Salt River Ecosystem Restoration Project

Adaptive Management Plan
Monitoring Report 2017

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EXECUTIVE SUMMARY

The Salt River Ecosystem Restoration Project (Project) has been developed in collaboration with landowners and resource and regulatory agencies for over 30 years. The Humboldt County Resource Conservation District (HCRCD) is spearheading the Project on behalf of multiple private landowners throughout the Salt River watershed. The Salt River watershed is located in Humboldt County, California; approximately 15 miles south of the City of Eureka. The watershed surrounds the City of Ferndale and is bounded to the south by the Wildcat Mountains, to the east and north by the Eel River and to the west by the Pacific Ocean. The watershed derives its name from the Salt River that historically flowed across the Eel River delta discharging into the Eel River estuary about 0.2 miles from the mouth of the Eel River.

The overarching goal of the Project is to restore and improve hydrologic function and fish and wildlife habitat in the Salt River watershed. The Project area includes the main stem of the Salt River, four Salt River tributaries originating in the Wildcat Hills above the town of Ferndale (Williams Creek, Francis Creek, Reas Creek, and Smith Creek), and the approximately 400-acre Riverside Ranch, which is contiguous to the Salt River estuary. The California Department of Fish and Wildlife (CDFW) acquired Riverside Ranch in 2012 from Western Rivers Conservancy, who had purchased the property from a willing seller. CDFW is an active partner in the Project. The remainder of the Project Area is in private ownership.

The Project intends to restore natural hydrologic processes to a significant portion of the watershed, promoting restoration of ecological processes and functions. The Project is presented in two primary phases to distinguish between the tidal wetland restoration (known as Phase 1) and the riverine restoration work (known as Phase 2). The Project includes work that will be accomplished over several years. Within the two phases, the Project is further broken down in to four primary components, discussed below:

- Upslope erosion control: Work with willing landowners to implement upslope erosion control activities in the upper portions of the Francis, Williams, and Reas Creeks watersheds to reduce the level of sediment input and delivery to the Salt River, thereby improving water quality while reducing sediment deposits in the channel.

- Salt River channel excavation: Excavate and rehabilitate approximately 7.4 miles of the historic Salt River channel to restore hydrologic connectivity within the watershed thereby improving aquatic and riparian habitat, providing fish passage to tributaries, and improve drainage in the delta.

- Riverside Ranch tidal marsh restoration: Restore tidal marsh in the lower Salt River. This will also increase the tidal prism exchanged through the lower river, increasing sediment transport potential, increasing scour and promoting hydraulic connectivity with the upper watershed.

- Adaptive Management: Work with the community and regulatory agencies to implement an environmentally and geomorphically acceptable adaptive maintenance and management program to maintain hydraulic and ecological function in the Project Area into the future.

In 2013, restoration of Riverside Ranch (Phase 1 of the Project) restored 330 acres of pasture land back to intertidal wetland habitat, while also preserving approximately 70 acres that will be agriculturally managed to provide short-grass habitat for Aleutian cackling geese and other wetland-associated birds. Three miles of internal slough networks were excavated to create additional habitat for salmonids, tidewater goby, and other fish and aquatic species, and provide areas for the natural recruitment of eelgrass. Two miles of setback berm were constructed to create a boundary between the tidal area and the retained agricultural area, and a gravel road was installed on top of the berm to provide access for monitoring and maintenance. This component of the Project also widened and deepened approximately 2.5 miles of the tidally-influenced portion of the Salt River channel, thereby increasing tidal exchange and greatly improving fish passage and fish habitat in the lower Salt River channel.

The design of Phase 1 was intended to strike a balance between creating significant amounts of new tidal marsh habitat, retaining and enhancing some of the important existing upland and riparian features, preserving sufficient acreage to manage for short grass habitat for Aleutian cackling geese, minimizing long-term site maintenance, and incorporating design features that accommodate sea-level rise. Earthwork on Phase 1 was balanced on site, with excavated materials all being utilized to construct a range of habitat features at varying elevations and to construct the 2-mile setback berm.

Phase 2 represents the Salt River “corridor restoration” portion of the larger project. Within Phase 2, design plans call for 4.5 miles of the Salt River channel and its adjacent floodplain to be excavated. Wetlands and riparian corridors would be re-vegetated with a diverse palette of native plants. Fish passage would be restored to three watershed tributaries – Reas, Francis and Williams Creeks.

Across the years of 2013, 2014, 2015, and 2017, a total of 4.7 miles of Salt River channel and floodplain were constructed and re-vegetated. These construction efforts also reconnected two tributaries (Reas and Francis Creek). The 2017 construction season restored 0.5 miles of the channel and floodplain in Francis Creek (Figure 1). It is

anticipated that future Phase 2 construction will occur in 2018 and 2019, completing the Salt River corridor restoration.

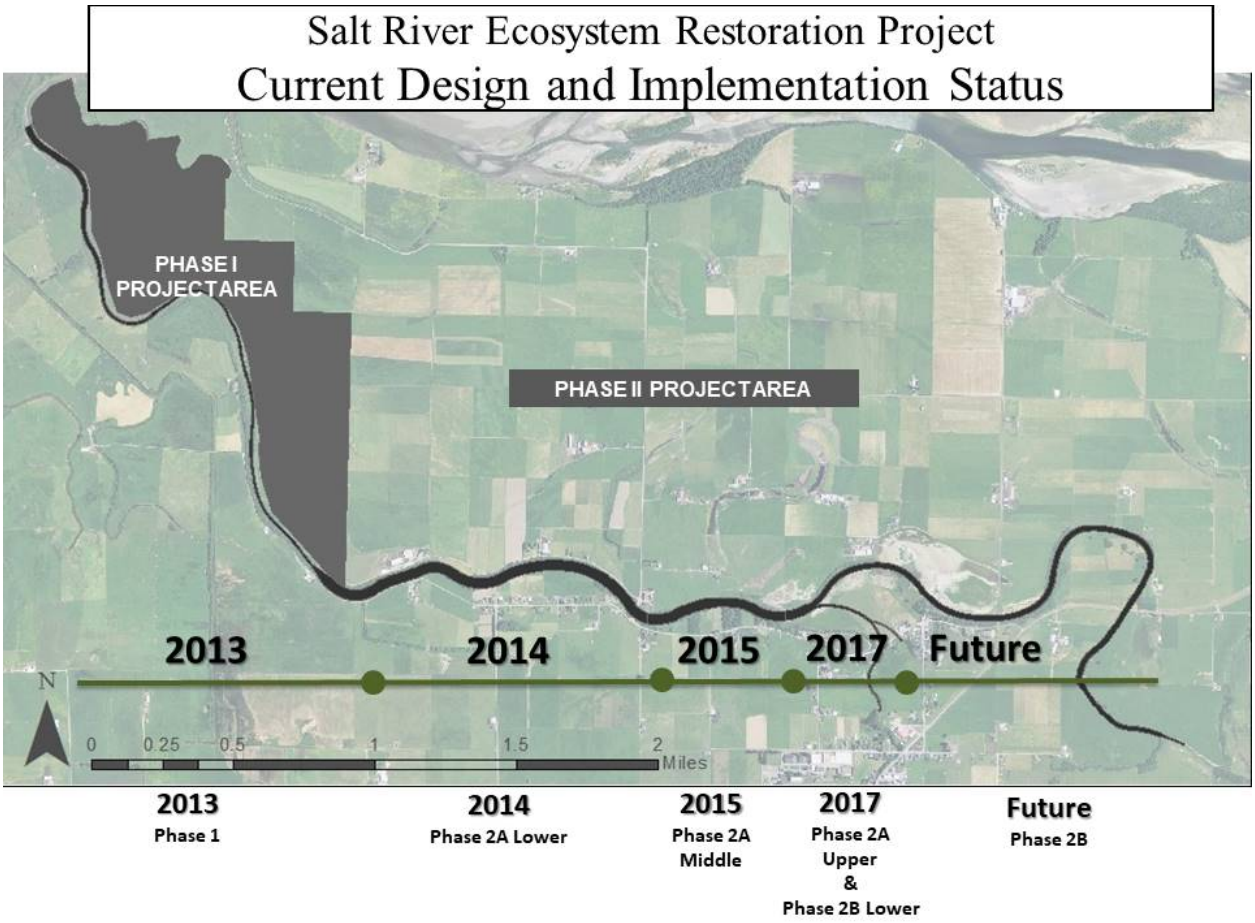

Figure 1: Salt River Ecosystem Restoration Construction Timeline as of 2017

Upon completed construction portions of the Project, monitoring is performed under direction of the Humboldt County Resource Conservation District and complies with requirements from Project documents generated during the development of the Project, including the Salt River Ecosystem Restoration Project's Habitat Mitigation and Monitoring Plan (HMMP) and the Adaptive Management Plan (AMP). This report provides information on data collected for monitoring tasks pertaining to the AMP of the Salt River Ecosystem Restoration Project as follows:

- Phase 1: Year 4 (post construction 2013)
- Phase 2: Year 3 and Year 2 (post construction 2014 and 2015)

As discussed in the Summary of Conclusions section of this report below, monitoring results demonstrate the Project is performing successfully and largely meeting Project goals.

SUMMARY OF CONCLUSIONS

As detailed in this report, the 2017 monitoring results provide a point of reference on how the restoration activities completed in 2013 (Phase 1), 2014 (Phase 2A Lower), and 2015 (Phase 2B Middle) have responded to the area's environmental conditions during its formative years after construction. One important environmental input to consider is the previous season's amount of precipitation. The north coast of California generally experiences precipitation from October to the end of April. This period of time is referred to as a *hydrologic year*. The amount of the hydrologic year's precipitation prior to monitoring efforts can significantly affect the findings of a handful of monitoring tasks, such as riparian success and cross-sectional surveys. The 2016/2017 hydrologic year was substantially wet. Over 60 inches of rain fell across the north coast (Eureka NOAA station) from October to April, with 17 days that experienced a one-inch or greater, rain storm. That can be compared to the relatively "normal" 2015/2016 hydrologic year where close to 47 inches of rain fell and 11 days experienced a one-inch or greater, rain storm. On average, the northern coast of Humboldt County receives approximately 40 inches of rain annually.

The following is a brief summary of the findings of the various monitoring efforts under the identified Adaptive Management Plan's monitoring categories. Please reference reports listed at the end of this report for more detailed findings.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Salt River Corridor

The cross-section surveys on Phase 2 of the Salt River corridor indicate that the Salt River is adjusting to the variation of annual environmental conditions where channel capacity has both increased and decreased at individual sites. Tidal exchange and water quality monitoring was required for the first three years after Project construction in tidally influenced regions. This monitoring was concluded in its entirety across all phases in the Salt River Ecosystem Restoration Project in 2016. Monitoring indicated that water quality parameters achieved ranges appropriate for salmonids at sampling sites and the restored tidal prism reached the predicted extent in the restoration area. Other monitoring under this heading included observing the function of bridges and culverts. For the 2017 monitoring period, one bridge, Dillon Road Bridge, exists within

the constructed project footprint and was functioning normally. No culverts were installed during the Phase 2 construction, though adjacent culverts are present along the Project footprint at Reas Creek, the Boynton swale, and Bush Street, and were found to be unimpeded. Geomorphic surveys for the Sediment Management Area were not performed due to the structure not being constructed as of the 2017 monitoring period.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch

Cross-section surveys on Phase 1 (Riverside Ranch) indicate that the Salt River channel and slough channels are adjusting to varying annual environmental conditions where channel capacity has both increased and decreased at individual sites. Additional monthly general visual inspections of the Phase 1 elements include the setback berm, outboard ditches, and tide gates. The setback berm has experienced minor erosion located in the northern hemisphere portion of the Salt River estuary, primarily due to significant flood events in January 2017. The outboard ditches are functioning as designed, though heavy vegetation growth occurring within the outboard ditch may inhibit flow and capacity. All three tide gates are functioning normally with typical leakage and doors have not been observed to have any obstructions.

Water Quality Monitoring and Adaptive Management for the Salt River Corridor and Riverside Ranch

Water quality monitoring was required for the first three years after Project construction in tidally influenced regions. Water quality monitoring was concluded in its entirety across all phases in the Salt River Ecosystem Restoration Project in 2016. Monitoring indicated that water quality parameters achieved ranges appropriate for salmonids at sampling sites and restored tidal prism reached the predicted extent in the restoration area. Additional water quality spot measurements are taken monthly in spring and summer during fish surveys at each monitoring site and indicate appropriate water quality parameters for healthy fish habitat are being met.

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

A variety of monitoring and management actions are included under this category, primarily relating to fish and vegetation. In collaboration with CDFW, National Oceanic

and Atmospheric Administration/National Marine Fisheries Service (NOAA/NMFS), and Humboldt State University, a fish sampling program has been ongoing since 2014 in constructed phases of the Project. The 2017 sampling effort took place from March to August at 11 sites. Fifteen anadromous, freshwater, and marine species were captured in 2017. Salmonids were captured in the first two months of the sampling season. Tidewater gobies were present in the tidally influenced reaches during the entire sampling season. The 2017 fish sampling effort, once again, proved that the Project is a success for fish species. Aleutian cackling goose habitat management continues to be negotiated with CDFW (no significant management has been performed since 2014). The vegetation percent cover survey for the Phase 1 High Marsh Ecotone was not due to be performed in 2017; however, previous surveys indicate that the area is meeting and exceeding the success criteria. Woody vegetation surveys and management within the channel was not performed due to the nascent tree growth in the corridor. A formal weed abatement effort was not performed within the Project footprint. Non-native non-invasive species and invasive species vegetative percent cover exceeded recommended limits throughout the Project footprint. Some of these species are colonizer species and may decrease in the following years as a riparian canopy develops. Reed canary grass is present in the agricultural fields of Phase 1 and in the Phase 2 channel and accounts for a large proportion of the invasive species percent cover value. Reed canary grass is currently considered a native species by Cal-IPC (California Invasive Plant Council) and the Humboldt Weed Management Area. Nonetheless, Project documents and subsequent Project monitoring biologists consider reed canary grass as an invasive species as it is aggressive and compromises habitat development. *Spartina densiflora* is an invasive species that is present on Phase 1 and is establishing upstream in Phase 2 from the tidal restoration area. HCRCD and partners continue to seek funding opportunities to control/eradicate *Spartina*. Management of invasive wildlife species, namely pikeminnow, is currently being implemented during fish surveys where all captured pikeminnow individuals are humanely euthanized.

INTRODUCTION

The Salt River Ecosystem Restoration Project (SRERP) took some 30 years to develop and drew upon several studies and assessments completed during that time examining cultural, biological, geological, aquatic, and vegetative resources as well as tidal influences in the watershed. Project proponents also developed documents to guide implementation, maintenance, and long-term monitoring. Monitoring documents include the Salt River Monitoring Plan, Habitat Mitigation and Monitoring Plan, the Adaptive Management Plan, and other specialized plans to assure the protection of sensitive wildlife habitats, landowner properties, and the hydrologic system itself.

As outlined in the Project's CEQA and the Adaptive Management Plan documents, a variety of monitoring tasks are required to be conducted to demonstrate achievement of Project goals and objectives as well as to guide Project management and maintenance. Most of the monitoring tasks are to be completed over a period of ten years, post-implementation. Monitoring was conducted prior to beginning Project implementation to establish baseline data and/or assist in identifying and protecting resources in the Project area. Post-implementation monitoring is being conducted as required by the Project's various funders, permit requirements, and environmental compliance documents. Many of the individual reports are available from the Humboldt County Resource Conservation District upon request.

This report is structured and provides findings related to the monitoring requirements in the four identified Adaptive Management Plan categories:

- *Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Salt River Corridor*
- *Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch*
- *Water Quality Monitoring and Adaptive Management for the Salt River Corridor and Riverside Ranch*
- *Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch*

Within each category is a description that identifies 1) the discrete task called for, 2) the agency requiring the task, 3) the reference document, and 4) description of the task, 5) goals and objectives of the tasks, 6) the resulting monitoring report (if applicable), 7) a description of methods, and 8) a results and discussion section.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Salt River Corridor

Monitoring Task: Cross Sectional and Longitudinal Surveys - Salt River Channel Corridor Upstream of Reas Creek - Erosion and Sediment Deposition Surveys

Agencies/Acts: Coastal Commission, and California Environmental Quality Act (CEQA)

Compliance Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Final Environmental Impact Report (FEIR); and Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Cross-sectional and longitudinal profile surveys are performed across and along the main channel Salt River.

Goals:

- Cross-sectional and longitudinal surveys will describe how the channel is remaining consistent with restoration designs, or if areas are aggrading or eroding to the point of intervention.

Report: *Sedimentation and Erosions Patterns Within Anabranching Channels in a Lowland River Restoration Project* (2017). By Ivan Mendel. Humboldt State University Master's Thesis.

Methods: The cross-sectional and longitudinal surveys were done by a Humboldt State University graduate student for a Master's thesis under the supervision of a Salt River Project engineer from USFWS.

The cross-sectional surveys and longitudinal profile were conducted on the Salt River (SR) channel above Reas Creek to just downstream of the Francis Creek confluence using a CTS/Berger automatic level, tripod and stadia rod. This portion of the channel was constructed in 2014 and 2015. All elevations are geo-referenced in meters to the 1988 North American Vertical Datum (NAVD88) using Trimble Real Time Kinematic technology based on project survey control point SR11.

Nine cross-sectional profiles of the Salt River channel, between Reas Creek to the upstream end of the 2015 construction area, were collected in December 2015, June 2016, and May 2017 (Figure 2). Permanent, rebar monuments were set on both sides of the main channel at a minimum of three feet above bank full elevation and referenced to the Salt River Ecosystem Restoration Project's survey control points. The cross-sectional monuments were established using 4-foot lengths of ½"-rebar pounded into the substrate, leaving 12 – 16 inches exposed. Sub-meter GPS locations were recorded for each monument using a Trimble Geo-XH, along with photo documentation.

Elevations and distances were collected at a maximum resolution of every two meters and at each major break in slope, vegetation edge, water's edge, and mid-channel. Flood plain measurements were collected approximately 200-feet on either side of the main channel.

The longitudinal profile survey of the main Salt River channel from Reas Creek to the upper extent of the 2015 construction site was collected over four days in June 2016.

Surveys were timed to coincide with dry weather and low tide (within intertidal reaches) conditions to allow for maximum visibility of the channel thalweg. Elevation data were collected within the thalweg at a maximum resolution of approximately every 50 meters. A total of 44 measurements were collected along the Salt River, from the upstream extent (below the Francis Creek confluence) to the downstream extent (just upstream of Reas Creek).

Figure 2: Salt River Phase 2 Cross-Section Sites

Results and Discussion: For the student's Master's thesis, nine cross-sections sites were developed and surveyed in the 1.5 miles of the 2014 and 2015 restored reach of the Salt River. The nine sites are divided into three groups or "Units", each Unit consisting of three sites. Unit 1 contains sites 1, 2, and 3 (tidally influenced); Unit 2 contains sites 4, 5, and 6 (freshwater); and Unit 3 contains 7, 8, and 9 (freshwater) (Figure 2).The following graphs (Figures 3 - 5) show cross-sections from each Unit from two hydrologic years.

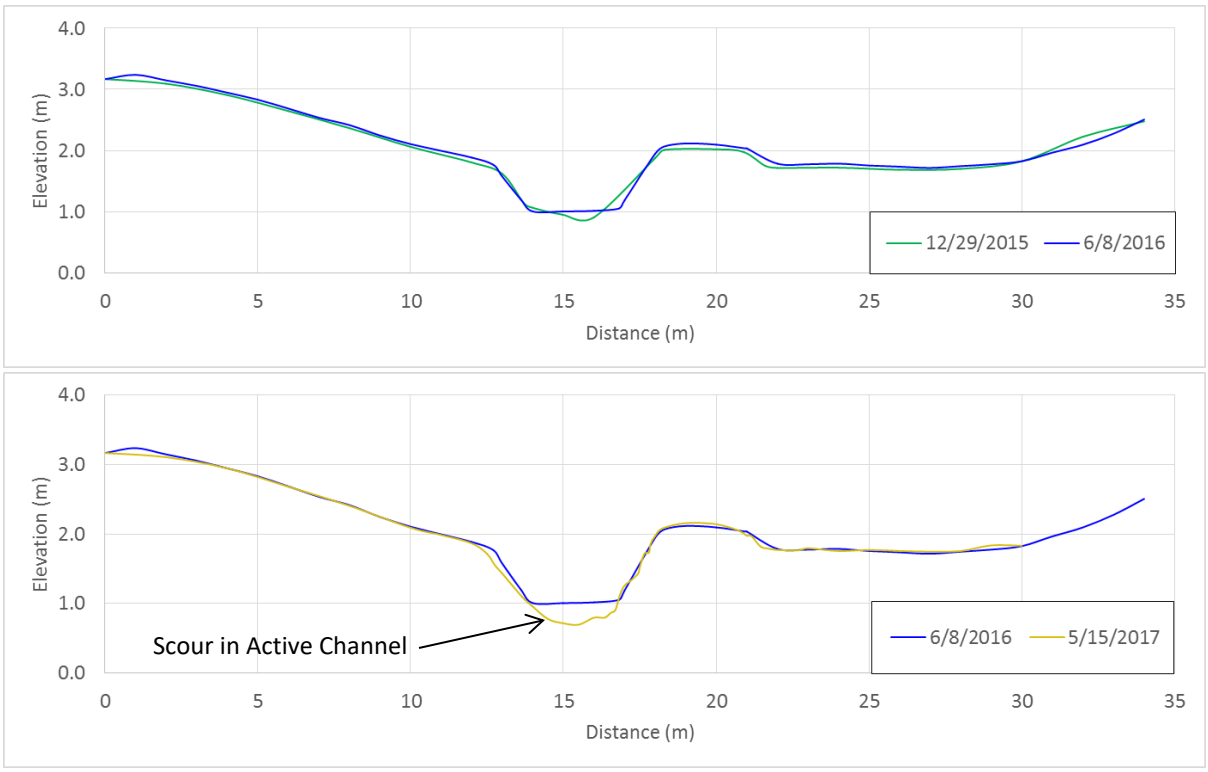

Figure 3: Unit 1 - Site 1 in 2015/16 and 2016/17

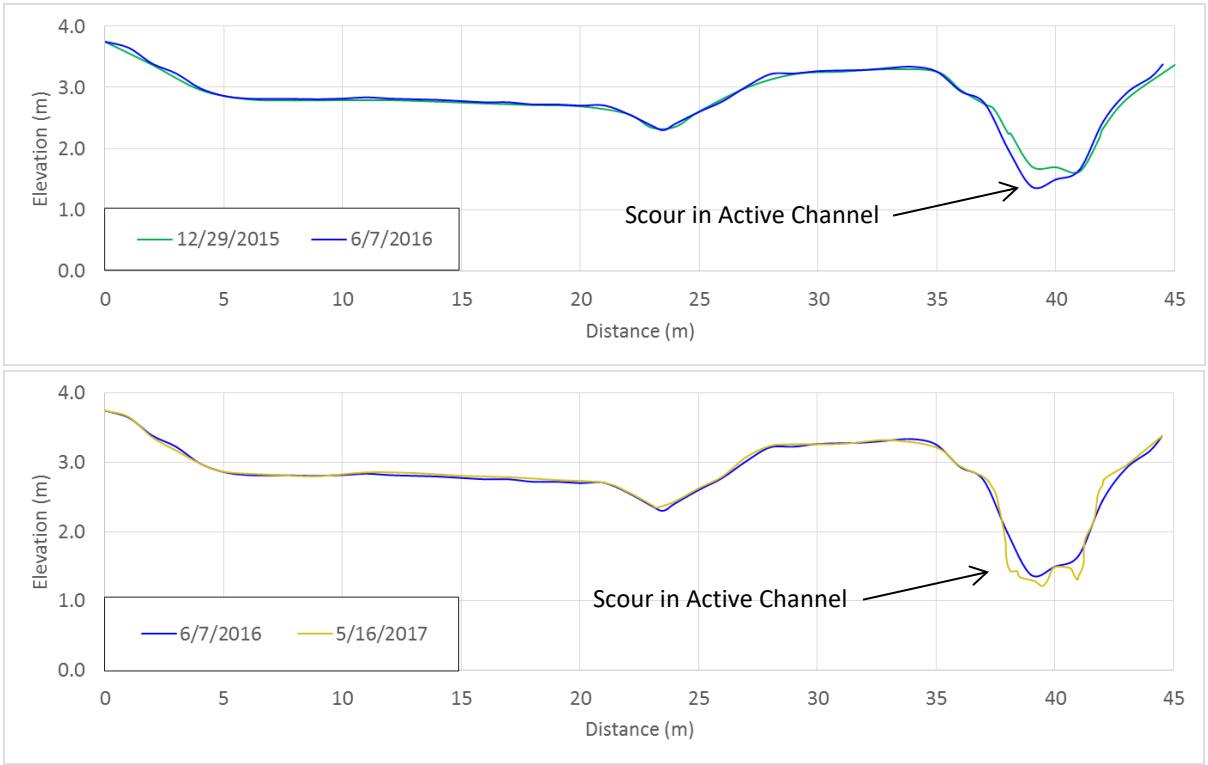

Figure 4: Unit 2 – Site 4 in 2015/16 and 2016/17

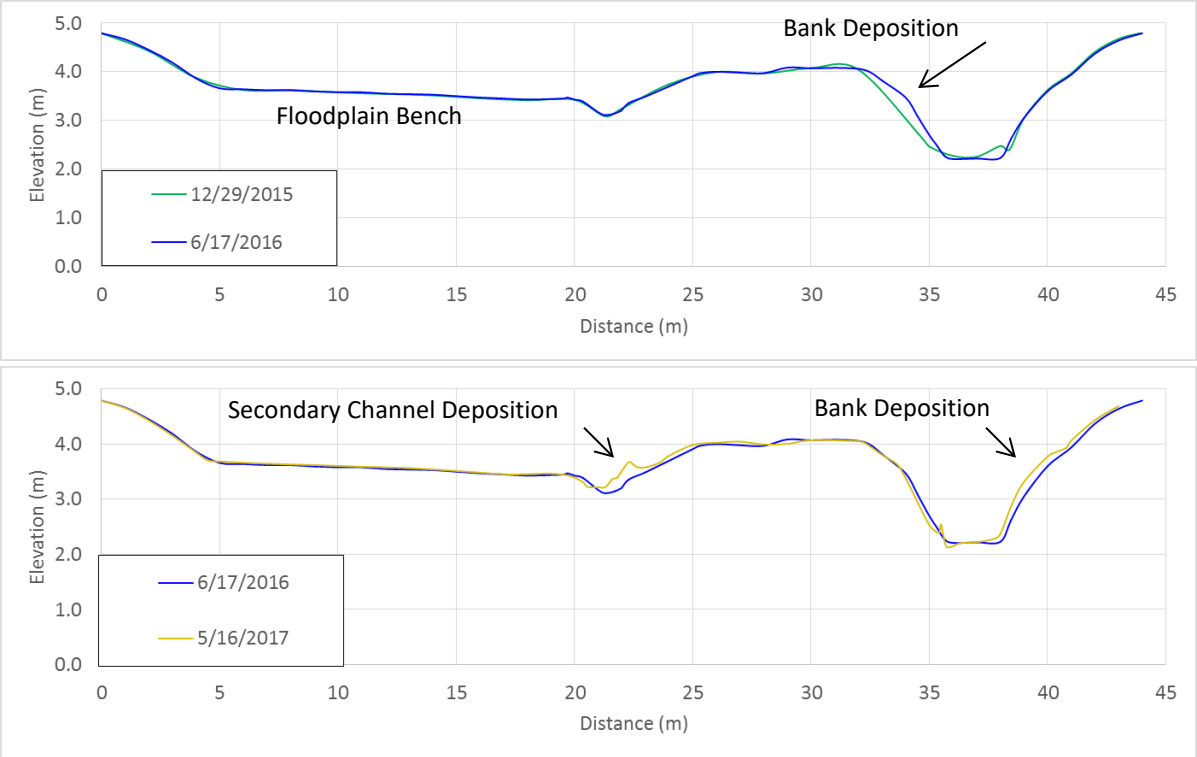

Figure 5: Unit 3 – Site 8 in 2015/16 and 2016/17

Comparing the cross-sectional graphs provides a visual indication on how the channel changed over two winter periods. The 2015/16 winter was a relatively mild, yet typical with a flood event. The 2016/17 winter was the fifth wettest winter recorded, which included multiple large flood events. Each year's cross-section is compared to the previous. In Units 1 and 2, active channel bottom elevations decreased due to channel scour in 2017. However, Unit 3 had a stable active channel elevation through both hydrologic years with deposition on either side of the bank. Looking at all the sites together, more deposition occurred in the 2015/16 winter and more scour was observed in 2016/17. In general, the active channel is primarily scouring vertically (i.e. bottom elevation is decreasing), and increasing channel capacity, which may potentially cause future bank slumping. The active channel is considered overly efficient to transport sediment out of the system; however, at this point in time monitoring, two large tributaries with a significant sediment loads have yet to be re-connected to the system.

Reviewing the nine cross-sections, 6 out of 9 sites decreased in capacity from 2015 to 2016; then 7 out of 9 increased in capacity from 2016 to 2017 (likely due to the wetter water year). Two cross-sections in Unit 1 and one in Unit 2 have increased in capacity beyond the 10% adaptive management trigger outlined in the AMP. These sites will be evaluated within the AMP's Project Management Team process.

High water flows from the active channel accesses the floodplain benches via the secondary channels. As sediment drops out of the sediment laden water onto the floodplain bench, the sediment will be temporarily stored until a large storm event mobilizes the particles to move downstream out of the system. The cross-sectional surveys show that the secondary channels are relatively stable, though Unit 3 has some deposition at the entrance of the floodplain bench. This is identified as an area to monitor and possibly address to make sure the entrances are unobstructed for water to enter. Further data on the cross sections indicate that the Unit 1 floodplain has more deposition downstream than upstream (likely due to tidal inundation). Units 1 and 2 appear to be stable and functioning appropriately.

A longitudinal survey was completed along the constructed Phase 2 footprint. The longitudinal profile graphs presented (Figures 6 - 8) concentrate on Units 1-3. Unit 1 shows topographic heterogeneity and a uniform channel bottom scouring from 2016 to 2017 with a pool development in the upstream section (between 1,900m and 2,000m) (Figure 6). The Unit 2 profile indicates fluctuations between scour and deposition with pool formation in the upstream section (between 700m and 800m) (Figure 7). Unit 3 is primarily stable in elevation, with some pool development in the downstream section (between 200m and 300m) (Figure 8).

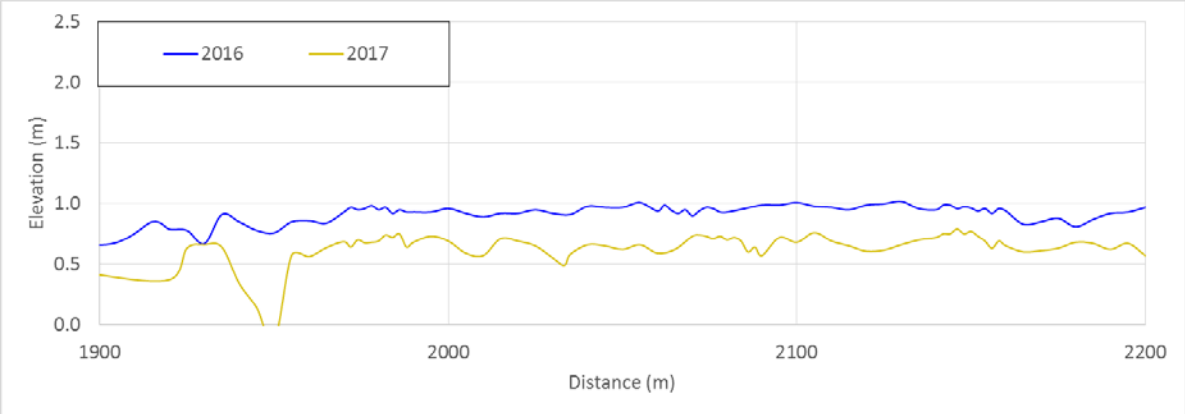

Figure 6: Unit 1 Longitudinal Profile in 2016 and 2017

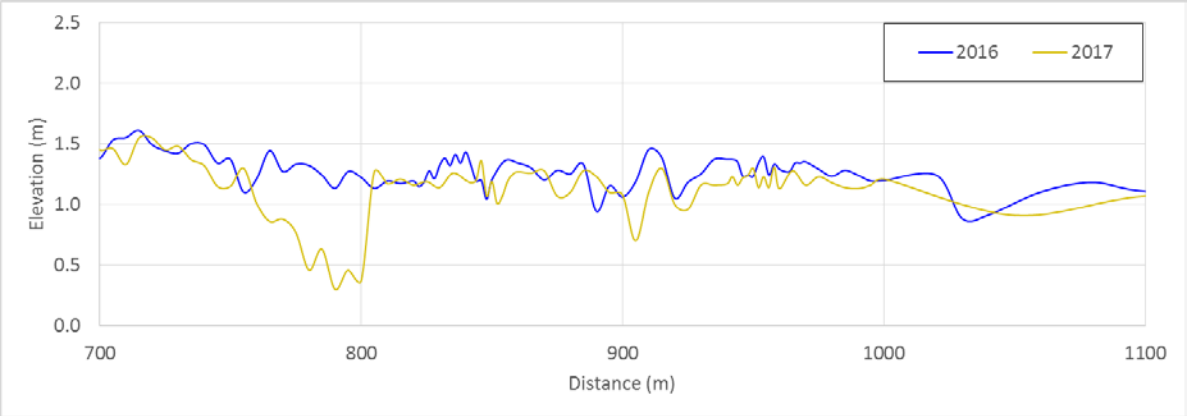

Figure 7: Unit 2 Longitudinal Profile in 2016 and 2017

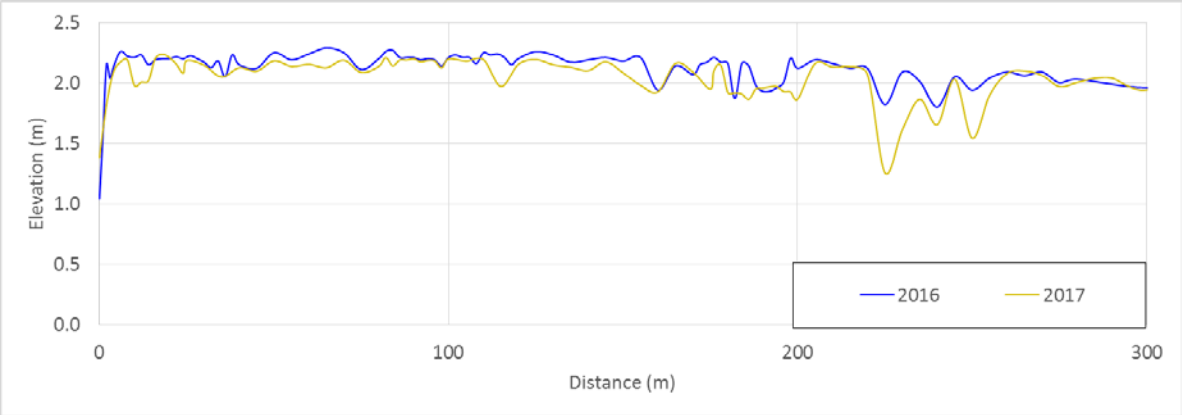

Figure 8: Unit 3 Longitudinal Profile in 2016 and 2017

Other channel considerations include a number of identified bank failures due to groundwater seepage or sand pockets. Unit 1 has a very large bank failure due to groundwater seepage. This failure occurred immediately after 2014 construction and is being monitored. Unit 2 has numerous bank failures caused by large pockets of sand composing a majority of the right bank. Much of this sand is being transported to the Unit 2 floodplain bench. Unit 3 has two bank failures that merit further monitoring. All bank failures will be assessed and determined if each will be allowed to stabilize on their own or if intervention is needed.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Salt River Corridor

Monitoring Task: Bridges and Culvert Inspections on Salt River Corridor

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Annual visual inspection of culverts and bridges in the restored Salt River corridor

Goals:

- All culverts and bridges on the restored Salt River corridor are to remain unobstructed and functional.

Report: N/A. Observational data sheets are available upon request.

Methods: All culverts and bridges will be visually inspected upstream and downstream, inlet/outlet, at low and high water flows to determine that these structures are functioning as intended and not being occluded by debris or sediment deposition. Erosion factors will also be noted. Dillion Road Bridge is the only bridge spanning the restored Salt River as of 2017. Existing and adjacent culverts at Reas Creek, Boynton Swale, and Bush Street deliver flows to the Salt River.

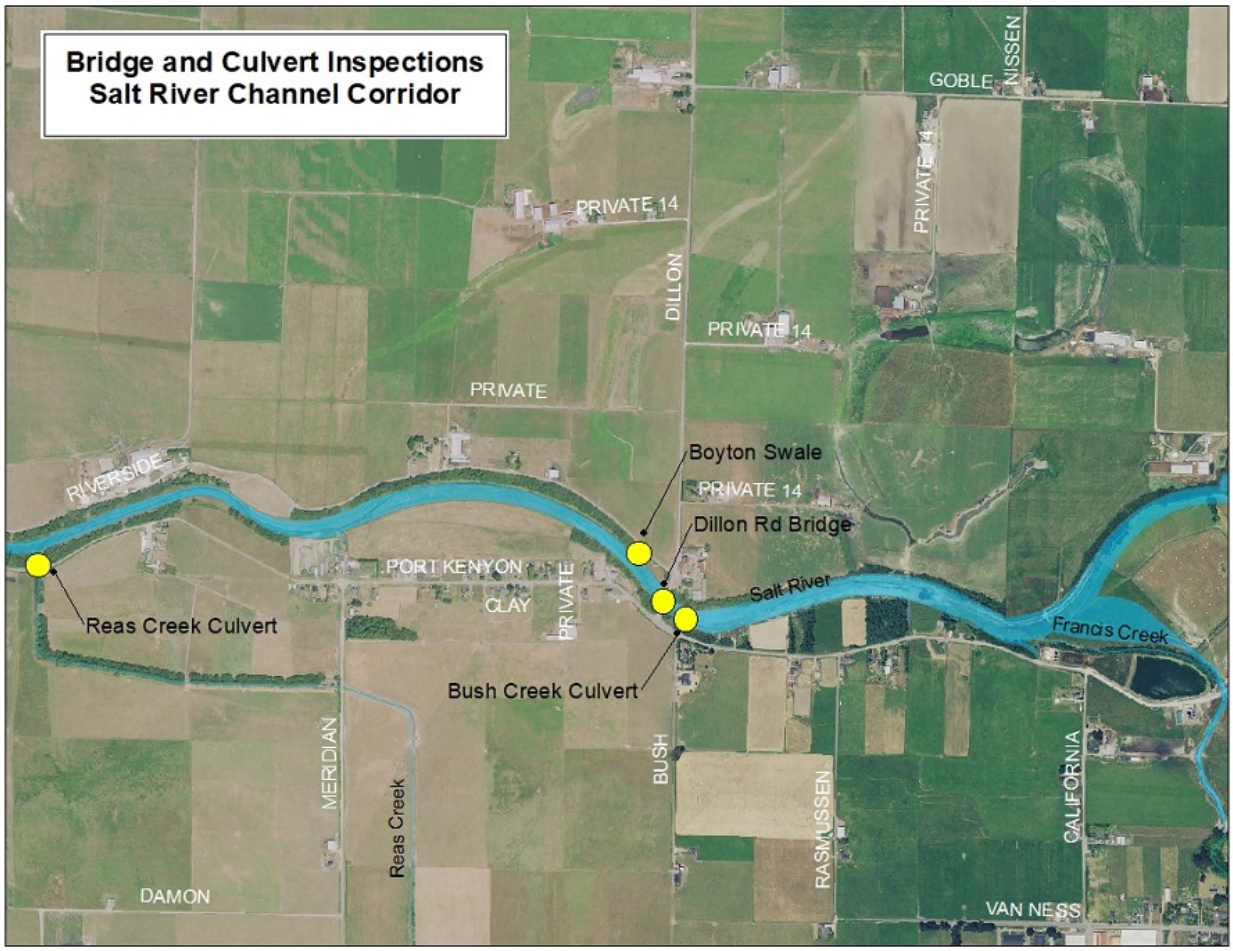

Figure 9: Bridges and Culverts Locations on the Salt River restored corridor

Results and Discussion: No culverts or bridges were constructed within the Salt River corridor as of the 2017 monitoring period. However, one bridge and three culverts remain along the Salt River post-project construction. Dillon Road Bridge spans the Salt River at its upper tidal prism extent. It has been observed during low and high flows and no debris in the channel or flood plain are racking up on the bridge abutments. Erosion around the footings is not occurring. Some individual red alder (*Alnus rubra)* saplings are growing close to the bridge deck and should be considered for removal. The Reas Creek, Boynton Swale, and Bush Street culverts have been observed during high and low flows and appear to be functioning normally.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Salt River Corridor

Monitoring Task: Inspection of Sediment Management Areas

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Annual inspection of the sediment management area at the confluence of Francis Creek and the Salt River as well as passive sediment management areas in the restored Salt River corridor

Goals:

- Sustain hydraulic conveyance and ecological function
- Minimize sediment management maintenance activities

Report: Refer to:

- *Sedimentation and Erosions Patterns Within Anabranching Channels in a Lowland River Restoration Project* (2017). By Ivan Mendel. Humboldt State University Master's Thesis.

Methods: Methods to determine sediment deposition in the active and passive sediment management areas include cross-sectional surveys and sediment monitoring plates. Visual inspections of connection points of passive sediment management areas (floodplains) to the main stem Salt River are also used as an evaluation method for site specific deposition. Visual assessments of vegetation growth within sediment management areas will determine whether present vegetation affects flow and deposition.

Results & Discussion: The active sediment management area at the confluence of Francis Creek and Salt River was not yet constructed as of the 2017 monitoring period and is therefore not described in this report. In previously restored portions of the channel corridor, passive sediment management areas are identified as specific constructed floodplain features. Cross-sections of the floodplains show (see Figures 3 - 5 above) minimal deposition since 2015, likely indicating that sediment becomes mobilized during high flow events. Cross-sectional and sediment plates determined that some inlets to passive sediment management areas/floodplains are experiencing some deposition and should be addressed. Visual vegetative assessments at the inlets also indicate that vegetation should be managed at some of these sites.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch

Monitoring Task: Cross Sectional and Longitudinal Surveys-Riverside Ranch Erosion and Sediment Deposition Surveys

Agencies/Acts: Coastal Commission, and California Environmental Quality Act (CEQA)

Compliance Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Final Environmental Impact Report (FEIR); and Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Cross-sectional and longitudinal profile surveys are performed across and along the main channel Salt River and interior estuary slough channels.

Goals:

- Cross-sectional and longitudinal surveys will describe how the channel is remaining consistent with restoration designs, or if areas are aggrading or eroding to the point of intervention.

Report: Salt River Ecosystem Restoration Project Post-Construction Geomorphic Channel Survey Report, Phase 1, Year 4 - 2017, prepared by Daniel O'Shea and Susannah Manning

Methods: The Riverside Ranch cross-sectional surveys were conducted on the main channel of the lower Salt River (SR), and of the newly excavated slough channels, in both the northern (NC) and southern (SC) regions, that were excavated during the summer and fall of 2013. A longitudinal survey was conducted of the lower main Salt River channel from Cutoff Slough to the Riverside Ranch barn. This effort concentrates on Phase 1 of the restoration Project in the Estuarine and Salt Marsh portions. All elevations are geo-referenced in feet to the 1988 North American Vertical Datum (NAVD88).

Three cross-sectional profiles of the main Salt River channel, and three cross-sections in each of the northern and southern slough channels (Figure 10), were collected using a Nikon DTM-352 Total Station laser theodolite, tripod, prism pole and single prism along the lower, middle and upper sections of the main Salt River channel. Permanent rebar monuments were set on both sides of the main channel and referenced to the Salt River Ecosystem Restoration Project's survey control points SR12, SR14 and SR11. The cross-sectional monuments were established using 4-foot lengths of ½"-rebar pounded into the substrate, leaving 3-inches exposed, and topped with labeled end

caps. GPS (Garmin GPSMAP 62s) locations were recorded for each monument, along with photo documentation.

Elevations and distances were collected at each major break in slope, vegetation edge, water's edge (based on tidal stage), mid-channel, and at least 2 locations on either side of mid-channel. Flood plain measurements were collected approximately 200-feet on either side of the main channel. The only exception was cross-section three (SR 3), where fencing of private lands limited access.

The longitudinal profile survey of the main Salt River channel from Cutoff Slough to the Riverside Ranch barn was collected using a Nikon DTM-352 Total Station laser theodolite, tripod, stadia rod, prism pole and single prism. The prism pole was placed in the thalwag approximately every 200-feet with the total station located at one of four locations along the north bank of the main Salt River channel and geo-referenced to the project's survey control points SR11, SR14 and SR12. A total of 48 measurements were taken along 11,789 feet of the Salt River. All elevations are reported in feet using the NAVD88 vertical datum.

Figure 10: Location of the cross section and longitudinal profiles for Salt River Ecosystem Restoration Survey Project, Spring 2017.

Results and Discussion: Results are summarized from the monitoring report in the following narrative and figures. . Cross-sections determine the width and depth of the channels. Figures 11 – 20 are the cross-sectional and longitudinal profiles for the Salt River main channel and the southern and northern slough channel network.

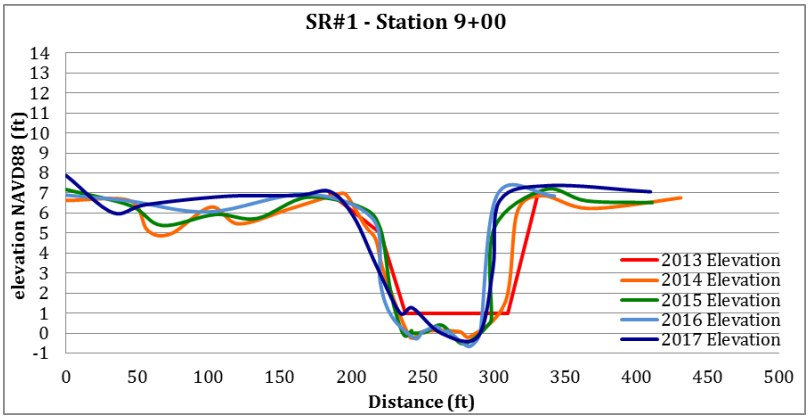

Figure 11: Salt River Cross-Section #1 (SR1)

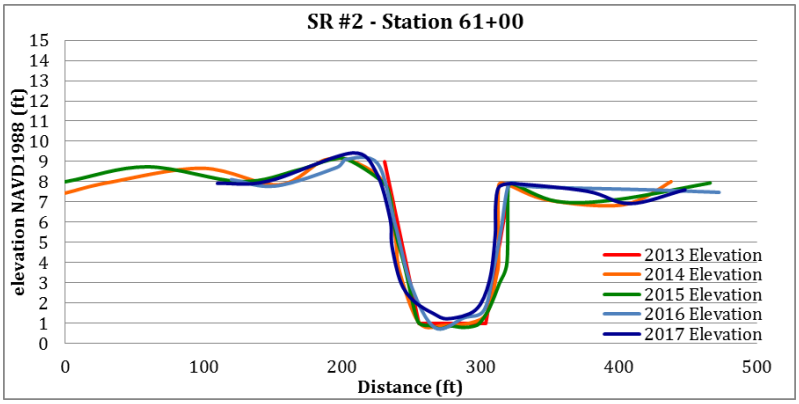

Figure 12: Salt River Cross-Section #2 (SR2)

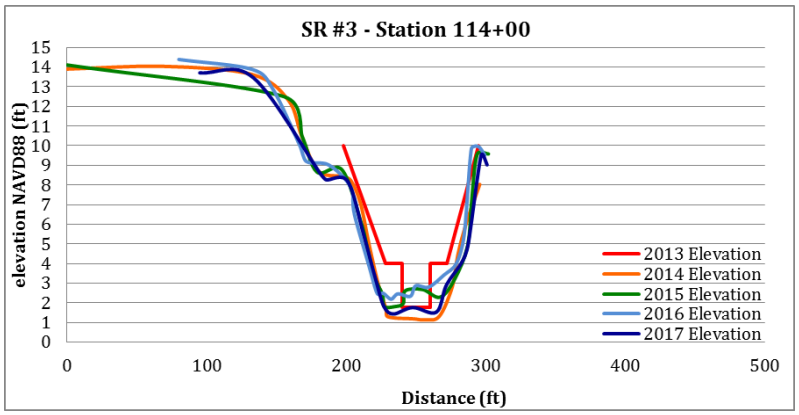

Figure 13: Salt River Cross-Section #3 (SR3)

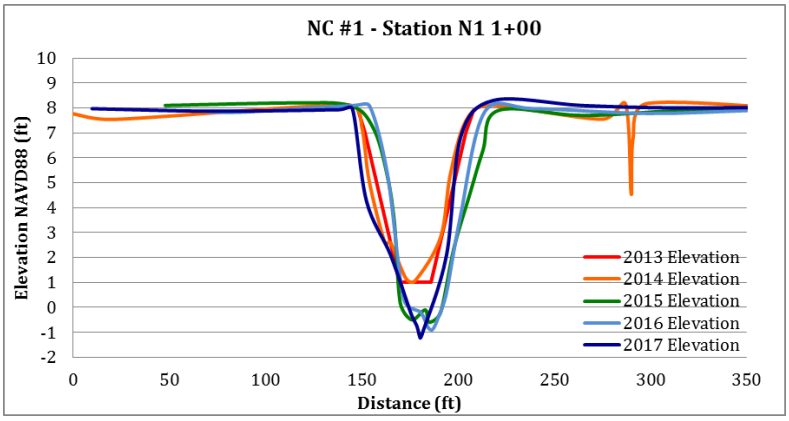

Figure 14: Slough North Channel Cross-Section #1 (NC1)

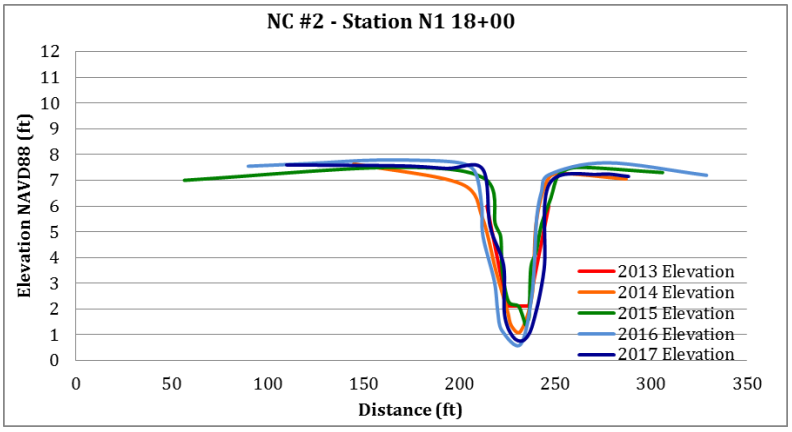

Figure 15: North Slough Channel Cross-Section #2 (NC2)

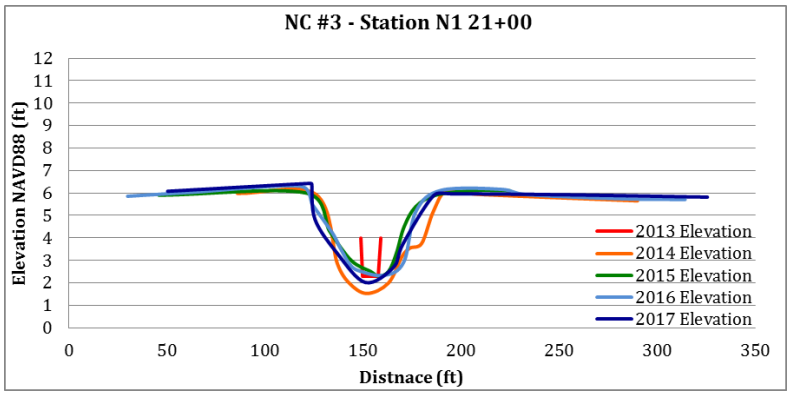

Figure 16: North Slough Channel Cross-Section #3 (NC3)

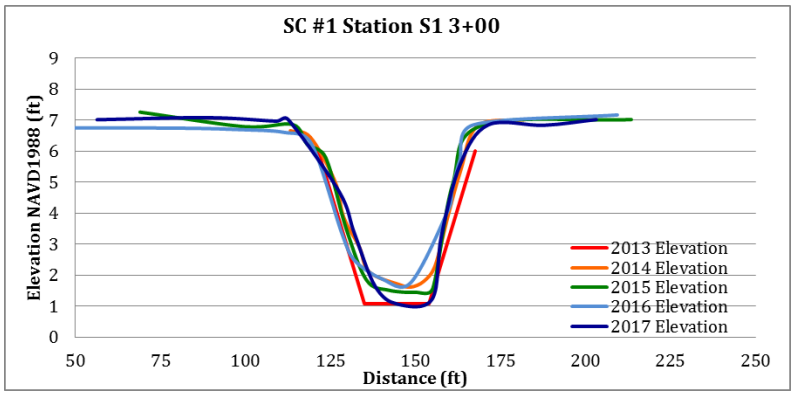

Figure 17: South Slough Channel Cross-Section #1 (SC1)

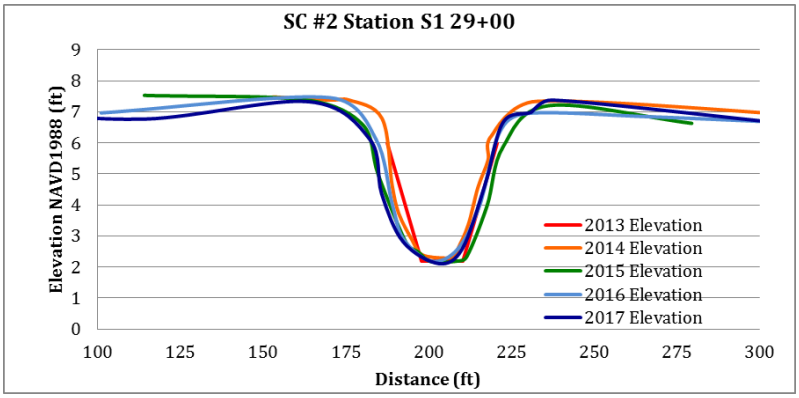

Figure 18: South Slough Channel Cross-Section #2 (SC2)

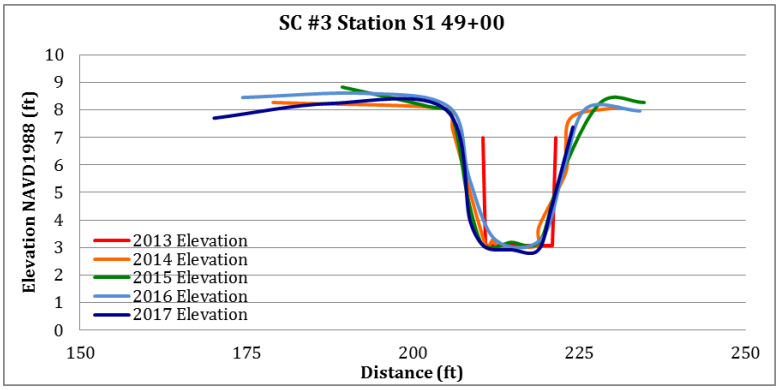

Figure 19: South Slough Channel Cross-Section #3 (SC3)

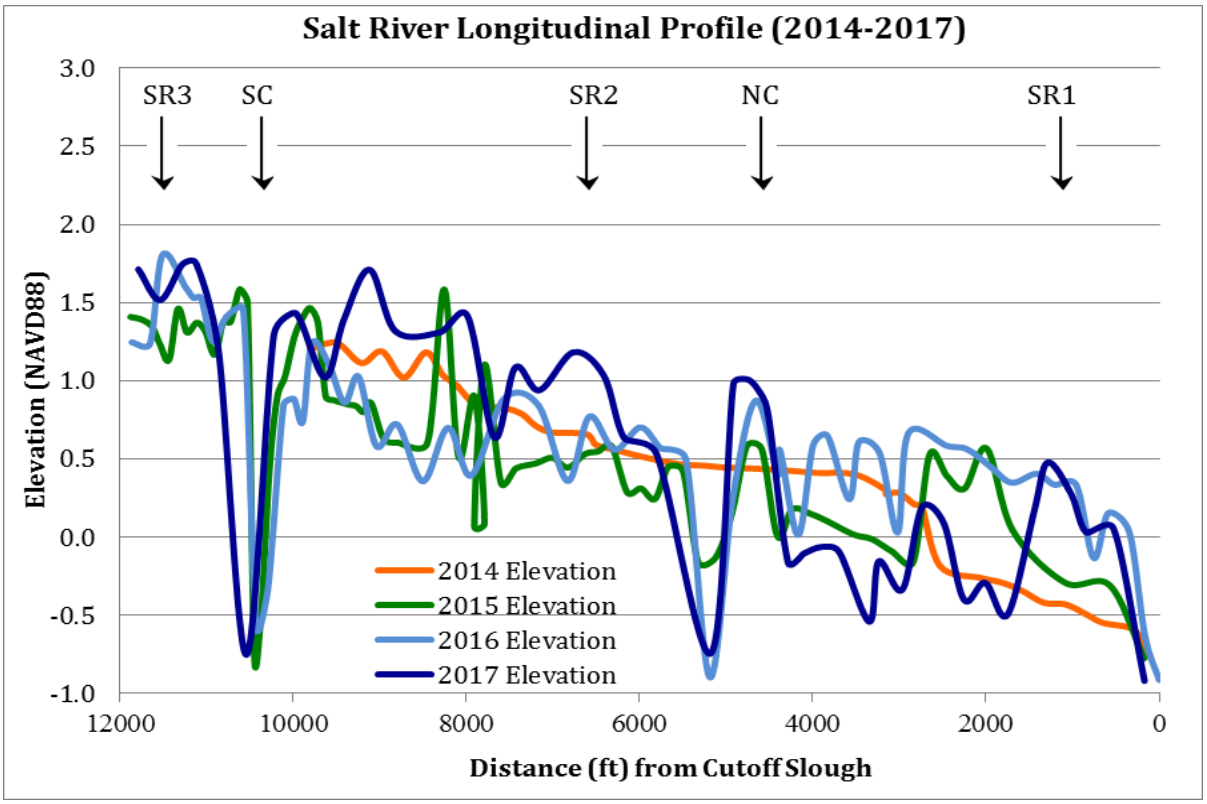

Figure 20: 2017 Salt River Longitudinal Profile

Figure 20 graphs the Salt River longitudinal profile of the main channel of the Salt River 2014-2017. The graphic identifiers SR1, SR2 and SR3 are the estimated locations of cross sections, while NC and SC are the approximate locations of the confluence with the North and South slough channels, respectively.

Patterns of erosion, transport and deposition observed in previous years continued in a similar manner in 2017. The primary difference was channel bed erosion in the lower main stem Salt River, and deposition in the middle to upper sections. Bank erosion and slumping were observed throughout the project area, particularly in the downstream reaches of the SR near the confluences with Cutoff Slough and the northern slough channel (NC). Main channel bed erosion in the Salt River was observed in the lower section of the Salt River channel below NC.

The SRERP's Adaptive Management Plan identifies a 10% change in channel capacity as a trigger level for potential management actions. Seven of the nine cross-sections have experienced an increase in channel capacity since 2014 (Table 1), two of which merit discussion and further monitoring (NC1 and SC2). Two cross-sections (NC3 and SR1) have slightly decreased in capacity beyond the 10% trigger level and further monitoring is recommended. Sediment deposition in the upstream section of the Salt

River channel between SR2 and SC is seen in the longitudinal profiles (Figure 20) and is likely the result of re-suspension of fine-grain sediments (e.g. silt and clay) that are transported upstream during flood tide then deposited at slack, high water. This system exhibits a net upstream transport of sediment in the Salt River main channel; however, the long-term, net-transport direction and quantity of sediment should be resolved in future channel surveys. Sediment erosion, transport and deposition, will continue in response to pending upstream restoration that will introduce more sediment inputs into the system.

The northern slough channel is experiencing channel erosion, deposition, and bank erosion (bank undercutting) throughout the network. The southern slough channels show aggradation at SR1 and show little change at others.

The longitudinal profile in the main Salt River channel indicates highly mobile sedimentation and erosion patterns. Much of the erosion and deposition are located near the confluences of the slough channel networks and at Cutoff Slough.

Table 1. Channel capacity change from 2014 to 2017

	Change in Capacity	
Cross Section	**Direction of Change**	**Percent of Change**
SR1	decrease	11%
SR2	increase	9%
SR3	increase	3%
NC1	increase	31%
NC2	increase	8%
NC3	decrease	12%
SC1	increase	5%
SC2	increase	25%
SC3	increase	2%

Though this is the third year of surveys on Phase 1, Riverside Ranch, of the Salt River Ecosystem Restoration Project, sediment erosion, transport and deposition, has not equalized and it is likely to continue to evolve in response to the implementation of upstream restoration that will introduce more sediment inputs into the system, while at the same time bring in larger volumes of water as the project connects two upstream tributaries.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch

Monitoring Task: Culvert and Tide Gate Inspections on Riverside Ranch

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Annual inspection of tide gates, culverts, and outboard drainage ditch

Goals:

- All tide gates and remaining culverts on Riverside Ranch remain unobstructed and operational.
- The Riverside Ranch outboard ditch will be monitored for flow and erosion impacts and maintained

Report: N/A. Observational data sheets are available upon request.

Methods: Any culverts or tide gates remaining or installed in Riverside Ranch (Figure 21) as part of the restoration design will be inspected annually and regularly maintained to ensure that they are functioning as designed. Annual reconnaissance of the outboard drainage ditch adjacent to the new Riverside Ranch berm will also be conducted to identify areas of impacted flow conveyance and/or erosion and any maintenance recommendations.

Although the SRERP's Adaptive Management Plan calls for annual monitoring , during 2014, HCRCD staff monitored the above items at least weekly to ensure tide gates and the outboard ditch were working properly to prevent high salinity water from encroaching onto neighboring lands. A site-check form has been developed to help monitor various elements on Riverside Ranch. The form includes observations pertaining to the tide gates, outboard ditch, pasture condition, fencing, wildlife, roads, structures, etc. The forms are reviewed by the HCRCD Project Manager to determine any issues that need to be addressed. Monthly reports are forwarded to CDFW Lands Division staff.

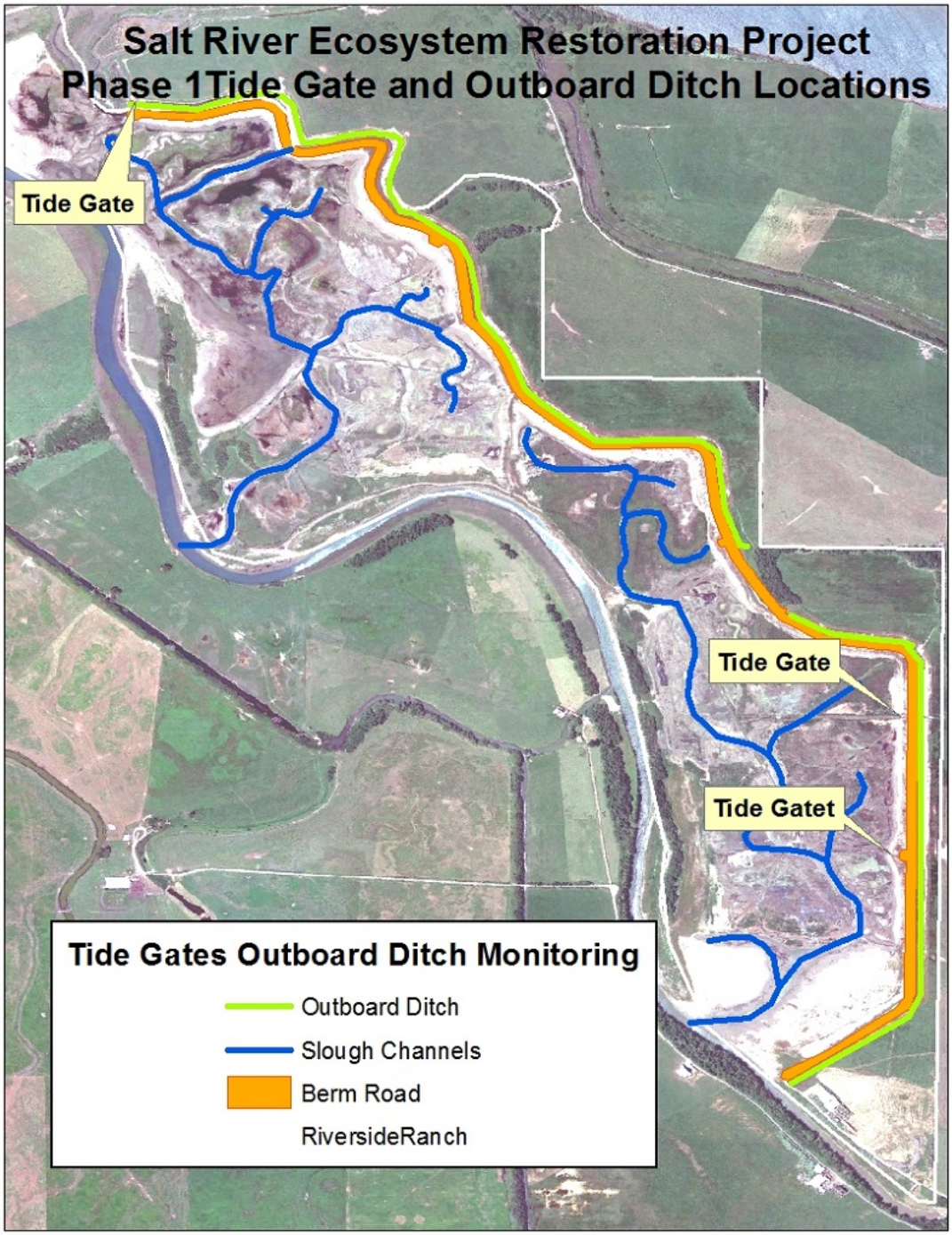

Figure 21: Tide Gates and Outboard Ditch Locations

Results and Discussion: The Phase 1 (Riverside Ranch) project area is monitored for various items, which include the three tide gates and the outboard ditch. Monitoring is conducted on a nearly weekly basis. No culverts remain on Riverside Ranch; all culverts were removed during construction. The installed tide gates are functioning as expected. No debris has been observed to obstruct the closing or opening of the tide gates thus

far. However, the southernmost tide gate has been observed to leak more than the other two during higher tide events. The outboard ditch has accommodated the excess water from the leaking tide gate during the summer and fall months. During winter months, the ditch accommodates average rain fall events, though during persistent rain periods and rain events of over 1" in 24 hours can cause water to back up in adjacent agricultural ditches and partially inundate agricultural fields when tide gates remain closed. Vegetation has been observed within most of the area of the outboard ditch. Considerations to manage vegetation are merited.

Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch

Monitoring Task: Setback Berm Inspection

Agencies/Acts: Coastal Commission, and California Environmental Quality Act (CEQA)

Compliance Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Adaptive Management Plan; and Salt River Ecosystem Restoration Project Final Environmental Impact Report (FEIR)

Description: Visual inspections for evidence of erosion and/or cracks after major storm events and high tides.

Goals:

- Determine if any annual maintenance is needed on the setback berm (berm road).

Report: N/A. Observational data sheets are available upon request.

Methods: Monitoring will consist of qualitative monitoring including visual inspections performed annually and after major storm and high tide events. Monitoring will look for evidence of obvious erosion caused by flooding or erosion resulting from wind generated waves. If significant erosion or signs of potential failure are observed, engineering evaluations will be performed to determine whether any structural repairs are needed.

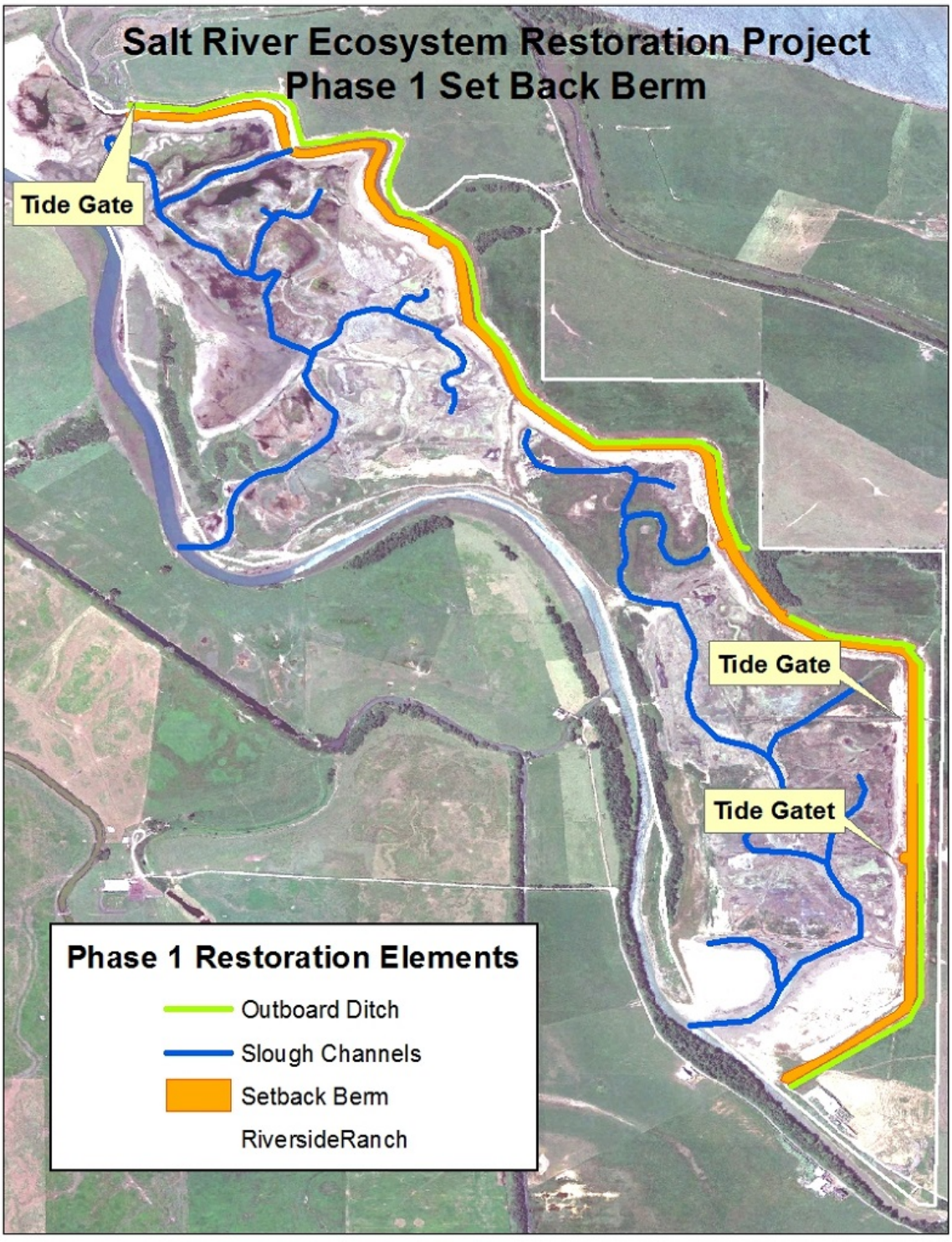

Figure 22: Setback Berm Location

Results and Discussion: The HCRCD makes monthly observations on the various elements on Riverside Ranch. Taking observations on the setback berm and the berm road are included in the visual inspections. Minor rills are observed on the estuary side of the berm and appear to be stable. Some minor erosion caused by wind wave fetch during large winter events is also evident on the northern end of the berm on the estuary side. Photos were taken and presented to project engineers who determined that the erosion should be only monitored at this time. The road that leads up to the berm from the barn was impacted by a large Eel River flood event in January 2017, where all gravel and road base material were washed away. Currently, that portion of the road is only passable by 4-wheel drive vehicles. CDFW, who owns the property, has been notified and they have indicated that they will try and address it.

Water Quality Monitoring and Adaptive Management for the Salt River Corridor and Riverside Ranch

Monitoring Task: Tidal Exchange and Water Quality

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Adaptive Management Plan

Water level and water quality parameters within the tidally influenced areas of the restored project were required to be conducted for the first three years post-construction. The 2016 monitoring effort marked the end of water level and water quality monitoring. Therefore, water level or water quality monitoring data was not produced for this 2017 monitoring report. Additional water quality spot measurements are taken monthly from spring to summer during fish surveys at each monitoring site and indicate appropriate water quality parameters for healthy fish habitat are being met.

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

Monitoring Task: Salmonid and Tidewater Goby Monitoring

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions 12, 13; SRERP Habitat Mitigation and Monitoring Plan and the Adaptive Management Plan

Description: Survey for presence of salmonids and tidewater gobies on Phase 1 in the spring through summer months.

Goals:

- Surveys will show that salmonids and tidewater gobies will utilize the restored Salt River main channel and the tidal slough networks.

Report: Salt River Ecosystem Restoration Project Fish Monitoring Program 2017. Results of fish species presence and distribution monitoring conducted from March to August, 2017 within the Salt River, Eel River Estuary, Phase 1 and 2 Project areas, Humboldt County California. Prepared By Doreen Hansen of the Humboldt County Resource Conservation District.

Methods: Field fisheries biologists from the California Department of Fish and Wildlife and Humboldt State University led the fish monitoring program.

Once a month, from March to August 2017, (except during July 2017 due to availability of a CDFW fisheries biologist) sites distributed across the Phase 1 and Phase 2 (Figure 23) constructed portions of the Salt River Ecosystem Restoration Project were surveyed for salmonids and tidewater gobies during low tide periods. Eleven sites on the Salt River Phase 1 and constructed portions of the Phase 2 restoration area were selected for fish presence and distribution monitoring to represent the diversity of channel size and habitats in the main Salt River channel in the slough network. Each tidally influenced site was sampled using a 1/8th inch mesh pole seine net. Typically a single 1/8th inch mesh pole seine pass was made through each site. Sites located further up the river channel were sampled by minnow traps deployed for at least an hour. These sites were not seined if it was determined ineffective due to narrow channel size. Captured fish were held in aerated buckets, identified to species, counted, and released back into the waterway. Additionally, juvenile salmonids were measured, held in a recovery bucket, and then released back into the waterway. Captured pike minnow were enumerated into 100 millimeter size classes by visual estimation, and the non-native pike minnow are humanely euthanized and buried via permit requirement. A start time, end time, and air and water temperature, measured by thermometer, were recorded for each minnow trap and seine deployment. In previous years minnow traps were deployed at each site but results did not significantly add further information to the seining effort, thus minnow trapping has since been limited to specific sites.

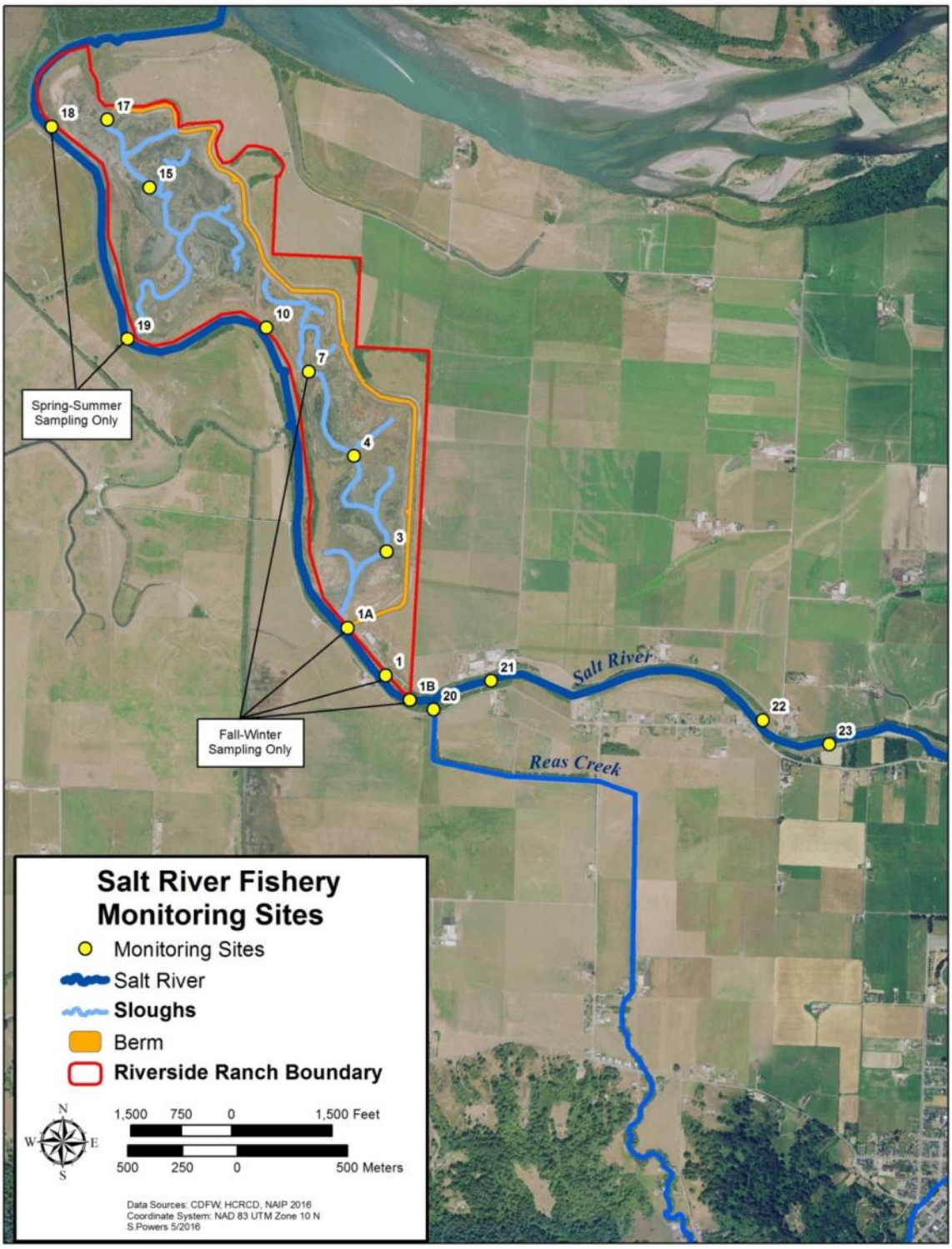

Figure 23: Fish Monitoring Sites Across Phase 1 and 2 of the Salt River Ecosystem Restoration Project (2017)

Results and Discussion: Over the five month sampling period, water temperatures ranged between a maximum of 34.7°C (August) and minimum of 12.5°C (March). Conductivity measurements were only taken in April and May, due to availability of a meter. Average conductivity ranged between a minimum of 7,185 CµS/cm and a maximum of 17,300 CµS/cm in the tidal reaches, while the freshwater reaches ranged from 274 CµS/cm to 470 CµS/cm. Salinity was measured in June and August. Average salinity ranged from 20.3 to 21.8 in the estuary and 1.6 to 20.2 upstream of Reas Creek. Dissolved oxygen was also measured during the surveys and each month's average ranged between a maximum of 11.2 ppm and a minimum of 9.02 ppm (100% oxygen saturation is 10.0 ppm). The dissolved oxygen maximum value is beyond a maximum level, though dissolved oxygen probes are notorious for reading above 10.0 ppm.

Over the five month sampling period, seining and minnow trapping efforts at the 11 fisheries monitoring sites identified the presence of 15 species. Approximately 7,692 individuals were captured (approximate numbers were often made for three-spined stickleback and the lined or yellow crab). The following table (Table 2) presents the total number of fish and marine invertebrates sampled from March to August in 2017 (excluding the month of July).

Ten Coho salmon (*Oncorhynchus kisutch)* juveniles were present during the March and April sampling months as well as one Chinook salmon (*Oncorhynchus tshawytscha*). Salmonids were captured in the tidal marsh area and in the main channel Salt River.

In previous years immediately after construction of the tidal marsh in 2013, tidewater gobies (*Eucyclogobius newberryi)* were abundant at the southern slough channel terminal arms, where over a hundred individuals would be caught in one sampling period (month). In 2017, only 15 tidewater goby individuals were sampled during the sampling season. The low numbers are likely due to degraded or loss of backwater habitat, caused by anticipated tidal regime impacts of sedimentation and/or erosion of channel features within the created slough channels at three sites. These sites previously held high concentrations of tidewater goby and have now been abandoned as fish sampling sites. The 2017 captured tidewater gobies occurred at sites #3, #4, and #17.

Marine species were present in the estuary portion of the Project area. Though the internal slough channel network provides saline habitat, most marine species were captured in the main channel Salt River. Marine species include: Bay Pipefish *(Syngnthus leptorhynchus*), Pacific Herring (*Clupea pallasii*), Shiner Surfperch (*Cymatogaster aggregata*), Starry Flounder (*Platichthys stellatus*), and Top Smelt (*Atherinops affinis*).

Table 2: Number of individual fish captured by each month's fish survey efforts in 2017

	Number of Fish Captured in 2017					
	March	**April**	**May**	**June**	**August**	**Total**
Fish Common Name						
Tidewater Goby	3	9	0	0	3	**15**
Coho	6	4	0	0	0	**10**
Chinook	0	1	0	0	0	**1**
Three-Spined Stickleback	1,699	157	82	1,755	1,293	**4,986**
Staghorn sculpin	127	40	18	21	6	**212**
Un. ID Sculpin	2	0	1	0	0	**3**
Pike Minnow	960	49	82	44	100	**1,235**
Pacific Herring	2	0	0	0	0	**2**
Bay Pipefish	0	0	0	3	0	**3**
Top Smelt	0	0	0	0	1,105	**1,105**
Un. ID Smelt (juv)	0	0	0	10	0	**10**
Starry Flounder	0	0	0	2	1	**3**
Shiner Surf Perch	0	0	0	50	5	**55**
California Roach	37	3	0	9	0	**49**
Dungeness Crab	0	0	0	0	0	**0**
Yellow/Lined Shore Crab	0	0	0	2	1	**3**
Total	**2,836**	**263**	**183**	**1,896**	**2,514**	**7,692**

Significant numbers (212) of staghorn sculpins (*Leptocottus armatus)* were captured in 2017. This is the second year of increased staghorn sculpin numbers in the Project area. Three-Spined Stickleback continue be captured in the thousands of individuals. The number of Sacramento Pike Minnow has increased alarmingly in 2017 as compared to previous years. This may be due to the higher level of precipitation received through the winter and spring providing suitable low salinity habitat throughout a majority of Project area; whereas, in previous years the region was in a drought and the marine environment stayed highly saline throughout the winter and spring. In June of 2016, a highly abundant species of shore crab (yellow or lined) was first seen in the estuary since restoration was completed in 2013. For this sampling season, the crabs have reduced from numbers in the thousands in 2016 to just a few individuals in 2017.

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

Monitoring Task: Aleutian Goose Short-Grass Habitat Monitoring

Agencies/Acts: California Department of Fish and Wildlife (CDFW)

Compliance Documents: Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Approximately 72 acres of land is retained on Phase 1 (Riverside Ranch) of the Salt River Ecosystem Restoration Project to be agriculturally managed. Agricultural activities will follow CDFW protocols in order to achieve short-grass habitat for migrating flocks of Aleutian cackling geese and other wetland-associated birds.

Goals:

- Develop a pasture management plan on Phase 1.
- Annual evaluation of vegetation on Phase 1
- Provide short-grass habitat for Aleutian Cackling Geese

Report: N/A

Methods: From 2001 through 2012, a Memorandum of Understanding (MOU) between the HCRCD and the California Department of Fish and Wildlife (CDFW) allowed for the HCRCD to manage leases and oversee agricultural activities on several CDFW-owned Wildlife Management Areas (WMAs). The purpose of these types of activities was to achieve a variety of wildlife habitat goals through well-managed agricultural practices. Livestock grazing and/or other agricultural management techniques are used to create, maintain and/or enhance habitat for plants, wetland associated birds such as Canada Goose, Aleutian cackling goose, waterfowl, shorebirds, or wading birds and other wildlife. To this end, CDFW and HCRCD jointly developed the *Protocol for Prescribing Agricultural Activities on Lands Within the North Coast Wildlife Area Complex,* to outline the process to determine and monitor specific agricultural activities, such as livestock grazing, haying, mowing, irrigation, fertilizing and seeding on all CDFW WMAs in Humboldt County, including Riverside Ranch.

Under the MOU, HCRCD provided ongoing monitoring and oversight and made recommendations for agricultural practices to be adjusted as needed to achieve CDFW goals. This successful model was utilized by CDFW up and down the State until it was ended in late 2012 when an internal CDFW audit revealed that the practice of allowing RCDs to manage lands and lease payments for CDFW conflicted with State regulations. Due to these findings, all agricultural activities on WMAs were suspended in 2013/2014.

Therefore, the 72 acres of pasture on Phase 1 (Figure 24) reserved for shortgrass habitat has not been managed to promote optimal forage for Aleutian geese since the winter of 2013. In March 2018, CDFW released a Request for Proposals for Permit for Excess Vegetation Disposal on the Salt River Unit of the Eel River Wildlife Area (aka Phase 1/Riverside Ranch), which has not yet been awarded.

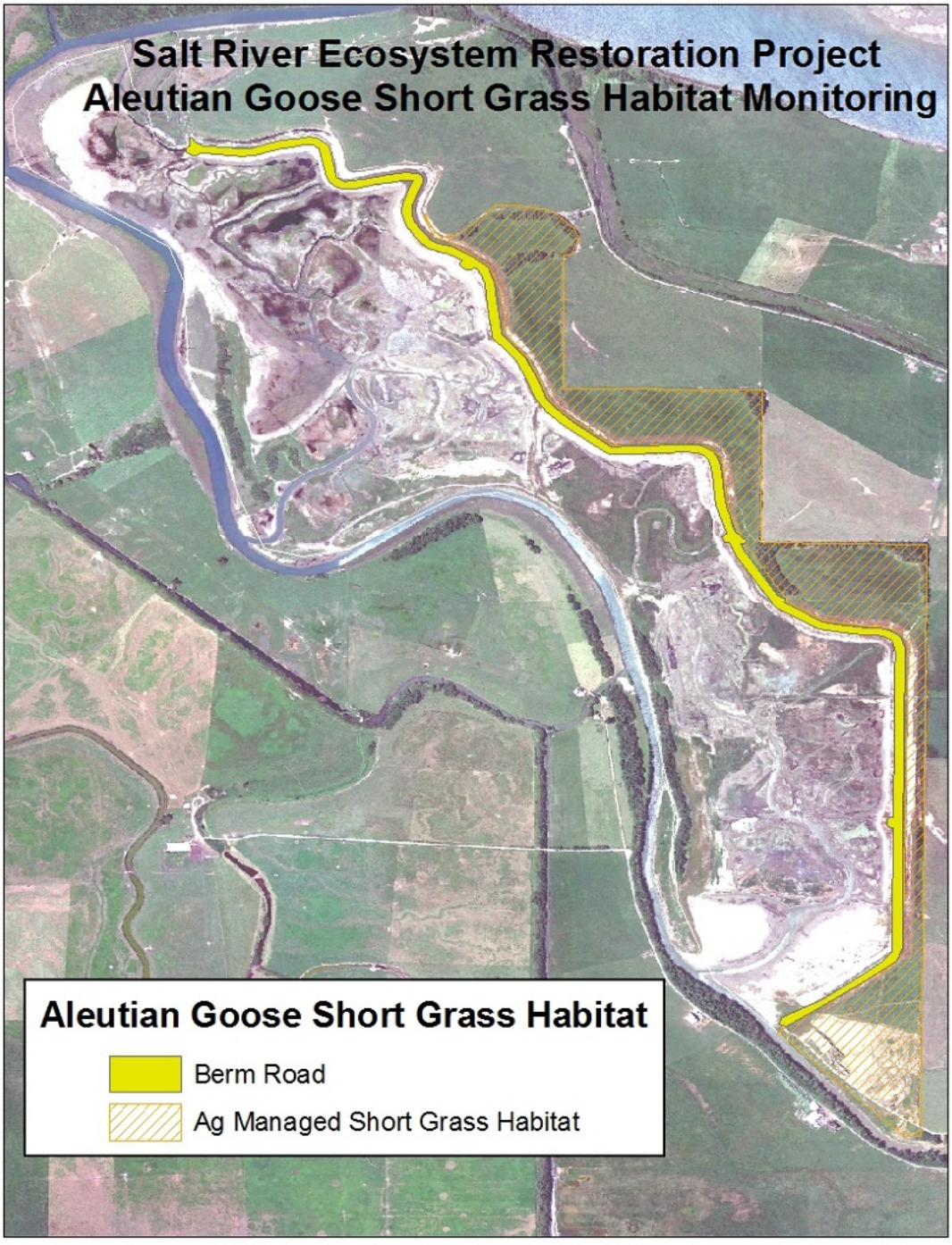

Figure 24: Proposed Managed Short Grass Habitat on Phase 1

Results and Discussion: Since 2014, the pasture land has sporadically been managed. In 2014, the HCRCD used its own funding to twice mow the pastures during the summer growing season to control weeds and manage the grass and a CDFW contract allowed for the forage to be removed once in the fall; however, this did not provide shortgrass habitat in the winter of 2014/2015. Again in 2015, the HCRCD worked closely with the regional CDFW office to develop a haying contract in late fall to have the overgrown forage removed. However, a single haying activity that occurs in the late summer or early fall season does not promote the short grass habitat that Aleutian geese prefer. In 2016 and again in 2018, CDFW released a Request for Proposals (RFP) for vegetation management (grazing) for their north coast wildlife management areas. Phase 1/Riverside Ranch was one of these areas. In 2016, and due to the RFP's application criteria and local level of interest, CDFW did not receive any applications for Phase 1/Riverside Ranch. CDFW received two applications to the 2018 RFP, but has not yet awarded a contract.

Agricultural managed short grass habitat and the "prime agricultural" status on Phase 1/Riverside Ranch was not achieved during the winters of 2014/2015, 2015/2016, 2016/2017, or 2017/2018. If the RFP is awarded in 2018, HCRCD will work with CDFW to establish the monitoring protocol.

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

Monitoring Task: High Marsh Ecotone Vegetation Percent Cover Survey

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; SRERP Habitat Mitigation and Adaptive Management Plan

The High Marsh Ecotone vegetation percent cover was not scheduled to be performed in 2017.

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

Monitoring Task: Woody Vegetation Management

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; SRERP Adaptive Management Plan

Description: Perform woody vegetation management (e.g. removal or planting of woody vegetation) to ensure the hydrologic function of the Salt River channel.

Goals:

- Woody vegetation will be managed consistent with the goal to maintain structure and function of the Salt River corridor
- Manage situations that impede channel function.
- Woody vegetation management cannot contribute to bank or channel erosion

Report: Refer to:

- 2017 Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District by J.B. Lovelace & Associates
- *Sedimentation and Erosions Patterns Within Anabranching Channels in a Lowland River Restoration Project* (2017). By Ivan Mendel. Humboldt State University Master's Thesis.

Methods: Review results of the vegetation monitoring and cross-sectional & longitudinal surveys to determine if channel hydrologic function is being affected by the presence or removal of woody vegetation.

Results & Discussion: Results from the geomorphic surveys indicate that although discreet channel sites are experiencing some sedimentation and erosion, these situations are not caused by woody vegetation that is growing, has fallen, or been removed in or along the channel. The vegetation monitoring effort sampled planted and naturally recruited trees along the restored channel for basal area and approximated the total nascent woody vegetation to be less than 0.001 acres within the 33 acres of restored channel corridor and estuary; thus planted and naturally recruited woody vegetation is not anticipated to impact the channel in the near future. However, one to two downed existing alders have fallen into the larger Salt River channel within the Phase 1 footprint, and have been observed over the past three years and do not appear to be adversely impacting channel function or the banks.

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

Monitoring Task: Weed Abatement

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; SRERP Adaptive Management Plan

Description: After 3 years post construction – weed abatement shall be performed using a variety of methods

Goals:

- Limit colonization of weedy species within the restoration area
- Ensure that weedy species do not dominate the restoration area or expand onto adjacent properties
- Weedy species do not present a detriment toward maintaining a self-sustaining riparian forest or tidal salt marsh

Report: Refer to:

- 2017 Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District by J.B. Lovelace & Associates

Methods: Review vegetation report for non-native non-invasive and invasive findings to determine location and percent cover of weed species. Weed abatement may include mechanical or manual control by paid staff, contractors, or volunteers. Controlled and limited flash grazing may also be used to control weeds.

Results & Discussion: Staff observation and the vegetation monitoring effort have found that numerous weedy species exist and are becoming prolific in the restored portions of the project area. *Spartina densiflora*, reed canary grass (*Phalaris arundinacea)*, creeping bent grass (*Agrostis stolonifera)*, and a variety of thistles (*Helminthotheca echioides and Cirsium vulgare)* are present and need to be addressed.

No formal reach wide weed abatement efforts were made on the restored project footprint. However, individual pampus grass (*Cortaderia jubata)* clumps on Phase 1 and in the Phase 2 channel corridor were removed. It has been recommended by re-vegetation experts that much of the reed canary and creeping bent grasses will eventually be controlled when wood riparian species achieve a shaded canopy in the river corridor.

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

Monitoring Task: Invasive Species Management – Vegetation

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; SRERP Adaptive Management Plan

Description: Map invasive vegetation species during surveys required by the Habitat Mitigation and Monitoring Plan for the Salt River Ecosystem Restoration Project

Goals:

- Total invasive plant species within sampling areas will not exceed a percent cover of 5%

Report: 2017 Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District by J.B. Lovelace & Associates

Methods: The following is a modified excerpt from the 2017 Annual Habitat Monitoring Report

All encountered occurrences of invasive vegetation were documented using a GPS device. The resulting geographic data were subsequently uploaded, appropriately corrected, and used to update relevant maps using ArcMap® software and the most recent satellite imagery (NAIP 2016) to reflect the most current knowledge of the distribution and extent of invasive species occurring throughout the SRERP area.

Where feasible, the distributions of discrete invasive species are mapped separately, and in the case of the highly invasive salt marsh species, *Spartina densiflora* ("dense-flowered cord grass"), *Spartina*-specific figures were created to clearly depict updated observations of the distribution of this species throughout the SRERP restoration area. In some instances, the distributions of multiple co-occurring species overlapped to produce such complex mosaics that mapping separate species was not practical in the context of this effort. In such instances, the resulting combined species distribution mosaics were mapped as species "complexes." These "complexes" were assigned titles referencing the most dominant invasive species genera represented.

Our categorization of plant species as being native, non-native non-invasive, and invasive is consistent with that used in previous SRERP habitat monitoring efforts (H.T. Harvey & Associates 2014 & 2015; J.B. Lovelace & Associates 2017) in an attempt to

maintain consistency throughout the duration of the entire SRERP monitoring period. Native plants are considered to be those “occurring naturally in an area, as neither a direct nor indirect consequence of human activity” (Baldwin et al. 2012). Non-native species are those introduced as a direct or indirect result of human activity. Non-native invasive plants are defined by the California Invasive Plant Council (Cal-IPC 2017) as non-native species threatening “wildlands“ by displacing and/or hybridizing with native species and/or likely to “alter biological communities, or alter ecosystem processes.”

Except as noted otherwise, plant species are regarded as being “invasive” if they are assigned a “high” invasive rating by the Cal-IPC (2017), are listed as “noxious weeds” by the California Department of Food & Agriculture (CDFA 2017), are listed as “federal noxious weeds” (USDA 2017), are considered invasive in the Humboldt County Weed Management Area (HWMA) (2010), or otherwise warrant concern based on known or perceived potential for preventing the establishment of intended vegetation in the SRERP restoration area. Although some non-native plants detected in the current monitoring fieldwork regarded by the Cal-IPC (2017) as having “moderate” or “limited” invasive potential were considered invasive in the context of the SRERP restoration goals, it is also true that other species classified similarly were not considered problematic in the context of the current effort, based on local species observations.

Two native plant species are considered as invasive vegetation in this effort based on their potential for ecosystem-altering effects in this nascent, large-scale restoration project: *Phalaris arundinacea* (“reed canary grass”) and *Typha latifolia* (“broad-leaved cattail”), although neither is listed as invasive by Cal-IPC (2017) or the Humboldt County Weed Management Area (2010). Although there is some ambiguity with respect to variation in the invasive potential of different populations of *P. arundinacea* (and the ability to distinguish between them in the field), both *P. arundinacea* and *Typha latifolia* are currently considered to be native in California. However, up until relatively recently, *Phalaris arundinacea* was not regarded as being native to California, and was considered invasive in previous SRERP habitat monitoring efforts (H.T. Harvey and Associates 2014 & 2015; J.B. Lovelace & Associates 2017). Both species are considered by some sources to be invasive elsewhere due to their potential to alter ecosystem processes by becoming rapidly established and developing dense, monotypic stands which aggressively outcompete other species, and can result in sediment accretion and eventual channel occlusion and/or habitat conversion in some aquatic habitats.

Results & Discussion: Vegetation surveys across all phases of the constructed project footprint mapped (Figures 25 - 29) and determined percent cover for invasive species. Project documents set the limit of invasive species presence below 5%. All restoration areas exceeded the invasive species limit (Table 3). *Spartina densiflora* is dominating the salt marsh habitat in Phase 1 and is accompanied by *Agrostis stolonifera* (“creeping

bent"), *Phalaris arundinacea* ("reed canary grass"), *Polypogon monspeliensis* ("rabbitfoot grass"), and *Lotus corniculatus* ("bird's-foot trefoil"). Both Phase 2A Lower and Middle areas also exceeded the invasive species threshold of 5%. These areas have *Phalaris arundinacea* ("reed canary grass"), *Agrostis stolonifera* ("creeping bent"), *Ranunculus repens* ("creeping buttercup"), *Lotus corniculatus* ("bird's-foot trefoil"), *Helminthotheca echioides* ("bristly ox-tongue"), and *Cirsium vulgare* ("bull thistle").

Results indicate increasing trends in the abundance of invasive vegetation in all sampled habitats, with the exception of the active bench habitat in the middle Phase 2A restoration reach. It is recommend that immediate and aggressive invasive vegetation management efforts be initiated and repeated as necessary until future monitoring results demonstrate a sustained decreasing trend in the observed extent and abundance of invasive species throughout the SRERP restoration area to a level that will meet established respective success criteria.

Table 3: Summary of 2017 SRERP Quantitative Vegetation Percent Cover Sampling Results & Respective Success Criteria. Mean percent cover estimates are in bold and associated 95% confidence intervals follow in parentheses.

	Mean Percent Cover for Vegetation Categories of Interest							
	Total Vegetation[1]	Native Vegetation		Non-Native Non-Invasive Vegetation		Invasive Vegetation		Sterile Hybrid Wheatgrass[1]
SRERP Habitat Sampling Area	Observed	Observed	2017 Success Criteria[2]	Observed	Final Success Criteria[3]	Observed	Final Success Criteria[3]	Observed
Phase 1 – Riverside Ranch Tidal Marsh Restoration Area								
Replanted Riparian Forest (n=32)	**99.7** (97.8, 100.0)	**46.7** (34.3, 59.1)	≥30%	**15.8** (9.2, 26.5)	<15%	**37.2** (27.8, 47.3)	<5%	**0.0** (NA)
Phase 2 – Salt River Corridor Restoration Area								
Phase 2A (Lower) – Salt River Channel Wetlands								
Active Channel (n=32)	**78.4** (70.6, 84.2)	**40.2** (30.6, 50.4)	≥30%	**18.3** (12.2, 25.8)	<15%	**20.0** (13.3, 28.8)	<5%	**0.0** (NA)
Active Bench (n=32)	**88.8** (83.9, 92.3)	**55.9** (46.5, 65.8)	≥30%	**16.6** (10.7, 24.1)	<15%	**16.2** (9.9, 25.9)	<5%	**0.0** (NA)
Phase 2A (Lower) – Riparian Planting Zones								
Active Riparian Berm (n=32)	**96.7** (92.8, 98.4)	**64.3** (54.6, 73.0)	≥30%	**12.6** (8.0, 21.7)	<15%	**19.8** (13.7, 27.2)	<5%	**0.01** (0.0, 0.04)
Replanted Riparian Forest (n=32)	**99.4** (97.8, 99.8)	**62.1** (49.9, 72.5)	≥30%	**7.3** (4.1, 15.0)	<15%	**30.0** (21.3, 40.7)	<5%	**0.0** (NA)
Phase 2A (Middle) – Salt River Channel Wetlands								
Active Channel (n=32)	**92.8** (88.1, 95.8)	**80.3** (71.8, 86.8)	≥20%	**6.1** (2.5, 12.5)	<15%	**6.4** (3.7, 10.2)	<5%	**0.0** (NA)
Active Bench (n=32)	**87.3** (82.8, 91.3)	**59.0** (49.7, 67.8)	≥20%	**16.2** (9.8, 25.9)	<15%	**12.2** (8.4, 16.9)	<5%	**0.0** (NA)
Phase 2A (Middle) – Riparian Planting Zones								
Active Riparian Berm (n=32)	**93.6** (88.4, 96.4)	**58.3** (48.0, 68.2)	≥15%	**23.4** (16.0, 33.0)	<15%	**11.4** (6.9, 17.9)	<5%	**0.5** (0.1, 1.9)
Replanted Riparian Forest (n=32)	**95.3** (89.0, 98.1)	**42.2** (32.4, 52.8)	≥15%	13.1 (7.8, 20.8)	<15%	**40.0** (30.4, 50.4)	<5%	**0.05** (0.0, 0.15)

[1] No specific success criteria are indicated in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

[2] Adapted from Tables 8-10 of the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

[3] Must be achieved by the final monitoring year for each respective habitat sampling area (i.e., Year 5 for Salt River Channel Wetlands or Year 10 for all others) (H.T. Harvey & Associates with Winzler & Kelly 2012).

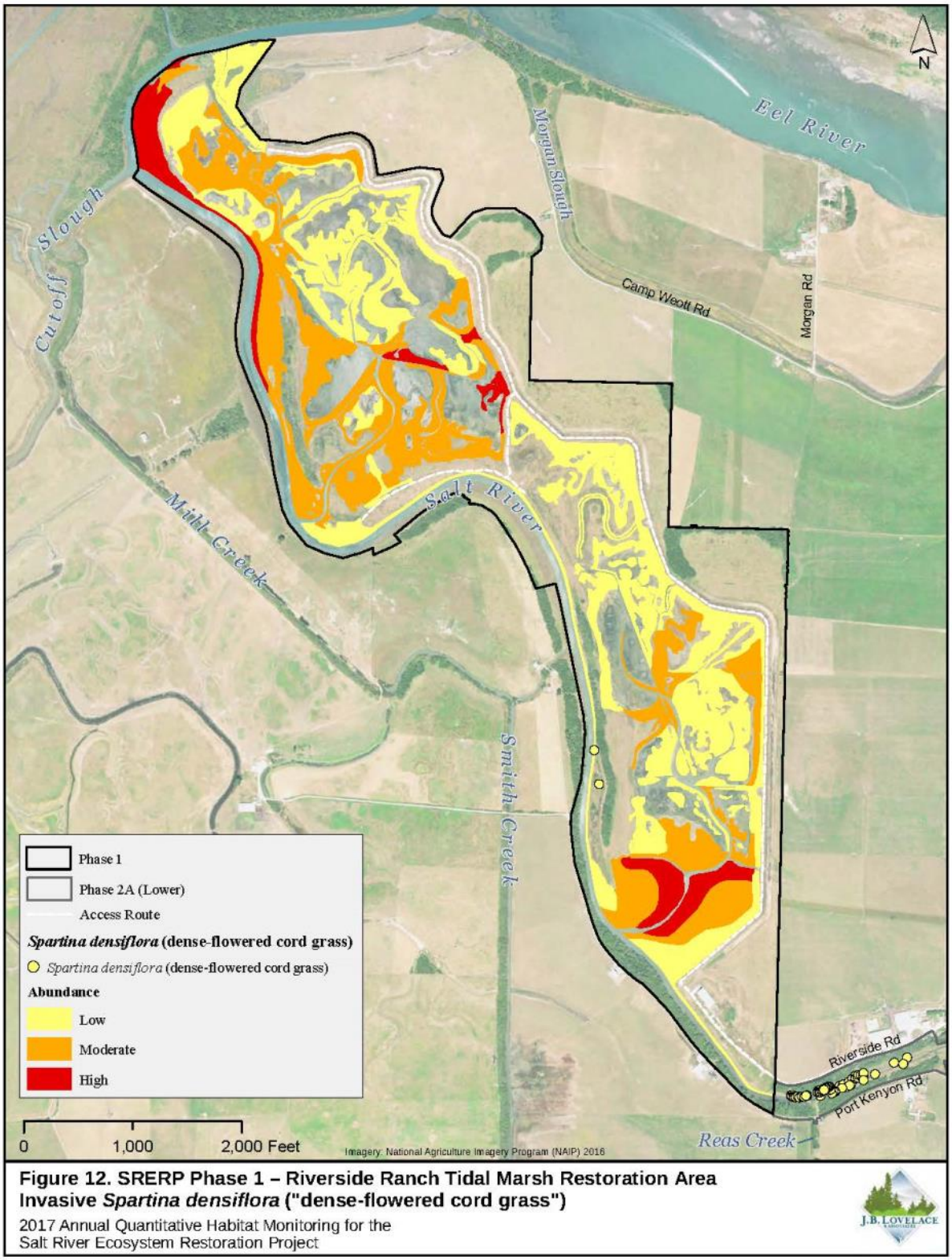

Figure 25. Invasive *Spartina densiflora* densities on Phase 1 (Riverside Ranch) of the Salt River Ecosystem Restoration Project

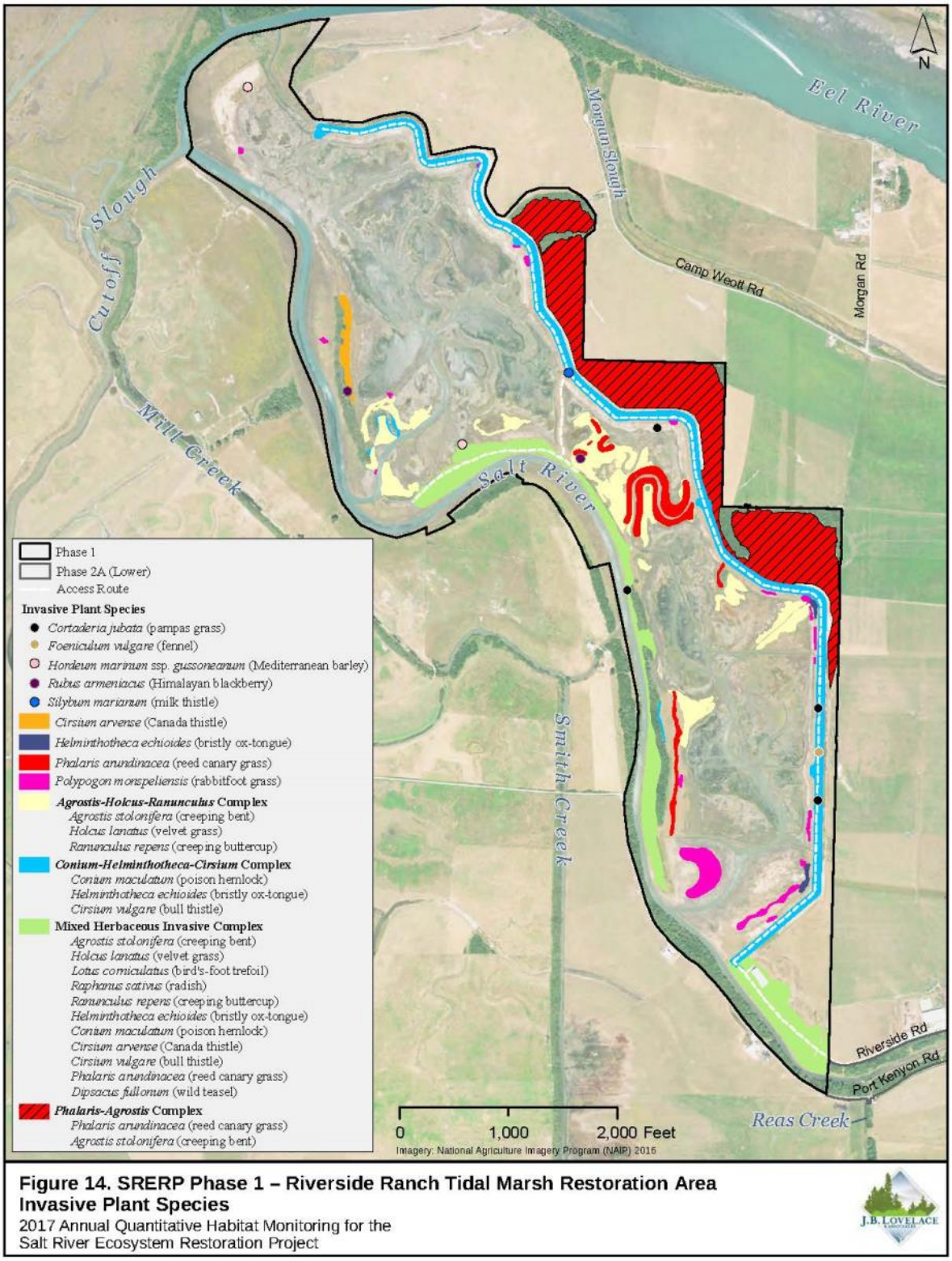

Figure 26. Invasive plant individuals and complexes on Phase 1 (Riverside Ranch) of the Salt River Ecosystem Restoration Project

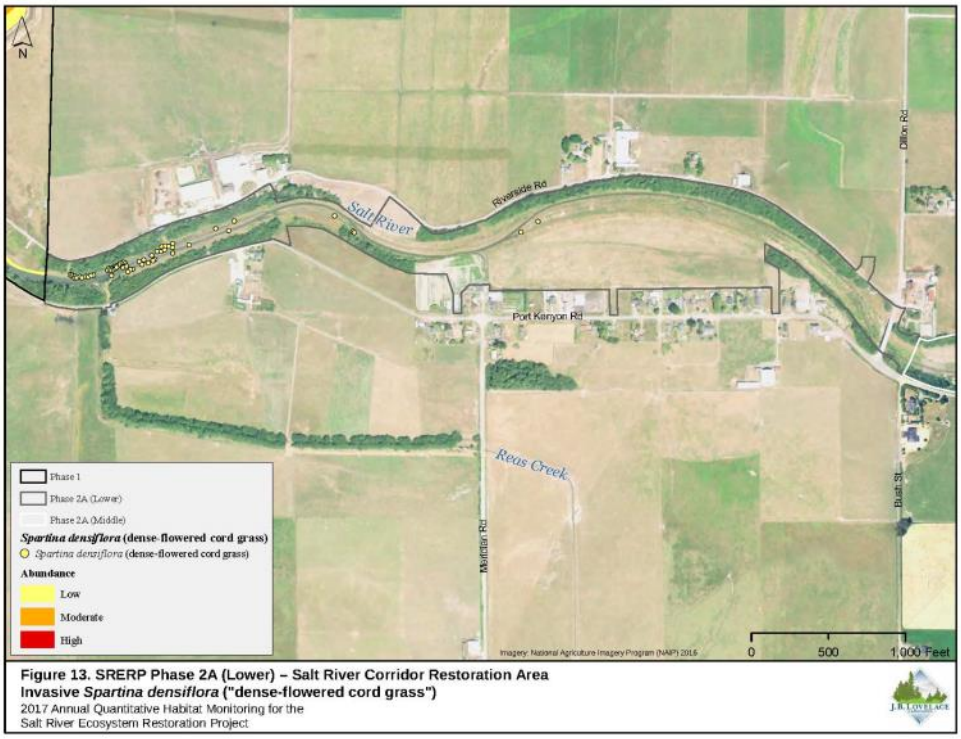

Figure 27. Invasive *Spartina densiflora* locations on the Phase 2A Lower (2014) Salt River Corridor of the Salt River Ecosystem Restoration Project

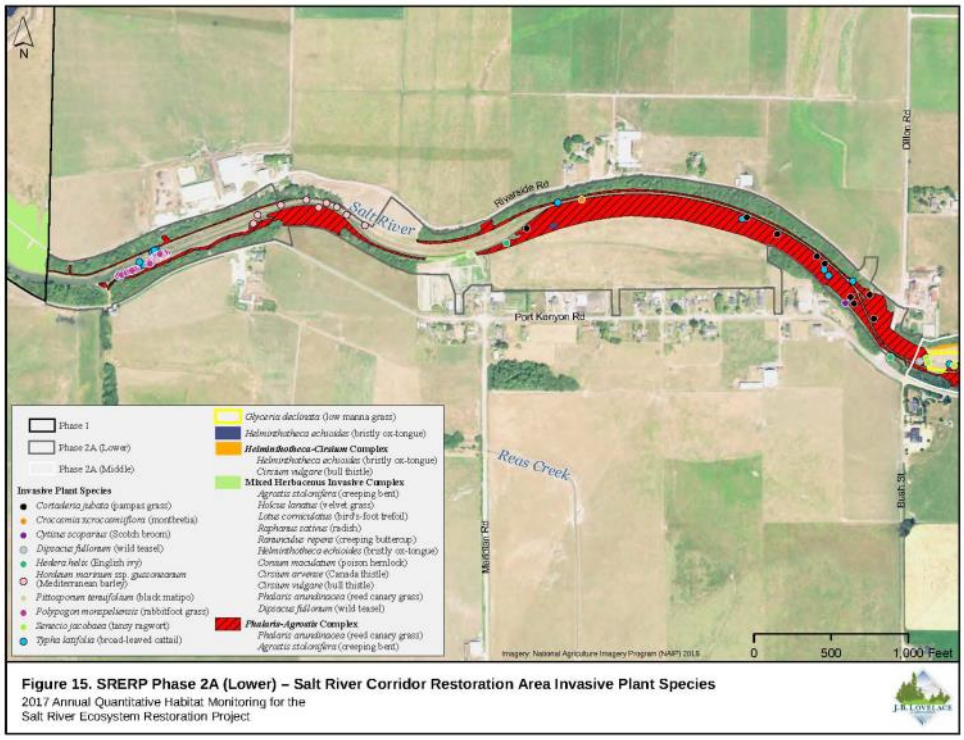

Figure 28. Invasive plant individuals and complexes on Phase 2A Lower (2014) Salt River Corridor of the Salt River Ecosystem Restoration Project

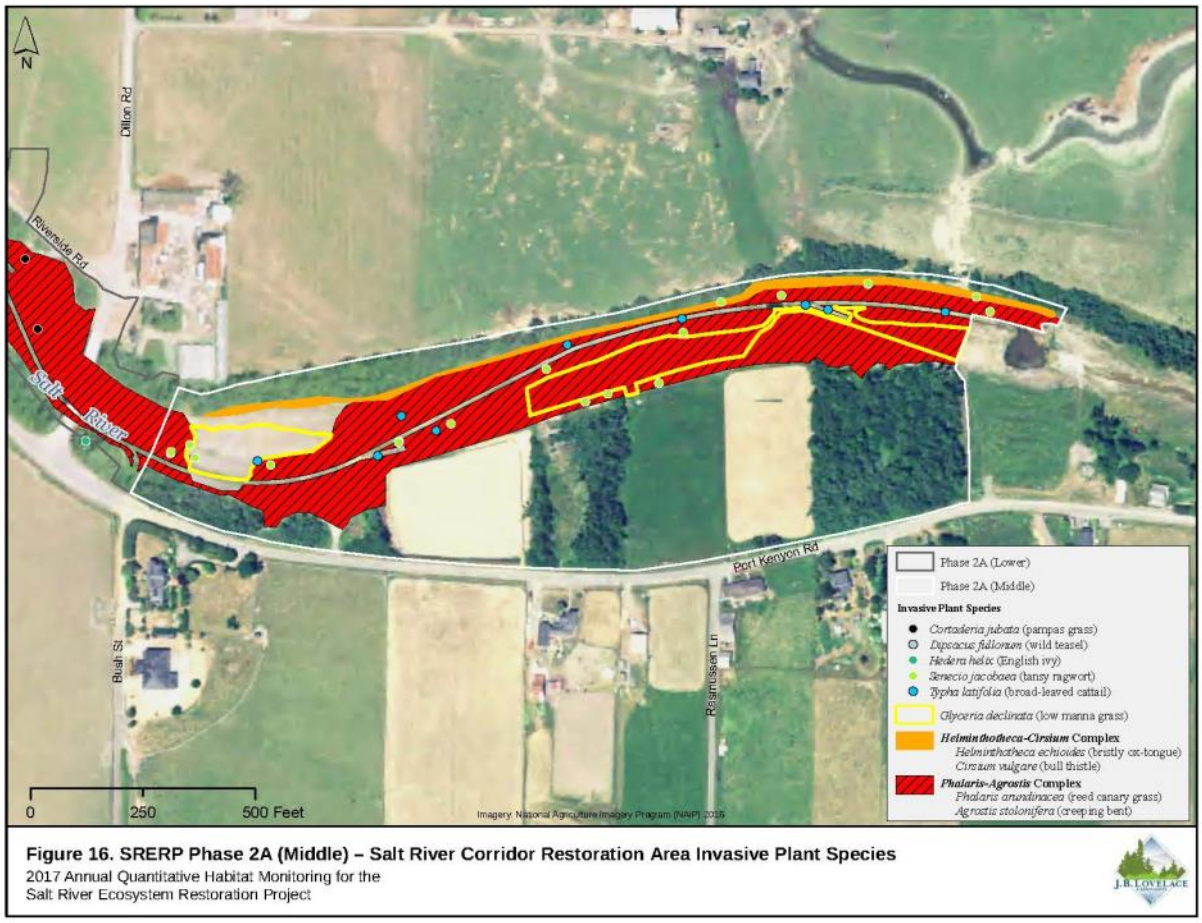

Figure 29. Invasive plant individuals and complexes on Phase 2A Lower (2014) Salt River Corridor of the Salt River Ecosystem Restoration Project

Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch

Monitoring Task: Invasive Species Management - Pikeminnow

Agencies/Acts: Coastal Commission

Compliance Documents: Coastal Development Permit- Special Conditions; SRERP Adaptive Management Plan

Description: Attempt to control pikeminnow (*Ptychocheilus grandis)* populations

Goals:

- Reduce occupation of pikeminnow in newly created habitat
- Increase occupation by native fish species in newly created habitat

Report: Refer to:

- Salt River Ecosystem Restoration Project Fish Monitoring Program 2017. Results of fish species presence and distribution monitoring conducted from March to August, 2017 within the Salt River, Eel River Estuary, Phase 1 and 2 Project areas, Humboldt County California. Prepared By Doreen Hansen of the Humboldt County Resource Conservation District

Methods: The California Department of Fish and Wildlife, Humboldt State University, and the Humboldt County Resource Conservation District developed a fish monitoring program in early 2014. During the development of this program, participants determined that pikeminnow populations cannot be eradicated or controlled in the Salt River watershed. However, a standard practice was adopted for all pikeminnow encountered during fish monitoring to will be humanely euthanized. Additionally, if pikeminnow individuals are longer than 10 inches, those individuals will be measured and the stomach contents examined for evidence of piscivory and findings recorded.

Results & Discussion: During the 2017 spring-summer fish monitoring effort, over 1,200 pikeminnow were captured and euthanized. Nearly 1,000 pikeminnows (under 10 inches) were also captured and euthanized during winter fish surveys in 2017.

LIST OF AVAILABLE REPORTS

J.B. Lovelace & Associates. 2017. Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District.

H. T. Harvey with Winzler and Kelly. 2012. Salt River Ecosystem Restoration Project Adaptive Management Plan. Prepared for the Humboldt County Resource Conservation District. Eureka, California

H. T. Harvey with Winzler and Kelly. 2012. Salt River Ecosystem Restoration Project Habitat Mitigation and Monitoring Plan. Prepared for the Humboldt County Resource Conservation District. Eureka, California

Mendel, Ivan. *Sedimentation and Erosions Patterns Within Anabranching Channels in a Lowland River Restoration Project* (2017). Humboldt State University Master's Thesis. Arcata, California.

O'Shea, Daniel and Susannah Manning. Salt River Ecosystem Restoration Project Post-Construction Geomorphic Channel Survey Report, Phase 1, Year 4 – 2017. Prepared for the Humboldt County Resource Conservation District. Eureka, California.

Salt River Ecosystem Restoration Project - Fish Monitoring Program 2017. Results of fish species presence and distribution monitoring conducted from March to August, 2017 within the Salt River, Eel River Estuary, Phase 1 and 2 Project areas, Humboldt County California. Prepared By Doreen Hansen of the Humboldt County Resource Conservation District. Eureka, California.