# Electron Hydro

A Renewable Resource Community Partner

www.electronhydro.com

## Electron Hydro is committed to:

- Produce clean renewable energy
- Protect and enhance Puyallup River salmon

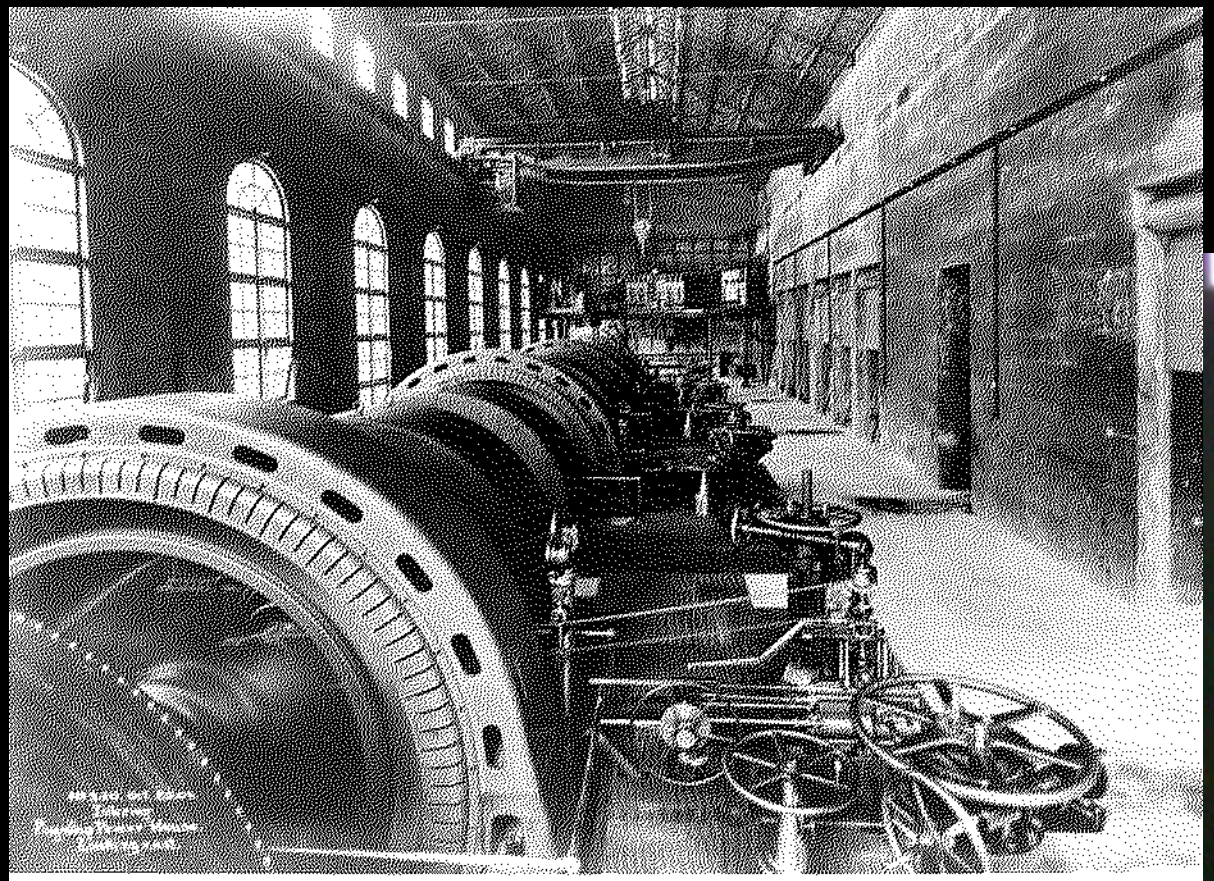
## Construction of the Wooden Diversion 1903



## Loading Pack Trains for Headworks 1903

Electron constructed in 18 months with 1,500 to 2,500 men and 600 horses and donkeys

# Inside Original Powerhouse 1904



Property of Special Collections, University of Washington Libraries.

# Inside the Powerhouse Today

Installing high strength geotextile fabric and welded HDPE sheeting to provide a durable, leak proof liner in the 10-mile flume. Total cost $5 million.

# Replace Wood Bents (supports) with steel and micropile foundations

1903 Meters

1965 Relays

# New PLC SCADA Controls
# HMI software (below)

New PLC at Intake (not shown)

2015 PLC Powerhouse Controller

Relay2015

Installation of 11 miles fiberoptic line from powerhouse to intake

10 flume stations for
real-time flume level

# Stream gage station access and equipment

Stream gage controls

Stream gage station approx. 2000’ downstream of diversion

Stage sensor and staff gage

## Puget Sound Fisheries

ESA listed Orcas, Chinook, Steelhead and Bull Trout
Diminished Salmon Populations in General
Recovery Plans, Funding and Effectiveness

## Puyallup River

High Priority River for Chinook Recovery
Electron Hydro Potential Impacts:
Entrained Fish, Passage, Instream Flow, Future Operations & Climate Change

# What is Electron Hydro doing to help salmon recover in the Puyallup River?

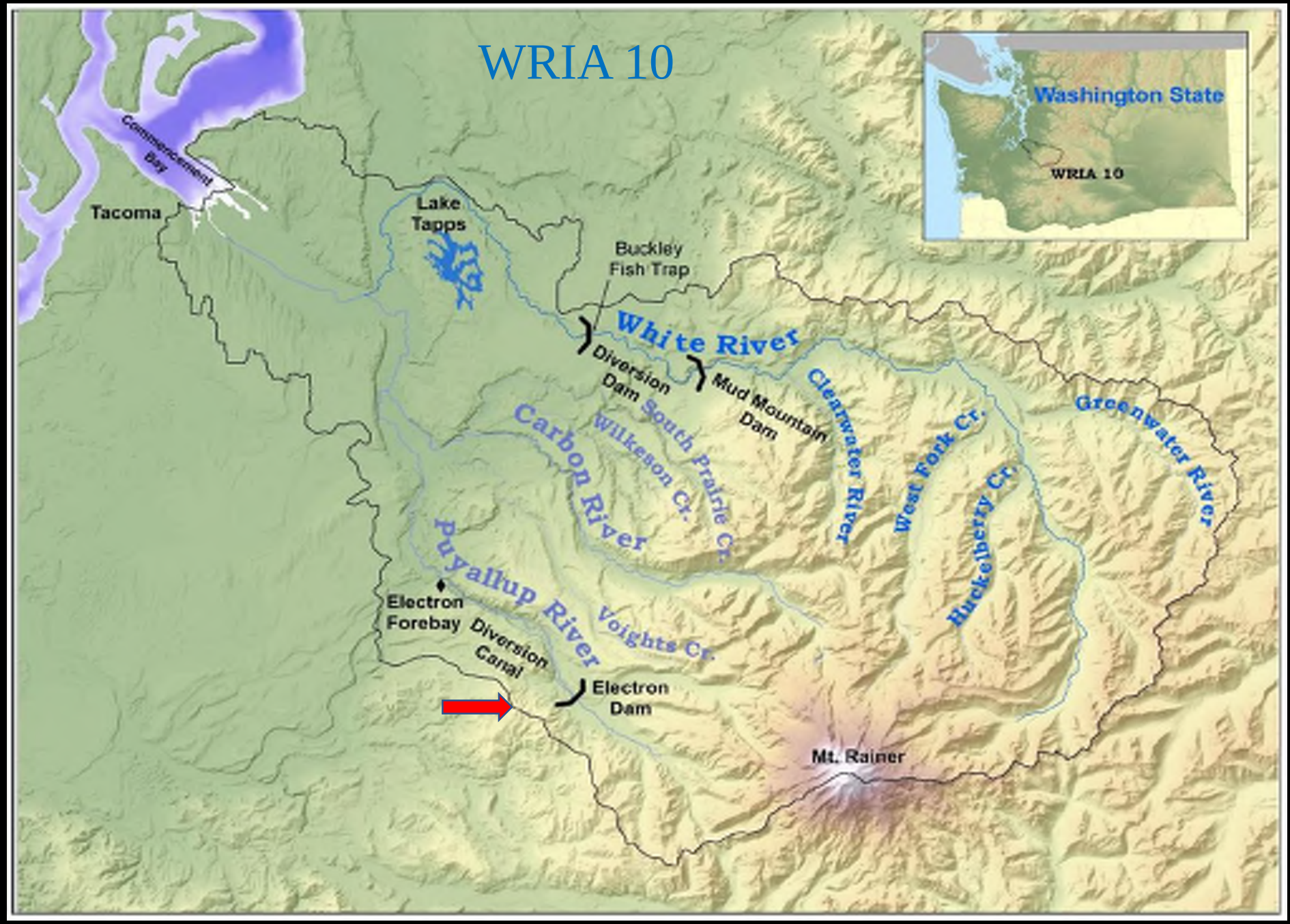
# Electron Hydro, LLC (EH) assumed ownership November 14, 2014

EH spent the first six months making safety and stability improvements.

July 28, 2015 EH met with NMFS, USFWS, WDFW, PTI and Pierce Co officials on-site to discuss potential fish exclusion remedies and expedited permitting.

August to November 2015 lined all 10 miles of the flume with geotextile and HDPE to eliminate flume leakage and restore capacity.  This liner reduces landslide and environmental risk due to elimination of ground saturation below the flume.

August to December 2015 performed extensive feasibility analysis and design to determine the best available technology for fish exclusion screen given large bedload.


WRIA 10
Washington State
WRIA 10
Commencement Bay
Tacoma
Lake Tapps
Buckley Fish Trap
White River
Diversion Dam
Mud Mountain Dam
Clearwater River
West Fork Cr.
Huckelberry Cr.
Greenwater River
Carbon River
Wilkeson Cr.
South Prairie Cr.
Puyallup River
Voights Cr.
Electron Forebay
Diversion Canal
Electron Dam
Mt. Rainer


Flume
Spillway
Pre-Reconstruction
Wood Diversion Structure
Fish Ladder
Project
Intake

# Storm Events

Three storm events of over 10,000 cfs occurred within the first 13 months of ownership. These extreme events substantially influenced the final project design.

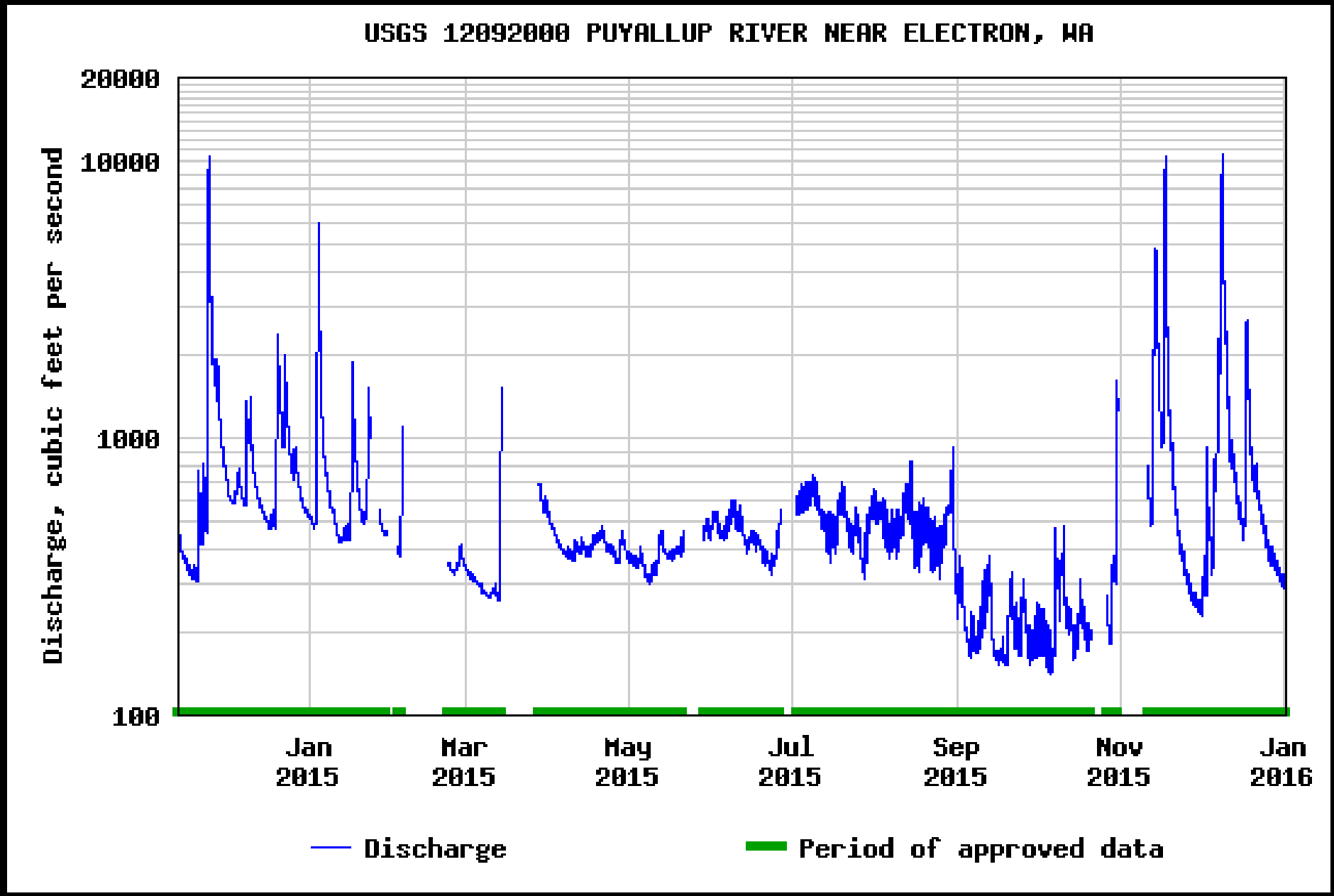
EH developed a two-phase project that would:

| | |
|---|---|
| Phase I | repair the diversion<br>rebuild the shoreline protection upstream and downstream<br>replace the existing spillway with a bladder spillway |
| Phase II | install a sediment and fish exclusion system at the intake. |

A 10,000 cfs storm event at the USGS Electron gaging station is estimated to have a statistical return frequency of about once every 18 years.

# Electron diversion during heavy flow

# USGS gage is located approximately 1/3 mile upstream of the diversion



# Intake Improvements

Spring 2016 EH made Phase I application to the USACE to repair the diversion, reinforce the shoreline protection, and construct an inflatable bladder spillway.

In-stream work window is from July 15 to September 15.

August 8, 2018 permits were received to construct Phase I.  This resulted in a shortened in-water work season for 2018.  EH was able to complete the upstream shoreline protection during summer 2018

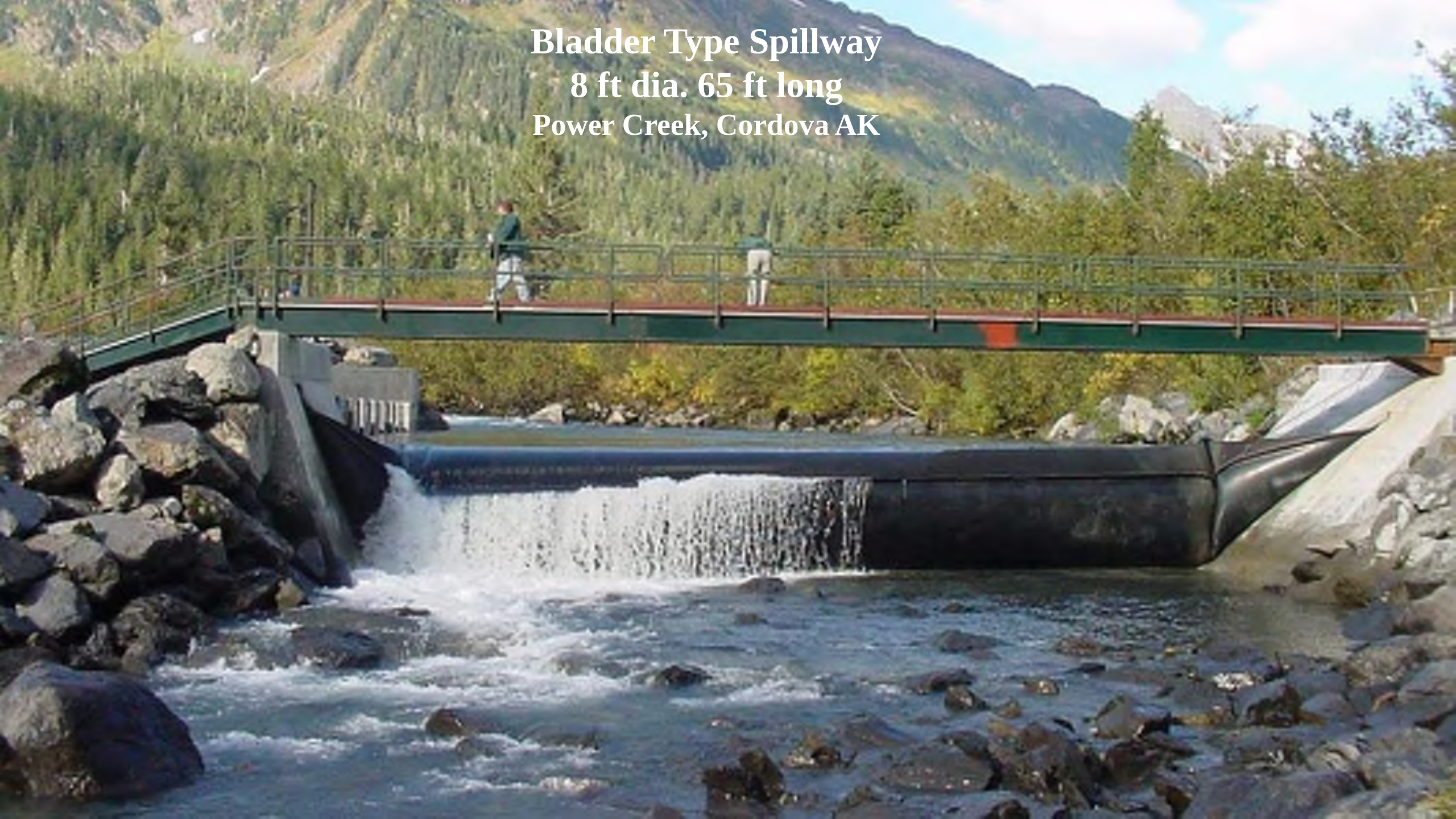
Summer 2019 EH completed the downstream shoreline protection.

Summer 2020 EH will construct the Bladder spillway and complete Phase I.

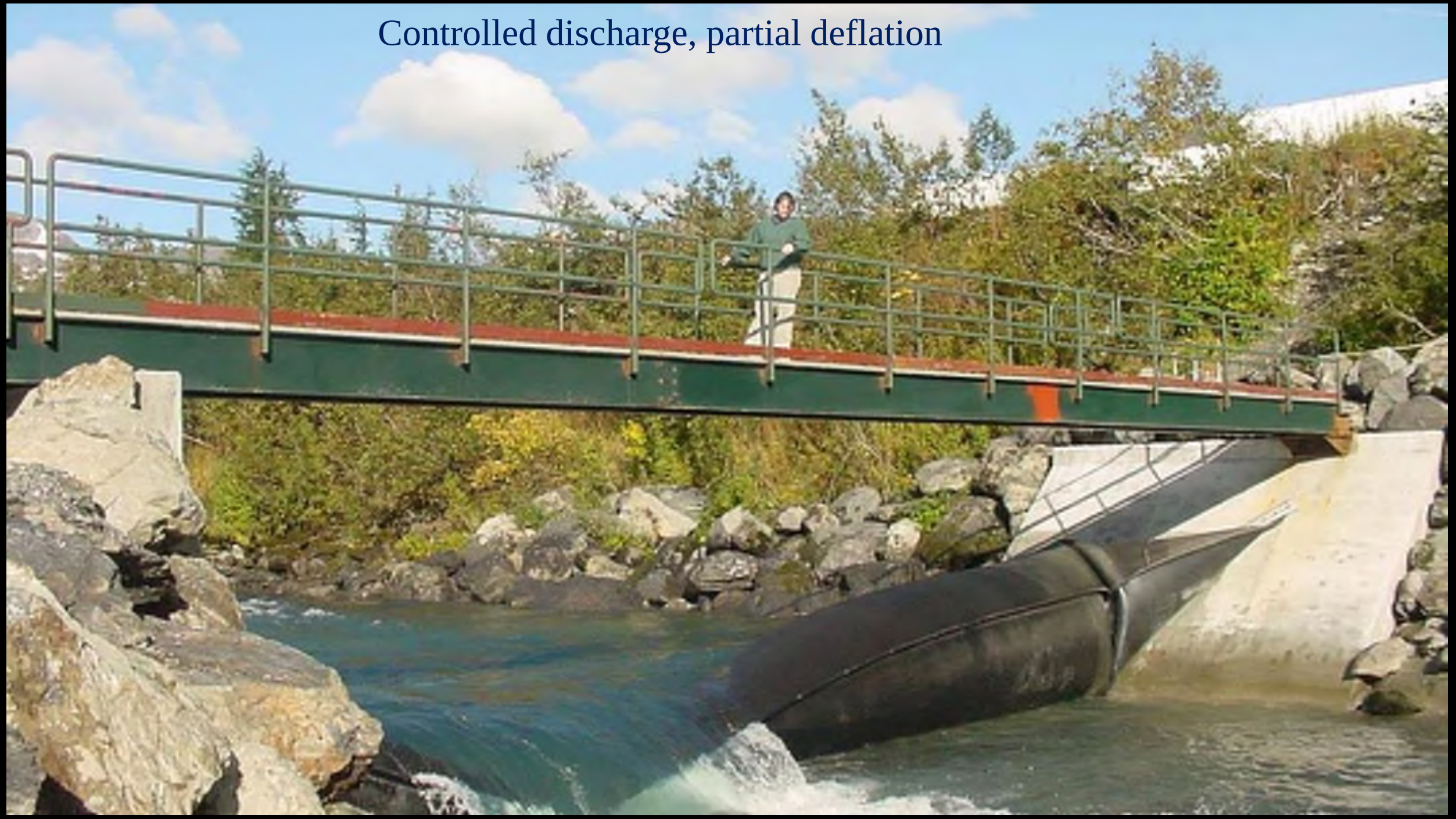
# ELECTRON PHASE I SPILLWAY REPLACEMENT AND BANK PROTECTION

Upstream shoreline protection completed summer 2018

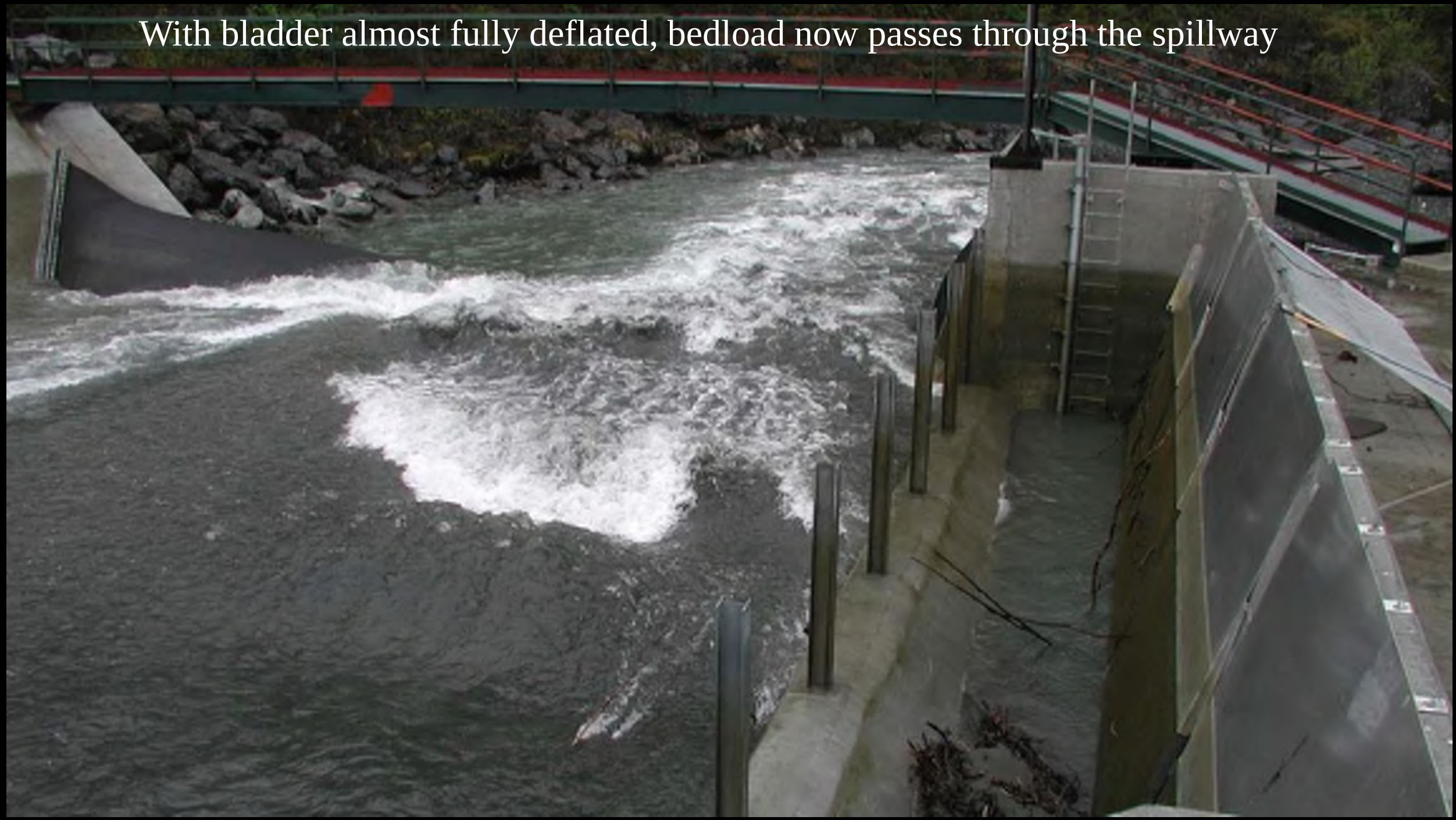

Downstream shoreline protection completed summer 2019


Bladder Type Spillway
8 ft dia. 65 ft long
Power Creek, Cordova AK

# Controlled discharge, partial deflation



With bladder almost fully deflated, bedload now passes through the spillway



# Intake Permitting and Schedule

Phase I was permitted under USACE NWP 3 and 13, via ESA Section 7 Consultation.

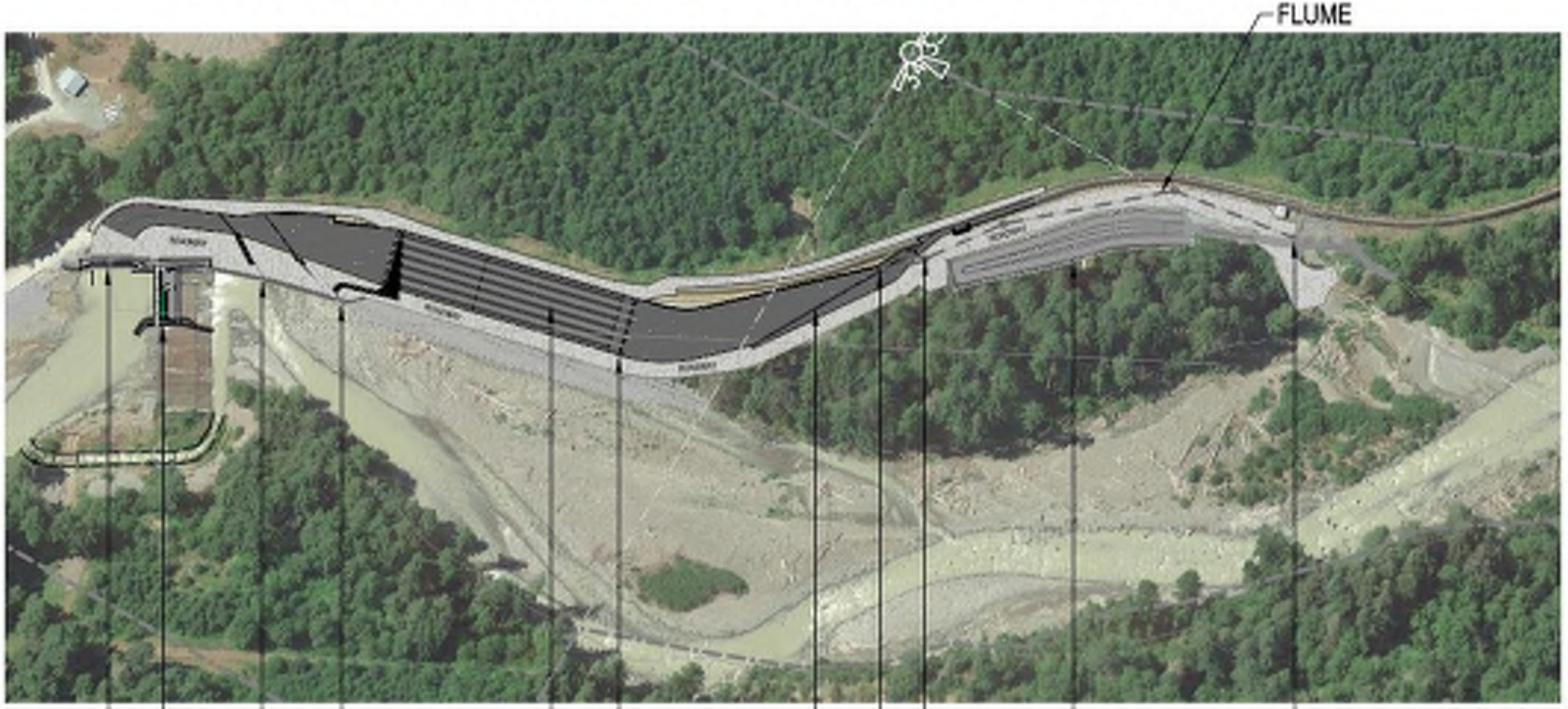
Phase II, “Sediment and Fish Exclusion Facilities” will be completed with state and local permitting.

Phase II will proceed simultaneously with the completion of a “Habitat Conservation Plan” consistent with ESA Section 10.

Phase II is estimated to proceed and be completed by or before Fall 2022.

A draft Habitat Conservation Plan (HCP) has been initiated by EH and is anticipated to be available for review this Spring 2020. The HCP will guide future operations and fish/habitat protection measures.

# ELECTRON PHASE II FISH AND SEDIMENT EXCLUSION FACILITY



# Electron Hydro Fish Program

**Electron**;

Makes annual payments that go toward Puyallup Tribe fisheries management.  2020 payment will be $323, 217, escalates at 3% per year, ends Dec 2026.

Maintains the fish ladder at the diversion

Performs “trap & haul” procedures to transfer fish from the forebay back to the river.

Manages its own gaging station for instream flows.  Monitors and provides instream flows in bypass reach.

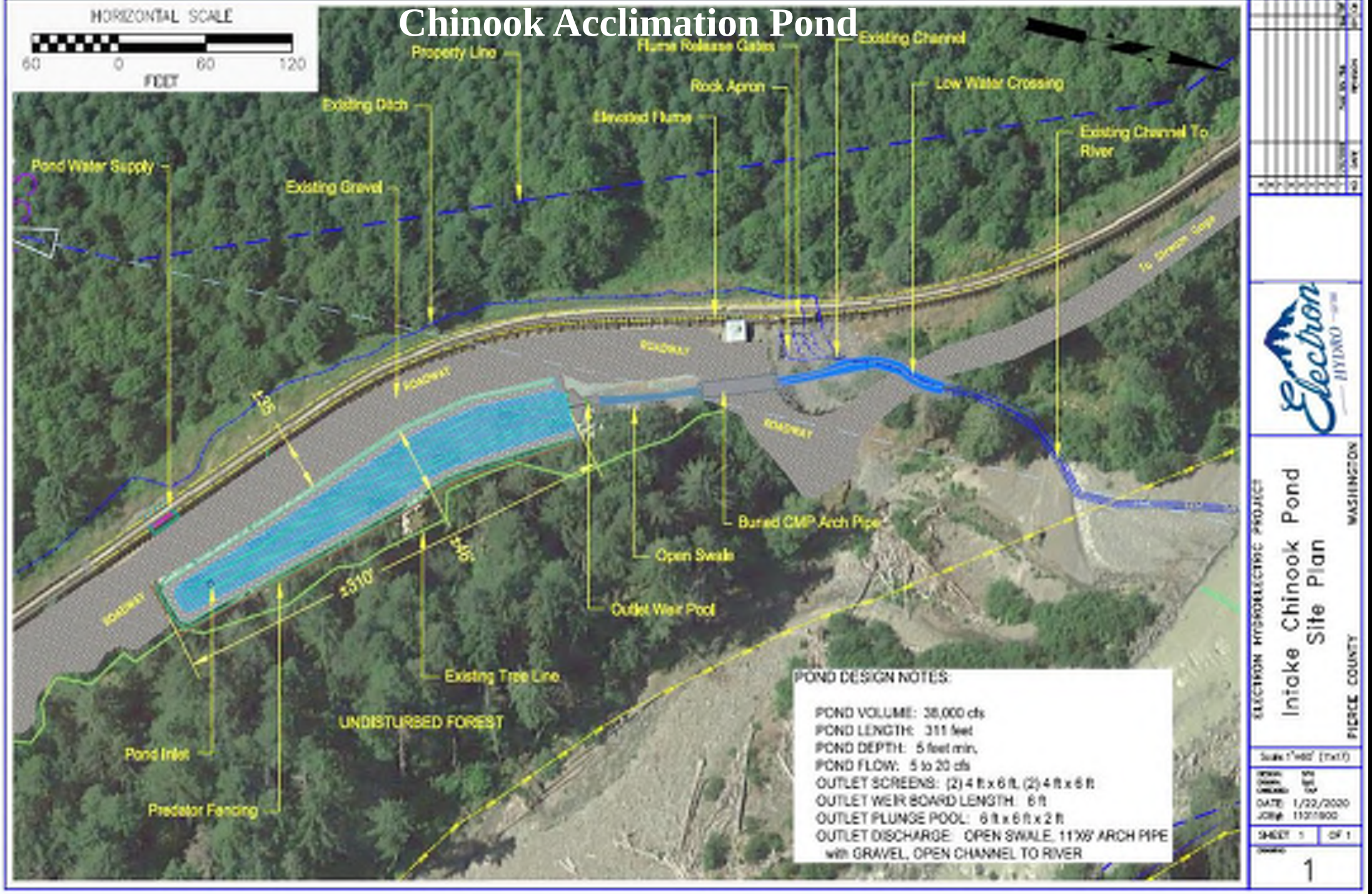
Assisted the PTI with maintenance of their existing acclimation ponds above the diversion.

Constructed a new acclimation pond just below the diversion for the PTI to use for Chinook rearing.  The pond has a capacity of up to a million fish.

New fish guide/barrier net with increased floats and lead line for efficiency

Flow deflector plates (below balls), debris boom and guide/barrier net all in proper position

# Chinook Acclimation Pond




Electron Hydro

ELECTRON HYDROELECTRIC PROJECT

Intake Chinook Pond Site Plan

PIERCE COUNTY WASHINGTON

DATE 1/22/2020

SHEET 1 OF 1

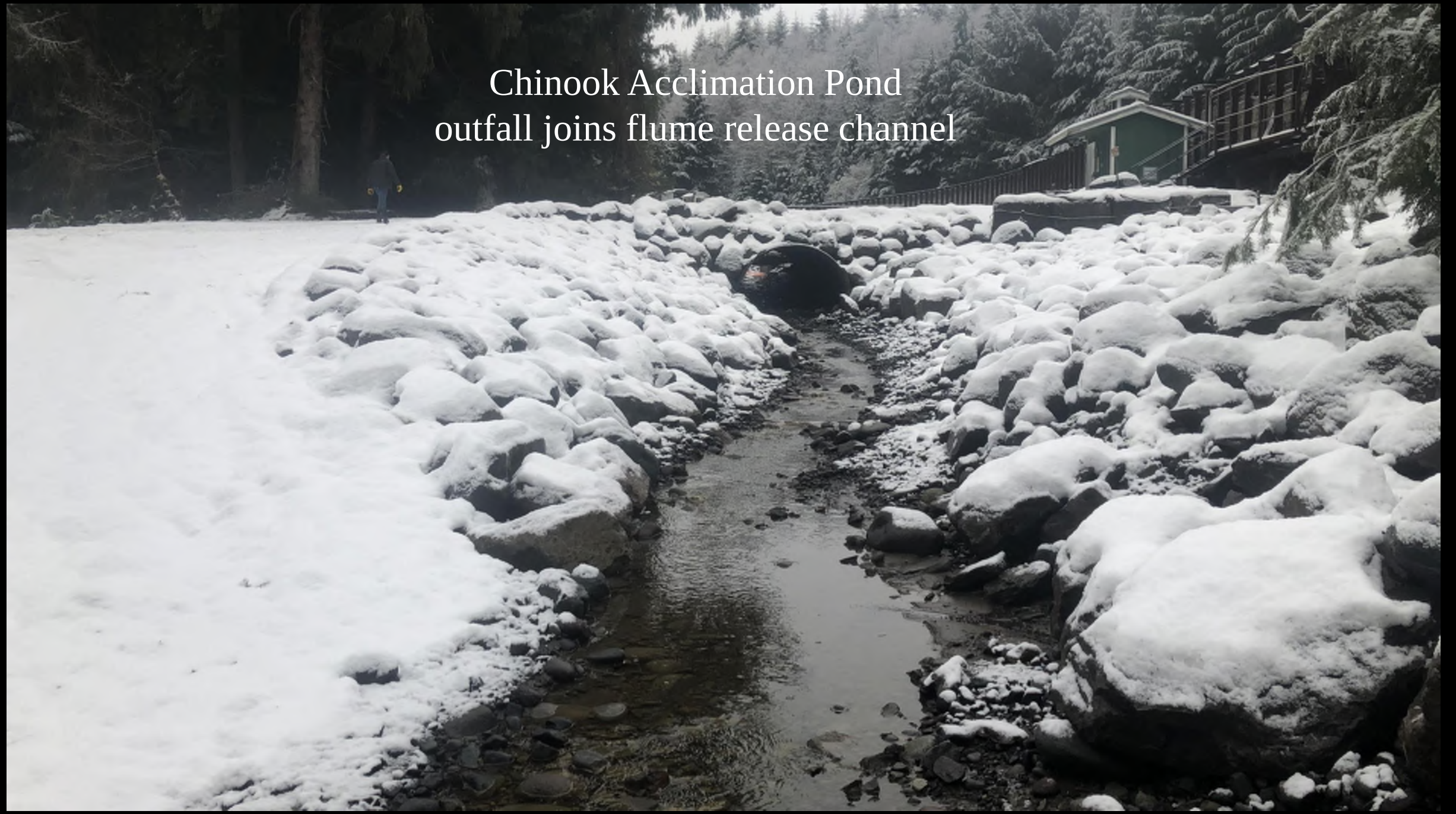
1

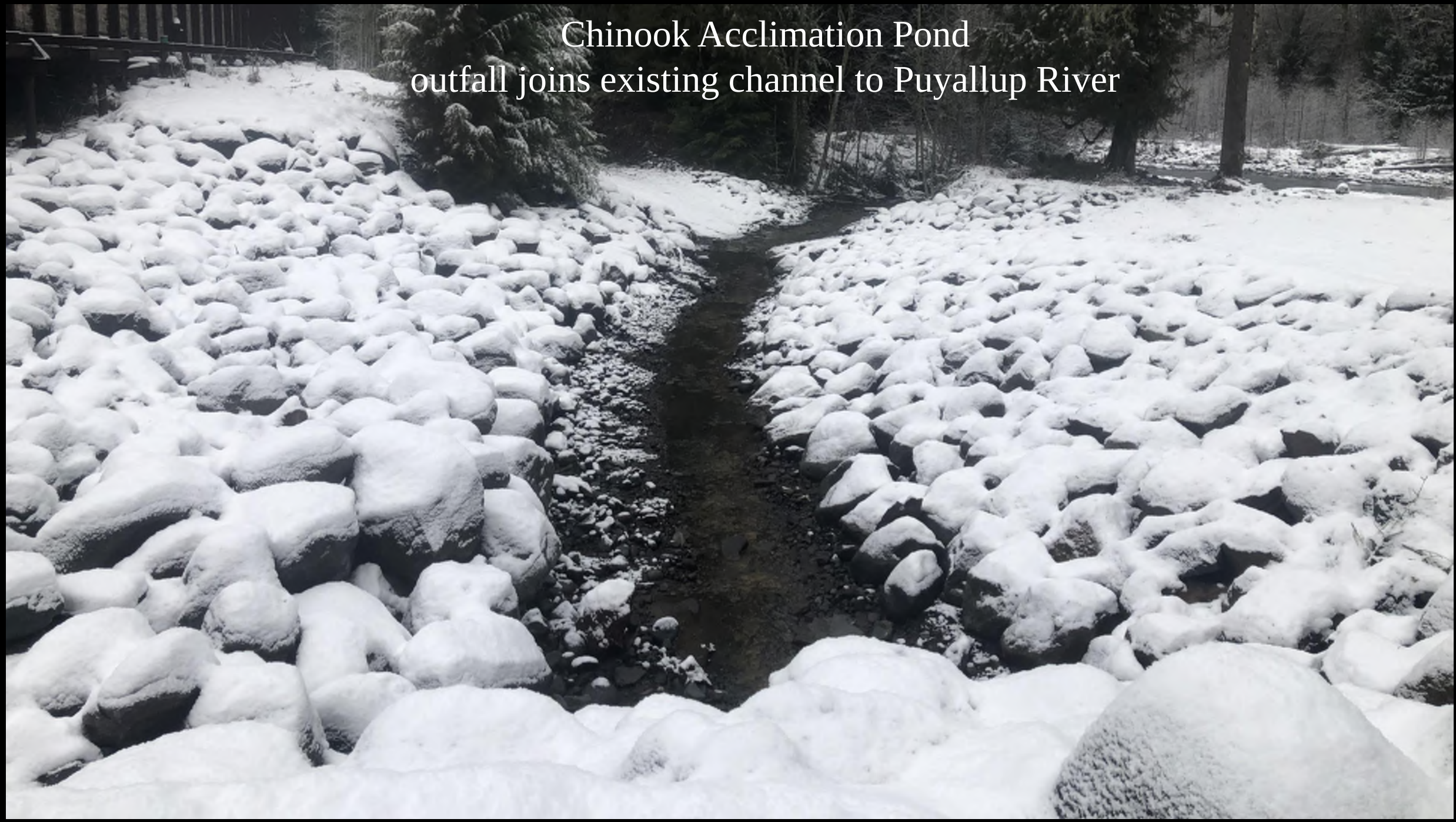
# Constructing Chinook Acclimation Pond Inflow from Flume

Chinook Acclimation Pond
Inflow diffuser silo

Chinook Acclimation Pond
predator fencing under construction

# Chinook Acclimation Pond
## Constructing outlet screen location with flow control


Chinook Acclimation Pond
outfall joins flume release channel


Chinook Acclimation Pond
outfall joins existing channel to Puyallup River

Puyallup River Fall Chinook Escapement (PTI 2019 Draft)

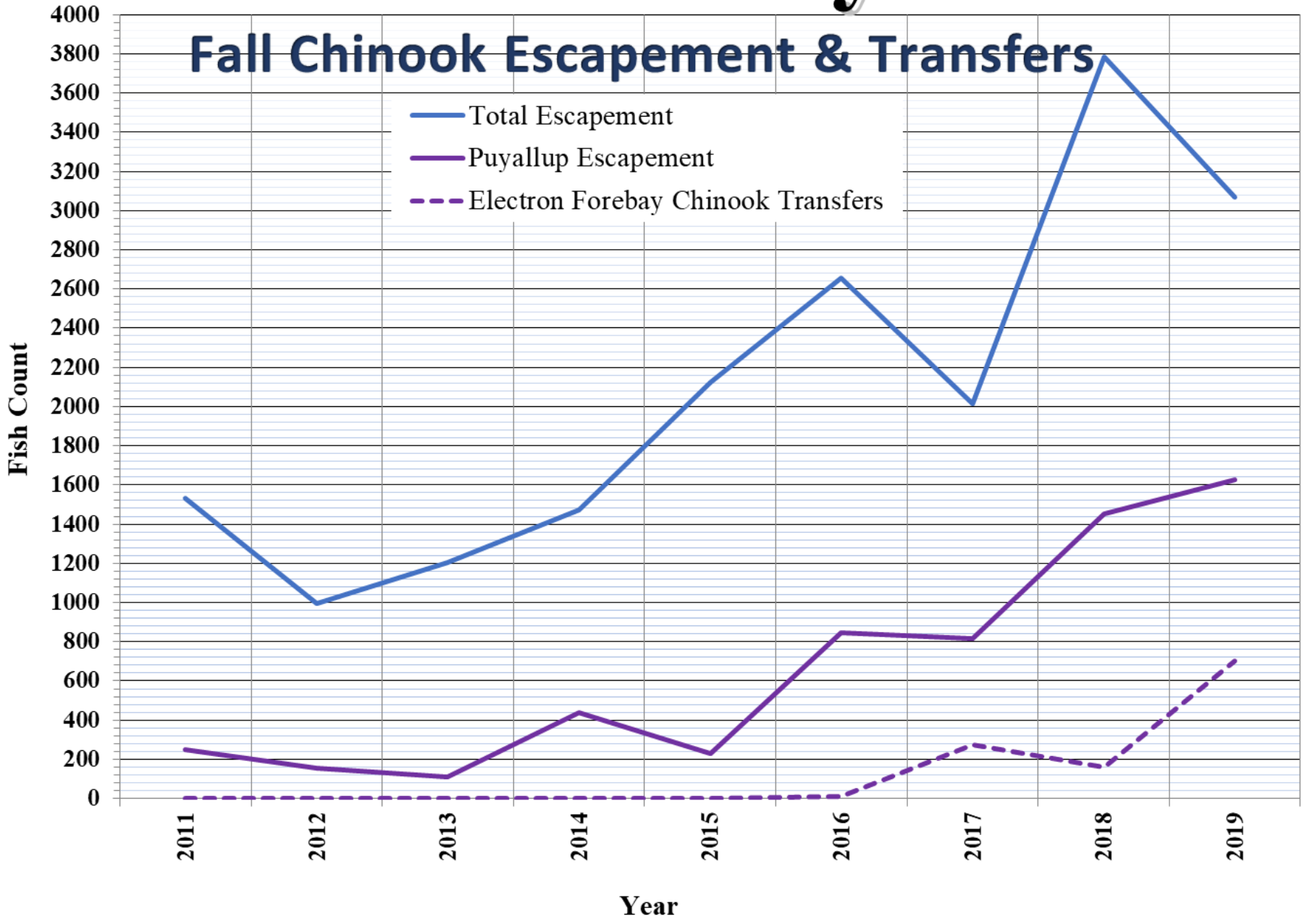
**Total Natural Spawning Escapement (HORs and NORs)[1]**

| Return Year | SPC | Canyon Clark's | Canyon Clear | Canyon Fennel | Canyon Falls | Canyon Kapowsin | Canyon Wilkeson | Carbon | Puyallup | Boise | Salmon | White | Total Escapement |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | **387** | **396** | **99** | **49** | **1** | **10** | **9** | **70** | **250** | **161** | **4** | **94** | **1,530** |
| HOR | 178 | 378 | 97 | 46 | 1 | 4 | 9 | 33 | 205 | 140 | 4 | 0 | 1,095 |
| NOR | 209 | 18 | 2 | 3 | 0 | 6 | 0 | 37 | 45 | 21 | 0 | 94 | 435 |
| mark rate | 0.46 | 0.95 | 0.98 | 0.94 | 1.00 | 0.40 | 1.00 | 0.47 | 0.82 | 0.87 | 1.00 | 0.00 | 0.72 |
| **2012** | **225** | **60** | **95** | **18** | **0** | **13** | **0** | **40** | **155** | **150** | **17** | **221** | **994** |
| HOR | 116 | 40 | 72 | 0 | 0 | 8 | 0 | 20 | 104 | 59 | 0 | 0 | 419 |
| NOR | 109 | 20 | 23 | 18 | 0 | 5 | 0 | 20 | 51 | 91 | 17 | 221 | 575 |
| mark rate | 0.52 | 0.67 | 0.76 | 0.00 | #DIV/0! | 0.62 | #DIV/0! | 0.50 | 0.67 | 0.39 | 0.00 | 0.00 | 0.42 |
| **2013** | **528** | **190** | **308** | **5** | **6** | **17** | **2** | **13** | **112** | **21** | **0** | **0** | **1,202** |
| HOR | 422 | 186 | 282 | 5 | 6 | 5 | 2 | 2 | 92 | 9 | 0 | 0 | 1,011 |
| NOR | 106 | 4 | 26 | 0 | 0 | 12 | 0 | 11 | 20 | 12 | 0 | 0 | 191 |
| mark rate | 0.80 | 0.98 | 0.92 | 1.00 | 1.00 | 0.29 | 1.00 | 0.15 | 0.82 | 0.43 | 0.00 | 0.00 | 0.84 |
| **2014** | **408** | **218** | **48** | **10** | **3** | **25** | **5** | **59** | **440** | **200** | **28** | **26** | **1,470** |
| HOR | 228 | 217 | 48 | 5 | 1 | 12 | 3 | 33 | 220 | 138 | 19 | 0 | 924 |
| NOR | 180 | 1 | 0 | 5 | 2 | 13 | 2 | 26 | 220 | 62 | 9 | 26 | 546 |
| mark rate | 0.56 | 1.00 | 1.00 | 0.50 | 0.33 | 0.48 | 0.60 | 0.56 | 0.50 | 0.69 | 0.68 | 0.00 | 0.63 |
| **2015** | **533** | **72** | **281** | **177** | **0** | **55** | **0** | **94** | **231** | **560** | **72** | **48** | **2,123** |
| HOR | 224 | 71 | 270 | 51 | 0 | 20 | 0 | 39 | 77 | 348 | 41 | 0 | 1,141 |
| NOR | 309 | 1 | 11 | 126 | 0 | 35 | 0 | 55 | 154 | 212 | 31 | 48 | 982 |
| mark rate | 0.42 | 0.99 | 0.96 | 0.29 | 0.00 | 0.36 | 0.00 | 0.41 | 0.33 | 0.62 | 0.57 | 0.00 | 0.54 |
| **2016** | **568** | **0** | **28** | **315** | **33** | **10** | **10** | **122** | **846** | **533** | **105** | **88** | **2,658** |
| HOR | 338 | 0 | 26 | 271 | 28 | 10 | 9 | 73 | 737 | 369 | 105 | 0 | 1,966 |
| NOR | 230 | 0 | 2 | 44 | 5 | 0 | 1 | 49 | 109 | 164 | 0 | 88 | 692 |
| mark rate | 0.60 | #DIV/0! | 0.93 | 0.86 | 0.85 | 1.00 | 0.90 | 0.60 | 0.87 | 0.69 | 1.00 | 0.00 | 0.74 |
| **2017** | **259** | **0** | **138** | **45** | **5** | **27** | **4** | **101** | **817** | **409** | **89** | **118** | **2,012** |
| HOR | 136 | 0 | 138 | 39 | 4 | 7 | 3 | 53 | 374 | 243 | 83 | 0 | 1,080 |
| NOR | 123 | 0 | 0 | 6 | 1 | 20 | 1 | 48 | 443 | 166 | 6 | 118 | 932 |
| mark rate | 0.53 | #DIV/0! | 1.00 | 0.87 | 0.80 | 0.26 | 0.75 | 0.52 | 0.46 | 0.59 | 0.93 | 0.00 | 0.54 |
| **2018** | **1,325** | **0** | **105** | **10** | **3** | **0** | **65** | **435** | **1,451** | **145** | **51** | **195** | **3,785** |
| HOR | 1,111 | 0 | 95 | 6 | 2 | 0 | 14 | 365 | 856 | 100 | 39 | 81 | 2,669 |
| NOR | 214 | 0 | 10 | 4 | 1 | 0 | 51 | 70 | 595 | 45 | 12 | 114 | 1,116 |
| mark rate | 0.84 | 0.00 | 0.90 | 0.60 | 0.67 | 0.00 | 0.22 | 0.84 | 0.59 | 0.69 | 0.76 | 0.42 | 0.71 |
| **2019** | **397** | **9** | **393** | **3** | **3** | **34** | **83** | **180** | **1,628** | **243** | **81** | **17** | **3,071** |
| HOR | 334 | 9 | 392 | 2 | 2 | 15 | 83 | 152 | 961 | 183 | 62 | 13 | 2,208 |
| NOR | 63 | 0 | 1 | 1 | 1 | 19 | 0 | 28 | 667 | 60 | 19 | 4 | 863 |
| mark rate | 0.84 | 0.00 | 1.00 | 0.67 | 0.67 | 0.00 | 1.00 | 0.84 | 0.59 | 0.75 | 0.77 | 0.76 | 0.72 |

## Electron Forebay Chinook Transfers

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yr. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Age | | | | | | | | | | | | | |
| **2015** | 0+ | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | closed | closed | partial 0 | no data | 2 |
| | Adult | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | closed | closed | partial 0 | no data | 0 |
| **2016** | 0+ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | no data | 2 | 8 | 0 | 10 |
| | Adult | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | no data | 2 | 0 | 0 | 2 |
| **2017** | 0+ | 4 | 18 | 174 | 24 | 25 | 7 | 0 | 1 | 1 | 7 | 4 | 0 | 265 |
| | Adult | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 3 | 0 | 10 |
| **2018** | 0+ | 0 | 0 | 0 | 1 | 7 | 24 | 94 | 19 | 1 | 6 | 0 | 0 | 152 |
| | Adult | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 6 |
| **2019** | 0+ | 0 | 1 | 0 | 0 | 18 | 24 | 264 | 175 | 81 | 80 | 21 | 7 | 671 |
| | Adult | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 25 | 2 | 0 | 29 |

# Electron Hydro



## Electron Hydro:

Is rated at 26 MW, providing enough power for about 20,000 local area homes.

Supports Washington’s clean energy objectives defined and legislated by SB 5116

Provides firm energy necessary for stabilizing solar and wind sources and will become more important as thermal energy generation is phased out in Washington State.

Does not require use of high capacity transmission lines to deliver energy over great distances because the electrical load is local.  Project is located on the west side of the Cascades.

Works with the PTI and resource agencies to protect and enhance Puyallup River salmon.

Electron Hydro is a Renewable Resource Community Partner

Electron Hydro is committed to:

Produce clean renewable energy

Protect and enhance Puyallup River salmon

We recommend “Salmon Power!”

go to electronhydro.com to find out more

360-738-9999