BIO-6 STREAM HABITAT TYPING TECHNICAL MEMORANDUM

KERN RIVER NO. 3 HYDROELECTRIC PROJECT
FERC PROJECT NO. 2290

PREPARED FOR:

SOUTHERN CALIFORNIA EDISON®
Energy for What's Ahead®

KERNVILLE, CALIFORNIA

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LIST OF ACRONYMS AND ABBREVIATIONS

cfs	cubic feet per second
FERC	Federal Energy Regulatory Commission
KR3	Kern River No. 3
NFKR	North Fork Kern River
Project	Kern River No. 3 Hydroelectric Project (FERC Project No. 2290)
RM	River Mile
RSP	Revised Study Plan
SCE	Southern California Edison
SPD	Study Plan Determination

1.0 INTRODUCTION

This Technical Memorandum provides the methods and findings of desktop analyses and field surveys associated with the *BIO-6 Stream Habitat Typing Study Plan* in support of Southern California Edison's (SCE) Kern River No. 3 (KR3) Hydroelectric Project (Project) relicensing, Federal Energy Regulatory Commission (FERC) Project No. 2290. The BIO-6 Study Plan was included in SCE's Revised Study Plan (RSP) submitted on July 1, 2022 (SCE, 2022). In the October 12, 2022, Study Plan Determination (SPD) (FERC, 2022), FERC approved the BIO-6 Study Plan with modifications. Specifically, FERC stipulated that SCE expand the study to generally describe physical habitat upstream and downstream of the diversions and along accessible areas of the bypassed reaches of Salmon and Corral Creeks in addition to the Fairview Dam Bypass Reach.[1]

Data collection efforts were initiated in the North Fork Kern River (NFKR) in September 2022. Field surveys were conducted in March 2023 in the NFKR and in July 2023 in Salmon and Corral Creeks. All field sampling efforts and data analyses are complete and summarized below.

2.0 STUDY GOALS AND OBJECTIVES

The objectives of the study, as outlined in the BIO-6 Study Plan (SCE, 2022) and as amended in the SPD (FERC, 2022), follow:

- Conduct reach-scale habitat characterization within the Fairview Dam Bypass Reach to evaluate the effects of Project operations on stream habitat and distribution.
- Map macro-habitats within the NFKR study area using high-resolution aerial photographs or video of the Fairview Dam Bypass Reach.
- Compare current conditions to habitat composition described in the *Kern River No. 3 Water Power Project (FERC Project No. 2290) Application for New License* (SCE, 1991).
- Describe physical habitat upstream and downstream of the diversions and along accessible areas in the Salmon Creek and Corral Creek Bypass Reaches.

3.0 STUDY AREA AND STUDY SITES

The study area includes Project-affected stream reaches along the NFKR and Salmon and Corral Creeks for the purposes of characterization and data collection relevant to understanding potential effects of Project operations and maintenance activities on stream habitat and distribution. Specifically, the study area includes the Project-affected stream reaches between Fairview Dam and the KR3 Powerhouse on the NFKR and Salmon and Corral Creeks downstream of the Project diversions. Consistent with the 1991 Application for New License (SCE, 1991), the study reach in the NFKR was divided

[1] The Fairview Dam Bypass Reach is defined as the approximately 16-mile bypass reach of the North Fork Kern River (NFKR) between Fairview Dam and the KR3 Powerhouse tailrace.

into two segments: a narrow single channel segment from Fairview Dam downstream to Hospital Flat Campground (NFKR Segment 1) and a wider segment with split and single channels from Hospital Flat Campground to the KR3 Powerhouse (NFKR Segment 2; see Table 3-1). The study reaches in Salmon and Corral creeks extend from 0.1 mile upstream of the diversions to the confluence with the NFKR. Project features and streams are shown in Figure 3-1.

Table 3-1. Habitat Mapping Stream Segments

Segment	Boundaries	River Mile
NFKR Segment 1	Fairview Dam to Hospital Flat Campground	18.6–7.3[a]
NFKR Segment 2	Hospital Flat Campground to KR3 Powerhouse	7.3–3.1[a]
Salmon Creek	Upstream of Salmon Creek Diversion to Salmon Creek Confluence with the NFKR	From 0.1 mile upstream of Salmon Creek Diversion to the NFKR confluence (total of 0.5 mile)
Corral Creek	Upstream of Corral Creek Diversion to Coral Creek Confluence with the NFKR	From 0.1 mile upstream of Corral Creek Diversion to the NFKR confluence (total of 1.2 miles)

KR3 = Kern River No. 3; NFKR= North Fork Kern River
Notes:
[a] For the purposes of this document, NFKR River Mile (RM) 0.0 begins at the high-water mark of Isabella Lake.

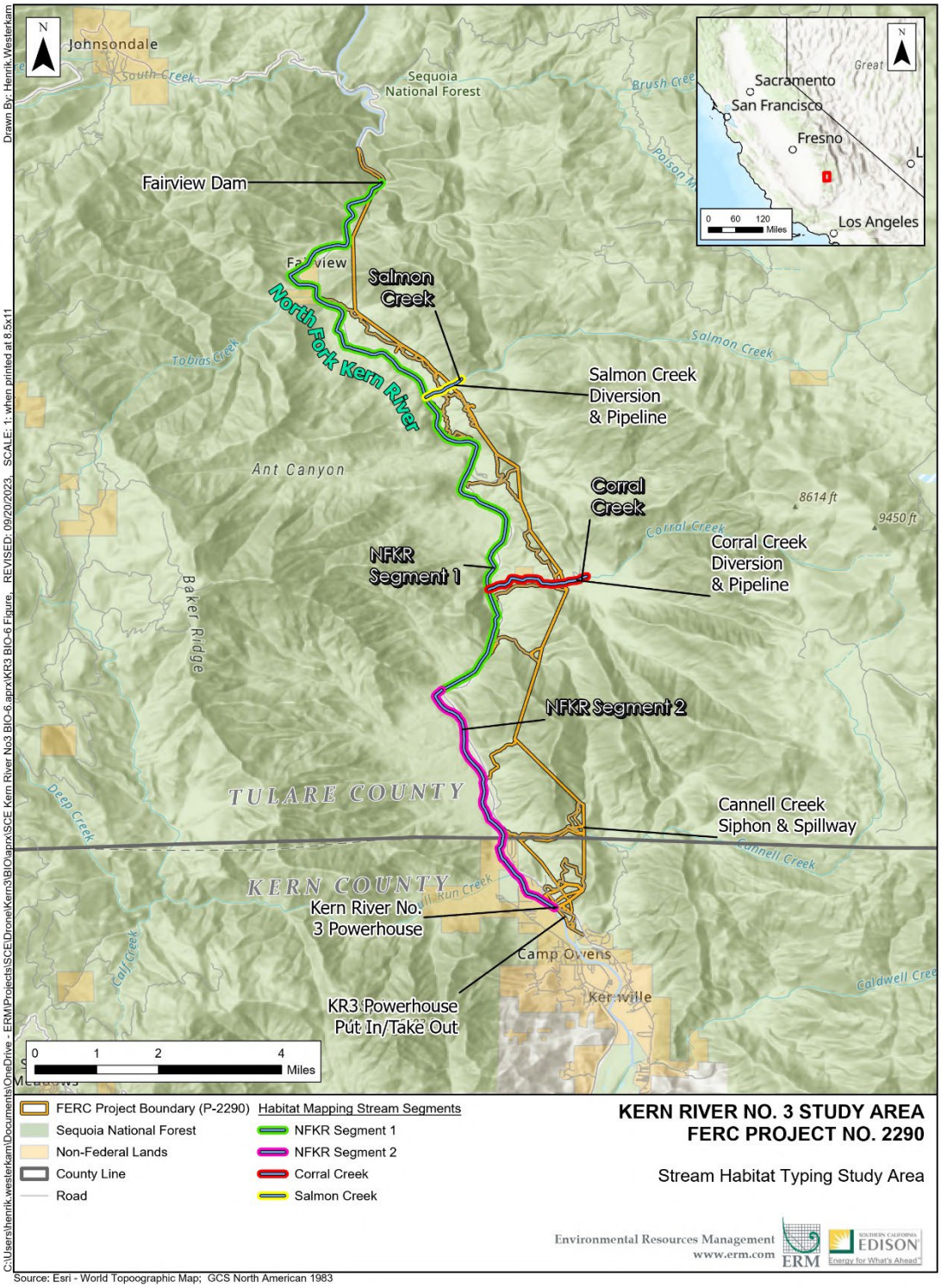

Figure 3-1. Stream Habitat Typing Study Area.

4.0 METHODS

Study implementation followed the methods described in SCE's RSP Package (SCE, 2022), and as amended by FERC in its SPD (FERC, 2022).

Study Plan Variances

There are no variances from the BIO-6 Study Plan as amended by FERC in its SPD (FERC, 2022).

4.1. HABITAT TYPE CLASSIFICATION

Habitat typing was conducted via pedestrian surveys and through use of aerial videography and high-resolution aerial photographs. Macrohabitat typing followed the previous habitat-type classifications used in the 1991 Application for New License (SCE, 1991) (see Table 4.1-1). Habitat units were separately identified where the unit length was at least equal to one-to-two times the active channel width (McCain et al., 1990; Flosi and Reynolds, 1994), or if the unit was otherwise distinctive. Mapping was contiguous within accessible portions of the channel, with each habitat unit abutted to the next unit. Each distinct habitat unit was numbered consecutively in an upstream direction, beginning at the downstream end of a designated reach.

Table 4.1-1. Habitat-type Classifications

Macrohabitat	Description
Boulder Pocket Water	Moderate- and high-gradient stream sections containing large closely spaced boulders that cause uneven water surface elevations, multi-directional flow patterns, small cascades, strong eddy currents, and backwater zones.
Boulder Run	Low- to moderate-gradient stream reach containing sparsely spaced boulders and cobbles. Water surface elevations are generally flat and of a uniform gradient through the habitat unit. The large streambed particles disrupt vertical and horizontal velocity profiles often causing high velocity zones to occur adjacent to low velocity areas.
Cascade	Steep gradient habitat unit with a vertical change or series of changes in the water surface elevation of more than 4 percent.
Deep Pools	Low-gradient habitat unit with a flat-water surface, low velocities, and depths greater than 6 feet.
Shallow Pools	Low-gradient habitat unit with a flat-water surface, low velocities, and depths less than 6 feet.
Runs	Low- to moderate-gradient habitat unit with a relatively uniform water surface gradient, moderate velocities, and relatively uniform depths.
Riffles	Moderate- to steep-gradient habitat unit of shallow depth, high velocity, and irregular water surface elevation.

Source: SCE, 1991

Aerial video and high-resolution aerial photographs were used to map habitat types and measure unit dimensions in the Fairview Dam Bypass Reach. Drone footage captured in October 2022 was analyzed using mapping software in spring 2023. Unit lengths and widths were calculated using a distance measuring tool in mapping software on georeferenced aerial footage. The most and second-most common particle sizes found on the bed of the stream were recorded as dominant and subdominant substrate types for each unit, where visible from the aerial footage.

Pedestrian surveys were conducted by teams of two individuals in stream and river reaches where crews were able to safely access and hike portions of the reach. Pedestrian surveys of the NFKR were conducted on March 7 to 8, 2023, at a subset of units and in areas without aerial footage to validate and refine desktop mapping results; unit type, unit boundaries, and substrate types were confirmed and updated as needed based on pedestrian surveys. Habitat typing in Corral and Salmon Creeks was conducted on July 10 to 11, 2023, entirely via pedestrian surveys due to the narrow width of the streams and dense vegetation cover. In addition to habitat typing, other habitat attributes (unit length, dominant substrate type, subdominant substrate type, stream width, and pool depth) were quantified and recorded.

4.2. ANALYSIS

Data were entered into a Microsoft Excel spreadsheet for reduction, tabulation, and summarization. Habitat-type composition was calculated using individual unit lengths and the number of habitat units. The substrate composition and average stream width and pool depths were evaluated and summarized; 2022 and 2023 survey results were compared to the habitat compositions described in the 1991 Application for New License (SCE, 1991).

5.0 DATA SUMMARY

5.1. NORTH FORK KERN RIVER

NFKR Segment 1 (River Mile [RM] 18.6 to 7.3) primarily consisted of low gradient pools, runs, and pocket water (Table 5.1-1). Most of the segment was a single channel with wetted channel widths ranging from 33 to 164 feet and averaging 77 feet.

NFKR Segment 2 (RM 7.3 to 3.1) was primarily characterized by boulder runs, shallow pools, riffles, and runs (Table 5.1-2). The channel was split throughout several portions of the segment with wetted widths ranging from 33 to 138 feet and averaging 86 feet.

The substrate in both segments of the NFKR was primarily composed of boulder and cobble (Table 5.1-3). Dominant and subdominant substrate types could not be identified in some individual habitat unit types in NFKR Segments 1 and 2 due to high turbidity in the NFKR at the time of aerial data collection (Table 5.1-3). Representative photos of habitat units in assessed segments of the NFKR are provided in Figures 5.1-1 through 5.1-4.

Table 5.1-1. North Fork Kern River, Fairview Dam to Hospital Flat Campground (Segment 1, RM 18.6–7.3) Stream Habitat Typing Summary, 2023

Habitat Type	Total Length (feet)	Length Relative Frequency (%)	Number of Units	Unit Relative Frequency (%)
Boulder Pocket Water	2,996	5	9	5
Boulder Run	14,754	25	39	21
Cascade	2,692	5	20	11
Deep Pool	7,421	13	16	8
Shallow Pool	12,105	20	33	17
Run	10,787	18	35	18
Riffle	8,395	14	38	20
Total	59,149	100	190	100

Table 5.1-2. North Fork Kern River, Hospital Flat Campground to KR3 Powerhouse (Segment 2, RM 7.3–3.1) Stream Habitat Typing Summary, 2023

Habitat Type	Total Length (feet)	Length Relative Frequency (%)	Number of Units	Unit Relative Frequency (%)
Boulder Pocket Water	965	4	3	5
Boulder Run	5,682	24	15	25
Cascade	1,034	4	4	7
Deep Pool	1,004	4	2	3
Shallow Pool	6,690	28	10	17
Run	3,248	13	10	17
Riffle	5,525	23	15	25
Total	24,149	100	59	100

Table 5.1-3. North Fork Kern River Dominant Substrate Composition, 2023

Substrate Type	NFKR Segment 1		NFKR Segment 2	
	Dominant Substrate (%)	Subdominant Substrate (%)	Dominant Substrate (%)	Subdominant Substrate (%)
Bedrock	1	3	1	0
Boulder	43	23	36	31
Cobble	29	29	59	31
Gravel	0	<1	0	4
Sand	7	9	2	2

Substrate Type	NFKR Segment 1		NFKR Segment 2	
	Dominant Substrate (%)	Subdominant Substrate (%)	Dominant Substrate (%)	Subdominant Substrate (%)
Silt	0	1	0	7
Unknown[a]	20	35	2	25

Notes:
[a] High turbidity prevented substrate type identification.

Figure 5.1-1. Representative Boulder Run in NFKR Segment 1 at 81 cfs, March 2023.

Figure 5.1-2. Representative Shallow Pool in NFKR Segment 1 at 81 cfs, March 2023.

Figure 5.1-3. Representative Riffle in NFKR Segment 2 at 81 cfs, March 2023.

Figure 5.1-4. Representative Deep Pool in NFKR Segment 2 at 81 cfs, March 2023.

5.2. CORRAL AND SALMON CREEKS

Corral Creek, from its confluence with the NFKR upstream to 0.1 mile past the diversion, was generally steep and characterized by boulder cascades and riffles with small sections of flatwater habitat (Table 5.2-1). The average maximum pool depth was 2.6 feet, and the average pool depth across pool units was 2 feet. The wetted channel width in the reach was 11 feet on average and ranged from 3 to 33 feet. Corral Creek was primarily composed of boulder substrate with some sections of cobble and bedrock (Table 5.2-2).

Salmon Creek, from the confluence with the NFKR upstream to 0.1 mile past the diversion, was mainly composed of long, high-gradient boulder and bedrock cascades, punctuated by a few deep pools and runs throughout the reach (Table 5.2-3). The average maximum pool depth was 4.3 feet, and the average pool depth across pool units was 3.8 feet. The wetted channel width in the reach was 4 feet on average and ranged from 4 to 30 feet. The primary substrate for most of the assessed portion of Salmon Creek was boulders and bedrock (Table 5.2-3). Representative photos of habitat in Corral and Salmon Creeks are provided in Figure 5.2-1.

Table 5.2-1. Corral Creek Stream Habitat Typing Summary, 2023

Habitat Type	Total Length (feet)	Length Relative Frequency (%)	Number of Units	Unit Relative Frequency (%)
Boulder Pocket Water	0	0	0	0
Boulder Run	59	1	1	1
Cascade	4,449	60	27	40
Deep Pool	0	0	0	0
Shallow Pool	568	8	11	16
Run	827	11	12	18
Riffle	1,542	21	16	24
Total	7,444	0	67	100

Table 5.2-2. Substrate Composition in Corral and Salmon Creeks, 2023

Substrate Type	Corral Creek		Salmon Creek	
	Dominant Substrate (%)	Subdominant Substrate (%)	Dominant Substrate (%)	Subdominant Substrate (%)
Bedrock	9	10	36	0
Boulder	67	20	62	38
Cobble	16	59	2	62
Sand	8	11	0	0

Table 5.2-3. Salmon Creek Stream Habitat Typing Summary, 2023

Habitat Type	Total Length (feet)	Length Relative Frequency (%)	Number of Units	Unit Relative Frequency (%)
Boulder Pocket Water	0	0	0	0
Boulder Run	0	0	0	0
Cascade	800	90	5	50
Deep Pool	26	3	2	20
Shallow Pool	0	0	0	0
Run	64	7	3	30
Riffle	0	0	0	0
Total	890	0	10	100

Figure 5.2-1. Representative Cascades in Corral Creek at Roughly 3 cfs (Top) and Salmon Creek at Roughly 4 cfs (bottom) Downstream of the Diversions, July 2023.

5.3. COMPARISON TO PREVIOUS HABITAT COMPOSITION

Habitat typing results within Segment 1 and Segment 2 of the NFKR in 2023 were generally consistent with the results from the habitat conditions described in the 1991 Application for New License (SCE, 1991) with few minor differences. The 2023 typing show a higher percentage of boulder run versus boulder pocket water and a higher percentage of riffles with lower percentage of runs (Figures 5.3-1 and 5.3-2). These trends continue over the entire sampled portion of the NFKR (Figure 5.3-3) and may reflect tighter delineation (i.e., “splitting”) of defined units (e.g., short riffles between longer runs).

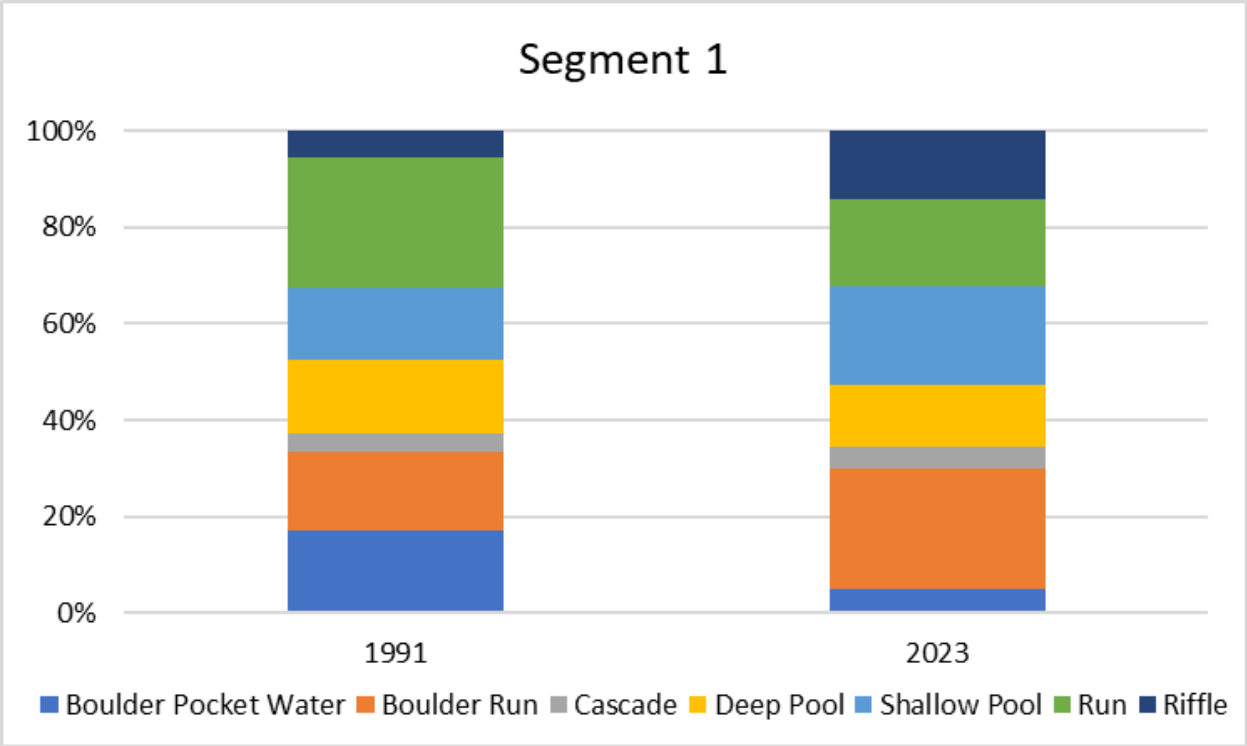

Figure 5.3-1. Habitat Composition in Segment 1 of the North Fork Kern River in 1991 and 2023.

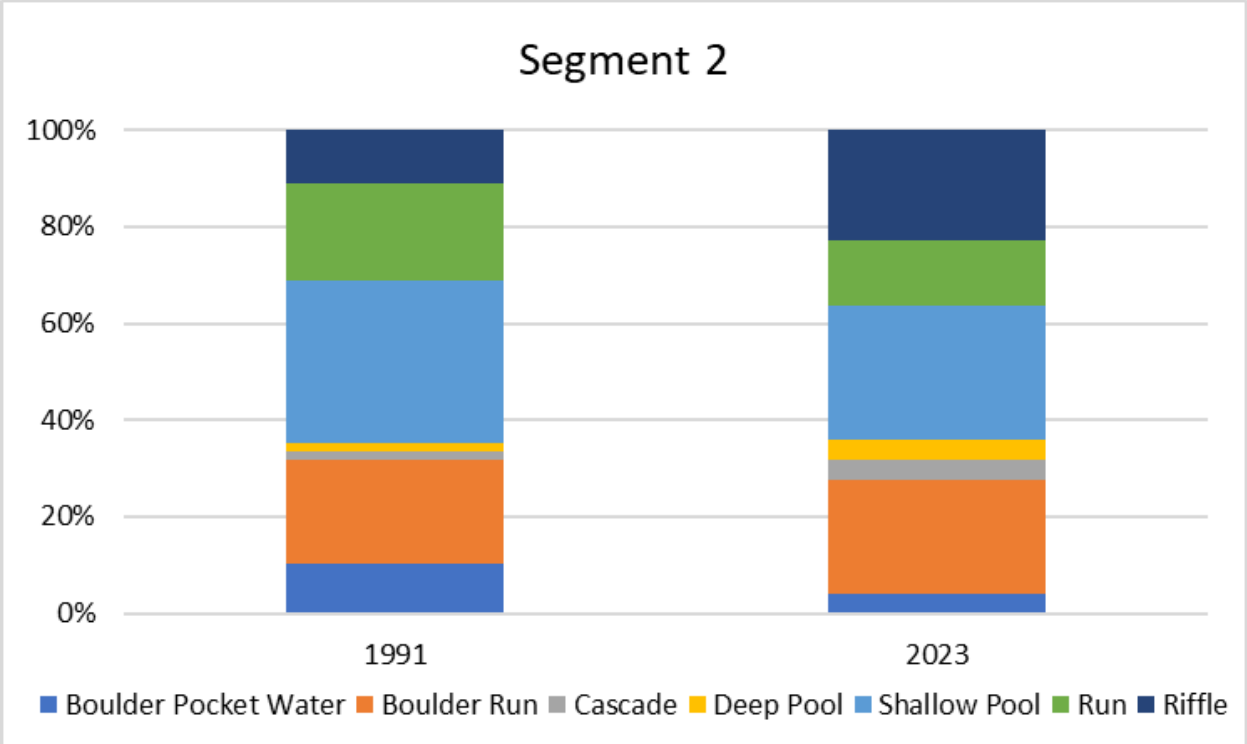

Figure 5.3-2. Habitat Composition in Segment 2 of the North Fork Kern River in 1991 and 2023.

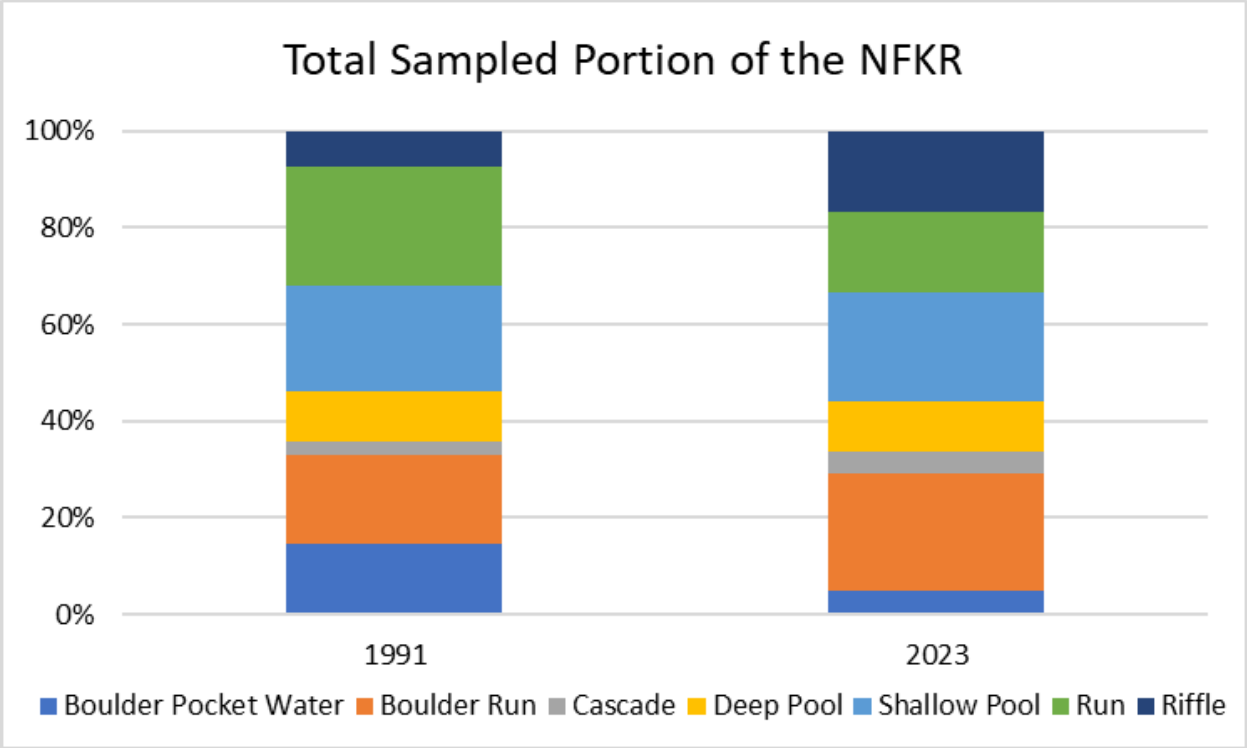

Figure 5.3-3. Habitat Composition in the Total Sampled Portion of the North Fork Kern River in 1991 and 2023.

6.0 STUDY SPECIFIC CONSULTATION

No study-specific consultation is required; no consultation has been conducted to date.

7.0 OUTSTANDING STUDY PLAN ELEMENTS

All Study Plan elements have been completed as specified in SCE's RSP (SCE, 2022) filing and FERC's SPD (FERC, 2022).

8.0 REFERENCES

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