

**Salt River Ecosystem Restoration Project  
Post-Construction Geomorphic Channel Survey Report  
Phase 1  
Year 4 – 2017**

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2017



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## 1) INTRODUCTION

In compliance with the Salt River Ecosystem Restoration Project (SRERP) Adaptive Management Plan, the Year 4 cross sectional and longitudinal surveys were conducted across the Phase 1 - tidal marsh project area during May and June 2017. The cross sectional surveys were conducted on the main channel of the lower Salt River (SR), and on the recently excavated North (NC) and South (SC) slough channels, which were excavated during the summer of 2013 (Figure 1). Longitudinal surveys were conducted of the main-stem Salt River channel from Cutoff Slough (CO) to near the Phase 1 excavation boundary (Riverside Ranch barn), the North slough channel (NC), the north branch of the North slough channel (NCC), and of the South slough channel (SC) (Figure 1). All elevations are geo-referenced, in feet, to the 1988 North American Vertical Datum (NAVD88). Horizontal locations are determined using GPS North American Datum 1983 (NAD83) in degrees (°), minutes (′) and seconds (″).

In 2013 the SRERP returned 330 acres of dairy ranchland to a salt marsh estuary. Two and a half miles of the Salt River channel were excavated, expanded, and deepened. Three miles of new slough channels (i.e. NC and SC) were also excavated and enhanced. The channels excavated in 2013 are being monitored using cross sectional surveys to assess the amount of sediment deposition, erosion, channel scour, and side slope slumping. The 2014 survey results are used as baseline comparison data to determine if corrective management actions are necessary. The 2013 cross sections are from as-built design criteria, not actual survey results.



**Figure 1: Location of the cross section and longitudinal profiles for Salt River Ecosystem Restoration Survey Project, Spring 2017. SR = Salt River profiles; NC= North Channel slough profiles; SC= South channel slough profiles.**

## 2) METHODS

### 2.1) Cross section elevations

Cross section elevations and distances were collected across the flood plain, channel slope, vegetation edge, water's edge, mid-channel or thalweg, and at least 2 locations on either side of the mid-channel. All data for the 2014 cross sections and longitudinal profiles were collected using a CTS/Berger automatic level, tripod and stadia rod. The data collected for 2015, 2016 and 2017 used a Nikon DTM-352 Total Station laser theodolite, tripod, prism pole and single prism (Figure 2). All elevations are reported in feet using the NAVD88 datum and elevations are based off a corrected position using survey benchmarks SR11, SR12, and SR14 (Table 1) on Riverside Ranch (Phase 1 project area), established in 2013. Flood plain measurements were collected up to 200-feet on either side of the main channel, with the exception of the south bank of SR3 due to limited access across private land. Cross section profiles are viewed from the west (or north) with the zero-point on the left-side of the graph and extending up to 400 feet toward the south (and east). The discussion refers to left bank and right bank when viewed looking downstream.

### 2.2) Channel cross-section profiles

A total of 9 cross sectional profiles are compared for the years 2014 through 2017 with 3 profiles on each of the main stem Salt River (SR), the recently excavated North slough channel (NC), and the recently excavated South slough channel (SC). All cross sections are GPS referenced (NAD83) to the survey benchmarks (e.g. SR11, SR12, SR14) and the survey endpins (e.g. SR1, SC1, NC1, etc.) are monumented with ½" rebar and orange caps above the highest high water level. Several of the stations in the NC and SC are in the flood plain and are subject to disturbance, biofouling and/or burial. Several of the endpins were not re-occupied and transects were located using GPS coordinates and True north azimuth direction (14.5°E declination). A list of the stations is provided to more easily locate cross section endpins (Table 1).

### 2.3) Salt River longitudinal profile

The main Salt River channel (SRL) from Cutoff Slough to the Riverside Ranch barn, the North slough channel (NCL) and the South slough channel (SCL) longitudinal profile surveys were collected using a Nikon DTM-352 Total Station laser theodolite, tripod, prism pole and single prism. The prism pole was placed in the thalweg approximately every 200-feet with the survey instrument located at one of four locations along the north bank of the main Salt River channel, then geo-referenced to the Salt River Restoration Project's survey benchmarks SR11, SR 12 and SR 14. A total of 48 measurements were taken along the Salt River. All elevations are reported in feet using the NAVD88 vertical datum. Results for these longitudinal profiles are presented in Figures 7A-9A and tables are presented in the appendix.



**Figure 2: View looking west of the project site from the SR 3 cross-section near the Riverside Ranch Barn site. Salt River is to the left in the photo and the monumented survey endpin, with orange cap, is indicated beneath the theodolite.**

<b>Salt River Endpin and Benchmark Locations</b>				
Downstream view: rb = right bank; lb = left bank * Indicates endpin not located in 2017				
	<b><u>Latitude</u></b>	<b><u>Longitude</u></b>	<b>Azimuth (°T)</b>	<b>Elevation ft. (NAVD88)</b>
<b>Main Salt River Channel</b>				
<b>SR1_rb</b>	40° 37' 5.80"N	124° 18' 49.16"W	210	7.08
<b>SR1_lb*</b>	40° 37' 4.33"N	124° 18' 50.37"W		
<b>SR2_rb</b>	40° 36' 41.14"N	124° 18' 13.56"W	200	7.91
<b>SR2_lb*</b>	40° 36' 39.91"N	124° 18' 14.25"W		
<b>SR3_rb</b>	40° 35' 55.15"N	124° 17' 51.81"W	230	8.19
<b>SR3_lb*</b>	40° 35' 54.57"N	124° 17' 52.70"W		
<b>North Channel</b>				
<b>NC1_rb*</b>	40° 36' 38.03"N	124° 18' 35.75"W		
<b>NC1_lb*</b>	40° 36' 36.46"N	124° 18' 34.86"W	335	8.1
<b>NC2_rb*</b>	40° 36' 51.35"N	124° 18' 28.76"W		
<b>NC2_lb</b>	40° 36' 51.13"N	124° 18' 27.54"W	280	7.15
<b>NC3_rb</b>	40° 36' 52.30"N	124° 18' 30.28"W		6.93
<b>NC3_lb*</b>	40° 36' 52.88"N	124° 18' 29.46"W	225	
<b>South Channel</b>				
<b>SC1_rb*</b>	40° 36' 0.57"N	124° 17' 55.10"W		
<b>SC1_lb*</b>	40° 35' 59.90"N	124° 17' 54.60"W	330	7.02
<b>SC2_rb*</b>	40° 36' 19.92"N	124° 17' 52.75"W		
<b>SC2_lb</b>	40° 36' 20.24"N	124° 17' 51.91"W	240	7.38
<b>SC3_rb*</b>	40° 36' 33.44"N	124° 18' 4.75"W		7.7
<b>SC3_lb*</b>	40° 36' 33.67"N	124° 18' 3.40"W	255	
<b>Benchmarks</b>				
<b>SR11</b>	40° 35' 47.00"N	124° 17' 39.76"W		13.85
<b>SR12</b>	40° 37' 10.50"N	124° 18' 43.55"W		11.07
<b>SR14</b>	40° 36' 36.29"N	124° 18' 33.19"W		13.32

**Table 1: GPS locations (NAD83) and elevations (NAVD88), azimuth bearings (magnetic declination=14.5°E) for survey benchmarks: SR11, SR12, SR14; and cross-section endpins on Salt River SR1, SR2, SR3; North Channels: NC1, NC2, NC3; and South Channels SC1, SC2, SC3. Asterisks indicate endpin not located during 2017 survey.**

### **3) RESULTS**

#### **3.1) Cross section profiles**

##### **3.1.1) Salt River cross section profiles**

The cross section profiles of the main channel of the Salt River indicate that the SR1 experienced approximately 0.5 feet of erosion on the south/left side of the channel since 2016. Slumping is most prominent on the left bank of the channel (Figure 3A), and there was some erosion on the upper portion of the right bank. Cross section SR2 showed deposition, which is a significant change from previous years, with sediment accumulation at the base of the north bank (Figure 3B) since 2016. Cross section SR3 had approximately 1 foot of erosion in the thalweg, which is a reversal from previous years' consistent sedimentation across the bottom of the channel (Figure 3C).

##### **3.1.2) North and South slough channel cross section profiles**

The North slough channels cross section profiles show that the NC1 experienced another 0.25 feet of erosion at the thalweg since 2016 (Figure 4A) and has continued to scour on the upper left bank (Appendix VII, Fig. N-3). The NC2 cross section shows that the bottom of the channel filled by 0.16 feet since 2016 (Figure 4B). The NC3 cross section showed about 0.20 feet of erosion since 2016 (Figure 4C).

The 2017 South slough channel cross sectional surveys indicate 0.70 feet of scour at the bottom of the channel at SC1 since 2016 (Figure 5A). Cross section SC2 experienced very little change since 2016 (Figure 5B). However, scour occurred mainly along the upper portion of the right bank over the last several years (Appendix VII, N2-C). Minor changes occurred at cross section SC3 over the past year and since 2014; where channel erosion of 0.3 feet (Figure 5C).

#### **3.2) Longitudinal profiles**

##### **3.2.1) Salt River longitudinal profile**

The total relief on the 11,789-foot longitudinal profile section of the main Salt River channel surveyed in 2017 was 2.67 feet, yielding an average gradient of 0.023%, and remains the same as the 2016 survey that had a relief of 2.72 feet on the 11,865-ft survey. Although the average gradient remained unchanged from 2016 to 2017, sediment flux was observed in several sections of the Salt River. Thalweg scour was observed on the lower Salt River from 1,800 feet to 4,500 feet upstream from CO. Upstream of the NC confluence, from about 6,000 feet to 9,500 feet upstream from CO slough, an average of 0.6 feet of sediment accumulation occurred. This aggradation contrasts to an approximate 1.7 ft deep scour pool that persists in the SR near the SC confluence, 10,400 feet upstream from CO.

##### **3.2.2) North slough channel longitudinal profile**

Longitudinal profiles of the NC for 2017 indicate about 0.57 feet of sediment accumulation compared to the 2016 profiles approximately 1,000 feet upstream from the confluence with SR. The total relief on the 1,999-foot NC in 2017 was 2.68 feet, yielding an average gradient of 0.13%. The relief in 2016 was 2.11 feet, yielding an average gradient of 0.10%.

### **3.2.3) South slough channel longitudinal profile**

The total relief on the 4,620-foot SC channel in 2017 was 3.55 feet yielding and average gradient of 0.077%, a slight increase from the 2016 survey, which was 4687-foot in length with a 3.50 feet, yielding an average gradient of 0.075%. The relief of the 3,943-foot channel in 2015 was 2.76 feet, yielding an average gradient of 0.069%.



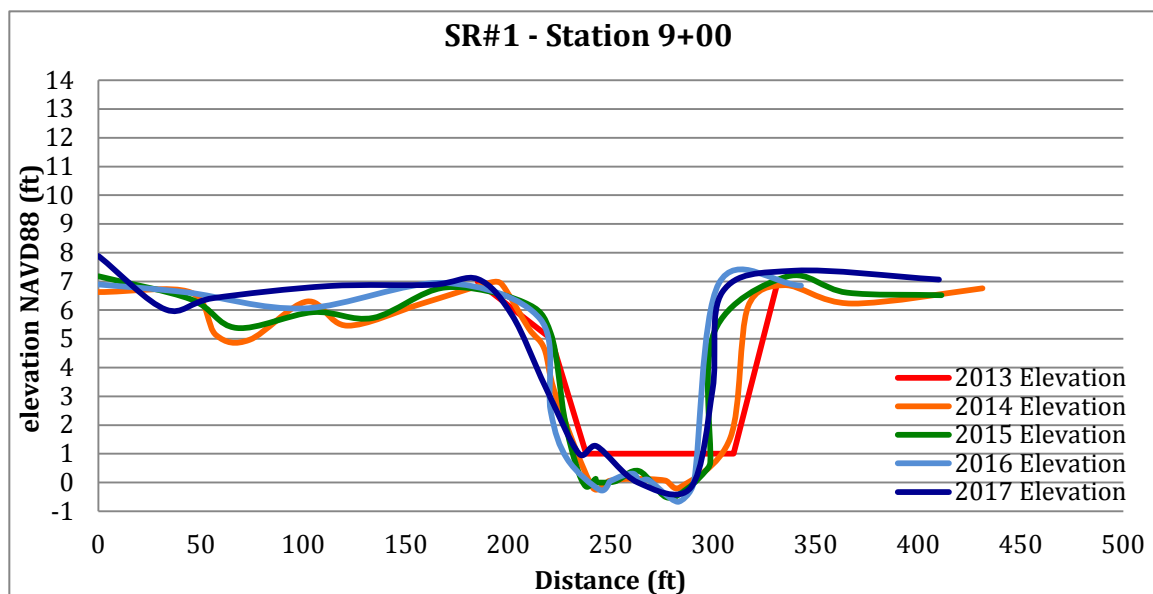


Figure 3A: Salt River main channel cross section SR 1, 2013 - 2017.

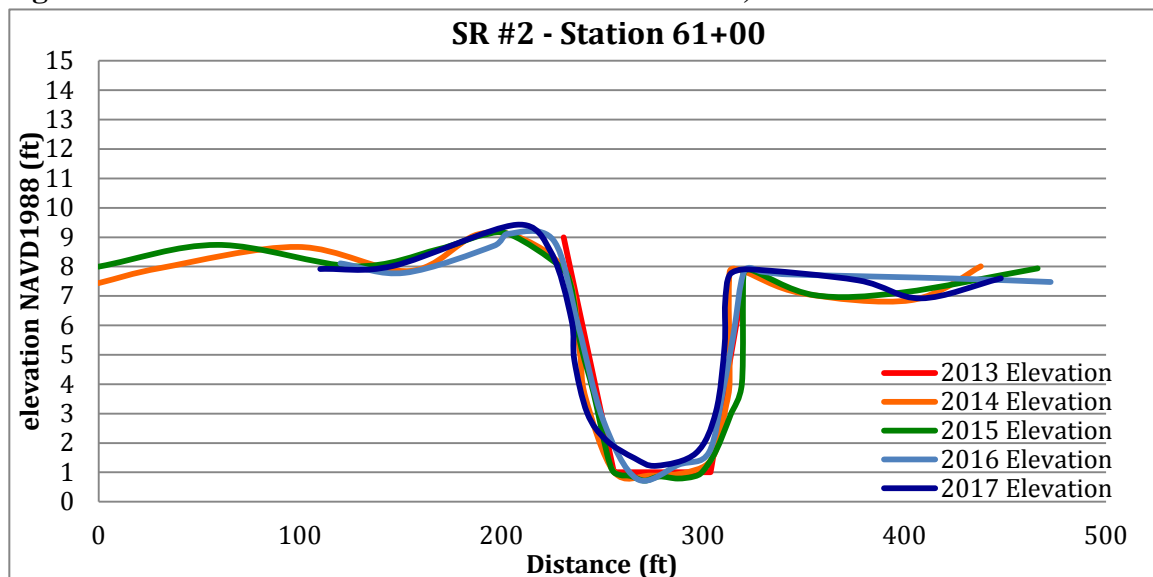


Figure 3B: Salt River main channel cross section SR2, 2013 - 2017.

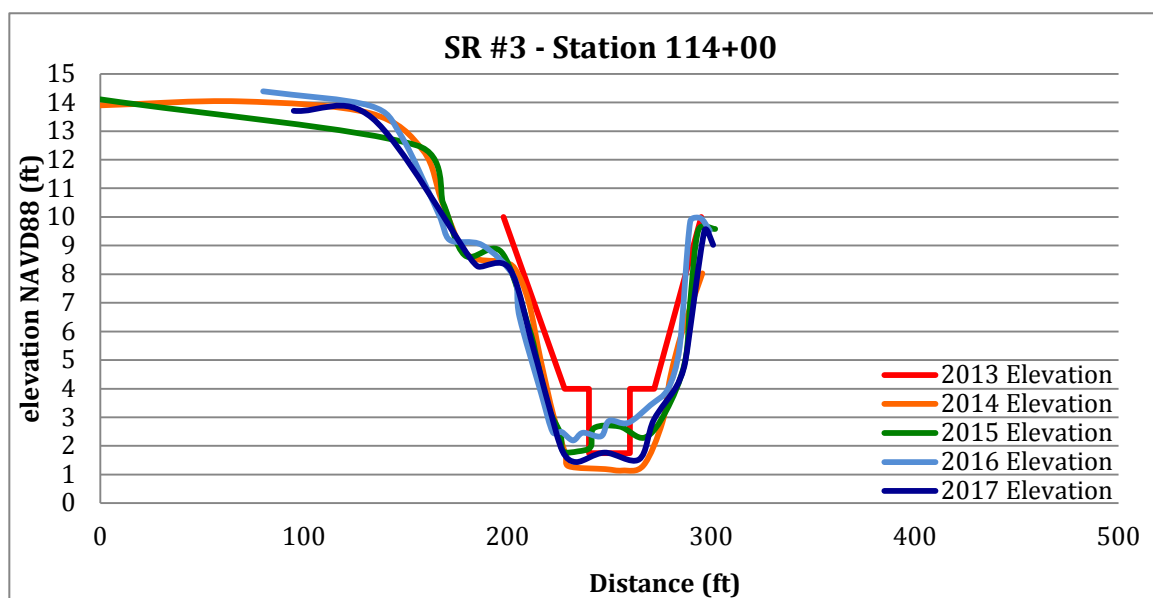


Figure 3C: Salt River main channel cross section SR3, 2013 - 2017.

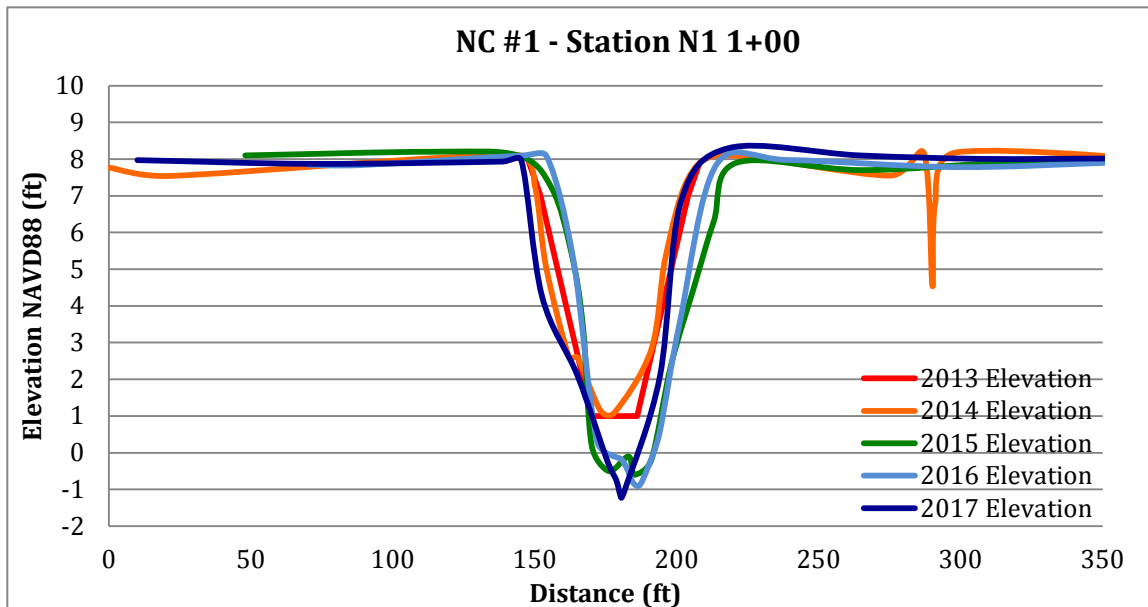


Figure 4A: North slough channel cross section NC1, 2013 - 2017.

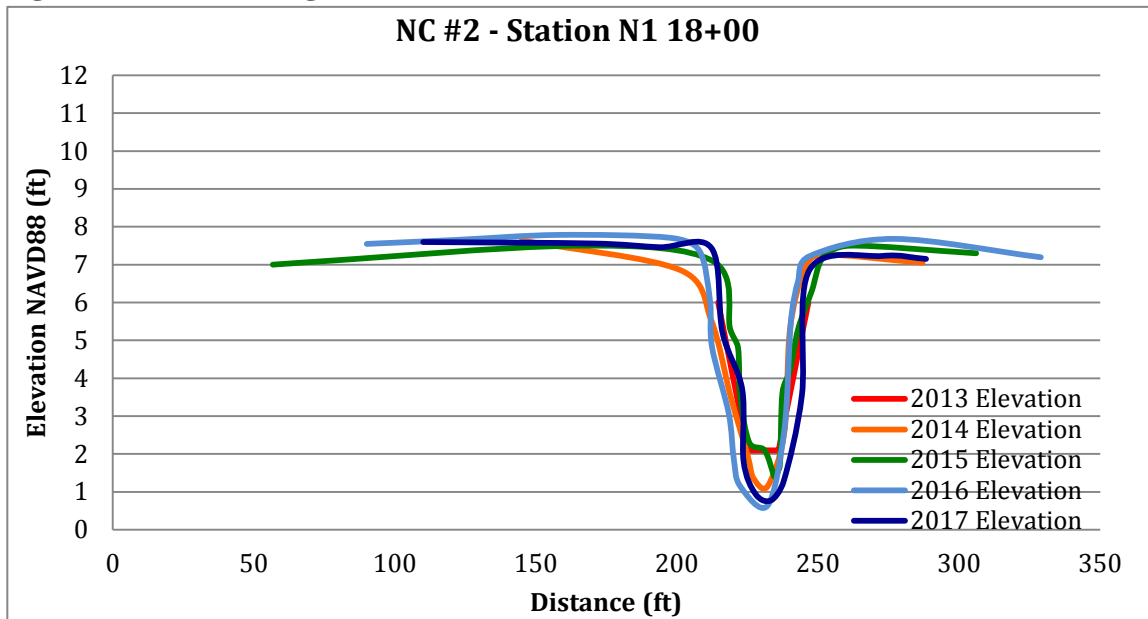


Figure 4B: North slough channel cross section NC2, 2013 - 2017.

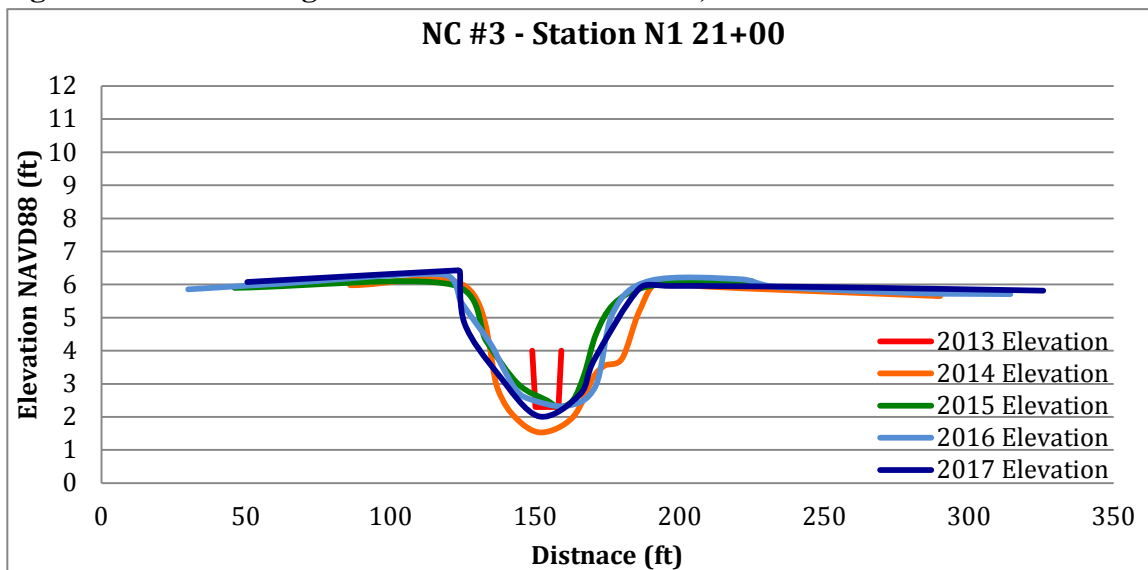
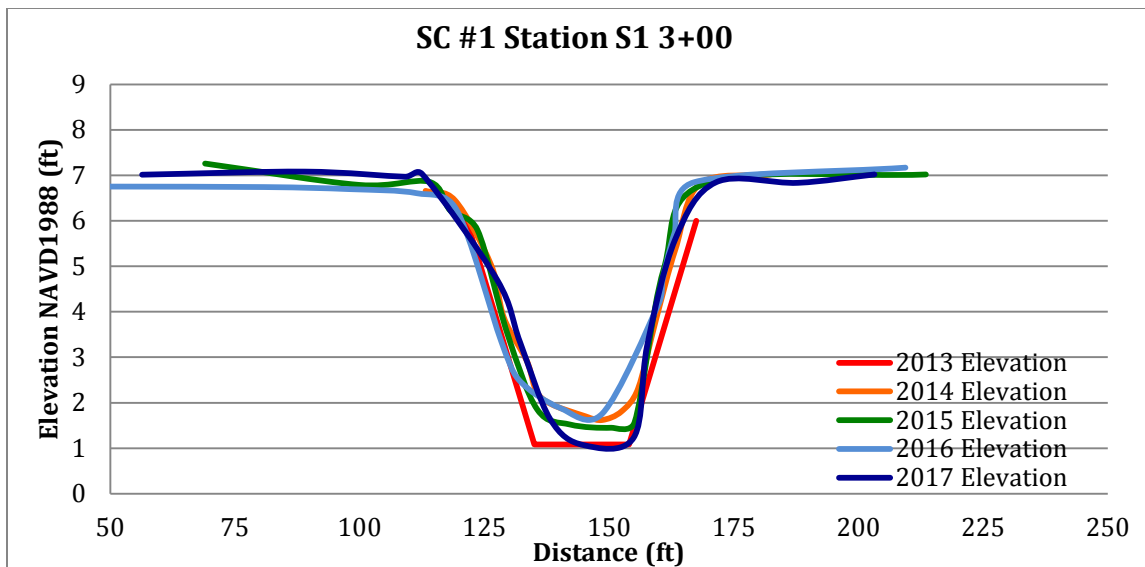
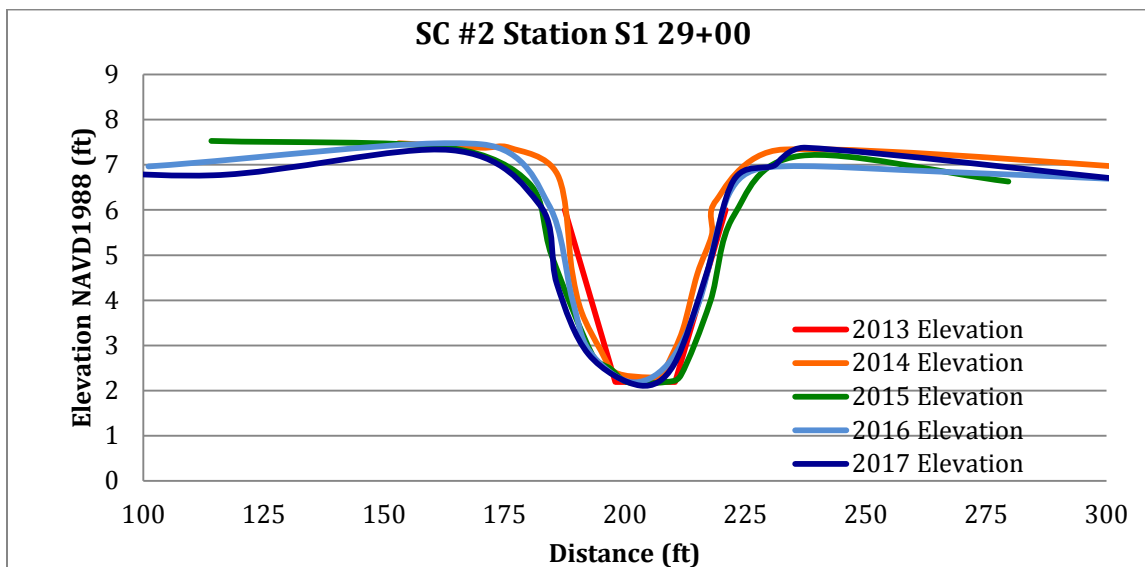


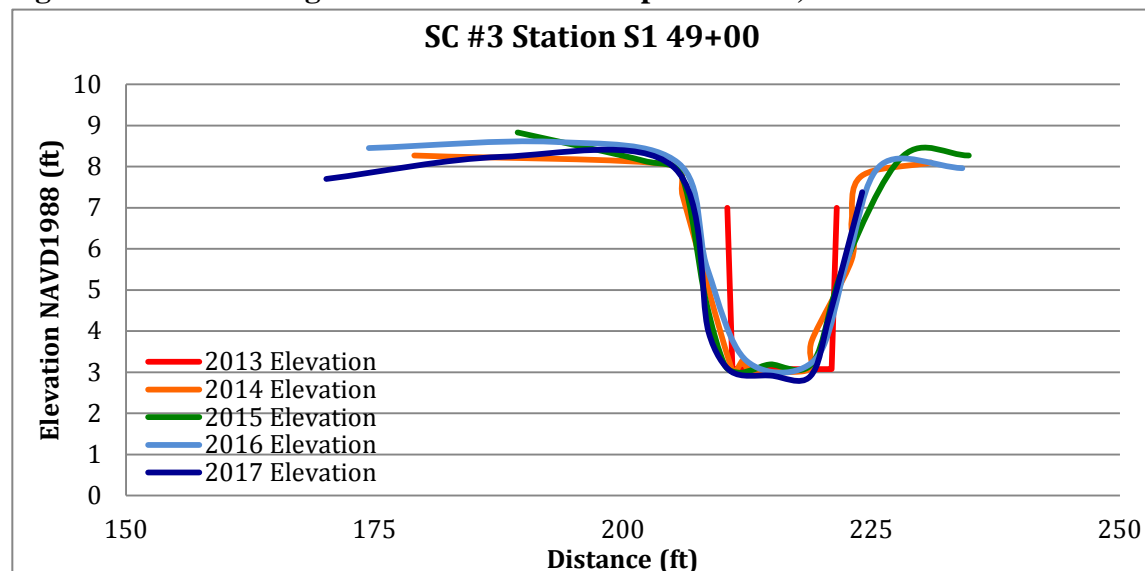
Figure 4C: North slough channel cross section NC3, 2013, 2015 - 2017.



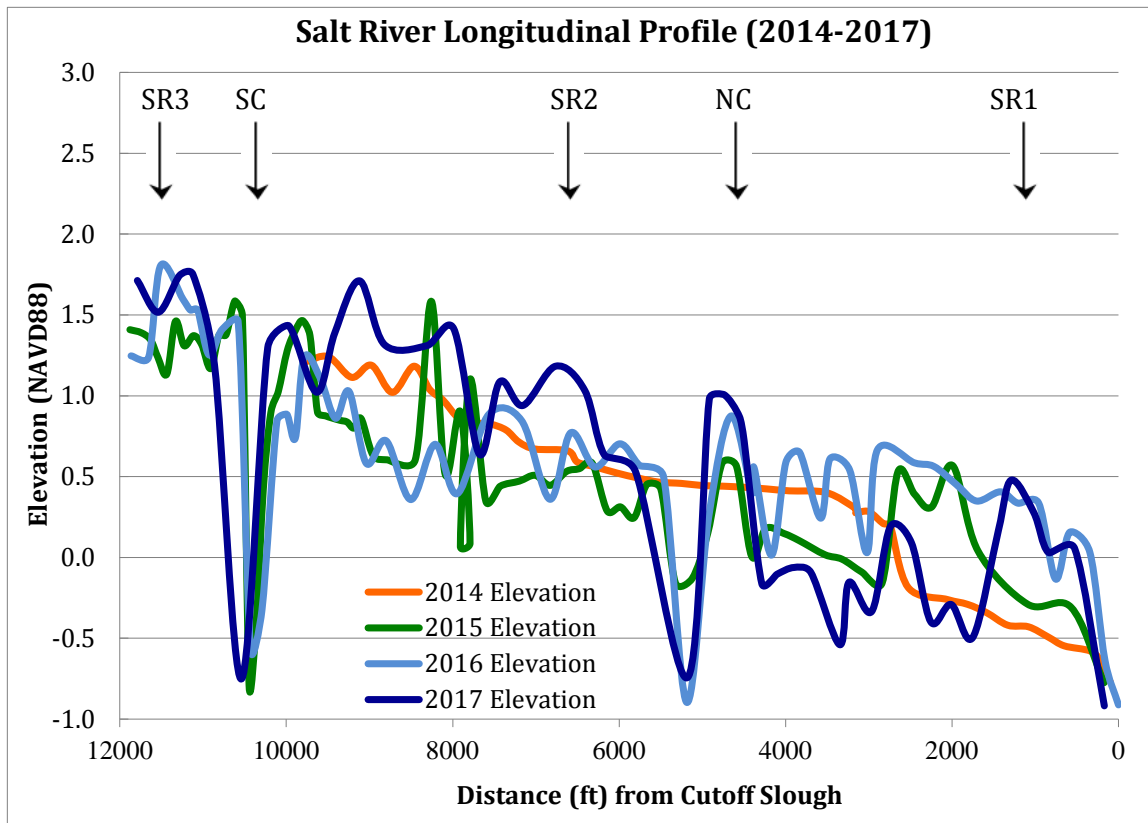
**Figure 5A: South slough channel cross section profile SC1, 2013-2017**



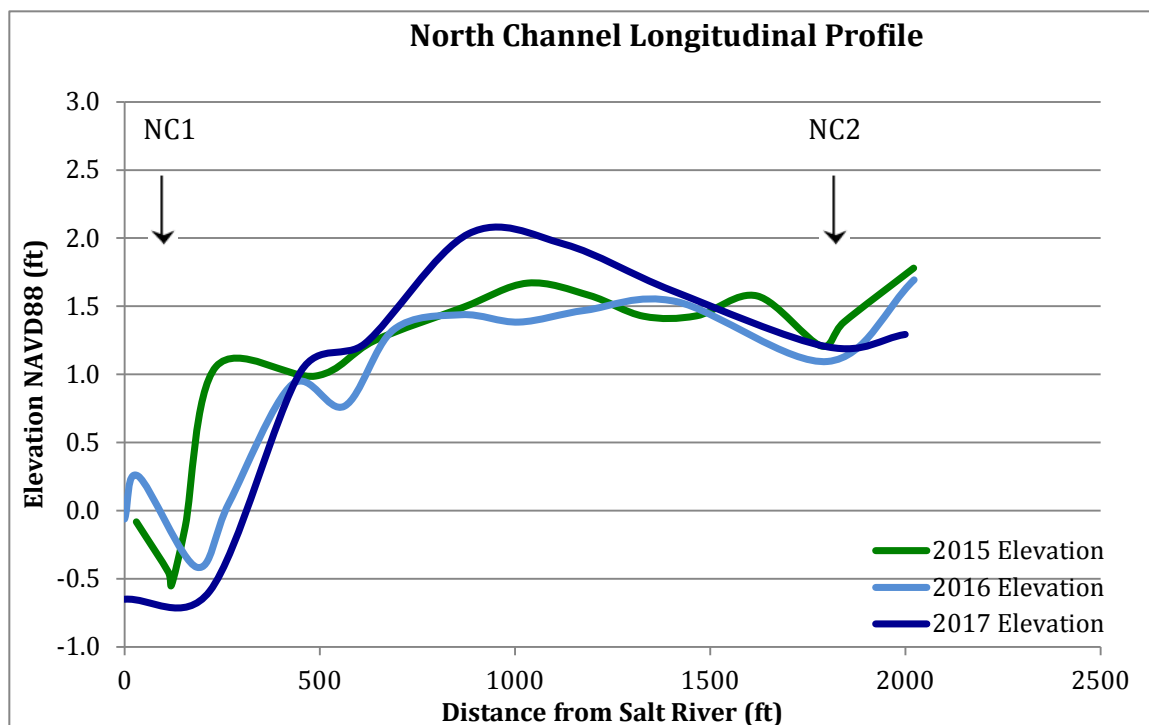
**Figure 5B: South slough channel cross section profile SC2, 2013 -2017**



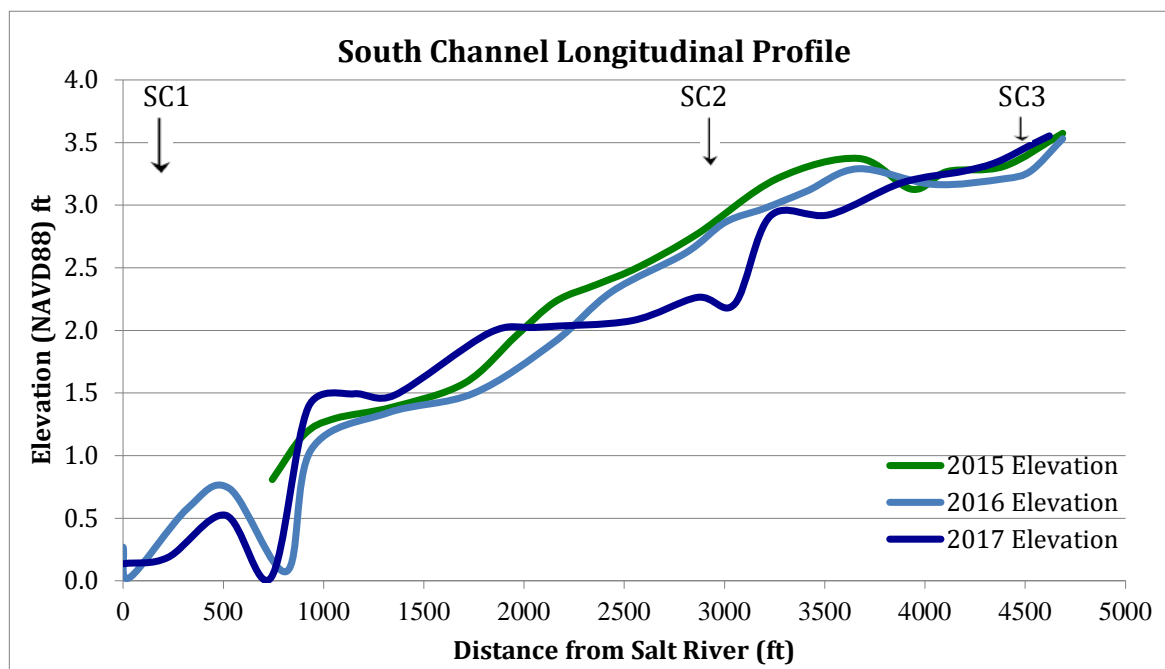
**Figure 5C: South slough channel cross-section profile SC3, 2013-2017.**



**Figure 6: Salt River longitudinal profile of the main channel of the Salt River 2014-2017. SR1, SR2 and SR3 are locations of cross sections; NC and SC are the approximate locations of the confluence with the North and South slough channels, respectively.**



**Figure 7: North slough channel of the Salt River longitudinal profile 2015-2017.**



**Figure 8: South slough channel of the Salt River longitudinal profile 2015-2017.**

## **4) Discussion**

Patterns of erosion, transport and deposition observed 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 CO and NC. Main channel bed erosion in the Salt River was observed in the lower section of the SR below NC. Sediment deposition in upstream section of the Salt River channel between SR2 and SC is seen in the longitudinal profiles (Figure 6) 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. Sediment cohesion inhibits the amount of re-suspension during the ebb tide, which accounts for the net deposition observed. In contrast, however, approximately 1 foot of sediment was removed from the SR3 cross section, likely the result of higher winter storm discharge. 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 will 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. This may be balanced by increased volumes of water as the project extends the channel length. More importantly, normal to above-normal, storm-water discharge events will likely serve to re-suspend and remove the fine grained sediments from the main-stem Salt River channel.

### **4.1 Salt River cross sections**

The Salt River channel continues to adjust to the base levels established in 2014, following the 2013 excavation of the main Salt River and the North and South slough channels. The bottom right side (downstream view) at cross section SR1 in the main-stem Salt River channel has infilled a couple of inches from the 2016 survey (Figure 3A, Appendix VII, 1-C). The high-water portion of the right bank exhibited erosion with coarser grains (gravel) as well as in a nearby gully that drains the floodplain. The left-side channel remained stable, however, the left bank at the mid to high-water portion of the bank continues to be undercut and slumps into the channel, reducing the average channel capacity. The SR 2 right-side channel accumulated 0.3 to 0.5 feet of sediment, likely due to the re-suspension/transport mechanism. The left channel bank was undercut and slumped and the left endpin was not located (Figure 2-C, Appendix VII, 2C). Following the 2013 excavation, the SR3 channel initially eroded, then aggraded on the left side of the channel in 2014 at a faster rate than the mid- and right portion of the channels (Figure 3-C). The 2017 survey indicates that the channel bottom elevation has aggraded to the original As-Built elevation.

### **4.2 North and South slough channel cross sections (NC and SC)**

The NC includes a main channel and three, upstream channel branches. The channel profile of NC1 indicates continued erosion of the channel bottom, as well as erosion of the left-side cut-bank downstream to the confluence with SR (Figure 4A, Appendix VII, N-3). The NC2 channel cross section is located just downstream of the confluence of three upstream branches and exhibited about 0.1 foot of mid-channel deposition, minor erosion of the right bank, and slumping of the left bank. There was noticeable erosion around a large root wad in the channel 75 feet downstream of NC2 (Appendix VII, N2-D). The north branch of the NC is the location of cross section NC3. The right bank endpin was covered by approximately 8 cm of sediment (Appendix VII, NB-3). The channel bottom eroded to the As-Built elevation. The central and south branches were not surveyed.

The South slough channel has two linear, channels with floodgates that drain bottomlands located to the northeast of the project area that were not surveyed. The South slough channel cross section at SC1 had aggraded over the past several years, however, in 2017 erosion to the 2013 “as built”

depth was observed. Cross section SC2 remains unchanged. Cross section SC3 exhibits minor erosion of the right hand side of the channel.

### **4.3 Longitudinal Profiles**

#### **4.3.1 Salt River**

The Salt River longitudinal profile indicates a highly mobile sedimentary environment exists with distinct erosion near the confluences with CO, NC and SC. Re-suspension and transport of fine-grain sediments migrate up, and down the channel during flood, and ebb tides, respectively. It is not clear if there is a net transport of sediment out of the system or if continued upstream restoration work is providing additional sediment flux. The upper reaches of the surveyed Salt River thalweg appears to have aggraded at least 0.5 feet since 2016, while the lower reaches have scoured approximately 0.5 feet since 2016. Development of scour pools near the confluence with CO, NC and SC are the result of large eddies observed during maximum ebb tide.

#### **4.3.2 North and South slough channels**

The longitudinal profile on the NC generally remains stable with minimal erosion on the lower and upper channel and deposition along the mid channel. Incision near the NC1 cross section continued to lower the channel bottom by another 1/3 foot. An average of 1/3-foot deposition was observed from 600 to 1,400 feet upstream of the SR confluence.

The longitudinal profile on the SC remains stable with scour developing approximately 900 feet upstream from the confluence at an unnamed right bank side channel entrant.

**Appendix I: Salt River main channel cross section data.  
SR1**

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
185	7	0	6.63	0	7.18	0.0	6.90	410.1	7.06
220.9	5	44.9	6.62	45	6.38	43.2	6.62	339.6	7.37
237.9	1	57.4	5.13	67.5	5.38	100.3	6.06	304.4	6.64
309.9	1	73.8	4.97	104.7	5.93	168.6	6.95	299.6	3.25
331.4	7	101.7	6.3	134	5.73	215.5	5.70	289.1	-0.17
		121.4	5.46	169.1	6.79	220.6	2.50	263.2	0.00
		157.4	6.22	207.3	6.28	228.6	0.83	243.0	1.27
		191.2	6.96	220.7	5.18	244.7	-0.26	234.4	1.00
		196.8	6.9	227.3	2.27	249.5	0.03	217.9	3.35
		209.9	5.37	233	0.62	249.8	0.05	201.9	5.82
		217.5	4.66	237.9	-0.14	255.8	0.24	185.1	7.08
		223	3.06	242.5	0.13	261.2	0.30	162.8	6.88
		241.1	-0.17	242.6	0.01	263.5	0.05	112.1	6.84
		249.3	0.06	252	0.04	264.4	0.04	55.9	6.42
		260.8	0.13	263.7	0.4	268.4	0.09	32.9	6.02
		276.5	0.07	277	-0.51	282.8	-0.67	0.0	7.88
		283.7	-0.17	287.3	-0.21	290.5	0.03		
		308.3	1.56	296.4	0.42	302.7	6.93		
		316.8	6.1	298.5	0.71	342.7	6.86		
		334.6	6.87	300.5	5.25				
		367.4	6.23	335.9	7.17				
		431.3	6.76	365.2	6.61				
				411.3	6.52				



**SR2**

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
231	9	0.0	7.44	0	8.00	120.0	8.11	110.0	7.92
256	1	31.2	7.96	59.1	8.74	151.9	7.79	146.2	8.02
304	1	99.1	8.67	126.6	8.01	196.4	8.71	207.4	9.42
319	7	154.2	7.85	168.0	8.58	202.9	9.11	224.7	8.47
		187.9	9.09	190.5	9.07	225.7	8.90	234.7	6.19
		211.6	8.91	204.7	9.08	238.1	5.98	236.1	4.81
		232.9	7.68	228.6	8.03	250.3	2.80	242.5	3.03
		238.8	5.12	234.4	7.34	267.3	0.77	252.0	2.10
		241.7	3.54	238.9	5.46	288.0	1.27	265.9	1.48
		255.8	1.02	245.5	3.75	302.9	1.68	276.9	1.22
		273.9	0.89	252.2	1.67	310.1	3.84	296.6	1.66
		292.6	1.01	255.0	1.07	315.1	5.69	306.4	3.07
		305.0	1.53	258.8	0.91	320.4	7.84	310.7	5.32
		311.6	3.32	263.9	0.88	329.4	7.83	311.0	6.76
		313.2	4.09	271.0	0.72	341.2	7.74	313.4	7.74
		313.2	7.81	278.3	0.86	424.6	7.60	322.8	7.91
		319.8	7.85	287.4	0.79	472.6	7.48	377.1	7.53
		349.3	7.09	295.5	0.86			408.2	6.92
		403.4	6.86	299.8	1.03			447.85	7.602
		437.9	8.01	306.4	1.73				
				313.7	2.96				
				319.3	4.03				
				320.1	7.78				
				323.8	7.89				
				355.3	7.03				
				398.9	7.12				
				466.1	7.94				

**SR3**

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
198	10	0	13.9	0	14.11	80.0	14.39	95.0	13.71
228	4	68.5	14.04	155.4	12.5	132.6	13.88	133.5	13.46
240	4	132.2	13.63	168.3	10.49	147.5	12.87	181.4	8.58
240	1.75	158.4	12.33	179	8.66	166.2	10.09	185.5	8.27
260	1.75	168	10.5	197	8.77	171.4	9.20	201.0	8.19
260	4	179.8	8.72	210.7	6.07	187.5	9.02	212.4	5.47
272	4	197.2	8.43	214.6	4.94	203.1	7.90	220.4	3.38
295	10	203.6	8.19	220.1	3.33	205.8	6.51	227.0	1.81
		210.3	7.04	225.9	2.44	216.4	3.85	233.7	1.44
		216.2	5.01	227.2	1.82	222.2	2.48	247.6	1.77
		222.5	3.06	234.5	1.81	226.4	2.49	264.5	1.53
		228.4	1.71	240.8	1.97	232.1	2.19	271.7	2.91
		230	1.29	242.3	2.62	236.9	2.46	282.8	4.07
		248	1.19	254.9	2.68	245.9	2.34	287.2	4.95
		256.2	1.14	267.2	2.29	249.8	2.88	296.6	9.51
		266.7	1.32	277.7	3.21	259.1	2.81	300.9	9.02
		276	2.83	287	4.92	270.0	3.42		
		279.9	4.42	289.7	7.07	279.0	4.02		
		285.8	6.01	293.7	9.55	284.5	5.47		
		295.6	8.03	301.9	9.58	289.7	9.84		
						294.6	9.96		
						299.3	9.53		

## Appendix II: North slough channel cross section data.

### NC1

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
148	7.9	0	7.77	48.0	8.10	70.0	7.85	10	7.97
152	7	21	7.54	114.0	8.20	88.5	7.84	71.9	7.87
170	1	144	8.11	144.0	8.10	145.4	8.10	138.2	7.93
186	1	150	7.27	156.0	7.20	154.2	8.07	145.2	7.96
204	7	154	5.04	163.0	5.40	163.5	5.29	152.5	4.28
208	7.9	162	2.61	167.0	3.40	171.9	0.32	165.1	2.09
		165	2.6	170.0	0.20	180.5	-0.18	175.6	-0.25
		173	1.16	176.0	-0.50	184.5	-0.81	178.7	-0.75
		178	1.09	183.0	-0.10	186.8	-0.89	180.5	-1.23
		191	2.81	185.0	-0.60	189.8	-0.40	181.7	-1.01
		196	5.32	191.0	-0.20	193.9	0.55	194.0	2.08
		204	7.47	198.0	2.40	201.2	3.60	201.5	6.85
		216	8.11	206.0	4.50	214.1	7.87	218.3	8.30
		275	7.55	213.0	6.30	239.1	7.98	264.4	8.10
		287	8.16	221.0	7.90	298.9	7.78	307.5	8.01
		290	4.55	265.0	7.70	357.0	7.92	353.3	8.018
		291	6.81	315.0	7.90				
		299	8.19	365.0	8.00				
		406	7.81						

### NC2

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
214.5	6	145.0	7.64	56.7	7.00	90.0	7.55	110.00	7.60
225	2.1	201.0	6.86	164.2	7.50	121.2	7.65	170.58	7.56
236	2.1	212.0	5.55	212.5	7.10	158.0	7.79	193.56	7.46
246.5	6	219.0	3.51	218.8	5.30	197.4	7.71	212.15	7.44
		225.0	1.96	221.6	4.80	207.9	7.37	216.08	5.21
		227.0	1.37	222.4	3.50	211.7	6.04	223.09	3.70
		232.0	1.14	225.6	2.30	212.4	4.83	223.55	1.81
		238.0	2.57	231.0	2.10	218.3	3.07	227.81	0.94
		240.0	5.29	234.4	1.40	220.0	1.92	233.31	0.78
		245.0	6.85	234.5	1.40	222.3	1.16	237.83	1.30
		251.0	7.26	236.4	1.70	232.0	0.64	244.23	3.56
		287.0	7.05	237.3	3.60	238.0	2.63	246.96	6.87
				240.0	4.20	240.3	5.47	272.85	7.23
				242.9	5.30	242.8	6.55	288.23	7.15
				247.7	6.30	246.9	7.22		
				251.8	7.20	277.0	7.68		
				261.2	7.50	328.9	7.20		
				306.0	7.30				

### NC3

2013		2014*		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
149	4	86.0	5.98	46.0	5.90	30.0	5.86	325.6	5.82
150	2.3	126.0	5.94	121.0	6.00	61.8	6.03	253.7	5.92
158	2.3	137.0	2.85	133.0	4.30	118.1	6.31	196.9	5.96
159	4	143.0	1.99	144.0	3.00	124.3	5.47	186.2	5.90
		152.0	1.53	154.0	2.50	134.5	4.22	170.4	3.74
		163.0	1.99	158.0	2.30	138.3	3.57	165.5	2.69
		170.0	3.19	163.0	2.50	143.2	2.84	151.3	2.02
		174.0	3.55	167.0	3.30	147.9	2.54	137.1	3.30
		180.0	3.76	171.0	4.50	160.8	2.33	125.6	4.82
		186.0	5.2	177.0	5.40	170.8	2.93	123.9	6.40
		193.0	6.11	187.0	5.90	177.0	5.17	123.2	6.43
		209.0	5.94	205.0	6.10	190.0	6.12	50.4	6.08
		290.0	5.65	225.0	6.10	221.1	6.16		
						233.1	5.93		
						281.4	5.74		
						314.3	5.71		

\*survey errors exist in the 2014 data set

### Appendix III: South slough channel cross section data.

#### SC1

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
121.5	6	113.2	6.66	69	7.26	48.2	6.75	56.4	7.02
135	1.08	119.1	6.45	99.9	6.79	80.8	6.74	89.0	7.08
154	1.08	126.3	5.04	113.9	6.86	97.9	6.70	109.1	6.97
167.5	6	128.9	3.87	118.2	6.22	111.4	6.61	112.6	7.03
		133.5	2.92	123.6	5.8	119.4	6.25	127.5	4.70
		136.4	2.11	129.6	3.52	128.4	3.35	132.1	3.33
		145.3	1.7	135.6	1.85	131.9	2.51	138.2	1.64
		148.6	1.62	142.2	1.52	140.1	1.89	144.9	1.07
		152.5	1.81	150.4	1.45	148.7	1.77	154.9	1.23
		155.8	2.31	155.1	1.57	159.9	4.18	157.7	3.27
		159.4	3.83	160.9	4.92	160.7	4.68	163.3	5.60
		163.3	5.38	169.5	6.83	163.1	5.74	171.5	6.85
		168.3	6.82	213.5	7.02	167.1	6.85	187.8	6.84
		182.4	7.02			209.4	7.17	203.2	7.02

#### SC2

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
187.5	6	153.0	7.48	114.1	7.53	101.0	6.97	70.0	7.01
198	2.19	170.0	7.38	163.2	7.38	170.3	7.46	114.5	6.77
210.4	2.19	176.0	7.38	180.1	6.59	184.1	6.12	163.8	7.33
220.9	6	186.0	6.78	184.8	4.98	189.0	4.02	182.2	6.12
		189.0	4.64	193.2	2.79	192.6	2.88	185.9	4.36
		191.0	3.73	196.9	2.49	200.9	2.19	192.4	2.81
		195.0	2.88	200.7	2.18	208.9	2.59	203.2	2.11
		198.0	2.40	208.5	2.19	215.4	3.96	210.2	2.57
		205.0	2.29	211.6	2.34	221.6	6.36	217.0	4.63
		208.0	2.35	217.7	3.97	229.9	6.95	222.6	6.66
		209.0	2.61	222.5	5.86	267.9	6.84	231.1	6.99
		212.0	3.35	236.4	7.20	312.8	6.63	237.5	7.38
		215.0	4.58	279.6	6.63			314.6	6.55
		218.0	5.44						
		219.0	6.22						
		233.0	7.34						
		341.0	6.68						

### SC3

2013		2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
210.5	7	179	8.27	189.4	8.83	174.4	8.45	170.1	7.70
211	3.08	205	8.04	202.1	8.14	192.9	8.60	187.8	8.24
221	3.08	206	7.29	205.9	7.77	205.6	8.09	205.0	8.01
221.5	7	211	3.04	208.3	4.78	208.5	5.52	208.6	3.98
		212	3.28	210.2	3.19	212.5	3.27	210.8	3.02
		213	3.02	211.6	2.99	219.3	3.30	214.8	2.92
		218	3.02	213.2	3.07	222.6	5.77	218.8	2.90
		219	3.16	214.8	3.19	226.0	8.05	220.8	4.41
		219	3.77	219.1	3.23	234.1	7.96	224.1	7.38
		223	5.73	222.2	5.56				
		223	6.66	228.2	8.26				
		224	7.77	234.8	8.27				
		231	8.10						

**Appendix IV: Salt River main channel longitudinal profile data.**

**SRL**

2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
9774.4	1.21	11879	1.41	11865	1.25	11789	1.71
9495	1.24	11742	1.39	11654	1.24	11538	1.52
9214	1.11	11629	1.35	11509	1.81	11281	1.75
8976.4	1.19	11542	1.24	11241	1.60	11122	1.75
8724.9	1.02	11435	1.14	11151	1.53	10862	1.19
8466.3	1.18	11332	1.46	11065	1.53	10540	-0.75
8276.5	1.04	11228	1.31	10929	1.25	10223	1.30
8118.2	0.97	11114	1.37	10774	1.41	9972	1.43
7918.4	0.86	11016	1.32	10579	1.46	9635	1.02
7726.5	0.83	10909	1.17	10429	-0.57	9416	1.39
7546.8	0.83	10810	1.37	10293	-0.33	9118	1.71
7358.1	0.79	10723	1.38	10112	0.85	8821	1.32
7204	0.71	10617	1.59	9994	0.89	8310	1.31
7012.2	0.67	10528	1.50	9890	0.74	7987	1.41
6619.7	0.66	10447	-0.79	9787	1.24	7679	0.64
6501.8	0.59	10365	-0.44	9596	1.11	7437	1.09
6293.8	0.56	10276	0.42	9410	0.86	7158	0.94
6024.1	0.52	10185	0.90	9244	1.03	6764	1.18
5779.9	0.49	10096	1.03	9040	0.58	6413	1.03
5520.3	0.47	9989	1.28	8798	0.72	6179	0.64
5251.5	0.46	9889	1.41	8504	0.36	5804	0.53
5002.4	0.45	9804	1.47	8213	0.70	5176	-0.74
4755.4	0.44	9715	1.37	7943	0.40	4917	0.98
4490.7	0.43	9625	0.90	7569	0.88	4739	1.01
4226.1	0.42	9534	0.88	7171	0.85	4554	0.87
3956	0.41	9453	0.86	6832	0.36	4498	0.72
3507.7	0.40	9353	0.85	6583	0.77	4286	-0.16
3156.6	0.30	9270	0.84	6292	0.56	4103	-0.10
3156.4	0.28	9188	0.80	5992	0.70	3900	-0.06
3003.4	0.28	9101	0.86	5751	0.57	3696	-0.09
2825.7	0.21	8959	0.63	5466	0.50	3348	-0.54
2740.9	0.19	8787	0.60	5189	-0.90	3239	-0.15
2528.4	-0.19	8450	0.60	4922	0.26	2965	-0.33
2058.4	-0.26	8257	1.59	4657	0.88	2740	0.19
1814.1	-0.29	8092	0.52	4406	0.40	2488	0.09
1586.4	-0.34	7908	0.90	4377	0.55	2256	-0.40
1331.9	-0.42	7792	0.09	4170	0.01	2010	-0.29
1081.4	-0.43	7908	0.07	3997	0.59	1750	-0.49
841.5	-0.49	7792	1.10	3832	0.95	1442	0.17
650.8	-0.55	7602	0.35	3579	0.24	1290	0.48
333.4	-0.58	7431	0.44	3467	0.91	1018	0.28
192.5	-0.65	7201	0.47	3230	0.84	842	0.03
184.1	-0.68	7008	0.51	3020	0.03	526	0.05

**Appendix IV: Salt River main channel longitudinal profile data (continued).**  
**SRL (cont'd.)**

2014		2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation	Distance	Elevation
95.9	-0.77	6828	0.45	2896	0.67	170	-0.92
10	-0.78	6633	0.53	2451	0.79		
		6479	0.55	2217	0.56		
		6323	0.58	1948	0.45		
		6143	0.29	1705	0.35		
		5986	0.31	1417	0.71		
		5822	0.25	1210	0.84		
		5667	0.45	959	0.54		
		5499	0.42	757	-0.13		
		5323	-0.16	585	0.16		
		5122	-0.13	345	0.33		
		4935	0.15	163	-0.64		
		4762	0.59	0	-0.91		
		4590	0.56				
		4408	0.01				
		4238	0.18				
		4019	0.15				
		3836	0.10				
		3528	0.02				
		3321	-0.01				
		3083	-0.09				
		2840	-0.16				
		2651	0.53				
		2452	0.39				
		2247	0.31				
		1992	0.57				
		1692	0.04				
		1092	-0.29				
		570	-0.31				
		173	-0.78				



**Appendix V: North slough channel longitudinal profile data.**

2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation
2021	1.78	2022	1.69	0	-0.65
1843	1.39	1801	1.10	218	-0.59
1784	1.21	1414	1.53	451	1.02
1620	1.58	1181	1.47	615	1.23
1465	1.43	1010	1.38	880	2.03
1329	1.43	863	1.44	1127	1.96
1190	1.58	689	1.33	1404	1.61
1032	1.67	563	0.77	1801	1.20
867	1.49	429	0.93	1999	1.29
640	1.25	268	0.06		
489	0.99	185	-0.41		
234	1.06	35	0.25		
155	-0.12	0	-0.06		
120	-0.55				
112	-0.45				
30	-0.08				

**Appendix VI: South slough channel longitudinal profile data.**

2015		2016		2017	
Distance	Elevation	Distance	Elevation	Distance	Elevation
4687	3.57	4687	3.53	4620	3.55
4393	3.31	4526	3.27	4542	3.49
4111	3.27	4395	3.21	4359	3.34
3935	3.13	4042	3.17	4192	3.27
3670	3.37	3666	3.29	3882	3.18
3262	3.21	3410	3.11	3524	2.92
2865	2.77	3197	2.97	3229	2.91
2571	2.51	3003	2.86	3052	2.21
2365	2.37	2805	2.62	2864	2.26
2156	2.23	2437	2.31	2537	2.08
1959	1.96	2151	1.91	2073	2.03
1703	1.58	1750	1.50	1828	1.98
1344	1.39	1322	1.34	1354	1.48
1053	1.30	937	1.05	1152	1.49
902	1.17	815	0.08	923	1.39
744	0.81	530	0.74	737	0.02
		322	0.58	510	0.52
		32	0.03	224	0.19
		0	0.27	0	0.14

**Appendix VII:** 2015, 2016 and 2017 Photographic analysis of Salt River, North and South channels  
(All photos by Daniel O'Shea):



1-A) 2015 Salt River main channel cross section 1 –SR1. View is looking south toward the left bank.



1-B) 2016 Salt River main channel cross section 1 –SR1. View is looking south toward the left bank.



1-C) 2017 Salt River main channel cross section 1 –SR1. View is looking south toward the left bank.



2-A) 2015 Salt River main channel cross section 2 –SR2. View is looking south.



2-B) 2016 Salt River main channel cross section 2 –SR2. View is looking south.



2-C) 2017 Salt River main channel cross section 2 –SR2. View is looking toward left bank (south).



a)



b)

2-D) 2017 Salt River main channel cross section 2 –SR2. View is looking: a) upstream, b) downstream.





3-A) 2015 Salt River main channel cross section, SR3. View is looking upstream.



3-B) 2016 Salt River main channel cross section, SR3. View is looking upstream.



3-C) 2017 Salt River main channel cross section SR3. View is looking across the channel from the right bank towards the left bank.



N1-A) 2015 North slough channel cross section 1 –NC1. View is looking south. Note scour on left bank indicated by arrow.



N1-B) 2016 North slough channel cross section NC-1. View is looking south. Continued scour on left bank indicated by arrow.



a) N1-C) 2017 North slough channel cross section NC-1. View a) is looking downstream toward SR confluence showing the ongoing scour upstream on the left bank indicated by arrow. NC1-C b) is looking upstream.





N2-A) 2015 North slough channel cross section NC2. View is looking west.



N2-B) 2016 North slough channel cross section NC2. View is looking west.



N2-C) 2017 North slough channel cross section NC2. View is looking west showing erosion on upper section of the right bank.



N2-D) Rootwad in 2017 survey downstream of NC2 with downstream erosion indicated.



N2-E) North branch cross section NC2 view upstream showing the confluence of the three branches with NC3 indicated by the arrow.





N3-A) 2017 North Channel cross section NC3 with exposed endpin (yellow notepad) under 10 cm of sediment in 2017. View is looking north toward the left bank.



N3-B) 2017 North Channel cross section NC3 cross section view looking upstream.



N3-C) 2017 North Channel cross section NC3 cross section view looking downstream.



N3-D) NC3 survey endpin in 2016 buried by 5 cm of sediment since 2015.



N3-E) NC3 survey endpin in 2017 now buried by 10 cm of sediment since 2015.