Stream Fish Populations
SUMMARY

Consistent with Section 6.0 of the *Stream Fish Populations Study Plan* (Plan) as filed with FERC on January 9, 2017[1], the SSWD provides the following status update for the *Stream Fish Populations Study (Study).* The summary includes a description of work completed to date, key findings, variances, and remaining work. Links to associated data files are also included. The SSWD consider these data to be public.

Work Completed as of 4/1/18:

SSWD has completed all, or portions of each of the three steps outlined in the Plan. Step 1, SSWD selected sampling sites on the Bear River; Step 2, fall fish population sampling was conducted in October 2017 and eDNA (environmental deoxyribonucleic acid) sample collection was conducted in February and March of 2017; and Step 3, quality control/quality assurance and data analysis of all data has been ongoing since the inception of data collection in March of 2017.

Fish population and eDNA data for all completed activities are provided in this summary. Fish population sampling included electrofishing in Reach 1 and snorkel surveys and seine hauls for the fall sampling period in Reaches 2, 3, and 4 (Table 1). Imagery of each fish population site can be found on SSWD's public relicensing website. eDNA sampling was conducted in Reaches 2 through 4 and aerial imagery of sample locations and findings are provided in Figures 1 through 3.

Table 1. Location and Dates of Stream Fish Surveys.

Location	Survey Type	River Mile	Date of Survey(s)	Latitude	Longitude
CAMP FAR WEST DAM REACH					
Reach 1	Backpack Electrofishing	17.8	10/27/2017	39.0484111	121.3192528
LOWER BEAR RIVER					
Reach 2	eDNA	16.9	2/22/2017, 3/8/2017	39.0417222	121.3322222
Reach 2	eDNA	16.7	2/22/2017, 3/8/2017	39.0394444	121.3347500
Reach 2	Snorkel/Seine	15.0	10/25/2017	39.0233500	121.3544417
Reach 3	eDNA	11.4	2/23/2017, 3/8/2017	38.9996667	121.4072222
Reach 3	Snorkel/Seine	7.8	10/24/2017	38.9879889	121.4692667
Reach 4	eDNA	5.1	3/1/2017, 3/15/2017	38.9783056	121.5166389
Reach 4	Snorkel/Seine	4.5	10/26/2017	38.9736389	121.5244111
Reach 4	eDNA	4.0	3/1/2017, 3/15/2017	38.9740833	121.5349167
Reach 4	eDNA	0.6	2/28/2017, 3/15/2017	38.9434722	121.5709444

[1] The Plan is available on SSWD's public relicensing website (www.sswdrelicensing.com) under 'Study Plans.'

Figure 1. eDNA Sampling Locations (Reach 2).

Figure 2. eDNA Sampling Location (Reach 3).

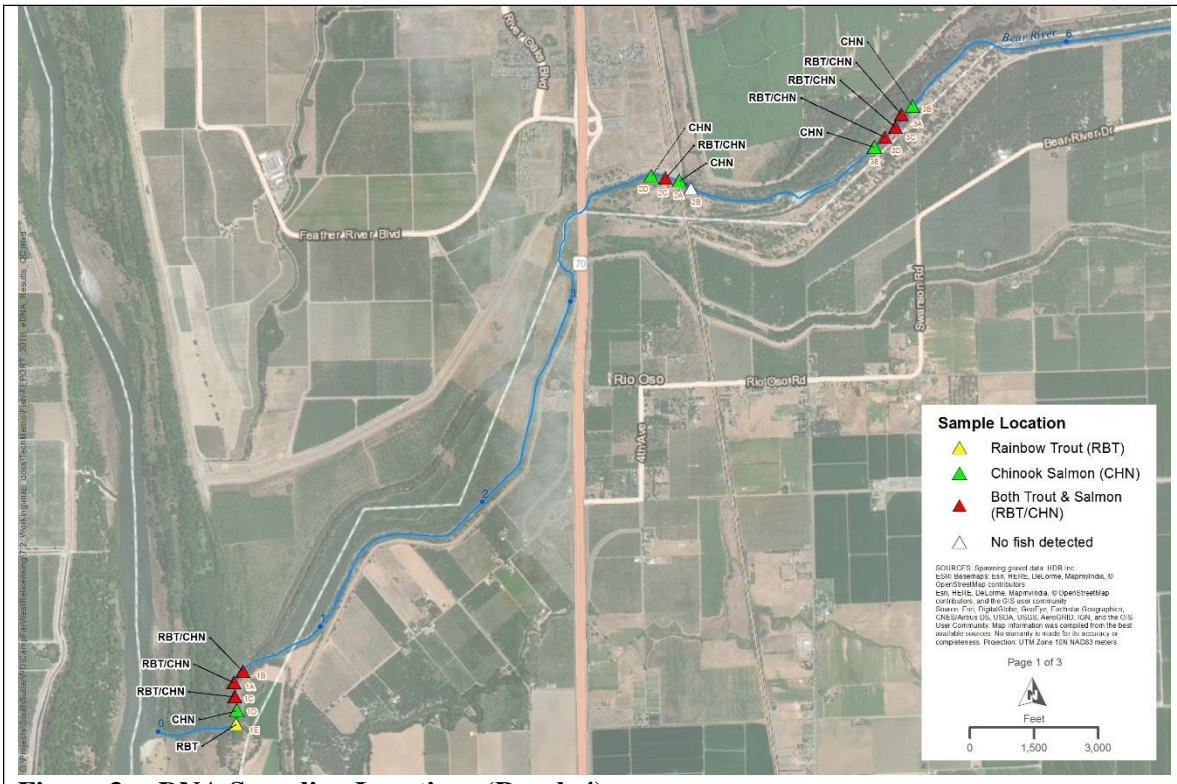

Figure 3. eDNA Sampling Locations (Reach 4).

Key Findings:

Electrofishing and Seining

The fish population sample site in Reach 1 was represented by a series of riffle, pool, run habitat units. The channel and substrate was visibly composed of bedrock with moderate amounts of cobble. Depth was minimal and averaged 0.2 m (Table 3).

Table 3. Habitat characteristics for all sites.

		Reach 1	Reach 2	Reach 3	Reach 4
Timing	**Sample date**	October 27, 2017	October 25, 2017	October 24, 2017	October 26, 2017
Water Quality	**Air temp. (C)**	16.0	27.8	26.7	27.8
	Water temp. (C)	12.9	15.8	14	18
	Dissolved oxygen (mg/l)	9.8	10.7	-	10.5
	Conductivity (µS)	88.7	86.2	-	-
Site Characteristics	**Weather**	Clear	Clear	Clear	Clear
	Elevation (m msl)	41.1	29.3	21.3	20.1
	Rivermile	17.8	15	7.8	4.5
	Site length (m)	83.8	145.4	271.3	176.8
	Average site width (m)	7.2	13.7	12.3	13.2
	Average depth (m)	0.2	0.5	0.3	0.5
	Maximum depth (m)	1.0	1.7	1.1	1.5
	Estimated Flow	16 cfs	16 cfs	16 cfs	16 cfs
Habitat Characteristics	**Dominant substrate**	To be documented in a follow-up survey.	Cobble	Gravel	Gravel
	Sub-dominant substrate		Gravel	Sand	Sand
	Confinement		-	-	-
	Fish passage impediments present		No	No	No

	Number of Large Woody Debris Pieces		0	0	0
	Suitable spawning gravel (sq ft)		-	-	-
	Low-gradient riffle		21.2%	15.2%	4.1%
	High-gradient riffle		-	-	-
	% Run		16.4%	6.1%	-
	% Glide		-	-	21.6%
	% Pool		-	-	-
	% Lateral Pool		32.8%	10.7%	-
	% Mid-channel Pool		29.7%	68.8%	13.0%
	% Chute		-	-	1.7%
	% Trench Pool		-	-	59.6%
GPS Units	**Upstream Coordinate**	**Latitude**	**Latitude**	**Latitude**	**Latitude**
		39.048411	39.023350	38.987989	38.973639
		Longitude	**Longitude**	**Longitude**	**Longitude**
		121.319253	121.354442	121.469267	121.524411
	Downstream Coordinate	**Latitude**	**Latitude**	**Latitude**	**Latitude**
		39.047894	39.022283	38.987758	38.973625
		Longitude	**Longitude**	**Longitude**	**Longitude**
		121.319486	121.353883	121.472219	121.526675

Multi-pass depletion sampling was conducted using two Smith Root LR-24 backpack electrofishers. Sampling results are presented in Table 4, and length-frequency of fish is presented in Figure 5.

Table 4. Population summary of electrofished habitat in Reach 1.

Species		**Bluegill**	**Channel Catfish**	**Green Sunfish**	**Mosquitofish**	**Shiner**	**Spotted Bass**	**White Crappie**
Abundance	**No. captured by pass (total)**	6-2-2 (10)	0-1-0 (1)	43-30-13 (86)	9-11-4 (24)	0-1-0 (1)	42-6-5 (53)	0-1-0 (1)
	Estimated abundance	10	1	104	33	1	53	1
	95% CI	7-13	1-1	83-125	11-55	1-1	51-55	1-1
	Fish/100m[1]	11.9	1.2	124.1	39.4	1.2	63.2	1.2
	Fish/mi[1]	192.0	19.2	1,996.8	633.6	19.2	1017.6	19.2
Length (mm)	**Range (Average)**	52-103 (79)	112	32-98 (63)	21-50 (36)	55	49-167 (85)	56
Weight (g)	**Total**	70.1	7.3	396.1	13	1.5	498.1	1.3
	Range (Average)	2.1-15.0 (7.0)	7.3	0.4-17.1 (4.6)	0.1-1.3 (0.5)	1.5	1.2-53.7 (9.4)	1.3
	Total estimated weight (g)	70.0	7.3	479.0	17.9	1.5	498.1	1.3
	Weight (g)/100m	83.6	8.7	472.6	15.5	1.8	594.2	1.6
	lbs/ac	0.9	0.1	6.5	0.2	<0.1	6.7	<0.1
	kg/ha	1.2	0.1	8.0	0.3	0.03	8.3	0.02
Condition Factor	**Relative – range**	0.44-1.22	N/A	0.67-1.42	0.51-1.83	N/A	0.73-1.89	N/A
	Fulton's – range (average)	0.52-1.49 (1.30)	0.52	1.09-2.33 (1.57)	0.57-2.16 (1.07)	0.90	0.86-2.21 (1.17)	0.74
RSD (% of population >150mm FL)[3]		0	0	0	0	0	3.8	0

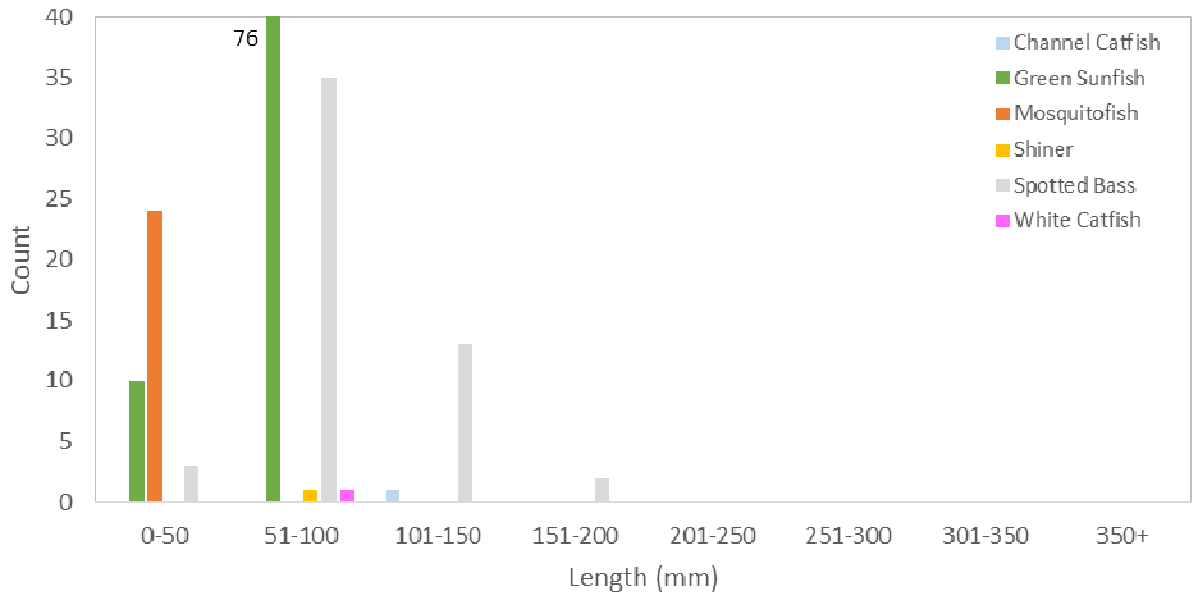

Figure 4. Length-frequency of fish collected during electrofishing in Reach 1.

A three-pass composite snorkel survey and three standardized 10 m seine hauls were completed in Reach 2 -4 sites. Habitat characterictics for each site can be found in Table 3. Sampling results are presented in Tables 5 and 6, and length-frequency of fish is presented in Figure 5.

Table 5. Population summary of snorkeled habitat units in Reaches 2 through 4.

Species	Abundance						Fork length (mm)	
	# Counted by Pass	% of Total Fish Counted	Estimated abundance	95% CI	Fish/100m	Fish/mi	Min (bin)	Max (bin)
SNORKELED REACH 2 - 145.4 Meters								
Spotted Bass	71-76-83	34.3%	76.7	75.3-78.0	52.7	848.6	0-50	151-200
Bluegill	4-9-4	2.5%	5.7	3.1-8.2	3.9	62.7	0-50	51-100
Sacramento sucker	30-10-8	7.2%	16.0	10.0-22.0	11.0	177.1	0-50	151-200
Sacramento Pikeminnow	13-8-7	4.2%	9.3	7.2-11.4	6.4	103.3	51-100	151-200
Mosquitofish	131-114-102	51.8%	115.7	113.0-118.3	79.6	1,280.3	0-50	0-50
SNORKELED REACH 3 - 271.3 Meters								
Spotted Bass	127-162-181	57.7%	156.7	152.4-161.0	57.7	929.3	0-50	251-300
Bluegill	7-3-6	2.0%	5.3	3.5-7.2	2.0	31.6	0-50	101-150
Sacramento Pikeminnow	2-2-2	0.7%	2.0	2.0	0.7	11.9	151-200	251-300
Mosquitofish	77-115-130	39.6%	107.3	102.2-112.5	39.5	636.7	0-50	0-50
SNORKELED REACH 4 - 176.8 Meters								
Spotted Bass	40-36-30	27.1%	35.3	33.7-37.0	20.0	321.3	0-50	301-350
Sacramento Pikeminnow	0-1-0	1.0%	1.0	1.0	0.6	9.1	101-150	101-150
Lepomis sp.	45-66-83	49.6%	64.7	60.0-69.3	36.6	588.9	0-50	201-250
Mosquitofish	30-30-30	23.0%	30.0	30.0	17.0	273.1	0-50	0-50

Table 6. Population summary of 10 m standardized seine hauls in Reaches 2 through 4.

Species	Abundance			Fork length (mm)	Weight (g)	Condition Factor	
	# By Pass (Total)	% of Total Fish	CPUE (catch by pass)	Min-Max (Avg)	Min-Max (Avg)	Relative – range	Fulton's – range (average)
REACH 2 SEINE (n=47)							
Bluegill	0-5-0 (5)	10.6%	1.7	50-58 (54)	1.6-2.4 (1.9)	0.8-1.32	1.02-1.68 (1.23)
Green Sunfish	0-3-0 (3)	6.4%	1.0	44-61 (52)	1.6-3.8 (2.5)	1.08-1.17	1.67-1.88 (1.77)
Mosquito Fish	0-3-0 (3)	6.4%	1.0	30-41 (35)	0.4-0.6 (0.5)	0.89-1.38	0.87-1.48 (1.16)
Pumkinseed	0-1-0 (1)	2.1%	0.3	72	5.1	N/A	1.37
Sacramento pikeminnow	2-0-0 (2)	4.3%	0.7	84-88 (86)	5.9-6.1 (6.0)	0.73-1.81	0.90-1.00 (0.95)
Spotted Bass	0-23-10 (33)	70.2%	11.0	45-152 (61)	1.1-43.9 (3.7)	0.79-0.87	0.86-2.22 (1.22)
REACH 3 SEINE (n=6)							
Spotted Bass	5-0-1 (6)	100.0%	2.0	125-150 (136)	19.4-37.7 (28.3)	0.85-1.38	0.92-1.49 (1.10)
REACH 4 SEINE (n=60)							
Bluegill	0-3-9 (12)	20.0%	4.0	26-117 (54)	0.3-21.5 (3.3)	0.84-1.23	1.07-1.71 (1.26)
Mosquitofish	0-43-0 (43)	71.7%	14.3	12-52 (27)	N/A	N/A	N/A
Riffle Sculpin	0-1-3 (4)	6.7%	1.3	15-110 (63)	2.0-18.0 (6.7)	N/A	1.25-1.51 (1.35)
Spotted Bass	0-0-1 (1)	1.7%	0.3	153 (153)	37.1 (37.1)	0.97	1.04

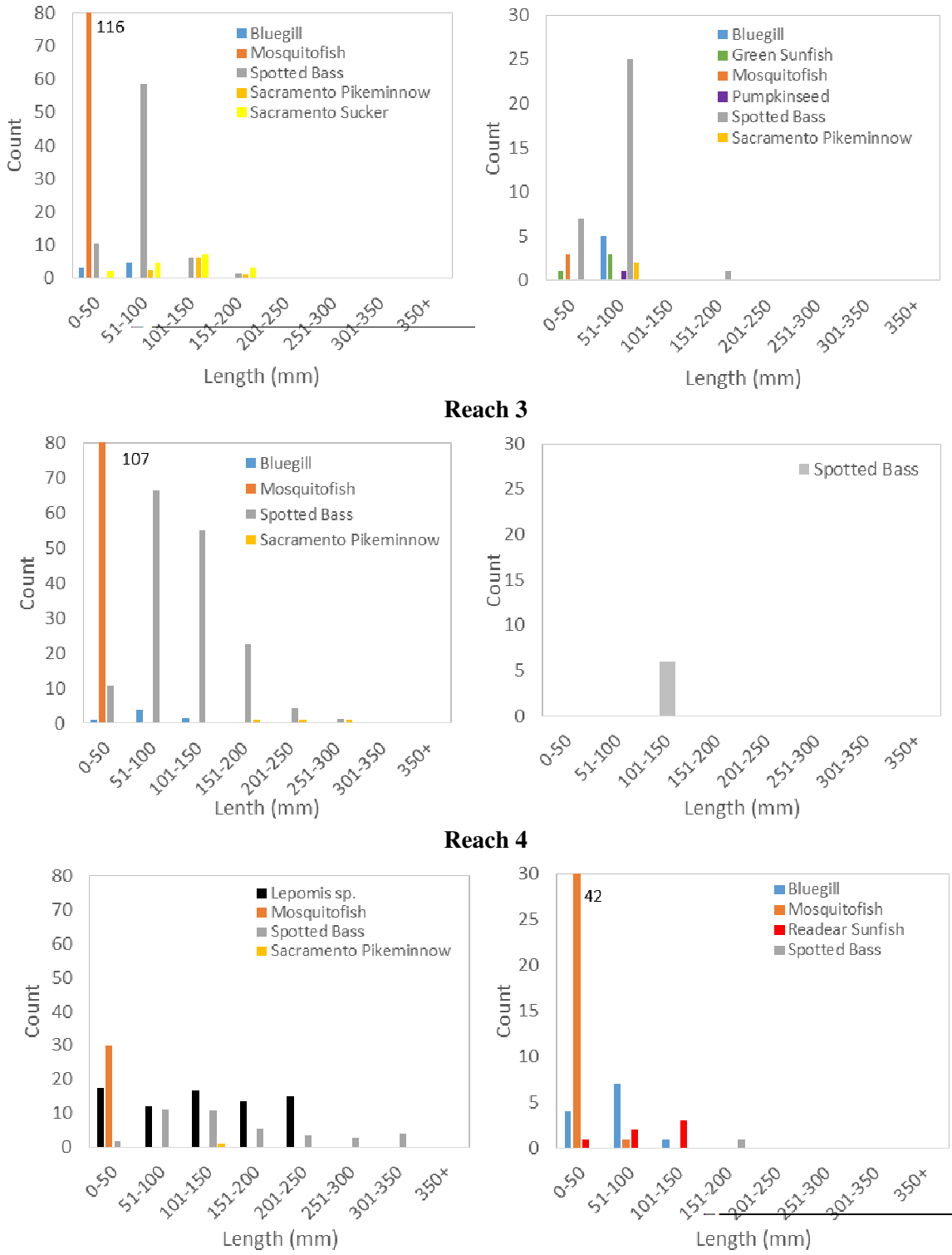

Figure 5. Length-frequency of species collected for snorkeling (left) and seining (right) for Reaches 2 through 4.

eDNA

The eDNA survey sample collection occurred from February 22 – March 1, 2017, and was followed by a second survey that occurred on March 8 and 15, 2017. The eDNA testing selectively targeted salmonids and sturgeon species. Chinook salmon (*Oncorhynchus tshawytscha*) and rainbow trout (*Oncorhynchus mykiss*) were detected in the eDNA analysis, while both green sturgeon (*Acipenser medirostris*) and white sturgeon (*Acipenser transmontanus*) were not. Chinook salmon and rainbow trout were detected in all reaches sampled by eDNA sampling (Table 2; Figures 2 through 4). All eDNA results from the filter analysis can be found on SSWD's relicensing website.

All of the data collected was checked according to SSWD's QA/QC procedures and scanned to pdf files. Data entry and analysis are in progress and will proceed upon completion of additional field work and data collection.

Associated Data Files:

The three data files listed in Table 7 below are available on SSWD's public relicensing website (www.sswdrelicensing.com).

Table 7. Data files associated with Study summary.

File Name	Data Description	File Type and Size
SSWD_eDNA sampling results	Results from eDNA sampling, including all sample sites, elution controls, no template controls, and positive controls.	Excel workbook – 21 KB
SSWD_Population sampling database	Includes all raw data from all population sampling completed to date.	Excel workbook – 31 KB
SSWD_Population photos	Photos of each population sampling site.	Word – 2,374 KB

Variances from Study:

There were four variances. The first variance was that according to the Plan, study sites were to be located "within 1 mile (mi) of the non-Project diversion dam, within 0.5-mi of the Highway 65 Bridge and, within 0.5-mi of the Highway 70 Bridge. These were geographic bounds based on SSWD's understanding of access to the Bear River when the Plan was written. During implementation of Study 3.1 *Salmonid Redd Surveys* and Study 3.3 *Instream Flow*, access points were developed to reach more appropriate study sites. As a result, SSWD determined that it would be beneficial to co-locate the sites for the Study with the sites from study 3.3 *Instream Flow*. The third site was located approximately one mile upstream of Highway 70 because a site conducive to snorkel sampling was not identified within 0.5 miles of Highway 70 as described in the Plan. This change will result in improved data coordination with other studies and is seen a as benefit.

The second variance was that snorkel sampling and seining were to be conducted in April, May, and June of 2017, but due to high flows after the wet water year sampling was postponed. SSWD anticipates sampling will be conducted in the spring of 2018 and should not affect the outcome of the Study. One of the goals of spring sampling is to document the presence of rearing Chinook salmon and rainbow trout following the fall and winter spawning seasons. SSWD conducted additional redd surveys in January of 2018 and recorded the presence of numerous redds presenting the potential to document juveniles and successful spawning in the spring of 2018.

The third variance to the study plan was the amount of water filtered for eDNA analysis. Samples were collected during high flows in the Bear River, as described in the study plan filed with FERC. As a result of the high flows, turbidity was also high, which severely limited the volume of water that could be filtered for each sample. Suspended sediment clogged the filter quickly. As a result, the field team used five filters for each sample and recorded the volume of water filtered by each filter. On average this was approximately one liter (total of five filters) for each sample. Discussions with the analysis lab determined that filtering close to one liter would not adversely affect the results (Personal Communication, Scott Blankenship [Genidaqs], February 2017).

The fourth variance was that boat electrofishing was not conducted in October of 2017 as directed by the Plan due to operations of the Project and non-project diversion dam and safety concerns. Sampling will be conducted once flows reduce to levels low enough to alleviate these safety issues. This delay in sampling should not affect the outcome of the study, as populations in small reservoirs do not undergo significant seasonal population fluctuations. This variance should not affect the schedule of study completion. SSWD anticipates completion of boat electrofishing by July 31, 2018. This variance will delay completion of the overall study from November 2017 to August 2018.

Remaining Work:

Study requirements remaining include: 1) complete Stream Fish Population sampling and habitat typing in April, May, and June of 2018; 2) complete boat electrofishing in the impoundment above the diversion dam in July of 2018; and 3) complete QA/QC and data analysis of remaining fieldwork.

SSWD anticipates that the Study will be completed by August 2018.