New Eel-Russian Facility Update
Technical Advisory Group
Fish Passage and Water Supply Alternatives
3-19-2024

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Eel-Russian Project Authority

Today's Presentation

- Technical Advisory Group (TAG) Process
- Renderings for Alternative E-2 (Pump Station)
- Renderings for Alternative E-3 (Roughened Channel)
- Final Evaluation Criteria
- TAG Alternative Scoring Results
- Preferred Alternative
- Next Steps

Eel-Russian Project Authority

Technical Advisory Group (TAG)

10 Meetings from July 2023 to March 2024

Biologists, Engineers, Water Managers from:

- California Department of Fish and Wildlife
- National Marine Fisheries Service
- U.S. Fish and Wildlife Service
- California Trout
- Round Valley Indian Tribes
- Mendocino IWPC
- Sonoma Water
- McMillen, Assoc. and Stillwater Sciences

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Current Conditions

3/25/2024

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Current Conditions

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E-2 Pump Station

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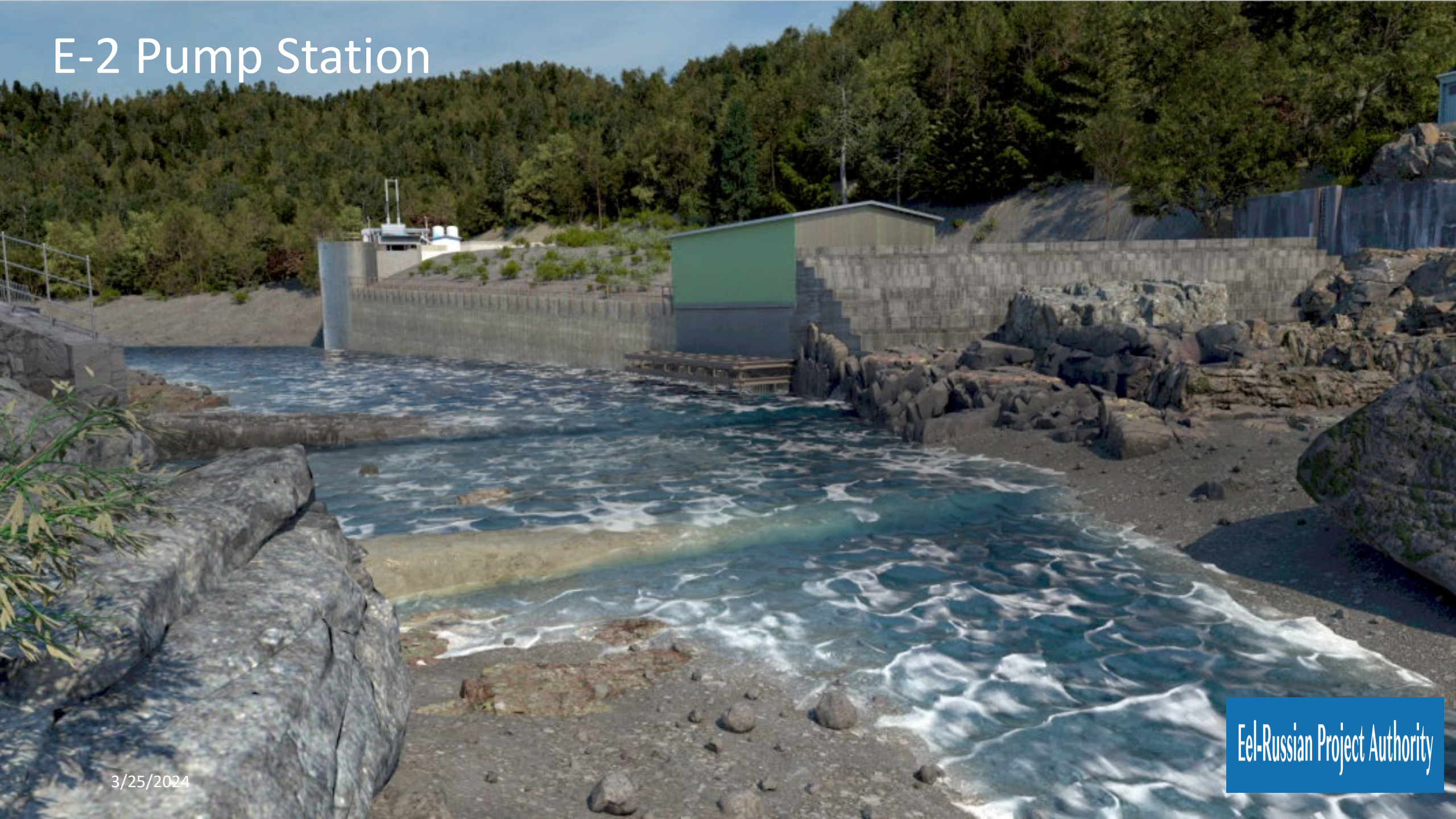
E-2 Pump Station



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E-2 Pump Station

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E-3 Roughened Channel

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E-3 Roughened Channel

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E-3 Roughened Channel

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E-3 Roughened Channel

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Biological Feasibility Evaluation Criteria

Evaluation Criteria	Description	Scoring Key 1 2 3 4 5 6 7 8 9 10		Supporting Information
Biological Feasibility for Upstream Passage				
High Flow Fish Passage Hydraulics	Ability to meet prescribed design criteria for velocity, depth, energy dissipation, hydraulic drop.	Velocity/depth inadequate	Velocity/depth optimal	1D velocity contours, cross-sectional velocity plots, long profile of velocity, field visit information at reference reach
Low Flow Fish Passage Hydraulics	Ability to meet prescribed design criteria for velocity, depth, energy dissipation, hydraulic drop.	Velocity/depth inadequate	Velocity/depth optimal	1D velocity contours, cross-sectional velocity plots, long profile of velocity, field visit information at reference reach
Energy Expenditure	Overall swimming performance and total energy expenditure; bioenergetics and optimal swimming speed; jump height from pool to pool; comparison with reference reach; presence of resting areas.	High expenditure/exhaustion likely	Low expenditure/good performance	1D velocity contours, cross-sectional velocity plots, long profile of velocity, field visit information at reference reach
Delay	Risks of migration delay, fallback potential, confusion or lost migratory cues, etc. Consider all infrastructure, hydraulic, and hydrologic constraints. Successful and efficient fish passage must be safe, timely, and effective.	Appreciable migration delay/low success	No delay/high success	Length of reservoir; structure of channel
Injury	Presence of threats to bodily harm (e.g., sharp objects; risks of impingement; risk of gilling).	High injury potential	Low injury potential	Concept design descriptions; expected to be roughly the same between E-2 and E-3
Predation	Potential risk of being consumed by bass, pikeminnow, mammals, and birds, possibly indicated by presence of slow-moving water (e.g., reservoir; lower slope channel); availability of refugia.	High risk	Low risk	Concept design descriptions
Habitat	Potential habitat conversion within the former reservoir footprint.	Poor spawning/resting habitat	Good spawning/resting habitat	Concept design descriptions; drawings showing long profile and channel plan

Resiliency and Reliability Evaluation Criteria

Resiliency and Reliability (Water Supply and Fish Passage)				
Long-Term Sedimentation after Scott Dam Removal (Water Supply)	Ability to meet water supply needs through sediment management associated with long-term run-of-river sediment supply and transport regime.	Likely to affect water diversion	Unlikely to affect	PER discussion of sediment management
Long-Term Sedimentation after Scott Dam Removal (Fish Passage)	Ability to meet fish passage goals through sediment management associated with long-term run-of-river sediment supply and transport regime.	Likely to affect fish passage	Unlikely to affect	PER discussion of sediment management
Short-term Sedimentation after Scott Dam Removal; Water Supply)	Ability to meet water supply needs through sediment management under phased or rapid approach to Scott Dam removal.	Likely to affect water diversion	Unlikely to affect	PER discussion of sediment management
Short-term Sedimentation after Scott Dam Removal (Fish Passage)	Ability to meet fish passage goals through sediment management under phased or rapid approach to Scott Dam removal.	Likely to affect fish passage	Unlikely to affect	PER discussion of sediment management
Geomorphic Stability (Water Supply)	Overall stability at the facility during a 100-year event or more frequent (including immediately downstream and upstream) and associated vulnerability to water supply due to headcut formation, channel avulsion, and meandering.	Unstable	Stable	PER discussion of stable channel design; PG&E decommissioning and channel restoration plan (not yet available)
Geomorphic Stability (Fish Passage)	Overall stability at the facility during a 100-year event or more frequent (including immediately downstream and upstream) and associated vulnerability to formation of new fish passage barriers due to headcut formation, channel avulsion, and meandering.	Unstable	Stable	PER discussion of stable channel design; PG&E decommissioning and channel restoration plan (not yet available)
Mechanical Systems	Vulnerability of mechanical systems to a 100-year event or more frequent, and likelihood of need to replace mechanical systems within 25 years.	High failure probability	Low failure probability	Concept design drawings and PER discussion of mechanical equipment.
Vulnerability to Natural and Other Hazards (Water Supply)	Likelihood of impacts to facility operations (duration of outages) associated with loss of grid power, and effects from wildfires, earthquakes, flooding.	High vulnerability	Low vulnerability	Historical information related to power outages in the region; seismicity information in the region; historical information related to wildfires; hydrologic record; nonstationary
Vulnerability to Natural and Other Hazards (Fish Passage)	Likelihood of impacts to fish passage associated with loss of grid power, and effects from wildfires, earthquakes, flooding.	High vulnerability	Low vulnerability	Historical information related to power outages in the region; seismicity information in the region; historical information related to wildfires; hydrol nonstationary

Constructability and Cost Evaluation Criteria

Constructability and Implementation				
Design Complexity	Design is a proven technology with precedent at the scale of this application.	Highly complex	Simple design	
Timeframe to Achieve Benefits	Timeframe to achieve ecosystem benefits, related to overall duration of design, permitting, and construction efforts.	Lengthy timeframe	Short timeframe	Conceptual drawings of dam removal sequencing
Site Access	Potential complications due to land ownership; overall difficulty and uncertainties related to site access.	Significant access improvements	Existing access is sufficient	Conceptual drawings
Cofferdam and Dewatering Challenges	Environmental restrictions on dewatering and in-water work window; constructability challenges of managing water; risks associated with dewatering.	Complex/high risk/long duration	Simple/low risk/short duration	Conceptual drawings
Integration with PG&E Dam Removal Approach (Scott Dam)	Easier to coordinate with project; ability to continue diversions hindered; dam removal/project sequencing considerations.	Easy to coordinate	Difficult to coordinate	
Integration with PG&E Dam Removal Approach (Cape Horn Dam)	Easier to coordinate with project; ability to continue diversions hindered; dam removal/project sequencing considerations.	Easy to coordinate	Difficult to coordinate	
Vulnerability to Subsurface Conditions	Likelihood of discovery of subsurface conditions that would impact design and construction approach.	Highly vulnerable	Invulnerable	
Availability of Materials and Equipment	Extent to which project depends on long-lead items and items that may be vulnerable to supply chain.	Long lead or difficult to procure	Simple and speedy to procure	
Cost				
Construction Cost	Overall construction capital cost, including direct and indirect costs and contingencies.	Higher cost	Lower cost	PER cost estimate
Operational Cost	Operational cost (typically annual) associated with labor and materials (including fuel and electricity).	Higher cost	Lower cost	PER cost estimate
Maintenance Cost	Regular maintenance cost (typically annual) associated with labor, equipment, and materials needed to maintain infrastructure both in and out of the river.	Higher cost	Lower cost	PER cost estimate
Repair and Replacement Cost	Cost associated with non-routine repairs, refurbishments, or replacements, typically on a 5-10 year schedule, depending on facility component under consideration; cost for labor, materials, and equipment.	Higher cost	Lower cost	PER cost estimate

Results: E-2 Upstream Fish Passage Average Scores

	Juvenile Steelhead	Smolt Steelhead	Adult Winter-Run Steelhead	Steelhead Kelts	Adult Summer (Spring)-Run Steelhead Migration	Juvenile Chinook	Adult Fall-run Chinook	Pacific Lamprey	Sacramento Sucker/other native fish species
Biological Feasibility for Upstream Passage									
High Flow Fish Passage Hydraulics	6.8	7.0	7.8	NA	8.0	6.0	7.4	6.6	6.5
Low Flow Fish Passage Hydraulics	7.4	8.0	7.8	NA	7.8	6.7	7.2	7.8	7.5
Energy Expenditure	8.4	10.0	8.8	NA	8.8	8.0	8.6	8.2	8.8
Delay	8.0	10.0	8.6	NA	8.6	7.7	8.4	7.8	8.8
Injury	8.6	9.0	9.4	NA	9.4	8.3	9.0	8.8	9.3
Predation	7.6	9.0	8.8	NA	8.6	7.3	8.2	8.4	8.3
Habitat	7.6	9.0	7.8	NA	7.8	6.7	7.8	7.8	7.8

Results: E-3 Upstream Fish Passage Average Scores

	Juvenile Steelhead	Smolt Steelhead	Adult Winter-Run Steelhead	Steelhead Kelts	Adult Summer (Spring)-Run Steelhead Migration	Juvenile Chinook	Adult Fall-run Chinook	Pacific Lamprey	Sacramento Sucker/other native fish species
Biological Feasibility for Upstream Passage									
High Flow Fish Passage Hydraulics	5.0	4.0	6.0	NA	6.0	4.7	5.6	5.0	3.8
Low Flow Fish Passage Hydraulics	5.4	6.0	5.6	NA	5.6	4.7	5.0	6.2	5.8
Energy Expenditure	4.8	5.0	5.4	NA	5.4	5.0	4.8	5.8	6.8
Delay	5.2	6.0	6.0	NA	6.0	5.0	5.0	6.4	6.3
Injury	7.2	7.0	7.4	NA	7.2	7.0	7.0	7.2	7.5
Predation	6.0	5.0	8.0	NA	8.0	6.0	7.2	6.4	6.8
Habitat	6.8	6.0	5.4	NA	5.4	6.7	5.0	7.0	6.5

Comparing Averages and Ranges Between Alternatives E-2 and E-3

Criteria	Scores		Fraction of Scorer Participation	Score Commentary	Range	
	E-2 Pump Station	E-3 Roughened Channel			E-2	E-3
Biological Feasibility for Upstream Passage						
High Flow Fish Passage Hydraulics	7.0	5.0	5/6	High flow upstream fish passage for roughened channel is likely to be more challenging, particularly for weaker species/life stages than for pump station alternative due to steeper and longer length of passage route.	3.4	5.1
Low Flow Fish Passage Hydraulics	7.5	5.5	5/6	Challenges in low flow water retention in the roughened channel are likely to increase risk or low flow passage impediments more severely than in pump station alternative. Concerns about low-flow (<369cfs) passage conditions for adult Chinook salmon and juveniles (11 cfs).	3.6	4.9
Energy Expenditure	8.7	5.4	5/6	Energy expenditures likely higher for roughened channel due to longer periods of burst speeds required to navigate roughened channel compared to naturally occurring channel upstream of control section of pump station. Energy expenditures could be high for adult Chk salmon if low-flow passage is constrained.	2.7	2.4
Delay	8.5	5.7	5/6	Upstream delay for both adult and juveniles likely to be somewhat higher for roughened channel due to higher velocities for longer distances. Potential for fallback within roughened channel (particularly for lamprey).	2.6	1.5
Injury	9.0	7.2	5/6	Higher likelihood of impact of juveniles and kelts against boulders during fallback; higher gradient and velocities increase susceptibility to injury.	1.8	2.9
Predation	8.3	6.7	5/6	Predation risk is likely low, but potential residual reservoir upstream of roughened channel plus pools below roughened may provide pikeminnow holding areas. Also, low-flow conditions (<150cfs) could present more migration issues with the roughened channel leading to energy expense/delay and increased predation of adults by otters, etc.	2.1	3.1
Habitat	7.8	6.1	5/6	The pump station may have marginally better habitat due to greater habitat area. For juveniles, the roughened channel would provide a well-oxygenated reach with diverse substrate and complex flow paths, which could provide rearing habitat opportunities. For adults, however, the reach is a steep, high-energy environment with no spawning habitat in the channel.	2.7	2.6

Comparing Averages and Ranges Between Alternatives
higher average = better performance
higher range = greater uncertainty

Criteria	Scores		Fraction of Scorer Participation	Score Commentary	Range		Range Commentary
	E-2 Pump Station	E-3 Roughened Channel			E-2	E-3	
Constructability and Implementation							
Design Complexity	6.8	4.6	5/6	The pump station includes more proven infrastructure design, wheras the type and scale of design for roughened channel is considered to be less proven and more unprecedented.	2.0	6.0	Some scorers factored in more advanced CFD and/or physical modeling; others only considered channel and not diversion.
Timeframe to Achieve Benefits	6.4	5.4	5/6	Pump station is assumed to be slightly speedier construction with similar design and permitting windows.	3.0	5.0	
Site Access	7.8	5.8	4/6	Site access accomodating large boulders for roughened channel may prove more challenging if imported from offsite; larger equipment needed if harvested onsite.	1.0	5.0	
Cofferdam and Dewatering Challenges	5.2	4.2	5/6	Pump station ranked slightly higher due to roughened channel having longer temporary channel for diversion and larger area to be dewatered, in addition to relying on adit for temporary diversions to Potter Valley, whose condition is unknown. May be slightly more challeneing to meet fish passage needs during construction under Alternative E-3. May be more opportunity to dewater by dividing channel longitduinally under Alternative E-2 (i.e., may be mroe flexibility).	3.0	2.0	
Integration with PG&E Dam Removal Approach	5.0	6.0	5/6	Due to similarity in overall project extents and uncertainties related to PG&E restoration plan, little discernible different between alternatives at this stage.	2.0	4.0	
Vulnerability to Subsurface Conditions	6.8	3.5	4/6	Pump station ranked higher due to potential for larger removal of subsurface for foundation of roughened channel; much more earthwork leading to potential changed conditions and impacts to design/construction	1.0	2.0	
Availability of Materials and Equipment	7.0	5.0	5/6	Pump station equipment may be difficult to procure; this can be managed by procuring in a timely manner. However, the size and quantity of material needed for a roughened channel of this scope may challenge both materials sourcing and equipment sizing.	4.0	2.0	

Differentiating Between the Alternatives

Table 6. Average criteria scores that differed by more than 2 points, with ranges shown in parentheses. The higher scoring criteria among the two alternatives are highlighted in green.

Criteria	Pump Station (E-2)	Roughened Channel (E-3)	Score Differential E-2 vs. E-3
Upstream Passage			
High Flow	7.0 (3.4)	5.0 (5.1)	2.0
Low Flow	7.5 (3.6)	5.5 (4.9)	2.0
Energy Expenditure	8.7 (2.7)	5.4 (2.4)	3.3
Delay	8.5 (2.6)	5.7 (1.5)	2.7
Downstream Passage			not significant
Resiliency and Reliability			
Geomorphic Stability (fish passage)	7.7 (2.0)	5.2 (4.0)	2.5
Mechanical Systems	5.4 (3.0)	7.6 (3.0)	2.2
Natural Hazards (water supply)	5.4 (1.0)	7.4 (3.0)	2.0
Natural Hazards (fish passage)	7.8 (2.0)	5.3 (5.0)	2.5
Constructability and Implementation			
Design Complexity	6.8 (2.0)	4.6 (6.0)	2.2
Site Access	7.8 (1.0)	5.8 (5.0)	2.0
Subsurface Conditions	6.8 (1.0)	3.5 (2.0)	3.3
Materials Availability	7.0 (4.0)	5.0 (2.0)	2.0
Cost			
Operational Cost	3.7 (2.0)	7.7 (1.0)	4.0

TAG Scoring Results Summary

Fish Passage: Potential superior passage both upstream and downstream for E2 based on current design and limited hydraulic modeling. Potentially mitigated in E3 with advanced hydraulic modeling and design; however, the ability to design to full parity with E2 is unknown. ***Advantage: E2.***

Sedimentation: Greater risk of aggradation (sediment deposition) associated with E3 than E2, although minimal impact to passage through either E2 or E3 footprint. ***Advantage: E2.***

Construction Costs: Construction cost for E2 should be lower, and with less construction cost risk due to unforeseen circumstances. ***Advantage: E2.***

Operations & Maintenance Costs: O&M costs for the roughened channel should be substantially less due to no pumping costs. ***Advantage: E3.***

Constructability & Implementation: Constructability and implementation challenges generally favor E2, with advantages in lower design complexity, better site access, and less vulnerability to subsurface conditions. ***Advantage: E2.***

Non-Differentiating Factors: A number of factors are non-differentiating or very close between the alternatives, including categories such as geomorphic stability for water supply, low and high flow diversion, and challenges integrating with PG&E dam removal alternatives. ***Advantage: equal.***

TAG Preferred Alternative

The results of the scoring and discussion among the TAG indicate that E2 is the lower risk alternative for water supply and superior alternative for fish passage due to:

- lower design and construction risk,
- better upstream and downstream passage, and
- better ability to design around potential reliability issues.

Report from New Eel-Russian Facility Proponents Steering Committee

Grant Davis, General Manager

Sonoma Water

Eel-Russian Project Authority

Next Steps

- CA Dept. of Water Resources (DWR) Grant
  - Final Diversion Facility Assessment Report

- New Eel-Russian Facility (NERF) Design and Operations Technical Advisory Group (TAG) “NERF-TAG”
  - Eel River Flow and Diversion Criteria – guidance for NERF operations

- US Bureau of Reclamation (USBR) Aquatic Ecosystem Restoration Program
  - Preferred Diversion Facility Alternative to 60% design
  - Grant Awarded
  - Grant Agreement: anticipated by May 2024
  - RFP for Consultant Services: summer 2024

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Recommendation

Select Alternative E2 for transmittal to PG&E as information for its License Surrender Application for the Potter Valley Project

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Thank You

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