LAND 2 – EROSION AND SEDIMENTATION TECHNICAL MEMORANDUM

KERN RIVER NO. 1 HYDROELECTRIC PROJECT
FERC PROJECT NO. 1930

PREPARED FOR:

January 2025

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List of Acronyms

CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CNRFC	California Nevada River Forecast Center
FERC	Federal Energy Regulatory Commission
KR1	Kern River No. 1
LAND 2 TSP	LAND 2 – Erosion and Sedimentation Technical Study Plan
LB	Left Bank (when viewed in the downstream direction)
NOE	Notice of Exemption
Project	Kern River No. 1 Hydroelectric Project (FERC Project No. 1930)
RB	Right Bank (when viewed in the downstream direction)
SCE	Southern California Edison
SCH	State Clearinghouse
SMP	Sediment Management Plan
SPD	Study Plan Determination
SR-178	State Route 178
SWRCB	State Water Resources Control Board

TM	Technical Memorandum
USACOE	United States Army Corps of Engineers
USGS	United States Geological Survey

1.0 INTRODUCTION

This LAND 2 – Erosion and Sedimentation Technical Memorandum (TM) provides the methods and findings of the LAND 2 – Erosion and Sedimentation Technical Study Plan (LAND 2 TSP) in support of Southern California Edison's (SCE) Kern River No. 1 (KR1) Hydroelectric Project (Project) relicensing, Federal Energy Regulatory Commission (FERC) Project No. 1930. The LAND 2 TSP was included in SCE's Revised Study Plan submitted to FERC on February 13, 2024 (SCE 2024). In its March 14, 2024, Study Plan Determination (SPD), FERC approved the LAND 2 TSP without modification (FERC 2024).

During a desktop review from May to June 2024, aerial imagery and available operation and maintenance records were reviewed. A field survey was conducted from June 17 to 21, 2024 to document erosion from Project-related sources. All field reconnaissance efforts and data analyses are complete and summarized below.

2.0 STUDY OBJECTIVES

The objectives of the erosion and sedimentation study, as outlined in LAND 2 TSP (SCE 2024), include the following:

- Identify historical and existing sources of sediment adjacent to the bypass reach[1], Democrat Dam Impoundment, water conveyance system, and other Project facilities, including major gullies; areas of vegetation and/or soil loss; hillslope destabilization; and mass wasting.

- Identify and describe historical and existing operation and maintenance practices associated with managing accumulated sediment behind Democrat Dam.

- Document erosion and sedimentation associated with SCE's ongoing operation and maintenance activities.

- Document natural sources of sediment unrelated to the Project.

3.0 STUDY AREA

The study area for erosion and sedimentation includes the bypass reach, Democrat Dam Impoundment, water conveyance system, and other Project facilities listed in Table 3-1. Roads and trails are reported in the LAND 1 – Road and Trail Condition Assessment TM. Underground and underwater Project facilities were not evaluated.

[1] A bypass reach is a segment of a river downstream of a diversion facility where Project operations result in the diversion of a portion of the water from the river. For this Project, the bypass reach is a 10.2-mile reach of the lower Kern River from Democrat Dam downstream to the Kern River No. 1 Powerhouse Tailrace.

Table 3-1. Kern River No. 1 Hydroelectric Project Facilities

Diversion Dam
Democrat Dam
Impoundment
Democrat Dam Impoundment
Water Conveyance System
Sandbox
Tunnels, Flumes, Conduits, and Adits
Forebay
Forebay Overflow Spillway
Penstock
Powerhouse and Switchyard
Kern River No. 1 Powerhouse and Switchyard
Access Roads
Willow Spring Creek Road (also referred to as Democrat Dam Road)
Powerline Road
Flume No. 1 Road
Dougherty Creek Road
Stark Creek Road
Forebay Operations Area Road
Lower Powerhouse Road
Upper Powerhouse Road
Access Trails
Democrat Gage Trail
Conduit No. 3 Trail
Cow Flat Creek Trail
Steel Flume Trail
Lucas Creek Trail
Dougherty Creek Trail
Stark Creek Trail
Adit 17 & 18 Trail
Overflow Spillway Trail
Skip Hoist / Forebay Trail
Communication and Power Lines
Intake Gatehouse to Flume No. 1 Powerline
Powerhouse to Forebay Communication / Powerline
Gages and Stilling Wells
Kern River near Democrat Springs (USGS Gage No. 11192500 / SCE Gage No. 409)
Kern River No. 1 Conduit near Democrat Springs (USGS Gage No. 11192000 / SCE Gage No. 410)
Kern River near Democrat Springs (USGS Gage No. 11192501; calculated 11192500+11192000)

Stilling Well No. 1
Stilling Well No. 2
Ancillary and Support Facilities
Democrat Dam Area
Buoy Line in Democrat Dam Impoundment
Democrat Dam Intake Gatehouse
Democrat Dam Drainage Tower
Democrat Dam Drainage Tunnel
Democrat Dam Drainage Tunnel Outlet
Democrat Dam Access Walkway
Sandbox Drainage Channel
Gaging Cableway
Water Conveyance
Flume No. 6 Access Platform
Forebay Operations Area
Old Admin Building
Garage No. 1
Garage No. 2
Old Ice House
Water Tank
Aerial Cable Tower
Skip Hoist House and Lower Landing
Skip Hoist Cables and Cart
Skip Hoist Upper Landing
Skip Hoist Upper Landing to Forebay Catwalk
Communication Site
Forebay Operations Area Perimeter Fence
Forebay Perimeter Fence
Powerhouse Area
Machine Shop
Office / Lunchroom
Restroom
Powerhouse and Switchyard Perimeter Fence

4.0 METHODS

Study implementation followed the methods described in the LAND 2 TSP (SCE 2024).

4.1 STUDY PLAN VARIANCES

There are no variances from the LAND 2 TSP, as approved by FERC in its SPD (FERC 2024).

4.2 IDENTIFY HISTORICAL AND EXISTING SOURCES OF SEDIMENT AND PROJECT-RELATED EROSION AREAS

- Document the location and relative volume of historic and existing sediment recruitment to stream channels.

  – Significant sediment recruitment, mass wasting, and/or bank erosion sites were mapped via aerial photography (e.g., Google Earth images), topographic maps, geology and soils maps, and ground survey. Potential locations for ground survey included steep drainages in direct contact with the mainstem Kern River channel and/or State Route 178 (SR-178), the presence of rilling and/or signs of landsliding, areas with steep rock outcrops that could be susceptible to mass wasting processes, and areas that appeared to have loose material on the ground surface.

  – Identification of whether the sources of sediment were derived from natural watershed process or Project-related effects was based on context and field observation June 18–21, 2024. Surveys included GPS mapping, photographs, and if direct visual inspection was not possible, use of binoculars to assess conditions.

  – Determination of whether sediment sources were actively or inactively contributing sediment and if so by how much (e.g., low, moderate, high delivery potential to the stream channel) was based on field observation.

  – Reviewed the August 19, 2013, storm event that caused multiple rock falls and debris slides that closed SR-178 and caused a spill at the KR1 forebay (Section 3.7, Geology and Soils of the Pre-Application Document includes additional information).

  – Reviewed winter storm cycles of 2022–2023, which caused debris slides in the Project area/canyon closing SR-178.

  – Mapped historic and/or potential ongoing erosion at the Project facilities (including Project impoundment) by means of aerial photography (e.g., Google Earth images) and ground surveys June 18–21, 2024. Where possible, volumes of eroded material were estimated by measuring the surface area and approximate depth of the deposit.

- Summarized past and current sediment management practices at Democrat Dam, including sediment releases into the bypass reach and current permits associated with sediment management practices.

5.0 RESULTS SUMMARY

5.1 SEDIMENT RECRUITMENT, MASS WASTING, AND/OR BANK EROSION SITES

5.1.1 Natural Sediment Sources

Geology and soils data show that the study area is a steep, deeply incised, V-shaped canyon mostly dominated by bedrock and boulders. Periodic hillslope erosion and mass wasting processes do occur but are considered to be a relatively low contributor of sediment into the mainstem Kern River channel (SCE 2023). Reviews of aerial imagery showed many steep gullies and drainages with an abundance of boulders and cobbles present on the ground surface, as well as many steep to vertical rock outcrops, indicating the potential for debris flow, landslide, and rockfall processes of erosion. There is a history of periodic debris flow, landslide, and rockfall events that have occurred in the canyon, often closing SR-178 for extended periods of time. This was the case repeatedly during warm atmospheric river storm events of the 2022–2023 winter when heavy rain fell upon a record-breaking snowpack in the upper watersheds of the canyon. Additionally, there are several sub-vertical to vertical outcrops of bedrock at road cuts along SR-178. Such features have the potential for periodic rockfall events which could block the highway.

Of the 62 points of interest identified during the desktop review process, significant potential for erosion and/or sedimentation was observed at 19 sites during field surveys (June 18–21, 2024). Potential for erosion and/or sedimentation at 17 of the sites was a result of natural processes. Table 5-1 has a description of the type of erosion or deposition, and whether the feature was naturally caused or Project related. The locations of the sites are shown on Map 5-1 and photographs of the sites are shown in Appendix A. These sites showed signs of significant erosion and/or sedimentation in the form of: (1) sediment available for transport; (2) sand and gravel deposits at SR-178 culverts and/or in the stream channels and at confluences with the mainstem channel; (3) signs of active bank erosion on the mainstem channel of the Kern River; and/or (4) evidence of periodic landslide events.

Based on field observation, few of the sites were actively eroding, with the only exceptions being two sites where active bank erosion was observed (Bank Erosion RB_1, and Bank Erosion RB_2 in Table 5-1). The few drainages that had flowing water (low flows) were not actively contributing sediment to the stream channel. The sites presented in Table 5-1 were classified as having high sediment delivery potential during high flow / heavy precipitation events. Hazards related to debris flows, landslides, and rock falls during heavy precipitation are a distinct possibility throughout the canyon.

Table 5-1. Locations of Potentially Significant Sources of Erosion and Sedimentation

Site	Photographs (Appendix A)	Approximate Volume (CY)	Hydrology at the Time of the Survey	Project Related	Natural Causes	Description
Willow Spring Creek	N/A	N/A	N/A	No	Yes	Willow Spring Creek at Democrat Dam. Considered to be a potentially significant source of sediment during high flows based on observations of other creeks in the canyon and aerial imagery. Not accessible for visual observation or photos.
Unnamed Tributary	A-1 to A-2	N/A	Dry	No	Yes	Unnamed Tributary (Lower) that connects to the mainstem channel on LB below the Democrat Dam access road parking area. Sand and gravel deposits above and below culvert would likely be transported during high-flow conditions.
	A-3	4	Dry	No	Yes	Unnamed Tributary (Upper) at water crossing on Cow Flat Rd. Prism of sand and gravel deposited above road suggests significant potential for sediment transport during high-flow conditions.
Saturday Spring Creek	N/A	N/A	N/A	No	Yes	Saturday Spring Creek on RB of mainstem channel. Considered to be a potentially significant source of sediment during high flows based on observations of other creeks in the canyon and aerial imagery. Not accessible for visual observation or photos.
Democrat Spring Creek	N/A	N/A	N/A	No	Yes	Democrat Spring Creek on LB of mainstem channel. Considered to be a potentially significant source of sediment during high flows based on observations of other creeks in the canyon and aerial imagery. Not accessible for visual observation or photos.
Cow Flat Creek	A-4	7	Dry	No	Yes	Upper Cow Flat Creek at water crossing on Cow Flat Rd. Prism of sand and gravel deposited above road suggests significant potential for sediment transport during high-flow conditions.
	A-5 to A-6	N/A	Dry	No	Yes	Cow Flat Creek at SR-178 culvert and confluence with mainstem channel. Prism of sand and gravel deposited below culvert adjacent to confluence suggests significant potential for sediment transport during high-flow conditions.
Lucas Creek	A-7 to A-8	N/A	Flowing	No	Yes	Upper Lucas Creek at water crossing on Cow Flat Rd. Abundant fine sediment that would likely be transported during high-flow conditions
	N/A	N/A	Flowing	No	Yes	Lucas Creek at SR-178 culvert and confluence with mainstem channel. Cobbles, sand, and gravel deposited below culvert adjacent to confluence suggests significant potential for sediment transport during high-flow conditions.
Dougherty Creek	A-9	N/A	Flowing	No	Yes	Dougherty Creek at SR-178 culvert and confluence with mainstem channel. Steep drainage with rilling suggests significant potential for erosion and sediment transport during high-flow conditions. Boulders, cobbles, gravel, and sand deposited below culvert.
Bank Erosion_RB1	A-10 to A-11	N/A	N/A	No	Yes	Bank erosion at the confluence of an ephemeral drainage and the mainstem channel on RB. Steep cut bank composed of loose cobbles, gravel, and sand with rilling, slumping, and potential for significant erosion and sediment deposition.
Stark Creek	A-12	N/A	Dry	No	Yes	Upper Stark Creek at the end of the flowline access road. Scoured bedrock channel and matrix supported cobbles suggest potential for significant episodic erosion and sediment transport. Deposits of fine sand and gravel that would likely be transported during high-flow conditions.
	A-13	N/A	Dry	No	Yes	Stark Creek at SR-178. Boulder and cobble bed with some sand and gravel. Observations of the upper drainage and channel geometry suggest the potential for episodic debris flows and sediment transport that could impact travel on SR-178. Confluence with mainstem channel not accessible for visual observation or photos.
Rilling/Landslide_RB1	A-14 to A-15	N/A	N/A	No	Yes	Landslide scar with rilling on RB across from Lower Richbar Day Use Area. Potential for episodic erosion and sediment delivery directly into mainstem channel.
Bank Erosion_RB2	A-16	N/A	N/A	No	Yes	Steep eroding cut bank on RB. Composed of boulders and cobbles supported by sand and gravel matrix.
Peachacho Creek	N/A	N/A	Dry	No	Yes	Peachacho Creek at SR-178. Steep, deeply incised drainage. Considered to be a potentially significant source of sediment during high flows based on observations of other creeks in the canyon and aerial imagery. Not accessible for visual observation or photos.
Natural Rockslide near KR1 Powerhouse	A-17 to A-19	N/A	N/A	No	Yes	Large rockslide above the KR1 powerhouse.

Site	Photographs (Appendix A)	Approximate Volume (CY)	Hydrology at the Time of the Survey	Project Related	Natural Causes	Description
8/20/2013 Forebay Spill	A-20	N/A	N/A	No*	Yes*	Rock, mud, water, and plant material from a landslide entered the KR1 conduit approximately 1 mile upstream of the forebay. This material continued downstream in the tunnel creating a temporary surge in flows at the forebay, causing the pipe spillway to plug and forebay to spill. This resulted in erosion of the hillside below the forebay and along the pipe spillway. This area is not subject to erosion/sedimentation due to ongoing, regular Project operations. Rather, the erosion was due to a unique, one-time event. At the time of field observations for this study, there was no evidence of ongoing erosion observed at this location.
8/20/2013 Forebay Erosion Deposit	A-21 to A-22	N/A	N/A	No*	Yes*	

Notes:

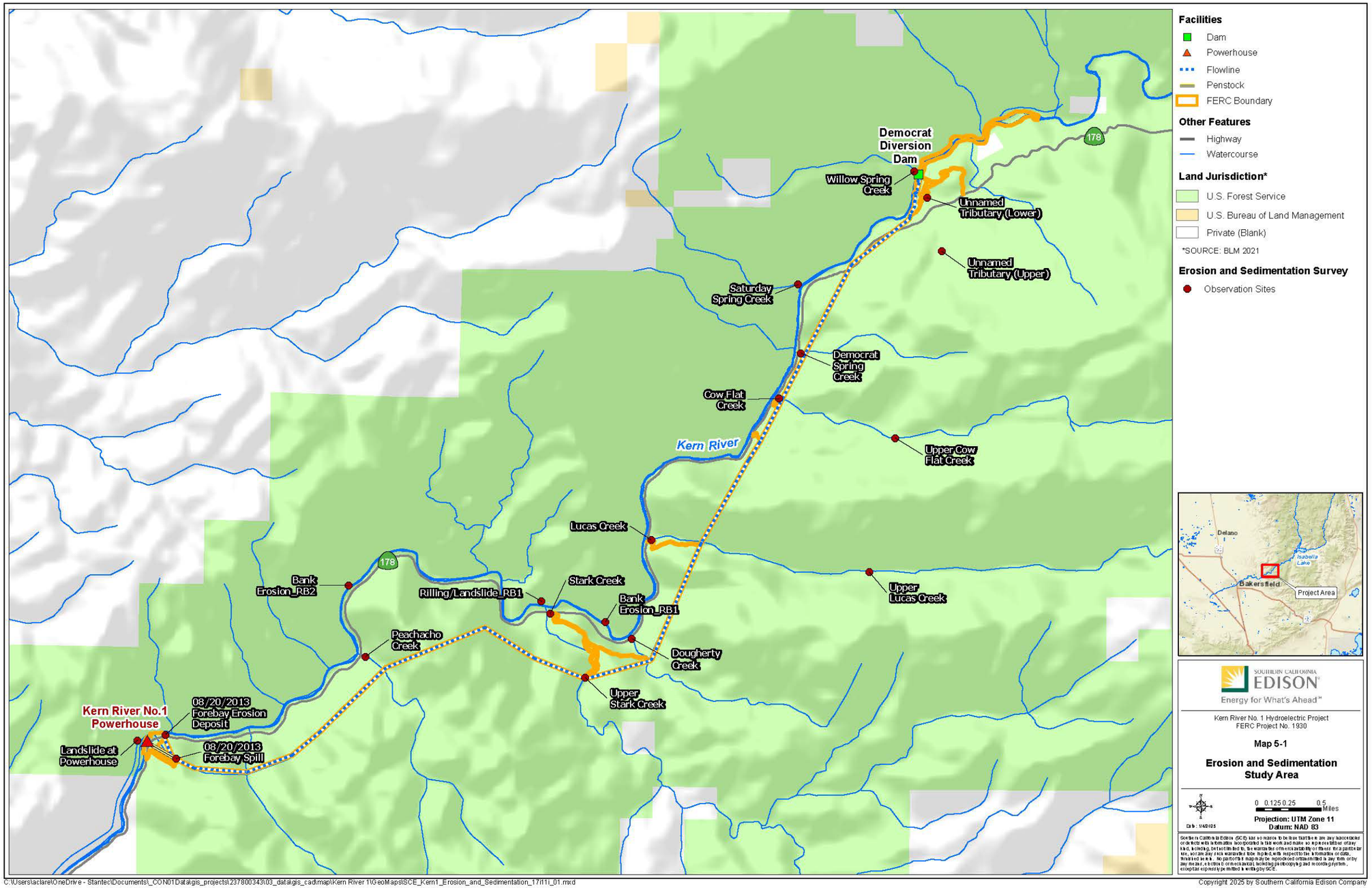
* This was a natural landslide that affected Project infrastructure causing a spill/erosion.

LB = Left Bank (when viewed in the downstream direction)

RB = Right Bank (when viewed in the downstream direction)

SR-178 = State Route 178

N/A = Not Applicable (not accessible for direct visual observation or photos, or the parameter is not applicable to the feature being described)



Map 5-1. Locations of Potentially Significant Sources of Erosion and Sedimentation in the Study Area

5.1.2 Project-Related Sediment Sources

A review of historical aerial imagery and field observations indicated that potential erosion and sedimentation related to Project features was small scale and remained stable from 2002 to 2023 (availability of imagery). The only Project-related features that were identified as locations of potential ongoing erosion and sedimentation were the legacy spoil piles from drilling the KR1 Conveyance Flowline. These spoil piles were visible in all photo sets and appear largely unchanged between 2002 and 2023. An aerial image of a few of the spoil piles is provided in Figure 5-1 (January 2025).

5.2 HISTORICAL STORMS AND DEBRIS SLIDES

5.2.1 August 19, 2013, Storm Event

On August 19, 2013, thunderstorms caused localized heavy rain in the Kern River Canyon at a peak intensity of approximately 0.5 inch per hour, and a cumulative total daily rainfall of approximately 0.83 inch. The impact on hydrology in the Kern River was minor, with river stage increasing from 2.29 to 2.66 feet following the storm (CDEC 2024).

During the storm, however, rock, mud, water, and plant material from a debris flow entered the KR1 conduit approximately 1 mile upstream of the forebay. This debris flow (mud and plant material) entered the flowline at Adit 17/18, which is an open-air vent location in the flowline. At Adit 17/18 the debris flow passed over and into the flowline at the vent location and this temporary surge of flow (with mud and plant material) continued down the flowline to the forebay. At the forebay an overflow spillway pipe would have handled the flow surge except for the mud and plant material caused the intake to the spillway pipe to plug. The overflow spillway pipe conveys flow surges to the Kern River. Due to the plugged intake the forebay was overtopped resulting in erosion of the hillside below the forebay and along (parallel to) the overflow spillway pipe (SCE 2013). Refer to Appendix A, Photos A-20 to A-22.

The storm and resulting landslide that caused this incident was a naturally occurring event which could not have been anticipated. Thus, no measures could have been taken to prevent worsening of the condition. SR-178 was closed by the California Highway Patrol the evening of August 19, 2013 because of multiple rockslides that blocked the road, which made the Project inaccessible.

Following this event, SCE completed modifications to the flowline to prevent recurrence of a similar event. SCE has made modifications at the vent opening at Adit 17/18 to redirect any upslope runoff or debris flows over the opening and preventing flow, mud or plant material from entering the flowline. At the forebay measures were completed to prevent future overtopping by removing the screen/rack at the intake to the overflow spill pipe thus preventing plugging to allow any surge flow to enter the overflow pipe. Thus, this area is not subject to erosion/sedimentation due to ongoing, regular Project operations. Rather, the erosion was due to a unique, one-time event. At the time of field observations for this study, there was no evidence of ongoing active erosion observed at this location.

5.2.1.1 FERC Correspondence on Landslide Event

On September 10, 2013, in accordance with 18 CFR § 12.10(a) and verified according to § 12.13, SCE filed an incident report regarding the KR1 forebay spill. In a letter dated September 19, 2013, FERC requested additional information on the incident, including: (1) clarification on the landslide location and supporting maps and photographs; (2) description of the current and future strategy for ensuring that debris does not enter the flowline; (3) a Registered Professional Engineer's assessment of the stability of all structures impacted by the event; (4) description of how information collected from the forebay overflow sensor is transmitted and used in controlling operations and measures to be implemented to ensure that the forebay overflow sensor functions and effectively detects similar future events prior to the forebay overtopping; (5) an update on consultation with resource agencies and coordination efforts with Caltrans; and (6) a proposed plan and schedule to mitigate the severely eroded areas. The requested information was provided in a letter to FERC dated November 1, 2013.

As a result of the landslide event, in a letter dated March 12, 2014, FERC made a determination to change the downstream potential hazard classification of the Kern River No. 1 Project from Low to Significant. Significant hazard Project features were identified by FERC as the Stark Creek Flume, Adit 17/18, and Kern No. 1 Forebay. Based on the revised hazard classification, FERC requested that SCE: (1) prepare a Dam Safety Surveillance Monitoring Plan (DSSMP); (2) prepare and Emergency Action Plan (EAP); (3) provide a schedule with milestones to complete rehabilitation of Project structures; (4) provide an update on consultation with resource agencies; and (5) provide an update on the proposed plan and schedule to mitigate the severely eroded areas. In a letter dated April 28, 2014, SCE provided responses to items 3 through 5.

To support development of the DSSMP and EAP (items 1 and 2 of FERC's request), SCE conducted Qualitative Risk Assessment (QRA) Workshops on September 18, 2014 and November 20, 2014, which included representatives from FERC. In addition, SCE conducted an investigation of the foundation conditions at Adit 17/18 to determine the soundness of the exposed existing foundation and collect soil data that could be used in development of remedial actions. Findings of the QRA Workshops and Adit 17/18 investigation were filed with FERC on January 6, 2015 and April 2, 2015, respectively. Responses to additional information requests by FERC on both filings were timely filed by SCE.

The DSSMP was accepted by FERC on November 23, 2015, the Adit 17/18 investigation accepted by FERC on December 22, 2015, and the EAP was submitted to FERC on December 28, 2015. Publicly available documentation associated with this incident is available in FERC's eLibrary.

5.2.2 Winter 2022–2023 Storm Cycles and Debris Slides

The 2023 Water Year, in particular the period from late December through the first half of January, and then again from late February through March, brought historic precipitation and snowpack conditions to parts of California and Nevada. Many of the storm systems

were characterized by cool temperatures and low snow levels, brought on by numerous moist and strong low-pressure systems, including over a dozen Atmospheric Rivers and three bomb cyclones (i.e., a rapidly developing area of low pressure where the atmospheric pressure drops at least 24 millibars over a 24-hour period) during the period from December 2022 through March 2023.

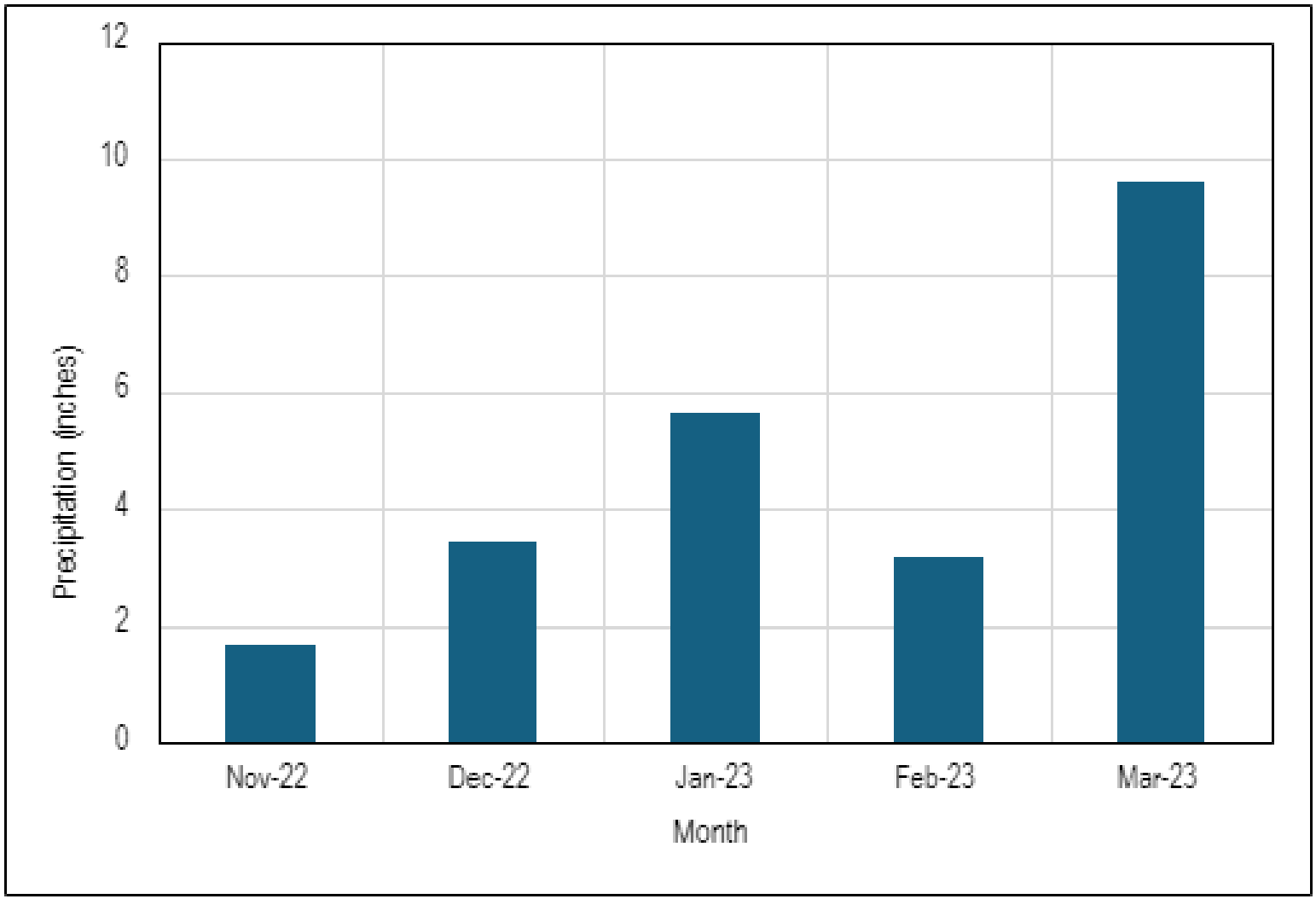
Peak monthly rainfall of approximately 5.62 inches in January 2023, and 9.61 inches in March 2023 was measured at Lake Isabella (CNRFC 2024) (Figure 5-2). On March 10, 2023, flows in the Kern River at Kernville peaked at 15,700 cubic feet per second (cfs) (USGS 2024) (Figure 5-3). This was the second highest peak flow recorded at Kernville for the period of record spanning from 1961–2023, with the peak flow of 33,600 cfs occurring on December 6, 1966 (USGS 2024).

Heavy rainfall on a record snowpack in the upper watershed's drainages caused debris slides and rockfalls which closed SR-178 for several days on March 1 and March 15, 2023 (Appendix A, Photos A-23 to A-24).

5.3 PROJECT FACILITY EROSION

At the time of field observation there was no active erosion occurring at any Project facilities. The forebay spill event discussed in Section 5.2.1 was the most significant documented erosion that has occurred in the vicinity of the Project. There is rockfall area on the other side of the river from the KR1 Powerhouse that has potential to affect the powerhouse. A steel rockfall mitigation fence has been installed to help protect the powerhouse (Appendix A, Photos A-17 to A-19). The rockfall area is not caused by Project facilities.

Figure 5-1. Example of Legacy Spoil Piles from Drilling the KR1 Conveyance Flowline.



Source: CNRFC 2024

Figure 5-2. Monthly Peak Precipitation at Lake Isabella from November 2022–March 2023

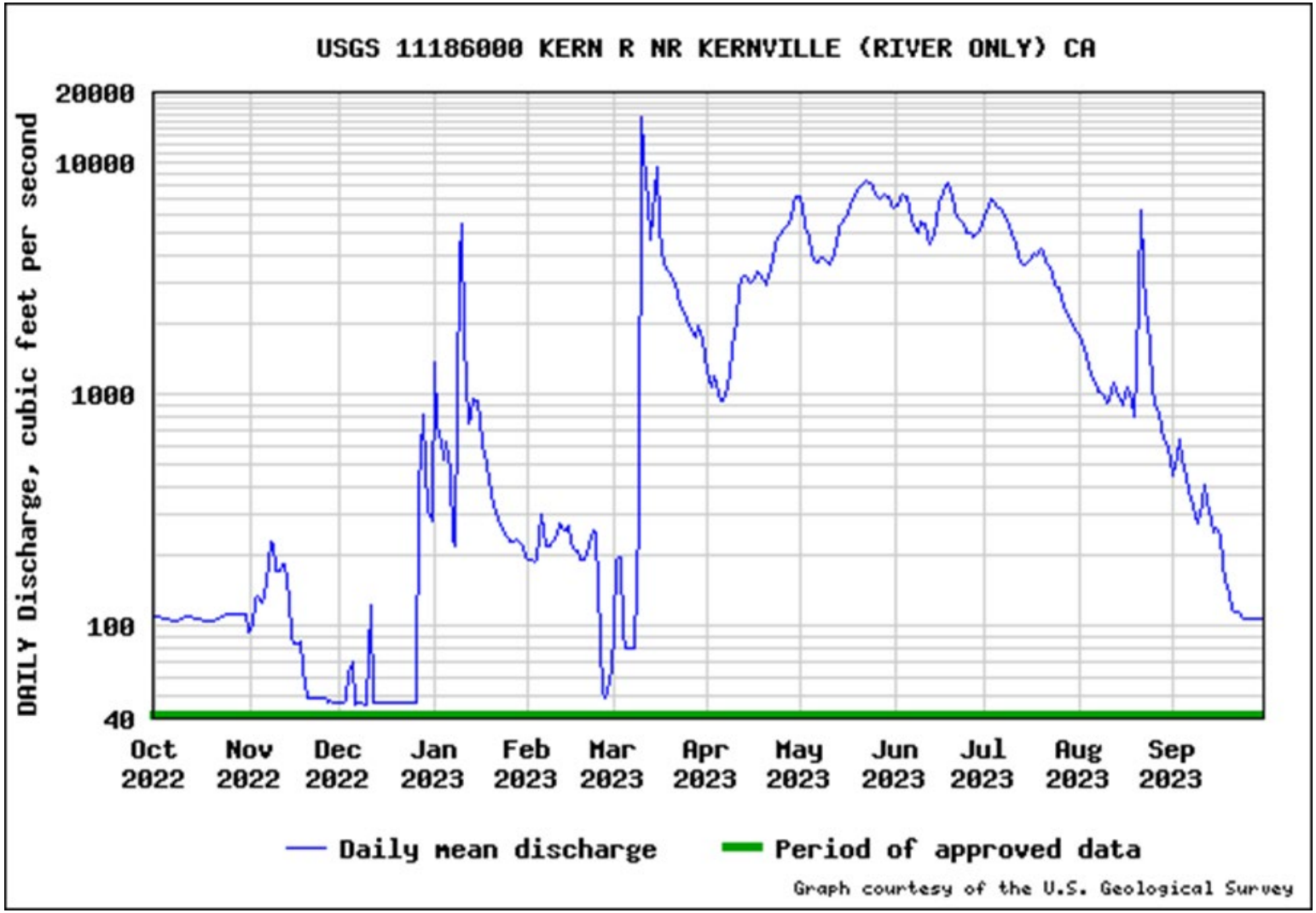


Figure 5-3. USGS Water Year Summary for Site USGS 11186000 at Lake Isabella Dam

5.4 SEDIMENT MANAGEMENT

Lake Isabella traps most sediment derived from the upper Kern River watershed. Downstream of Lake Isabella, there are several tributaries, however, entering the Kern River in the 20 miles between Lake Isabella and Democrat Dam. During intense winter storms and late summer and fall thunderstorm events these tributaries can introduce significant volumes of sediment to the Democrat Dam Impoundment.

Democrat Dam is an overflow concrete gravity dam with a crest length of 204 feet and a height of 29 feet. The impoundment formed by the dam has a surface area of 27 acres. Water is typically released to the Kern River either by flow over the dam or by a valve located along the southeast bank of the Kern River at the head of the flowline that diverts water to the Kern River No. 1 Powerhouse. Water stored in Democrat Impoundment can also be released from a low-level outlet, or drain gate, located at the bottom of the impoundment, immediately in front of the intake. The drain gate measures 4-feet wide by 8-feet tall, and when completely open can pass approximately 800 cfs of water.

The sandbox located at the head of the flowline beneath Democrat Dam acts as a sediment trap, preventing the entry of damaging sediments into the flowline and the downstream hydroelectric plant. Water flows from the flowline and diversion dam into the sandbox, which contains two slide-gate valves. Part of the water flowing from these valves is diverted to the Kern River No. 1 Powerhouse, the remaining water is released into the Kern River. One valve is left open year-round to provide minimum instream flow releases to the river (15 cfs minimum from October 1 through May 31 and 50 cfs minimum from June 1 through September 30). Since continuous flow occurs, there is a continuous sediment release and sediment does not accumulate in the sandbox. This is a pass through of naturally occurring sediment.

Naturally occurring sediment also accumulates and is temporarily stored behind Democrat Dam. Sediment behind the dam is currently managed with a low-level outlet, or drain gate, located at the bottom of Democrat Dam. The drain gate bypasses water and sediment from behind the dam. The drain gate and the diversion can operate simultaneously. That is, if total river flow is 1,212 cfs, then SCE may divert 412 cfs to the Project powerhouse and 800 cfs may flow through the drain gate. However, it is typical to cease diverting water into the flowline prior to operating the lower drain gate, in order to avoid entraining mobilized sediment into the flowline, where it could cause damage to the powerhouse turbines.

Sediment management in Democrat Dam Impoundment was historically conducted in accordance with the Project's *Sediment Monitoring Results and Sediment Management Plan* (SMP) (ENTRIX/SCE 1999). The 1999 SMP was filed on March 1, 1999 pursuant to Article 402 of the license, and was approved by FERC Order on April 6, 1999 (FERC 1999).

In 2005, SCE, in consultation with resource agencies, prepared a *Revised Sediment Management Plan* (SCE 2005), which proposed additional sediment management strategies, as well as monitoring and adaptive management. From approximately 2005

until recently, accumulated sediment was managed in accordance with SCE's Revised Sediment Management Plan (SCE 2005) and resource agency permits. These permits include, California Department of Fish and Wildlife (CDFW) Fish and Game Code Section 1600 Routine Maintenance Agreement (Agreement), State Water Resources Control Board (SWRCB) Clean Water Act Section 401 Water Quality Certification, and U.S. Army Corps of Engineers (USACOE) 404. CDFW filed a Notice of Categorical Exemption (NOE) with the State Clearinghouse (SCH 2006038514) on March 27, 2006. CDFW filed a second NOE with the SCH on August 24, 2018 (SCH 2006038514) to cover the 5-year extension of the CDFW Agreement (until March 17, 2023). The U.S. Forest Service, Sequoia National Forest completed an internal Decision Letter, dated January 14, 2013, approving sediment management activities at the KR1 Project. The letter determined that "this activity is necessary to maintain the safe and reliable operation of the hydroelectric project. This activity is authorized by SCE's Federal Energy Regulatory Commission license."

In February 2022, the USACOE permits expired followed by expiration of the CDFW Agreement in March 2023. SCE is currently in the process of renewing the permits. Historical and current sediment management is described below:

- Historical operation (2005 to 2022) for Democrat Dam included an operational flushing procedure, full pond drain procedure, and peak flow sediment bypass procedure:

  – Operational Flushing Procedure – Operational flushing is a standard maintenance procedure and is performed as needed to bypass sediment that has accumulated directly in front of the drain gate. During operational flushing only sediment directly in front of the drain gate is scoured, resulting in mobilization of a relatively insignificant amount of sediment. Operational flushing should occur annually, whenever flow conditions allow, reducing the storage of sediments behind the dam and keeping the area in front of the intake clear of sediment. Operational flushing is subject to seasonal flow constraints related to fish spawning and rearing. Flow criteria include (1) flow in the bypassed reach >600 cfs from July 1 to March 14, and (2) flow in the bypassed reach >1,200 cfs during the smallmouth bass spawning and rearing period from March 15 to June 30.

  – Full Pond Drain Procedure – Full pond drain involves draining the Democrat Impoundment by releasing full river flow through the lower drain gate, thereby creating conditions for increased scouring in the impoundment. A full pond drain can only feasibly occur when the lower drain gate is fully opened (releasing approximately 800 cfs) and the inflow into Democrat Impoundment is less than 800 cfs. This reduces the water level of the impoundment and allows the natural flow of the river and the impounded water to scour sediment accumulated in the impoundment. Full pond drains are more effective than operational flushing at removing sediment accumulated upstream from the intake gates due to increased velocity and scouring potential of the released

water. Water is not typically diverted to the KR1 Powerhouse during full pond drains.

During full pond drains, inflows must be less than 800 cfs to allow the impoundment to drain, and therefore flow in the bypassed reach does not exceed 800 cfs. However, flows exceeding 800 cfs are required to successfully transport the high volumes of sediment released into the bypassed reach from full pond drains. This causes temporary sediment deposition in the river below the dam. To address this, full pond drains are only implemented when anticipated flows, based on weather forecasts and expected Lake Isabella water releases, are determined to be sufficient to transport the deposited sediment through the bypassed reach.

Based on previous consultation with CDFW, SCE only implements full pond drains between July 1 and March 14, to avoid the spawning and rearing period for hardhead minnow, which extends from March 15 to June 30.

Full pond drains should occur annually, if possible, to ensure that sediment trapped behind the dam does not accumulate to unmanageable levels. However, full pond drains are not recommended during extended drought periods, when sediment transport in the lower Kern River is significantly reduced.

– Peak Flow Sediment Bypass Procedure – The peak flow sediment bypass procedure manages sediment-laden peak flows resulting from natural precipitation events, including winter storms and summer and fall thunderstorms. During storm events, tributary streams entering the Kern River below Isabella Dam can transport significant amounts of sediment into the Democrat Impoundment. Under these conditions, fine sediment suspended in the water column can be entrained into the flowline and delivered to the powerhouse where it can cause increased wear on the wetted portion of the hydraulic turbines. Therefore, during turbid flow conditions SCE may temporarily cease diversion to the KR1 Powerhouse and allow the full river flow to pass over and through the lower drain gate directly into Kern River bypassed reach. In these situations, SCE closes the valve at the head of the flowline, and fully opens the lower drain gate to allow all inflow to flow into the bypassed reach. The sediment load is carried by the full river flow, thereby mimicking the natural sediment transport regime. When flood conditions and turbid flow conditions have improved, standard operating procedures are resumed.

- Current sediment management activities (since the permits expired) are limited to activities that allow inflow sediment to bypass Democrat Dam as part of regular Project operation and maintenance activities. These include the operational flushing and peak flow sediment bypass, but do not include full pond drain (see above). Full pond drain would occur in the future when the agency permits (CDFW Section 1600, SWRCB 401, USACOE 404) are renewed.

Reporting of sediment operations listed above is provided in annual reports that SCE prepares each year for CDFW and the SWRCB. Since 2005, SCE has implemented full pond drains on five occasions (March 2007, September–March 2009, February 2012, February–March 2013, January–February 2018). Operational flushing and peak flow sediment bypass has occurred on an as needed basis since 2005.

The goal of sediment management at Democrat Dam is to emulate the natural sediment regime of the lower Kern River (to the extent possible) by allowing naturally occurring sediment that is temporarily deposited in the impoundment to continue downstream, past Democrat Dam, and through the lower Kern River system without building up behind Democrat Dam.

6.0 STUDY SPECIFIC CONSULTATION

No specific consultation is required for this study, and no consultation has been conducted to date.

7.0 OUTSTANDING STUDY PLAN ELEMENTS

There are no outstanding study plan elements.

The anticipated schedule for next steps associated with completion of this Technical Memorandum are identified in Table 7-1.

Table 7-1. Schedule for Completion of Study

Date	Activity
January 2025	Distribute draft Technical Memorandum to stakeholders
February–April 2025	Stakeholders review and provide comments on draft Technical Memorandum (90 days)
May–June 2025	Resolve comments and prepare Final Technical Memorandum
December 2025	Distribute Final Technical Memorandum in Draft License Application

8.0 REFERENCES

CDEC (California Data Exchange Center). 2024. California Department of Water Resources, hourly and daily precipitation at the Kern Powerhouse station on August 19, 1013. Accessed November 2024.

CNRFC (California Nevada River Forecast Center). National Oceanic and Atmospheric Administration, Monthly Precipitation Summary Water Year 2023, Station ISAC1 at Lake Isabella Dam. Accessed December 2024.

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ENTRIX. 1999. Sediment Monitoring Results and Sediment Management Plan. Prepared for Southern California Edison.

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SCE (Southern California Edison). 2005. Revised Sediment Management Plan for the Kern River No. 1 Hydroelectric Project. Prepared for Southern California Edison, Rosemead, CA. Prepared by ENTRIX, Inc., Ventura, CA. February 28.

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USGS (United States Geological Survey). 2024. Water Year Summary for Site USGS 1118600. Accessed December 2024.

APPENDIX A

Photographs of Observed Potentially Significant Sources of Erosion and Sedimentation

Photo A-1. Unnamed tributary on Democrat Dam Flowline Access Road

Photo A-2. Unnamed tributary on Democrat Dam Flowline Access Road

Photo A-3. Unnamed tributary at water crossing on Cow Flat Road

Photo A-4. Upper Cow Flat Creek

Photo A-5. Cow Flat Creek at SR-178 and confluence with mainstem channel

Photo A-6. Cow Flat Creek at SR-178 and confluence with mainstem channel

Photo A-7. Upper Lucas Creek at water crossing on Cow Flat Road

Photo A-8. Upper Lucas Creek at water crossing on Cow Flat Road

Photo A-9. Dougherty Creek drainage above SR-178

Photo A-10. Bank Erosion RB_1

Photo A-11. Bank Erosion RB_1

Photo A-12. Fine sediment in Stark Creek at end of flowline access road

Photo A-13. Stark Creek at SR-178

Photo A-14. Rilling/Landslide RB-1

Photo A-15. Rilling/Landslide RB-1 (Google Earth Image, Date: 8/24/23)

Photo A-16. Bank Erosion RB-2

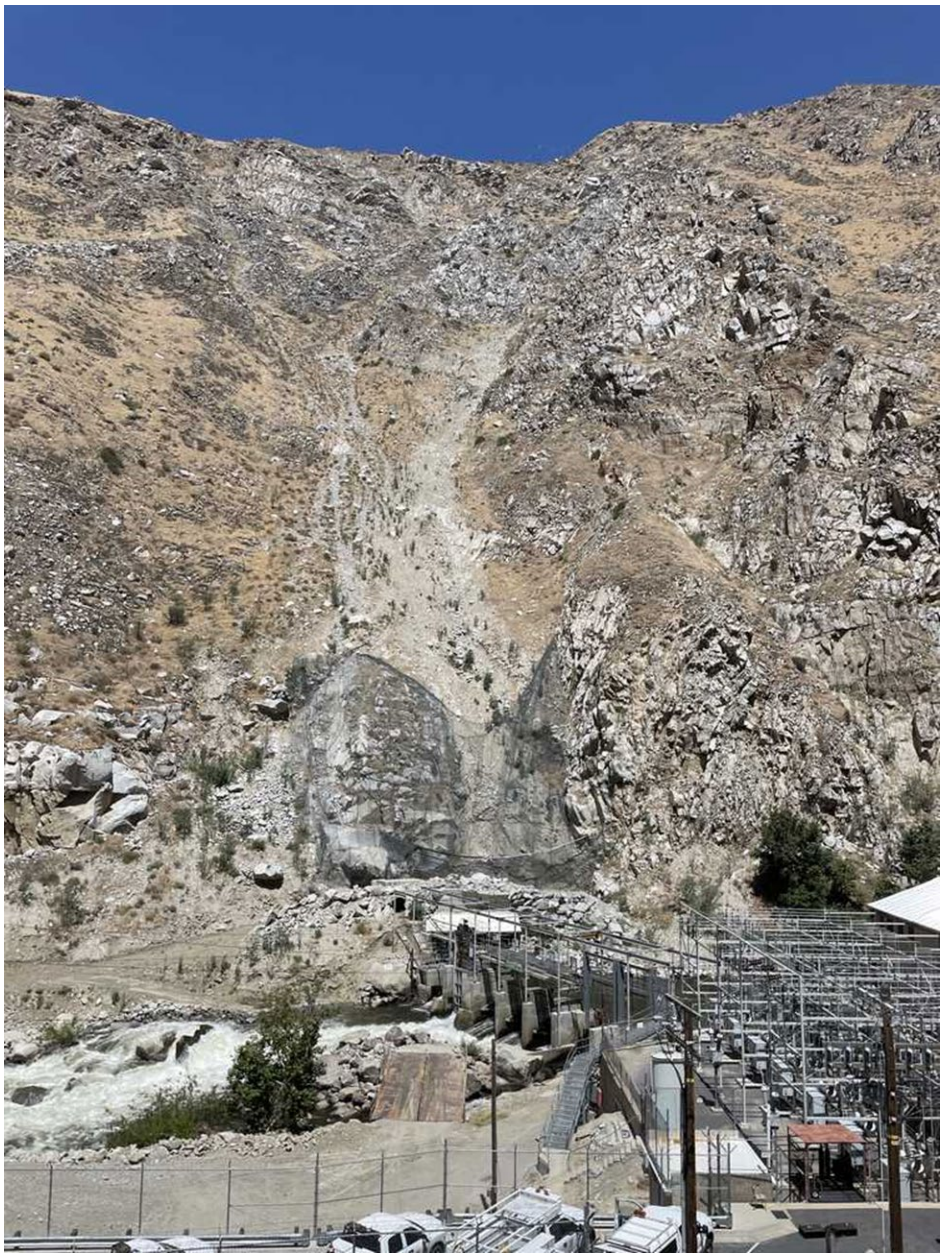

Photo A-17. Natural Rockslide at KR1 Powerhouse

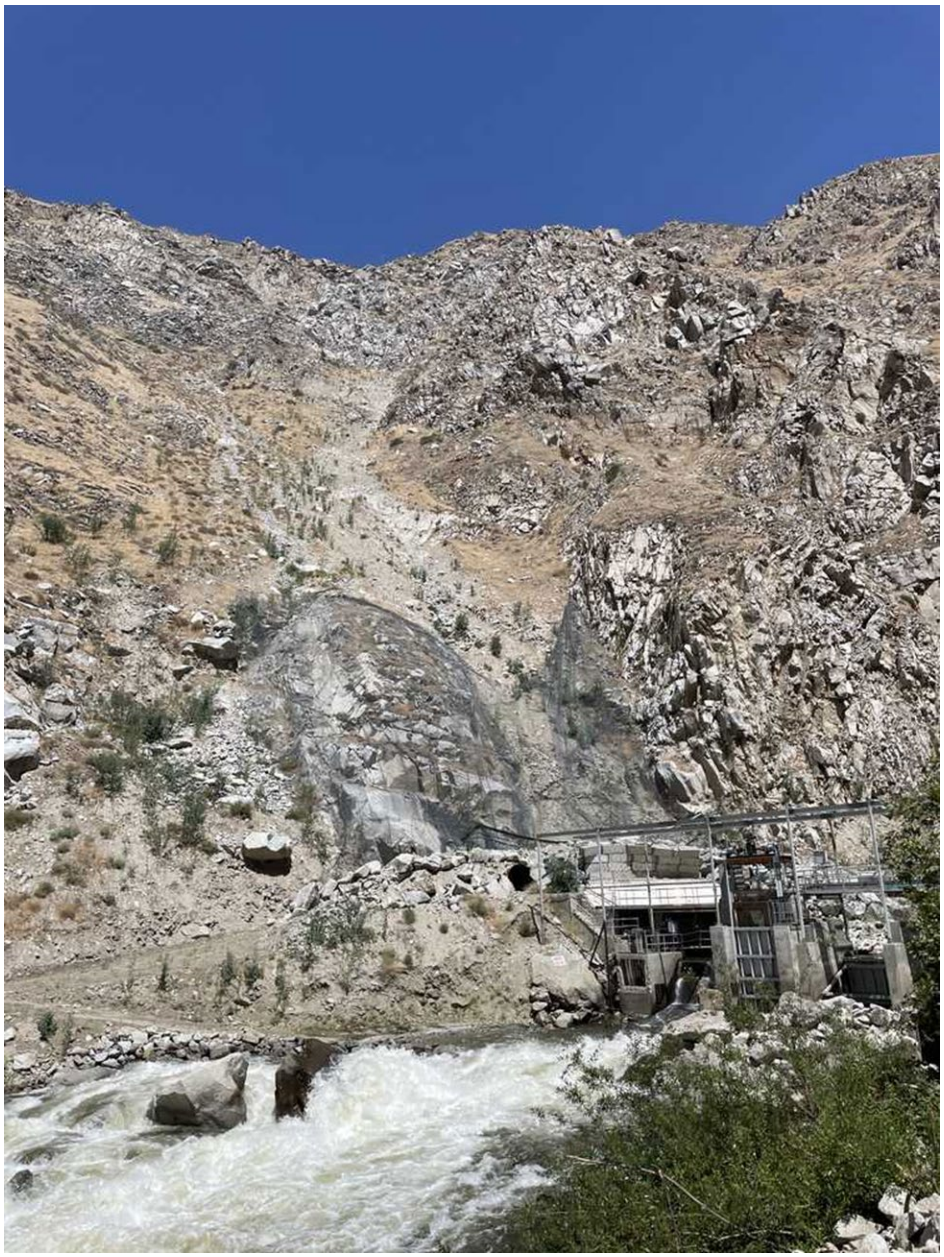

Photo A-18. Natural Rockslide at KR1 Powerhouse

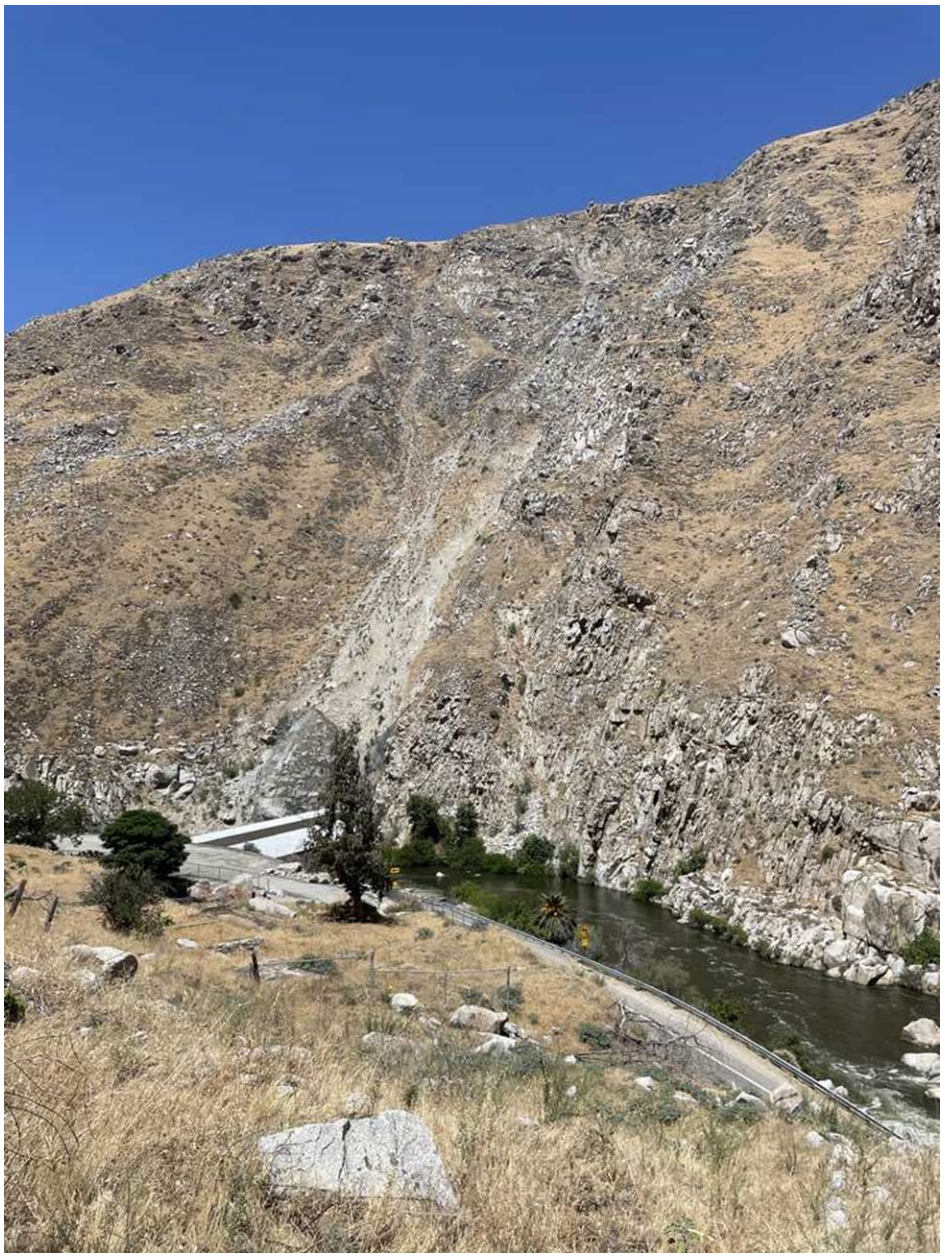

Photo A-19. Natural Rockslide at KR1 Powerhouse

Kern River No. 1 Forebay Spill – August 20, 2013
Kern River No. 1 Project – FERC Project No. 1930

Kern River No. 1 Forebay

Photo A-20. Erosion from the August 20, 2013, Forebay Spill Event (SCE 2013)

Photo A-21. KR1 Penstock before the August 20, 2013, Forebay Spill Event (Google Earth Image, Date: 8/12/2013)

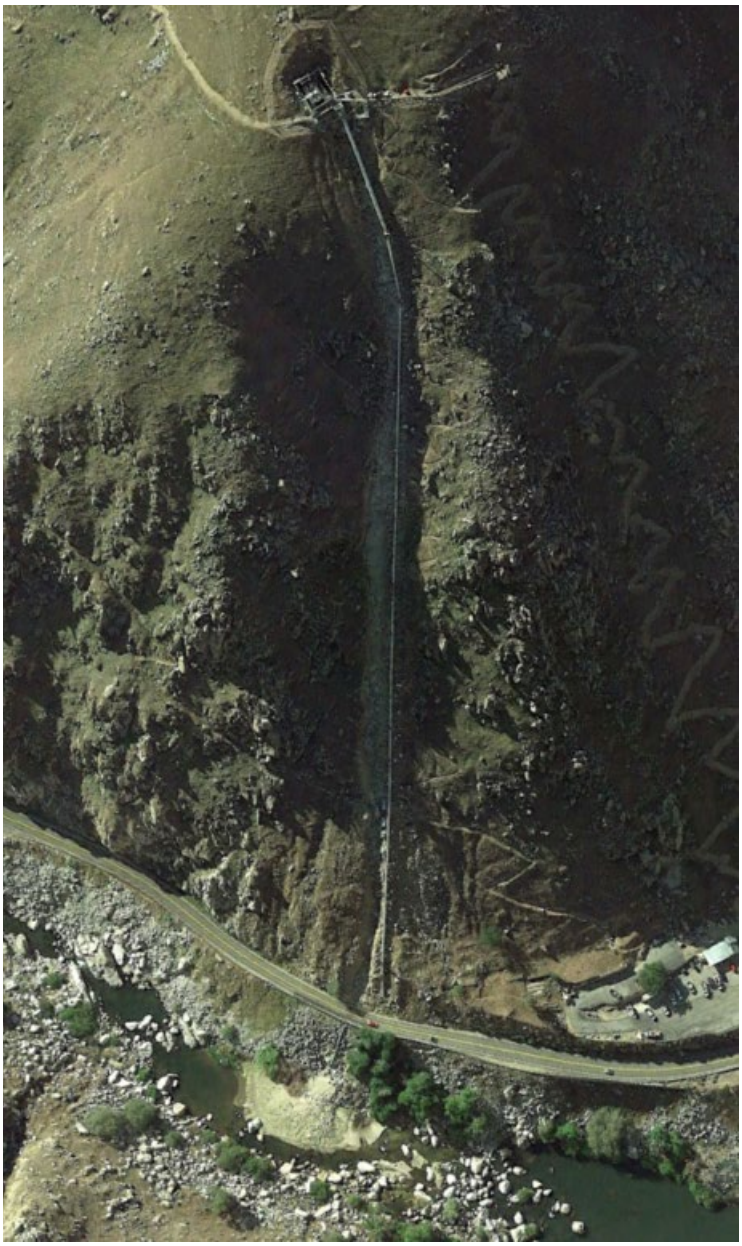

Photo A-22. KR1 Penstock Erosion and Sediment Deposition in the Kern River Channel After the August 20, 2013, Forebay Spill Event (Google Earth Image, Date: 4/15/2014)

Photo A-23. Debris Slide Closing SR-178 on March 1, 2023 (Caltrans 2023)

Photo A-24. Debris Slide Closing SR-178 on March 15, 2023 (Caltrans 2023)