Water Resources and Policy Initiatives (WRPI) Final Report: Geomorphological Survey of Piru Creek, Downstream of Pyramid Lake

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Executive Summary

With Pyramid Lake Dam being due for Federal Energy Regulatory Commission (FERC) relicensing, Angeles National Forest (ANF) dispatched a team to acquire baseline data in order to monitor the effects of the dam on Piru Creek downstream of Pyramid Lake. Original project objectives were to collect data for cross sectional elevations, total dissolved solids and electrical conductivity, stream velocity, water chemistry (PH, dissolved O2, fecal coliform), wolman pebble count, and suspended sediment. All of the objectives were met, with the exception of suspended sediment due to vacuum pump mechanical issues. Having a small and inexperienced team proved to be strong limitations. This internship has instilled confidence and helped me gain skills as a river surveyor that I would not have had otherwise, and am now strongly considering a future career with the USDA.

Project Objectives

Introduction

Pyramid Lake Dam, located in Los Angeles County CA, was due for Federal Energy Regulatory Commission (FERC) relicensing, and Angeles National Forest (ANF) dispatched a team for this project in order to acquire baseline data in order to monitor the effects of the dam on Piru Creek downstream of Pyramid Lake.

Potential USDA Career Pathways

At this time, I am highly considering a hydrologic technician position with the US forest service, and it's only by completing this internship that I realized that I would be capable of this position.

Original Project Goals

Project objectives were to establish baseline geomorphological measurements for Piru Creek downstream of Pyramid Lake (Figure 22), involving the collection of the following datasets:

1. Channel elevations, derived from channel cross section surveys
2. Total dissolved solids and electrical conductivity
3. Stream velocity
4. Water chemistry, consisting of: PH, dissolved oxygen, and fecal coliform
5. Wolman pebble count
6. Suspended Sediment

Suspended sediment later had to be discarded due to mechanical issues with the laboratory's vacuum pump.

Project Approach

Data Collection

Channel cross sections were performed at four locations, selected out of the stream's reach to most accurately represent the reach's geomorphic nature. Total dissolved solids/electrical conductivity, velocity, water chemistry, wolman pebble count, and suspended sediment were collected for each of these cross sections.

Channel cross sections were performed to collect channel elevation, beginning from right bankfull and ending at left bankfull. USGS benchmarks were used as elevation reference points. Due to high incline slope, cross sections were generally performed with a total station, while with only cross section 4 being performed with an autolevel due to total station battery failure.

Total dissolved solids (TDS) and electrical conductivity (EC) were collected with an HM digital COM-80 handheld meter which was able to deliver immediate results in the field. Samples were collected in the stream's right of center, center, and left of center.

Velocity was collected with a Flowprobe fp111 mechanical current meter. Depth averaged velocities for the stream's right bank, center, and left bank were collected by slowly "sweeping" the meter vertically over the course of 30 seconds. Due to the flowprobe's onboard computer capable of velocity averaging, results were acquired immediately and calculated automatically in the field.

Water chemistry (PH, dissolved oxygen, and fecal coliform) was acquired by collecting water samples in sterile 100 ML Nalgene bottles while wearing sterile, unused latex gloves. Water samples were taken at the stream's right of center, center, and left of center. Samples were brought back to the laboratory for later testing.

Wolman pebble count were performed by looking straight ahead to select random samples beginning at right bank and ending at left bank. Samples' long, intermediate, and short axes were measured using imperial ruler and measuring tape, and their shape was noted (angular, sub angular, rounded, and well rounded). These results were determined immediately in the field with no calculation.

Suspended sediment was collected with a DH-48 at the stream's right of center, center, and left of center.

Data Processing

Results for TDS/EC and velocity were calculated automatically in the field, while the wolman pebble count required no calculation. The following includes information on how final results were derived from raw data back in the laboratory.

Channel cross section elevations for total station and autolevel were calculated by using the following formulas.

Total station	Elevation = height of instrument + (vertical distance – prism height)

Autolevel	Elevation = height of instrument – middle stadia

Water chemistry (PH, dissolved oxygen, and fecal coliform) were all analyzed in the laboratory. PH was analyzed using a handheld PH meter, dissolved oxygen was analyzed with an AquaKing colorimeter, while fecal coliform was analyzed using a chemical tester in conjunction with an incubator.

Suspended sediment was unable to be processed due to mechanical issues with the vacuum pump, and so the collected samples were discarded.

Project Outcomes

Results

With the exception of suspended sediment, objectives were successfully met, and the results are viewable in the appendix (Figure 1 – Figure 21).

Limitations

This project was accomplished with a team of 2 people, which is considered shorthanded of the typical 6 for a river surveying crew. Additionally, the team lacked much experience, and thus much time was spent on learning river surveying technique and methods and performing a survey from start to finish. Due to these factors, performing US Forest Service Stream Condition Inventory (SCI) was not a viable option.

Conclusions

Overall, baseline data was successfully collected, with the exception of suspended sediment.

Future Research

Future research at this study site should remedy the limitations experienced on this project, which includes a larger team. Additionally, a Stream Condition Inventory should be conducted to establish baseline measurements in accordance with US Forest Service Hydrology protocol.

Internship Impact on Career Goals

This experiential learning internship has given me confidence in my skills as a river surveyor by strongly reinforcing techniques learned in my academics. The confidence that developed from this internship has created a cascade of other opportunities in my academics for me to further explore and develop these skillsets. As a result of this internship, I will be entering another internship with the USDA in the summer of 2019, and hope to gain eventual permanent employment with the USDA.

Appendix

Cross Section 1

Cross Section 1									
STATION	HI	SDx	HD	HA	VA	VD	ELEV	NOTES	
UNITS	FT	FT	FT	° " '	° " '	FT	FT	Monday July 23, 2018 9:30 AM	
P1TBM2							2222.196	No cloud cover, sunny, 939.2	
BS1	2,211.34	145.44	144.46	48.55.17	83.20.47	16.85	2,222.20	BS to P1TBM1	
FS1	2,211.34	43.52	43.23	227.51.39	96.39.52	-5.05	2,200.29	FS to "P1TBM1a"	
BS2	2,192.51	97.16	96.18	47.53.21	81.50.47	13.78	2,184.73	BS to "P1TBM1a" from P1TBM2	
FS2	2,192.51	25.74	23.82	182.38.50	67.42.08	9.77	2,196.28	FS to starting point of cross	
FS3	2,192.51	25.57	24.64	219.44.17	105..31.1	-6.84	2,179.67	FS to 2nd point	
FS4	2,192.51	38.20	35.54	249.42.19	111.30.24	-14.01	2,172.51		
FS5	2,192.51	45.18	42.48	257.40.43	109.56.01	-14.40	2,172.11		
FS6	2,192.51	54.42	51.63	268.42.04	108.25.23	-17.20	2,169.32		
FS7	2,192.51	61.03	57.53	273.11.06	109.29.44	-20.37	2,166.15		
BS3	2,192.51	54.61	51.16	86.01.41	69.32.42	19.08	2,205.60	Set up at Northside of big flat	
FS8	2,192.51	6.72	6.40	301.59.02	107.47.52	-2.05	2,184.46		
FS9	2,192.51	29.47	29.31	296.33.58	95.53.14	-3.02	2,183.49		
FS10	2,192.51	33.97	33.77	297.27.00	96.11.23	-3.62	2,182.89		
FS11	2,192.51	40.06	39.79	295.57.19	96.45.30	-4.71	2,181.80		
FS12	2,192.51	43.68	43.32	285.40.12	97.19.31	-5.57	2,180.95		
FS13	2,192.51	50.62	50.14	296.30.31	97.56.05	-6.99	2,179.53	Right bank dry	
FS14	2,192.51	55.57	54.92	298.21.31	98.46.59	-8.49	2,178.03	Right bank wet	No right of center. Can't touch ground because of rock
FS15	2,192.51	60.67	59.99	299.44.52	98.37.10	-9.09	2,177.42	Center	
FS16	2,192.51	64.90	64.33	301.04.48	97.36.08	-8.86	2,177.66	Left of center	
FS17	2,192.51	67.24	66.61	299.11.35	97.58.53	-9.18	2,177.33	left bank wet.	
FS18	2,192.51	75.84	75.46	296.35.43	95.41.52	-7.53	2,178.98	Left bank dry	
FS19	2,192.51	82.09	81.86	296.44.26	94.17.20	-6.14	2,180.37		
FS20	2,192.51	90.78	90.63	297.16.43	93.17.28	-5.21	2,182.30	PH changed from 6 to 5 ft.	
FS21	2,192.51	98.15	98.07	296.57.54	92.17.47	-3.93	2,183.58		

Figure 1: Cross section 1 channel survey

CS1 TDS/EC				
STATION	°C	mS	PPM	NOTES
Right bank	24	1	226	7-23-2018
Center	22	1	229	
Left bank	22	1	232	

Figure 2: Cross section 1 total dissolved solids and electrical conductivity

CS1 Velocity		
STATION	Ft/S	NOTES
Right bank	0.1	7-20-2018
Center	0.2	
Left	0.2	

Figure 3: Cross section 1 velocity

CS1 water chemistry	
STATION	PH
Right of center	8.43
Center	8.45
Left of center	7.37
STATION	Dissolved O2
Right of center	1 PPM
Center	0.3 PPM
Left of center	1.3 PPM
STATION	Fecal Coliform
Right of center	negative
Center	negative
Left of center	negative

Figure 4: Cross section 1 water chemistry (PH, dissolved O2, fecal coliform)

CS1 Wolman Pebble Count					
	A (inches)	B (inches)	C (inches)	Shape	Notes
1	5.5	3.5	2.25	sub angular	right to left bank, using imperial ruler, not 10ths
2	4	4	3	sub angular	
3	4.25	3.25	1.25	angular	
4	2.75	2	2	sub rounded	
5	4.25	2.5	1.5	angular	
6	5	4.5	2.75	sub rounded	
7	4.25	3.25	2.5	sub angular	
8	3.5	2.75	1.5	sub angular	
9	2	1.5	1	sub rounded	
10	5	4	2.5	sub rounded	
11	5	4.5	2.25	rounded	
12	3.5	2.5	1.75	rounded	
13	2.5	2	1.75	sub rounded	
14	11.5	3.7	2.25	very angular	
15	4.5	2.5	1	sub rounded	
16	7	4.25	3.25	well rounded	
17	7.5	6.5	3	sub angular	
18	6.5	4.5	3.25	sub rounded	
19	5.5	3.5	1.5	sub rounded	
20	3.5	2.25	1.5	rounded	
21	3	2.5	1	sub angular	
22	7.75	3.5	2.5	angular	
23	5	4.5	2.5	rounded	
24	7.5	4.5	4	sub angular	
25	20	14	8	angular	
26	38	19	9	sub angular	
27	16	10	8	angular	
28	12	11	4	angular	
29	35	30	13	sub angular	
30	14	13	8	sub rounded	

Figure 5: Cross section 1 wolman pebble count

Cross Section 2

Cross Section 2								
STATION	HI	SDx	HD	HA	VA	VD	ELEV	NOTES
UNITS	FT	FT	FT	° " '	° " '	FT	FT	Friday 8/10/18 8:45 AM
P2TBM1							2216.58	
BS1	2169.15	123.17	110.98	272.56.57	64.17.42	53.42	2216.58	BS1 to P2TBM1 at start point
FS1	2169.15	4.502	4.5	73.16.16	91.45.30	-0.14	2163.01	FS1 from start point
FS2	2169.15	30.758	30.734	64.25.20		-1.23	2161.92	
FS3	2169.15	46.894	46.856	64.08.23	92.19.25	-1.9	2161.25	
FS4	2169.15	53.768	53.606	62.53.03		-4.18	2158.97	
FS5	2169.15	62.872	62.714	63.12.59	94.03.54	-4.46	2158.7	
FS6	2169.15	66.32	66.226	62.49.16	93.02.48	-3.52	2159.63	
FS7	2169.15	85.272	84.93	62.46.04	95.08.10	-7.63	2154.02	Right bank dry. Adjuted PH from 6 to 7
FS8	2169.15	89.626	89.348	62.33.58	94.30.24	-7.04	2153.61	Right bank wet. Adjusted PH to 8.5
FS9	2169.15	92.224	91.976	62.02.06	94.12.29	-6.77	2153.88	Right of center
FS10	2169.15	94.518	94.254	62.02.17		-7.06	2153.6	Center
FS11	2169.15	97.128	96.826	62.42.25	94.30.46	-7.64	2153.01	Left of center
FS12	2169.15	98.966	98.68	62.37.49	94.21.13	-7.51	2153.14	Left bank wet
FS13	2169.15	100.59	100.31	62.46.54	94.15.50	-7.48	2153.17	Left bank dry
FS14	2169.15	103.67	103.47	62.20.11	93.33.36	-6.44	2154.71	Adjusted PH to 8 ft
FS15	2169.15	108.27	108.1	62.00.31	93.16.05	-6.17	2154.98	
FS16	2169.15	115.69	115.66	61.26.08	91.16.42	-2.58	2158.57	
FS17	2169.15	122.75	122.74	60.48.51	90.51.42	-1.85	2159.31	
FS18	2169.15	126.4	126.4	60.20.49	90.18.26	-0.68	2160.47	

Figure 6: Cross section 2 channel survey

CS2 TDS/EC				
STATION	°C	mS	PPM	NOTES
Right bank	22	1	256	8-10-2018
Center	21	1	257	
Left bank	20	1	262	

Figure 7: Cross section 2 total dissolved solids and electrical conductivity

CS2 Velocity		
STATION	Ft/S	NOTES
Right bank	3.6	8/10/2018
Center	0.9	
Left	0.8	

Figure 8: Cross section 2 velocity

CS2 water chemistry	
STATION	PH
Right of center	7.42
Center	8.07
Left of center	8.09
STATION	Dissolved O2
Right of center	0 PPM
Center	0.28 PPM
Left of center	1.0 PPM
STATION	Fecal Coliform
Right of center	negative
Center	negative
Left of center	negative

Figure 9: Cross section 2 water chemistry (PH, dissolved O2, fecal coliform)

CS2 Wolman Pebble Count					
	A (inches)	B (inches)	C (inches)	Shape	Notes
1	1.5	1.75	0.25	sub rounded	right to
2	0.75	1.5	0.5	well rounded	
3	0.75	1	0.5	sub angular	
4	0.5	1	0.25	rounded	
5	0.5	0.75	0.25	sub angular	
6	0.5	0.5	0.25	sub angular	
7	0.5	0.75	0.25	sub angular	
8	0.25	0.25	0.25	angular	
9	0.25	0.25	0.25	well rounded	
10	0.25	0.5	0.25	sub angular	
11	7.5	8	4	sub rounded	
12	2	2.75	1.5	rounded	
13	0.5	1	2.5	rounded	
14	1	2	2.5	rounded	
15	0.75	1	0.5	sub angular	
16	0.75	1.25	0.5	well rounded	
17	0.75	1	0.25	sub angular	
18	31	45	16	angular	
19	18	19.5	11	angular	
20	19	26	10	angular	
21	7.5	8	3.25	angular	
22	53.5	74	18	sub rounded	
23	2.5	4	1	well rounded	
24	4	5.5	2.5	sub angular	
25	3	4	1.5	subrounded	
26	2	2.25	0.75	angular	
27	1	1.5	0.75	sub rounded	
28	1.25	1.75	1	sub rounded	
29	6.5	8.5	5.5	rounded	
30	7.5	11.5	25	angular	

Figure 10: Cross section 2 wolman pebble count

Cross Section 3

Cross Section 3								
STATION	HI	SDx	HD	HA	VA	VD	ELEV	NOTES
UNITS	FT	FT	FT	° " '	° " '	FT	FT	
BM							2155.93	
BS 1	2161.84	67.394	67.394	156.20.31	89.55.20	0.092	2155.93	this BS was tken to
FS1	2161.84	79.166	74.314	48.21.02	110.09.43	-27.29	2128.56	
FS2	2161.84	86.044	81.036	47.51.16	109.38.47	-28.93	2126.91	
FS3	2161.84	94.926	89.34	48.07.18	109.45.20	-32.09	2123.76	
FS4	2161.84	101.45	95.74	47.53.53	109.18.32	-33.54	2119.8	
FS5	2161.84	107.69	102.34	48.10.59	108.08.12	-33.52	2119.82	
FS6	2161.84	114.34	109.83	48.27.33	106.08.19	-31.78	2121.56	
FS7	2161.84	121.75	118.04	48.33.08	104.10.30	-29.81	2123.53	
FS8	2161.84	132.22	128.78	48.48.07	103.05.31	-29.95	2123.39	
FS9	2161.84	145.87	141.91	48.25.37	103.23.08	-33.77	2119.57	Placed TS on FS9
BS2	2091.27	129.1	123.75	231.42.25	73.26.18	36.8	2119.57	This is when height
FS10	2091.27	29.042	28.996	42.32.58	42.32.58	-1.646	2081.13	
FS11	2091.27	33.73	33.708	42.44.02	92.06.01	-1.236	2081.54	
FS12	2091.27	39.352	39.252	42.23.51	94.04.15	-2.982	2079.79	
FS13	2091.27	41.988	41.86	44.04.57	94.28.01	-3.27	2079.5	
FS14	2091.27	48.058	47.924	42.18.23	94.16.28	-3.582	2079.19	
BS3	2077.96	44.89	43.824	215.20.36	77.20.97	9.734	2079.19	
FS15	2077.96	4.908	4.898	357.46.31	85.52.11	0.354	2069.81	
FS16	2077.96	6.148	6.14	12.16.10	92.45.00	-0.294	2069.16	
FS17	2077.96	9.472	9.384	21.12.58	97.46.18	-1.28	2068.18	
FS18	2077.96	12.996	12.884	25.27.12	97.31.29	-1.702	2067.76	ds right bank dry
FS19	2077.96	14.184	13.978	25.30.04	99.47.13	-2.412	2067.05	right bank wet
FS20	2077.96	16.228	16.048	24.10.57	98.18.20	-2.342	2067.12	right of center
FS21	2077.96	17.318	17.136	24.28.50	98.18.22	-2.502	2066.96	center
FS22	2077.96	20.334	20.174	19.37.35	97.11.07	-2.544	2066.91	left of center
FS23	2077.96	22.958	22.846	28.18.02	95.40.24	-2.27	2067.19	left bank wet
FS24	2077.96	23.87	23.798	35.01.37	94.26.18	-1.848	2067.61	left back dry
FS25	2077.96	25.146	25.102	26.49.16	93.22.34	-1.48	2067.98	
FS26	2077.96	33.692	33.506	25.42.44	96.00.50	-3.53	2069.03	
FS27	2077.96	40.082	39.902	25.17.34	95.25.38	-3.79	2069.27	
FS28	2077.96	42.94	42.83	25.06.27	94.05.28	-3.064	2069.99	

Figure 11: Cross section 3 channel survey

CS3 TDS/EC				
STATION	°C	mS	PPM	NOTES
Right bank	23	1	287	8-2-2018
Center	23	1	288	
Left bank	23	1	289	

Figure 12: Cross section 3 total dissolved solids and electrical conductivity

CS3 Velocity		
STATION	Ft/S	NOTES
Right bank	0.5	8/2 2018
Center	1.3	
Left	0.2	

Figure 13: Cross section 3 velocity

CS3 water chemistry	
STATION	PH
Right of center	8.05
Center	7.77
Left of center	8.06
STATION	Dissolved O2
Right of center	N/A
Center	N/A
Left of center	N/A
STATION	Fecal
Right of center	negative
Center	negative
Left of center	negative

Figure 14: Cross section 3 water chemistry (PH, dissolved O2, fecal coliform)

CS3 Wolman Pebble Count					
	A (inches)	B (inches)	C (inches)	Shape	Notes
1	3	3.75	2	rounded	right to left
2	4.25	3.5	2	angular	
3	3.5	3	0.1	well rounded	
4	2.25	1.25	1	sub rounded	
5	2.5	2	0.75	sub angular	
6	5.75	5	2.5	rounded	
7	2	1	1	sub rounded	
8	2	1	0.25	sub rounded	
9	2	1.5	0.5	angular	
10	1.5	1	0.25	angular	
11	3	1.75	1.5	angular	
12	4.5	4.5	2.75	sub angular	
13	2.5	2	1.75	sub rounded	
14	3.5	2.5	1.5	sub angular	
15	1.25	0.75	0.75	sub angular	
16	1.25	0.5	0.75	angular	
17	1	0.75	0.5	sub angular	
18	1	1	0.5	sub rounded	
19	3	2	1.25	sub angular	
20	2.75	2	0.75	angular	
21	0.75	1.5	0.75	sub angular	
22	31	2.5	1.5	sub angular	
23	2.5	1.5	1	rounded	
24	4	2.5	3	sub rounded	
25	2	2	0.5	rounded	
26	2	1.5	1	angular	
27	2.5	2.5	1	sub rounded	
28	4.5	3	2.75	sub rounded	
29	5	3.5	2	sub angular	
30	4	2	2.5	rounded	

Figure 15: Cross section 3 wolman pebble count

Cross Section 4

Cross Section 4 (part 1 of 2)								
STATION	HI	SDx	HD	HA	VA	VD	ELEV	NOTES
UNITS	FT	FT	FT	° " '	° " '	FT	FT	Monday July 9, 2018 10:10 AM
								942 hPa, 34.6°C, Cirrus 20%
								Total Station = Kevin, Rod = Suzette, Notetaker = Amalie
P3 TBM1							2181.22	
BS1	2173.01	256.42	256.42	171.50.32	86.49.40	14.212	2181.22	BS to P3TBM1, PH= 6.0 FT
P3TBM2	2173.01	99.638	98.908		96.56.31	-12.04	2154.97	FS to point (Nail w/flag) on SE edge of concrete irish bridge
B2	2140.07	248.67	247.79	207.17.03	85.10.47	20.898	2154.97	TS moved to irish bridge across from CK. BS to TBM P3TBM2
FS P3 TBM3	2140.07	62.942	62.924	74.56.57	91.22.30	-1.51	2132.56	FS to point (Nail) near big tree in dry channel west of gravel bar
								*Battery change) battery failure as soon as PT.4 read
								Kevin photographed the data & then recorded, 35°5°C
								1100
								Moved TS to bridge below gate. BS (3) to P3TBM2 to get HI, then shot to P3TBM4, then changed to auto level

Figure 16: Cross section 4 channel survey with autolevel

Cross Section 4 Automatic Level (part 2 of 2)							
STATION	HI	BS	FS	BEARING	DISTANCE	ELEV	NOTES (part 2 of 2)
							With T.S. battery failure, the auto level was moved to the gravel bar, then a BS to TBM P3TBM4 (near big tree on the west side of the boulder channel) was taken. All subsequent readings done with auto level continue same STN numbering
	2139.16	6.8		223	0.35	2132.562	
		6.6					
		6.4					
6	2139.16		6.9	226	0.729	2132.608	East bank of west channel with sand bar
			6.55				
			6.17				
7	2139.16		5.42	224	0.625	2134.058	flood plain towards level with nettles, willows
			5.1				
			4.79				
8	2139.16		4.42	222	1.325	2135.408	floodplain (little ridge in channel)
			3.75				
			3.09				
9	2139.16		7.04	223	0.292	2132.266	in bouldery channel (dry)
			6.9				
			6.75				
10	2139.16		7.88	222	0.25	2131.412	in bouldery channel (dry)
			7.75				
			7.63				
11	2139.16		8.38	225	0.167	2130.87	in bouldery channel (dry)
			8.29				
			8.21				
12	2139.16		7.85	226	0.125	2131.37	channel east edge with vegetation
			7.79				
			7.73				
13	2139.16		6.69	229	0.084	2132.516	base of boulder bar
			6.65				
			6.6				
14	2139.16		4.94	247	0.042	2134.245	west edge of boulder bar
			4.92				
			4.9				
15	2139.16		5.73	42	0.062	2133.454	rod placed on east side of bar
			5.71				
			5.67				
16	2139.16		7.69	45	0.146	2131.516	low west edge of gravel bar
			7.65				
			7.54				
17	2139.16		8.48	42	0.229	2130.808	west edge of active channel
			8.35				
			8.25				
18	2139.16		9.02	42	0.229	2130.266	in water 6"
			8.9				
			8.79				
19	2139.16		9	40	0.292	2130.308	in water 6.5"
			8.85				
			8.71				
20	2139.16		9.08	39	0.291	2130.224	in water 5.5"
			8.94				
			8.79				
21	2139.16		8.79	37	0.667	2130.704	east edge of active channel
			8.46				
			8.13				
22	2139.16		7.54	33	0.417	2131.829	east bank of channel with boulders
			7.33				
			7.13				
23	2139.16		7.63	39	0.521	2131.797	"floodplain"
			7.37				
			7.1				
24	2139.16		7.17	54	0.5	2132.245	boulders above floodplain
			6.92				
			6.67				

Figure 17: Cross section 4 channel survey with total station

CS4 TDS/EC				
STATION	°C	mS	PPM	NOTES
Right bank	24	1	374	8-2-2018
Center	24	1	375	
Left bank	25	1	369	

Figure 18: Cross section 4 total dissolved solids and electrical conductivity

CS4 Velocity		
STATION	Ft/S	NOTES
Right of center	0.4	7-9-2018
Center	1	Left bank downstream
Left of center	0.9	

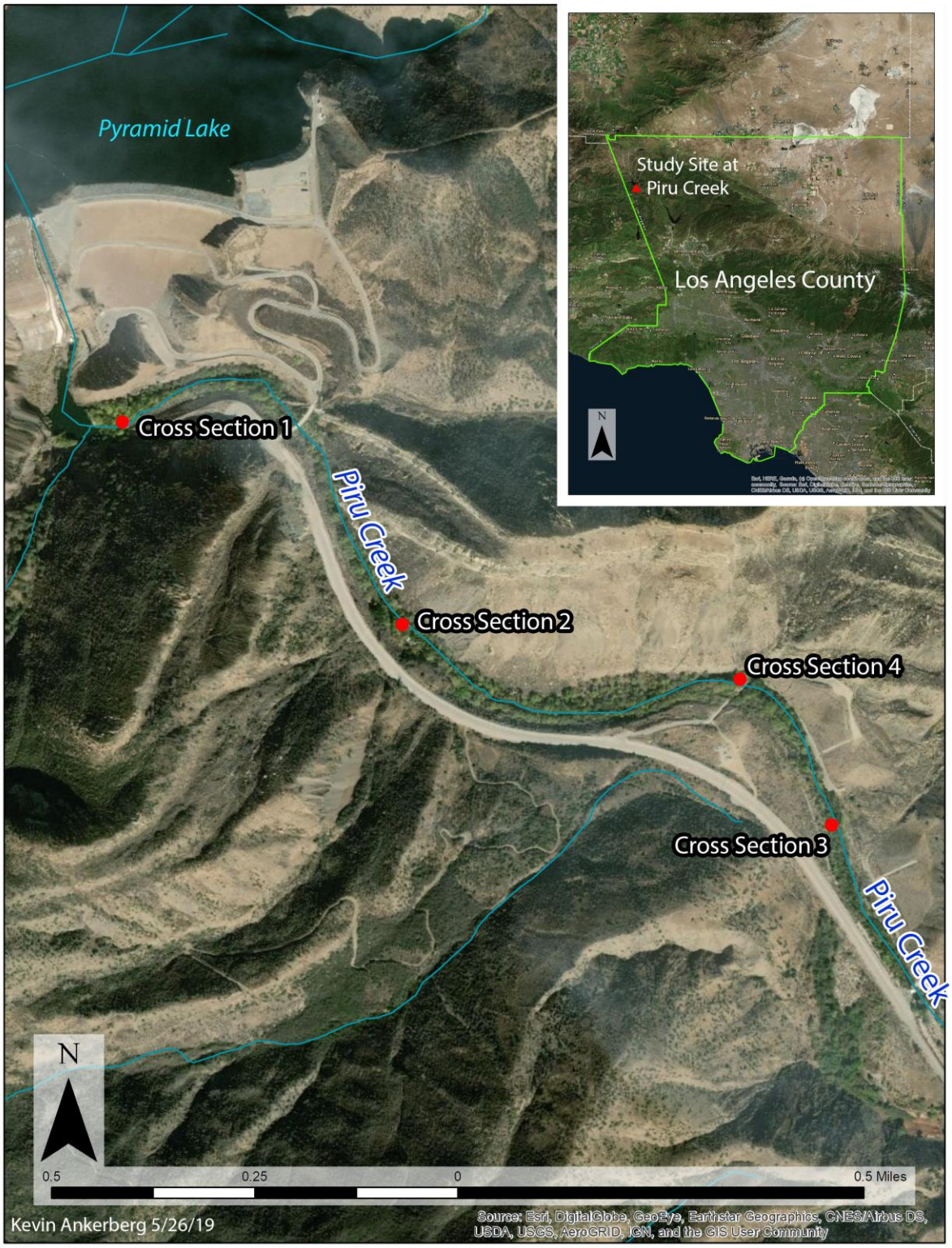
Figure 19: Cross section 4 velocity

CS4 water chemistry	
STATION	PH
Right of center	7.74
Center	7.73
Left of center	7.15
STATION	Dissolved O2
Right of center	N/A
Center	N/A
Left of center	N/A
STATION	Fecal
Right of center	negative
Center	negative
Left of center	negative

Figure 20: Cross section 4 water chemistry (PH, dissolved O2, fecal coliform)

CS4 Wolman Pebble Count					
	A	B	C	Shape	Notes
1	0.9	0.8	0.3	sub angular	right to left bank, using imperial ruler, not 10ths
2	0.8	0.7	0.2	angular	
3	0.75	0.525	0.1	angular	
4	0.3	0.3	0.1	angular	
5	0.275	0.275	0.025	angular	
6	0.9	0.8	0.5	sub angular	
7	0.2	0.1	0.05	sub rounded	
8	0.5	0.4	0.1	angular	
9	0.2	0.125	0.1	angular	
10	1.25	0.55	0.3	angular	
11	0.6	0.55	0.15	angular	
12	0.55	0.3	0.1	angular	
13	0.45	0.35	0.3	sub rounded	
14	0.3	0.25	0.15	angular	
15	0.275	0.1	0.05	very angular	
16	0.775	0.75	0.3	angular	
17	0.65	0.625	0.25	angular	
18	0.2	0.2	0.125	round	
19	0.95	0.7	0.2	angular	
20	0.4	0.2	0.125	angular	

Figure 21: Cross section 4 wolman pebble count



- **Figure 22:** Study site location at Piru Creek, downstream of Pyramid Lake. Data sources: https://catalog.data.gov/dataset/tiger-line-shapefile-2016-state-california-current-census-tract-state-based; ESRI; USGS hydrography dataset.