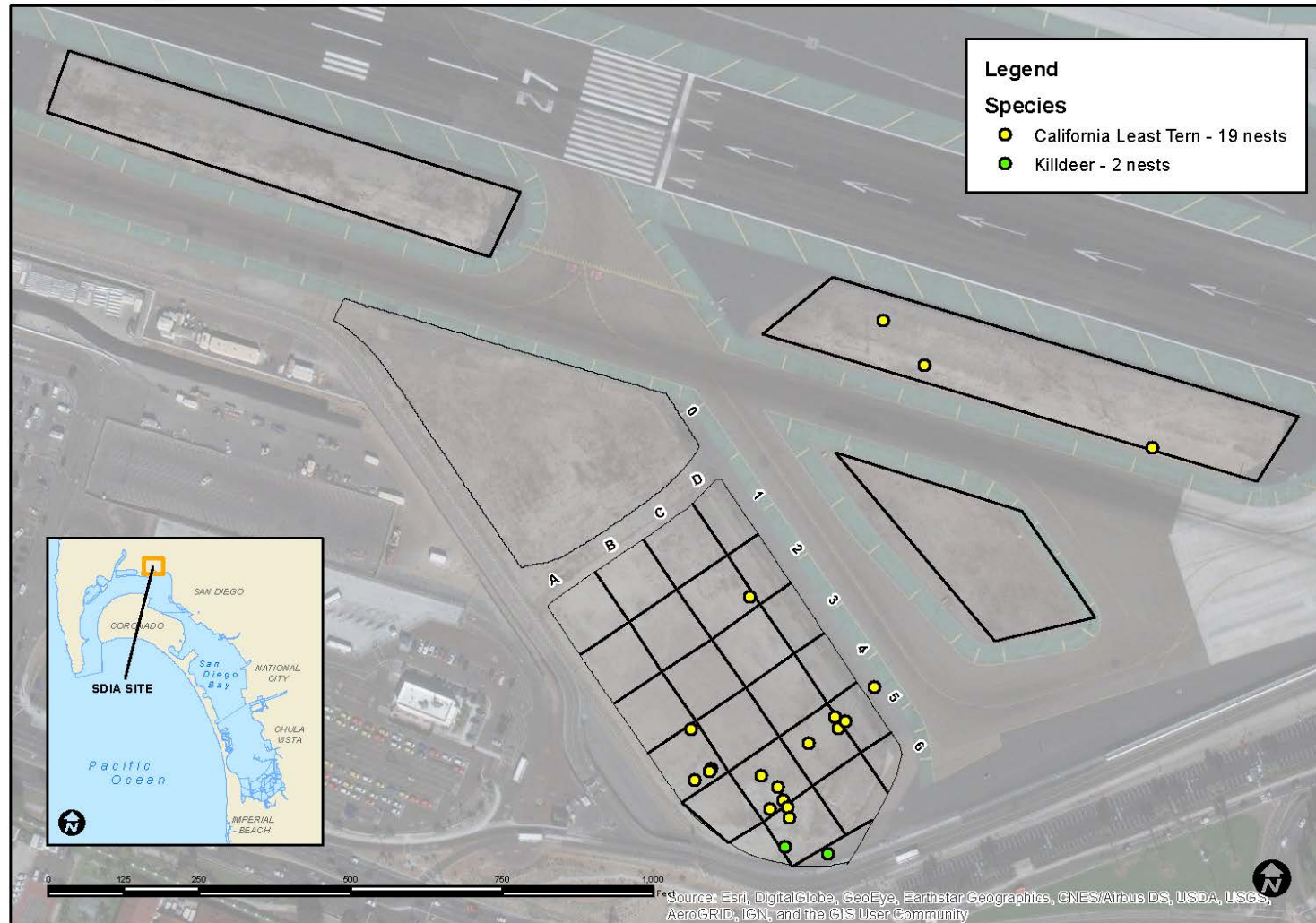
\* included in more than one category

\*\* not including previously abandoned eggs that were depredated/scavenged



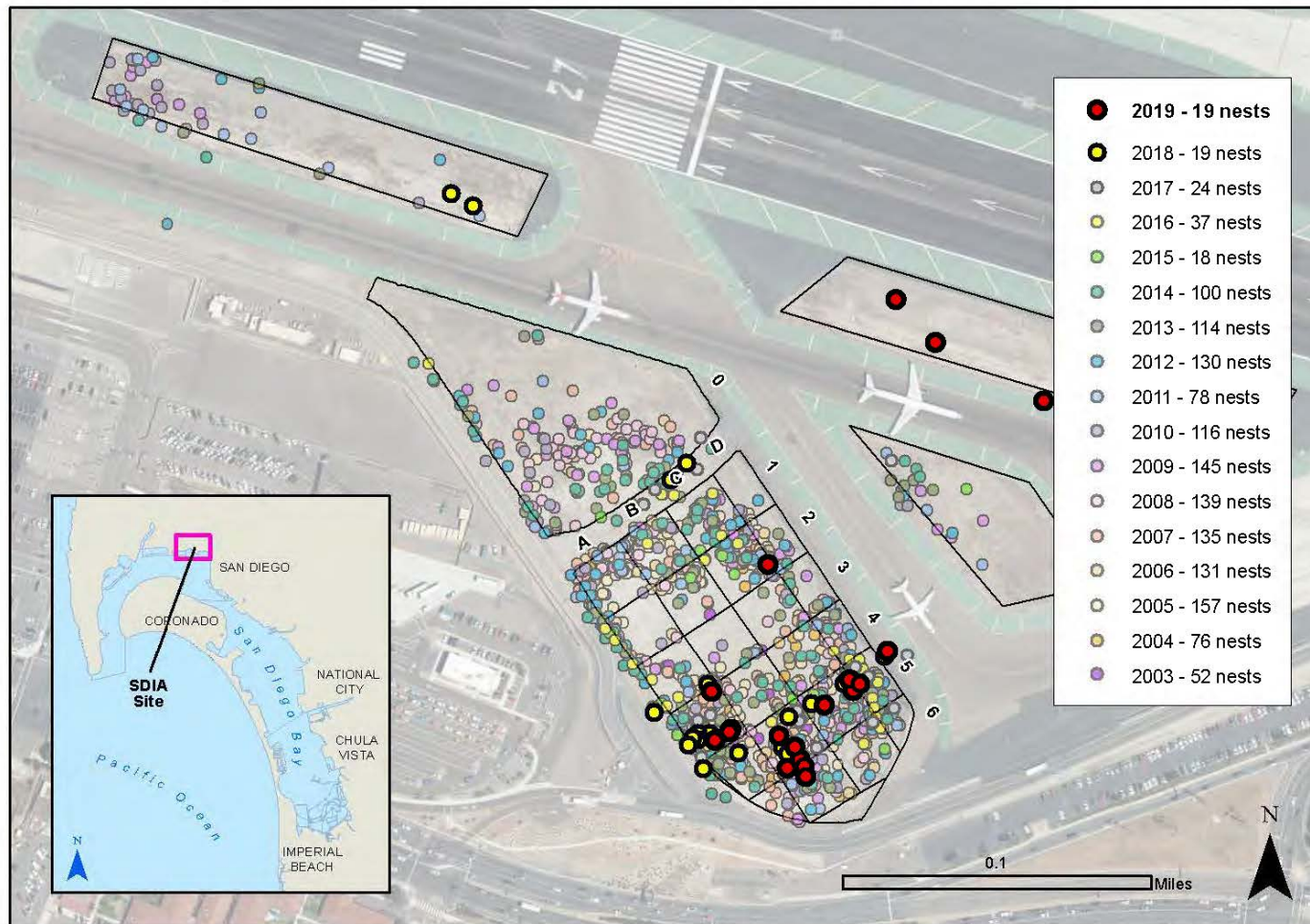
## Appendix A

### Nesting Sites: San Diego International Airport 2019



## Appendix A

### Least Tern Nests: San Diego International Airport - Chronological





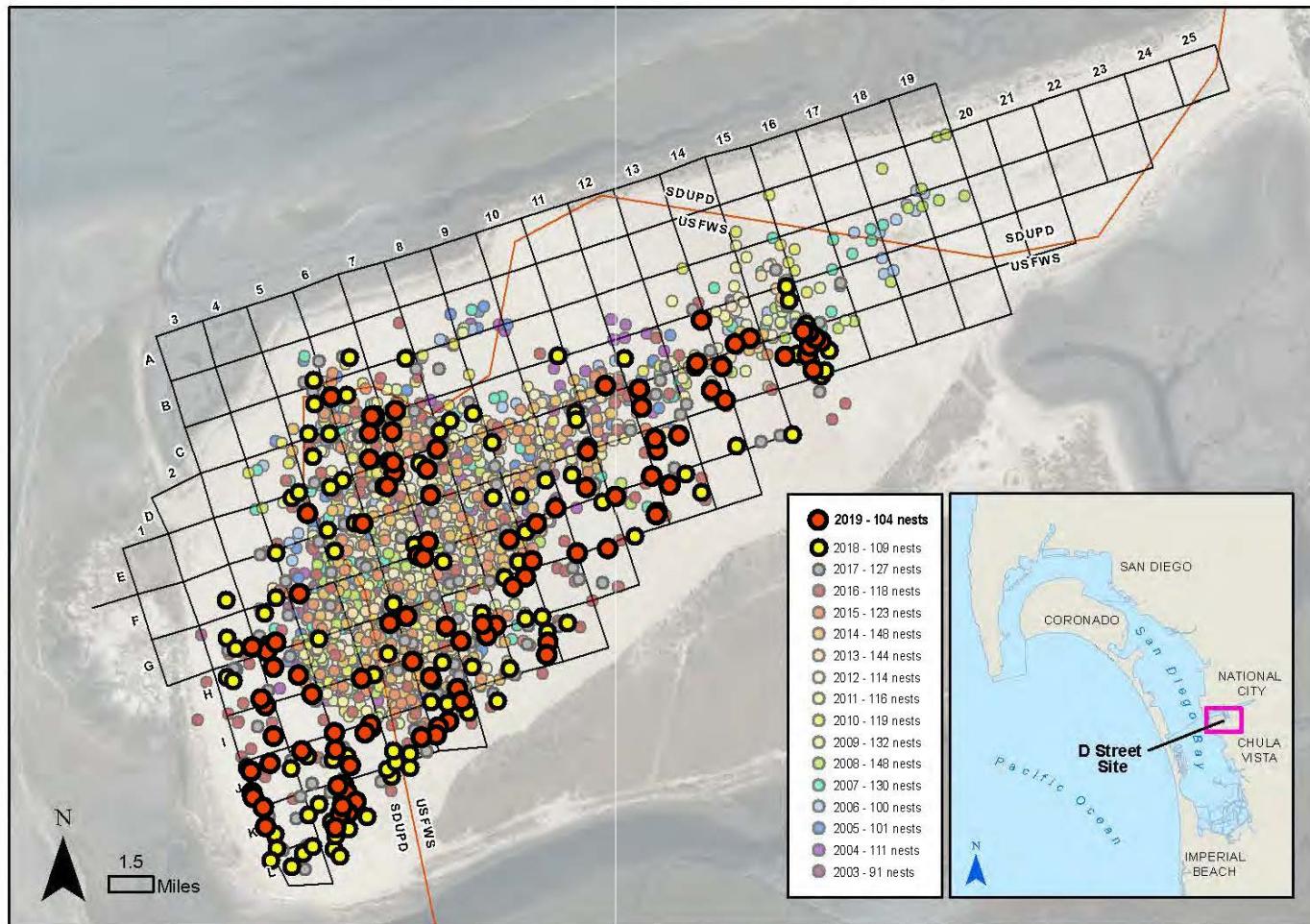
## Appendix A

### Nesting Sites: D Street 2019



## Appendix A

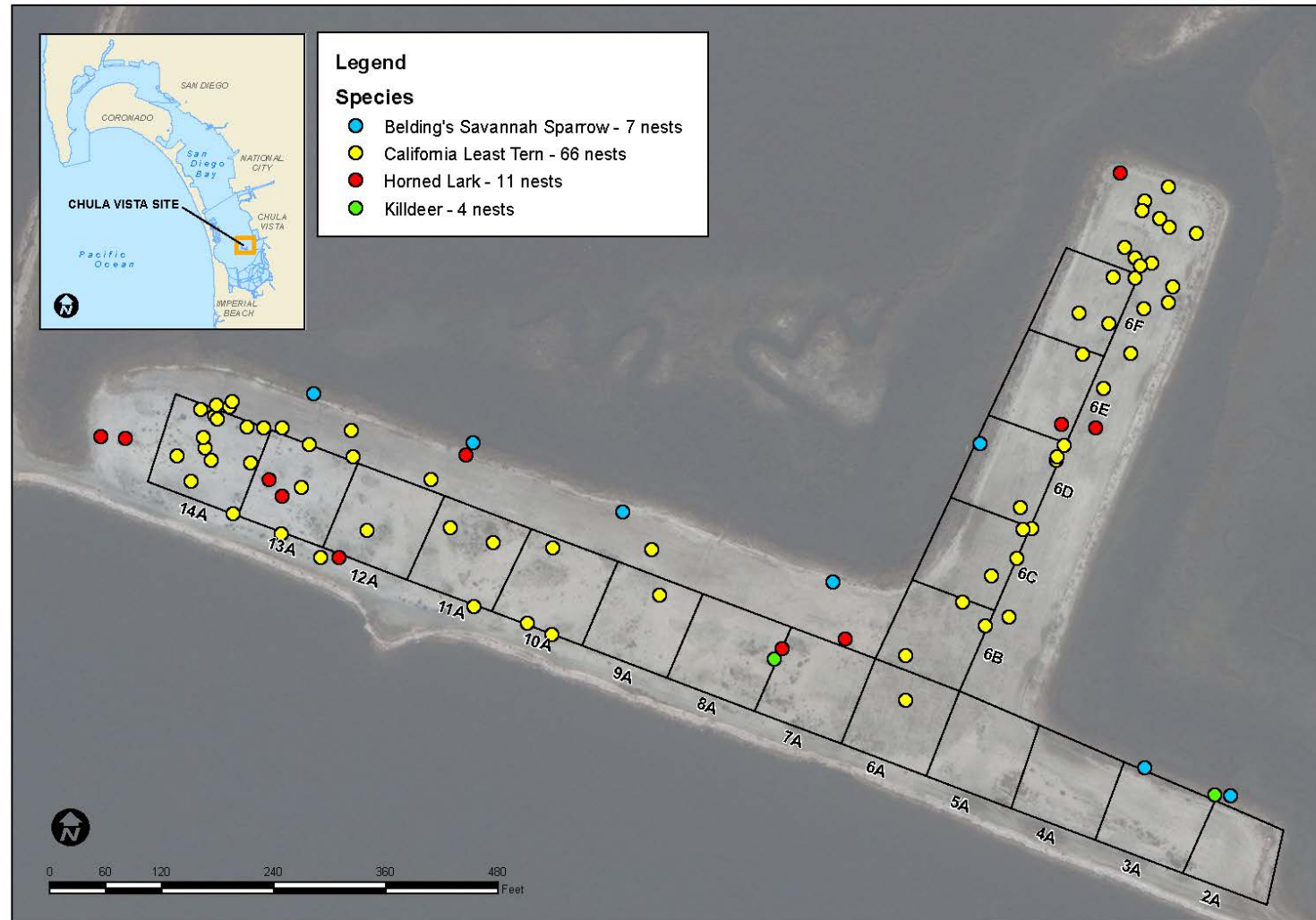
### Least Tern Nests: D Street - Chronological





## Appendix A

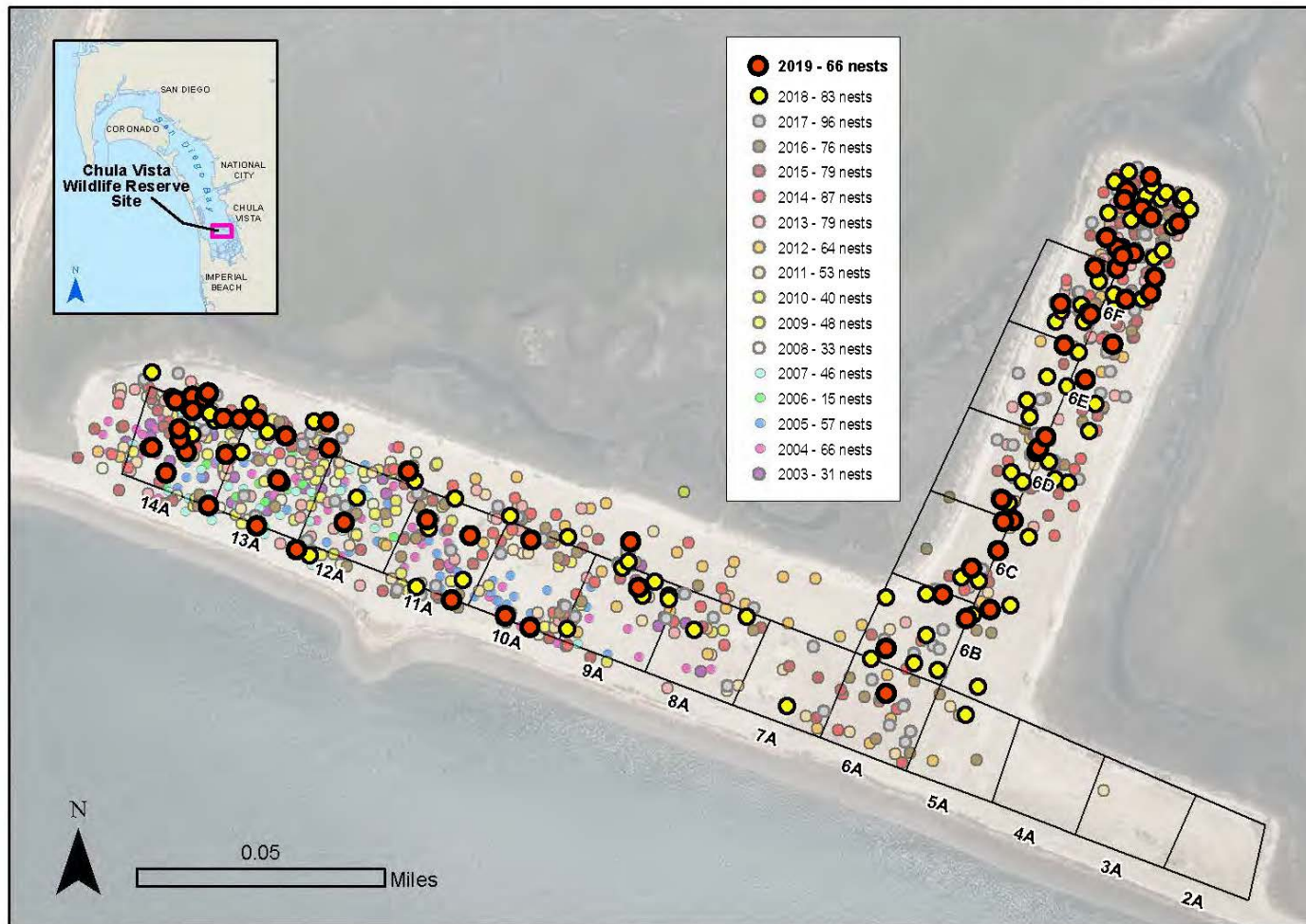
### Nesting Sites: Chula Vista Wildlife Reserve 2019





## Appendix A

### Least Tern Nests: Chula Vista Wildlife Reserve Chronological



## Appendix A

Appendix D. Distribution of nests of California least tern and western snowy plover at D Street Fill, 1997-2019.

	Number of Nests			
Year	CLT	WSP	W-E Row	N-S Column
1997	41	10-12	3-12	C-I
1998	7	2	4-11	D-F
1999	36	2	4-11	D-H
2000	34	1	4-10	D-H
2001	32	0	4-12	D-H
2002	24	0	4-11	E-H
2003	91	0	2-12	C-I
2004	111	0	3-14	B-I
2005	101	0	3-13	B-I
2006	100	0	3-19	B-I
2007	130	0	3-18	B-I
2008	148	0	3-20	B-I
2009	132	0	4-16	B-J
2010	119	0	4-16	B-J
2011	116	0	3-15	B-J
2012	114	0	4-15	C-I
2013	144	0	4-15	C-J
2014	148	0	4-15	C-J
2015	123	0	3-15	C-J
2016	118	0	2-17	B-K
2017	127	0	2-17	B-L
2018	109	0	2-16	B-L
2019	104	0	2-16	C-K

**Appendix B**

2019 Predator Management Report for the San Diego International Airport, Chula Vista Wildlife Reserve, and D Street Fill



## Appendix B

United States Department of Agriculture

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Animal and Plant  
Health Inspection  
Service

Wildlife Services

South District Office

9380 Bond Avenue  
Suite A  
El Cajon, CA 92021  
Phone: 619-561-3752

### **PREDATOR MANAGEMENT REPORT**

### **FOR SAN DIEGO INTERNATIONAL AIRPORT, CHULA VISTA WILDLIFE RESERVE, AND D STREET FILL**

**2019**

**California Least Tern (*Sternula antillarum browni*)  
Breeding Season**

#### **COOPERATOR:**

**USDA-APHIS-Wildlife Services  
3419A Arden Way, Sacramento, CA 95825**

#### **PREPARED BY:**

**Taylor W. Higgins  
Biological Science Technician  
And  
John W. Turman  
South District Supervisor**

**USDA APHIS Wildlife Services  
9380 Bond Ave. Suite A, El Cajon, CA 92021**

#### **CONTRACTED BY:**

**PORT OF SAN DIEGO  
P.O. Box 120488  
San Diego, CA 92112-0488  
Cooperative Agreement #19-73-06-2014-RA**

**And**

**SAN DIEGO COUNTY REGIONAL AIRPORT AUTHORITY  
P.O. Box 82776  
San Diego, CA 92138-2776  
Cooperative Agreement #19-73-06-5773-RA**



## Appendix B

### INTRODUCTION

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) program entered into Cooperative Agreements with the Port of San Diego (#19-73-06-2014 RA) and the San Diego County Regional Airport Authority (SDCRAA) (#19-73-06-5773 RA) to provide predator management for the protection of the federally-endangered California least tern (*Sternula antillarum browni*) (LETE) during the 2019 breeding season. This agreement was executed in fulfillment of the Port's and SDCRAA's requirements under the Endangered Species Act of 1973, as amended. Predator management activities were conducted at the following properties in San Diego County: San Diego International Airport (SDIA) and the former Teledyne-Ryan, Chula Vista Wildlife Reserve (CVWR), and D Street Fill.

### LOCATIONS

#### San Diego International Airport:

San Diego International Airport (SDIA) is located next to San Diego Bay, west of Interstate 5, and along Harbor Drive. The LETS nesting areas are found on the southern part of the Air Operations Area (AOA). In this area, three sites or "ovals", have been protected with a seven-inch tall plastic fence to keep chicks from wandering onto the taxiways. The Rental Car Over-flow, and Terminal Link Road (TLR) construction site (former Teledyne-Ryan) property borders the southeastern boundary of SDIA property between Harbor Drive and SDIA. Wildlife Services performed limited predator control in this area because several predators travel to and from the property to the nesting areas on SDIA. Wildlife Services only conducted limited predator control on the former Teledyne-Ryan property during the 2019 nesting season due to restricted access, the presence of rental car personnel, on-going construction activity, and increased public access to the area. The SDIA and former Teledyne-Ryan property are administered exclusively by the SDCRAA.

#### Chula Vista Wildlife Reserve:

The Chula Vista Wildlife Reserve (CVWR) is a 20-acre artificial peninsula located in South San Diego Bay, off of the L Street exit from Interstate 5, and behind the site of the former South Bay Power Plant. The CVWR is primarily a tidal marsh with elevated fill areas and roads. It is surrounded by rip-rap along its south and west shorelines. The CVWR, which supports a wide variety of shore birds, is administered by the SDCRAA and held in-trust by the State of California and the Port of San Diego.

#### D Street Fill:

The D Street Fill is located in San Diego Bay, west of Interstate 5, and is reached using the Marina Bay Drive then driving on the Bay Shore Bike Path. The nesting site is on the south side of Sweetwater Channel, approximately 0.25 mile north of the Living Coast Discovery Center (formerly, Chula Vista Nature Center). The LETS nesting area is primarily comprised of elevated fill, which transitions to sparse, upland scrub along the outer edges and a large tidal mud flat to the west. The D Street Fill property is jointly

## Appendix B

managed by the Port of San Diego and the U.S. Fish and Wildlife Service, San Diego Bay National Wildlife Refuge Complex.

### METHODS

The principal equipment and techniques used for predator management included various sizes of cage traps (Tomahawk® Live Trap Co.), padded-jaw foothold traps (Victor Soft-Catch®), neck snares, raptor traps (i.e. Bal-chatri, noose harness, and Swedish goshawk traps), Compound DRC-1339 avicide, shooting, calling/shooting, spotlighting/shooting, monitoring cameras, and night-vision/thermal imaging equipment. These methods, techniques, and tools were applied at or near the previously described nesting areas. Their placement and usage was primarily based on predator observations, predator sign, and predation or threats thereof.

All trapping devices were used in accordance with all applicable laws and regulations; including Title 14, section 465.5 of the California Code of Regulations, and Wildlife Services Directive 2.450, sections 3a through 3d. Migratory birds were managed under the terms of two federal Migratory Bird Depredation Permits issued to Wildlife Services (#MB74626A-1 and amendments) and the San Diego National Wildlife Refuge Complex (#MB61966A-0 and amendments), by the U.S. Fish and Wildlife Service (USFWS), Region 8 Migratory Bird Permit Office (MBPO). The combination of the two permits allowed lethal and non-lethal management of avian predators to be conducted on properties owned or managed by SDIA/Teledyne-Ryan, CVWR, and D Street Fill.

Cage traps were used to capture a variety of mammalian predators and were placed in various locations in and around the nesting areas. They were baited with either dry or canned pet food or a combination of both, and were concealed from view to prevent theft and/or tampering. Cage traps were inspected a minimum of once daily, as required by law. Padded-jaw foothold traps and neck snares were placed in and around the nesting area to remove coyotes (*Canis latrans*) and were inspected a minimum of once daily, as required by law. Smaller padded-jaw foothold traps (modified Victor Soft-Catch® size #1.5) were used in efforts to capture common ravens (*Corvus corax*) and American crows (*Corvus brachyrhynchos*).

Raptor traps, to include: Bal-chatri traps, noose harnesses, and Swedish goshawk traps were placed in and around LETS nesting areas to capture a variety of raptor species. Raptor traps were closely monitored when set; and were unset and reset periodically throughout the day/night to reduce the unintentional capture of non-target species. Bal-chatri traps consist of a small wire cage with monofilament nooses attached to the top and baited with a mouse or other live bait. The trap is tethered to a weight to prevent the raptor from flying off with the trapping device. Bal-chatri traps were continuously monitored when used. Noose harnesses consisted of a leather strap equipped with monofilament nooses that would be placed on a European starling (*Sturnus vulgaris*) or rock pigeon (*Columba livia*). Harnesses were affixed with a long cord on a spool, sometimes held by the trapper, along with a large weight to prevent escape of a caught

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raptor. Harness traps were constantly monitored when deployed. Swedish Goshawk traps consist of an A-frame type cage constructed of netting and a pair of spring-loaded doors held open by a hinged perch bar and baited with live bait; such as a European starling or rock pigeon. They were checked every two hours and at least once when used at night. Raptors captured and in healthy condition were banded by WS with USGS permanent bands and transferred to Skyhunters, a local bird rehabilitation facility. Birds were then relocated within 72 hours; as required by the previously-mentioned federal Migratory Bird Depredation Permits. Some birds were kept longer than 72 hours because personnel were not available to transport birds, or when birds required longer rehabilitation periods. As required in the permits, the USFWS MBPO was notified when birds were held longer than 72 hours. All relocation efforts were performed by California Department of Fish and Wildlife (CDFW), Senior Volunteer program.

Hazing was occasionally used to disperse raptors from LETE nesting sites. Hazing consisted of non-lethal dispersal techniques including, but not limited to: voice and physical actions, using a vehicle to disperse raptors, or using firearms in a non-lethal manner. Although these methods were employed on multiple occasions and in accordance with the requirements of the MBTA permit, they were only temporarily effective in deterring raptors from the nesting sites.

Firearms, to include calling/shooting, spotlight/shooting and the use of night-vision/thermal imaging equipment in conjunction with shooting, were used when other methods were unproductive or when the immediate removal of a predator was necessary. Shooting was used only when safe conditions existed and in accordance with all applicable laws, regulations and policies. The method of euthanasia for captured predators was sodium pentobarbital, delivered via injection from either a hand-held syringe or a syringe pole.

Compound DRC-1339, a federally registered avicide (EPA Reg. No. 56228-29) was used to control common ravens and American crows that prey on the eggs and/or young of LETE. Compound DRC-1339 is a soluble powder that is mixed with water into a 4% solution. One-half ml of 4% solution was injected into medium-boiled chicken eggs; resulting in each egg containing 20 mg of the compound. Untreated eggs were first used as pre-bait to condition the target birds into consuming eggs from the bait stations. Once consumption of the pre-bait eggs was observed, treated eggs were then placed into the bait stations. The bait stations consisted of a wooden box, approximately one foot square; either elevated approximately five feet above the ground, or placed at ground level and filled with sand and/or foliage to simulate a bird nest. Up to three eggs were placed in each bait station and secured with wire to prevent them from being removed by corvids. Bait stations were inspected daily and re-baited when 50% or more of the treated eggs offered had been consumed; depending on corvid activity. Eggs not consumed after approximately two weeks were removed and properly disposed of; by then the active ingredient was no longer effective. All bait stations were marked with signs indicating the signal words "Danger - Poison", with a copy of the registration label as required by law. Additionally, each individual egg was marked with a small skull-and-crossbones

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stamped in red ink. In 2019, Compound DRC-1339 was applied at the Port properties and SDCRAA under the conditions of a Restricted Materials Permit (No. 37-19-37R6175) issued by the County of San Diego, Department of Agriculture Weights and Measures, Pesticide Division.

The number of corvids taken with Compound DRC-1339 was determined by first estimating the number of birds consistently consuming untreated pre-bait eggs from bait stations. Following the placement and subsequent consumption of DRC-1339-treated eggs, follow-up observations were conducted. The average difference between the two surveys provided an estimate of the number of birds taken during each treatment cycle. Because DRC-1339 is a slow-acting toxicant (24-48 hours), the recovery of exposed birds is unlikely; thus, it was not possible to determine the exact number of birds that consumed or succumbed to the effects of this material.

### SDIA/SDCRAA:

Cage traps were used in efforts to capture small mammals on Lindbergh Field in 2019 (e.g. black rats (*Rattus rattus*), feral cats (*Felis domesticus*) and striped skunks (*Mephitis mephitis*)). All traps were placed along the perimeter fence or along the chick barrier fencing immediately adjacent to the nesting areas. Swedish Goshawk and Bal-chatri traps were employed in efforts to remove problem raptors from the nesting site. Two small padded jaw foothold traps were deployed on a few occasions at the SDIA in efforts to capture problem corvids in the nesting area. Firearms were not used during the 2019 nesting season at SDIA, due to the inherent risk factors associated with increased airplane, automotive, and pedestrian traffic in the adjacent areas. Compound DRC-1339 avicide was utilized at two bait stations in and near the nesting area to reduce to the number of American crows and common ravens.

### Chula Vista Wildlife Reserve:

Cage traps were used to capture potential nest predators such as Virginia opossums (*Didelphis virginiana*), striped skunks, feral cats, raccoons (*Procyon lotor*) and black rats. Cage traps were placed throughout the site in various locations and concealed from view. Padded jaw foot hold traps and neck snares were used in coyote removal efforts. Swedish Goshawk and Bal-chatri traps were employed in efforts to remove problem raptors from the nesting site. Firearms were used when trapping methods were unsuccessful, or when immediate removal of a predator was necessary. Firearms were used to remove American crows, feral cats, western gulls (*Larus occidentalis*) and skunks on Chula Vista Wildlife Reserve during the 2019 nesting season. Compound DRC-1339 avicide was utilized at one bait station near the nesting area to reduce to the number of American crows and common ravens.

### D Street Fill:

Cage traps were used to capture mammalian predators such as California ground squirrels (*Spermophilus beecheyi*), striped skunks, black rats, Virginia opossums and feral cats. Cage traps were placed near the entrance to the site, in and around the vegetation, as well as around the perimeter of the nesting area proper. Swedish Goshawk, harness, and Bal-

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chatri traps were employed in efforts to remove problem raptors from the nesting site. Firearms were employed at D Street Fill when trapping methods were unsuccessful, or when immediate removal of a predator was necessary. Compound DRC-1339 avicide was utilized at two bait stations near the nesting area to reduce to the number of American crows and common ravens.

### **RESULTS**

A total of 173 animals, from six avian and seven mammalian species, were removed or released from the three properties, using both non-lethal and lethal methods (Table 1). These species were recognized as known or potential predators of the LETE eggs, young or adults. Non-lethal methods were used to remove seven raptors from the nesting sites (Table 2).

Predator management activities at all Port/SDIA nesting sites, specifically trapping efforts, resulted in a total of 4,791 cage trap-nights, 191 padded jaw foothold trap-nights, 93 neck snare trap-nights, and 250 raptor trap-nights (Table 3). Raptor trap-nights combines the use of Bal-chatri, Swedish goshawk, and harness traps (Table 4). There were 431 site-visits totaling 1090 staff-hours for all predator management activities at the nesting sites during the 2019 nesting season (Table 5). The total hours listed does not include time spent transporting raptors, maintaining equipment, contacting and coordinating with LETE monitors/managers, assisting other WS personnel, record keeping and preparing reports.

### **DISCUSSION**

Predator management began March 4, 2019 with initial site inspections, visual observations and foot surveys, as well as cage trap placement at D Street Fill and CVWR. Cage traps were placed on each site prior to the arrival of the LETE and were used continuously throughout the nesting season. Several known and potential mammalian predators were removed from each site during this period. Common ravens and American crows were also controlled at each active LETE nesting site during this period to minimize the threat of egg predation with the use of DRC-1339 and firearms. Raptor control work was not initiated until after confirmed predation or excessive harassment resulting in nest failure had occurred at each site; in accordance with the requirements of the 2015 MBTA permit.

There were a combined total of nine confirmed predation incidents and 22 suspected predation incidents at the three nesting sites during the 2019 nesting season. Many incidents at all three sites were deemed suspected depredation, due to the condition of missing eggs only; no sign of predators were found. One nest with one egg was damaged by human activity at CVWR. One chick at SDIA and one chick at D Street were depredated by fire ants. Predator management activities are discussed in greater detail in the site-specific sections below.



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### SDIA/SDCRAA:

LETE were first observed at SDIA on April 17, with the first nest being established on May 9 and nesting continuing through July 3. During this time, 19 LETE nests by 11-13 pairs were established on SDIA, which hatched 10 chicks from 12 nests and produced six fledglings in 2019 (Robert Patton, personal communication). The number of nests in 2019 at SDIA represents a reduction when compared to 2016 and 2017 nesting seasons. However, numbers were up from the 2015 nesting season, and were comparable to that of the 2018 nesting season. Specific or significant predation events documented at CVWR in 2019 are described in chronological detail below.

Trapping efforts began at SDIA on May 6, 2019 when eight cage traps were placed around the nesting areas. Although cage trappings efforts were maintained through August 21, no predators were removed from the airfield via this trapping method. One black rat was hand captured by a LETE monitor and later removed from the site. One western gull fledgling was hand captured by Wildlife Services and removed from the site.

Corvids presented an early problem at SDIA with high numbers and frequent visits, mostly by American crows. Wildlife Services and monitors suspected that at least seven eggs from at least five different nests were depredated by American crows. Small padded foothold traps and DRC-1339 avicide were the only means of control for corvids during the 2019 season. The use of DRC-1339 resulted in the removal of an estimated six American crows; no corvids were removed via padded foothold trap. Fewer corvids were seen and no further predation events suspected after the initial round of DRC-1339 was implemented.

Raptors, particularly American kestrels (*Falco sparverius*), were the cause of one confirmed chick predation and suspected in the predation of four other chicks. On July 21, a monitor observed the depredation of a LETE chick by an American kestrel. Wildlife Services was able to later remove the American kestrel on July 29 using a Bal-chatri trap baited with a mouse (Table 2). An additional four chicks were missing and depredation was suspected by LETE monitors, however no sign was found and these incidents were not confirmed. At total of nine known nest predators were removed from SDIA during the 2019 nesting season (Table 1).

Least tern nesting was completed by July 3 at SDIA; with sightings of LETE continuing through August 15 (R. Patton, personal communication). All predator management activities and equipment were removed for the season from SDIA/SDCRAA property on August 21.

### Chula Vista Wildlife Reserve:

The first sighting of least terns at CVWR in 2019 occurred on April 10. More consistent numbers of LETE began to show up April 17-24, with sightings continuing regularly through July 13. Nesting began on May 7 and continued through July 6. A total of 66 LETE nests by 31-45 pairs were established on CVWR; of which 38 chicks hatched from 26 nests and produced an estimate of two to four fledglings in 2019 (R. Patton, personal

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communication). Thirty nests containing 41 eggs were abandoned early in the season; thought to be caused by an unusual and significant rain event. A total of 85 known and potential predators were removed or dispersed from CVWR during the 2019 season (Table 1). Specific or significant predation events documented at CVWR in 2019 are described in chronological detail below.

Site visits and cage trapping efforts to remove nest predators began at CVWR on March 4, 2019. A total of 13 cage traps were placed in and around the nesting site. DRC- 1339 was implemented at CVWR beginning on May 6, resulting in an estimated removal of five American crows during the nesting season. Two padded foothold traps and one neck snare were implemented at the site due to documented coyote activity. One adult coyote was removed via foothold trap on May 10.

Increased raptor sightings coincided with high numbers of LETÉ predation. Raptor species observed on site included peregrine falcon (*Falco peregrinus*) Cooper's hawk (*Accipiter cooperii*), northern harrier (*Circus hudsonius*), red-tailed hawk (*Buteo jamaicensis*), and American kestrel. The continual use of a Swedish goshawk trap and selective use of a Bal-chatri trap proved fairly unsuccessful at CVWR; with one red-tailed hawk captured via Bal-chatri trap on May 31 (Table 2). Depredation of three adult LETÉ by barn owl (*Tyto alba*) were confirmed with the recovery of pellets matching that species. Wildlife Services made unsuccessful attempts to remove barn owls, by leaving the Swedish goshawk trap open overnight and using a calling device on multiple occasions. One confirmed adult LETÉ was depredated by peregrine falcon. Attempts to capture the peregrine falcon were unsuccessful at CVWR; however WS was able to capture three peregrine falcons at the adjacent Saltworks nesting site that were most likely the same birds. An additional nine eggs from seven nests were suspected to have been depredated by northern harrier, and the disappearance of 30 chicks was also suspected raptor depredation by LETÉ monitors; however, little to no evidence existed and these events were not confirmed. On May 9 one LETÉ egg was damaged by trespassers at CVWR.

Least tern nesting was completed by July 6 at CVWR; with sightings of LETÉ continuing through July 13, and one to two additional LETÉ being observed on July 22 (R. Patton, personal communication). All predator management activities and equipment were removed for the season from SDIA/SDCRAA property on August 21.

### D Street Fill:

The first LETÉ sighting at D Street Fill occurred on April 10, 2019. More consistent numbers of LETÉ began to show up April 24, with sightings continuing regularly through August 17. Nesting began on May 1 and continued through July 13. A total of 104 LETÉ nests, by 55-72 pairs were established at D Street Fill; of which 59 chicks hatched from 45 nests, producing an estimated 12 fledglings in 2019 (R. Patton, personal communication). At least 32 nests were thought to have been the result of re-nesting, possibly coinciding with an unusual event of heavy rain earlier in the season. A total of 79 known and potential predators were removed or dispersed from D Street Fill during

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the 2019 season (Table 1). Specific or significant predation events documented at D Street Fill in 2019 are described in chronological detail below.

Site visits and cage trapping efforts to remove nest predators at D Street Fill began on March 4, 2019. A total of 13 cage traps were placed in and around the nesting site. Compound DRC-1339 avicide was implemented at D Street Fill beginning on April 9, due to increased corvid sightings. The use of DRC-1339 resulted in an estimated removal of 14 American crows and four common ravens during the nesting season.

As is often the case, increased raptor sightings coincided with high numbers of LETE depredation. Raptor species observed on site included northern harrier, Cooper's hawk, peregrine falcon, red-tailed hawk, and American kestrel. Northern harriers were by far the most often observed species at the nesting site, mostly thought to be two to three individuals continually hunting the site. A total of 15 eggs from 13 nests were suspected to have been depredated by northern harriers. Wildlife Services reported the incidents to the Refuge Manager, however, lethal removal of northern harriers was not authorized. It should be stated that Northern harriers are very difficult to live trap, particularly if the nest location is not known or accessible (as in the case at D Street in 2019). Subsequently, lethal removal is often the only option when predation levels are severe enough and site managers determine that it is warranted.

In attempts to mitigate the effects of the continual presence of the northern harriers, WS used a Swedish goshawk trap almost daily; however no northern harriers were removed from the site. However, the continual use of a Swedish goshawk trap and selective use of a Bal-chatri trap proved fairly successful for other raptors at D Street; resulting in the capture of four Cooper's hawks and one red-tailed hawk via Swedish goshawk trap (Table 2). One LETE chick was suspected to have been depredated by a peregrine falcon and efforts were made to trap the falcon with Bal-chatri and noose-harness traps; however, these attempts were unsuccessful. The disappearance of 29 additional chicks was also suspected raptor depredation by LETE monitors, however little to no evidence existed and these were not confirmed.

Least tern nesting was completed by July 13 at D Street Fill; with sightings of LETE continuing through August 17 (R. Patton, personal communication). All predator management activities and equipment were removed for the season from D Street Fill property on August 21.

### RECOMMENDATIONS

Maintain predator management efforts to assist in the recovery of the state and federally-listed California Least Tern. The recorded accounts of numerous predation events in 2019, as well as the untold number of undocumented events that are suspected to have occurred, demonstrate that the California Least Tern continues to be in need of protection from the many predators that occur in coastal San Diego County. Effective predator management will be best achieved by establishing the necessary financial agreements well in advance of the nesting season. This

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will help to ensure the retention of trained and experienced staff, knowledge and understanding of protocols and regulations associated with all aspects of the program, improved management techniques, and continuity from year to year.

As previously described, there were several problems regarding the federal Migratory Bird Depredation Permits for SDIA/Teledyne-Ryan, D Street, and CVWR; including the following: 1) trap inspection intervals that were logistically/financially burdensome, 2) restrictions on trap types and conditions for their use, 3) the requirement to release captured raptors within 72 hours, 4) the length of time required to negotiate permit conditions and amendments, 5) confusing and often contradictory language, and 6) not allowing the pre-emptive removal of raptors, despite substantial evidence demonstrating that delaying trapping efforts until after predation has occurred fails to protect the endangered species, and results in significant colony disturbance and diminished seasonal productivity. Cumulatively, these restrictions continue to play a major role in our ability to respond to predation and the level/type of response rendered. We recommend that Refuge staff, along with SDCRAA and Port of San Diego work with the CDFW and MBPO to develop more reasonable permit conditions that 1) provide greater ability for the on-the-ground personnel to make informed decisions in a timely manner based on current needs, and 2) offer greater consideration for the listed species being protected.

Additional site-specific recommendations include the following:

### SDIA/Teledyne-Ryan:

1. Remove weeds, trash, leaves, and other debris that accumulates along the airport perimeter fence, the fence bordering the former Teledyne-Ryan property, the old Cell Phone Lot and along Harbor Drive to reduce harborage for rodents and other wildlife. Trash (i.e. food wrappers, etc.) provide a visual attractant for both corvid and gull species.
2. Lower construction crane booms when not in use to reduce their attraction to perching raptors/avian predators overlooking the nesting site.
3. Do not store equipment or other items against the perimeter fence or allow debris to accumulate between perimeter fences to prevent harboring rodents or other small mammals.
4. Improved vegetation management on the LETE nesting site is needed to prevent attracting birds seeking nesting materials, such as corvid and gull species.
5. Place a permanent barrier or gate to prevent unauthorized vehicle access to the LETE observation area adjacent to the nesting site, near the southwest corner and TLR P14 gate. Place “authorized access only” or similarly worded signs in the area.

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### Chula Vista Wildlife Reserve:

1. Maintain future access for WS staff through the former South Bay Power Plant property during continued construction activities scheduled for the Chula Vista Bay Front project and other future construction projects scheduled for the site.
2. All fences bordering the CVWR or site of the former South Bay Power Plant should be repaired and posted to prevent unwanted incursions by trespassers. Repair gaps under the fence to minimize mammalian predator access to the site.
3. More frequent patrols by Harbor Police and/or USFWS law enforcement to prevent trespassing by kayakers or fisherman at CVWR are recommended. As in previous years, kayakers again beached their crafts on the west end of CVWR several times during the 2019 nesting season.
4. Piles of lumber, driftwood, trash, and other debris that have washed up on CVWR shorelines over the years should be hauled away to prevent harborage for rodents or other potential LETÉ predators/scavengers near the nesting site.
5. Replace Park Service signs that state to “Stay below the high tide line” or “Closed from April through September” with more appropriately-worded signs warning the public that the area is entirely off-limits at all times of the year.
6. Remove old posts, poles, pipes and old survey markers that allow raptors to perch overlooking the nesting site.
7. Repair the rusting chain link fence, especially where it comes in contact with rip-rap and salt water near the entrance that may allow predators entry.

### D Street Fill:

1. Trim brush near the bike path, under the power lines, along the D Street fence line, inside the gate, and along the east perimeter road to remove raptor perches and prevent harboring other LETÉ predators. Brush and small trees growing through the fence has caused holes, thus allowing mammalian predator access to the site. Remove the palm tree stump growing under the power lines on the SDG&E right-of-way just south east of the D Street gate to prevent raptors using this perch that overlooks the nesting site.
2. Replace faded or graffiti-covered USFWS Refuge Boundary Signs or “Area Closed” signs near the gate and southeast channels. The “Area Closed” and “Restricted Area” channel marker buoys stranded in the southeast and southwest corners should be placed in the water at the northwest tidal marsh and southwest channel opening, since most kayakers and personal watercraft use these channels when trespassing on D Street.



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3. Repair the D Street entrance to reduce gaps under the gates and around the south channel grating to eliminate mammalian entry beneath and around the sides of the fences.
4. Place a lock-box near the logbook area to reduce boxes and clutter that may attract rodents and/or trespassers and keep material stored out of sight.
5. Piles of lumber, driftwood, trash, and other debris that has washed up on D Street shorelines over the years should be hauled away to prevent harboring rodents or other potential least tern predators near the nesting site.
6. Place a “Watch for vehicles on bike path” or other appropriately worded sign on the Bay Shore bike path entrance and near the pedestrian bridge to warn bikers and pedestrians of on-coming vehicles accessing D Street Fill site. Clear the brush growing along the fence at the entrance to the bike path, especially at the entrance off Bay Marina Drive and near the pedestrian bridge so that drivers exiting D Street can see on-coming bikers, pedestrians, and vehicle traffic.

### **ACKNOWLEDGMENTS**

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**Table 1. Predator species removed or released from SDIA/Teledyne-Ryan, CVWR, and D Street Fill during the 2019 California Least Tern breeding season.**

Species	Location			Species Total
	SDIA/Teledyne	CVWR	D Street Fill	
<b>Mammalian species</b>				<b>103</b>
Virginia Opossum ( <i>Didelphis virginiana</i> )	0	16	6	22
Feral Cat ( <i>Felis catus</i> )	0	17	5	22
Striped Skunk ( <i>Mephitis mephitis</i> )	0	13	8	21
CA Gr. Squirrel ( <i>Spermophilus beecheyi</i> )	0	0	18	18
Black Rat ( <i>Rattus rattus</i> )	1	5	8	14
Raccoon ( <i>Procyon lotor</i> )	0	5	0	5
Coyote ( <i>Canis latrans</i> )	0	1	0	1
<b>Avian species</b>				<b>70</b>
American Crow ( <i>Corvus brachyrhynchos</i> )	6	23	24	53
Common Raven ( <i>Corvus corax</i> )	0	1	5	6
Western Gull ( <i>Larus occidentalis</i> )	1	3	0	4
Coopers Hawk ( <i>Accipiter cooperii</i> ) <sup>1</sup>	0	0	4	4
Red-tailed Hawk ( <i>Buteo jamaicensis</i> ) <sup>1</sup>	0	1	1	2
American Kestrel ( <i>Falco sparverius</i> ) <sup>1</sup>	1	0	0	1
<b>Location Total</b>	<b>9</b>	<b>85</b>	<b>79</b>	<b>173</b>
<sup>1</sup> Released in Northern California				

**Table 2: Raptors removed from SDIA/Teledyne-Ryan, CVWR, and D-Street Fill during the 2019 California Least Tern nesting season.**

Species	Trap/Removal Method	Nesting Site	Date	Band Number	Date Released
Red-tailed Hawk	Bal-chatri	CVWR	5/31/2019	1177-13389	6/4/19
Coopers Hawk	Swedish Goshawk	D Street	5/31/2019	1004-04646	6/4/19
Coopers Hawk	Swedish Goshawk	D Street	6/3/2019	1004-04647	6/4/19
Coopers Hawk	Swedish Goshawk	D Street	6/4/2019	1115-18418	6/7/19
Coopers Hawk	Swedish Goshawk	D Street	6/12/2019	1004-04651	6/13/19
American Kestrel	Bal-chatri	SDIA	7/29/2019	1593-34398	8/1/19
Red-tailed Hawk	Swedish Goshawk	D Street	8/8/2019	1177-13390	8/12/19

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**Table 3. Number of trap-nights/days by method type at each Port/SDIA California Least Tern nesting site during the 2019 nesting season.**

<b>Nesting Site</b>	<b>Cage Trap</b>	<b>Padded Jaw Foothold</b>	<b>Raptor Trap</b>	<b>Neck Snare</b>
SDIA/ Teledyne Ryan	824	8	57	0
CVWR	1,993	183	87	93
D Street Fill	1,974	0	106	0
<b>Total</b>	<b>4,791</b>	<b>191</b>	<b>250</b>	<b>93</b>

**Table 4. Number of raptor trap-nights/days by trapping device type at each Port/SDIA California Least Tern nesting site during the 2019 nesting season.**

<b>Nesting Site</b>	<b>Bal-Chatri</b>	<b>Swedish Goshawk</b>	<b>Harness</b>
SDIA/ Teledyne Ryan	12	45	0
CVWR	8	79	0
D Street Fill	15	84	7
<b>Total</b>	<b>35</b>	<b>208</b>	<b>7</b>

**Table 5. Number of site-visits and hours spent conducting predator management activities at SDIA/Teledyne-Ryan, CVWR, and D Street Fill during the 2019 nesting season.**

<b>Nesting Site</b>	<b>Number of Visits</b>	<b>Percent of Total Visits/Site</b>	<b>Staff-hours/ Site</b>	<b>Percent of Total Hours/Site</b>
SDIA/ Teledyne-Ryan	106	24.6%	192	17.6%
CVWR	162	37.6%	504	46.2%
D Street Fill	163	37.8%	394	36.2%
<b>Total</b>	<b>431</b>	<b>100%</b>	<b>1090</b>	<b>100%</b>