Salt River Ecosystem Restoration Project

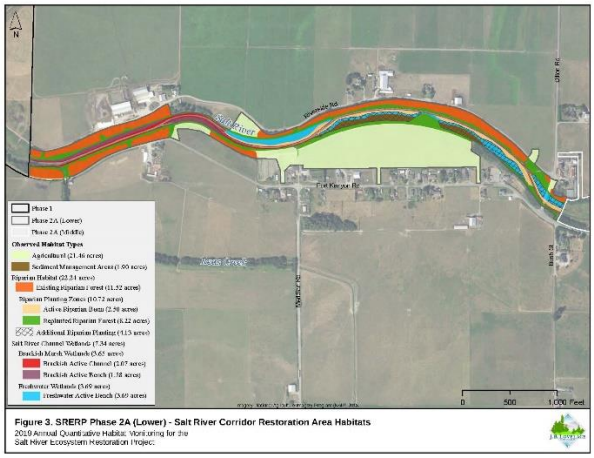

Figure 3. SRERP Phase 2A (Lower) - Salt River Corridor Restoration Area Habitats
2019 Annual Quantitative Habitat Monitoring for the
Salt River Ecosystem Restoration Project

Habitat Mitigation and Monitoring Plan
Monitoring Report 2019

Finalized February 2019

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RESOURCE
CONSERVATION DISTRICT

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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 approximately 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.
- **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.

- **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.

- **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 will 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, 2017, 2018, and 2019 a total of 6.2 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 also restored 0.5 miles of the channel and floodplain in Francis Creek (Figure 1). It is anticipated that the remaining 1.2 miles of the Phase 2 construction will occur in 2020, completing the Salt River corridor restoration.

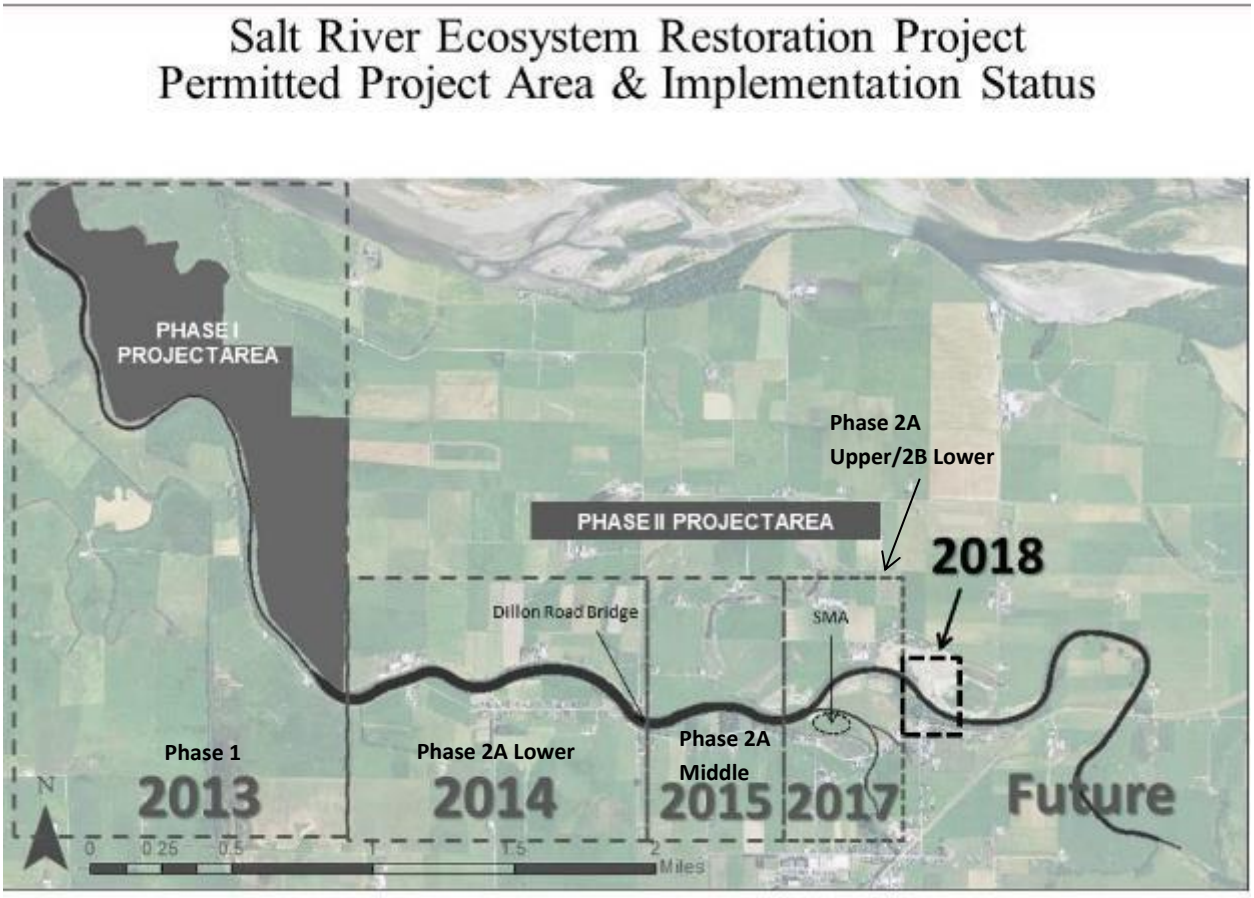

Figure 1: Salt River Ecosystem Restoration Construction Timeline as of 2018

Upon completed portions of the Project, monitoring is performed under direction of the Humboldt County Resource Conservation District and complies with requirements generated from Project documents, 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 HMMP of the Salt River Ecosystem Restoration Project as follows:

- Phase 1: Year 6 (post construction 2013)
- Phase 2: Year 5, Year 4, Year 2, Year 1 (post construction 2014, 2015, 2017, and 2018 respectively)

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

SUMMARY OF CONCLUSIONS

As detailed in this report, the 2019 monitoring results provide a point of reference on how the restoration activities completed in 2013 (Phase 1), 2014 (Phase 2A Lower), 2015 (Phase 2A Middle), 2017 (Phase 2A Upper/2B Lower), and 2019 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 2018/2019 hydrologic year set rain records at the Eureka weather station on February 25th and 26th. February 27th experienced severe flooding with water levels reaching the highest point since 1986 at Fernbridge, achieving 25.7 feet by 4pm that day. February saw a total of 14.43 inches of rain, the third most on record for that month. February also saw a 24-hour record, with 3.07 inches falling between Feb 26th and 27th, the greatest since 2002.

The following is a brief summary of the findings of the various HMMP monitoring efforts. Please reference reports listed at the end of this report for more detailed findings.

Vegetation

Phase 1 and the completed portions of Phase 2 were mapped to depict all projected habitat acreages for the various habitat types, including: tidal salt marsh, high marsh ecotone, riparian, and channel wetlands. At the culmination of 10 years (post-implementation), specific acreage goals are expected to be achieved for each habitat type. In 2019 (5 years post-implementation), the project is within the 90% success criteria for riparian acreages in Phase 1. Phase 2A Lower and Middle riparian areas are on a positive trajectory and represents 31% of the total Phase 2 project riparian habitat acreages.

The 2019 percent cover sampling results indicate that Phase 1, Phase 2A Lower, Phase 2A Upper, and Phase 2B Middle are achieving and exceeding native plant success criteria. However, Phase 2A Lower exceeds the minimum threshold for non-native non-invasive and invasive vegetation. Recommendations for addressing non-native non-invasive and invasive vegetation is stated in the 2019 vegetation monitoring report.

Average tree diameter/basal area was estimated for planted riparian areas in Phase 1 and Phase 2A Lower. A comparison between 2017 and 2019 estimated basal area for those areas indicate that basal area is increasing significantly for each riparian area.

Wildlife

In collaboration with CDFW, NOAA/NMFS, Humboldt State University, and Ducks Unlimited, a fish sampling program has been ongoing since 2014. The 2019 fish sampling effort took place from March to August (excluding July) at six sites across the Phase 2 project area. Thirteen anadromous, freshwater, and marine species were captured. Salmonids were captured in April of the sampling season and were not sampled the remaining of the sampling period. With fish presence confirmed throughout the Phase 2 area, the 2019 fish sampling effort, once again, proved that the Project is a success for fish species.

Geomorphic

The results of the monitoring tasks conducted under the Geomorphic heading demonstrate that the entire Project site is a dynamic system. The photo documentation not only visually records the dramatic differences between pre-construction to post-construction conditions but records the vegetation recruitment and tidal effects. The cross-sectional surveys across the Phase 2 project area indicate that the Salt River channel is adjusting to the environmental conditions and is trending toward a scour process where channel bottom elevation is decreasing overall.

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 that examined 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 help determine if Project goals and objectives are being achieved, 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 monitoring reports are available from the

Humboldt County Resource Conservation District upon request or can be accessed on the website (http://humboldtrcd.org/salt_river_ecosystem_restoration_project/reports_and_documents).

This report presents monitoring results under three broad categories:

1. Vegetation
2. Wildlife
3. Geomorphic

Within each category is a discussion that identifies 1) the discrete task called for, 2) the agency requiring the task, 3) the reference document, 4) a 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.

VEGETATION

Monitoring Task: Habitat Mapping – Riparian Acreage (Phase 1, Phase 2A Lower, and Phase 2B Middle project areas)

Agencies/Acts: Coastal Commission

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

Description: For the 2019 monitoring effort, riparian acreage is determined on Phase 1 (2013 restoration), Phase 2A Lower (2014 restoration), Phase 2B Middle (2018 restoration) of the Salt River Ecosystem Restoration Project

Goals:

- Achieve 43 acres of riparian acres in Phase 1 by Year 10
- Achieve 85 acres of riparian in Phase 2 by Year 10

Report: 2019 Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District by J.B. Lovelace & Associates

Methods: Habitat maps were created using ArcMap® (ESRI) geographic information system (GIS) desktop software, the most recent satellite imagery (Google Earth 2019 and National Agriculture Imagery Program [NAIP]), and were based on observations made during fieldwork performed in 2019. Geographic field data were collected using a

Trimble® Juno® global positioning system (GPS) device with ArcPad® software (ESRI). Habitat area (acreage) totals were calculated as part of this process.

Results & Discussion: The total mapped area of the Phase 1 riparian habitat is 43 acres (Figure 1). The original goal of the project, as stated in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012), is to achieve 43 acres of planted and existing riparian habitats, thus the project met the Year 10 goal in 2019 (Year 6) (Table 1).

The extent of existing and planted riparian forest occurring within the Phase 2A Lower (2014 restoration) and Phase 2B Middle (2018 restoration) were estimated at 26.8 acres (Figures 2 and 3), which comprise 31% of the total expected riparian acreage for the entire Phase 2 footprint (Phase 2 total projected riparian is 85 acres) (Table 1).

Phase 1 riparian is achieving Year 10 project success criteria goals established in Year 6. The incremental construction of the Phase 2 portion of the Salt River Ecosystem Restoration Project complicates the habitat monitoring. Phase 2A Lower is in Year 5 of the monitoring schedule and Phase 2B Middle is in Year 1. Both these "sub"-phases of Phase 2 riparian monitoring appear to be establishing in a positive trajectory.

Table 1. SRERP Habitats. Summary of 2019 Observed Habitat Areas & Respective Success Criteria

	Area (Acres)		
SRERP Habitat Type	**Observed**	**Projected Acres for Phase 1 & 2**	**% of Projected**
Phase 1			
Riparian – planted & existing	**43**	**43**	**100**
Phase 2			
Phase 2A Lower Riparian – planted & existing	22		
Phase 2A Upper/2B Lower Riparian - planted & existing	5		
Total	**27**	**85**	**31**

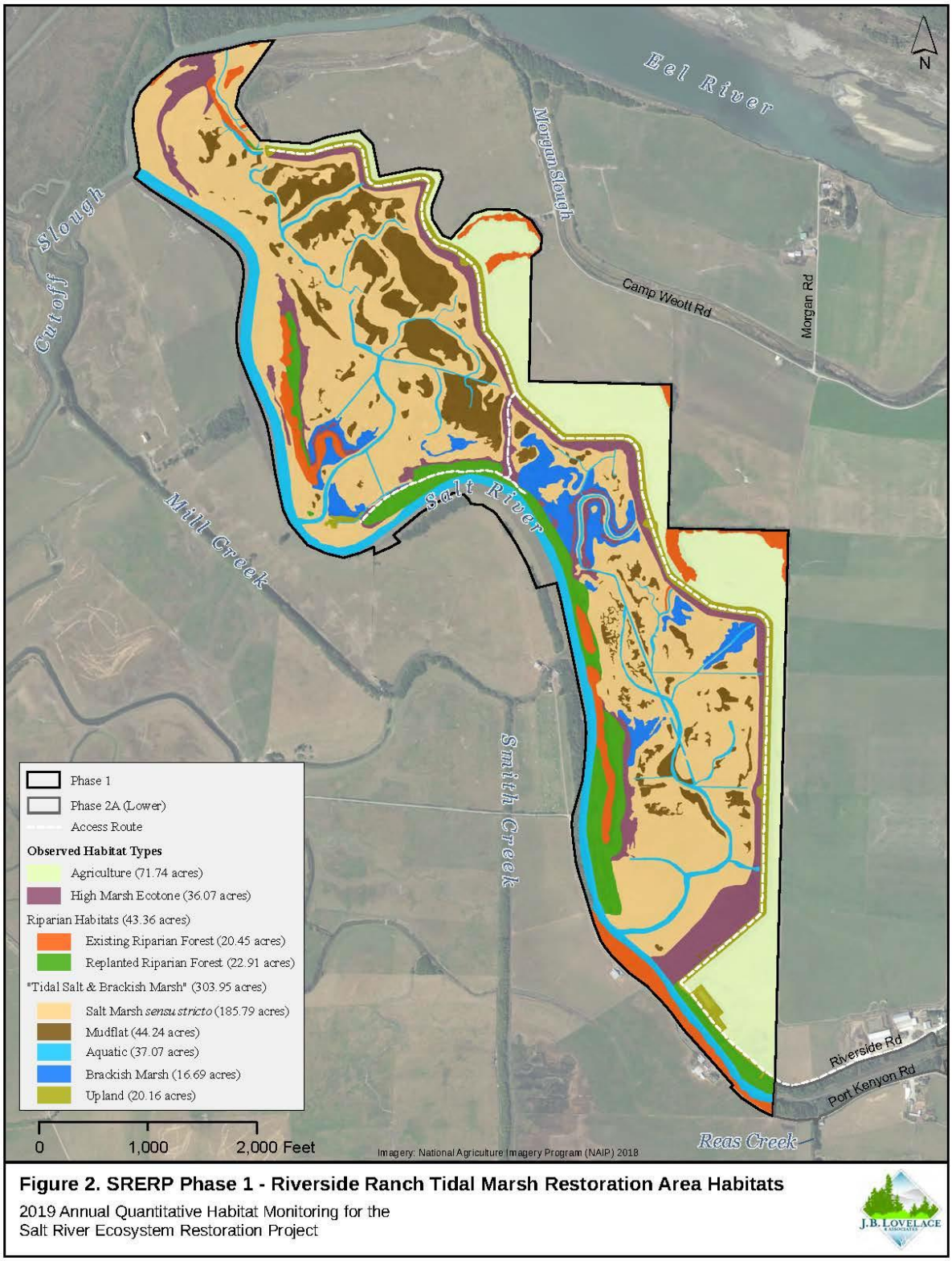

Figure 1: Habitat Acres (2019)

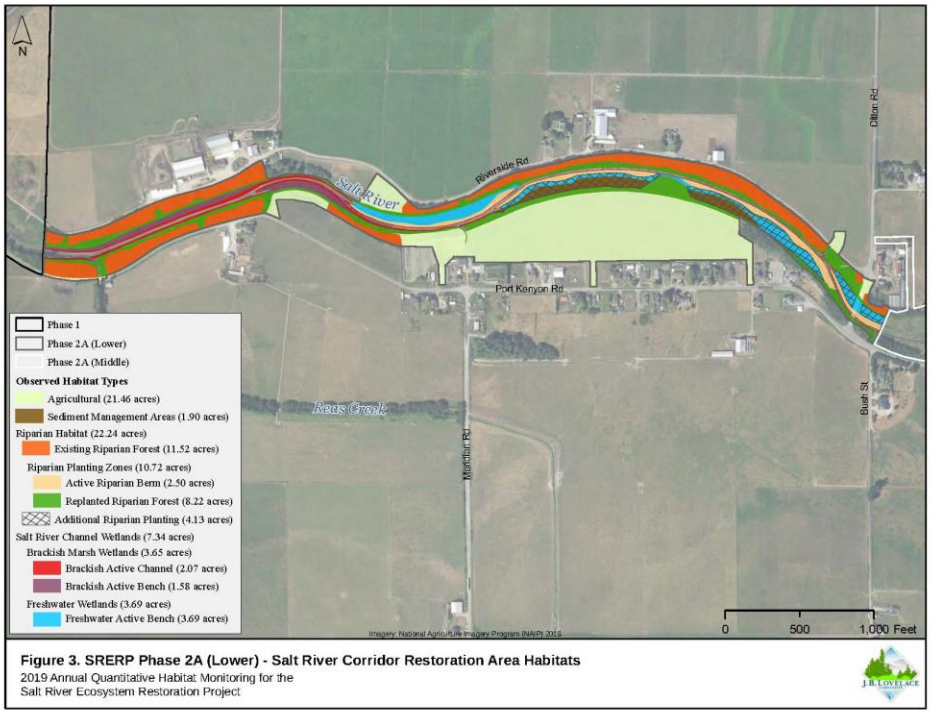

Figure 2: Phase 2A Lower Salt River Corridor Habitat Acreage (2019)

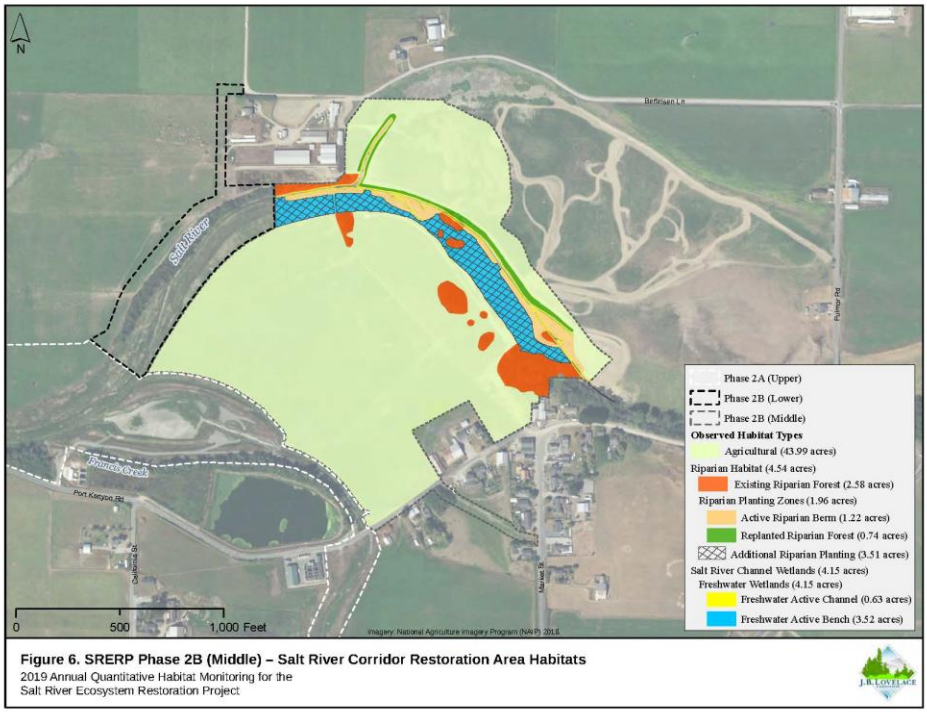

Figure 3: Phase 2B Middle Salt River Corridor Habitat Acreage (2019)

VEGETATION

Monitoring Task: Vegetation Percent Cover – Riparian (Phase 1) and Riparian, Wetlands (Phase 2A Lower and Phase 2A Upper/2B Lower), Wetlands (Phase 2B Middle), and Invasives in all monitored areas

Agencies/Acts: Coastal Commission

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

Description: Estimate percent cover of vegetation for: riparian planted areas in Phase 1 (2013 restoration), Phase 2A Lower (2014 restoration), and Phase 2A Upper/2B Lower (2017 restoration); wetland planted areas in Phase 2A Lower (2014 restoration), and Phase 2A Upper/2B Lower (2017 restoration), and Phase 2B Middle (2018 restoration); and native, non-native, and invasive species within the all monitored areas.

Goals:

- Achieve 2018 Native Vegetation Percent Cover of: ≥40% in Phase 1 riparian; ≥50% in Phase 2A Lower wetlands; ≥40% in Phase 2A Lower riparian; ≥20% in Phase 2A Upper/2B Lower wetlands; ≥15% in Phase 2A Upper/2B Lower riparian; ≥10% Phase 2B Middle wetlands; and ≥10% Phase 2B Middle riparian habitats.
- Achieve Non-Native Non-Invasive Vegetation Percent Cover of: <15% in all restored habitats
- Achieve 2018 Invasive Vegetation Percent Cover of: <5% in all restored habitats

Report: 2019 Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District by J.B. Lovelace & Associates

Methods:

A stratified, randomized sampling approach is used to characterize the abundance, species composition, and structural composition of existing vegetation in each vegetation sampling area. A previous year power analyses of vegetation sampling data, established a sample size (n=32) that was determined to be sufficient to detect a "medium" effect size of 0.5 standard deviations (following Cohen 1988) between the observed sample means and their respective success criteria using a two-sided t-test, and assuming both 95% confidence and a statistical power of 80%.

Using updated SRERP habitat GIS data and ArcMap® software, each phase and sub-phase of the restoration area was partitioned into vegetation sampling areas of specific habitat types within project phases. ArcMap® software was then used to randomly

distribute sampling plots throughout each of these sampling areas. Given that each sampling area is composed of multiple, geographically separated polygons, the 32 sample plots were randomly allocated throughout each sampling area, in quantities proportionate to the size (i.e., area) of each polygon (Figures 4 – 7). Once sample plots were located in the field, a $1m^2$ sampling frame, or "quadrat," constructed from ¼-inch diameter PVC was then used to visually estimate:

- (total) percent vegetative cover, and
- (absolute) percent cover of each species present.

In order to evaluate these data against the success criteria for specific vegetative parameters, each observed plant species was categorized as:

- native,
- non-native non-invasive,
- non-native invasive, or
- sterile “wheatgrass” hybrid (Elymus x Triticum);

as well as being:

- herbaceous (an herb),
- arborescent (a tree), or a
- shrub.

Percent cover data collected for each species is absolute cover, which is distinct from relative cover. Absolute cover quantifies the vegetative coverage of each species, or category, within the sample frame, regardless of any canopy overlap between different species. When measuring absolute cover, resulting cumulative cover values for sampled locations that exceed 100% for a given sample are not uncommon (Barbour et al. 1998, etc.).

The vegetation success criteria specified in the HMMP consist of minimum percent cover thresholds for native species and maximum percent cover thresholds for both non-native non-invasive and non-native invasive species.

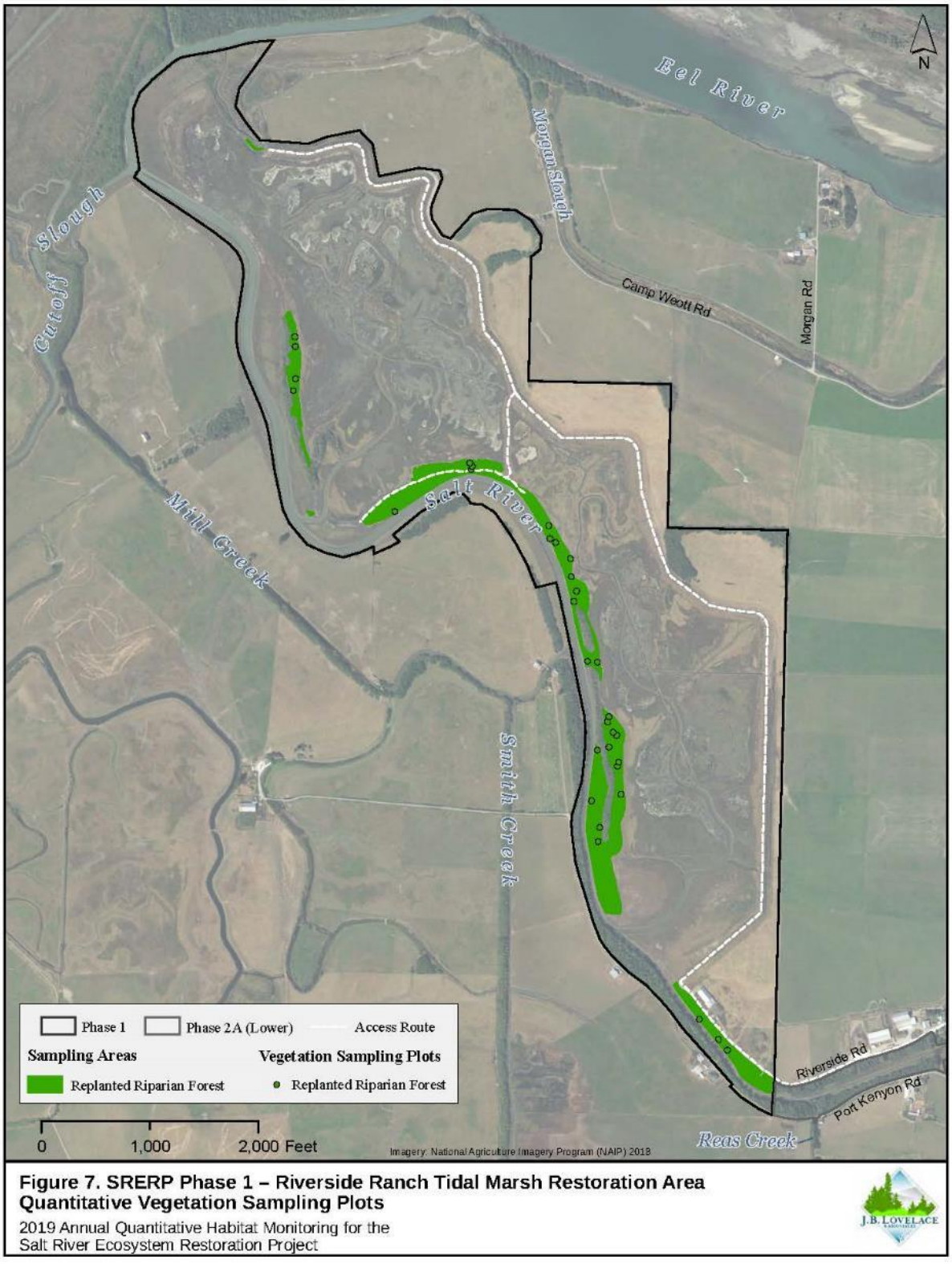

Figure 4: Phase 1 Riparian Percent Cover Sampling Plots 2019

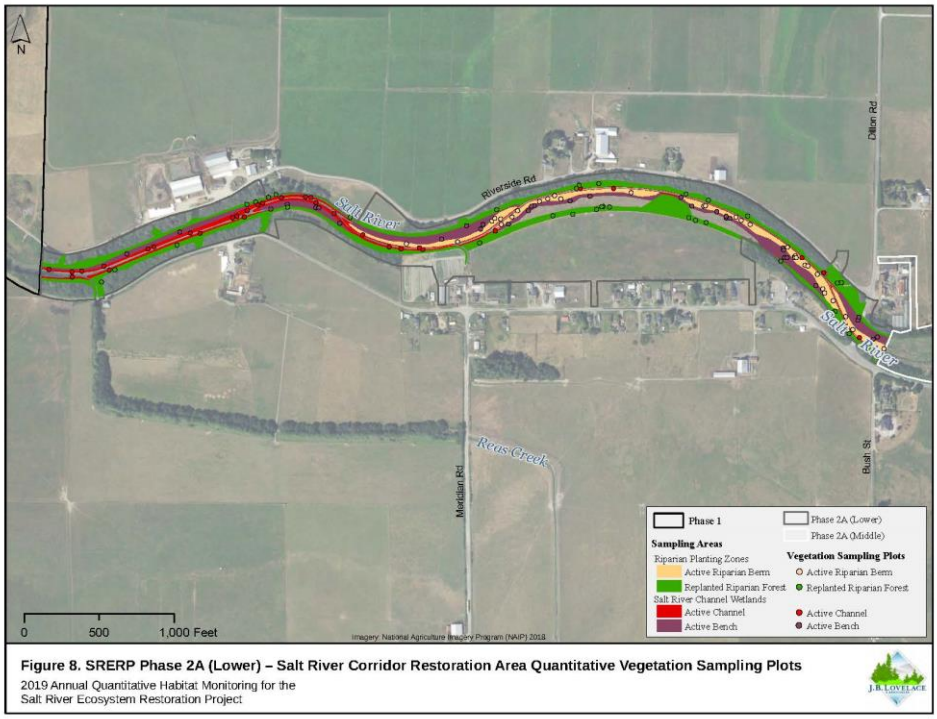

Figure 5: Phase 2A Lower Wetland and Riparian Percent Cover Sampling Plots 2019

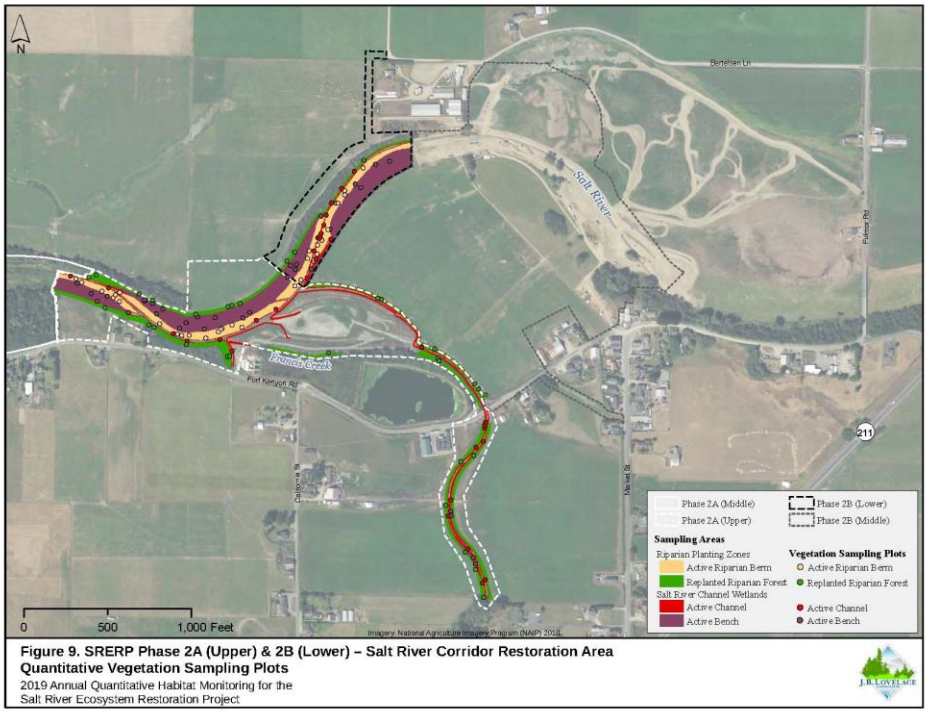

Figure 6: Phase 2A Upper/2B Lower Wetland and Riparian Percent Cover Sampling Plots 2019

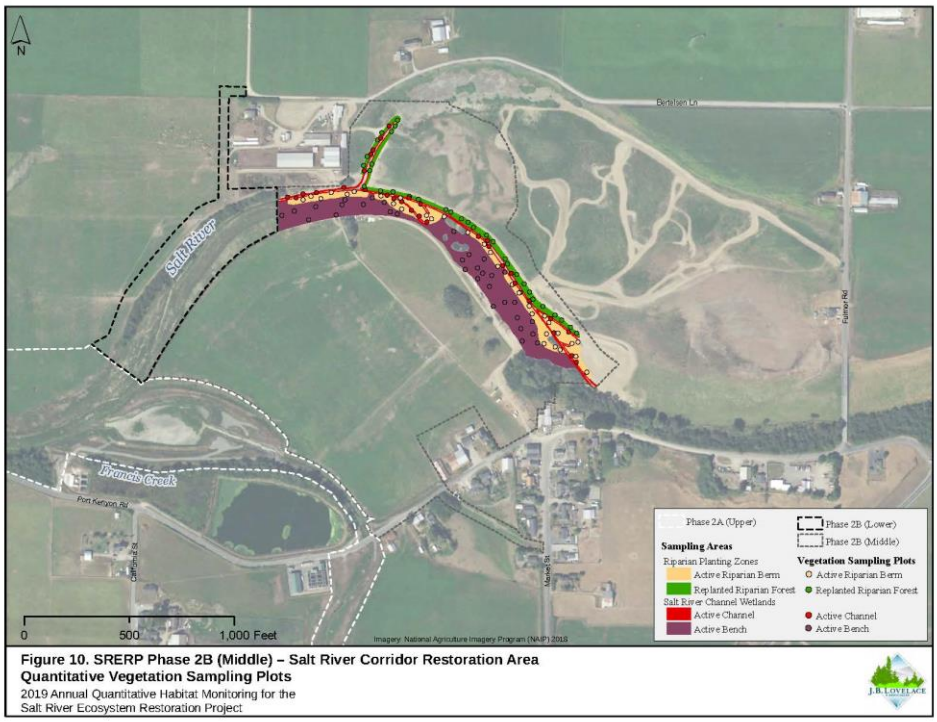

Figure 7: Phase 2B Middle Wetland Percent Cover Sampling Plots 2019

Results & Discussion: The sampling effort shows that the monitoring areas are achieving the percent cover success criteria of native vegetation in all phases and habitat areas (Table 2). It is established that the final success criteria for non-native non-invasive shall not exceed 15% percent cover. The Phase 1 and Phase 2A Lower monitored habitats are all within the non-native success criteria. The most recently constructed phases, Phase 2A Upper/2B Lower in 2017 and Phase 2B Middle in 2018, do not achieve the non-native non-invasive level of <15%. This could be attributed to colonizing non-native vegetative species as reflected in the higher non-native percent cover in the most recently restored areas as compared to the preceding restored areas. The final success criterion for invasive vegetation is not to exceed 5% cover. Unfortunately, all phases exceed this limit considerably, especially Phase 2A Lower. *Spartina densiflora* is becoming dominant in large areas of Phase 1 and a suite of *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”) are found throughout the Phase 2 footprint. Recommendations include the continuation of monitoring and instituting a robust invasive species control program, notably addressing the Phase 2A Lower restoration area.

Table 2: Summary of 2019 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.

Summary of 2019 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	2019 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)	**100.0** NA	**47.5** (38.2, 57.2)	≥40%	**8.8** (6.2, 12.1)	<15%	**43.7** (34.8, 52.3)	<5%	**0.0** NA
Phase 2 – Salt River Corridor Restoration Area								
Phase 2A (Lower) – Salt River Channel Wetlands								
Active Channel (n=32)	**82.0** (74.3, 87.5)	**59.9** (51.9, 67.8)	≥50%	**3.9** (1.9, 7.1)	<15%	**18.3** (14.1, 22.9)	<5%	**0.0** NA
Active Bench (n=32)	**94.4** (90.4, 97.0)	**62.5** (54.4, 70.0)	≥50%	**1.2** (0.4, 2.9)	<15%	**30.6** (23.0, 38.9)	<5%	**0.0** NA
Phase 2A (Lower) – Riparian Planting Zones								
Replanted Riparian Forest (n=32)	**100.0** NA	**66.6** (53.8, 77.1)	≥40%	**0.9** (0.0, 2.4)	<15%	**32.6** (21.8, 45.4)	<5%	**0.0** NA
Active Riparian Berm (n=32)	**97.0** (94.5, 98.4)	**72.0** (62.1, 79.4)	≥40%	**1.2** (0.4, 2.7)	<15%	**23.9** (16.3, 34.5)	<5%	**0.0** NA
Phase 2A (Upper)/Phase 2B (Lower) – Salt River Channel Wetlands								
Active Channel (n=32)	**90.5** (84.6, 94.4)	**62.2** (53.3, 70.2)	≥20%	**7.1** (3.7, 13.6)	<15%	**21.2** (15.3, 29.7)	<5%	**0.01** (0.0, 0.03)
Active Bench (n=32)	**92.3** (87.6, 95.5)	**44.5** (35.6, 54.1)	≥20%	**20.8** (13.7, 29.4)	<15%	**26.7** (18.8, 37.2)	<5%	**0.3** (0.0, 1.0)
Phase 2A (Upper)/Phase 2B (Lower) – Riparian Planting Zones								
Replanted Riparian Forest (n=32)	**98.8** (96.4, 99.7)	**43.8** (34.4, 54.0)	≥15%	**19.7** (14.0, 27.0)	<15%	**33.4** (25.3, 43.2)	<5%	**1.5** (0.5, 3.0)
Active Riparian Berm (n=32)	**85.3** (75.7, 91.4)	**32.7** (26.5, 40.9)	≥15%	**26.5** (18.9, 35.1)	<15%	**24.7** (18.0, 33.1)	<5%	**1.8** (0.8, 3.1)
Phase 2B (Middle) – Salt River Channel Wetlands								
Active Channel (n=32)	**70.0** (60.3, 77.3)	**31.6** (25.1, 38.1)	≥10%	**31.0** (24.6, 39.5)	<15%	**6.8** (4.1, 10.4)	<5%	**0.6** (0.1, 1.9)
Active Bench (n=32)	**75.8** (65.0, 83.8)	**11.5** (7.2, 18.1)	≥10%	**46.5** (35.8, 56.3)	<15%	**17.0** (12.6, 22.3)	<5%	**0.8** (0.2, 2.8)
Phase 2B (Middle) – Riparian Planting Zones								
Replanted Riparian Forest (n=32)	**91.1** (83.1, 95.1)	**22.5** (14.5, 34.0)	≥10%	**49.6** (40.2, 58.3)	<15%	**17.1** (12.3, 22.9)	<5%	**1.9** (0.8, 3.5)
Active Riparian Berm (n=32)	**89.5** (85.3, 92.7)	**19.3** (13.7, 26.4)	≥10%	**50.5** (40.7, 58.4)	<15%	**18.5** (13.8, 28.1)	<5%	**1.2** (0.5, 3.5)

[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).

VEGETATION

Monitoring Task: Average Tree Diameter – Average Basal Area – Phase 1 and Phase 2A Lower.

Agencies/Acts: Coastal Commission

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

Description: Estimate average tree diameter at breast height (DBH) in Phase 1 (2013 restoration) and Phase 2A Lower (2014 restoration) riparian habitats

Goals:

- Planted trees in restoration area will show an increasing trend of average DBH between sampling years 3, 5, and 10.

Report: 2019 Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District by J.B. Lovelace & Associates

Methods: The percent cover sampling approach was used for stratifying restoration sampling areas and creating random basal area 10-meter radius sampling plots (using ArcMap® GIS software and the Trimble GPS unit), throughout Phase 2A Middle which include the active riparian berm and replanted riparian forest. Diameter-at-breast-height (DBH) in millimeters, species, and geographic coordinates were recorded for all trees located within the plot that were ≥4.5 feet tall. For sampling purposes, "Breast Height" is defined as 4.5 feet.

Following direction from HCRCD staff (Hansen pers. comm.), individual plants were considered to be a "tree" if they were a species whose vegetative "habit" is described in relevant botanical literature (e.g., Baldwin et al. 2012; etc.) as being a tree at maturity.

All metric DBH measurements collected during fieldwork were subsequently converted to inches, and were then squared and multiplied by 0.005454 ("the forester's constant") to derive basal area values (measured in square-feet), otherwise expressed as:

Basal area = DBH^2 x 0.005454

Resulting sampling plot measurements of both basal area and actual-plot-area were summed to derive basal-area-per-unit-area-sampled totals for each tree species in each sampled habitat. These measurements were then extrapolated to produce projected estimates of total habitat- and phase-wide basal area for each species using respective habitat areas (acreages) obtained from current SRERP GIS data. Tabulated values for the resulting projected basal area estimates are provided to characterize the current developmental status of this vegetation type in sampled habitats.

To demonstrate a "statistically significant increasing trend" in basal area a hypothesis test was conducted and p-values computed. P-values less than 0.05 indicate statistically significant change in Basal-Area-Per-Unit Area (BAPA) from 2017 to 2019. A 95% confidence interval level was used to assess the results.

Results & Discussion: Basal area in the 2019 sampling effort reflects current growth and development of replanted and naturally recruited woody riparian vegetation (Table 3). Seven tree species occur across both project phases monitored. In Phase 1, the prominent tree species of the 1.87 ft^2 of measured basal area where coastal willow (*Salix hookeriana*) and red alder (*Alnus rubra*). Total Phase 2A Lower basal area achieved 19.427 ft2 of sampled woody material. Of this woody material, red alder (*Alnus rubra*), coastal willow (*Salix hookeriana*), and arroyo willow (*Salix lasiolepis*) are the primary species contributing. Table 4 provides P-values that indicate whether

sampled basal area is significantly increasing between years 2017 and 2019. As mentioned in the methods above, a P-value less than 0.05 indicates statistically significant change from 2017 to 2019. All P-values indicate that basal area is increasing significantly.

Table 3: Summary of 2019 of Planted SRERP Woody Riparian Basal Area Sampling Results.

Summary Table of 2019 SRERP Replanted Woody Riparian Vegetation Basal Area Sampling Measurements. Basal area values represent summed total basal area measurements for each tree species observed in each habitat sampled in 2019.

	Measured Basal Area (ft^2)				
	Phase 1 – Riverside Ranch Tidal Marsh Restoration Area	Phase 2A (Lower) – Salt River Corridor Restoration Area			
Tree Species	Replanted Riparian Forest (22.71 acres) (n = 30)	Replanted Riparian Forest (8.05 acres) (n = 21)	Active Riparian Berm (2.44 acres) (n = 10)	Total Phase 2A (Lower) (10.49 acres)	Total§ SRERP (33.2 acres)
Alnus rubra (red alder)	0.5485	7.5682	6.5162	14.0844	14.6330
Salix hookeriana (coastal willow)	1.1825	2.2355	0.0502	2.2857	3.4682
Salix lasiolepis (arroyo willow)	0	1.8204	0.0313	1.8517	1.8517
Salix lasiandra (Pacific willow)	0.0158	0.7681	0.0401	0.8082	0.8240
Salix sitchensis (Sitka willow)	0	0.0304	0.3012	0.3317	0.3317
Picea sitchensis (Sitka spruce)	0.0869	0.0233	0.0416	0.0650	0.1519
Pinus contorta (shore pine)	0.0333	0	0	0	0.0333
Total	**1.8671**	**12.4460**	**6.9807**	**19.4267**	**21.2938**

§ All SRERP restoration areas addressed during the 2019 basal area sampling effort

Table 4: Trajectory of Basal Area Changes in 2019 Monitored Areas in SRERP

Changes in Basal Area of Arborescent-Riparian-Vegetation-per-Unit-Area Surveyed ("BAPA") During the Period: 2017-2019. *P-values* represent the proportion of permutation data sets (n=10,000) for which the mean difference in BAPA between 2017 & 2019 equaled or exceeded actual observed values.

2017 & 2019 SRERP Basal Area Sampling Regions	Mean Δ BA/Area (ft^2/acre)	*P*
Phase 1 – Riverside Ranch Tidal Marsh Restoration Area		
Replanted Riparian Forest (n=30)	0.56	0.0312*
Phase 2 – Salt River Corridor Restoration Area		
Phase 2A (Lower) – Riparian Planting Zones		
Replanted Riparian Forest (n=21)	7.47	0.0001*
Active Riparian Berm (n=10)	11.49	0.0017*
Phase 2 – Salt River Corridor Restoration Area Total	8.77	0.0001*
SRERP Total	4.73	0.0001*

* *P-values* < 0.05 indicate statistically significant changes in BAPA during this period.

WILDLIFE

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 Spring-Summer Fish Monitoring Program 2019. Results of fish species presence and distribution monitoring conducted from March to August 2019 within the Salt River, Eel River Estuary, Phase 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 led and/or participated in the fish monitoring program.

A fish sampling program was developed in the spring of 2014 and is conducted annually across the constructed reaches of the SRERP. In 2019, project monitoring documents only required that the Phase 2 river corridor be monitored for fish presence and distribution (i.e. Phase 1 was NOT included in the 2019 monitoring effort).

In 2019, once a month, from March to August (excluding July), sites across the restored portions of Phase 2 (Figure 8) of the Salt River Ecosystem Restoration Project were surveyed for salmonids and tidewater gobies during low tide periods. Six (6) sites on constructed portions of the Phase 2 restoration areas were surveyed for fish presence and species distribution which include sites #20, #21, #22, #23, #24, and #25. These sites represent the diversity of channel size and habitats in the main Salt River channel. Sites where the channel was wide enough (Sites #20, #21, #24, and #25) were sampled using a 1/8th inch mesh pole seine net. Typically, a single pass with an 1/8-inch seine was made at each site. Non-seined sites were solely sampled by minnow traps which were deployed for at least an hour.

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 non-native pike minnow were enumerated into 100 millimeter size classes by visual estimation, and were humanely euthanized and buried via permit requirement. A start time, end time, and air and water temperatures, 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.

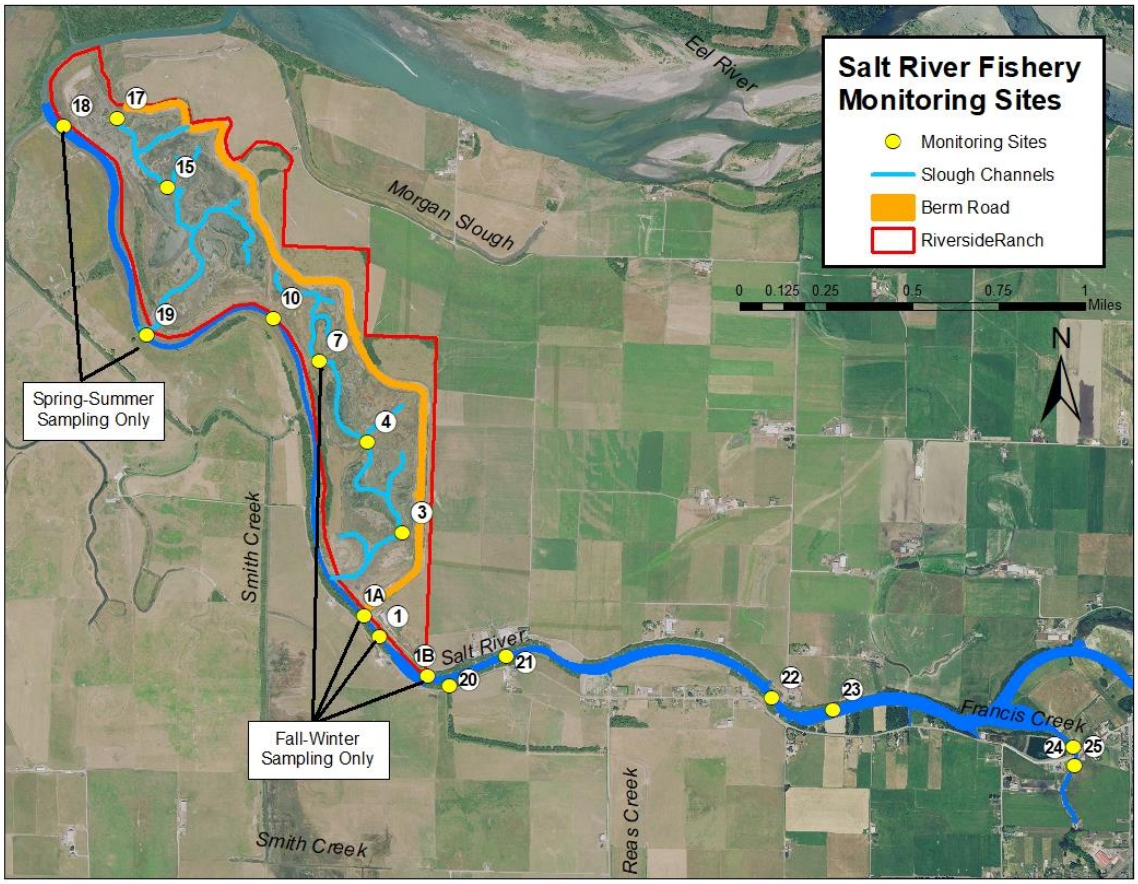

Figure 8: Fish Monitoring Sites Across Phase 1 and 2 of the Salt River Ecosystem Restoration Project

Results and Discussion: Concurrent with the fish seining and trapping, water quality measurements are recommended to be taken for temperature, salinity/conductivity (depending on what equipment was available), and dissolved oxygen. Unfortunately, monitoring equipment was unavailable for most of the spring-summer survey dates. Temperature was the only reliable water quality measurement taken in 2019. Over the five month sampling period, water temperatures ranged between a maximum of 22.2°C (August) and a minimum of 9.0°C (March).

Seining and minnow trapping efforts at the six fisheries monitoring sites identified the presence of 13 known species. Approximately 1,147 individuals were captured (approximate numbers in 2019 were often estimated during the capture of large numbers of three-spined stickleback). The following table (Table 5) presents the total number of fish and marine invertebrates sampled from March to August in 2019 (excluding the month of July).

Nineteen Coho salmon (*Oncorhynchus kisutch),* one Steelhead *(Oncorhynchus mykiss),* two Cutthroat (*Oncorhynchus clarkii*), and one unidentified salmonid were present during the April 2019 monitoring efforts. All salmonids captured were juveniles. Most of these salmonids were captured at sites #20, #24, and #25.

Given that the only the Phase 2 portion of the Salt River corridor was sampled in 2019 (i.e. not including Phase 1), it is not unreasonable that zero tidewater goby were captured. Two sites (#20 and #21) are tidally influenced. In the past, site #20 occasionally held one or two tidewater gobies in the step pools during low water flows. Site #21 is open channel and is not suitable habitat for gobies.

Three-spined stickleback (*Gasterosteus aculeatus*) continue to be captured in high numbers. The 2019 sampling effort captured less than 40 Staghorn sculpins (*Leptocottus armatus*), unlike recent past years where sculpins numbered into the hundreds. The number of captured Sacramento pikeminnow (*Ptychocheilus grandis*) continue to decrease from 2017 to 2019.

Table 5: Number of individual fish captured by each month's fish survey efforts in 2019 SRERP Phase 2 area

	2019					
Common Species Name	**March**	**April**	**May**	**June**	**August**	**TOTAL**
Tidewater Goby	0	0	0	0	0	**0**
Coho Salmon	0	19	0	0	0	**19**
Steelhead	0	1	0	0	0	**1**
Cutthroat	0	2	0	0	0	**2**
Unidentified Salmonid	0	1	0	0	0	**1**
Bay Pipefish	0	0	0	0	30	**30**
California Roach	0	1	0	0	0	**1**
Lamprey Sp.	0	0	7	0	0	**7**
Lined Shore Crab	0	0	0	0	1	**1**
Prickly Sculpin	0	8	0	0	0	**8**
Three-Spined Stickleback	7	92	66	535	259	**959**
Sacramento Pikeminnow	1	15	3	35	10	**64**
Staghorn sculpin	0	3	15	5	16	**39**
Starry Flounder	0	0	0	0	1	**1**
Un. ID Sculpin	9	1	4	0	0	**14**
TOTAL	**17**	**143**	**95**	**575**	**317**	**1147**

GEOMORPHIC

Monitoring Task: Restoration Documentation Photos

Agencies/Acts: Coastal Commission

Compliance Documents: SRERP Habitat Mitigation and Monitoring Plan

Description: Perform qualitative documentation of the restoration project with feature and landscape photos such as stream profile, floodplain, and riparian conditions.

Goals:

- Photo point monitoring will be used to qualitatively document pre- and post-project visual changes at restoration sites.

Report(s): Salt River Ecosystem Restoration Project – Photo Monitoring - 2019. Prepared by HCRCD

Methods: Photo monitoring was performed across the Phase 1 and the completed Phase 2 footprint by a staff member of the HCRCD.

Seven photo monitoring sites were established across Phase 1 and eight across the completed Phase 2 channel corridor (Figure 9). Photos were taken prior to construction and annually post construction. The compass direction of the photo was recorded and aligned with previous photo elements. Post-project photos will be taken during the same season or month as pre-project photos (Fall/Winter, November/December).

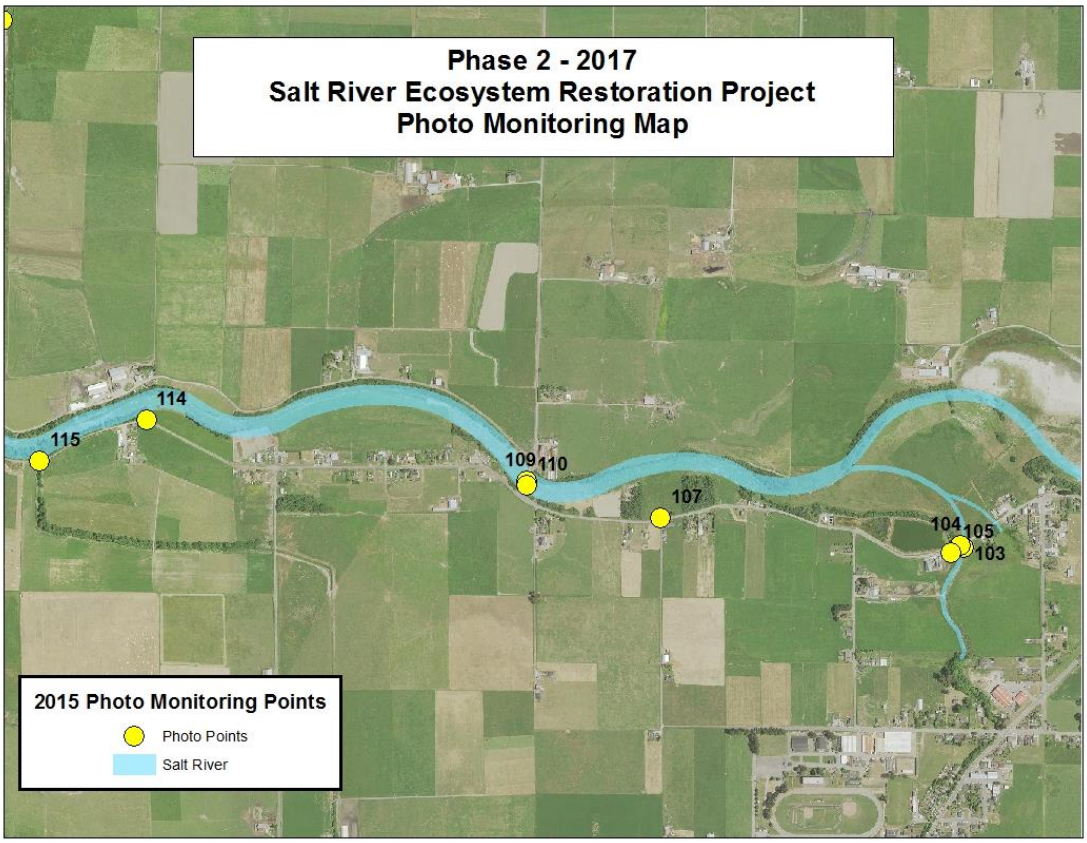

Figure 9: Photo Monitoring Points for the Constructed Footprint - 2019

Results and Discussion: A total of 15 photo point sites are established across the Phase 1 and the completed portion of the Phase 2 project area. Pre-construction and post-construction photos have been recorded. The following five photo points are a sample of the 15 sites described in the two photo monitoring reports cited above.

PP145 – SW – Nov 2013

PP145 – SW – Nov 2015

PP145 – SW – Jan 2020

PP159 – SW Tidegates – Nov 2013

PP159 – SW Tidegates – Nov 2015

PP159 – SW Tidegates – Jan 2020

PP115 – Reas Ck – Jul 2011

PP115 – Reas Ck – Nov 2014

PP115 – Reas Ck – Jan 2020

PP109 – Dillon Br W – Nov 2014

PP109 – Dillon Br W – Nov 2015

PP109 – Dillon Br W – Jan 2020

PP103 – Up Strm – Apr 2017

PP103 – Up Strm – Dec 2017

PP103 – Up Strm – Jan 2020

Vegetation continues to establish on Phase 1 and 2 where seed mixes are persisting and natural recruitment of natives, non-natives, and, in some cases, invasives are evolving. Some sites are experiencing increasing canopy cover where some of the photos of the restored areas are obscured.

GEOMORPHIC

Monitoring Task: Cross Sectional and Longitudinal Surveys-Salt River Channel Corridor –Phase 2 - 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: Channel Profile Report: Salt River Ecosystem Restoration Project – Phase Two – Year 2019 by Melissa Kobetsky. December 2019.

Methods: Project documents do not require the Phase 1 construction area (constructed in 2013) to be geomorphically surveyed in 2019. However, a Phase 2 geomorphic was completed.

The 2019 channel profile surveys in the Phase 2 project area consisted of four cross-sections and a longitudinal profile (Figure 10). The longitudinal channel profile covers a distance 3.5 kilometers from the confluence of Reas Creek to immediately upstream of cross-section ten. Cross-sections one, five, and seven were established in 2015 (Medel 2017). Cross-section ten was established in 2019 to include the most recent completed portion of channel construction. Only the monument for cross-section seven was reoccupied in 2019, other cross-section locations were approximated using a handheld Garmin Global Position System (GPS) with an accuracy of ± 10 m. Permanent benchmarks were installed at the start of each cross-section to ensure accurate

reoccupation of transect locations in future surveys. Permanent benchmark elevations were measured with a Trimble (Model XXX) Real-time Kinematic GPS receiver to position and orient the total station.

Elevation were collected using a Nikon DTM 322 Total Station, tripod, prism pole and reflector in the 1988 North American Vertical Datum (NAVD88). Data for cross-sectional surveys were collected across the floodplain, channel slope, water's edge, thalweg and across the bottom of the channel. The length of each cross-section varied due to private property or thick riparian vegetation that impeded access on either side of the floodplain. Measurements were taken at a minimum of 2 meter intervals across the floodplain, and at higher resolutions across areas with greater morphological complexity. Elevation points for the longitudinal profile were collected at 60 meter intervals where possible, and coarser resolutions where channel height and/or vegetation prevented sighting of the prism.

Figure 10: Salt River Phase 2 Cross-Section Sites

Results and Discussion: Four cross-sections sites were surveyed in the 3.5 kilometers of the 2014, 2015, 2017, and 2018 restored reaches of the Salt River (Figure 10). The following graphs (Figures 11 to 14) show cross-sections from years 2015, 2016, 2017, and 2018 of sites 1, 5, and 7. The following cross-sectional profile graphs are presented looking downstream. The following is an excerpt from the channel profile report that describes the cross-section sites and the longitudinal survey:

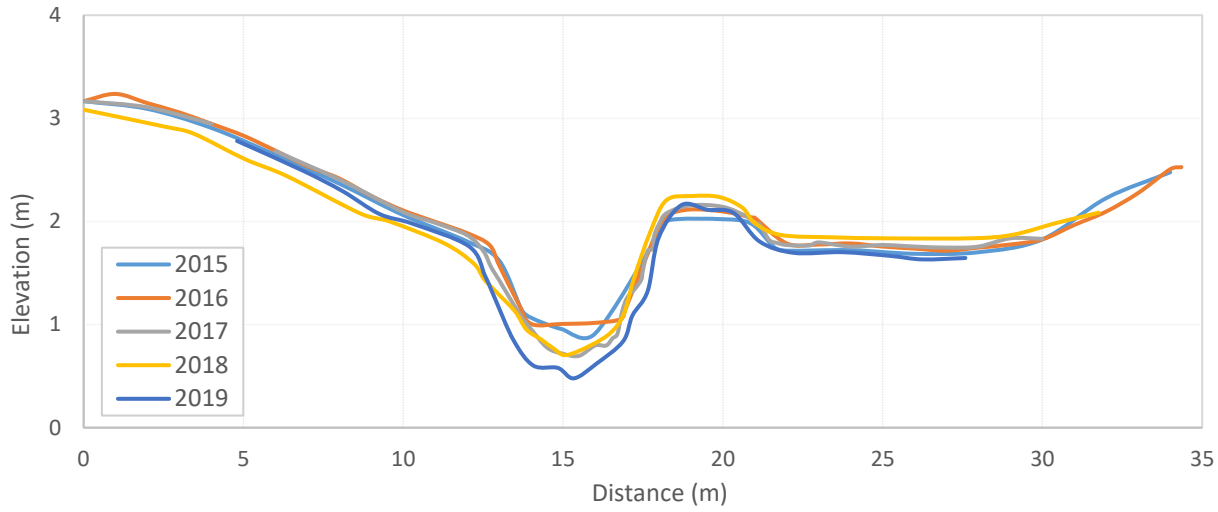

Figure 11: Cross-section one, profile for years 2015-2019.

The profile for cross-section one (Figure 11) indicates both widening and deepening in the main channel but nominal elevation change in the active bench and floodplain. Degradation was relatively uniform across the channel, with a decrease in thalweg elevation of 0.23m compared to 2018.

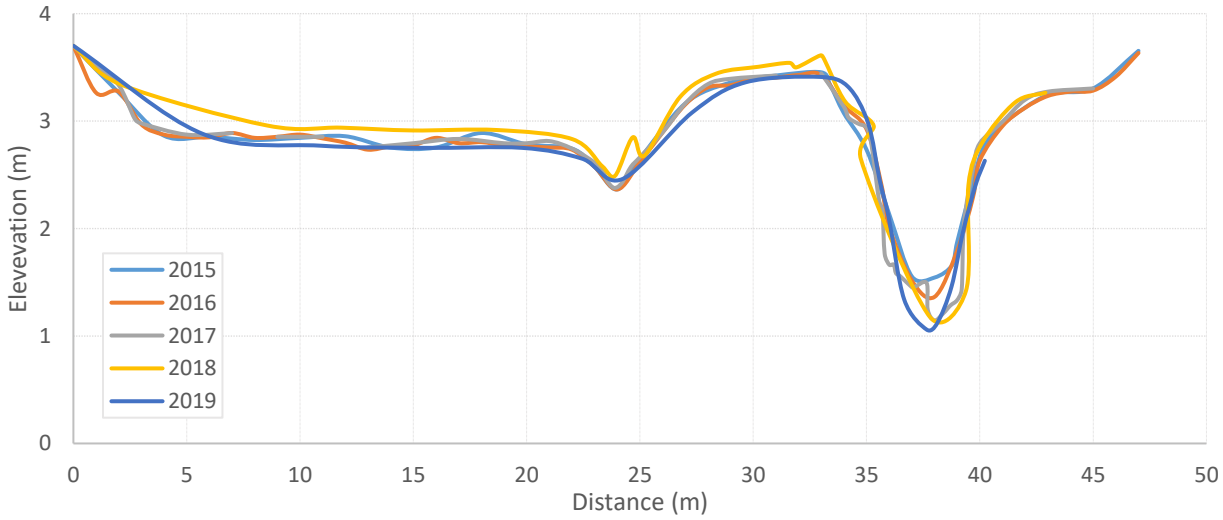

Figure 12: Cross-section five, profile for year 2018-2019.

Cross-section five maintained a similar width-to-depth ratio compared to 2018, with a decrease in thalweg elevation of 0.12 m (Figure 12). The cross-sectional profile shows floodplain elevations consistent with previous survey years but slight aggradation in the side channel (0.08 m).

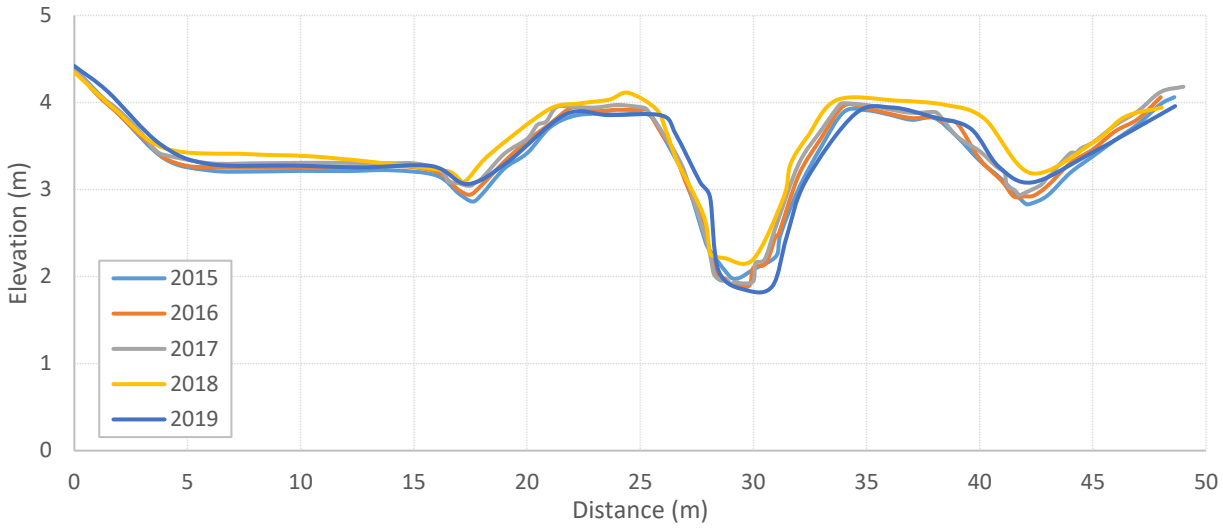

Figure 13: Cross-section seven, profile for years 2015-2019.

The channel in cross-section seven experienced scour towards the right bank, resulting in slight widening and decrease in thalweg elevation of 0.26 m compared to 2018 (Figure 13). Channel geometry remains relatively stable with potential for more lateral migration based on visual observation in the field of slumping on the right bank.

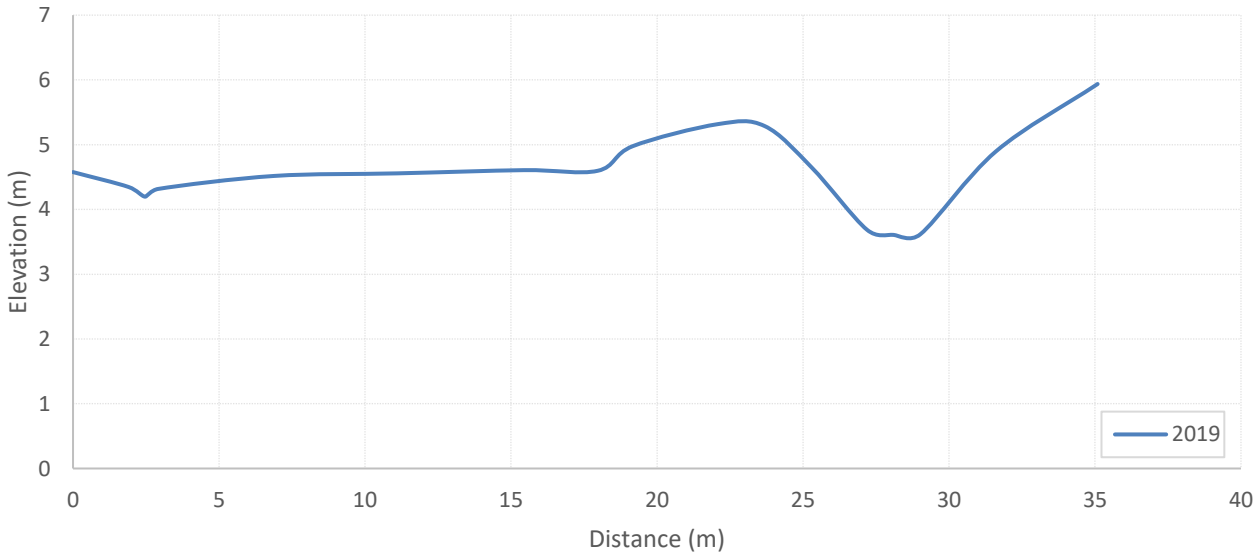

Figure 14: Cross-section ten, profile for year 2019.

Cross-section ten (Figure 14) was established to capture the most recent phase of the SRERP and the 2019 cross-sectional profile serves as baseline data.

Table 6: Cross-section thalweg elevation (m) for each survey period.

Cross-section	***2015***	***2016***	***2017***	***2018***	***2019***	***Total Change***
One	*0.91*	*1.01*	*0.70*	*0.70*	*0.47*	*0.44*
Five	*1.54*	*1.36*	*1.14*	*1.18*	*1.06*	*0.48*
Seven	*1.99*	*1.89*	*1.91*	*2.10*	*1.84*	*0.15*

Channel degradation is the dominant trend across transects; particularly in cross-sections one and five, which have decreased in thalweg elevation by almost a half a meter since 2015 (Table 6). Cross-section one has been more dynamic throughout the five survey years and experienced deposition in 2016 and 2018 whereas cross-section five shows a more consistent trend of elevation loss. Cross-section seven also shows a trend toward erosion in the channel but of less overall magnitude than the other cross-sections.

The longitudinal profile spans a distance of 3,700 m and is presented in two segments that cover Phase 2 (Figure 15) and a recently completed section that extends upstream of the Francis Creek sediment retention basin (Figure 16). Data resolution is courser in portions of the reach due to dense vegetation and channel incision that prevented sighting of the prism. The distribution of elevation points is illustrated by markers to show areas with less data, notable sections include between 1,000 and 1,500 m (Figure 15) as well as from 2,300 to 2,600 m (Figure 16). Results for these segments are not presented due to the low confidence interval in making topographic comparisons with a small sample size.

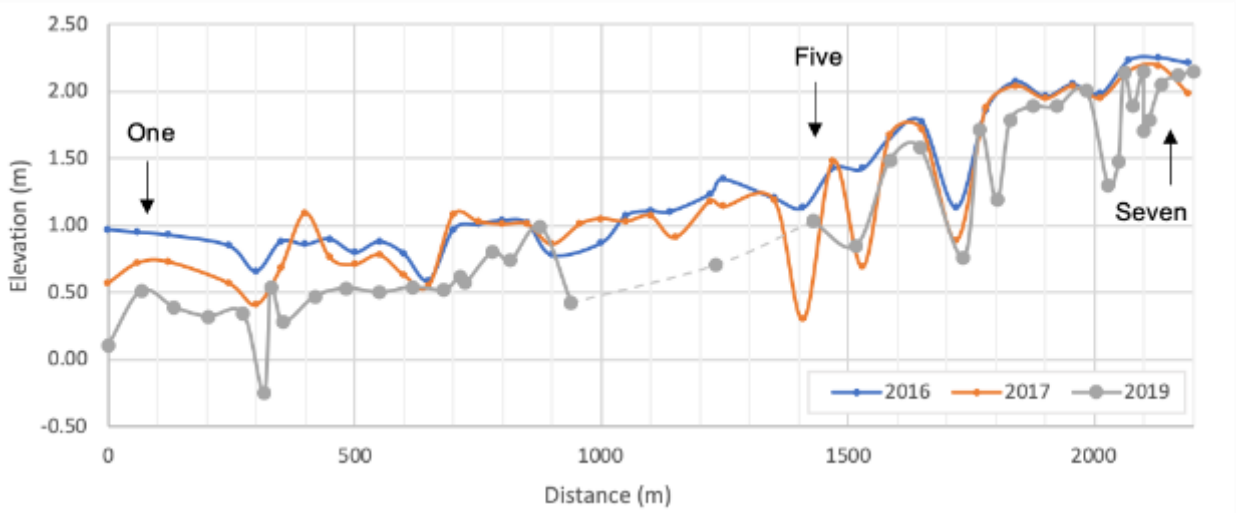

Figure 15: Section of longitudinal profile for the Phase 2A portion of the SRERP with locations of cross sections labeled. *The dashed line for 2019 indicates a segment with course data resolution that may not accurately reflect trends in channel morphology.*

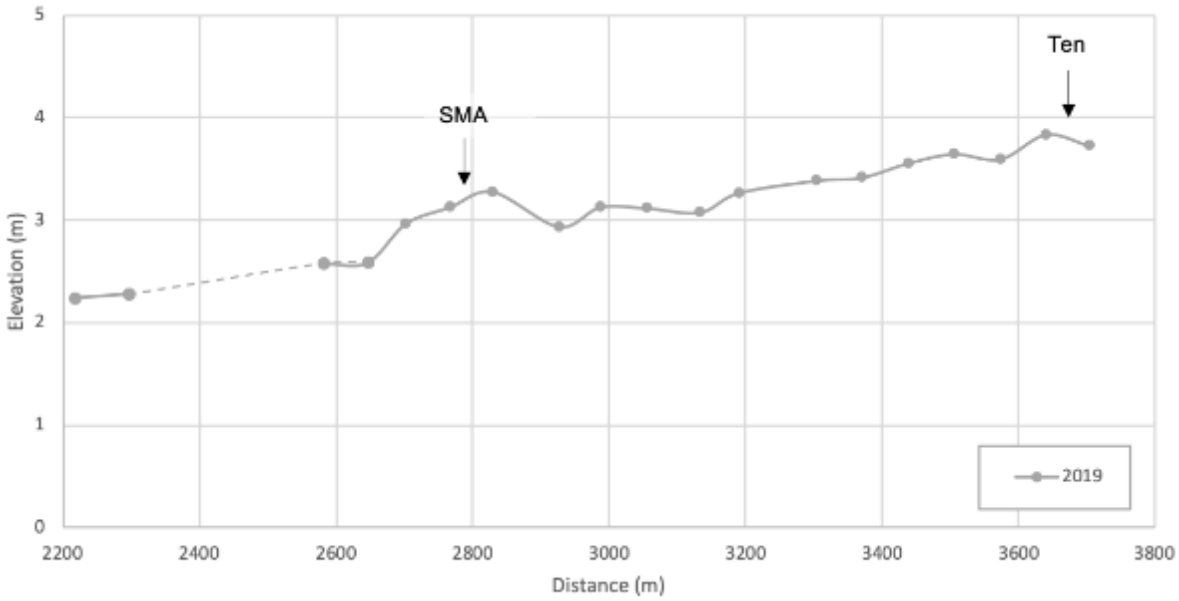

Figure 16: New section of the longitudinal profile that continues upstream from previous years surveys.

Cross-section ten and the sediment management area (SMA) at the confluence with Francis Creek are labeled. The dashed line indicates a segment with course data resolution that might not accurately reflect trends in channel morphology.

In agreement with cross-sectional surveys, the longitudinal profile shows a dominant trend of scouring as illustrated by reductions in elevation throughout majority of the channel. The downstream portion (0-950 m) had the greatest overall erosion compared to other channel segments. The first 875 m displayed relatively uniform bed lowering, with a mean elevation decrease of 0.31 m. An existing pool at approximately 300 m continued to scour, but at a higher magnitude compared to previous years with a decrease in elevation of 0.66 (Figure 15).

The upstream portion (1,400-2,200 m) displayed variable erosion dynamics with more scouring compared to other survey years and a mean elevation 0.13 m lower than in 2017. The most downstream pool deepened slightly with a decrease in thalweg elevation of 0.12 m. Two incipient pools formed that deepened the channel thalweg elevation by approximately 0.85 m. Minor deposition (0.15 m) occurred upstream of the sediment management area, but the average relief of the channel downstream of the SMA decreased at a rate relatively consistent with the rest of the channel.

Overall, the data shows trends of decreased channel elevations and potential net sediment transport out of the project area, which is consistent with past survey years.

LIST OF AVAILABLE REPORTS

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

Hansen, Doreen. 2019. Salt River Ecosystem Restoration Project Spring-Summer Fish Monitoring Program 2019. Results of fish species presence and distribution monitoring conducted from March to August 2019 within the Salt River, Eel River Estuary, Phase 2 Project areas, Humboldt County California. Prepared for the Humboldt County Resource Conservation District.

Hansen, Doreen. 2019. Salt River Ecosystem Restoration Project – Photo Monitoring - 2019. Prepared for the Humboldt County Resource Conservation District.

J.B. Lovelace & Associates. 2019. 2019 Annual Habitat Monitoring Report - Salt River Ecosystem Restoration Project, Prepared for the Humboldt County Resource Conservation District.

Kobetsky, Melissa. 2019. Channel Profile Report: Salt River Ecosystem Restoration Project – Phase Two – Year 2019. Prepared for the Humboldt County Resource Conservation District. December 2019.