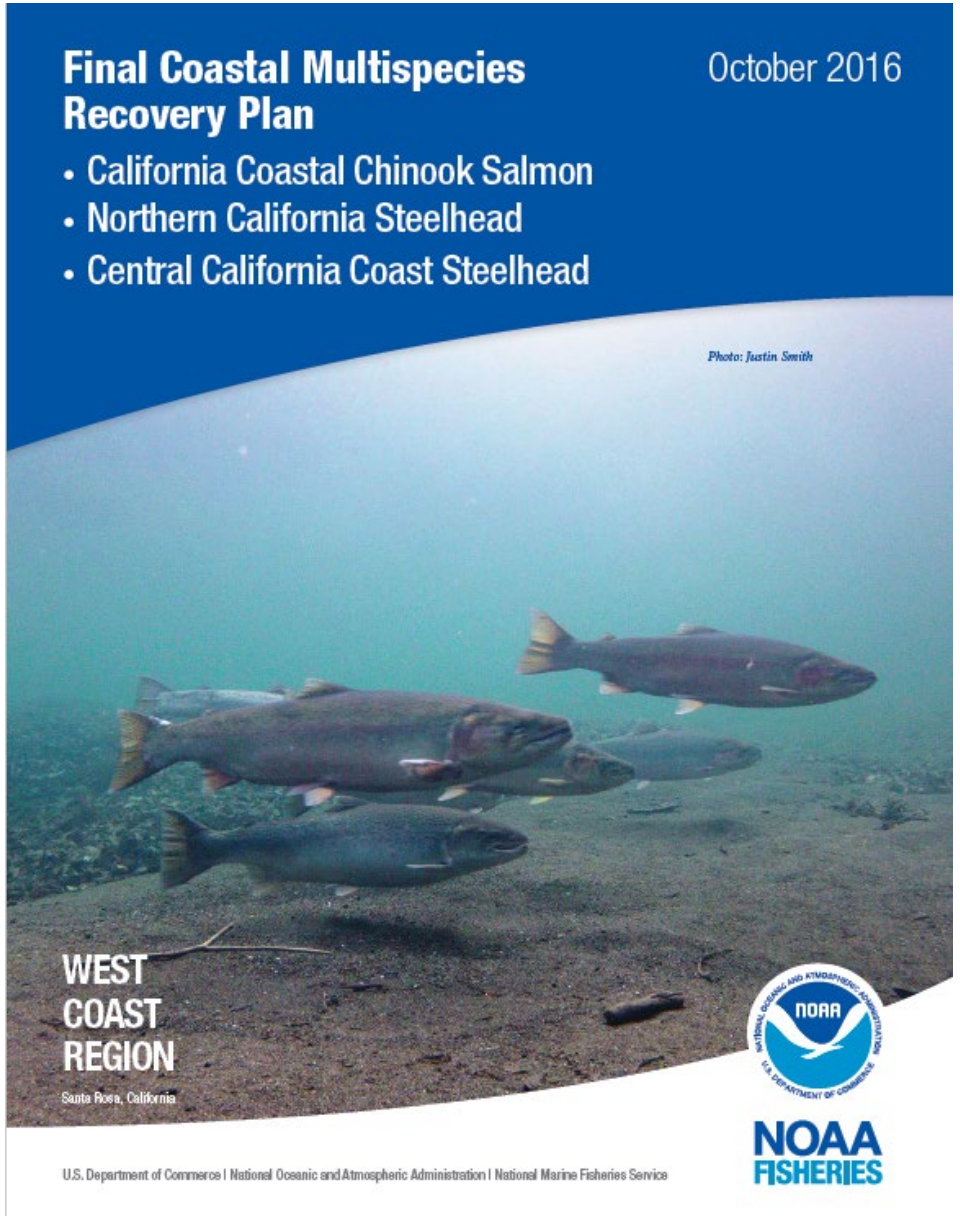
# Introduction to Potter Valley Project Two-Basin Solution Fisheries Studies

David Manning

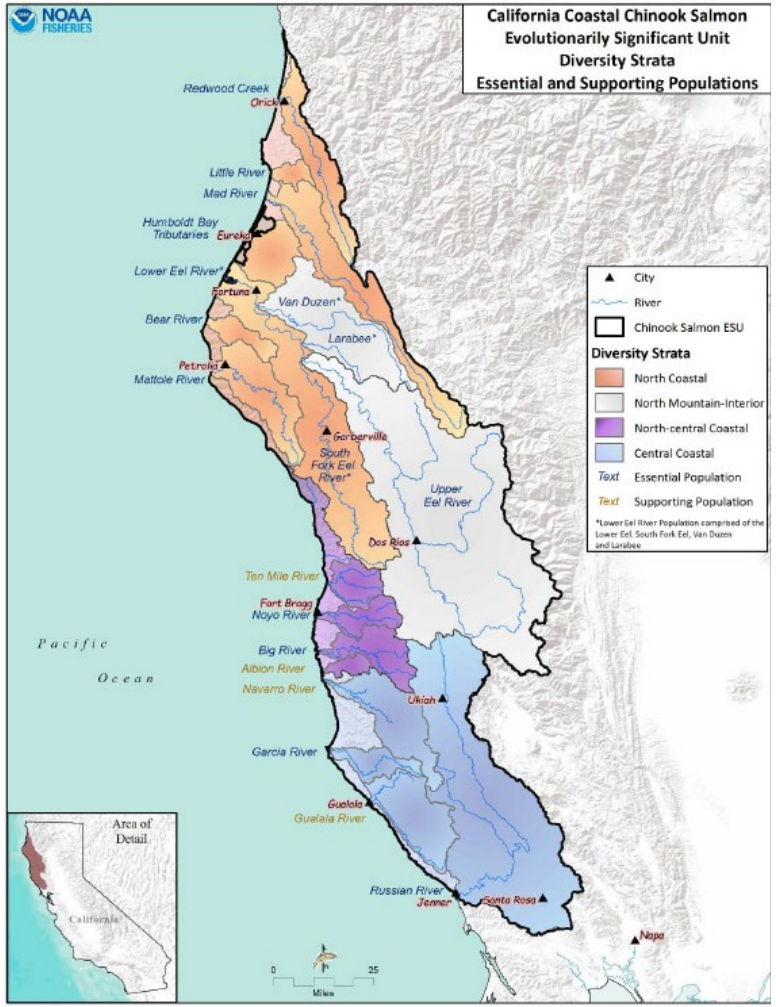
Environmental Resources Manager, Sonoma Water

# Today's Presentation

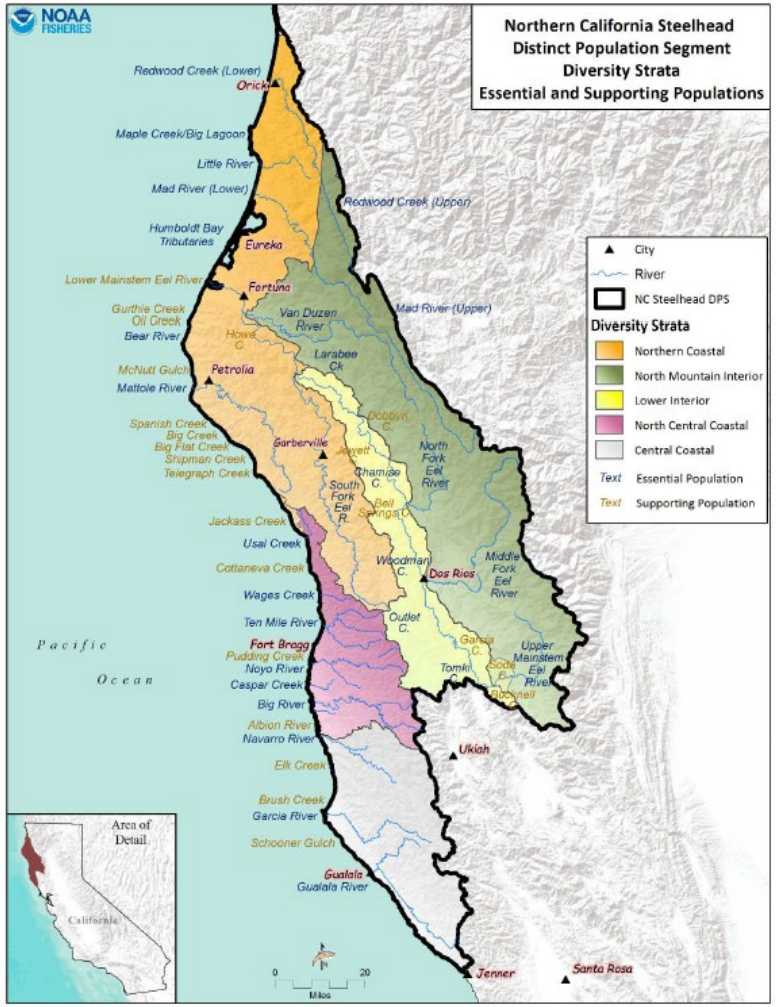
- Listing and Status of Salmonids in Both Basins
- Huffman Ad Hoc Fish Passage Evaluation – Dec 2019
- Fisheries and Ecosystem Responses – April 2021
- Scott and Cape Horn Dam Removal Alternatives – Nov 2021
- Cape Horn Dam Fish Passage Improvements – Nov 2021


Final Coastal Multispecies Recovery Plan
October 2016
• California Coastal Chinook Salmon
• Northern California Steelhead
• Central California Coast Steelhead
Photo: Justin Smith
WEST COAST REGION
Santa Rosa, California
U.S. Department of Commerce | National Oceanic and Atmospheric Administration | National Marine Fisheries Service
NOAA FISHERIES

# CC Chinook




# NC Steelhead

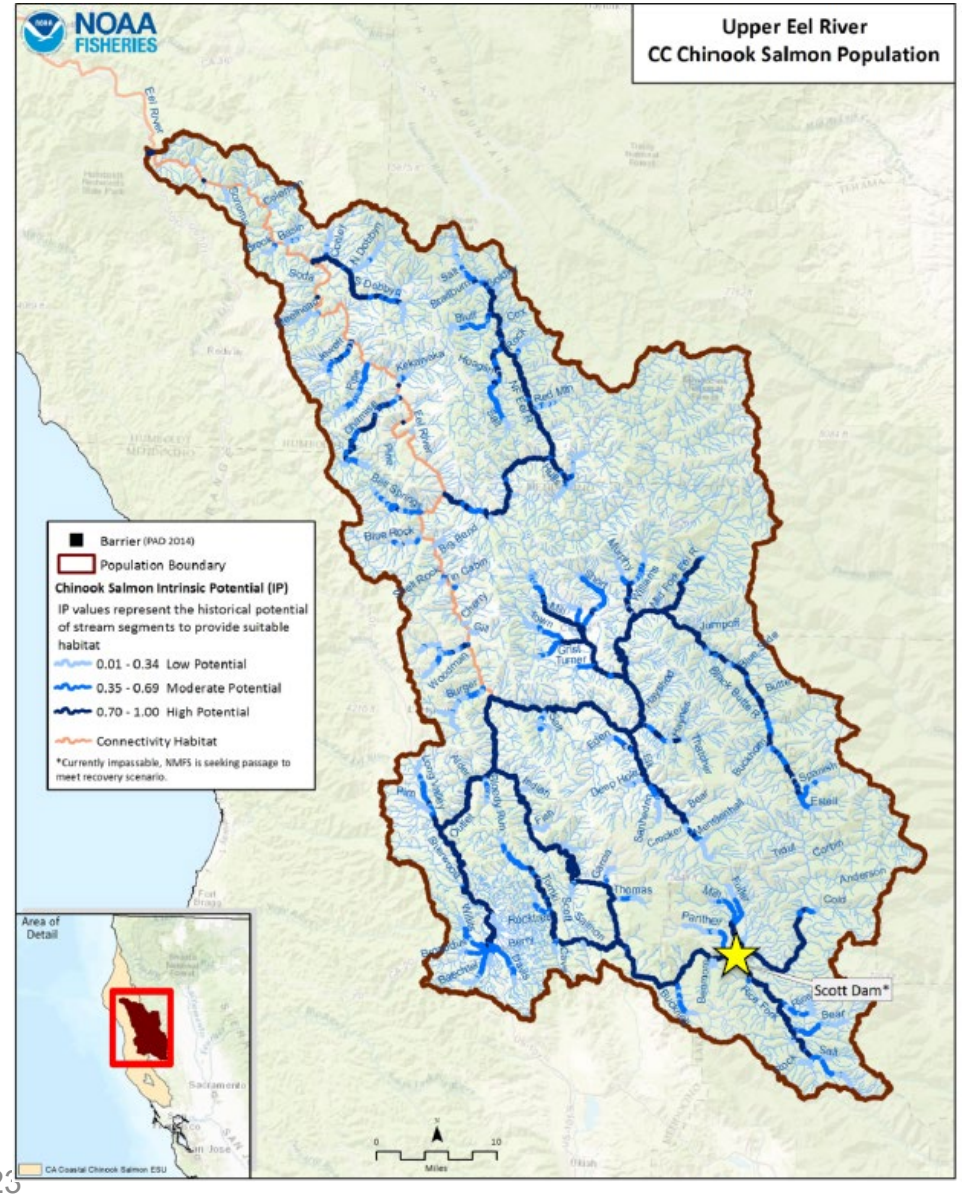


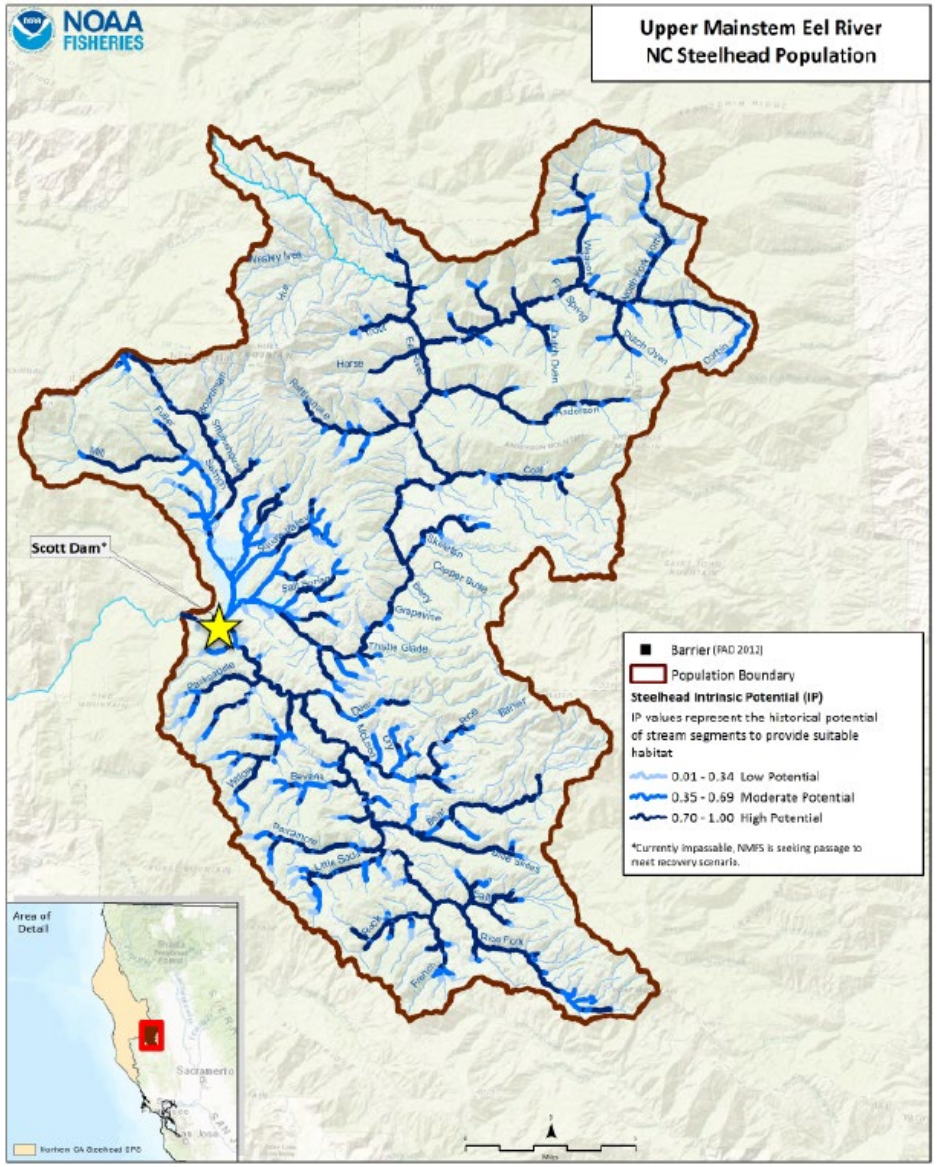

# CCC Steelhead




RUSSIAN RIVER WATER FORUM

# Upper Eel River Chinook and Steelhead Habitat



# CC Chinook Eel River (interior) & Russian River

| Diversity Strata | CC Chinook salmon Populations | Historical Population Status | Population's Role In Recovery | Current Weighted IP-km | Spawner Density | Spawner Abundance |
|---|---|---|---|---|---|---|
| North Mountain Interior | Lower Eel River ~ *Larabee Creek/ Van Duzen River** | I | Essential | 144.0 | 20.0 | 2,900 |
| | Upper Eel River | I | Essential | 528.5 | 20.0 | 10,600 ★ |
| | **North Mountain Interior Diversity Stratum Recovery Target** | | | | | **13,500** |
| Central Coastal | Garcia River | I | Essential | 56.2 | 36.0 | 2,000 |
| | Gualala River | I | Supporting | 175.6 | 6-12 | 1,052-2,105 |
| | Navarro River | I | Supporting | 131.5 | 6-12 | 787-1,576 |
| | Russian River | I | Essential | 465.2 | 20.0 | 9,300 ★ |
| | **Central Coastal Diversity Stratum Recovery Target** | | | | | **11,300** |
| | **CC Chinook ESU Recovery Target** | | | | | **52,800** |

# Upper Eel River (Cape Horn) Chinook

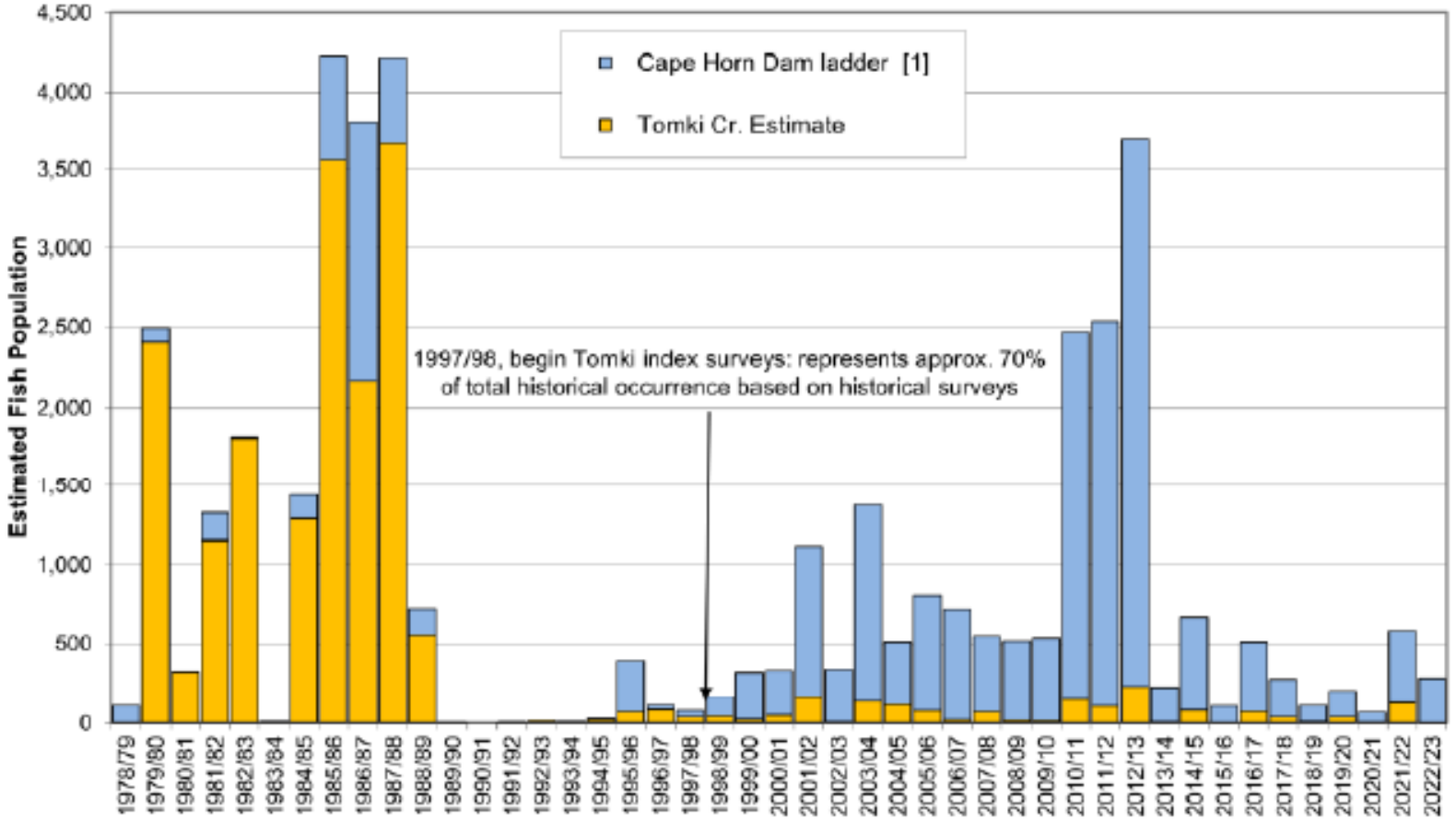



*Figure 2. Historical adult Chinook salmon returns to the upper Eel River at the Cape Horn Dam fish ladder and Tomki Creek. PG&E Potter Valley Project 2023 Annual Agency Meeting.*

# Russian River Chinook

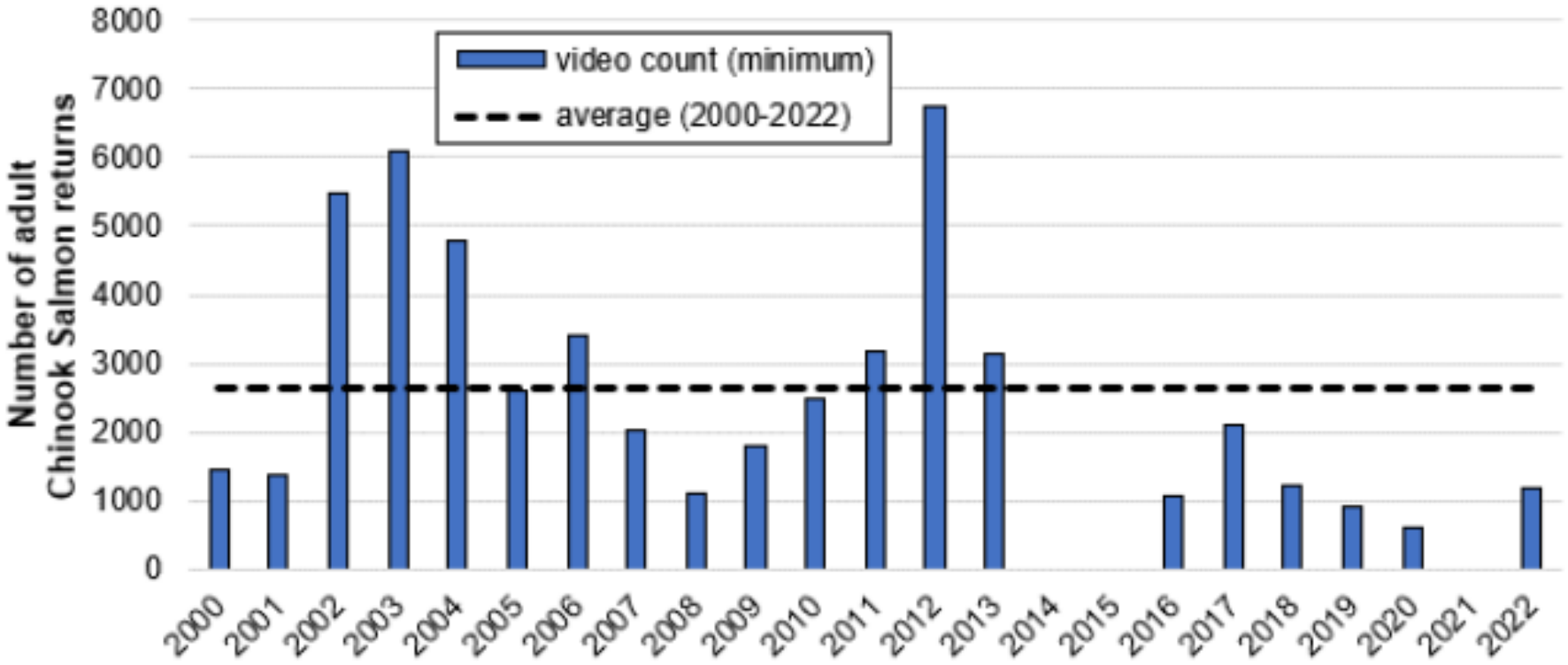



*Figure 4. Video counts of adult Chinook salmon passing through the fish ladder at Mirabel Dam on the lower Russian River (Sonoma Water 2022).*

# NC Winter Steelhead Eel River (interior populations)

| Diversity Strata | NC winter-run steelhead populations | Historical Population Status | Population's Role In Recovery | Current Weighted IP-km | Spawner Density | Spawner Abundance |
|---|---|---|---|---|---|---|
| | Middle Fork Eel River | I | Essential | 472.4 | 20.0 | 9,400 |
| | North Fork Eel River | I | Essential | 315.7 | 20.0 | 6,300 |
| | Redwood Creek (Humboldt Co) (Upper)* | I | Essential | 86.2 | 30.2 | 2,600 |
| | Upper Mainstem Eel River | I | Essential | 317.5 | 20.0 | 6,400 |
| | Van Duzen River | I | Essential | 312.2 | 20.0 | 6,200 |
| **North Mountain Interior Diversity Stratum Recovery Target** | | | | | | **39,300** |

# Upper Eel River (Cape Horn) Steelhead

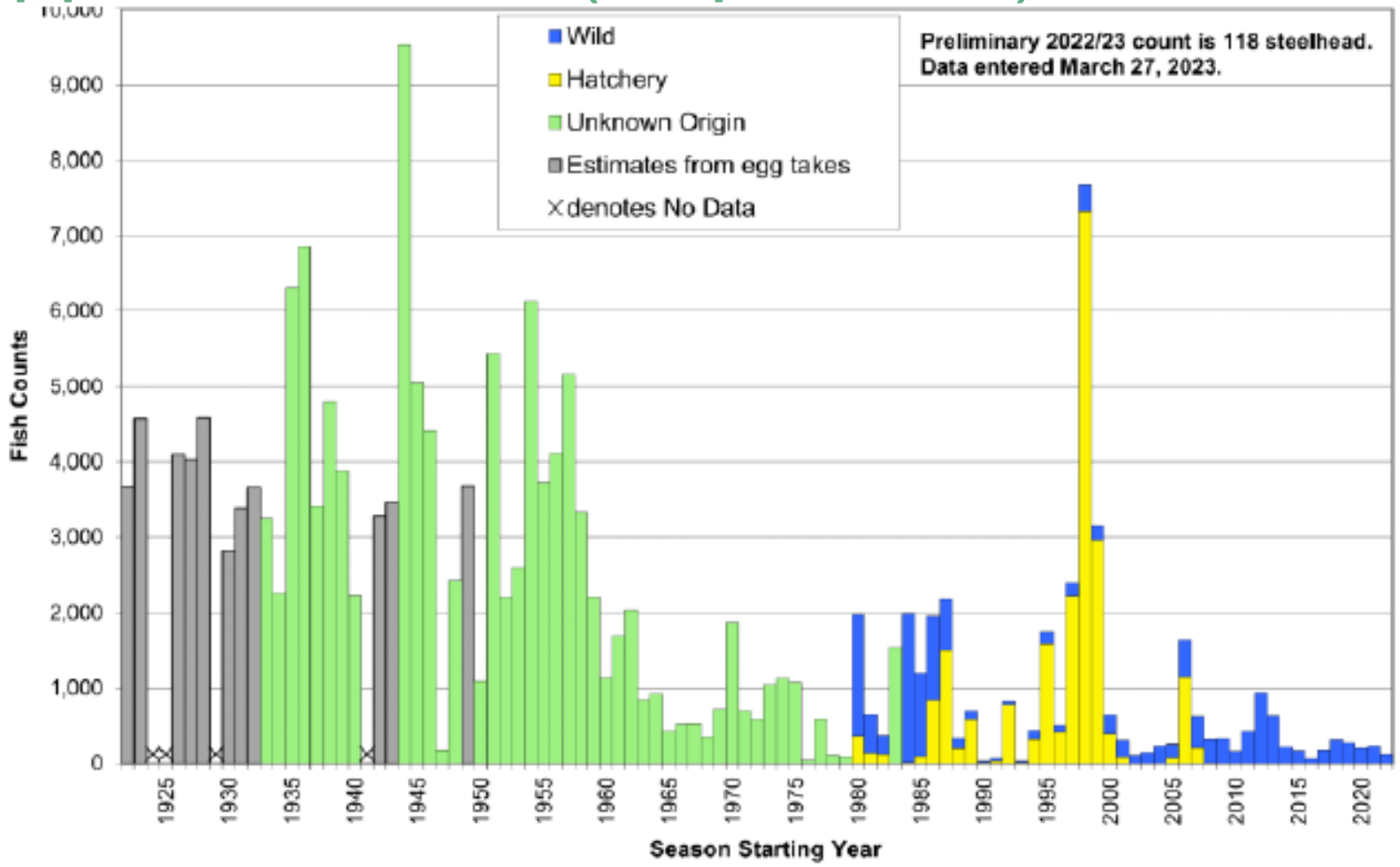



*Figure 1. Historical adult steelhead counts at the Eel River Van Arsdale (Cape Horn Dam) Fisheries Station. PG&E Potter Valley Project 2023 Annual Agency Meeting.*

# CCC Steelhead Russian River (interior populations)

| Diversity Strata | CCC Steelhead Population | Historical Population Status | Population's Role In Recovery | Current Weighted IP-km | Spawner Density | Spawner Abundance |
|---|---|---|---|---|---|---|
| Interior | Crocker Creek | D | Supporting | 4.5 | 6-12 | 25-52 |
| | Dry Creek | I | Essential | 116.7 | 26.0 | 3,000 |
| | Gill Creek | D | Supporting | 7.2 | 6-12 | 41-84 |
| | Maacama Creek | I | Essential | 76.2 | 31.6 | 2,400 |
| | Mark West Creek | I | Essential | 164.2 | 20 | 3,300 |
| | Miller Creek (Russian) | D | Supporting | 3.1 | 6-12 | 17-35 |
| | Sausal Creek | D | Supporting | 11.1 | 6-12 | 65-131 |
| | Upper Russian River | I | Essential | 423.9 | 20 | 8,500 |
| **Interior Diversity Stratum Recovery Target** | | | | | | **17,200** |

# Russian River Steelhead

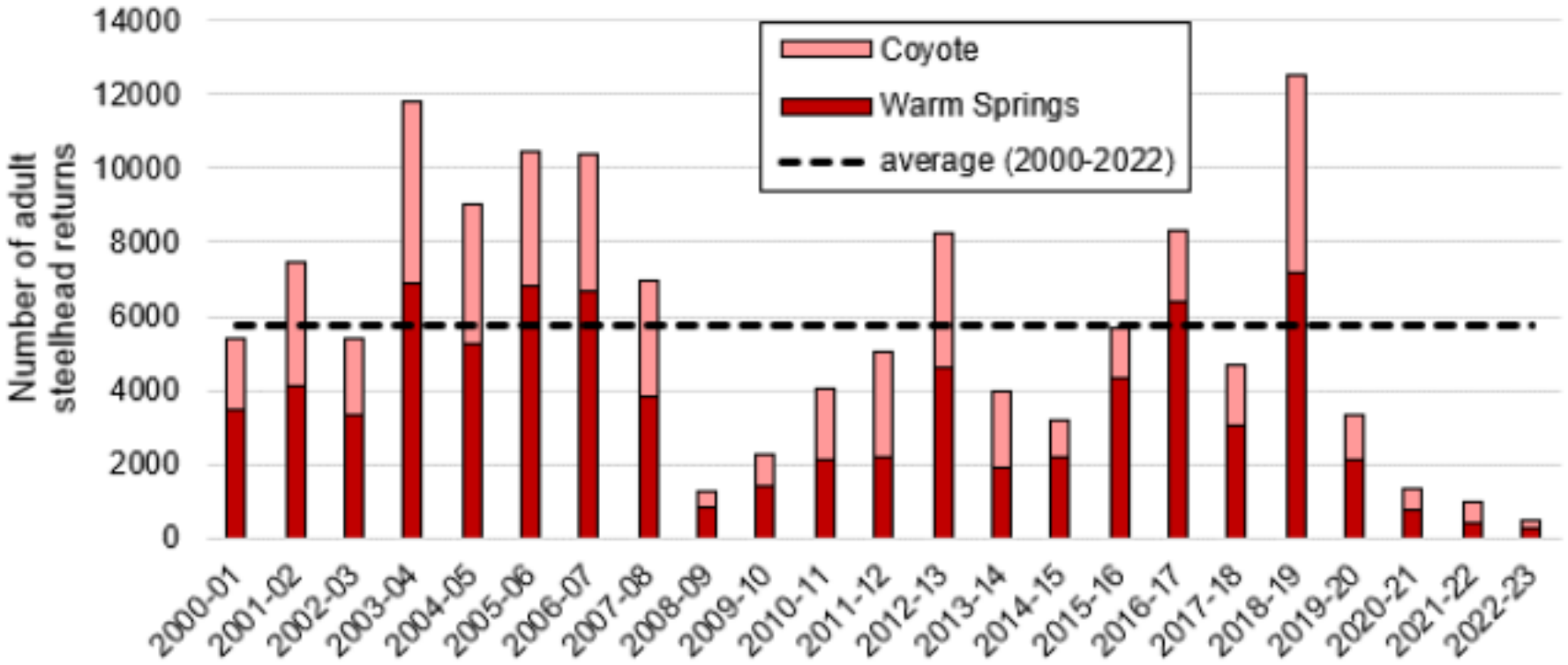



*Figure 3. Adult steelhead returns to Russian River hatcheries at Coyote Valley Dam/Lake Mendocino and Warm Springs Dam/Lake Sonoma (Sonoma Water 2022).*

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PROJECT

Potter Valley Project Ad Hoc Committee

# Fish Passage Profiles Evaluation Report

December 2019
Developed by the Fish Passage Working Group

## Fish Passage Working Group Report Contributors

**Scenarios and Options Subgroup**

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Joshua Fuller (NMFS)
Paul Kubicek (PG&E)
Jon Mann (CDFW)
David Manning (Sonoma Water)
Scott McBain (Consultant to RVIT)
Darren Mierau (CalTrout)
Steve Thomas (NMFS)

**Scoring Subgroup**

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# Scott Dam and Lake Pillsbury

# PVP Ad Hoc Alternatives

## Fish Passage Scenarios and Options Summary Table

This table provides a summary of the various options for each fish passage scenario that the working group developed and evaluated.

| Scenarios | 1<br>Fishway at Existing Scott Dam | 2<br>Trap & Haul | 3<br>Partial Scott Dam Removal | 4<br>Remove Scott Dam and Modify Cape Horn Dam |
|---|---|---|---|---|
| Options | **1.1 Semi-Natural, Low-Gradient Bypass Channel**<br><br>**1.2 Conventional Fishway**<br>1.2a Mead & Hunt Study<br>1.2b Modified Mead & Hunt | **2.1 Trap & Haul, Van Arsdale to Scott Dam**<br><br>**2.2 Trap & Haul, at Scott Dam** | **3.1 Lower Scott Dam to 80' ~** Meets current PVID water demand and NMFS 2002 BiOp RPA environmental flows<br><br>**3.2 Lower Scott Dam to 50' ~** Retain and manage accumulated sediment, no water storage within Lake Pillsbury | **4.1 Remove Scott Dam and Modify Cape Horn Dam** Diversion to East Branch Russian River with modified Cape Horn Dam infrastructure<br><br>**4.2 Remove both Scott Dam and Cape Horn Dam** With alternative diversion infrastructure |

# Species Life History Stages and Timing

Table 4-2. Adult Migration and Smolt Outmigration Timing (Source: Stillwater Sciences et al. 2021).

| Species | Life Stage | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Chinook Salmon (Fall-run) | Adult Migration | | | | | | | | | | | | |
| | Smolt Outmigration | | | | | | | | | | | | |
| Steelhead (Summer- and Winter-run) | Adult Migration (Winter-Run) | | | | | | | | | | | | |
| | Adult Migration (Summer-Run) | | | | | | | | | | | | |
| | Smolt and Kelt Outmigration | | | | | | | | | | | | |
| Coho Salmon* | Adult Migration | | | | | | | | | | | | |
| | Smolt Outmigration | | | | | | | | | | | | |
| Pacific Lamprey | Adult Migration | | | | | | | | | | | | |
| Sacramento Sucker | TBD | | | | | | | | | | | | |

# PVP Ad Hoc Scoring Matrix for Alternatives

| Fish Passage Scenario Scoring Key | Score Range 1 | 5 | 10 |
|---|---|---|---|
| **Biological Feasibility for Upstream Passage** | | | |
| Reservoir navigability | Difficulty finding tributary | | Success finding tributary |
| Passage efficiency (fishway, etc.) | Migration delay/low success | | No delay/high success |
| Predation | Likely to be consumed | | Successfully avoids predators |
| **Biological Feasibility for Downstream Passage** | | | |
| Reservoir navigability | Difficulty finding way out of lake | | Successfully finds route through lake |
| Passage efficiency (fishway, etc.) | Delay/Low success past dam crest | | No delay/high success past dam crest |
| Predation | Likely to be consumed | | Successfully avoids predators |
| **Habitat and Water Quality** | | | |
| Habitat upstream of Scott Dam | Poor spawning/rearing habitat | | Good spawning/rearing habitat |
| Water quality within reservoir | Warm temp/low dissolved $O_2$ | | Cool temp/high dissolved $O_2$ |
| Habitat downstream of Scott Dam | Poor spawning/rearing/holding habitat | | Good spawning/rearing/holding habitat |
| Water quality below reservoir | Warm temp/low dissolved $O_2$ | | Cool temp/high dissolved $O_2$ |
| **Hydrologic Implications** | **Unnatural flow timing and duration** | | **Natural flow timing and duration** |
| **Biological Viability (Spatial Structure & Diversity)** | **Limited natural seasonal movement and life history expression (due to human intervention)** | | **Natural seasonal movement and life history expression (no human intervention)** |

# PVP Ad Hoc Upstream and Downstream Passage Scoring Results

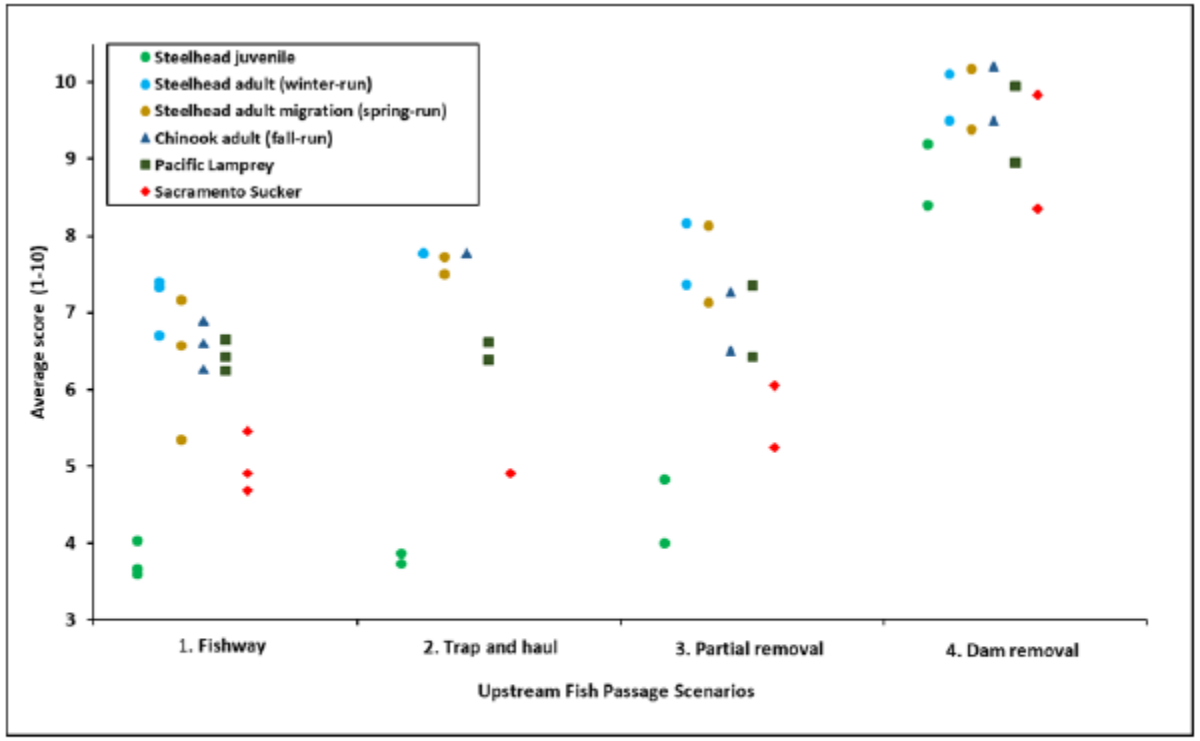


***Figure 1.*** *Biological feasibility for upstream fish passage is the ability for targeted species and associated life stages to successfully find the fishway and migrate to spawning/rearing tributaries above Scott Dam (upper Eel River, Rice Fork, and Salmon Creek, etc.). Allows for the potential benefit to the species by reestablishing occupancy of habitats, thereby promoting ecological and evolutionary processes responsible for local adaptation and diverse life histories.*

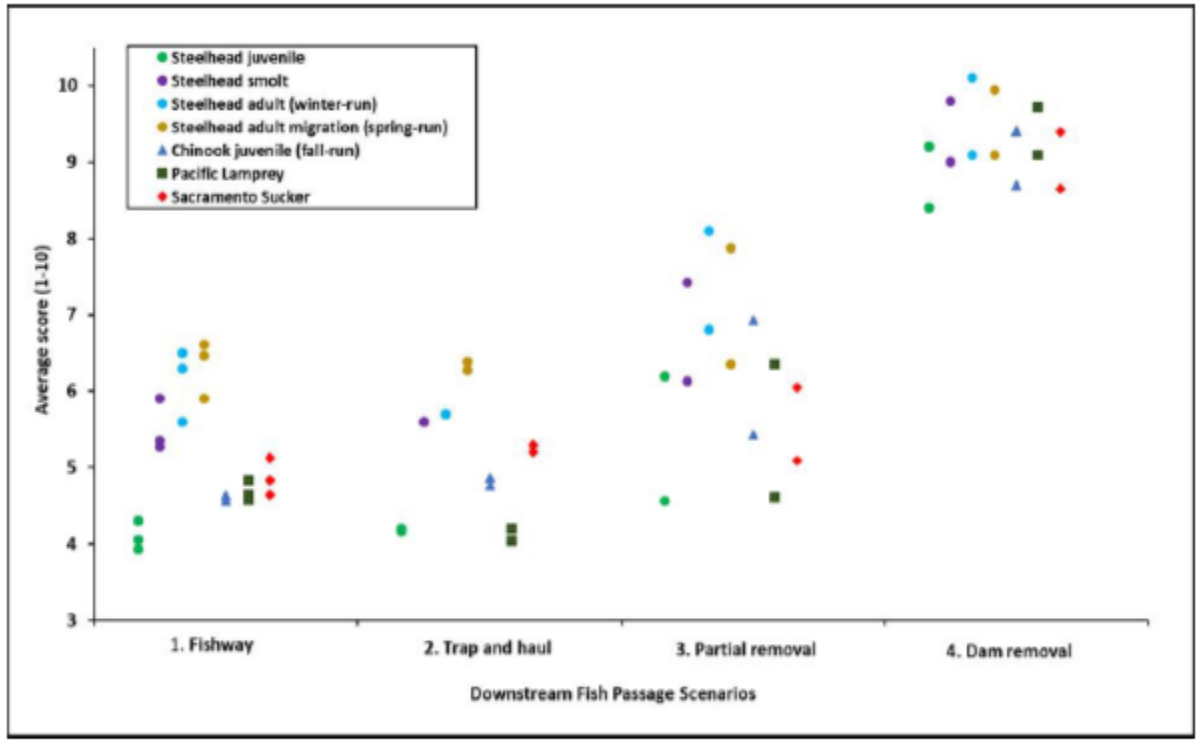


***Figure 2.*** *Biological feasibility for downstream fish passage is ability for targeted species and associated life stages to successfully migrate from spawning/rearing tributaries above Scott Dam (upper Eel River, Rice Fork, and Salmon Creek, etc.) to the lower Eel River and ocean. Allows for the potential benefit to the species by reestablishing occupancy of habitats, thereby promoting ecological and evolutionary processes responsible for local adaptation and diverse life histories.*

# PVP Ad Hoc Biological Viability (behavior, life history expression)

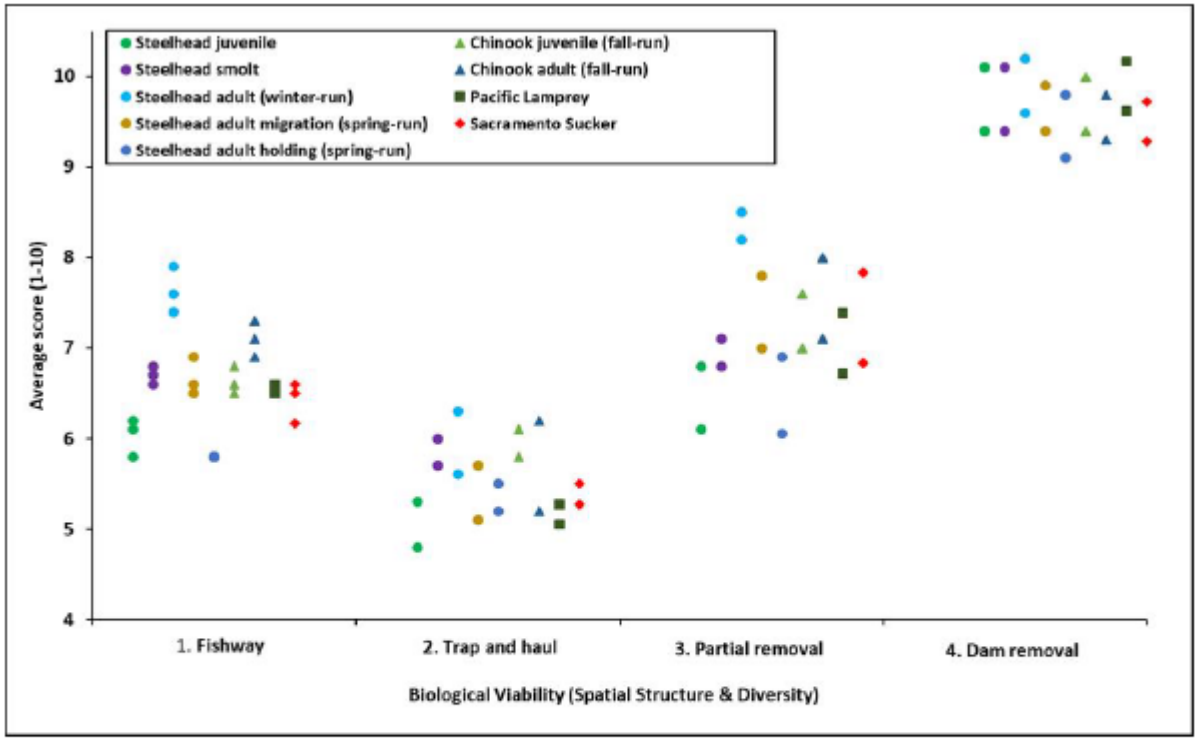


***Figure 3.*** *Biological viability (spatial structure and diversity) refers to the natural behavior and life history expression of a focal species life stage relevant habitat access and a fish passage option. The passage option allows adult fish to make choices related to spawning location and timing (e.g., site fidelity, mainstem or tributary, no delays). The passage option allows juvenile fish to imprint on natal streams and express diverse rearing and migration strategies. The extent of which the fish passage option includes selective pressures (e.g., degree of human intervention, unnatural environmental constraints, etc.) that could limit life history adaptation and phenotype or genotype expression.*

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# Scott Dam and Cape Horn Dam Removal Alternatives

PREPARED FOR

Two-Basin Solution Partners
California Trout
Humboldt County
Mendocino County Inland Water and Power Commission
Round Valley Indian Tribes
Sonoma County Water Agency

PREPARED BY

McMillen Jacobs Associates
1471 Shoreline Drive, Suite 100
Boise, ID 83702

# Preliminary Scott Dam Removal Cost (rapid S-1 and phased S-2)

Table 2-1. Scott Dam Removal Alternatives Cost Estimate Summary.

| Division | Item | Cost | |
|---|---|---|---|
| | | Alternative S-1 | Alternative S-2 |
| 1 | GC's & Mobilization | $15,940,000 | $25,665,000 |
| 2 | Demolition | $46,980,000 | $47,230,000 |
| 5 | Metals | $50,000 | $50,000 |
| 31 | Earthwork | $1,700,000 | $350,000 |
| 32 | Exterior Improvements | $1,500,000 | $1,000,000 |
| 35 | Marine and Waterway | $2,900,000 | $2,700,000 |
| **Total Construction Price** | | **$69,070,000** | **$76,995,000** |
| **Taxes, Overhead, Profit & Bond** | | | |
| Overhead | | $4,144,200 | $4,619,700 |
| Profit | | $8,288,400 | $9,239,400 |

| Division | Item | Cost | |
|---|---|---|---|
| | | Alternative S-1 | Alternative S-2 |
| Construction Bonds and Insurance | | $2,196,426 | $2,448,441 |
| California Sales Tax | | $5,007,575 | $5,582,138 |
| **Total** | | **$19,636,601** | **$21,889,679** |
| **Contingency** | | | |
| Contingency | | $17,267,500 | $19,248,750 |
| **Total Contingency** | | $17,267,500 | $19,248,750 |
| ***Median Construction Cost*** | | ***$105,974,101*** | ***$118,133,429*** |
| ***Total Construction Cost Range (-50%)*** | | ***$52,987,051*** | ***$59,066,714*** |
| ***Total Construction Cost Range (+100%)*** | | ***$211,948,202*** | ***$236,266,857*** |

WORKING DRAFT TECHNICAL MEMORANDUM • APRIL 2021

# Potter Valley Project Feasibility Study: Potential Ecosystem and Fisheries Responses to Project Alternatives

PREPARED FOR

Potter Valley Project Planning Agreement Parties
- California Trout
- Humboldt County
- Mendocino County Inland Water and Power Commission
- Round Valley Indian Tribes
- Sonoma County Water Agency

PREPARED BY

Stillwater Sciences

McMILLEN JACOBS ASSOCIATES

McBain Associates
APPLIED RIVER SCIENCES

M3

pH

Geosyntec

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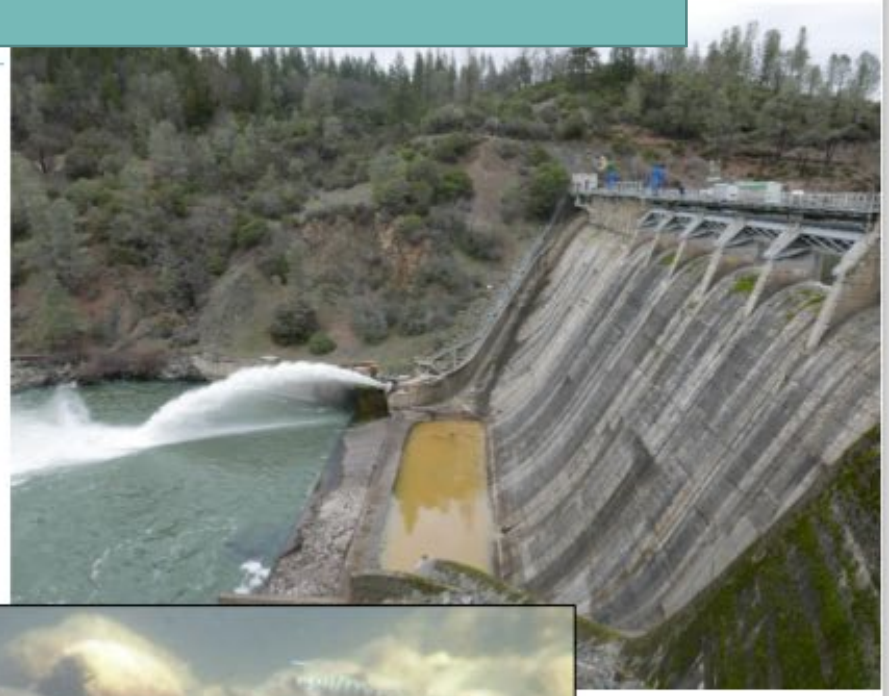
# Two-Basin Partnership Project Plan = Run of the River, no Scott Dam

- Volitional Passage Above Scott Dam
- Minimize Impacts of Sediment on Biota and Habitat
- Restore Natural Processes (hydrology, geomorphology, water quality)
- Improve Cape Horn Dam Fish Passage
- Improve Van Arsdale Flow Bypass and Fish Screens



TWO-BASIN PARTNERSHIP
POTTER VALLEY

# Spring Flow Recession With and Without Scott Dam

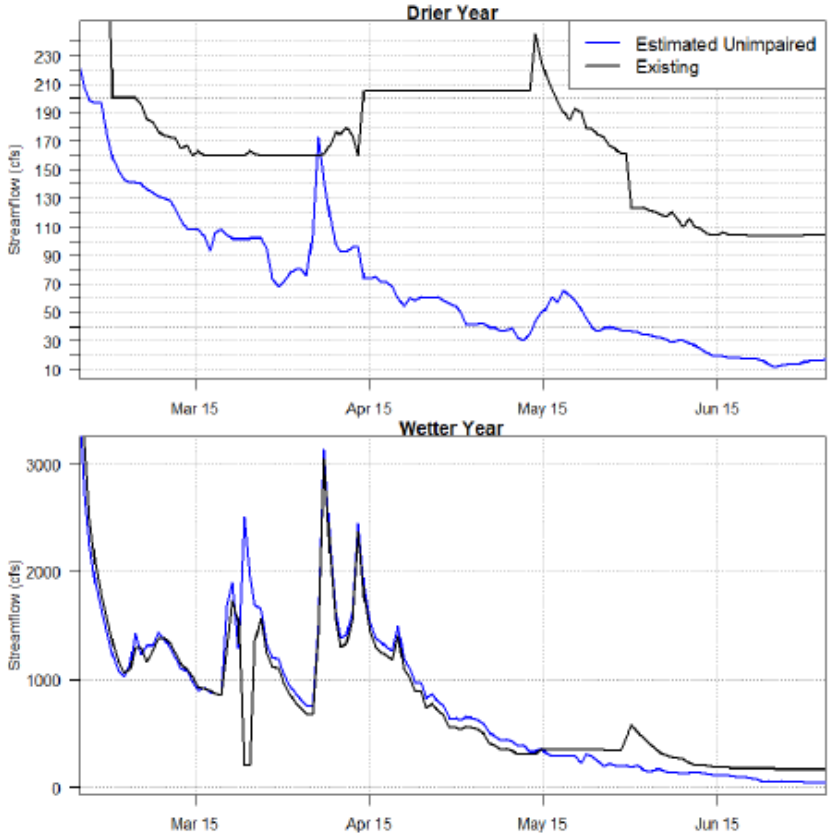



*Figure 5. Spring recession hydrographs comparing modeled existing and modele unimpaired flows for between Scott Dam and Cape Horn Dam for an example dr year (2015) and wetter year (2017).*

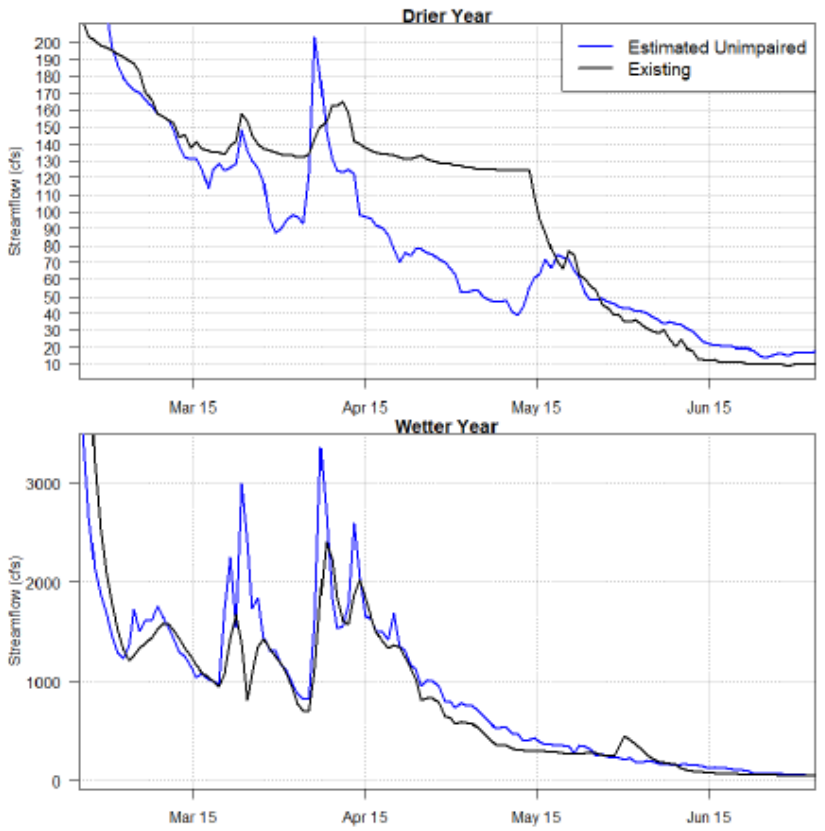



*Figure 6: Spring recession hydrographs comparing modeled existing and modeled unimpaired flows for below Cape Horn Dam using the same example drier (2015) and wetter water (2017) year used in Figure 5.*

# Steelhead Response to Project Plan

- Juvenile Rearing and Smolts Below Scott Dam
  - Natural lower flow and warmer water = reduced carrying capacity, survival, productivity
- Juvenile Rearing and Smolts Below CHD
  - Minor changes in summer water temperatures = small change in productivity
- Adult Spawning, Juvenile Rearing, and Smolts Above Scott Dam
  - 200-300 miles of habitat
  - Coldwater historical habitat = increased productivity
  - Access for summer run steelhead = increased genetic diversity

TWO-BASIN PARTNERSHIP
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# Chinook Salmon Response to Project Plan

- **Spring Juvenile Outmigration**
  - Natural higher flow and warmer water = natural outmigration timing & better survival
- **Fall Adult Migration**
  - Lower flow = restricted passage & limited early season spawning – dry years may be problematic
- **Productivity of Habitat Above Scott Dam**
  - 100 miles of habitat = greater juvenile life history diversity and population resiliency
- **Productivity of Habitat Below Scott Dam**
  - Varies by water year – little change most years

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# Ecological & Fisheries Responses to Project Plan
## (Huffman Ad Hoc Water Supply Scenario 2)

Positive | Neutral or Unclear | Negative

| Parameter | Eel River | Russian River |
|---|---|---|
| Water Quality | Positive / Neutral or Unclear | Positive |
| Geomorphic Function | Positive / Positive | Neutral or Unclear |
| Riparian Habitat | Positive | Positive |
| Aquatic Insects and Fish Energetics | Positive | Neutral or Unclear |
| Salmonid Flow/Habitat Relationships | Negative / Neutral or Unclear / Positive / Positive | Neutral or Unclear / Neutral or Unclear / Neutral or Unclear |
| Fish Passage | Positive / Negative | Neutral or Unclear |
| Non-Native Predators | Positive | Negative |
| Herpetofauna | Positive / Positive / Positive | Neutral or Unclear |
| Lamprey | Neutral or Unclear | Neutral or Unclear |
| Salmonid Productivity Below Scott Dam | Positive / Negative / Negative / Negative | |
| Salmonid Productivity Above Scott Dam | Positive | |

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# Non-Native Predator Response to Project Plan

- Scott Dam/Lake Pillsbury removal reduces habitat for Pikeminnow & Bass
- Access to habitat above Scott Dam reduces overlap between predators and salmonids
- Lower flow & warmer water below Scott Dam could increase interactions between predators and salmonids
- Predation risk remains high at CHD/Van Arsdale

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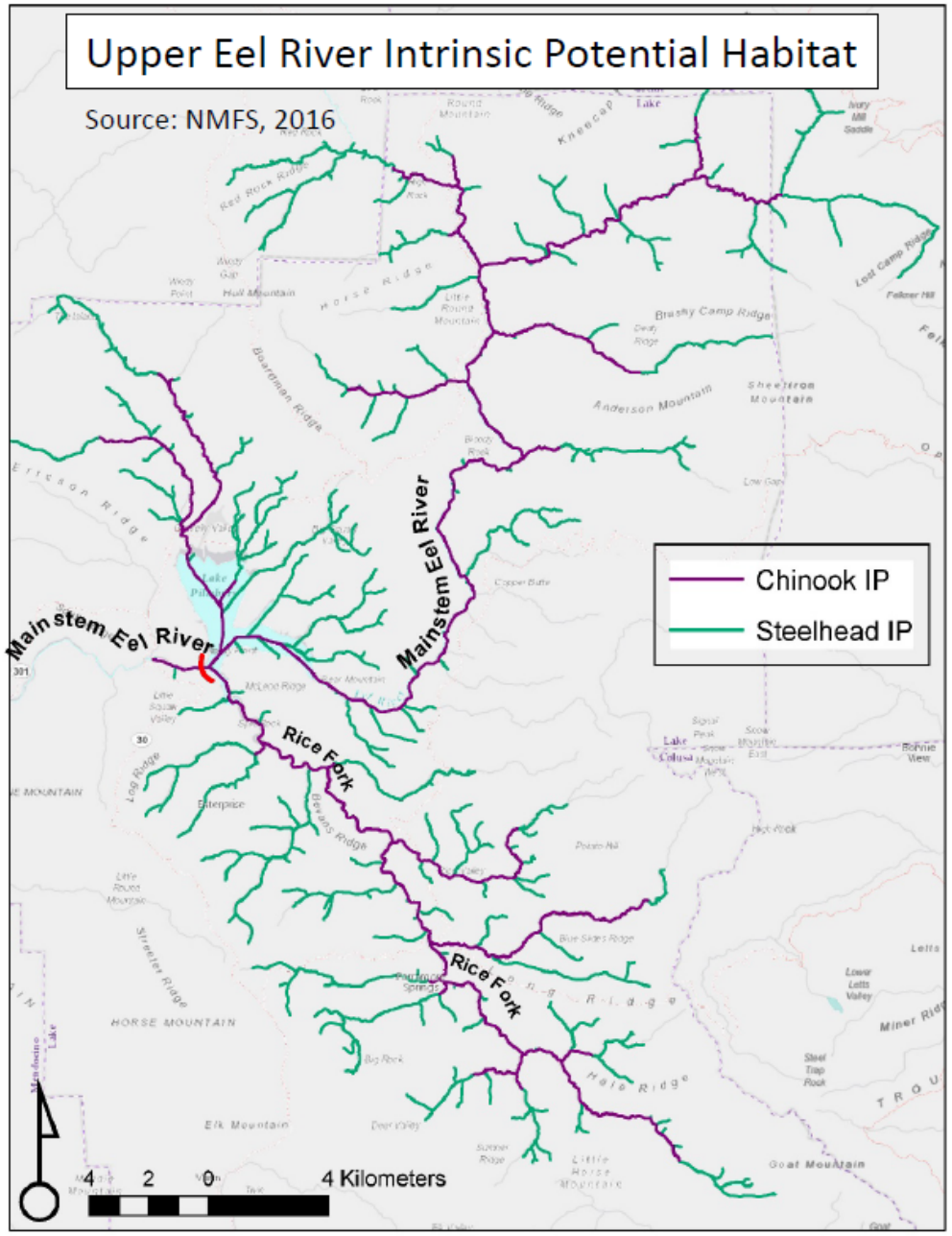
POTTER VALLEY

# Salmonid Productivity & Project Plan

*"In conclusion, any potential declines in both Steelhead and Chinook Salmon population productivity resulting from dam removal would be compensated for by the increased productivity resulting from access to the extensive, high-quality, coldwater habitats in the upper Eel River and tributaries upstream of Scott Dam."*

-Stillwater Sciences Team




TWO-BASIN PARTNERSHIP
POTTER VALLEY

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# Cape Horn Dam Fish Passage Improvements

PREPARED FOR

Two-Basin Solution Partners
- California Trout
- Humboldt County
- Mendocino County Inland Water and Power Commission
- Round Valley Indian Tribes
- Sonoma County Water Agency

PREPARED BY

McMillen Jacobs Associates
1471 Shoreline Drive, Suite 100
Boise, ID 83702

# Cape Horn Dam Existing Conditions

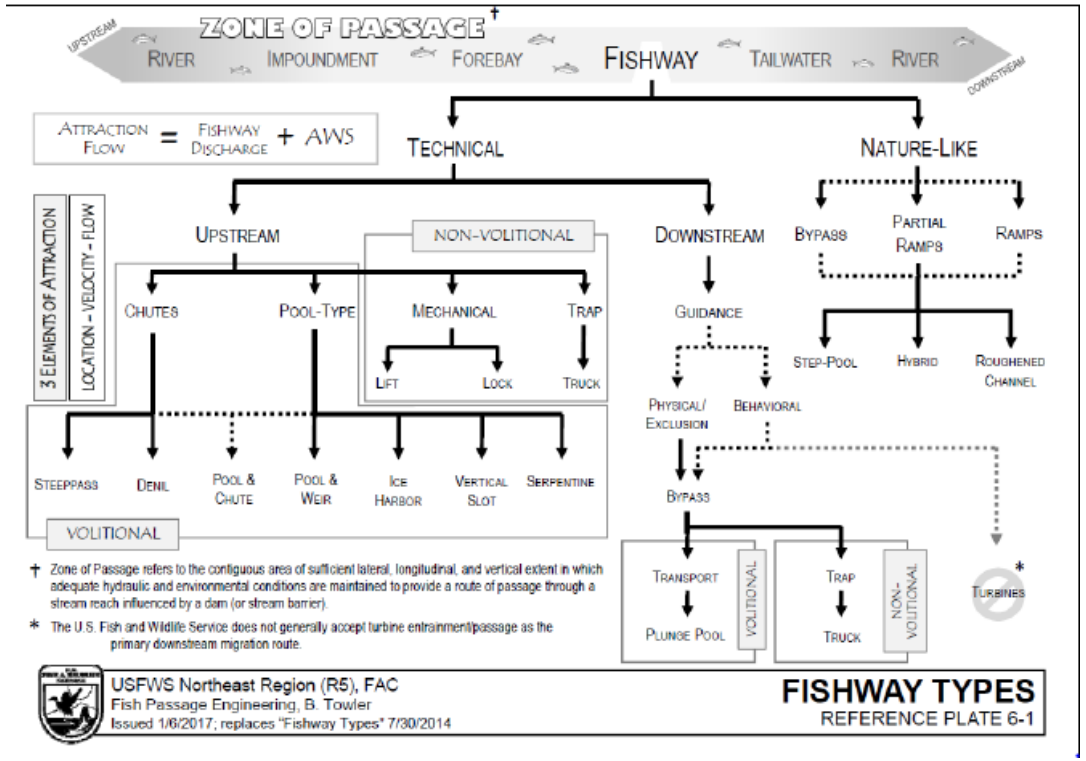

# Existing Pool and Weir Fish Ladder

# Cape Horn Dam After High Flow in 2019

# Cape Horn Dam Fish Hotel and Ladder with Debris

# Fish Passage Improvements at Cape Horn Dam

- New Fish Ladder
- Dam Removal with Pump Station
- Dam Removal with Roughened Channel
- Dam Removal with Upstream Diversion



# New Fish Ladder and Dam Crest Alternative 1

- Keep Cape Horn Dam and gravity diversion
- Construct new fish ladder for NMFS/CDFW compliance
- Improve upstream and downstream passage with inflatable bladder weirs
- Improve downstream passage with ogee section on dam face
- Provide sluicing capability at the ladder exit
- Protect lower ladder pools from debris and sediment accumulation
- Re-rate Van Arsdale fish screens to convey up to 300 cfs
- Modify bypass to discharge entrained fish back to the river
- Install suction dredging operation to address sediment load from Scott Dam removal

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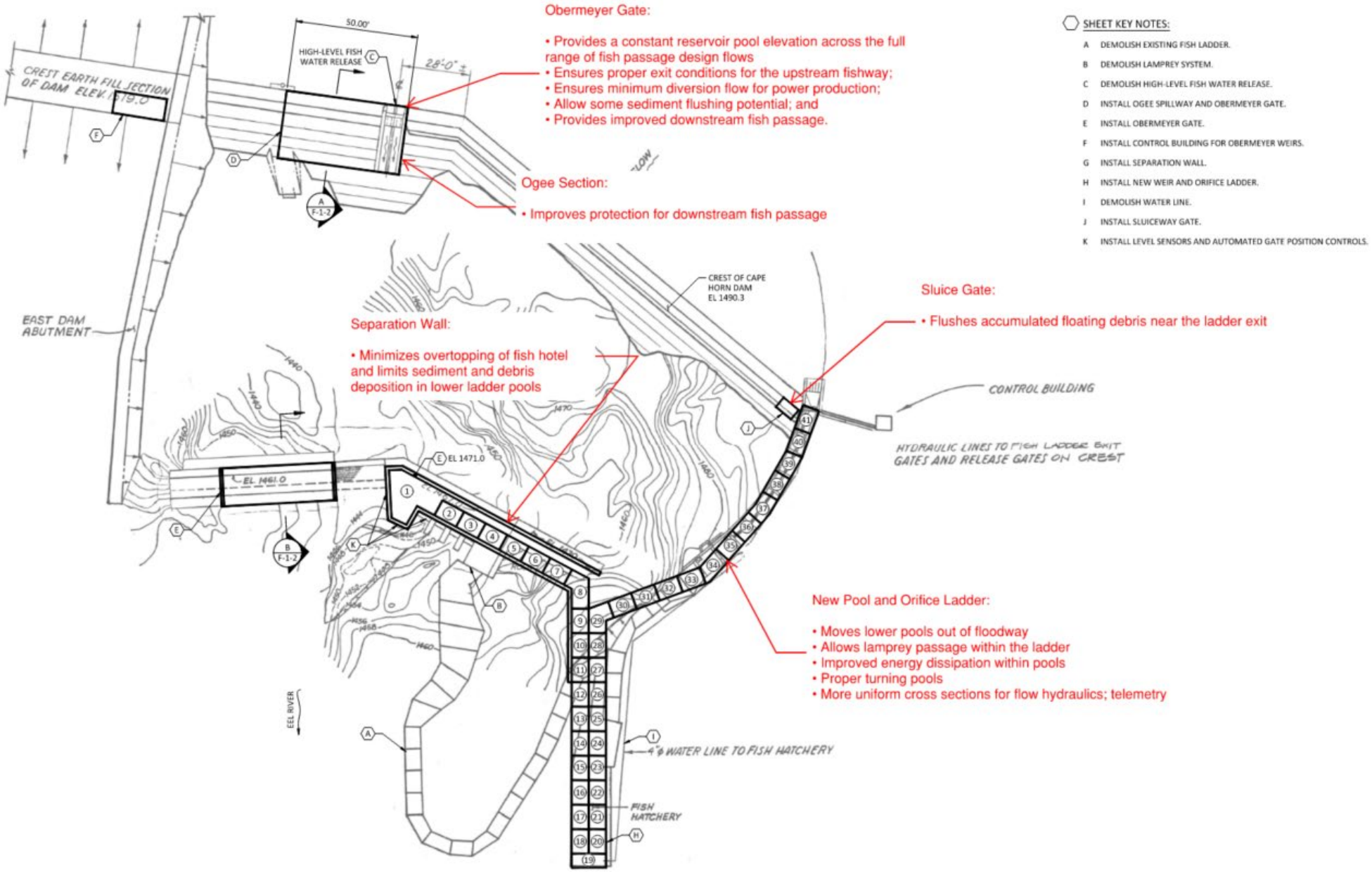
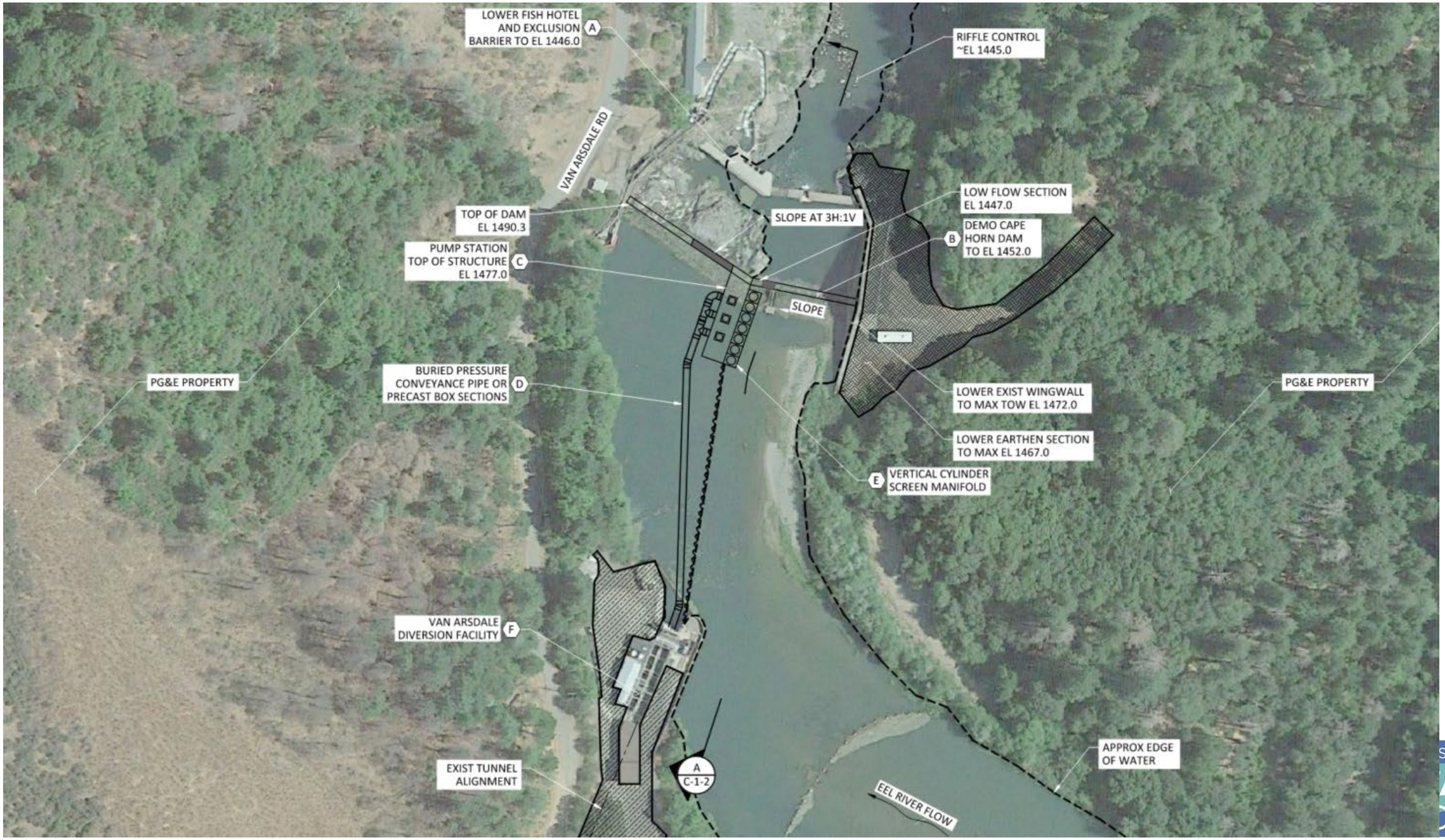



RUSSIAN RIVER WATER FORUM

# Cape Horn Dam Removal with Pump Station Alternative 2

- Remove a section of the dam close to level of existing downstream hydraulic control: existing CHD crest El. 1,490 to El. 1,447 = 43.3 ft.; riffle downstream El. 1,445 ft.
- Lower the fish barrier as needed (to El. 1,446) to serve as additional hydraulic control
- Construct new pump station to pump Eel River water to the existing Van Arsdale Diversion via large diameter pipeline
- Potentially install Obermeyer check structure to create submergence; alternatively, install low flow section
- Install array of vertical cylindrical screens to divert water and to screen fish
- Remove Van Arsdale Diversion fish screens and reconfigure to receive pumped water

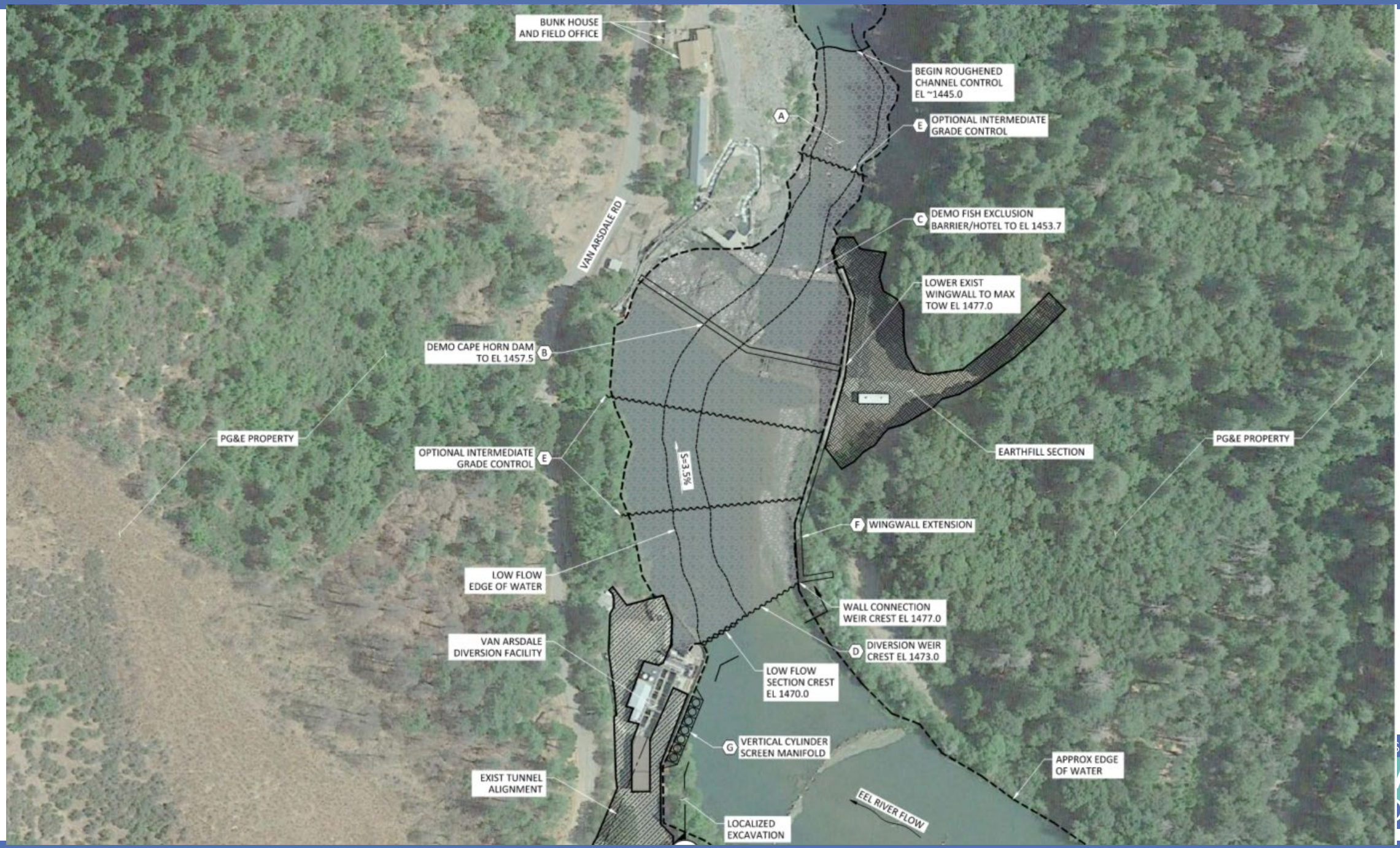
RUSSIAN RIVER WATER FORUM


LOWER FISH HOTEL AND EXCLUSION BARRIER TO EL 1446.0
A
RIFFLE CONTROL ~EL 1445.0
VAN ARSDALE RD
TOP OF DAM EL 1490.3
SLOPE AT 3H:1V
LOW FLOW SECTION EL 1447.0
DEMO CAPE HORN DAM TO EL 1452.0
B
PUMP STATION TOP OF STRUCTURE EL 1477.0
C
SLOPE
PG&E PROPERTY
BURIED PRESSURE CONVEYANCE PIPE OR PRECAST BOX SECTIONS
D
LOWER EXIST WINGWALL TO MAX TOW EL 1472.0
LOWER EARTHEN SECTION TO MAX EL 1467.0
PG&E PROPERTY
E
VERTICAL CYLINDER SCREEN MANIFOLD
VAN ARSDALE DIVERSION FACILITY
F
EXIST TUNNEL ALIGNMENT
A
C-1-2
APPROX EDGE OF WATER
EEL RIVER FLOW

# Cape Horn Dam Removal with Roughened Channel Alternative 3

- Lower gravity portion of dam to achieve target roughened channel slope: CHD crest El. 1,490 to channel crest El. 1,470; channel from 1,470 to 1,445 (3.1% grade, 800 ft. long, depth 10-15 ft., large boulders)
- Build out roughened channel “skeleton” using combination of sheetpile and existing concrete structures
- Install roughened channel beginning downstream near riffle control and extending upstream to existing diversion
- Install low flow section in upstream diversion weir
- Reconfigure diversion to include array of vertical cylindrical screens along outside guide wall

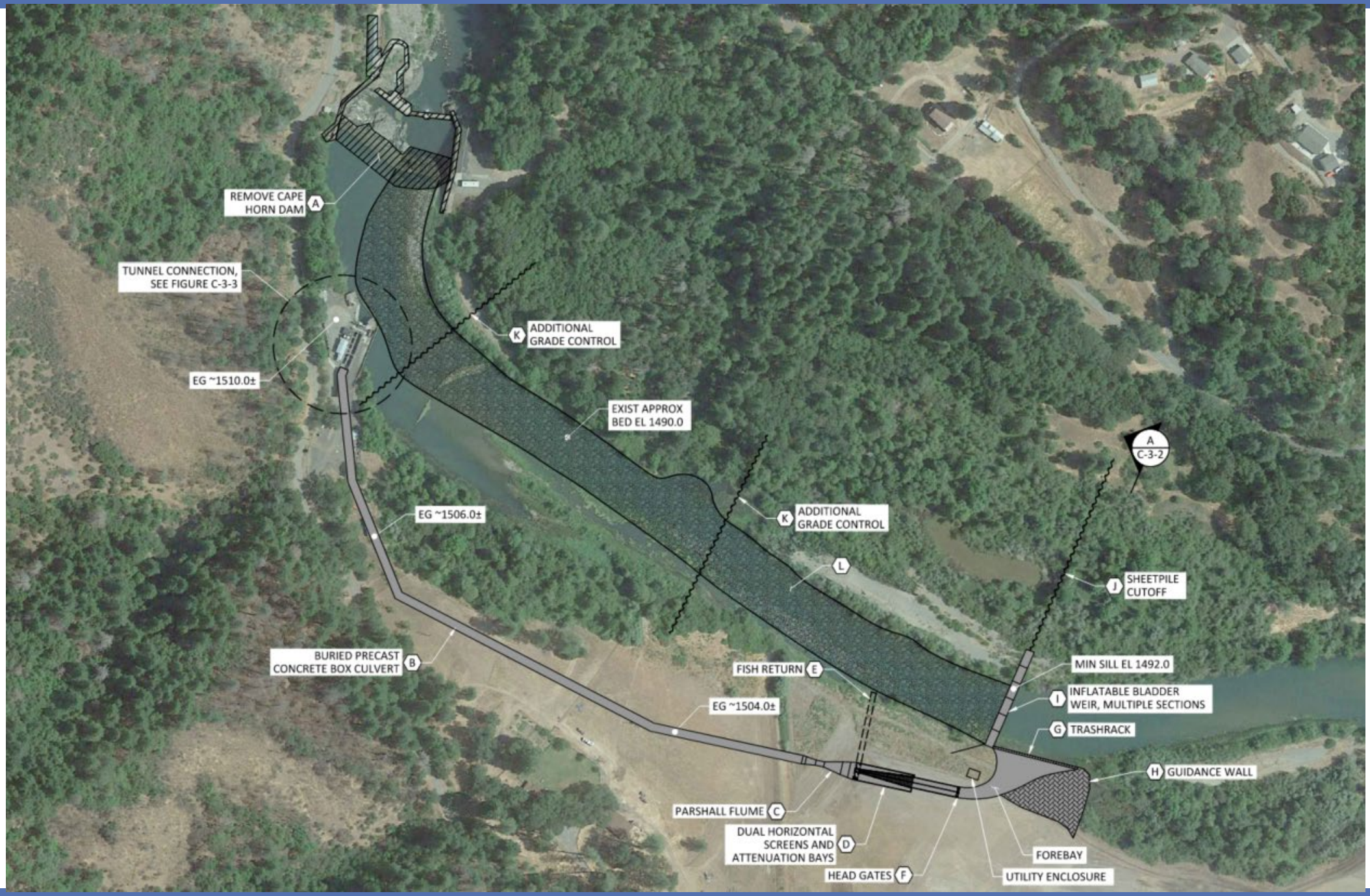
RUSSIAN RIVER WATER FORUM


BUNK HOUSE AND FIELD OFFICE
BEGIN ROUGHENED CHANNEL CONTROL EL ~1445.0
A
E OPTIONAL INTERMEDIATE GRADE CONTROL
VAN ARSDALE RD
C DEMO FISH EXCLUSION BARRIER/HOTEL TO EL 1453.7
LOWER EXIST WINGWALL TO MAX TOW EL 1477.0
DEMO CAPE HORN DAM TO EL 1457.5 B
PG&E PROPERTY
OPTIONAL INTERMEDIATE GRADE CONTROL E
S=3.5%
EARTHFILL SECTION
PG&E PROPERTY
F WINGWALL EXTENSION
LOW FLOW EDGE OF WATER
WALL CONNECTION WEIR CREST EL 1477.0
VAN ARSDALE DIVERSION FACILITY
D DIVERSION WEIR CREST EL 1473.0
LOW FLOW SECTION CREST EL 1470.0
G VERTICAL CYLINDER SCREEN MANIFOLD
APPROX EDGE OF WATER
EXIST TUNNEL ALIGNMENT
EEL RIVER FLOW
LOCALIZED EXCAVATION

# Upstream Diversion with Gravity Supply Alternative 4:

- Lower gravity portion of dam to appropriate elevation to achieve target roughened channel slope
- Build out roughened channel “skeleton” using combination of sheetpile and existing concrete structures
- Install roughened channel beginning downstream near riffle control and extending upstream to existing diversion
- Install low flow section in upstream diversion weir
- Reconfigure diversion to include array of vertical cylindrical screens along outside guide wall

RUSSIAN RIVER WATER FORUM

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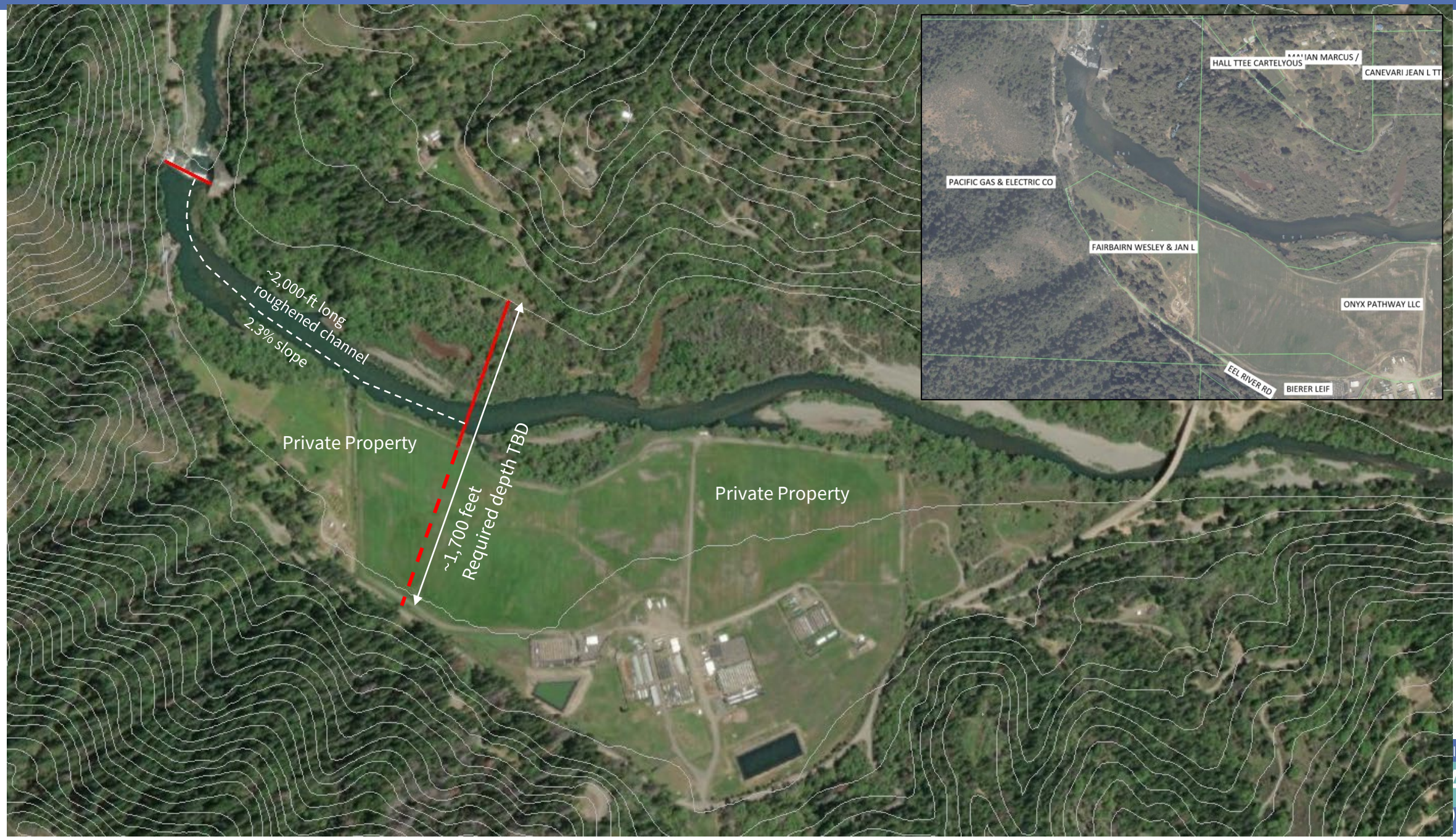
# Alternative 4 Summary of Issues

- Lateral control may be needed for the entire valley width of approximately 1,700 feet into order to prevent avulsion; alternatively, substantial bank armoring may be needed.
- Maintains reservoir upstream, with implications to passage efficiency (particularly juveniles)
- Does not allow river to “evolve” post-project
- Substantial length (2,000 ft) of over-steepened channel (2.3%) may require several intermediate vertical controls to prevent formation of barriers
- Material requirements for roughened channel would include ~3-ft diameter D50 over 9 acres; may require significant maintenance
- Sited on private property; would require easement or property transfer
- Unknown geotechnical conditions
- Most expensive

RUSSIAN RIVER WATER FORUM


~2,000-ft long
roughened channel
2.3% slope
Private Property
~1,700 feet
Required depth TBD
Private Property
HALL TTEE CARTELYOUS
CANEVARI JEAN L TT
PACIFIC GAS & ELECTRIC CO
FAIRBAIRN WESLEY & JAN L
ONYX PATHWAY LLC
EEL RIVER RD
BIERER LEIF

# Report has Evaluation Matrix no Preferred Alternative



Table 7-1. Evaluation Matrix.

| Criteria | Evaluation | | | |
|---|---|---|---|---|
| | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
| | New Fish Ladder | Control Section with Pump Station | Roughened Channel with Gravity Supply | Upstream Diversion with Gravity Supply |
| **Biological Efficiency** | | | | |
| Volitional Upstream Passage | Low | High | Medium | High |
| Volitional Downstream Passage | Low | High | Medium | Medium |
| Energy Expenditure | High | Low | Medium | Low |
| Stress Factor | High | Low | Low | Low |
| **Constructability** | | | | |
| Site Access | Medium | High | High | Low |
| Rock Excavation | Medium | Low | High | Low |
| Cofferdam Challenges | Medium | Medium | High | Medium |
| Dewatering Challenges | Low | Medium | Medium | Medium |
| **Environmental Considerations** | | | | |
| Sediment Management | High | Low | Medium | Low |
| Footprint Impact | Low | Low | Medium | High |
| Permitting Effort | Low | Medium | Medium | High |
| **Operation** | | | | |
| Mechanical Equipment | High | Medium | Low | Medium |
| Screen O&M Effort | Low | Medium | High | Low |
| Pump O&M Effort | NA | High | NA | NA |
| Gate(s) O&M Effort | High | Low | Low | Medium |
| **Design Approach** | | | | |
| Proven Technology | Medium | High | Medium | Low |
| Ability to Meet Fish Passage Goals | High | High | High | High |
| Design Complexity | Medium | Low | High | High |
| **Safety** | | | | |
| Safety Concerns | High | Medium | Low | Medium |
| **Cost** | | | | |
| Construction Cost | Low | Medium | High | High |
| O&M Cost | Low | High | Low | Low |

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# Preliminary Cost Estimates

*Potter Valley Project Feasibility Study* — *Cape Horn Dam Fish Passage Improvements*

| Line Item | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| Contingency – 10% | $ 1,272,899 | $ 1,987,311 | $ 3,513,731 | $ 4,803,844 |
| | | | | |
| **Median Const. Cost** | **$ 17,620,742** | **$ 27,510,348** | **$ 48,640,573** | **$ 66,499,606** |
| -30% | $ 12,334,520 | $ 19,257,244 | $ 34,048,401 | $ 46,549,724 |
| +50% | $ 26,431,114 | $ 41,265,522 | $ 72,960,859 | $ 99,749,409 |

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# Next Steps

- CA Dept. of Water Resources (DWR) Grant - underway
  - Water Form
  - Potter Valley Water Resources Investigation
  - Van Arsdale / Cape Horn Diversion Facility Assessment
    - 3 Alternatives to 20-30% design
    - Technical Advisory Group

- Application to new US Bureau of Reclamation (USBR) Aquatic Ecosystem Restoration Program
  - Grant awards announced late 2023/early 2024
  - Technical Advisory Group preferred alternative
  - 1 Alternative to 60% design

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# Thank You

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