

# FOSTER FISH LADDER ASSESSMENT REPORT (FFLAR) *WFFDG Presentation*

Chris Budai, PM

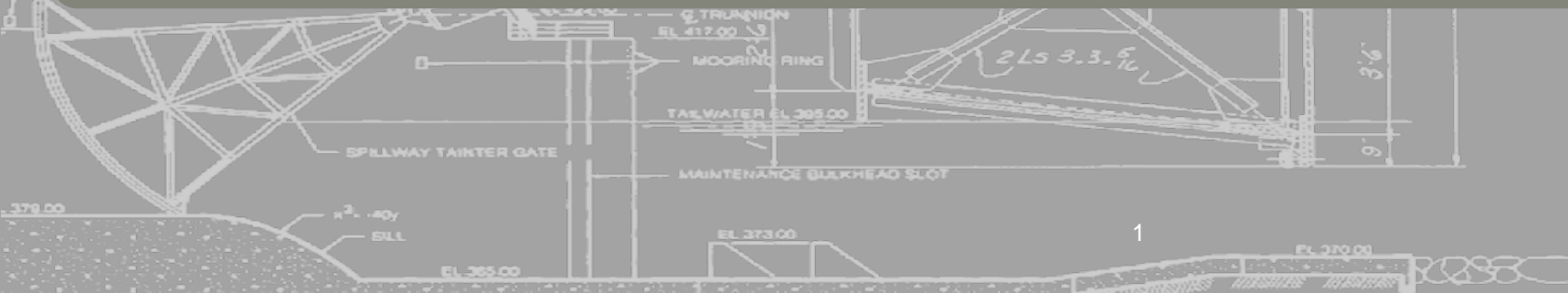
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Norm Buccola, Hydraulic Engineer

05 MAR 2019



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NOTE:  
TAINTER GATE

# AGENDA

## Project Overview

- Upgraded Fishladder
- Existing Intakes

## Problem Overview

- Temperature
- Olfactory or scents

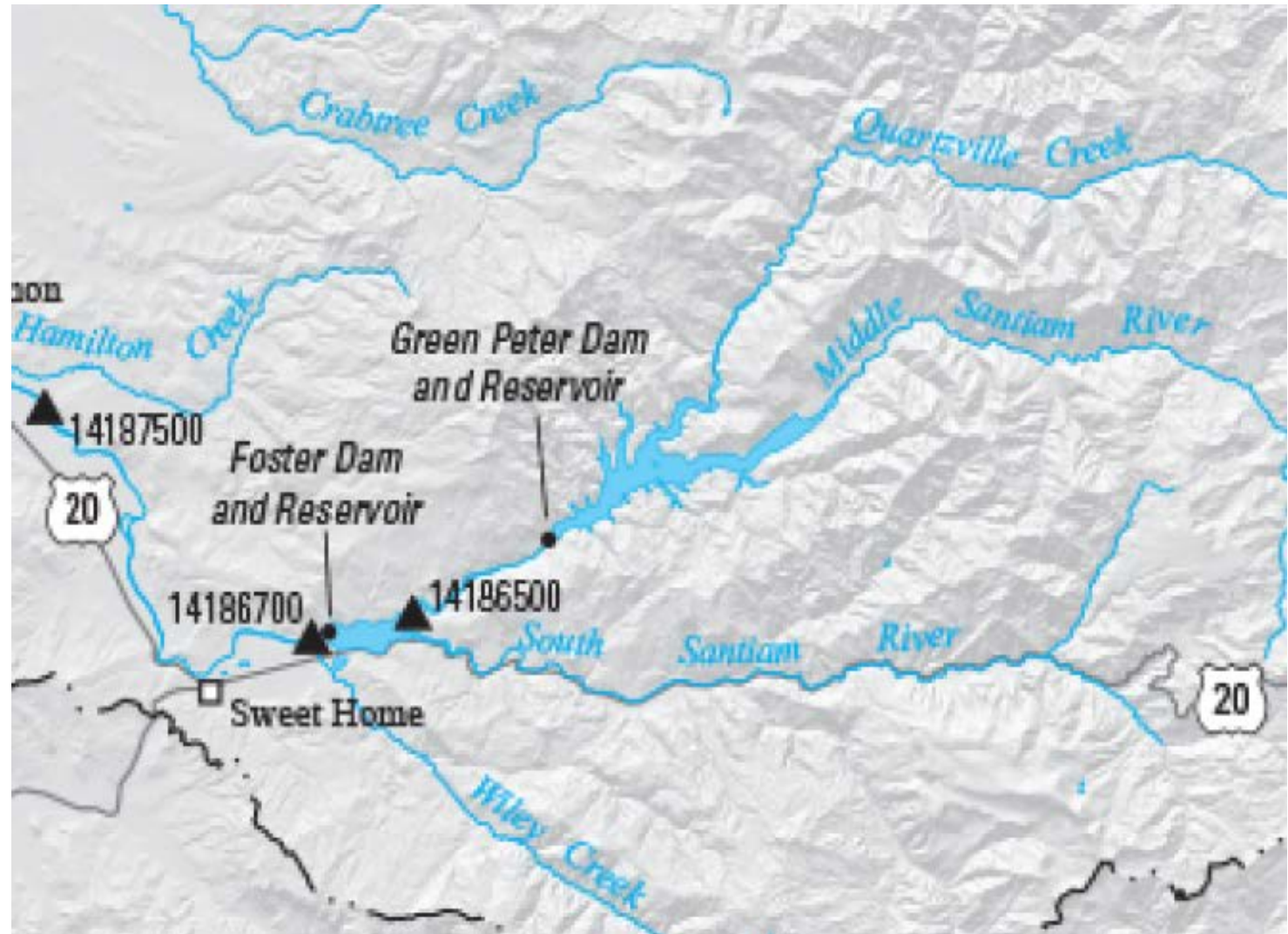
## Alternatives

- Modeling of Green Peter outflows
- Target locations for warm water
  - AWS pump sump
  - Truck fill

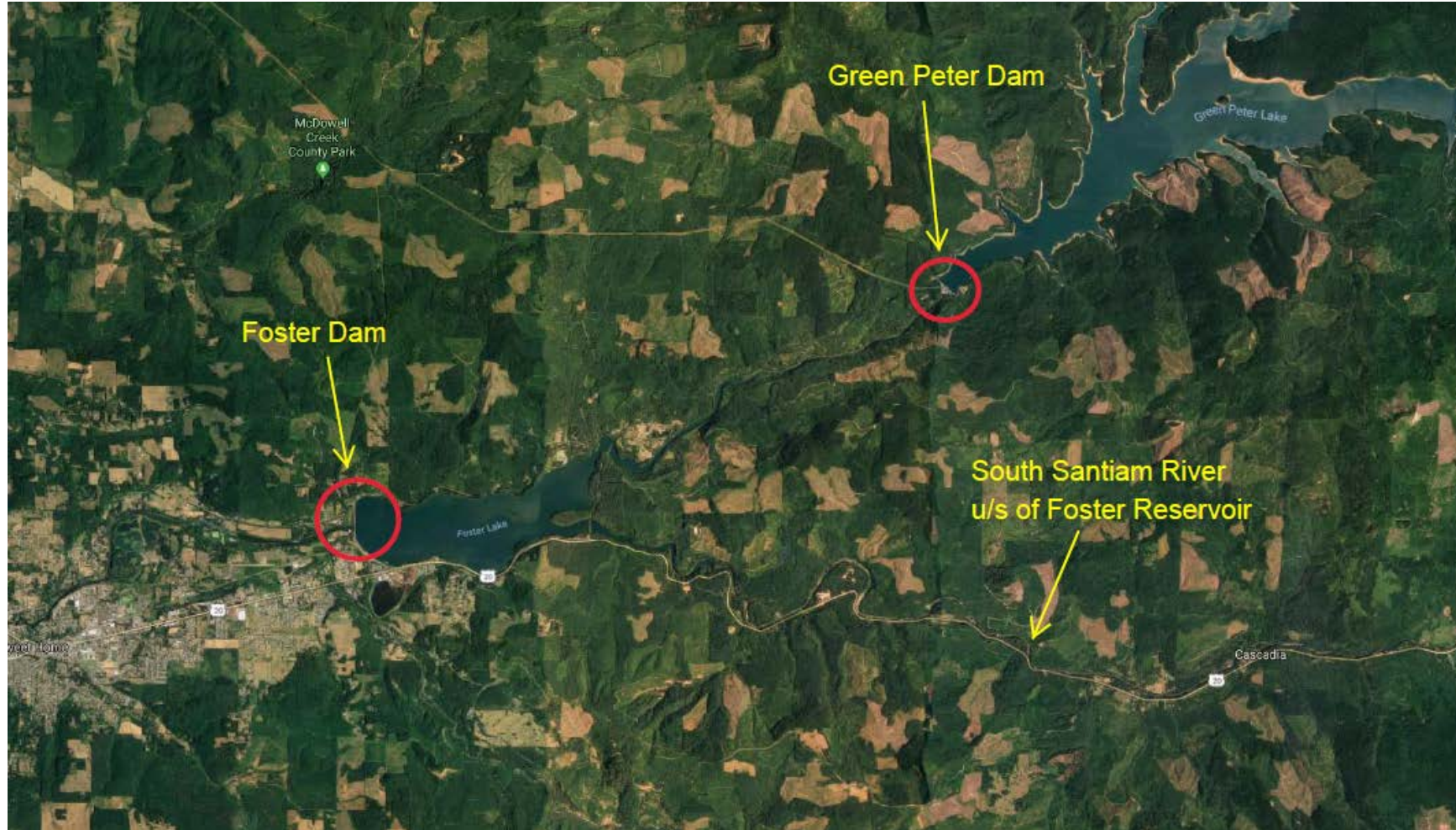
## Potential source locations

## Optional juvenile holding pond

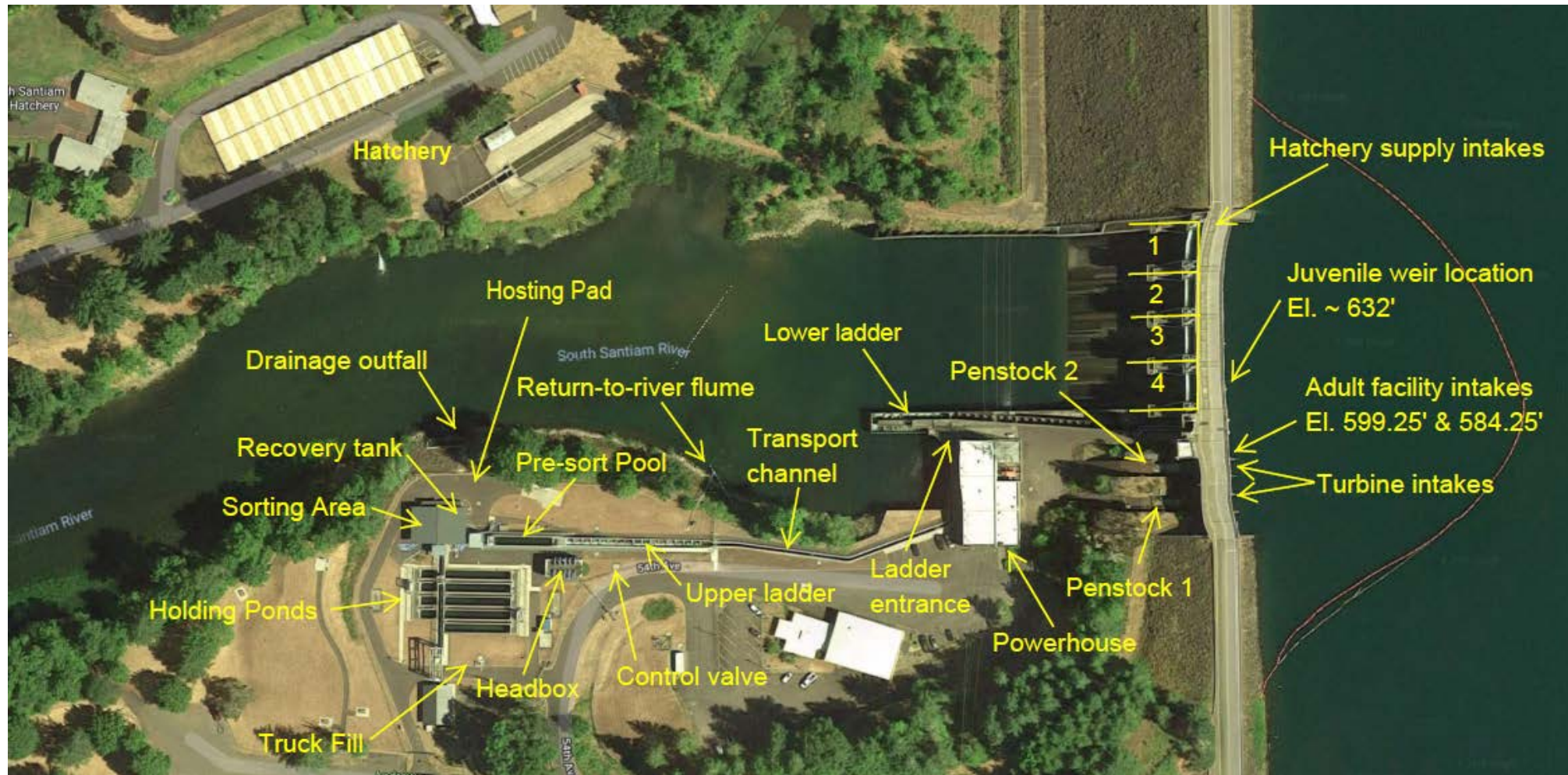
## FFLAR Schedule



# TRIBUTARIES TO FOSTER DAM



# FOSTER DAM AND ADULT FISH COLLECTION FACILITY



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# PROBLEM

Fish Holding in and below FOS Tailrace for a median time of 25-52 days

- Both natural-origin (NOR) and
- Hatchery-origin (HOR) spring Chinook

## Temperature

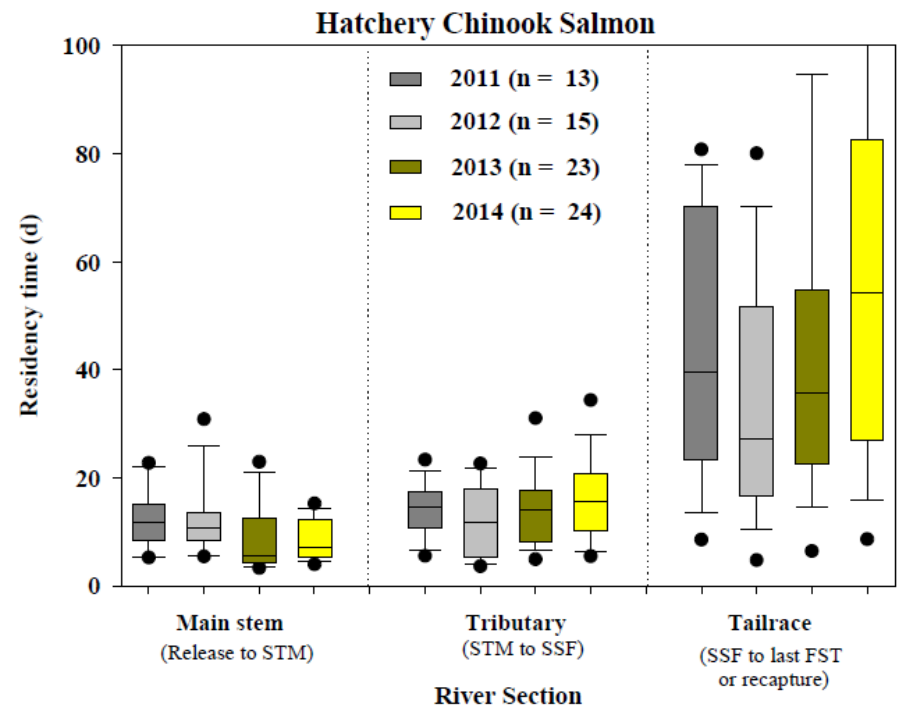
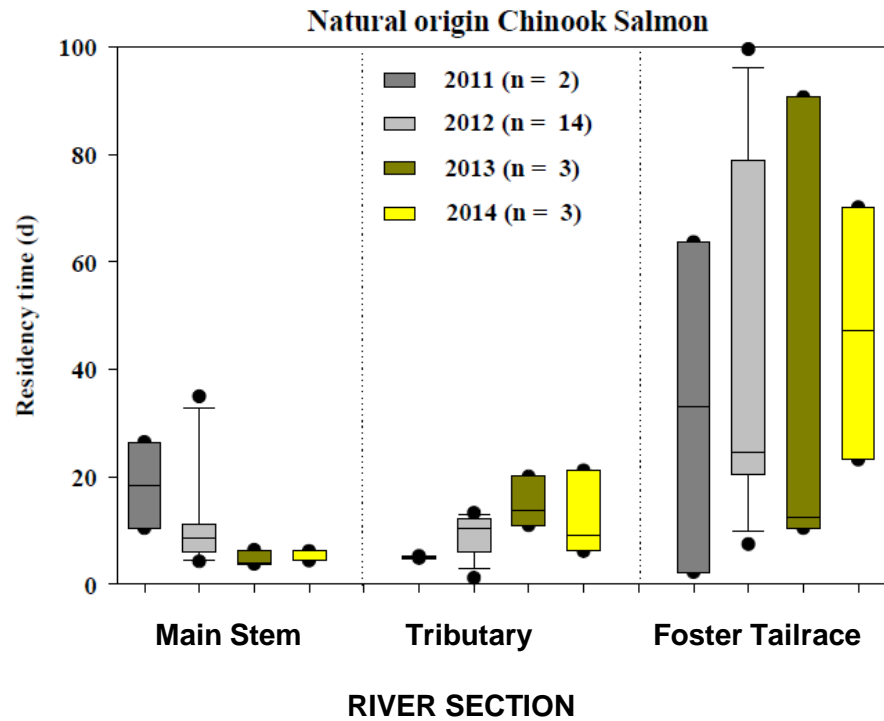
- \*Water from Presort Pool and ladder are believed to be too cold during May – September based on regional observations
- \*Chinook salmon collection at the Foster AFF trap begins in April-May, peaks in June-August, and finishes in Sept-early Oct, meaning these fish are migrating during these temperature dynamics.

## Olfactory Cues

- South Santiam River form the upper water layer where fish are homing to
- Middle Santaim (Green Peter) forms the lower strata from which ladder is supplied

Entrance velocity/head was determined not to be a controlling factor by UI study





# FOSTER ADULT FISH FACILITY WATER SUPPLY INTAKES

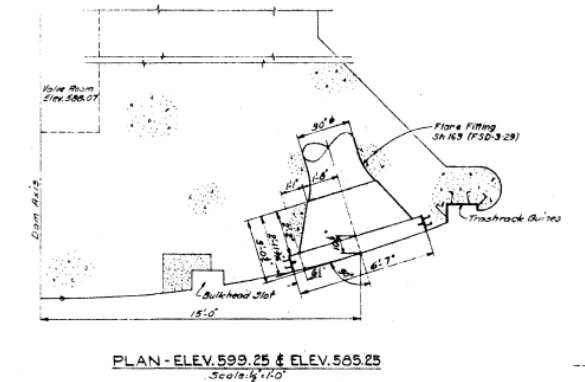
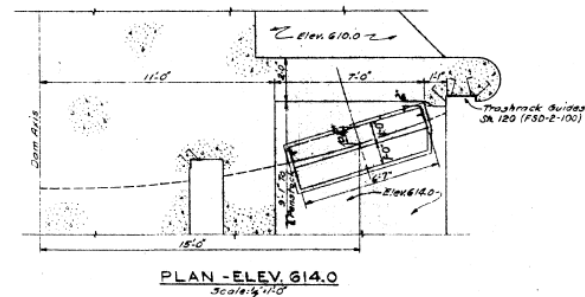
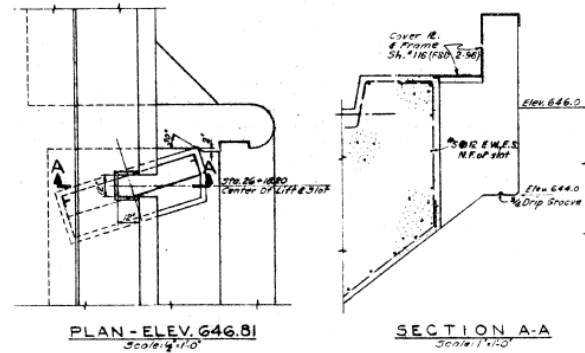
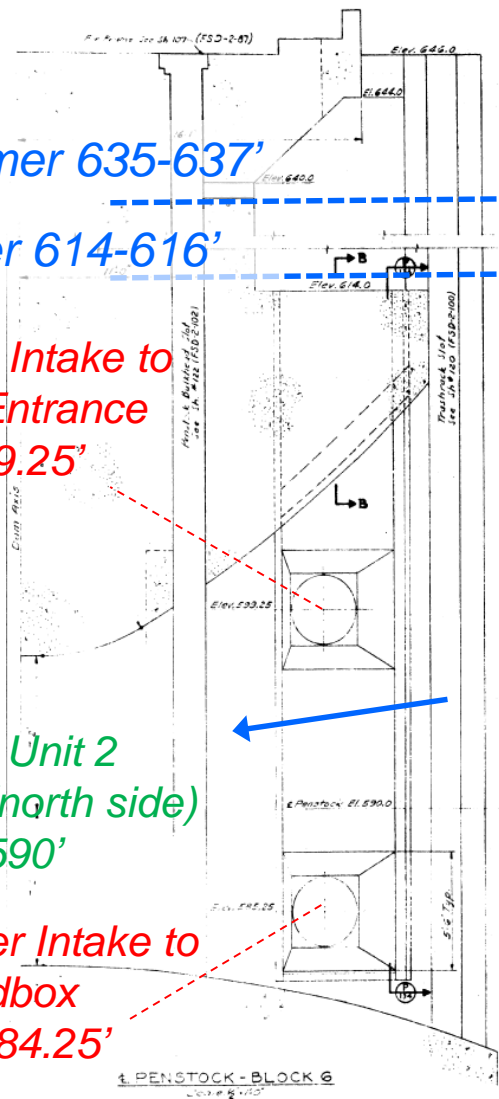
Summer 635-637'

Winter 614-616'

Upper Intake to Side Entrance  
EL 599.25'

Turbine Unit 2 Intake (north side)  
CL EL 590'

Lower Intake to Headbox  
EL 584.25'



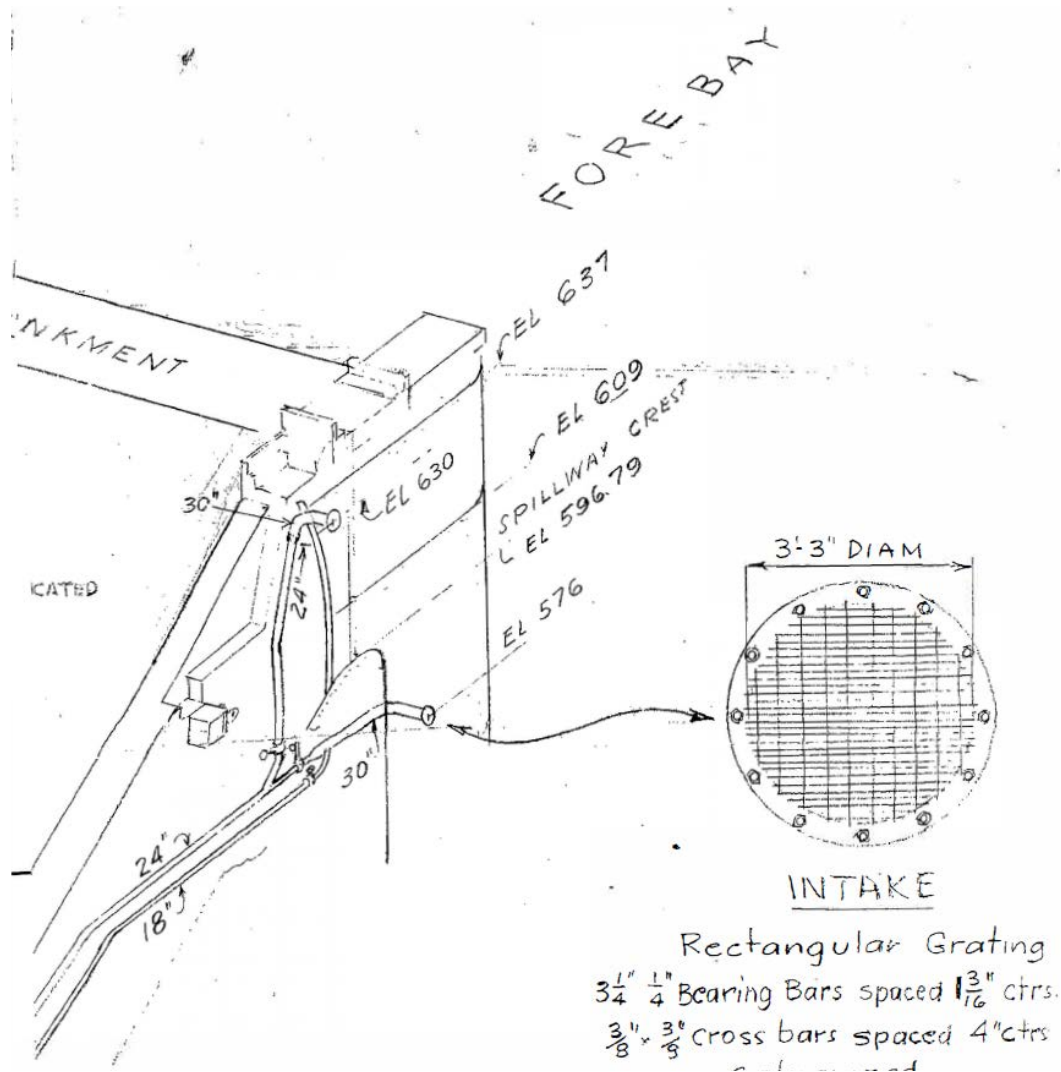
Adult Facility Water Supply Intakes



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# HATCHERY INTAKE



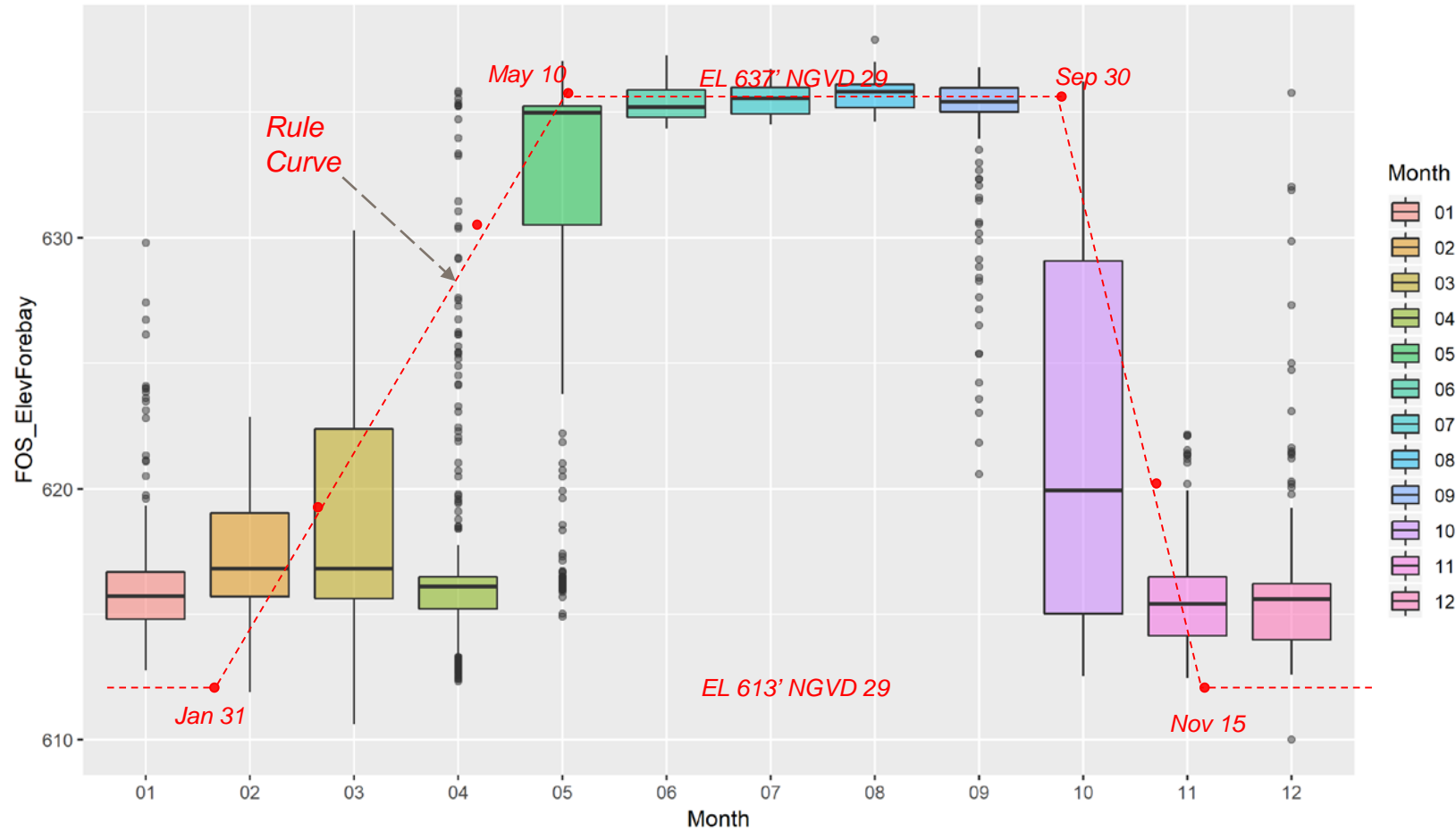
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# FOSTER MONTHLY RESERVOIR ELEVATIONS (NGVD 29)

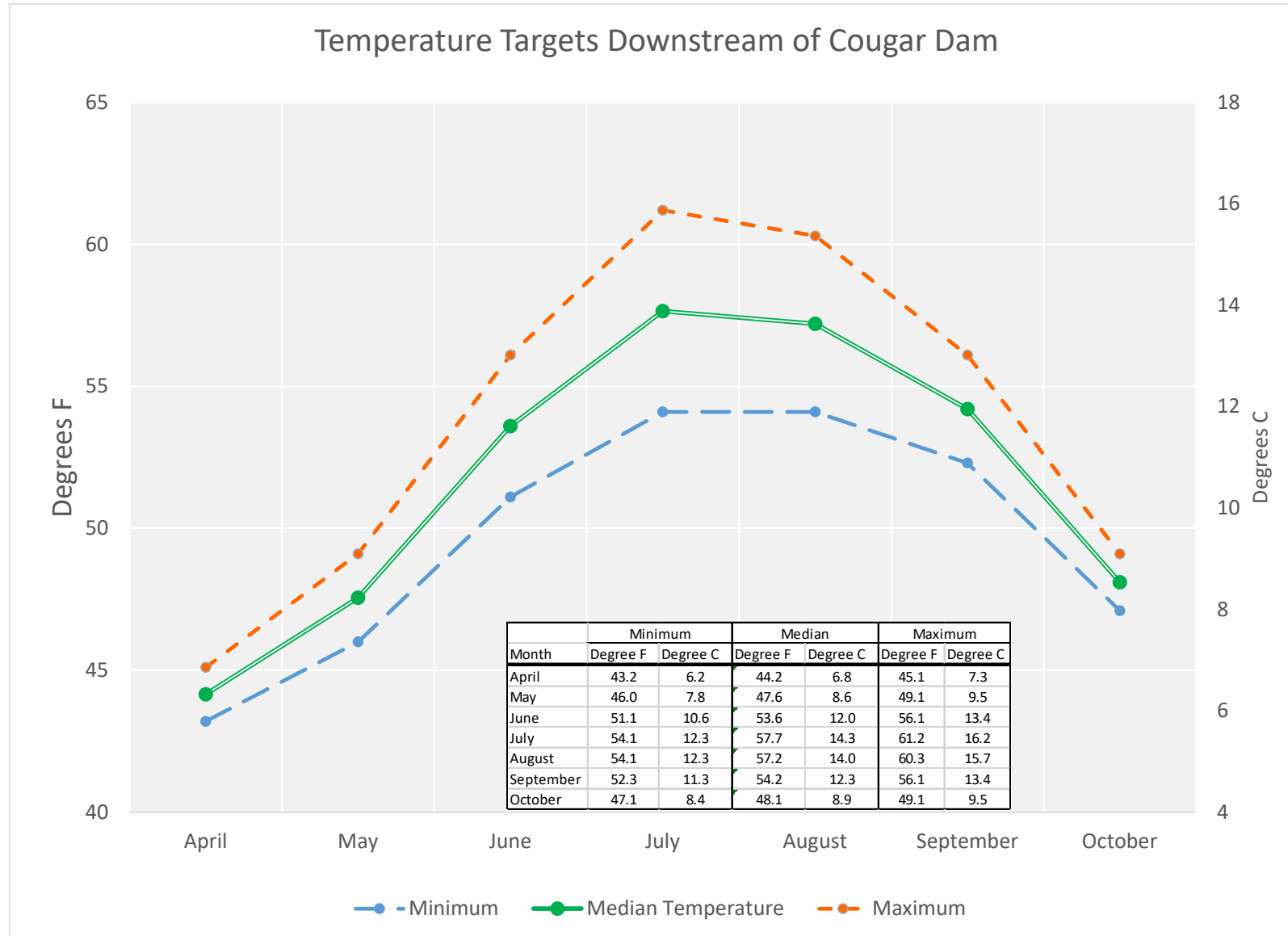
FOS Lake Level By Month 2010-2018



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# TEMPERATURE TARGETS FOR THE UPSTREAM PASSAGE



Preliminary results, subject to revision. For USGS, USACE, UI only.



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# ALTERNATIVES

1. Operational – Green Peter spill
2. Structural changes to raise Temperature in Presort Pool and other locations
  1. Gravity source from upper pool to presort pool, AWS sump and truck fill
    1. Higher new intake above existing fish water supply intakes at turbine intake
    2. Adjacent to new Juvenile fish weir
    3. Upper hatchery intake
  2. Shallow wells on edge of forebay
  3. Heat up water in piping to from headbox to Presort
  4. Partition Headbox (warm water sent to different part of box)
3. Ancillary Options
  1. Lower ladder diffusers
  2. Use one holding pond to hold juvenile fish for scented water source



# 1. OPERATIONAL ALTERNATIVE: GREEN PETER SPILL

## Green Peter spill during May - September

### 1. USGS temperature modelling Treatments

1. 3 day alternating blocks of spill and power
2. 7 day alternating blocks of spill and power
3. 10 day alternating blocks of spill and power
4. Potential continuous 60% spill & 40% power

### 2. Pros

1. Opens potential habitat on Middle Santiam
2. Minimal or no structural requirements

### 3. Cons or Concerns

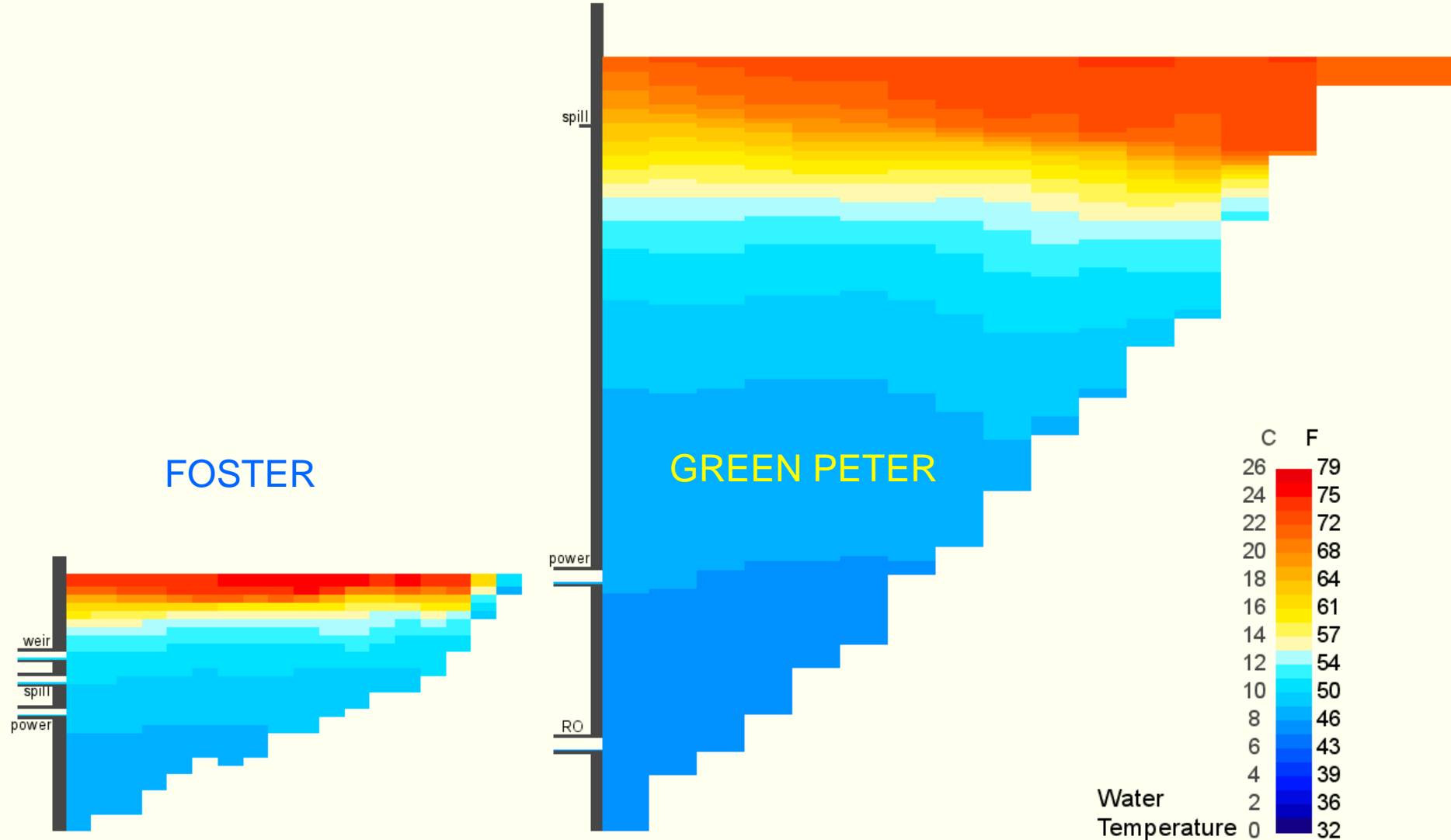
1. Possible environmental concerns with significant warming of reservoir
2. Warm water layers may not adequately reach existing intakes
3. Spillway gates untested under flow
4. Warmer water at Foster holding tanks
5. May lose pool below spillway crest (EI 968.7' ; pool ranges between 922 -1015')
6. Lost power at Green Peter



Foster (left) Green Peter (right), OR

July 14, 2002 day 195.6

USGS - DRAFT



FOSTER

GREEN PETER

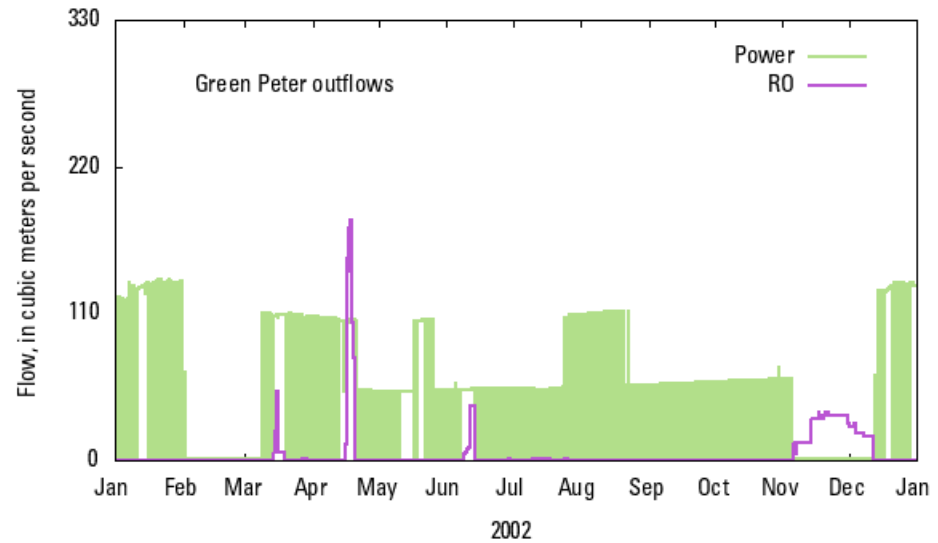
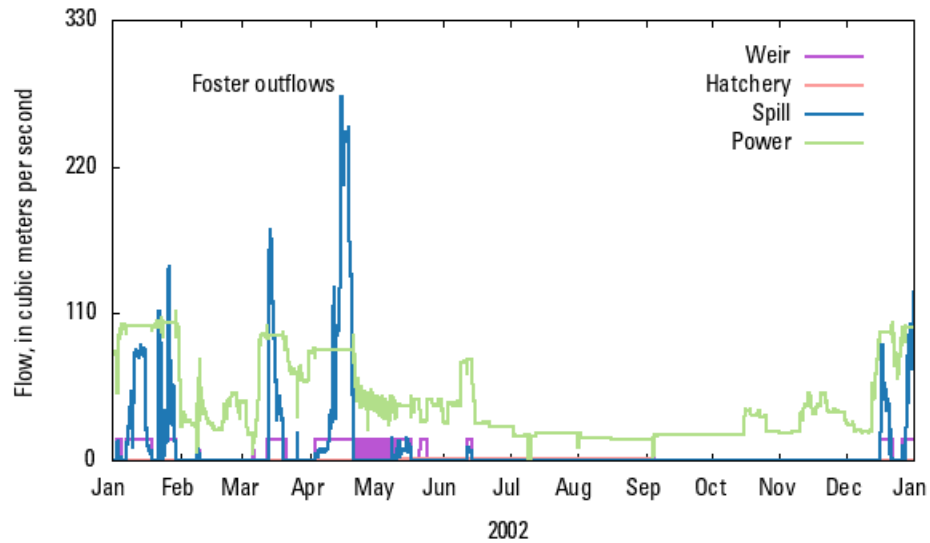
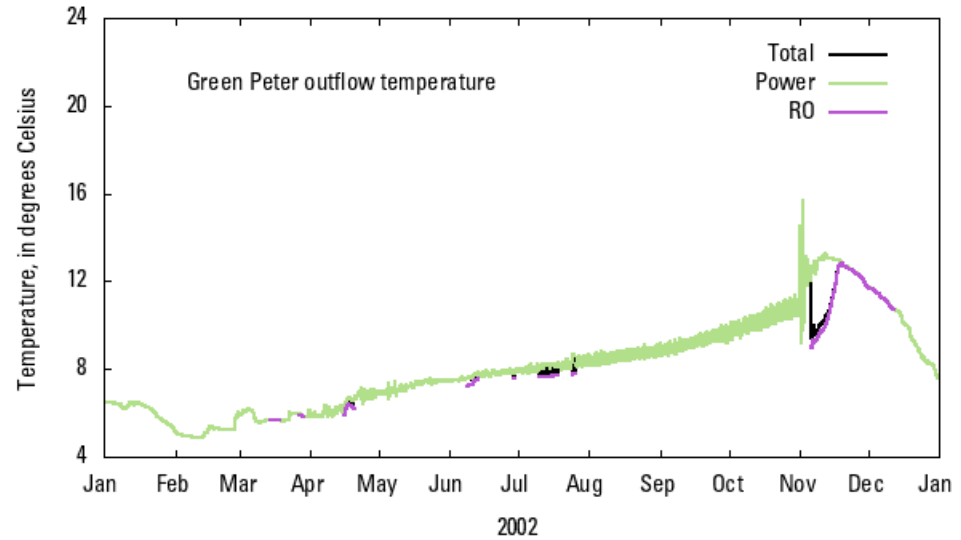
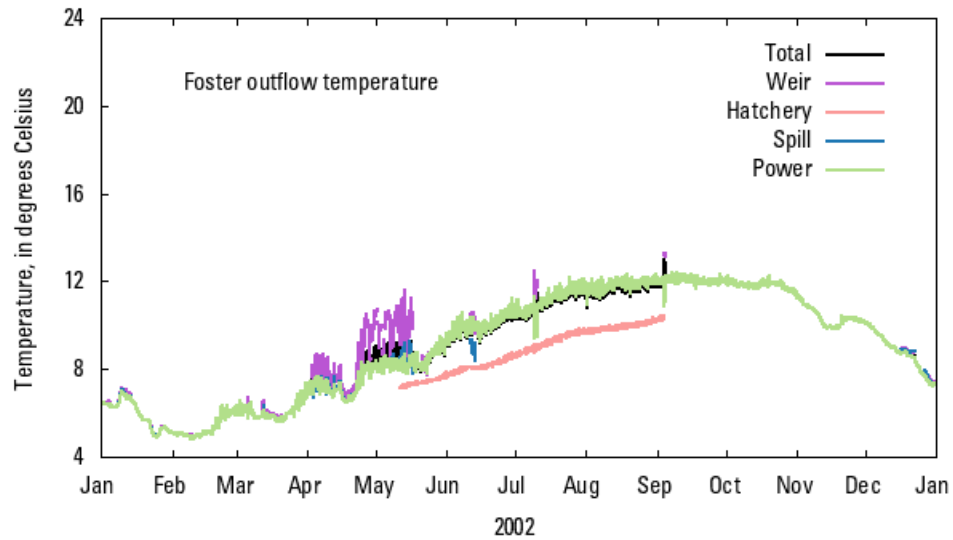


Water Temperature

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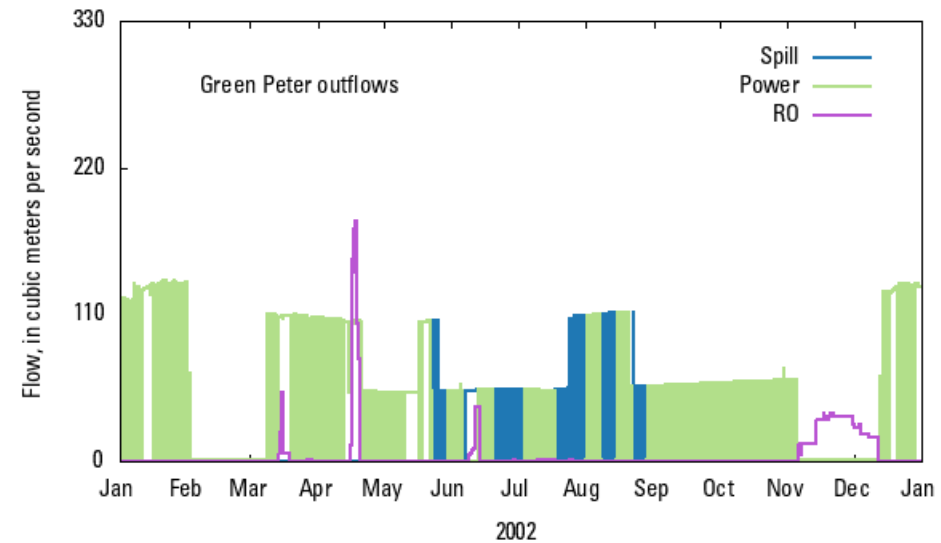
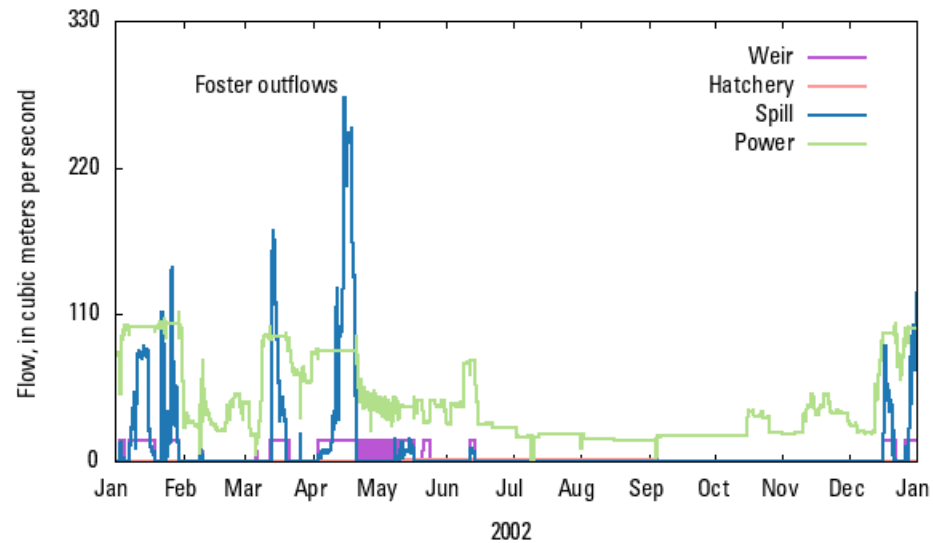
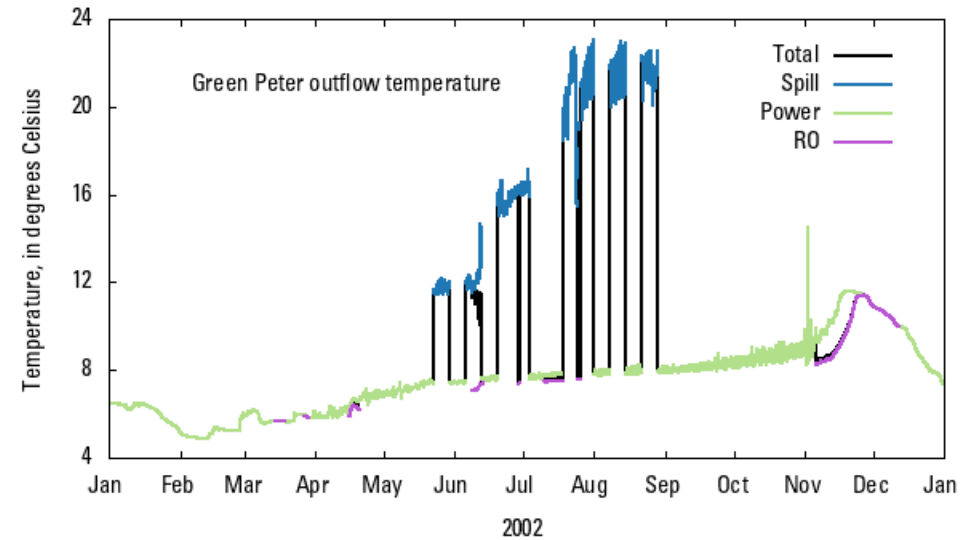
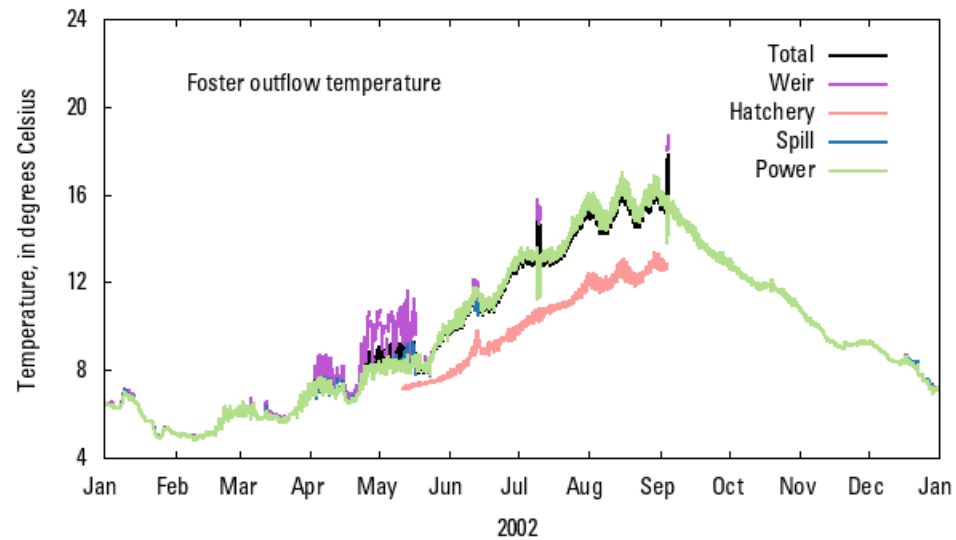
# A. Base Operations (no change), 2002



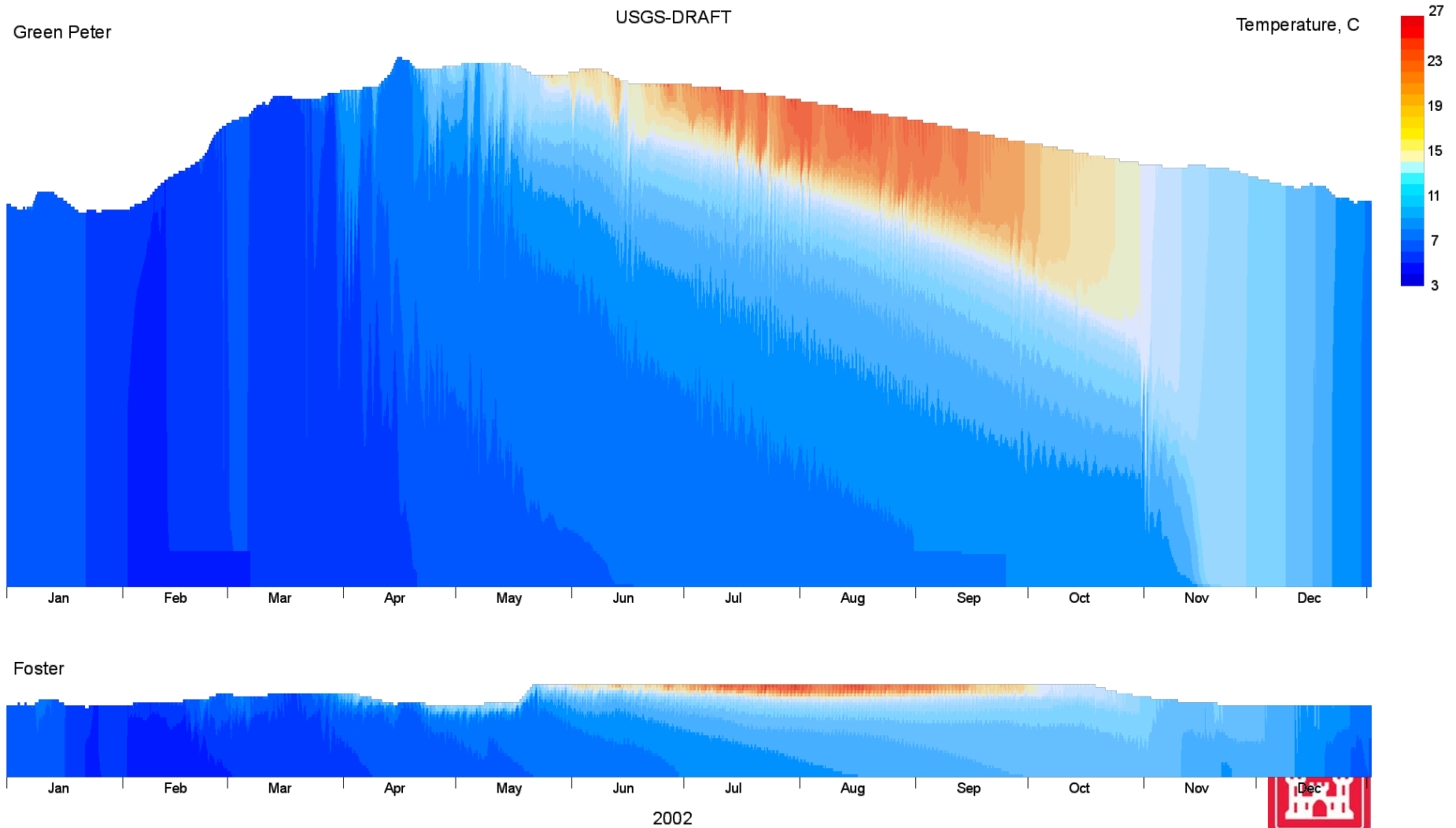
Preliminary results, subject to revision. For USGS, USACE, UI only.



# 7-Day Schedule at Green Peter, 2002



# A. Base Operations (no change), 2002



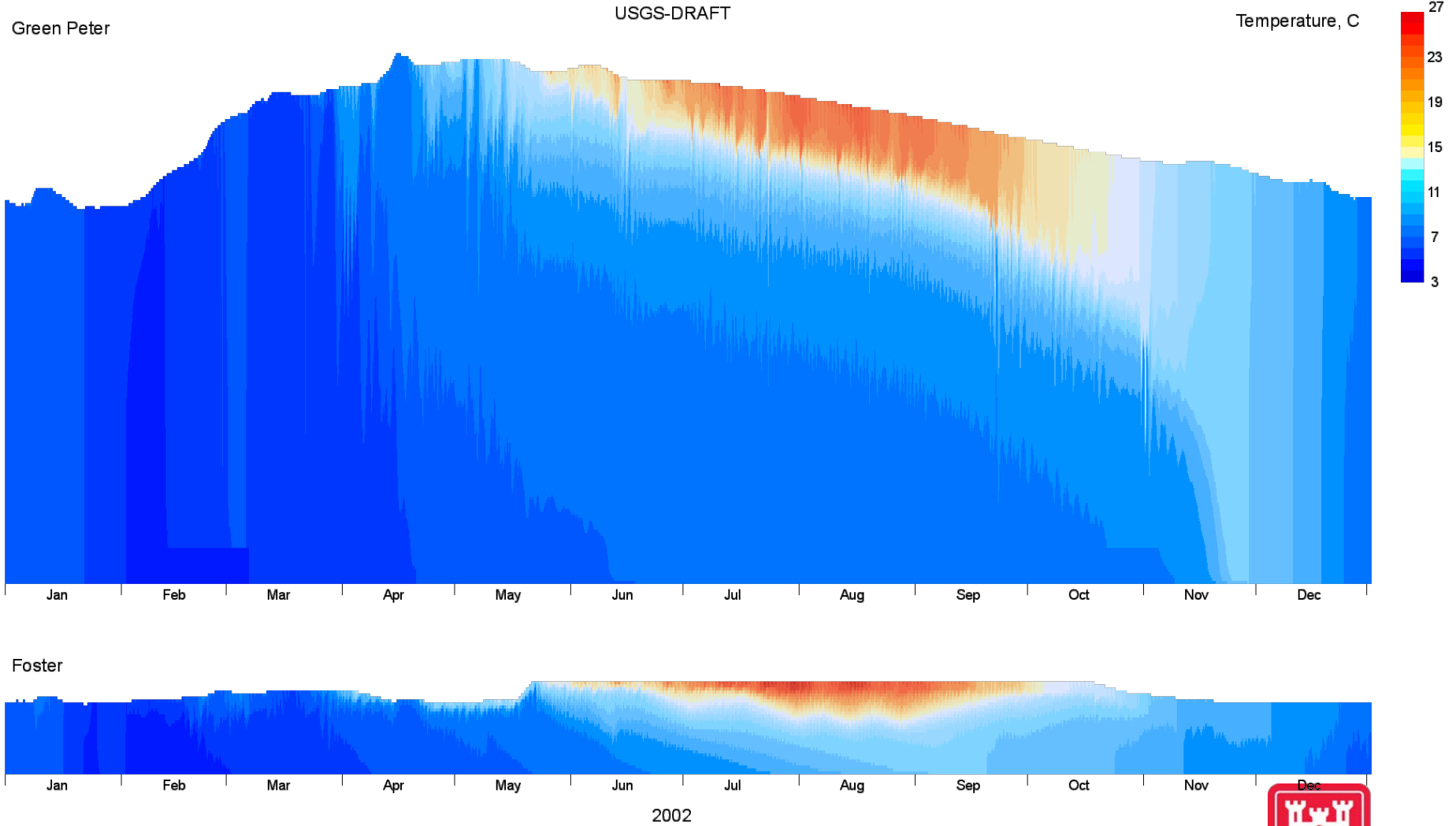
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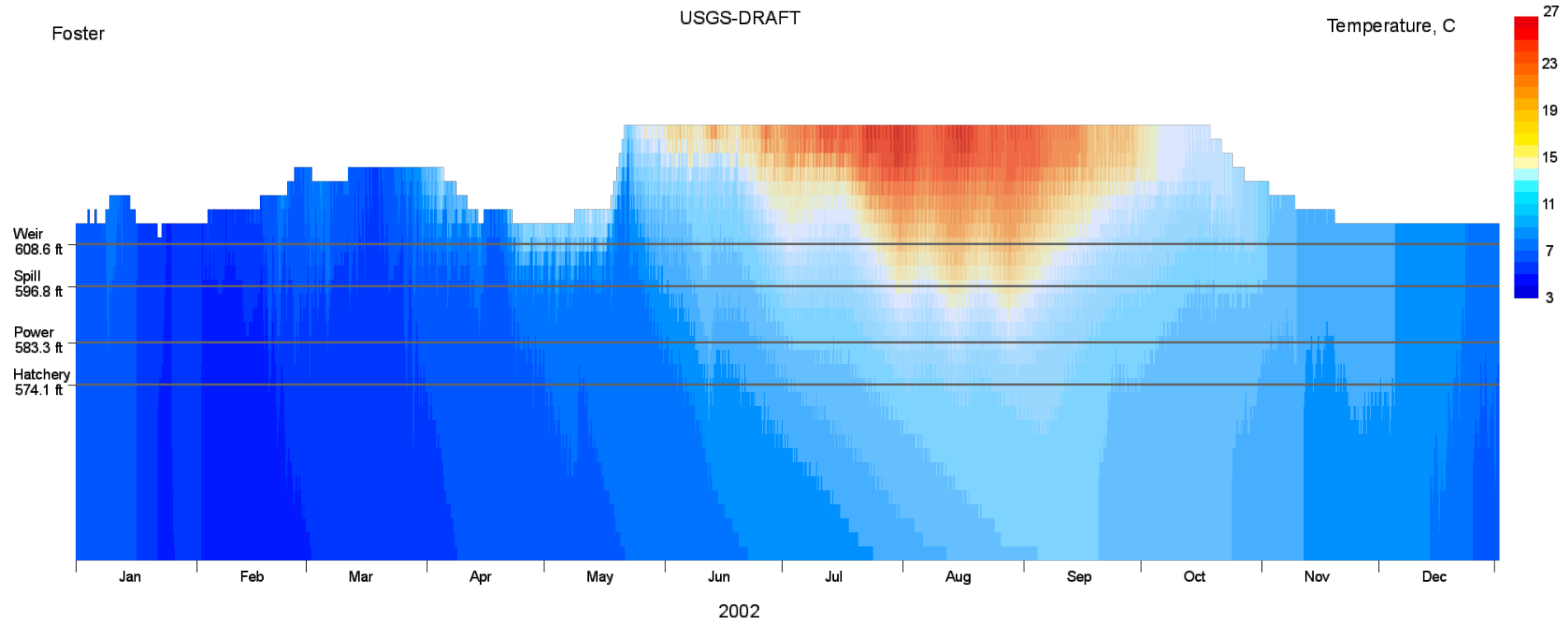
# 7-Day Schedule at Green Peter, 2002



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# (...zoomed in for Foster)



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## 2. STRUCTURAL ALTERNATIVES: TO RAISE TEMPERATURES AT FACILITY

1. Gravity source from upper pool to presort pool, AWS sump and truck fill
  1. Draw from upper level in reservoir for mixing below to meet target temperatures
  2. Fish screening requirement assumed
  3. Need to determined alignment connecting into existing valve room
  4. New mixing chamber on north side of Presort pool
  5. Should also acquire some olfactory benefit from South Santiam River
    1. Higher new intake above existing fish water supply intakes at turbine intake
      1. Uncertain for sweeping flow at upper level
      2. Adjacent to new juvenile fish weir
      3. Upper hatchery intake
        1. Pumping likely required and piping across forebay bays.
        2. Existing intake too small and is not screened



## 2. STRUCTURAL ALTERNATIVES: TO RAISE TEMPERATURES (CONT.)

### 2. Shallow wells on edge of forebay

1. Pro - Avoids fish screening
2. Cons or concerns
  1. Difficult piping alignment & pumping required
  2. Hydro-geologically uncertain conditions

### 3. Heat up water in piping to from headbox to Presort

1. Likely infeasible due to excessive power requirements

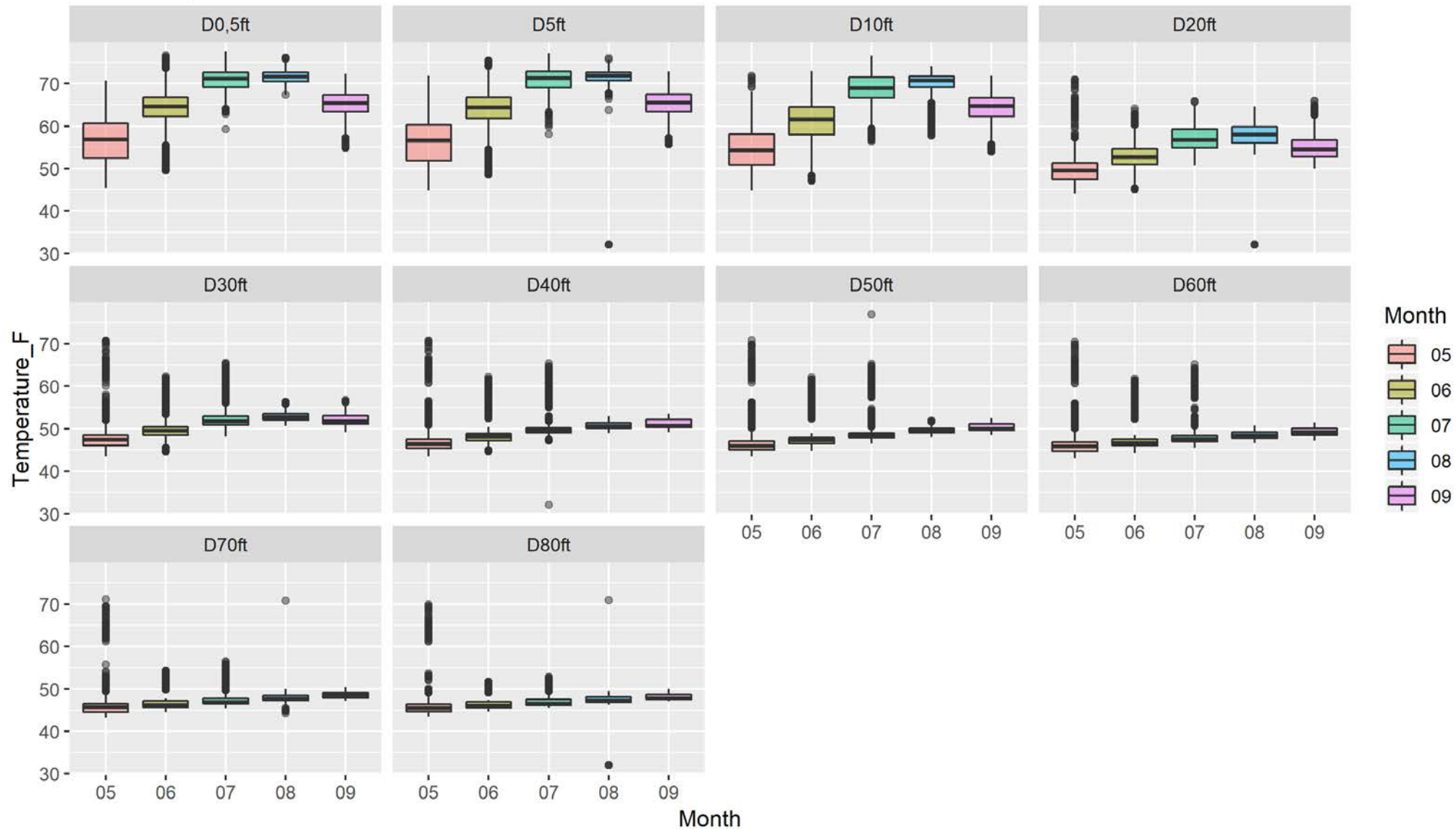
### 4. Partition Headbox (warm water sent to different part of box)

1. Pros
  1. Provides means of separate water temperatures going to Presort and holding ponds
2. Cons or concerns
  1. Excess flow would need to overflow into existing chamber holding cold water
  2. Difficult piping alignment options



# FOSTER RESERVOIR TEMPERATURES AS FUNCTION OF DEPTH

FOS Temperature w/Depth 2010-2018

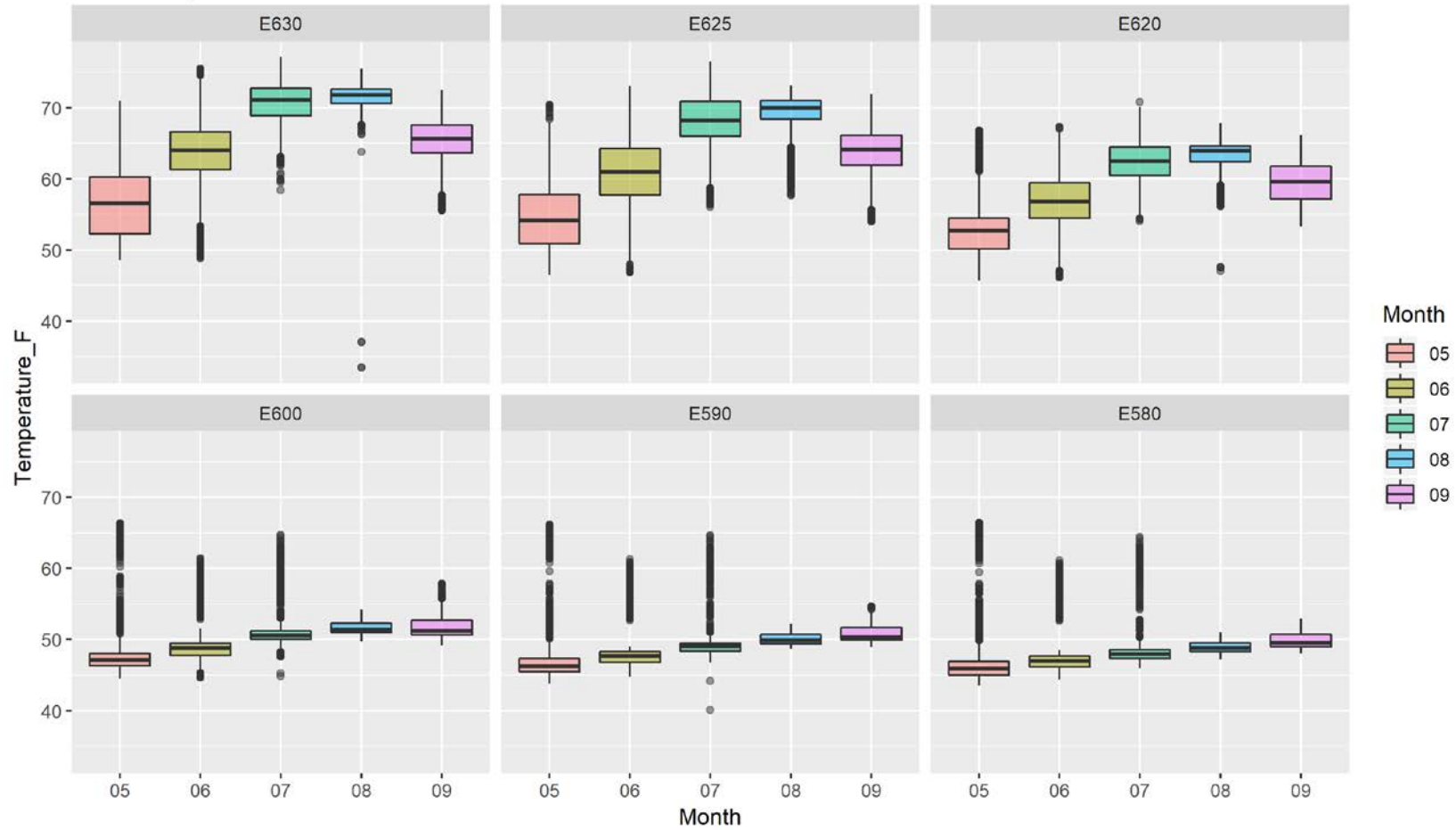


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# FOSTER RESERVOIR TEMPERATURES AS FUNCTION OF ELEVATION

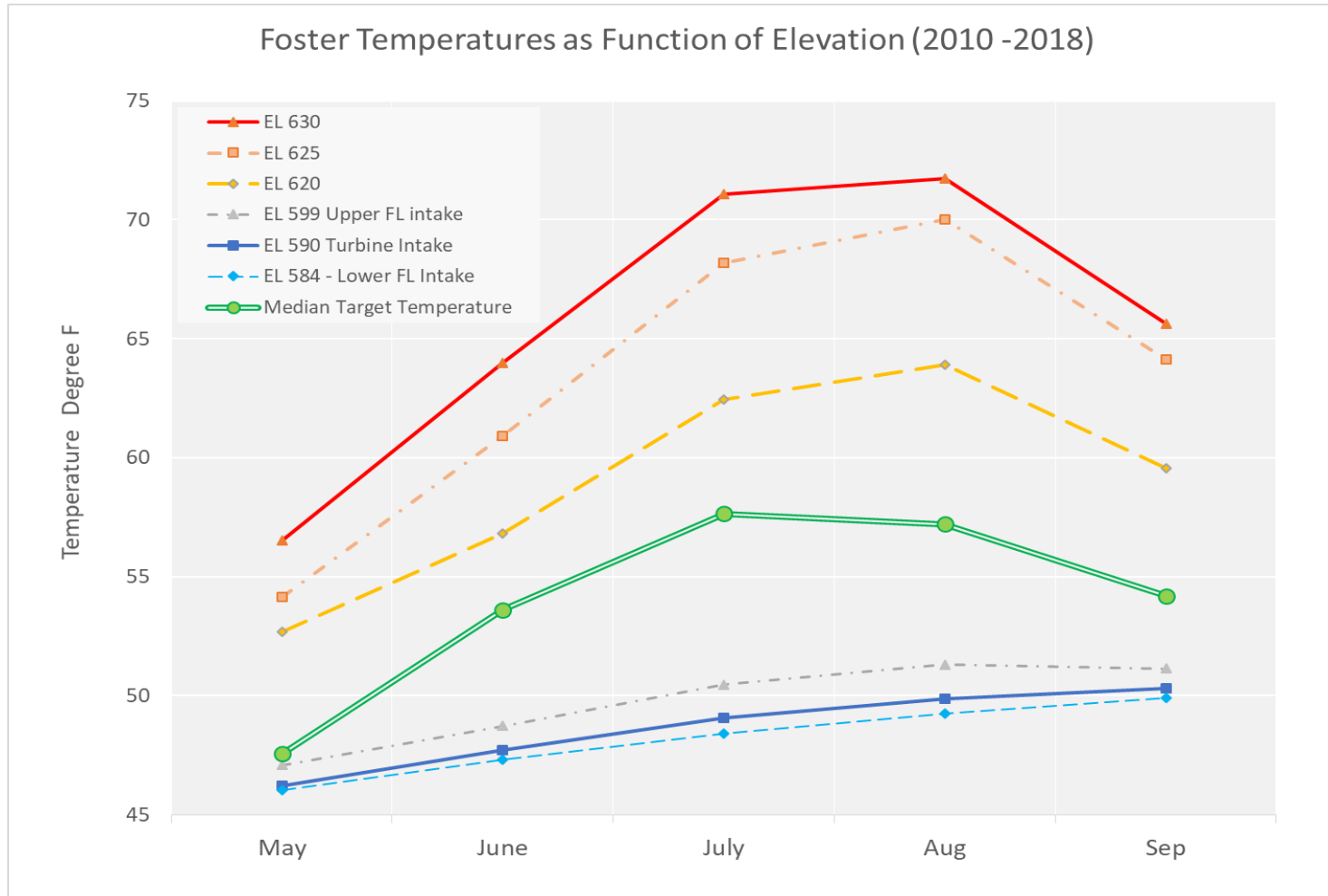
FOS Temperature at Fixed Elevations 2010-2018



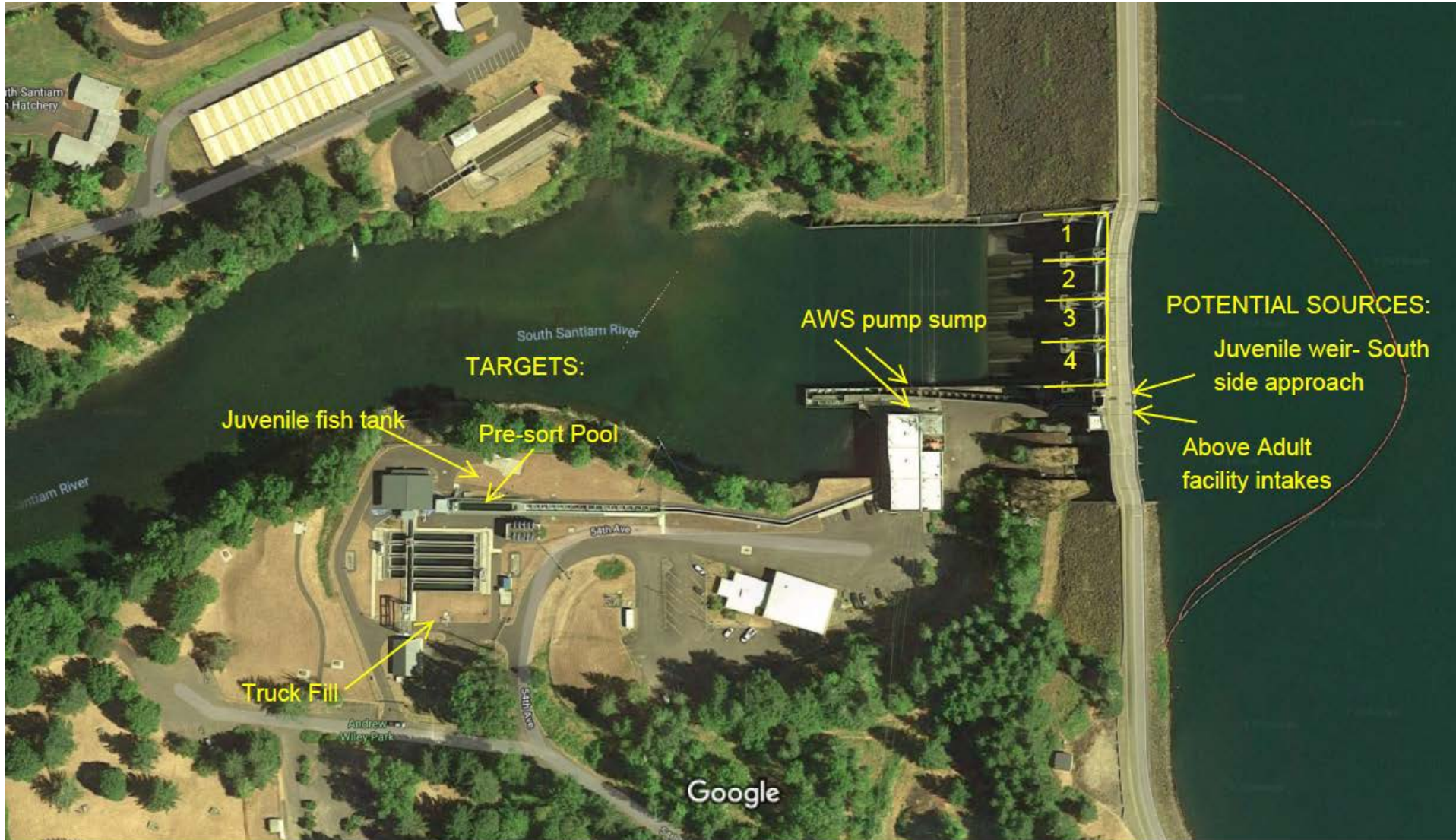
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# FOSTER TEMPERATURES AT SOURCE LOCATIONS

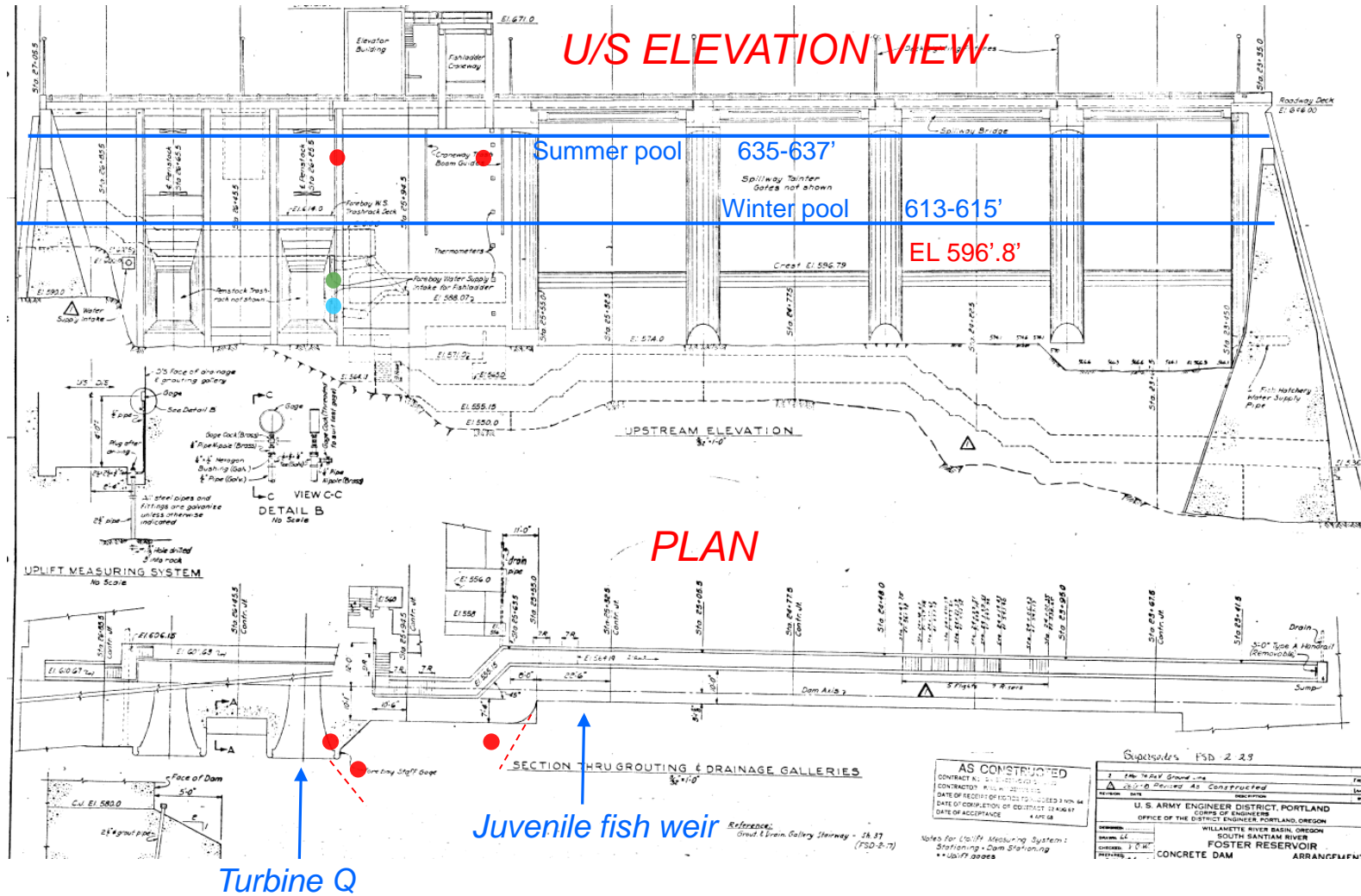


# FOSTER POTENTIAL SOURCE & TARGET LOCATIONS





# POTENTIAL SOURCE LOCATIONS



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### 3. ANCILLARY OPTIONS (TO AUGMENT TEMPERATURE INCREASES)

#### 1. Lower ladder pool diffusers

1. Add lower ladder diffuser above Pool 1
2. Pros
  1. Improves hydraulic conditions (more head differential) through lower ladder pools otherwise submerged by tailwater influences
  2. Allows incremental transition of any temperature differences between presort pool and entrance area (pool 1)
3. Cons
  1. Structural changes in ladder to add diffusers
  2. May require pumping to force water

#### 2. Use portable pond to hold juvenile hatchery fish for scented water source

1. Description on next slide
2. Pros
  1. Potential option that could be tested inexpensively
  2. Fish could be sent to Return to River pipe when ready to release
3. Cons
  1. More complicated plumbing and controls



# OPTIONAL JUVENILE HOLDING POND TO ADD SCENTS

Circulate small quantity of water through portable juvenile holding tank to add to Presort pool

Two fiberglass tanks on existing host pad north of Presort pool

- 5' deep x 12' in diameter
- Walkways to access ponds, predator protection netting
- Water depth 4' and ~ 450 cubic feet of H<sub>2</sub>O
- 10,000 juveniles (hatchery fish)
- 5-10% of Presort flow = 30 cfs (1.5 – 3 cfs)



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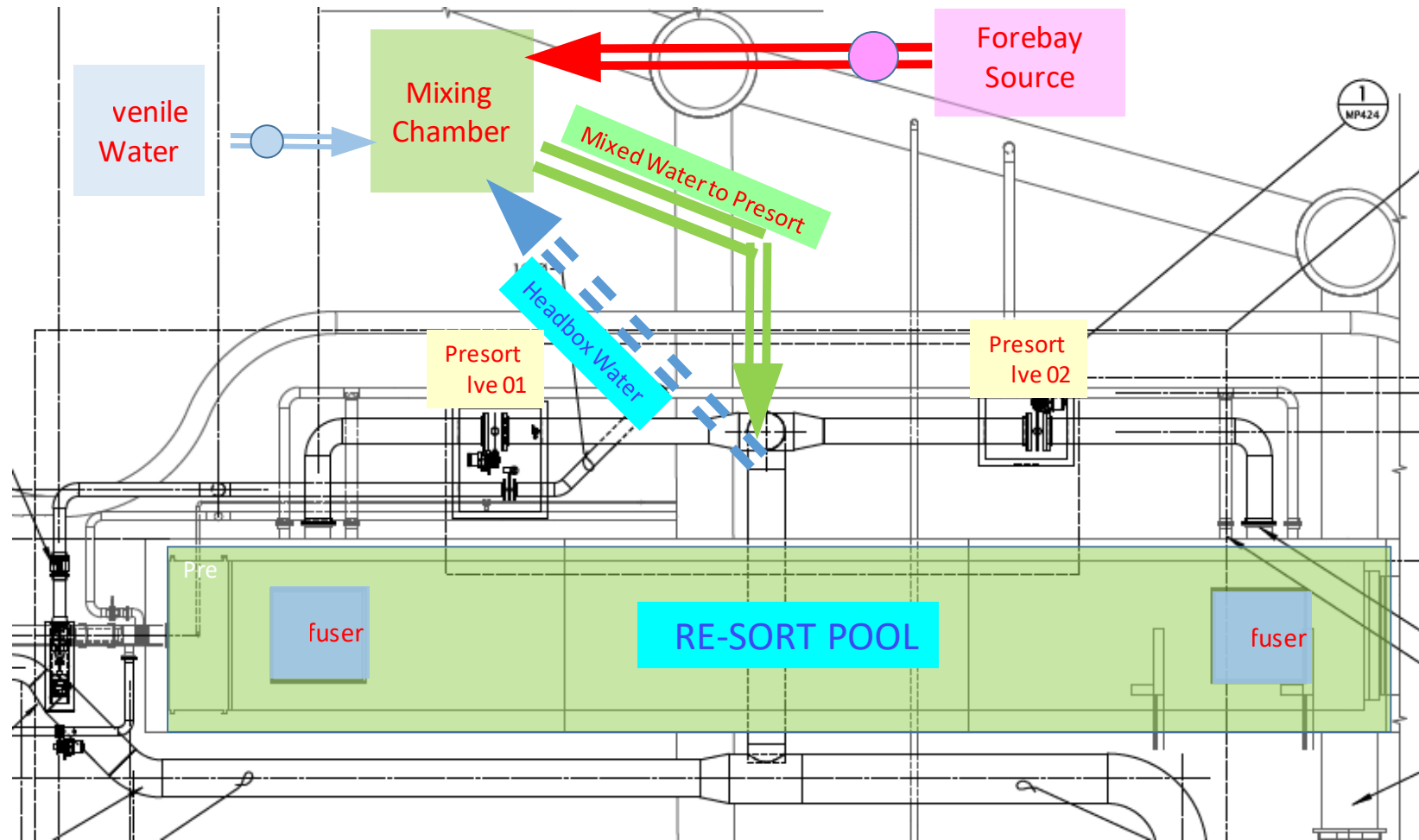


## 4. CONCEPTUAL MIXING CHAMBER FOR WARM WATER

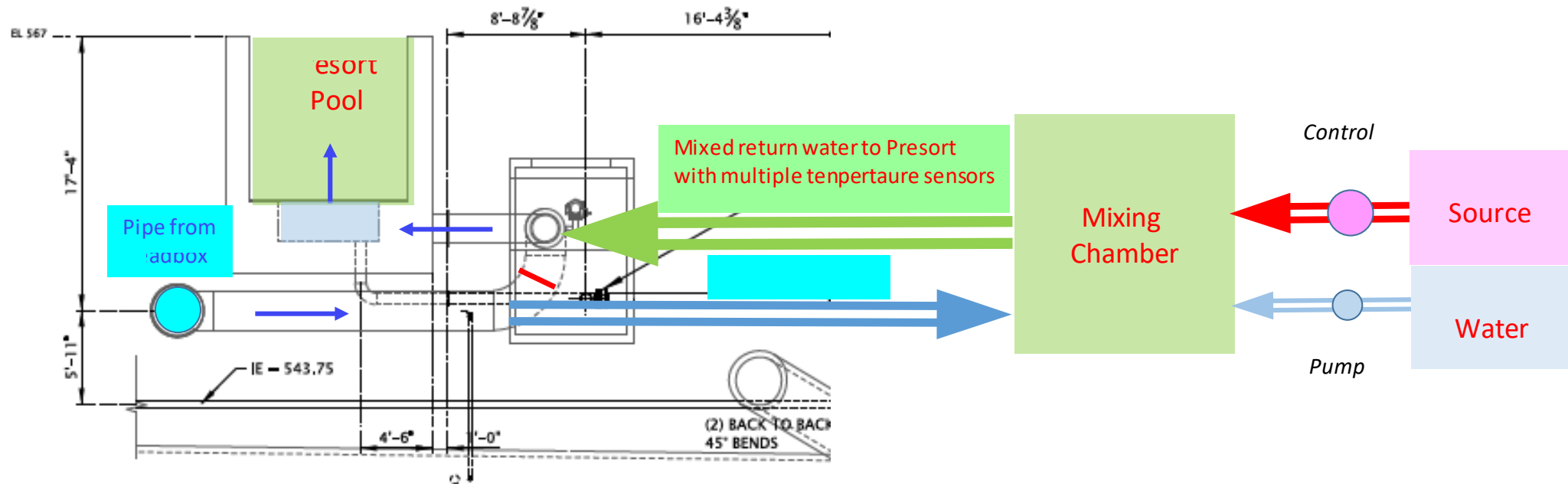
1. For application of gravity source alternatives (& potential scented water) to Presort Pool
  1. Pulls water from headbox into chamber
  2. Warm water piped down to north side of Presort sent into chamber
  3. Return piping exits chamber at target temperature to connect directly to existing presort piping
  4. Redundant temperature sensors in return piping
  5. Control valve adjusts flow of warm water to provide target temperature



# PLAN SCHEMATIC OF MIXING CHAMBER AND ADDITION TO PRESORT POOL



# ELEVATION SCHEMATIC OF MIXING CHAMBER AND RETURN TO PRESORT POOL



# SCHEDULE

WFFDG Presentation	Mar 5, 2019
Develop and Screen Alternatives	<i>Mar 31 2019</i>
Draft assessment report complete	21 Jun 2019
Final assessment report complete	30 Sep 2019

*Added analyses of operational alternative may extend scope*

Begin DDR after assessment report



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# QUESTIONS

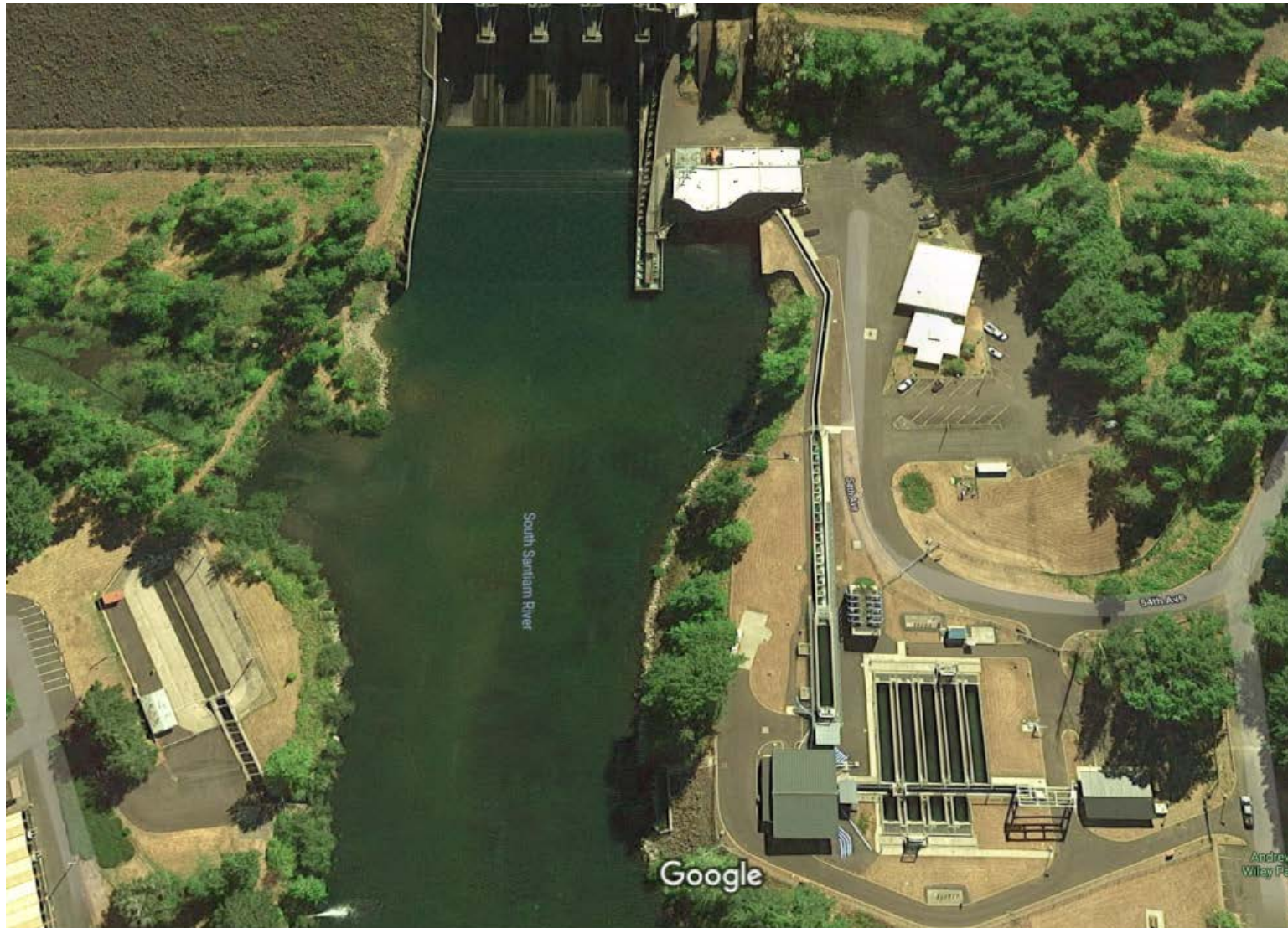


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# QUESTIONS



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