WETLAND HABITAT AND HYDROLOGY BASELINE MONITORING REPORT FOR THE SAN ELIJO LAGOON RESTORATION PROJECT

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LIST OF ACRONYMS AND ABBREVIATIONS

AA	assessment area
AOU	American Ornithologists' Union
CAD	computer aided design
Cal-IPC	California Invasive Plant Council
CCC	California Coastal Commission
CDFW	California Department of Fish and Wildlife
cm	centimeter(s)
cm^2	square centimeter(s)
Corps	U.S. Army Corps of Engineers
CRAM	California Rapid Assessment Method
CWA	Clean Water Act
CWMW	California Wetlands Monitoring Workgroup
DEM	Digital Elevation Model
ft	feet
LFRR	light-footed Ridgway's rail
LTMP	Long-Term Management Plan
m	meter(s)
m^2	square meter(s)
mg/l	milligrams per liter
MLLW	Mean Lower Low Water
Monitoring Plan	*Wetland Habitat and Hydrology Monitoring Plan* (Nature Collective 2020)
mm	millimeter(s)
NAD 83	North American Datum of 1983
NAVD	North American Vertical Datum
NAVD88	North American Vertical Datum of 1988
PEP	plant establishment period
ppm	parts per million
RTK GPS	real time kinematic global positioning system
RWQCB	Regional Water Quality Control Board
SELRP	San Elijo Lagoon Restoration Project
TIF	tidal inundation frequency
TN	total nitrogen
TOC	total organic carbon
USFWS	U.S. Fish and Wildlife Service

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

San Elijo Lagoon is a coastal wetland formed at the confluence of Escondido Creek and La Orilla Creek as they meet the Pacific Ocean. Located in the city of Encinitas, San Diego County, California, the lagoon provides habitat for sensitive, threatened, and endangered plants and animals, including resident and migratory wildlife. The San Elijo Lagoon Ecological Reserve is owned and managed by the California Department of Fish and Wildlife (CDFW), County of San Diego Parks and Recreation Department, and the Nature Collective (formerly the San Elijo Lagoon Conservancy). Lagoon functions have become compromised over time, as development and infrastructure constraints have affected the ecosystem, charcaterized in part by changes in the gradient of habitats within the lagoon (e.g., between unvegetated and vegetated intertidal habitats). The San Elijo Lagoon Restoration Project (SELRP) is an effort to restore lagoon functions and services to the extent practicable given the current constraints of surrounding development.

SELRP is being implemented by the Nature Collective and Caltrans District 11 to enhance and restore the physical and biological functions and services of San Elijo Lagoon. These include increasing hydraulic efficiency in the lagoon, improving pre-construction water quality impairments, and halting ongoing conversion of unvegetated wetland habitats (mudflat) to vegetated salt marsh with the goal of restoring a more connected gradient of balanced habitat types. Success of the restoration effort is being measured through the implementation of a monitoring program developed in coordination with various permitting and approval agencies, including the California Coastal Commission (CCC), the U.S. Army Corps of Engineers (Corps), the U.S. Fish and Wildlife Service (USFWS) and the California Regional Water Quality Control Board (RWQCB).

1.2 REPORTING REQUIREMENTS

This Baseline Monitoring Report provides a starting point against which a number of metrics will be compared once restoration within San Elijo Lagoon has been completed. Post-restoration, annual reports will be completed based on this framework, and will identify which metrics have or haven't met performance standards, and whether the project is on a trajectory to meet success requirements. Reports will be submitted to agencies as required, and will also include recommendations for remedial activities or adaptive management strategies that may be required over the next year.

Metrics included in the monitoring program are defined in the SELRP *Wetland Habitat and Hydrology Monitoring Plan* (Monitoring Plan) (Nature Collective 2020) prepared for the project. The Monitoring Plan was developed in compliance with the conditions set forth in project permits and approvals provided by the CCC, Corps, USFWS and RWQCB, including:

- CCC: Coastal Development Permit (#6-16-0275-A1) – Special Condition #1
- Corps: Clean Water Act (CWA) Section 404 Permit (#SPL-2009-00575-MG) – Special Conditions #6, #7, and #36

- USFWS: Biological Opinion for the SELRP (FWS-SDG-09B0046-17F0616) – Conservation Measure #8
- RWQCB: CWA Section 401 Certification (#R9-2016-0111) – Monitoring Requirement P 2

The Monitoring Plan includes both relative and absolute metrics. Relative metrics are those that compare post-restoration conditions to reference wetlands in the region. Absolute standards require that the variable of interest be evaluated only within San Elijo Lagoon. Absolute standards are those that compare post-construction conditions to pre-construction conditions or project design. Absolute standards are not compared to reference wetlands. Absolute performance standards for the SELRP fall into two general categories:

- Project design absolute performance standards have been developed based on the SELRP design in order to meet project objectives. For example, topography or habitat cover variables have pre-determined goals based on the final design and restoration plans. These standards are not dependent on pre-restoration conditions.
- Pre-restoration absolute performance standards were developed based on the pre-restoration condition of the lagoon. These standards ensure the SELRP does not negatively impact pre-existing positive ecological attributes of San Elijo Lagoon. They are used to determine if post-restoration conditions are similar to pre-restoration conditions.

This report documents pre-restoration conditions in the lagoon that will be compared to post-restoration conditions in future annual reports. Information was collected prior to the initiation of construction; preparation of this report was delayed to ensure consistency with the Monitoring Plan and has been prepared at the completion of construction. Tenses throughout this report reflect that timing. Data for collected for pre-restoration absolute performance standards will serve as the benchmark for success for these variables. Baseline information for relative metrics and project design absolute performance standards does not affect project success in future years. However, baseline data for these variables are also included in this report to consolidate data into a single reference document and facilitate a more complete discussion of results post-restoration such as for identifying trends in improvement post-restoration.

This baseline report is framed to be consistent with the Monitoring Plan and anticipated Annual Reports to facilitate reference between documents. Table 1-1 summarizes the specific resources being monitored for success of the SELRP, the agency requiring the monitoring, and performance standards for each of the 13 broad physical and biological variables. Data for those 13 variables were generally collected in 2016 and 2017 during the pre-construction phase of the project. Some variables, such as water quality and habitat, were monitored for many years leading up to the project construction. Table 1-1 also identifies those metrics for which baseline information was collected either to provide a comparison for post-restoration success or as a reference point post-restoration. These baseline data will be used to establish pre-restoration conditions for each variable, to identify trends in the data during construction and post-construction phases of the SELRP and inform adaptive management decisions in future years. Per the Monitoring Plan, annual reports will be completed as needed until Year 10 post-construction, after which a final monitoring report will be prepared and submitted. Monitoring and reporting beyond 10 years

post-construction for the life of the project (defined as a minimum of 50 years) will be detailed in a Long-Term Management Plan (LTMP).

Detailed methods including data collection, monitoring frequency, analysis, and performance standards are discussed in the Monitoring Plan. This Baseline Report focuses on identifying the performance standard for each variable, summarizing the survey approach, summarizing the baseline data collected, and discussing how the information will be used for comparison in future years.

Table 1-1. Monitoring Plan Variable Summary

Chapter	Variable	Variable Type	Performance Standard	Baseline Information Required for Post-Restoration Success
2	Topography	Project Design Absolute	Within 10% (+/-) of habitat areas indicated in the final restoration plan by Year 5 post-construction	No
3	Bathymetry	Project Design Absolute	Within 10% (+/-) of subtidal habitat areas indicated in the final restoration plan by Year 5 post-construction	No
4	Tidal Elevation	Project Design Absolute	• Habitat areas must be within 10% of the designed habitat area targets • Predicted seawater residence time must remain on average shorter than 7 days in the central and 9 days in the east basins, as estimated using a numerical hydrodynamic model (such as RMA) to indicate first order water quality	No
5	Habitat Areas	Project Design Absolute	Within 10% (+/-) of habitat areas indicated in the final restoration plan by Year 5 post-construction	No
6.1	Vegetative Cover	Project Design Absolute	Meet the 5- and 10-year absolute performance standards defined in the final restoration plan and Table 7-1 in Chapter 7 of this Plan	No
6.2	*Spartina* Canopy Architecture	Relative	Not significantly worse than the mean value at the lowest performing reference wetland within 5 years of monitoring following construction	No
6.3	Exotics	Project Design Absolute	No more than 0% coverage by California Invasive Plant Council "Invasive Plant Inventory" species of "high" or "moderate" threat and no more than 5% coverage by other exotic/weed species during any year	No
7	Water Quality	Relative	Not significantly worse than the mean value at the lowest performing reference wetland within 5 years of monitoring following construction	No
8	Benthic Invertebrates	Relative	Not significantly worse than the mean value at the lowest performing reference wetland within 10 years of monitoring following construction	No
9	Sediments	Not Applicable	Success tied to water quality and benthic invertebrate standards	No
10	Fish	Relative	Not significantly worse than the mean value at the lowest performing reference wetland within 5 years of monitoring following construction	No
11.1	Breeding Marsh Birds with focus on light-footed Ridgway's rail	Pre-Restoration Absolute	Within 95% or greater of pre-construction survey data (2016, 2017)	Yes
11.2	Western snowy plover, California least tern, and waterbird species	Pre-Restoration Absolute	Within 95% or greater of pre-construction survey data (2016, 2017)	Yes

Chapter	Variable	Variable Type	Performance Standard	Baseline Information Required for Post-Restoration Success
11.3	Belding's savannah sparrow	Pre-Restoration Absolute	Within 95% or greater of pre-construction survey data (2016, 2017)	Yes
12	Wetland Function (CRAM)	Pre-Restoration Absolute	Post-restoration greater than or equal to Baseline CRAM Attribute Score	Yes
13	Eelgrass	Pre-Restoration Absolute	No permanent losses of eelgrass	Yes
14	*Caulerpa*	Pre-Restoration Absolute	*Caulerpa* absent from project site	Yes

CRAM = California Rapid Assessment Method

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2. TOPOGRAPHY

2.1 PERFORMANCE STANDARD

Topography is a project design absolute monitoring variable and, as such, will not be held to comparisons with reference wetlands for purposes of determining success of the SELRP. Performance standards shall be considered met if post-construction monitoring results show that habitat areas are within 10% of the design habitat distribution according to the permit (see Chapter 5).

2.2 APPROACH

An extensive combined topographic and bathymetric survey of the lagoon was conducted in 2011 by KDM Meridian, and again in August of 2017 by the same surveyor supplemented by Coastal Frontiers Corporation for more detailed bathymetry (bathymetry is specifically addressed in Chapter 3). Topography in the three basins was mapped to 1-foot contours using digital aerial imagery. Elevation contours were produced in digital computer aided design (CAD) format. A complete description of survey methodology can be found in the Monitoring Plan.

2.3 RESULTS

The 2011 survey was used in the design of the restoration and to confirm target elevation breaks based on hydrodynamic modeling. The 2017 survey was conducted to document the topography of the lagoon immediately prior to the initiation of the restoration program and to refine the design for changes to the site that may have occurred since 2011 (Table 2-1).

Table 2-1. Elevations of Habitats According to Tidal Inundation Frequency Analysis (ft NAVD88) 2017

Habitat Type	Pre-Construction Conditions in the Lagoon
Subtidal	Below +2.1
Mudflat	+2.1 - +3.4
Low Marsh	+3.4 - + 4.1
Mid-High Marsh	+4.1 - +5.8
Transitional	Above +5.8

ft NAVD88 = feet North American Vertical Datum of 1988

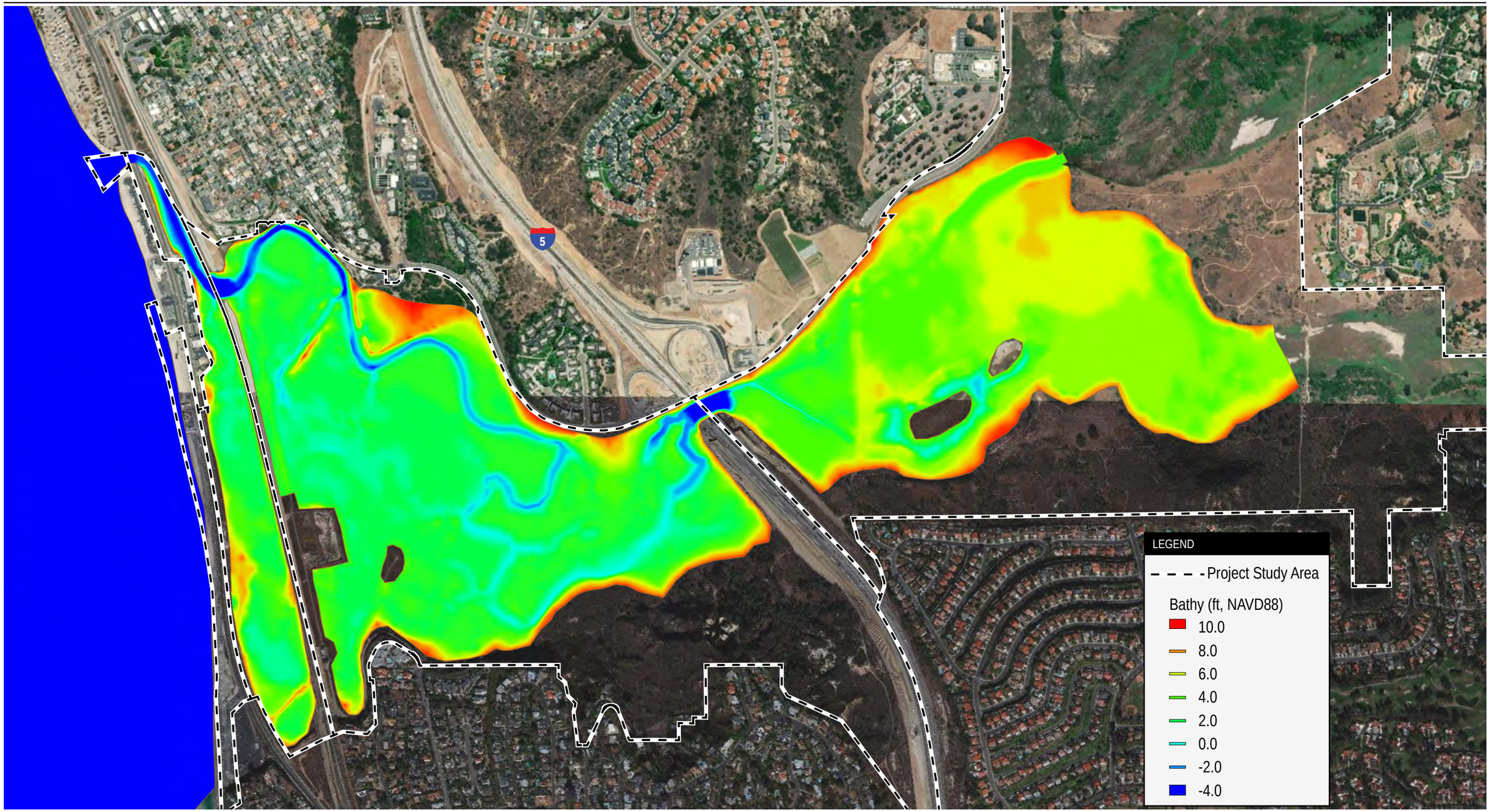
2.4 DISCUSSION

Topography is defined as the landcover above water; therefore, this discussion applies to areas above the elevation of subtidal habitat. The upper elevation of subtidal habitat is +2.1 feet relative to feet North American Vertical Datum of 1988 (NAVD88). For reference, NAVD88 is very close to the Mean Lower Low Water (MLLW) vertical datum. NAVD88 is 0.41 feet (5 inches) higher than the MLLW.

The project site is quite variable in its topography (Figure 2-1). The majority of the restoration site is between +2 feet and +6 feet NAVD88. Other areas along the transitional/upland perimeter are higher, but they comprise a small area of the site in relative terms. The site is broad and low with few areas above tidal influence except along the transitional/upland borders.

To account for sea level rise, the project has added several areas that are elevated above existing tidal elevations to provide for future wetland habitat areas following predicted sea level rise. These are referred to as transitional habitat areas as they occur between the highest elevation of salt marsh and true upland habitats (e.g., coastal sage scrub). The vast majority of the site remains between +2 and +6 feet NAVD88. The overdredge pit in the central basin is a large low and relatively flat area that is predicted to consolidate over time, subsiding from its initial elevation of approximately +7 feet NAVD88 to approximately +4 feet NAVD88.

The bird nesting area created in the central basin south of the overdredge pit is a small area that will be elevated as high as +20 feet NAVD88.



Source: Moffatt & Nichol 2020

NO SCALE

Figure 2-1
San Elijo Lagoon Pre-construction Topography/Bathymetry

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3. BATHYMETRY

3.1 PERFORMANCE STANDARD

Like topography, bathymetry is a project design absolute monitoring variable and will not be subject to comparisons with reference wetlands. Success of the project with respect to bathymetry will be determined based on post-construction subtidal habitat area and channel capacity. Habitat mapping will indicate changes in bathymetric function based on changes in the area of subtidal habitat. Subtidal habitat targets included constructing channel depths of approximately 2 feet at low tide to prevent elevated temperatures from occurring and potentially harming aquatic organisms. In addition, the channel cross-sections were designed to be large enough to reduce hydraulic friction and allow for tidal flow to be conveyed effectively to the inland limit of tidal influence in the east basin. Iterations of hydraulic modeling were performed to determine the optimal depth of the channels. Modeling identified that the elevation of -4 feet NAVD88 was optimal for providing effective water conveyance with some tolerance for shoaling. Therefore, the subtidal habitat within the main tidal channel was designed to be at a depth of -4 feet NAVD88 in the center.

3.2 APPROACH

Bathymetric monitoring was completed in 2011 by KDM Meridian to set the baseline condition for project design, and again in 2017 by KDM Meridian and Coastal Frontiers Corporation to identify site changes and verify whether the design needed to be updated, and to set the baseline for pre-construction conditions prior to dredging. Bathymetric data were obtained using a survey-grade digital acoustic echosounder operated from a small boat and focused on subtidal areas, with some overlap into mudflat areas to provide a single comprehensive dataset with topography discussed in Chapter 2. Bathymetry was obtained along pre-established channel-perpendicular transects spaced at a nominal interval of 100 feet. A real-time kinematic global positioning system (RTK GPS) base-rover set was used to determine the horizontal position of each sounding, as well as the water surface elevation (relative to NAVD88). The soundings were merged with the topographic data described in Chapter 2 and used to develop a digital elevation model (DEM). A complete description of survey methodology can be found in the Monitoring Plan.

3.3 RESULTS

Bathymetry varied gradually throughout the site from the ocean to the upstream end of the project area. Pre-restoration, the tidal channels were flat in the center and sloped upward to mudflat elevation at +2.1 feet NADV88 (Table 2-1). They reached a maximum depth of -8 feet NAVD88 in the deepest portion of the inlet channel, to -1 foot NAVD88 at the farthest upstream reach of the main channel and tributaries.

3.4 DISCUSSION

Bathymetry at the site will change substantially following construction. The two main goals for the bathymetry are to (1) improve tidal and storm flow hydraulics sufficiently to enable seawater to reach farther upstream and flush more frequently, and (2) to allow storm flows to drain from the site without flooding major roads. The pre-project main tidal channel was sinuous and very shallow (-2 feet NAVD88 maximum) and the proposed main channel has been deepened to -4 feet NAVD88. It has also been widened from its pre-construction condition of between 50 to 100 feet wide, to between 100 and 200 feet wide in some areas. A very long meander that existed in the main channel of the central basin remains but is improved with a new channel segment that short-cuts the meander to enhance hydraulics and improve storm flow conveyance.

The subtidal habitat area has increased substantially. Channels have been widened and deepened throughout the main tidal channel along the entire length from the ocean to the upstream end. The design extended the subtidal channels upstream to east of the previously existing CDFW dike, allowing tides to reach substantially farther than the pre-construction bathymetry permitted. The CDFW dike was also removed as part of construction.

4. TIDAL ELEVATIONS

4.1 PERFORMANCE STANDARD

Tidal elevation is a project design absolute monitoring variable and, therefore, will not be compared to reference wetlands. Performance standards include the following metrics:

1. Habitat areas must fall within 10% of the designed habitat area targets in response to tidal inundation frequencies (TIF); and
2. Predicted seawater residence time must remain on average shorter than 7 days in the central basin and 9 days in the east basin, as estimated using a numerical hydrodynamic model (such as RMA) to indicate first order water quality.

4.2 APPROACH

Tidal elevations in each basin were measured using pressure sensors to supplement the existing data loggers (sondes) deployed for water quality monitoring (sondes used are RBRsolo^{3}D by RFR, Limited of Canada), as shown in Figure 4-1. A network of tidal elevation measurements was made in September 2016 prior to construction and included the tidal inlet and west and central basins. Recorded water pressure was converted to water surface elevation above each gage. Pre-construction monitoring was conducted for 1 year prior to construction. Tidal elevation data were collected and downloaded roughly each quarter in 2017. A complete description of survey methodology can be found in the Monitoring Plan.

4.3 RESULTS

Pre-construction tidal elevations are shown below in Tables 4-1 and 4-2. These elevations represent cleared conditions of the tidal inlet. Shoaled conditions result in a compressed tidal range and slightly muted tidal elevations.

Table 4-1. Pre-construction Tidal Ranges for Cleared Conditions with Ocean Sea Level in 2017

	Tidal Range (feet)[1]					
	Open Ocean	Hwy 101 Bridge	West Basin (Las Olas)	Central Basin (Former Dock)	I-5 Bridge	East Basin (CDFW Dike)
Pre-construction	7.97	4.56	3.99	3.85	3.78	3.76

[1] Numbers represent the difference between high and low tide elevations (see Table 5-2).

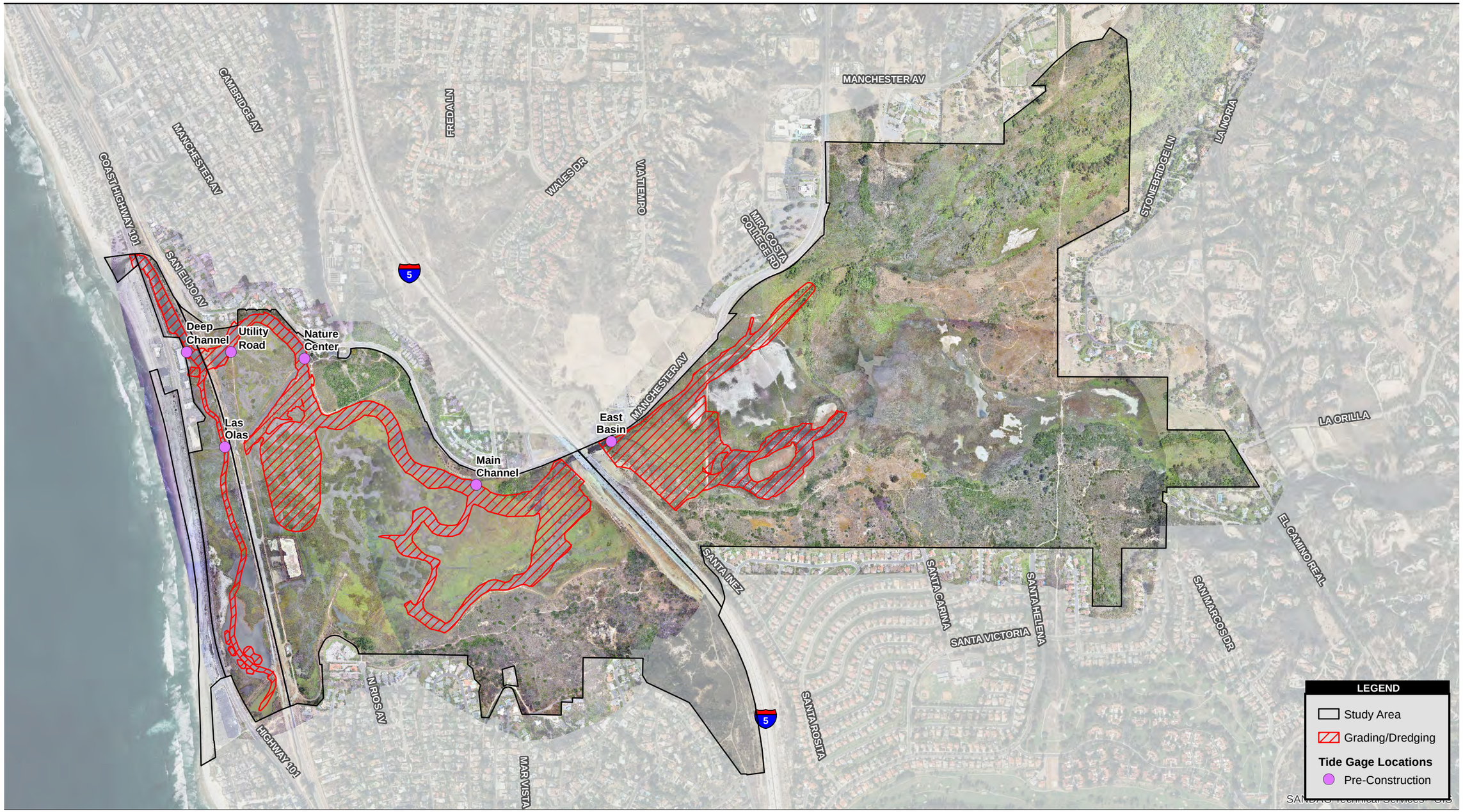
Table 4-2. Pre-construction Spring High and Low Tidal Elevations for Cleared Conditions with Ocean Sea Level in 2017

	High and Low Tidal Elevations (ft NAVD88)											
	Open Ocean		Hwy 101 Bridge		West Basin (Las Olas)		Central Basin (Former Dock)		I-5 Bridge		East Basin (CDFW Dike)	
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Pre-construction	6.50	-1.47	6.30	1.74	5.77	1.78	5.65	1.80	5.63	1.85	5.63	1.87

ft NAVD88 = feet North American Vertical Datum of 1988

4.4 DISCUSSION

Tides are expected to expand in range from high to low under nearly all conditions after restoration. The goal is to expand the tidal range to a point that habitats experience a broader vertical elevation range, thus expanding the wetland habitat types within the lagoon. In addition, expanding the tidal range correspondingly increases the tidal prism. The tidal prism is the mechanism for scouring the tidal inlet channel to keep the lagoon open and connected to the sea. An increased tidal prism will result in a more stable lagoon inlet and improved water quality and fish habitat. Finally, increasing the tide range and tidal prism will increase the frequency of tidal flushing within the lagoon and result in shorter seawater residence time and improved water quality.



MoffattNichol (2015-18); AECOM (2018), SanGIS (2018).

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

Figure 4-1
Tide Gage Locations

Path: P:_6058\60582908_SELRP_ConPh2\900-CAD-GIS\920 GIS\map_docs\mxd\Report\Baseline\Tide Gages.mxd, 2/21/2020, paul.moreno

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5. HABITAT AREAS

5.1 PERFORMANCE STANDARD

Habitat areas are a project design absolute monitoring variable and will not be held to comparisons with reference wetlands for purposes of determining success of the SELRP. CCC Coastal Development Permit conditions stipulate that areas of different habitats not vary by more than 10% from the final approved habitat distribution. Target habitat acreages for CCC requirements are identified in Table 5-1.

Table 5-1. Target Habitat Distribution

Habitat Type	Target Acres
Subtidal	62
Intertidal Mudflat[1]	32-47
Intertidal Salt Marsh[1]	293-308
Transitional	7
Total[2]	**409**

[1] Intertidal salt marsh and mudflat ranges are due to uncertainty of converted low marsh areas within the overdredge pit.
[2] The total is based on the fixed area in which restoration is occurring.

5.2 APPROACH

Vegetation mapping was completed throughout the project area by AECOM during the spring of 2010 and was updated in 2012 and 2015 (AECOM 2016a). Vegetation was monitored in late summer of 2017, prior to the start of construction to assess pre-project conditions of areas to be impacted by restoration activities. Habitats were classified based on the dominant and characteristic plant species, plant physiognomy, and soils in accordance with the Draft Vegetation Communities of San Diego County (Oberbauer et al. 2008)). Subtidal, intertidal mudflat, and intertidal salt marsh habitats were categorized based on the criteria identified in the San Dieguito Wetlands Restoration Project (low marsh, mid marsh, and high marsh have been combined). A complete description of survey methodology can be found in the Monitoring Plan.

5.3 RESULTS

Vegetation communities mapped within San Elijo Lagoon are presented in Table 5-2.

Table 5-2. Habitat Distribution within San Elijo Lagoon

Habitat Type[1]	Habitat Distribution (acres)
Avian Nesting Areas	0
Intertidal Mudflat[2]	50
Salt Marsh (Subtotal of low, mid, and high)[2]	287
Low marsh	27
Mid marsh	140
High marsh	120
Salt Panne	37
Freshwater/Brackish marsh	132
Subtidal Habitat (Open Water)[2]	40
Riparian	70
Coastal Strand	5
Upland & Others	299
Beach	15
Berms and Roads	23
Transitional	0

[1] Habitat descriptions are provided in Appendix A.
[2] Habitats defined based on criteria identified in the San Dieguito Wetlands Restoration Project and tracked per California Coastal Commission requirements.

5.4 DISCUSSION

The baseline (pre-construction) vegetation mapping can be used as a comparison to future habitat distribution mapping to determine if habitat is trending towards the targeted habitat distributions identified in Table 5-1. Habitat is dependent upon achieving the target goals of topography, bathymetry, and tidal elevation, which have all been directly modified as part of the SELRP to ultimately alter habitat. Accordingly, habitat distribution must be within 10% of the designed acreages presented in Table 5-1.

6. VEGETATION

6.1 VEGETATIVE COVER

6.1.1 Performance Standards

Vegetative cover is a project design absolute monitoring variable. Performance standards for vegetation cover address the post-construction 240-workday Plant Establishment Period (PEP) and interim yearly performance standards that serve as milestones to determine if the restoration is on an adequate trajectory to meet final cover standards (Table 6-1). Final standards shall be considered met when the Year 10 cover standards have been met.

Table 6-1. 10-Year Absolute Performance Standards

Milestone	Planted Low Marsh Native Cover (absolute)	Planted Mid and High Marsh Native Cover (absolute)	Unplanted Marsh Native Cover (absolute)[1]	Planted Transitional Habitat Native Cover (absolute)	Species Diversity	Nonnative Cover (absolute)	Container Plant Survival
240-Workday Plant Establishment Period	N/A	N/A	N/A	N/A	N/A	<5% nonnative and 0% Cal-IPC listed "high" or "moderate" threat species	100%
Year 1	5%	10%	N/A	10%	80% of the species planted present	<5% nonnative and 0% Cal-IPC listed "high" or "moderate" threat species	80% (unless function has been replaced by recruitment)
Year 2	10%	20%	N/A	20%	Natural recruitment of multiple species in habitat types and 75% of the species planted present	<5% nonnative and 0% Cal-IPC listed "high" or "moderate" threat species	80% (unless function has been replaced by recruitment)
Year 3	20%	30%	N/A	35%			
Year 4	35%	45%	N/A	50%			
Year 5	45%	55%	30%	70%			
Year 6	50%	60%	30%	N/A			
Year 7	55%	65%	35%	N/A			
Year 8	60%	70%	40%	N/A			
Year 9	65%	75%	40%	N/A			
Year 10	70%	80%	45%	N/A			

Cal-IPC = California Invasive Plant Council; N/A = not applicable
[1]These are areas that have been identified and are expected to convert to vegetated marsh over time.

6.1.2 Approach

Vegetation cover was monitored in late summer 2017 (prior to construction) to assess pre-project conditions of areas to be impacted by restoration activities. Mid and high marsh adjacent to and within the impact area during dredging and grading operations were the focus of this monitoring effort. Quantitative monitoring included 30-meter (m) point-intercept transects, with a 2.5-m-wide plant diversity belt on both sides of the transect line and visual cover estimates within 10-m x 10-m square quadrats as detailed in the Monitoring Plan. Pre-construction monitoring efforts within mid and high salt marsh habitat included eight transects and four quadrats in the west basin; 12 transects and 29 quadrats in the central basin, and nine transects and 11 quadrats in the east basin (Figure 6-1). No transects or quadrats were placed within low marsh to monitor for cover because the low marsh was monitored using transects to measure California cordgrass (*Spartina foliosa*) canopy architecture. Total native and nonnative cover in each basin was determined by averaging the transect and quadrat data within each basin.

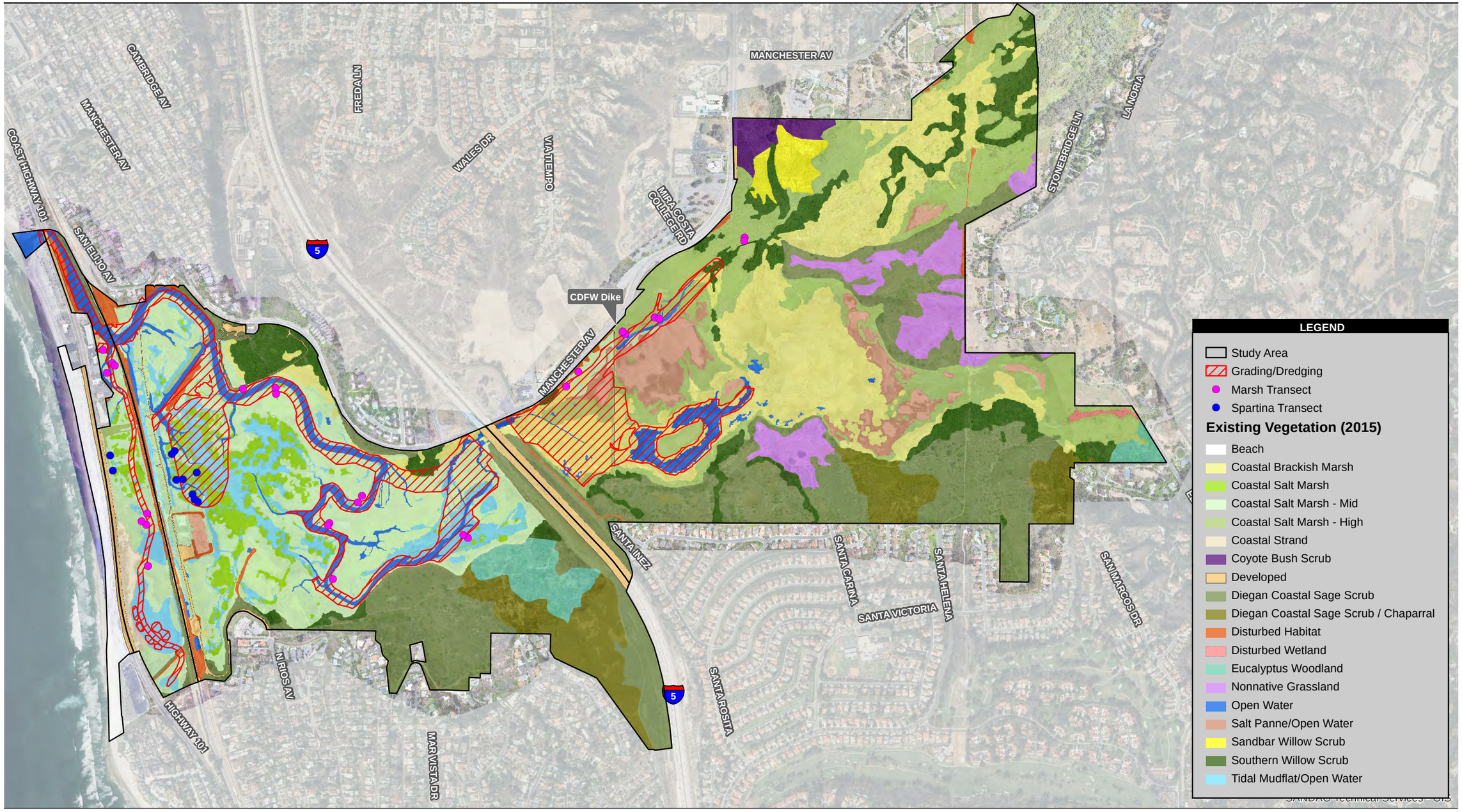
6.1.3 Results

Transect data results are summarized in Table 6-2. In the west basin, the average total native cover along the transects was estimated to be 94.8% with five native species observed. In the central basin, the average total native cover along the transects was estimated to be 96.1% with seven native species observed. No nonnative species were observed in either the west or central basin. In the east basin, the average total native cover along the transects was estimated to be 106.7%[1] and the total nonnative species cover estimate was 10.9%. Twelve native species and five nonnative species were observed. Detailed transect results by species are included in Appendix B.

Table 6-2. Mid and High Salt Marsh Transect Monitoring Results

Basin	Native Species		Nonnative Species	
	Average Absolute Cover	Total Species Richness	Average Absolute Cover	Total Species Richness
West	94.8%	5	0%	0
Central	96.1%	7	0%	0
East	106.7%	12	10.9%	5
All Basins	*99.2%*	*8*	*0%*	*1.7*

[1] Absolute cover is estimated by summing the total number of plant hits at each intercept and then dividing the total by the number of intercepts. An intercept is each point in a transect where data are collected so each intercept has the potential of having more than one species recorded due to overlapping species and/or multiple canopy layers. The end result is that there is a potential to have more than 100% cover even with open space and potentially no species hits at a number of intercepts.



MoffattNichol (2015-18); AECOM (2018), SanGIS (2018).

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

Figure 6-1
Pre-Construction
Vegetation Transects

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Quadrat data results are summarized in Table 6-3. In the west basin, the average total native cover was 88.8%, the nonnative species estimate was 0.5%, and bare ground was estimated at 11.3%. In the central basin, the average total native cover was 79.1%, the nonnative species estimate was 0.5%, and bare ground was estimated at 20.4%. In the east basin, the average total native cover was 49.6%, the nonnative species estimate was 15.7%, and bare ground was estimated at 34.7%. Detailed quadrat results by species are included in Appendix B.

Table 6-3. Mid and High Salt Marsh Quadrat Monitoring Results

Basin	Average Cover		
	Bare Ground	Total Nonnative	Total Native
West	11.3%	0.5%	88.8%
Central	20.4%	0.5%	79.1%
East	34.7%	15.7%	49.6%
All Basins	*22.1%*	*5.6%*	*72.5%*

6.1.4 Discussion

These data are presented to summarize baseline conditions prior to construction. The vegetation cover success criteria are an absolute performance standard and success for vegetation will be based on meeting the criteria identified in Table 6-1. However, understanding baseline vegetation cover is important as it relates to other monitoring variables, such as avian use. It is possible that the vegetation cover monitoring variable could achieve the performance standards prior to the avian monitoring variable achieving performance standards because there could be a lag between the time habitat becomes suitable for avian species versus the time avian abundance or density increases back to pre-restoration conditions. Some avian species could also require more cover than what is required for restoration success standards. Given that the avian monitoring variables will be based on pre-construction data, it is important to understand vegetation cover prior to construction to allow inferences related to avian performance to be made in future years.

6.2 CALIFORNIA CORDGRASS (*SPARTINA FOLIOSA*) CANOPY ARCHITECTURE

6.2.1 Performance Standards

California cordgrass canopy architecture is a relative monitoring variable and will be compared to reference wetlands for purposes of determining success of the SELRP. The restored wetland areas shall have a California cordgrass canopy architecture similar to reference wetlands. The relative performance standard will be considered met if the 4-year running average of the mean proportion of stems >3 feet (>90 centimeters [cm]) is not significantly worse than the mean value at the lowest performing reference wetland.

6.2.2 Approach

Pre-construction monitoring was conducted in 2017. Transects measuring 20 m long were established in the areas of cordgrass-dominated low marsh impacted during construction, as illustrated above in Figure 6-1. Data were collected along two transects in the west basin and seven transects in the central basin. Transects were not monitored in the east basin due to the lack of California cordgrass in this basin. The number and height of cordgrass stems was assessed in 0.1 square-meter (m^2) (circular) quadrats placed over the cordgrass every 2 m along each transect (a total of nine points along each transect). Stems were measured in inches in the field and converted to centimeters for reporting purposes. A complete description of survey methodology can be found in the Monitoring Plan.

6.2.3 Results

Table 6-4 summarizes the results in each of the basins monitored (see Appendix B for details). In the west basin, the average number of stems within each 0.1 m^2 circular quadrat was 42.39 and the average number of stems >3 feet (>90 cm) stem height was 0.11 or 0.18% of the total number of stems per quadrat. In the central basin, the average number of stems within each 0.1 m^2 circular quadrat was 24.74 and the average number of stems >3 feet (>90 cm) stem height was 6.26 or 25.29% of the total number of stems per quadrat. The average density of stems in the west and central basins combined estimated per quadrat was 33.57 while the average number of stems greater than 90 cm tall was 3.19 or 12.74% of the total number of stems per quadrat

Table 6-4. Spartina Transect Results

Metric	West Basin	Central Basin	All Basins
Density of Stems per 0.1 m^2 (Avg)	42.39	24.74	33.57
Number of Stems >60–90 cm Tall per 0.1 m^2 (Avg)	5.22	7.9	6.56
Percent of Stems >60–90 cm Tall per 0.1 m^2(Avg)	13.36%	33.74%	23.55%
Number of Stems >90 cm Tall per 0.1 m^2 (Avg)	0.11	6.26	3.19
Percent of Stems >90 cm Tall per 0.1 m^2 (Avg)	0.18%	25.29%	12.74%

cm = centimeters; m^2 = square meter

6.2.4 Discussion

These data are presented to summarize baseline conditions prior to construction and not as a reference for future comparison as the Spartina canopy architecture success criterion is relative to a reference site other than San Elijo Lagoon. However, as explained previously for vegetation cover, this variable is important as it relates to other monitoring variables, such as avian usage, particularly nesting by light-footed ’s rail (LFRR; *Rallus obsoletus levipes*) . Given that the avian monitoring variables will be based on pre-construction data, it is important to understand Spartina cover prior to construction to allow inferences related to avian usage to be made in future years.

6.3 EXOTICS

6.3.1 Performance Standards

Exotic plant cover is a project design absolute monitoring variable and will not be held to comparisons with reference wetlands for purposes of determining success of the SELRP. Conditions included in the CCC Coastal Development Permit and the USFWS Biological Opinion state that important functions of the restored wetland shall not be impaired by exotic species, including 0% coverage by California Invasive Plant Council (Cal-IPC) “Invasive Plant Inventory” species of “high” or “moderate” threat and no more than 5% coverage by other exotic/weed species. Should such species exceed the thresholds, they will be removed.

6.3.2 Approach

Vegetation cover, including native and nonnative, was monitored prior to construction (late summer 2017) to assess pre-project conditions of areas to be impacted by restoration activities as described in Section 6.1.1. A complete description of survey methodology can be found in the Monitoring Plan.

6.3.3 Results

The total nonnative cover recorded along transects and within quadrats is presented in Tables 6-2 and 6-3. Detailed species results are presented in Appendix B. In the west and central basins, no nonnative plant species occurred along the transects. In the east basin, the average total nonnative species cover estimate was 10.9% and the total number of nonnative species present was five along transects. In the west basin, the average total nonnative cover estimated within the quadrats was 0.5% (one single species). In the central basin, the average total nonnative cover estimated within the quadrats was 0.5% (one single species). In the east basin, the average total nonnative cover estimated within the quadrats was 15.7%.

6.3.4 Discussion

Of the species identified within the transects and quadrats, only one species, fennel (*Foeniculum vulgare*), was listed by Cal-IPC as a "Moderate" threat. No "High" threat by Cal-IPC species was detected within the transects or quadrats. Understanding baseline exotic cover and where nonnative species occur is useful as it provides background information as to where exotics are already an issue relative to the performance standards in Table 6-1.

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7. WATER QUALITY

7.1 PERFORMANCE STANDARD

Water quality is a relative monitoring variable and will be compared to reference wetlands for purposes of determining success of the SELRP. The water quality standard is evaluated by comparing the mean duration in hours of episodes of continuous hypoxia within channels of the restored San Elijo Lagoon and those in reference wetlands. If the mean duration of dissolved oxygen levels <3 parts per million (ppm) is significantly higher in San Elijo Lagoon than in the reference wetland with the highest value, then San Elijo Lagoon fails to meet the standard.

The final relative performance standard is considered met if the 4-year running average of the mean duration of dissolved oxygen levels <3 ppm is not significantly worse than the mean value at the lowest performing reference wetland.

7.2 APPROACH

To calculate the relative performance metric for the SELRP, one continuous-monitoring data sonde deployed near the inlet (Nature Center Sonde) will be analyzed for success following construction. Data prior to construction were analyzed to provide a reference point for comparison in future years. In addition to the data sonde used for calculating the relative standard, Nature Collective will continue to conduct its historical monitoring using weekly sampling stations established in 1991 and add three additional data sondes to capture the spatial and temporal variability of water quality for informing adaptive management strategies. A complete description of survey methodology can be found in the Monitoring Plan.

Time period for the baseline analysis is 5.9 years at the Nature Center station (2012 through 2017). Because the Nature Center station has more than 4 years of baseline data, 2013–2016 and 2014–2017 4-year running averages are calculated as well. The dissolved oxygen threshold of <3.0 milligrams per liter (mg/l) is used to determine if a measurement is part of a hypoxic event. Dissolved oxygen, water depth, conductivity, temperature, pH, turbidity, and chlorophyll were recorded every 15 minutes by the data sondes.

The criterion for event duration determines whether two readings are considered unique events or the same event. A 1-hour envelope was used to classify hypoxic events in proximity to each other as one event. The start and end of an event must be at least 1 hour apart to signal an event is complete. Otherwise, readings triggering the threshold value are considered the same event. Table 7-1 illustrates how events are categorized and event duration is calculated. No other filtering of the data was performed. The duration of each hypoxic event is quantified and then averaged across the total number of events (i.e., mean hypoxic duration). There are numerous events of only a single reading (15 minutes) that did not have any other hypoxic reading within an hour of that event occurring.

Table 7-1. Example Hypoxic Event Duration Calculation[1]

Reading	1	2	3	4	5	6	7	8	9	10	11	12	13		
Time (hr)	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3		
Examples														# Events	Duration (hr)
A	3.84	3.57	3.29	3.01	1.84	1.77	1.51	1.84	3.99	5.59	6.24	6.56	6.68	1	1
B	3.5	3.22	3.14	3.05	2.99	2.97	3.12	2.42	2.53	2.65	3.08	3.07	2.92	1	1.5
C	4.53	4.16	3.71	3.29	2.97	3.7	5.08	5.26	5.79	2.59	3.28	3.38	3.27	2	.25 (for both)

[1] Gray highlights represent hypoxic events (i.e., dissolved oxygen threshold of <3.0 milligrams per liter)

7.3 RESULTS

Results from the baseline period for water quality are presented in Tables 7-2 and 7-3. For success criteria, the Nature Center sonde was operational 98% of the time. For adaptive management sondes, the W6 (Manchester Historical) sonde was operational 92% of the time, the Rios sonde was operational 81% of the time, and the W5 sonde was operational 80% of the time. At the Nature Center, the mean duration of hypoxic events was 4.5 hours for the 2013–2016 4-year running average and the mean duration of hypoxic events was 4.1 hours for the 2014–2017 4-year running average (Table 7-4). The Nature Center sonde had a maximum event length of 133.25 hours and a minimum event length of 15 minutes. Appendix C details supplemental baseline water quality data collected at each sonde for other water quality variables, including water depth, conductivity, temperature, pH, turbidity, and chlorophyll.

Table 7-2. Sonde Operational Period

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Years of Baseline Data	5.9	4	2.5	1.7
Date Range[1]	6/8/2012 – 11/13/2017	1/23/2014 – 2/14/2018	6/25/2015 – 12/18/2017	8/3/2015 – 4/7/2017
Total Possible Days	1,985	1,483	908	614
Days Operational	1,856	1,334	452	492
Total Possible Readings	190,515	142,357	87,057	57,880
Readings Taken	178,108	128,030	43,324	46,371
Sonde Operational Period (%)[2]	98%	90%	50%	80%

[1] End date is when the sensor was taken out at the start of SELRP construction. The W6 sonde in the east basin was left in longer because work did not start at that location after work had been in the central basin for 3 months. The W5 sonde was removed in April to accommodate planned construction.
[2] "Readings Taken" out of "Total Possible Readings."

Table 7-3. Baseline Dissolved Oxygen and Hypoxic Events

Metric[1]	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Total Hours of Hypoxic Events	7,644	5,454	2,373	2,360
15-Minute Dissolved Oxygen Samples <3 mg/l	29,818	21,504	9,283	9,152
15-Minute Dissolved Oxygen Samples < 3 mg/l (%)	17%	17%	21%	20%
Hypoxic Events	1682	426	384	440
Mean hypoxic duration (hr)[2]	4.5	12.8	6.2	5.4
Median hypoxic duration (hr)	3.25	5.5	3.25	2.9
Max Hypoxic event (hr)	133.25	228	332	76
Min Hypoxic event (hr)	0.25	0.25	0.25	0.25
Single sample hypoxic event	231	42	52	48
% Hypoxic events that are single sample	14%	10%	14%	11%

hr = hour; mg/l = milligrams per liter
[1] Results for each metric are based on time periods reported in Table 7-2.
[2] "Total Hours of Hypoxic Events" divided by "Hypoxic Events."

Table 7-4. Four-Year Running Averages of Duration of Hypoxic Events (<3mg/l)

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
2013-2016 Mean Hypoxic Duration[1]	4.5	N/A	N/A	N/A
2014-2017 Mean Hypoxic Duration[2]	4.1	11.6	6.2	5.4

N/A = not applicable
[1] Running averages were not calculated for W6, Rios, and W5 because no data were available for 2013 at these stations and values would be the same as those quantified for 2014 – 2017.
[2] Running averages for Rios and W5 are based on the available data from the date ranges provided in Table 7-2.

7.4 DISCUSSION

The patterns in the pre-construction data illustrate the water quality issues at San Elijo Lagoon. The Nature Center is closest to the tidal inlet and has the most tidal circulation. Therefore, it's not surprising that it had the lowest mean hypoxic duration. The farther the sondes are from the inlet, the greater the mean hypoxic duration because there is less mixing of highly oxygenated tidal water. W6, the east basin sonde, was cut off from tidal exchange because of the man-made CDFW dike that bisected the wetland at the location of the sonde. The impact of the dike on water quality

can be seen in the water depth variability and conductivity variability data alongside the hypoxic data (Appendix C). Tidal waters did not reach this part of the wetland, and oxygen levels were lower than at other locations measured in the lagoon. One of the main goals of the restoration project was to remove this blocking feature from the lagoon and restore the hydrologic conductivity between the ocean and this part of the wetland. Substantial improvement in dissolved oxygen levels east of Interstate 5 are expected post-restoration.

When it comes to actual data, most interesting is the amount of both single sample hypoxic events (a single reading below 3 mg/l with a +/- 1-hour window of time) and number of hypoxic events (at least 15 minutes in duration) at the Nature Center sonde. This sonde location has numerous short duration hypoxic events when compared to the other sonde locations. The presence of numerous short hypoxic events reduces the calculated performance standard of mean duration of hypoxic events. A single long duration hypoxic event would have less impact on the performance standard measure than more short duration events. Keeping track of the maximum duration hypoxic event is important for adaptive management as a measure of knowing the range of hypoxic conditions the wetland experiences in the context of the other performance standards measured.

Of note is the amount of downtime (whether no sonde in water, bad data, etc.) for sondes at W5 and Rios. There was failure of sondes at these locations that could have influenced conclusions; however, sufficient data were recorded to support conclusions. Despite this downtime, these locations still had numerous hypoxic events and the duration of each event was longer than those that occurred at the Nature Center. For post-restoration water quality monitoring, live data stream capability will be added to all four sondes in the wetland; this will enable quick replacement of failed sensors and keep sonde sensor uptime above 99% of the time.

Supplemental tables include the summary statistics on the additional water quality variables that the sondes collect at all locations (Appendix C). Water depth, temperature, pH, conductivity, chlorophyll, and turbidity data are collected at 15-minute intervals (turbidity and chlorophyll sensors were not on the Rios or W5 sondes). Water quality issues apparent in the 4-year running averages of hypoxic event duration are visible in the supplemental data as well, with muting in conductivity, pH variability, temperature, and tidal prism (water depth variability) seen at W6. High turbidity events are captured, which can impact the short-term water quality impacts from storm events throughout the lagoon, and the chlorophyll readings show the presence of algae blooms that can occur with poor water quality conditions.

Turbidity has the noisiest data of all variables since material floating in the water or marine life can generate very high spike readings when they interfere with the sensor. Turbidity was cleaned of these noise spikes by calculating a 2-hour running average and then removing data that were more than three times the running average and above a minimum value of 30 NTU. Four percent of all readings at the Nature Center sonde and 7% of all readings at the W6 sonde classified as “High Turbidity” readings. These readings are most likely associated with high flow storm events when there are substantial sediment loads flowing through the wetland. The mean turbidity at W6 was more than double the mean turbidity reading at the Nature Center sonde.

The pH ranges are not true ranges but approximate since range was calculated using the minimum and maximum pH values from each day instead of the actual ion count. If the ranges had been

calculated using ions, they would have to stay in that unit of measurement, which would have not been very useful for quick comparisons between sondes and years. The variability in pH was similar at the three sondes that experience tidal exchange. There was less variability in pH for the W6 sonde, which was cut off from tidal exchange. The variability in temperature, conductivity, and water depth mirror the pH data, and can be linked to the influence of tidal exchange on the water quality at each sensor location.

In summary, the results will be used as a baseline to help track improvements in water quality over time. Ultimately, the post-construction data will be compared to the reference wetland sonde data to determine success of this variable. Should metrics fail to achieve success standards, tracking trends from baseline at Nature Center and data from sondes at adaptive management stations will be useful in determining if or when adaptive management measures should be implemented.

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8. BENTHIC INVERTEBRATES

8.1 PERFORMANCE STANDARD

Benthic invertebrates are a relative monitoring variable and will be compared to reference wetlands for purposes of determining success of the SELRP. The relative performance standard shall be considered met if the 4-year running average of the benthic invertebrate densities and number of species at San Elijo Lagoon are not significantly worse than the mean value at the lowest performing reference wetland.

8.2 APPROACH

Pre-construction monitoring was completed in late October through early November 2017, as illustrated in Figure 8-1. Benthic invertebrate sampling was conducted for both epifauna and infauna. Sampling consisted of counting individuals in quadrats and cores. Invertebrate capture during fish sampling were also counted for purposes of estimating species richness. A complete description of survey methodology can be found in the Monitoring Plan.

Density was standardized to number per 100 square centimeters (cm^2) for both epifauna and infauna sampling techniques. Species richness was standardized to number per sampling location for each sampling techniques including small cores, large cores, quadrats, enclosures, and seines. The standardized densities (number per 100 cm^2) and richness estimates for each method were summed to provide a combined estimate. All organisms, including those identified using a microscope, were included in the macro-invertebrate counts and results.

8.3 RESULTS

The density and richness of invertebrates within main and tidal channel habitats of San Elijo Lagoon in 2017 are summarized in Table 8-1. Numbers were generally consistent across the tidal channels with the exception of sample station 2. This station's invertebrate density was less than 25% of the other sampling stations. The average main channel invertebrate density was much higher than tidal channels. This is predominately because of main channel stations 5 and 6 having two to three times higher densities than other stations. It is unknown what factors are driving high variability in density at some locations. Detailed results for each sampling method can be found in Appendix D. 9

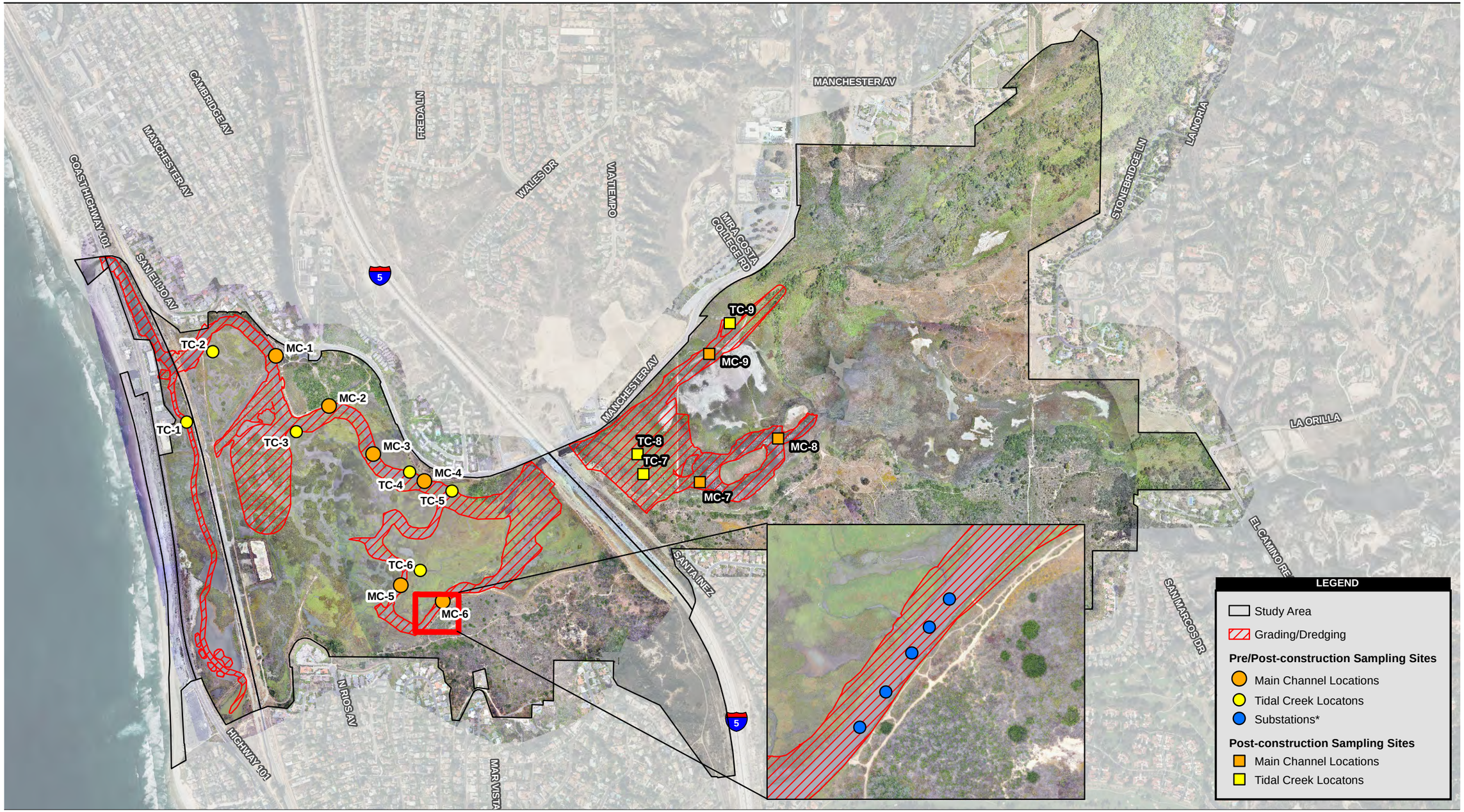
Table 8-1. Summary of Pre-Construction Invertebrate Densities and Species Richness for Each Sampling Station

Sampling Station	Density (# per 100 cm^2)	Richness (# of unique species per sampling location)
Tidal Channel		
TC1	224.3143	28.0
TC2	54.4894	22.0
TC3	252.8498	21.0
TC4	291.4914	20.0
TC5	213.1984	18.0
TC6	219.6287	19.0
Average	209.3287	21.3
Main Channel		
MC1	217.0627	26.0
MC2	212.1818	24.0
MC3	216.4514	22.0
MC4	235.1378	26.0
MC5	495.0403	27.0
MC6	702.4438	19.0
Average	346.3863	24.0

cm^2 = square centimeters

8.4 DISCUSSION

The pre-construction monitoring was conducted to serve as a baseline to help track trends in post-construction invertebrate metrics relative to numbers pre-construction. Ultimately, the post-construction data will be compared to the reference wetland to determine success of this variable. Should metrics fail to achieve success standards, comparing post-restoration data to baseline data will be useful in determining if or when adaptive management measures should be implemented.



MoffattNichol (2015-18); AECOM (2018), SanGIS (2018).

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* Substation sampling occurs at Main Channel and Tidal Creek locations.

Figure 8-1
Benthic Invertebrate and Fish Sampling Sites

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9. SEDIMENTS

9.1 PERFORMANCE STANDARD

Sediment quality data will be collected for information only and will not have a specific performance standard associated with it, as described above. In the event benthic invertebrate populations or water quality performance standards are not met, reference monitoring for sediment quality will be used to help identify whether there is continued presence of historic high-nutrient sediments and/or whether they continue to affect metrics with performance standards. Monitoring for grain size is supplemental to nutrients and may be referenced for adaptive management actions if nutrient levels appear improved, but benthic invertebrate populations are not establishing as anticipated.

9.2 APPROACH

Pre-construction monitoring was completed in December 2017. Sediment samples were collected from the upper, middle, and lower tidal elevations at the same sampling stations where invertebrate communities were assessed (Figure 8-1). Total nitrogen (TN), and total organic carbon (TOC), and sediment grain size were analyzed. A complete description of survey methodology can be found in the Monitoring Plan. Total organic carbon and total nitrogen are reported as percentages by dry weight basis of the dried sediment samples.

9.3 RESULTS

Table 9-1 provides TOC and TN results on a percent dry weight basis. Table 9-2 provides the result of the grain size analysis and Table 9-3 provides results of the analysis of the sand subset of the sediment sample. A range of additional characteristics of the sediment were measured as well. The full sediment report is attached as Appendix E.

Soil organic matter is modest at 2.07% on a dry weight basis on average. Soil organic matter ranges from 0.84% to 4.13% Nitrogen is moderate at 0.11% on average and ranges from 0.05 % to 0.33%. The soil textures range from loamy sand to clay. The average soil texture is sandy clay. The sand is mostly fine to very fine.

Table 9-1. Sediment Sample Total Organic Carbon and Total Nitrogen

Sampling Station	Total Organic Carbon (%- dry weight basis)	Total Nitrogen (%- dry weight basis)
Tidal Channel		
TC1	0.69%	0.07%
TC2	2.06%	0.33%
TC3	0.61%	0.07%
TC4	0.64%	0.07%
TC5	0.90%	0.09%
TC6	1.71%	0.17%
Average	*1.10%*	*0.13%*
Main Channel		
MC1	1.24%	0.11%
MC2	0.45%	0.05%
MC3	0.42%	0.05%
MC4	0.85%	0.07%
MC5	1.62%	0.15%
MC6	1.20%	0.12%
Average	*0.96%*	*0.09%*

Table 9-2. Sediment Sample Grain Size Analysis

Sampling Station	Overall Texture	Clay (%)	Silt (%)	Sand (%) – (Details in Table 9-3)	Gravel >2mm	Gravel >1/4 Inch	Gravel >1/2 Inch
Tidal Channel							
TC1	sandy loam	10.5%	13.1%	76.3%	5.1%	4.0%	4.0%
TC2	clay	48.7%	36.6%	14.7%	0.0%	0.0%	0.0%
TC3	loamy sand	7.2%	11.3%	81.5%	0.0%	0.0%	0.0%
TC4	sandy loam	10.7%	11.4%	77.9%	0.0%	0.0%	0.0%
TC5	sandy loam	19.6%	23.1%	57.3%	0.0%	0.0%	0.0%
TC6	clay loam	33.9%	39.0%	27.1%	0.0%	0.0%	0.0%
Average	-	*21.8%*	*22.4%*	*55.8%*	*0.9%*	*0.7%*	*0.7%*
Main Channel							
MC1	clay loam	30.1%	34.9%	34.9%	0.4%	0.0%	0.0%
MC2	loamy sand	8.2%	13.0%	78.8%	0.0%	0.0%	0.0%

Sampling Station	Overall Texture	Clay (%)	Silt (%)	Sand (%) – (Details in Table 9-3)	Gravel >2mm	Gravel >1/4 Inch	Gravel >1/2 Inch
MC3	loamy sand	5.0%	10.4%	84.6%	0.0%	0.0%	0.0%
MC4	sandy loam	12.6%	11.1%	76.3%	0.6%	0.0%	0.0%
MC5	clay	49.5%	26.9%	23.6%	0.0%	0.0%	0.0%
MC6	loam	24.7%	32.7%	42.6%	0.0%	0.0%	0.0%
Average	-	*21.7%*	*21.5%*	*56.8%*	*0.2%*	*0.0%*	*0.0%*

mm = millimeters

Table 9-3. Sand Size Analysis

Sampling Station	Very Coarse Sand (1–2mm)	Coarse Sand (0.5–1mm)	Medium Sand (0.25–0.5mm)	Fine Sand (0.15–0.25mm)	Very Fine Sand (0.05–0.15mm)
Tidal Channel					
TC1	1.3%	14.0%	38.5%	21.2%	19.6%
TC2	0.0%	0.9%	5.8%	30.5%	61.1%
TC3	0.0%	0.4%	1.5%	37.9%	59.9%
TC4	0.0%	0.4%	1.8%	32.9%	64.3%
TC5	0.0%	0.3%	1.4%	30.1%	67.4%
TC6	0.3%	0.5%	3.3%	25.3%	68.5%
Average	*0.3%*	*2.8%*	*8.7%*	*29.7%*	*56.8%*
Main Channel					
MC1	0%	0.9%	8.0%	33.6%	56.7%
MC2	0%	0.3%	1.2%	17.8%	79.8%
MC3	0%	0.3%	4.2%	48.1%	46.8%
MC4	0.7%	1.8%	6.8%	45.2%	44.7%
MC5	0.3%	0.2%	1.2%	15.8%	79.7%
MC6	0%	0.1%	2.0%	16.2%	78.7%
Average	*0%*	*1%*	*4%*	*29%*	*64%*

mm = millimeters

9.4 DISCUSSION

These results are for contextual information in interpreting the other performance standards, such as water quality and benthic invertebrates, that are part of the monitoring requirements of the restoration. The average distribution of sediment grain sizes between the tidal channels and the main channels were the same. The largest outlier was the presence of material with diameters larger than ½ inch in the west basin of the lagoon. These are probably old lagoonal deposits of cobble when the inlet to the lagoon was unconstrained by infrastructure and burst free to the ocean at other locations. The average composition of the tidal channel and main channel TOC and TN are also about the same.

The channels that samples were taken from were pre-construction channels in the lagoon. For post-restoration monitoring, data might vary from these pre-construction data because of the widening and deepening of the channels in the lagoon that may lead to a different mix of sediments in the soil profile.

10. FISH

10.1 PERFORMANCE STANDARD

Fish are a relative monitoring variable and will be compared to reference wetlands for purposes of determining success of the SELRP. The relative performance standard shall be considered met if the 4-year running average of fish densities and number of species at the San Elijo Lagoon are not significantly worse than the mean value at the lowest performing reference wetland.

10.2 APPROACH

Pre-construction monitoring was completed in late October through early November 2017. Fish data were collected using two methods: seining and enclosure traps. Figure 8-1 illustrates sampling locations. A complete description of survey methodology can be found in the Monitoring Plan.

Density was standardized to number per m^2 for both seining and enclosure trap data. Species richness was standardized to number per sampling location for each sampling technique. The fish sampling locations are the same as the invertebrate sampling locations and fall into two categories: main channels and tidal creeks. The averages for enclosures and beach seines are summed to produce a combined estimate of total density (average number perm^2) for each tidal creek or main channel replicate.

10.3 RESULTS

The density and richness of fish within main and tidal channel habitats of San Elijo Lagoon in 2017 is summarized in Table 10-1. Tidal channel station 1 had the highest density and richness of all sample stations. This station's fish density was higher than that of other sampling stations. The average tidal channel invertebrate density was much higher than main channels. This is predominately because of tidal channel stations 1 and 4 having much higher densities than other stations. Detailed results for each sampling method can be found in Appendix D.

Table 10-1. Summary of Pre-Construction Fish Densities and Species Richness for Each Sampling Station

Sampling Station	Density (# per m^2)	Richness (# of unique species per sampling location)
Tidal Channel		
TC1	7.11	16.0
TC2	0.85	5.0
TC3	1.30	5.0
TC4	3.10	7.0
TC5	0.15	3.0
TC6	1.47	7.0
Main Channel		
MC1	0.59	6.0
MC2	0.65	8.0
MC3	0.12	4.0
MC4	0.13	2.0
MC5	0.39	7.0
MC6	0.20	6.0

m^2 = square meter

10.4 DISCUSSION

The pre-construction monitoring was conducted to serve as a baseline to help track trends in post-construction fish metrics. Ultimately, the post-construction data will be compared to the reference wetlands to determine success of this variable. Should metrics fail to achieve success standards, tracking trends from baseline will be useful in determining if or when adaptive management measures should be implemented.

11. BIRDS

11.1 BREEDING MARSH BIRDS

11.1.1 Performance Standards

Success for breeding marsh birds will be measured by comparing project-specific pre-construction (defined as those data collected in 2016 and 2017) and construction / post-construction data metrics using the "floating alpha" method described in Sections 2.1.2 and 2.2.2 of the Monitoring Plan (Nature Collective 2020).

Interim standard: Post-construction 4-year running average density and number of individuals 75% or greater than that of pre-construction survey data (2016, 2017) by year 7 post-construction

Final standard: Post-construction 4-year running average density and number of individuals 95% or greater than that of pre-construction survey data (2016, 2017) by year 10 post-construction

Running averages will be used to account for annual population variability. Standards will not be considered met until performance standards are met for 3 consecutive years (see Section 2.3 of the Monitoring Plan).

11.1.2 Approach

The focus of these surveys was to estimate density and abundance for the federally- and state-listed endangered LFRR. The Standardized North American Marsh Bird Monitoring Protocol (Conway 2011) recommends recording an additional five focal marsh bird species, these include: Virginia rail (*Rallus limicola*); least bittern (*Ixobrychus exilis*) (CDFW Species of Special Concern); American bittern (*Botaurus lentiginosus*); common gallinule (*Gallinula galeata*); and pied-billed grebe (*Podilymbus podiceps*).

Breeding marsh bird surveys were conducted between April 6, and June 3, 2016 and March 15, and June 6, 2017. LFRR data were collected within the 200-m radius of survey points using independent double-observer methods (Nichols et al. 2000), as described in the Monitoring Plan. To estimate the LFRR population size for the entire lagoon (i.e., the lagoon-wide abundance estimate), including areas of un-surveyed habitat, LFRR density estimates (and associated confidence intervals) were multiplied by the total acreage of preferred habitat across the entire lagoon (301.17 acres). A complete description of survey methodology and rationale can be found in the Monitoring Plan.

11.1.3 Results

A detailed summary of the survey dates, survey times, survey personnel, and weather conditions, in addition to raw counts of LFRR pairs and individuals, can be found in the 2016 and 2017 *Light-footed Ridgway's Rail 45-Day Summary Reports* (AECOM 2016a, 2017a).

11.1.3.1 Light-footed Ridgway's rail

LFRR were detected predominantly in areas dominated by Coastal Brackish Marsh (CBM), Coastal Salt Marsh – Low (CSM – Low), and Coastal Salt Marsh – Mid (CSM – Mid). The locations of LFRR detections from 2016 and 2017 surveys are detailed in Appendix F.

LFRR density estimates for each of the six surveys conducted in 2016 and 2017 are presented in Table 11-1 with associated model-generated 95% confidence intervals. Values represent the estimated number of individuals per acre of preferred habitat within the survey area. LFRR density estimates are presented for 2016, 2017, and both years combined, with the latter representing the baseline LFRR density estimate.

Table 11-1. Summary of Light-Footed Ridgway's Rail Results

Survey Number	LFRR Survey Area Density Estimates (# Individuals per Acre)		
	2016	2017	2016–2017 Baseline
	Estimate (95% CI)[1]		Overall Baseline Estimate[2]
1	0.289 (0.281–0.296)	0.210 (0.203–0.217)	0.249
2	0.210 (0.203–0.216)	0.231 (0.224–0.238)	0.220
3	0.231 (0.224–0.238)	0.226 (0.218–0.234)	0.228
4	0.215 (0.208–0.223)	0.204 (0.198–0.210)	0.210
5	0.157 (0.152–0.163)	0.174 (0.166–0.182)	0.166
6	0.215 (0.208–0.222)	0.147 (0.140–0.154)	0.181
Overall Mean (95% CI)[3]	0.219 (0.186–0.253)	0.199 (0.173–0.224)	0.209 (0.184–0.234)

[1] Density estimates and 95% confidence intervals for Surveys 1–6 in 2016 and 2017 were calculated by dividing the model-generated light-footed Ridgway's rail (LFRR) abundance estimates (and associated confidence limits) within the survey area by the amount of preferred habitat within the survey area (192.49 acres).
[2] The six survey-specific baseline density estimates in this column were calculated as the mean of 2016 and 2017 density estimates and lack model-generated confidence limits.
[3] Overall Mean Estimates in this row for 2016, 2017, and both years combined were calculated as the mean of the six survey-specific estimates. Confidence limits for 95% confidence intervals calculated as mean estimate +/- 1.96 x standard error of the six estimates.

The overall mean LFRR density estimates for 2016 and 2017, shown in the bottom row of Table 11-1, did not differ dramatically, and their 95% confidence intervals overlapped considerably. Lagoon-wide estimates of LFFR abundance (total number of individuals) were generated for 2016 and 2017 by extrapolating survey area density estimates (and confidence limits) (Table 11-1) to the approximately 301 total acres of preferred habitat within the entire lagoon. The mean lagoon-wide LFRR abundance estimate in 2017 was slightly lower than in 2016 (60 versus 66 individuals, respectively) (Appendix F), but this was driven mainly by one particularly high estimate during Survey 1 in the 2016 season (Appendix F). Overall, the estimates were not dramatically different, however, as their 95% confidence intervals overlapped considerably with each other (Appendix F).

11.1.3.2 Other Focal Marsh Bird Species

On average, Virginia rails were the most commonly detected of the focal marsh bird species during surveys and common gallinule were the least detected (Table 11-2). Aside from Virginia rails, the numbers were relatively low for focal marsh bird species in both years, and there was little difference between the 2 years of baseline data for any of the focal marsh bird species. The average from 2016 and 2017 detection rates (Table 11-2) provides the baseline pre-construction abundance metrics for these species.

Table 11-2. Other Focal Marsh Bird Species

Focal Species		Average Number Detected per Survey (Standard Error)		
Common Name	**Scientific Name**	**2016[1]**	**2017[1]**	**2-Year Baseline Average[2]**
Virginia Rail	*Rallus limicola*	6.17 (1.49)	5.83 (2.24)	6.00 (1.41)
Least Bittern	*Ixobrychus exilis*	0.17 (0.17)	0.50 (0.34)	0.33 (0.17)
American Bittern	*Botaurus lentiginosus*	0.83 (0.65)	0.67 (0.42)	0.75 (0.48)
Common Gallinule	*Gallinula galeata*	0.00 (0.00)	0.17 (0.17)	0.08 (0.08)
Pied-billed Grebe	*Podilymbus podiceps*	2.17 (0.79)	1.33 (0.49)	1.75 (0.38)
All Species[3]	-----	9.33 (2.49)	10.67 (3.21)	10.00 (2.49)

[1] Mean and standard error for 2016 and 2017 estimates calculated from number of individuals detected during the six surveys each year.
[2] Baseline average and standard error calculated from the 2-year average (2016 and 2017) number of individuals detected during each of the six surveys each year.
[3] Values are based on the survey-specific totals (number of individuals of all focal species) detected for surveys 1–6 during 2016 and 2017.

11.1.4 Discussion

11.1.4.1 Light-footed Ridgway's rail

The objective of the LFRR surveys is to provide a replicable survey method that can act as a reliable abundance index to monitor for changes in the LFRR population size within San Elijo Lagoon over time. The mean survey area density estimate for 2016 did not differ significantly from that in 2017, and the average estimate from both years combined was 0.209 (0.167 – 0.252) individuals per acre of preferred habitat. This density estimate translates to an extrapolated lagoon-wide population estimate of 63 (95% CI: 50 – 76) individuals. These estimates will serve as the pre-construction baseline estimate for comparison with estimates derived from surveys conducted during and after construction.

Methods in this study were designed to provide metrics of LFRR density and abundance during the breeding season rather than a census of individuals and/or documentation of nesting activity. The lagoon-wide LFRR abundance estimates in this study are less than those documented in 2016 and 2017 by Zembal (2019). However, because the surveys described herein were designed to provide an index of abundance, the results from the two studies are not directly comparable.

In summary, the LFRR survey results from 2016 and 2017 combined provide a baseline lagoon-wide density estimate of 0.209 (95% CI: 0.167 – 0.252) individuals per acre of preferred habitat and a lagoon-wide abundance estimate of 63 (95% CI: 50 – 76) individuals for comparisons with data collected during the construction and post-construction phases of the project. As LFRR surveys continue to be conducted during the construction and post-construction phases of the project, a running average will be calculated for the 4 most recent years of construction/post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring reports prepared for the SELRP.

11.1.4.2 Other Focal Marsh Bird Species

The focal bird species results are intended to provide an index of relative abundance of key marsh bird species other than LFRR during the 2 years of pre-construction surveys, for comparison with detection rates during construction and post-construction marsh bird surveys. These other focal bird species have utility as “indicator species” for assessing wetland ecosystem quality (Conway 2011) and their continued presence will be another indicator of project success.

Observations of the five other focal species were estimated as the average number of individuals per survey (for each year, 2016, 2017, and 2016 and 2017 combined; Table 11-2). Due to the low number of detections for each of these species, abundance estimates were not corrected for detection probabilities, so the reported numbers probably underestimate true abundance of focal marsh bird species. They are, thus, not directly comparable to the estimates of LFRR abundance. The focal marsh bird data represent the number of detections within the survey area and are also not adjusted for the amount of suitable habitat, or extrapolated to provide an estimate of the lagoon-wide abundance.

In summary, the other focal bird species survey results from 2016 and 2017 combined provide the baseline lagoon-wide abundance estimate of individuals for comparisons with data collected during the construction and post-construction phases of the project. As surveys continue to be conducted during the construction and post-construction phases of the project, a running average will be calculated for the 4 most recent years of construction/ post-construction marsh bird surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between years will be summarized and discussed in the annual monitoring report prepared for the SELRP.

11.2 WATERBIRD SURVEYS, INCLUDING WESTERN SNOWY PLOVER AND CALIFORNIA LEAST TERN

Monitoring waterbird species (e.g., seabirds, waterfowl, shorebirds, wading birds) that use open water, and mudflat habitats in the SELRP study area is a pre-restoration absolute monitoring variable and will not be compared to reference wetlands for purposes of determining success of the SELRP. In the process of monitoring waterbird numbers, these avian surveys will generate information about western snowy plovers and California least terns.

11.2.1 Performance Standards

Success for western snowy plovers, California least terns, and other waterbird species will be measured by comparing project-specific pre-construction (defined as those data collected in 2016 and 2017) and construction/post-construction data metrics using the "floating alpha" method described in Sections 2.1.2 and 2.2.2 of the Monitoring Plan (Nature Collective 2020).

Interim standard: Post-construction 4-year running average number of individuals 75% or greater than that of pre-construction survey data (2016, 2017) by year 7 post-construction

Final standard: Post-construction 4-year running average number of individuals 95% or greater than that of pre-construction survey data (2016, 2017) by year 10 post-construction

Running averages will be used to account for annual population variability. Standards will not be considered met until performance standards are met for 3 consecutive years (see Section 2.3 of the Monitoring Plan).

11.2.2 Approach

Waterbird surveys focused on birds that utilize open water, mudflat, and sand habitat, including western snowy plovers and California least terns. A complete description of survey methodology for waterbird surveys can be found in the Monitoring Plan. Each survey was conducted in a fashion that yielded a census of all waterbirds observed in the west, central, and east basins of the lagoon. Abundance of two species, western snowy plover (*Charadrius nivosus nivosus*) and California least tern (*Sternula antillarum browni*), were estimated as the number of individuals observed per survey for each basin (Appendix F) and overall. Estimates were averaged between the 2 years to yield a baseline level against which construction and post-construction levels will be compared. Observations of other target species were grouped broadly into cohorts reflecting different taxonomic Orders and summarized as the number of individuals in each cohort observed per survey for each basin, overall, and averaged between the 2 years. A list of the species associated with each taxonomic order can be found in Appendix F.

Surveys were conducted from April through December in 2016 and from January through December in 2017. Within these periods, at least one survey was conducted per month during January, February, October, November and December, and at least two surveys were conducted per month during March through September. In 2016, separate surveys were conducted for California least terns from mid-April through September, but in 2017 California least tern surveys were conducted simultaneously with western snowy plover and other waterbird surveys. Detailed summaries of the survey dates, survey times, survey personnel and weather conditions for surveys conducted are provided in Appendix F – 2016 waterbirds/western snowy plover surveys; Appendix F – 2016 California least tern surveys; and Appendix F – 2017 waterbird, western snowy plover, and California least tern surveys.

11.2.3 Results

Survey results are summarized by month and lagoon basin in Section 2.2.3 of Appendix F for western snowy plover, California least tern, and waterbirds. When multiple surveys were conducted in a month for a given year, the mean number of individuals detected across surveys conducted in that month was calculated. The mean number of individuals detected per survey during each month was used to evaluate temporal variation in abundance (across seasons, and between years), and to calculate the overall baseline average abundance metrics.

11.2.3.1 Western Snowy Plover

Results from 2016 and 2017 western snowy plover surveys are summarized by month in Table 11-3. During 2016, western snowy plovers were detected during 5 of 18 surveys and the number of individuals observed ranged from 0 to 9 per survey (Appendix F), for a total of 17 detections (see Appendix F for locations of western snowy plover observations). No western snowy plovers were detected within the lagoon during 2017 waterbird surveys. Based on monthly averages, the number of western snowy plovers detected in 2017 (0.00 individuals/survey) was only slightly lower than 2016 (0.72 individuals/survey), for an overall lagoon-wide annual average of 0.27 individuals per survey across both years (Table 11-3). For western snowy plover observations by survey number and by lagoon basin, see Appendix F.

Table 11-3. Summary of Western Snowy Plover Results by Month

Monthly Averages (Mean # Individuals/Survey)			
Month	**2016**	**2017**	**2016-2017 Baseline**
Jan	-	0.00	0.00
Feb	-	0.00	0.00
Mar	-	0.00	0.00
Apr	0.00	0.00	0.00
May	0.00	0.00	0.00
Jun	0.00	0.00	0.00
Jul	0.00	0.00	0.00
Aug	0.00	0.00	0.00
Sep	2.50	0.00	1.25
Oct	4.00	0.00	2.00
Nov	0.00	0.00	0.00
Dec	0.00	0.00	0.00
Overall Average (Standard Error)	**0.72 (0.49)**	**0.00 (0.00)**	**0.27 (0.19)**

11.2.3.2 California Least Tern

Results from California least tern surveys are provided only for the months of April through September because the species is generally not present on their breeding range outside of this date range. Results from 2016 and 2017 California least tern surveys are summarized by month below (Table 11-4). Lagoon-wide, California least terns were not detected during surveys conducted in the months of April, August, or September, and their numbers tended to be highest during May and particularly June, coincident with the arrival of migrant birds that overwinter in central and

south America and breed in Southern California. This was true in both 2016 and 2017, even though overall numbers were slightly lower during 2017 (Table 11-4).

During 2016, California least terns were detected during 9 of 20 waterbird surveys and the number of individuals observed ranged from 0 to 7 per survey (Appendix F). See Appendix F for locations of tern observations. In 2017, the species was detected in 3 of 13 surveys and the number of individuals observed ranged from 0 to 5 per survey (Appendix F). See Appendix F for locations of tern observations. Across all three basins, the mean number of California least terns detected per survey was slightly higher in 2016 (1.12 individuals/survey) compared to 2017 (0.58 individuals/survey), for an overall lagoon-wide annual average across the two years of 0.85 individuals per survey (Table 11-4). For California least tern observations by survey number and by lagoon basin, see Appendix F.

Table 11-4. Summary of California Least Tern Results by Month

Monthly Averages (Mean # Individuals/Survey)			
Month	**2016**	**2017**	**2016–2017 Baseline**
Apr	0.0	0.0	0.0
May	1.8	1.0	1.4
Jun	4.2	2.5	3.4
Jul	0.8	0.0	0.4
Aug	0.0	0.0	0.0
Sep	0.0	0.0	0.0
Overall Average (Standard Error)	**1.12 (0.68)**	**0.58 (0.42)**	**0.85 (0.55)**

11.2.3.3 Other Waterbird Species

Results from 2016 and 2017 general waterbird surveys are summarized by month below (Table 11-5). Lagoon-wide, waterbird numbers tended to be lowest during the months of May through August, coincident with the time most migrants are away at breeding grounds farther north, and highest during the other months. This pattern held in both 2016 and 2017, even though overall waterbird numbers tended to be lower during 2017 (Table 11-5). The mean number of waterbirds detected per survey was slightly higher in 2016 (383.6 individuals/survey) compared to 2017 (327.9 individuals/survey), for an overall lagoon-wide annual average across the 2 years of 355.8 individuals per survey (Table 11-5). For waterbird observations by survey number and by lagoon basin, see Appendix F.

Table 11-5. Summary of Waterbird Results by Month

Monthly Averages (Mean # Individuals/Survey)			
Month	**2016**	**2017**	**2016-2017 Baseline**
Jan	-	509.5	509.5
Feb	-	857.0	857.0
Mar	-	458.5	458.5
Apr	435.0	222.5	328.8
May	212.0	150.7	181.3
Jun	202.3	95.5	148.9
Jul	194.5	115.0	154.8
Aug	287.0	237.0	262.0
Sep	402.0	171.5	286.8
Oct	304.0	69.0	186.5
Nov	512.5	587.0	549.8
Dec	903.5	462.0	682.8
Overall Average (Standard Error)	**383.6 (74.9)**	**327.9 (70.5)**	**355.8 (72.7)**

Waterbirds belonging to the taxonomic orders Anseriformes and Charadriiformes comprised more than 80% of all observations during both 2016 and 2017, and this was true across all three lagoon basins (Appendix F). Because both groups consist largely of migrant species that overwinter in the area or pass through when traveling between winter and breeding grounds, seasonal variation in overall waterbird numbers are largely driven by differences in the abundance of these two groups through the year.

11.2.4 Discussion

11.2.4.1 Western Snowy Plover

Western snowy plovers were observed within the lagoon in very low numbers during the late summer and fall (Appendix F), and were only observed in 2016.

When averaged across all basins and the 2 years (2016 and 2017), the overall baseline abundance estimate for western snowy plovers is 0.27 individuals per survey (Table 11-3). As waterbird surveys continue to be conducted during the construction and post-construction phases of the project, a running average of western snowy plover abundance will be calculated for the 4 most recent years of construction/post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

11.2.4.2 California Least Tern

California least terns were present in low numbers during the summer months of May through July in both years. Based on monthly counts conducted at the lagoon from 1973–1983, and again from 2002–2017 (Nature Collective 2019), their numbers reached an all-time low in 2015 and have

remained low, with maximum counts ranging from 3–7 individuals for surveys conducted during 2015-2017, compared to counts as high as 69 and 78 in 2004 and 2007, respectively. The 2015–2017 numbers are comparable with the results of this study, where the maximum California least tern counts during 2016 and 2017 were 7 and 5 individuals, respectively.

Overall, the number of California least tern detections during 2016 and 2017 combined was 0.85 individuals per survey (Table 11-4). As waterbird surveys continue to be conducted during the construction and post-construction phases of the project, a running average of California least tern abundance will be calculated for the 4 most recent years of construction/post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

11.2.4.3 Other Species

Waterbird surveys were designed to assess the abundance of waterbird species (e.g., seabirds, waterfowl, shorebirds, wading birds) that use open water and mudflat habitats in the SELRP study area. A total of six orders of waterbird were recorded in surveys, but more than 80% of observations were of birds in the orders Anseriformes (waterfowl) and Charadriiformes (shorebirds). This is primarily because these orders include large numbers of species and because the species in these orders tend to be gregarious during the non-breeding season, which is when they are most abundant at the San Elijo Lagoon.

Interpretation of patterns in the general waterbird data are more complex to interpret than the other datasets involving a single species, such as western snowy plover or California least tern, due to the diversity of species within each group and the variability in the presence of these species across different basins in the lagoon and different seasons of the year. For example, 39 species of birds were observed within the order Charadriiformes, and 19 were observed within the order Anseriformes (Appendix F). Although the abundance of different species may vary over time, the comparison of waterbird abundance between the pre-construction and construction/post-construction periods is intended to provide an indication of whether dramatic declines in waterbirds in general have occurred as a result of the restoration project. To this end, although the overall number of waterbirds varied between 2016 (383.6 individuals/survey) and 2017 (327.9 individuals/survey), the overall baseline average from the 2 years of 355.8 individuals per survey provides a suitable baseline value to which post-construction abundance numbers can be compared.

As waterbird surveys continue to be conducted during the construction and post-construction phases of the project, running averages will be calculated for the general waterbird surveys overall and for each order of birds for the 4 most recent years of construction/post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

11.3 BELDING'S SAVANNAH SPARROW SURVEYS

11.3.1 Performance Standards

Success for Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) will be measured by comparing pre-construction (defined as those data collected in 2016 and 2017) and construction / post-construction data metrics using the "floating alpha" method described in Sections 2.1.2 and 2.2.2 of the Monitoring Plan (Nature Collective 2020).

Interim standard: Post-construction 4-year running average density 75% or greater than that of pre-construction survey data (2016, 2017) by year 7 post-construction

Final standard: Post-construction 4-year running average density 95% or greater than that of pre-construction survey data (2016, 2017) by year 10 post-construction

Running averages will be used to account for annual population variability. Standards will not be considered met until performance standards are met for 3 consecutive years (see Section 2.3 of the Monitoring Plan).

11.3.2 Approach

The focus of these surveys was to estimate density for the state endangered Belding's savannah sparrow. Surveys were conducted during the breeding season for the species, between April 11 and May 20, 2016 (six surveys) and March 20 and May 19, 2017 (four surveys). Belding's savannah sparrow detections were recorded at all distances from 19 survey transects measuring 100 m long located within suitable habitat and spread throughout the lagoon, following methods described in the Monitoring Plan. Detailed summaries of the survey dates, survey times, survey personnel and weather conditions for 2016 and 2017 are provided in Appendix F for surveys conducted. Survey data were analyzed using a distance sampling approach (Buckland et al. 2001), which applied the distances between the observer and each detected bird to control for differences in detectability and estimate the density (per acre) of Belding's savannah sparrow individuals within the survey area, as the number of individuals per acre across the survey area as a whole. See Appendix F Section 1.3.2 for more details on the methods.

11.3.3 Results

The number and timing of surveys for Belding's savannah sparrows varied between the 2016 and 2017 survey seasons such that results from specific survey numbers were not comparable across years. Results from these surveys are included in Appendix F. For example, six surveys were conducted in 2016, compared to four surveys in 2017, and the first survey in 2016 was conducted later in the season (early April) than the first survey in 2017 (early March). For this reason, survey results are summarized according to the following four "survey periods" designed to enable grouping of survey results across four roughly equal time:

- Late February to Mid-March (February 25 to March 21)
- Late March to Early April (March 22 to April 12)

- Mid- to Late April (April 13 to 30)
- Early to Mid-May (May 1 to 20)

When multiple surveys were conducted in a survey period for a given year, the mean number of individuals detected across surveys conducted in that survey period was calculated. The mean number of individuals detected per survey during each survey period was then used to evaluate temporal variation in abundance (across seasons and between years), and to calculate the overall baseline average abundance metrics. Belding's savannah sparrows were detected predominantly in areas dominated by coastal salt marsh (Low, Mid, and High). The locations of detections from 2016 and 2017 surveys are detailed in Appendix F.

Based on results from the distance sampling model approach (Buckland et al. 2001), only detections within 75 m perpendicular distance from the transect were included in the final analysis 2016 and 2017 data. Belding's savannah sparrow density within the survey area was higher during 2017 (2.83 individuals/acre) compared to 2016 (1.43 individuals/acre) (Table 11-6). The 2-year average density within the survey area (baseline pre-construction average) was 2.69 individuals per acre.

Table 11-6. Summary of Belding's Savannah Sparrow Results by Survey Period

Survey Period Averages (Density [Mean # Individuals/acre])			
Survey Period	**2016**	**2017**	**2016–2017 Baseline**
Late-Feb to Mid-Mar	-	5.9	5.9
Late-March to Early-Apr	1.7	2.0	1.9
Mid-Apr to Late-Apr	1.4	2.0	1.7
Early-May to Mid-May	1.2	1.5	1.3
Overall Average (Standard Error)	**1.43 (0.14)**	**2.83 (1.02)**	**2.69 (1.07)**

The higher density estimate in the survey area during 2017 appears to be driven by one exceptionally high estimate (5.9 individuals/acre; Appendix F) from the one survey during the early to mid-March survey period that year, for which there was no corresponding survey from 2016. Aside from this survey, other survey-specific estimates from both years were relatively consistent, ranging from 1.2 to 2.0 individuals per acre, and the 95% confidence intervals for these estimates all overlapped, indicating they were similar.

11.3.4 Discussion

The estimated Belding's savannah sparrow density within the survey area differed between 2016 and 2017. The significantly higher estimated density in 2017 (Table 11-6) was driven by one unusually high estimate from the first survey in 2017 (Appendix F). One potential reason for that unusually high estimate is that surveys were initiated earlier in 2017. The first survey in 2017 occurred on March 20, whereas the first survey in 2016 did not occur until April 11. It is possible that Belding's savannah sparrows call more frequently or are otherwise more detectable earlier in the season, which could have contributed to these results. Additionally, there was a greater amount of precipitation during 2017 compared to 2016, which could have caused differences in behavior that resulted in different detection rates.

As Belding's savannah sparrow surveys continue to be conducted during the construction and post-construction phases of the project, running averages will be calculated for the species' density within the survey area for the 4 most recent years of construction/post-construction surveys. These estimates will be compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

12. WETLAND FUNCTION

12.1 PERFORMANCE STANDARD

Wetland function is an absolute monitoring variable and will not be compared to reference wetlands for purposes of determining success of the SELRP. The individual AA California Rapid Assessment Method (CRAM) scores and averaged lagoon CRAM score will used to compare post-restoration conditions to pre-restoration conditions and function of the lagoon. This average score will serve as the reference for determining the success of the restoration activities. Table 12-1 contains the CRAM performance standards.

Table 12-1. CRAM Performance Standards

CRAM Score	Expected Results	Performance Standard	Year
Buffer and Landscape Context Attribute	Not expected to change, mostly outside the scope of the SELRP	Post-Restoration ≥ Baseline CRAM Attribute Score	Year 5
Hydrology Attribute	Expected to increase slightly due to dredging and topography changes to increase tidal flow and flushing	Post-Restoration ≥ Baseline CRAM Attribute Score	Year 5
Physical Structure Attribute	Expected to recover to equal or exceed Baseline condition	Post-Restoration ≥ Baseline CRAM Attribute Score	Year 5
Biotic Structure Attribute	Expected to recover to equal or exceed Baseline condition	Post-Restoration ≥ Baseline CRAM Attribute Score	Year 5
Overall CRAM	Expected to recover to equal or exceed Baseline condition	Post-Restoration ≥ Baseline CRAM Overall Score	Year 5

12.2 APPROACH

AECOM CRAM-certified practitioners conducted the pre-construction CRAM assessment from September 12 through 14, 2016. The CRAM assessment was performed following the latest guidelines, currently version 6.1 (CWMW 2013a) and the field book of the appropriate wetland module (CWMW 2013b, 2013c). There were 25 assessment areas (AA) used for the 2016 baseline condition assessment (Figure 12-1). A complete description of survey methodology can be found in the Monitoring Plan. Moreover, in accordance with CWA Section 401 Certification requirements, photographs of the lagoon were taken to document pre-restoration conditions (Appendix G).

12.3 RESULTS

Overall, CRAM scores in the lagoon ranged from a low of 60 to a high of 85. Two different wetland types, and, therefore, two different modules, were used for the assessment: estuarine and depressional. The majority of the AAs (20) were estuarine wetlands, found in the west, central, and westernmost portions of the east basin. However, five AAs in the east basin did not fit the CRAM definition of estuarine wetland and were assessed using the depressional module.

Average scores for each CRAM attribute are provided in Table 12-2. The highest scoring AAs were C48 and C60 in the central basin and E75, a depressional AA in the east basin (Figure 12-1). The lowest scoring AAs were the estuarine AAs in the east basin (E2 and E36) as well as W4 in the west basin (Figure 12-1). The lowest scores for the entire lagoon were received in the hydrology and physical structure attributes and associated metrics. Detailed results for each AA can be found in Appendix H.

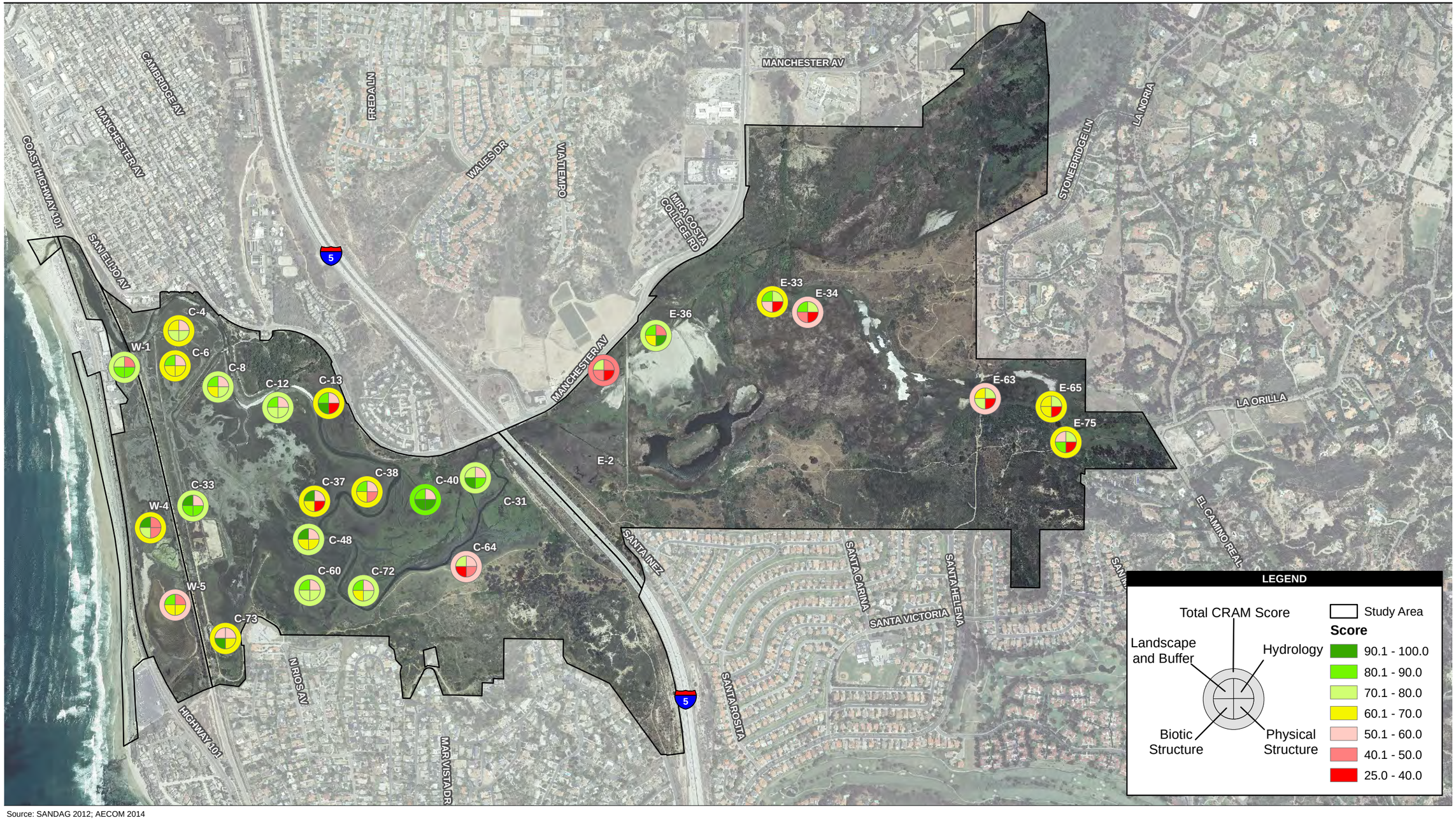
Table 12-2. Average CRAM Attribute Scores by Wetland Type

Attribute	Estuarine	Depressional	Estuarine & Depressional (± Standard Error)
Buffer & Landscape Connectivity	85.65	93.40	87.20 ± 2.23
Hydrology	58.70	79.80	62.92 ± 2.10
Physical Structure	71.00	45.20	65.84 ± 3.48
Biotic Structure	74.55	84.80	76.60 ± 2.04
Overall Assessment Area Score	72.30	75.80	73.00 ± 1.21

12.4 DISCUSSION

Buffer and Landscape metrics are not expected to change after restoration has been implemented. Hydrology, specifically water source, is affected by the level of development surrounding the lagoon. This is not expected to change after restoration. However, hydroperiod scores (tidal muting experienced by the lagoon) may increase after restoration, which aims to increase tidal flushing. After restoration, an increase in physical and biotic structure scores may occur. At a minimum, after restoration has been implemented, the lagoon is expected to achieve the pre-restoration CRAM scores identified in Table 12-2.

After restoration activities are completed (construction on all phases complete and a successful 240-day PEP), post-restoration CRAM will be performed during Year 1, Year 3, and Year 5 and then every other year until performance standards are met, during the monitoring period. Average CRAM scores during these years will be compared to the baseline CRAM scores described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and post-construction periods will be summarized and discussed in annual monitoring reports prepared for the SELRP.



Source: SANDAG 2012; AECOM 2014

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

Figure 12-1
Spatial Distribution of CRAM Index and Attribute Scores

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13. EELGRASS

13.1 PERFORMANCE STANDARD

No permanent loss of eelgrass is documented.

13.2 APPROACH

Merkel & Associates, Inc. conducted the pre-construction eelgrass survey on October 9 and 17, 2017 (Appendix I). The survey was conducted by running parallel transects across the study area. Spatial extent data were collected using a 3-D sidescan sonar, which was then joined together and geographically registered and ground-truthed. Snorkeling was also conducted within deeper waters of the westernmost portions of the lagoon channel during low tide, as described in the Monitoring Plan.

13.3 RESULTS

Small patches of eelgrass were detected in the inlet channel west of the railroad bridge during pre-construction surveys conducted for the project. Pre-construction bed spatial metrics are summarized in Table 13-1.

Table 13-1. Eelgrass Bed Metrics as Defined under the California Eelgrass Mitigation Policy

Location	Spatial Distribution	Eelgrass Areal Extent	Vegetated Cover	Percent Vegetated Cover
Area of Potential Effect	716 m^2	19 m^2	0.9 m^2	4.7%

13.4 DISCUSSION

Eelgrass was identified during pre-construction surveys; observed eelgrass was in small patches and very sparse. These data will be used to facilitate interpretation of any change in eelgrass beds between pre-construction and post-construction surveys. Post-restoration surveys for eelgrass are required 30 days, 1 year, and 2 years after restoration activities have been completed. If post-restoration surveys identify a permanent loss of eelgrass relative to pre-construction areal extent, remedial measures may be required to ensure no permanent loss of eelgrass occurs.

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14. CAULERPA

14.1 PERFORMANCE STANDARD

Performance standards for *Caulerpa* are to confirm that *Caulerpa* is not present within the project site, and there would be no risk for introduction to other sites by project implementation.

14.2 APPROACH

Surveys were conducted per the *Caulerpa* Control Protocol on October 9 and 17, 2017 (Version 4.0, adopted February 25, 2008). The project area was surveyed using one of several methods, including a 3-D sidescan sonar, an unmanned aerial vehicle, snorkeling, and deployed underwater video camera. The survey area included the subtidal marine waters within the lagoon system.

14.3 RESULTS

Caulerpa was not detected within the project area. Additional survey details are included in Appendix J to this report.

14.4 DISCUSSION

Since *Caulerpa* was not detected during pre-construction surveys, post-construction survey data will be used to confirm if project implementation introduced this species to San Elijo Lagoon. If post-restoration surveys identify *Caulerpa* within the project area, remedial measures would be implemented to ensure eradication of this species.

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15. LIST OF PREPARERS

Table 15-1 includes a list of persons and organizations who participated in the monitoring program and/or preparation of this report.

Table 15-1. List of Preparers

Chapter	Variable	Lead Author	Organization
1-14	General Report Preparation	Cindy Kinkade (Project Manager)	AECOM
		Michael Anguiano	AECOM
2	Topography	Chris Webb	Moffatt & Nichol
3	Bathymetry	Chris Webb	Moffatt & Nichol
4	Tidal Elevation	Chris Webb	Moffatt & Nichol
5	Habitat Areas	Aaron Andrews	AECOM
6.1	Vegetative Cover	Aaron Andrews	AECOM
6.2	*Spartina* Canopy Architecture	Aaron Andrews	AECOM
6.3	Exotics	Aaron Andrews	AECOM
7	Water Quality	Nature Collective	Nature Collective
8	Benthic Invertebrates	Andres Deza	Nature Collective
9	Sediments	Nature Collective	Nature Collective
10	Fish	Andres Deza	Nature Collective
11.1	Breeding Marsh Birds with focus on Light-Footed Ridgway's Rail	Michael Kuehn	AECOM
11.2	Western snowy plover, California least tern, and waterbird species	Michael Kuehn	AECOM
11.3	Belding's Savannah Sparrow	Michael Kuehn	AECOM
12	Wetland Function (CRAM)	Aaron Andrews	AECOM
13	Eelgrass	Merkel	Merkel
14	*Caulerpa*	Merkel	Merkel

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APPENDIX A

HABITAT DESCRIPTIONS

Appendix A – Habitat Descriptions based on Holland and Oberbauer

Habitats descriptions based on the dominant and characteristic plant species, plant physiognomy, and soils in accordance with the Draft Vegetation Communities of San Diego County (Oberbauer et al. 2008), based on the Preliminary Descriptions of the Terrestrial Natural Communities of California (Holland 1986).

Tidal Mudflat/Open Water

Tidal mudflats are coastal wetlands that form when mud is deposited by tides or rivers. Most of the sediment within a mudflat is within the intertidal zone, and thus the flat is submerged and exposed approximately twice daily. Mudflats are typically important regions for wildlife, including invertebrates and migratory birds.

Coastal Salt Marsh

Southern coastal salt marsh is an association of herbaceous and suffrutescent, salt-tolerant hydrophytes that form a moderate to dense cover and can reach a height of 1 m (3 feet). Most species are active in summer and dormant in winter (Holland 1986). Coastal salt marsh plants are distributed along distinct zones depending upon such environmental factors as frequency and length of tidal inundation, salinity levels, and nutrient status (MacDonald 1977). In the higher littoral zone, there is much less tidal inflow, resulting in lower salinity levels, while soil salinity in the lower littoral zone is fairly constant due to everyday annual tidal flow (Adam 1990).

Within the different littoral zones, species can be segregated with California cordgrass (*Spartina foliosa*) nearest the open water in the low-littoral zone; Pacific pickleweed and saltwort (*Batis maritima*) in the mid-littoral zones; and a richer mixture of species, including alkali-heath and Parish's pickleweed, in the higher littoral zone (Holland 1986). Other characteristic species include coastal saltgrass (*Distichlis spicata*), alkali weed (*Cressa truxillensis*), and salty susan.

Saltpan/Open Water

Saltpans are unvegetated to sparsely vegetated flat, alkaline areas near the coast that are subject to tidal influence. In coastal areas, saltpans are most often associated with salt marsh habitat. While saltpans can cover relatively large areas, they often occur in a mosaic pattern with more densely vegetated areas within the salt marsh. The paucity of vegetation on saltpans is apparently due to seasonally high soil salinity levels that prevent colonization by perennial salt marsh species. However, the open substrate associated with saltpans is available for colonization by short-lived annual species after winter rains temporarily reduce salinity levels (Ferren et al. 1987).

Coastal Brackish Marsh (Freshwater/Brackish Marsh)

Coastal brackish marsh is dominated by perennial, emergent, herbaceous monocots to 2 m tall (6 feet). Coastal brackish marsh is similar to both freshwater marsh and salt marsh, with some

plants characteristic of each. Salinity may vary considerably and may increase at high tide or during seasons of low freshwater runoff or both (Holland 1986).

Dominant plants within this community include California bulrush (*Schoenoplectus californicus*) and Olney's bulrush (*Schoenoplectus americanus*), with these species forming pure stands more characteristic of freshwater marsh in some areas. However, salt marsh species, such as Pacific pickleweed (*Sarcocornia pacifica*), alkali-heath (*Frankenia salina*), Parish's pickleweed (*Arthrocnemum subterminale*), and salty susan (*Jaumea carnosa*) are dispersed throughout the coastal brackish marsh in varying degrees of abundance.

Open Water (Tidal Channels and Basins)

This habitat type consists of any open water body including lakes, reservoirs, bays, flowing water within a river channel, and small ponds along stream courses. Open water bodies provide important habitat for a variety of aquatic organisms and water fowl.

Riparian (Disturbed Wetland, Sandbar Willow Scrub, and Southern Willow Scrub)

Disturbed wetlands are communities dominated by exotic wetland species. These species have invaded sites that had been previously disturbed or are periodically disturbed.

Sandbar Willow Scrub relate to areas being colonized by sandbar (= thin-leaved) willow (*Salix exigua*) and arroyo willow (*Salix lasiolepis*). Left unaltered, this community may eventually mature into southern willow scrub.

Southern willow scrub is a densely vegetated riparian thicket, dominated by several willow species (*Salix* spp.), with scattered emergent western cottonwood (*Populus fremontii* ssp. *fremontii*) and western sycamore (*Platanus racemosa*). This community is generally greater than 6 m (20 feet) high and occupies drainages and floodplains supporting perennially wet streams. Understory species such as mulefat (*Baccharis salicifolia*), Douglas mugwort (*Artemisia douglasiana*), and hoary nettle (*Urtica dioica* ssp. *holosericea*), may also be present (Holland 1986).

Coastal Strand

Coastal strand is an area of loose to partially stabilized sand that forms near the shore above the high tide line. The plants found in this community are able to tolerate harsh conditions, such as high winds, salt, and a low nutrient supply. Many of the plants in this community have deep taproots and/or a prostrate growth form to help stabilize them in the loose sand. Dominant plants within the coastal strand community include arrow weed (*Pluchea sericea*), beach evening-primrose (*Camissonia cheiranthifolia* ssp. *suffruticosa*), beach sand-verbena (*Abronia umbellata* var. *umbellata*), Nuttall's lotus (*Lotus nuttallianus*), and coast woolly-heads (*Nemacaulis denudata* var. *denudata*).

Upland and Others (Coyote Brush Scrub, Diegan Coastal Sage Scrub-Coastal Form, Diegan Coastal Sage Scrub/Chaparral, Eucalyptus Woodland, Nonnative Grassland)

Coyote brush scrub is typically found on disturbed sites or those with nutrient-poor soils (Oberbauer 2008).

Diegan coastal sage scrub may be dominated by a variety of different species depending upon site-specific topographic, geographic, and edaphic conditions. California sagebrush (*Artemisia californica*) is more dominant in coastal forms (Oberbauer 2008), but it often occurs with various codominant species. There are several recognized subassociations of Diegan coastal sage scrub based upon the dominant species. Typical Diegan coastal sage scrub dominants include California sagebrush, California buckwheat (*Eriogonum fasciculatum*), laurel sumac (*Malosma laurina*), black sage (*Salvia mellifera*), lemonadeberry (*Rhus integrifolia*), and California encelia (*Encelia californica*).

Diegan coastal sage scrub/chaparral is a mix of chaparral and sage scrub species. Chamise (*Adenostoma fasciculata*) and coastal sagebrush are dominant and relatively equal in cover. Generally, laurel sumac, black sage, and lemonadeberry are more common in coastal sage scrub, while lilac (*Ceanothus* spp.), scrub oak (*Quercus* spp.), and mission manzanita (*Xylococcus bicolor*) are more common in chaparrals (Oberbauer 2008).

Eucalyptus woodland is dominated by several species of eucalyptus (*Eucalyptus* spp.). These introduced species produce large amounts of leaf and bark litter, the chemical composition of which may inhibit the establishment and growth of other species, especially natives, in the understory. Generally, these species were planted for aesthetic and horticultural purposes, but many species of eucalyptus have become naturalized and have been quite successful in invading riparian areas.

Nonnative grassland generally occurs on fine-textured loam or clay soils that are moist or even waterlogged during the winter rainy season and very dry during the summer and fall. It is characterized by a dense to sparse cover of annual grasses, often with native and nonnative annual forbs (Holland 1986). Typical grasses within the region include ripgut grass (*Bromus diandrus*), red brome (*Bromus madritensis* ssp. *rubens*), soft chess (*Bromus hordeaceus*), wild oats (*Avena* spp.), and fescue (*Vulpia myuros*). Nonnative disturbance-related annuals, such as red stem filaree (*Erodium cicutarium*) and horseweed (*Conyza canadensis*), are common to this community. Though named as a nonnative community, nonnative grassland often has significant biological value since it typically supports native grassland species, such as tarweed (*Deinandra* spp.), common goldfields (*Lasthenia gracilis*), blue dicks (*Dichelostemma capitatum* ssp. *capitatum*), and purple owl's-clover (*Castilleja exserta* ssp. *exserta*); provides foraging habitat for raptors; and often supports sensitive wildlife species.

Beach

Beach habitat is the flat, sandy area along the immediate coastline that occurs between mean tide and the foredune, or to the farthest inland reach of storm waves. This habitat is characterized by high exposure to salt spray and sand blast, and sandy substrate with a low organic content and

water-holding capacity (Barbour and Johnson 1977). The lower portions of beaches are unvegetated, while the upper beach sometimes supports a sparse herbaceous cover, especially in areas where foredunes are present.

Disturbed Habitat (Berms and Roads)

Disturbed habitat is any land that has been permanently altered by previous human activity, including grading, repeated clearing, intensive agriculture, vehicular damage, or dirt roads. Disturbed land is typically characterized by more than 50 percent bare ground and an absence of remnant native vegetation. Furthermore, the previous disturbance was severe enough to eliminate future potential biological value of the land without active restoration.

Transitional

Supratidal transition zone habitat occurs between the range of the highest high tides and non-tidal supratidal uplands, from approximately +4.2 ft to + 5.2 ft NGVD in 2015. These areas represent a transition from the highest salt marsh plant species to upland plant species with both plant assemblages occurring within this relatively narrow elevation band. High soil salinities prevent upland species from invading the lower transition zone while upland species out compete salt tolerant species at the higher transition zone elevations.

Transition zone habitat is very rare in southern California coastal wetlands where development has encroached upon the edges of tidal lagoons and estuaries. As a result, this habitat is perhaps the least understood of all wetland-associated habitats. What is known is that these habitats provide refugia for salt marsh species, such as the light-footed ridgway's rail, during extreme weather and tides, as well as additional foraging habitat. It has been postulated that important plant pollinators, such as ground dwelling bees, occur in the transition zone.

The transition zone is also important in terms of climate change and predicted sea level rise. Should sea level rise as predicted, areas of low and mid-high salt marsh will be inundated more frequently and by increasingly deeper water, ultimately converting to subtidal habitat. Under this scenario, transition zone will convert to intertidal salt marsh. Thus, inclusion of transition zone in restoration alternatives provides a potential mechanism for maintaining the biological diversity of the lagoon in the future.

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APPENDIX B

DETAILED TRANSECT AND QUADRAT RESULTS

Appendix B – Detailed Transect and Quadrat Results

Table B-1 Mid and High Salt Marsh Transect Monitoring Results by Species

Scientific Name	Common Name	Average Absolute Cover[1]	Relative Cover[2]
West Basin			
Native Species			
Cressa truxillensis	alkali weed	3.2%	3.4%
Distichlis spicata	saltgrass	0.6%	0.7%
Frankenia salina	alkali heath	40.5%	42.7%
Jaumea carnosa	marsh jaumea	4.1%	4.3%
Salicornia pacifica	Pacific pickleweed	46.3%	48.9%
	Total Absolute Native Cover (Avg)	**94.8%**	-
Central Basin			
Native Species			
Batis maritima	saltwort	1.3%	1.3%
Cuscuta pacifica	dodder	2.4%	2.5%
Distichlis littoralis	shore grass	0.6%	0.6%
Distichlis spicata	salt grass	0.7%	0.7%
Frankenia salina	alkali heath	10.1%	10.5%
Jaumea carnosa	marsh jaumea	38.1%	39.6%
Salicornia pacifica	Pacific pickleweed	43.0%	44.7%
	Total Absolute Native Cover (Avg)	**96.1%**	-
East Basin			
Native Species			
Ambrosia psilostachya	Western ragweed	6.9%	5.9%
Cuscuta salina	dodder	1.0%	0.8%
Distichlis spicata	saltgrass	3.4%	2.9%
Frankenia salina	alkali heath	36.8%	31.3%
Isocoma menziesii	coastal goldenbush	3.8%	3.3%
Jaumea carnosa	marsh jaumea	5.4%	4.6%
Juncus acutus	spiny rush	1.9%	1.6%
Juncus mexicanus	Mexican rush	1.3%	1.1%
Pluchea odorata	marsh fleabane	0.4%	0.3%
Salicornia pacifica	Pacific pickleweed	41.4%	35.2%
Schoenoplectus californicus	California bulrush	1.5%	1.3%
Typha domingensis	Southern cattail	2.9%	2.4%
	Total Absolute Native Cover (Avg)	**106.7%**	-
Nonnative Species			
Atriplex prostrata	spearscale	9.6%	8.1%
Erigeron canadensis	horseweed	0.2%	0.2%
Foeniculum vulgare	fennel	0.2%	0.2%

Scientific Name	Common Name	Average Absolute Cover[1]	Relative Cover[2]
Helminthotheca echioides	Bristly ox-tongue	0.4%	0.3%
Xanthium strumarium	cocklebur	0.6%	0.5%
	Total Nonnative Cover (Avg)	**10.9%**	**-**

[1] Absolute cover is estimated by summing the total number of plant hits at each intercept and then dividing the total by the number of intercepts. An intercept is each point in a transect where data is collected so each intercept has the potential of having more than one species recorded due to overlapping species and/or multiple canopy layers. The end result is that there is a potential to have more than 100% cover even with open space and potentially no species hits at a number of intercepts.
[2] Relative cover is estimated by dividing each of the species by the other species cover in a given basin to determine the relative individual species. As a result, the relative cover will always equal 100% across all species.

Table B-2. Mid and High Salt Marsh Quadrat Monitoring Results

Scientific Name	Common Name
West Basin	
Native Species	
Cressa truxillensis	alkali weed
Distichlis littoralis	shore grass
Distichlis spicata	saltgrass
Frankenia salina	alkali heath
Heliotropium curassavicum	salt heliotrope
Jaumea carnosa	marsh jaumea
Juncus acutus	spiny rush
Salicornia pacifica	Pacific pickleweed
Nonnative Species	
Chenopodium album	lamb's quarters
Bare Ground (Avg)	**11.3%**
Total Nonnative Cover (Avg)	**0.5%**
Total Native Cover (Avg)	**88.8%**
Central Basin	
Native Species	
Ambrosia psilostachya	Western ragweed
Arthrocnemum subterminale	Parish's glasswort
Batis maritima	saltwort
Cressa truxillensis	alkali weed
Cuscuta salina	dodder
Distichlis littoralis	shore grass
Distichlis spicata	saltgrass
Frankenia salina	alkali heath
Heliotropium curassavicum	salt heliotrope
Jaumea carnosa	marsh jaumea

Scientific Name	Common Name
Juncus acutus	spiny rush
Juncus mexicanus	Mexican rush
Limonium californicum	California sea-lavender
Salicornia pacifica	Pacific pickleweed
Schoenoplectus californicus	California bulrush
Schoenoplectus americanus	chairmaker's bulrush
Spartina foliosa	California cordgrass
Typha domingensis	Southern cattail
Typha latifolia	broad-leaf cattail
Nonnative Species	
Atriplex prostrata	spearscale
Bare Ground (Avg)	**20.4%**
Total Nonnative Cover (Avg)	**0.5%**
Total Native Cover (Avg)	**79.1%**
East Basin	
Native Species	
Cuscuta salina	dodder
Cyperus sp.	sedge
Frankenia salina	alkali heath
Jaumea carnosa	marsh jaumea
Juncus acutus	spiny rush
Pluchea odorata	marsh fleabane
Pluchea sericea	arrowweed
Salicornia pacifica	Pacific pickleweed
Schoenoplectus californicus	California bulrush
Schoenoplectus americanus	chairmaker's bulrush
Spartina foliosa	California cordgrass
Stephanomeria sp.	wreath plant
Typha domingensis	Southern cattail
Nonnative Species	
Atriplex prostrata	spearscale
Polypogon monspeliensis	rabbit foot grass
Xanthium strumarium	cocklebur
Bare Ground (Avg)	**34.7%**
Total Nonnative Cover (Avg)	**15.7%**
Total Native Cover (Avg)	**49.6%**

APPENDIX C

SUPPLEMENTAL BASELINE WATER QUALITY DATA

Appendix C – Supplemental Baseline Water Quality Data

Table C-1. Water Depth

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Total Possible Readings	190,515	142,357	87,057	57,880
Readings taken	187,305	131,377	70,472	46,371
Sensor uptime (%)	98%	92%	81%	80%
mean water depth (m)	1	0.36	0.70	0.56
min water depth (m)	-0.07	-0.19	-0.04	-0.04
max water depth (m)	2.24	1.82	1.97	2.11
median water depth (m)	0.96	0.34	0.71	0.53
maximum daily water depth range (m)	1.77	1.07	1.56	1.67
minimum daily water depth range (m)	0.01	0.01	0.02	0.03
median daily water depth range (m)	1.15	0.04	1.01	0.81

Table C-2. Conductivity

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Total Possible Readings	190,515	142,357	87,057	57,880
Readings taken	186,709	129,372	64,306	46,371
Sensor uptime (%)	98%	91%	74%	80%
mean conductivity (mS/cm)	41	6.34	33.93	26.19
min conductivity (mS/cm)	0.4	0.5	0.5	0.3
max conductivity (mS/cm)	53.2	51.1	54.1	53.8
median conductivity (mS/cm)	45.8	3.3	39.5	30.9
maximum daily conductivity range (mS/cm)	49.3	41.9	47.5	46.0
minimum daily conductivity range (mS/cm)	0.3	0.0	0.2	0.1
median daily conductivity range (mS/cm)	18.6	0.3	24.5	20.0

Table C-3. Temperature

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Total Possible Readings	190,515	142,357	87,057	57,880
Readings taken	186,709	129,372	70,472	46,371
Sensor uptime (%)	98%	91%	81%	80%
mean temperature (°C)	19	19.1	20.1	17.8
min temperature (°C)	4.4	5.6	3.6	5.2
max temperature (°C)	32.4	31.7	31.7	33.5
median temperature (°C)	19.5	19.5	21.0	16.9
maximum daily temperature range (°C)	13.5	6.7	14.4	10.6
minimum daily temperature range (°C)	0.5	0.4	0.3	0.6
median daily temperature range (°C)	4.6	3.1	4.9	4.1

Table C-4. pH

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Total Possible Readings	190,515	142,357	87,057	57,880
Readings taken	151,730	112,877	58,581	20,842
Sensor uptime (%)	80%	79%	67%	36%
mean pH	7.96	7.97	8.26	8.65
min pH	6.49	7.03	6.60	7.15
max pH	8.80	10.04	8.70	8.49
median pH	8.01	7.90	7.82	7.72
maximum daily pH range	1.45	1.74	1.58	0.74
minimum daily pH range	0.02	0.03	0.07	0.03
median daily pH range	0.56	0.13	0.55	0.39

Table C-5. Turbidity

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Total Possible Readings	190,515	142,357	n/a	n/a
Readings taken	136,644	59,452	n/a	n/a
Sensor uptime (%)	72%	42%	n/a	n/a
mean turbidity	9.1	14.7	n/a	n/a
min turbidity	-4.6	-6.6	n/a	n/a
max turbidity	368.3	396.5	n/a	n/a
median turbidity	5.3	13.1	n/a	n/a
Readings > highTurbidity threshold - 30 NTU	5,344	4,324	n/a	n/a
Reading >highTurbidity threshold (%)	4%	7%	n/a	n/a
High turbidity Events	535	601	n/a	n/a
Mean High turbidity duration (hr)	2.8	2.1	n/a	n/a
Median High turbidity duration (hr)	0.8	0.3	n/a	n/a
Max High turbidity duration event (hr)	164.0	124.5	n/a	n/a
Min High turbidity event (hr)	0.3	0.3	n/a	n/a
Single sample High turbidity event	211	340	n/a	n/a
% High turbidity events that are single sample	39%	57%	n/a	n/a

Table C-6. Chlorophyll

Metric	Success Criteria Station	Historical Adaptive Management Stations		
	Nature Center	W6 (Manchester Historical)	Rios	W5
Total Possible Readings	190,515	142,357	n/a	n/a
Readings taken	75,968	60,735	n/a	n/a
Sensor uptime (%)	40%	43%	n/a	n/a
mean chlorophyll	3.8	15.1	n/a	n/a
min chlorophyll	-3.4	-0.1	n/a	n/a
max chlorophyll	117.0	138.1	n/a	n/a
median chlorophyll	2.7	11.2	n/a	n/a
maximum daily chlorophyll range	114.5	127.5	n/a	n/a
minimum daily chlorophyll range	1.7	1.7	n/a	n/a
median daily chlorophyll range	6.8	7.4	n/a	n/a

APPENDIX D

SAN ELIJO LAGOON RESTORATION PROJECT PRE-CONSTRUCTION FISH AND INVERTEBRATE ASSESSMENT

SAN ELIJO LAGOON RESTORATION PROJECT

Pre-Construction Fish and Invertebrate Assessment

Prepared for:

California Department of Transportation
California Coastal Commission
Nature Collective (Formerly: San Elijo Lagoon Conservancy)
San Diego Association of Governments
Moffatt and Nichol

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1. Introduction

This document reports the activities and findings from the pre-construction monitoring surveys of the San Elijo Lagoon (SEL) in Cardiff by the Sea, CA. Under contract with Moffatt and Nichol, AZED Environmental LLC performed pre-construction fish and invertebrate surveys within SEL in order to assist the San Elijo Lagoon Conservancy and the California Coastal Commission in establishing a baseline of the relative density and species richness for both fish and invertebrates. Surveys took place in the fall of 2017 (late October to mid-November) before any construction activities began that could significantly alter the hydrology or topography of the estuarine system. These data will serve as a basis of comparison for the performance of the San Elijo Lagoon Restoration Project (SELRP) after construction activities are completed in 2020.

2. Site Background

The San Elijo Lagoon Restoration Plan seeks to restore lagoon functions and services to the extent practicable following degradation associated with urbanization of the lagoon's watershed. Urbanization has accelerated freshwater storm flows, generated year-round urban run-off and increased chemical and nutrient levels within the lagoon. Hydraulic efficiency within the channels and tidal inlet of the lagoon has been reduced due to infrastructure that obstructs water flow, including Coast Highway 101, the North County Transit District railroad, Interstate 5 and a weir in the eastern lagoon basin. These constraints have led to a degradation of water quality, such as elevated bacterial levels, leading to beach closures during moderate to large storm events.

The SELRP seeks to restore tidal influence to the lagoon and enhance freshwater fluvial flows out of the lagoon. This would, in turn, restore the physical (soils and hydrology) and biological (biogeochemical/water quality and habitat) functions that have been degraded over the years.

The SELRP proposes to modify the channels and habitats throughout the entire 960-acre lagoon. These modifications are expected to improve lagoon habitats that support sensitive coastal wetland plant and animal species. Restoration is expected to take approximately three years with the restoration of each of the three lagoon basins conducted in sequence, beginning with the Central Basin, followed by the Eastern Basin and finally the Western Basin. Following the completion of construction, monitoring of physical and biological processes will be initiated. Following completion of construction activities in all three basins, a minimum of 10 years of post-construction monitoring will be initiated for all wetland habitats. A minimum of five years of monitoring will be initiated for all restored upland habitats. In addition, long-term monitoring of selected parameters will be conducted for the life of the project, defined as 50 years post-construction.

3. Survey Methods

3.1 Benthic Invertebrate Surveys

Benthic invertebrate community composition includes two components: average total density and average number of species per location surveyed. These are relative standards, which will be used to evaluate the SELRP and potentially compare them to similar measurements taken at reference wetlands in southern California as well as pre-restoration conditions within SEL.

During the pre-construction monitoring period, benthic invertebrate populations were sampled in the fall months ranging from late October to mid-November in order to characterize invertebrate food resources for fish and bird populations. These methods are summarized below:

- **Epifauna:** Epifauna, such as the California Horn Snail (*Cerithidea californica*) was sampled by counting live individuals in 0.25 X 0.25 m quadrats. Twelve (12) sampling stations were located in tidally influenced areas throughout the lagoon with six (6) stations located in main channels and six (6) stations located in tidal creeks (Figure 1). Only locations that were tidally influenced were chosen; therefore, no locations were selected in the east basin. If necessary, additional locations can be added to the post-construction monitoring program once newly proposed tidally influenced areas develop. Each of the 12 sampling stations was composed of 5 substations where epifauna was assessed. Data collection at each of the substation (12 sampling stations x 5 substation = 60 substations) consisted of counting individual epifauna present within three pairs of 0.25 X 0.25 m quadrats, which were spaced uniformly and confined to mudflat habitat. Upper, middle, and lower tidal elevations of the mudflat habitat each had a set of quadrats.

- **Infauna:** Infaunal sampling, as with epifauna sampling, was confined to the intertidal mudflats of the restored lagoon and was sampled in conjunction with the epifaunal assessment. Three sets of uniformly spaced cores (10-cm and a 3.5-cm diameter core) were collected at each substation located at the 12 sampling stations described above for epifauna. Infaunal core samples were taken at the same elevations as the epifaunal samples upper, middle, and lower tidal elevations of the mudflat habitat. Deep burrowing infauna (clams and ghost shrimp) were sampled using a 10-cm diameter core expressed into the sediment to a depth of 50 cm. The 10-cm diameter cores were sieved through a 3-mm screen in the field. All infauna collected using the 10-cm diameter cores was identified, counted and released.

- Smaller invertebrates (mostly annelids) were sampled using a 3.5-cm diameter core expressed into the sediment to a depth of 6 cm. The 3.5-cm diameter cores were preserved in the field in 10% buffered formalin and subsequently processed in the laboratory by sieving the core through a 0.5-mm mesh screen. The organisms retained by the 0.5-mm mesh were preserved in alcohol and identified to as low a taxonomic level as possible. All sorted specimens were archived for more detailed identification based on availability of resources and changes in project goals.

- **Metrics:** Density was standardized to number of individuals per 100 cm^2 for each quadrat/core and then averaged across quadrats/cores at a given sampling station. Species richness was standardized to the number of unique species per sampling location (i.e. quadrats and cores combined). Additionally, unique species of macroinvertebrates captured in during the seine and enclosure trapping described in section 3.2 (Fish Assemblage Surveys) are also included in the species richness metric, however, these species are not included in the invertebrate density metric.

3.2 Fish Assemblage Surveys

As with invertebrates, fish community assessment consists of two relative standards: average total fish densities and average number of fish species per location surveyed. As is the case for invertebrates, the fish community within the restored areas of the San Elijo Lagoon will be compared to post-restoration conditions.

Fish habitat created by restoration includes primarily shallow subtidal channels. Intertidal channels are expected to develop and can be added to the post-construction monitoring program upon their development; however, for the purposes of this monitoring program, fish monitoring in main channel / basins habitats were confined to shallow (-1.5 to -3.6 ft. NGVD) subtidal habitats. Fish measurements were collected in the fall of 2017 in order to avoid nesting activities of the federally endangered Ridgeway Rail (formerly the Light-footed Clapper Rail). These methods are summarized below:

- **Seines:** Seining at each fish sampling station was conducted by blocking each end of an approximately 7-m long channel/creek segment using blocking nets. Blocking nets consist of bagless seines approximately 15.2 m x 1.8 m with 3.2 mm mesh. Small seines (approximately 7.6 x 1.8 m with 3.2-mm mesh) were used to sample the 7-m long area blocked by the blocking nets. The small seine was hauled across the blocked area (perpendicular to the long axis of the channel) to collect the fish trapped by the blocking nets (Figure 2a). Five replicate hauls were made at each station (12 stations total) and each station was visited on 3 distinct days. Additionally, all blocking nets were examined for fish that may have become trapped in small areas that are not covered by the smaller seine net. Samples were processed in the field to the extent possible. Fish were processed in the following manner: the first 10 specimens of each fish species were counted and measured (total length) to the nearest millimeter and the remaining individuals were only counted. Fish were returned to the water immediately after processing, when possible. Any macroinvertebrates collected during seine hauls will be identified to major taxonomic categories and released. Fish abundance was expressed in terms of density (number per m^2) for each seining event and then averaged across the 3 days of seining at any given sampling station. Species richness was standardized to the number unique species per replicate (given that 3 days of seining at a given location is equal to one replicate). Macroinvertebrates collected during these hauls were identified to the fines taxonomic level possible and released.

- **Enclosures:** Enclosures were employed to sample demersal, burrowing fish. An enclosure trap was used to sample primarily gobies (family Gobiidae), small, burrowing fishes that are often poorly sampled by other methods. The enclosure trap is composed of a polypropylene sheet fixed as a 1-m-tall cylinder with a 0.43 m^2 sampling area (Figure 2b). The trap is thrown away from the sampler in an attempt to minimize the startling of any fish nearby. A BINCKE net is then swept inside the trap and fish are identified by species, counted, measured for length, and released. This is repeated until no fish are caught a total of 3 times. Enclosure trapping was conducted at 5 substations (similar to invertebrate methods) located at each of the 12 sampling stations. Thus, a total of 60 enclosure samples will be collected during each monitoring effort. Density was expressed in terms of number of individuals per m^2 for each enclosure and then averaged across enclosure at a given sampling station.

Species richness of demersal, burrowing fish was standardized to number of unique species per sampling station.

4. Results

4.1 Benthic Invertebrate Surveys

The density and richness of invertebrates within main and tidal channel habitats of SEL in 2017 is summarized in Table 1. Numbers were generally consistent across the tidal channels with the exception of sample station 2. This station's invertebrate density was less than 25% of the other sampling stations. The average main channel invertebrate density was much higher than tidal channels. This is predominately because of main channel stations 5 and 6 having 2 to 3 times higher densities than other stations. It is unknown what factors are driving high variability in density at some locations.

4.2 Fish Assemblage Surveys

The density and richness of fish within main and tidal channel habitats of SEL in 2017 is summarized in Table 2. Tidal channel station 1 had the highest density and richness of all sample stations. This was due to the presence of a large school of California killifish (*Fundulus parvipinnis*) that were encountered during the monitoring effort at this station. The average tidal channel fish density was much higher than main channels. This is predominately because of tidal channel stations 1 and 4 having much higher densities than other stations.

5. Discussion

The pre-construction monitoring was conducted to serve as a baseline to help track trends in post-construction invertebrate and fish metrics relative to numbers pre-construction. Ultimately, the post-construction data will be compared to the reference wetland to determine success of this variable. Should metrics fail to achieve success standards, comparing post restoration data to baseline data will be useful in determining if or when adaptive management measures should be implemented.

Appendix A – FIGURES

Figure 1: Map depicting sampling locations where fish and invertebrate surveys took place in fall of 2017

Figure 2a: (Top) Scientists using a combination of blocking nets and beach seine in order to assess fish assemblages

Figure 2b: (Bottom) Project personnel conducting infaunal core assessment as well as deploying enclosure trap with BINCKE net

Photo by Howard Lipin

Appendix B – TABLES

Table 1: Summary of pre-construction invertebrate densities and species richness for each sampling station surveyed within the San Elijo Lagoon

Sampling Station	Invert Density (# per 100 cm^2)	Invert Richness (# of species per replicate)
Tidal Channel		
TC1	224.31	28
TC2	54.49	22
TC3	252.85	21
TC4	291.49	20
TC5	213.20	18
TC5	219.63	19
TC Average	209.33	21.33
Main Channel		
MC1	217.06	26
MC2	212.18	24
MC3	216.45	22
MC4	235.14	26
MC5	495.04	27
MC6	702.44	19
MC Average	346.39	24.0

Table 2: Summary of pre-construction fish densities and species richness for each sampling station surveyed within the San Elijo Lagoon

Sampling Station	Fish Density (# per m^2)	Fish Richness (# of species per replicate)
Tidal Channel		
TC1	7.11	16
TC2	0.85	5
TC3	1.30	5
TC4	3.10	7
TC5	0.15	3
TC5	1.47	7
TC Average	2.33	7.17
Main Channel		
MC1	0.59	6
MC2	0.65	8
MC3	0.12	4
MC4	0.13	2
MC5	0.39	7
MC6	0.20	6
MC Average	0.35	5.50

Appendix C – REFERENCES

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APPENDIX E

SOILS REPORT

WALLACE LABORATORIES, LLC
365 Coral Circle
El Segundo, CA 90245
phone (310) 615-0116 fax (310) 640-6863

December 18, 2017

Tony Maggio, tmaggio@moffattnichol.com
Moffatt & Nichol Engineers
3780 Kilroy Airport Way
Long Beach, CA 90806

RE: San Alejo, Job No. 7017-04

Dear Tony,

These 12 samples have high alkalinity on average. The average pH is 8.13. The pH values range from 7.63 to 8.45.

Salinity is high at 31.4 millimho/cm on average. This is about three-fourth the salinity of seawater. Salinity range from 21.5 millimho/cm 45.4 millimho/cm. On average, chloride is high at 11,250 parts per million in the saturation extract. Salt-sensitive plants need chloride below about 150 parts per million.

SAR (sodium adsorption ratio) is high. The average value is 38.6. SAR ranges from 33.6 for 4 to 42.7 for 2.

High sodium and high SAR values have adverse effects on soil physical properties including reduced water percolation, decreased soil aggregate stability, increased clay dispersion, increased swelling of expandable clays, increased surface crusting and reduced soil tilth. High sodium also restricts the uptake of competitive ions such as potassium. Normally the SAR should be less than 3. Soils are defined as being sodic if the SAR is over 13. Gypsum can be applied followed with leaching to lower the concentration of sodium and SAR.

Soil organic matter is modest at 2.07% on a dry weight basis on average. Soil organic matter ranges from 0.84% to 4.13%

Nitrogen is moderate. Potassium is high. Phosphorus is modest for MC-6 and TC-6. The other samples have moderate phosphorus. The micronutrients are high except for modest zinc and copper is several samples. Magnesium is high. Sulfur is high on average.

The soil textures range from loamy sand to clay. The average soil texture is sandy clay loam. The sieve data are attached. The sand sizing is mostly fine and very fine.

Sincerely,

Garn A. Wallace, Ph. D.
GAW:n

WALLACE LABS	SOILS REPORT	Print Date	Dec. 15, 2017	Receive Date	12/13/17
365 Coral Circle	Location	San Alejo, Job No. 7017-04			
El Segundo, CA 90245	Requester	Tony Maggio, Moffatt & Nichol			
(310) 615-0116	graphic interpretation: * very low, ** low, *** moderate				
ammonium bicarbonate/DTPA	**** high, ***** very high				

extractable - mg/kg soil	Sample ID Number	17-348-21		17-348-22		17-348-23		17-348-24	
Interpretation of data	Sample Description	MC-1		MC-2		MC-3		MC-4	
low medium high	elements		graphic		graphic		graphic		graphic
0 - 7 8-15 over 15	phosphorus	13.45	****	10.13	***	14.70	****	13.12	****
0-60 60 -120 121-180	potassium	1,229.88	*****	656.13	*****	509.23	*****	803.89	*****
0 - 4 4 - 10 over 10	iron	84.22	*****	140.04	*****	163.35	*****	128.73	*****
0- 0.5 0.6- 1 over 1	manganese	13.13	*****	1.82	****	6.82	****	20.44	*****
0 - 1 1 - 1.5 over 1.5	zinc	3.89	****	0.88	**	1.41	***	1.72	****
0- 0.2 0.3- 0.5 over 0.5	copper	4.30	*****	1.07	****	0.48	***	1.31	****
0- 0.2 0.2- 0.5 over 1	boron	3.61	*****	2.17	*****	2.13	*****	2.98	*****
	calcium	331.07	***	165.23	**	133.97	**	126.71	**
	magnesium	1,506.37	*****	682.87	*****	563.26	*****	857.84	*****
	sodium	7,268.52	*****	4,237.95	*****	3,998.05	*****	5,471.48	*****
	sulfur	598.64	****	342.95	***	355.95	***	523.47	****
	molybdenum	0.02	**	0.02	**	0.02	***	0.02	**
	nickel	0.42	*	n d	*	n d	*	0.16	*
The following trace	aluminum	1.61	***	3.19	****	4.37	****	4.11	****
elements may be toxic	arsenic	n d	*	0.17	*	0.26	*	0.02	*
The degree of toxicity	barium	n d	*	n d	*	n d	*	n d	*
depends upon the pH of	cadmium	0.04	*	n d	*	n d	*	n d	*
the soil, soil texture,	chromium	n d	*	n d	*	n d	*	n d	*
organic matter, and the	cobalt	0.16	*	n d	*	n d	*	n d	*
concentrations of the	lead	3.92	**	2.92	**	1.95	**	2.08	**
individual elements as	lithium	0.52	*	0.29	*	0.19	*	0.30	*
well as to their interactions.	mercury	n d	*	n d	*	n d	*	n d	*
	selenium	n d	*	n d	*	n d	*	0.45	*
The pH optimum depends	silver	n d	*	n d	*	n d	*	n d	*
upon soil organic	strontium	5.15	**	2.85	*	2.31	*	1.62	*
matter and clay content-	tin	n d	*	n d	*	n d	*	n d	*
for clay and loam soils:	vanadium	1.03	**	1.66	**	0.82	*	2.43	***
under 5.2 is too acidic									
6.5 to 7 is ideal	Saturation Extract								
over 9 is too alkaline	pH value	7.63	****	8.18	****	7.83	****	8.25	****
The ECe is a measure of	ECe (milli-mho/cm)	38.10	*****	29.70	*****	30.80	*****	36.00	*****
the soil salinity:			millieq/l		millieq/l		millieq/l		millieq/l
1-2 affects a few plants	calcium	461.3	23.1	294.7	14.7	353.0	17.6	463.8	23.2
2-4 affects some plants,	magnesium	898.6	74.3	738.6	61.0	791.3	65.4	961.4	79.5
> 4 affects many plants.	sodium	6,595.1	286.7	5,176.1	225.0	5,205.8	226.3	6,122.8	266.2
	potassium	288.8	7.4	298.8	7.6	321.3	8.2	366.3	9.4
	cation sum		391.5		308.5		317.6		378.2
problems over 150 ppm	chloride	12,544	353.4	11,456	322.7	11,391	320.9	11,582	326.3
	nitrate as N	51	3.6	45	3.2	47	3.3	41	2.9
	phosphorus as P	4.3	0.1	4.1	0.1	2.6	0.1	4.0	0.1
toxic over 800	sulfate as S	426.4	26.7	660.1	41.3	746.4	46.6	885.0	55.3
	anion sum		383.8		367.3		370.9		384.6
toxic over 1 for many plants	boron as B	2.54	*****	2.05	*****	2.09	*****	2.43	*****
increasing problems start at 3	SAR	41.2	*****	36.6	*****	35.2	*****	37.2	*****
est. gypsum requirement-lbs./1000.sq. ft.		1650		863		783		1131	
	relative infiltration rate	slow/fair		fair/slow		fair/slow		fair/slow	
	soil texture	clay loam	gravel > 2 mm	loamy sand	gravel > 2 mm	loamy sand	gravel > 2 mm	sandy loam	gravel > 2 mm
	sand	34.9%	0.4%	78.8%	0.0%	84.6%	0.0%	76.3%	0.6%
	silt	34.9%	gravel > 1/4 inch	13.0%	gravel > 1/4 inch	10.4%	gravel > 1/4 inch	11.1%	gravel > 1/4 inch
	clay	30.1%	0.0%	8.2%	0.0%	5.0%	0.0%	12.6%	0.0%
	lime (calcium carbonate)	no	gravel > 1/2 inch	no	gravel > 1/2 inch	no	gravel > 1/2 inch	no	gravel > 1/2 inch
	Total nitrogen	0.112%	0.0%	0.054%	0.0%	0.052%	0.0%	0.074%	0.0%
	Total carbon	1.240%		0.453%		0.420%		0.851%	
	carbon:nitrogen ratio	11.0		8.4		8.2		11.4	
	organic matter based on carbon	2.48%		0.91%		0.84%		1.70%	
	moisture content of soil	6.0%		1.8%		2.5%		4.9%	
	half saturation percentage	38.8%		25.7%		24.3%		28.9%	

Elements are expressed as mg/kg dry soil or mg/l for saturation extract.
pH and ECe are measured in a saturation paste extract. nd means not detected.
Analytical data determined on soil fraction passing a 2 mm sieve.

WALLACE LABS	SOILS REPORT	Print Date	Dec. 15, 2017	Receive Date	12/13/17
365 Coral Circle	Location	San Alejo, Job No. 7017-04			
El Segundo, CA 90245	Requester	Tony Maggio, Moffatt & Nichol			
(310) 615-0116	graphic interpretation: * very low, ** low, *** moderate				
ammonium bicarbonate/DTPA	**** high, ***** very high				

extractable - mg/kg soil Interpretation of data low medium high	Sample ID Number Sample Description elements	17-348-25 MC-5	graphic	17-348-26 MC-6	graphic	17-348-27 TC-2	graphic	17-348-28 TC-3	graphic
0 - 7 8-15 over 15	phosphorus	10.23	***	8.90	***	15.02	*****	12.45	****
0-60 60 -120 121-180	potassium	2,032.65	*****	1,486.62	*****	1,843.25	*****	735.85	*****
0 - 4 4 - 10 over 10	iron	81.30	*****	66.18	*****	242.93	*****	164.56	*****
0- 0.5 0.6- 1 over 1	manganese	16.17	*****	3.51	****	35.63	*****	2.24	****
0 - 1 1 - 1.5 over 1.5	zinc	1.82	****	1.99	****	2.36	****	2.19	****
0- 0.2 0.3- 0.5 over 0.5	copper	2.52	****	3.64	*****	n d	*	0.47	***
0- 0.2 0.2- 0.5 over 1	boron	3.64	*****	4.67	*****	3.88	*****	2.49	*****
	calcium	161.36	**	452.29	****	285.19	***	194.87	***
	magnesium	1,658.65	*****	1,887.29	*****	1,566.48	*****	702.34	*****
	sodium	7,275.73	*****	10,000.00	*****	8,112.64	*****	5,443.69	*****
	sulfur	471.04	****	1,032.41	*****	639.73	****	432.19	****
	molybdenum	0.02	**	0.02	***	0.02	***	0.02	**
	nickel	0.28	*	0.12	*	0.17	*	n d	*
The following trace	aluminum	0.71	**	11.66	****	n d	*	n d	*
elements may be toxic	arsenic	0.08	*	0.07	*	0.04	*	n d	*
The degree of toxicity	barium	n d	*	n d	*	n d	*	n d	*
depends upon the pH of	cadmium	n d	*	n d	*	n d	*	n d	*
the soil, soil texture,	chromium	n d	*	n d	*	n d	*	n d	*
organic matter, and the	cobalt	0.15	*	n d	*	n d	*	n d	*
concentrations of the	lead	3.86	**	3.79	**	4.26	**	2.19	**
individual elements as	lithium	0.51	*	0.68	*	0.54	*	0.29	*
well as to their interactions.	mercury	n d	*	n d	*	n d	*	n d	*
	selenium	n d	*	n d	*	0.51	**	n d	*
The pH optimum depends	silver	n d	*	n d	*	n d	*	n d	*
upon soil organic	strontium	1.68	*	6.97	**	4.54	*	3.07	*
matter and clay content-	tin	n d	*	n d	*	n d	*	n d	*
for clay and loam soils:	vanadium	4.03	*****	2.43	***	2.37	***	1.08	**
under 5.2 is too acidic									
6.5 to 7 is ideal	Saturation Extract								
over 9 is too alkaline	pH value	8.45	****	7.89	****	8.27	****	8.19	****
The ECe is a measure of	ECe (milli-	24.70	*****	45.40	*****	21.50	*****	25.50	*****
the soil salinity:	mho/cm)		millieq/l		millieq/l		millieq/l		millieq/l
1-2 affects a few plants	calcium	251.1	12.6	473.8	23.7	218.6	10.9	265.9	13.3
2-4 affects some plants,	magnesium	559.6	46.2	1,255.0	103.7	513.4	42.4	659.3	54.5
> 4 affects many plants.	sodium	4,366.0	189.8	7,449.5	323.9	4,004.6	174.1	4,781.6	207.9
	potassium	246.2	6.3	351.7	9.0	235.2	6.0	278.3	7.1
	cation sum		254.9		460.3		233.5		282.8
problems over 150 ppm	chloride	7,811	220.0	17,340	488.5	7,869	221.7	10,307	290.3
	nitrate as N	28	2.0	51	3.7	32	2.3	36	2.6
	phosphorus as P	1.1	0.0	1.3	0.0	0.9	0.0	3.9	0.1
toxic over 800	sulfate as S	521.1	32.6	974.4	60.9	488.8	30.6	595.3	37.2
	anion sum		254.6		553.1		254.5		330.2
toxic over 1 for many plants	boron as B	1.95	*****	2.95	*****	1.39	*****	1.85	*****
increasing problems start at 3	SAR	35.1	*****	40.7	*****	33.8	*****	35.8	*****
est. gypsum requirement-lbs./1000 sq. ft.		1702		2240		1814		1075	
	relative infiltration rate	slow		fair/slow		fair/slow		fair/slow	
	soil texture	clay	gravel > 2 mm	loam	gravel > 2 mm	clay	gravel > 2 mm	loamy sand	gravel > 2 mm
	sand	23.6%	0.0%	42.6%	0.0%	14.7%	0.0%	81.5%	0.0%
	silt	26.9%	gravel > 1/4 inch	32.7%	gravel > 1/4 inch	36.6%	gravel > 1/4 inch	11.3%	gravel > 1/4 inch
	clay	49.5%	0.0%	24.7%	0.0%	48.7%	0.0%	7.2%	0.0%
	lime (calcium carbonate)	no	gravel > 1/2 inch	no	gravel > 1/2 inch	no	gravel > 1/2 inch	no	gravel > 1/2 inch
	Total nitrogen	0.154%	0.0%	0.118%	0.0%	0.328%	0.0%	0.068%	0.0%
	Total carbon	1.618%		1.201%		2.064%		0.614%	
	carbon:nitrogen ratio	10.5		10.2		6.3		9.0	
	organic matter based on carbon	3.24%		2.40%		4.13%		1.23%	
	moisture content of soil	7.0%		9.2%		14.7%		4.9%	
	half saturation percentage	42.3%		39.3%		61.9%		26.1%	

Elements are expressed as mg/kg dry soil or mg/l for saturation extract.
pH and ECe are measured in a saturation paste extract. nd means not detected.
Analytical data determined on soil fraction passing a 2 mm sieve.

WALLACE LABS	SOILS REPORT	Print Date	Dec. 15, 2017	Receive Date	12/13/17
365 Coral Circle	Location	San Alejo, Job No. 7017-04			
El Segundo, CA 90245	Requester	Tony Maggio, Moffatt & Nichol			
(310) 615-0116	graphic interpretation. * very low, ** low, *** moderate, **** high, ***** very high				

ammonium bicarbonate/DTPA

extractable - mg/kg soil Interpretation of data low medium high	Sample ID Number	17-348-29		17-348-30		17-348-31		17-348-32	
	Sample Description	TC-4		TC-5		TC-6		Las Olas	
	elements		graphic		graphic		graphic		graphic
0 - 7 8-15 over 15	phosphorus	17.14	*****	14.02	****	9.52	***	12.53	****
0-60 60 -120 121-180	potassium	742.80	*****	1,134.59	*****	2,123.45	*****	870.23	*****
0 - 4 4 - 10 over 10	iron	110.31	*****	85.96	*****	228.28	*****	201.88	*****
0- 0.5 0.6- 1 over 1	manganese	7.75	****	12.44	*****	12.46	*****	1.09	****
0 - 1 1 - 1.5 over 1.5	zinc	1.91	****	1.93	****	1.55	****	1.43	***
0- 0.2 0.3- 0.5 over 0.5	copper	1.23	****	1.92	****	0.32	***	2.26	****
0- 0.2 0.2- 0.5 over 1	boron	2.39	*****	3.65	*****	4.37	*****	2.59	*****
	calcium	227.78	***	327.40	***	308.74	***	152.55	**
	magnesium	697.36	*****	1,096.09	*****	1,702.61	*****	697.91	*****
	sodium	5,306.01	*****	6,803.92	*****	9,715.26	*****	5,787.36	*****
	sulfur	374.74	***	597.38	****	743.23	****	413.80	****
	molybdenum	0.02	***	0.02	***	0.23	****	0.02	**
	nickel	0.27	*	n d	*	0.16	*	0.28	*
The following trace	aluminum	3.84	****	2.53	***	4.89	****	3.69	****
elements may be toxic	arsenic	n d	*	0.16	*	n d	*	0.06	*
The degree of toxicity	barium	n d	*	n d	*	n d	*	n d	*
depends upon the pH of	cadmium	n d	*	n d	*	n d	*	n d	*
the soil, soil texture,	chromium	n d	*	n d	*	n d	*	n d	*
organic matter, and the	cobalt	n d	*	n d	*	n d	*	n d	*
concentrations of the	lead	1.49	**	2.18	**	3.29	**	2.74	**
individual elements as	lithium	0.34	*	0.47	*	0.60	*	0.39	*
well as to their interactions.	mercury	n d	*	n d	*	n d	*	n d	*
	selenium	n d	*	n d	*	n d	*	n d	*
The pH optimum depends	silver	n d	*	n d	*	n d	*	n d	*
upon soil organic	strontium	3.27	*	4.08	*	4.94	*	2.54	*
matter and clay content-	tin	n d	*	n d	*	n d	*	n d	*
for clay and loam soils:	vanadium	1.11	**	1.86	**	2.64	***	1.58	**
under 5.2 is too acidic									
6.5 to 7 is ideal	**Saturation Extract**								
over 9 is too alkaline	pH value	8.02	****	8.27	****	8.38	****	8.16	****
The ECe is a measure of	ECe (milli-mho/cm)	29.10	*****	28.50	*****	32.60	*****	34.70	*****
the soil salinity:			millieq/l		millieq/l		millieq/l		millieq/l
1-2 affects a few plants	calcium	315.6	15.8	295.0	14.7	344.9	17.2	352.0	17.6
2-4 affects some plants,	magnesium	719.6	59.5	736.8	60.9	883.6	73.0	847.5	70.0
> 4 affects many plants.	sodium	4,889.0	212.6	4,890.2	212.6	5,827.6	253.4	5,763.7	250.6
	potassium	260.7	6.7	279.6	7.2	351.3	9.0	329.4	8.4
	cation sum		294.5		295.4		352.6		346.7
problems over 150 ppm	chloride	10,049	283.1	10,114	284.9	12,477	351.5	12,030	338.9
	nitrate as N	35	2.5	33	2.3	40	2.8	47	3.4
	phosphorus as P	4.9	0.2	3.5	0.1	3.6	0.1	2.4	0.1
toxic over 800	sulfate as S	627.2	39.2	636.2	39.8	753.6	47.1	698.6	43.7
	anion sum		324.9		327.1		401.5		386.0
toxic over 1 for many plants	boron as B	1.98	*****	1.40	*****	1.89	*****	1.83	*****
increasing problems start at 3	SAR	34.7	*****	34.6	*****	37.8	*****	37.9	*****
est. gypsum requirement-lbs./1000 sq. ft.		1050		1436		2131		1132	
	relative infiltration rate	fair/slow		fair/slow		slow/fair		slow/fair	
	soil texture	sandy loam	gravel > 2 mm	sandy loam	gravel > 2 mm	clay loam	gravel > 2 mm	sandy loam	gravel > 2 mm
	sand	77.9%	0.0%	57.3%	0.0%	27.1%	0.0%	76.3%	5.1%
	silt	11.4%	gravel > 1/4 inch	23.1%	gravel > 1/4 inch	39.0%	gravel > 1/4 inch	13.1%	gravel > 1/4 inch
	clay	10.7%	0.0%	19.6%	0.0%	33.9%	0.0%	10.5%	4.0%
	lime (calcium carbonate)	no	gravel > 1/2 inch	no	gravel > 1/2 inch	slight	gravel > 1/2 inch	no	gravel > 1/2 inch
	Total nitrogen	0.073%	0.0%	0.093%	0.0%	0.165%	0.0%	0.069%	4.0%
	Total carbon	0.638%		0.901%		1.712%		0.693%	
	carbon:nitrogen ratio	8.7		9.7		10.3		10.0	
	organic matter based on carbon	1.28%		1.80%		3.42%		1.39%	
	moisture content of soil	4.3%		6.3%		18.4%		4.7%	
	half saturation percentage	24.2%		32.4%		54.8%		20.7%	

Elements are expressed as mg/kg dry soil or mg/l for saturation extract.
pH and ECe are measured in a saturation paste extract. nd means not detected.
Analytical data determined on soil fraction passing a 2 mm sieve.

WALLACE LABORATORIES
365 Coral Circle
El Segundo, CA 90245
(310) 615-0116

Sand and Gravel Sieve Analysis

date Dec. 18, 2017
location San Alejo, Job No. 7017-04
requested by Tony Maggio, Moffatt & Nichol

		Lab ID	17-348-21		17-348-22		17-348-23		17-348-24	
		Material	MC-1		MC-2		MC-3		MC-4	
	mesh	millimeter	percent passing	percent retained	percent passing	percent retained	percent passing	percent retained	percent passing	percent retained
coarse gravel	2	12.5	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
	4	4.75	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
fine gravel	10	2.00	99.6%	0.4%	100.0%	0.0%	100.0%	0.0%	99.4%	0.6%
	14	1.41	99.6%	0.0%	100.0%	0.0%	100.0%	0.0%	99.0%	0.4%
	16	1.19	99.6%	0.0%	100.0%	0.0%	100.0%	0.0%	98.8%	0.2%
coarse sand	20	0.84	99.6%	0.0%	100.0%	0.0%	100.0%	0.0%	98.6%	0.2%
	28	0.59	99.2%	0.4%	99.9%	0.1%	99.9%	0.1%	97.6%	1.0%
	32	0.50	98.7%	0.4%	99.7%	0.2%	99.7%	0.2%	96.9%	0.8%
medium sand	40	0.42	98.0%	0.7%	99.5%	0.3%	99.2%	0.5%	96.1%	0.8%
	48	0.30	95.4%	2.6%	99.1%	0.4%	97.8%	1.4%	93.3%	2.8%
fine sand	60	0.25	90.8%	4.6%	98.5%	0.6%	95.5%	2.3%	90.1%	3.2%
	80	0.177	77.6%	13.2%	95.1%	3.4%	76.6%	18.9%	67.7%	22.4%
	100	0.149	57.2%	20.4%	80.8%	14.3%	47.3%	29.3%	44.9%	22.8%
very fine sand	150	0.104	26.1%	31.1%	28.7%	52.0%	15.2%	32.1%	14.4%	30.5%
	200	0.074	4.9%	21.1%	5.5%	23.3%	2.6%	12.5%	2.3%	12.1%
	270	0.053	0.4%	4.5%	1.0%	4.5%	0.5%	2.1%	0.2%	2.1%
	pan			0.4%		1.0%		0.5%		0.2%

Sand Sizing					
very coarse sand	1 to 2 mm	0.0%	0.0%	0.0%	0.7%
coarse sand	0.5 to 1 mm	0.9%	0.3%	0.3%	1.8%
medium sand	0.25 to 0.5 mm	8.0%	1.2%	4.2%	6.8%
fine sand	0.15 to 0.25 mm	33.6%	17.8%	48.1%	45.2%
very fine sand	0.05 to 0.15 mm	56.7%	79.8%	46.8%	44.7%

WALLACE LABORATORIES
365 Coral Circle
El Segundo, CA 90245
(310) 615-0116

Sand and Gravel Sieve Analysis

date Dec. 18, 2017
location San Alejo, Job No. 7017-04
requested by Tony Maggio, Moffatt & Nichol

		Lab ID	17-348-25		17-348-26		17-348-27		17-348-28	
		Material	MC-5		MC-6		TC-2		TC-3	
	mesh	millimeter	percent passing	percent retained	percent passing	percent retained	percent passing	percent retained	percent passing	percent retained
coarse gravel	2	12.5	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
	4	4.75	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
fine gravel	10	2.00	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
	14	1.41	99.8%	0.2%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
	16	1.19	99.8%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
coarse sand	20	0.84	99.5%	0.3%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%
	28	0.59	99.5%	0.0%	100.0%	0.0%	99.4%	0.6%	99.8%	0.2%
	32	0.50	99.5%	0.0%	99.9%	0.1%	99.1%	0.3%	99.6%	0.2%
medium sand	40	0.42	99.1%	0.3%	99.9%	0.0%	98.6%	0.6%	99.6%	0.0%
	48	0.30	99.0%	0.2%	98.9%	1.0%	96.0%	2.6%	99.1%	0.6%
fine sand	60	0.25	98.3%	0.7%	97.9%	1.1%	93.4%	2.6%	98.1%	0.9%
	80	0.177	94.3%	4.0%	94.0%	3.8%	85.6%	7.8%	79.5%	18.7%
	100	0.149	82.4%	11.9%	81.7%	12.4%	62.8%	22.8%	60.2%	19.3%
very fine sand	150	0.104	43.4%	39.1%	42.0%	39.7%	30.3%	32.6%	19.1%	41.1%
	200	0.074	11.4%	32.0%	13.6%	28.3%	8.9%	21.3%	2.9%	16.2%
	270	0.053	2.8%	8.6%	3.0%	10.7%	1.7%	7.2%	0.3%	2.7%
	pan			2.8%		3.0%		1.7%		0.3%

Sand Sizing					
very coarse sand	1 to 2 mm	0.3%	0.0%	0.0%	0.0%
coarse sand	0.5 to 1 mm	0.2%	0.1%	0.9%	0.4%
medium sand	0.25 to 0.5 mm	1.2%	2.0%	5.8%	1.5%
fine sand	0.15 to 0.25 mm	15.8%	16.2%	30.5%	37.9%
very fine sand	0.05 to 0.15 mm	79.7%	78.7%	61.1%	59.9%

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El Segundo, CA 90245
(310) 615-0116

Sand and Gravel Sieve Analysis

date Dec. 18, 2017
location San Alejo, Job No. 7017-04
requested by Tony Maggio, Moffatt & Nichol

		Lab ID	17-348-29		17-348-30		17-348-31		17-348-32	
		Material	TC-4		TC-5		TC-6		Las Olas	
	mesh	millimeter	percent passing	percent retained	percent passing	percent retained	percent passing	percent retained	percent passing	percent retained
coarse gravel	2	12.5	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	96.0%	4.0%
	4	4.75	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	96.0%	0.1%
fine gravel	10	2.00	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	94.9%	1.1%
	14	1.41	100.0%	0.0%	100.0%	0.0%	99.8%	0.2%	94.4%	0.5%
	16	1.19	100.0%	0.0%	100.0%	0.0%	99.8%	0.0%	93.9%	0.5%
coarse sand	20	0.84	100.0%	0.0%	100.0%	0.0%	99.5%	0.3%	93.3%	0.6%
	28	0.59	99.9%	0.1%	99.9%	0.1%	99.5%	0.0%	87.0%	6.4%
	32	0.50	99.6%	0.3%	99.7%	0.1%	99.2%	0.3%	79.6%	7.4%
medium sand	40	0.42	99.3%	0.3%	99.3%	0.4%	98.8%	0.5%	69.3%	10.3%
	48	0.30	98.7%	0.6%	98.8%	0.5%	97.2%	1.6%	50.3%	19.0%
fine sand	60	0.25	97.8%	0.9%	98.3%	0.5%	96.0%	1.2%	41.1%	9.2%
	80	0.177	82.3%	15.5%	86.8%	11.5%	88.7%	7.3%	29.2%	11.9%
	100	0.149	64.9%	17.4%	68.2%	18.6%	70.7%	18.0%	19.9%	9.4%
very fine sand	150	0.104	19.5%	45.4%	24.1%	44.1%	36.2%	34.5%	8.2%	11.7%
	200	0.074	3.6%	15.9%	5.0%	19.1%	10.4%	25.8%	2.1%	6.1%
	270	0.053	0.6%	3.0%	0.9%	4.2%	2.2%	8.2%	0.2%	1.8%
	pan			0.6%		0.9%		2.2%		0.2%

Sand Sizing					
very coarse sand	1 to 2 mm	0.0%	0.0%	0.3%	1.3%
coarse sand	0.5 to 1 mm	0.4%	0.3%	0.5%	14.0%
medium sand	0.25 to 0.5 mm	1.8%	1.4%	3.3%	38.5%
fine sand	0.15 to 0.25 mm	32.9%	30.1%	25.3%	21.2%
very fine sand	0.05 to 0.15 mm	64.3%	67.4%	68.5%	19.6%

Possible Soil Sampling Locations

APPENDIX F

PRE-CONSTRUCTION AVIAN MONITORING REPORT

PRE-CONSTRUCTION AVIAN MONITORING REPORT FOR THE SAN ELIJO LAGOON RESTORATION PROJECT

Prepared for:

Nature Collective

Prepared by:

AECOM
401 W. A. Street, Suite 1200
San Diego, California 92101

August 2020

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LIST OF ACRONYMS AND ABBREVIATIONS

CBM	Coastal Brackish Marsh
CDFW	California Department of Fish and Wildlife
CSM	Coastal Salt Marsh
LCL	lower confidence limit
LFRR	light-footed Ridgway's rail
SELRP	San Elijo Lagoon Restoration Project
UCL	upper confidence limit
USFWS	U.S. Fish and Wildlife Service

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

San Elijo Lagoon is a coastal wetland formed at the drainage of the Escondido and La Orilla Creeks into the Pacific Ocean and is located in Encinitas, San Diego County, California. The lagoon provides habitat for sensitive, threatened, and endangered plants and animals, including resident and migratory wildlife. The San Elijo Lagoon Ecological Reserve is owned and managed by the California Department of Fish and Wildlife (CDFW), County of San Diego Parks and Recreation Department, and the Nature Collective. Lagoon functions became compromised over time, as development and infrastructure constraints have affected the ecosystem and the gradient of habitats within the lagoon (e.g., between unvegetated and vegetated intertidal habitats). The San Elijo Lagoon Restoration Project (SELRP) is an effort to restore lagoon functions and services to the extent practicable given the current constraints of surrounding development and activities.

The SELRP is being implemented by the Nature Collective and California Department of Transportation to enhance and restore the physical and biological functions and services of San Elijo Lagoon by increasing hydraulic efficiency in the lagoon, addressing existing water quality impairments, and halting ongoing conversion of unvegetated wetland habitats to support a more connected gradient of balanced habitat types. Success of the restoration effort is being measured through the implementation of a monitoring program developed in coordination with various permitting and approval agencies, including the California Coastal Commission, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service (USFWS), and Regional Water Quality Control Board.

Avian monitoring was conducted in both 2016 and 2017 to establish baseline values of select avian taxa prior to the initiation of construction activities and changes to the habitat in San Elijo Lagoon. These data will provide the baseline metrics against which values collected during the construction and post-construction periods will be compared using performance standards as defined in the SELRP *Wetland Habitat and Hydrology Monitoring Plan for the San Elijo Lagoon Restoration Project* (Monitoring Plan) (Nature Collective 2020).

1.2 REPORTING REQUIREMENTS

This Pre-construction Avian Monitoring Report documents the results of avian surveys for the years 2016 and 2017 prior to the start of construction of the SELRP. These results provide a baseline of avian numbers that will be used to compare numbers during the construction and post-construction periods.

This Pre-construction Avian Monitoring Report is framed to be consistent with the Monitoring Plan and anticipated annual reports to facilitate reference between documents. Post-restoration annual monitoring reports in upcoming years will include results for these avian variables, and will identify whether the avian metrics have or have not met performance standards, and whether the project is on a trajectory to meet success requirements. Reports will be submitted to agencies as required and will also identify recommendations for remedial activities or adaptive management strategies that may be required over the next year.

Table 1-1 summarizes the specific variables discussed in this report and performance standards for each variable. Per the Monitoring Plan, annual reports will be completed as needed until Year 10 post-construction, after which a final monitoring report will be prepared and submitted. Monitoring and reporting beyond 10 years post-construction for the life of the project (defined as a minimum of 50 years) will be detailed in a Long-Term Management Plan. Detailed methods, including data collection, monitoring frequency, analysis, and performance standards, are discussed in the Monitoring Plan.

Table 1-1. Avian Variable Summary

Chapter	Variable	Variable Type	Performance Standard
2.1	Breeding Marsh Birds with focus on Light-footed Ridgway's Rail	Pre-Restoration Absolute	Within 95% or greater of pre-construction survey data (2016, 2017)
2.2	Western Snowy Plover, California Least Tern, and Waterbird Species	Pre-Restoration Absolute	Within 95% or greater of pre-construction survey data (2016, 2017)
2.3	Belding's Savannah Sparrow	Pre-Restoration Absolute	Within 95% or greater of pre-construction survey data (2016, 2017)

2. BIRDS

2.1 BREEDING MARSH BIRDS

2.1.1 Performance Standards

Success for breeding marsh birds will be measured by comparing project-specific pre-construction (defined as those data collected in 2016 and 2017) and construction / post-construction data metrics using the "floating alpha" method described in Sections 2.1.2 and 2.2.2 of the Monitoring Plan (Nature Collective 2020).

Interim standard: Post-construction 4-year running average density and number of individuals 75% or greater than that of pre-construction survey data (2016, 2017) by year 7 post-construction

Final standard: Post-construction 4-year running average density and number of individuals 95% or greater than that of pre-construction survey data (2016, 2017) by year 10 post-construction

Running averages will be used to account for annual population variability. Standards will not be considered met until performance standards are met for 3 consecutive years (see Section 2.3 of the Monitoring Plan).

2.1.2 Approach

The focus of these surveys was to estimate density and abundance for the federally- and state-listed endangered light-footed Ridgway's rail (LFRR; *Rallus obsoletus levipes*). The Standardized North American Marsh Bird Monitoring Protocol (Conway 2011) recommends that an additional five focal marsh bird species were also recorded: Virginia rail (*Rallus limicola*), least bittern (*Ixobrychus exilis*) (CDFW Species of Special Concern), American bittern (*Botaurus lentiginosus*), common gallinule (*Gallinula galeata*), and pied-billed grebe (*Podilymbus podiceps*).

Breeding marsh bird surveys were conducted between April 6 and June 3, 2016 and March 15 and June 6, 2017. LFRR data were collected within the 200-meter radius of survey points using independent double-observer methods (Nichols et al. 2000), as described in the Monitoring Plan. A complete description of survey methodology and rationale can be found in the Monitoring Plan.

2.1.2.1 Light-footed Ridgway's Rail

A Huggins' (1991) closed mark-recapture model was used to generate separate estimates of LFRR abundance and associated 95% upper and lower confidence limits (UCL and LCL, respectively) for each of the six surveys conducted between late March and early June in 2016 and 2017. Model-

averaging was used to generate LFRR estimates and confidence intervals for 2016 and 2017 in this report. The 2016 results differ slightly from those presented in the 2016 Light-footed Ridgway's Rail 45-Day Summary Report (AECOM 2016, Attachment 1), which were based on the null model.

LFRR density was calculated by dividing the model-generated estimate of LFRR abundance within the survey area by the total acreage of "preferred" habitat within the survey area (192.49 acres). For this analysis, LFRR preferred habitat was considered Coastal Brackish Marsh (CBM), Coastal Salt Marsh – Low (CSM – Low), and Coastal Salt Marsh – Mid (CSM – Mid), based on habitat types described by Oberbauer et al. (2008). Although LFRR were sometimes recorded in other habitats, these three habitat types match breeding habitat described by Massey et al. (1984) most closely, and they were the habitat types most consistently associated with LFRR presence during surveys. Observations of LFRR in other habitat types that may be considered "suitable" (e.g., CSM – High, or others in which LFRR were sometimes detected) were generally restricted to areas of those habitats immediately adjacent to one of the preferred types. To estimate the LFRR population size for the entire lagoon (i.e., the lagoon-wide abundance estimate), including areas of un-surveyed habitat, LFRR density estimates (and associated confidence intervals) were multiplied by the total acreage of preferred habitat across the entire lagoon (301.17 acres). The acreages of LFRR preferred habitat presented herein are slightly lower than those presented in the 2016 and 2017 45-day reports (AECOM 2016, 2017; Attachments 1 and 2, respectively) because lesser-used habitats such as CSM – High and Mudflat have been excluded from the totals and, to a lesser degree, because field observations led to improvements in the habitat mapping layer.

2.1.2.2 Other Focal Marsh Bird Species

In addition to LFRR, estimates for the five other focal species of marsh birds are provided as the average number of individuals detected per survey. There was an insufficient number of detections for these other species to generate modeled estimates of abundance. For this reason, raw numbers of detected individuals are presented as an index reflecting relative abundance.

2.1.3 <u>Results</u>

A detailed summary of the survey dates, survey times, survey personnel, and weather conditions, in addition to raw counts of LFRR pairs and individuals, can be found in the 2016 and 2017 Light-footed Ridgway's Rail 45-Day Summary Reports (AECOM 2016, 2017; Attachments 1 and 2, respectively).

2.1.3.1 Light-footed Ridgway's Rail

LFRR were detected predominantly in areas dominated by Coastal Brackish Marsh (CBM), Coastal Salt Marsh – Low (CSM – Low), and Coastal Salt Marsh – Mid (CSM – Mid). The

locations of LFRR detections from 2016 and 2017 surveys are depicted in Figures 2-1 and 2-2, respectively.

Based on results from the Huggins (1991) model, LFRR density estimates for each of the six surveys conducted in 2016 and 2017 are presented in Table 2-1 with associated model-generated 95% confidence intervals. Values represent the estimated number of individuals per acre of preferred habitat within the survey area. LFRR density estimates are presented for 2016, 2017, and both years combined, with the latter representing the baseline LFRR density estimate.

Table 2-1. Summary of Light-Footed Ridgway's Rail (LFRR) Results

Survey Number	LFRR Survey Area Density Estimates (# Individuals per Acre)		
	2016	2017	2016 & 2017
	Estimate (95% CI)[1]		Overall Baseline Estimate[2]
1	0.289 (0.281-0.296)	0.210 (0.203-0.217)	0.249
2	0.210 (0.203-0.216)	0.231 (0.224-0.238)	0.220
3	0.231 (0.224-0.238)	0.226 (0.218-0.234)	0.228
4	0.215 (0.208-0.223)	0.204 (0.198-0.210)	0.210
5	0.157 (0.152-0.163)	0.174 (0.166-0.182)	0.166
6	0.215 (0.208-0.222)	0.147 (0.140-0.154)	0.181
Overall Mean (95% CI)[3]	0.219 (0.186 – 0.253)	0.199 (0.173 – 0.224)	0.209 (0.184 – 0.234)

[1] Density estimates and 95% confidence intervals for Surveys 1 through 6 in 2016 and 2017 were calculated by dividing the model-generated LFRR abundance estimates (and associated confidence limits) within the survey area by the amount of preferred habitat within the survey area (192.49 acres).
[2] The six survey-specific baseline density estimates in this column were calculated as the mean of 2016 and 2017 density estimates and lack model-generated confidence limits.
[3] Overall Mean Estimates in this row for 2016, 2017, and both years combined were calculated as the mean of the six survey-specific estimates. Confidence limits for 95% confidence intervals calculated as mean estimate +/- 1.96 x standard error of the six estimates.

Density estimates varied considerably among the six surveys conducted during each year. In 2016, the estimated LFRR density ranged from a low of 0.157 individual/acre during Survey 5 to a high of 0.289 individual/acre during Survey 1 (mean=0.219 individual/acre); whereas in 2017, estimates ranged from a low of 0.147 individual/acre in Survey 6 to a high of 0.231 individual/acre in Survey 2. LFRR density estimates tended to be greater in surveys conducted earlier in the season, compared to later in the season (Figure 2-3). This variation was significant in many cases, with non-overlapping 95% confidence intervals for several estimates from different surveys during the same survey season. However, the overall mean LFRR density estimates for 2016 and 2017, shown in the bottom row of Table 2-1, did not differ dramatically, and their 95% confidence intervals overlapped considerably.

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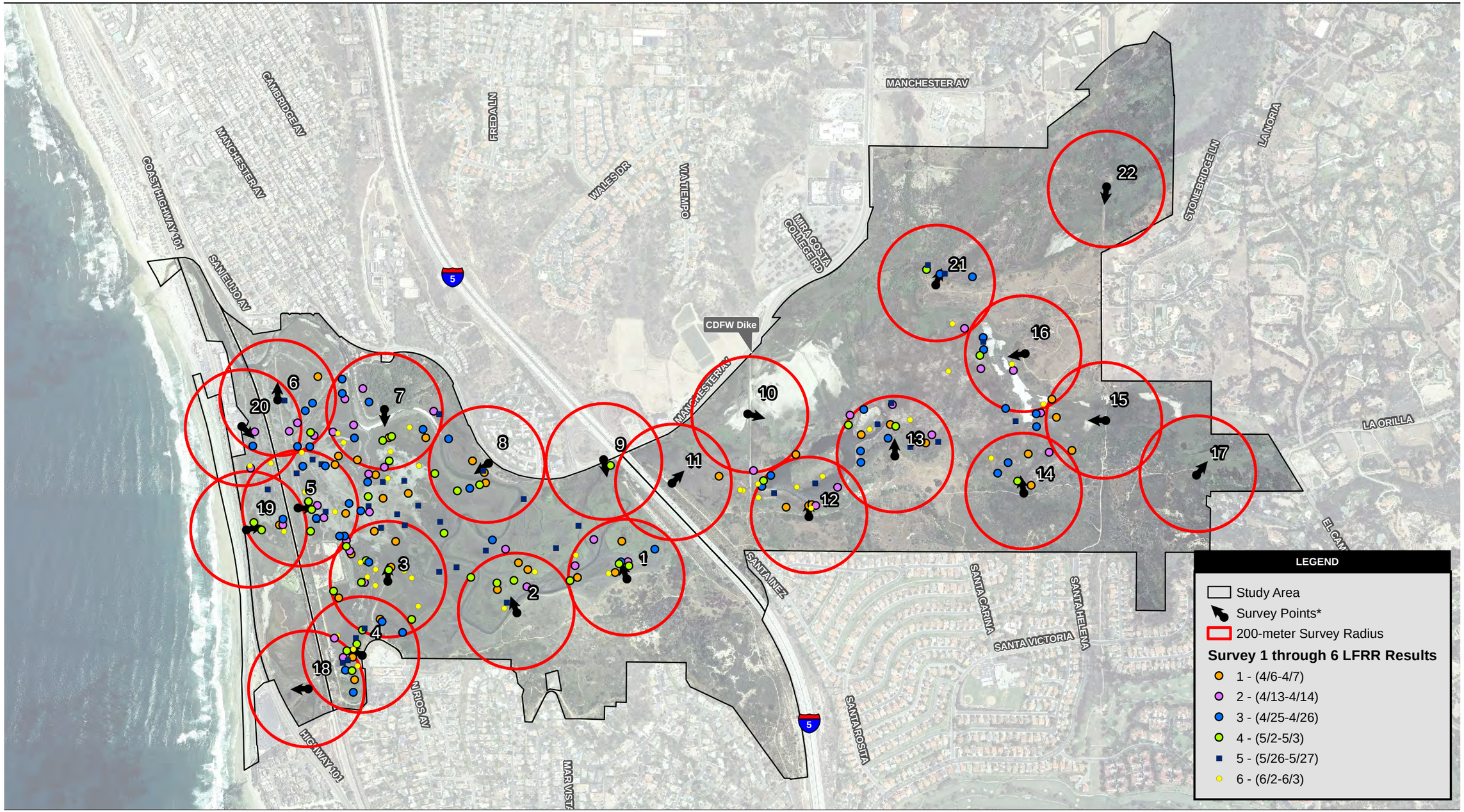


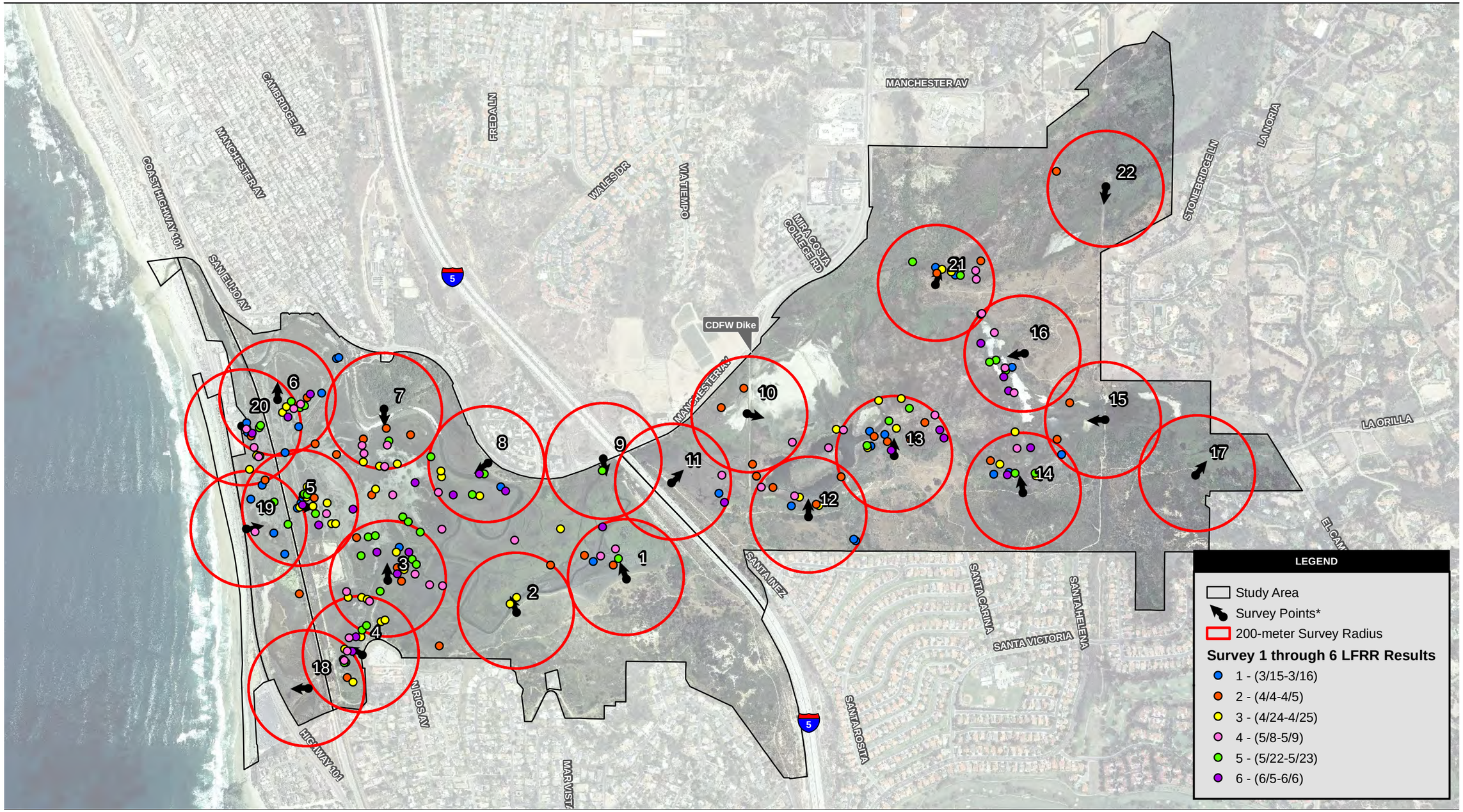
Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 2-1
2016 LFRR Results: Surveys 1 through 6



Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

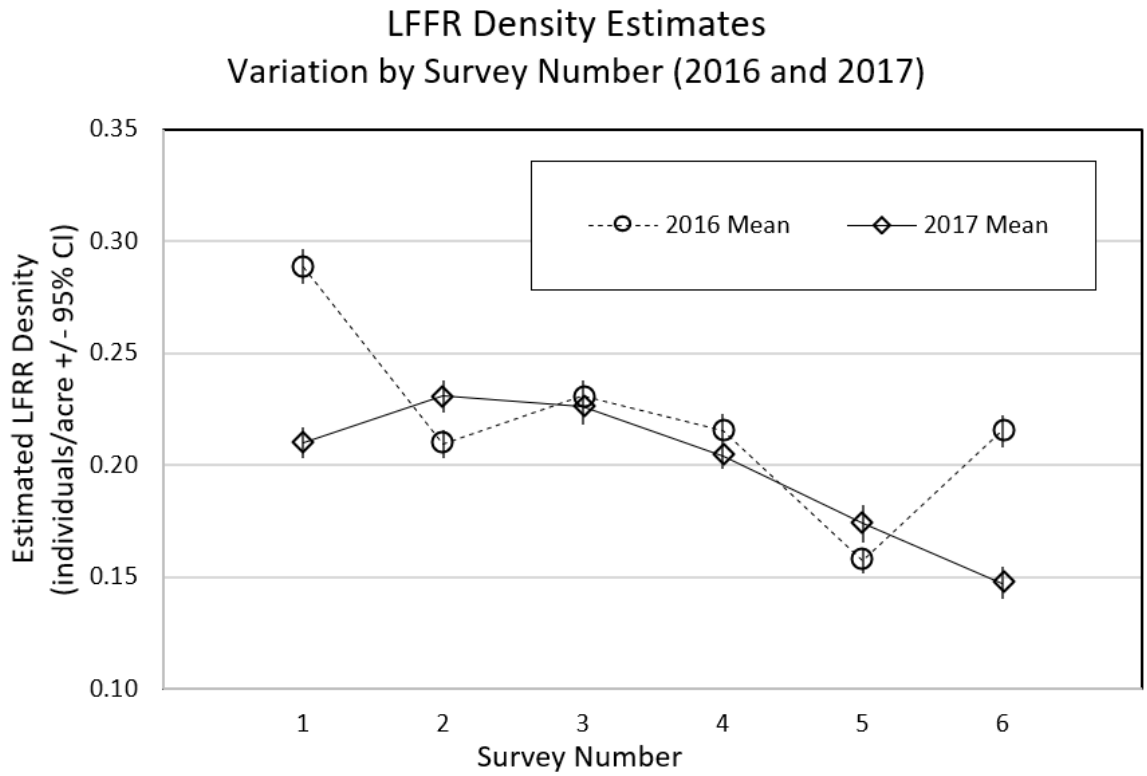
Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 2-2
2017 LFRR Results: Surveys 1 through 6

Figure 2-3. Estimates of Light-footed Ridgway's Rails Density (2016 and 2017)

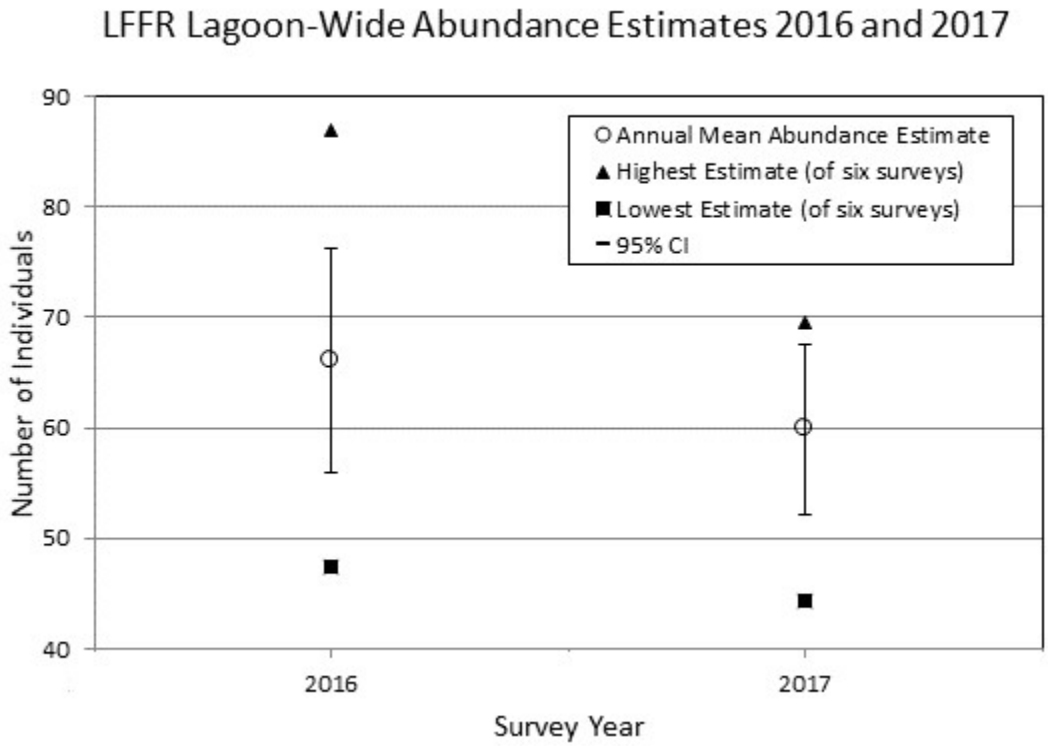
Model-generated lower and upper 95% confidence limits (LCL and UCL, respectively) are indicated by vertical lines.



Lagoon-wide estimates of LFFR abundance (total number of individuals) were generated for 2016 and 2017 by extrapolating survey area density estimates (and confidence limits) (Table 2-1) to the approximately 301 total acres of preferred habitat within the entire lagoon. The mean lagoon-wide LFRR abundance estimate in 2017 was slightly lower than in 2016 (60 versus 66individuals, respectively) (Figure 2-4), but this was driven mainly by one particularly high estimate during Survey 1 in the 2016 season. Overall, the estimates were not dramatically different, however, as their 95% confidence intervals overlapped considerably with each other (Figure 2-4).

Figure 2-4. Estimates of Light-footed Ridgway's Rails (2016–2017)

Lower and Upper confidence limits (LCL and UCL, respectively) are indicated by vertical bars.



2.1.3.2 Other Focal Marsh Bird Species

On average, Virginia rails were the most commonly detected of the focal marsh bird species during surveys and common gallinule were the least detected (Table 2-2). Aside from Virginia rails, the numbers were relatively low for focal marsh bird species in both years, and there was little difference between the 2 years of baseline data for any of the focal marsh bird species. The average from 2016 and 2017 detection rates (Table 2-2) provides the baseline pre-construction abundance metrics for these species.

Table 2-2. Other Focal Marsh Bird Species

Focal Species		Average Number Detected per Survey (Standard Error)		
Common Name	**Scientific Name**	**2016[1]**	**2017[1]**	**2-Year Baseline Average[2]**
Virginia Rail	*Rallus limicola*	6.17 (1.49)	5.83 (2.24)	6.00 (1.41)
Least Bittern	*Ixobrychus exilis*	0.17 (0.17)	0.50 (0.34)	0.33 (0.17)
American Bittern	*Botaurus lentiginosus*	0.83 (0.65)	0.67 (0.42)	0.75 (0.48)
Common Gallinule	*Gallinula galeata*	0.00 (0.00)	0.17 (0.17)	0.08 (0.08)
Pied-billed Grebe	*Podilymbus podiceps*	2.17 (0.79)	1.33 (0.49)	1.75 (0.38)
All Species[3]	-----	9.33 (2.49)	10.67 (3.21)	10.00 (2.49)

[1] Mean and standard error for 2016 and 2017 estimates calculated from number of individuals detected during the six surveys each year.
[2] Baseline average and standard error calculated from the 2-year average (2016 and 2017) number of individuals detected during each of the six surveys each year.
[3] Values are based on the survey-specific totals (number of individuals of all focal species) detected for surveys 1 through6 during 2016 and 2017.

2.1.4 Discussion

2.1.4.1 Light-footed Ridgway's Rail

The objective of the LFRR surveys is to provide a replicable survey method that can act as a reliable abundance index to monitor for changes in the LFRR population size within San Elijo Lagoon over time. The mean survey area density estimate for 2016 did not differ significantly from that in 2017, and the average estimate from both years combined was 0.209 (0.167 – 0.252) individuals per acre of preferred habitat. This density estimate translates to an extrapolated lagoon-wide population estimate of 63 (95% CI: 50 – 76) individuals. These estimates will serve as the pre-construction baseline estimate for comparison with estimates derived from surveys conducted during and after construction.

Methods in this study were designed to provide metrics of LFRR density and abundance during the breeding season rather than a census of individuals and/or documentation of nesting activity. The lagoon-wide LFRR abundance estimates in this study are less than those documented in 2016 and 2017 by Zembal (2019). However, because the surveys described herein were designed to provide an index of abundance, the results from the two studies are not directly comparable.

LFRR abundance estimates tended to be lower during surveys conducted later in the season. This observed pattern is likely more reflective of differences in detectability of birds through the season than actual changes in population size. For example, LFRR in Southern California have been documented to give "clapper" and "kek" calls less frequently during May and June, after a peak in the spring (Zembal and Massey 1987) and LFRR in Arizona were shown to be less responsive to playback during May and June compared to March and April (Conway et al. 1993). LFRR may

also be more difficult to detect after most pairs have begun incubation, which generally occurs by late April or early May in Southern California (Eddleman and Conway 2018). Although the average from the six surveys conducted each year may not reflect the actual population size throughout the season, it provides a balanced index of abundance by providing multiple sampling periods over the course of the season. This index should remain unbiased, provided surveys are conducted at approximately the same time across years. Using only data from a subset of surveys (e.g., the first two surveys) could result in a greater opportunity for erroneous estimates due simply to sampling error because any single survey could be non-representative of the population simply by random chance. The average of the six surveys was used because it is more likely to approximate the true mean for the period of observation and provide a comparable index for comparisons between survey years.

In summary, the LFRR survey results from 2016 and 2017 combined provide a baseline lagoon-wide density estimate of 0.209 (95% CI: 0.167 – 0.252) individuals per acre of preferred habitat and a lagoon-wide abundance estimate of 63 (95% CI: 50 – 76) individuals for comparisons with data collected during the construction and post-construction phases of the project. As LFRR surveys continue to be conducted during the construction and post-construction phases of the project, a running average will be calculated for the 4 most recent years of construction/post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring reports prepared for the SELRP.

2.1.4.2 Other Focal Marsh Bird Species

The focal bird species results are intended to provide an index of relative abundance of key marsh bird species other than LFRR during the 2 years of pre-construction surveys, for comparison with detection rates during construction and post-construction marsh bird surveys. These other focal bird species have utility as “indicator species” for assessing wetland ecosystem quality (Conway 2011) and their continued presence will be another indicator of project success.

Observations of the five other focal species were estimated as the average number of individuals per survey (for each year, 2016, 2017, and 2016 and 2017 combined; Table 2-2). Due to the low number of detections for each of these species, abundance estimates were not corrected for detection probabilities, so the reported numbers probably underestimate true abundance of focal marsh bird species. They are, thus, not directly comparable to the estimates of LFRR abundance derived from the Huggins (1991) model. The focal marsh bird data represent the number of detections within the survey area and are also not adjusted for the amount of suitable habitat, or extrapolated to provide an estimate of the lagoon-wide abundance.

In summary, the other focal bird species survey results from 2016 and 2017 combined provide the baseline lagoon-wide abundance estimate of individuals for comparisons with data collected during the construction and post-construction phases of the project. As surveys continue to be conducted during the construction and post-construction phases of the project, a running average will be calculated for the 4 most recent years of construction/ post-construction marsh bird surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between years will be summarized and discussed in the annual monitoring report prepared for the SELRP.

2.2 WATERBIRD SURVEYS, INCLUDING WESTERN SNOWY PLOVER AND CALIFORNIA LEAST TERN

Monitoring waterbird species (e.g., seabirds, waterfowl, shorebirds, wading birds) that use open water, and mudflat habitats in the SELRP study area is a pre-restoration absolute monitoring variable and will not be compared to reference wetlands for purposes of determining success of the SELRP. In the process of monitoring waterbird numbers, these avian surveys will generate information about western snowy plovers and California least terns.

2.2.1 Performance Standards

Success for western snowy plovers, California least terns, and other waterbird species will be measured by comparing project-specific pre-construction (defined as those data collected in 2016 and 2017) and construction/post-construction data metrics using the "floating alpha" method described in Sections 2.1.2 and 2.2.2 of the Monitoring Plan (Nature Collective 2020).

Interim standard: Post-construction 4-year running average number of individuals 75% or greater than that of pre-construction survey data (2016, 2017) by year 7 post-construction

Final standard: Post-construction 4-year running average number of individuals 95% or greater than that of pre-construction survey data (2016, 2017) by year 10 post-construction

Running averages will be used to account for annual population variability. Standards will not be considered met until performance standards are met for 3 consecutive years (see Section 2.3 of the Monitoring Plan).

2.2.2 Approach

Waterbird surveys focused on birds that utilize open water, mudflat, and sand habitat, including western snowy plovers and California least terns. A complete description of survey methodology for waterbird surveys can be found in the Monitoring Plan. Each survey was conducted in a fashion that yielded a census of all waterbirds observed in the west, central, and east basins of the lagoon.

Abundance of two species, western snowy plover (*Charadrius nivosus nivosus*) and California least tern (*Sternula antillarum browni*), were estimated as the number of individuals observed per survey for each basin and overall. Estimates were averaged between the 2 years. Observations of other target species were grouped broadly into cohorts reflecting different taxonomic Orders and summarized as the number of individuals in each cohort observed per survey for each basin, overall, and averaged between the 2 years. A list of the species associated with each taxonomic order is provided in Attachment 3.

Surveys were conducted from April through December in 2016 and from January through December in 2017. Within these periods, at least one survey was conducted per month during January, February, October, November, and December, and at least two surveys were conducted per month during March through September. In 2016, separate surveys were conducted for California least terns from mid-April through September, but in 2017 California least tern surveys were conducted simultaneously with western snowy plover and other waterbird surveys. Detailed summaries of the survey dates, survey times, survey personnel, and weather conditions for surveys conducted are provided in Attachment 4 – 2016 waterbirds/western snowy plover surveys; Attachment 5 - 2016 California least tern surveys; and Attachment 6 - 2017 waterbird, western snowy plover, and California least tern surveys.

2.2.3 Results

Survey results are summarized by month in the subsections below for western snowy plover, California least tern, and waterbirds. When multiple surveys were conducted in a month for a given year, the mean number of individuals detected across surveys conducted in that month was calculated. The mean number of individuals detected per survey during each month was then used to evaluate temporal variation in abundance (across seasons, and between years), and to calculate the overall baseline average abundance metrics.

2.2.3.1 Western Snowy Plover

Results from 2016 and 2017 western snowy plover surveys are summarized by survey number and month in Table 2-3. During 2016, western snowy plovers were detected during 5 of 18 surveys and the number of individuals observed ranged from 0 to 9 per survey, for a total of 17 detections. All 2016 detections occurred during the months of September and October (Table 2-3). No western snowy plovers were detected within the lagoon during 2017 waterbird surveys. Based on monthly averages, the number of western snowy plovers detected in 2017 (0.00 individuals/survey) was only slightly lower than 2016 (0.72 individuals/survey), for an overall lagoon-wide annual average of 0.27 individuals per survey across both years (Table 2-3).

Table 2-3. Summary of Western Snowy Plover Results by Survey Number and Month

Month	Survey #		# Individuals		Monthly Averages (Mean # Individuals/Survey)			
	2016	2017	2016	2017	Month	2016	2017	2016-2017 Baseline
Jan	-	1	-	0	Jan	-	0.00	0.00
Jan	-	2	-	0				
Feb	-	3	-	0	Feb	-	0.00	0.00
Feb	-	4	-	0				
Mar	-	5	-	0	Mar	-	0.00	0.00
Mar	-	6	-	0				
Apr	-	7	-	0	Apr	0.00	0.00	0.00
Apr	1	8	0	0				
May	2	9	0	0	May	0.00	0.00	0.00
May	3	10	0	0				
May	-	11	-	0				
Jun	4	12	0	0	Jun	0.00	0.00	0.00
Jun	5	13	0	0				
Jun	6	-	0	-				
Jul	7	14	0	0	Jul	0.00	0.00	0.00
Jul	8	15	0	0				
Aug	9	16	0	0	Aug	0.00	0.00	0.00
Aug	-	17	-	0				
Sep	10	18	1	0	Sep	2.50	0.00	1.25
Sep	11	19	4	0				
Oct	12	20	2	0	Oct	4.00	0.00	2.00
Oct	13	-	9	-				
Oct	14	-	1	-				
Nov	15	21	0	0	Nov	0.00	0.00	0.00
Nov	16	-	0	-				
Dec	17	22	0	0	Dec	0.00	0.00	0.00
Dec	18	-	0	-				
Overall Average (Standard Error)						**0.72 (0.49)**	**0.00 (0.00)**	**0.27 (0.19)**

The numbers of western snowy plovers detected in each lagoon basin are presented below in Table 2-4. Small numbers of western snowy plovers were detected in the west basin of the lagoon in 2016 but not in 2017, and they were not detected in the east or central basins in either year (Table 2-4). Western snowy plovers detected in the west basin were generally observed foraging or roosting on mud flats. The locations of western snowy plover observations from 2016 surveys are displayed in Figure 2-5. Individuals detected in flight are not displayed in these figures because

their location was only recorded at the lagoon basin level (e.g., east, west, central basin), since a specific location could not be mapped.

Table 2-4. Summary of Western Snowy Plover Results by Lagoon Basin

Lagoon Basin	Mean # Individuals/Survey (Standard Error)	
	2016 (18 surveys[1])	2017 (22 surveys[2])
Central	0.00 (0.00)	0.00 (0.00)
East	0.00 (0.00)	0.00 (0.00)
West	0.72 (0.49)	0.00 (0.00)

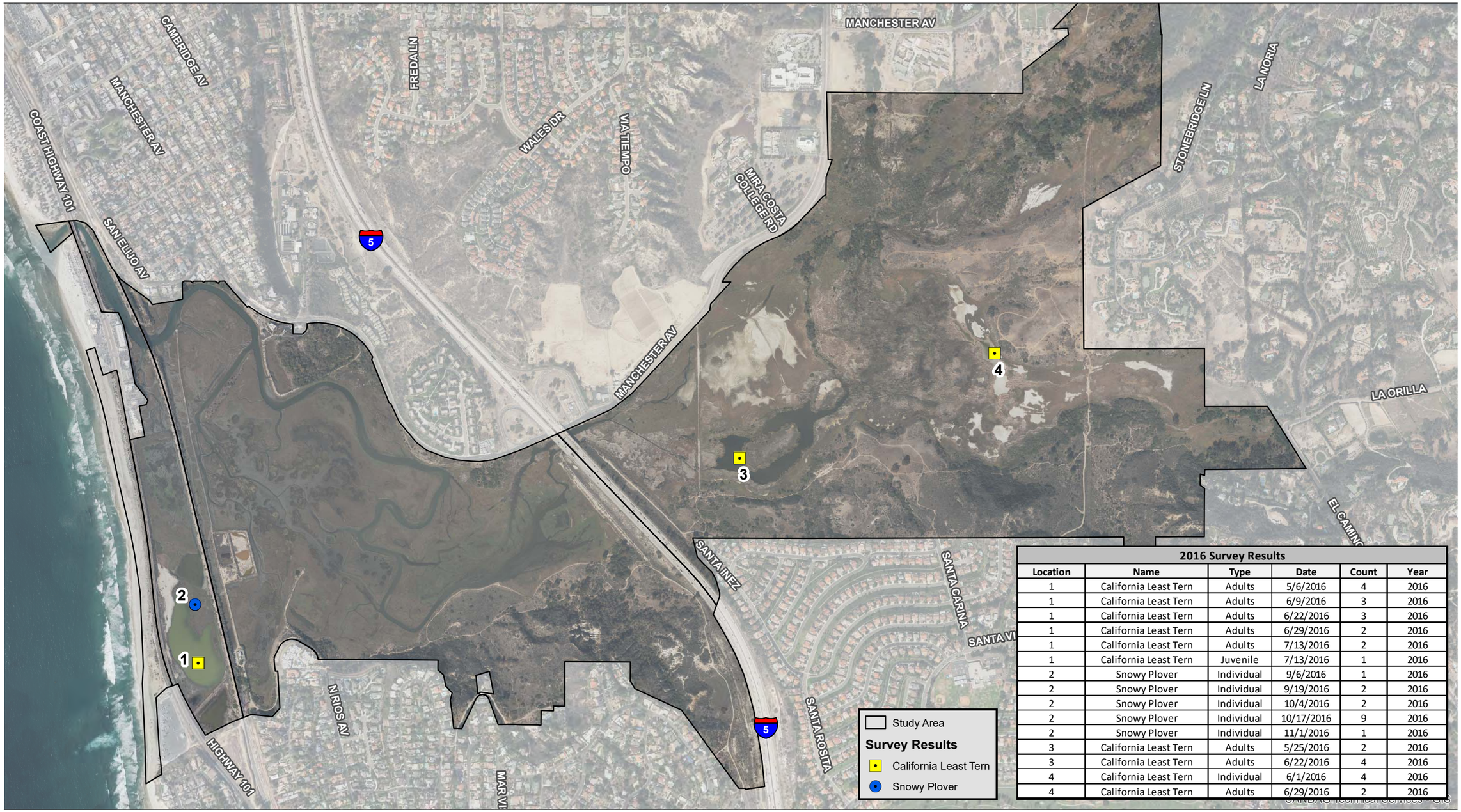
[1] Mean and standard error values for each basin calculated from 9 monthly values (averaged among surveys when multiple surveys conducted in a month)

[2] Mean and standard error values for each basin calculated from 12 monthly values (averaged among surveys when multiple surveys conducted in a month)

2.2.3.1 California Least Tern

Results from California least tern surveys are provided only for the months of April through September because the species is generally not present on their breeding range outside of this date range. Results from 2016 and 2017 California least tern surveys are summarized by survey number and month below (Table 2-5). Lagoon-wide, California least terns were not detected during surveys conducted in the months of April, August, or September, and their numbers tended to be highest during May and particularly June, coincident with the arrival of migrant birds that overwinter in central and south America and breed in Southern California. This was true in both 2016 and 2017, even though overall numbers were slightly lower during 2017 (Table 2-5).

During 2016, California least terns were detected during 9 of 20 waterbird surveys and the number of individuals observed ranged from 0 to 7 per survey. In 2017, the species was detected in 3 of 13 surveys and the number of individuals observed ranged from 0 to 5 per survey. Across all three basins, the mean number of California least terns detected per survey was slightly higher in 2016 (1.12 individuals/survey) compared to 2017 (0.58 individuals/survey), for an overall lagoon-wide annual average across the 2 years of 0.85 individuals per survey (Table 2-5).



2016 Survey Results

Location	Name	Type	Date	Count	Year
1	California Least Tern	Adults	5/6/2016	4	2016
1	California Least Tern	Adults	6/9/2016	3	2016
1	California Least Tern	Adults	6/22/2016	3	2016
1	California Least Tern	Adults	6/29/2016	2	2016
1	California Least Tern	Adults	7/13/2016	2	2016
1	California Least Tern	Juvenile	7/13/2016	1	2016
2	Snowy Plover	Individual	9/6/2016	1	2016
2	Snowy Plover	Individual	9/19/2016	2	2016
2	Snowy Plover	Individual	10/4/2016	2	2016
2	Snowy Plover	Individual	10/17/2016	9	2016
2	Snowy Plover	Individual	11/1/2016	1	2016
3	California Least Tern	Adults	5/25/2016	2	2016
3	California Least Tern	Adults	6/22/2016	4	2016
4	California Least Tern	Individual	6/1/2016	4	2016
4	California Least Tern	Adults	6/29/2016	2	2016

Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,000 500 0 1,000 Feet

Scale: 1:12,000; 1 inch = 1000 feet

Figure 2-5
2016 California Least Tern and Snowy Plover Survey Results

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Table 2-5. Summary of California Least Tern Results by Survey Number and Month

Month	Survey #		# Individuals		Monthly Averages (Mean # Individuals/Survey)			
	2016	2017	2016	2017	Month	2016	2017	2016-2017 Baseline
Apr	1	1	0	0	Apr	0.0	0.0	0.0
Apr	2	2	0	0				
May	3	3	4	2	May	1.8	1.0	1.4
May	4	4	0	0				
May	5	5	1	1				
May	6	-	2	-				
Jun	7	6	4	0	Jun	4.2	2.5	3.4
Jun	8	7	3	5				
Jun	9	-	3	-				
Jun	10	-	7	-				
Jun	11	-	4	-				
Jul	12	8	0	0	Jul	0.8	0.0	0.4
Jul	13	9	3	0				
Jul	14	-	0	-				
Jul	15	-	0	-				
Aug	16	10	0	0	Aug	0.0	0.0	0.0
Aug	17	11	0	0				
Aug	18	-	0	-				
Aug	19	-	0	-				
Sep	20	12	0	0	Sep	0.0	0.0	0.0
Sep	-	13	-	0				
Overall Average (Standard Error)						**1.12 (0.68)**	**0.58 (0.42)**	**0.85 (0.55)**

During both 2016 and 2017, this species was detected infrequently in each of the three basins of the lagoon (Table 2-6). When present within the lagoon, individuals were generally observed aerial foraging over open water. The locations of California least tern observations from 2016 and 2017 surveys are displayed in Figures 2-5 and 2-6, respectively. However, individuals detected in flight are not displayed in these figures unless they were foraging over specific areas of open water. Otherwise, the locations of birds observed flying were recorded at the lagoon basin level (e.g., east, west, central basin), since a specific location could not be mapped.

Table 2-6. Summary of California Least Tern Results by Lagoon Basin

Lagoon Basin	Mean # Individuals/Survey (Standard Error)	
	2016 (20 surveys[1])	2017 (13 surveys[1])
Central	0.10 (0.10)	0.00 (0.00)
East	0.42 (0.33)	0.47 (0.41)
West	0.60 (0.29)	0.11 (0.11)

[1] Mean and standard error values for each basin calculated from 6 monthly values (averaged among surveys when multiple surveys conducted in a month)

2.2.3.2 Other Waterbird Species

Results from 2016 and 2017 general waterbird surveys are summarized by survey number and month below (Table 2-7). Lagoon-wide, waterbird numbers tended to be lowest during the months of May through August, coincident with the time most migrants are away at breeding grounds farther north, and highest during the other months. This pattern held in both 2016 and 2017, even though overall waterbird numbers tended to be lower during 2017 (Table 2-7).

Across all three lagoon basins combined, the mean number of waterbirds detected per survey was slightly higher in 2016 (383.6 individuals/survey) compared to 2017 (327.9 individuals/survey), for an overall lagoon-wide annual average across the 2 years of 355.8 individuals per survey.

The two orders of birds most frequently observed during waterbird surveys were the Anseriformes (waterfowl) and Charadriiformes (shorebirds). Anseriformes were most frequently detected in the central basin in 2016 (73.56 individuals/survey) and 2017 (112.86 individuals/survey) and least frequently detected in the west basin (3.37 and 10.14 individuals/survey in 2016 and 2017, respectively), with intermediate abundances in the east basin (Table 2-8). Charadriiformes were detected most frequently in the central basin in 2016 (111.76 individuals/survey) and 2017 (46.72 individuals/survey), and least frequently in the east basin (28.41 and 22.43 individuals/survey in 2016 and 2017, respectively), with intermediate abundances in the west basin (Table 2-8). Across all taxonomic groups and lagoon basins, patterns in abundance were generally consistent between 2016 and 2017. One exception was in the central basin where the number of Anseriformes increased from 73.56 to 112.86 individuals per survey, while the number of Charadriiformes decreased from 111.76 to 46.72 individuals per survey between 2016 and 2017.

Aside from Anseriformes and Charadriiformes, the next most abundant groups were birds in the orders Pelecaniformes (mainly herons and egrets), Gruiformes (mainly coots and LFRR), and to a lesser extent Suliformes (mainly cormorants) (Table 2-8). In the west basin, the most abundant of these was Pelecaniformes, and in the east basin it was Gruiformes. The three groups were present in roughly equal numbers in the central basin. As a group, Suliformes was most abundant in the central basin and nearly absent from the other two.

Table 2-7. Summary of Waterbird Results by Survey Number and Month

Month	Survey #		# Individuals		Monthly Averages (Mean # Individuals/Survey)			
	2016	2017	2016	2017	Month	2016	2017	2016-2017 Baseline
Jan	-	1	-	537	Jan	-	509.5	509.5
Jan	-	2	-	482				
Feb	-	3	-	1,179	Feb	-	857.0	857.0
Feb	-	4	-	535				
Mar	-	5	-	657	Mar	-	458.5	458.5
Mar	-	6	-	260				
Apr	-	7	-	173	Apr	435.0	222.5	328.8
Apr	1	8	435	272				
May	2	9	239	222	May	212.0	150.7	181.3
May	3	10	185	137				
May	-	11	-	93				
Jun	4	12	211	91	Jun	202.3	95.5	148.9
Jun	5	13	280	100				
Jun	6	-	116	-				
Jul	7	14	141	211	Jul	194.5	115.0	154.8
Jul	8	15	248	19				
Aug	9	16	287	245	Aug	287.0	237.0	262.0
Aug	-	17	-	229				
Sep	10	18	503	136	Sep	402.0	171.5	286.8
Sep	11	19	301	207				
Oct	12	20	233	69	Oct	304.0	69.0	186.5
Oct	13	-	191	-				
Oct	14	-	488	-				
Nov	15	21	356	587	Nov	512.5	587.0	549.8
Nov	16	-	669	-				
Dec	17	22	708	462	Dec	903.5	462.0	682.8
Dec	18	-	1,099	-				
Overall Average (Standard Error)						**383.6 (74.9)**	**327.9 (70.5)**	**355.8 (72.7)**

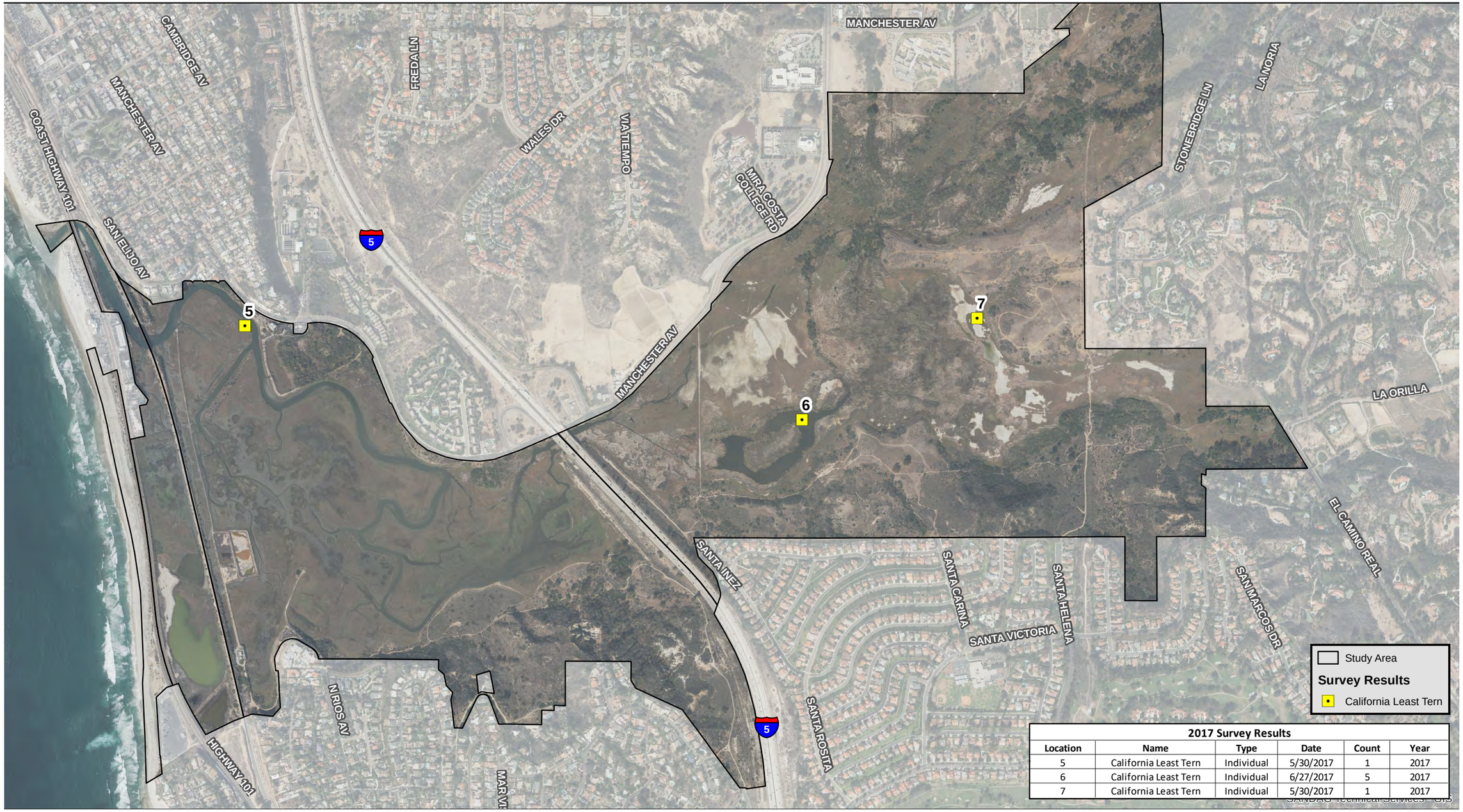
Table 2-8. Summary of Waterbird Results by Taxonomic Group and Lagoon Basin

Lagoon Basin	Taxonomic Order	Mean # of Individuals Detected per Survey (Standard Error)	
		2016 (18 surveys[1])	2017 (22 surveys[2])
Central	**Total (all species)**	**207.65 (49.77)**	**177.85 (51.31)**
	Anseriformes (Waterfowl)	73.56 (47.86)	112.86 (42.04)
	Charadriiformes (Shorebirds, Sandpipers, Gulls, Terns)	111.76 (28.76)	46.72 (13.57)
	Gruiformes (Rails, Coots)	4.74 (1.46)	5.86 (3.02)
	Pelecaniformes (Pelicans, Wading birds)	7.52 (0.97)	6.00 (1.92)
	Podicipediformes (Grebes)	1.44 (0.77)	0.61 (0.32)
	Suliformes (Cormorants)	8.63 (1.45)	5.79 (1.48)
East	**Total (all species)**	**95.83 (35.97)**	**90.63 (25.07)**
	Anseriformes (Waterfowl)	50.56 (28.92)	52.01 (18.45)
	Charadriiformes (Shorebirds, Sandpipers, Gulls, Terns)	28.41 (5.78)	22.43 (8.15)
	Gruiformes (Rails and Coots)	10.31 (7.25)	10.75 (4.87)
	Pelecaniformes (Pelicans and Wading birds)	5.56 (1.63)	4.49 (1.23)
	Podicipediformes (Grebes)	0.89 (0.32)	0.78 (0.24)
	Suliformes (Cormorants)	0.11 (0.11)	0.17 (0.09)
West	**Total (all species)**	**80.17 (21.57)**	**59.46 (11.35)**
	Anseriformes (Waterfowl)	3.37 (1.08)	10.14 (4.60)
	Charadriiformes (Shorebirds, Sandpipers, Gulls, Terns)	71.30 (22.79)	41.06 (11.68)
	Gruiformes (Rails and Coots)	0.00 (0.00)	0.54 (0.30)
	Pelecaniformes (Pelicans and Wading birds)	3.70 (1.50)	3.47 (0.84)
	Podicipediformes (Grebes)	1.39 (0.59)	3.67 (1.14)
	Suliformes (Cormorants)	0.41 (0.27)	0.58 (0.50)

[1] Mean and standard error values for each basin calculated from 9 monthly values (averaged among surveys when multiple surveys conducted in a month)

[2] Mean and standard error values for each basin calculated from 12 monthly values (averaged among surveys when multiple surveys conducted in a month)

Waterbirds belonging to the taxonomic orders Anseriformes and Charadriiformes comprised more than 80% of all observations during both 2016 and 2017, and this was true across all three lagoon basins. Because both groups consist largely of migrant species that overwinter in the area or pass through when traveling between winter and breeding grounds, seasonal variation in overall waterbird numbers are largely driven by differences in the abundance of these two groups through the year. The average number of Charadriiformes and Anseriformes detected per survey, across all basins combined, is displayed below for each month of the year (Figure 2-7). Separate lines depict trends during 2016 and 2017. As a group, Anseriformes were largely absent from the lagoon



2017 Survey Results

Location	Name	Type	Date	Count	Year
5	California Least Tern	Individual	5/30/2017	1	2017
6	California Least Tern	Individual	6/27/2017	5	2017
7	California Least Tern	Individual	5/30/2017	1	2017

Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,000 500 0 1,000 Feet

Scale: 1:12,000; 1 inch = 1000 feet

Figure 2-6
2017 California Least Tern and Snowy Plover Survey Results

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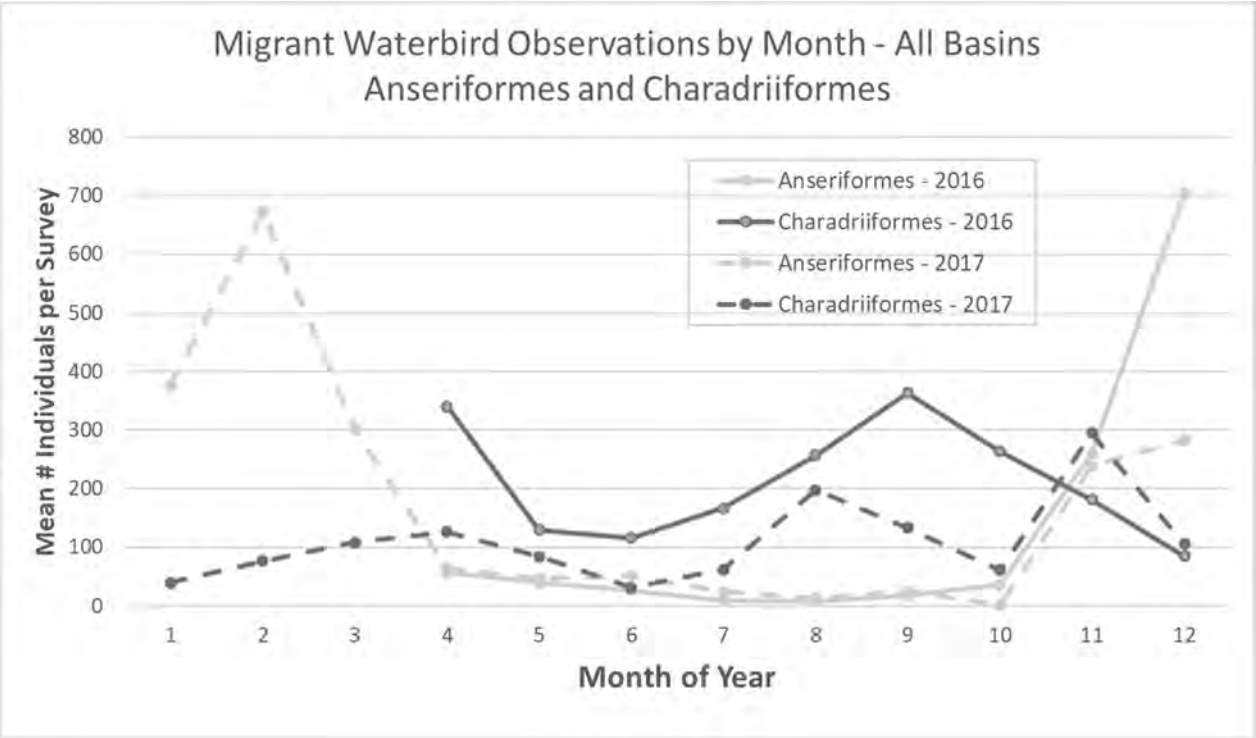
during the months of April through October, while peak numbers were observed during the winter months of December through February. Charadriiformes displayed peaks in abundance during spring (April) and again in the late summer and fall (August-November).

Figure 2-7. Mean Number of Waterfowl, Shorebirds, Sandpipers, Gulls, and Terns (2016 and 2017)

Surveys during 2016 (solid lines) were only conducted during months 4 through 12 (April – December).



2.2.4 Discussion

2.2.4.1 Western Snowy Plover

Western snowy plovers were observed within the lagoon in very low numbers during the late summer and fall (Table 2-3), and were only observed in 2016, and then only in the west basin (Table 2-4, Figure 2-5). Within the survey area, foraging and roosting habitat for western snowy plovers is concentrated in the west basin where coastal strand habitat is present. Little suitable habitat is present in the central and east basins where open water and vegetative cover are dominant. The west basin is also immediately adjacent to the coastal habitat, which is dominated by open sandy and areas and the intertidal zone, and where the species is most commonly found due to the presence of abundant foraging and roosting habitat.

When averaged across all basins and the 2 years (2016 and 2017), the overall baseline abundance estimate for western snowy plovers is 0.27 individuals per survey (Table 2-3). As waterbird

surveys continue to be conducted during the construction and post-construction phases of the project, a running average of western snowy plover abundance will be calculated for the 4 most recent years of construction/ post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

2.2.4.2 California Least Tern

California least terns were present in low numbers during the summer months of May through July in both years. Based on monthly counts conducted at the lagoon from 1973–1983, and again from 2002–2017 (Nature Collective 2019), their numbers reached an all-time low in 2015 and have remained low, with maximum counts ranging from 3–7 individuals for surveys conducted during 2015–2017, compared to counts as high as 69 and 78 in 2004 and 2007, respectively. The 2015–2017 numbers are comparable with the results of this study, where the maximum California least tern counts during 2016 and 2017 were 7 and 5 individuals, respectively.

California least terns were observed in all three lagoon basins, but were only observed aerial foraging over open water in the central and eastern basins, where open, sandy substrates more typically associated with ground foraging or roosting are essentially absent. The species historically nested in colonies on saltpan, patches of sand on alluvial fans and channel edges, and on the two islands in the east basin north of Santa Carina Street that were constructed by CDFW and San Diego County in 1981. However, changes in flood patterns and habitat quality may have had a negative effect on the breeding success within the study area and no breeding has been documented since 2002 (Patton 2010).

Overall, the number of California least tern detections during 2016 and 2017 combined was 0.85 individuals per survey (Table 2-5). As waterbird surveys continue to be conducted during the construction and post-construction phases of the project, a running average of California least tern abundance will be calculated for the 4 most recent years of construction/post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

2.2.4.3 Other Species

Waterbird surveys were designed to assess the abundance of waterbird species (e.g., seabirds, waterfowl, shorebirds, wading birds) that use open water and mudflat habitats in the SELRP. A total of six orders of waterbird were recorded in surveys, but more than 80% of observations were

of birds in the orders Anseriformes (waterfowl) and Charadriiformes (shorebirds). This is primarily because these orders include large numbers of species and because the species in these orders tend to be gregarious during the non-breeding season, which is when they are most abundant at the SLERP.

The abundance of birds in different taxonomic orders varied among the three basins surveyed in the lagoon, and across the seasons or months of the year, but were relatively consistent between 2016 and 2017. Spatial variation in abundance of waterbirds is most likely driven by differences in habitat between basins, relative to the habitat preferences of those groups. Among the three basins, overall waterbird numbers were highest in the central basin, which averaged 207.65 and 177.85 individuals per survey during 2016 and 2017, respectively. Waterbird abundance in the west basin (59.46 to 80.17 individuals/survey) was more similar to that in the east basin (90.63 to 95.83 individuals/survey), despite the west basin's much smaller area. This was largely driven by the high abundance of Charadriiformes (shorebirds) in the west basin, which is most likely due to its proximity to the coastal zone and the presence of coastal strand and mudflat habitats used by shorebirds for roosting and foraging. Anseriformes (waterfowl) were least prevalent in the west basin, comprising only 10.6% of waterbird observations there during 2016 and 2017, compared to the east and central basins, where Anseriformes comprised 55.1% and 49.4% of waterbird observations (respectively) over the 2-year baseline study period. Although the central and east basins are larger than the west basin, the greater prevalence of waterfowl there appears driven mainly by the presence of significant areas of open water with which waterfowl associate.

Interpretation of patterns in the general waterbird data are more complex to interpret than the other datasets involving a single species, such as western snowy plover or California least tern, due to the diversity of species within each group and the variability in the presence of these species across different basins in the lagoon and different seasons of the year. For example, 39 species of birds were observed within the order Charadriiformes, and 19 were observed within the order Anseriformes. Although the abundance of different species may vary over time, the comparison of waterbird abundance between the pre-construction and construction/post-construction periods is intended to provide an indication of whether dramatic declines in waterbirds in general have occurred as a result of the restoration project. To this end, although the overall number of waterbirds varied between 2016 (383.6 individuals/survey) and 2017 (327.9 individuals/survey), the overall baseline average from the 2 years of 355.8 individuals per survey provides a suitable baseline value to which post-construction abundance numbers can be compared.

As waterbird surveys continue to be conducted during the construction and post-construction phases of the project, running averages will be calculated for the general waterbird surveys overall and for each order of birds for the 4 most recent years of construction/ post-construction surveys and compared to the baseline abundance levels described herein to evaluate performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between

pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

2.3 BELDING'S SAVANNAH SPARROW SURVEYS

2.3.1 Performance Standards

Success for Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) will be measured by comparing pre-construction (defined as those data collected in 2016 and 2017) and construction / post-construction data metrics using the "floating alpha" method described in Sections 2.1.2 and 2.2.2 of the Monitoring Plan (Nature Collective 2020).

Interim standard: Post-construction 4-year running average density 75% or greater than that of pre-construction survey data (2016, 2017) by year 7 post-construction

Final standard: Post-construction 4-year running average density 95% or greater than that of pre-construction survey data (2016, 2017) by year 10 post-construction

Running averages will be used to account for annual population variability. Standards will not be considered met until performance standards are met for 3 consecutive years (see Section 2.3 of the Monitoring Plan).

2.3.2 Approach

The focus of these surveys was to estimate density for the state endangered Belding's savannah sparrow. Surveys were conducted during the breeding season for the species, between April 11 and May 20, 2016 (six surveys) and March 20 and May 19, 2017 (four surveys). Detailed summaries of the survey dates, survey times, survey personnel and weather conditions for 2016 and 2017 for surveys conducted are provided in Attachment 7. Belding's savannah sparrow detections were recorded at all distances from nineteen 100-meter-long survey transects located within suitable habitat and spread throughout the lagoon, following methods described in the Monitoring Plan. Transects 1–4, 6, 9, and 11–15 were surveyed only on one side due to the lack of sufficient suitable habitat on the other side.

Survey data were analyzed using a distance sampling approach (Buckland et al. 2001), which applied the distances between the observer and each detected bird to control for differences in detectability and estimate the density (per acre) of Belding's savannah sparrow individuals within the survey area, as the number of individuals per acre across the survey area as a whole.

2.3.3 Results

The number and timing of surveys for Belding's savannah sparrows varied between the 2016 and 2017 survey seasons such that results from specific survey numbers were not comparable across years. Results from these surveys are included in Attachment 7. For example, six surveys were conducted in 2016, compared to four surveys in 2017, and the first survey in 2016 was conducted later in the season (early April) than the first survey in 2017 (early March). For this reason, survey results are summarized according to the following four "survey periods" designed to enable grouping of survey results across four roughly equal time:

- Late February to Mid-March (February 25 to March 21)
- Late March to Early April (March 22 to April 12)
- Mid- to Late April (April 13 to April 30)
- Early to Mid-May (May 1 to May 20)

When multiple surveys were conducted in a survey period for a given year, the mean number of individuals detected across surveys conducted in that survey period was calculated. The mean number of individuals detected per survey during each survey period was then used to evaluate temporal variation in abundance (across seasons and between years), and to calculate the overall baseline average abundance metrics.

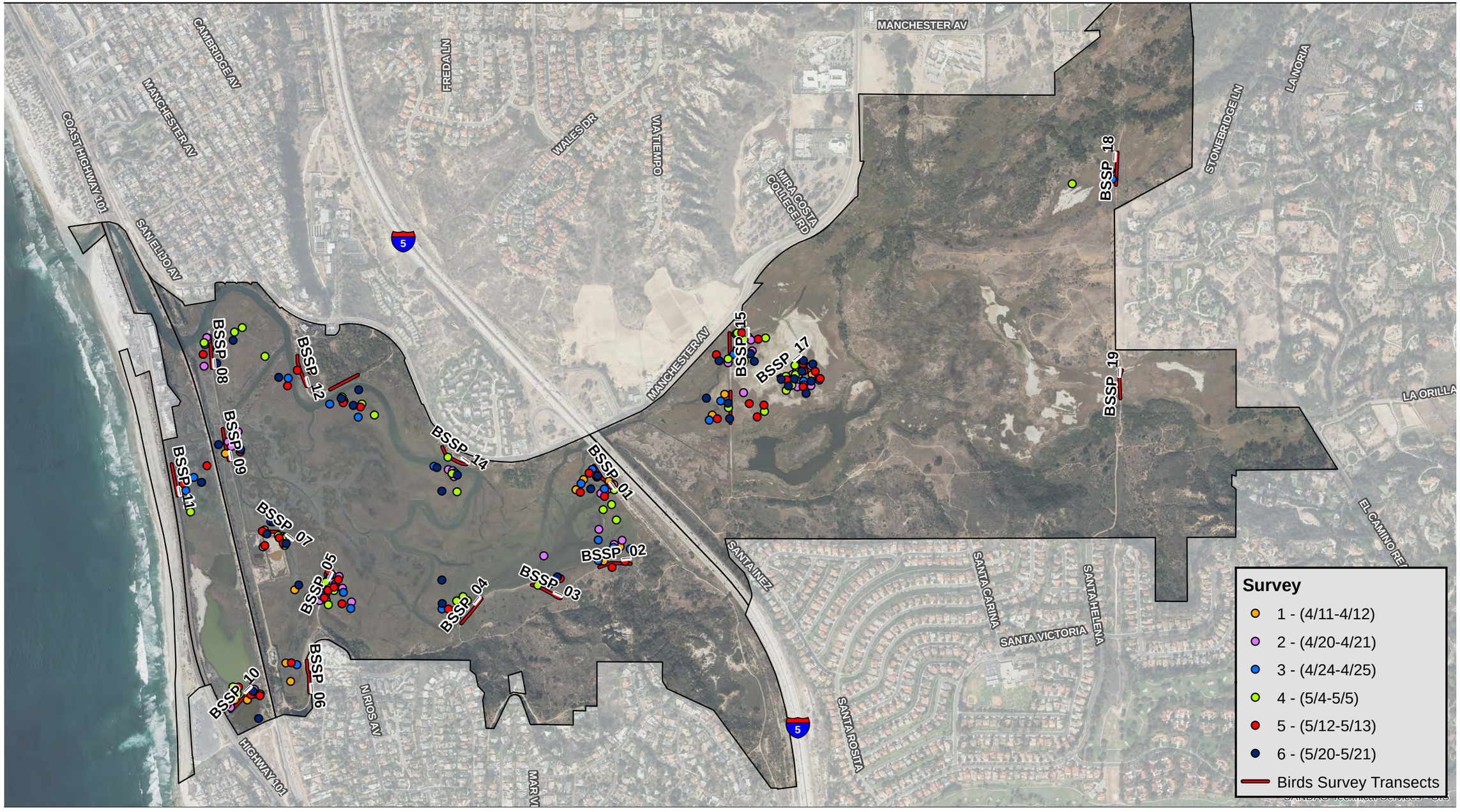
Belding's savannah sparrows were detected predominantly in areas dominated by coastal salt marsh (Low, Mid, and High). The locations of detections from 2016 and 2017 surveys are depicted in Figures 2-8 and 2-9, respectively.

Based on results from the distance sampling model approach (Buckland et al. 2001), only detections within 75 meters perpendicular distance from the transect were included in the final analysis 2016 and 2017 data. Belding's savannah sparrow density within the survey area was higher during 2017 (2.83 individuals/acre) compared to 2016 (1.43 individuals/acre) (Table 2-9). The 2-year average density within the survey area (baseline pre-construction average) was 2.69 individuals per acre.

Table 2-9. Summary of Belding's Savannah Sparrow Results by Survey Number and Survey Period

Month	Survey #		Density (# Individuals/ acre)		Survey Period Averages (Density [Mean # Individuals/acre])			
	2016	2017	2016	2017	Survey Period	2016	2017	2016-2017 Baseline
Mar (early)	-	1	-	5.9	Late-Feb to Mid-Mar	-	5.9	5.9
Mar (mid)	-	-	-	-				
Mar (late)	-	-	-	-	Late-March to Early Apr	1.7	2.0	1.9
Apr (early)	1	2	1.7	2.0				
Apr (mid)	-	-	-	-	Mid- to Late-Apr	1.4	2.0	1.7
Apr (late)	2	3	1.6	2.0				
Apr (late)	3	-	1.1	-				
May (early)	4	-	1.1	-	Early- to Mid-May	1.2	1.5	1.3
May (mid)	5	4	1.7	1.5				
May (mid)	6		0.8	-				
Overall Average (Standard Error)						**1.43 (0.14)**	**2.83 (1.02)**	**2.69 (1.07)**

Belding's savannah sparrow survey area density estimates for each survey during 2016 and 2017 are shown below according to the date of each survey (Figure 2-10). The higher density estimate in the survey area during 2017 appears driven by one exceptionally high estimate (5.9 individuals/acre) from the one survey during the early to mid-March survey period that year, for which there was no corresponding survey from 2016. Aside from this survey, other survey-specific estimates from both years were relatively consistent, ranging from 1.2 to 2.0 individuals per acre, and the 95% confidence intervals for these estimates all overlapped, indicating they were similar.



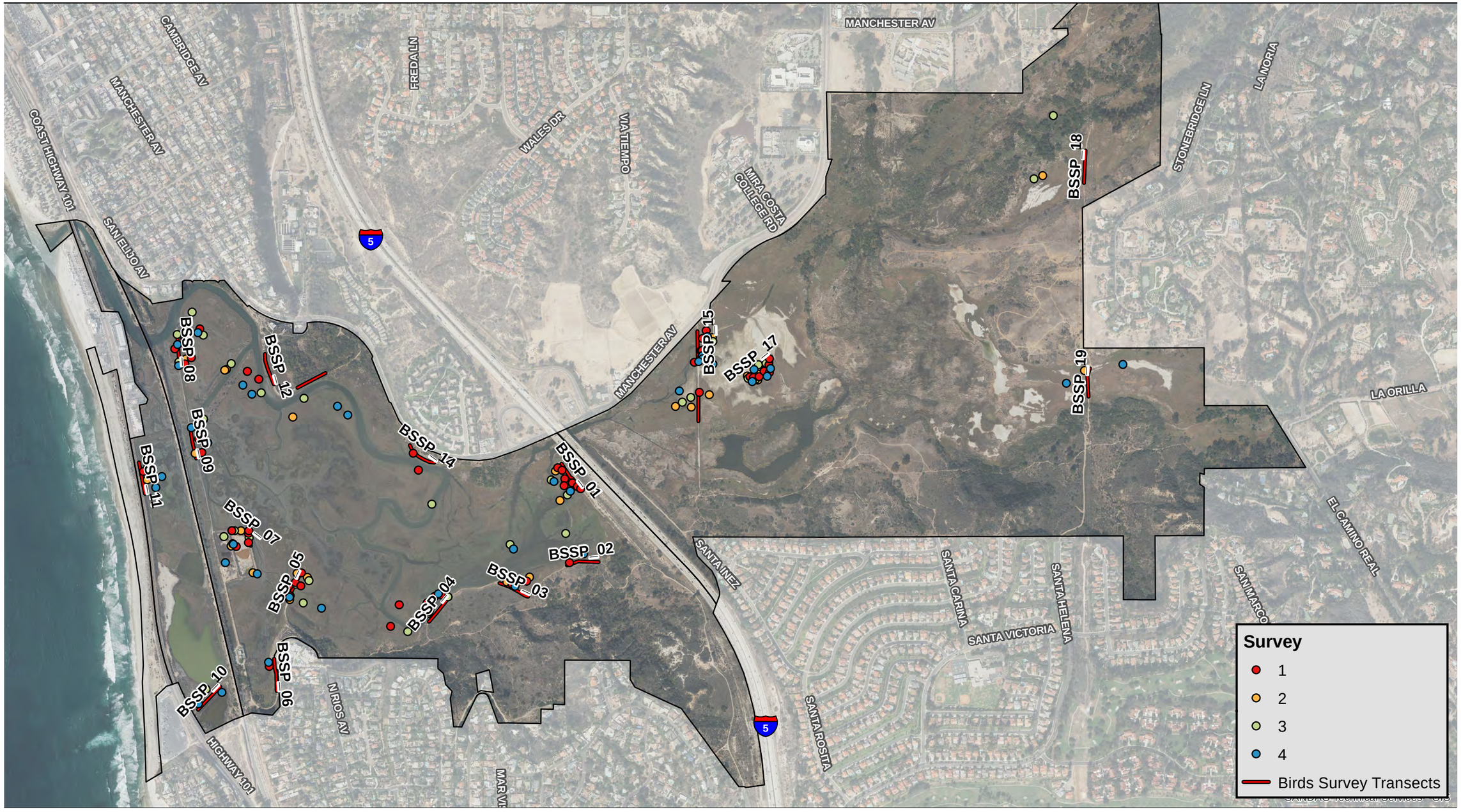
Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,000 500 0 1,000 Feet

Scale: 1:12,000; 1 inch = 1000 feet

Figure 2-8
2016 Belding's Savannah Sparrow Survey Results

Path: P:_6058\60582908_SELRP_ConPh2\900-CAD-GIS\920 GIS\map_docs\mxd\Report\HMMP\BSSP_Survey_Areas_2016_Survey_Results.mxd, 12/10/2019, paul.moreno



Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,000 500 0 1,000 Feet

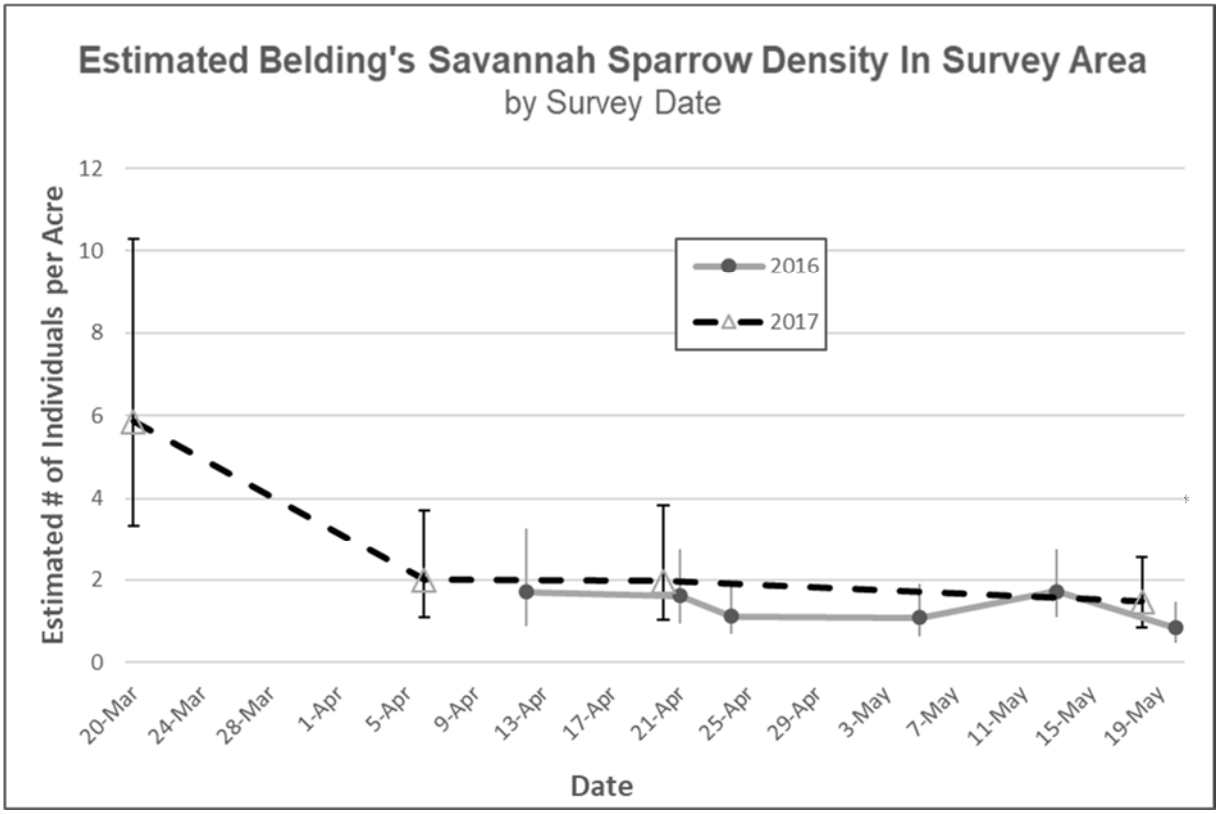
Scale: 1:12,000; 1 inch = 1000 feet

Figure 2-9
2017 Belding's Savannah Sparrow Survey Results

Path: P:_6058\60582908_SELRP_ConPh2\900-CAD-GIS\920 GIS\map_docs\mxd\Report\HMMP\BSSP_Survey_Areas_2017_Survey_Results.mxd, 12/10/2019, paul.moreno

Figure 2-10. Belding's Savannah Sparrow Density within the Survey Area (2016 and 2017)

Lower and Upper 95% confidence limits (LCL and UCL, respectively) are indicated by vertical error bars.



2.3.4 Discussion

The estimated Belding's savannah sparrow density within the survey area differed between 2016 and 2017. The significantly higher estimated density in 2017 (Table 2-9) was driven by one unusually high estimate from the first survey in 2017 (see Section 2.3.3). One potential reason for that unusually high estimate is that surveys were initiated earlier in 2017. The first survey in 2017 occurred on March 20, whereas the first survey in 2016 did not occur until April 11. It is possible that Belding's savannah sparrows call more frequently, or are otherwise more detectable earlier in the season, which could have contributed to these results. Additionally, there was a greater amount of precipitation during 2017 compared to 2016, which could have caused differences in behavior that resulted in different detection rates.

As Belding's savannah sparrow surveys continue to be conducted during the construction and post-construction phases of the project, running averages will be calculated for the species' density within the survey area for the 4 most recent years of construction/post-construction surveys. These estimates will be compared to the baseline abundance levels described herein to evaluate

performance standards as described in the Monitoring Plan (Nature Collective 2020). Data comparisons between pre-construction and construction/post-construction periods will be summarized and discussed in the annual monitoring report prepared for the SELRP.

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Attachment 1

2016 Light-footed Ridgway's Rail 45-Day Summary Report

AECOM
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December 20, 2016

Ms. Stacey Love
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

RE: San Elijo Lagoon Restoration Project 2016 Light-footed Ridgway's Rail 45-Day Summary Report, San Diego County, California

Dear Ms. Love:

In compliance with the Special Terms and Conditions for Endangered and Threatened Wildlife Species Permit TE-42833A-2 (Ian Maunsell, Blackhawk Environmental) and TE-50992B-0 (Antonette Gutierrez, Blackhawk Environmental), AECOM submits this letter report summarizing the results of focused surveys conducted during 2016 for the federally and state listed endangered light-footed Ridgway's rail (*Rallus obsoletus levipes*; LFRR) associated with the San Elijo Lagoon Restoration Project (SELRP). These surveys were conducted as part of a multi-species monitoring effort to provide the first year of baseline data for the multi-year avian monitoring that will be conducted for the SELRP Monitoring Plan (Moffat and Nichol *in progress*). This survey for LFRR was itself part of a multi-species marsh bird survey.

This report includes a description of the SELRP; a site description; and a discussion of species background, survey methodology, and results for surveys. A list of wildlife species detected throughout surveys is provided in Appendix A.

Project Description

San Elijo Lagoon represents a valuable coastal wetland with significant biological and ecological resources within the San Diego region. Over time, upstream development and infrastructure installation within the lagoon have restricted the natural movement of water flowing in and out of the lagoon (tidal prism), and have modified freshwater flows and inputs. As a result of these changes, sedimentation within the lagoon has increased. Historic inputs into the lagoon have also included high-nutrient sewage discharges. These physiological and hydrological changes in sediment quality and circulation patterns have caused ecological functions of the lagoon to become compromised, leading to degraded water quality, eutrophication, and elevated bacteria levels. Additionally, the lagoon habitat has experienced substantial transformation, including conversion of historical unvegetated wetland (mudflat) to vegetated wetland (low- and mid-marsh). If no action is taken to restore the lagoon, it will continue to transition from a lagoon with a mosaic of habitats, including

open water/mudflats, to one heavily dominated by vegetated wetlands. Eutrophication and bacteria issues will continue to be a concern. Eventually, based on sea level rise predictions, the remaining marsh will be substantially inundated.

The SELRP intends to restore the water quality and biological and hydrologic functions of the lagoon, as well as adjacent uplands. The restored lagoon would contain a balance of habitat types taking into account regional historic losses and current constraints. To accomplish these goals, the SELRP will reconfigure lagoon hydrology, address existing water quality impairments within the lagoon, restore and revegetate habitats, reuse suitable excavated material, and establish a monitoring and maintenance plan to ensure long-term viability of the restoration efforts.

Site Description

San Elijo Lagoon is located in the city of Encinitas, San Diego County, California (Figure 1). The lagoon is the terminus of Escondido Creek and La Orilla Creek at the Pacific Ocean. The SELRP study area is composed of approximately 960 acres, primarily within the San Elijo Lagoon Ecological Reserve, and separated into four areas: east basin, central basin, west basin, and coastal area (Figure 2). Riparian habitat is present in the east and central basins.

Light-footed Ridgway's rail

LFRR is federally and state listed as endangered. It was listed as endangered on October 13, 1970 (Federal Register 35 FR 16047). This listing status applies to the entire U.S. population of the species. The state listed the subspecies as endangered on June 27, 1971. USFWS has not designated critical habitat for this species.

The species is restricted to coastal salt marshes in southern California where vegetation is dominated by cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia* sp.) (USFWS 1985). LFRR nest in pickleweed are most often located on the ground while nest in cordgrass are elevated 10 to 45 cm (4-18 inches) above the ground (USFWS 1985). LFRR forage in higher marsh vegetation and along tidal creeks and at the interface between vegetation and adjacent mudflats (USFWS 1985).

Common LFRR vocalizations include *clapper, kek, kek-burr* and *agitated kek* calls. *Clappering* vocalizations have a bimodal peak, with peaks during the onset of breeding season (mid-February to mid-April) and in late summer / early fall (September to October) (Zembal and Massey 1987). The majority (96%) of LFRR "kekking" calls have been documented March through June in southern California (Zembal and Massey 1987).

Focused breeding surveys have been conducted in the spring for LFRR at San Elijo Lagoon over a span of 35 years by Zemball et al. (2015). Historically, this species has been present in low numbers at the lagoon with an annual average of 5 breeding pairs present at the lagoon between 1981 and 2009 and as recently as 2001 there was only 1 breeding pair present at the lagoon (Zembal et al. 2014). In the past 6 years, the number of breeding pairs in the San Elijo Lagoon has increased from 15 in 2010 to 59 pairs in 2015 to 70 pairs in 2016 (Zembal et al. 2014, Zembal 2015, Zembal 2016).

Survey Methodology

LFRR surveys were conducted in conjunction with the breeding marsh bird surveys at the San Elijo Lagoon. The primary objectives of breeding marsh bird surveys as detailed in the SELRP Monitoring Plan (Moffat and Nichol *in progress*) are as follows:

1. Compare presence or distribution of breeding marsh birds between pre- and post-construction conditions;
2. Compare density and abundance of breeding marsh birds between pre- and post-construction conditions;
3. Estimate the post-construction population trend for breeding marsh birds in the SELRP Area; and
4. Evaluate effects of restoration on breeding marsh birds.

The field methodologies for marsh bird, with a focus on LFRR, surveys described herein are primarily based on the *Standardized North American Marsh Bird Monitoring Protocol* (Conway 2011), the *Survey Frequency and Timing Affect Occupancy and Abundance Estimates for Salt Marsh Birds* (Wiest and Shriver 2015), and *Survey Guidelines to Determine Presence/Absence of the Light-footed Clapper Rail in Southern California; Recommendations of the Clapper Rail Study Team* (Konecny et al. 2009). In addition to surveying for LFRR, Virginia rail (*Rallus limicola*), least bittern (*Ixobrychus exilis*) (California Department of Fish and Wildlife [CDFW] Species of Special Concern), American bittern (*Botaurus lentiginosus*), common gallinule (*Gallinula galeata*), and pied-billed grebe (*Podilymbus podiceps*) were also surveyed as recommended by the *Standardized North American Marsh Bird Monitoring Protocol*.

Field Methods

Surveys were conducted by experienced marsh bird ornithologists with required permits from U.S Fish and Wildlife Service (USFWS) and CDFW. Six surveys were conducted between March 15 and June 15. This time period coincides with the approximate peak of the marsh bird breeding season and the seasonal peak in vocalization for most marsh birds.

The initial goal was to conduct at least one survey within each of the following survey windows: March 15 – March 31, April 1 – April 14; April 15 –April 30; May 1 – May 14; May 15 – May 31 and June 1 – June 15. However, the first survey window was missed due to project scheduling issues and two surveys were conducted during the second window as a result of this issue.

At least one survey was conducted at dusk and one at dawn. Dawn surveys were conducted at or just before sunrise and proceeded for no more than three hours after sunrise. Dusk surveys were conducted within 2 hours before sunset and were completed by 30 minutes after sunset. Surveys were only conducted on mornings and evenings greater than 50º Fahrenheit (10º Celsius). Surveys were not conducted when wind speed was greater than 12 miles per hour or during sustained rain or heavy fog.

Surveys were conducted at 22 survey points to provide coverage of existing marsh habitat and areas that are predicted to be marsh habitat within five years post-construction (Figure 2). Survey points were spaced at least 400 meters apart to minimize the risk of birds at adjacent points approaching the call broadcast, which may result in double counting of birds. Points on either side of the railway or Interstate 5 were sometimes closer than 400 meters because these features provided a natural sound barrier.

Each survey followed the same survey route so the methods were identical between surveys (i.e., same timing, points and follow the same survey routes). Consistency in the chronological order of survey points was important to help reduce the sampling variation created by changes in vocalization probability of marsh birds as the surveys progressed. The survey route (i.e., points were surveyed in the order listed) and timing of surveys was as follows:

- Dawn survey: 22, 21, 16, 17
- Evening survey: 13, 14, 15
- Dawn survey: 12, 11, 10, 8, 9
- Evening survey: 19, 20, 7
- Dawn survey: 1, 2, 3, 4
- Dawn survey: 6, 5, 18

The following information was recorded at each survey point for each survey (Appendix B):

- Survey point number
- Observers name
- Survey start times

- Temperature and average wind speed using a handheld weather meter (e.g., Kestrel 3000).
- Wind speed according to the Beaufort scale (0 to 5)
    - 0 = smoke rises vertically
    - 1 = wind direction shown by smoke drift
    - 2 = wind felt on face; leaves rustle
    - 3 = leaves , small twigs in constant motion; light flag extended 4 raises dust and loose paper; small branches are moved
    - 5 = small trees with leaves sway; crested wavelets on inland waters
- Sky conditions on a scale from 0 to 4
    - 0 = clear or a few clouds
    - 1 = partly cloudy or variable sky
    - 2 = cloudy or overcast
    - 3 = fog
    - 4 = drizzle
- The background noise category at each point on a scale from 0 to 4:
    - 0 = no background noise during virtually all of the survey,
    - 1 = faint background noise during at least half of the survey,
    - 2 = moderate background noise (probably cannot hear some birds beyond 100m during >30 seconds of the survey),
    - 3 = loud background noise (probably cannot hear some birds beyond 50m during >30 seconds of the survey),
    - 4 = intense background noise (probably cannot hear some birds beyond 25m during >30 seconds of the survey),

Survey methodology for the surveys consisted of a passive component and broadcast component at each survey point. All six survey species noted above (LFRR, Virginia rail, least bittern, American bittern, common gallinule, and pied-billed grebe) were considered secretive species. These species required the use of broadcast calls to elicit vocalizations in order to detect them. For these “broadcast” species a portable audio player with speakers was used to broadcast calls at a volume of 80-90 decibels at 1 meter in front of the speakers.

Upon arriving at a survey point, ornithologists stood quietly for 5 minutes (i.e., passive component) and recorded observations both aurally and visually. After 5 minutes ornithologists played approximately 30 seconds of calls for each “broadcast” species followed by 30 seconds of silence. Because there were six species that required the use of broadcast calls to elicit vocalizations, the survey time at each survey point was approximately 11 minutes (5 minutes initially plus 1 minute for each species (i.e., 6 species equals 6 minutes)). The broadcast sequence audio file with silence and avian calls for the survey was provided by Courtney Conway and Wesley Glisson (Idaho Cooperative Fish and Wildlife Research Unit) (Glisson and Conway 2016).

Ornithologists stood 2 meters to one side of the speaker while listening for vocal responses. Ornithologists pointed the speaker toward the center of the marsh and did not rotate the speaker during the call-broadcast survey. The speakers were pointed in the same direction for all surveys. Ornithologists recorded the direction of the speakers at each point on a map and on their datasheets so that it could be duplicated for each survey. The arrows on Figure 2 depict the direction the speakers were aimed for each point.

Marsh birds visually and aurally detected during the survey period were recorded. Monitoring data collected for each marsh bird detected included the following (Appendix B):

- Time of observation (1-minute increments)
- Detection type (visual, aural)
- Type of call if detection aural
- Species (AOU four-letter code, including an unknown category)
- Number of individuals, sex, age class, if possible
- Distance of observation from observer within the following categories (a range finder will be used to help determine the distance):
    - 1 – 10 meters;
    - 11 – 20 meters;
    - 21 – 50 meters;
    - 51- 100 meters;
    - 101 – 200 meters; or
    - Outside 200 meters.
- LFRR locations were also noted on a hard copy map.

Vocalizations of LFRR were classified assigned a call type based on descriptions in Zembal and Massey 1987. The majority of calls types recorded were one of three types: clapper, kek, or kek-burr. The sex of some LFRR was determined based on the call type that was heard. A repeated kek call resulted in the bird being recorded as a male. A kek-burr resulted in the bird being recorded as a female. When two individuals were heard giving simultaneous clapper calls (dueting) from one location, they were recorded as a male-female pair.

All data was recorded on field data sheets and later transcribed into a Microsoft access database for analysis. As time permitted (i.e., when focal species are not calling), other avian species incidentally detected during breeding marsh bird surveys were recorded. Avian species were also recorded incidentally while ornithologists moved between points.

Independent Double Observer Survey Approach

While conducting surveys, the number of focal species counted is assumed to be a subset of actual species abundance because some individuals may not be detected by ornithologists. Thus detection probabilities need to be estimated for abundance to be correctly quantified. There is no way to know what detection probabilities will be in the future as detection can be affected by aspects controllable (e.g., training of field crews) as well as aspects not controllable (e.g., weather), and thus detection needs to be estimated during each survey period. Multiple visits are needed to estimate detection probability. The six repeat surveys were conducted to allow detection probabilities to be estimated.

An independent double observer survey approach was used for surveys, meaning two ornithologists were present for each survey (Nichols et al. 2000). Two ornithologists recorded data independently from the other ornithologist. This was done to increase the number of repeated samples (12) over 6 visits and to improve the ability to model detection probability. The double-observer approach allowed for estimation of detection probabilities between observers and improved overall detection probabilities to yield more precise estimates of abundance than if a single observer were used. At the end of each survey at a specific point count station, observers compared data to determine which individual birds were detected by both observers or only detected by one observer.

Training

Prior to implementation of the monitoring protocol, a 1-day training was conducted with all field staff. The training focused on review of logistics, schedule, and data collection protocol. In addition, it consisted of a mock field survey in which the trained ornithologists executed the field protocol and discussed potential issues with data collection.

Statistical Analysis

Because two independent observers simultaneously surveyed each point on each day, an encounter history could be constructed for each detected LFRR. Encounter histories were denoted by 1's (I.e., detected) and 0's (i.e., not detected in the data set. For example, if only the first observer detected an individual rail the encounter history was denoted as 1, 0 or 10. If only the second observer detected an individual then the encounter history was 01 or if both observers detected an individual the encounter history was 11. Only observations recorded during the 11-minute survey period were used for analysis in order to standardize the data. Observations detected beyond 200 meters were not included in the analysis to minimize the potential for double counting individuals between survey points.

Data was reviewed to determine the most appropriate statistical analysis for the data set The probability of detecting individual LFRR (p) and a corrected estimate of abundance (N) at our survey points was derived using a Huggins model (Huggins 1989, 1991) as implemented in Program MARK (White and Burnham 1999). Models were constructed for detection probability such that detection was constant across all observers and surveys, that detection varied by observer only, that detection varied by survey only, that detection varied by observer and survey additively, and interactively, as well as a general individual heterogeneity in detection model. Due to variability between surveys, abundance or N was estimated separately for each of the six surveys. Akaike's Information Criterion was used with a small sample size correction (AICc) for model selection (Burnham and Anderson 2002). AICc is a measure of the relative support of a statistical model (the lower the AICc value, the better the fit or model) given the data.

For purposes of this report, abundance reflects number of individuals LFRR present. Separate estimates were not completed for pairs of LFRR versus single observations of LFRR. Abundance was estimated for the suitable habitat that was surveyed within the 200 meter radius of survey points (i.e., 298 acres). Upon estimating abundance for the survey area, density per acre was calculated that could be used to extrapolate an abundance estimate for all suitable LFRR habitat (i.e., 469 acres) in the SELRP study area.

Results

LFRR (i.e., marsh bird) surveys were conducted between April 6, 2016 and June 3, 2016. A summary of the survey dates, survey times, survey personnel and weather conditions are provided in Table 1. Table 2 details the results of the analysis and provides the raw detections counts of LFRR pairs and individuals. The series of Figure 3 maps display an overview of results for all six surveys as well as results broken down by each survey.

Table 1
Light-Footed Ridgway's Rail Survey Dates and Weather Conditions[1]

Survey Number	Date	AM/PM Survey Session	Time	Average Temperature (°F)	Average Sky Condition Rating[2]	Average Wind Speed (mph)	Average Background Noise Rating[3]
1	4/6/2016	AM	6:19 - 8:46	55.0	0.6	1.1	2.1
		PM	17:06 - 18:56	65.5	2.1	3.5	1.3
	4/7/2016	AM	6:15 - 7:51	60.9	2.3	0.8	1.3
2	4/13/2016	AM	6:04 - 8:19	59.1	2.0	1.4	1.7
		PM	17:58 - 19:29	63.6	0.5	2.2	1.5
	4/14/2016	AM	5:59 - 7:26	60.1	2.0	2.0	1.6
3	4/25/2016	AM	5:45 - 7:46	59.3	2.0	2.9	2.2
	4/26/2016	AM	5:36 - 7:13	51.2	0.4	2.2	1.6
		PM	18:27 - 19:36	62.9	0.3	1.5	1.3
4	5/2/2016	AM	5:35 - 8:03	56.1	0.0	0.4	1.9
	5/3/2016	AM	5:35 - 7:01	61.7	1.9	1.0	1.6
		PM	18:33 - 19:40	64.2	1.4	2.4	1.5
5	5/26/2016	AM	5:38 - 7:29	60.8	1.8	0.8	1.6
		PM	18:34 - 20:01	64.7	0.9	1.9	1.5
	5/27/2016	AM	5:42 - 7:02	61.0	2.7	1.3	1.3
6	6/2/2016	AM	5:27 - 7:21	56.5	0.2	0.5	1.6
		PM	18:29 - 20:02	65.3	1.8	1.5	1.5
	6/3/2016	AM	5:22 - 6:43	63.6	2.4	1.1	1.4

[1] Each survey session was conducted by the same four ornithologists: Ian Maunsell (TE-42833A-2, Blackhawk Environmental); Antonette Gutierrez (TE-50992B-9, Blackhawk Environmental); James McMorran (AECOM); and Brennan Mulrooney (AECOM)
[2] Sky Condition Ratings: 0 = clear or a few clouds; 1 = partly cloudy or variable sky; 2 = cloudy or overcast; 3 = fog; 4 = drizzle
[3] Background Noise Ratings: 0 = no noise; 1 = faint noise; 2 = moderate noise (probably can't hear some birds beyond 100m); 3 = loud noise (probably can't hear some birds beyond 50m); 4 = intense noise (probably can't hear some birds beyond 25m)

Table 2
Summary of Light-Footed Ridgway's Rail Results

Survey Number	Estimated Number of Individuals for SELRP study area[1]				Raw Counts[2, 3]			
	Estimate	Standard Error	95% Lower Confidence Limit	95% Upper Confidence Limit	Pairs	Individuals		
						Male	Female	Unknown
1	87.39	1.19	86.65	93.08	29	4	2	16
2	63.56	1.01	63.00	68.70	19	3	-	20
3	69.91	1.06	69.31	75.22	21	13	1	13
4	65.15	1.02	64.58	70.33	12	15	2	16
5	47.67	0.87	47.25	52.35	12	1	-	32
6	65.15	1.02	64.58	70.33	17	11	9	16

[1] Estimates using the Huggins (Huggins 1991) closed mark recapture model. Observations beyond 200 meters and outside the 11-minute survey period were not used in the estimate of abundance for the SELRP study area in order to standardize results for comparison to surveys in future years.
[2] Comprises of all detections recorded during surveys including detections beyond 200 meters from the survey point and detections outside the 11-minute survey period (i.e., incidentals while walking between points). These locations were not always mapped because detections were often very far from the observer and/or the observers were in transit to the next survey point. As a result, the number of detections noted in Table 2 is equal to or greater in number than the detections displayed on the series of Figure 3 maps.
[3] The LFRR pairs and the sex of some individual LFRR was determined based on the call type that was heard (see methods section).

The results of the statistical analysis using the Huggins (Huggins 1991) closed mark recapture model and extrapolated to the SELRP study area are summarized in Table 2. The model that considered detection constant was the highest ranked model with the next closest model having and AICc of 2. Detection was 0.90 (SE = 0.01). Estimates varied across survey sessions. Survey 1 had the highest number of LFRR individuals (87.4 $\pm$ 1.2 standard errors [SE]) estimated (i.e., extrapolated) for the SELRP study area following data standardization and statistical analysis (Table 2). Survey 5 had the lowest number of LFRR individuals (47.67 $\pm$ 0.87 SE) estimated (i.e., extrapolated) for the SELRP study area. Data used to extrapolate an abundance estimate for all suitable habitat in the SELRP study area only included LFRR detections during the 11-minute survey period that were within 200 meters of a survey point.

Total detections of LFRR, including incidentals, varied across the survey sessions. The maximum number of individual LFRR detected was 78 individuals (28 pairs and 22 single LFRR) during survey 1 (Table 2). The lowest number of individual LFRR detected was 52 individuals (11 pairs and 30 single LFRR) during survey 4 (Table 2). These numbers include detections of LFRR that were not included in the data analysis such as individual detections beyond 200 meters from the survey point and detections outside the 11-minute survey period (i.e., incidentals while walking between points). These locations were not always mapped because detections were often very far from the observer and/or the observers were in transit to the next survey point. As a result, the number of detections noted in Table 2 is equal to or greater in number than the detections displayed on the series of Figure 3 maps.

Other secretive marsh bird species detected during surveys included American bittern, least bittern, pied-billed grebe, and Virginia rail. A complete list of avian species detected during surveys is located in Appendix A.

Discussion

The LFRR survey methodologies described herein were designed to be replicable for pre- and post-construction monitoring for the SELRP. This will ensure data collection is standardized which will allow for unbiased comparisons of LFRR results between years. It is important to note that the survey methods in this study were designed to provide a metric of LFRR abundance and distribution during the breeding season rather than a census of individuals and/or documentation of nesting activity.

During the first survey (April 6 and 7) LFRR were often actively calling without eliciting response using the broadcast speaker. Table 3 details the minute an individual LFRR was first (i.e., initially) detected during a survey as percentage of the total detections. Over 60% of the total number of individual LFRRs detected during the first survey were detected prior to playing the broadcast call. In future years surveys should start in mid-February or March as suggested by Konecny et al. (2016). Surveys were initially scheduled to start in mid-March for this study, but project scheduling issues delayed the start.

The estimated numbers of individual LFRR for the SELRP study area are less than those documented in 2016 by Zembal (2016). However, it should be noted that this study was not designed to detect the maximum number of LFRR, but rather to provide a replicable survey method that can provide a reliable index of population size within SELRP over time. A number of individuals were detected before and often after the 11-minute survey period (Table 3). An extended survey period could result in more LFRR detections. Konecny (2016) has noted several instances where LFRR respond to a call prompt 10 to 15 minutes after the call prompt.

Another factor potentially affecting the number of LFRR detections is the duration and frequency of tape playback. For this study, approximately 30 seconds of the LFRR broadcast call was played during the 11-minute survey period at each survey point. During surveys 2 through 6, our data indicates that playing the LFRR broadcast call increased the chance that an LFRR was detected (Table 3).

For this study the number of individuals was estimated rather than number of pairs. The majority (90%) of detections were auditory only which makes it difficult to confirm the

presence of all pairs at San Elijo Lagoon. For this study, pairs were recorded when observers heard simultaneous clapper calls (dueting), during call and response detections between pairs, or distinct calls occurring in close temporal and spatial proximity to one another. In some cases multiple birds were detected, but observers were not confident that these individuals were a pair using the methods described above. In order to minimize the assumptions required and to standardize the analysis process this uncertainty was removed from the equation by simply focusing on number of individuals present.

Table 3
Percentage of Light-Footed Ridgway's Rail Initial Detections by Survey Minute[1]

Survey Minute	Survey Number					
	1	2	3	4	5	6
1 - Passive Period	19.72%	10.58%	13.68%	11.49%	6.74%	6.25%
2 - Passive Period	11.97%	3.85%	5.98%	5.75%	3.37%	1.79%
3 - Passive Period	8.45%	1.92%	12.82%	5.75%	4.49%	10.71%
4 - Passive Period	14.08%	6.73%	3.42%	6.90%	10.11%	8.04%
5 - Passive Period	6.34%	9.62%	4.27%	2.30%	3.37%	5.36%
6 - Least Bittern Broadcast	3.52%	4.81%	6.84%	8.05%	1.12%	8.93%
7 - Virginia Rail Broadcast	0.70%	8.65%	8.55%	31.03%	7.87%	12.50%
8 – Ridgway's Rail Broadcast	4.93%	32.69%	18.80%	18.39%	35.96%	27.68%
9 – American Bittern Broadcast	4.23%	6.73%	5.13%	1.15%	1.12%	0.00%
10 - Common Gallinule Broadcast	1.41%	3.85%	4.27%	1.15%	4.49%	0.00%
11 – Pied-billed Grebe Broadcast	10.56%	0.00%	1.71%	2.30%	4.49%	4.46%
Outside Survey Period	14.08%	10.58%	14.53%	5.75%	16.85%	14.29%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

[1] Comprised of all detections recorded during surveys, including detections beyond 200 meters from the survey point and detections outside the 11-minute survey period (i.e., incidentals while walking between points).

In summary, the range of LFRR estimates provided in this study will serve as a solid baseline for comparison to data collected after implementation of the SELRP. The standardized data collection and analysis methods will be useful for detecting any changes

in LFRR abundance at San Elijo Lagoon. If you have any questions or require additional information, please feel free to contact me at (619) 610-7600.

Sincerely,

Michael Anguiano
Wildlife Biologist
michael.anguiano@aecom.com

Attachments:

Figure 1 – Regional Map
Figure 2 – Vicinity Map and Survey Locations
Figure 3 – LFRR Observations
Appendix A – Avian Species Detected during Surveys
Appendix B – Blank Datasheet

Certification Statement

Qualified biologists who conducted LFRR surveys for the SELRP certify that the information in this survey report fully and accurately represents the work performed. Signatures of biologists who conducted protocol-level surveys are included below.

Ian Maunsell
Wildlife Biologist
TE-42833A-2

Antonette Gutierrez
Wildlife Biologist
TE-50992B-0

James McMorran
Wildlife Biologist

Brennan Mulrooney
Wildlife Biologist

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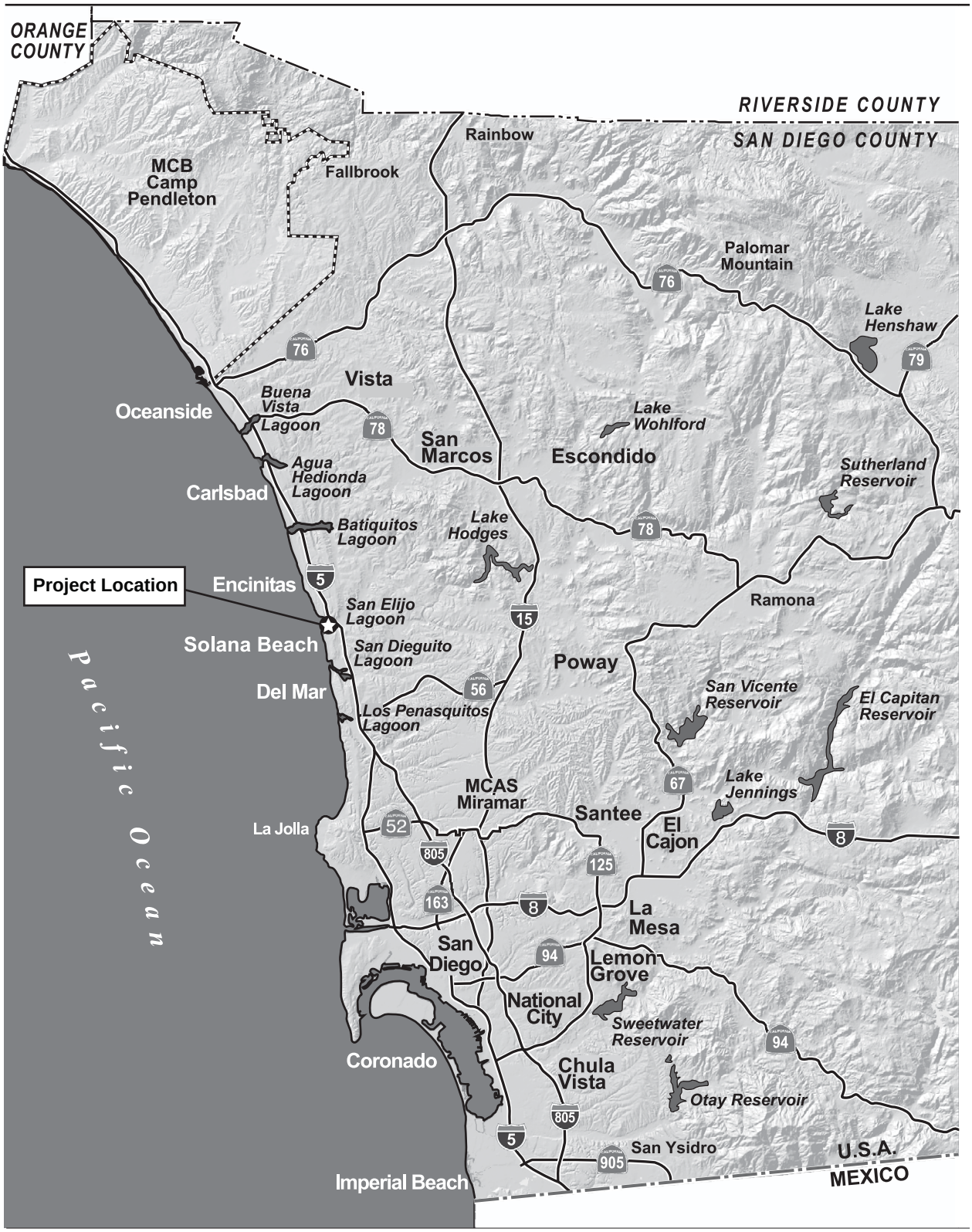
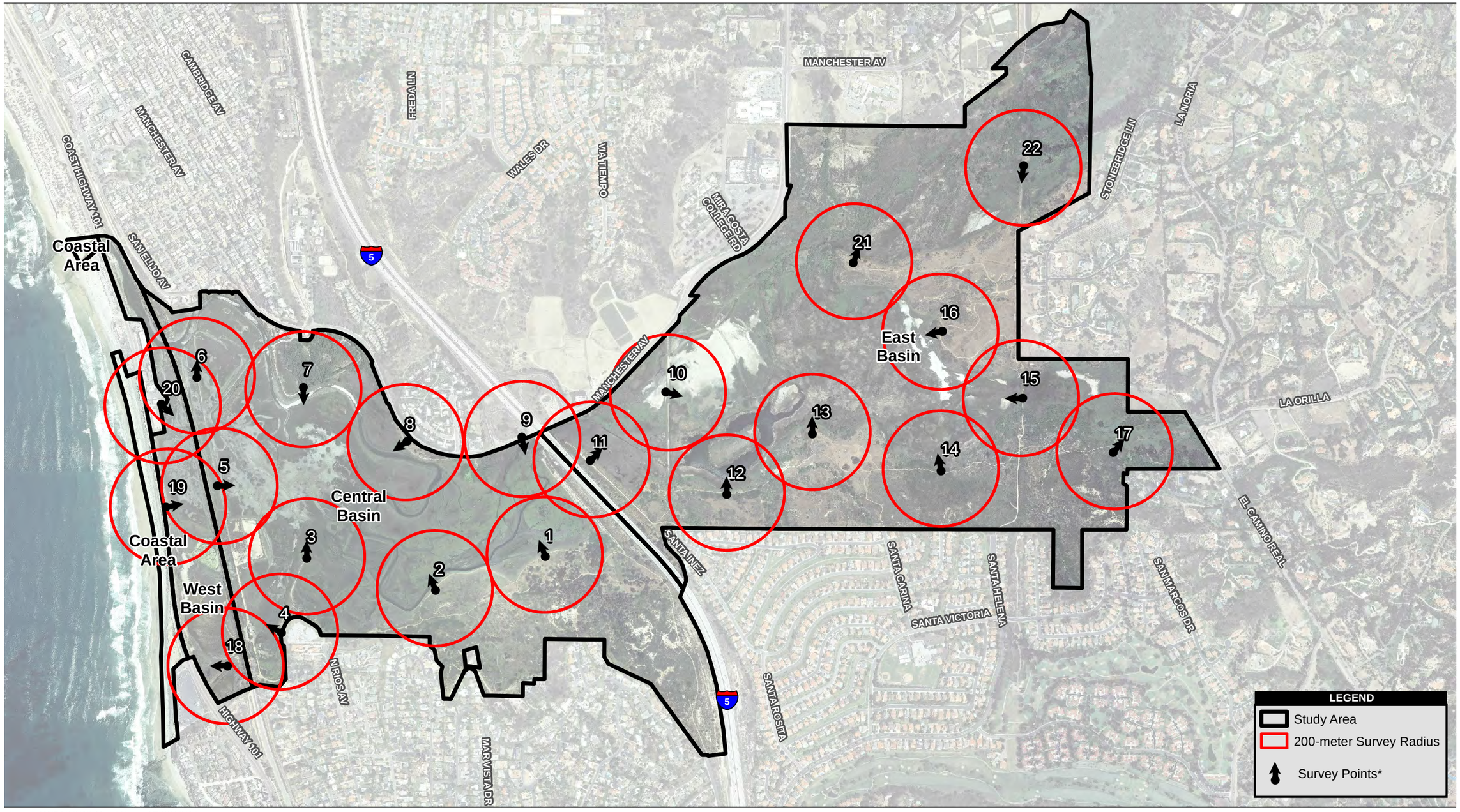
FIGURES



0 3.75 7.5 15 Miles

1" = 7.5 Miles

Figure 1
Regional Map



Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 2
Vicinity Map and Survey Points

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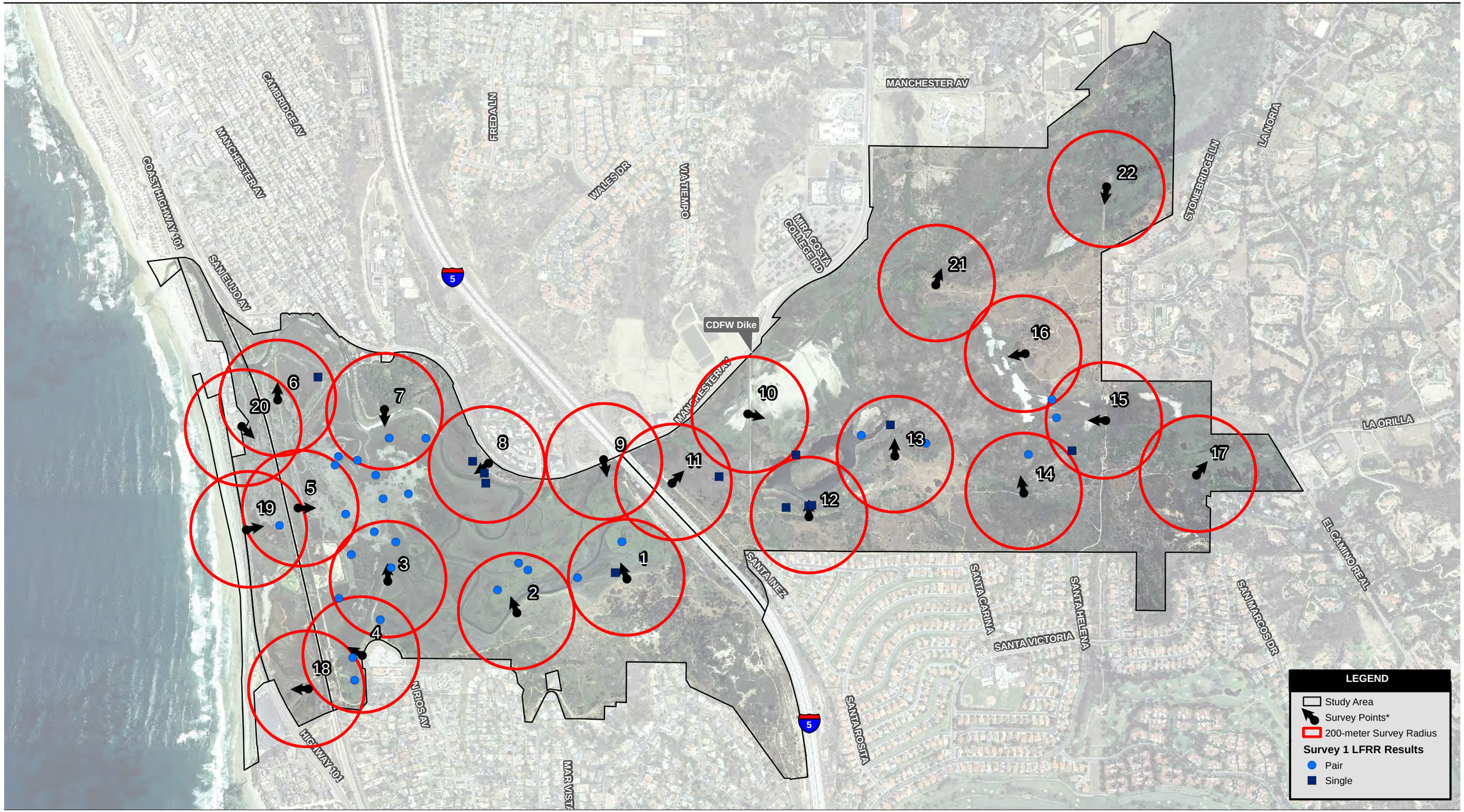

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3a
Light-footed Ridgway's Rail Results – Survey 1

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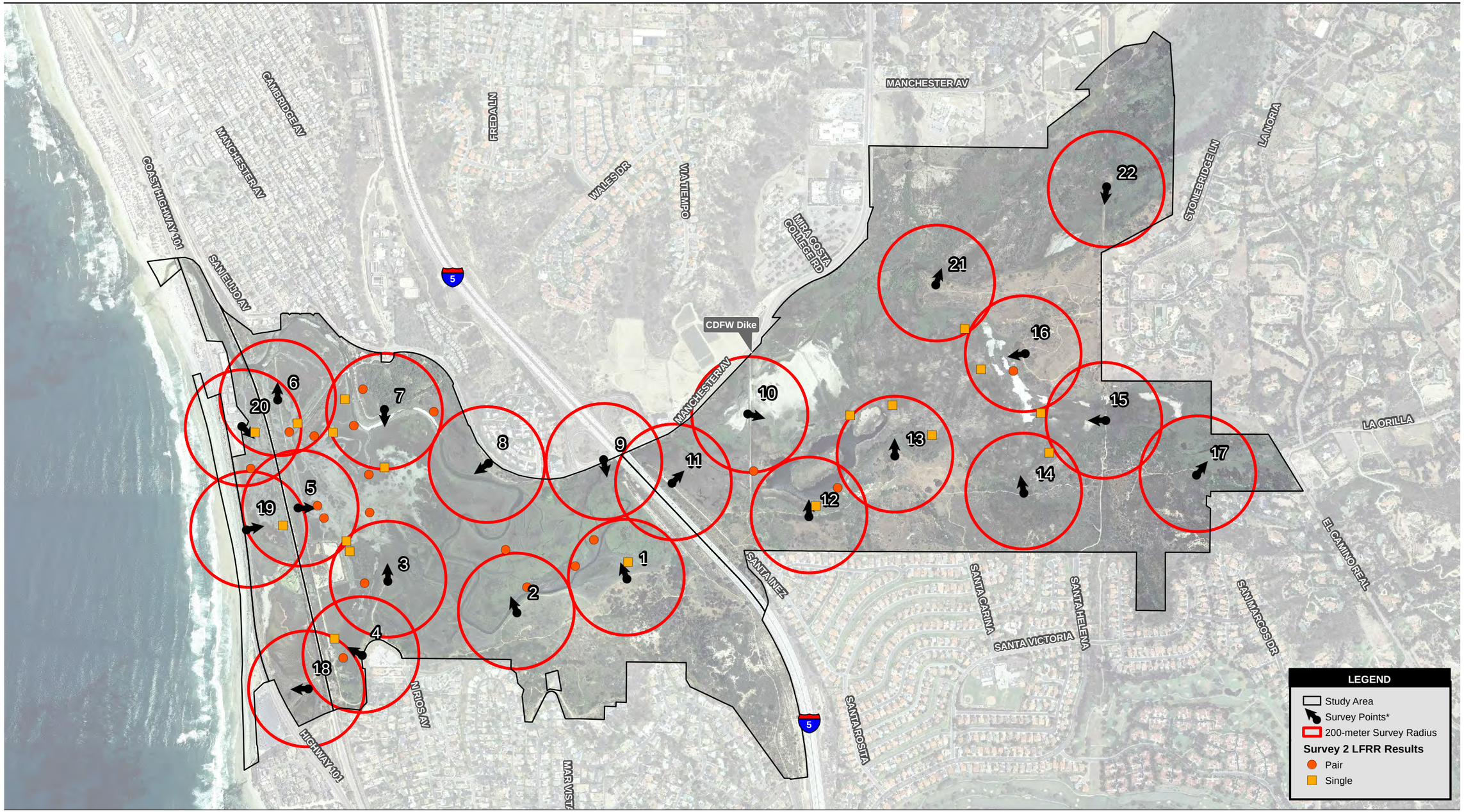

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3b
Light-footed Ridgway's Rail Results – Survey 2

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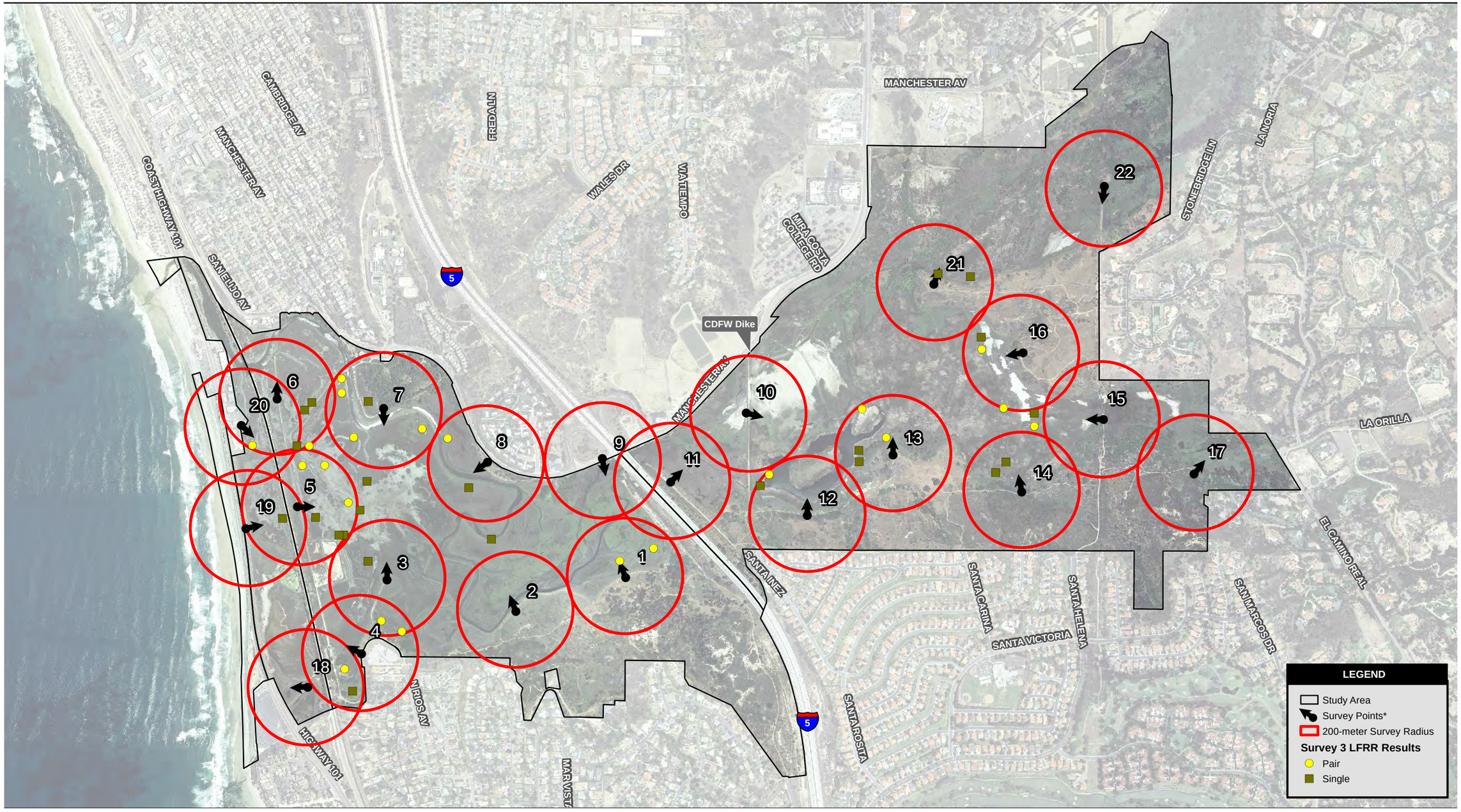

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3c
Light-footed Ridgway's Rail Results – Survey 3

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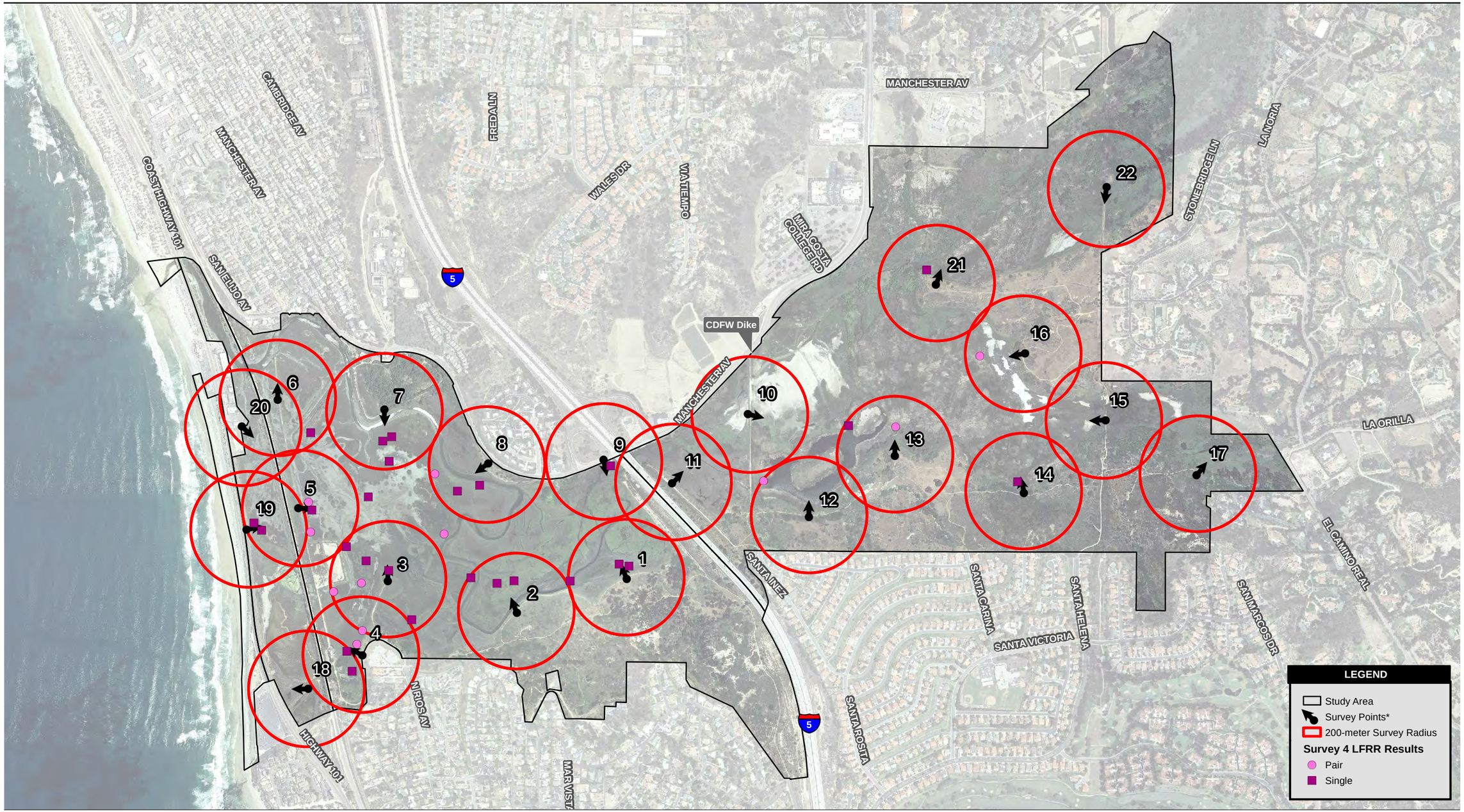

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

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Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3d
Light-footed Ridgway's Rail Results – Survey 4

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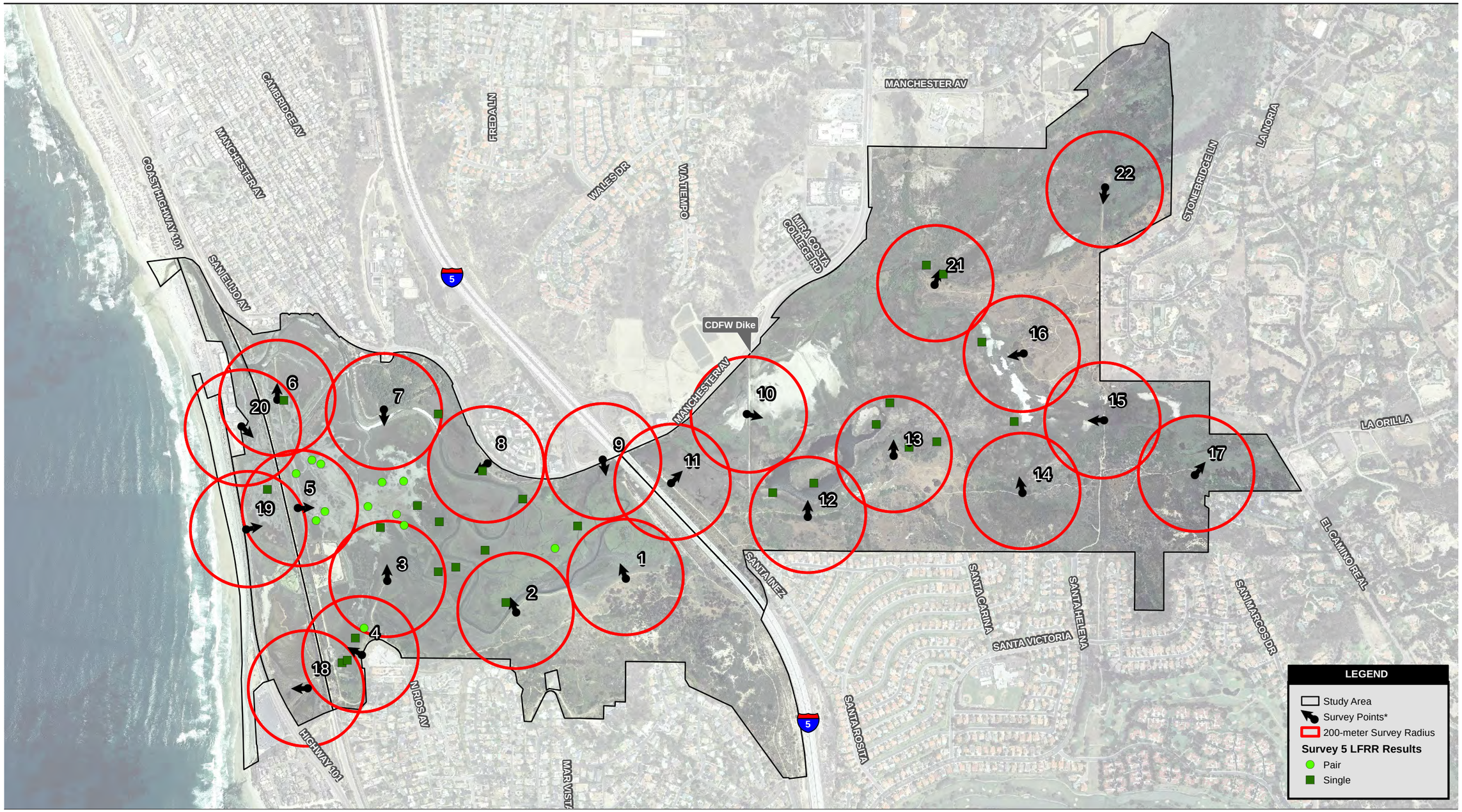

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3e
Light-footed Ridgway's Rail Results – Survey 5

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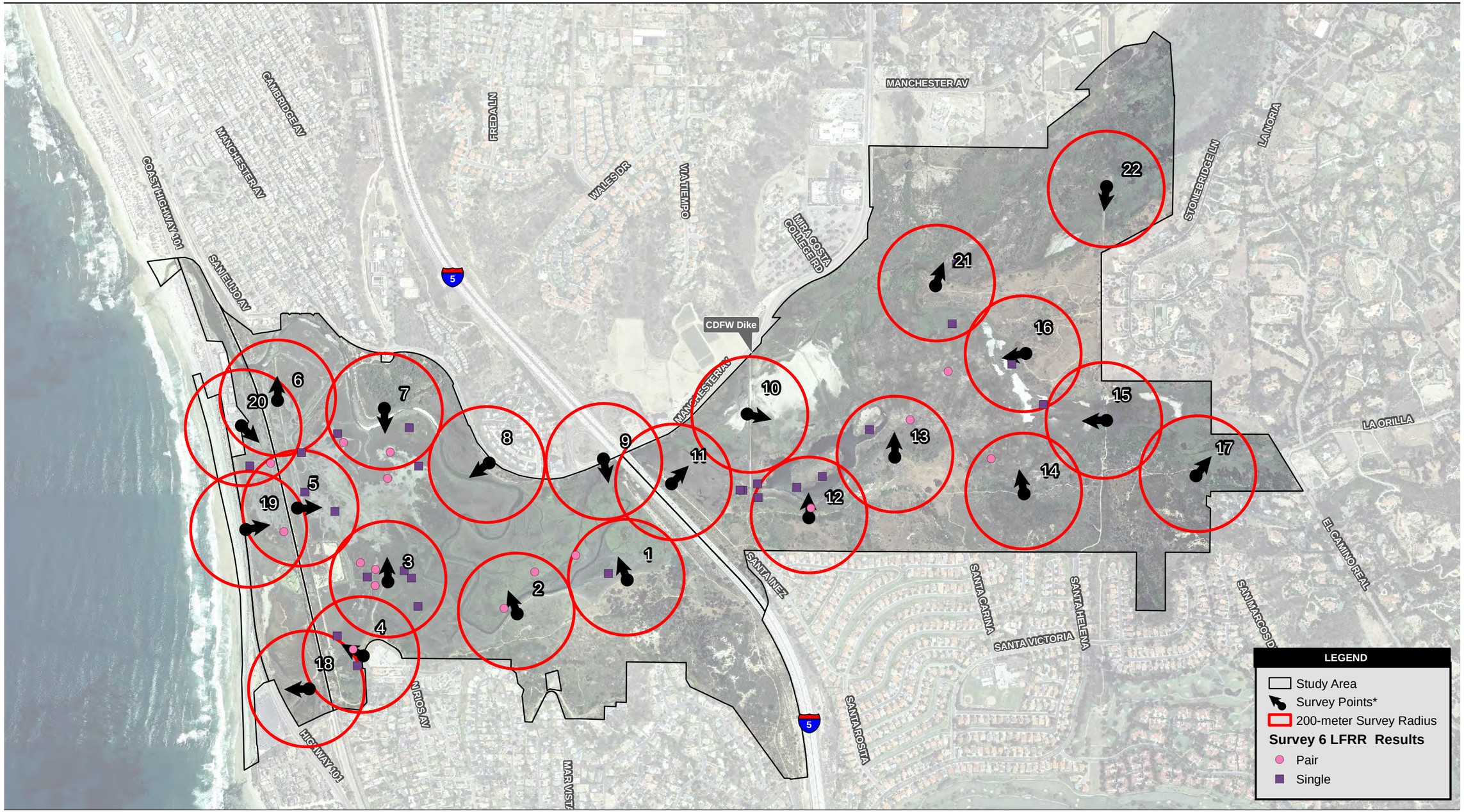

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3f
Light-footed Ridgway's Rail Results – Survey 6

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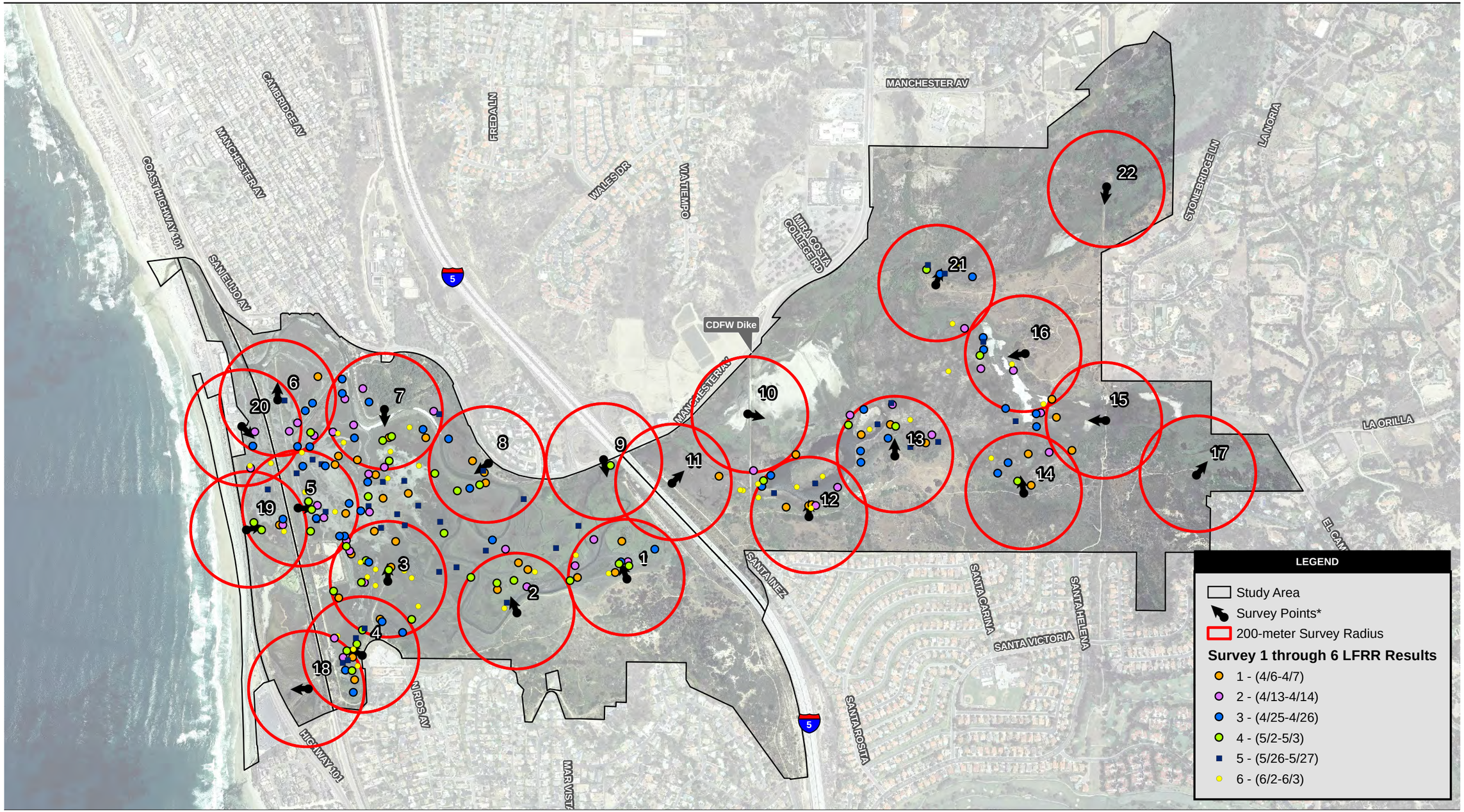

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3
Survey 1 through 6 LFRR Results

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APPENDIX A

AVIAN SPECIES DETECTED DURING SURVEYS

Appendix A
Avian Species Detected During Surveys

Common Name	Scientific Name	Order	Family
Cooper's Hawk	*Accipiter cooperii*	Accipitriformes	Accipitridae
Red-tailed Hawk	*Buteo jamaicensis*	Accipitriformes	Accipitridae
Red-shouldered Hawk	*Buteo lineatus*	Accipitriformes	Accipitridae
Northern Harrier	*Circus cyaneus*	Accipitriformes	Accipitridae
White-tailed Kite	*Elanus leucurus*	Accipitriformes	Accipitridae
Osprey	*Pandion haliaetus*	Accipitriformes	Accipitridae
Northern Pintail	*Anas acuta*	Anseriformes	Anatidae
American Wigeon	*Anas americana*	Anseriformes	Anatidae
Northern Shoveler	*Anas clypeata*	Anseriformes	Anatidae
Green-winged Teal	*Anas crecca*	Anseriformes	Anatidae
Cinnamon Teal	*Anas cyanoptera*	Anseriformes	Anatidae
Blue-winged Teal	*Anas discors*	Anseriformes	Anatidae
Mallard	*Anas platyrhynchos*	Anseriformes	Anatidae
Gadwall	*Anas strepera*	Anseriformes	Anatidae
Bufflehead	*Bucephala albeola*	Anseriformes	Anatidae
Ruddy Duck	*Oxyura jamaicensis*	Anseriformes	Anatidae
White-throated Swift	*Aeronautes saxatalis*	Apodiformes	Apodidae
Vaux's Swift	*Chaetura vauxi*	Apodiformes	Apodidae
Anna's Hummingbird	*Calypte anna*	Apodiformes	Trochilidae
Costa's Hummingbird	*Calypte costae*	Apodiformes	Trochilidae
Allen's Hummingbird	*Selasphorus sasin*	Apodiformes	Trochilidae
Lesser Nighthawk	*Chordeiles acutipennis*	Caprimulgiformes	Caprimulgidae
Common Poorwill	*Phalaenoptilus nuttallii*	Caprimulgiformes	Caprimulgidae
Snowy Plover	*Charadrius alexandrinus*	Charadriiformes	Charadriidae
Semipalmated Plover	*Charadrius semipalmatus*	Charadriiformes	Charadriidae
Killdeer	*Charadrius vociferus*	Charadriiformes	Charadriidae
Black-bellied Plover	*Pluvialis squatarola*	Charadriiformes	Charadriidae
Bonaparte's Gull	*Chroicocephalus philadelphia*	Charadriiformes	Laridae
Caspian Tern	*Hydroprogne caspia*	Charadriiformes	Laridae
Western Gull	*Larus occidentalis*	Charadriiformes	Laridae
Black Skimmer	*Rynchops niger*	Charadriiformes	Laridae
California Least Tern	*Sternula antillarum browni*	Charadriiformes	Laridae
Elegant Tern	*Thalasseus elegans*	Charadriiformes	Laridae
Royal Tern	*Thalasseus maxima*	Charadriiformes	Laridae
Black-necked Stilt	*Himantopus mexicanus*	Charadriiformes	Recurvirostridae
American Avocet	*Recurvirostra americana*	Charadriiformes	Recurvirostridae
Spotted Sandpiper	*Actitis macularius*	Charadriiformes	Scolopacidae
Black Turnstone	*Arenaria melanocephala*	Charadriiformes	Scolopacidae
Sanderling	*Calidris alba*	Charadriiformes	Scolopacidae
Dunlin	*Calidris alpina*	Charadriiformes	Scolopacidae
Western Sandpiper	*Calidris mauri*	Charadriiformes	Scolopacidae
Least Sandpiper	*Calidris minutilla*	Charadriiformes	Scolopacidae
Long-billed Dowitcher	*Limnodromus scolopaceus*	Charadriiformes	Scolopacidae
Marbled Godwit	*Limosa fedoa*	Charadriiformes	Scolopacidae

Common Name	Scientific Name	Order	Family
Long-billed Curlew	*Numenius americanus*	Charadriiformes	Scolopacidae
Whimbrel	*Numenius phaeopus*	Charadriiformes	Scolopacidae
Red-necked Phalarope	*Phalaropus lobatus*	Charadriiformes	Scolopacidae
Greater Yellowlegs	*Tringa melanoleuca*	Charadriiformes	Scolopacidae
Willet	*Tringa semipalmata*	Charadriiformes	Scolopacidae
Rock Pigeon	*Columba livia*	Columbiformes	Columbidae
Mourning Dove	*Zenaida macroura*	Columbiformes	Columbidae
American Peregrine Falcon	*Falco peregrinus anatum*	Falconiformes	Falconiformes
American Kestrel	*Falco sparverius*	Falconiformes	Falconiformes
California Quail	*Callipepla californica*	Galliformes	Odontophoridae
American Coot	*Fulica americana*	Gruiformes	Rallidae
Sora	*Porzana carolina*	Gruiformes	Rallidae
Virginia Rail	*Rallus limicola*	Gruiformes	Rallidae
Light-footed Ridgway's Rail	*Rallus obsoletus levipes*	Gruiformes	Rallidae
Bushtit	*Psaltriparus minimus*	Passeriformes	Aegithalidae
Black-headed Grosbeak	*Pheucticus melanocephalus*	Passeriformes	Cardinalidae
Western Scrub-Jay	*Aphelocoma californica*	Passeriformes	Corvidae
American Crow	*Corvus brachyrhynchos*	Passeriformes	Corvidae
Common Raven	*Corvus corax*	Passeriformes	Corvidae
Song Sparrow	*Melospiza melodia*	Passeriformes	Emberizidae
California Towhee	*Melozone crissalis*	Passeriformes	Emberizidae
Belding's Savannah Sparrow	*Passerculus sandwichensis beldingi*	Passeriformes	Emberizidae
Spotted Towhee	*Pipilo maculatus*	Passeriformes	Emberizidae
White-crowned Sparrow	*Zonotrichia leucophrys*	Passeriformes	Emberizidae
Scaly-breasted Munia	*Lonchura punctulata*	Passeriformes	Estrildidae
House Finch	*Haemorhous mexicanus*	Passeriformes	Fringillidae
Lesser Goldfinch	*Spinus psaltria*	Passeriformes	Fringillidae
Barn Swallow	*Hirundo rustica*	Passeriformes	Hirundinidae
Cliff Swallow	*Petrochelidon pyrrhonota*	Passeriformes	Hirundinidae
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Passeriformes	Hirundinidae
Red-winged Blackbird	*Agelaius phoeniceus*	Passeriformes	Icteridae
Bullock's Oriole	*Icterus bullockii*	Passeriformes	Icteridae
Hooded Oriole	*Icterus cucullatus*	Passeriformes	Icteridae
Brown-headed Cowbird	*Molothrus ater*	Passeriformes	Icteridae
Great-tailed Grackle	*Quiscalus mexicanus*	Passeriformes	Icteridae
Western Meadowlark	*Sturnella neglecta*	Passeriformes	Icteridae
Northern Mockingbird	*Mimus polyglottos*	Passeriformes	Mimidae
California Thrasher	*Toxostoma redivivum*	Passeriformes	Mimidae
American Pipit	*Anthus rubrescens*	Passeriformes	Motacillidae
Wilson's Warbler	*Cardellina pusilla*	Passeriformes	Parulidae
Common Yellowthroat	*Geothlypis trichas*	Passeriformes	Parulidae
Yellow-breasted Chat	*Icteria virens*	Passeriformes	Parulidae
Orange-crowned Warbler	*Oreothlypis celata*	Passeriformes	Parulidae
Audubon's Yellow-rumped Warbler	*Setophaga coronata auduboni*	Passeriformes	Parulidae
Yellow Warbler	*Setophaga petechia brewsteri*	Passeriformes	Parulidae

Common Name	Scientific Name	Order	Family
House Sparrow	*Passer domesticus*	Passeriformes	Passeridae
Blue-gray Gnatcatcher	*Polioptila caerulea*	Passeriformes	Polioptilidae
Coastal California Gnatcatcher	*Polioptila californica californica*	Passeriformes	Polioptilidae
Wrentit	*Chamaea fasciata*	Passeriformes	Sylviidae
Marsh Wren	*Cistothorus palustris*	Passeriformes	Troglodytidae
Bewick's Wren	*Thryomanes bewickii*	Passeriformes	Troglodytidae
House Wren	*Troglodytes aedon*	Passeriformes	Troglodytidae
Pacific-slope Flycatcher	*Empidonax difficilis*	Passeriformes	Tyrannidae
Ash-throated Flycatcher	*Myiarchus cinerascens*	Passeriformes	Tyrannidae
Black Phoebe	*Sayornis nigricans*	Passeriformes	Tyrannidae
Say's Phoebe	*Sayornis saya*	Passeriformes	Tyrannidae
Cassin's Kingbird	*Tyrannus vociferans*	Passeriformes	Tyrannidae
Hutton's Vireo	*Vireo huttoni*	Passeriformes	Vireonidae
Great Egret	*Ardea alba*	Pelecaniformes	Ardeidae
Great Blue Heron	*Ardea herodias*	Pelecaniformes	Ardeidae
American Bittern	*Botaurus lentiginosus*	Pelecaniformes	Ardeidae
Cattle Egret	*Bubulcus ibis*	Pelecaniformes	Ardeidae
Snowy Egret	*Egretta thula*	Pelecaniformes	Ardeidae
Least Bittern	*Ixobrychus exilis*	Pelecaniformes	Ardeidae
Black-crowned Night-Heron	*Nycticorax nycticorax*	Pelecaniformes	Ardeidae
White-faced Ibis	*Plegadis chihi*	Pelecaniformes	Threskiornithidae
Nuttall's Woodpecker	*Picoides nuttallii*	Piciformes	Picidae
Downy Woodpecker	*Picoides pubescens*	Piciformes	Picidae
Eared Grebe	*Podiceps nigricollis*	Podicipediformes	Podicipedidae
Pied-billed Grebe	*Podilymbus podiceps*	Podicipediformes	Podicipedidae
Double-crested Cormorant	*Phalacrocorax auritus*	Suliformes	Phalacrocoracidae

APPENDIX B

BLANK DATASHEET

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)* **:**

Multiple Observer Survey: Y / N

List all non-focal species surveyed:

Name of marsh:

Observer:

Closest High Tide Time:

Tidal Amplitude*:

**difference in water level in feet between the highest and lowest tide on that day. http://tides.willyweather.com/ca/san-diego-county/cardiff-state-beach.html*

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Temp (C or F *circle one*)	Sky	Wind (Beaufort)	Avg Wind Speed (mph)	Background noise	Species	Responded During												Call Type(s)	In target area	Distance (meters)	Detected at a Previous Point	Comments	Other Observer Detected (Y/N)
								Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	LEBI	VIRA	CLRA	AMBI	COMO	PBGR	Outside survey period						

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*
3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

Beaufort scale: 0 *smoke rises vertically* 1 *wind direction shown by smoke drift* 2 *wind felt on face; leaves rustle*
3 *leaves , small twigs in constan motion; light flag extended* 4 *raises dust and loose paper; small branches are moved* 5 *small trees with leaves sway; crested wavelets on inland waters*

Sky: 0 *clear or a few clouds* 1 *partly cloud or variable sky* 2 *cloudy or overcast* 4 *fog or smoke* 5 *drizzle* 6 *snow* 8 *showers*

Distance *1: 1 – 10 meters; 2: 11 – 20 meters; 3: 21 – 50 meters; 4: 51- 100 meters; 5: 101 – 200 meters; 6: > 200 meters*

Attachment 2

2017 Light-footed Ridgway's Rail 45-Day Summary Report

AECOM
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August 30, 2017

Ms. Stacey Love
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

RE: San Elijo Lagoon Restoration Project 2017 Light-footed Ridgway's Rail 45-Day Summary Report, San Diego County, California

Dear Ms. Love:

In compliance with the Special Terms and Conditions for Endangered and Threatened Wildlife Species Permit TE-038701-2 (Bonnie Peterson, Blackhawk Environmental), TE-50992B-0 (Antonette Gutierrez, Blackhawk Environmental), and TE-42833A-2 (Ian Maunsell, Blackhawk Environmental), AECOM submits this letter report summarizing the results of focused surveys conducted during 2017 for the federally and state listed endangered light-footed Ridgway's rail (*Rallus obsoletus levipes*; LFRR) associated with the San Elijo Lagoon Restoration Project (SELRP). These surveys were conducted as part of a multi-species monitoring effort to provide the second year of baseline data for the multi-year avian monitoring that will be conducted for the SELRP Monitoring Plan (Moffat and Nichol *in progress*). This survey for LFRR was itself part of a multi-species marsh bird survey. The first year (2016) of baseline data was summarized in the 2016 Light-footed Ridgway's Rail 45-Day Summary Report (AECOM 2016).

This report includes a description of the SELRP; a site description; and a discussion of species background, survey methodology, and results for surveys. A list of avian species detected throughout surveys is provided in Appendix A.

Project Description

San Elijo Lagoon represents a valuable coastal wetland with significant biological and ecological resources within the San Diego region. Over time, upstream development and infrastructure installation within the lagoon have restricted the natural movement of water flowing in and out of the lagoon (tidal prism), and have modified freshwater flows and inputs. As a result of these changes, sedimentation within the lagoon has increased. Historic inputs into the lagoon have also included high-nutrient sewage discharges. These physiological and hydrological changes in sediment quality and circulation patterns have caused ecological functions of the lagoon to become compromised, leading to degraded water quality, eutrophication, and elevated bacteria levels. Additionally, the lagoon habitat has experienced substantial transformation, including conversion of historical unvegetated

wetland (mudflat) to vegetated wetland (low- and mid-marsh). If no action is taken to restore the lagoon, it will continue to transition from a lagoon with a mosaic of habitats, including open water/mudflats, to one heavily dominated by vegetated wetlands. Eutrophication and bacteria issues will continue to be a concern.

The SELRP intends to restore the water quality and biological and hydrologic functions of the lagoon, as well as adjacent uplands. The restored lagoon would contain a balance of habitat types taking into account regional historic losses and current constraints. To accomplish these goals, the SELRP will reconfigure lagoon hydrology, address existing water quality impairments within the lagoon, restore and revegetate habitats, reuse suitable excavated material, and establish a monitoring and maintenance plan to ensure long-term viability of the restoration efforts.

Site Description

San Elijo Lagoon is located in the City of Encinitas, San Diego County, California (Figure 1). The lagoon is the terminus of Escondido Creek and La Orilla Creek at the Pacific Ocean. The SELRP study area is composed of approximately 960 acres, primarily within the San Elijo Lagoon Ecological Reserve, and separated into four areas: east basin, central basin, west basin, and coastal area (Figure 2). Riparian habitat is present in the east and central basins.

Light-footed Ridgway's Rail

LFRR is federally and state listed as endangered. It was listed as endangered on October 13, 1970 (*Federal Register* 35 FR 16047). This listing status applies to the entire U.S. population of the species. The state listed the subspecies as endangered on June 27, 1971. The U.S Fish and Wildlife Service (USFWS) has not designated critical habitat for this species.

The species is restricted to coastal salt marshes in southern California where vegetation is dominated by cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia* sp.) (USFWS 1985). LFRR nests in pickleweed are most often located on the ground while nests in cordgrass are elevated 10 to 45 centimeters (4 to 18 inches) above the ground (USFWS 1985). LFRR forage in higher marsh vegetation and along tidal creeks and at the interface between vegetation and adjacent mudflats (USFWS 1985).

Common LFRR vocalizations include clapper, kek, kek-burr and agitated kek calls. Clappering vocalizations have a bimodal peak, with peaks during the onset of breeding season (mid-February through mid-April) and in late summer/early fall (September through

October) (Zembal and Massey 1987). The majority (96%) of LFRR “kekking” calls have been documented March through June in southern California (Zembal and Massey 1987).

Focused breeding surveys have been conducted in the spring for LFRR at San Elijo Lagoon over a span of 35 years by Zembal et al. (2015). Historically, this species has been present in low numbers at the lagoon with an annual average of five breeding pairs present at the lagoon between 1981 and 2009 and as recently as 2001 there was only 1 breeding pair present at the lagoon (Zembal et al. 2014). In the past seven years, the number of breeding pairs in the San Elijo Lagoon has increased from 15 in 2010 to 59 pairs in 2015 to 70 pairs in 2016 (Zembal et al. 2014, Zembal 2015, Zembal 2016). Similar to 2016, an estimated 68 pairs of LFRR were detected in 2017 (Zembal 2017).

Survey Methodology

LFRR surveys were conducted in conjunction with the breeding marsh bird surveys at the San Elijo Lagoon. The primary objectives of breeding marsh bird surveys as detailed in the SELRP Monitoring Plan (Moffat and Nichol *in progress*) are as follows:

1. Compare presence or distribution of breeding marsh birds between pre- and post-construction conditions,
2. Compare density and abundance of breeding marsh birds between pre- and post-construction conditions,
3. Estimate the post-construction population trend for breeding marsh birds in the SELRP Area, and
4. Evaluate effects of restoration on breeding marsh birds.

The field methodologies for marsh bird, with a focus on LFRR, surveys described herein are primarily based on *Standardized North American Marsh Bird Monitoring Protocol* (Conway 2011), *Survey Frequency and Timing Affect Occupancy and Abundance Estimates for Salt Marsh Birds* (Wiest and Shriver 2015), and *Survey Guidelines to Determine Presence/Absence of the Light-footed Clapper Rail in Southern California; Recommendations of the Clapper Rail Study Team* (Konecny et al. 2009). In addition to surveying for LFRR, Virginia rail (*Rallus limicola*), least bittern (*Ixobrychus exilis*) (California Department of Fish and Wildlife [CDFW] Species of Special Concern), American bittern (*Botaurus lentiginosus*), common gallinule (*Gallinula galeata*), and pied-billed grebe (*Podilymbus podiceps*) were also surveyed as recommended by *Standardized North American Marsh Bird Monitoring Protocol*.

Field Methods

Surveys were conducted in teams of two by experienced marsh bird ornithologists with required permits from USFWS and CDFW. Six surveys were conducted between March 15 and June 15, 2017. This time period coincides with the approximate peak of the marsh bird breeding season and the seasonal peak in vocalization for most marsh birds. The six surveys were conducted with at least one survey within each of the following survey windows: March 15–March 31, April 1–April 14, April 15–April 30, May 1–May 14, May 15–May 31, and June 1–June 15.

For each survey (n=6), observations were conducted at dawn, dusk, and dawn over a 2-day survey period. Dawn surveys were conducted at or just before sunrise and proceeded for no more than 3 hours after sunrise. Dusk surveys were conducted within 2 hours before sunset and were completed by 30 minutes after sunset. Surveys were only conducted during dawn and dusk when air temperature was greater than 50 degrees Fahrenheit (10 degrees Celsius). Surveys were not conducted when wind speed was greater than 12 miles per hour or during sustained rain or heavy fog.

Surveys were conducted at 22 survey points to provide coverage of existing marsh habitat and areas that are predicted to be marsh habitat within 5 years post-construction (Figure 2). Survey points were spaced at least 400 meters apart to minimize the risk of birds at adjacent points approaching the call broadcast, which may result in double counting of birds. Points on either side of the railway or Interstate 5 were sometimes closer than 400 meters because these features provided a natural sound barrier.

Each survey followed the same survey route so the methods were identical between surveys (i.e., same timing, points and follow the same survey routes). Consistency in the chronological order of survey points was important to help reduce the sampling variation created by changes in vocalization probability of marsh birds as the surveys progressed. The survey route (i.e., points were surveyed in the order listed) and timing of surveys for each survey team was as follows:

- Team 1 – Dawn: 22, 21, 16, 17
- Team 2 – Dawn:12, 11, 10, 8, 9
- Team 1 – Dusk: 13, 14, 15
- Team 2 – Dusk: 18, 19, 20
- Team 1 – Dawn: 1, 2, 7
- Team 2 – Dawn: 6, 5, 4, 3

The following information was recorded at each survey point for each survey (Appendix B):

- Survey point number
- Name of observer(s)
- Survey start and times
- Weather (temperature and average wind speed/direction) at the start and end of each survey period. Temperature and wind data were obtained using a handheld weather meter (e.g., Kestrel 3000).
- The background noise category at each point on a scale from 0 to 4:
    - 0 = no background noise during virtually all of the survey
    - 1 = faint background noise during at least half of the survey
    - 2 = moderate background noise (probably cannot hear some birds beyond 100 meters during >30 seconds of the survey)
    - 3 = loud background noise (probably cannot hear some birds beyond 50 meters during >30 seconds of the survey)
    - 4 = intense background noise (probably cannot hear some birds beyond 25 meters during >30 seconds of the survey)

Survey methodology for the surveys consisted of a passive component and broadcast component at each survey point. All six survey species noted above (LFRR, Virginia rail, least bittern, American bittern, common gallinule, and pied-billed grebe) were considered secretive species. These species required the use of broadcast calls to elicit vocalizations in order to detect them. For these “broadcast” species, a portable audio player with speakers was used to broadcast calls at a volume of 80 to 90 decibels at 1 meter in front of the speakers.

Upon arriving at a survey point, ornithologists stood quietly for 5 minutes (i.e., passive component) and recorded observations both aurally and visually. After 5 minutes, ornithologists played approximately 30 seconds of calls for each “broadcast” species followed by 30 seconds of silence. Because there were six species that required the use of broadcast calls to elicit vocalizations, the survey time at each survey point was approximately 11 minutes (5 minutes initially plus 1 minute for each species (i.e., six species equals 6 minutes)). The broadcast sequence audio file with silence and avian calls for the survey was provided by Courtney Conway, PhD, and Wesley Glisson (Idaho Cooperative Fish and Wildlife Research Unit) (Glisson and Conway 2016).

Ornithologists stood 2 meters to one side of the speaker while listening for vocal responses. Ornithologists pointed the speaker toward the center of the marsh and did not rotate the speaker during the call-broadcast survey. The speakers were pointed in the same direction for all surveys. Ornithologists recorded the direction of the speakers at each point on a map and on their datasheets so that it could be duplicated for each survey. The arrows in Figure 2 depict the direction the speakers were oriented for each point.

Marsh birds visually and aurally detected during the survey period were recorded. Monitoring data collected for each marsh bird detected included the following (Appendix B):

- Time of observation (1-minute increments)
- Detection type (visual, aural)
- Type of call if detection aural
- Species (American Ornithological Union four-letter code, including an unknown category)
- Number of individuals, sex, age class, if possible
- Distance of observation from observer (a range finder is used to help determine the distance)
- Light-footed Ridgway's rail locations were recorded on a digitized map in Collector for ArcGIS or on a hard copy map

Vocalizations of LFRR were classified and assigned a call type based on descriptions in Zembal and Massey 1987. The majority of call types recorded were one of three types: clapper, kek, or kek-burr. The sex of some LFRR was determined based on the call type that was heard. A repeated kek call resulted in the bird being recorded as a male. A kek-burr resulted in the bird being recorded as a female. When two individuals were heard giving simultaneous clapper calls (dueting) from one location, they were recorded as a male-female pair.

All data were recorded on field data sheets and later transcribed into a Microsoft access database for analysis. As time permitted (i.e., when focal species were not calling), other avian species incidentally detected during breeding marsh bird surveys were recorded. Avian species were also recorded incidentally while ornithologists moved between points.

Independent Double Observer Survey Approach

While conducting surveys, the number of focal species counted is assumed a subset of actual species abundance because some individuals may not be detected by ornithologists. Thus, detection probabilities need to be estimated for abundance to be correctly quantified. There is no way to know what detection probabilities will be in the future as detection can be

affected by aspects controllable (e.g., training of field crews) as well as aspects not controllable (e.g., weather), and thus detection needs to be estimated during each survey period. Multiple visits are needed to estimate detection probability. The six repeat surveys were conducted to allow detection probabilities to be estimated.

An independent double-observer survey approach was used for surveys, meaning two ornithologists were present for each survey (Nichols et al. 2000). Each ornithologist recorded data independently from the other ornithologist. This was done to increase the number of repeated samples (12) over six visits and to improve the ability to model detection probability. The double-observer approach allowed for estimation of detection probabilities between observers and improved overall detection probabilities to yield more precise estimates of abundance compared to a single observer only. At the end of each survey at a specific point count station, observers compared data to determine which individual birds were detected by both observers or only detected by one observer. At this time, observers assigned birds alphanumeric identification codes based on detection by one or both observers.

Training

Prior to implementation of the monitoring protocol, 1-day training was conducted with all field staff. The training focused on review of logistics, schedule, and data collection protocol. In addition, it consisted of a mock field survey in which the trained ornithologists executed the field protocol and discussed potential issues with data collection.

Statistical Analysis

Because two independent observers simultaneously surveyed each point on each day, an encounter history could be constructed for each detected LFRR. Encounter histories were denoted by 1's (i.e., detected) and 0's (i.e., not detected in the data set). For example, if only the first observer detected an individual rail, the encounter history was denoted as 1, 0, or 10. If only the second observer detected an individual, then the encounter history was 01; if both observers detected an individual, the encounter history was 11. Only observations recorded during the 11-minute survey period were used for analysis in order to standardize the data. Observations detected beyond 200 meters were not included in the analysis to minimize the potential for double counting individuals between survey points. Thus, raw counts of birds are greater than those included in the independent double-observer statistical analyses.

Data were reviewed to determine the most appropriate statistical analysis for the data set The probability of detecting individual LFRR (p) and a corrected estimate of abundance (N) at the survey points was derived using a Huggins model (Huggins 1989, 1991) as

implemented in Program MARK (White and Burnham 1999). Models were constructed for detection probability such that detection was constant across all observers and surveys, that detection varied by observer only, that detection varied by survey only, that detection varied by observer and survey additively, and interactively, as well as a general individual heterogeneity in detection model. Due to variability between surveys, abundance or N was estimated separately for each of the six surveys. Akaike's Information Criterion was used with a small sample size correction (AICc) for model selection (Burnham and Anderson 2002). AICc is a measure of the relative support of a statistical model (the lower the AICc value, the better the fit or model) given the data.

For the purposes of this report, abundance reflects number of individual LFRR present. Separate estimates were not completed for pairs of LFRR versus single observations of LFRR. Abundance was estimated for the suitable habitat that was surveyed within the 200-meter radius of survey points (i.e., 298 acres). Upon estimating abundance for the survey area, density per acre was calculated that could be used to extrapolate an abundance estimate for all suitable LFRR habitat (i.e., 469 acres) in the SELRP study area.

Results

LFRR (i.e., marsh bird) surveys were conducted between March 15, 2017, and June 6, 2017. Survey dates, survey times, survey personnel, and weather conditions are summarized in Table 1. Table 2 details the results of the analysis and provides the raw detections counts of LFRR pairs and adult individuals. The series of Figure 3 maps display an overview of results for all six surveys as well as results broken down by each survey. Although chicks were observed during surveys 5 and 6, these were not included in the raw counts or analyses.

Table 1
Light-Footed Ridgway's Rail Survey Dates and Weather Conditions[1]

Survey Number	Date	AM/PM Survey Session	Time	Average Temperature (°F)	Average Sky Condition Rating[2]	Average Wind Speed (mph)	Average Background Noise Rating[3]
1	3/15/2017	AM	06:50 – 09:16	60.2	1.0	0.3	1.7
		PM	18:15 – 19:38	64.6	0.0	1.3	1.7
	3/16/2017	AM	06:45 – 08:11	60.6	2.0	0.8	1.4
2	4/4/2017	AM	06:02 – 08:08	60.8	1.3	0.9	1.5
		PM	18:03 - 19:23	62.0	1.0	4.6	1.6
	4/5/2017	AM	06:08 – 07:46	52.1	0.0	2.1	1.3
3	4/24/2017	AM	05:45 – 07:51	62.6	2.0	1.6	1.6
		PM	17:48 – 19:11	64.4	2.0	3.5	1.6
	4/25/2017	AM	05:43 – 07:37	57.7	1.5	1.3	1.5
4	5/8/2017	AM	05:43 – 07:49	50.8	1.0	1.2	1.6
		PM	17:53 – 19:09	65.0	0.3	3.5	1.7
	5/9/2017	AM	05:40 – 07:16	59.9	2.0	1.2	1.1
5	5/22/2017	AM	05:29 – 07:17	62.9	2.2	1.1	1.6
		PM	17:47 – 18:48	67.0	1.5	2.8	1.5
	5/23/2017	AM	05:27 – 07:21	62.9	2.0	1.4	1.1
6	6/5/2017	AM	05:16 – 07:12	62.7	2.0	0.9	1.3
		PM	18:06 – 19:07	65.5	2.0	3.2	1.0
	6/6/2017	AM	05:20 -07:01	62.6	2.9	0.7	1.1

°F = degrees Fahrenheit; mph = miles per hour

[1] Surveys 1, and 3 through 6 were conducted by the same four ornithologists: Bonnie Peterson (TE 038701-2, Blackhawk Environmental); Antonette Gutierrez (TE-50992B-0 Blackhawk Environmental); James McMorran (AECOM); and Brennan Mulrooney (AECOM); survey 2 was conducted by Bonnie Peterson; Ian Maunsell (TE 42833A-2, Blackhawk Environmental); James McMorran; and Brennan Mulrooney.

[2] Sky Condition Ratings: 0 = clear or a few clouds; 1 = partly cloudy or variable sky; 2 = cloudy or overcast; 3 = fog; 4 = drizzle

[3] Background Noise Ratings: 0 = no noise; 1 = faint noise; 2 = moderate noise (probably can't hear some birds beyond 100 meters); 3 = loud noise (probably can't hear some birds beyond 50 meters); 4 = intense noise (probably can't hear some birds beyond 25 meters)

Table 2
Summary of Light-Footed Ridgway's Rail Results

Survey Number	Estimated Number of Individuals for SELRP study area[1]				Raw Counts[2, 3]			
	Estimate	Standard Error	95% Lower Confidence Limit	95% Upper Confidence Limit	Pairs	Individuals		
						Male	Female	Unknown
1	89.00	4.69	84.05	104.93	19	10	-	14
2	73.04	1.13	72.45	78.90	19	11	-	10
3	91.68	4.46	87.02	106.90	20	7	1	16
4	74.10	0.50	73.96	77.29	15	6	-	19
5	74.51	4.71	69.68	90.85	14	8	-	13
6	56.07	2.56	54.00	66.58	10	1	-	16

[1] Estimates using the Huggins (Huggins 1991) closed mark recapture model. Observations beyond 200 meters and outside the 11-minute survey period were not used in the estimate of abundance for the SELRP study area in order to standardize results for comparison to surveys in future years.

[2] Composed of all detections recorded during surveys including detections beyond 200 meters from the survey point and detections outside the 11-minute survey period (i.e., incidentals while walking between points). These locations were not always mapped because detections were often very far from the observer and/or the observers were in transit to the next survey point. As a result, the number of detections noted in Table 2 is equal to or greater in number than the detections displayed in Figures 3a through 3f.

[3] The LFRR pairs and the sex of some individual LFRR were determined based on the call type heard (see Survey Methodology section).

The results of the statistical analysis using the Huggins (Huggins 1991) closed mark recapture model and extrapolated to the SELRP study area are summarized in Table 2. The model that considered detection constant was the highest ranked model with the next closest model having an AICc 9.53 units away. Detection was 0.80 (SE = 0.02). Estimates varied across survey sessions. Survey 1 (March 15–16, 2017) and survey 3 (April 24–25, 2017) had the highest estimates for number of LFRR adult individuals, 89.00 $\pm$ 4.69 standard errors [SE] and 91.68 $\pm$ 4.46 SE estimated (i.e., extrapolated) for the SELRP study area following data standardization and statistical analysis (Table 2). Survey 6 had the lowest number of LFRR individuals (56.07 $\pm$ 2.56 SE) estimated (i.e., extrapolated) for the SELRP study area. Data used to extrapolate an abundance estimate for all suitable habitat in the SELRP study area only included LFRR detections during the 11-minute survey period that were within 200 meters of a survey point.

Total detections of LFRR, including incidentals, varied across the survey sessions. The maximum number of individual LFRR detected was 64 individuals (20 pairs and 24 single LFRR) during survey 3 (Table 2). The lowest number of individual LFRR detected was 37 individuals (10 pairs and 17 single LFRR) during survey 6 (Table 2). These numbers include detections of LFRR that were not included in the data analyses such as individual detections beyond 200 meters from the survey point and detections outside the 11-minute survey period (i.e., incidentals while walking between points).

Other secretive marsh bird species detected during surveys included American bittern, common gallinule, and Virginia rail. A complete list of avian species detected during surveys is located in Appendix A.

Discussion

The LFRR survey methodologies described herein were designed to be replicable for pre- and post-construction monitoring for the SELRP. This will ensure data collection is standardized, which will allow for unbiased comparisons of LFRR results between years. It is important to note that the survey methods in this study were designed to provide a metric of LFRR abundance and distribution during the breeding season rather than a census of individuals and/or documentation of nesting activity.

LFRR detections were highest during surveys 1 and 3 (Table 2), and LFRR were most often initially detected during survey minute 8 of the broadcast call (Table 3).Table 3 details the minute an individual LFRR was first (i.e., initially) detected during a survey as percentage of the total detections. The majority of initial detections for all six surveys, ranging from 22.77% in survey 3 to 51.72% in survey 6, occurred during the active broadcast period. Survey six had demonstrably the lowest estimation of LFRR, based on estimated density or raw counts (Table 2). Interestingly, the majority of initial detections for LFRR during survey six occurred during survey minute 8—the LFRR broadcast (51.72%; Table 3). Perhaps this is indicative that later in the season birds are calling less frequently because they have nests and/or chicks and are most inclined to call when prompted (e.g., with a broadcast call or from another bird).

The estimated numbers of individual LFRR for the SELRP study area are less than those documented in 2017 by Zembal (2017). However, it should be noted that this study was not designed to detect the maximum number of LFRR, but rather to provide a replicable survey method that can provide a reliable index of population size within SELRP over time. A number of individuals were detected before and often after the 11-minute survey period (Table 3). An extended survey period could result in more LFRR detections. Konecny (2016) has noted several instances where LFRR respond to a call prompt 10 to 15 minutes after the call prompt.

Another factor potentially affecting the number of LFRR detections is the duration and frequency of tape playback. For this study, approximately 30 seconds of the LFRR broadcast call was played during the 11-minute survey period at each survey point. During all surveys, our data indicate that playing the LFRR broadcast call increased the chance that an LFRR was detected (Table 3).

For this study, the number of individuals was estimated rather than number of pairs. The majority (>90%) of detections were auditory only, which makes it difficult to confirm the presence of all pairs at San Elijo Lagoon. For this study, pairs were recorded when observers heard simultaneous clapper calls (dueting), during call and response detections between pairs, or distinct calls occurring in close temporal and spatial proximity to one another. In some cases, multiple birds were detected, but observers were not confident that these individuals were a pair using the methods described above. To minimize the assumptions required and to standardize the analysis process, this uncertainty was removed from the equation by simply focusing on number of individuals present.

Table 3
Percentage of Light-Footed Ridgway's Rail Initial Detections by Survey Minute[1]

Survey Minute	Survey Number[2]					
	1	2	3	4	5	6
1 – Passive Period	15.22%	14.56%	18.81%	12.75%	10.67%	6.90%
2 – Passive Period	7.61%	5.83%	6.93%	4.90%	6.67%	1.72%
3 – Passive Period	4.35%	6.80%	3.96%	6.86%	0.00%	3.45%
4 – Passive Period	6.52%	0.97%	6.93%	10.78%	5.33%	5.17%
5 – Passive Period	15.22%	8.74%	5.94%	3.92%	0.00%	0.00%
6 – Least Bittern Broadcast	2.17%	8.74%	3.96%	1.96%	5.33%	1.72%
7 – Virginia Rail Broadcast	2.17%	0.00%	1.98%	8.82%	16.00%	3.45%
8 – Ridgway's Rail Broadcast	30.43%	28.16%	22.77%	27.45%	32.00%	51.72%
9 – American Bittern Broadcast	2.17%	2.91%	4.95%	0.00%	6.67%	1.72%
10 – Common Gallinule Broadcast	2.17%	5.83%	4.95%	5.88%	1.33%	3.45%
11 – Pied-billed Grebe Broadcast	4.35%	10.68%	4.95%	3.92%	4.00%	8.62%
Outside Survey Period	7.61%	6.80%	13.86%	12.75%	12.00%	12.07%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

[1] Composed of all detections recorded during surveys, including detections beyond 200 meters from the survey point and detections outside the 11-minute survey period (i.e., incidentals while walking between points).
[2] Values may not total exactly to 100% due to rounding after summation.

In summary, the range of LFRR estimates provided in 2017 along with 2016 data (AECOM 2016) will serve as a solid baseline data for comparison to data collected after implementation of the SELRP. The standardized data collection and analysis methods will be useful for detecting any changes in LFRR abundance at San Elijo Lagoon. LFRR data

comparisons between years will be summarized and discussed in an annual avian monitoring report prepared for the SELRP. If you have any questions or require additional information, please feel free to contact Michael Anguiano at (619) 610-7600.

Sincerely,

Michael Anguiano
Wildlife Biologist
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Sheila V. Madrak, PhD
Wildlife Biologist
sheila.madrak@aecom.com

Attachments:

Figure 1 – Regional Map
Figure 2 – Vicinity Map and Survey Points
Figure 3 – Surveys 1 through 6 LFRR Results
Figure 3a – Light-footed Ridgway's Rail – Survey 1
Figure 3b – Light-footed Ridgway's Rail – Survey 2
Figure 3c – Light-footed Ridgway's Rail – Survey 3
Figure 3d – Light-footed Ridgway's Rail – Survey 4
Figure 3e – Light-footed Ridgway's Rail – Survey 5
Figure 3f – Light-footed Ridgway's Rail – Survey 6
Appendix A – Avian Species Detected during Surveys
Appendix B – Blank Datasheet

Certification Statement

Qualified biologists who conducted LFRR surveys for the SELRP certify that the information in this survey report fully and accurately represents the work performed. Signatures of biologists who conducted protocol-level surveys are included below.

Ian Maunsell
TE-42833A-2

Bonnie Peterson
Wildlife Biologist
TE-038701-2

Antonette Gutierrez
Wildlife Biologist
TE-50992B-0

James McMorran
Wildlife Biologist

Brennan Mulrooney
Wildlife Biologist

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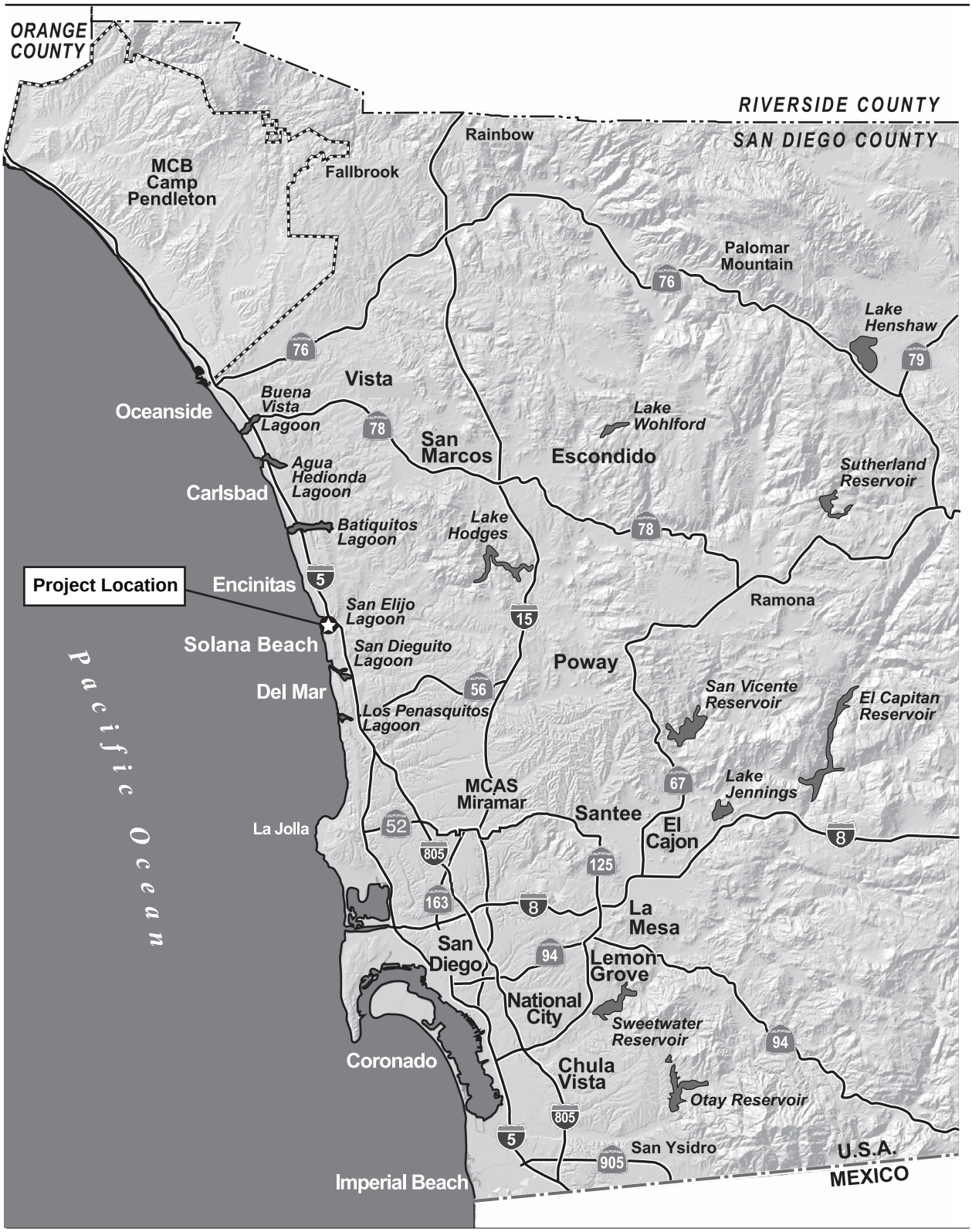
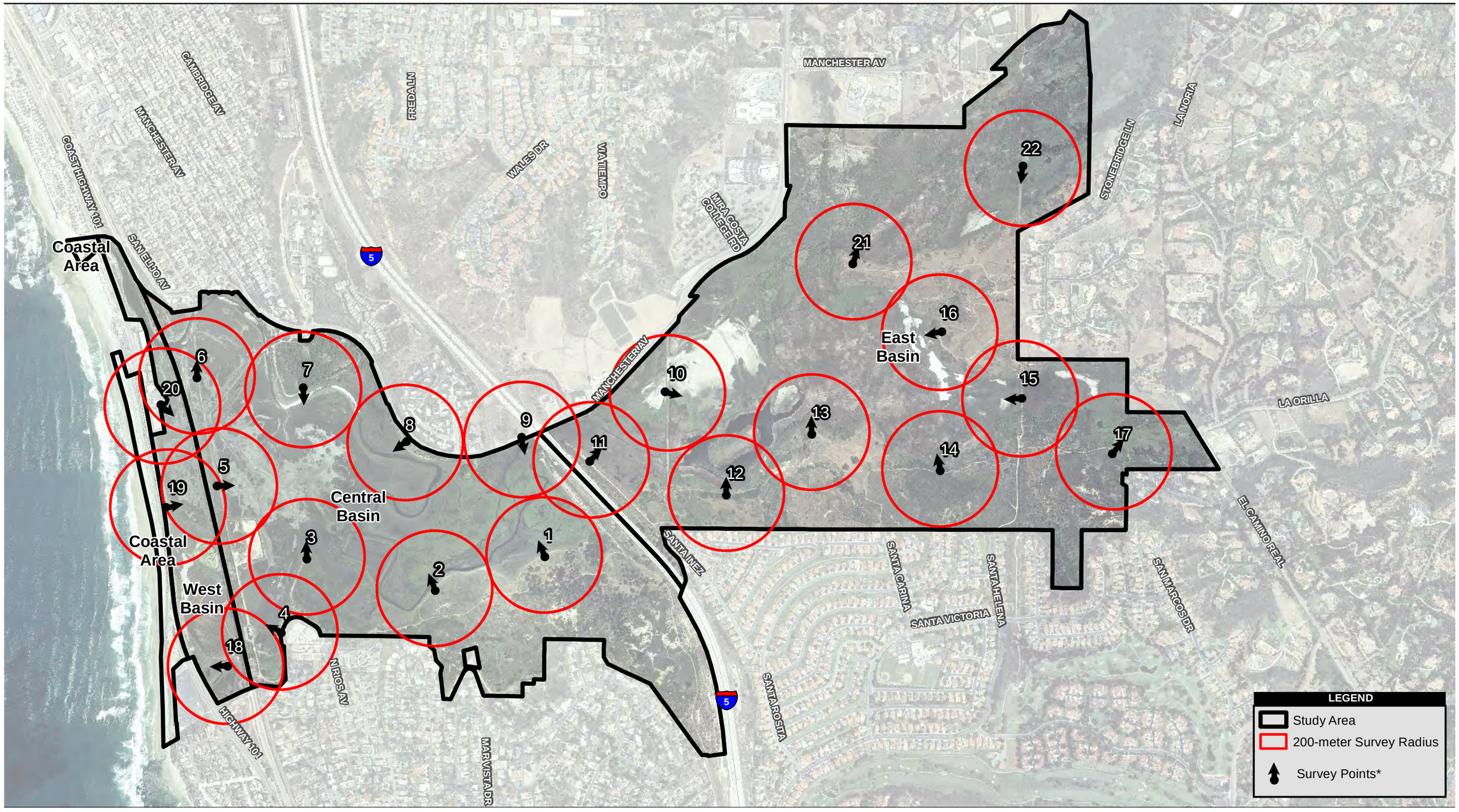
FIGURES



0 3.75 7.5 15 Miles

1" = 7.5 Miles

Figure 1
Regional Map



Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 2
Vicinity Map and Survey Points

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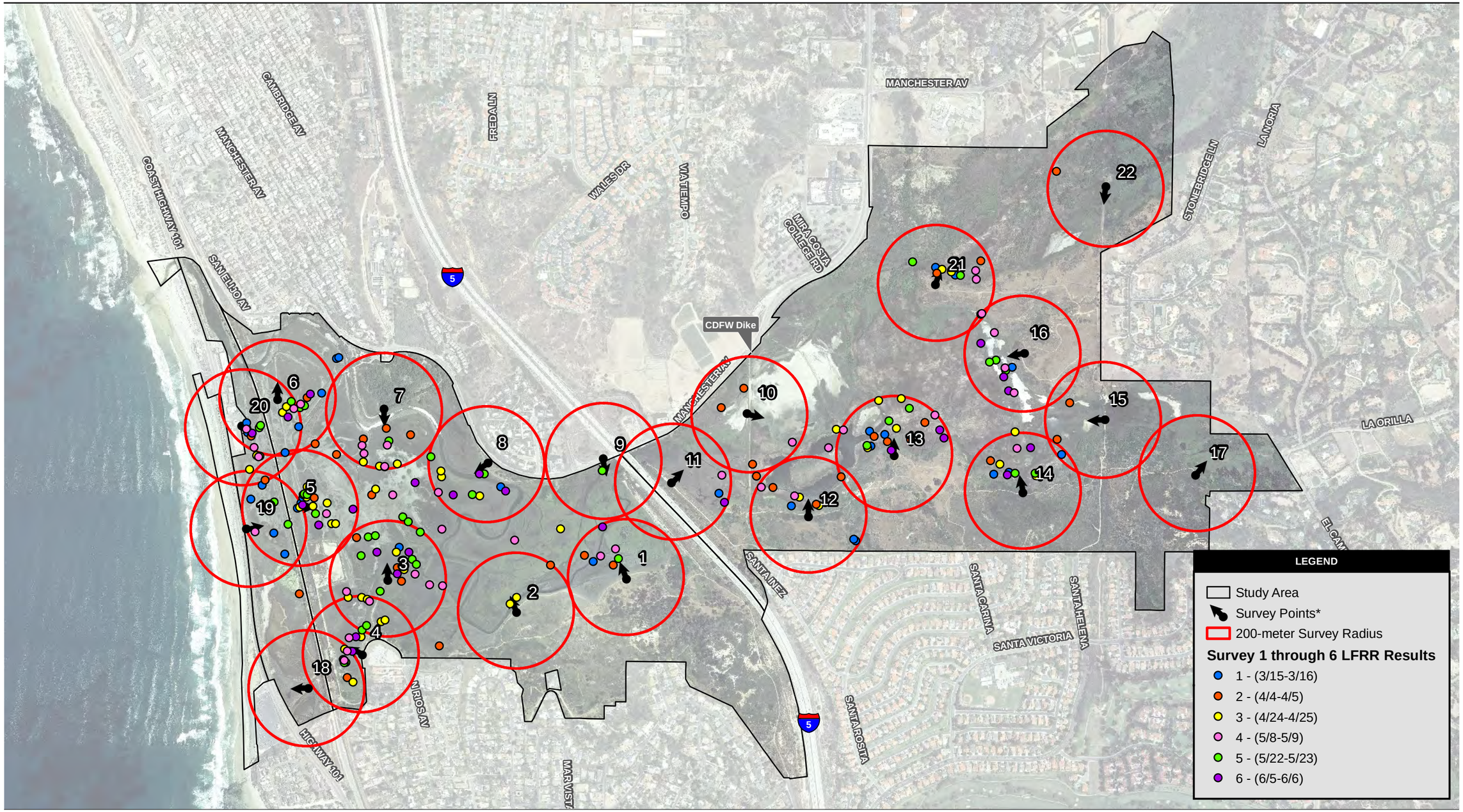

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3
Surveys 1 through 6 LFRR Results

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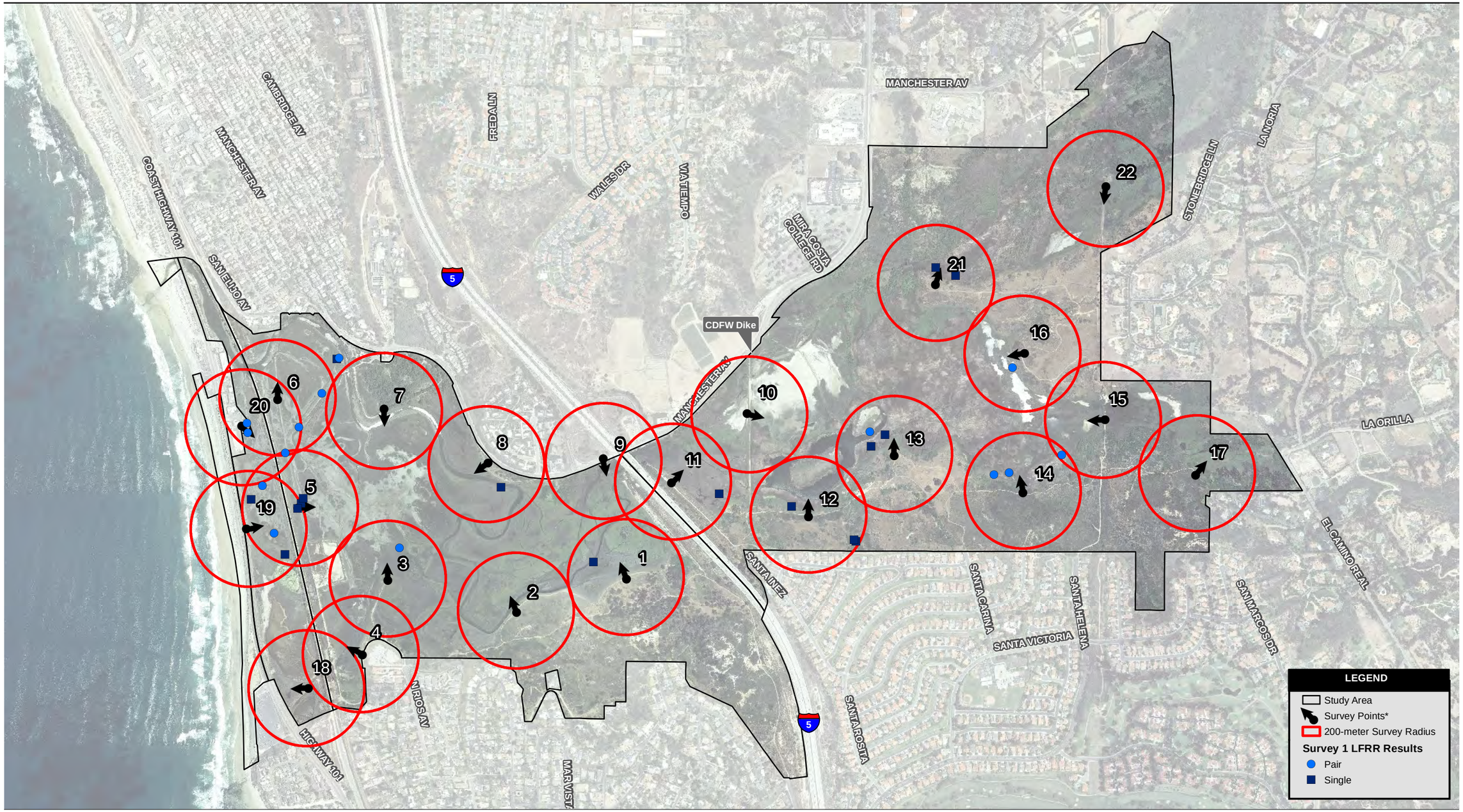

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3a
Light-footed Ridgway's Rail Results – Survey 1

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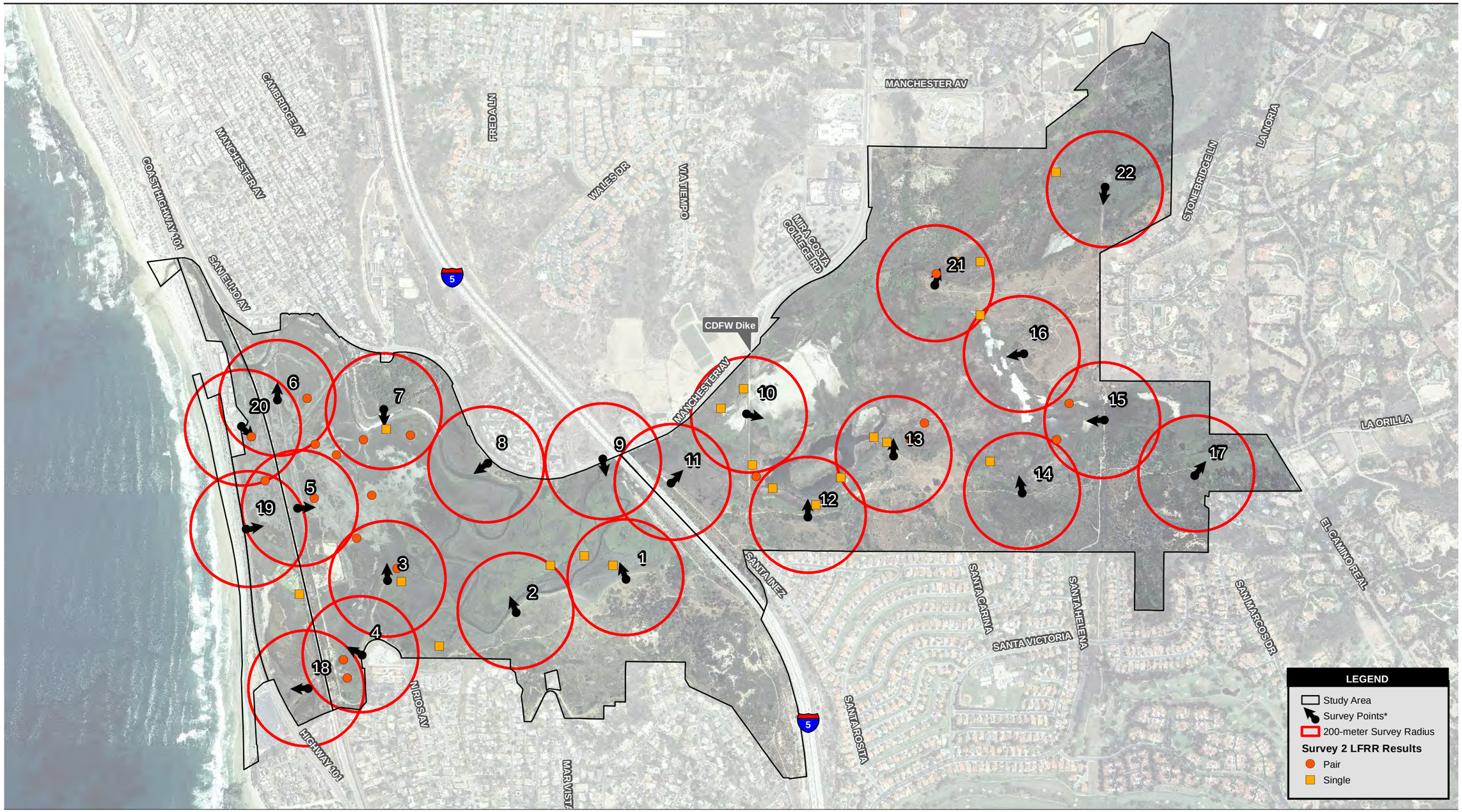

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3b
Light-footed Ridgway's Rail Results – Survey 2

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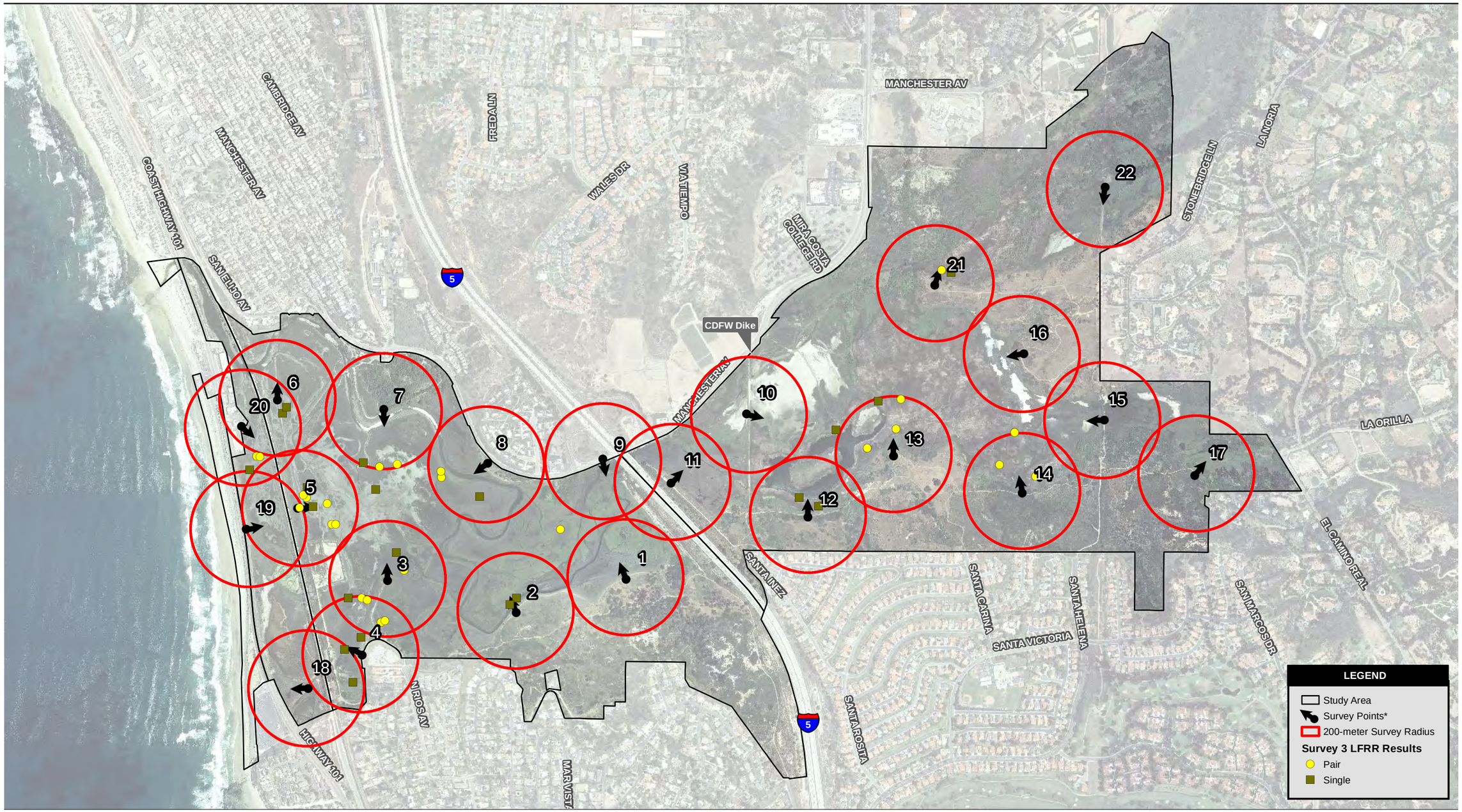

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3c
Light-footed Ridgway's Rail Results – Survey 3

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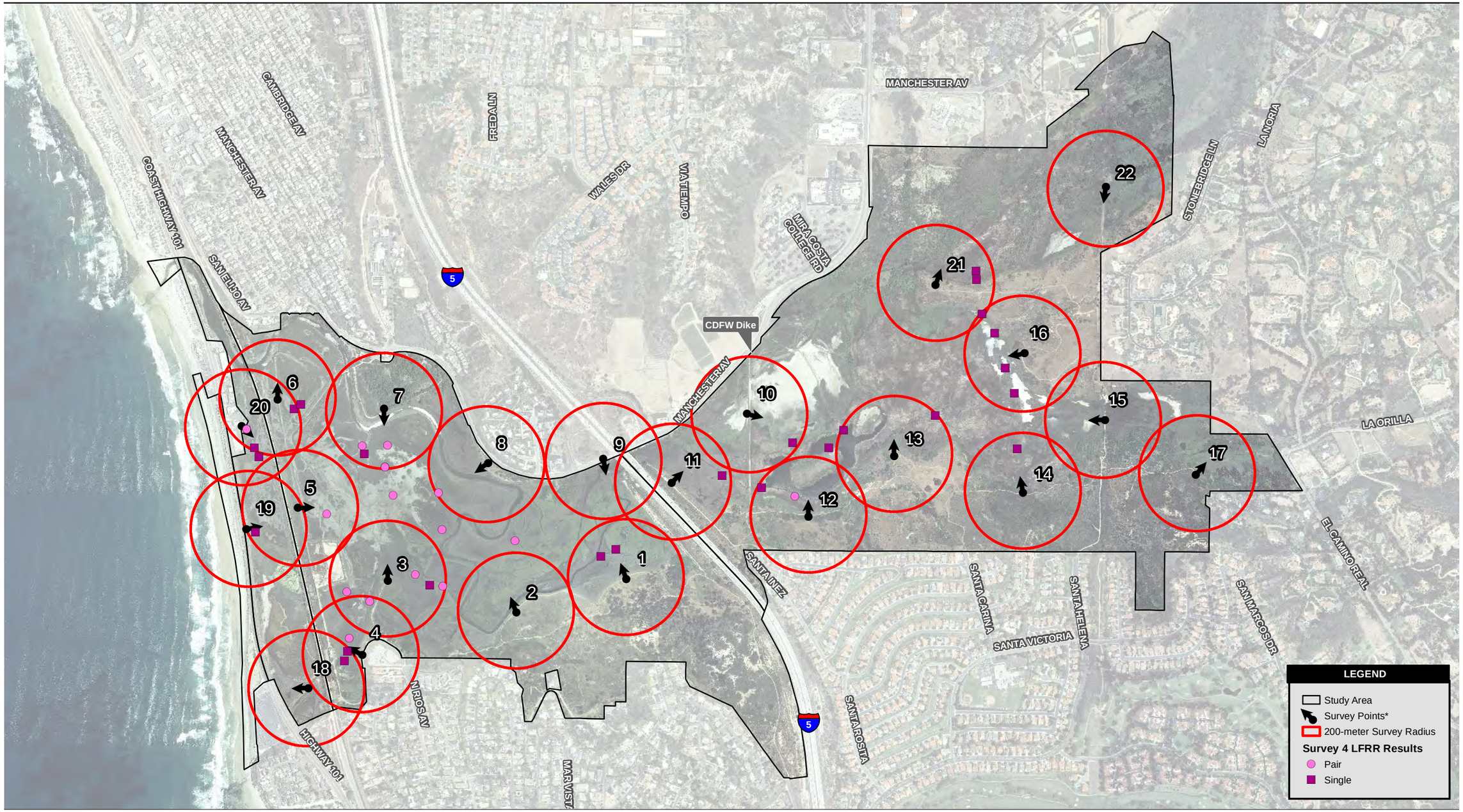

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3d
Light-footed Ridgway's Rail Results – Survey 4

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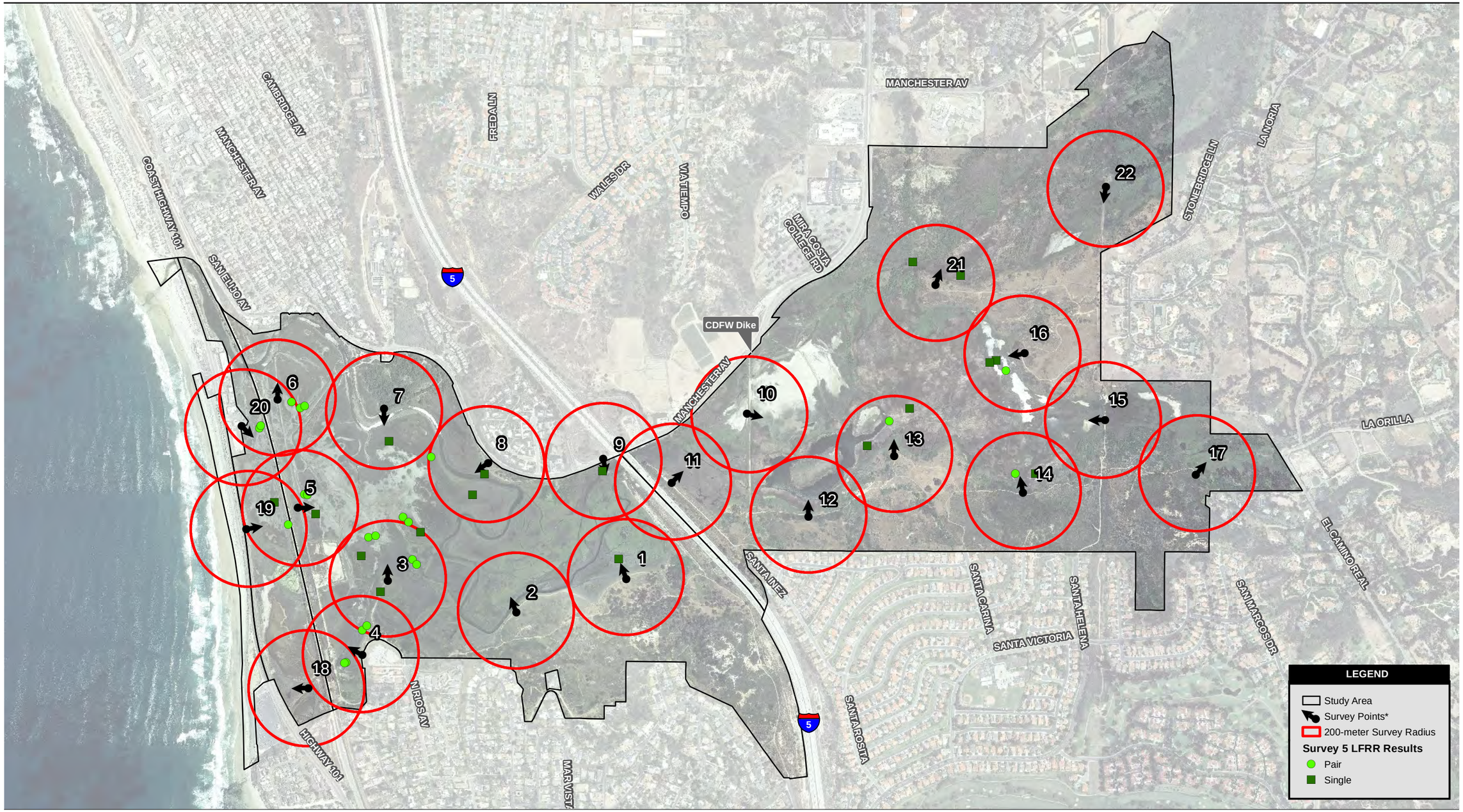

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3e
Light-footed Ridgway's Rail Results – Survey 5

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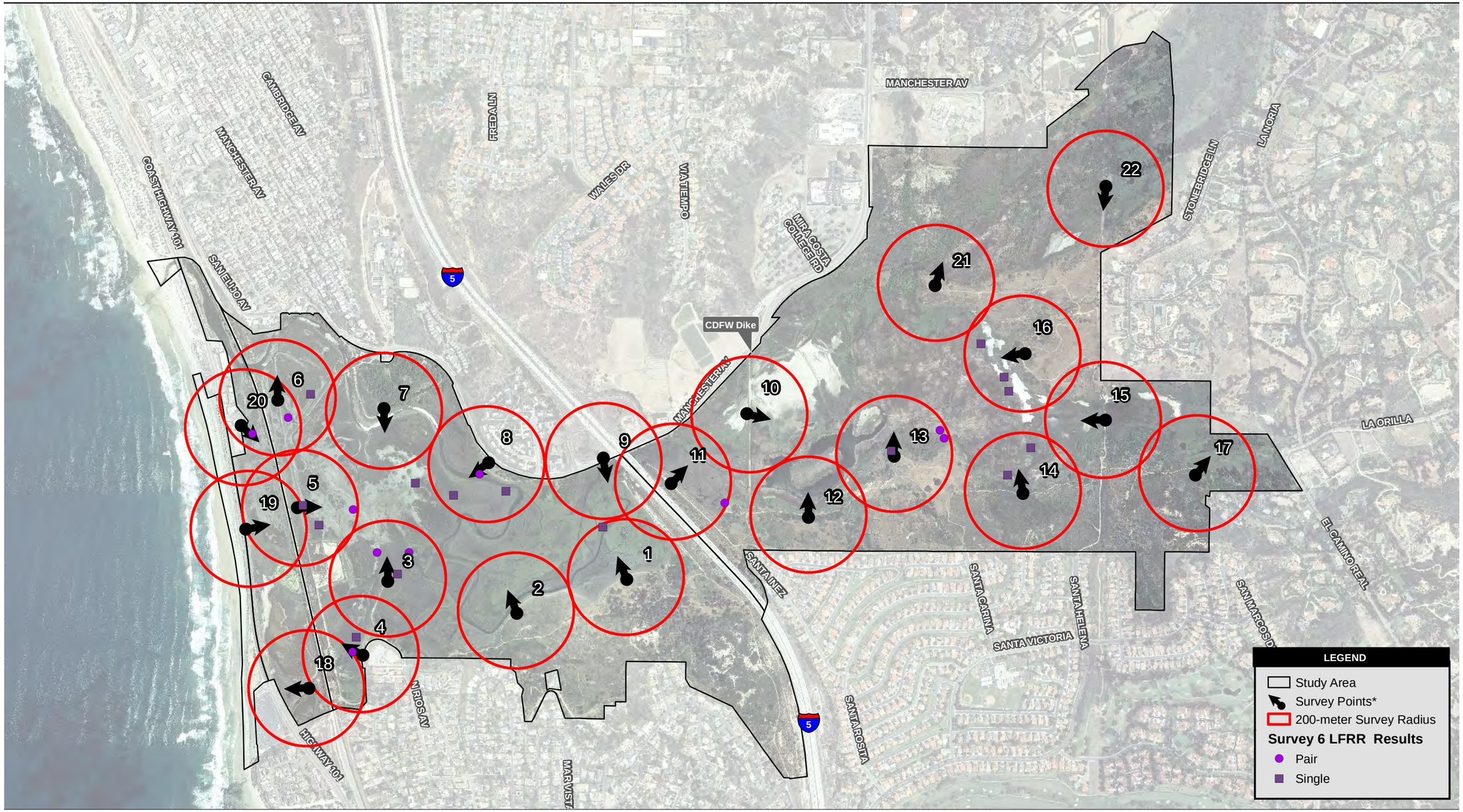

Source: SANDAG 2012; MoffattNichol; AECOM General Veg 2015.

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

* arrows depict direction of broadcast call

Figure 3f
Light-footed Ridgway's Rail Results – Survey 6

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APPENDIX A

AVIAN SPECIES DETECTED DURING SURVEYS

Appendix A
Avian Species Detected During Surveys

Common Name	Scientific Name	Order	Family
Cooper's Hawk	*Accipiter cooperii*	Accipitriformes	Accipitridae
Osprey	*Pandion haliaetus*	Accipitriformes	Accipitridae
Red-shouldered Hawk	*Buteo lineatus*	Accipitriformes	Accipitridae
Red-tailed Hawk	*Buteo jamaicensis*	Accipitriformes	Accipitridae
White-tailed Kite	*Elanus leucurus*	Accipitriformes	Accipitridae
American Wigeon	*Anas americana*	Anseriformes	Anatidae
Bufflehead	*Bucephala albeola*	Anseriformes	Anatidae
Blue-winged Teal	*Anas discors*	Anseriformes	Anatidae
Cinnamon Teal	*Anas cyanoptera*	Anseriformes	Anatidae
Gadwall	*Anas strepera*	Anseriformes	Anatidae
Green-winged Teal	*Anas crecca*	Anseriformes	Anatidae
Hooded Merganser	*Lophodytes cucullatus*	Anseriformes	Anatidae
Mallard	*Anas platyrhynchos*	Anseriformes	Anatidae
Northern Pintail	*Anas acuta*	Anseriformes	Anatidae
Northern Shoveler	*Anas clypeata*	Anseriformes	Anatidae
Red-breasted Merganser	*Mergus serrator*	Anseriformes	Anatidae
Ring-necked Duck	*Aythya collaris*	Anseriformes	Anatidae
Ruddy Duck	*Oxyura jamaicensis*	Anseriformes	Anatidae
White-throated Swift	*Aeronautes saxatalis*	Apodiformes	Apodidae
Allen's Hummingbird	*Selasphorus sasin*	Apodiformes	Trochilidae
Anna's Hummingbird	*Calypte anna*	Apodiformes	Trochilidae
Common Poorwill	*Phalaenoptilus nuttallii*	Caprimulgiformes	Caprimulgidae
Lesser Nighthawk	*Chordeiles acutipennis*	Caprimulgiformes	Caprimulgidae
Killdeer	*Charadrius vociferus*	Charadriiformes	Charadriidae
Semipalmated Plover	*Charadrius semipalmatus*	Charadriiformes	Charadriidae
Black Skimmer	*Rynchops niger*	Charadriiformes	Laridae
California Gull	*Larus californicus*	Charadriiformes	Laridae
Caspian Tern	*Hydroprogne caspia*	Charadriiformes	Laridae
Elegant Tern	*Thalasseus elegans*	Charadriiformes	Laridae
California Least Tern	*Sternula antillarum browni*	Charadriiformes	Laridae
American Avocet	*Recurvirostra americana*	Charadriiformes	Recurvirostridae
Black-necked Stilt	*Himantopus mexicanus*	Charadriiformes	Recurvirostridae
Black-winged Stilt	*Himantopus himantopus*	Charadriiformes	Recurvirostridae
Greater Yellowlegs	*Tringa melanoleuca*	Charadriiformes	Scolopacidae
Long-billed Curlew	*Numenius americanus*	Charadriiformes	Scolopacidae
Long-billed Dowitcher	*Limnodromus scolopaceus*	Charadriiformes	Scolopacidae
Least Sandpiper	*Calidris minutilla*	Charadriiformes	Scolopacidae
Red-necked Phalarope	*Phalaropus lobatus*	Charadriiformes	Scolopacidae

Common Name	Scientific Name	Order	Family
Solitary Sandpiper	*Tringa solitaria*	Charadriiformes	Scolopacidae
Spotted Sandpiper	*Actitis macularius*	Charadriiformes	Scolopacidae
Western Sandpiper	*Calidris mauri*	Charadriiformes	Scolopacidae
Whimbrel	*Numenius phaeopus*	Charadriiformes	Scolopacidae
Willet	*Tringa semipalmata*	Charadriiformes	Scolopacidae
Mourning Dove	*Zenaida macroura*	Columbiformes	Columbidae
Eurasian Collared-Dove	*Streptopelia decaocto*	Columbiformes	Columbidae
Belted Kingfisher	*Megaceryle alcyon*	Coraciiformes	Alcedinidae
American Kestrel	*Falco sparverius*	Falconiformes	Falconiformes
American Peregrine Falcon	*Falco peregrinus anatum*	Falconiformes	Falconiformes
California Quail	*Callipepla californica*	Galliformes	Odontophoridae
American Coot	*Fulica americana*	Gruiformes	Rallidae
Common Gallinule	*Gallinula galeata*	Gruiformes	Rallidae
Sora	*Porzana carolina*	Gruiformes	Rallidae
Bushtit	*Psaltriparus minimus*	Passeriformes	Aegithalidae
Black-headed Grosbeak	*Pheucticus melanocephalus*	Passeriformes	Cardinalidae
Blue Grosbeak	*Passerina caerulea*	Passeriformes	Cardinalidae
American Crow	*Corvus brachyrhynchos*	Passeriformes	Corvidae
Western Scrub-Jay	*Aphelocoma californica*	Passeriformes	Corvidae
Belding's Savannah Sparrow	*Passerculus sandwichensis beldingi*	Passeriformes	Emberizidae
California Towhee	*Melozone crissalis*	Passeriformes	Emberizidae
Lincoln's Sparrow	*Melospiza lincolnii*	Passeriformes	Emberizidae
Song Sparrow	*Melospiza melodia*	Passeriformes	Emberizidae
Spotted Towhee	*Pipilo maculatus*	Passeriformes	Emberizidae
White-crowned Sparrow	*Zonotrichia leucophrys*	Passeriformes	Emberizidae
Scaly-breasted Munia	*Lonchura punctulata*	Passeriformes	Estrildidae
American Goldfinch	*Spinus tristis*	Passeriformes	Fringillidae
House Finch	*Haemorhous mexicanus*	Passeriformes	Fringillidae
Lesser Goldfinch	*Spinus psaltria*	Passeriformes	Fringillidae
Bank Swallow	*Riparia riparia*	Passeriformes	Hirundinidae
Barn Swallow	*Hirundo rustica*	Passeriformes	Hirundinidae
Cliff Swallow	*Petrochelidon pyrrhonota*	Passeriformes	Hirundinidae
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Passeriformes	Hirundinidae
Tree Swallow	*Tachycineta bicolor*	Passeriformes	Hirundinidae
Violet-green Swallow	*Tachycineta thalassina*	Passeriformes	Hirundinidae
Brown-headed Cowbird	*Molothrus ater*	Passeriformes	Icteridae
Great-tailed Grackle	*Quiscalus mexicanus*	Passeriformes	Icteridae
Hooded Oriole	*Icterus cucullatus*	Passeriformes	Icteridae

Common Name	Scientific Name	Order	Family
Red-winged Blackbird	*Agelaius phoeniceus*	Passeriformes	Icteridae
California Thrasher	*Toxostoma redivivum*	Passeriformes	Mimidae
Northern Mockingbird	*Mimus polyglottos*	Passeriformes	Mimidae
American Pipit	*Anthus rubrescens*	Passeriformes	Motacillidae
Audubon's Warbler	*Setophaga auduboni*	Passeriformes	Parulidae
Common Yellowthroat	*Geothlypis trichas*	Passeriformes	Parulidae
Orange-crowned Warbler	*Oreothlypis celata*	Passeriformes	Parulidae
Yellow-breasted Chat	*Icteria virens*	Passeriformes	Parulidae
Yellow Warbler	*Setophaga petechia brewsteri*	Passeriformes	Parulidae
Coastal California Gnatcatcher	*Polioptila californica californica*	Passeriformes	Polioptilidae
Wrentit	*Chamaea fasciata*	Passeriformes	Sylviidae
Bewick's Wren	*Thryomanes bewickii*	Passeriformes	Troglodytidae
House Wren	*Troglodytes aedon*	Passeriformes	Troglodytidae
Marsh Wren	*Cistothorus palustris*	Passeriformes	Troglodytidae
Swainson's Thrush	*Catharus ustulatus*	Passeriformes	Turdidae
Ash-throated Flycatcher	*Myiarchus cinerascens*	Passeriformes	Tyrannidae
Black Phoebe	*Sayornis nigricans*	Passeriformes	Tyrannidae
Cassin's Kingbird	*Tyrannus vociferans*	Passeriformes	Tyrannidae
Pacific-slope Flycatcher	*Empidonax difficilis*	Passeriformes	Tyrannidae
Western Kingbird	*Tyrannus verticalis*	Passeriformes	Tyrannidae
Least Bell's Vireo	*Vireo bellii pusillus*	Passeriformes	Vireonidae
California Scrub-Jay	*Aphelocoma californica*	Passeriformes	Corvidae
American Bittern	*Botaurus lentiginosus*	Pelecaniformes	Ardeidae
Black-crowned Night-Heron	*Nycticorax nycticorax*	Pelecaniformes	Ardeidae
Great Blue Heron	*Ardea herodias*	Pelecaniformes	Ardeidae
Great Egret	*Ardea alba*	Pelecaniformes	Ardeidae
Snowy Egret	*Egretta thula*	Pelecaniformes	Ardeidae
California Brown Pelican	*Pelecanus occidentalis californicus*	Pelecaniformes	Pelecanidae
White-faced Ibis	*Plegadis chihi*	Pelecaniformes	Threskiornithidae
American White Pelican	*Pelecanus erythrorhynchos*	Pelecaniformes	Pelecanidae
Eared Grebe	*Podiceps nigricollis*	Podicipediformes	Podicipedidae
Western Grebe	*Aechmophorus occidentalis*	Podicipediformes	Podicipedidae
Double-crested Cormorant	*Phalacrocorax auritus*	Suliformes	Phalacrocoracidae

APPENDIX B

BLANK DATASHEET

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)* **:**

Survey #:

Name of marsh:

Observer:

List all non-focal species surveyed:

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Temp (F)	Sky	Wind (Beaufort)	Avg Wind Speed (mph)	Background noise	Species	Responded During												Call Type(s)*	Distance (meters)	Detected at a Previous Point	Comments	ID Tag
								Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	LEBI	VIRA	RIRA	AMBI	COGA	PBGR	Outside survey					

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)*
3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

Beaufort scale: 0 *smoke rises vertically* 1 *wind direction shown by smoke drift* 2 *wind felt on face; leaves rustle*
3 *leaves , small twigs in constant motion; light flag extended* 4 *raises dust and loose paper; small branches are moved* 5 *small trees with leaves sway; crested wavelets on inland waters*

Sky: 0 *clear or a few clouds* 1 *partly cloudy or variable sky* 2 *cloudy or overcast* 4 *fog or smoke* 5 *drizzle* 6 *snow* 8 *showers*

Call Type: C = clapper/clatter, D = duet, K = kek, B = kek-burr, KH = kek-hurrah, SK = squawk

ID Tag Individual birds = use consecutive alpha codes (e.g. A, B, C…) Pairs = matching alpha code with additional numeric assignment of individuals in pair (e.g. A1, A2; B1, B2...)

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)* **:** **Name of marsh:** **Observer:**

put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Station#	Start Time (military)	Temp (F)	Sky	Wind (Beaufort)	Avg Wind Speed (mph)	Background noise	Species	Responded During												Call Type(s) Code*	Distance (meters)	Detected at a Previous Point	Comments	ID Tag
								Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	LEBI	VIRA	RIRA	AMBI	COGA	PBGR	Outside survey period					

Background noise: 0 *no noise* 1 *faint noise* 2 *moderate noise (probably can't hear some birds beyond 100m)* 3 *loud noise (probably can't hear some birds beyond 50m)* 4 *intense noise (probably can't hear some birds beyond 25m)*

Beaufort scale: 0 *smoke rises vertically* 1 *wind direction shown by smoke drift* 2 *wind felt on face; leaves rustle* 3 *leaves , small twigs in constant motion; light flag extended* 4 *raises dust and loose paper; small branches are moved* 5 *small trees with leaves sway; crested wavelets on inland waters*

Sky: 0 *clear or a few clouds* 1 *partly cloudy or variable sky* 2 *cloudy or overcast* 4 *fog or smoke* 5 *drizzle* 6 *snow* 8 *showers*

Call Type: C = clapper/clatter, D = duet, K = kek, B = kek-burr, KH = kek-hurrah, SK = squawk

ID Tag Individual birds = use consecutive alpha codes (e.g. A, B, C…) Pairs = matching alpha code with additional numeric assignment of individuals in pair (e.g. A1, A2; B1, B2...)

Attachment 3

2016 and 2017 Waterbird Survey Species List

2016 and 2017 Waterbird Survey Species List

Table 1. List of bird species observed during 2016 and 2017 waterbird surveys, sorted by taxonomic order.

Order	Common Name	Scientific Name
Anseriformes (Waterfowl)	American Wigeon	*Anas americana*
	Blue-winged Teal	*Anas discors*
	Brant	*Branta bernicla*
	Bufflehead	*Bucephala albeola*
	Canada Goose	*Branta canadensis*
	Cinnamon Teal	*Anas cyanoptera*
	Common Goldeneye	*Bucephala clangula*
	Eurasian Wigeon	*Anas penelope*
	Gadwall	*Anas strepera*
	Green-winged Teal	*Anas crecca*
	Hooded Merganser	*Lophodytes cucullatus*
	Lesser Scaup	*Aythya affinis*
	Mallard	*Anas platyrhynchos*
	Northern Pintail	*Anas acuta*
	Northern Shoveler	*Anas clypeata*
	Red-breasted Merganser	*Mergus serrator*
	Redhead	*Aythya americana*
	Ring-necked Duck	*Aythya collaris*
	Ruddy Duck	*Oxyura jamaicensis*
Charadriiformes (Shorebirds, Sandpipers, Gulls, Terns)	American Avocet	*Recurvirostra americana*
	Black Skimmer	*Rynchops niger*
	Black Turnstone	*Arenaria melanocephala*
	Black-bellied Plover	*Pluvialis squatarola*
	Black-necked Stilt	*Himantopus mexicanus*
	Bonaparte's Gull	*Chroicocephalus philadelphia*
	California Gull	*Larus californicus*
	California Least Tern	*Sternula antillarum browni*
	Caspian Tern	*Hydroprogne caspia*
	Common Murre	*Uria aalge*
	Dowitcher sp.	*Limnodromus sp.*
	Dunlin	*Calidris alpina*
	Elegant Tern	*Thalasseus elegans*
	Forster's Tern	*Sterna forsteri*
	Franklin's Gull	*Leucophaeus pipixcan*
	Greater Yellowlegs	*Tringa melanoleuca*
	Herring Gull	*Larus argentatus*
	Killdeer	*Charadrius vociferus*
	Least Sandpiper	*Calidris minutilla*
	Lesser Yellowlegs	*Tringa flavipes*
	Long-billed Curlew	*Numenius americanus*

Order	Common Name	Scientific Name
Charadriiformes (Shorebirds, Sandpipers, Gulls, Terns)	Long-billed Dowitcher	*Limnodromus scolopaceus*
	Marbled Godwit	*Limosa fedoa*
	Red-necked Phalarope	*Phalaropus lobatus*
	Ring-billed Gull	*Larus delawarensis*
	Royal Tern	*Thalasseus maxima*
	Ruddy Turnstone	*Arenaria interpres*
	Sanderling	*Calidris alba*
	Semipalmated Plover	*Charadrius semipalmatus*
	Short-billed Dowitcher	*Limnodromus griseus*
	Solitary Sandpiper	*Tringa solitaria*
	Spotted Sandpiper	*Actitis macularius*
	Stilt Sandpiper	*Calidris himantopus*
	Western Gull	*Larus occidentalis*
	Killdeer	*Charadrius vociferus*
	Western Sandpiper	*Calidris mauri*
	Whimbrel	*Numenius phaeopus*
	Willet	*Tringa semipalmata*
	Wilson's Phalarope	*Phalaropus tricolor*
	Wilson's Snipe	*Gallinago delicata*
Coraciiformes (Kingfishers)	Belted Kingfisher	*Megaceryle alcyon*
Gaviiformes (Loons)	Pacific Loon	*Gavia pacifica*
	Red-throated Loon	*Gavia stellata*
Gaviiformes (Loons)	American Coot	*Fulica americana*
	Common Gallinule	*Gallinula galeata*
	Light-footed Ridgway's Rail	*Rallus obsoletus levipes*
	Ridgway's Rail	*Rallus obsoletus*
	Sora	*Porzana carolina*
Pelecaniformes (Pelicans, Wading birds)	American Bittern	*Botaurus lentiginosus*
	American White Pelican	*Pelecanus erythrorhynchos*
	Black-crowned Night-Heron	*Nycticorax nycticorax*
	California Brown Pelican	*Pelecanus occidentalis californicus*
	Cattle Egret	*Bubulcus ibis*
	Great Blue Heron	*Ardea herodias*
	Great Egret	*Ardea alba*
	Green Heron	*Butorides virescens*
	Least Bittern	*Ixobrychus exilis*
	Snowy Egret	*Egretta thula*
	White-faced Ibis	*Plegadis chihi*
Podicipediformes (Grebes)	Clark's Grebe	*Aechmophorus clarkii*
	Eared Grebe	*Podiceps nigricollis*
	Horned Grebe	*Podiceps auritus*
	Pied-billed Grebe	*Podilymbus podiceps*
	Western Grebe	*Aechmophorus occidentalis*
Suliformes (Cormorants)	Double-crested Cormorant	*Phalacrocorax auritus*

Attachment 4

2016 Waterbird and Western Snowy Plover Surveys

2016 Waterbird and Western Snowy Plover Surveys

Table 1. List of survey dates, times, personnel, and weather conditions.

SURVEY #	DATE	TIME	BIOLOGIST	WEATHER Deg F, % Cloud Cover, Wind
1a	4/18/2016	3:55 PM – 6:15 PM	James McMorran, Emma Fraser	start: 81°, 0%, 5 mph end: 77°, 0%, 1 mph
1b	4/19/2016	3:15 PM – 5:30 PM	James McMorran, Emma Fraser	start: 77°, 10%, 3 mph end: 77°, 5%, 3 mph
2a	5/10/2016	7:45 AM – 12:00 PM	James McMorran, Emma Fraser	start: 62°, 100%, 1 mph end: 66°, 100%, 4 mph
2b	5/12/2016	9:32 AM – 2:25 PM	James McMorran, Brennan Mulrooney	start: 66°, 100%,3 mph end: 69°, 80%, 10 mph
3a	5/19/2016	10:29 AM – 1:38 PM	Brennan Mulrooney, Emma Fraser	start: 65°, 100%,4 mph end: 66°, 80%, 10 mph
3b	5/20/2016	8:04 AM – 1:02 PM	Brennan Mulrooney, Emma Fraser	start: 61°, 100%, 7 mph end: 62°, 20%, 10 mph
4a	6/9/2016	7:15 AM – 11:12 AM	Brennan Mulrooney, Emma Fraser	start: 64°, 100%, 3 mph end: 65°, 100%, 7 mph
4b	6/10/2016	7:28 AM – 11:28 AM	James McMorran, Brennan Mulrooney	start: 64°, 100%, 2 mph end: 66°, 100%, 5 mph
5a	6/14/2016	9:36 AM – 10:34 AM	James McMorran, Brennan Mulrooney	start: 69°, 10%, 3 mph end: 76°, 0%, 5 mph
5b	6/15/2016	7:31 AM – 1:30 PM	James McMorran, Brennan Mulrooney	start: 65°, 100%, 0 mph end: 77°, 50%, 3 mph
6a	6/23/2016	9:10 AM – 12:11 PM	James McMorran, Emma Fraser	start: 68°, 5%, 3 mph end: 70°, 0%, 5 mph
6b	6/24/2016	8:40 AM – 11:30 AM	James McMorran, Emma Fraser	start: 64°, 100%, 1 mph end: 68°, 0%, 6 mph
7a	7/11/2016	7:21 AM – 10:03 AM	James McMorran, Brennan Mulrooney	start: 66°, 80%, 3 mph end: 71°, 0%, 4 mph
7b	7/12/2016	9:26 AM – 11:43 AM	James McMorran, Brennan Mulrooney	start: 69°, 20%, 5 mph end: 73°, 0%, 3 mph
8a	7/25/2016	6:36 AM – 12:44 PM	James McMorran, Brennan Mulrooney	start: 68°, 80%, 2 mph end: 79°, 5%, 8 mph
8b	7/29/2016	7:39 AM – 11:05 AM	James McMorran, Brennan Mulrooney	start: 69°, 0%, 3 mph end: 78°, 50%, 3 mph
9a	8/11/2016	7:30 AM – 12:00 PM	James McMorran, Emma Fraser	start: 71°, 85%¸ 6 mph end: 73°, 15%¸ 8 mph
9b	8/12/2016	7:30 AM – 11:22 AM	James McMorran, Emma Fraser	start: 70°, 100%¸ 0 mph end: 73°, 15%, 4 mph
10a	9/6/2016	7:00 AM – 12:00 PM	James McMorran, Emma Fraser	start: 70°, 80%, 5 mph end: 72°, 10%, 2 mph
10b	9/9/2016	7:00 AM – 12:00 PM	James McMorran, Emma Fraser	start: 67°, 35%, 2 mph end: 72°, 10%, 4 mph
11a	9/19/2016	9:02 AM – 3:42 PM	James McMorran, Emma Fraser	start: 73°, 90%, 5 mph end: 72°, 100%, 4 mph

SURVEY #	DATE	TIME	BIOLOGIST	WEATHER Deg F, % Cloud Cover, Wind
11b	9/20/2016	7:00 AM – 12:00 PM	James McMorran, Emma Fraser	start: 68°, 100%, 0 mph end: 69°, 0%, 3 mph
12a	10/3/2016	12:12 PM – 3:20 PM	James McMorran, Brennan Mulrooney	start: 75°, 0%, 10 mph end: 75°, 0%, 8 mph
12b	10/4/2016	8:19 AM – 1:22 PM	James McMorran, Brennan Mulrooney	start: 68°, 0%, 3 mph end: 71°, 0%, 3 mph
13a	10/16/2016	8:02 AM – 2:19 PM	James McMorran, Brennan Mulrooney	start: 70°, 10%, 5 mph end: 76°, 30%, 9 mph
13b	10/17/2016	9:41 AM – 12:19 PM	James McMorran, Brennan Mulrooney	start: 65°, 100%, 2 mph end: 69°, 50%, 5 mph
14a	10/31/2016	7:30 AM – 12:15 PM	Brennan Mulrooney, Emma Fraser	start: 62°, 20%, 2 mph end: 67°, 75%, 3 mph
14b	11/1/2016	7:34 AM – 2:34 PM	James McMorran, Brennan Mulrooney	start: 63°, 20%, 3 mph end: 70°, 5%, 6 mph
15a	11/17/2016	8:57 AM – 12:56 PM	James McMorran, Brennan Mulrooney	start: 65°, 0%, 4 mph end: 70°, 0%, 4 mph
15b	11/18/2016	7:15 AM – 10:44 AM	James McMorran, Brennan Mulrooney	start: 55°, 0%, 1 mph end: 69°, 0%, 4 mph
16a	11/29/2016	8:36 AM – 12:28 PM	James McMorran, Brennan Mulrooney	start: 65°, 0%, 1 mph end: 69°, 0%, 3 mph
16b	12/2/2016	8:12 AM – 1:29 PM	James McMorran, Brennan Mulrooney	start: 59°, 0%, 5 mph end: 69°, 0%, 3 mph
17a	12/13/2016	8:34 AM – 3:28 PM	James McMorran, Brennan Mulrooney	start: 58°, 100%, 1 mph end: 64°, 15%, 4 mph
17b	12/14/2016	7:11 AM – 2:18 PM	James McMorran, Brennan Mulrooney	start: 63°, 20%, 2 mph end: 68°, 10%, 8 mph
18a	12/29/2016	7:00 AM – 2:23 PM	James McMorran, Brennan Mulrooney	start: 49°, 25%, 2 mph end: 70°, 20%, 5 mph
18b	12/31/2016	8:00 AM – 11:09 AM	James McMorran, Brennan Mulrooney	start: 54°, 100%, 3 mph end: 62°, 60%, 5 mph

Attachment 5

2016 California Least Tern Surveys

2016 California Least Tern Surveys

Table 1. List of survey dates, times, personnel, and weather conditions.

SURVEY #	DATE	TIME	BIOLOGIST	WEATHER Deg F, % Cloud Cover, Wind
1	4/21/2016	8:00 AM – 12:30 PM	James McMorran	start: 64°, 100%, 3 mph end: 69°, 60%, 6 mph
2	4/28/2016	6:37 AM – 11:23 AM	Brennan Mulrooney	start: 59°, 90%, 10 mph end: 59°, 90%, 10 mph
3	5/6/2016	8:30 AM – 2:10 PM	Brennan Mulrooney	start: 59°, 100%, 1 mph end: 64°, 80%, 3 mph
4	5/13/2016	9:32 AM – 2:03 PM	Brennan Mulrooney	start: 66°, 100%,3 mph end: 69°, 20%, 8 mph
5	5/18/2016	7:11 AM – 12:31 PM	Brennan Mulrooney	start: 66°, 100%,3 mph end: 67°, 80%, 5 mph
6	5/25/2016	7:45 AM – 11:39 PM	James McMorran	start: 63°, 50%, 3 mph end: 70°, 50%, 5 mph
7	6/1/2016	10:20 AM – 2:00 PM	James McMorran	start: 61°, 100%, 3 mph end: 68°, 90%, 5 mph
8	6/9/2016	7:16 AM – 11:41 PM	Brennan Mulrooney	start: 64°, 100%, 3 mph end: 66°, 100%, 6 mph
9	6/15/2016	7:57 AM – 12:48 PM	Brennan Mulrooney	start: 63°, 100%, 3 mph end: 68°, 0%, 5 mph
10	6/22/2016	7:27 AM – 12:53 PM	James McMorran	start: 68°, 40%, 3 mph end: 77°, 25%, 6 mph
11	6/29/2016	7:32 AM – 12:35 PM	James McMorran	start: 65°, 80%, 4 mph end: 75°, 10%, 8 mph
12	7/6/2016	12:30 PM – 5:20 PM	James McMorran	start: 73°, 90%, 8 mph end: 73°, 40%, 7 mph
13	7/13/2016	8:11 AM – 12:15 PM	James McMorran	start: 70°, 100%, 3 mph end: 75°, 10%, 7 mph
14	7/18/2016	2:59 PM – 7:09 PM	James McMorran	start: 77°, 20%, 8 mph end: 72°, 10%, 5 mph
15	7/28/2016	11:12 AM – 5:59 PM	Brennan Mulrooney	start: 73°, 0%, 3 mph end: 78°, 0%, 4 mph
16	8/3/2016	8:26 AM – 12:07 PM	Brennan Mulrooney	start: 69°, 25%, 3 mph end: 81°, 0%, 4 mph
17	8/8/2016	7:12 AM – 11:11 AM	James McMorran	start: 68°, 100%¸3 mph end: 75°, 100%¸ 4 mph
18	8/16/2016	8:35 AM – 12:47 PM	Brennan Mulrooney	start: 70°, 50%¸2 mph end: 78°, 0%, 8 mph
19	8/27/2016	10:09 AM – 3:24 PM	James McMorran	start: 68°, 100%,3 mph end: 77°, 5%, 8 mph
20	9/2/2016	11:27 AM – 3:18 PM	James McMorran	start: 74°, 20%, 5 mph end: 75°, 5%, 8 mph

Attachment 6

2017 Waterbird, Western Snowy Plover, and Least Tern Surveys

2017 Waterbird, Western Snowy Plover, and Least Tern Surveys

Table 1. List of survey dates, times, personnel, and weather conditions.

SURVEY #	DATE	TIME	BIOLOGIST	WEATHER Deg F, % Cloud Cover, Wind
1a	1/12/2017	9:18 AM – 1:51 PM	James McMorran Brennan Mulrooney	start: 58°, 100%, 3 mph end: 62°, 100%, 5 mph
1b	1/13/2017	8:23 AM – 12:44 PM	James McMorran Brennan Mulrooney	start: 61°, 100%, 2 mph end: 65°, 100%, 3 mph
2a	1/21/2017	7:00 AM – 12:15 PM	James McMorran Brennan Mulrooney	start: 62°, 100%, 9 mph end: 60°, 100%, 7 mph
2b	1/23/2017	7:32 AM – 4:23 PM	James McMorran Brennan Mulrooney	start: 60°, 80%,8 mph end: 61°, 70%, 9 mph
3a	2/6/2017	7:59 AM – 3:06 PM	James McMorran Brennan Mulrooney	start: 58°, 100%,5 mph end: 61°, 90%, 8 mph
3b	2/7/2017	9:20 AM – 4:06 PM	James McMorran Brennan Mulrooney	start: 57°, 100%, 4 mph end: 69°, 10%, 6 mph
4a	2/27/2017	8:23 AM – 2:17 PM	James McMorran Brennan Mulrooney	start: 54°, 100%, 3 mph end: 66°, 0%, 7 mph
4b	2/28/2017	7:44 AM – 2:00 PM	James McMorran Brennan Mulrooney	start: 56°, 30%, 6 mph end: 67°, 35%, 6 mph
5a	3/13/2017	9:54 AM – 1:38 PM	James McMorran Brennan Mulrooney	start: 61°, 40%, 8 mph end: 63°, 50%, 5 mph
5b	3/14/2017	8:00 AM – 12:55 PM	James McMorran Brennan Mulrooney	start: 62°, 80%, 3 mph end: 66°, 50%, 6 mph
6a	3/29/2017	2:50 PM – 4:45 PM	James McMorran Brennan Mulrooney	start: 65°, 0%, 5 mph end: 65°, 0%, 4 mph
6b	3/31/2017	9:46 AM – 1:01 PM	James McMorran Brennan Mulrooney	start: 61°, 40%, 4 mph end: 66°, 0%, 4 mph
7a	4/18/2017	11:34 AM – 5:54 PM	James McMorran Emma Fraser	start: 65°, 90%, 6 mph end: 68°, 5%, 7 mph
7b	4/19/2017	10:30 AM – 2:25 PM	James McMorran Emma Fraser	start: 64°, 30%, 7 mph end: 66°, 20%, 8 mph
8	4/27/2017	6:56 AM – 5:15 PM	James McMorran Brennan Mulrooney	start: 62°, 100%, 1 mph end: 78°, 30%, 1 mph
9a	5/2/2017	10:39 AM – 1:15 PM	James McMorran Brennan Mulrooney	start: 65°, 50%¸ 3 mph end: 68°, 20%¸ 5 mph
9b	5/3/2017	9:17 AM – 12:37 PM	James McMorran Brennan Mulrooney	start: 63°, 5%¸ 0 mph end: 65°, 5%, 8 mph
10a	5/15/2017	7:30 AM – 12:01 PM	James McMorran Brennan Mulrooney	start: 64°, 70%, 2 mph end: 62°, 90%, 1 mph
10b	5/16/2017	6:27 AM – 12:04 PM	James McMorran Brennan Mulrooney	start: 58°, 90%, 8 mph end: 68°, 80%, 3 mph
11a	5/29/2017	7:30 AM – 11:33 AM	James McMorran Brennan Mulrooney	start: 60°, 100%, 4 mph end: 63°, 100%, 3 mph
11b	5/30/2017	8:15 AM – 1:44 PM	James McMorran Brennan Mulrooney	start: 62°, 100%, 0 mph end: 66°, 100%, 3 mph
12a	6/12/2017	9:28 AM – 2:57 PM	James McMorran Brennan Mulrooney	start: 69°, 0%, 5 mph end: 68°, 0%, 0 mph

SURVEY #	DATE	TIME	BIOLOGIST	WEATHER Deg F, % Cloud Cover, Wind
12b	6/13/2017	11:55 AM – 1:50 PM	James McMorran Brennan Mulrooney	start: 70°, 0%, 0 mph end: 71°, 0%, 0 mph
13a	6/26/2017	9:01 AM – 11:16 AM	James McMorran Brennan Mulrooney	start: 72°, 20%, 0 mph end: 73°, 30%, 0 mph
13b	6/27/2017	9:16 AM – 1:21 PM	James McMorran Brennan Mulrooney	start: 71°, 0%, 0 mph end: 75°, 0%, 7 mph
14a	7/18/2017	6:45 AM – 10:57 AM	James McMorran Brennan Mulrooney	start: 69°, 100%, 0 mph end: 74°, 30%, 8 mph
14b	7/19/2017	7:01 AM – 11:37 AM	James McMorran Brennan Mulrooney	start: 71°, 90%, 4 mph end: 75°, 60%, 5 mph
15a	7/31/2017	7:30 AM – 1:59 PM	James McMorran Brennan Mulrooney	start: 73°, 100%, 1 mph end: 73°, 90%, 0 mph
15b	8/1/2017	7:17 AM – 12:30 PM	James McMorran Brennan Mulrooney	start: 69°, 100%, 0 mph end: 76°, 90%, 2 mph
16a	8/14/2017	8:58 AM – 12:20 PM	James McMorran Brennan Mulrooney	start: 67°, 100%, 0 mph end: 72°, 0%, 4 mph
16b	8/15/2017	10:58 AM – 3:24 PM	James McMorran Brennan Mulrooney	start: 68°, 100%, 0 mph end: 68°, 100%, 0 mph
17a	8/24/2017	8:58 AM – 12:51 PM	James McMorran Brennan Mulrooney	start: 69°, 100%, 0 mph end: 71°, 100%, 1 mph
17b	8/25/2017	8:36 AM – 12:24 PM	James McMorran Brennan Mulrooney	start: 70°, 100%, 1 mph end: 71°, 100%, 1 mph
18a	9/13/2017	7:06 AM – 2:30 PM	James McMorran Brennan Mulrooney	start: 71°, 100%, 1 mph end: 73°, 100%, 7 mph
18b	9/15/2017	8:52 AM – 1:38 PM	James McMorran Brennan Mulrooney	start: 72°, 100%, 1 mph end: 77°, 30%, 7 mph
19a	9/27/2017	11:31 AM – 2:54 PM	Emma Fraser Brennan Mulrooney	start: 77°, 0%, 1 mph end: 82°, 0%, 1 mph
19b	9/28/2017	8:53 AM – 12:51 PM	Emma Fraser Brennan Mulrooney	start: 74°, 100%, 1 mph end: 83°, 0%, 2 mph
20a	10/9/2017	7:00 AM – 12:10 PM	Rick Bailey James McMorran	start: 57°, 100%, 1 mph end: 64°, 60%, 0 mph
20b	10/10/2017	6:53 AM – 1:30 PM	Rick Bailey James McMorran	start: 60°, 0%, 1 mph end: 73°, 0%, 1 mph
21a	11/7/2017	6:45 AM – 10:36 AM	James McMorran Brennan Mulrooney	start: 58°, 100%, 0 mph end: 67°, 100%, 0 mph
21b	11/8/2017	6:48 AM – 9:18 AM	James McMorran Brennan Mulrooney	start: 55°, 20%, 0 mph end: 55°, 20%, 0 mph
22a	12/13/2017	7:00 AM – 12:31 PM	Emma Fraser James McMorran	start: 72°, 0%, 0 mph end: 73°, 0%, 0 mph
22b	12/14/2017	9:32 AM – 2:03 PM	Emma Fraser James McMorran	start: 66°, 5%, 0 mph end: 74°, 15%, 1 mph

Attachment 7

2016 and 2017 Belding's Savannah Sparrow Surveys

2016 and 2017 Belding's Savannah Sparrow Surveys

Table 1: Belding's Savannah Sparrow Surveys (2016/2017) Survey Dates, Personnel, Weather Conditions and Observations

Survey Number	Date	Survey Personnel	Time	Weather Conditions
1[a]	4/11/2016	James McMorran	0715–1123	Start: 58 °F; wind 0 mph; 0 % cloud cover End: 66 °F; wind 6 mph; 0 % cloud cover
1[b]	4/12/2016	James McMorran	0800–0940	Start: 61 °F; wind 0 mph; 90 % cloud cover End: 64 °F; wind 4 mph; 50 % cloud cover
2[a]	4/20/2016	James McMorran	0700–1130	Start: 62 °F; wind 2 mph; 0 % cloud cover End: 71 °F; wind 5 mph; 0 % cloud cover
2[b]	4/21/2016	James McMorran	0645–0955	Start: 64 °F; wind 2 mph; 60 % cloud cover End: 71 °F; wind 4 mph; 10 % cloud cover
3[a]	4/24/2016	James McMorran	0630–1030	Start: 55 °F; wind 4 mph; 60 % cloud cover End: 64 °F; wind 8 mph; 15 % cloud cover
3[b]	4/27/2016	James McMorran	0640-0850	Start: 55 °F; wind 0 mph; 0 % cloud cover End: 58 °F; wind 4 mph; 0 % cloud cover
4[a]	5/4/2016	Brennan Mulrooney	0605-0932	Start: 60 °F; wind 1 mph; 100 % cloud cover End: 62 °F; wind 4 mph; 100 % cloud cover
4[b]	5/5/2016	Brennan Mulrooney	0627-0939	Start: 55 °F; wind 0 mph; 60 % cloud cover End: 64 °F; wind 2 mph; 100 % cloud cover
5[a]	5/12/2016	James McMorran	0530-1050	Start: 59 °F; wind 3 mph; 100 % cloud cover End: 67 °F; wind 6 mph; 40 % cloud cover
5[b]	5/13/2016	James McMorran	0545-0840	Start: 62 °F; wind 4 mph; 70 % cloud cover End: 66 °F; wind 3 mph; 30 % cloud cover
6[a]	5/19/2016	James McMorran	0525-1055	Start: 61 °F; wind 2 mph; 100 % cloud cover End: 658 °F; wind 4 mph; 90 % cloud cover
6[b]	5/20/2016	James McMorran	0600-0840	Start: 59 °F; wind 4 mph; 70 % cloud cover End: 64 °F; wind 7 mph; 50 % cloud cover

2017

Survey Number	Date	Survey Personnel	Time	Weather Conditions
1[a]	3/20/2017	James McMorran	N/A	Start: N/A °F; wind N/A mph; N/A % cloud cover End: N/A °F; wind N/A mph; N/A % cloud cover
1[b]	3/21/2017	James McMorran	N/A	Start: N/A °F; wind N/A mph; N/A % cloud cover End: N/A °F; wind N/A mph; N/A % cloud cover
2[a]	4/6/2017	Brennan Mulrooney	0630–1030	Start: 58 °F; wind 0 mph; 100 % cloud cover End: 63 °F; wind 2 mph; 10 % cloud cover
2[b]	4/7/2017	Brennan Mulrooney	0620–0950	Start: 58 °F; wind 0 mph; 20 % cloud cover End: 64 °F; wind 4 mph; 30 % cloud cover
3[a]	4/20/2017	Brennan Mulrooney	0615–1029	Start: 56 °F; wind 2 mph; 100 % cloud cover End: N/A °F; wind N/A mph; N/A % cloud cover
3[b]	4/21/2017	Brennan Mulrooney	0620-0950	Start: 52 °F; wind 1 mph; 10 % cloud cover End: 66 °F; wind 0 mph; 4 % cloud cover
4[a]	5/18/2017	Brennan Mulrooney	0605-0932	Start: 58 °F; wind 0 mph; 10 % cloud cover End: 69 °F; wind 3 mph; 5 % cloud cover
4[b]	5/19/2017	Brennan Mulrooney	0612-0935	Start: 57 °F; wind 0 mph; 0 % cloud cover End: 69 °F; wind 3 mph; 0 % cloud cover

APPENDIX G

SAN ELIJO LAGOON RESTORATION PROJECT PRE-RESTORATION PHOTOPOINTS PHOTOLOG

SAN ELIJO LAGOON RESTORATION PROJECT
PRE-CONSTRUCTION PHOTOGRAPHS

Applicant

California Department of Transportation
District 11
4050 Taylor Street
San Diego, California 92110
and
San Elijo Lagoon Conservancy
P.O. Box 230634
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Prepared by:

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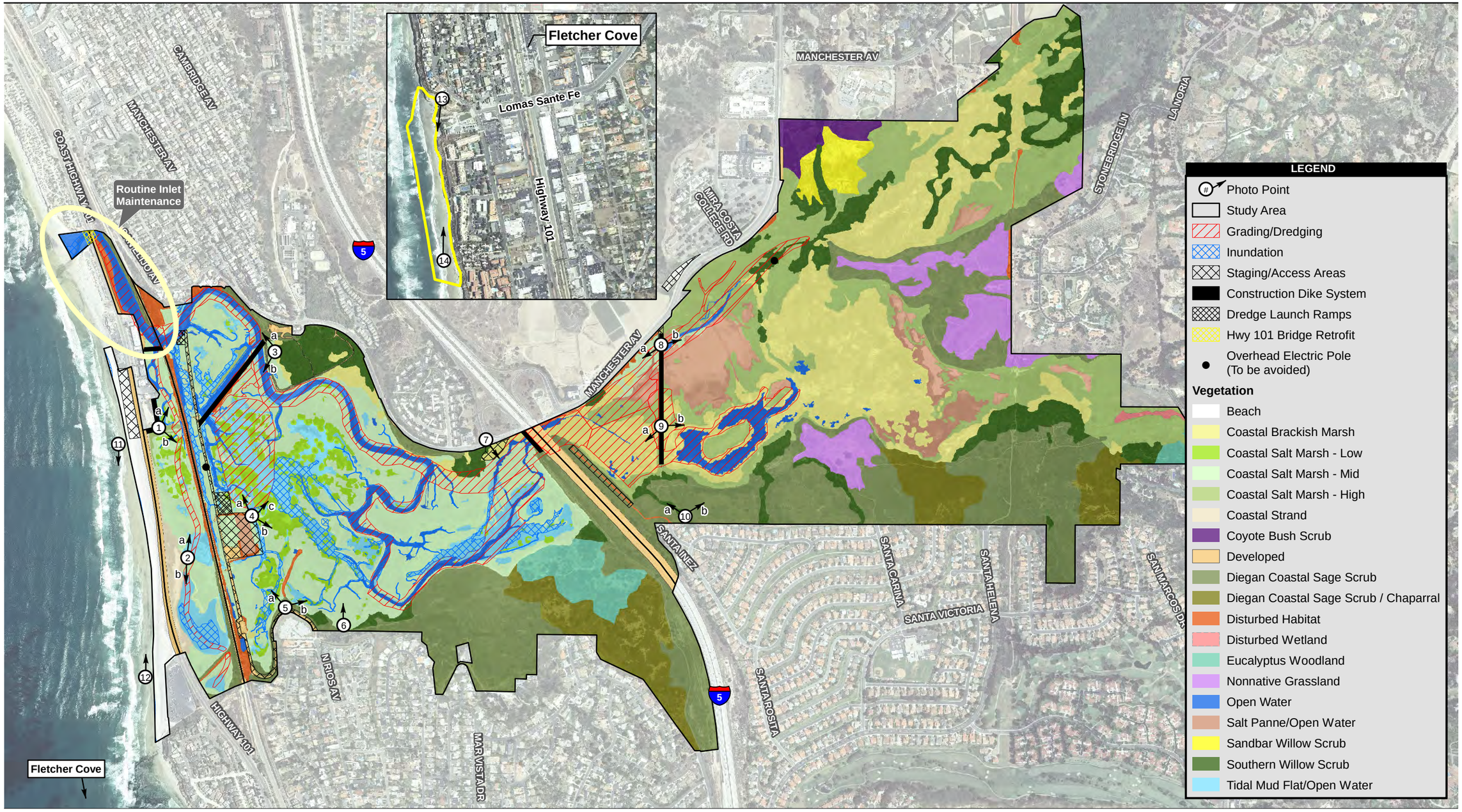
December 2017



Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

San Elijo Lagoon Restoration Project
Existing Vegetation & Limits of Disturbance
Photo Point Locations

San Elijo Lagoon Restoration Project

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\BTR_BA\BA\Revised_Alt_Jan2017\Addendum\Reduced_Alt1b_Refined_Photopoints_Map.mxd, 12/5/2017, paul.moreno

MONITORING PHOTOGRAPHS

Photo Point 1a, West Basin (33° 0′ 37″ N, -117° 16′ 43″ W); bearing to subject 16° N ± 10°

Photo Point 1b, West Basin (33° 0′ 37″ N, -117° 16′ 43″ W); bearing to subject 138° SE ± 10°

Permanent Photo Points 1a and 1b
12/1/2017

Photo Point 2a, West Basin (33° 0′ 24″ N, -117° 16′ 40″ W); bearing to subject 335° NW ± 15°

Photo Point 2b, West Basin (33° 0′ 24″ N, -117° 16′ 40″ W); bearing to subject 116° SE ± 10°

Permanent Photo Points 2a and 2b
12/1/2017

Photo Point 3a, Central Basin (33° 0′ 46″ N, -117° 16′ 28″ W); bearing to subject 254° W ± 25°

Point Photo 3b, Central Basin (33° 0′ 46″ N, -117° 16′ 28″ W); bearing to subject 181° S ± 15°

Permanent Photo Points 3a and 3b
12/1/2017

Photo Point 4a, Central Basin (33° 0′ 27″ N, -117° 16′ 30″ W); bearing to subject 318° W

Photo Point 4b, Central Basin (33° 0′ 27″ N, -117° 16′ 30″ W); bearing to subject 51° NE

Photo Point 4c, Central Basin (33° 0′ 27″ N, -117° 16′ 30″ W); bearing to subject 36° SE

Permanent Photo Point 4c
12/1/2017

Photo Point 5a, Central Basin (33° 0′ 15″ N, -117° 16′ 22″ W); bearing to subject 319° NW ± 15°

Photo Point 5b, Central Basin (33° 0′ 15″ N, -117° 16′ 22″ W); bearing to subject 47° NE ± 15°

Photo Point 6, Central Basin (33° 0′ 13″ N, -117° 16′ 18″ W); bearing to subject 10° N ± 15°

Permanent Photo Point 6
12/1/2017

Photo Point 7, Central Basin (33° 0′ 35″ N, -117° 15′ 58″ W); bearing to subject 120° SE ± 10°

Permanent Photo Point 7
12/1/2017

Photo Point 8a, East Basin (33° 0′ 46″ N, -117° 15′ 35″ W); bearing to subject 225° SW ± 85°

Photo Point 8b, East Basin (33° 0′ 46″ N, -117° 15′ 35″ W); bearing to subject 57° NE ± 35°

Photo Point 9a, East Basin (33° 0′ 36″ N, -117° 15′ 35″ W); bearing to subject 250° W ± 15°

Photo Point 9b, East Basin (33° 0′ 36″ N, -117° 15′ 35″ W); bearing to subject 78° E ± 15°

Permanent Photo Points 9a and 9b
12/1/2017

Photo Point 10a, East Basin (33° 0′ 26″ N, -117° 15′ 33″ W); bearing to subject 290° W ± 10°

Photo Point 10b, East Basin (33° 0′ 26″ N, -117° 15′ 33″ W); bearing to subject 5° N ± 10°

Permanent Photo Points 10a and 10b
12/1/2017

Photo Point 11, Cardiff State Beach (33° 0′ 43″ N, -117° 16′ 48″ W); bearing to subject 160° S ± 15°

Photo Point 12, Cardiff State Beach (33° 0′ 14″ N, -117° 16′ 42″ W); bearing to subject 343° N ± 15°

Photo Point 13, Fletcher Cove (32° 59′ 31″ N, -117° 16′ 28″ W); bearing to subject 144° SE ± 20°

Photo Point 14, Fletcher Cove (32° 59′ 26″ N, -117° 16′ 28″ W); bearing to subject 335° NW ± 10°

PHOTOGRAPH LOG FORM

PHOTO- LOG FORM

Project: san elijo lagoon restoration project
Location: san elijo lagoon
Date: 12/1/17
Photographer: kathryn cartaino and barry lindgren
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
25, 27	2:22pm	1ab	las olas parking lot	16°N ± 10°, 138°SE ± 10°	west basin veg
29, 31	2:40pm	2ab	san dune in wb	335°NW ± 15°, 116°SE ± 10°	west basin veg
19, 21	1:35pm	3ab	nature center trail	254°W ± 25°, 181°S ± 15°	main channel
1, 2, 3	8:00am	4abc	corner of settling pond	318°W, 51°NE, 36°SE	future od pit
13, 16	12:50pm	5ab	northrios access rd.	319°NW ± 15°, 47°NE ± 15°	central basin veg.
17	1:03pm	6	annie's trail	10°N ± 15°	central basin veg.
23	1:52pm	7	manchester ave	120°SE ± 10°	east basin veg.
2, 4	11:36am	8ab	cdfw dike 6 (N)	225°SW ± 85°, 57°NE ± 35°	east basin veg.
5, 7	11:57am	9ab	cdfw dike 6 (S)	250°W ± 15°, 78°E ± 15°	east basin veg.
9, 11	12:15pm	10ab	santa inez ave.	290°W ± 10°, 5°N ± 10°	east basin veg
33	2:58pm	11	cardiff beach (N)	160°S ± 15°	sand on cardiff
35	3:20pm	12	cardiff beach (S)	343°N ± 15°	sand on cardiff
37	3:47pm	13	fletcher cove (N)	144°SE ± 20°	sand on fletcher
39	4:00pm	14	fletcher cove (S)	335°NW ± 10°	sand on fletcher

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

69° sunny, no cloud cover
sunrise 6:35am, sunset 4:42pm
UV index 3, visibility 10 miles

tide 12/1/17
> high
6:50am, 6.7 feet
7:45pm, 4.7 feet
> low
12:28am, 1.0 feet
1:36 pm, -0.6 feet

PHOTO- LOG FORM

Project: sahelijo lagoon restoration project (selrp)
Location: san elijo lagoon
Date: 12/1/17
Photographer: kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
25	2:22	1a	corner of las olas	116°N ±10	west basin veg.
	pm		parking lot		
26	2:23	1a	facing north		
	pm				
27	2:25	1b	facing south	138° SE ±10	
	pm				
29	2:26	1b			
	pm				

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 37" N, 117°16' 43" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: SW corner of las olas parking lot

Subject Description: west basin veg

Date: 12/1/17

Time: 2:22-2:26pm

PHOTO- LOG FORM

Project: selrp
Location: San elijo lagoon
Date: 12/1/17
Photographer: kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
29	2:40 pm	2a	edge of coastal strand in W6	335°NW ±5	west basin veg.
30	2:41 pm	2a			
31	2:42 pm	2b		116°SE ±10°	
32	2:43 pm	2b			

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 24"N, 117° 16' 40"W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: west basin on sand tune (farthest point east)

Subject Description: west basin veg.

Date: 12/1/17

Time: 2:40 - 2:43 pm

PHOTO- LOG FORM

Project: selrp
Location: san elijo lagoon
Date: 12/1/17
Photographer: kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
19	1:35	3a	nature center	254°W ± 25°	main channel
	pm		trail where		
20	1:36	3a	future bridge		
	pm		connection will	be	
21	1:37	3b	south	191° S ± 15°	
	pm				
22	1:38	3b			
	pm				

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 46" N, 117° 16' 28" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: nature center trail where future bridge connection will be located

Subject Description: main channel, view of od pit

Date: 12/1/17

Time: 1:35pm - 1:38pm

Photo-Log

Project: SELRP Pre-construction Survey
Location: West Central Basin - SELER
Date: 12/1/2017
Time: 7:30am
Photographer: Barry Lindgren
Team Members: None

Photo No.	***Time (PST)***	***Photo Point (PPT) ID***	***PPT Description & Location***	***Bearing to Subject (Mag.)***	***Subject Description***
0112	0813	***4a***	Southeastern corner of old sewage settling pond: -117.275103 33.007561	318° W	Future Overdredge Pit (OD) - West Edge; Focus Point: Plastino Bldg.
0102	0730	***4b***	Southeastern corner of old sewage settling pond: -117.275103 33.007561	051° NE	Future Overdredge Pit (OD) - East Edge; Focus Point: western-most structure in cluster of homes
0109	0754	***4c***	Southeastern corner of old sewage settling pond: -117.275103 33.007561	036° SE	Future Overdredge Pit (OD) - Center; Focus Point: SEL Nature Center

PHOTO- LOG FORM

Project: SELPP
Location: San Elijo lagoon
Date: 12/1/17
Photographer: Kathryn Cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
13	12:50	5a	north rios access	319° NW ±15°	central basin veg
	pm		road (west)		
14	12:51	5a	north rios access		
	pm		road		
15	12:55	5b	north rios access	47° NE ±15°	
	pm		road		
16	12:56	5b	north rios access		
	pm		road		
17	1:03	6	annie's trail	10° N ±15°	
18	pm		east		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

(5) 33° 0' 15" N, 117° 16' 22" W

(6) 33° 0' 13" N, 117° 16' 18" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: ⑤ north vios access road

⑥ annie's trail

Subject Description: central basin vegetation, prior to overdredge pit

Date: 12/1/17

Time: 12:50pm - 1:03pm

PHOTO- LOG FORM

Project: selrep
Location: san elijo lagoon
Date: 12/1/17
Photographer: kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
23	1:52	7	manchester ave,	120° SE ±10°	east basin veg
	pm		west of I-5 at		
24	1:53		stop sign		
	pm		facing south		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 35" N, 117° 15' 58" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: manchester ave, west of I-5 at stop sign

Subject Description: east basin veg. prior to main channel widening

Date: 12/1/17

Time: 1:52-1:53pm

PHOTO- LOG FORM

Project: San elijo lagoon restoration project
Location: San elijo lagoon
Date: 12/1/17
Photographer: Kathryn Cartino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
1	11:36	8a	cdfw dike 6, eb	225° SW ±85°	east basin
	am				vegetation
			westward view		prior to
2	11:37	8a	cdfw dike 6, eb		channel
	am				widening
			westward view		
3	11:46	8b	cdfw dike 6, eb	67° NE ± 35°	
	am				
			eastward view		
4	11:47	8b	cdfw dike 6, eb		
	am				
			eastward view		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 46" N, 117° 15' 35" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: san elijo lagoon, cdfw dike 6 in the east basin (northern side of dike near manchester avenue)

Subject Description: vegetation in east basin, prior to widening of channel.
8a (1&2) - looking west towards I-5
8b (1&2) - looking east towards ecc/olivenhain

Date: 12/1/17

Time: 11:36am - 11:47am

PHOTO- LOG FORM

Project: san elijo lagoon restoration project (selrep)
Location: san elijo lagoon
Date: 12/1/17
Photographer: Kathryn castaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
5	11:57	9a	cdfw dike 6, eb	250° W ± 15°	east basin
	am		facing west		vegetation
					prior to
6	11:58	9a	cdfw dike 6, eb		channel
	am		facing west		widening;
					figure 8 pond
7	11:59	9b	cdfw dike 6, eb	79° E ± 15°	vegetation (9b)
	am		facing east		
8	12:00	9b	cdfw dike 6, eb		
	pm		facing east		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 36"N, 117° 15' 35"W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: cdfw dike 6 in the east basin (southern side near santa inez avenue)

Subject Description: vegetation in east basin, prior to channel widening. 9b shows figure 8 pond vegetation (cattails)

9a (1 of 2) - facing west

9b (1 of 2) - facing east

Date: 12/1/17

Time: 11:57 am - 12:00 pm

PHOTO- LOG FORM

Project: selrp
Location: san elijo lagoon
Date: 12/1/17
Photographer: kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
9	12:15	10a	santa inez ave	290°W ± 10°	east basin veg.
	pm		facing west		
10	12:16	10a	santa inez ave		
	pm		facing west		
11	12:21	10b	santa inez ave	5°N ± 10°	
	pm		facing east		
12	12:22	10b	santa inez ave		
	pm		facing east		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 26" N, 117° 15' 33" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: start of trail at santa inez ave

Subject Description: east basin veg along I-5 (west) and figure 8 pond (east)

Date: 12/11/7

Time: 12:15-12:22 pm

PHOTO- LOG FORM

Project: selap
Location: cardiff state beach
Date: 12/1/17
Photographer: kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
33	2:58	11	rock revet. outside	160° S ± 15°	sand on cardiff
	pm		of chart house		beach
34	2:59		on cardiff beach		
	pm		looking south		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 43" N, 117° 16' 48" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: cardiff state beach on rock revetment just south of the chart house

Subject Description: sand on cardiff beach

Date: 12/1/17

Time: 2:58 - 2:59 pm

PHOTO- LOG FORM

Project: selrap
Location: Cardiff state beach
Date: 12/11/17
Photographer: kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
35	3:20	12	rock revet	343°N ±15°	sand on cardiff
	pm		(north of seaside		
36	3:21		parking lot) on		
	pm		cardiff beach,		
			northbound		
			view		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

33° 0' 14" N, 117° 16' 42" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: rock revetment just north of seaside parking lot

Subject Description: sand on cardiff beach

Date: 12/1/17

Time: 3:20-3:21pm

PHOTO- LOG FORM

Project: selkp
Location: fletcher cove (solana beach)
Date: 12/1/17
Photographer: Kathryn Courtaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
37	3:47 pm	13	north end of fletcher cove,	144°SE ± 20	sand on fletcher cove
38	3:48 pm	13	on hillside by community center looking south		

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

32° 59' 31" N, 117° 16' 28" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: fletcher cove on hillside near the fletcher cove community center

Subject Description: sand on fletcher cove

Date: 12/1/7

Time: 3:47 -3:48 pm

PHOTO- LOG FORM

Project: selrp
Location: fletcher cove (solana beach)
Date: 12/1/17
Photographer: Kathryn cartaino
Team members:

Photo #	Time	Photo Point ID	Photo Pt. Description & Location	Bearing to Subject	Subject Description
39	4:00 pm	14	south at fletcher cove beach,	335° NW ± 10°	sand on fletcher
40	4:01 pm	14	next to start of sea wall looking north		cove

General Notes or Comments (weather, cloud cover, time of sunrise and sunset, other pertinent information):

32° 59' 26" N, 117° 16' 28" W

PHOTO SIGN FORM: Print this form on yellow paper. Complete the following information for each photograph. Include in the photographic view so that it will be legible in the finished photo.

Location: fletcher cove, south on the beach right as large bluff starts (before seawall)

Subject Description: sand on fletcher cove

Date: 12/1/17

Time: 1:00-1:01pm

APPENDIX H

SAN ELIJO LAGOON RESTORATION PROJECT PRE-RESTORATION CALIFORNIA RAPID ASSESSMENT METHOD ANALYSIS

SAN ELIJO LAGOON RESTORATION PROJECT
PRE-RESTORATION
CALIFORNIA RAPID ASSESSMENT METHOD ANALYSIS

Prepared for:

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November 2016

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EXECUTIVE SUMMARY

San Elijo Lagoon and adjacent uplands provide habitats that support sensitive species, including federally threatened and endangered plants and animals, and resident and migratory wildlife. The lagoon has three basins: west, central, and east. Over the past several decades, the lagoon system has gradually degraded due to the influence of urban development within the watershed. This development has altered the sediment supply, nutrient levels, and hydrology and, subsequently, the physical and biological functions of the lagoon system. Water quality is impaired due to historical accumulation of nutrients in lagoon sediments, lack of circulation in the lagoon, and sedimentation in areas of impounded water. Muted tidal conditions, changes in inundation frequency, and increasing freshwater inputs from upstream development have resulted in homogenizing of habitats with the loss of mudflats and an increase in freshwater marsh habitat. The overarching goal of the San Elijo Restoration Project (SELRP) is to protect and restore, then maintain via adaptive management, the San Elijo Lagoon ecosystem and its adjacent uplands to sustain and perpetuate native flora and fauna that are characteristic of southern California, and restore and maintain estuarine and brackish marsh hydrology. The SELRP is part of a mitigation strategy for transportation infrastructure projects associated with comprehensive, system-wide improvements in the North Coast Corridor.

The lagoon was assessed using the California Rapid Assessment Method for Wetlands (CRAM) before restoration activities begin to determine the current wetland condition of San Elijo Lagoon. CRAM is a rapid assessment method that requires collecting Level 2 data (coarse data) for monitoring wetland conditions. It is expected to become the chosen functional assessment method for future permitted projects throughout California, and is currently included in the U.S. Army Corps of Engineers mitigation ratio checklist. The pre-restoration CRAM scores will serve as reference for determining the success of the restoration activities. CRAM scores, 5-years post-restoration are expected to be the same or better than the pre-restoration CRAM scores.

CRAM was performed by AECOM CRAM certified practitioners from September 12 through 14, 2016. Twenty-five assessment areas (AAs) distributed across the lagoon were assessed to determine the condition of the lagoon in 2016 before restoration activities begin. The locations of 22 of the 25 AAs were the same as those used in the 2010 assessment conducted by the San Elijo Lagoon Conservancy. However, three of the AA locations were adjusted to better align with the post-restoration landscape.

Overall CRAM scores in the lagoon ranged from a low of 60 to a high of 85. The highest scoring AAs were C48 and C60 in the central basin and E75, a depressional AA in the east basin. The lowest scoring AAs were the estuarine AAs in the east basin (E2 and E36) as well as W4 in the

west basin. The lowest scores for the entire lagoon were received in the hydrology and physical structure attributes and associated metrics.

Buffer and Landscape metrics are not expected to change after restoration has been implemented. Hydrology, specifically water source, is affected by the level of development surrounding the lagoon. This is not expected to change after restoration. However, hydroperiod scores (tidal muting experienced by the lagoon) may increase after restoration, which aims to increase tidal flushing. After restoration an increase in physical and biotic structure scores may occur. At a minimum, after restoration has been implemented, the lagoon is expected to achieve these pre-restoration CRAM scores.

1.0 INTRODUCTION

1.1 SAN ELIJO LAGOON RESTORATION PROJECT OVERVIEW

San Elijo Lagoon (Figure 1) and adjacent uplands provide habitats that support sensitive species, including federally threatened and endangered plants and animals, and resident and migratory wildlife. The lagoon is composed of three basins: west, central, and east. The west basin is between the train tracks and Highway 101 and is the westernmost basin, closest to the coast. The central basin is between the train tracks and Interstate 5. The east basin is east of Interstate 5 and is the easternmost basin of the lagoon. San Elijo Lagoon has a relatively narrow connection to the ocean, and a confluence of freshwater flows from upstream sources. Transportation infrastructure traverses the lagoon, inhibiting freshwater flow to the ocean and tidal flow into the lagoon. Maintenance of the lagoon inlet is routinely performed to maintain a predominantly open system and allow for regular tidal flushing within the lagoon. While an open inlet allows freshwater and salt water exchange to occur more frequently, severe tidal muting occurs.

Over the past several decades, the lagoon system has gradually degraded due to the influence of urban development within the watershed. This development has altered the sediment supply, nutrient levels, and hydrology and, subsequently, the physical and biological functions of the lagoon system. Water quality is impaired due to historical accumulation of nutrients in lagoon sediments, lack of circulation in the lagoon, and sedimentation in areas of impounded water. Nutrient-laden sediment results in eutrophication, high biological oxygen demand, and low dissolved oxygen conditions. Low dissolved oxygen concentrations can increase mortality, reduce growth rates, and alter the distribution and behavior of aquatic organisms, all of which can have significant effects on the estuarine ecosystem (EPA 2003). Muted tidal conditions, changes in inundation frequency, and increasing freshwater inputs from upstream development have resulted in homogenizing of habitats with the loss of mudflats and an increase in freshwater marsh habitat

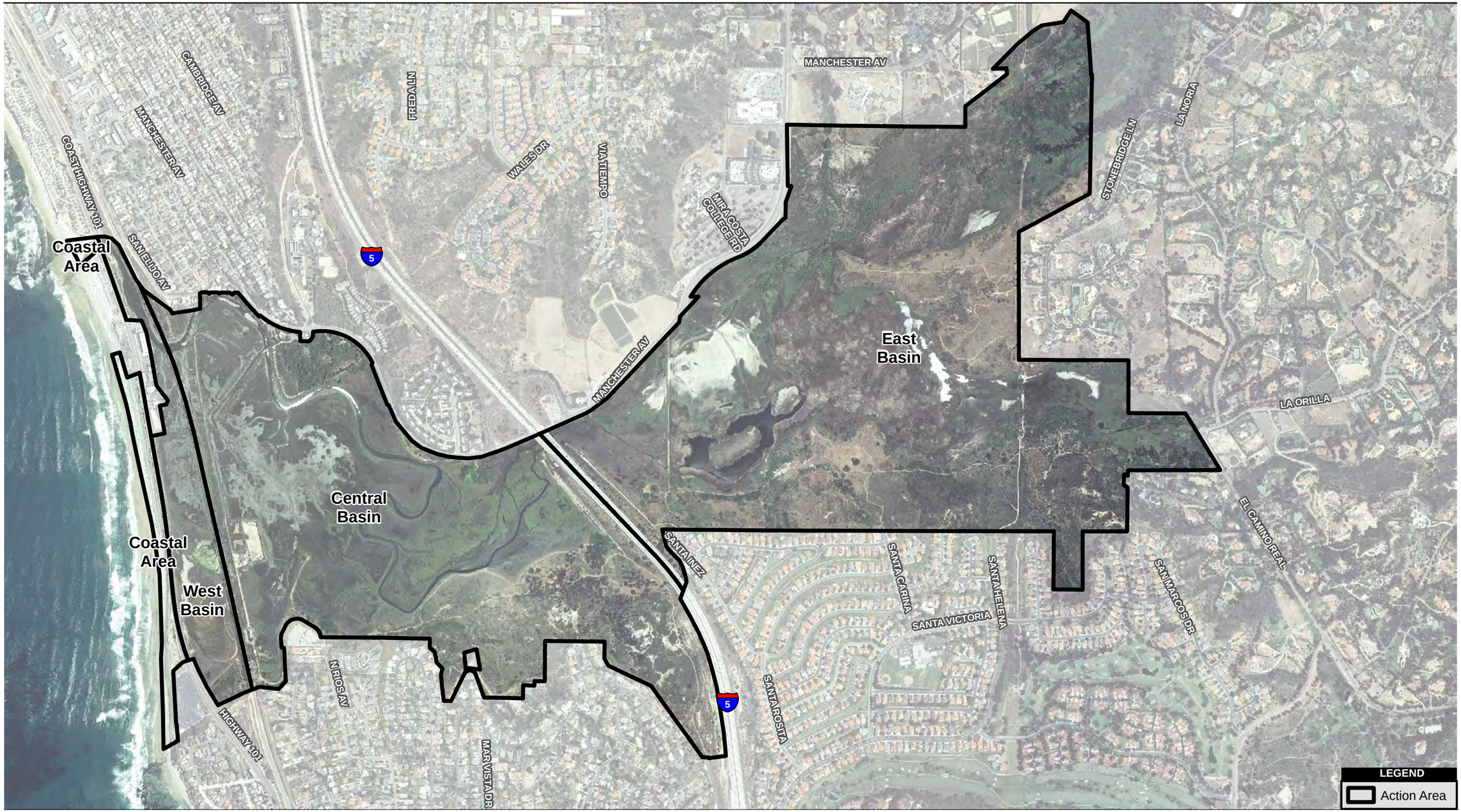
If measures are not taken to improve lagoon water quality and hydrology, eutrophication, muted tidal exchange, and restricted water circulation will continue to degrade the physical and biological functions of the lagoon. Therefore, the overarching goal of the San Elijo Restoration Project (SELRP) is to protect and restore, then maintain via adaptive management, the San Elijo Lagoon ecosystem and its adjacent uplands to sustain and perpetuate native flora and fauna that are characteristic of southern California, and restore and maintain estuarine and brackish marsh hydrology. The SELRP is part of a mitigation strategy for transportation infrastructure projects associated with comprehensive, system-wide improvements in the North Coast Corridor. The lagoon was assessed using the California Rapid Assessment Method for Wetlands (CRAM)

before restoration activities begin to determine the current wetland condition of San Elijo Lagoon. These pre-restoration CRAM scores will serve as reference for determining the success of the restoration activities. CRAM scores, 5-years post-restoration, are expected to be the same or better than the pre-restoration CRAM scores.

1.2 CALIFORNIA RAPID ASSESSMENT METHOD FOR WETLANDS OVERVIEW

CRAM has been in development over the last 10-plus years in collaboration with the resource agencies and scientists throughout California. The overall goal of CRAM is to "provide rapid, scientifically defensible, standardized, cost-effective assessments of the status and trends in the condition of wetlands and related policies, programs, and projects throughout California" (CWMW 2013a). CRAM is a rapid assessment method that requires collecting Level 2 data (coarse data) for monitoring wetland conditions. It is expected to become the chosen functional assessment method for future permitted projects throughout California, and is currently included in the U.S. Army Corps of Engineers mitigation ratio checklist.

One of the benefits of CRAM is that it does not require an intensive watershed-level assessment to calibrate variable scores. Instead, CRAM has been calibrated throughout California and in various wetland types. CRAM is an ambient monitoring and assessment tool that can be performed on different scales, ranging from an individual wetland to across a watershed or a larger region. CRAM is designed to collect a coarse assessment of a site's ambient conditions, but can be used to measure progress toward meeting success criteria established for wetland function/condition, and can be repeated over the long term if necessary or desired. Level 3 (fine scale) data are not necessary to complete a CRAM assessment, but are useful when determining many of the CRAM attribute scores and interpreting the final CRAM scores. CRAM is being used to assess the condition of San Elijo Lagoon before restoration begins. These scores will be used to determine ultimate success of the restoration actions over time as the lagoon is expected to achieve similar or better condition scores 5 years after the restoration implementation.



Source: SANDAG 2012; MoffattNichol; AECOM 2013

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

Figure 1
San Elijo Lagoon Project Area

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\Restoration_Plan\San Elijo Lagoon.mxd, 7/14/2016, Paul_Moreno

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2.0 METHODS

2.1 SELECTION OF ASSESSMENT AREA LOCATIONS

The San Elijo Lagoon Conservancy completed a CRAM assessment of the lagoon in 2010. Twenty-five assessment areas (AAs) were distributed across the lagoon to determine the condition of the lagoon in 2010. These same AAs served as the starting point for the 2016 baseline condition assessment before restoration activities begin at the lagoon. Three of the original AA locations were adjusted to better align with the post-restoration landscape (i.e., not be placed in a location that will be open water post-restoration) (Figure 2). CRAM was performed by AECOM CRAM certified practitioners from September 12 through 14, 2016, following the latest guidelines, currently version 6.1 (CWMW 2013a), and the field book of the appropriate wetland module (CWMW 2013b, 2013c).

2.2 DETERMINATION OF CRAM WETLAND TYPE

One of the first steps in CRAM is determining the wetland type to be assessed and using the appropriate field manual to assess a feature. Two different wetland types, and, therefore, two different modules, were used for this assessment: estuarine and depressional. The majority of the AAs (20) were estuarine wetlands, found in the west, central, and westernmost portion of the east Basin. However, five AAs in the east basin did not fit the CRAM definition of estuarine wetland and were assessed using the depressional module. The following summarizes these wetland types as defined by CRAM:

- **Estuarine** wetlands consists of aquatic (i.e., sub-tidal) and semi-aquatic (i.e., intertidal) environments that are strongly influenced by mixtures of ocean water and upland runoff due to tidal processes operating through an ocean inlet. Estuaries are mostly enclosed by land. Their inlets may be natural or unnatural.
- **Depressional** wetlands occur in topographic lows (i.e., closed-elevation contours) that allow the accumulation of surface water and, in some cases, groundwater. These systems can be natural or artificial in origin, and can occur on the landscape as isolated basins with distinct boundaries, as a complex of shallows and seasonally wet depressions created by the slight topographic relief with indistinct boundaries, or as a large complex of interconnected basins.

2.3 FIELD DETERMINATION OF ASSESSMENT AREA BOUNDARIES

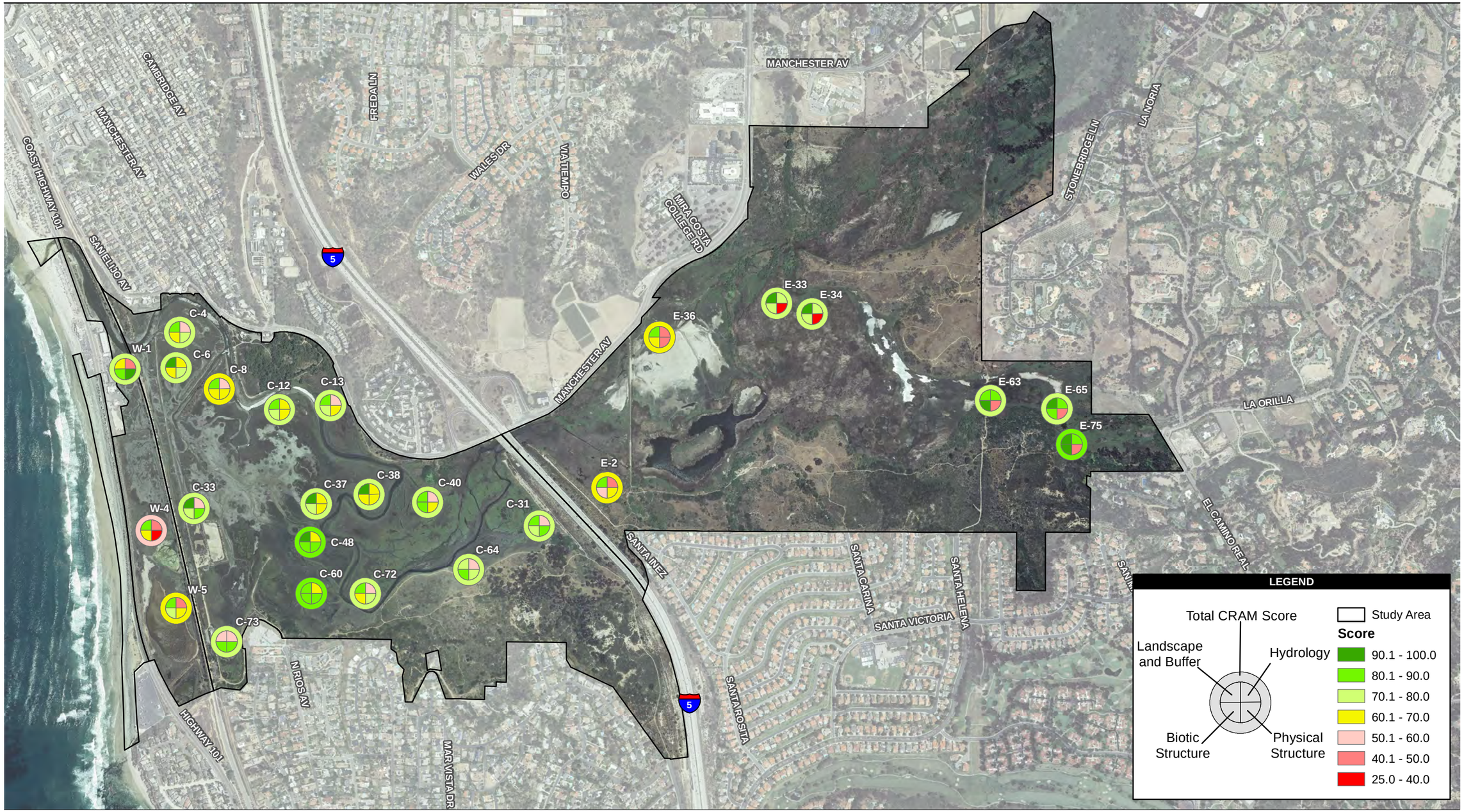
The boundaries of each AA were determined in the field using the guidance provided in the appropriate wetland type field manual. Figures 3.1 through 3.25 show the boundary of each AA.

Estuarine

The boundary of an estuarine wetland AA should be determined during low tide. The AA should not extend above the backshore, as indicated by wrack lines, transitions from intertidal to upland vegetation, etc., and it should not extend more than 10 meters across a non-vegetated tidal flat that adjoins the foreshore. The AA should not extend across any tidal channel that is wider than 30 meters or that cannot be safely crossed at low tide. The boundary of the AA can extend along the midline of such channels, but not across them. The AA can incorporate any smaller channels that can be safely crossed on the ground. The AA will, therefore, include all of the intertidal marsh plain and associated features, such as pannes and natural levees, plus all of the tidal channels that can be crossed, plus the exposed banks and beds of channels that border the AA. The recommended size and shape for estuarine wetlands is a 1-hectare circle, but the shape can be non-circular, if necessary, to fit the wetland with a minimum size of 0.1 hectare (CWMW 2013b).

Depressional

As a general rule, the AA should extend from the backshore, as indicated by high-water marks or a transition from wetland to upland plants, to the foreshore, the boundary between the vegetated wetland and any adjoining semi-aquatic, non-wetland area, or a fully aquatic area such as open water. If open water is present, the AA should extend 10 meters beyond the foreshore into open water. The backshore (landward boundary) of the AA will include any adjacent riparian vegetation that directly overhangs the wetland, including the entire footprint of individual trees or plants that overhang the wetland. If riparian vegetation does not overhang the wetland, an area 2 meters wide extending landward from the backshore as part of the AA is included. The recommended AA size for depressional wetlands is 1 hectare, and no larger than 2 hectares (CWMW 2013c).



Source: SANDAG 2012; AECOM 2014

1,100 550 0 1,100 Feet

Scale: 1:13,200; 1 inch = 1,100 feet

Figure 2
Spatial Distribution of CRAM Index and Attribute Scores

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Results_v2.mxd, 10/6/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
W1	N	30	W1	25
	S	40		15
	E	100		15
	W	75		15
	Average	**61.25**		15
				5
				5
				5
			Average	**12.5**

Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.1
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - W-1

AA		Aquatic Area Abundance	AA	Buffer
W4	N	91	W4	250
	S	76		50
	E	73		30
	W	88		120
	Average	**82**		250
				50
				20
				75
			Average	**105.625**

Source: SANDAG, MoffattNichol; AECOM.

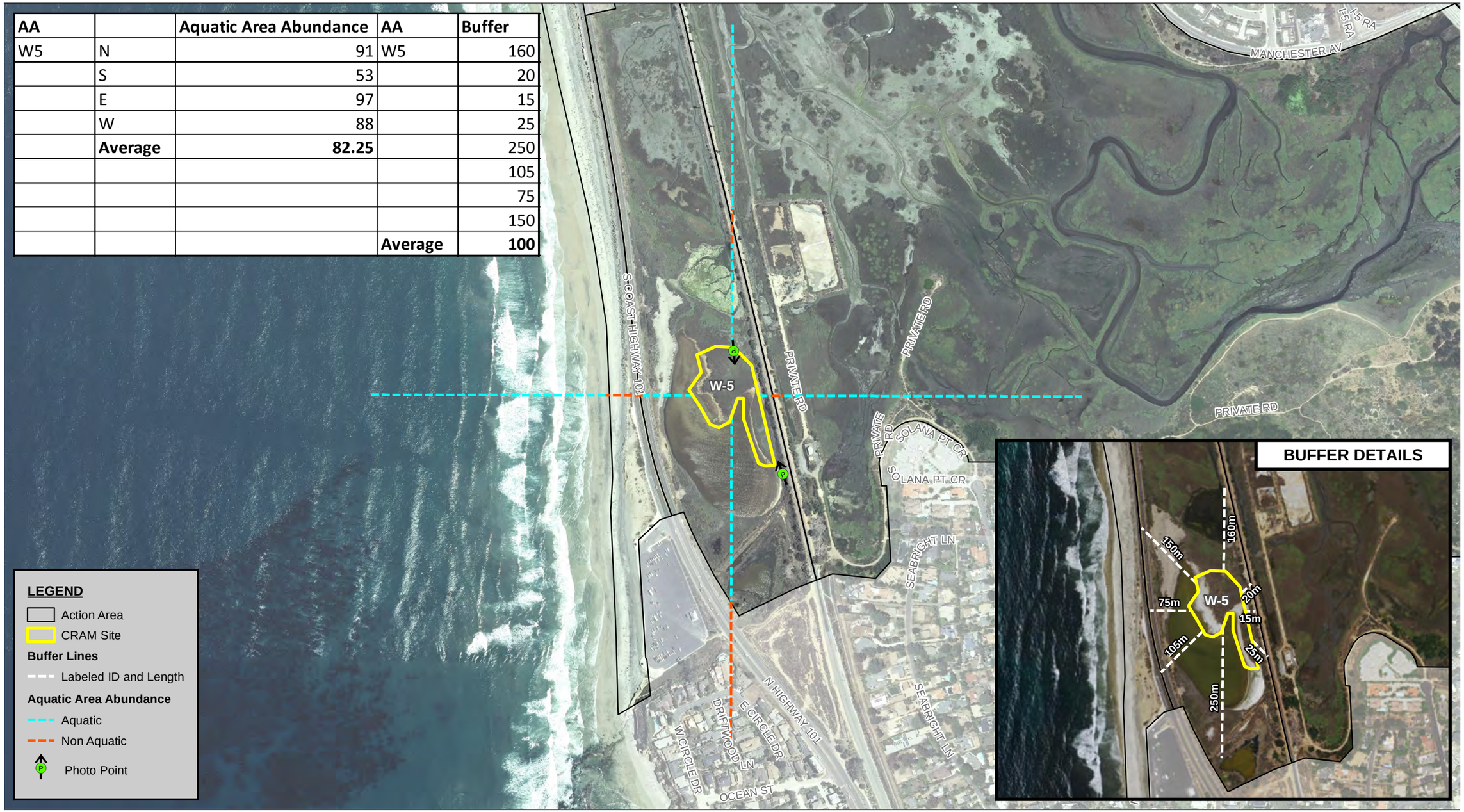
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.2
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - W-4

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_W4.mxd, 11/7/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
W5	N	91	W5	160
	S	53		20
	E	97		15
	W	88		25
	Average	**82.25**		250
				105
				75
				150
			Average	**100**



Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.3
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - W-5

AA		Aquatic Area Abundance	AA	Buffer
C4	N	15	C4	75
	S	100		88
	E	40		200
	W	75		250
	Average	**57.5**		250
				147
				147
				60
			Average	**152.125**

Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.4
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-4

AA		Aquatic Area Abundance	AA	Buffer
C6	N	40	C6	200
	S	91		176
	E	98		250
	W	74		250
	Average	**75.75**		250
				191
				162
				250
			Average	**216.125**

Source: SANDAG, MoffattNichol; AECOM.

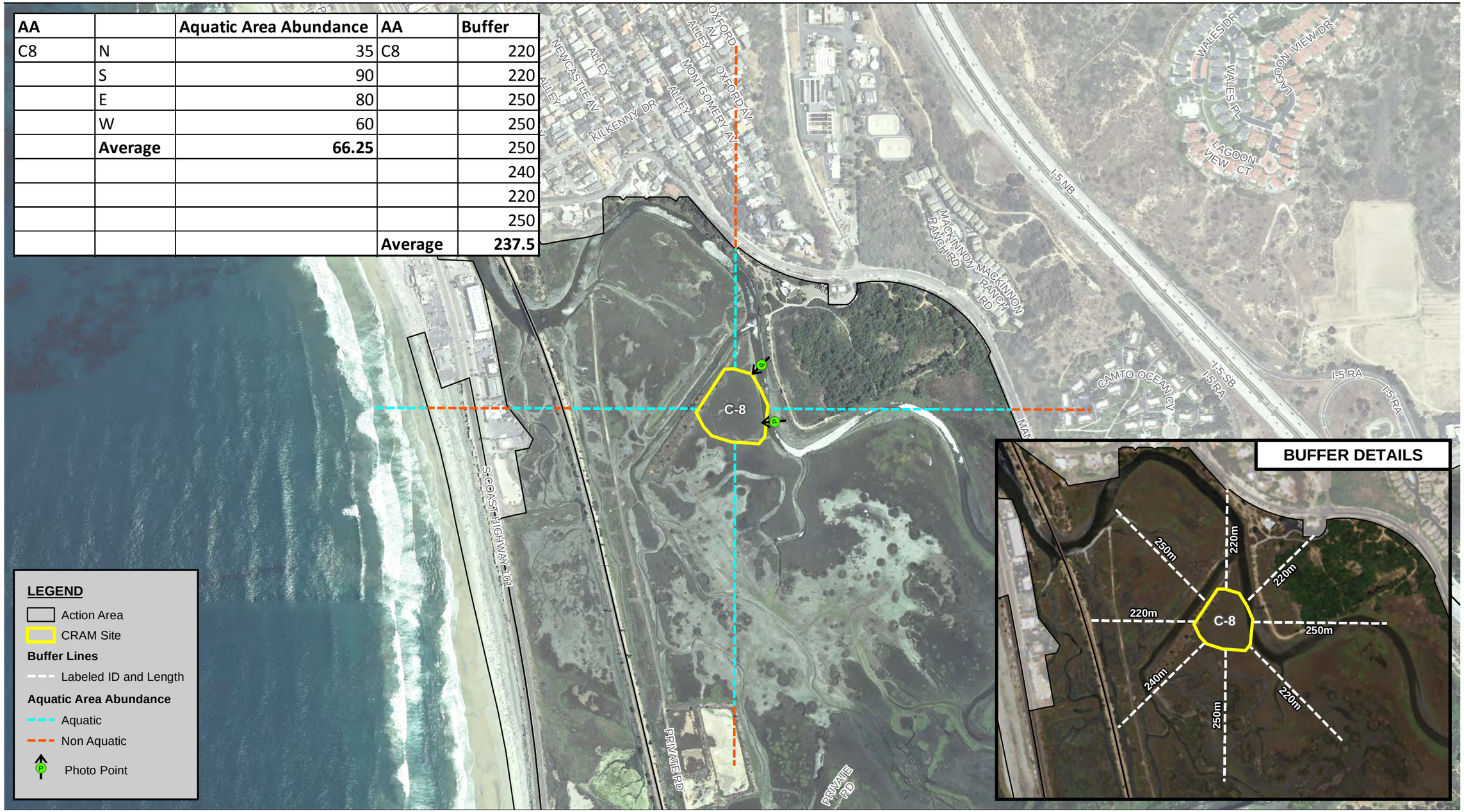
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.5
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-6

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C6.mxd, 11/8/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C8	N	35	C8	220
	S	90		220
	E	80		250
	W	60		250
	Average	**66.25**		250
				240
				220
				250
			Average	**237.5**



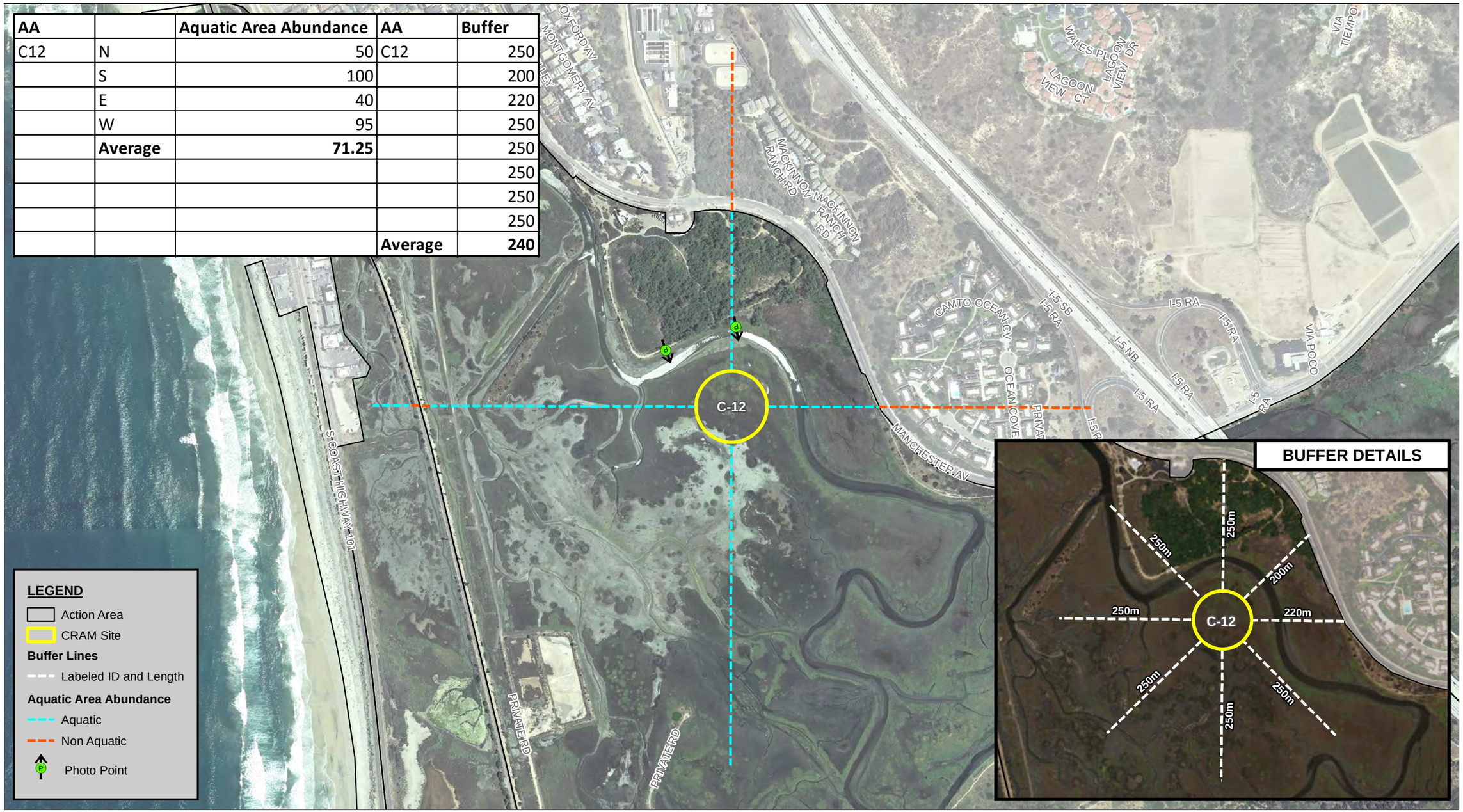
Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.6
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-8

AA		Aquatic Area Abundance	AA	Buffer
C12	N	50	C12	250
	S	100		200
	E	40		220
	W	95		250
	Average	**71.25**		250
				250
				250
				250
			Average	**240**



Source: SANDAG, MoffattNichol; AECOM.

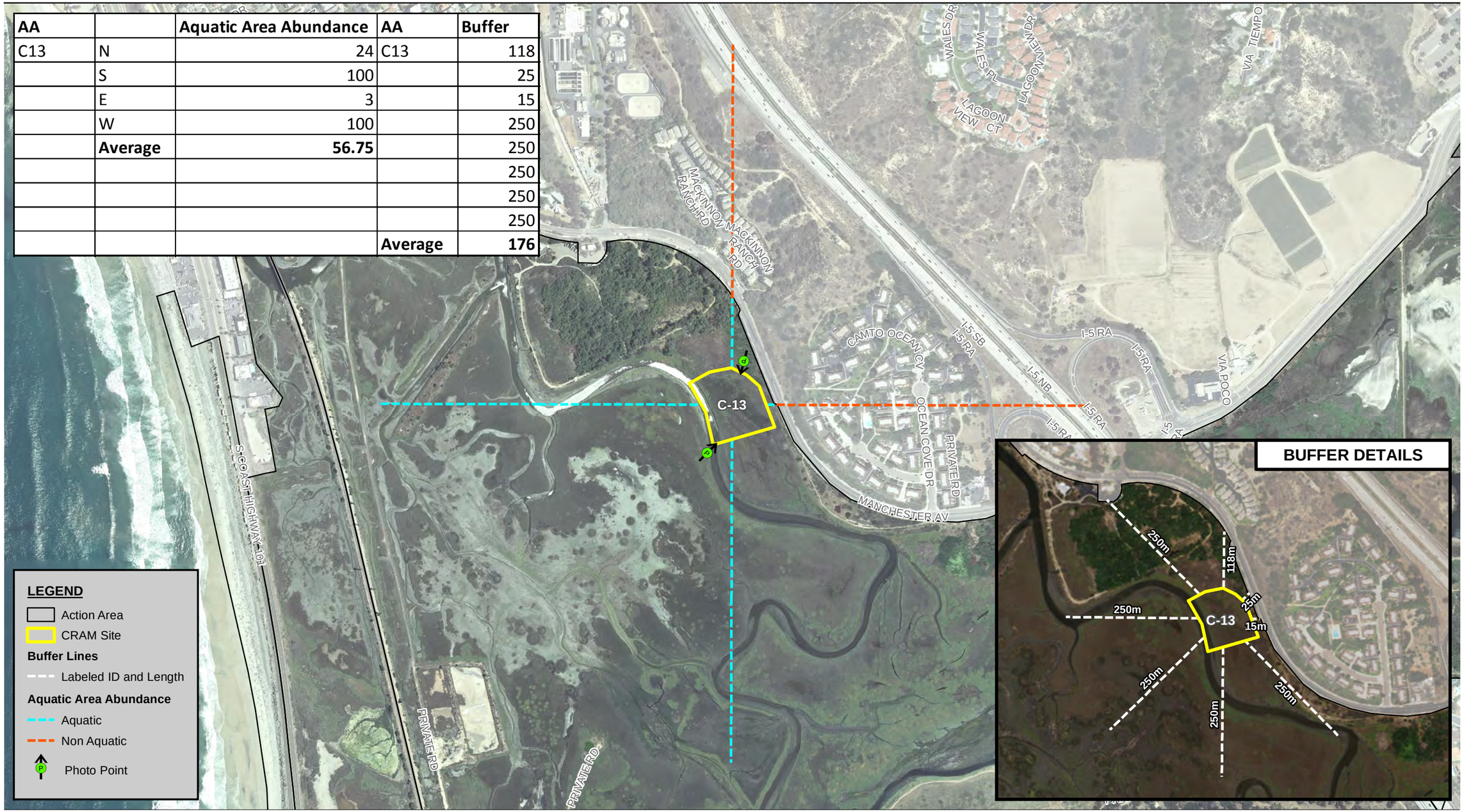
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.7
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-12

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C12.mxd, 11/8/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C13	N	24	C13	118
	S	100		25
	E	3		15
	W	100		250
	Average	**56.75**		250
				250
				250
				250
			Average	**176**



Source: SANDAG, MoffattNichol; AECOM.

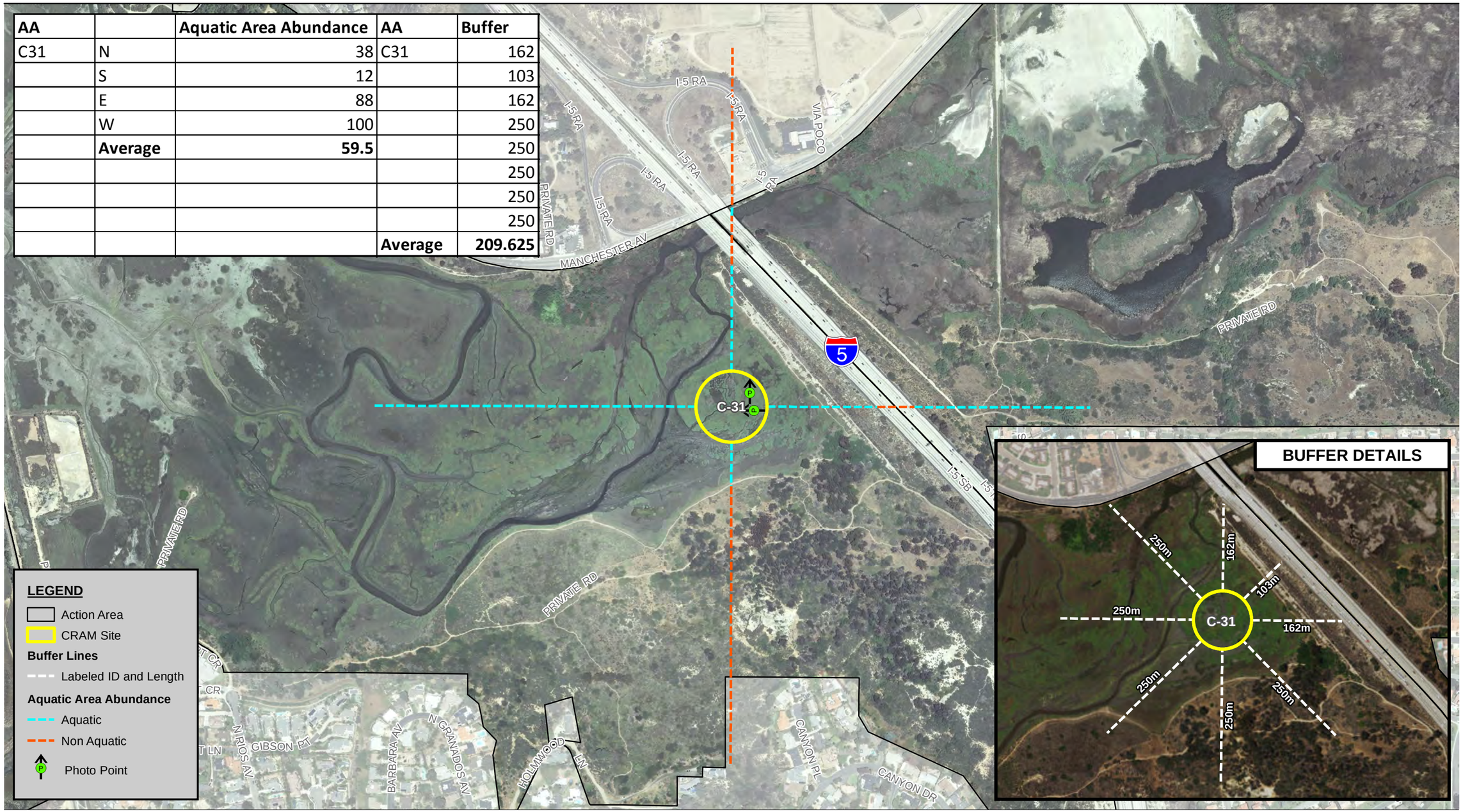
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.8
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-13

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C13.mxd, 11/8/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C31	N	38	C31	162
	S	12		103
	E	88		162
	W	100		250
	Average	**59.5**		250
				250
				250
				250
			Average	**209.625**



Source: SANDAG, MoffattNichol; AECOM.

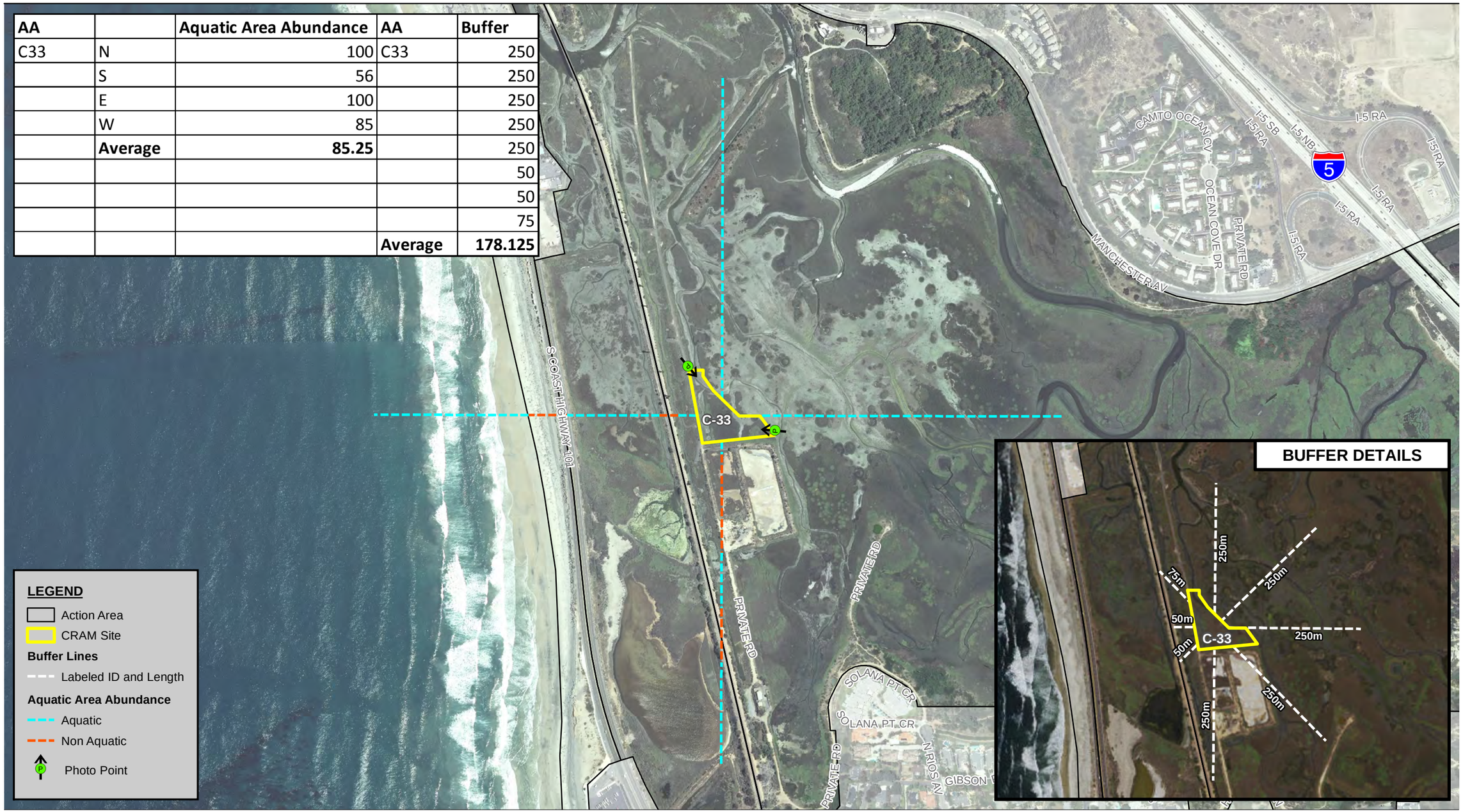
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.9
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-31

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C31.mxd, 11/8/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C33	N	100	C33	250
	S	56		250
	E	100		250
	W	85		250
	Average	**85.25**		250
				50
				50
				75
			Average	**178.125**



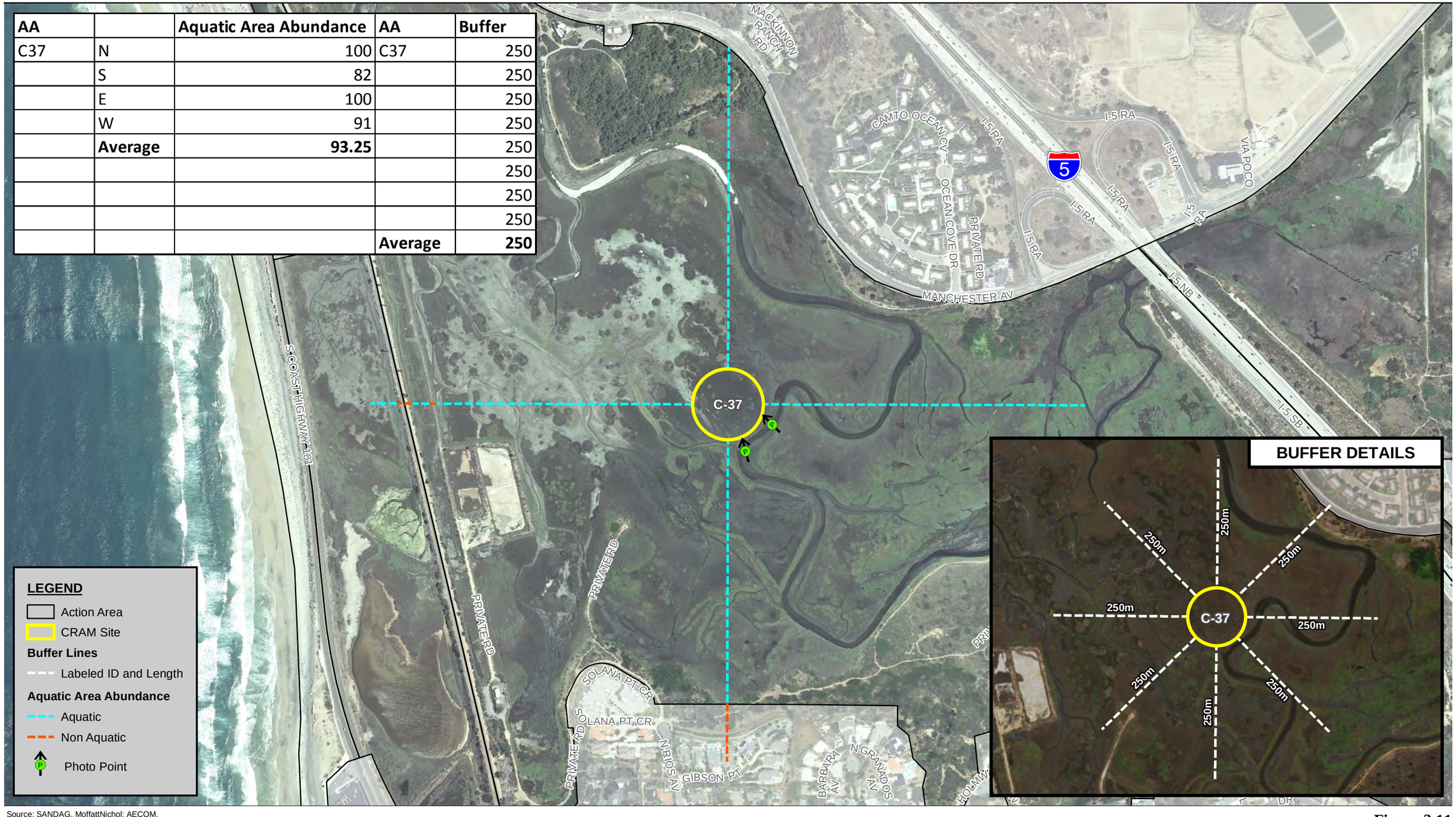
Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.10
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-33

AA		Aquatic Area Abundance	AA	Buffer
C37	N	100	C37	250
	S	82		250
	E	100		250
	W	91		250
	Average	**93.25**		250
				250
				250
				250
			Average	**250**



Source: SANDAG, MoffattNichol; AECOM.

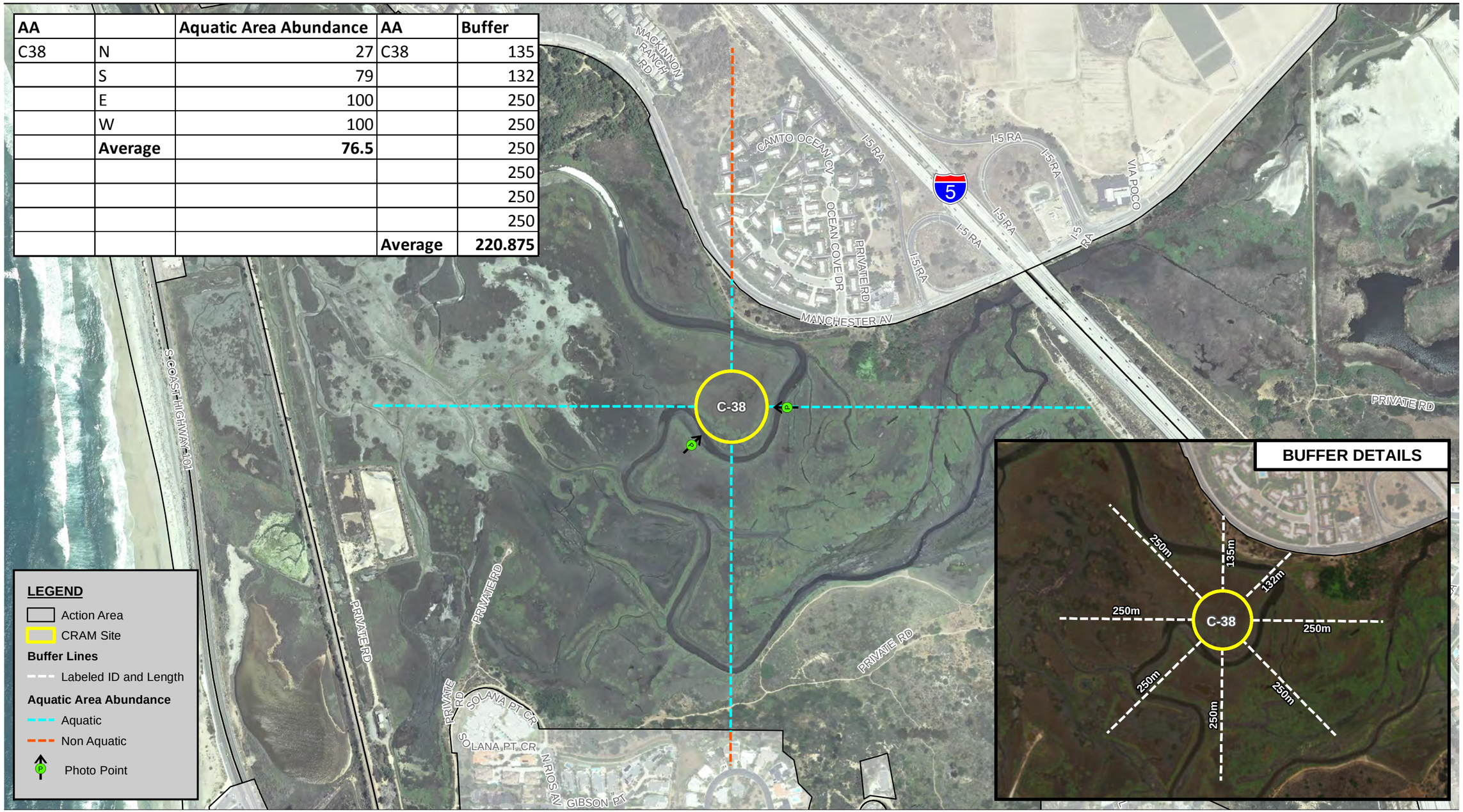
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.11
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-37

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C37.mxd, 11/3/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C38	N	27	C38	135
	S	79		132
	E	100		250
	W	100		250
	Average	**76.5**		250
				250
				250
				250
			Average	**220.875**



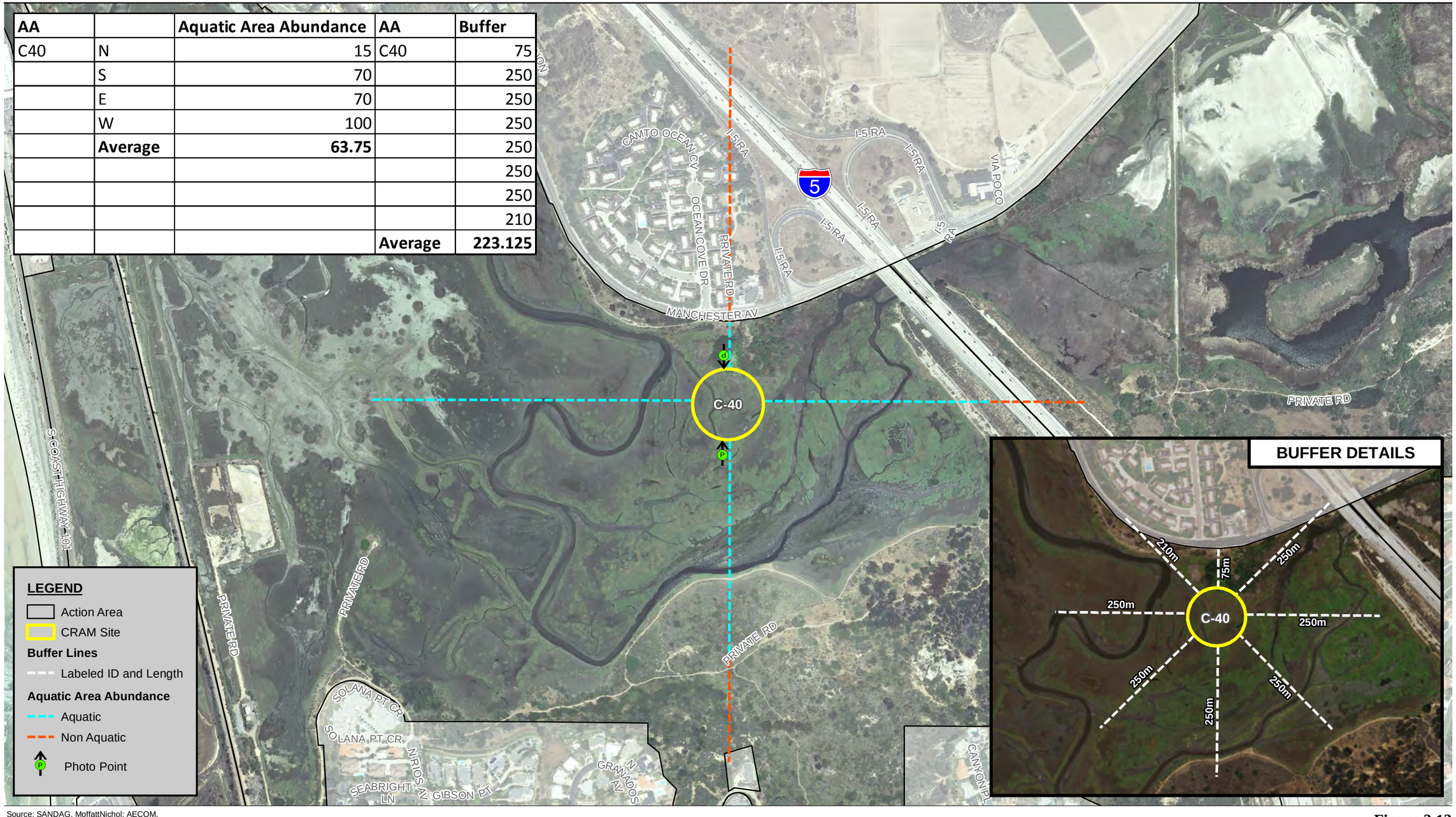
Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.12
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-38

AA		Aquatic Area Abundance	AA	Buffer
C40	N	15	C40	75
	S	70		250
	E	70		250
	W	100		250
	Average	**63.75**		250
				250
				250
				210
			Average	**223.125**



Source: SANDAG, MoffattNichol; AECOM.

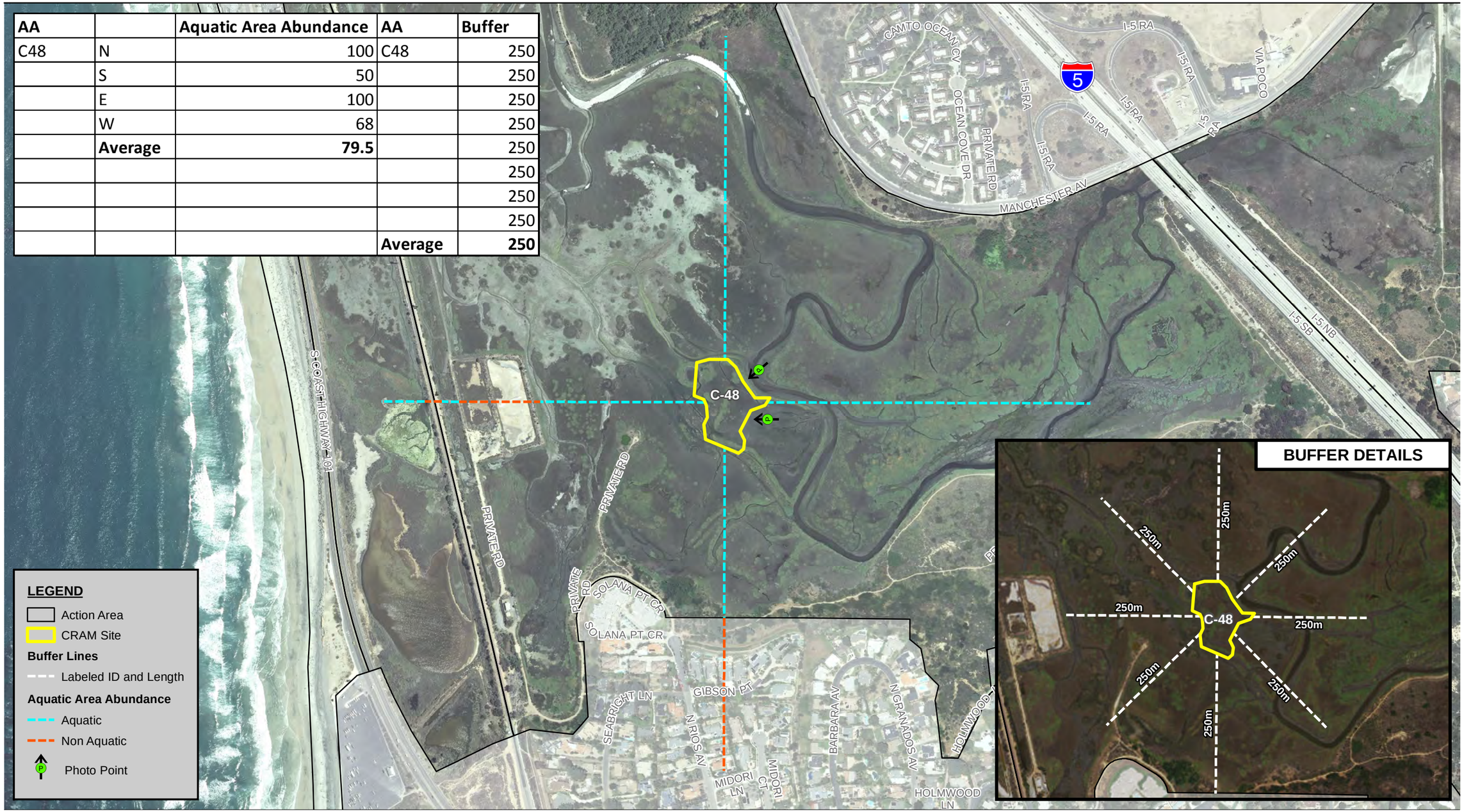
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.13
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-40

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C40.mxd, 11/3/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C48	N	100	C48	250
	S	50		250
	E	100		250
	W	68		250
	Average	**79.5**		250
				250
				250
				250
			Average	**250**



Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.14
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-48

AA		Aquatic Area Abundance	AA	Buffer
C60	N	100	C60	250
	S	18		250
	E	44		250
	W	91		191
	Average	**63.25**		147
				118
				250
				250
			Average	**213.25**

Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.15
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-60

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C60.mxd, 11/16/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C64	N	76	C64	250
	S	3		250
	E	3		250
	W	100		250
	Average	**45.5**		250
				250
				250
				250
			Average	**250**

Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.16
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-64

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C64.mxd, 11/3/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
C72	N	100	C72	250
	S	12		250
	E	9		250
	W	100		250
	Average	**55.25**		103
				220
				250
				250
			Average	**227.875**

Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.17
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-72

AA		Aquatic Area Abundance	AA	Buffer
C73	N	100	C73	250
	S	15		250
	E	3		45
	W	82		75
	Average	**50**		220
				30
				30
				88
			Average	**123.5**

Source: SANDAG, MoffattNichol; AECOM.

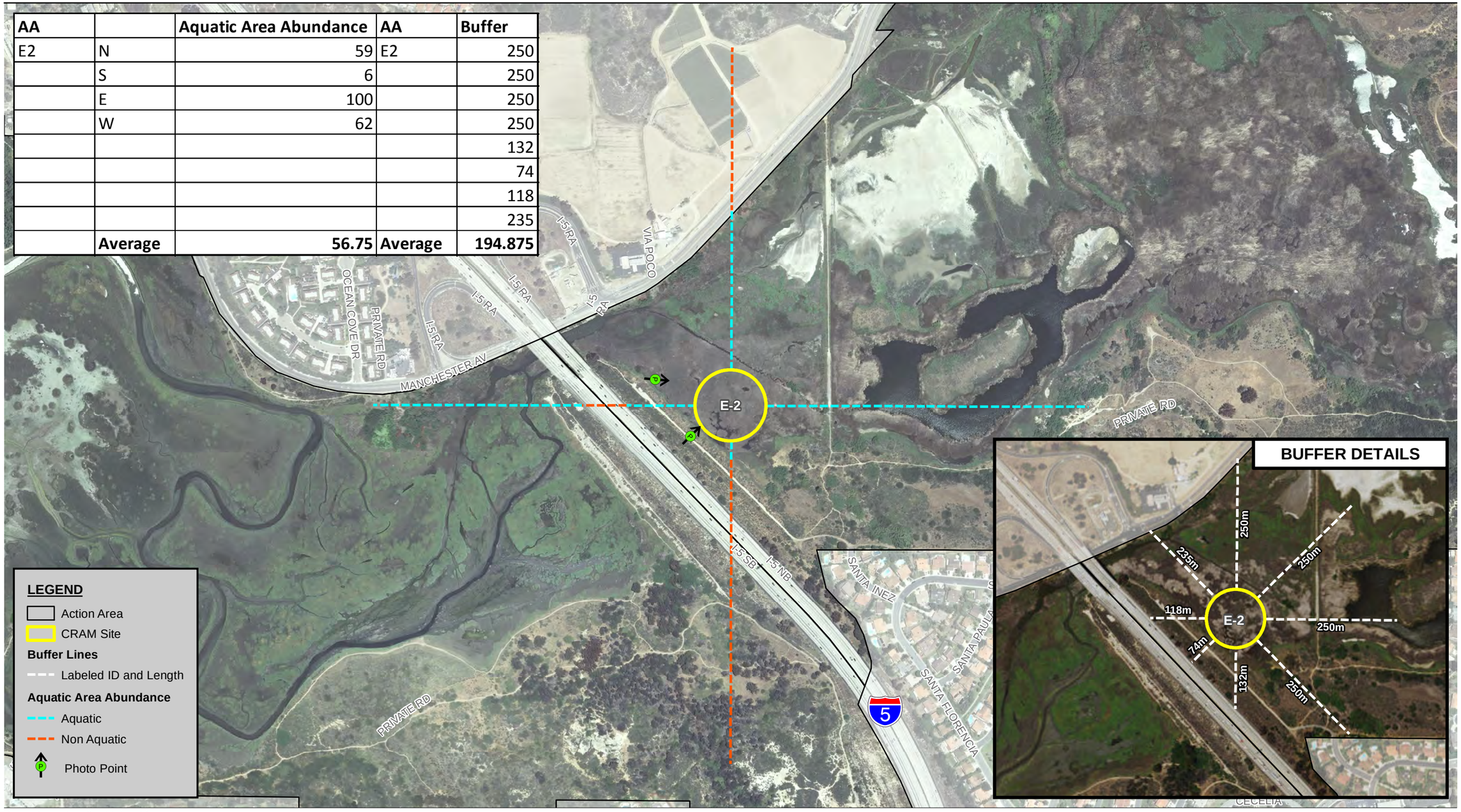
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.18
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - C-73

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_C73.mxd, 11/7/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
E2	N	59	E2	250
	S	6		250
	E	100		250
	W	62		250
				132
				74
				118
				235
	Average	**56.75**	**Average**	**194.875**



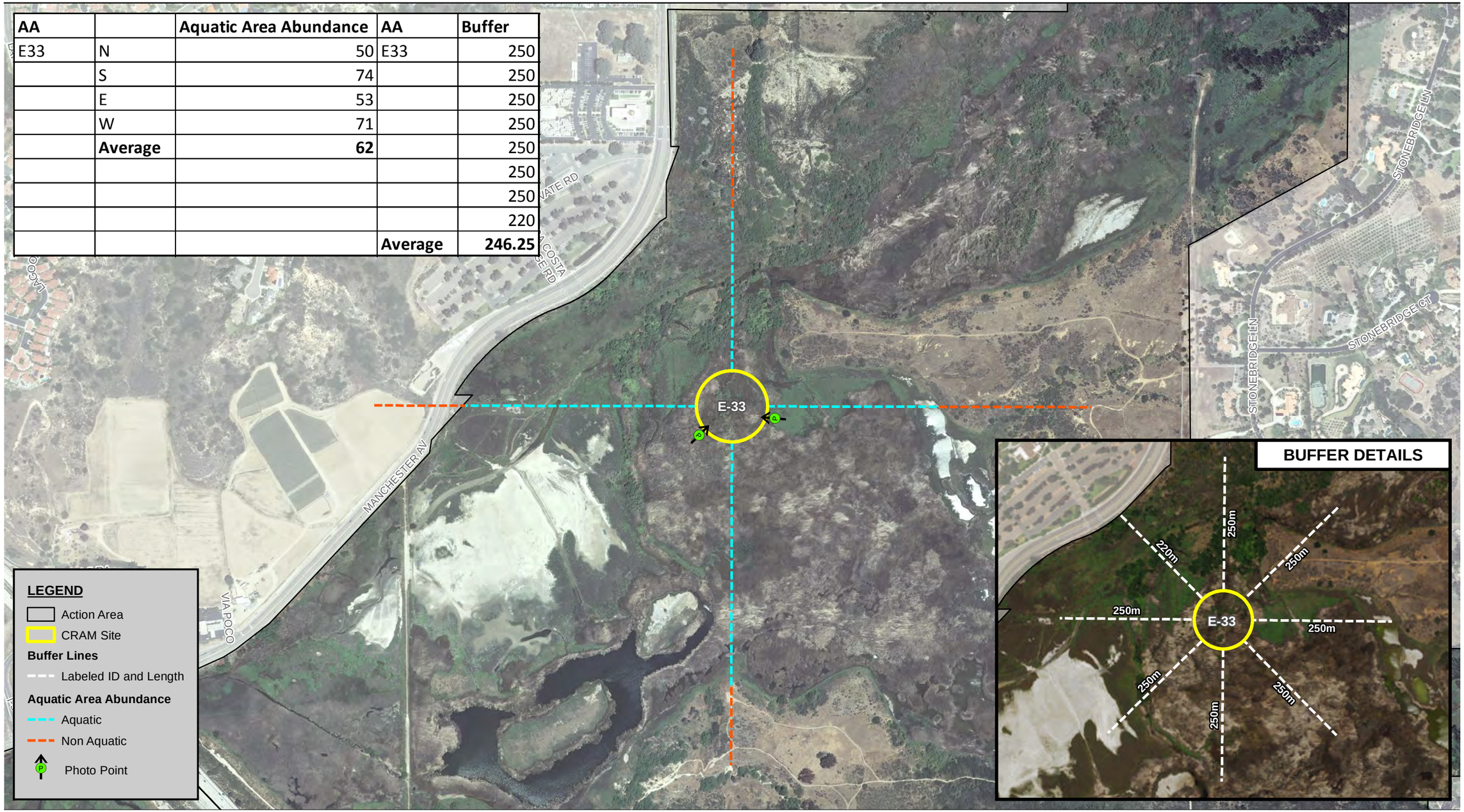
Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.19
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - E-2

AA		Aquatic Area Abundance	AA	Buffer
E33	N	50	E33	250
	S	74		250
	E	53		250
	W	71		250
	Average	**62**		250
				250
				250
				220
			Average	**246.25**



Source: SANDAG, MoffattNichol; AECOM.

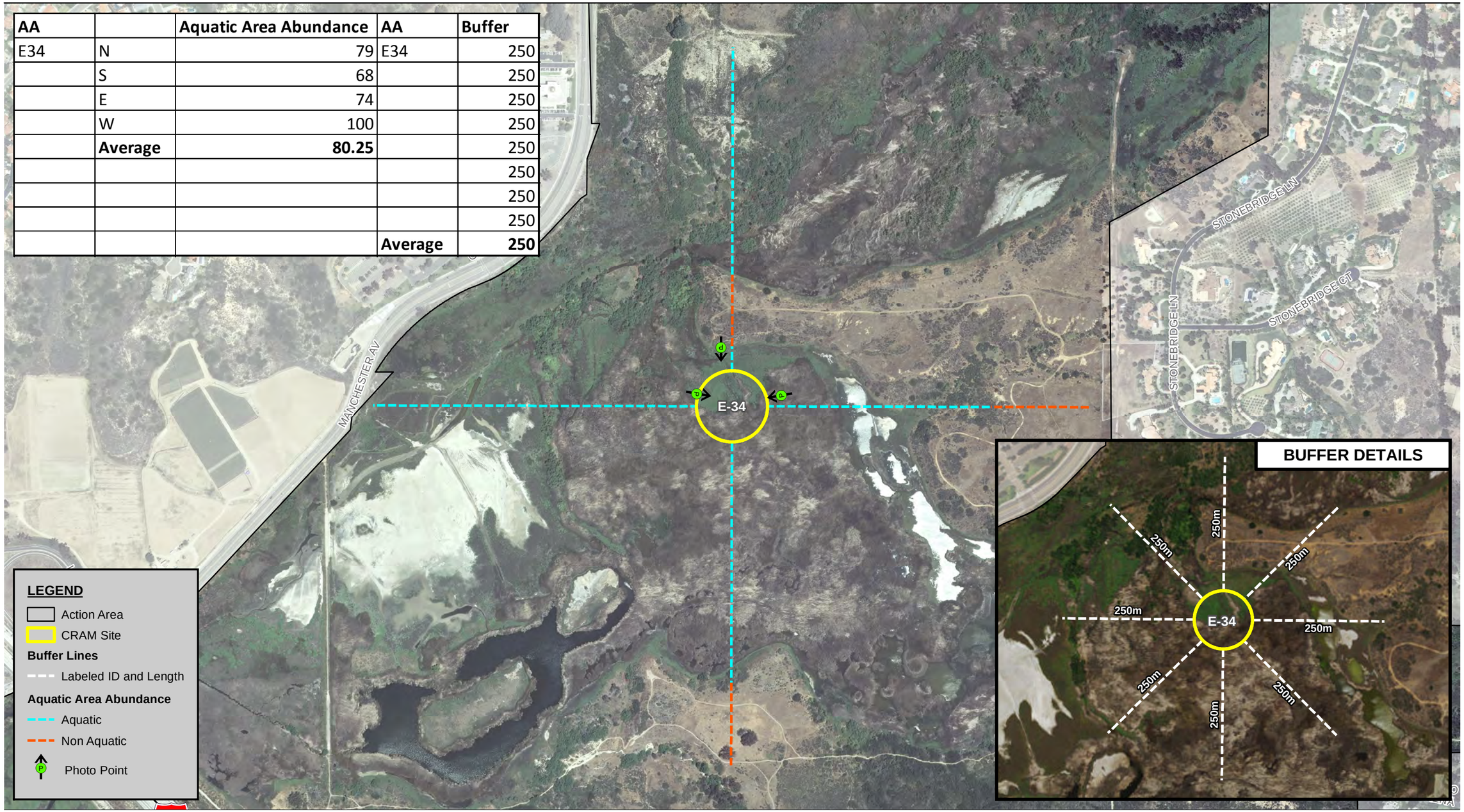
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.20
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - E-33

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_E33.mxd, 11/7/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
E34	N	79	E34	250
	S	68		250
	E	74		250
	W	100		250
	Average	**80.25**		250
				250
				250
				250
			Average	**250**



Source: SANDAG, MoffattNichol; AECOM.

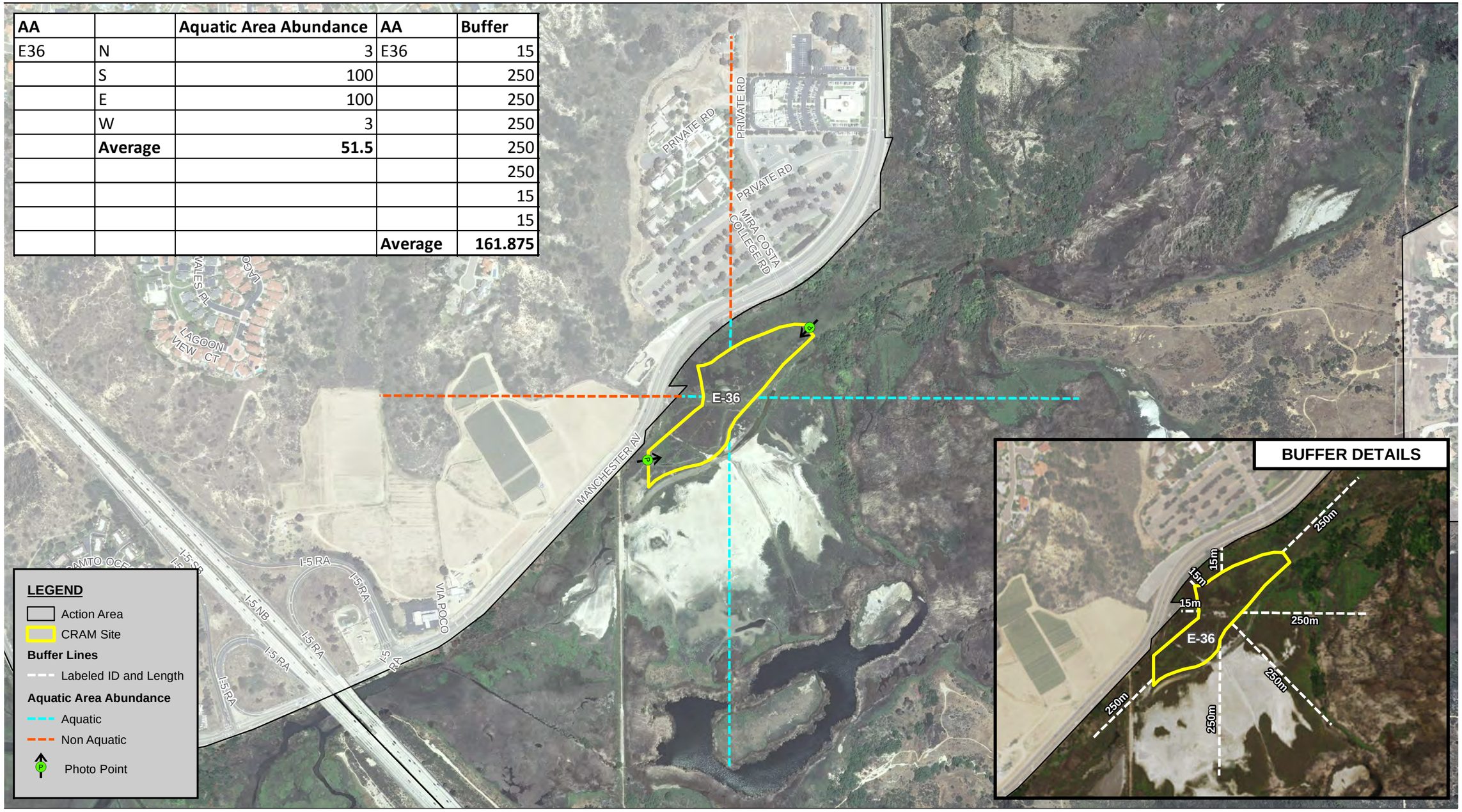
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.21
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - E-34

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_E34.mxd, 11/7/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
E36	N	3	E36	15
	S	100		250
	E	100		250
	W	3		250
	Average	**51.5**		250
				250
				15
				15
			Average	**161.875**



Source: SANDAG, MoffattNichol; AECOM.

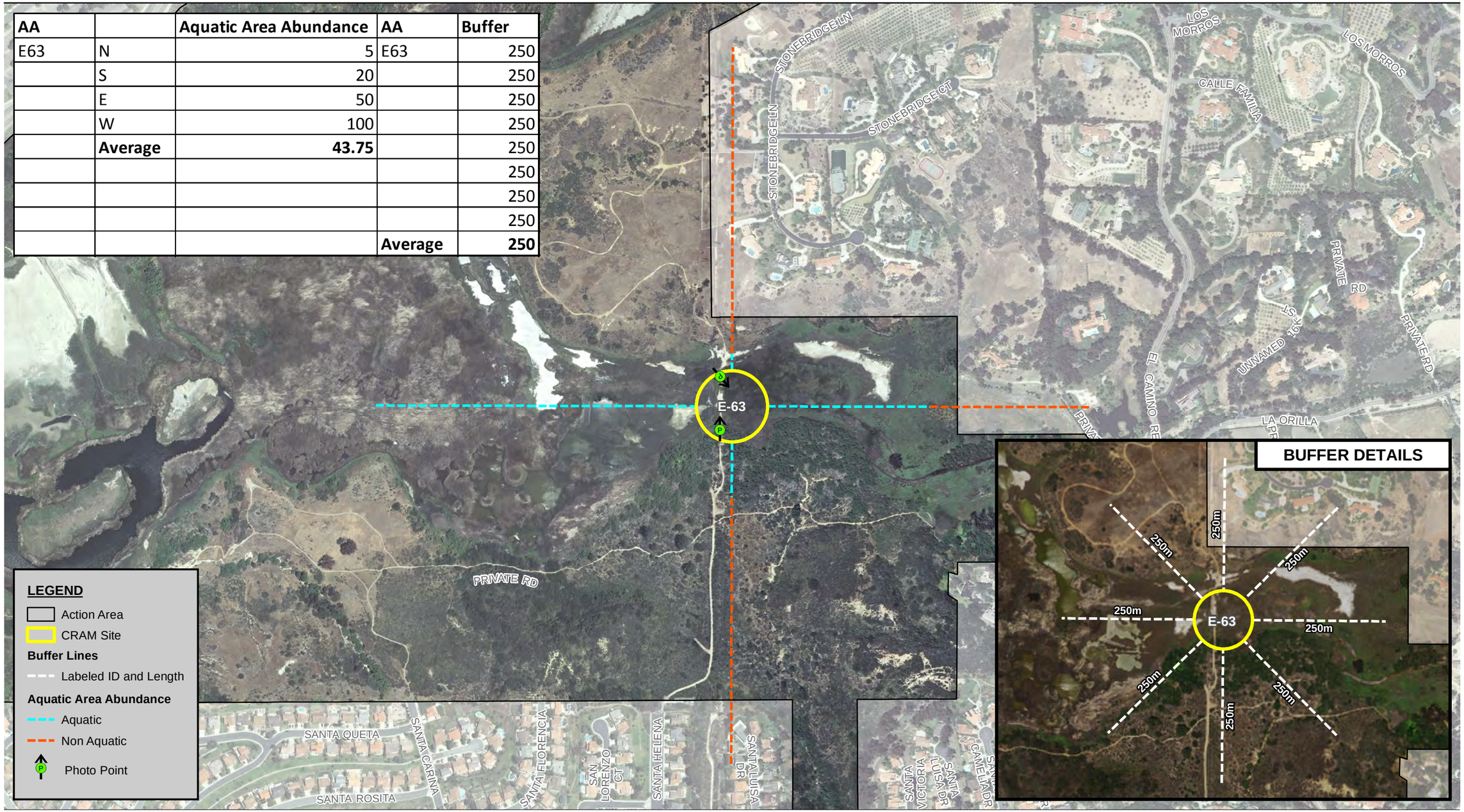
50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.22
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - E-36

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_E36.mxd, 11/8/2016, daniel.arellano

AA		Aquatic Area Abundance	AA	Buffer
E63	N	5	E63	250
	S	20		250
	E	50		250
	W	100		250
	Average	**43.75**		250
				250
				250
				250
			Average	**250**



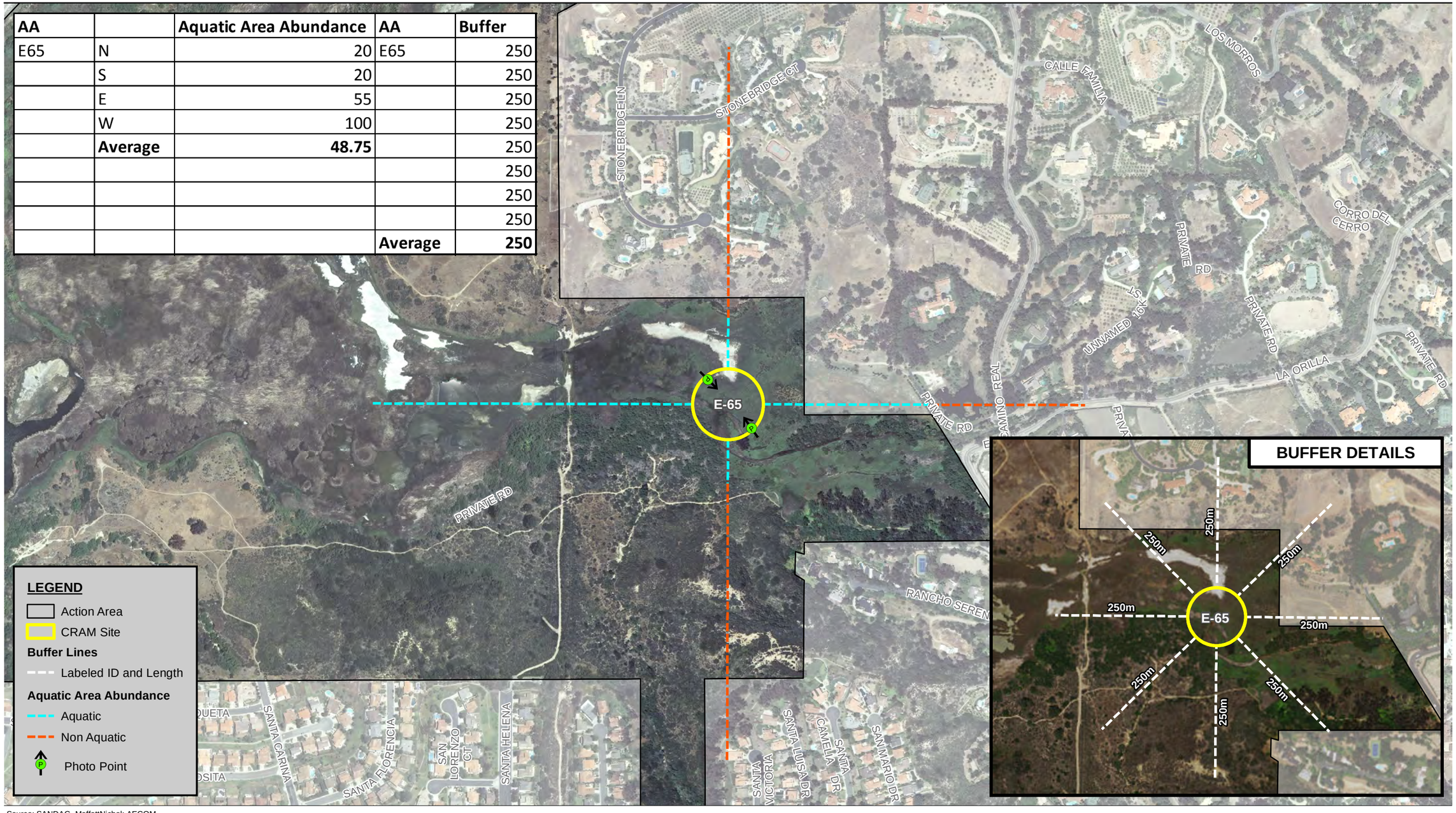
Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.23
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - E-63

AA		Aquatic Area Abundance	AA	Buffer
E65	N	20	E65	250
	S	20		250
	E	55		250
	W	100		250
	Average	**48.75**		250
				250
				250
				250
			Average	**250**



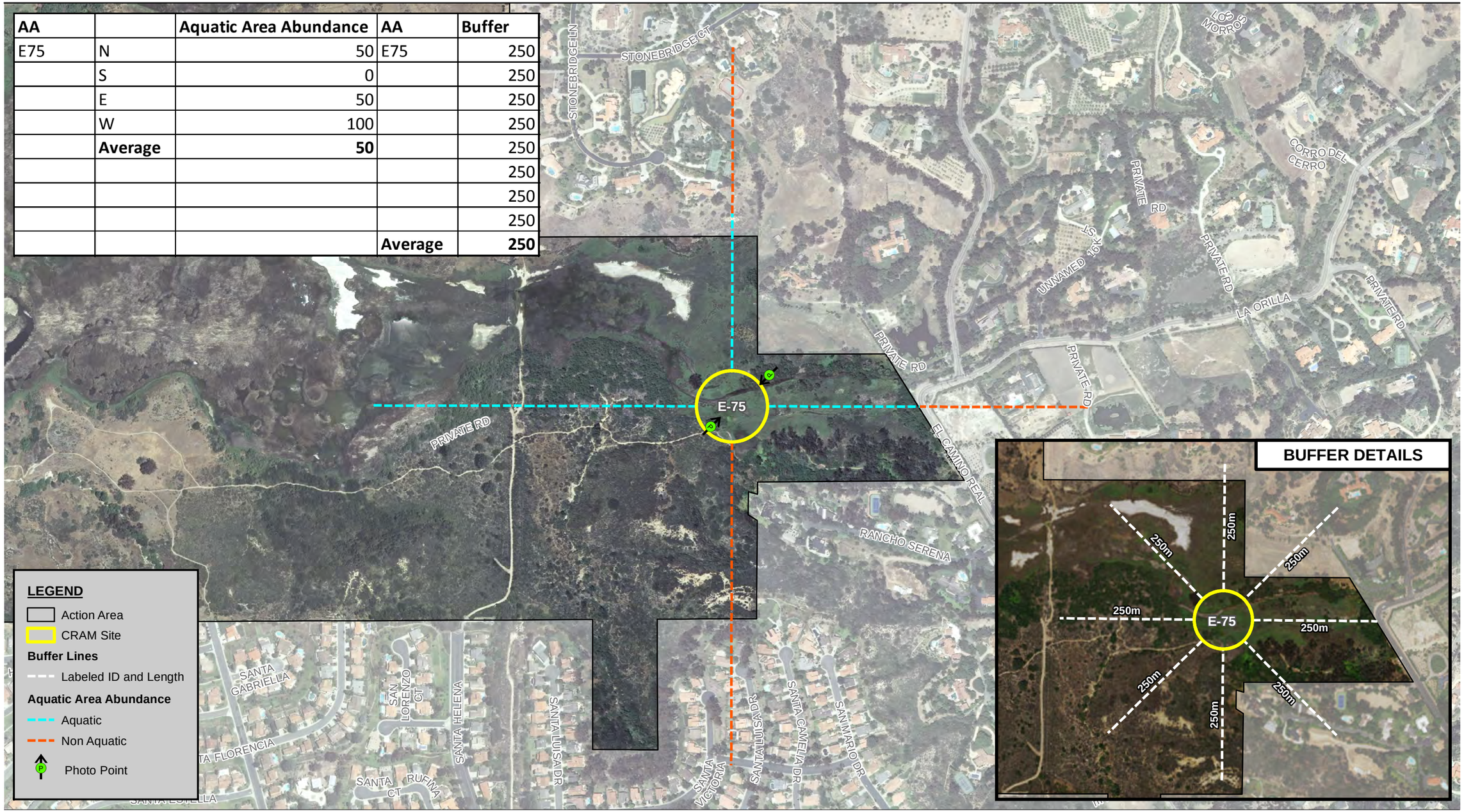
Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.24
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - E-65

AA		Aquatic Area Abundance	AA	Buffer
E75	N	50	E75	250
	S	0		250
	E	50		250
	W	100		250
	Average	**50**		250
				250
				250
				250
			Average	**250**



Source: SANDAG, MoffattNichol; AECOM.

50 0 50 100 150 200 250 Meters

Scale: 1:5,094; 1 in = 150 meters

Figure 3.25
CRAM Assessment Area Boundaries and Landscape Metrics
Assessment Area (AA) - E-75

Path: P:\2009\09080064_SELRP_EIR\6.0 GIS\6.3 Layout\CRAM\CRAM_Field_Map_E75.mxd, 11/8/2016, daniel.arellano

2.4 CRAM SCORING

The final CRAM score for each AA is composed of four main attribute scores (buffer and landscape context, hydrology, physical structure, and biotic structure), which are based on the metric and submetric scores (a measurable component of an attribute) (Table 1). The anticipated relationships between the CRAM attributes and metrics, and various ecological services expected from conceptual models of wetland form and function, are presented in Table 2. CRAM practitioners assign a letter rating (A–D) for each metric/submetric based on a defined set of condition brackets ranging from an "A" as the theoretical best case achievable for the wetland class across California, to a "D," the worst case achievable. Each metric/submetric condition level (A–D) has a fixed numerical value (A=12, B=9, C=6, D=3), which, when combined with the other metrics, results in a score for each attribute. That number is then converted to a percentage of the maximum score achievable for each attribute, and represents the final attribute score, ranging from 25 to 100%. The final overall CRAM score is the sum of the four final attribute scores, ranging from 25 to 100%.

Table 1
CRAM Attributes and Metrics

Attributes		Metrics and Submetrics
Buffer and Landscape Context		Aquatic Area Abundance
		Buffer:
		– Percent of Assessment Area with Buffer
		– Average Buffer Width
		– Buffer Condition
Hydrology		Water Source
		Hydroperiod
		Hydrologic Connectivity
Structure	Physical	Structural Patch Richness
		Topographic Complexity
	Biotic	Plant Community Composition:
		– Number of Plant Layers
		– Number of Codominant Species
		– Percent Invasion
		Horizontal Interspersion and Zonation
		Vertical Biotic Structure

Table 2
Expected Relationship among CRAM Attributes, Metrics, and Key Services

Attributes		Buffer and Landscape Context	Hydrology			Physical Structure		Biotic Structure				
Metrics or Submetrics		Buffer and Landscape Connectivity Metrics	Water Source	Hydroperiod	Hydrologic Connectivity	Structural Patch Richness	Topographic Complexity	Number of Plant Layers	Number of Codominant Species	Percent Invasion	Horizontal Interspersion	Vertical Biotic Structure
KEY SERVICES	Short- or long-term surface water storage	√		√	√	√	√				√	√
	Subsurface water storage		√	√	√		√					
	Moderation of groundwater flow or discharge	√	√									
	Dissipation of energy					√	√	√			√	√
	Cycling of nutrients	√		√	√	√	√	√	√	√		√
	Removal of elements and compounds	√		√	√		√	√			√	
	Retention of particulates			√	√	√	√	√	√		√	
	Export of organic carbon			√	√			√		√	√	√
	Maintenance of plant and animal communities	√		√	√	√	√	√	√	√	√	√

3.0 RESULTS

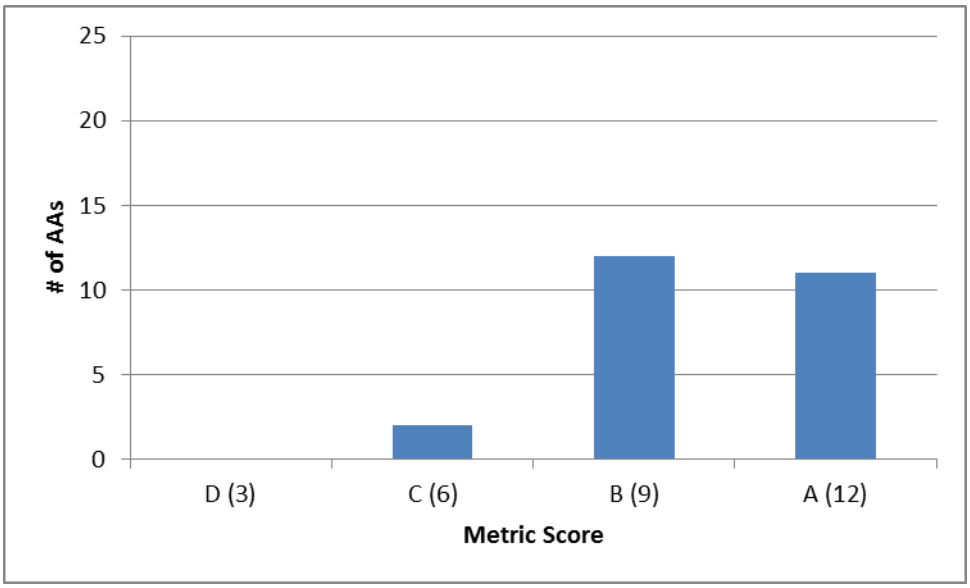
The CRAM scores for current wetland conditions at each AA can be found in Table 3, and CRAM data sheets can be found in Appendix B. Based on the known precision for overall CRAM scores, AAs that differ by more than 11 CRAM points represent a significant difference in condition. Overall CRAM scores in the lagoon ranged from a low of 60 to a high of 85 (Table 3). The highest scoring AAs were C48 and C60 in the central basin and E75, a depressional AA in the east basin. The lowest scoring AAs were the estuarine AAs in the east basin (E2 and E36) as well as W4 in the west basin. Scoring for each metric and submetric is discussed below. Based on the known precision for attribute scores, attribute scores that differ by 6 or more CRAM points represent a significant difference in condition.

Attribute 1: Buffer and Landscape Context

Metric 1: Aquatic Area Abundance

Aquatic area abundance is assessed in terms of its spatial association with other areas of aquatic resources, such as other wetlands, lakes, streams, etc. Wetlands close to each other have a greater potential to interact ecologically and hydrologically, and such interactions are generally beneficial. Almost all of the 25 AAs scored an A or B (Figure 4), indicating a high level of connectivity to nearby aquatic features. This makes sense given the lagoon setting.

Figure 4
Aquatic Area Abundance



Metric 2: Buffer

The buffer is the area adjoining the AA that is in a natural or semi-natural state and currently is not dedicated to anthropogenic uses that would severely detract from its ability to entrap contaminants, discourage entry into the AA by people and nonnative predators, or otherwise protect the AA from adjacent stress and disturbance. This metric is composed of three submetrics that assess various elements of the buffer habitat: presence, width, and condition (see below). The scoring for these submetrics is combined with the landscape connectivity metric score (above) in a simple algorithm that results in the overall buffer and landscape attribute score.

Submetric: Percent of Assessment Area with Buffer: This submetric is based on the relationship between the extent of the buffer and the functions the buffer provides to wetland areas. The percentage of buffer surrounding the AA is obtained by calculating the percentage of the area adjoining the AA that is in a natural or semi-natural state and is at least 5 meters wide. This submetric is calculated the same regardless of wetland module used. Every AA scored an A (Figure 5), indicating each of the 25 AAs had at least 5 meters of buffer along 75% to 100% of its perimeter.

Figure 5
Percent of AA with Buffer

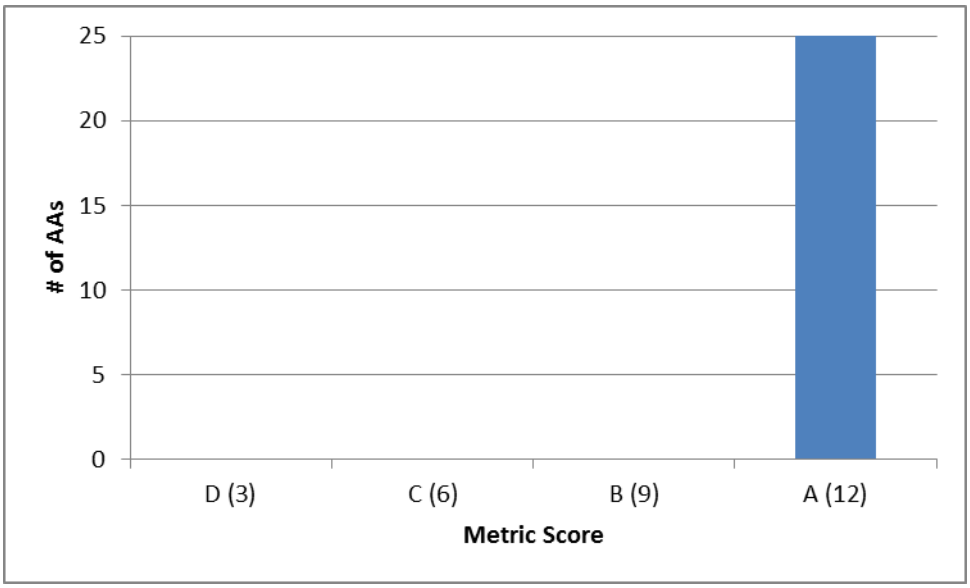


Table 3
CRAM Scores by AA

	Wetland Type	Estuarine																				Depressional				
Attribute	**AA Name**	**W1**	**W4**	**W5**	**C4**	**C6**	**C8**	**C12**	**C13**	**C31**	**C33**	**C37**	**C38**	**C40**	**C48**	**C60**	**C64**	**C72**	**C73**	**E2**	**E36**	**E33**	**E34**	**E63**	**E65**	**E75**
Buffer & Landscape Connectivity	Landscape Connectivity	9	12	12	9	12	9	9	9	9	12	12	12	9	12	9	6	9	6	9	9	12	12	9	12	12
	% AA with Buffer	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Average Buffer Width	3	6	6	12	12	12	12	9	12	9	12	12	12	12	12	12	12	6	12	9	12	12	12	12	12
	Buffer Condition	6	9	9	12	12	12	12	12	9	9	12	12	12	12	12	12	12	6	9	12	12	12	9	9	9
	Attribute Score Raw	15	21	21	21	24	21	21	20	19	22	24	24	21	24	21	18	21	13	19	20	24	24	19	22	22
	Attribute Score Final	**63**	**86**	**86**	**88**	**100**	**88**	**88**	**84**	**81**	**90**	**100**	**100**	**88**	**100**	**88**	**75**	**88**	**55**	**81**	**84**	**100**	**100**	**81**	**93**	**93**
Hydrology	Water Source	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Hydroperiod/Channel Stability	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6	6	12	12	12	12	12
	Hydrologic Connectivity	3	3	3	6	9	6	9	6	6	6	9	9	6	9	9	6	6	6	6	6	9	9	12	12	12
	Attribute Score Raw	18	18	18	21	24	21	24	21	21	21	24	24	21	24	24	21	21	21	18	18	27	27	30	30	30
	Attribute Score Final	**50**	**50**	**50**	**58**	**67**	**58**	**67**	**58**	**58**	**58**	**67**	**67**	**58**	**67**	**67**	**58**	**58**	**58**	**50**	**50**	**75**	**75**	**83**	**83**	**83**
Physical Structure	Structural Patch Richness	12	6	9	9	12	9	9	6	9	12	9	9	6	9	9	9	9	12	9	6	3	3	6	6	6
	Topographic Complexity	12	3	6	6	6	6	6	9	12	9	6	6	9	12	12	9	9	9	6	6	6	6	6	6	6
	Attribute Score Raw	24	9	15	15	18	15	15	15	21	21	15	15	15	21	21	18	18	21	15	12	9	9	12	12	12
	Attribute Score Final	**100**	**38**	**63**	**63**	**75**	**63**	**63**	**63**	**88**	**88**	**63**	**63**	**63**	**88**	**88**	**75**	**75**	**88**	**63**	**50**	**38**	**38**	**50**	**50**	**50**
Biotic Structure	Number of Plant Layers	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	12	9	12	9	12
	Number of Co-dominant Species	6	6	12	6	6	6	6	9	9	9	6	6	6	9	9	12	6	12	6	6	6	6	6	6	12
	Percent Invasion	12	12	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	6	9	9	12	12	12
	Plant Community Metric	9	9	10	9	9	9	9	10	10	10	9	9	9	10	10	11	9	11	9	7	9	8	10	9	12
	Horizontal Interspersion & Zonation	9	3	6	3	6	3	9	6	9	9	9	6	9	9	9	9	6	12	6	3	6	6	12	9	12
	Vertical Biotic Structure	12	12	12	12	9	12	9	12	9	9	9	9	12	12	12	9	9	9	6	12	12	12	12	12	12
	Attribute Score Raw	30	24	28	24	24	24	27	28	28	28	27	24	30	31	31	29	24	32	21	22	27	26	34	30	36
	Attribute Score Final	**83**	**67**	**78**	**67**	**67**	**67**	**75**	**78**	**78**	**78**	**75**	**67**	**83**	**86**	**86**	**81**	**67**	**89**	**58**	**61**	**75**	**72**	**94**	**83**	**100**
	OVERALL AA SCORE:	**74**	**60**	**69**	**69**	**77**	**69**	**73**	**71**	**76**	**78**	**76**	**74**	**73**	**85**	**82**	**72**	**72**	**72**	**63**	**61**	**72**	**71**	**77**	**77**	**82**

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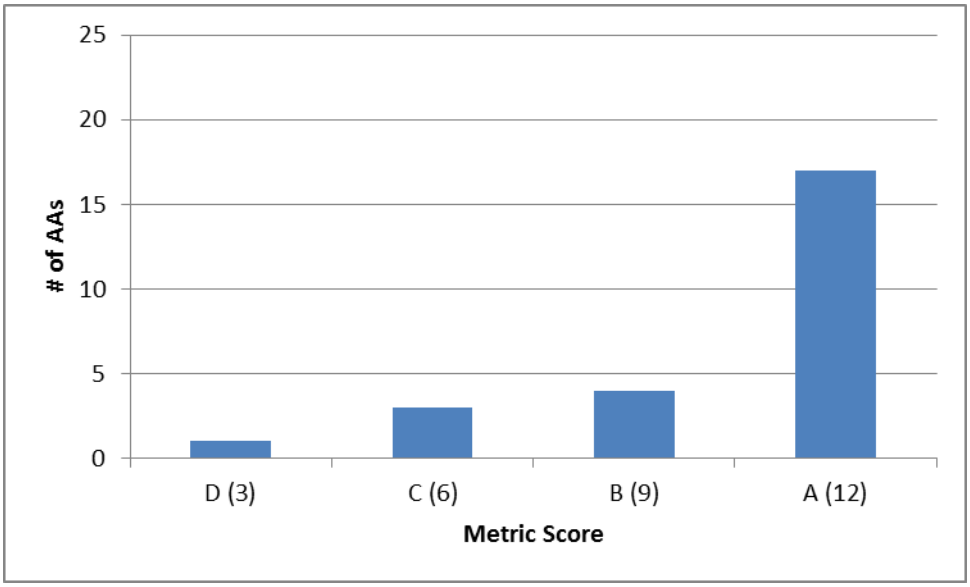
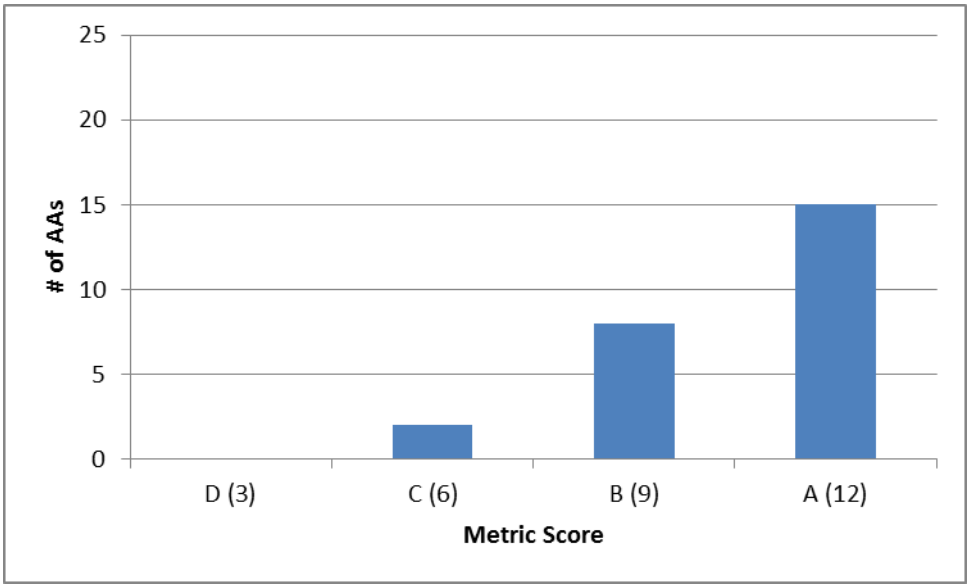
Submetric: Average Buffer Width: The average width of contiguous buffer adjoining the AA is estimated, with a maximum width of 250 meters. This submetric is assessed using straight lines extending out from the AA boundary at regular intervals. The lines are placed in the area already determined to be buffer habitat and are extended from the AA boundary until they hit non-buffer land cover (urban development, parking, large road, etc.) or until they reach the maximum evaluation length of 250 meters. The number of lines and the direction of those lines vary by wetland module used, but the general approach is the same. Most AAs scored an A for this submetric (Figure 6), indicating that the average buffer width around these AAs was between 190 and 250 meters. Except for those AAs near the edge of the lagoon or transportation infrastructure, most of the AAs have a large expanse of quality buffer habitat surrounding them.

Figure 6
Average Buffer Width



Submetric: Buffer Condition: The condition of the buffer area is determined by the quality of its vegetation cover (native versus nonnative species), the overall condition of its substrate (disturbed or undisturbed soils), and intensity of human use. This submetric is scored the same regardless of wetland module used. Most AAs scored an A or B (Figure 7), indicating that the buffer area surrounding the AA was characterized by native or intermediate mix of native and nonnative vegetation, mostly undisturbed soils, with little or low impact human visitation. As with buffer width, these scores are reasonable and characteristic for wetlands occurring in the lagoon.

Figure 7
Buffer Condition

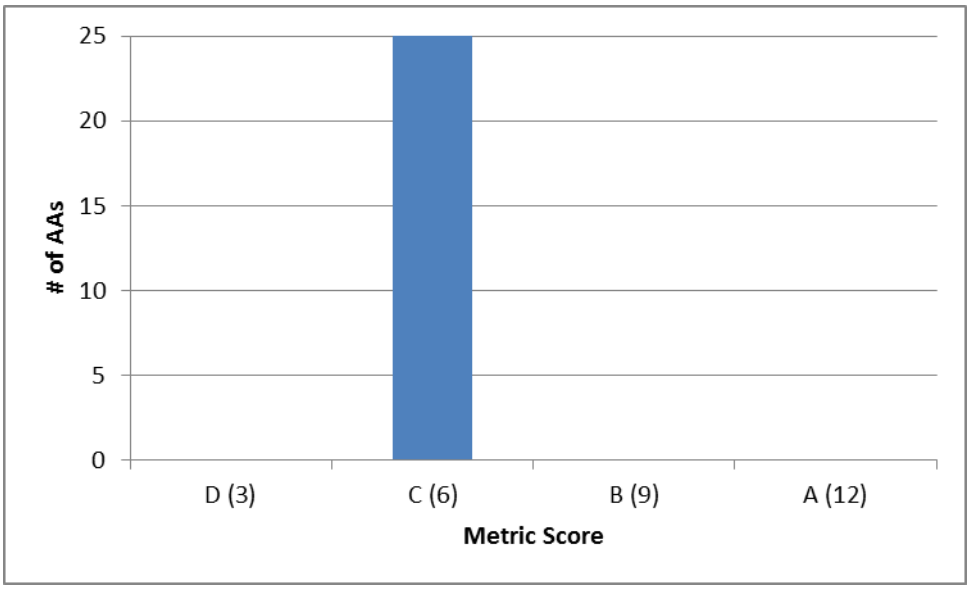


Attribute 2: Hydrology

Metric 1: Water Source

Water sources directly affect the extent, duration, and frequency of the hydrological dynamics within an AA. This metric is assessed based on water sources that enter the AA and their overall effect on the dry-season hydrology of the AA. This metric looks at both artificial inputs (urban runoff) and diversions (dams and drop structures). This metric is scored the same regardless of wetland module used. Every AA scored a C for this metric (Figure 8) because freshwater sources that affect the dry-season condition of the AAs are primarily unnatural, as they are dominated by urban runoff. Much of the immediate drainage basin (2 kilometers upstream) of each AA consists of residential development and commercial lands, although open space areas occur as well. The developed lands contribute urban freshwater to the AAs throughout the year, including during the dry season.

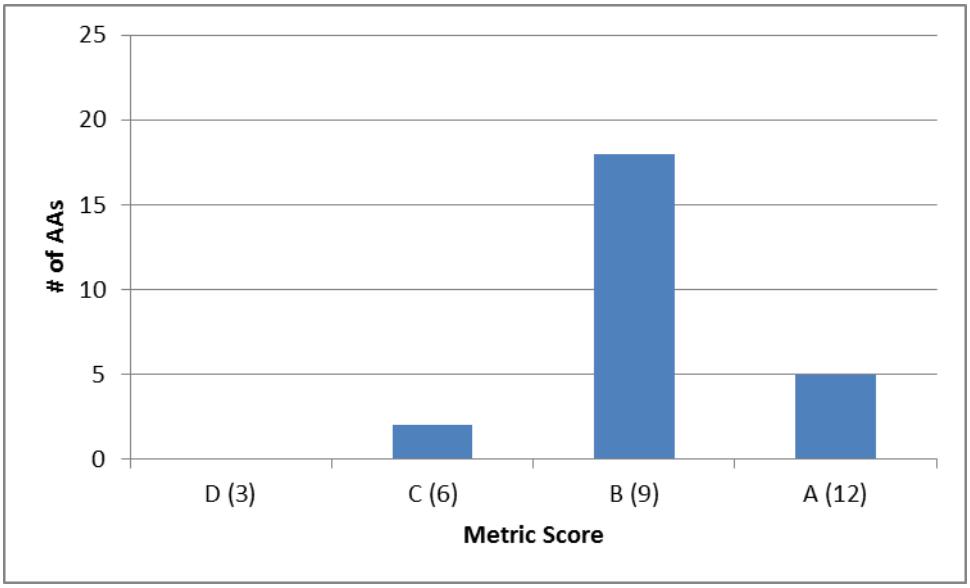
Figure 8
Water Source



Metric 2: Hydroperiod

Hydroperiod is the characteristic frequency and duration of inundation or saturation of a wetland during a typical year. Most AAs scored a B for this metric (Figure 9). This indicates that there are some artificial (usually human-caused) alterations to inundation and tidal prisms but they are not severe. The lagoon does have tidal muting but is still exposed to two daily minima and maxima.

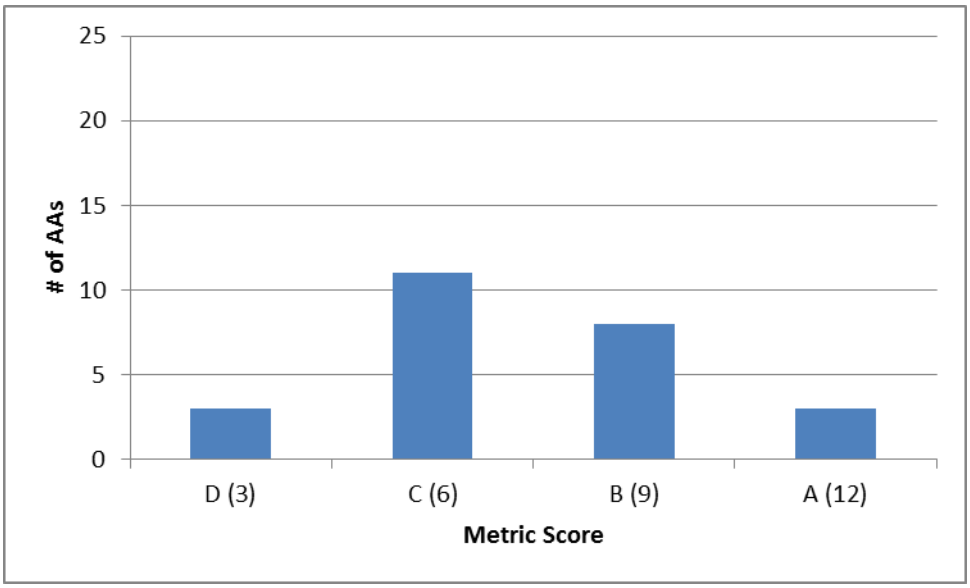
Figure 9
Hydroperiod



Metric 3: Hydrologic Connectivity

Hydrologic connectivity describes the ability of water to flow into or out of the wetland, or to accommodate rising floodwaters without dramatic changes in water level that can result in stress to wetland plants and animals. This metric is scored by assessing the degree to which the lateral movement of rising tides or flood waters is restricted by unnatural features in the AA, its encompassing wetland, or the associated upland transition zone. Most AAs scored a B or C for this metric (Figure 10), indicating that there are unnatural features such as steep banks, levees, roadgrades, etc. that restrict the lateral movement of flood waters within 500 meters of the AA.

Figure 10
Hydrologic Connectivity

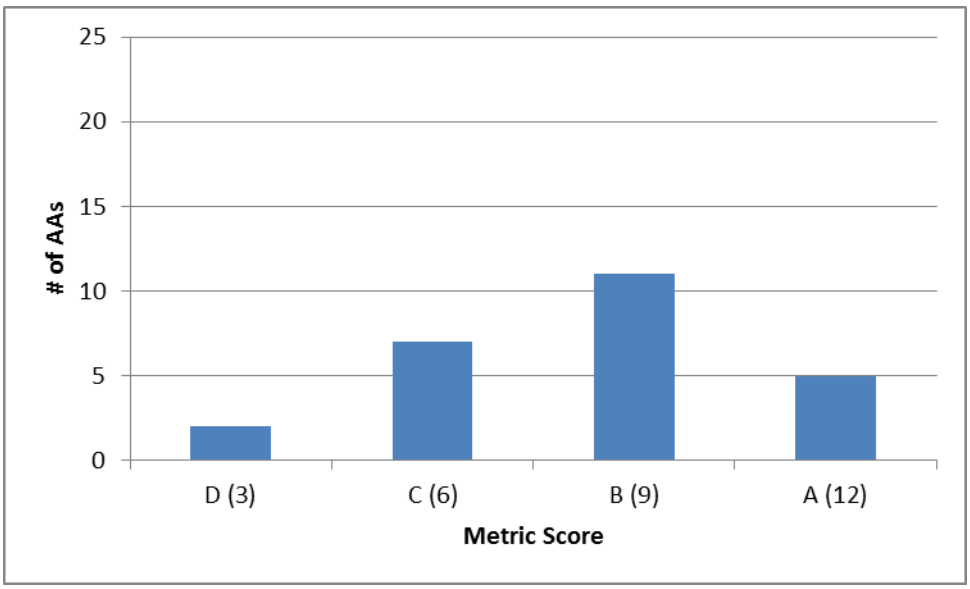


Attribute 3: Physical Structure

Metric 1: Structural Patch Richness

Patch richness is the number of different, obvious types of physical surfaces or features (i.e., patch types) that may provide habitat for aquatic, wetland, or riparian species. Each wetland type has different patch types that could be present, differences in total number of patches possible, and different "bins" for scoring. Patch types include features such as wrackline or organic debris, animal mounds, secondary channels, soil cracks, and submerged vegetation. The patch types and definitions for each wetland type can be found in the CRAM User's Manual and field books (CWMW 2013a, 2013b, 2013c). Most AAs scored a B or C for this metric (Figure 11), or between three and eight patches were found at most AAs.

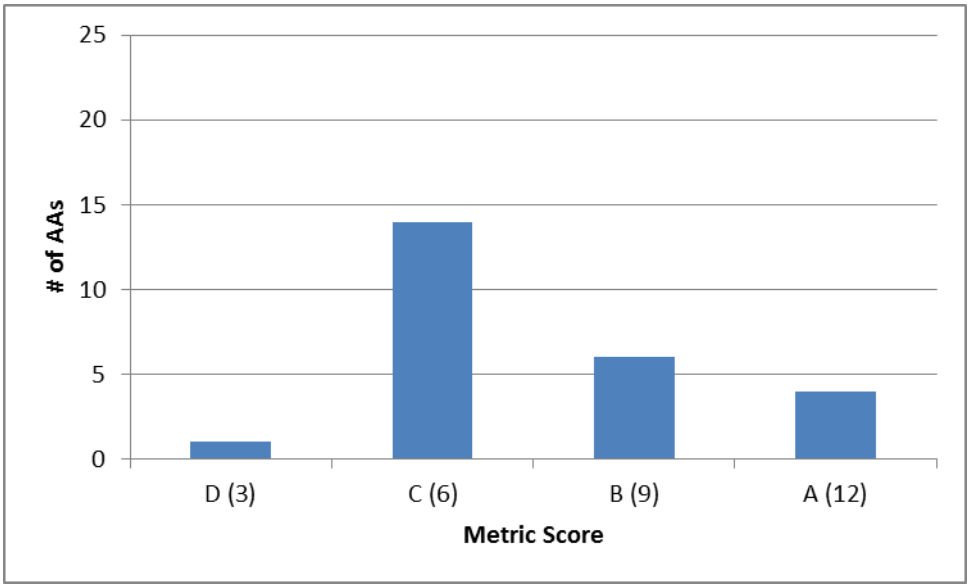
Figure 11
Structural Patch Richness



Metric 2: Topographic Complexity

Topographic complexity refers to micro- (patches) and macro-topographic (benches) relief and the variety of elevations within a wetland due to physical features and elevation gradients that affect moisture gradients or that influence the path of flowing water. Most AAs scored a B or C for this metric (Figure 12). The depressional features did not have benches, which leads to a score of C, and many of the estuarine features had micro-topography but not the macro-topographic complexity to garner an A score.

Figure 12
Topographic Complexity



Attribute 4: Biotic Structure

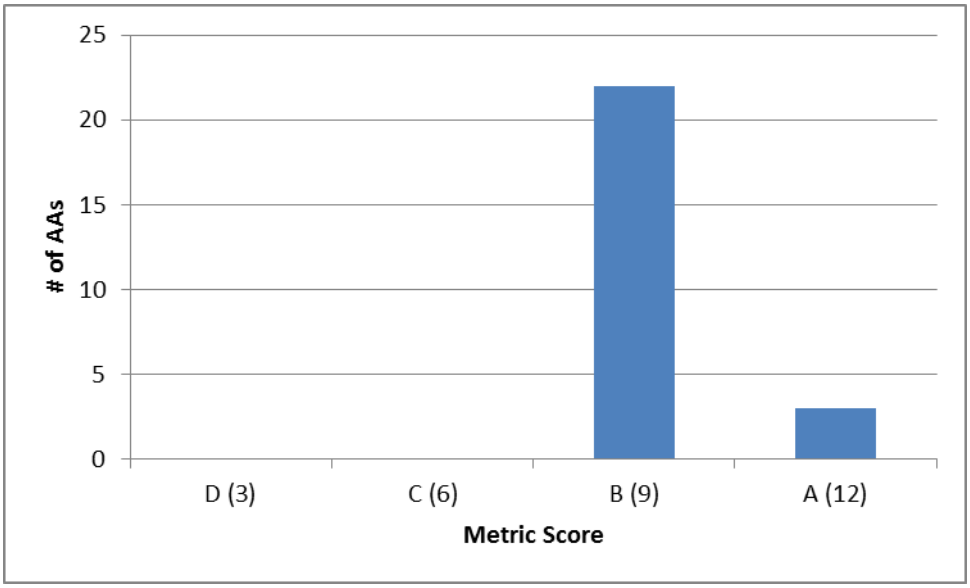
The biotic structure attribute is composed of three metrics, one of which (plant community composition) is further divided into three submetrics.

Metric 1: Plant Community Composition

The plant community composition metric is composed of three submetrics. The scoring for these submetrics is averaged for an overall metric score that is combined with the other biotic structure metric scores to get an overall attribute score.

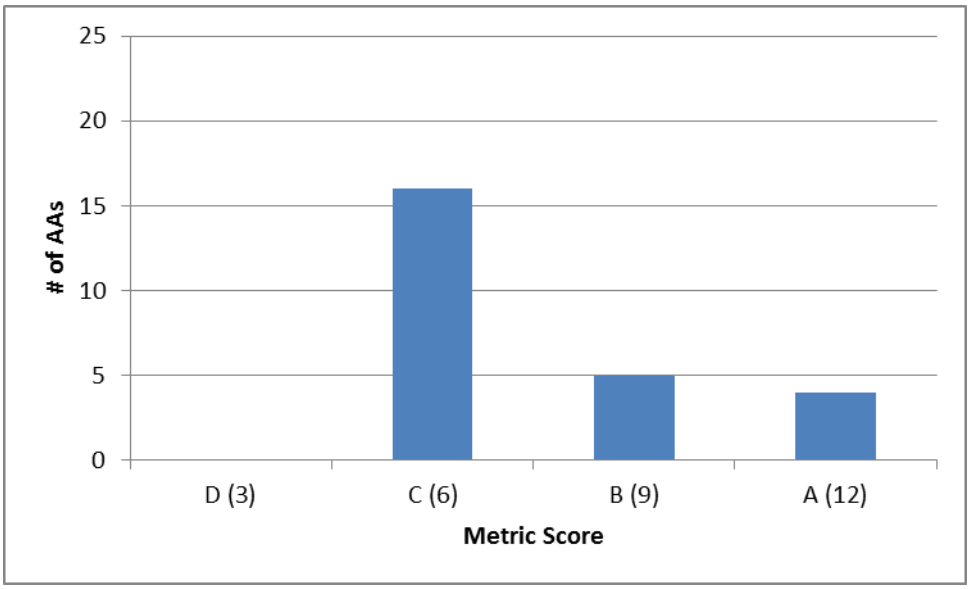
Submetric: Number of Plant Layers: To be counted in CRAM, a layer must cover at least 5% of the portion of the AA that is suitable for the layer. The height of vegetation composing a layer and the number of layers expected is different for each wetland module. All AAs scored an A or B for this metric (Figure 13). This indicates that the AAs had between two and four layers (A and B scores).

Figure 13
Number of Plant Layers



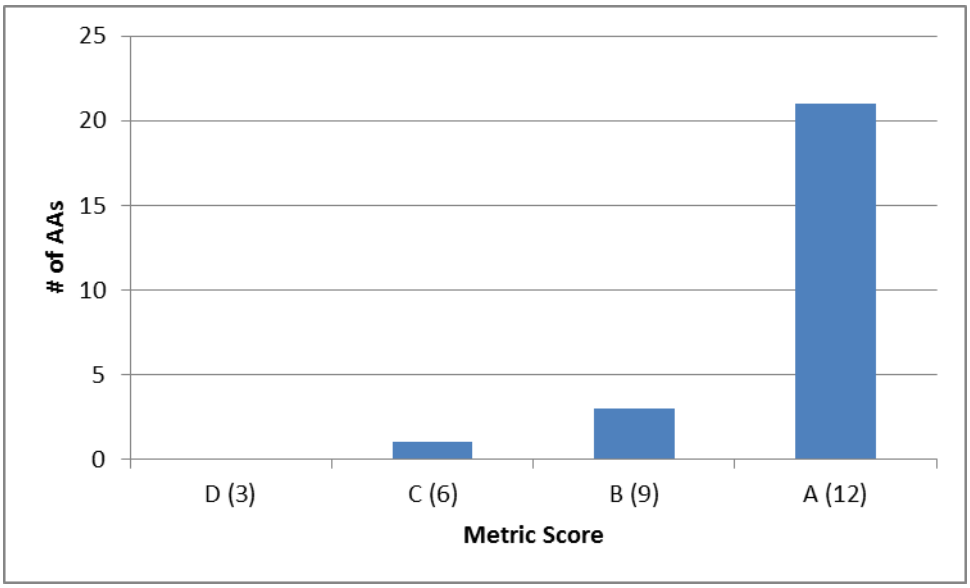
Submetric: Number of Codominant Species: All living plant species that compose at least 10% relative cover within each plant layer are considered dominant species. Although species may and often do occur as dominant species in multiple layers, an individual species is only counted once for the total number of codominants. The number of codominant species in each "bin" for scoring is dependent on the wetland module used. Most AAs scored a C for this metric (Figure 14), indicating that between two and six codominant species were observed.

Figure 14
Number of Codominant Species



Submetric: Percent Invasion: The number of invasive codominant species for all plant layers combined is assessed as a percentage of the total number of codominants in the AA. This is true for all wetland modules used. Most AAs scored an A for this metric (Figure 15). This indicates that most of the AAs had 15% or less invasion.

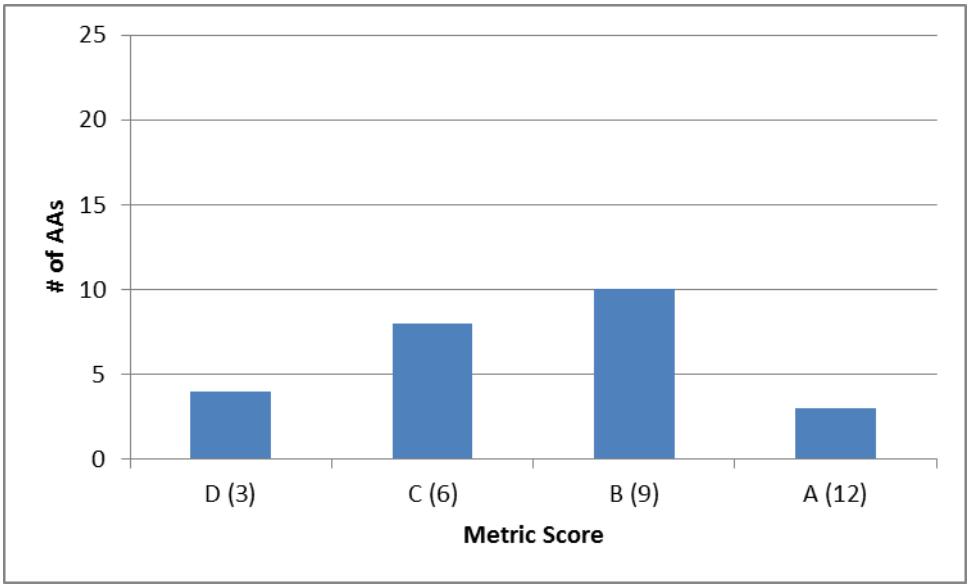
Figure 15
Percent Invasion



Metric 2: Horizontal Interspersion

This metric is a measure of horizontal biotic structure, which refers to the variety and interspersion of plant "zones." Plant zones are often plant monocultures or obvious multispecies associations that are arrayed along gradients of elevation, moisture, or other environmental factors that seem to affect the plant community organization in a two-dimensional plan view. Interspersion is essentially a measure of the number of distinct plant zones and the amount of edge between them. This is true for all wetland modules used. Most AAs scored a B or C for this metric (Figure 16). This indicates that most AAs had a moderate to low plan view interspersion.

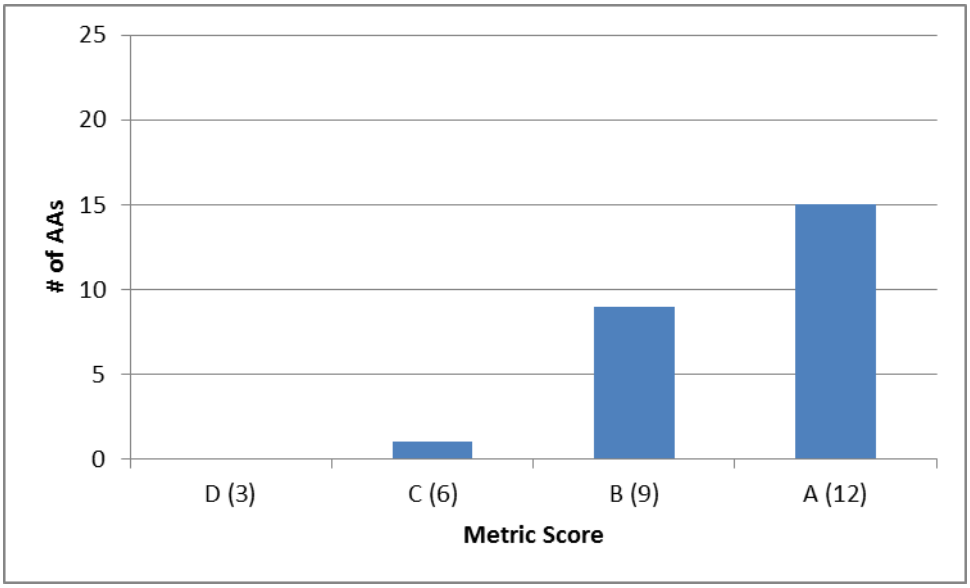
Figure 16
Horizontal Interspersion



Metric 3: Vertical Biotic Structure

The vertical component of biotic structure for estuarine wetlands and the depressional AAs in the lagoon consists of the interspersion and complexity of plant layers. It is assessed as the amount of living vegetation, entrained litter, or detritus across the wetland plain and the amount of space beneath it. Most AAs scored an A or B for this metric (Figure 17). This indicates that most AAs had dense living canopies forming ceilings with varying amounts (half to most) of the plain covered by this dense living canopy (difference between A and B).

Figure 17
Vertical Biotic Structure



4.0 DISCUSSION

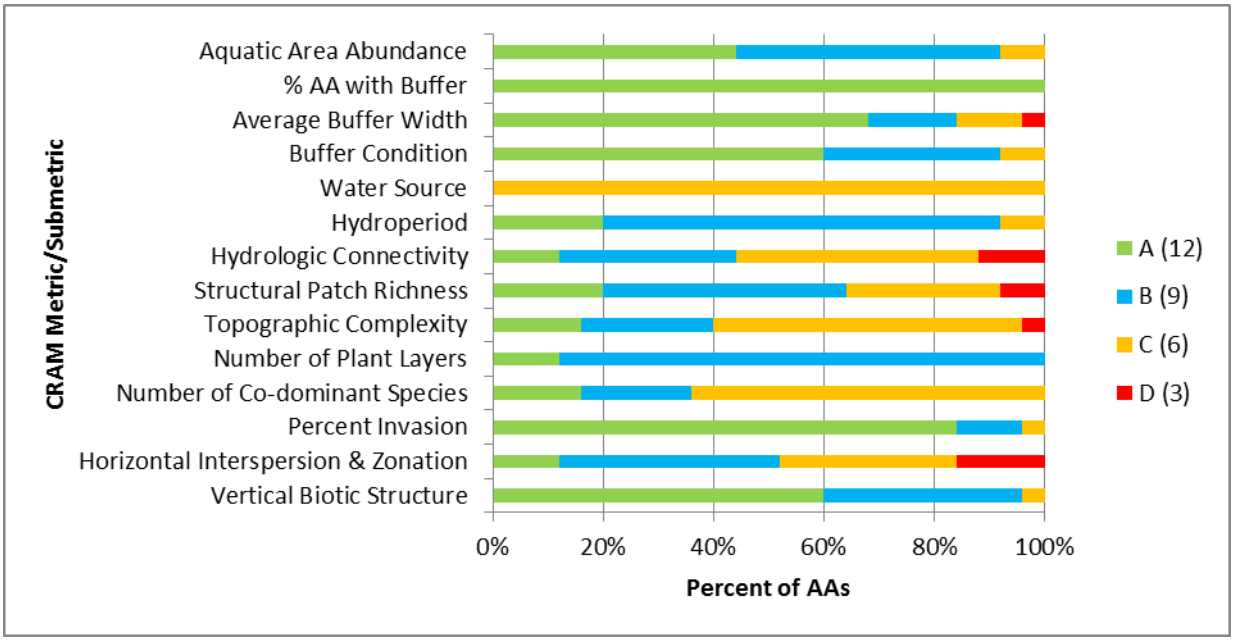
The average attribute scores and overall CRAM scores for the lagoon can be found in Table 4. Figure 18 shows the distribution of metric and submetric scores as a percent of the total AAs evaluated. Both Table 4 and Figure 18 indicate that the lowest scores were received in the hydrology and physical structure attributes and associated metrics.

Buffer and Landscape metrics are not expected to change after restoration has been implemented. Hydrology, specifically water source, is affected by the level of development surrounding the lagoon. This is not expected to change after restoration. However, hydroperiod scores (tidal muting experienced by the lagoon) may increase after restoration, which aims to increase tidal flushing. After restoration an increase in physical and biotic structure scores may result. At a minimum, after restoration has been implemented, the lagoon is expected to achieve these pre-restoration CRAM scores.

Table 4
Average Attribute and Overall CRAM Scores

CRAM Attributes	Average CRAM Score (%)
Buffer and Landscape Context	87
Hydrology	63
Physical Structure	66
Biotic Structure	77
Overall CRAM Score	**73**

Figure 18
Distribution of Metric/Submetric Scores (A–D) as Percent of AAs



5.0 REFERENCES

California Wetlands Monitoring Workgroup (CWMW)

2013a *California Rapid Assessment Method (CRAM) for Wetlands, User's Manual*, Version 6.1, pp. 67.

2013b *California Rapid Assessment Method (CRAM) for Wetlands, Perennial Estuarine Wetlands Field Book*, Version 6.1 pp. 38.

2013c *California Rapid Assessment Method (CRAM) for Wetlands, Depressional Wetlands Field Book*, Version 6.1 pp. 43.

U.S. Environmental Protection Agency (EPA)

2003 *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries*. April.

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APPENDIX A

AA SITE PHOTOS

C4 Facing Northeast

C4 Facing Southwest

Appendix A
Representative Photographs

C6 Facing Northeast

C6 Facing Southwest

Appendix A
Representative Photographs

C8 Facing Southwest

C8 Facing West

C12 Facing South

C12 Facing Southeast

Appendix A
Representative Photographs

C13 Facing North

C13 Facing South

Appendix A
Representative Photographs

C31 Facing North

C31 Facing West

Appendix A
Representative Photographs

C33 Facing Northwest

C33 Facing Southeast

C37 Facing North

C37 Facing Northwest

C38 Facing Northeast

C38 Facing West

C40 Facing Northeast

C40 Facing Southwest

Appendix A
Representative Photographs

C48 Facing Southwest

C48 Facing West

C60 Facing North

C60 Facing Northeast

Appendix A
Representative Photographs

C64 Facing East

C64 Facing West

Appendix A
Representative Photographs

C72 Facing East

C72 Facing West

Appendix A
Representative Photographs

C73 Facing Southeast

C73 Facing Southwest

Appendix A
Representative Photographs

E2 Facing East

E2 Facing Southeast

Appendix A
Representative Photographs

E33 Facing Northeast

E33 Facing West

Appendix A
Representative Photographs

E34 Facing East

E34 Facing West

Appendix A
Representative Photographs

E36 Facing East

E36 Facing West

Appendix A
Representative Photographs

E63 Facing North

E63 Facing Southeast

Appendix A
Representative Photographs

E65 Facing Northwest

E65 Facing Southeast

Appendix A
Representative Photographs

E75 Facing Northeast

E75 Facing Southwest

Appendix A
Representative Photographs

W1 Facing Northeast

W1 Facing Southeast

Appendix A
Representative Photographs

W4 Facing Northeast

W4 Facing Southwest

Appendix A
Representative Photographs

W5 Facing Northwest

W5 Facing South

APPENDIX B

AA DATA SHEETS

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C4

Project ID #: **Date:** 9/13/2016

Assessment Team Members for This AA:

LSL, BHE

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C6				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	58%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	B	9		152m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			20	**Final Attribute Score = (Raw Score/24) x 100**	84.03%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.33%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. A	Numeric 12	9 patches	
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/24) x 100**	75.00%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		D	3		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.67%
Overall AA Score (average of four final Attribute Scores)				71.01%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.15
South	1.00
East	0.40
West	0.75
Average Percentage of Transect Length that is an Aquatic Feature	57.50%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	75
B	88
C	200
D	250
E	250
F	147
G	147
H	60
Average Buffer Width ***Round to the nearest integer***	152

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☑
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☑
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	9

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Frankenia salina	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐		☐
Frankenia salina	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C6

Project ID #: | **Date:** 9/13/2016

Assessment Team Members for This AA:

LSL, BHE

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C6				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha.	Numeric	76%	
		A	12		
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha.	Numeric		100%	
	A	12			
Buffer submetric B: Average Buffer Width	A	12		216m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			24	**Final Attribute Score = (Raw Score/24) x 100**	100.00%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha.	Numeric		
		C	6		
Hydroperiod		B	9		
Hydrologic Connectivity		B	9		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.70%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha.	Numeric	9 patches	
		A	12		
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/24) x 100**	75.00%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha.	Numeric		2 layers	
	B	9			
Plant Community submetric B: Number of Co-dominant species	C	6		2 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		C	6		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.70%
Overall AA Score (average of four final Attribute Scores)				77.10%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.40
South	0.91
East	0.98
West	0.74
Average Percentage of Transect Length that is an Aquatic Feature	75.70%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	200
B	176
C	250
D	250
E	250
F	191
G	162
H	250
Average Buffer Width ***Round to the nearest integer***	216

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☑
Point bars and in-channel bars	☑
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	9

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	2
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C8

Project ID #: **Date:** 9/14/2016

Assessment Team Members for This AA:

LSL, JGR

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C8				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	66%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	A	12		238m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.30%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	7 patches	
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		2 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		D	3		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.70%
Overall AA Score (average of four final Attribute Scores)				68.80%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.35
South	0.90
East	0.80
West	0.60
Average Percentage of Transect Length that is an Aquatic Feature	66.20%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	**Buffer Width (m)**
A	220
B	220
C	250
D	250
E	250
F	240
G	220
H	250
Average Buffer Width ***Round to the nearest integer***	238

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☑
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☑
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	7

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	2
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C12

Project ID #: | **Date:** 9/14/2016

Assessment Team Members for This AA:

LSL, JGR

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C12				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	71%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	A	12		240m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		B	9		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.70%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	7 patches	
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			27	**Final Attribute Score = (Raw Score/36) x 100**	75.00%
Overall AA Score (average of four final Attribute Scores)				72.90%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.50
South	1.00
East	0.40
West	0.95
Average Percentage of Transect Length that is an Aquatic Feature	71.30%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	200
C	220
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	240

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☑
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☑
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	7

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Spartina foliosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C13

Project ID #: | **Date:** 9/13/2016

Assessment Team Members for This AA:

AAN, ACG, MMA

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C13				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	57%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	B	9		176m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			20	**Final Attribute Score = (Raw Score/24) x 100**	84.03%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.33%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. C	Numeric 6	4 patches	
Topographic Complexity		B	9		
Raw Attribute Score = sum of numeric scores			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	B	9		4 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			10		
Horizontal Interspersion		C	6		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			28	**Final Attribute Score = (Raw Score/36) x 100**	77.78%
Overall AA Score (average of four final Attribute Scores)				70.66%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.24
South	1.00
East	0.03
West	1.00
Average Percentage of Transect Length that is an Aquatic Feature	56.75%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	118
B	25
C	15
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	176

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	4

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Frankenia salina	☐
	☐	Distichlis spicata	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Frankenia salina	☐		☐
Salicornia pacifica	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	4
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C31

Project ID #: | **Date:** 9/14/2016

Assessment Team Members for This AA:

AAN, BHE

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C31				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	60% aquatic area abundance	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with at least 5m buffer	
Buffer submetric B: Average Buffer Width	A	12		210m	
Buffer submetric C: Buffer Condition	B	9			
Raw Attribute Score = D+[C x (A x B)½]½			19	**Final Attribute Score = (Raw Score/24) x 100**	80.80%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.33%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	6 patches	
Topographic Complexity		A	12	multiple channels and lots of micro	
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	B	9		4 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			10		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			28	**Final Attribute Score = (Raw Score/36) x 100**	77.78%
Overall AA Score (average of four final Attribute Scores)				76.10%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.38
South	0.12
East	0.88
West	1.00
Average Percentage of Transect Length that is an Aquatic Feature	59.50%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: _____%

Worksheet for calculating average buffer width of AA

Line	**Buffer Width (m)**
A	162
B	103
C	162
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	210

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	6

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South matches A on page 24 of Field Manual
East to West matches A on page 24 of Field Manual

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Spartina foliosa	☐	Spartina foliosa	☐
Salicornia pacifica	☐		☐
Frankenia salina	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	4
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C33

Project ID #: **Date:** 9/12/2016

Assessment Team Members for This AA:

LSL, AAN

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C33				**Date:** 9/12/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. A	Numeric 12	85%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with 5m buffer	
Buffer submetric B: Average Buffer Width	B	9		178m	
Buffer submetric C: Buffer Condition	B	9			
Raw Attribute Score = D+[C x (A x B)½]½			22	**Final Attribute Score = (Raw Score/24) x 100**	90.30%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.30%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. A	Numeric 12	10 patches	
Topographic Complexity		B	9		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	B	9		4 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			10		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			28	**Final Attribute Score = (Raw Score/36) x 100**	77.80%
Overall AA Score (average of four final Attribute Scores)				78.50%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	1.00
South	0.56
East	1.00
West	0.85
Average Percentage of Transect Length that is an Aquatic Feature	85.30%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	50
G	50
H	75
Average Buffer Width ***Round to the nearest integer***	178

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☑
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☑
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	10

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Frankenia salina	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Spartina foliosa	☐
Frankenia salina	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	4
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C37

Project ID #: **Date:** 9/14/2016

Assessment Team Members for This AA:

LSL, JGR

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C37				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. A	Numeric 12	93%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	A	12		250m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			24	**Final Attribute Score = (Raw Score/24) x 100**	100.00%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		B	9		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.67%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	7 patches	
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			27	**Final Attribute Score = (Raw Score/36) x 100**	75.00%
Overall AA Score (average of four final Attribute Scores)				76.04%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	1.00
South	0.82
East	1.00
West	0.91
Average Percentage of Transect Length that is an Aquatic Feature	93.25%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	250

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☑
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☐
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	7

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Spartina foliosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C38

Project ID #: **Date:** 9/14/2016

Assessment Team Members for This AA:

LSL, JGR

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C38			**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)			**Comments**	
Aquatic Area Abundance (D)	Alpha. A	Numeric 12	77%	
Buffer (based on sub-metrics A-C)				
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12	100%	
Buffer submetric B: Average Buffer Width	A	12	221m	
Buffer submetric C: Buffer Condition	A	12		
Raw Attribute Score = D+[C x (A x B)½]½		24	**Final Attribute Score = (Raw Score/24) x 100**	100.00%
Attribute 2: Hydrology (pp. 15-19)			**Comments**	
Water Source	Alpha. C	Numeric 6		
Hydroperiod	B	9		
Hydrologic Connectivity	B	9		
Raw Attribute Score = sum of numeric scores		24	**Final Attribute Score = (Raw Score/36) x 100**	66.67%
Attribute 3: Physical Structure (pp. 20-25)			**Comments**	
Structural Patch Richness	Alpha. B	Numeric 9	7 patches	
Topographic Complexity	C	6		
Raw Attribute Score = sum of numeric scores		15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)			**Comments**	
Plant Community Composition (based on sub-metrics A-C)				
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9	2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6	2 codominants	
Plant Community submetric C: Percent Invasion	A	12	0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*		9		
Horizontal Interspersion	C	6		
Vertical Biotic Structure	B	9		
Raw Attribute Score = sum of numeric scores		24	**Final Attribute Score = (Raw Score/36) x 100**	66.67%
Overall AA Score (average of four final Attribute Scores)			73.96%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.27
South	0.79
East	1.00
West	1.00
Average Percentage of Transect Length that is an Aquatic Feature	76.50%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	135
B	132
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	221

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☑
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	7

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	2
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: C40	
Project ID #:	**Date:** 9/13/2016

Assessment Team Members for This AA:

AAN, ACG, MMA

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C40				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	64%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	A	12		223m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.33%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. C	Numeric 6	4 patches	
Topographic Complexity		B	9		
Raw Attribute Score = sum of numeric scores			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	A	12			
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			30	**Final Attribute Score = (Raw Score/36) x 100**	83.33%
Overall AA Score (average of four final Attribute Scores)				72.92%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.15
South	0.70
East	0.70
West	1.00
Average Percentage of Transect Length that is an Aquatic Feature	63.75%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	75
B	250
C	250
D	250
E	250
F	250
G	250
H	210
Average Buffer Width ***Round to the nearest integer***	223

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	4

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Frankenia salina	☐
	☐	Salicornia pacifica	☐
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Frankenia salina	☐		☐
Salicornia pacifica	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✓	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer		
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✓	✓
Industrial/commercial		
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor	✓	✓
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)	✓	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C48

Project ID #: | **Date:** 9/14/2016

Assessment Team Members for This AA:

LSL, JGR

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C48				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. A	Numeric 12	80%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	A	12		250m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			24	**Final Attribute Score = (Raw Score/24) x 100**	100.00%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		B	9		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.70%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	8 patches	
Topographic Complexity		A	12		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	B	9		4 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			10		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			31	**Final Attribute Score = (Raw Score/36) x 100**	86.10%
Overall AA Score (average of four final Attribute Scores)				85.10%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	1.00
South	0.50
East	1.00
West	0.68
Average Percentage of Transect Length that is an Aquatic Feature	79.50%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	250

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☑
Point bars and in-channel bars	☑
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	8

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Frankenia salina	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Spartina foliosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	4
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C60

Project ID #: **Date:** 9/14/2016

Assessment Team Members for This AA:

LSL, JGR

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C60				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	63%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with at least 5m	
Buffer submetric B: Average Buffer Width	A	12		213m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		B	9		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.67%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	7 patches	
Topographic Complexity		A	12		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	B	9		4 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			10		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			31	**Final Attribute Score = (Raw Score/36) x 100**	86.11%
Overall AA Score (average of four final Attribute Scores)				81.94%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	1.00
South	0.18
East	0.44
West	0.91
Average Percentage of Transect Length that is an Aquatic Feature	63.25%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	191
E	147
F	118
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	213

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☑
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☑
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	7

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Spartina foliosa	☐
Frankenia salina	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	4
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)		
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer		
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential		
Industrial/commercial		
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor		
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)		
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: C64

Project ID #: | **Date:** 9/14/2016

Assessment Team Members for This AA:

AAN, BHE

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C64				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. C	Numeric 6	46%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with at least 5m buffer	
Buffer submetric B: Average Buffer Width	A	12		250m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			18	**Final Attribute Score = (Raw Score/24) x 100**	75.00%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.33%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	6 patches	
Topographic Complexity		B	9		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/24) x 100**	75.00%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	A	12		5 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			11		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			29	**Final Attribute Score = (Raw Score/36) x 100**	80.56%
Overall AA Score (average of four final Attribute Scores)				72.22%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.76
South	0.03
East	0.03
West	1.00
Average Percentage of Transect Length that is an Aquatic Feature	45.50%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	250

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	6

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South similar to B
East to West similar to B

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Distichlis spicata	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Spartina foliosa	☐
Frankenia salina	☐		☐
Spartina foliosa	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	5
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: C72	
Project ID #:	**Date:** 9/14/2016

Assessment Team Members for This AA:

AAN, BHE

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C72				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	55%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	A	12		228m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.33%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	6 patches	
Topographic Complexity		B	9		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/24) x 100**	75.00%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		C	6		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.67%
Overall AA Score (average of four final Attribute Scores)				71.88%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	1.00
South	0.12
East	0.09
West	1.00
Average Percentage of Transect Length that is an Aquatic Feature	55.25%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	103
F	220
G	250
H	250
Average Buffer Width ***Round to the nearest integer***	228

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	6

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South **closest to B**
East to West **closest to B**

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Frankenia salina	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Frankenia salina	☐		☐
Salicornia pacifica	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: C73	
Project ID #:	**Date:** 9/12/2016

Assessment Team Members for This AA:

LSL, AAN

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: C73				**Date:** 9/12/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. C	Numeric 6	50%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with 5m buffer	
Buffer submetric B: Average Buffer Width	C	6		124m	
Buffer submetric C: Buffer Condition	C	6			
Raw Attribute Score = D+[C x (A x B)½]½			13	**Final Attribute Score = (Raw Score/24) x 100**	54.70%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.30%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. A	Numeric 12	9 patches	
Topographic Complexity		B	9		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/24) x 100**	87.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	A	12		6 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			11		
Horizontal Interspersion		A	12		
Vertical Biotic Structure		B	9		
Raw Attribute Score = sum of numeric scores			32	**Final Attribute Score = (Raw Score/36) x 100**	88.90%
Overall AA Score (average of four final Attribute Scores)				72.40%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	1.00
South	0.15
East	0.03
West	0.82
Average Percentage of Transect Length that is an Aquatic Feature	50.00%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	45
D	75
E	220
F	30
G	30
H	88
Average Buffer Width ***Round to the nearest integer***	124

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☑
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☑
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	9

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Spartina foliosa	☐
Frankenia salina	☐	Schoenoplectus californica	☐
Spartina foliosa	☐		☐
Distichlis spicata	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	6
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: E2

Project ID #: **Date:** 9/14/2016

Assessment Team Members for This AA:

AAN, BHE

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☐ Perennial Saline ☑ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: E2				**Date:** 9/14/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	57%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with at least 5m buffer	
Buffer submetric B: Average Buffer Width	A	12		195m	
Buffer submetric C: Buffer Condition	B	9			
Raw Attribute Score = D+[C x (A x B)½]½			19	**Final Attribute Score = (Raw Score/24) x 100**	80.80%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		C	6		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/36) x 100**	50.00%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	7 patches	
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		4 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		C	6		
Vertical Biotic Structure		C	6		
Raw Attribute Score = sum of numeric scores			21	**Final Attribute Score = (Raw Score/36) x 100**	58.33%
Overall AA Score (average of four final Attribute Scores)				62.91%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.59
South	0.06
East	1.00
West	0.62
Average Percentage of Transect Length that is an Aquatic Feature	56.75%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	132
F	74
G	118
H	235
Average Buffer Width ***Round to the nearest integer***	195

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☐
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	7

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South No secondary channels but lots of microtopography
East to West No secondary channels but lots of microtopography

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Frankenia salina	☐
	☐	Salicornia pacifica	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Typha latifolia	☐	Typha latifolia	☐
Salicornia pacifica	☐		☐
Pluchea sericea	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	4
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

Basic Information Sheet: Depressional Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: E33	
Project ID #:	**Date:** 9/13//2016
Assessment Team Members for This AA	
AAN, ACG, MMA	

AA Category:

☑ Pre-Restoration ☐ Post-Restoration ☐ Pre-Mitigation ☐ Post-Mitigation

☐ Pre-Impact ☐ Post-Impact ☐ Training ☐ Ambient

☐ Reference ☐ Other:

Origin of Wetland (if known):

☑ Natural system ☐ Artificial system

Type of Management (if known):

☐ waterfowl/birds ☐ amphibians ☐ general wildlife ☐ sediment ☐ water quality ☐ stormwater

☐ water supply (agriculture) ☐ water supply (livestock) ☑ not managed ☐ other:

Which best describes the type of depressional wetland?

☐ freshwater marsh ☑ alkaline marsh ☐ brackish marsh

☐ other (specify):

AA Encompasses:

☐ entire wetland ☑ portion of the wetland

Which best describes the hydrologic state of the wetland at the time of assessment?

☐ ponded/inundated ☐ saturated soil, but no surface water ☑ dry

What is the apparent hydrologic regime of the wetland?

Perennially flooded systems contain surface water year-round, *seasonally flooded* depressional wetlands are defined as supporting surface water for 4-11 months of the year (in > 5 out of 10 years.) *Temporarily flooded* depressional wetlands possess surface water between 2 weeks and 4 months of the year.

☐ perennially flooded ☐ seasonally flooded ☑ temporarily flooded

Does your wetland connect with the floodplain of a nearby stream? ☑ yes ☐ no

(system subject to overbank flow, a dammed stream does not count)

Does the wetland have a defined on undefined <u>outlet</u>? ☑ defined ☐ undefined

Does the wetland have a defined on undefined <u>inlet</u>? ☑ defined ☐ undefined

Are the inlet and outlet at the same location? ☐ yes ☑ no

Is the topographic basin of the wetland ☐ distinct **or** ☑ indistinct **?**

An *indistinct* topographic basin is one that lacks obvious boundaries between wetland and upland. Examples of such features are seasonal, depressional wetlands in very low-gradient landscapes.

Photo Identification Numbers and Description:

Photos should be taken from edge of AA looking toward the centroid of AA

	Photo ID No.	Description	Latitude	Longitude	Datum
1		(to) North			
2		(to) East			
3		(to) South			
4		(to) West			
5					
6					
7					
8					
9					
10					

Site Location Description and Land Use:

Comments:

Scoring Sheet: Depressional Wetlands

AA Name: E33				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-15)				**Comments**	
Aquatic Area Abundance Score (D)			Alpha.	Numeric	
			A	12	62%
Buffer:					
Buffer submetric A: Percent of AA with Buffer	Alpha.	Numeric			
	A	12			100% with 5m buffer
Buffer submetric B: Average Buffer Width	A	12			246m
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = $D+[C \times (A \times B)^{1/2}]^{1/2}$				24	**Final Attribute Score = (Raw Score/24) x 100** 100
Attribute 2: Hydrology (pp. 16-21)					
Water Source			Alpha.	Numeric	
			C	6	
Hydroperiod			A	12	
Hydrologic Connectivity			B	9	
Raw Attribute Score = sum of numeric scores				27	**Final Attribute Score = (Raw Score/36) x 100** 75
Attribute 3: Physical Structure (pp. 22-28)					
Structural Patch Richness			Alpha.	Numeric	2 patches
			D	3	
Topographic Complexity			C	6	
Raw Attribute Score = sum of numeric scores				9	**Final Attribute Score = (Raw Score/24) x 100** 38
Attribute 4: Biotic Structure (pp. 29-39)					
Plant Community Composition (based on submetrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha.	Numeric			
	A	12			4 layers
Plant Community submetric B: Number of Co-dominant species	C	6			5 codominants
Plant Community submetric C: Percent Invasion	B	9			20% invasion
Plant Community Composition Metric *(numeric average of submetrics A-C)*				9	
Horizontal Interspersion			C	6	
Vertical Biotic Structure			A	12	
Raw Attribute Score = sum of numeric scores				27	**Final Attribute Score = (Raw Score/36) x 100** 75
Overall AA Score (average of four final Attribute Scores)					72

Worksheet for Aquatic Area Abundance Metric (Method 1)

Percentage of Transect Lines that Contains Aquatic Area of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	50
South	74
East	53
West	71
Average Percentage of Transect Length That Is an Aquatic Feature	62

Percent of AA with Buffer Worksheet.

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100 %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	220
Average Buffer Width ***Round to the nearest whole number (integer)***	246

Structural Patch Type Worksheet for Depressional Wetlands

Check each type of patch that is observed in the AA and use the total number of observed patches in Table 15.

STRUCTURAL PATCH TYPE (circle for presence)	**Depressional**
Minimum Patch Size	**3 m^2**
Abundant wrack or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☐
Bank slumps or undercut banks in channels or along shoreline	☐
Cobbles and Boulders	☐
Concentric or parallel high water marks	☐
Filamentous macroalgae or algal mats	☐
Islands (mostly above high-water)	☐
Large woody debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Open water	☑
Plant hummocks and/or sediment mounds	☐
Soil cracks	☐
Standing snag(s) (1 or more at least 3 m tall)	☐
Submerged vegetation	☑
Swales on floodplain or along shoreline	☐
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	☐
Woody vegetation in water	☐
Total Possible	**17**
No. Observed Patch Types (enter here and use in Table 15 below)	2

Worksheet for AA Topographic Complexity

At two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major topographic features, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 7, choose a description in Table 17 that best describes the overall topographic complexity of the AA.

North to South no benches but lots of microtopography
East to West

Plant Community Metric Worksheet 2 of 8: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.5 m)	Invasive?
		Frankenia salina	
		Chenopodium sp.	x
Medium (0.5 – 1.5 m)	**Invasive?**	**Tall (1.5 – 3.0 m)**	**Invasive?**
Schoenoplectus californicus		Schoenoplectus californicus	
Typha domingensis		Typha domingensis	
Very Tall (>3.0 m)	**Invasive?**		
Salix lasiolepis		**Total number of co-dominant species for all layers combined (enter here and use in Table 19)**	5
		Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 19)	20

Horizontal Interspersion Worksheet

Use the spaces below to make a sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign names to the zones and record them on the right. Based on the sketch, choose a single profile from Figure 8 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Wetland disturbances and conversions Worksheet

Has a major disturbance occurred at this wetland?	Yes	✔No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	bar-built estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)	☐	☐
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	☐
Flow diversions or unnatural inflows	☐	☐
Dams (reservoirs, detention basins, recharge basins)	☐	☐
Flow obstructions (culverts, paved stream crossings)	☐	☐
Weir/drop structure, tide gates	☐	☐
Dredged inlet/channel	☐	☐
Engineered channel (riprap, armored channel bank, bed)	☐	☐
Dike/levees	☐	☐
Groundwater extraction	☐	☐
Ditches (borrow, agricultural drainage, mosquito control, etc.)	☐	☐
Actively managed hydrology	☐	☐
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**	☐	☐
Grading/ compaction **(N/A for restoration areas)**	☐	☐
Plowing/Discing **(N/A for restoration areas)**	☐	☐
Resource extraction (sediment, gravel, oil and/or gas)	☐	☐
Vegetation management	☐	☐
Excessive sediment or organic debris from watershed	☐	☐
Excessive runoff from watershed	☐	☐
Nutrient impaired (PS or Non-PS pollution)	☐	☐
Heavy metal impaired (PS or Non-PS pollution)	☐	☐
Pesticides or trace organics impaired (PS or Non-PS pollution)	☐	☐
Bacteria and pathogens impaired (PS or Non-PS pollution)	☐	☐
Trash or refuse	☐	☐
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer		
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial		
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)	✔	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

Basic Information Sheet: Depressional Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: E34	
Project ID #:	**Date:** 9/13//2016

Assessment Team Members for This AA

AAN, ACG, MMA

AA Category:

☑ Pre-Restoration ☐ Post-Restoration ☐ Pre-Mitigation ☐ Post-Mitigation

☐ Pre-Impact ☐ Post-Impact ☐ Training ☐ Ambient

☐ Reference ☐ Other:

Origin of Wetland (if known):

☑ Natural system ☐ Artificial system

Type of Management (if known):

☐ waterfowl/birds ☐ amphibians ☐ general wildlife ☐ sediment ☐ water quality ☐ stormwater

☐ water supply (agriculture) ☐ water supply (livestock) ☑ not managed ☐ other:

Which best describes the type of depressional wetland?

☐ freshwater marsh ☑ alkaline marsh ☐ brackish marsh

☐ other (specify):

AA Encompasses:

☐ entire wetland ☑ portion of the wetland

Which best describes the hydrologic state of the wetland at the time of assessment?

☐ ponded/inundated ☐ saturated soil, but no surface water ☑ dry

What is the apparent hydrologic regime of the wetland?

Perennially flooded systems contain surface water year-round, *seasonally flooded* depressional wetlands are defined as supporting surface water for 4-11 months of the year (in > 5 out of 10 years.) *Temporarily flooded* depressional wetlands possess surface water between 2 weeks and 4 months of the year.

☐ perennially flooded ☐ seasonally flooded ☑ temporarily flooded

Does your wetland connect with the floodplain of a nearby stream? ☑ yes ☐ no

(system subject to overbank flow, a dammed stream does not count)

Does the wetland have a defined on undefined <u>outlet</u>? ☑ defined ☐ undefined

Does the wetland have a defined on undefined <u>inlet</u>? ☑ defined ☐ undefined

Are the inlet and outlet at the same location? ☐ yes ☑ no

Is the topographic basin of the wetland ☐ distinct **or** ☑ indistinct **?**

An *indistinct* topographic basin is one that lacks obvious boundaries between wetland and upland. Examples of such features are seasonal, depressional wetlands in very low-gradient landscapes.

Photo Identification Numbers and Description:

Photos should be taken from edge of AA looking toward the centroid of AA

	Photo ID No.	Description	Latitude	Longitude	Datum
1		(to) North			
2		(to) East			
3		(to) South			
4		(to) West			
5					
6					
7					
8					
9					
10					

Site Location Description and Land Use:

Comments:

Scoring Sheet: Depressional Wetlands

AA Name: E34				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-15)				**Comments**	
Aquatic Area Abundance Score (D)			Alpha.	Numeric	
			A	12	80%
Buffer:					
Buffer submetric A: Percent of AA with Buffer	Alpha.	Numeric			
	A	12			100% with 5m buffer
Buffer submetric B: Average Buffer Width	A	12			250m
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = $D+[C \times (A \times B)^{1/2}]^{1/2}$				24	**Final Attribute Score = (Raw Score/24) x 100** 100
Attribute 2: Hydrology (pp. 16-21)					
			Alpha.	Numeric	
Water Source			C	6	
Hydroperiod			A	12	
Hydrologic Connectivity			B	9	
Raw Attribute Score = sum of numeric scores				27	**Final Attribute Score = (Raw Score/36) x 100** 75
Attribute 3: Physical Structure (pp. 22-28)					
			Alpha.	Numeric	2 patches
Structural Patch Richness			D	3	
Topographic Complexity			C	6	
Raw Attribute Score = sum of numeric scores				9	**Final Attribute Score = (Raw Score/24) x 100** 38
Attribute 4: Biotic Structure (pp. 29-39)					
Plant Community Composition (based on submetrics A-C)					
	Alpha.	Numeric			
Plant Community submetric A: Number of plant layers	B	9			3 layers
Plant Community submetric B: Number of Co-dominant species	C	6			6 codominants
Plant Community submetric C: Percent Invasion	B	9			17% invasion
Plant Community Composition Metric *(numeric average of submetrics A-C)*				8	
Horizontal Interspersion			C	6	
Vertical Biotic Structure			A	12	
Raw Attribute Score = sum of numeric scores				26	**Final Attribute Score = (Raw Score/36) x 100** 72
Overall AA Score (average of four final Attribute Scores)					71

Worksheet for Aquatic Area Abundance Metric (Method 1)

Percentage of Transect Lines that Contains Aquatic Area of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	79
South	68
East	74
West	100
Average Percentage of Transect Length That Is an Aquatic Feature	80

Percent of AA with Buffer Worksheet.

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100 %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest whole number (integer)***	250

Structural Patch Type Worksheet for Depressional Wetlands

Check each type of patch that is observed in the AA and use the total number of observed patches in Table 15.

STRUCTURAL PATCH TYPE (circle for presence)	**Depressional**
Minimum Patch Size	**3 m^2**
Abundant wrack or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☐
Bank slumps or undercut banks in channels or along shoreline	☐
Cobbles and Boulders	☐
Concentric or parallel high water marks	☐
Filamentous macroalgae or algal mats	☐
Islands (mostly above high-water)	☐
Large woody debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Open water	☐
Plant hummocks and/or sediment mounds	☐
Soil cracks	☑
Standing snag(s) (1 or more at least 3 m tall)	☐
Submerged vegetation	☐
Swales on floodplain or along shoreline	☐
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	☐
Woody vegetation in water	☐
Total Possible	**17**
No. Observed Patch Types (enter here and use in Table 15 below)	2

Worksheet for AA Topographic Complexity

At two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major topographic features, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 7, choose a description in Table 17 that best describes the overall topographic complexity of the AA.

North to South no benches but lots of microtopography
East to West

Plant Community Metric Worksheet 2 of 8: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.5 m)	Invasive?
		Frankenia salina	
		Chenopodium sp.	x
		Salicornia pacifica	
		Cyperus sp.	
Medium (0.5 – 1.5 m)	**Invasive?**	**Tall (1.5 – 3.0 m)**	**Invasive?**
Schoenoplectus californicus		Schoenoplectus californicus	
Typha domingensis		Typha domingensis	
Very Tall (>3.0 m)	**Invasive?**		
		Total number of co-dominant species for all layers combined (enter here and use in Table 19)	6
		Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 19)	17

Horizontal Interspersion Worksheet

Use the spaces below to make a sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign names to the zones and record them on the right. Based on the sketch, choose a single profile from Figure 8 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Wetland disturbances and conversions Worksheet

Has a major disturbance occurred at this wetland?	Yes	✔No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	bar-built estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)	☐	☐
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	☐
Flow diversions or unnatural inflows	☐	☐
Dams (reservoirs, detention basins, recharge basins)	☐	☐
Flow obstructions (culverts, paved stream crossings)	☐	☐
Weir/drop structure, tide gates	☐	☐
Dredged inlet/channel	☐	☐
Engineered channel (riprap, armored channel bank, bed)	☐	☐
Dike/levees	☐	☐
Groundwater extraction	☐	☐
Ditches (borrow, agricultural drainage, mosquito control, etc.)	☐	☐
Actively managed hydrology	☐	☐
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**	☐	☐
Grading/ compaction **(N/A for restoration areas)**	☐	☐
Plowing/Discing **(N/A for restoration areas)**	☐	☐
Resource extraction (sediment, gravel, oil and/or gas)	☐	☐
Vegetation management	☐	☐
Excessive sediment or organic debris from watershed	☐	☐
Excessive runoff from watershed	☐	☐
Nutrient impaired (PS or Non-PS pollution)	☐	☐
Heavy metal impaired (PS or Non-PS pollution)	☐	☐
Pesticides or trace organics impaired (PS or Non-PS pollution)	☐	☐
Bacteria and pathogens impaired (PS or Non-PS pollution)	☐	☐
Trash or refuse	☐	☐
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer		
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial		
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor		
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)	✔	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: E36

Project ID #: | **Date:** 9/13/2016

Assessment Team Members for This AA:

AAN, ACG, MMA

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: E36				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	52%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100%	
Buffer submetric B: Average Buffer Width	B	9		162m	
Buffer submetric C: Buffer Condition	A	12			
Raw Attribute Score = D+[C x (A x B)½]½			20	**Final Attribute Score = (Raw Score/24) x 100**	84.03%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		C	6		
Hydrologic Connectivity		C	6		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/36) x 100**	50.00%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. C	Numeric 6	3 patches	
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			12	**Final Attribute Score = (Raw Score/24) x 100**	50.00%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	C	6		33% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			7		
Horizontal Interspersion		D	3		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			22	**Final Attribute Score = (Raw Score/36) x 100**	61.11%
Overall AA Score (average of four final Attribute Scores)				61.29%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.03
South	1.00
East	1.00
West	0.03
Average Percentage of Transect Length that is an Aquatic Feature	51.50%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	**Buffer Width (m)**
A	15
B	250
C	250
D	250
E	250
F	250
G	15
H	15
Average Buffer Width ***Round to the nearest integer***	162

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☐
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	3

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Salicornia pacifica	☐
	☐	Frankenia salina	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐		☐
Frankenia salina	☐		☐
Chenopodium sp.	✔		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	33
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	✔	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

Basic Information Sheet: Depressional Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: E63	
Project ID #:	**Date:** 9/13//2016

Assessment Team Members for This AA

LSL, BHE

AA Category:

☑ Pre-Restoration ☐ Post-Restoration ☐ Pre-Mitigation ☐ Post-Mitigation

☐ Pre-Impact ☐ Post-Impact ☐ Training ☐ Ambient

☐ Reference ☐ Other:

Origin of Wetland (if known):

☑ Natural system ☐ Artificial system

Type of Management (if known):

☐ waterfowl/birds ☐ amphibians ☐ general wildlife ☐ sediment ☐ water quality ☐ stormwater

☐ water supply (agriculture) ☐ water supply (livestock) ☑ not managed ☐ other:

Which best describes the type of depressional wetland?

☐ freshwater marsh ☑ alkaline marsh ☐ brackish marsh

☐ other (specify):

AA Encompasses:

☐ entire wetland ☑ portion of the wetland

Which best describes the hydrologic state of the wetland at the time of assessment?

☐ ponded/inundated ☐ saturated soil, but no surface water ☑ dry

What is the apparent hydrologic regime of the wetland?

Perennially flooded systems contain surface water year-round, *seasonally flooded* depressional wetlands are defined as supporting surface water for 4-11 months of the year (in > 5 out of 10 years.) *Temporarily flooded* depressional wetlands possess surface water between 2 weeks and 4 months of the year.

☐ perennially flooded ☐ seasonally flooded ☑ temporarily flooded

Does your wetland connect with the floodplain of a nearby stream? ☑ yes ☐ no

(system subject to overbank flow, a dammed stream does not count)

Does the wetland have a defined on undefined <u>outlet</u>? ☑ defined ☐ undefined

Does the wetland have a defined on undefined <u>inlet</u>? ☑ defined ☐ undefined

Are the inlet and outlet at the same location? ☐ yes ☑ no

Is the topographic basin of the wetland ☐ distinct **or** ☑ indistinct **?**

An *indistinct* topographic basin is one that lacks obvious boundaries between wetland and upland. Examples of such features are seasonal, depressional wetlands in very low-gradient landscapes.

Photo Identification Numbers and Description:

Photos should be taken from edge of AA looking toward the centroid of AA

	Photo ID No.	Description	Latitude	Longitude	Datum
1		(to) North			
2		(to) East			
3		(to) South			
4		(to) West			
5					
6					
7					
8					
9					
10					

Site Location Description and Land Use:

Comments:

Scoring Sheet: Depressional Wetlands

AA Name: E63					**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-15)					**Comments**	
Aquatic Area Abundance Score (D)			Alpha.	Numeric		
			B	9	44%	
Buffer:						
Buffer submetric A: Percent of AA with Buffer	Alpha.	Numeric				
	A	12			100% with 5m buffer	
Buffer submetric B: Average Buffer Width	A	12			250m	
Buffer submetric C: Buffer Condition	B	9				
Raw Attribute Score = D+[C x (A x B)^{½}]^{½}				19.4	**Final Attribute Score = (Raw Score/24) x 100**	81
Attribute 2: Hydrology (pp. 16-21)						
Water Source			Alpha.	Numeric		
			C	6		
Hydroperiod			A	12		
Hydrologic Connectivity			A	12		
Raw Attribute Score = sum of numeric scores				30	**Final Attribute Score = (Raw Score/36) x 100**	83
Attribute 3: Physical Structure (pp. 22-28)						
Structural Patch Richness			Alpha.	Numeric	4 patches	
			C	6		
Topographic Complexity			C	6		
Raw Attribute Score = sum of numeric scores				12	**Final Attribute Score = (Raw Score/24) x 100**	50
Attribute 4: Biotic Structure (pp. 29-39)						
Plant Community Composition (based on submetrics A-C)						
Plant Community submetric A: Number of plant layers	Alpha.	Numeric				
	A	12			4 layers	
Plant Community submetric B: Number of Co-dominant species	C	6			6 codominants	
Plant Community submetric C: Percent Invasion	A	12			0% invasion	
Plant Community Composition Metric *(numeric average of submetrics A-C)*				10		
Horizontal Interspersion			A	12		
Vertical Biotic Structure			A	12		
Raw Attribute Score = sum of numeric scores				34	**Final Attribute Score = (Raw Score/36) x 100**	94
Overall AA Score (average of four final Attribute Scores)					77	

Worksheet for Aquatic Area Abundance Metric (Method 1)

Percentage of Transect Lines that Contains Aquatic Area of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	5
South	20
East	50
West	100
Average Percentage of Transect Length That Is an Aquatic Feature	44

Percent of AA with Buffer Worksheet.

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100 %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest whole number (integer)***	250

Structural Patch Type Worksheet for Depressional Wetlands

Check each type of patch that is observed in the AA and use the total number of observed patches in Table 15.

STRUCTURAL PATCH TYPE (circle for presence)	**Depressional**
Minimum Patch Size	**3 m^2**
Abundant wrack or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Cobbles and Boulders	☐
Concentric or parallel high water marks	☐
Filamentous macroalgae or algal mats	☑
Islands (mostly above high-water)	☐
Large woody debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Open water	☐
Plant hummocks and/or sediment mounds	☐
Soil cracks	☑
Standing snag(s) (1 or more at least 3 m tall)	☐
Submerged vegetation	☐
Swales on floodplain or along shoreline	☐
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	☐
Woody vegetation in water	☐
Total Possible	**17**
No. Observed Patch Types (enter here and use in Table 15 below)	4

Worksheet for AA Topographic Complexity

At two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major topographic features, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 7, choose a description in Table 17 that best describes the overall topographic complexity of the AA.

North to South no benches but lots of microtopography
East to West

Plant Community Metric Worksheet 2 of 8: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.5 m)	Invasive?
		Frankenia salina	
Medium (0.5 – 1.5 m)	**Invasive?**	**Tall (1.5 – 3.0 m)**	**Invasive?**
Bolboschoenus maritimus		Typha domingensis	
Salicornia pacifica			
Juncus acutus			
Very Tall (>3.0 m)	**Invasive?**		
Salix lasiolepis		**Total number of co-dominant species for all layers combined (enter here and use in Table 19)**	6
		Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 19)	0

Horizontal Interspersion Worksheet

Use the spaces below to make a sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign names to the zones and record them on the right. Based on the sketch, choose a single profile from Figure 8 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Wetland disturbances and conversions Worksheet

Has a major disturbance occurred at this wetland?	Yes	✔No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	bar-built estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)	☐	☐
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	☐
Flow diversions or unnatural inflows	☐	☐
Dams (reservoirs, detention basins, recharge basins)	☐	☐
Flow obstructions (culverts, paved stream crossings)	☐	☐
Weir/drop structure, tide gates	☐	☐
Dredged inlet/channel	☐	☐
Engineered channel (riprap, armored channel bank, bed)	☐	☐
Dike/levees	☐	☐
Groundwater extraction	☐	☐
Ditches (borrow, agricultural drainage, mosquito control, etc.)	☐	☐
Actively managed hydrology	☐	☐
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**	☐	☐
Grading/ compaction **(N/A for restoration areas)**	☐	☐
Plowing/Discing **(N/A for restoration areas)**	☐	☐
Resource extraction (sediment, gravel, oil and/or gas)	☐	☐
Vegetation management	☐	☐
Excessive sediment or organic debris from watershed	☐	☐
Excessive runoff from watershed	☐	☐
Nutrient impaired (PS or Non-PS pollution)	☐	☐
Heavy metal impaired (PS or Non-PS pollution)	☐	☐
Pesticides or trace organics impaired (PS or Non-PS pollution)	☐	☐
Bacteria and pathogens impaired (PS or Non-PS pollution)	☐	☐
Trash or refuse	☐	☐
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer		
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial		
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor		
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)	✔	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

Basic Information Sheet: Depressional Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: E65	
Project ID #:	**Date:** 9/13//2016

Assessment Team Members for This AA

LSL, BHE

AA Category:

☑ Pre-Restoration ☐ Post-Restoration ☐ Pre-Mitigation ☐ Post-Mitigation

☐ Pre-Impact ☐ Post-Impact ☐ Training ☐ Ambient

☐ Reference ☐ Other:

Origin of Wetland (if known):

☑ Natural system ☐ Artificial system

Type of Management (if known):

☐ waterfowl/birds ☐ amphibians ☐ general wildlife ☐ sediment ☐ water quality ☐ stormwater

☐ water supply (agriculture) ☐ water supply (livestock) ☑ not managed ☐ other:

Which best describes the type of depressional wetland?

☐ freshwater marsh ☑ alkaline marsh ☐ brackish marsh

☐ other (specify):

AA Encompasses:

☐ entire wetland ☑ portion of the wetland

Which best describes the hydrologic state of the wetland at the time of assessment?

☐ ponded/inundated ☐ saturated soil, but no surface water ☑ dry

What is the apparent hydrologic regime of the wetland?

Perennially flooded systems contain surface water year-round, *seasonally flooded* depressional wetlands are defined as supporting surface water for 4-11 months of the year (in > 5 out of 10 years.) *Temporarily flooded* depressional wetlands possess surface water between 2 weeks and 4 months of the year.

☐ perennially flooded ☐ seasonally flooded ☑ temporarily flooded

Does your wetland connect with the floodplain of a nearby stream? ☑ yes ☐ no

(system subject to overbank flow, a dammed stream does not count)

Does the wetland have a defined on undefined <u>outlet</u>? ☑ defined ☐ undefined

Does the wetland have a defined on undefined <u>inlet</u>? ☑ defined ☐ undefined

Are the inlet and outlet at the same location? ☐ yes ☑ no

Is the topographic basin of the wetland ☐ distinct **or** ☑ indistinct **?**

An *indistinct* topographic basin is one that lacks obvious boundaries between wetland and upland. Examples of such features are seasonal, depressional wetlands in very low-gradient landscapes.

Photo Identification Numbers and Description:

Photos should be taken from edge of AA looking toward the centroid of AA

	Photo ID No.	Description	Latitude	Longitude	Datum
1		(to) North			
2		(to) East			
3		(to) South			
4		(to) West			
5					
6					
7					
8					
9					
10					

Site Location Description and Land Use:

Comments:

Scoring Sheet: Depressional Wetlands

AA Name: E65				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-15)				**Comments**	
Aquatic Area Abundance Score (D)			Alpha.	Numeric	
			A	12	48%
Buffer:					
Buffer submetric A: Percent of AA with Buffer	Alpha.	Numeric			
	A	12			100% with 5m buffer
Buffer submetric B: Average Buffer Width	A	12			250m
Buffer submetric C: Buffer Condition	B	9			
Raw Attribute Score = D+[C x (A x B)^{½}]^{½}				22.4	**Final Attribute Score = (Raw Score/24) x 100** 93
Attribute 2: Hydrology (pp. 16-21)					
			Alpha.	Numeric	
Water Source			C	6	
Hydroperiod			A	12	
Hydrologic Connectivity			A	12	
Raw Attribute Score = sum of numeric scores				30	**Final Attribute Score = (Raw Score/36) x 100** 83
Attribute 3: Physical Structure (pp. 22-28)					
			Alpha.	Numeric	5 patches
Structural Patch Richness			C	6	
Topographic Complexity			C	6	
Raw Attribute Score = sum of numeric scores				12	**Final Attribute Score = (Raw Score/24) x 100** 50
Attribute 4: Biotic Structure (pp. 29-39)					
Plant Community Composition (based on submetrics A-C)					
	Alpha.	Numeric			
Plant Community submetric A: Number of plant layers	B	9			3 layers
Plant Community submetric B: Number of Co-dominant species	C	6			5 codominants
Plant Community submetric C: Percent Invasion	A	12			0% invasion
Plant Community Composition Metric *(numeric average of submetrics A-C)*				9	
Horizontal Interspersion			B	9	
Vertical Biotic Structure			A	12	
Raw Attribute Score = sum of numeric scores				30	**Final Attribute Score = (Raw Score/36) x 100** 83
Overall AA Score (average of four final Attribute Scores)					77

Worksheet for Aquatic Area Abundance Metric (Method 1)

Percentage of Transect Lines that Contains Aquatic Area of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	20
South	20
East	55
West	100
Average Percentage of Transect Length That Is an Aquatic Feature	48

Percent of AA with Buffer Worksheet.

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100 %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest whole number (integer)***	250

Structural Patch Type Worksheet for Depressional Wetlands

Check each type of patch that is observed in the AA and use the total number of observed patches in Table 15.

STRUCTURAL PATCH TYPE (circle for presence)	**Depressional**
Minimum Patch Size	**3 m^2**
Abundant wrack or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Cobbles and Boulders	☐
Concentric or parallel high water marks	☐
Filamentous macroalgae or algal mats	☑
Islands (mostly above high-water)	☐
Large woody debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Open water	☐
Plant hummocks and/or sediment mounds	☐
Soil cracks	☑
Standing snag(s) (1 or more at least 3 m tall)	☐
Submerged vegetation	☐
Swales on floodplain or along shoreline	☑
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	☐
Woody vegetation in water	☐
Total Possible	**17**
No. Observed Patch Types (enter here and use in Table 15 below)	5

Worksheet for AA Topographic Complexity

At two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major topographic features, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 7, choose a description in Table 17 that best describes the overall topographic complexity of the AA.

North to South no benches but lots of microtopography
East to West

Plant Community Metric Worksheet 2 of 8: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.5 m)	Invasive?
		Frankenia salina	
		Jaumea carnosa	
Medium (0.5 – 1.5 m)	**Invasive?**	**Tall (1.5 – 3.0 m)**	**Invasive?**
Arthrocnemum subterminale		Juncus acutus	
Salicornia pacifica			
Very Tall (>3.0 m)	**Invasive?**		
Salix lasiolepis		**Total number of co-dominant species for all layers combined (enter here and use in Table 19)**	5
		Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 19)	0

Horizontal Interspersion Worksheet

Use the spaces below to make a sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign names to the zones and record them on the right. Based on the sketch, choose a single profile from Figure 8 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Wetland disturbances and conversions Worksheet

Has a major disturbance occurred at this wetland?	Yes	✔No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	bar-built estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)	☐	☐
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	☐
Flow diversions or unnatural inflows	☐	☐
Dams (reservoirs, detention basins, recharge basins)	☐	☐
Flow obstructions (culverts, paved stream crossings)	☐	☐
Weir/drop structure, tide gates	☐	☐
Dredged inlet/channel	☐	☐
Engineered channel (riprap, armored channel bank, bed)	☐	☐
Dike/levees	☐	☐
Groundwater extraction	☐	☐
Ditches (borrow, agricultural drainage, mosquito control, etc.)	☐	☐
Actively managed hydrology	☐	☐
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**	☐	☐
Grading/ compaction **(N/A for restoration areas)**	☐	☐
Plowing/Discing **(N/A for restoration areas)**	☐	☐
Resource extraction (sediment, gravel, oil and/or gas)	☐	☐
Vegetation management	☐	☐
Excessive sediment or organic debris from watershed	☐	☐
Excessive runoff from watershed	☐	☐
Nutrient impaired (PS or Non-PS pollution)	☐	☐
Heavy metal impaired (PS or Non-PS pollution)	☐	☐
Pesticides or trace organics impaired (PS or Non-PS pollution)	☐	☐
Bacteria and pathogens impaired (PS or Non-PS pollution)	☐	☐
Trash or refuse	☐	☐
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer		
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial		
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor		
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)	✔	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

Basic Information Sheet: Depressional Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: E75	
Project ID #:	**Date:** 9/13//2016

Assessment Team Members for This AA

LSL, BHE

AA Category:

☑ Pre-Restoration ☐ Post-Restoration ☐ Pre-Mitigation ☐ Post-Mitigation

☐ Pre-Impact ☐ Post-Impact ☐ Training ☐ Ambient

☐ Reference ☐ Other:

Origin of Wetland (if known):

☑ Natural system ☐ Artificial system

Type of Management (if known):

☐ waterfowl/birds ☐ amphibians ☐ general wildlife ☐ sediment ☐ water quality ☐ stormwater

☐ water supply (agriculture) ☐ water supply (livestock) ☑ not managed ☐ other:

Which best describes the type of depressional wetland?

☐ freshwater marsh ☑ alkaline marsh ☐ brackish marsh

☐ other (specify):

AA Encompasses:

☐ entire wetland ☑ portion of the wetland

Which best describes the hydrologic state of the wetland at the time of assessment?

☐ ponded/inundated ☐ saturated soil, but no surface water ☑ dry

What is the apparent hydrologic regime of the wetland?

Perennially flooded systems contain surface water year-round, *seasonally flooded* depressional wetlands are defined as supporting surface water for 4-11 months of the year (in > 5 out of 10 years.) *Temporarily flooded* depressional wetlands possess surface water between 2 weeks and 4 months of the year.

☐ perennially flooded ☐ seasonally flooded ☑ temporarily flooded

Does your wetland connect with the floodplain of a nearby stream? ☑ yes ☐ no

(system subject to overbank flow, a dammed stream does not count)

Does the wetland have a defined on undefined <u>outlet</u>? ☑ defined ☐ undefined

Does the wetland have a defined on undefined <u>inlet</u>? ☑ defined ☐ undefined

Are the inlet and outlet at the same location? ☐ yes ☑ no

Is the topographic basin of the wetland ☐ distinct **or** ☑ indistinct **?**

An *indistinct* topographic basin is one that lacks obvious boundaries between wetland and upland. Examples of such features are seasonal, depressional wetlands in very low-gradient landscapes.

Photo Identification Numbers and Description:

Photos should be taken from edge of AA looking toward the centroid of AA

	Photo ID No.	Description	Latitude	Longitude	Datum
1		(to) North			
2		(to) East			
3		(to) South			
4		(to) West			
5					
6					
7					
8					
9					
10					

Site Location Description and Land Use:

Comments:

Scoring Sheet: Depressional Wetlands

AA Name: E75				**Date:** 9/13/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-15)				**Comments**	
Aquatic Area Abundance Score (D)			Alpha.	Numeric	
			A	12	50%
Buffer:					
Buffer submetric A: Percent of AA with Buffer	Alpha.	Numeric			
	A	12			100% with 5m buffer
Buffer submetric B: Average Buffer Width	A	12			250m
Buffer submetric C: Buffer Condition	B	9			
Raw Attribute Score = D+[C x (A x B)^{½}]^{½}				22.4	**Final Attribute Score = (Raw Score/24) x 100** 93
Attribute 2: Hydrology (pp. 16-21)					
			Alpha.	Numeric	
Water Source			C	6	
Hydroperiod			A	12	
Hydrologic Connectivity			A	12	
Raw Attribute Score = sum of numeric scores				30	**Final Attribute Score = (Raw Score/36) x 100** 83
Attribute 3: Physical Structure (pp. 22-28)					
			Alpha.	Numeric	4 patches
Structural Patch Richness			C	6	
Topographic Complexity			C	6	
Raw Attribute Score = sum of numeric scores				12	**Final Attribute Score = (Raw Score/24) x 100** 50
Attribute 4: Biotic Structure (pp. 29-39)					
Plant Community Composition (based on submetrics A-C)					
	Alpha.	Numeric			
Plant Community submetric A: Number of plant layers	A	12			4 layers
Plant Community submetric B: Number of Co-dominant species	A	12			10 codominants
Plant Community submetric C: Percent Invasion	A	12			10% invasion
Plant Community Composition Metric *(numeric average of submetrics A-C)*				12	
Horizontal Interspersion			A	12	
Vertical Biotic Structure			A	12	
Raw Attribute Score = sum of numeric scores				36	**Final Attribute Score = (Raw Score/36) x 100** 100
Overall AA Score (average of four final Attribute Scores)					82

Worksheet for Aquatic Area Abundance Metric (Method 1)

Percentage of Transect Lines that Contains Aquatic Area of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	50
South	0
East	50
West	100
Average Percentage of Transect Length That Is an Aquatic Feature	50

Percent of AA with Buffer Worksheet.

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100 %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	250
B	250
C	250
D	250
E	250
F	250
G	250
H	250
Average Buffer Width ***Round to the nearest whole number (integer)***	250

Structural Patch Type Worksheet for Depressional Wetlands

Check each type of patch that is observed in the AA and use the total number of observed patches in Table 15.

STRUCTURAL PATCH TYPE (circle for presence)	**Depressional**
Minimum Patch Size	**3 m^2**
Abundant wrack or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Cobbles and Boulders	☐
Concentric or parallel high water marks	☐
Filamentous macroalgae or algal mats	☐
Islands (mostly above high-water)	☐
Large woody debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Open water	☐
Plant hummocks and/or sediment mounds	☐
Soil cracks	☑
Standing snag(s) (1 or more at least 3 m tall)	☐
Submerged vegetation	☐
Swales on floodplain or along shoreline	☑
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	☐
Woody vegetation in water	☐
Total Possible	**17**
No. Observed Patch Types (enter here and use in Table 15 below)	4

Worksheet for AA Topographic Complexity

At two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major topographic features, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 7, choose a description in Table 17 that best describes the overall topographic complexity of the AA.

North to South no benches but lots of microtopography
East to West

Plant Community Metric Worksheet 2 of 8: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.5 m)	Invasive?
		Frankenia salina	
		Malvella leprosa	
		Chenopodium sp.	x
		Jaumea carnosa	
Medium (0.5 – 1.5 m)	**Invasive?**	**Tall (1.5 – 3.0 m)**	**Invasive?**
Elymus triticoides		Typha domingensis	
Salicornia pacifica		Juncus acutus	
		Isocoma menziesii	
Very Tall (>3.0 m)	**Invasive?**		
Salix lasiolepis		**Total number of co-dominant species for all layers combined (enter here and use in Table 19)**	10
		Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 19)	10

Horizontal Interspersion Worksheet

Use the spaces below to make a sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign names to the zones and record them on the right. Based on the sketch, choose a single profile from Figure 8 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Wetland disturbances and conversions Worksheet

Has a major disturbance occurred at this wetland?	Yes	✔No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	bar-built estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)	☐	☐
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	☐
Flow diversions or unnatural inflows	☐	☐
Dams (reservoirs, detention basins, recharge basins)	☐	☐
Flow obstructions (culverts, paved stream crossings)	☐	☐
Weir/drop structure, tide gates	☐	☐
Dredged inlet/channel	☐	☐
Engineered channel (riprap, armored channel bank, bed)	☐	☐
Dike/levees	☐	☐
Groundwater extraction	☐	☐
Ditches (borrow, agricultural drainage, mosquito control, etc.)	☐	☐
Actively managed hydrology	☐	☐
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**	☐	☐
Grading/ compaction **(N/A for restoration areas)**	☐	☐
Plowing/Discing **(N/A for restoration areas)**	☐	☐
Resource extraction (sediment, gravel, oil and/or gas)	☐	☐
Vegetation management	☐	☐
Excessive sediment or organic debris from watershed	☐	☐
Excessive runoff from watershed	☐	☐
Nutrient impaired (PS or Non-PS pollution)	☐	☐
Heavy metal impaired (PS or Non-PS pollution)	☐	☐
Pesticides or trace organics impaired (PS or Non-PS pollution)	☐	☐
Bacteria and pathogens impaired (PS or Non-PS pollution)	☐	☐
Trash or refuse	☐	☐
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer		
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial		
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor		
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)	✔	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: W1

Project ID #: **Date:** 9/12/2016

Assessment Team Members for This AA:

LSL, AAN

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: W1				**Date:** 9/12/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. B	Numeric 9	61%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with 5m buffer	
Buffer submetric B: Average Buffer Width	D	3		13m	
Buffer submetric C: Buffer Condition	C	6			
Raw Attribute Score = D+[C x (A x B)½]½			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		D	3		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/36) x 100**	50.00%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. A	Numeric 12	9 patches	
Topographic Complexity		A	12		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/24) x 100**	100.00
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		B	9		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			30	**Final Attribute Score = (Raw Score/36) x 100**	83.30%
Overall AA Score (average of four final Attribute Scores)				74.00%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.30
South	0.40
East	1.00
West	0.75
Average Percentage of Transect Length that is an Aquatic Feature	61.30%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	**Buffer Width (m)**
A	25
B	15
C	15
D	15
E	15
F	5
G	5
H	5
Average Buffer Width ***Round to the nearest integer***	13

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☑
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☑
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☐
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☑
Pools or depressions in channels (wet or dry channels)	☑
Secondary channels	☑
Shellfish beds (living)	☐
Soil cracks	☑
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	9

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Frankenia salina	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐		☐
Frankenia salina	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:	
Project Name: SELRP	
Assessment Area ID #: W4	
Project ID #:	**Date:** 9/12/2016

Assessment Team Members for This AA:

LSL, AAN

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: W4				**Date:** 9/12/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. A	Numeric 12	82%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with 5m buffer	
Buffer submetric B: Average Buffer Width	C	6		106m	
Buffer submetric C: Buffer Condition	B	9			
Raw Attribute Score = D+[C x (A x B)½]½			21	**Final Attribute Score = (Raw Score/24) x 100**	86.40%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		D	3		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/36) x 100**	50.00%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. C	Numeric 6	3 patches	
Topographic Complexity		D	3	no channels	
Raw Attribute Score = sum of numeric scores			9	**Final Attribute Score = (Raw Score/24) x 100**	37.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		2 layers	
Plant Community submetric B: Number of Co-dominant species	C	6		3 codominants	
Plant Community submetric C: Percent Invasion	A	12		0% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			9		
Horizontal Interspersion		D	3		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			24	**Final Attribute Score = (Raw Score/36) x 100**	66.70%
Overall AA Score (average of four final Attribute Scores)				60.20%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.91
South	0.76
East	0.73
West	0.88
Average Percentage of Transect Length that is an Aquatic Feature	82.00%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	**Buffer Width (m)**
A	250
B	50
C	30
D	120
E	250
F	50
G	20
H	75
Average Buffer Width ***Round to the nearest integer***	106

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☐
Large Woody Debris	☑
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☐
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☐
Shellfish beds (living)	☐
Soil cracks	☐
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	3

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Cressa truxilensis	☐
	☐	Frankenia salina	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐		☐
Frankenia salina	☐		☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	3
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	0
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

SUBMIT FORM

Basic Information Sheet: Perennial Estuarine Wetlands

Assessment Area Name:

Project Name: SELRP

Assessment Area ID #: W5

Project ID #: **Date:** 9/12/2016

Assessment Team Members for This AA:

LSL, AAN

Center of AA:

Latitude: **Longitude:** **Datum:**

Wetland Sub-type:

☑ Perennial Saline ☐ Perennial Non-saline

AA Category:

☐ Restoration ☐ Mitigation ☐ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: Pre-Restoration

What best describes the tidal stage over the course of the time spent in the field?

Note: It is recommended that the assessment be conducted during low tide.

☐ high tide ☑ low tide

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		North			
2		South			
3		East			
4		West			
5					
6					
7					
8					
9					
10					

Site Location Description:

Comments:

Scoring Sheet: Perennial Estuarine Wetlands

AA Name: W5				**Date:** 9/12/2016	
Attribute 1: Buffer and Landscape Context (pp. 8-14)				**Comments**	
Aquatic Area Abundance (D)		Alpha. A	Numeric 12	82%	
Buffer (based on sub-metrics A-C)					
Buffer submetric A: Percent of AA with Buffer	Alpha. A	Numeric 12		100% with 5m buffer	
Buffer submetric B: Average Buffer Width	C	6		100m	
Buffer submetric C: Buffer Condition	B	9			
Raw Attribute Score = D+[C x (A x B)½]½			21	**Final Attribute Score = (Raw Score/24) x 100**	86.40%
Attribute 2: Hydrology (pp. 15-19)				**Comments**	
Water Source		Alpha. C	Numeric 6		
Hydroperiod		B	9		
Hydrologic Connectivity		D	3		
Raw Attribute Score = sum of numeric scores			18	**Final Attribute Score = (Raw Score/36) x 100**	50.00%
Attribute 3: Physical Structure (pp. 20-25)				**Comments**	
Structural Patch Richness		Alpha. B	Numeric 9	6 patches	
Topographic Complexity		C	6		
Raw Attribute Score = sum of numeric scores			15	**Final Attribute Score = (Raw Score/24) x 100**	62.50%
Attribute 4: Biotic Structure Attribute (pp. 26-34)				**Comments**	
Plant Community Composition (based on sub-metrics A-C)					
Plant Community submetric A: Number of plant layers	Alpha. B	Numeric 9		3 layers	
Plant Community submetric B: Number of Co-dominant species	A	12		6 codominants	
Plant Community submetric C: Percent Invasion	B	9		17% invasion	
Plant Community Composition *(numeric average of submetrics A-C)*			10		
Horizontal Interspersion		C	6		
Vertical Biotic Structure		A	12		
Raw Attribute Score = sum of numeric scores			28	**Final Attribute Score = (Raw Score/36) x 100**	77.80%
Overall AA Score (average of four final Attribute Scores)				69.20%	

Worksheet for Aquatic Area Abundance Metric for Estuarine Wetlands

Percentage of Transect Lines that Contains an Aquatic Feature of Any Kind	
Segment Direction	Percentage of Transect Length That is an Aquatic Feature
North	0.91
South	0.53
East	0.97
West	0.88
Average Percentage of Transect Length that is an Aquatic Feature	82.30%

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

Percent of AA with Buffer: 100.00% %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	160
B	20
C	15
D	25
E	250
F	105
G	75
H	150
Average Buffer Width ***Round to the nearest integer***	100

Structural Patch Type Worksheet for Estuarine Wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in the worksheet below.

STRUCTURAL PATCH TYPE (circle for presence)	**Estuarine**
Minimum Patch Size	**3 m^2**
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	☐
Animal mounds and burrows	☑
Bank slumps or undercut banks in channels or along shoreline	☐
Debris jams	☐
Filamentous macroalgae or algal mats	☑
Large Woody Debris	☑
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	☑
Pannes or pools on floodplain	☑
Plant hummocks and/or sediment mounds	☐
Point bars and in-channel bars	☐
Pools or depressions in channels (wet or dry channels)	☐
Secondary channels	☐
Shellfish beds (living)	☐
Soil cracks	☑
Standing snags (at least 3 m tall)	☐
Submerged vegetation	☐
Total Possible	**16**
No. Observed Patch Types (enter here and use in Table 14 below)	6

Worksheet for AA Topographic Complexity

At two locations in theAt two locations in the AA, make a sketch of the profile from the AA boundary to AA boundary. Try to capture the major channels, slopes and intervening micro-topographic relief. Based on these sketches and the profiles in Figure 8, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

North to South
East to West

Plant Community Metric Worksheet: Co-dominant species richness
(A dominant species represents ≥10% *relative* cover)

Special Note:

** Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming	Invasive?	Short (<0.3 m)	Invasive?
	☐	Jaumea carnosa	☐
	☐	Frankenia salina	☐
	☐	Distichlis littoralis	☐
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Medium (0.3 – 0.75 m)	**Invasive?**	**Tall (0.75 – 1.5 m)**	**Invasive?**
Salicornia pacifica	☐	Juncus acutus	☐
Frankenia salina	☐	Myoporum laetum	✔
	☐		☐
	☐		☐
	☐		☐
	☐		☐
Very Tall (>1.5 m)	**Invasive?**	**Total number of co-dominant species for all layers combined (enter here and use in Table 18)**	6
	☐		
	☐		
	☐	**Percent Invasion *Round to the nearest whole number (integer)* (enter here and use in Table 18)**	17
	☐		
	☐		

Horizontal Interspersion Complexity Worksheet

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Each zone should comprise at least 5% of the AA. Based on the sketch, choose a single profile from Figure 10 that best represents the AA overall.

	Assigned zones: **1)** **2)** **3)** **4)** **5)** **6)**

Table 21: Wetland Disturbances and Conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✔	
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)	☐	☐
Excessive human visitation	☐	☐
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)	☐	☐
Tree cutting/sapling removal	☐	☐
Removal of woody debris	☐	☐
Treatment of non-native and nuisance plant species	☐	☐
Pesticide application or vector control	☐	☐
Biological resource extraction or stocking (fisheries, aquaculture)	☐	☐
Excessive organic debris in matrix (for vernal pools)	☐	☐
Lack of vegetation management to conserve natural resources	☐	☐
Lack of treatment of invasive plants adjacent to AA or buffer	☐	☐
Comments		

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✔	✔
Industrial/commercial	☐	☐
Military training/Air traffic	☐	☐
Dams (or other major flow regulation or disruption)	☐	☐
Dryland farming	☐	☐
Intensive row-crop agriculture	☐	☐
Orchards/nurseries	☐	☐
Commercial feedlots	☐	☐
Dairies	☐	☐
Ranching (enclosed livestock grazing or horse paddock or feedlot)	☐	☐
Transportation corridor	✔	✔
Rangeland (livestock rangeland also managed for native vegetation)	☐	☐
Sports fields and urban parklands (golf courses, soccer fields, etc.)	☐	☐
Passive recreation (bird-watching, hiking, etc.)	✔	☐
Active recreation (off-road vehicles, mountain biking, hunting, fishing)	☐	☐
Physical resource extraction (rock, sediment, oil/gas)	☐	☐
Biological resource extraction (aquaculture, commercial fisheries)	☐	☐
Comments		

APPENDIX I

SAN ELIJO LAGOON RESTORATION PROJECT PRE-CONSTRUCTION EELGRASS SURVEY

Merkel & Associates, Inc.
5434 Ruffin Road, San Diego, CA 92123
Tel: 858/560-5465 • Fax: 858/560-7779
e-mail: associates@merkelinc.com

November 8, 2017
M&A #11-059-03

Mr. Chris Webb
Moffatt & Nichol
3780 Kilroy Airport Way
Suite 600
Long Beach, CA 90806

Re: San Elijo Lagoon Restoration Project
Pre-construction Eelgrass Survey

Dear Mr. Webb:

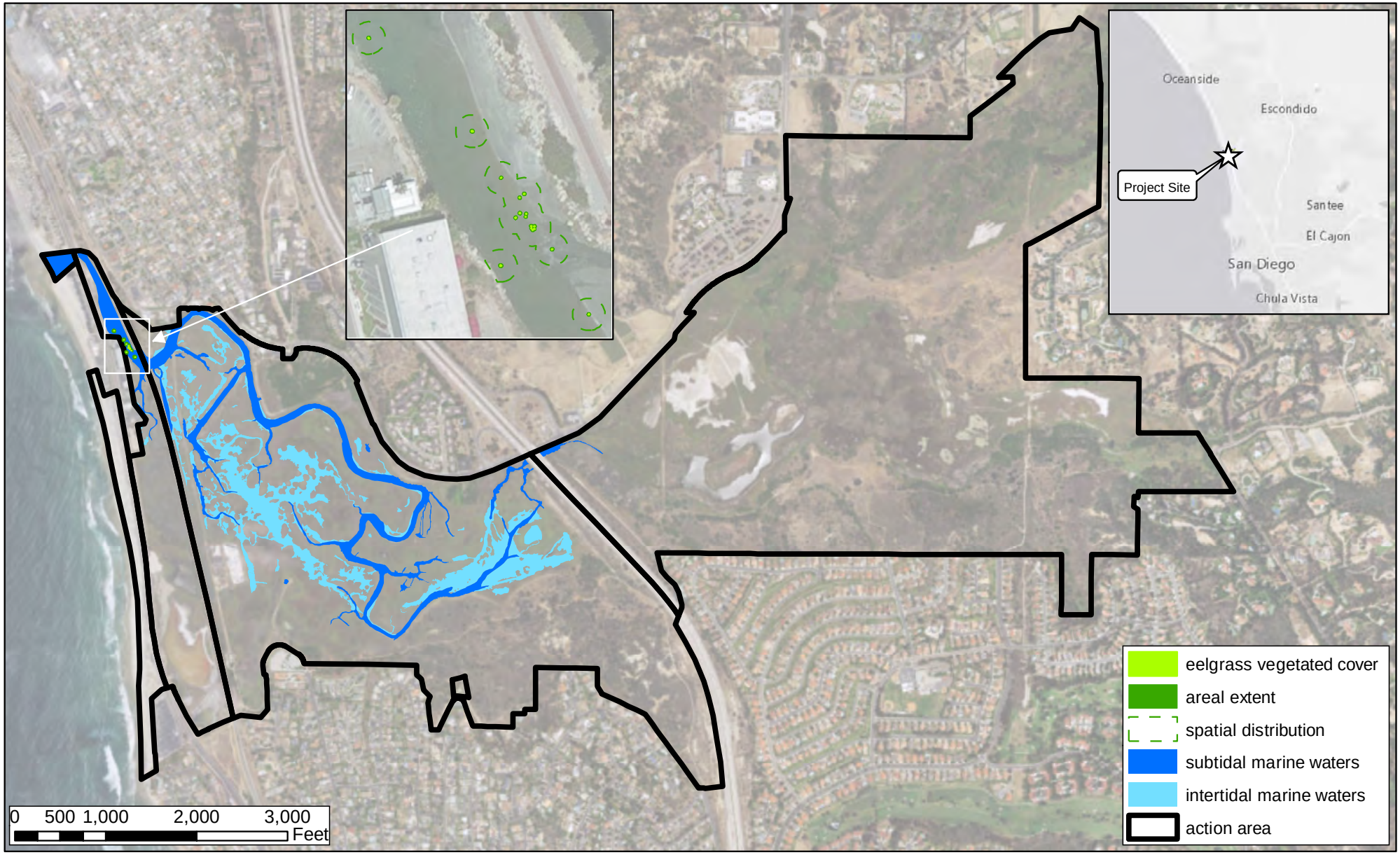
This letter serves to transmit information regarding the pre-construction eelgrass (*Zostera marina*) survey completed in support of the San Elijo Lagoon Restoration Project (Project). The purpose of this survey was to provide a quantitative assessment of the eelgrass communities within the vicinity of the Project in conformance with the California Eelgrass Mitigation Policy (CEMP) (NOAA 2014).

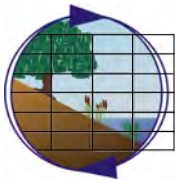
PROJECT LOCATION AND SURVEY AREA

San Elijo Lagoon is located in the City of Encinitas, San Diego County, California, and is the dividing feature separating the City of Encinitas to the north and Solana Beach to the south (Figure 1). The survey area included all areas considered to be suitable to support eelgrass. This included approximately 72 acres of subtidal and intertidal marine waters within the lagoon system. The depth at the survey area ranged from intertidal to approximately –9 ft mean lower low water (MLLW).

SURVEY METHODOLOGY

M&A conducted the pre-construction eelgrass survey on October 9 and 17, 2017. Spatial extent data were collected using a 3-D sidescan sonar, which provided an acoustic backscatter image of the seafloor within the project area. Interpretation of the backscatter data allowed for an assessment of the distribution of eelgrass. Sidescan backscatter data were acquired at a frequency of 468 kHz scanning out 31 meters on both the starboard and port channels for a 62-m wide swath. The 3-D sidescan system integrates motion sensors to control for heave pitch and roll, a sound velocity sensor for speed of sound correction, and a dual antenna real time kinematic global positioning system (RTK GPS) and electronic compass to control for vessel position and yaw. This rigid integration of the transducers within the positioning sensors provides significantly increased precision and accuracy over conventional towfish sidescan sonar equipment.





Pre-construction Eelgrass Survey - October 2017

San Elijo Lagoon Restoration Project

Figure 1

The survey was conducted by running parallel transects that were spaced to allow for overlap between adjoining sidescan swaths. Survey swaths were navigated until the entirety of the survey area was captured in the survey report. All data were collected in latitude and longitude using the North American Datum of 1983 (NAD 83), converted to the Universal Transverse Mercator system in meters (UTM), and plotted on a geo-rectified aerial image of the project site. Following completion of the survey, sidescan sonar traces were joined together and geographically registered.

Following the sidescan survey, the sonar data were then ground-truthed using ultra-low altitude aerial photographic flights by an Unmanned Aerial Vehicle (UAV) within the extreme shallows during low tide. Orthomosaic processing was then used to develop a rectified aerial photograph of the surveyed site with a horizontal spatial registration error of less than 1 meter. Snorkeling was also conducted within deeper waters of the western most portions of the lagoon channel during low tide.

The reported metrics for eelgrass are as follows:

- **Spatial Distribution**
  The spatial distribution of eelgrass habitat was delineated by a contiguous boundary around all areas of vegetated eelgrass cover extending outward a distance of 5 meters. The resultant spatial distribution boundary of the eelgrass habitat was then clipped to remove areas that were determined to be unsuited to supporting eelgrass based on depth, substrate, or existing structures.

- **Areal Extent**
  The eelgrass habitat areal extent includes vegetated cover and extent of unvegetated habitat that defines a coalesced bed with gaps of less than 1 meter across being considered part of the defined bed.

- **Percent Vegetated Cover**
  Eelgrass vegetated cover exists when one or more leaf shoots (turions) per square meter is present. The percent bottom cover within eelgrass habitat is determined by totaling the area of vegetated eelgrass cover and dividing this by the total eelgrass habitat area.

- **Turion (Shoot) Density**
  Turion density is the mean number of eelgrass leaf shoots per square meter within mapped eelgrass vegetated cover. Turion density should be reported as a mean ± the standard deviation of replicate measurements. The number of replicate measurements (n) is reported along with the mean and deviation. Turion densities are determined only within vegetated areas of eelgrass habitat; and therefore, it is not possible to measure a turion density equal to zero.

The mapping method applied during this investigation provides for a substantial degree of accuracy and repeatability over time.

SURVEY RESULTS

Pre-construction bed spatial metrics are summarized in Table 1. These data will be used to facilitate interpretation of any change in eelgrass beds between pre-construction and post-construction surveys. Eelgrass distribution from the survey is illustrated in Figure 1.

Table 1. Eelgrass bed metrics as defined under the CEMP.

Location	Spatial Distribution	Eelgrass Areal Extent	Vegetated Cover	Percent Vegetated Cover
Area of Potential Effect	716 m^2	19 m^2	0.9 m^2	4.7%

This survey completes your pre-construction eelgrass survey obligations and is valid for construction activities in the project area initiated by March 1, 2018.

It has been a pleasure working with you on this project. If you have any questions regarding the results of this investigation, please contact me.

Sincerely,

Keith W. Merkel
Principal Consultant

REFERENCES

National Oceanic and Atmospheric Administration (NOAA) 2014. California Eelgrass Mitigation Policy and Implementing Guidelines

APPENDIX J

SAN ELIJO LAGOON RESTORATION PROJECT PRE-CONSTRUCTION CAULERPA TAXIFOLIA SURVEY

Merkel & Associates, Inc.
5434 Ruffin Road, San Diego, CA 92123
Tel: 858/560-5465 • Fax: 858/560-7779
e-mail: associates@merkelinc.com

November 8, 2017
M&A #11-059-03

Mr. Chris Webb
Moffatt & Nichol
3780 Kilroy Airport Way
Suite 600
Long Beach, CA 90806

Re: San Elijo Lagoon Restoration Project
Pre-Construction *Caulerpa taxifolia* Survey

Dear Mr. Webb,

Enclosed is the report for the *Caulerpa* survey conducted in support of the San Elijo Lagoon Restoration Project.

The survey was performed on October 9 and 17, 2017 per the *Caulerpa* Control Protocol (Version 4.0, adopted February 25, 2008). The project area was surveyed using a 3-D sidescan sonar, an Unmanned Aerial Vehicle (UAV), snorkeling, and deployed underwater video camera. The survey area included the subtidal marine waters within the lagoon system.

I am pleased to report that *Caulerpa* was not found within the Project area. This survey will complete your pre-construction survey obligations for *Caulerpa.* This survey is valid for construction activities in the Project area initiated within the next 90 days.

I hope your construction activities proceed in a safe and timely manner. If you have any questions regarding the enclosed documents or this letter, please contact me at (858) 560-5465.

Sincerely,

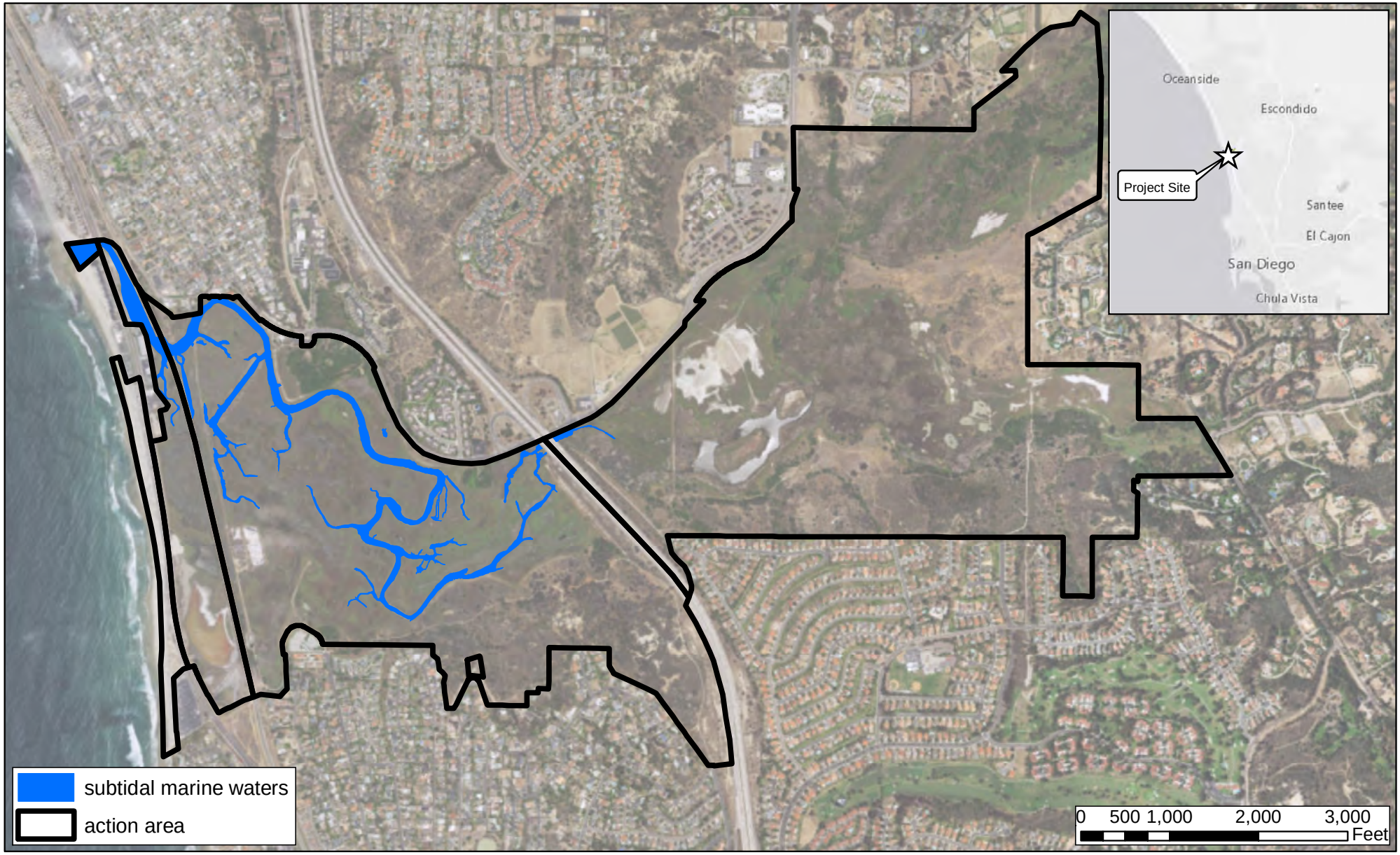
Keith W. Merkel
Principal Ecologist

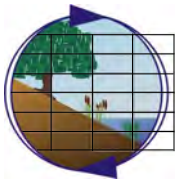
Caulerpa Survey Reporting Form

This form is required to be submitted for any surveys conducted for the invasive exotic alga *Caulerpa taxifolia* that are required to be conducted under federal or state permits and authorizations issued by the U.S. Army Corps of Engineers or Regional Water Quality Control Boards (Regions 8 & 9). The form has been designed to assist in controlling the costs of reporting while ensuring that the required information necessary to identify and control any potential impacts of the authorized actions on the spread of *Caulerpa*. Surveys required to be conducted for this species are subject to modification through publication of revisions to the *Caulerpa* survey policy. It is incumbent upon the authorized permittee to ensure that survey work is following the latest protocols. For further information on these protocols, please contact: Bryant Chesney, National Marine Fisheries Service (NOAA Fisheries), (562) 980-4037, or William Paznokas, California Department of Fish & Wildlife, (858) 467-4218).

Report Date:	November 8, 2017
Name of bay, estuary, lagoon, or harbor:	San Elijo Lagoon
Specific Location Name: (address or common reference)	San Elijo Lagoon , San Diego County, CA
Site Coordinates: (UTM, Lat./Long., datum, accuracy level, and an electronic survey area map or hard copy of the map **must** be included)	Approximate center point of survey area: 474,460 E, 3,652,503 N WGS84 UTM Zone 11N, meters See Figure 1
Survey Contact: (Name, phone, e-mail)	Keith Merkel Ph: 858-560-5465; kmerkel@merkelinc.com
Personnel Conducting Survey (if other than above): (name, phone, e-mail)	Daniel Kahl (Certified *Caulerpa* surveyor) Ph: 858-560-5465, email: dkahl@merkelinc.com Christopher Hughes (Certified *Caulerpa* surveyor) Ph: 858-560-5465, email: chughes@merkelinc.com Alan Merkel (*Vessel support*) Ph: 858-560-5465, email: amerkel@merkelinc.com
Permit Reference: (ACOE Permit No., RWQCB Order or Cert. No.)	
Is this the first or second survey for this project?	First, only
Was *Caulerpa* Detected?: (if *Caulerpa* is found, please immediately contact NOAA Fisheries or CDFW personnel identified above)	**_____Yes, Caulerpa was found at this site and** **_____has been contacted on _____ date.** **_____X_____No, Caulerpa was not found at this site.**

Description of Permitted Work: (describe briefly the work to be conducted at the site under the permits identified above)	The Project includes grading and dredging, removal of dike and weir, construction of pedestrian trails and bridges, removal of non-native species, planting of native species, export of beach quality sediment for reuse at local beaches and storage at off-shore sites.	
Description of Site: (describe the physical and biological conditions within the survey area at the time of the survey and provide insight into variability, if known. Please provide units for all numerical information).	*Depth range:*	0 to approximately -9 feet MLLW
	Substrate type:	Soft bottom sand and mud
	Temperature:	62 - 70°F
	Salinity:	~ 25 - 34 ppt (bottom salinity)
	Dominant flora:	macroalgae
	Dominant fauna:	benthic infauna, mullets, and round rays
	Exotic species encountered (including any other Caulerpa species):	*Crassostrea gigas* *Sargassum muticum* *Styela clava* *Musculista senhousii*
	Other site description notes:	Linear channel system within a true estuary lagoon with brackish water at the inner portions of the channel system and fully marine conditions near the ocean outlet
Description of Survey Effort: (please describe the surveys conducted including type of survey (SCUBA, remote video, etc.) and survey methods employed, date of work, and survey density (estimated percentage of the bottom actually viewed). Describe any limitations encountered during the survey efforts.	*Survey date and time period:*	October 9, 2017 9:00 - 17:00 October 17, 2017 12:00 - 16:45
	Horizontal visibility in water:	~ 4 feet
	Survey type and methods:	3-D sidescan sonar Unmanned Aerial Vehicle (UAV) Snorkeling Deployed underwater video camera
	Survey personnel:	Daniel Kahl (Certified *Caulerpa* surveyor) Christopher Hughes (Certified *Caulerpa* surveyor) Alan Merkel (Vessel Support)
	Survey density:	3-D sidescan sonar - 30% Unmanned Aerial Vehicle (UAV) - 100% Snorkeling -10% Deployed underwater video camera - 10% Overall effective coverage of ~ 50%
	Survey limitations:	None
Other Information: (use this space to provide additional information or references to attached maps, reports, etc.)	Please see attached map (Figure 1)	





Pre-construction Caulerpa Survey - October 2017

San Elijo Lagoon Restoration Project

Figure 1