

Channel Profile Report: Salt River Ecosystem Restoration Project

Phase Two- Year 2019

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2 INTRODUCTION

Phase two of the Salt River Ecosystem Restoration Project (SRERP) began in 2014 and is currently being implemented in stages. The phase two project area includes the Salt River corridor upstream of Riverside Ranch, as well as three tributaries that drain from the Wildcat Range into the main stem of the Salt River (Williams Creek, Francis Creek, and Reas Creek). One of the primary objectives of the larger SRERP is to re-establish a defined channel and riparian corridor to restore historic processes and functions in the Salt River watershed (GEC 2011). Over 750,000 cubic yards of sediment will ultimately be removed from the basin and a new, anabranching river system is being engineered along the original channel to increase sediment conveyance and facilitate fluvial interactions with the floodplain (Harvey & Associates 2012). In compliance with the SRERP Adaptive Management Plan, cross-sectional surveys and a longitudinal profile survey were conducted in the phase two project area to describe areas of erosion or deposition, deviations from restorations designs, and changes in channel planform over time.

3 METHODS



Figure 1: Locations of cross-section and longitudinal profile for phase two of the Salt River Ecosystem Restoration Project, 2019.

Elevation surveys in the Phase two project area for the 2019 monitoring year consisted of four cross-sections and a longitudinal profile (fig.1). The longitudinal profile spans a distance 3.5 kilometers from the confluence of Reas Creek to just upstream of cross-section ten. Cross-sections one, five, and seven were established in 2015 (Medel 2017) and cross-section ten was established this year 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 points 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.

4 RESULTS

4.1 CROSS-SECTION PROFILES

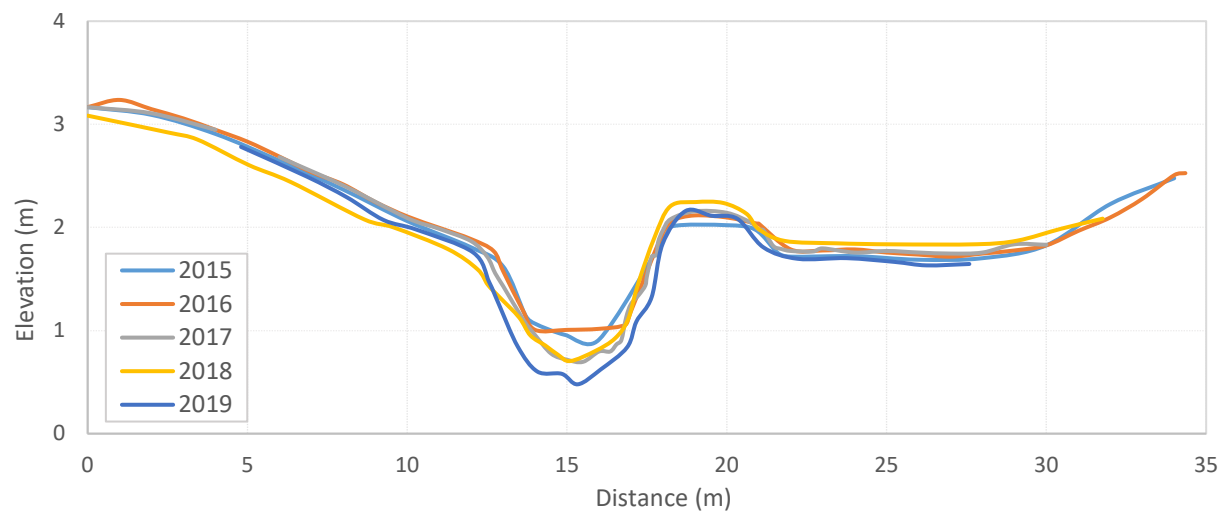


Figure 2: Cross-section one profile for years 2015-2019.

Cross-sectional profiles are presented looking downstream in the westerly direction, and start on the south side of the channel (left bank) and extend to the north (right bank) (fig. 1). The profile for cross-section one (fig. 2) 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.

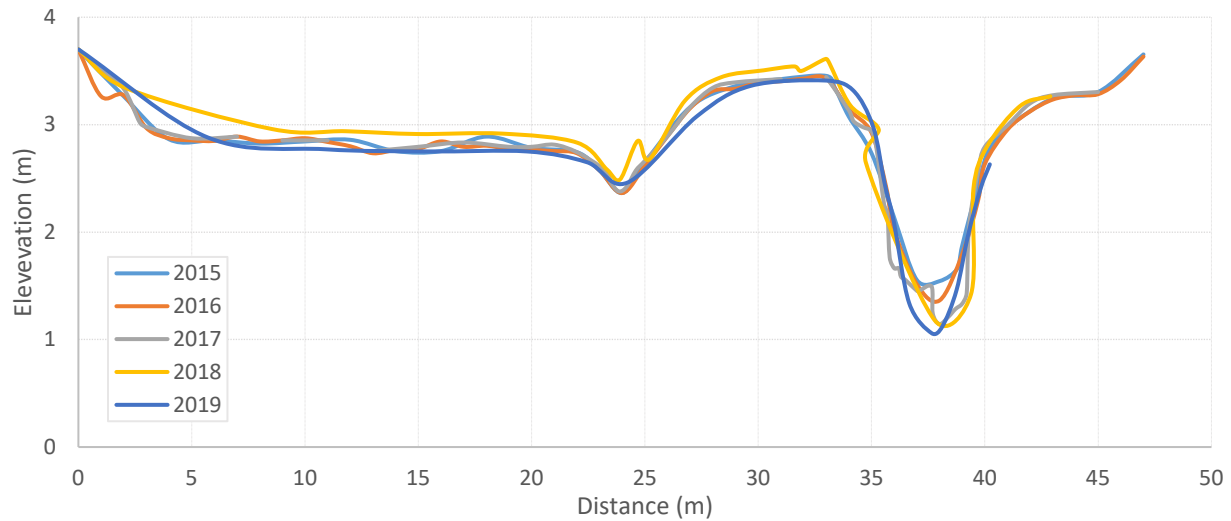


Figure 3: Cross-section five year 2018-2019.

Cross-section five maintained a similar width-to-depth ratio compared to 2018, with a decrease in thalweg elevation of 0.12 m (fig.3). The cross-sectional profile shows floodplain elevations consistent with previous survey years but slight aggradation in the side channel (0.08 m).

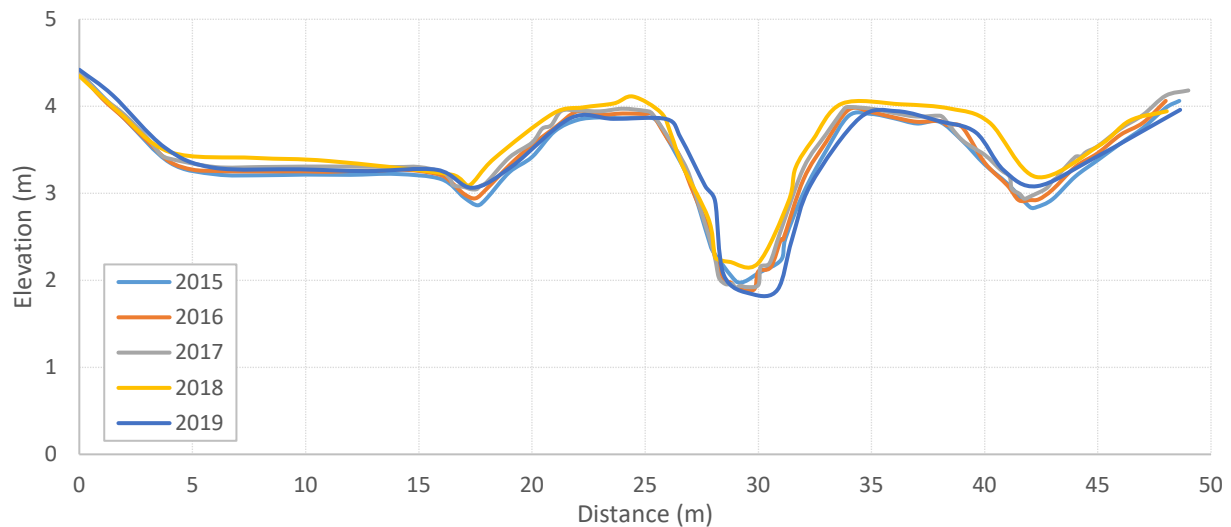


Figure 4: Cross-section seven years 2015-2019.

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 (fig.4). Channel geometry remains relatively stable with potential for more lateral migration based on visual observation in the field of slumping on the right bank.

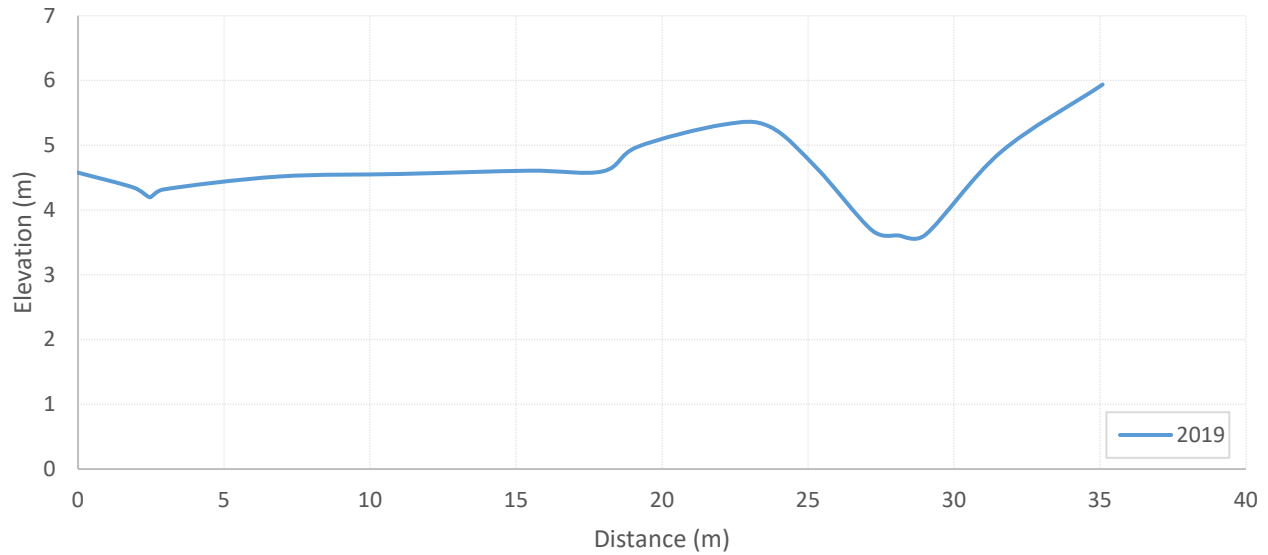


Figure 5: Cross-section ten was established to capture the most recent phase of the SRERP and the 2019 cross-sectional profile serves as baseline data serves as baseline data.

Table 1: 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 1). 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. Unit seven also shows a trend toward erosion in the channel but of less overall magnitude than the other cross-sections.

4.2 LONGITUDINAL PROFILE

The longitudinal profile spans a distance of 3,700 m and is presented in two segments that cover Phase 2 (fig. 6) and a recently completed section that extends upstream of the Francis Creek sediment retention basin (fig. 7). 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 (fig. 6) as well as from 2,300 to 2,600 m (fig. 7). Results for these segments are not presented due to the low confidence interval in making topographic comparisons with a small sample size.

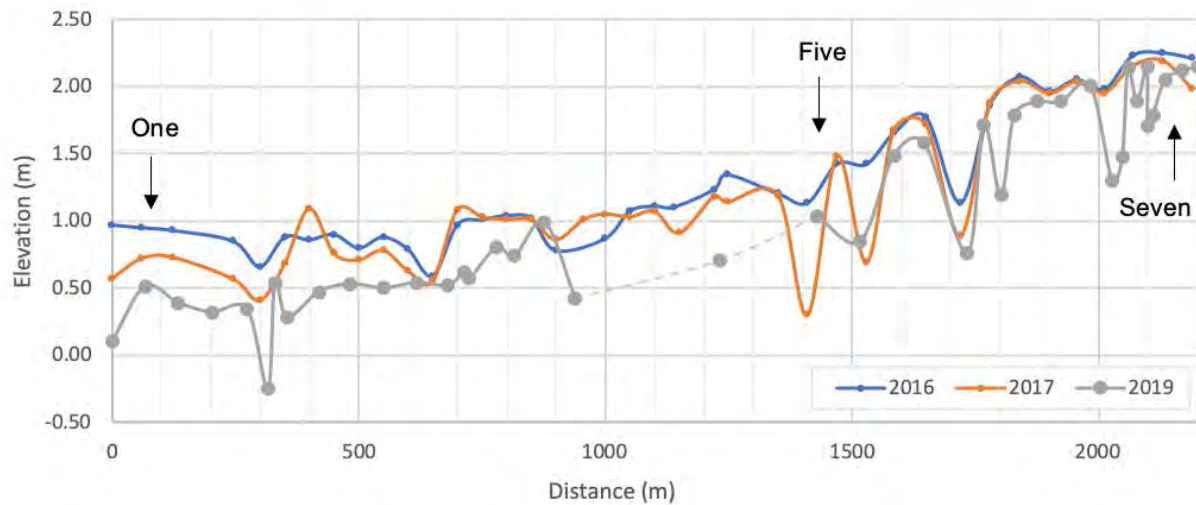


Figure 6: Section of longitudinal profile for the Phase 2A portion of the SRERP with locations of cross sections labeled. The dashed line for 2019 indicates a segment with course data resolution that may not accurately reflect trends in channel morphology.

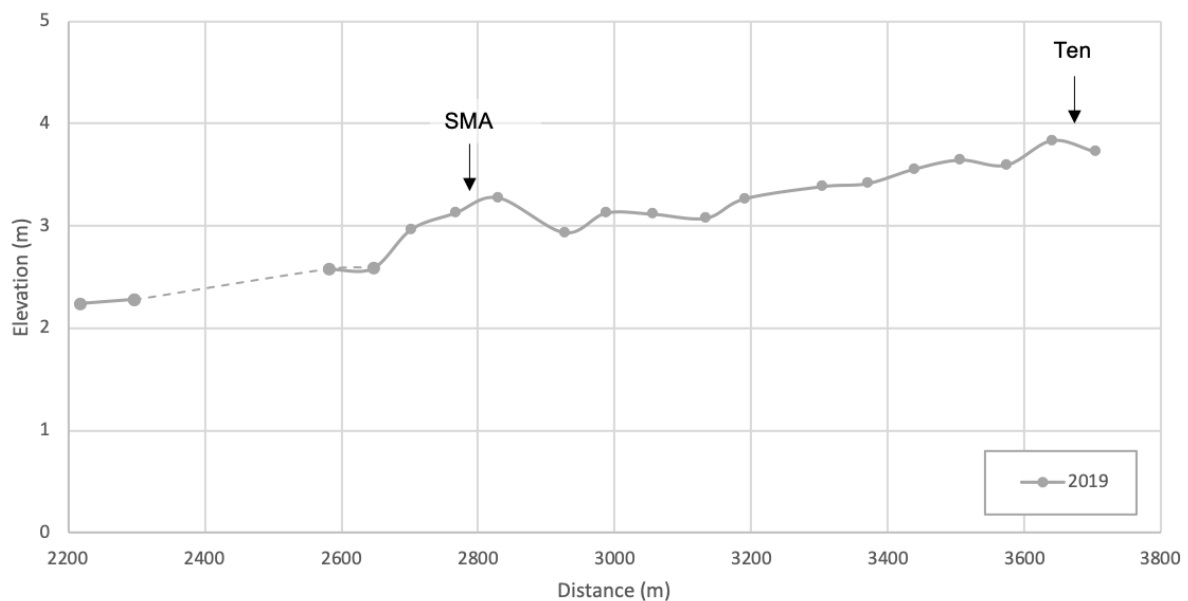


Figure 7: New section of the longitudinal profile that continues upstream from previous years surveys. Cross-section ten and the sediment management area (SMA) at the confluence with Francis Creek are labeled. The dashed line indicates a segment with course data resolution that might not accurately reflect 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 (fig.6).

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.

5 DISCUSSION

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. Channel degradation is most prominent in the downstream portions; as indicated by mean bed lowering in the longitudinal profile and lower thalweg elevations in cross-sectional profiles compared to previous years. The downstream section had relatively uniform bed lowering, whereas the upstream portion had more variable scour patterns leading to incipient pool formation and greater morphological complexity. Two new pools were formed in the upstream portion spanning between 60 and 80 meters in length. A prominent pool upstream of cross-section one (where an anabranching channel reconnects with the main channel) continued to deepen and lateral erosion on both sides of the bank was observed (Appendix, fig. 8 & 9).

Cross-sectional profiles indicate more lateral erosion in the lower portion compared to the upper portion. This could partially be due to several factors; vegetation was anecdotally observed to have propagated more rapidly in the upstream portion (Appendix, fig. 14), these reaches are also dominated by a freshwater hydrology regime towards Francis Creek and are less tidally influenced in the middle portions compared to the lower reach near Reas Creek. Increased exposure to fluvial processes, compounded by a lack of root stabilization (as lower bank vegetation is limited in these areas) could be contributing to the higher rates of lateral erosion in the downstream portion. Conversely, riparian vegetation in the upper portions may lead to greater bank stability and less lateral erosion. Additionally, dense in-channel vegetation in the upper portions was observed, potentially causing water velocity to slow and let entrained particles settling out- thus leading to less overall change in channel geometries.

LITERATURE CITED

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- H.T Harvey & Associates. 2012. "Salt River Ecosystem Restoration Project Habitat Mitigation and Monitoring Plan." Project No. 3117-05. Accessed http://humboldtrcd.org/Final_Salt_River_HMMP_Report_9.04.2012_Entire.pdf
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APPENDIX

5.1 CROSS SECTION ONE



Figure 8: Salt River main channel looking east in the upstream direction from cross-section one. .



Figure 9: Endpin marking the start of cross-section one.



Figure 10: Channel (top, 2019) and aerial view (bottom, 2018) of bank slumps approximately 240 meters upstream of cross-section one. In addition to lateral erosion, vertical scour has occurred throughout survey years as shown by consistent deepening of a pool in the area (fig. 6).

5.2 CROSS-SECTION FIVE



Figure 11: Cross-section five looking west in the downstream direction.



Figure 12: Bank failure downstream of cross-section five.



Figure 13: Endpin marking the start of cross-section five.

5.3 CROSS-SECTION SEVEN



Figure 14: Cross-section seven looking north across the channel transect, note dense riparian and in-channel vegetation.



Figure 15: Endpin marking the start of cross-section seven. .

5.4 CROSS-SECTION TEN



Figure 16: Cross-section ten looking upstream.



Figure 17: Endpin marking start of cross-section ten.

5.5 CROSS-SECTION LOCATIONS

Cross-section	Start		End	
	Latitude	Longitude	Latitude	Longitude
One	40.596153	-124.291790	40.596359	-124.291925
Five	40.596655	-124.277574	40.596968	-124.277332
Seven	40.594798	-124.271193	40.595225	-124.271380
Ten	40.596419	-124.256006	40.596605	-124.255673