UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Klamath River Renewal Corporation	**Project Nos. 14803-001;**
PacifiCorp	**2082-063**

AMENDED APPLICATION FOR SURRENDER OF LICENSE FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

Attachment A-2

Lower Klamath Project Biological Assessment

Appendix A (Figures)

Biological Assessment

Appendix A - Figures

KLAMATH RIVER RENEWAL CORPORATION

March 2021

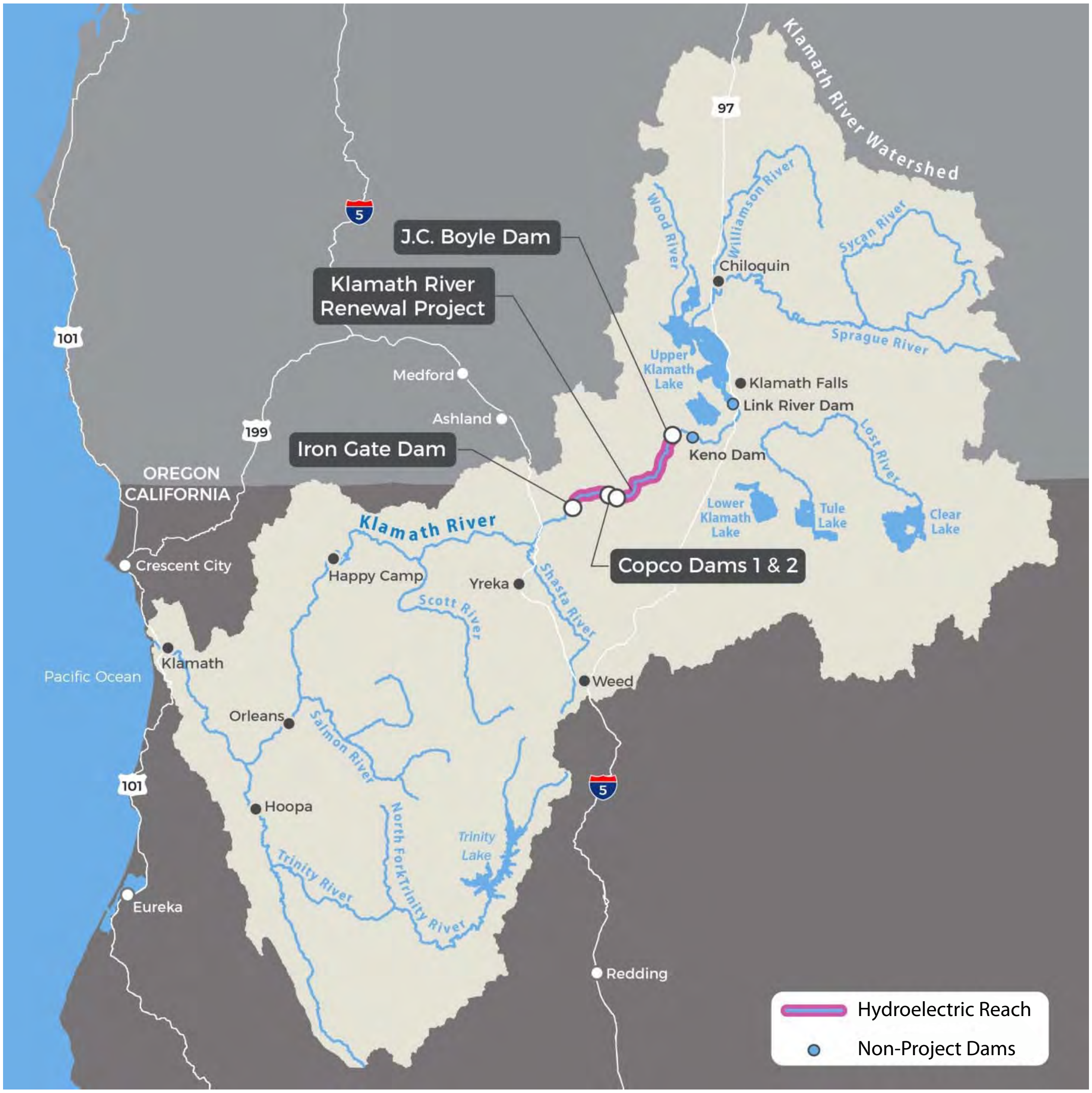
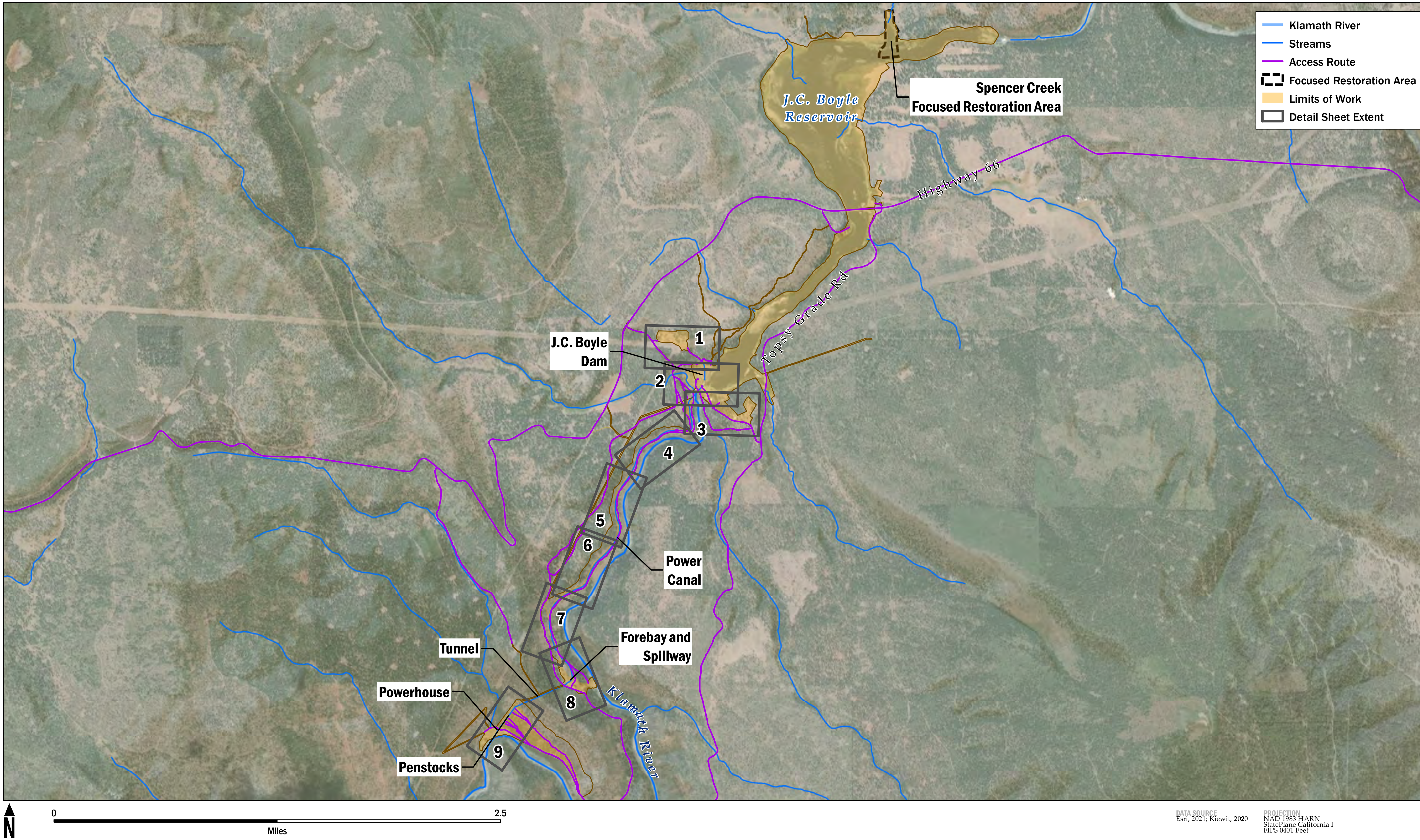


FIGURE 1-1

Klamath River Renewal Corporation
Klamath River Renewal Project

Klamath River Watershed and Facilities Locations



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

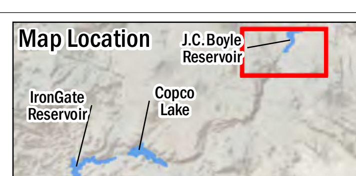
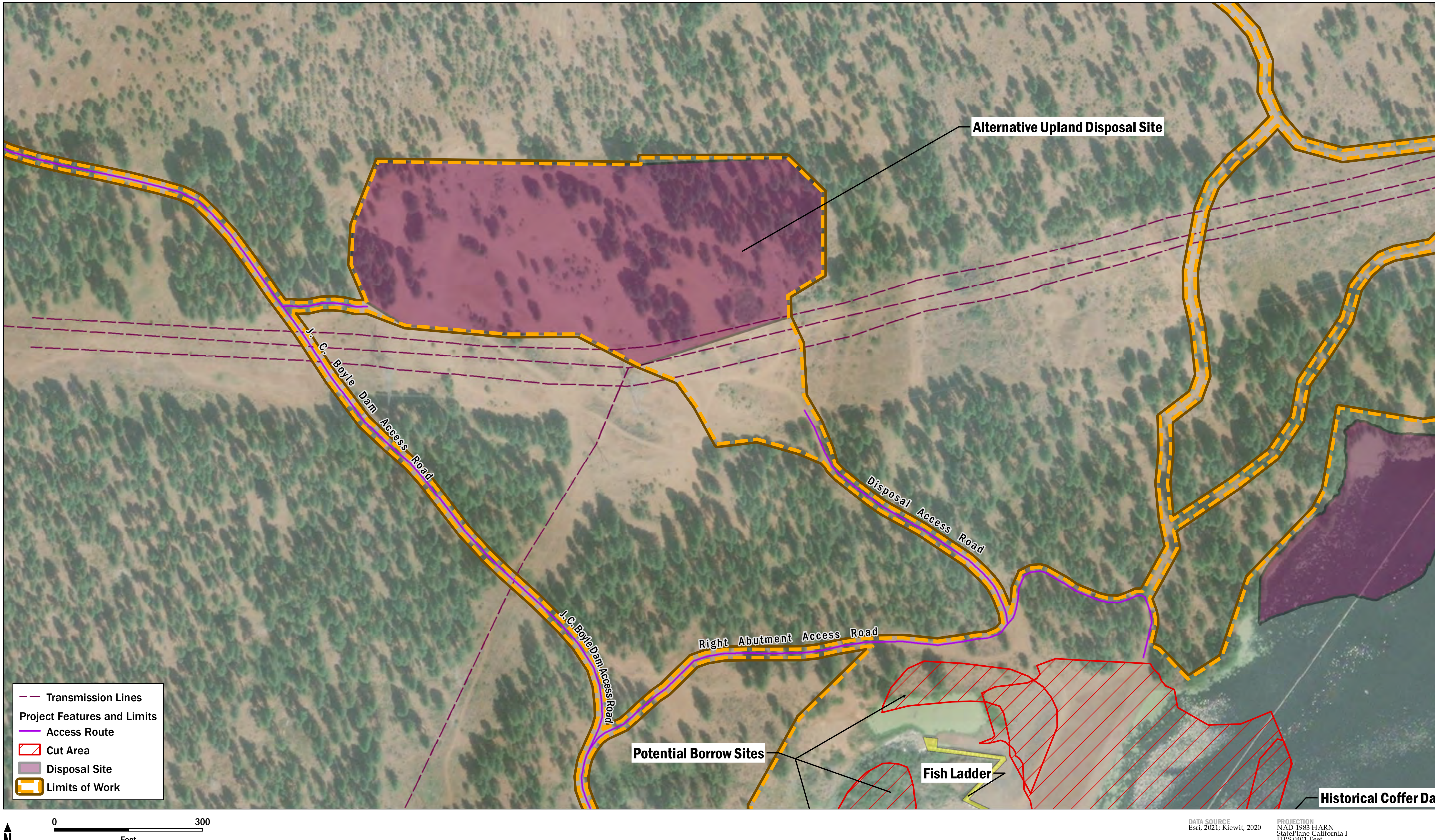


FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits Overview Sheet



Klamath River Renewal Corporation
Klamath River Renewal Project

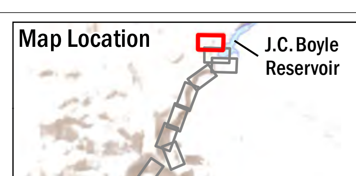
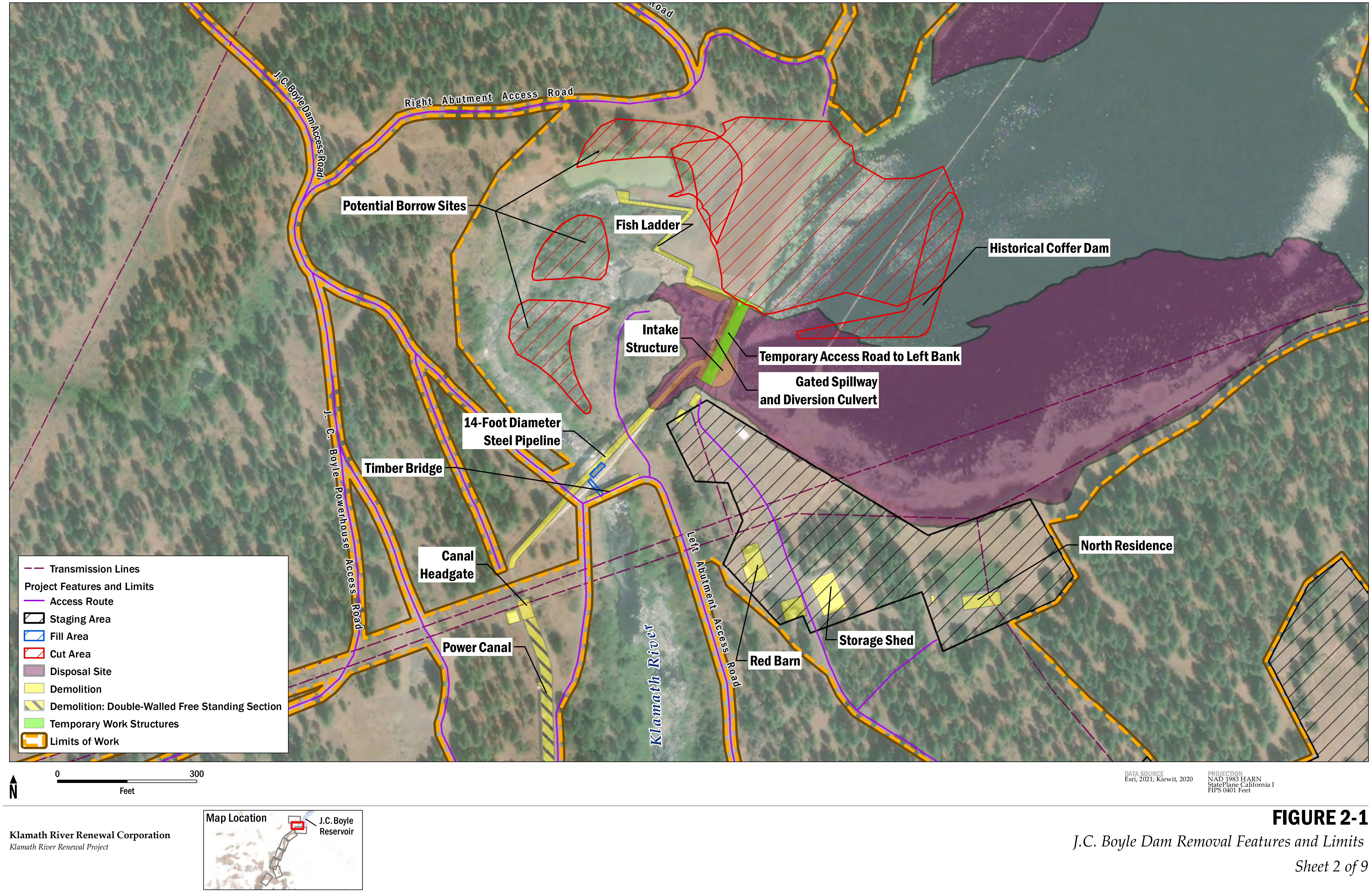


FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits

Sheet 1 of 9

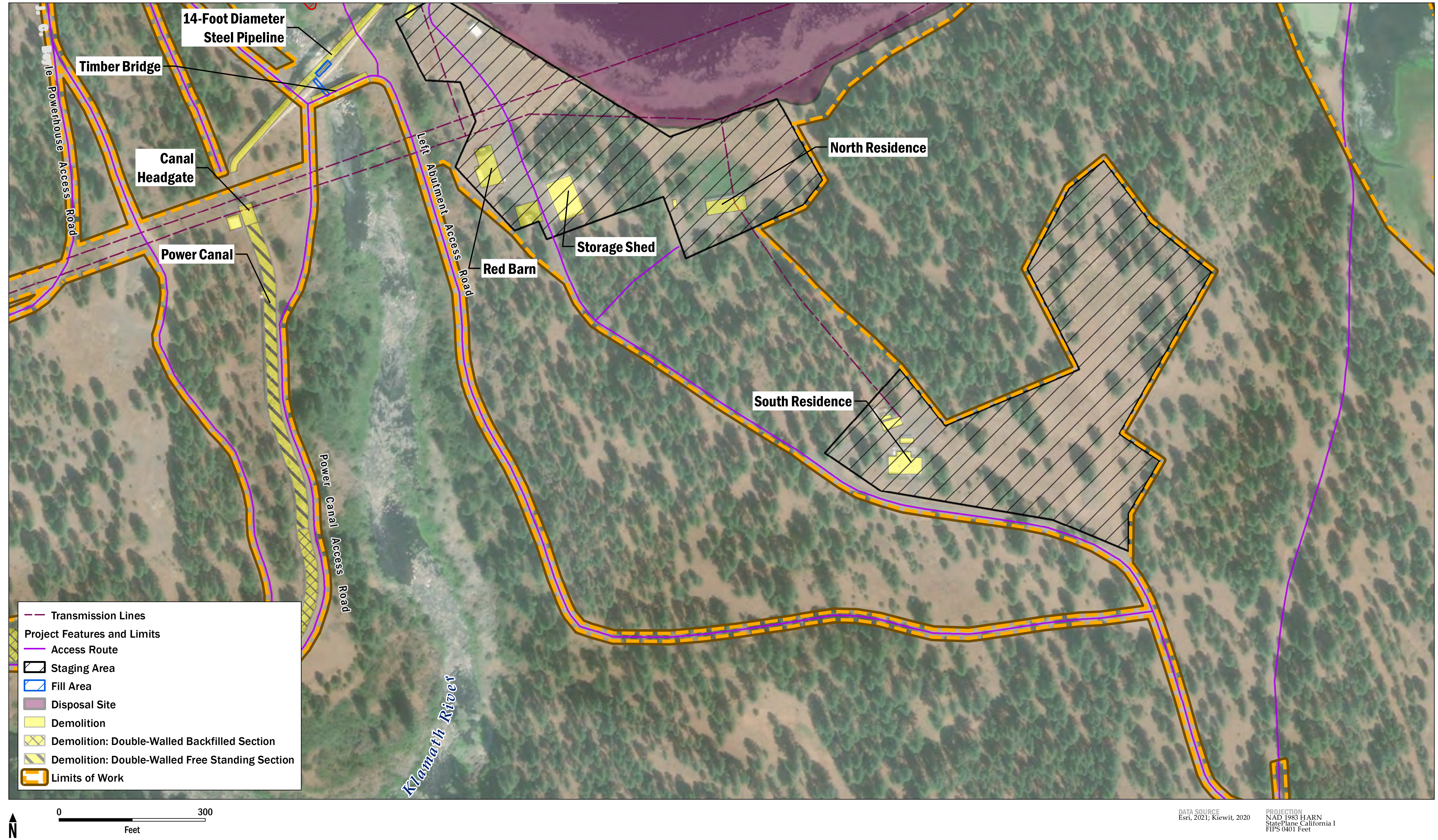


Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits

Sheet 2 of 9

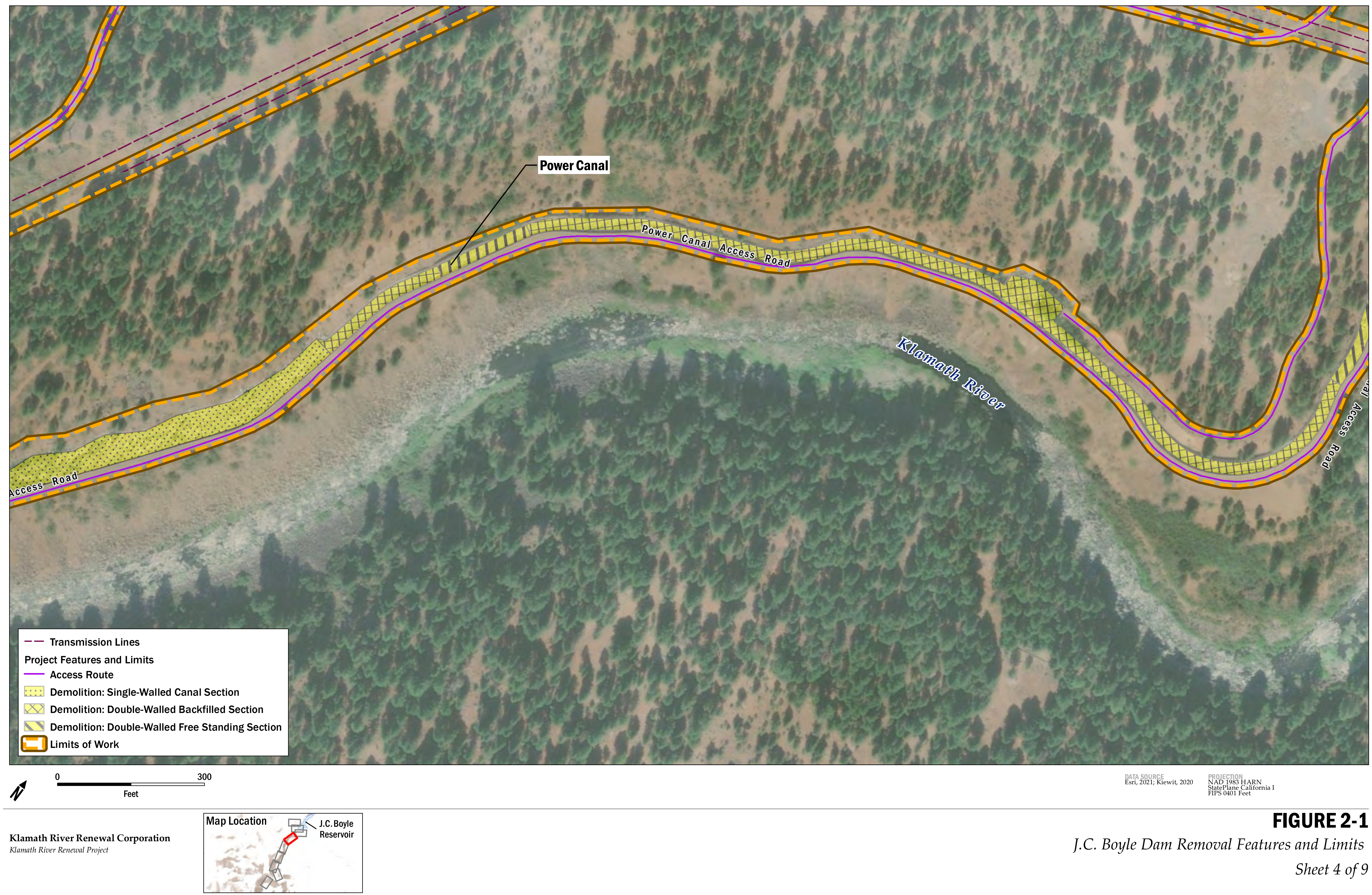


Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits

Sheet 3 of 9

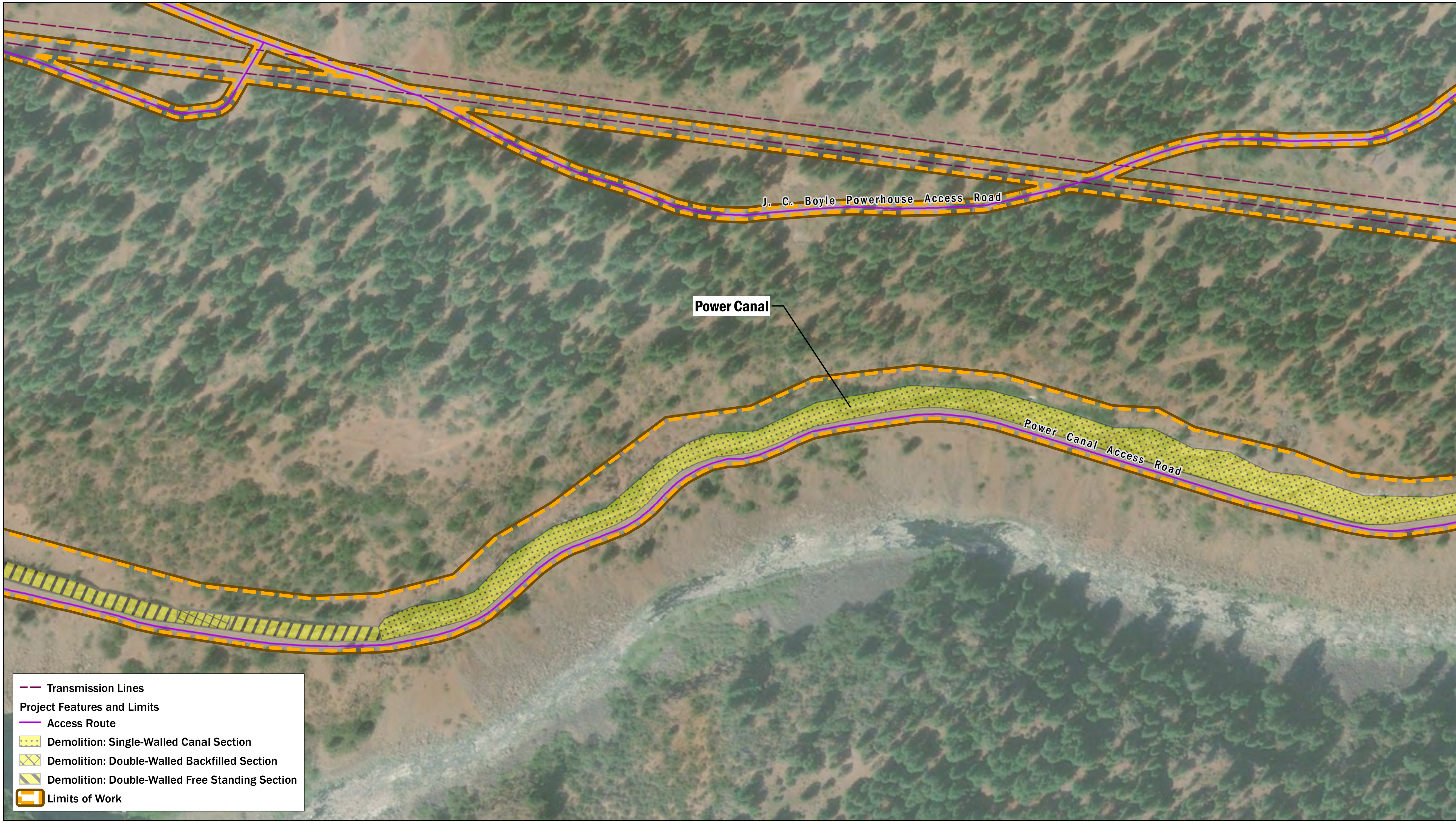


Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits

Sheet 4 of 9



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

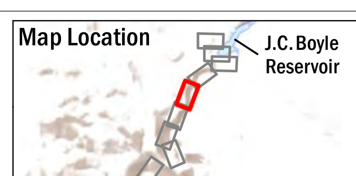
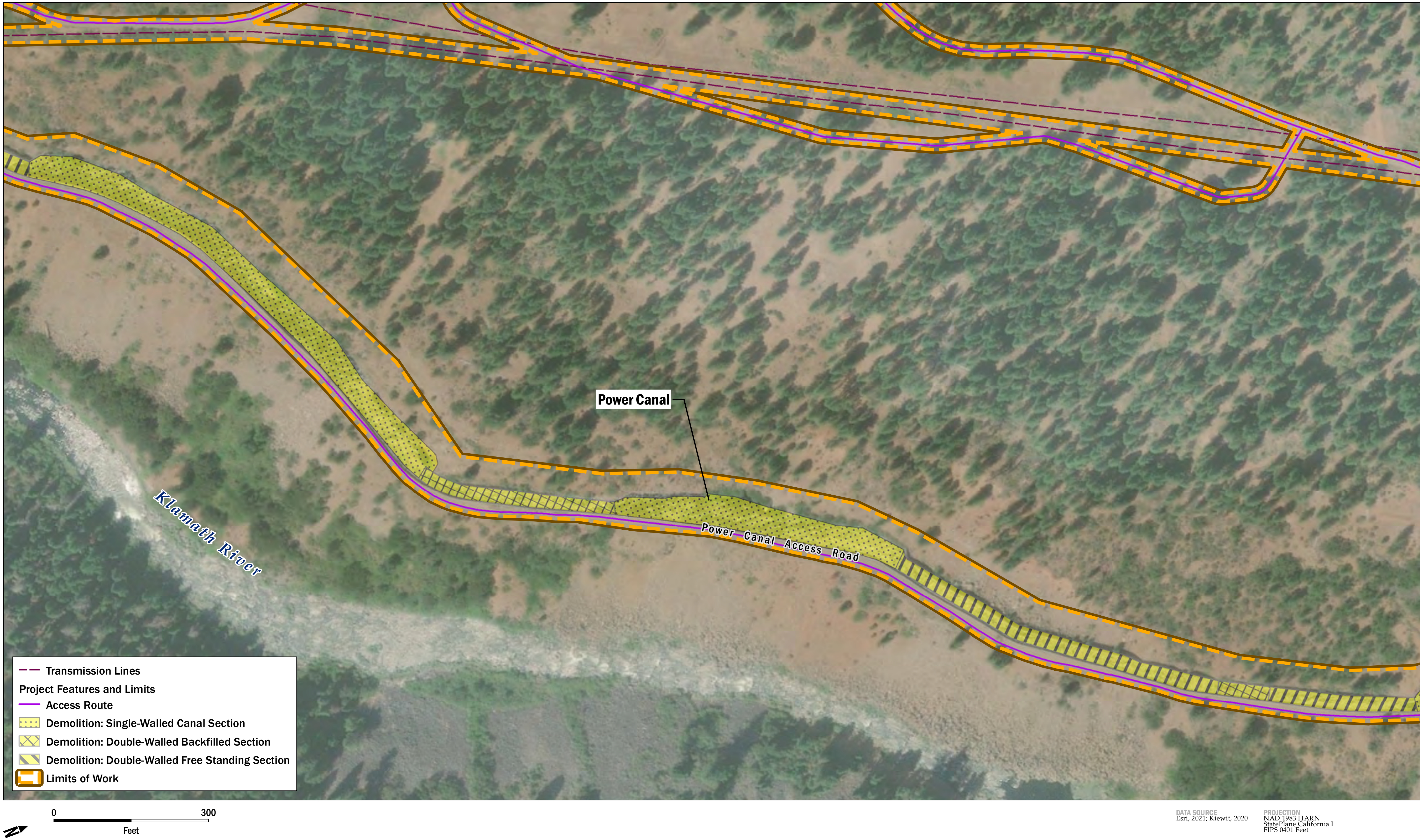


FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits

Sheet 5 of 9



Klamath River Renewal Corporation
Klamath River Renewal Project

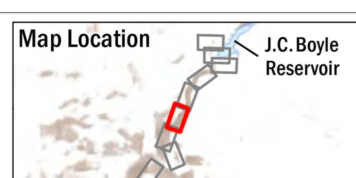
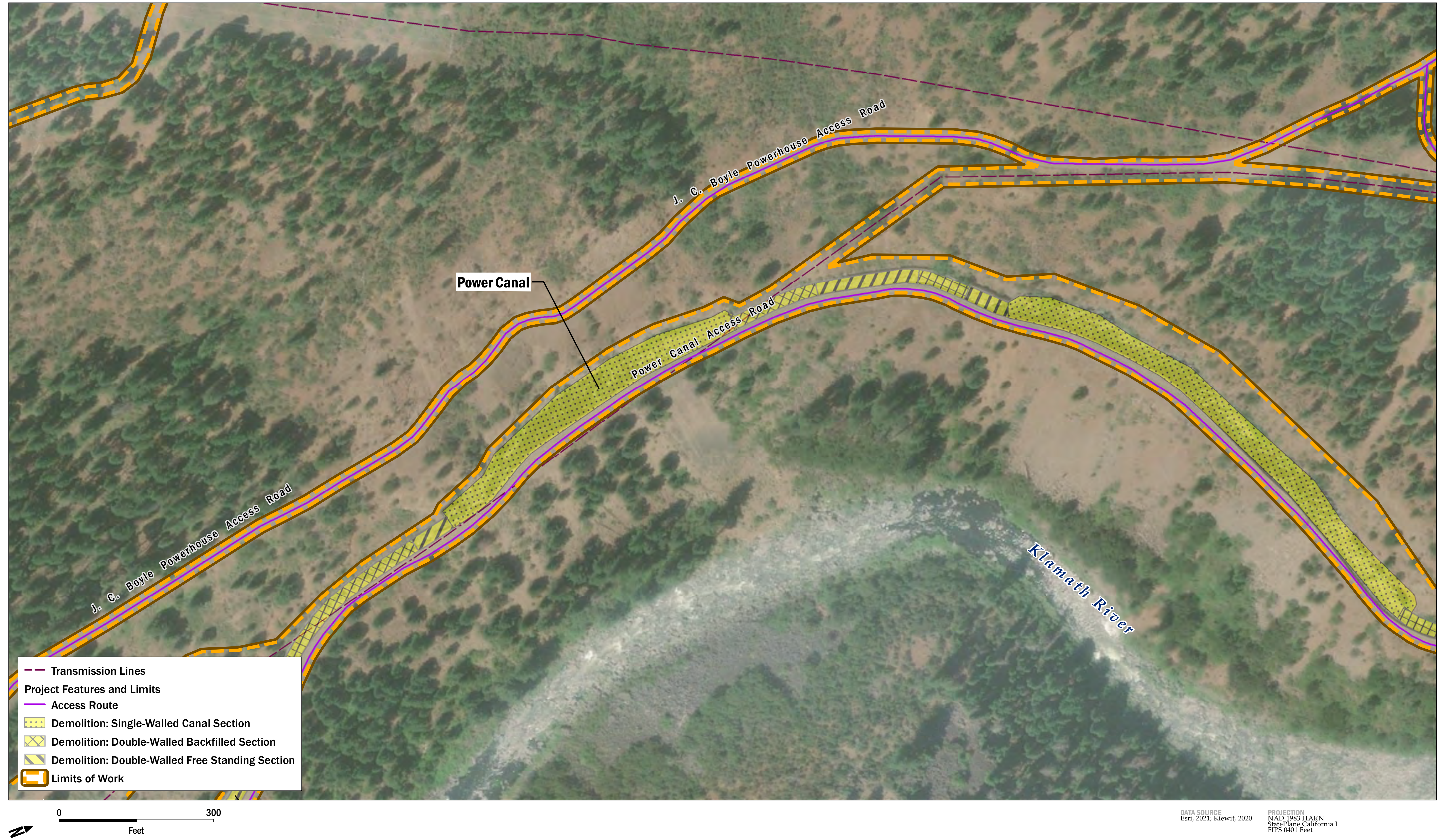
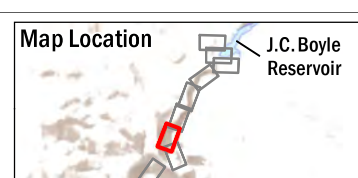


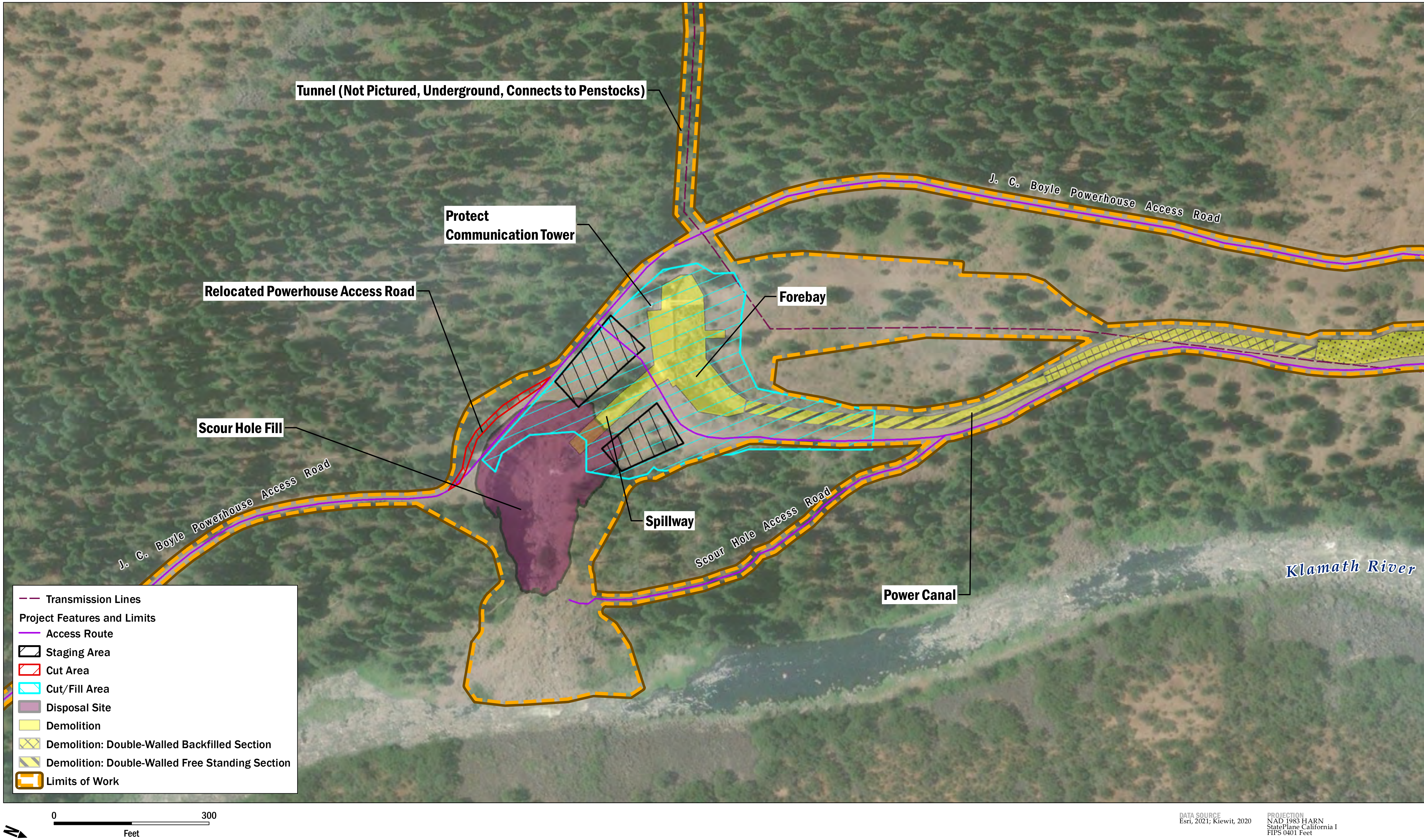
FIGURE 2-1
J.C. Boyle Dam Removal Features and Limits
Sheet 6 of 9





Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-1
J.C. Boyle Dam Removal Features and Limits
Sheet 7 of 9



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

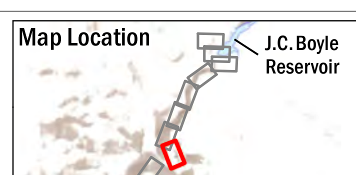
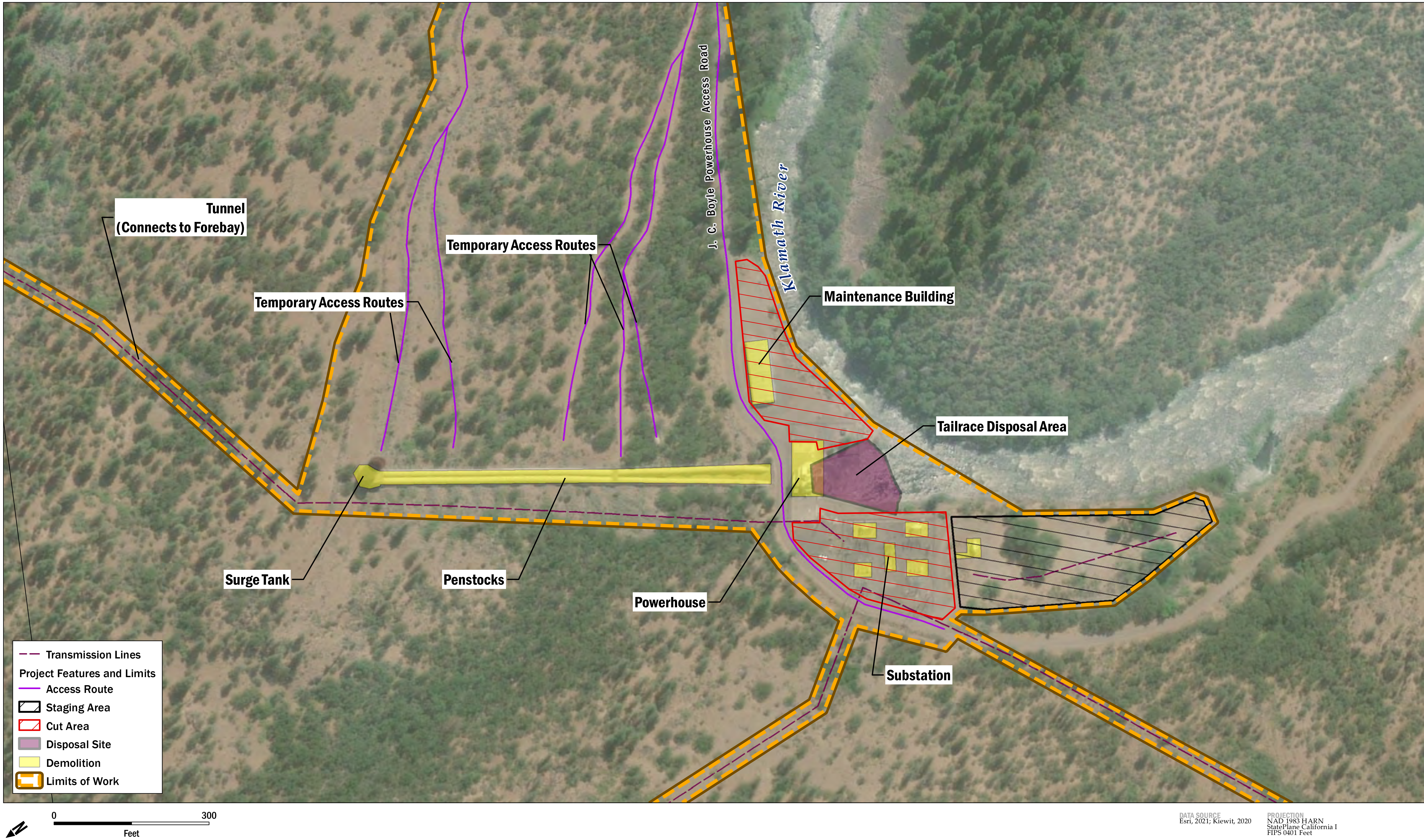


FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits

Sheet 8 of 9



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

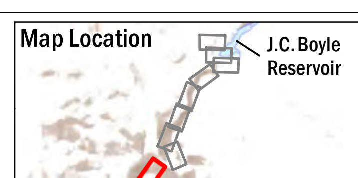
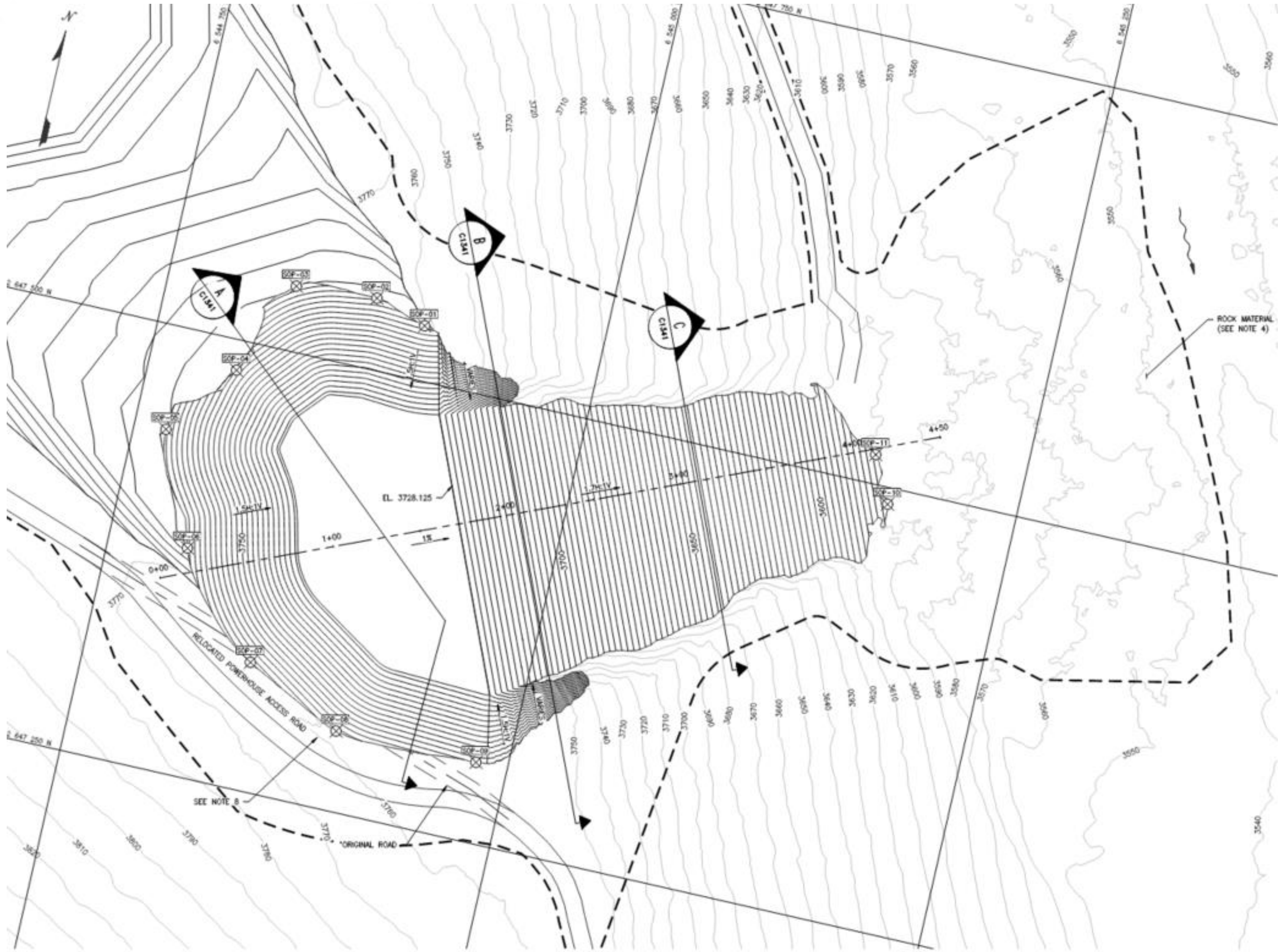


FIGURE 2-1

J.C. Boyle Dam Removal Features and Limits

Sheet 9 of 9



NOT TO SCALE

Source: Kiewit 2020

FIGURE 2-2
J.C. Boyle Facility
Spillway Scour Hole

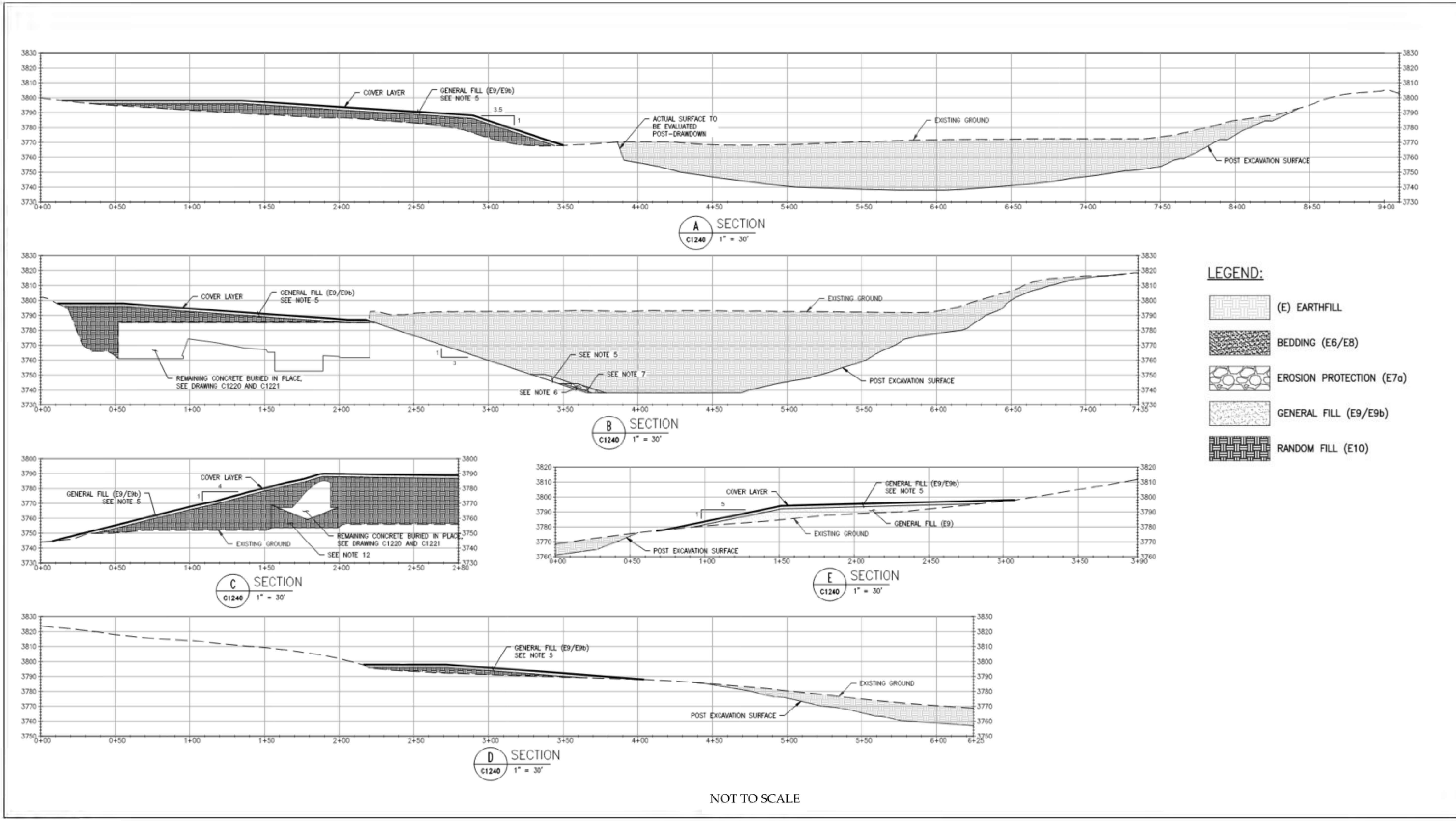
NOT TO SCALE

Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

- Final River Channel Grading (approximate future OHWM)
- Disposal Areas

FIGURE 2-3
J.C. Boyle Facility Disposal Areas and Final Channel Grading

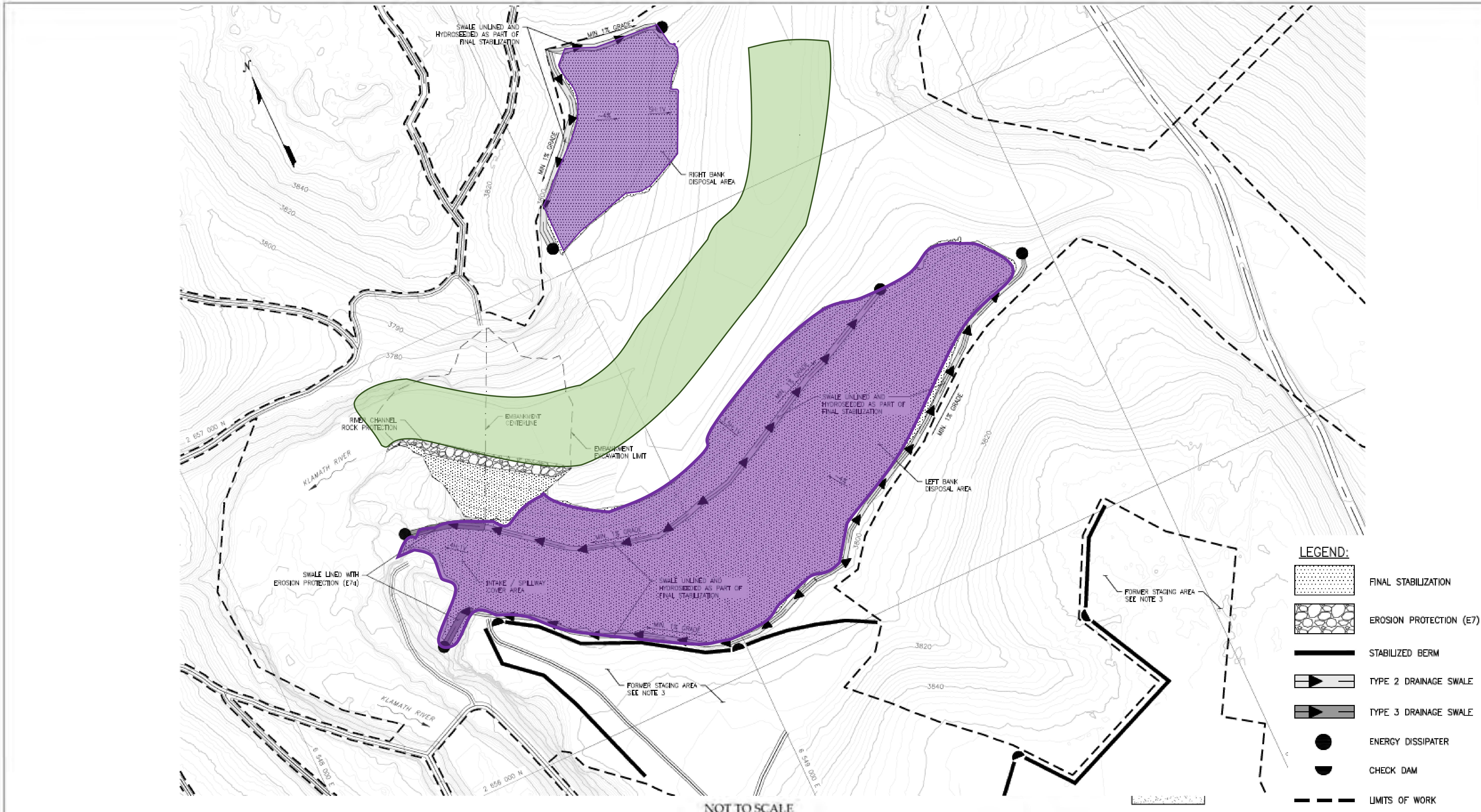


NOT TO SCALE

Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-4
J.C. Boyle Facility
Embankment Final Grading



Source: Kiewit 2020

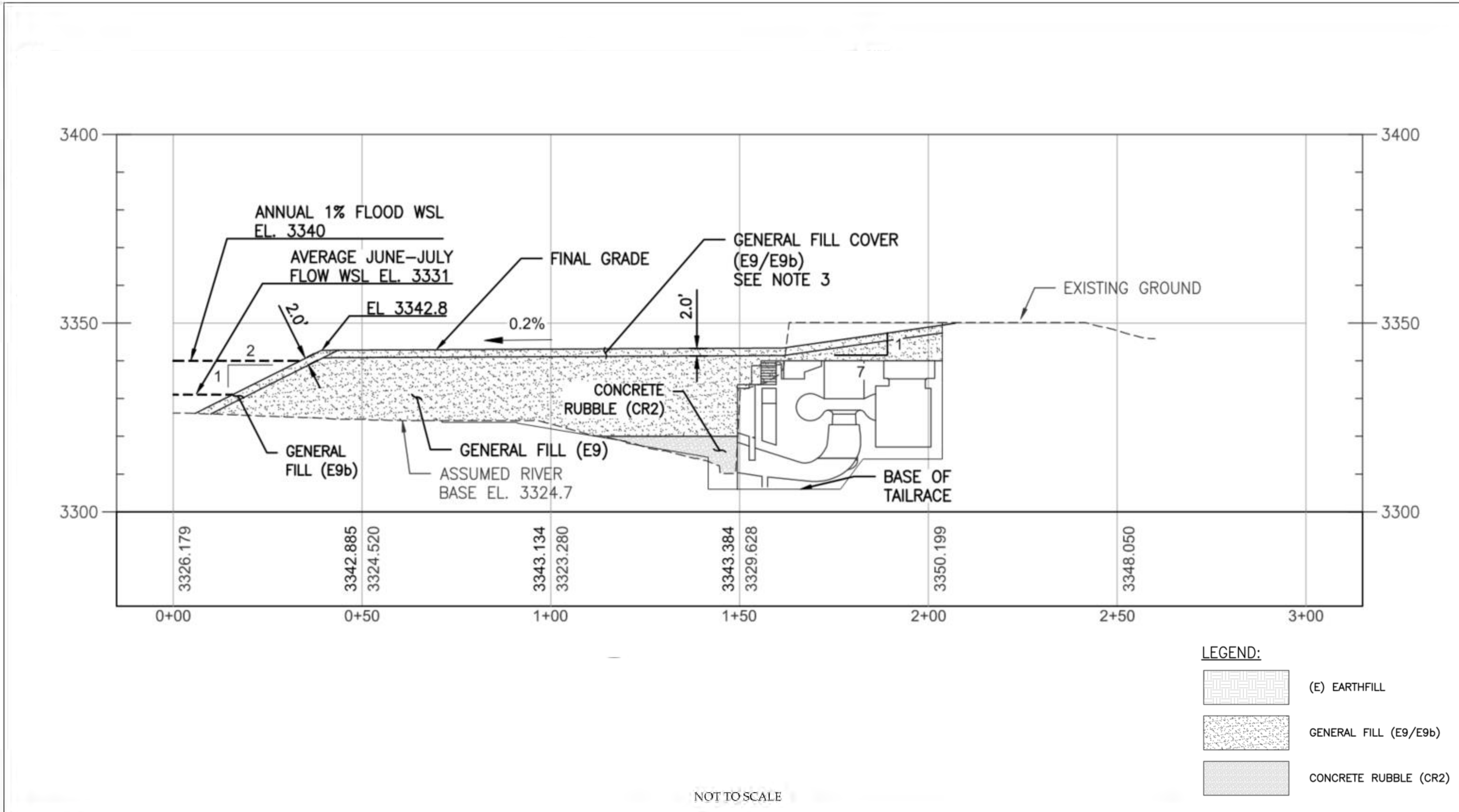
Klamath River Renewal Corporation
Klamath River Renewal Project

Final River Channel Grading (approximate future OHWM)

Disposal Areas

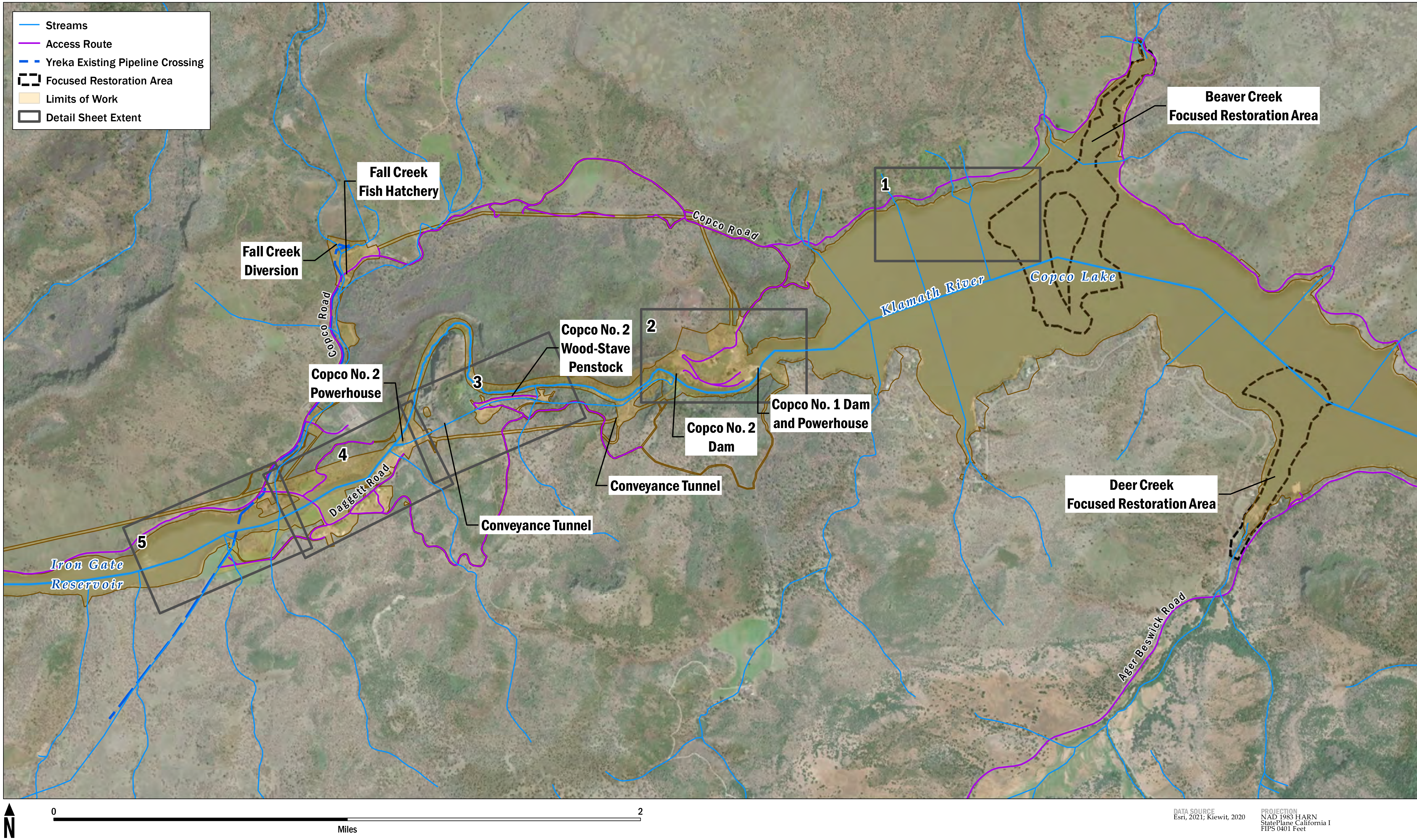
FIGURE 2-5

J.C. Boyle Facility Erosion Protection



Source: Kiewit 2020

FIGURE 2-6
J.C. Boyle Facility
Powerhouse and Tailrace Fill



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

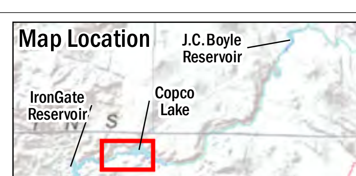
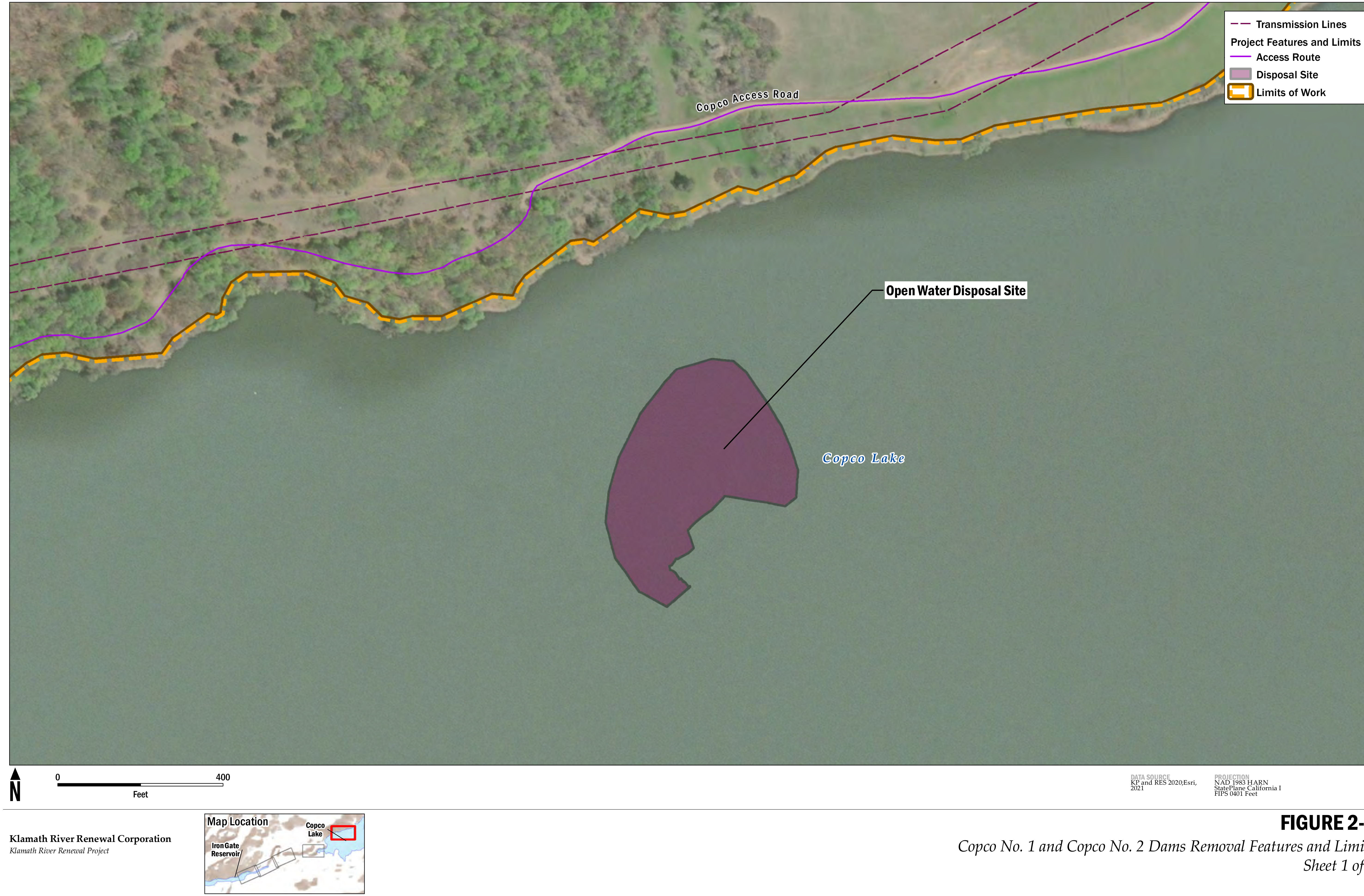


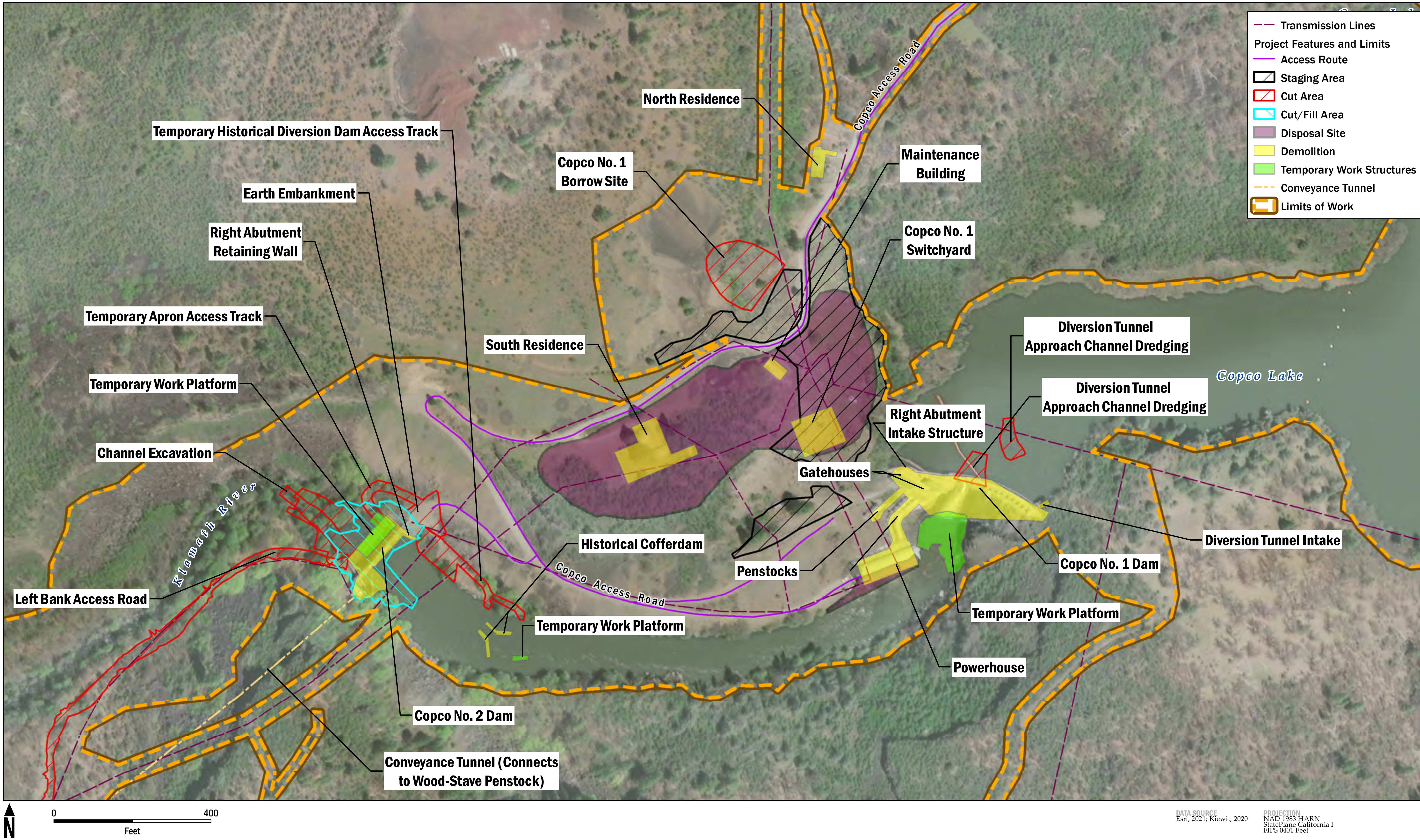
FIGURE 2-7

Copco No. 1 and Copco No. 2 Dams Removal Features and Limits
Overview Sheet



Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-7
Copco No. 1 and Copco No. 2 Dams Removal Features and Limits
Sheet 1 of 5



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

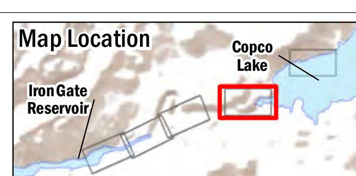
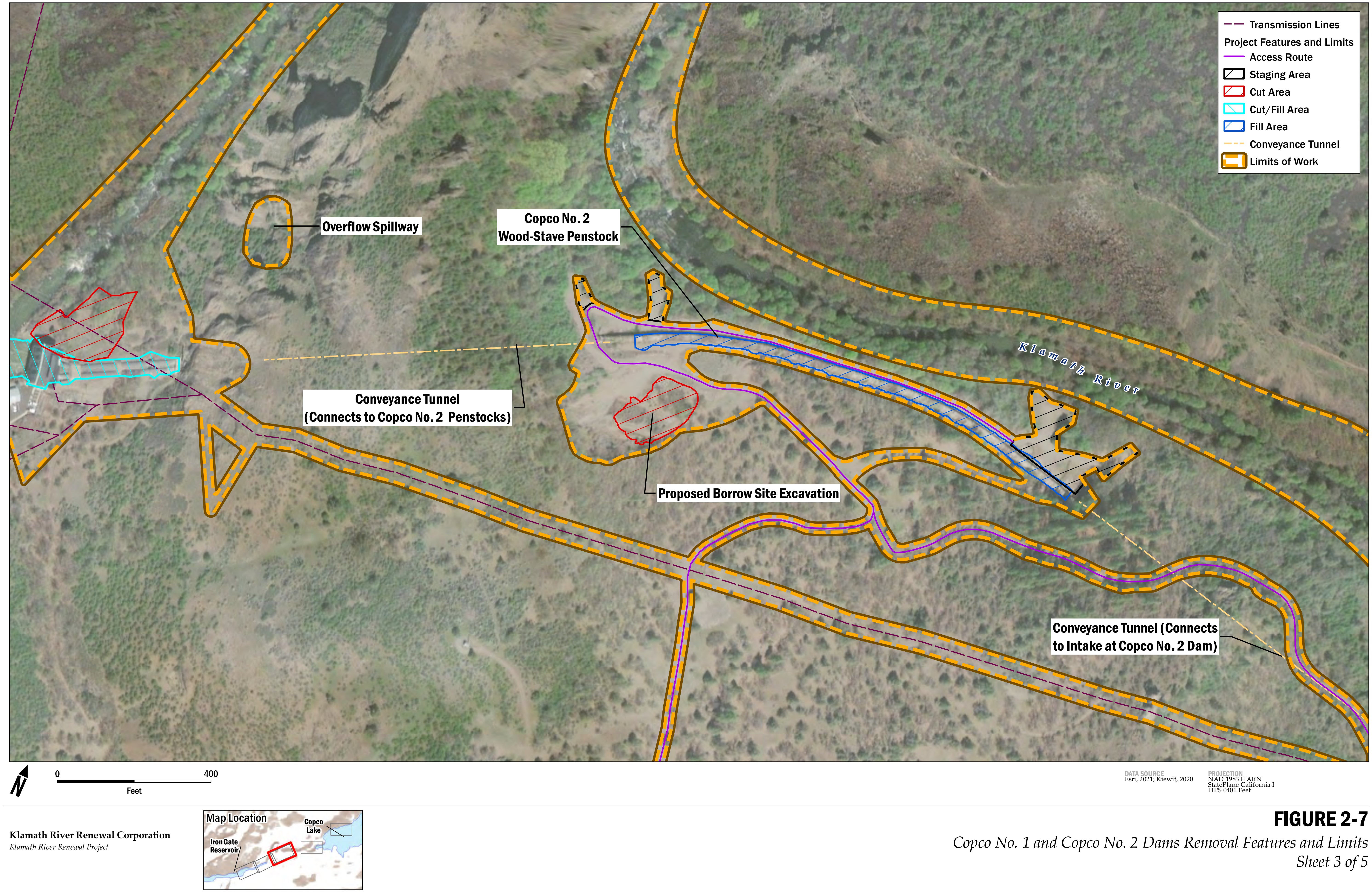


FIGURE 2-7

Copco No. 1 and Copco No. 2 Dams Removal Features and Limits
Sheet 2 of 5

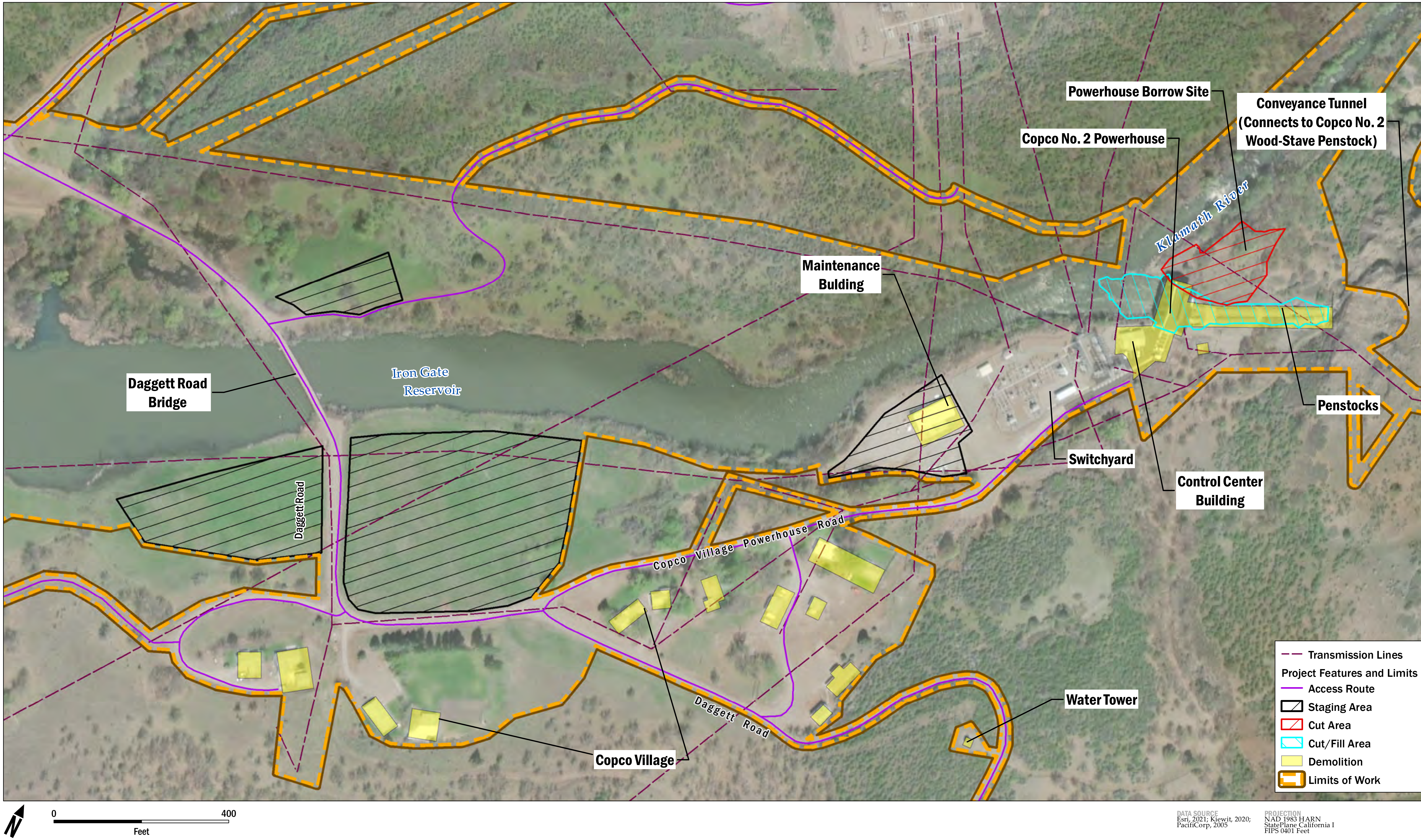


Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-7

Copco No. 1 and Copco No. 2 Dams Removal Features and Limits

Sheet 3 of 5



Klamath River Renewal Corporation
Klamath River Renewal Project

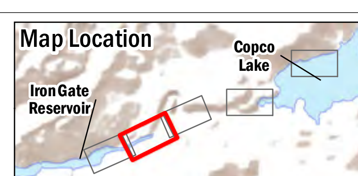
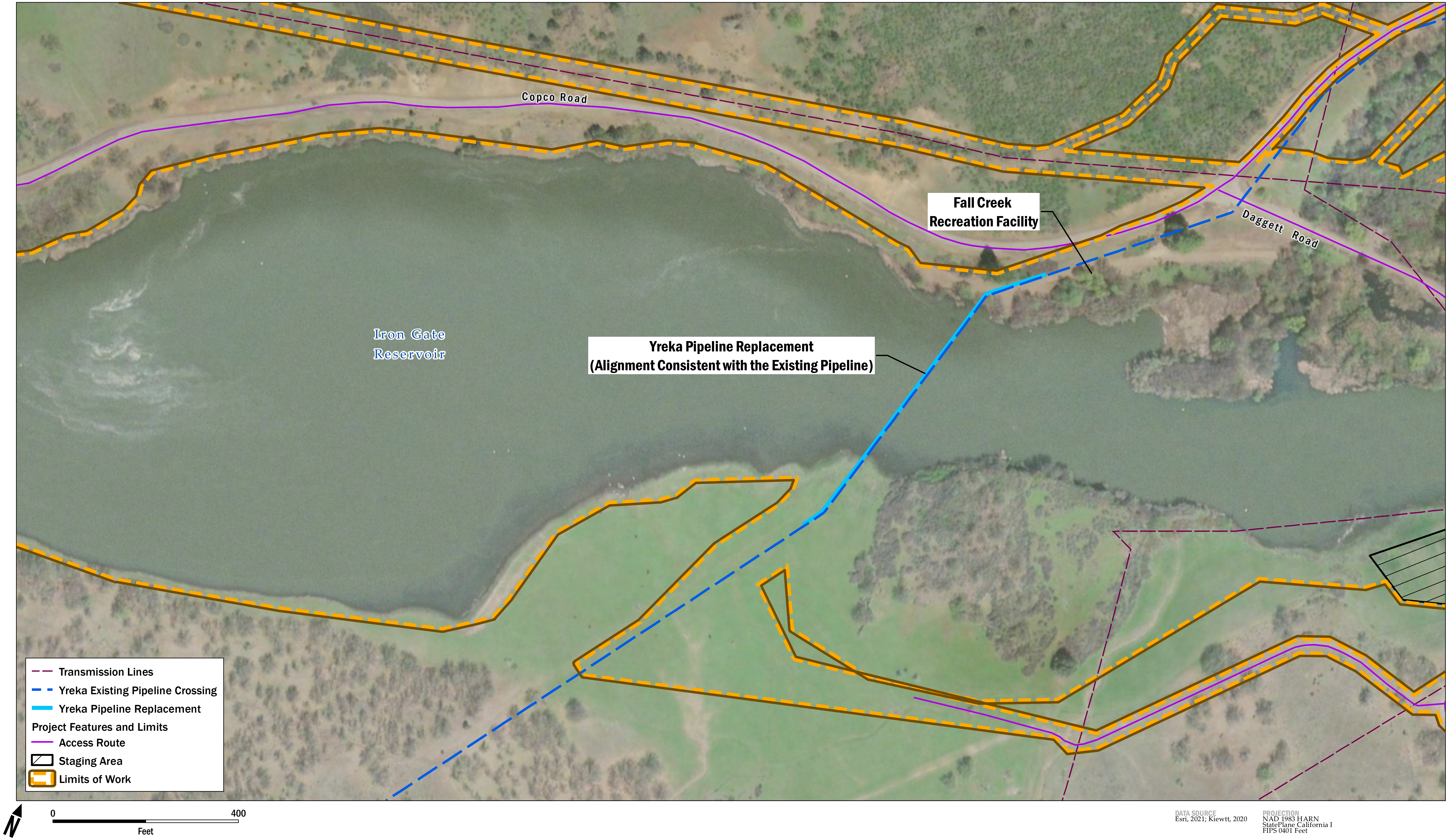


FIGURE 2-7

Copco No. 1 and Copco No. 2 Dams Removal Features and Limits

Sheet 4 of 5



DATA SOURCE
Esri, 2021; Kiewtt, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

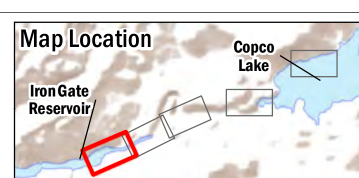
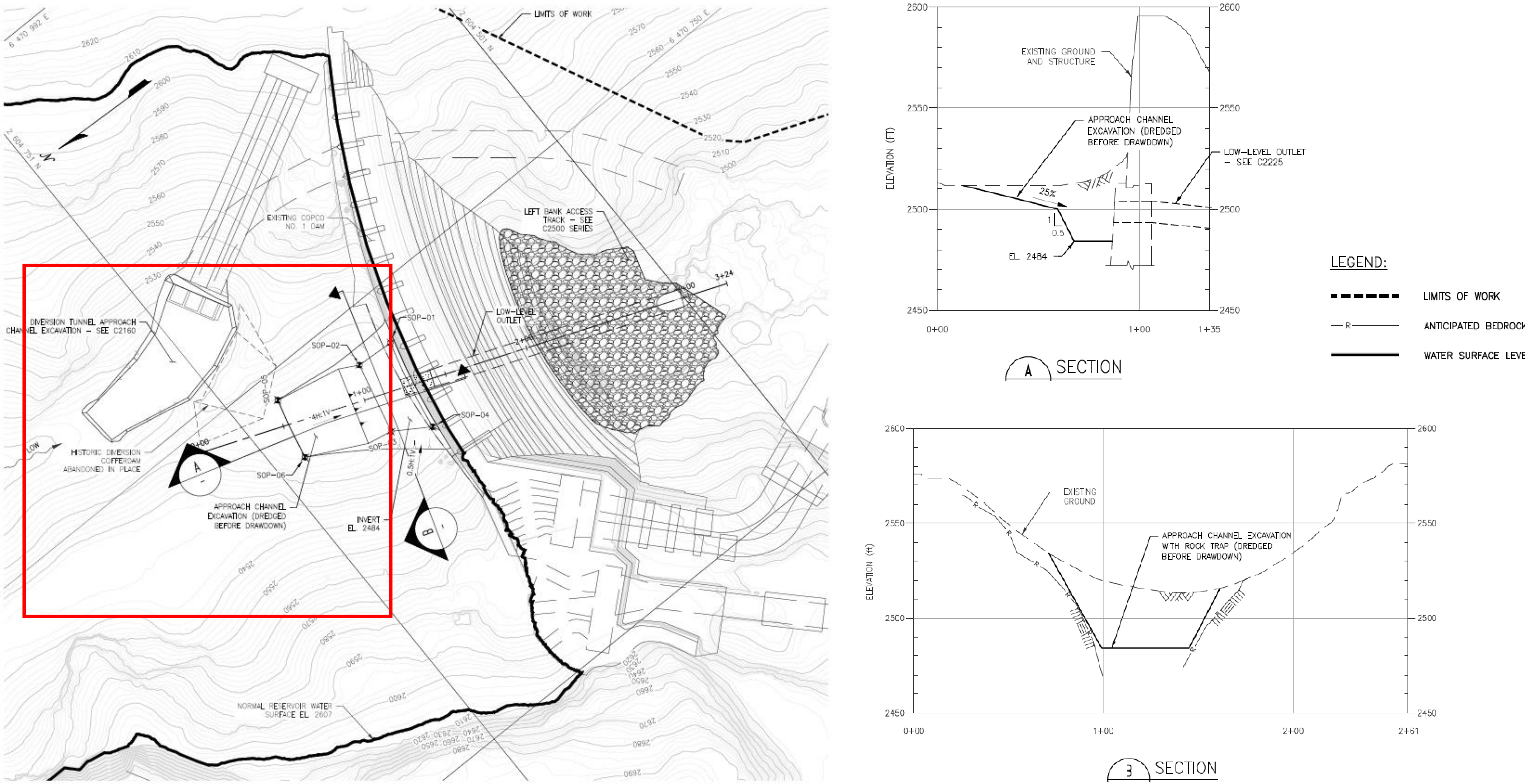


FIGURE 2-7

Copco No. 1 and Copco No. 2 Dams Removal Features and Limits
Sheet 5 of 5



NOT TO SCALE

Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

Excavation

FIGURE 2-8-a

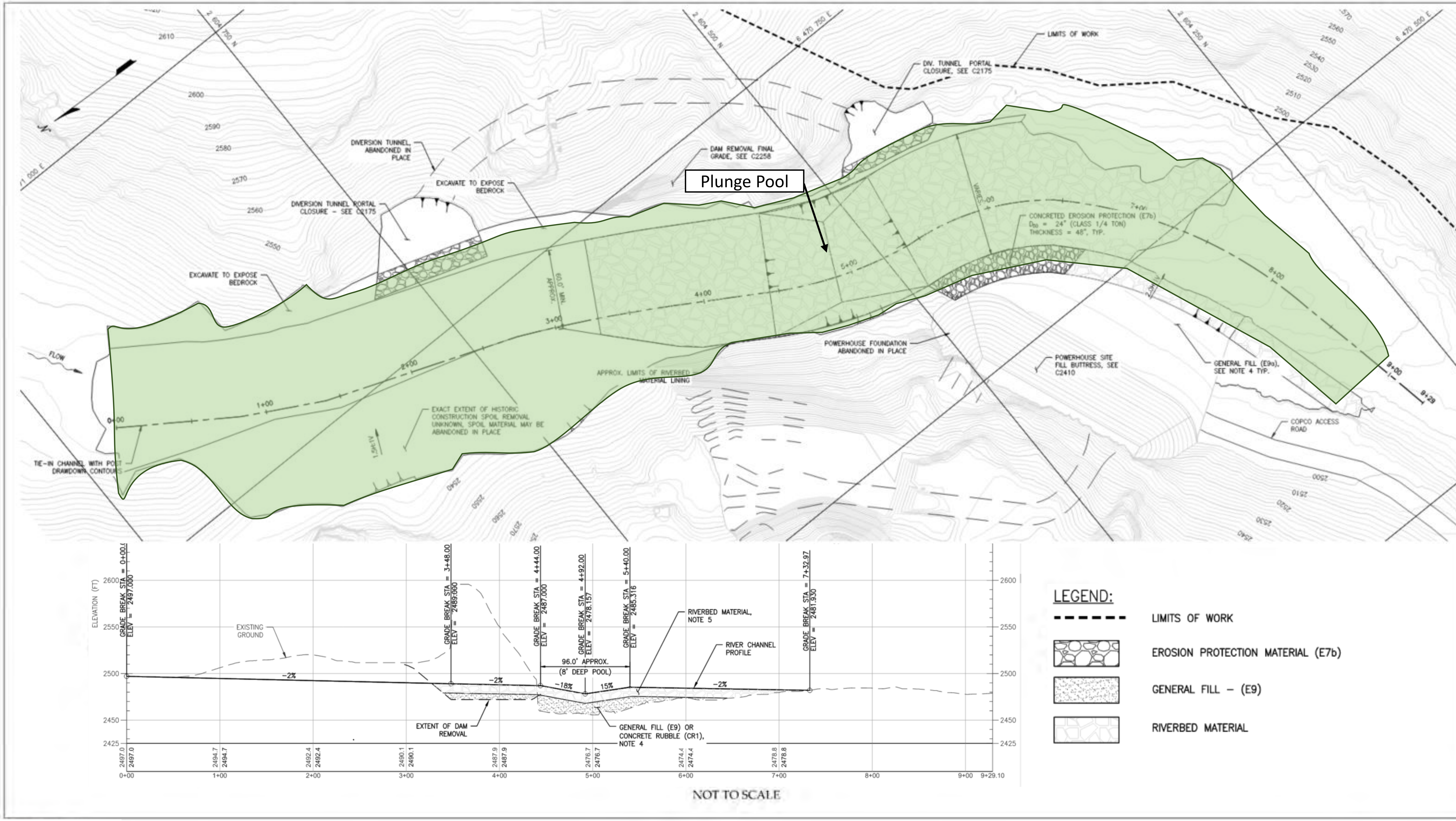
Copco No. 1 Facility Temporary Left Bank Access Track - Phase 1

NOT TO SCALE

Source: Kiewit 2020

FIGURE 2-8-b

Copco No.1 Facility
Spillway Work Platform –Phase 2



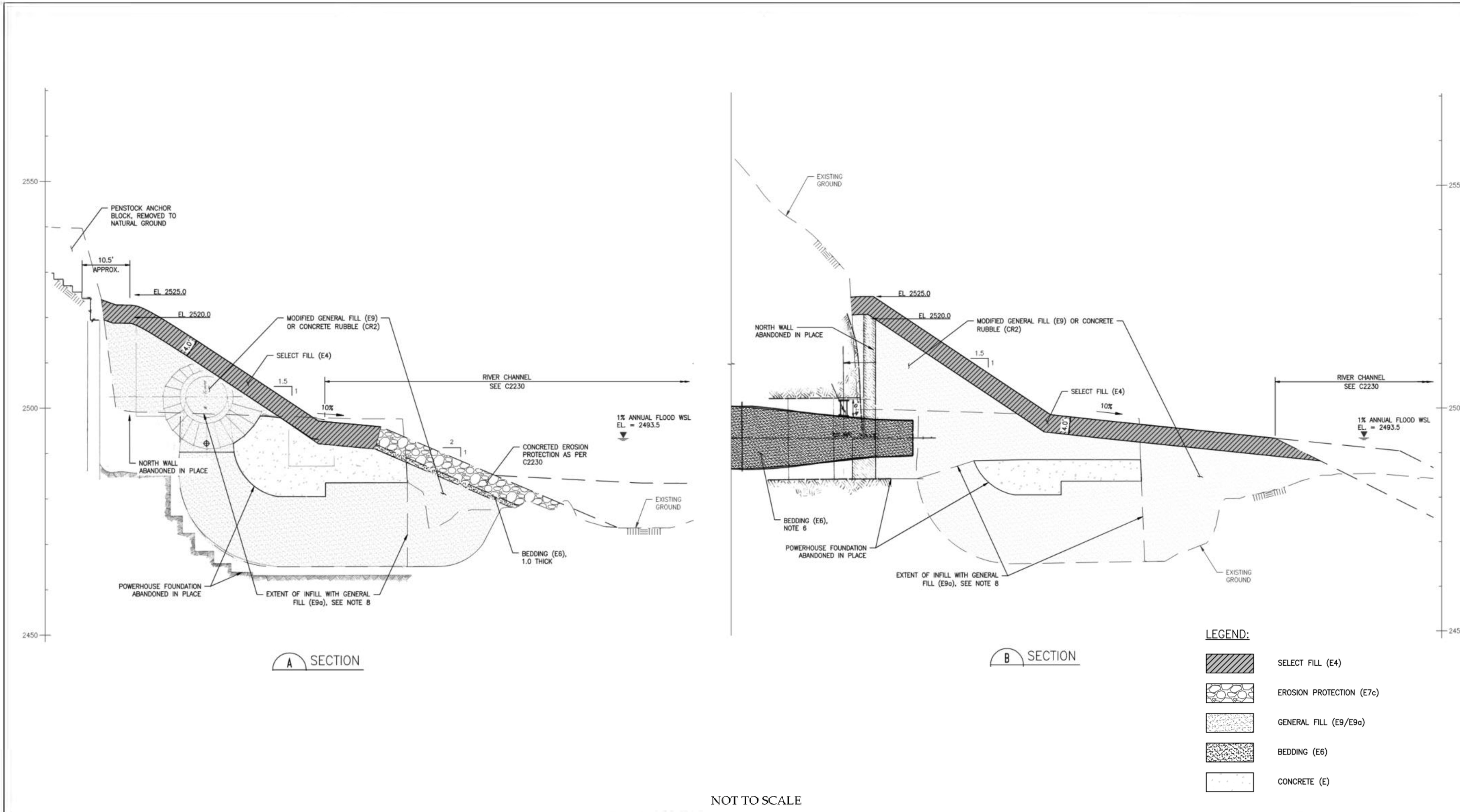
Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

Final River Channel Grading (approximate future OHWM)

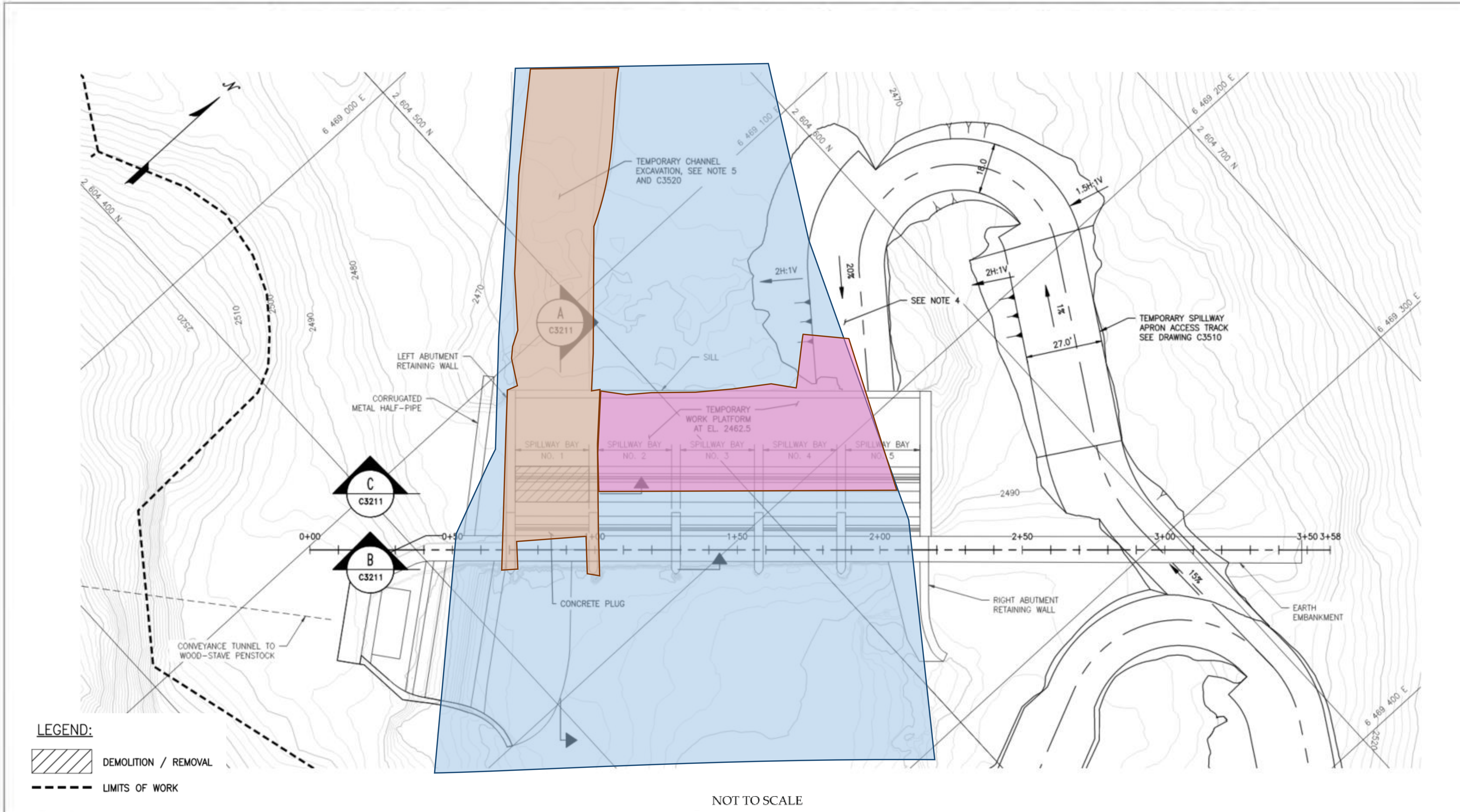
FIGURE 2-9

Copco No.1 Facility
Final Channel Grading and Erosion
and Riverbed Placement



Source: Kiewit 2020

FIGURE 2-10
Copco No. 1 Facility
Powerhouse Final Grade

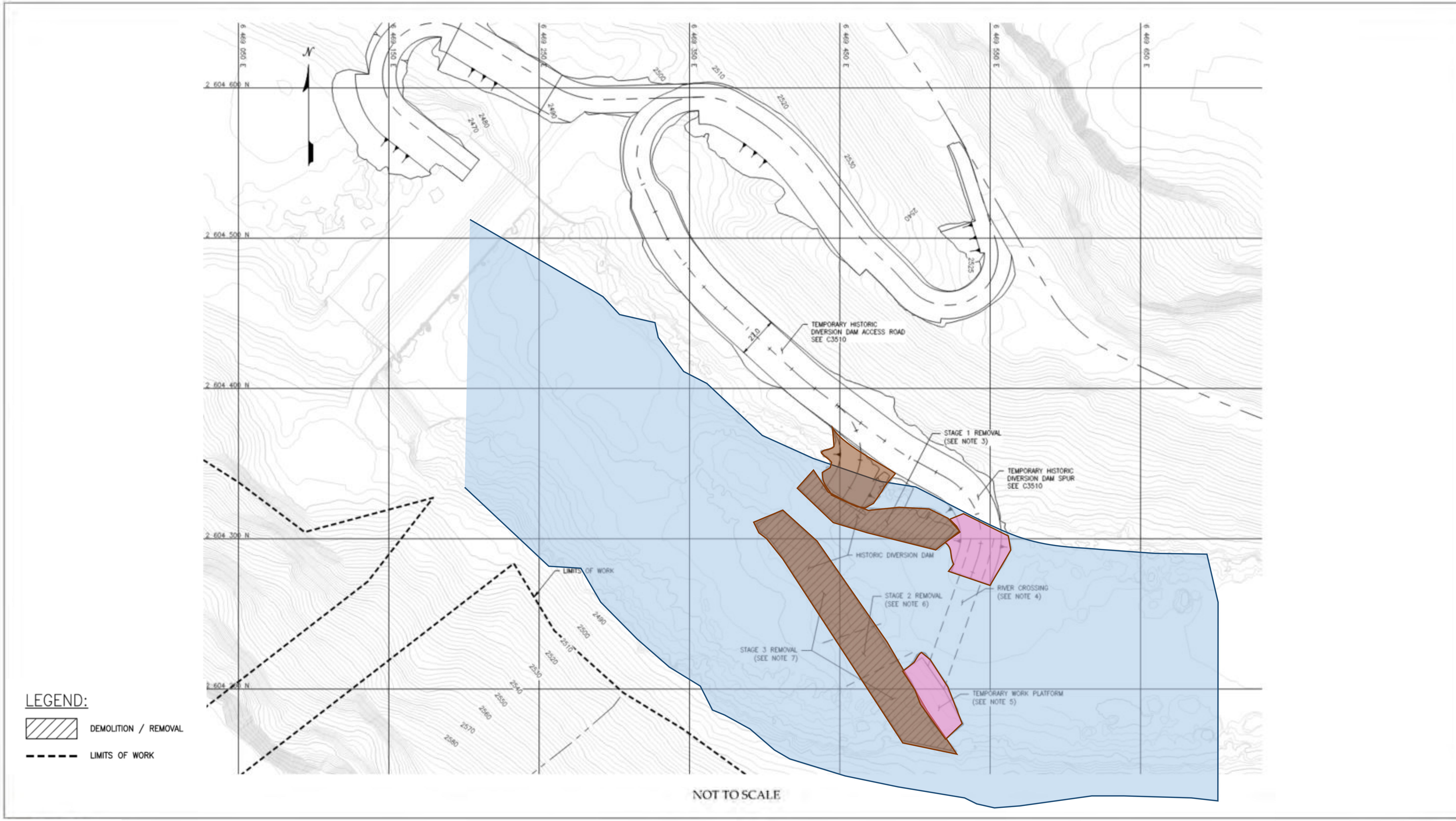


Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

OHWM (Approximate Existing Condition)
In-Water Work (Temporary Excavation)
In-Water Work (Temporary Fill)
**In-water work = work at or below the OHWM or NOPE*

FIGURE 2-11
Copco No. 2 Facility Temporary Apron Access Track and Work Platform



Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

Ordinary High Water Mark (Approximate Existing Condition)

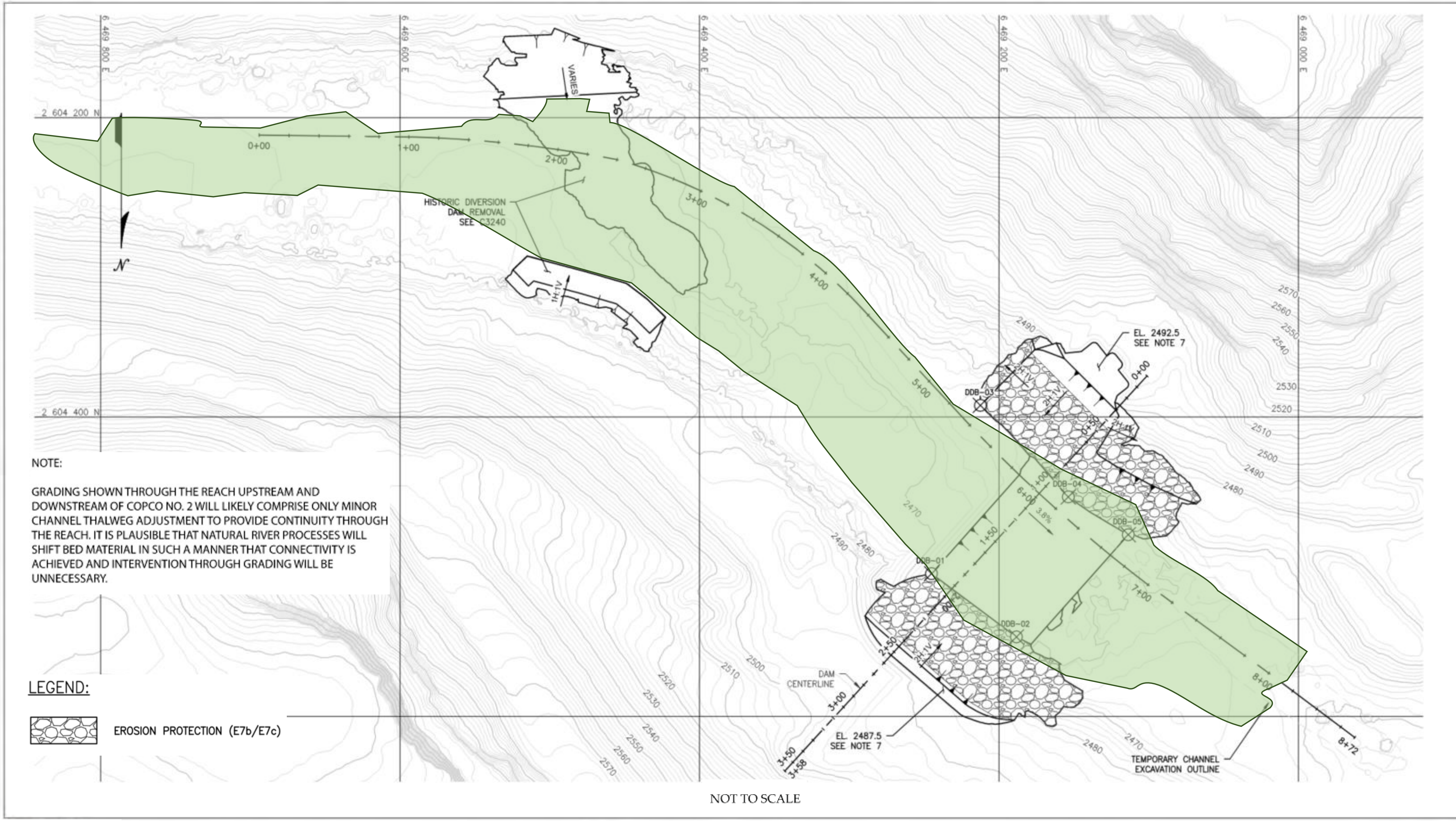
In-Water Work (Permanent Excavation)

In-Water Work (Temporary Fill)

***In-water work = work at or below the OHWM or NOPE**

FIGURE 2-12

Copco No. 2 Facility
Historical Diversion Dam



Source: Kiewit 2020

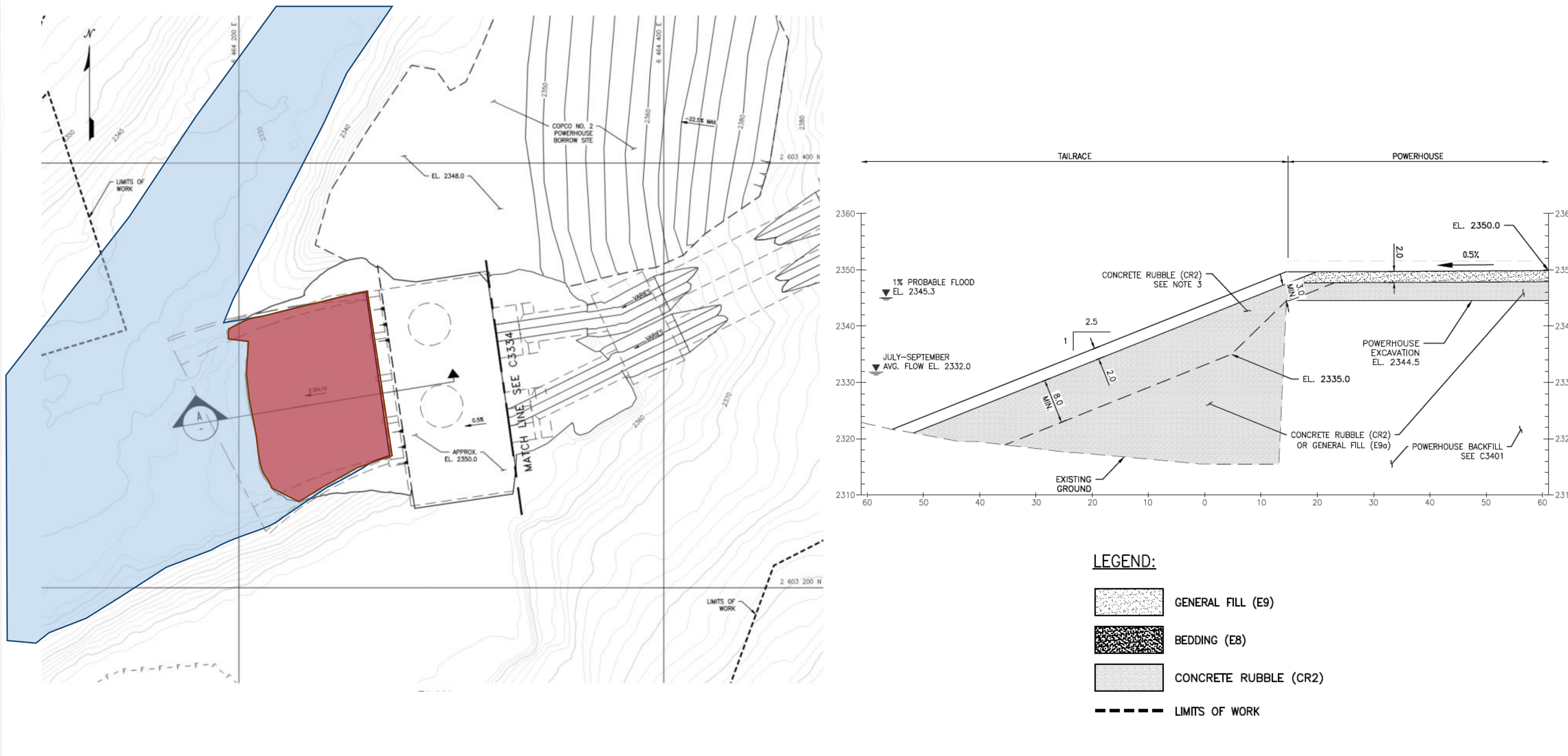
Klamath River Renewal Corporation

Klamath River Renewal Project

Final River Channel Grading (approximate future OHWM)

FIGURE 2-13

Copco No.2 Facility
Final Channel Grading and Erosion and Riverbed Placement



NOT TO SCALE

Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

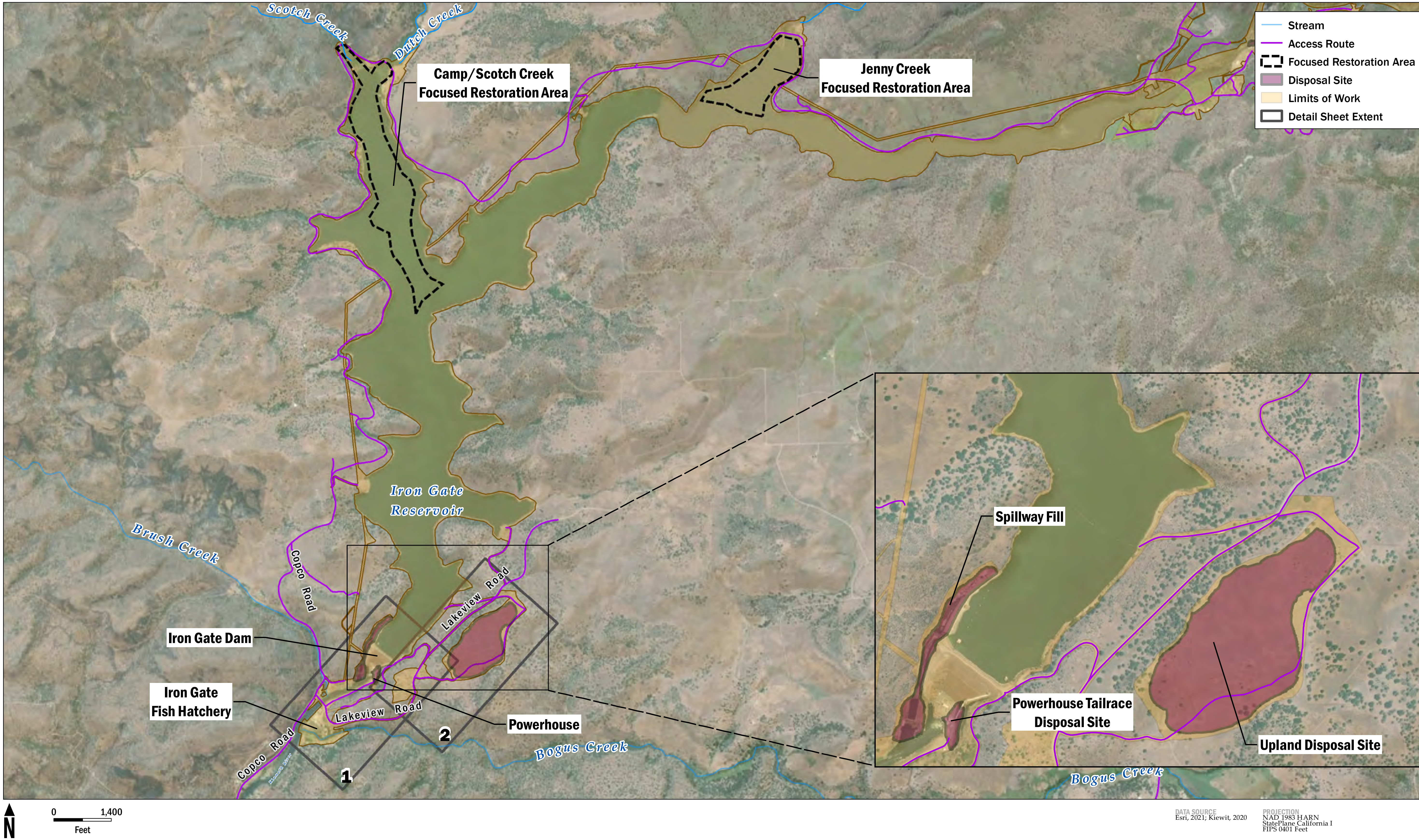
Approximate OHWM

In-Water Work (Permanent Fill)

**In-water work = work at or below the OHWM or NOPE*

FIGURE 2-14

Copco No. 2 Facility Tailrace Removal Plan



Klamath River Renewal Corporation

Klamath River Renewal Project

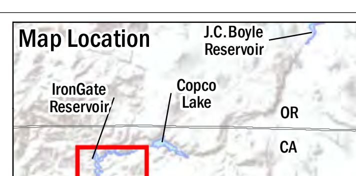
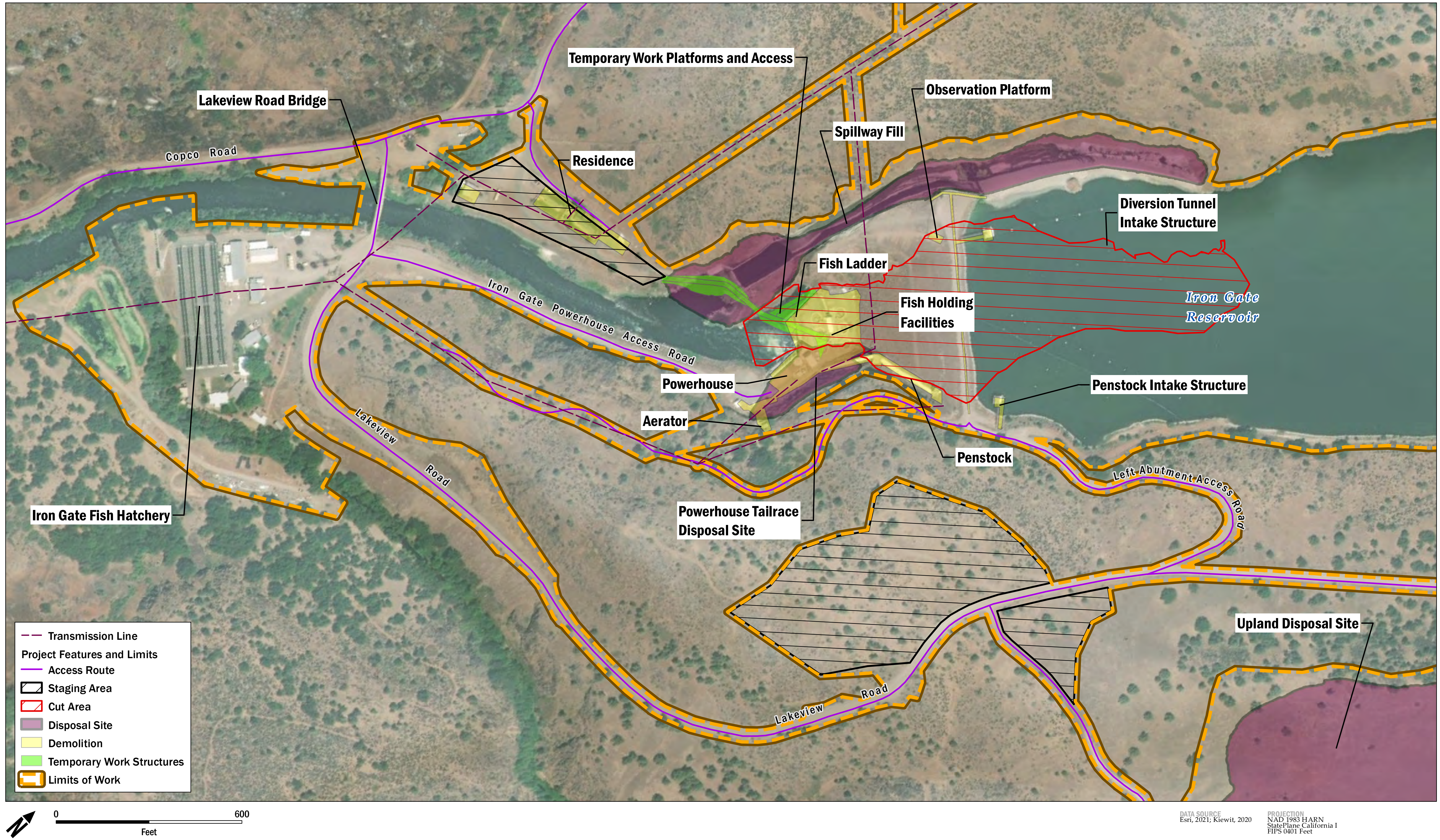


FIGURE 2-15

Iron Gate Dam Removal Features and Limits
Overview Sheet



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

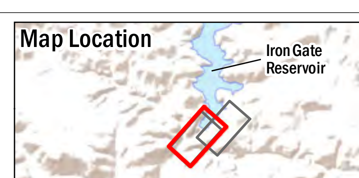
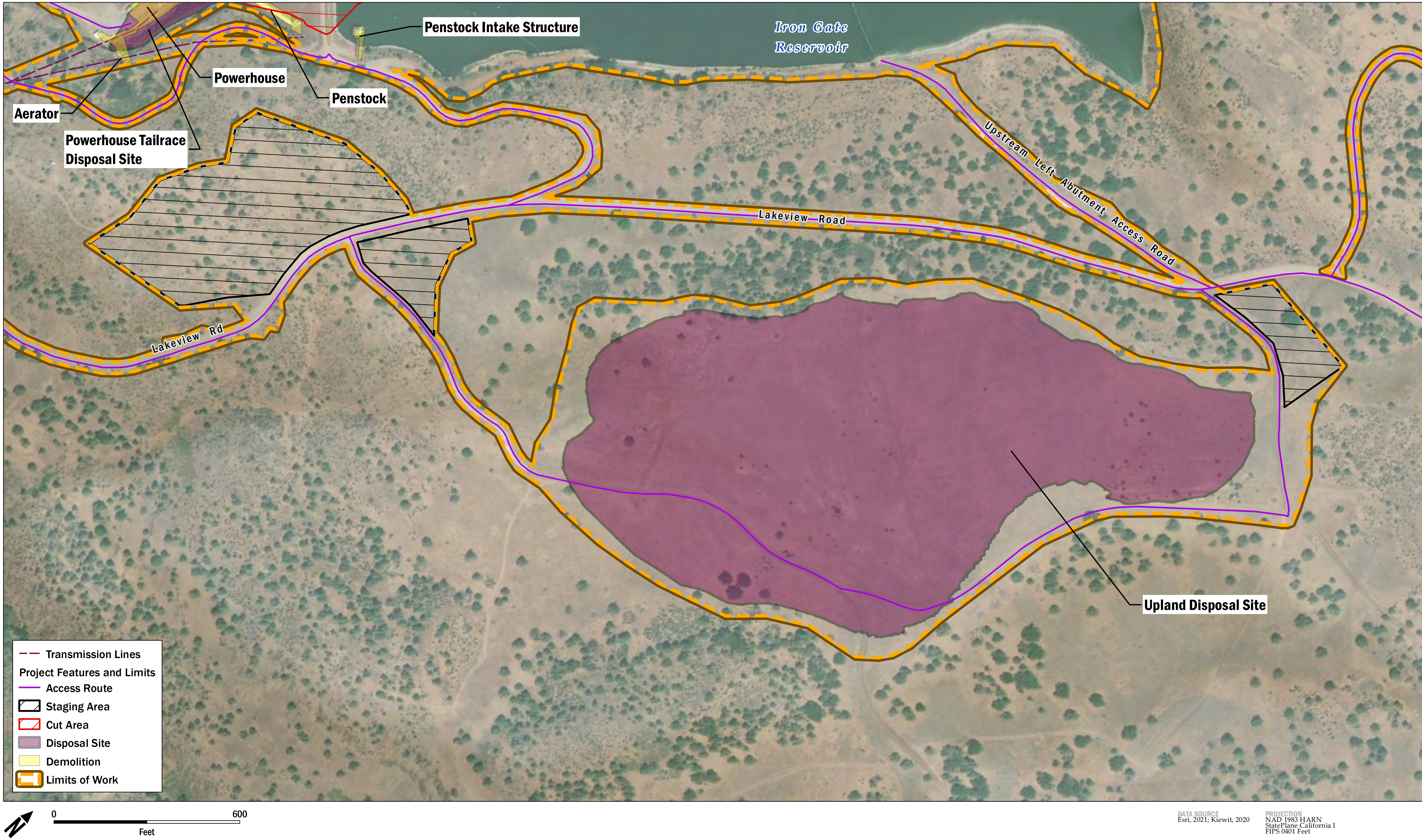


FIGURE 2-15
Iron Gate Dam Removal Features and Limits
Sheet 1 of 2



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

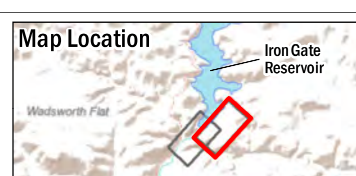
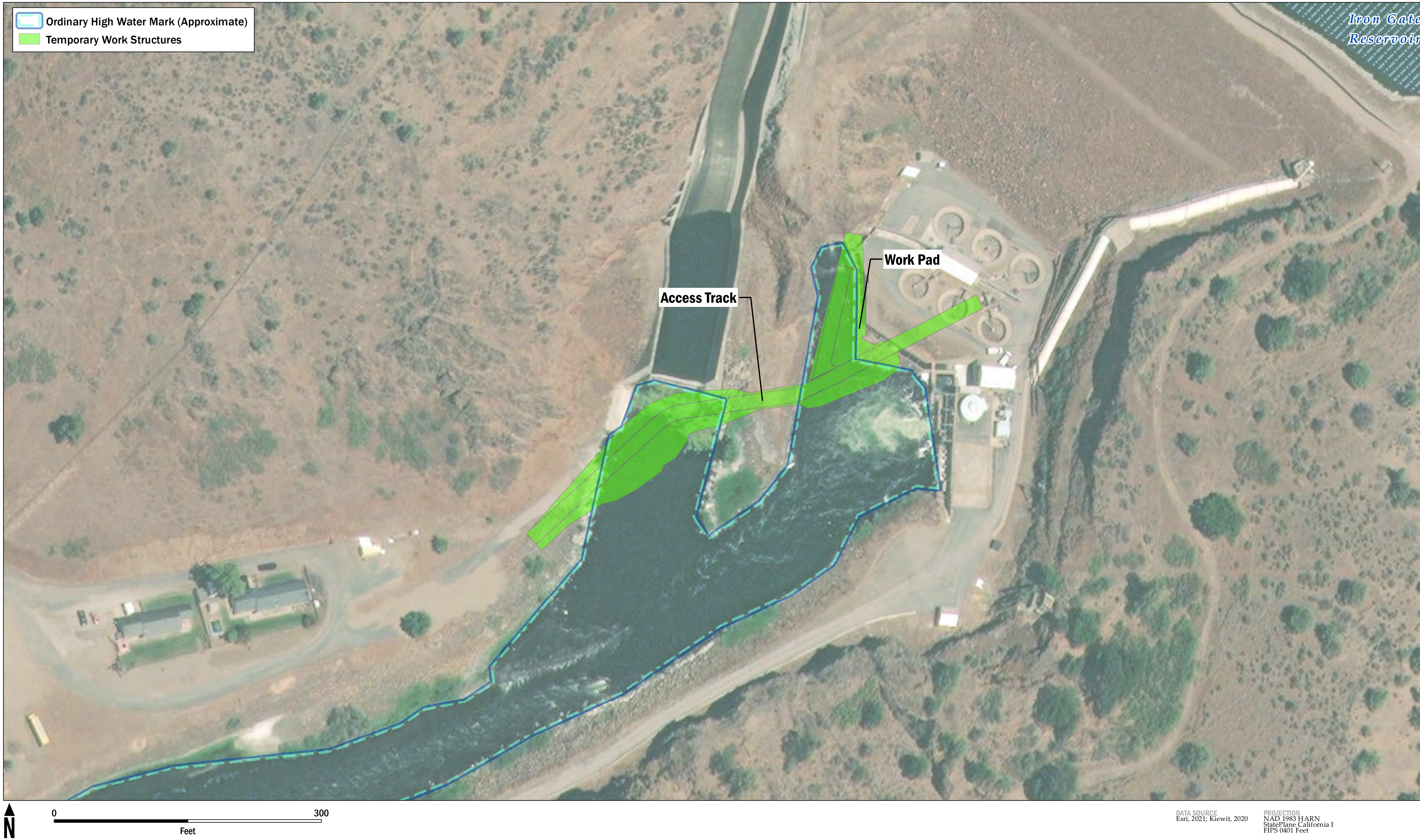


FIGURE 2-15
Iron Gate Dam Removal Features and Limits
Sheet 2 of 2



DATA SOURCE
Esri, 2021; Kiewit, 2020

PROJECTION
NAD 1983 HARN
StatePlane California I
FIPS 0401 Feet

Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 2-16
Iron Gate Facility
Work Platforms and Access Downstream
Tunnel Portal Overview

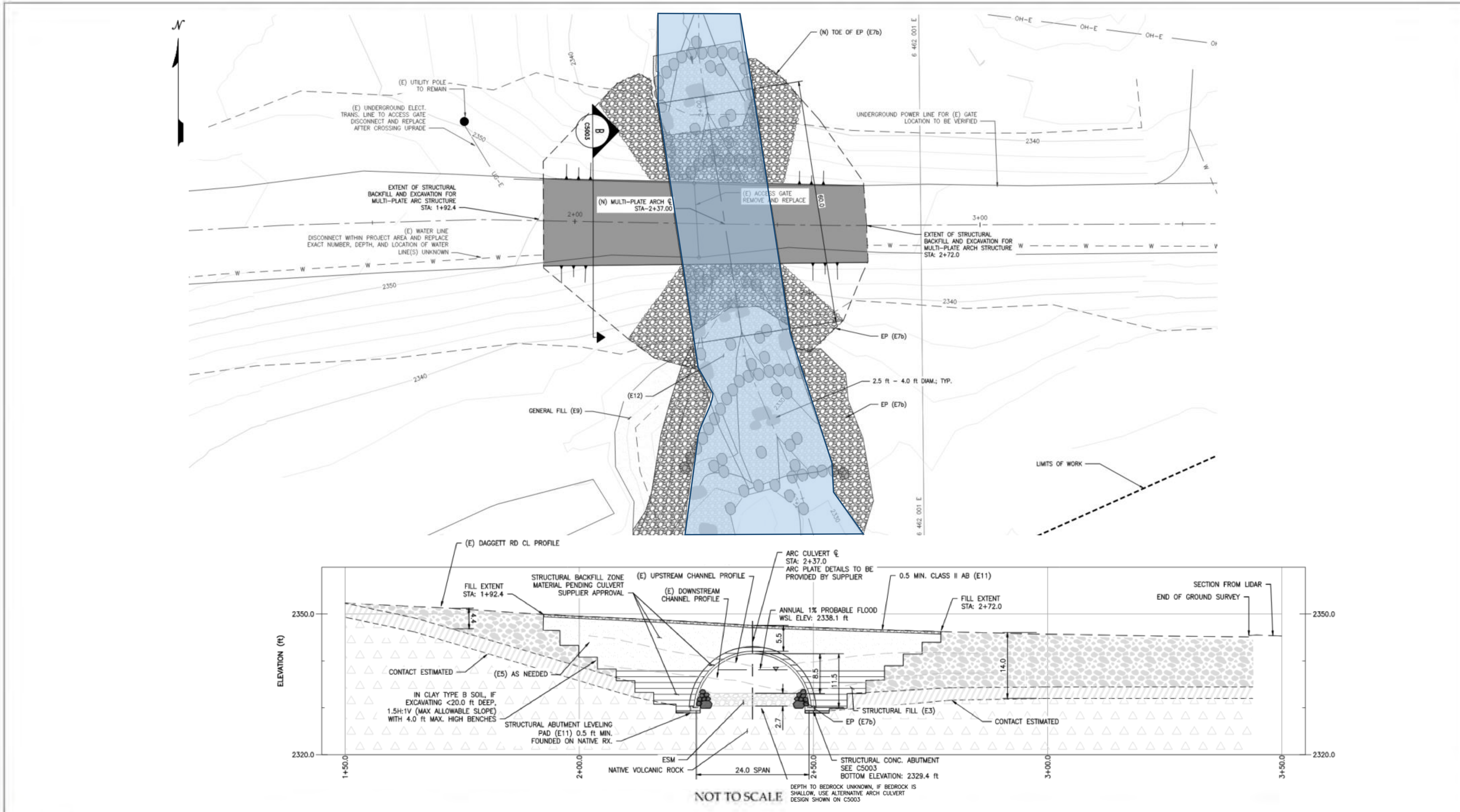
Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

Final River Channel Grading (approximate future OHWM)

Disposal Areas

FIGURE 2-17
Iron Gate
Final Channel Grading Erosion and Riverbed Placement

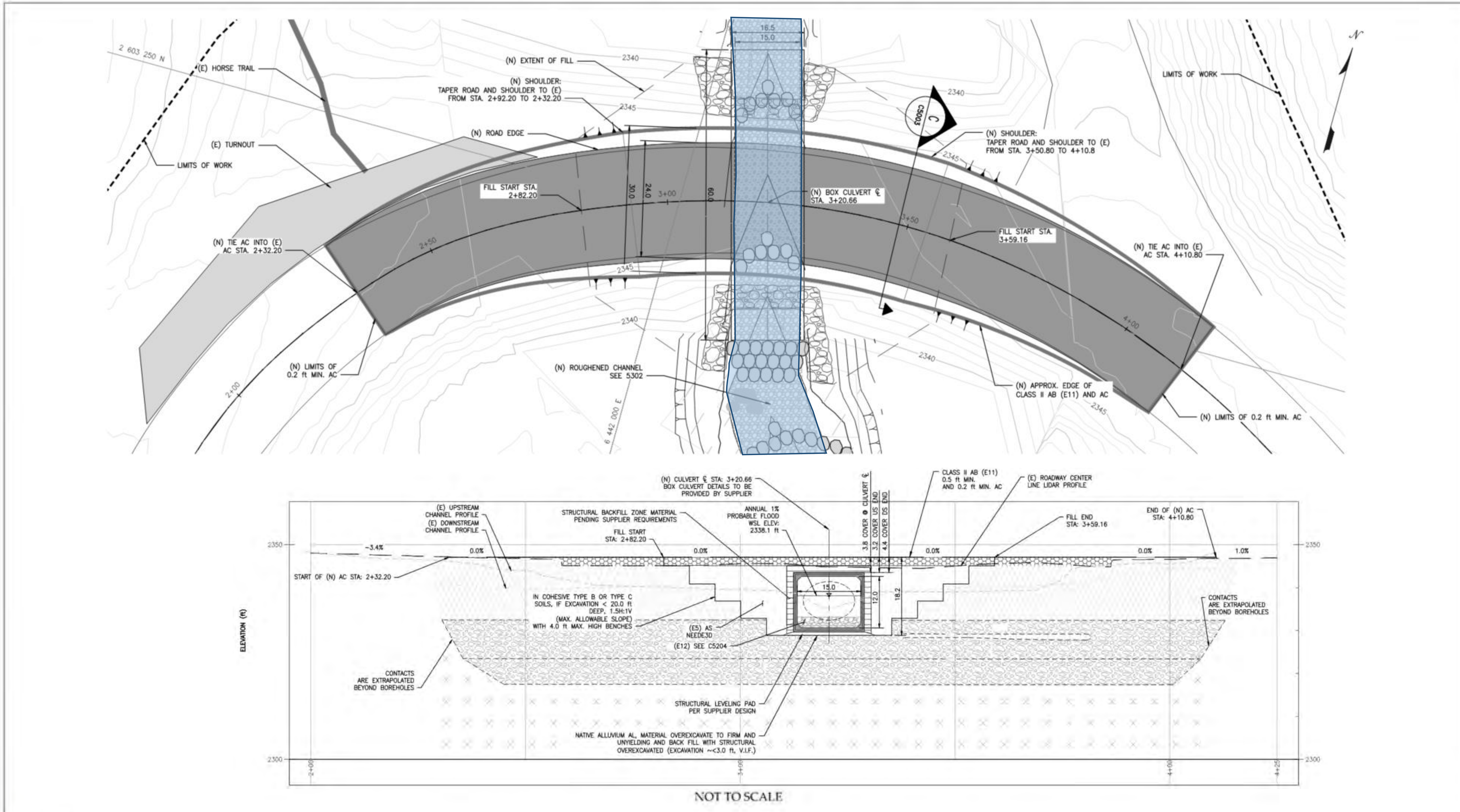


Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

OHWM (Approximate Existing Condition)

FIGURE 2-18
Fall Creek Culvert at Daggett Road



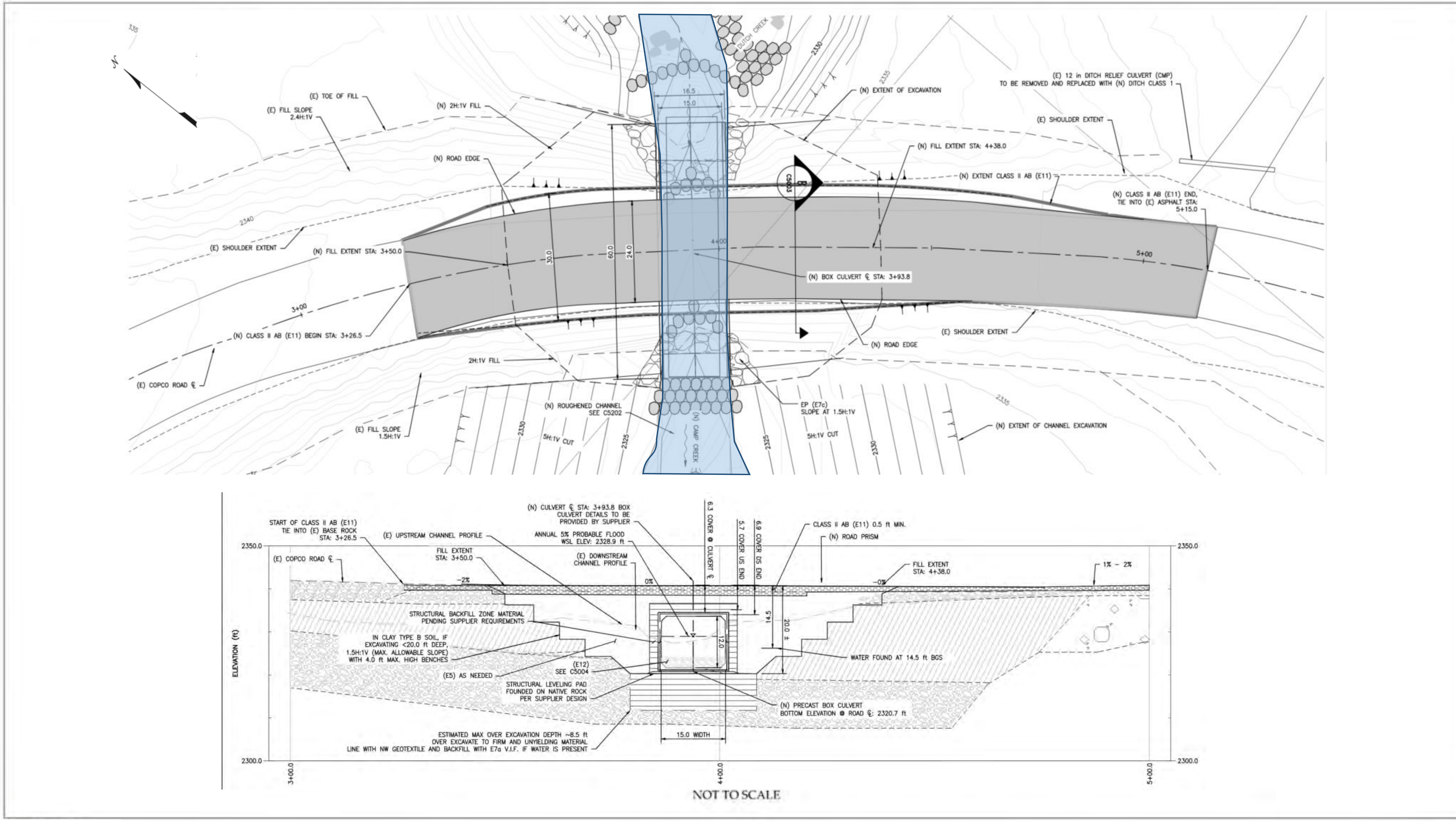
Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

OHWM (Approximate Existing Condition)

FIGURE 2-19

Scotch Creek Culvert at Copco Road

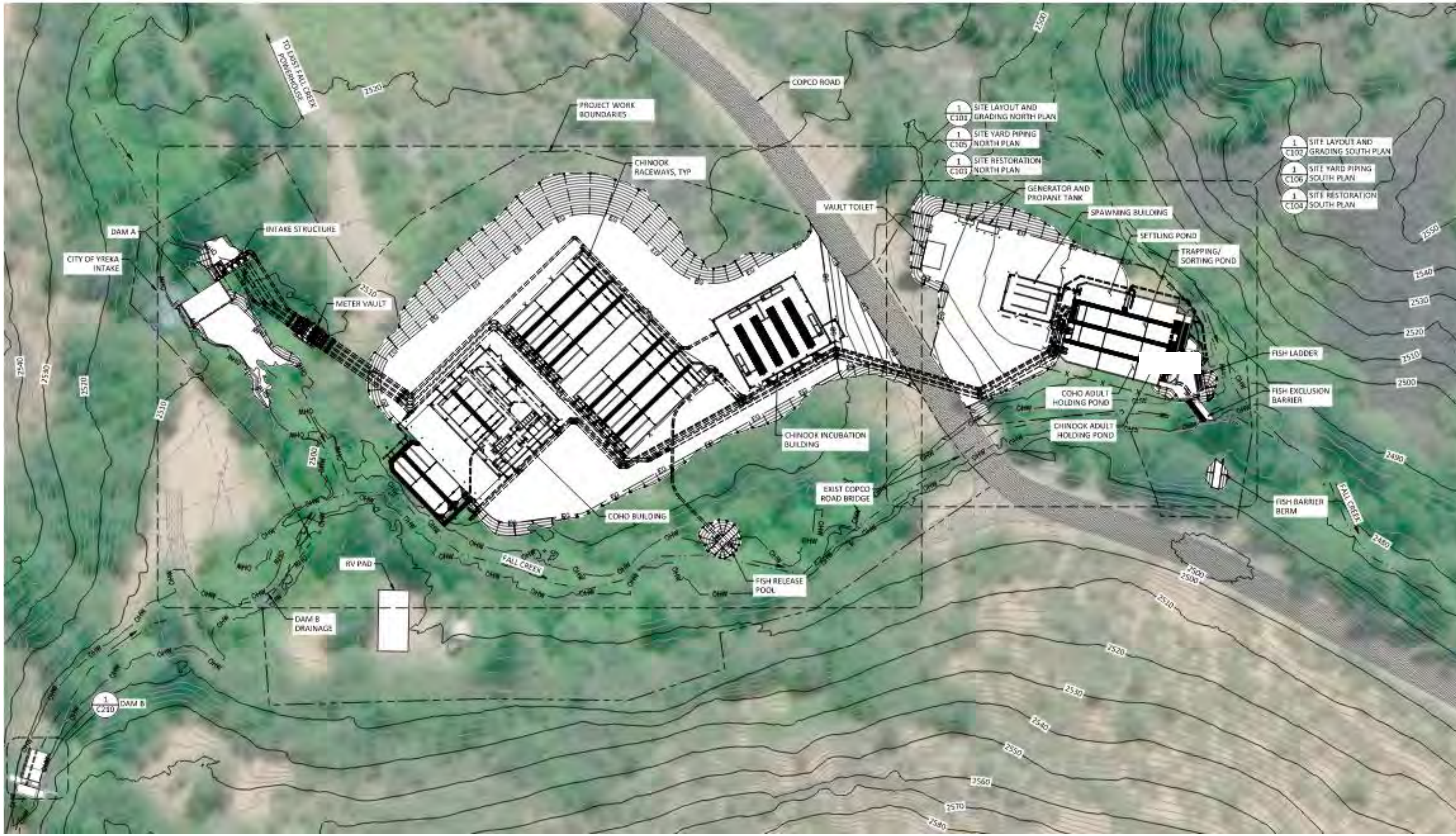


Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

OHWM (Approximate Existing Condition)

FIGURE 2-20
Camp Creek Culvert at Copco Road



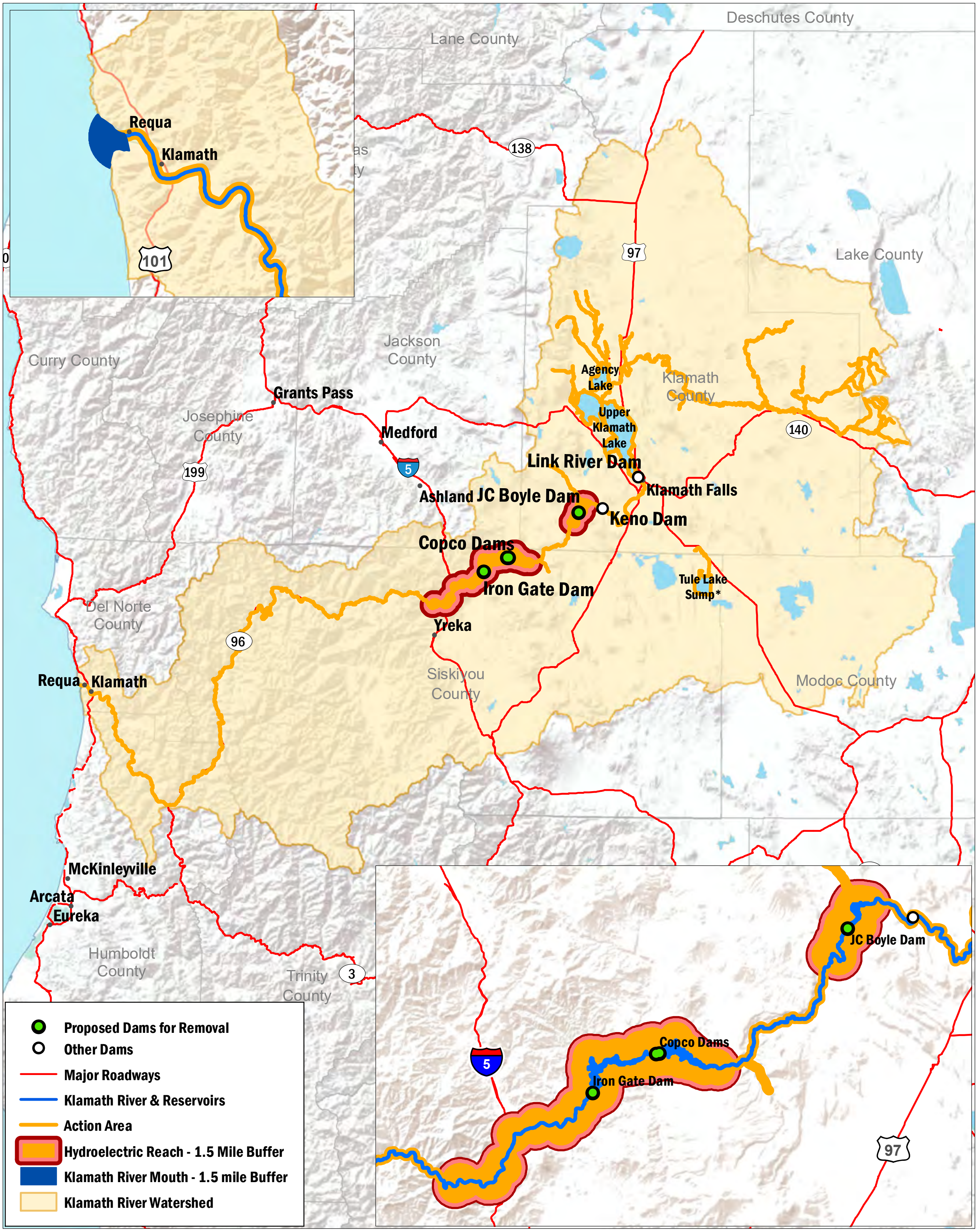
Source: Kiewit 2020

Klamath River Renewal Corporation
Klamath River Renewal Project

Approximate OHWM

*In-water work = work at or below the OHWM

FIGURE 2-21
Fall Creek Hatchery Overview



N
0 25
Miles

NOTE
*The Action Area includes Tule Lake Sump 1A.

DATA SOURCE
ODFW, Esri, USGS, NOAA

PROJECTION
COB NAD83 2007

CDM Smith
Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 3-1
Action Area

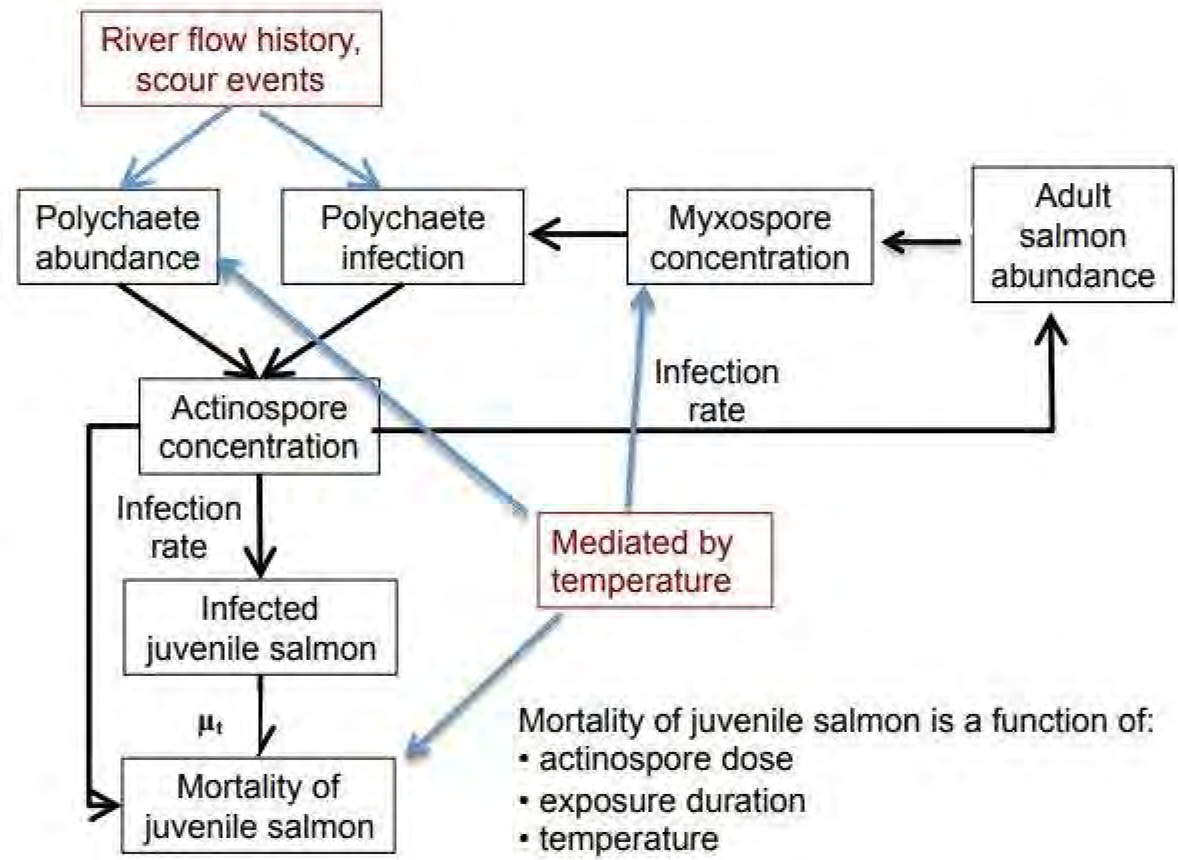


FIGURE 4-1

Conceptual Model for Variables that Influence Infection and Mortality of Juvenile Fall-Run Chinook Salmon

μ_t is the mortality rate of infected salmon, estimated from weekly actinospore concentration (Foott et al., 2011)

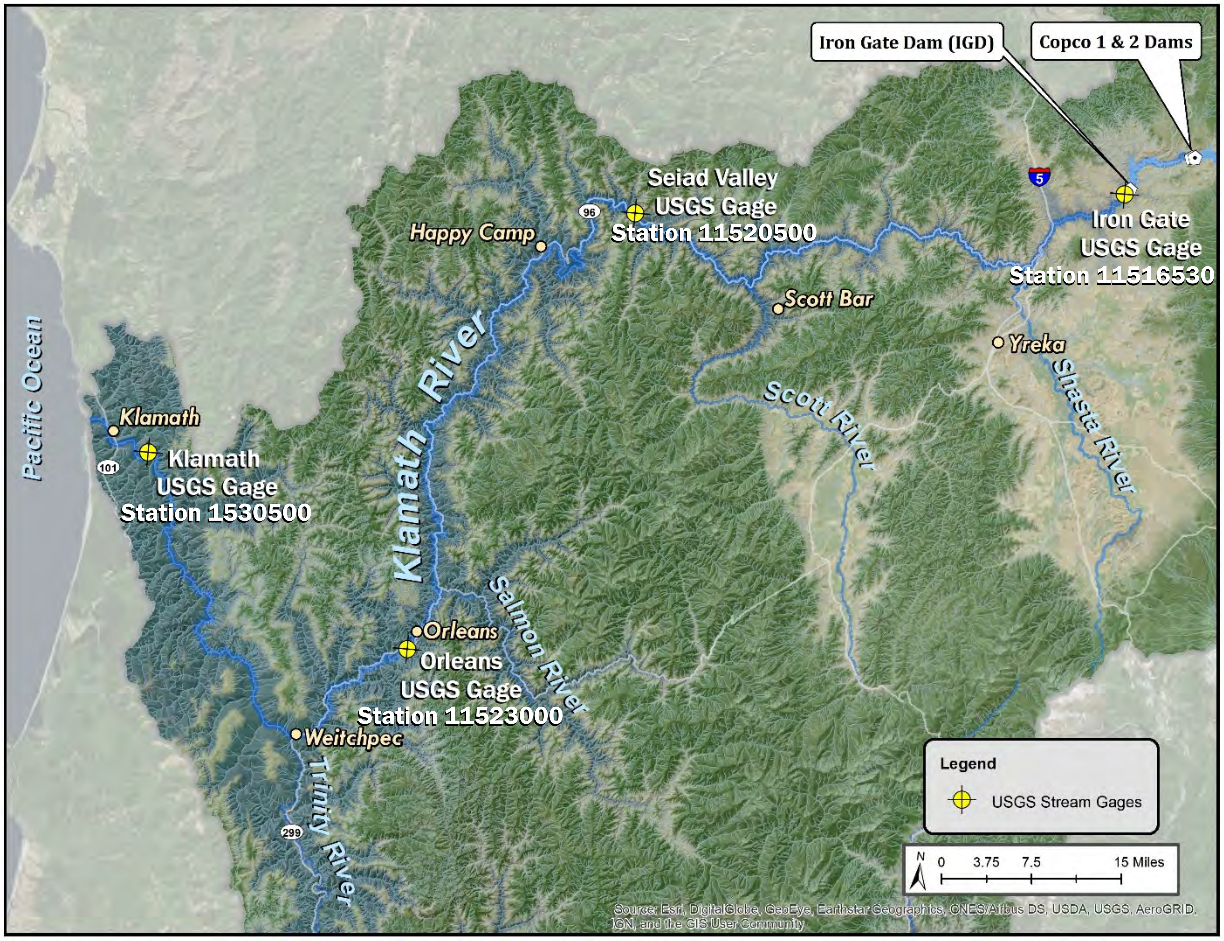


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FIGURE 5-1

U.S. Geological Survey Streamflow Gage Stations on the Klamath River Used to Develop the SRH-1D Hydraulic and Sediment Transport Model.

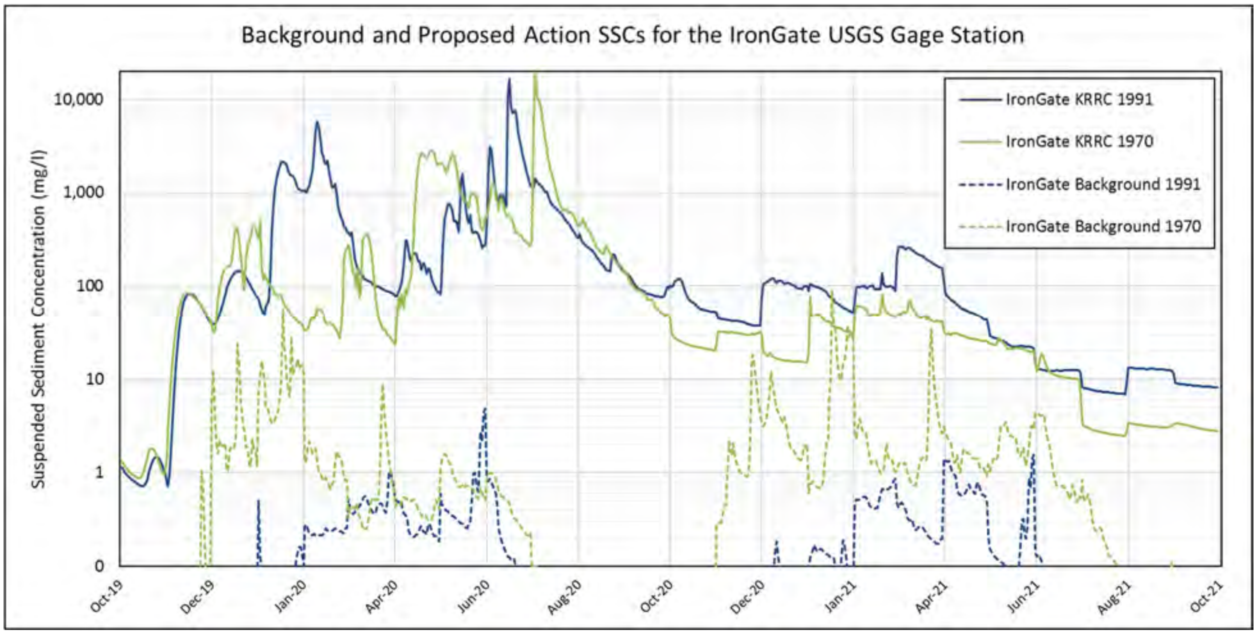

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FIGURE 5-2

Comparison of Modeled Daily SSCs at the Iron Gate Station (RM 193.1) for the Coho Salmon Median Impact Year (1991) and Severe Impact Year (1970) Scenarios Under Background Conditions and the Proposed Action, Based on SRH-1D Model Described in Appendix I

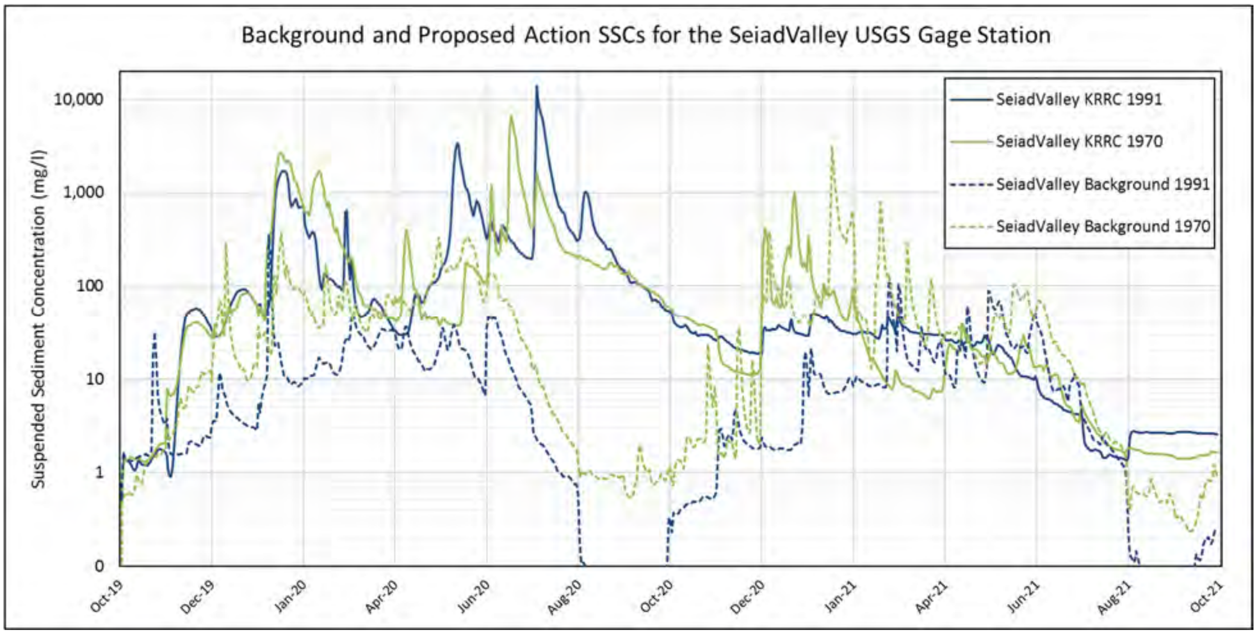

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FIGURE 5-3

Comparison of Modeled Daily SSCs at the Seiad Valley Station (RM 129.4) for the Coho Salmon Median Impact Year (1991) and Severe Impact Year (1970) Scenarios Under Background Conditions and the Proposed Action, Based on SRH-1D Model Described in Appendix I

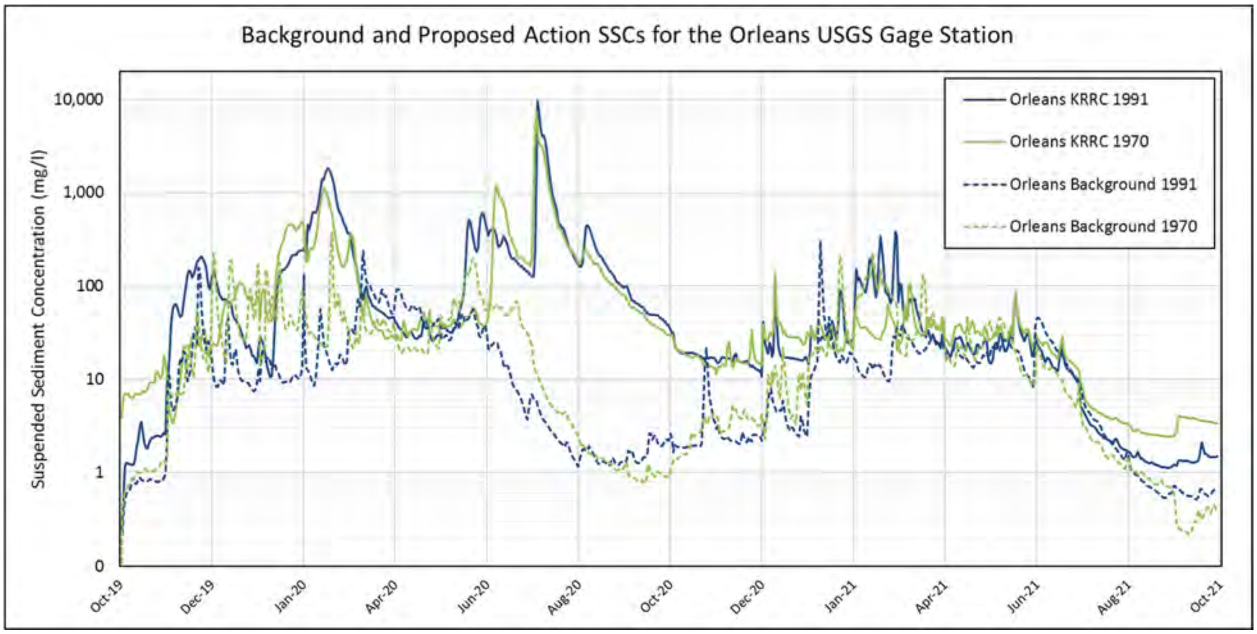

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FIGURE 5-4

Comparison of Modeled Daily SSCs at the Orleans Station (RM 59) for the Coho Salmon Median Impact Year (1991) and Severe Impact Year (1970) Scenarios Under Background Conditions and the Proposed Action, Based on SRH-1D Model Described in Appendix I

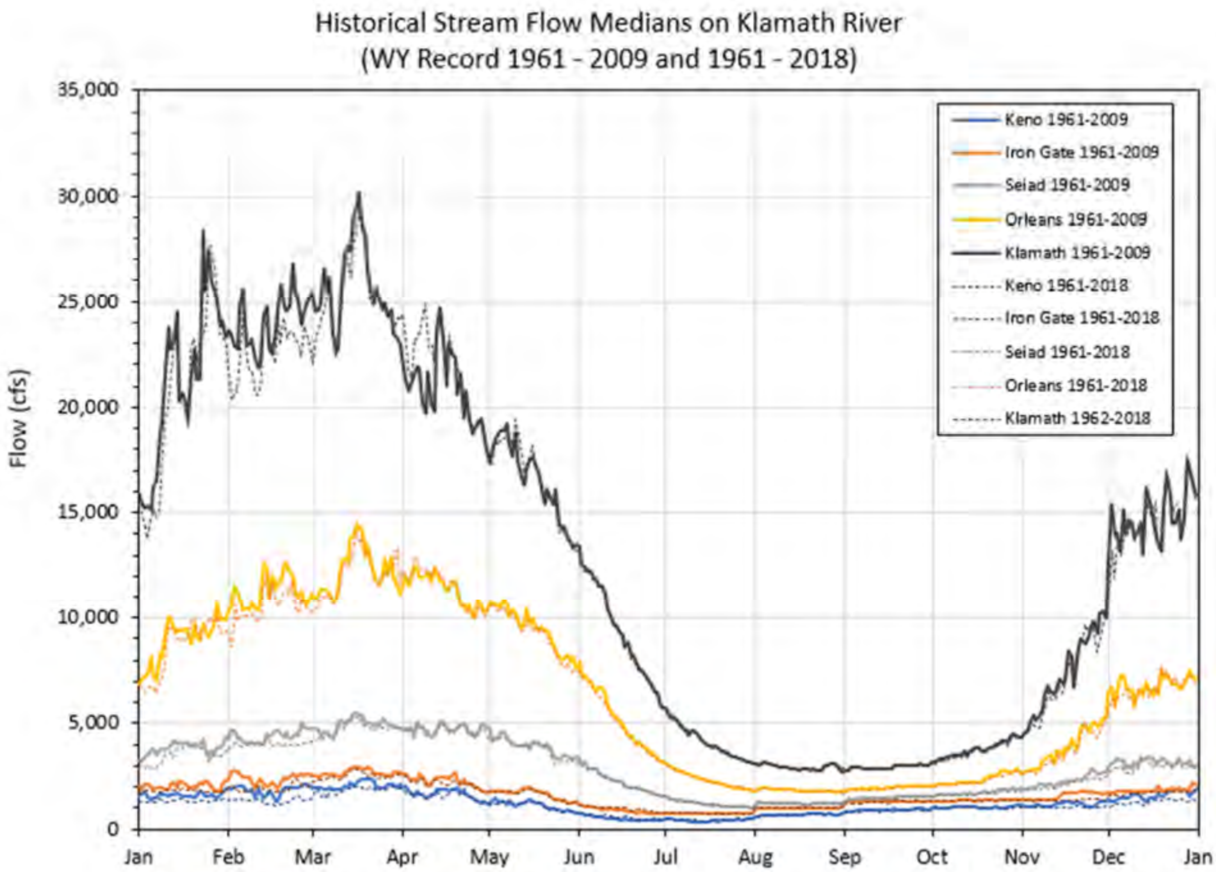

FIGURE 5-5

Median Flows at USGS Stream Gauges on the Klamath River for Two Hydroperiods; 1961 – 2008 and 2009 – 2018 (Source data USGS)

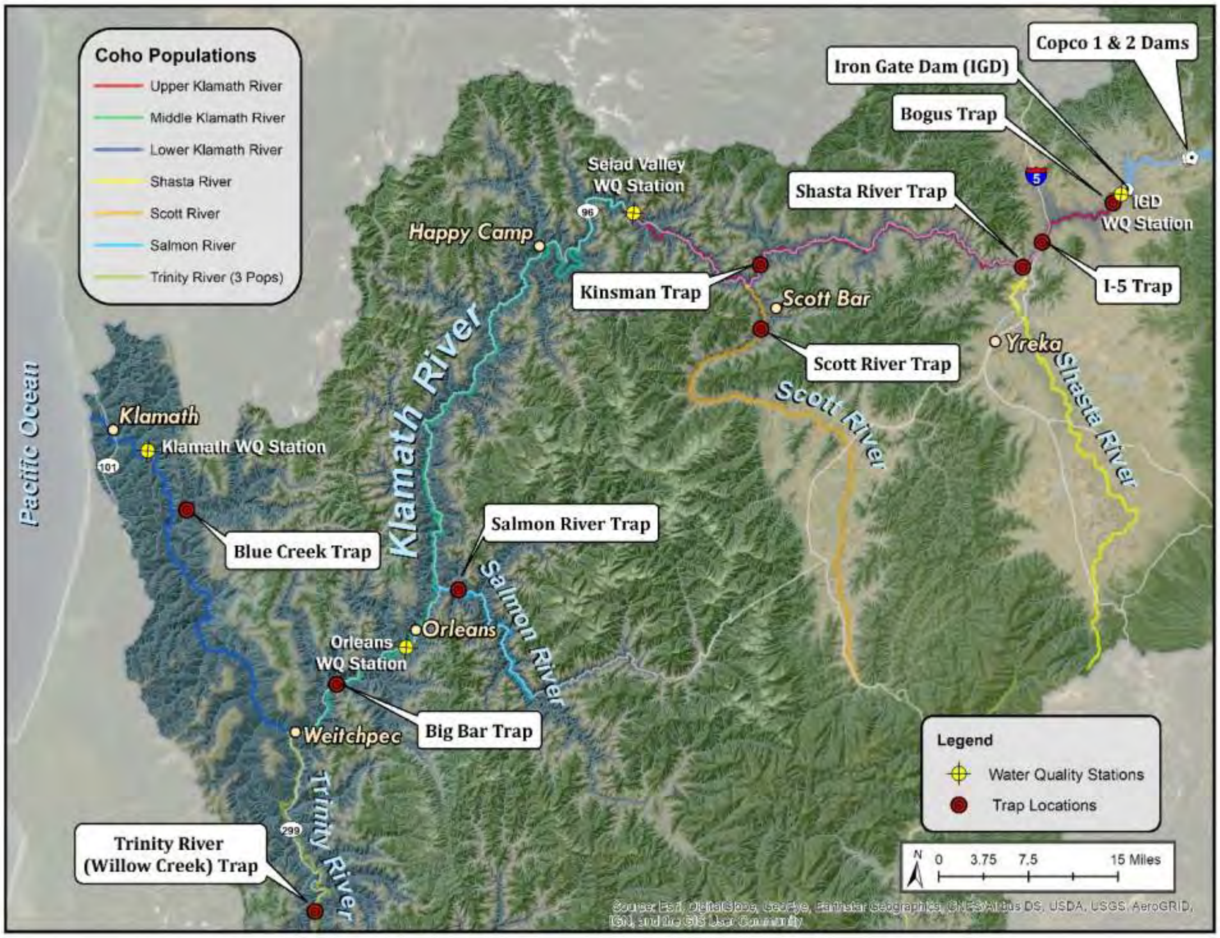

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FIGURE 5-6
Geographic Designation of Listed Coho Salmon Populations with SSC Modeling Result Stations and Select Trap Locations Used in Determining Suspended Sediment Effects to Coho Salmon.

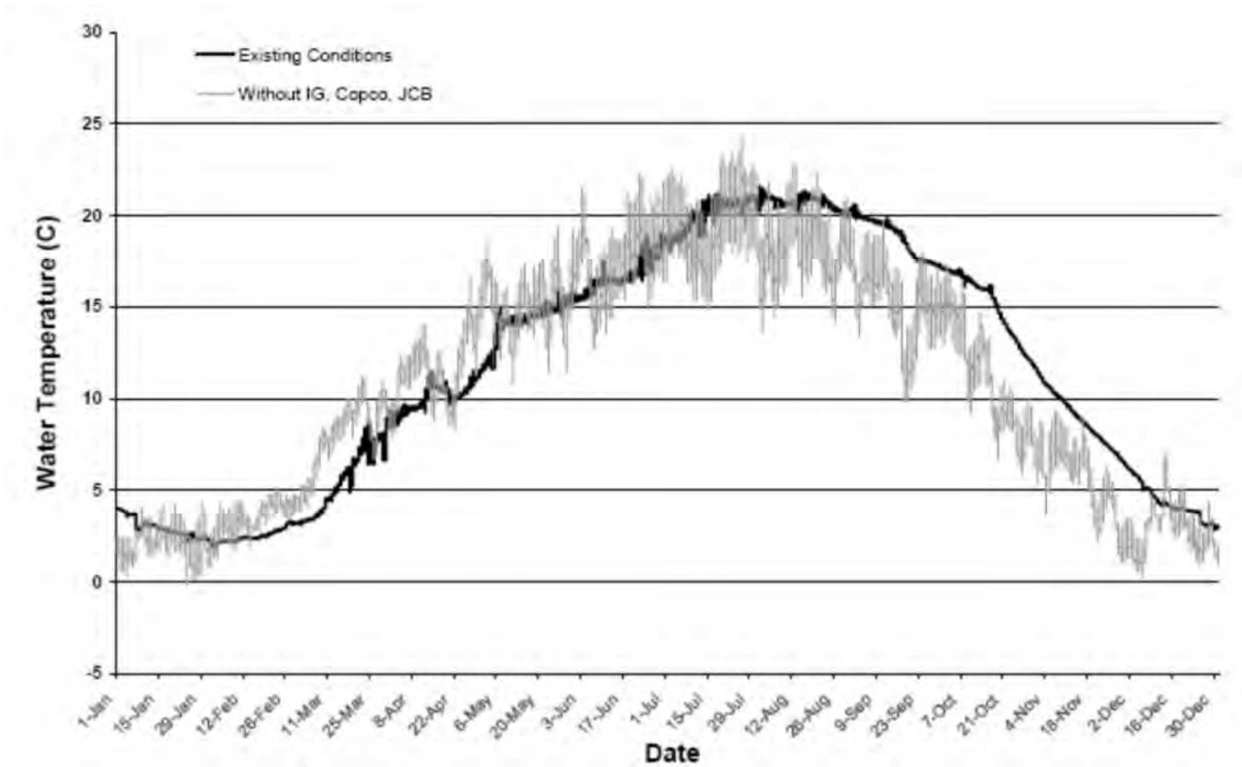

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FIGURE 5-7

Simulated Hourly Water Temperature Downstream of Iron Gate Dam (RM 193.1) Based on Year 2004 for Existing Conditions Compared with Hypothetical Conditions without J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Dams (From PacifiCorp 2004b)

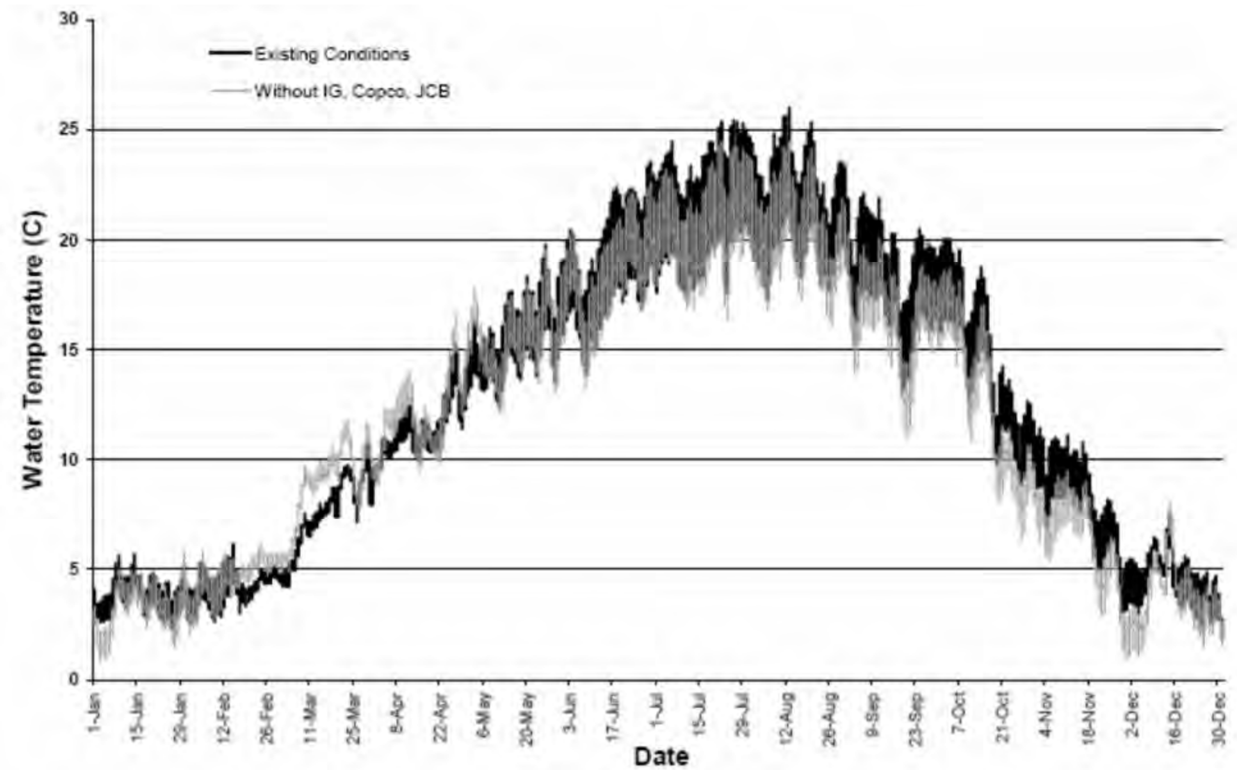

FIGURE 5-8

Simulated Hourly Water Temperature Downstream of the Scott River Confluence (RM 145.1) Based on Year 2004 for Existing Conditions Compared with Hypothetical Conditions without J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Dams (From PacifiCorp 2004b)

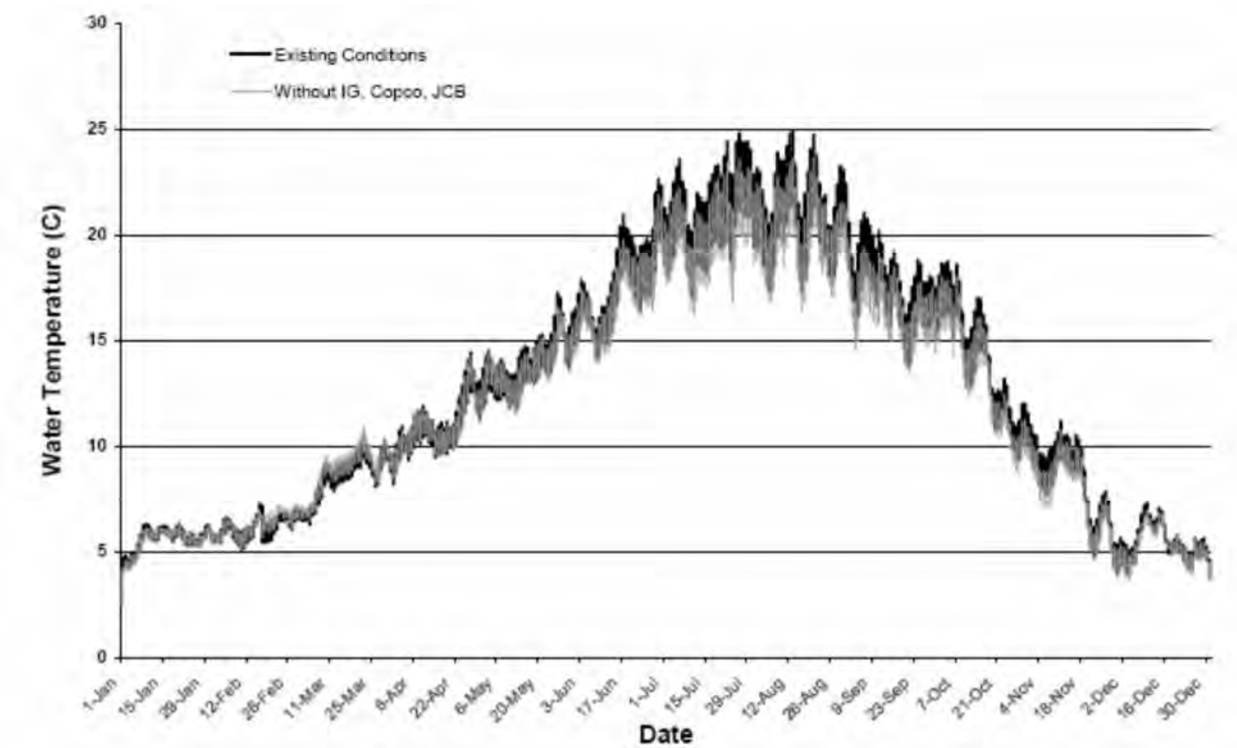

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FIGURE 5-9

Simulated Hourly Water Temperature Downstream of the Salmon River Confluence (RM 66.3) Based on Year 2004 for Existing Conditions Compared with Hypothetical Conditions without J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Dams (From PacifiCorp 2004b)

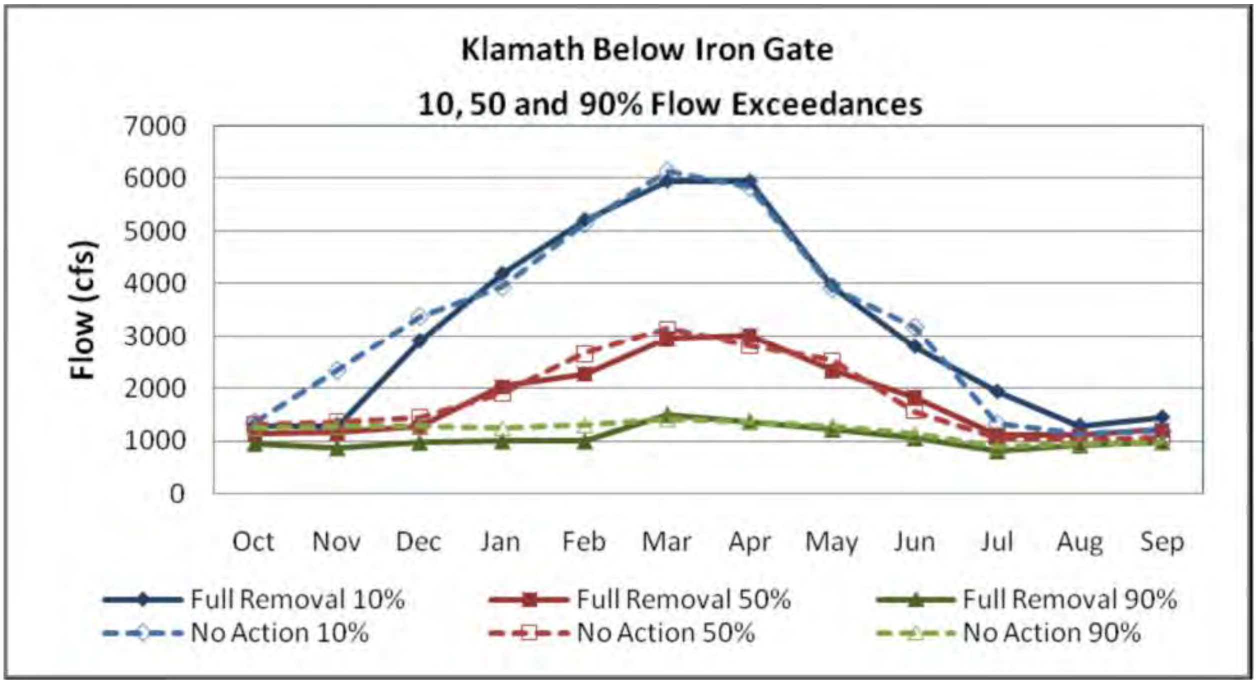

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FIGURE 5-10

Flow Exceedances Downstream of Iron Gate Dam Associated with Background Conditions and the Proposed Action (From USBR and CDFW 2012)

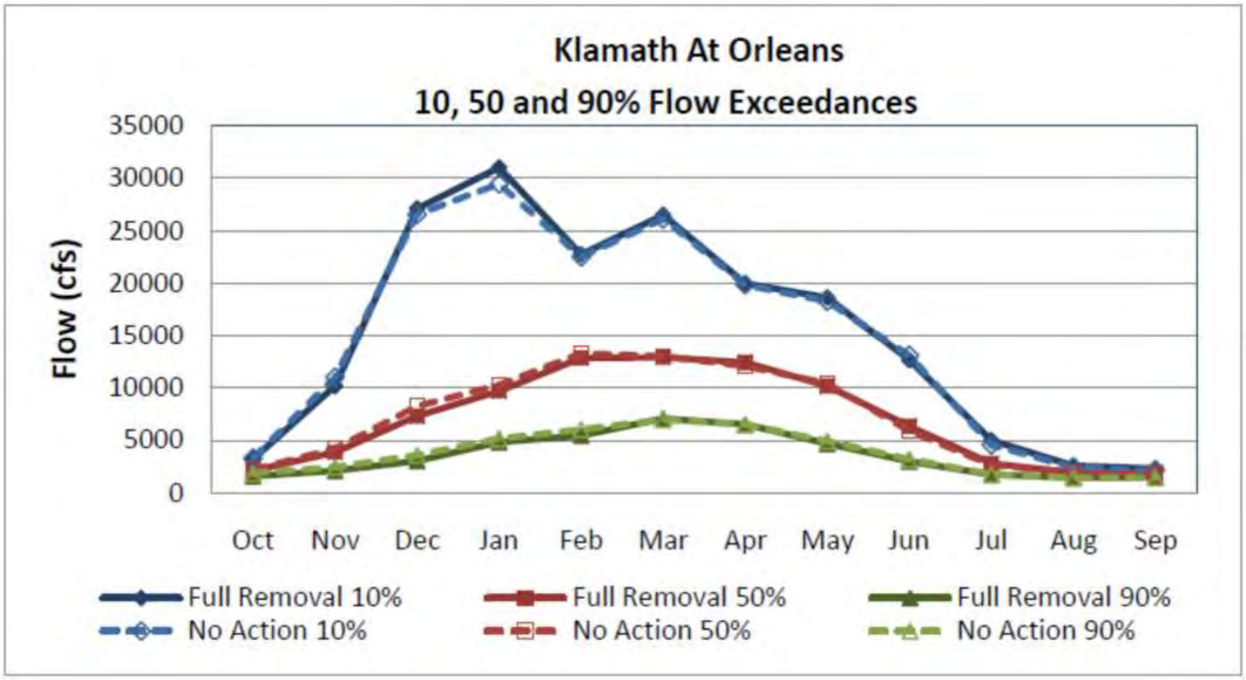

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FIGURE 5-11

Flow Exceedances Downstream of Orleans Associated with Background Conditions and the Proposed Action (From USBR and CDFW 2012)

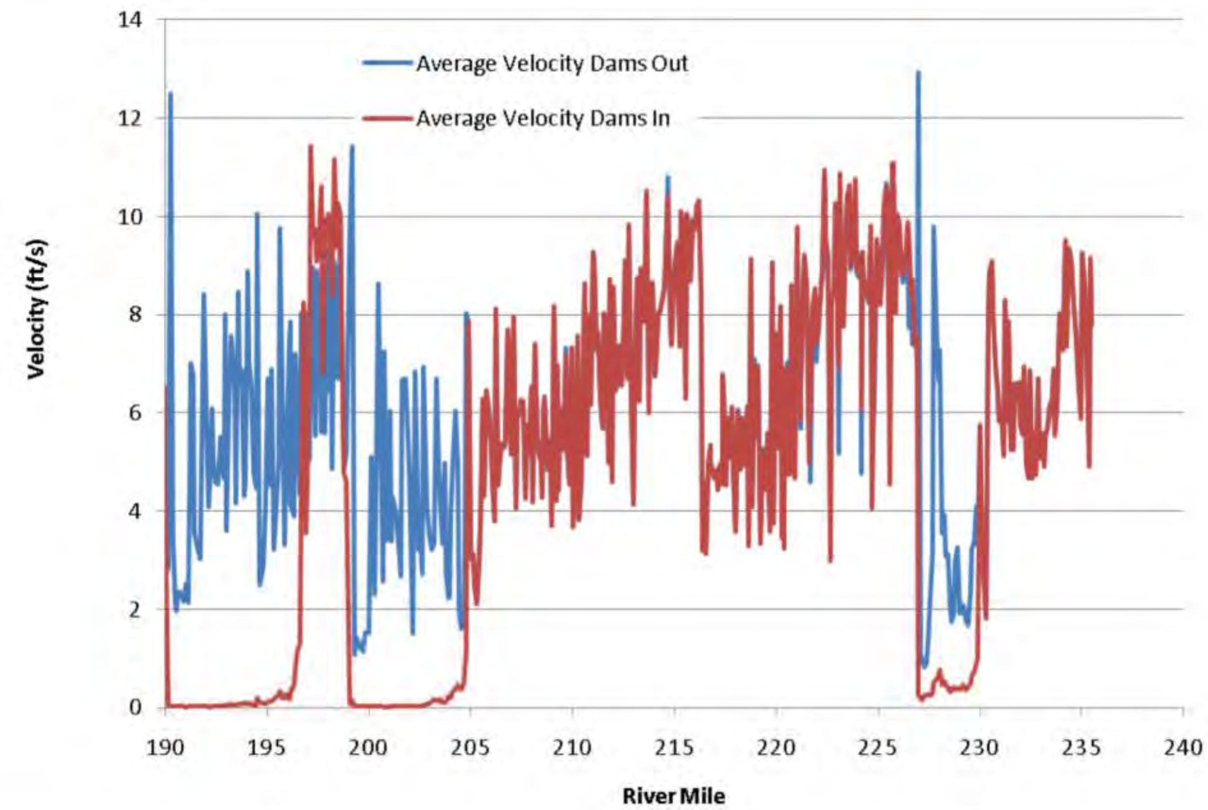

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FIGURE 5-12

Average Water Velocity in the J.C. Boyle to Iron Gate Reach for the Background Conditions and the Proposed Action at 3,000 Cubic Feet Per Second Flow (From USBR 2011a)

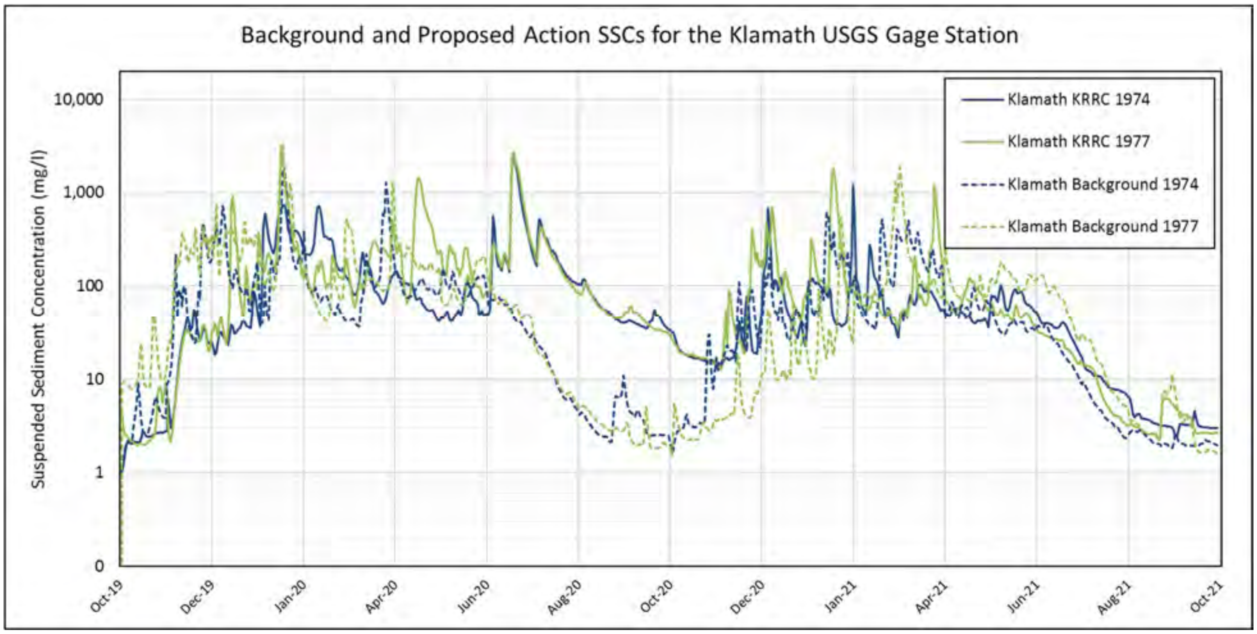

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FIGURE 5-13

Comparison of Modeled Daily SSCs at the Klamath Station (RM 5) for the sDPS Eulachon Median Impact Year (1974) and Severe Impact Year (1977) Scenarios Under Background Conditions and the Proposed Action, Based on SRH-1D Model Described in Appendix I

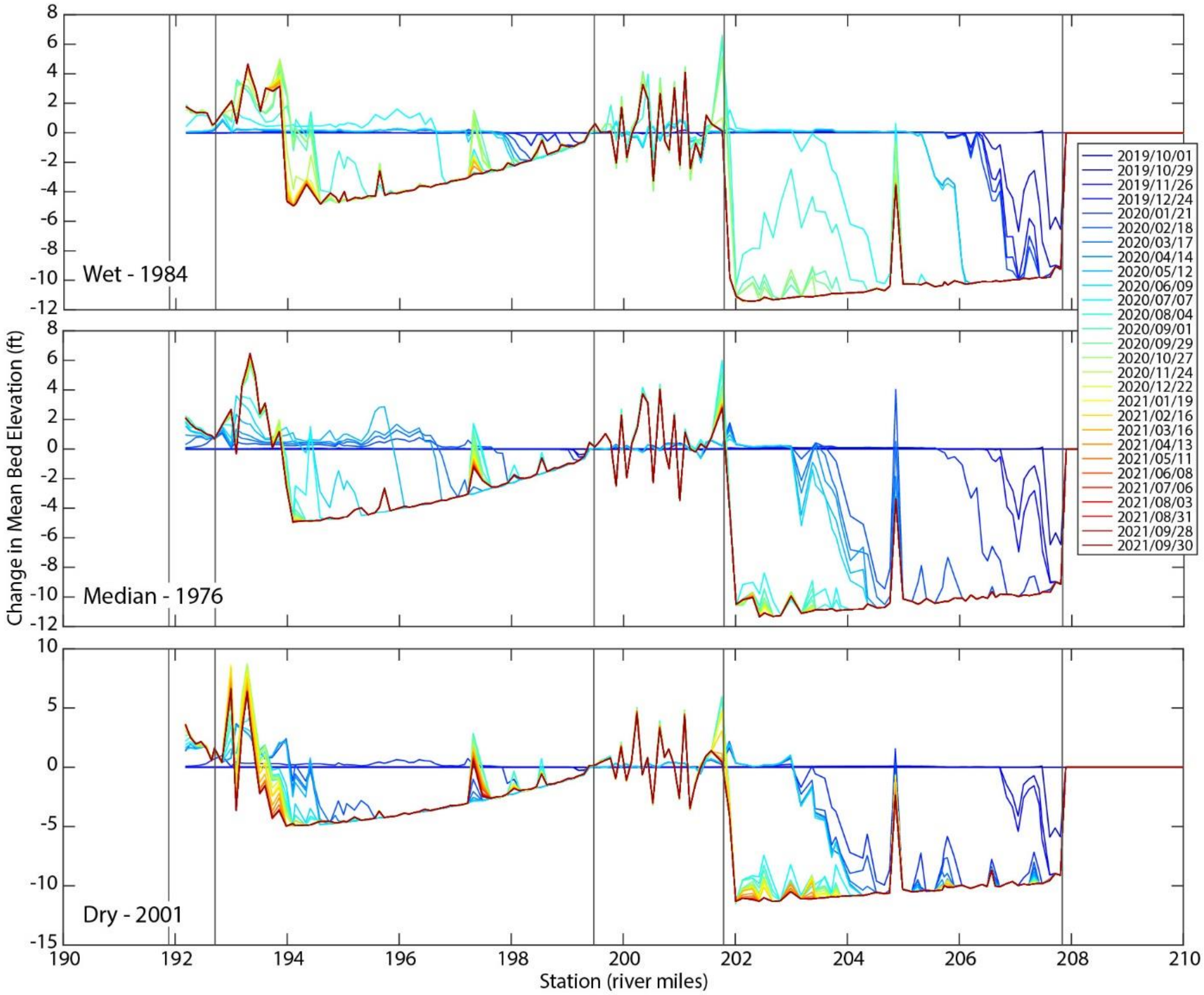

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FIGURE 5-14

Longitudinal Profile of Change in Mean Bed Elevation for the Upstream Reach (RM 192 to RM 210). References Lines Represent the Approximate Limits of Copco No. 1 Reservoir and Iron Gate Reservoir.

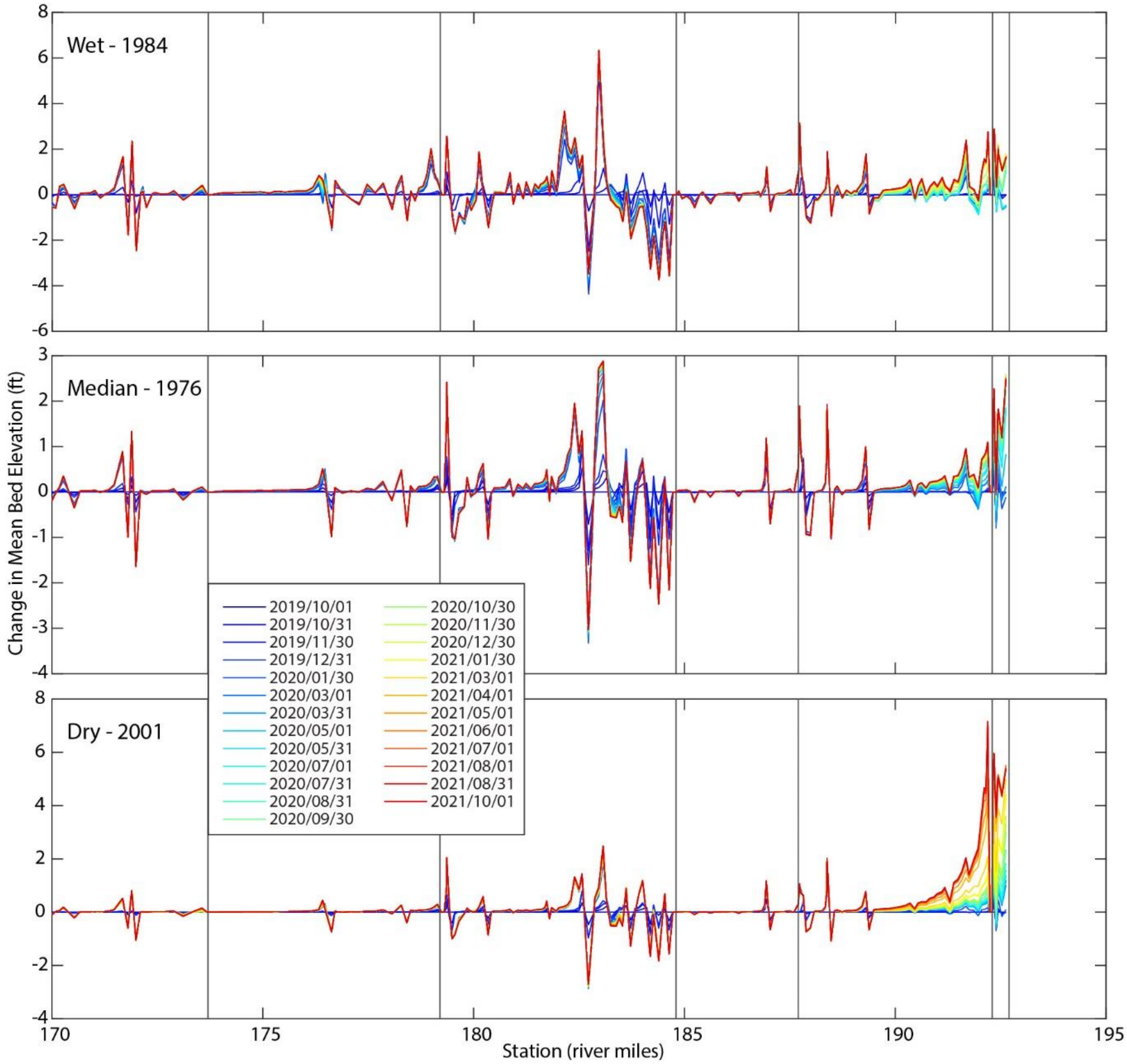

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FIGURE 5-15

Longitudinal Profile of Change in Mean Bed Elevation for the Downstream Reach (RM 170 to RM 192.7).

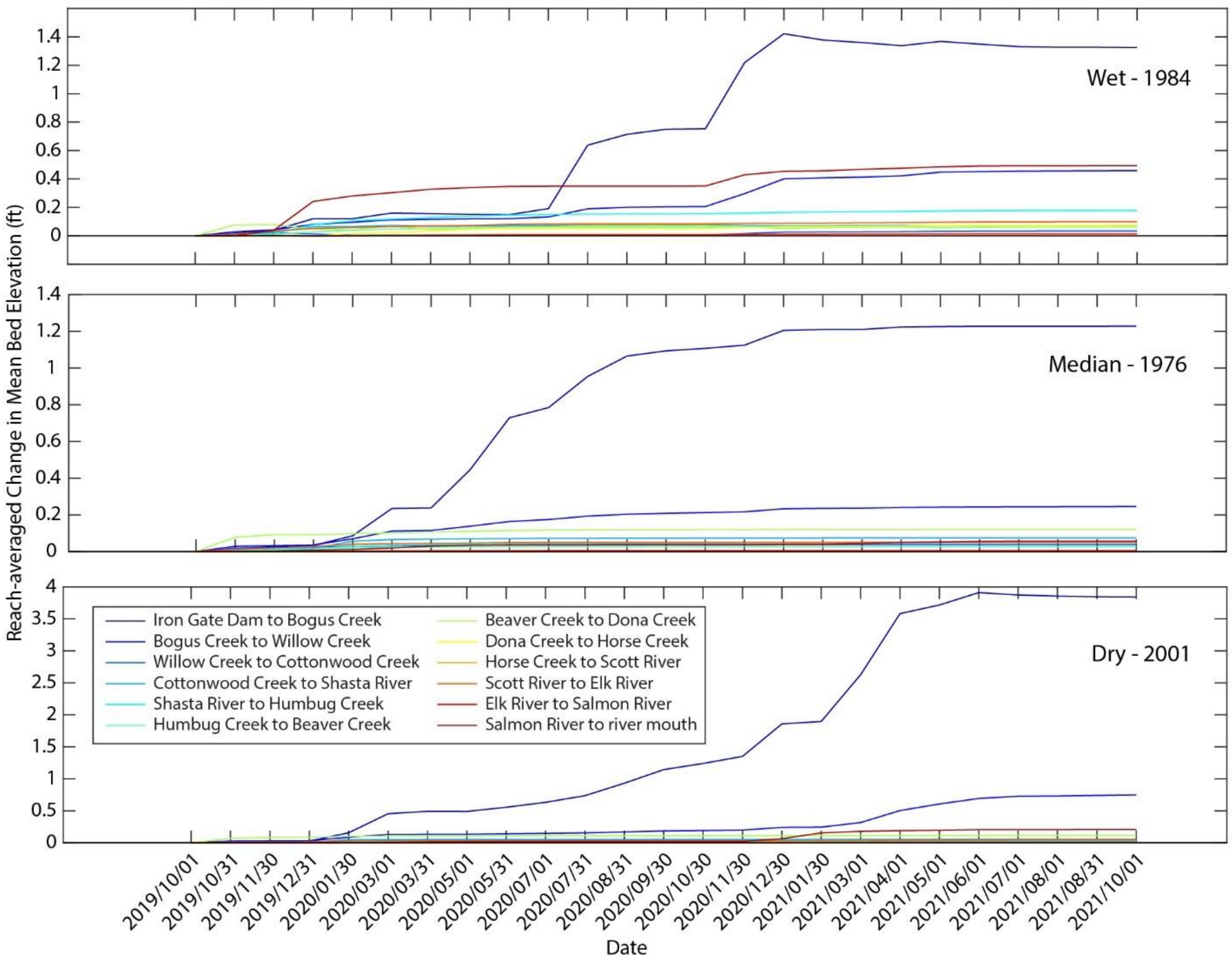

FIGURE 5-16

Reach-averaged Change in the Mean Bed Elevation for the Downstream Reach (Iron Gate Dam to Estuary).

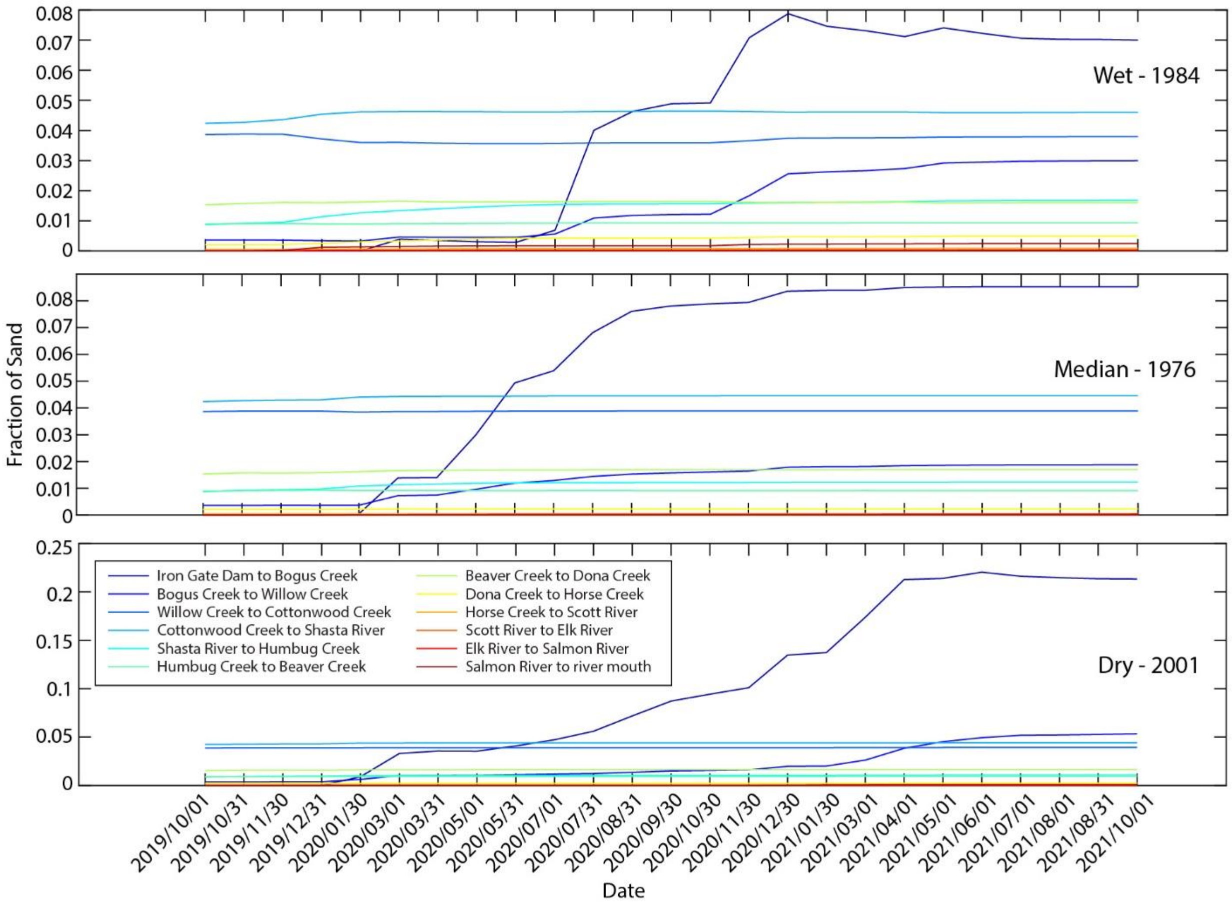

FIGURE 5-17

Reach-averaged Fraction of Sand in Surface Sediments for Reaches in the Downstream Reach.