

FOSTER FISH LADDER ASSESSMENT REPORT (FFLAR) *WFFDWG Presentation*

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02 JULY 2019



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AGENDA

Project Overview

- Upgraded Fishladder
- Existing Intakes

Problem Overview

- Temperature
- Olfactory or scents

Modeling of Green Peter outflows

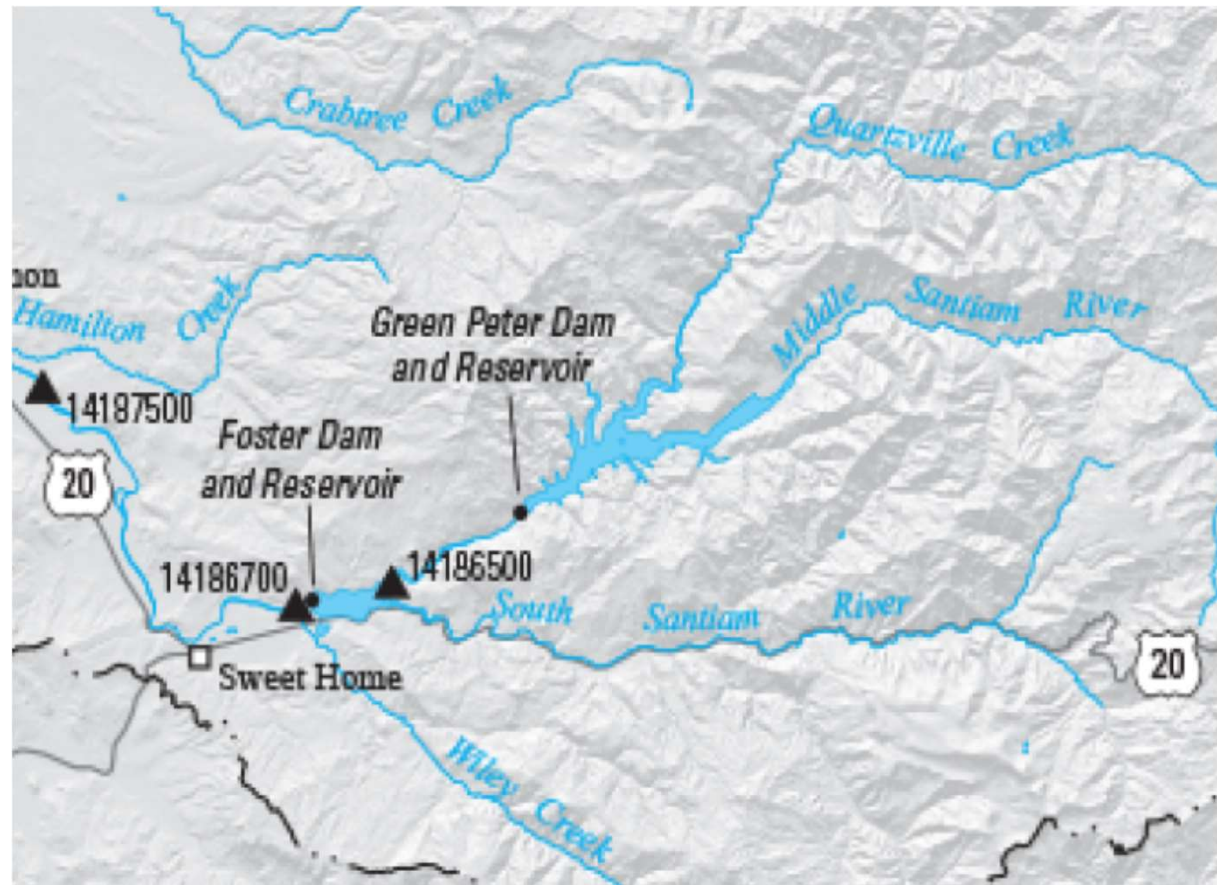
Target locations for warm water

- Pre-sort Pool
- AWS pump sump
- Truck fill

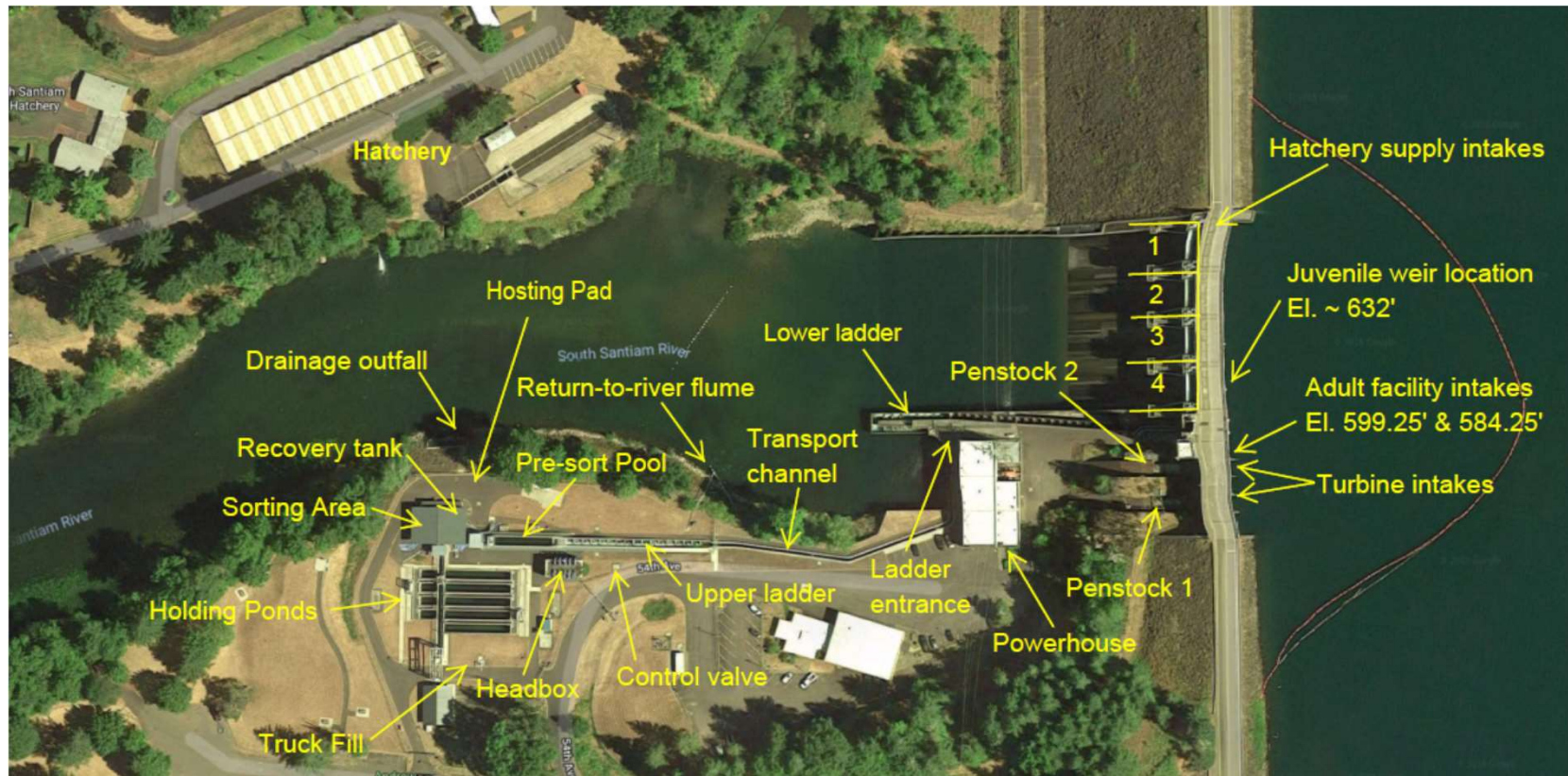
Potential source locations

Optional juvenile holding pond

FFLAR Schedule



FOSTER DAM AND ADULT FISH COLLECTION FACILITY



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.

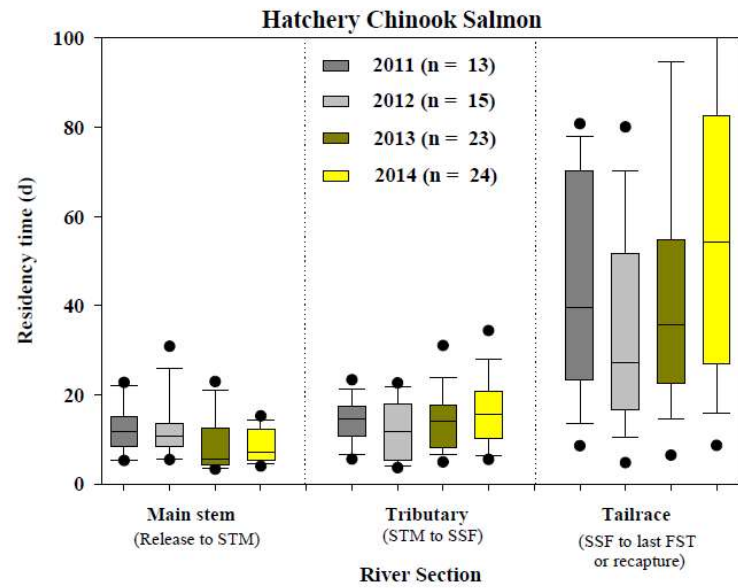
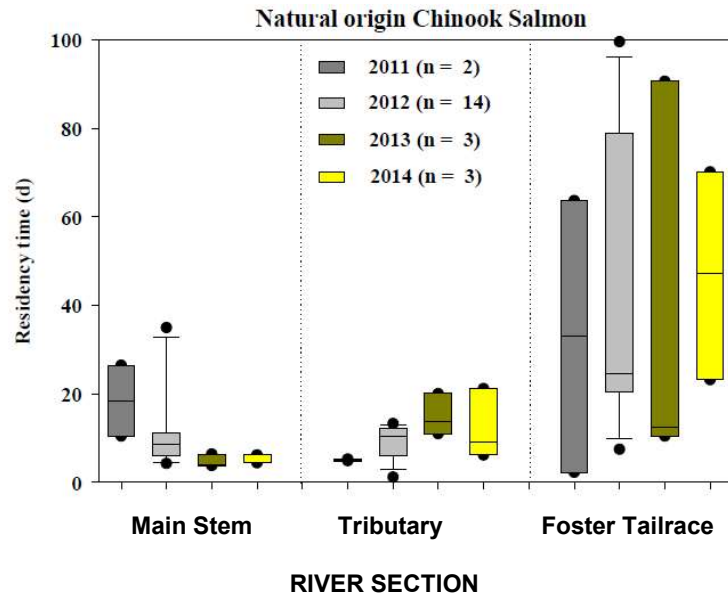
Olfactory Cues

- South Santiam River forms the upper water layer where fish are homing to
- Middle Santiam (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



Jepson et al. 2015



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FOSTER ADULT FISH FACILITY WATER SUPPLY INTAKES

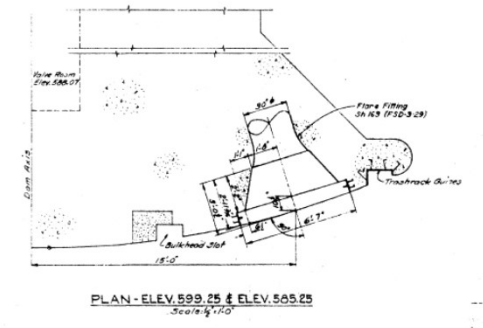
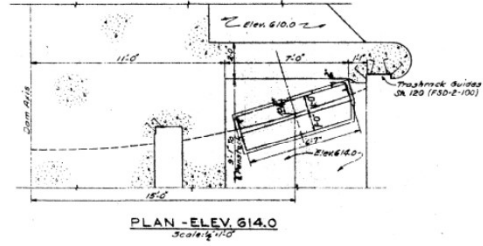
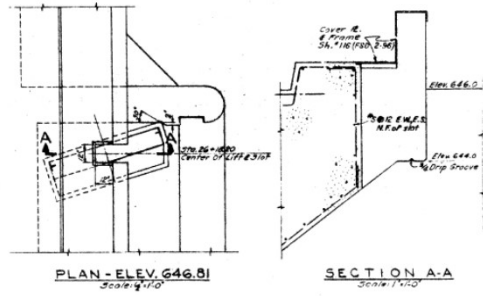
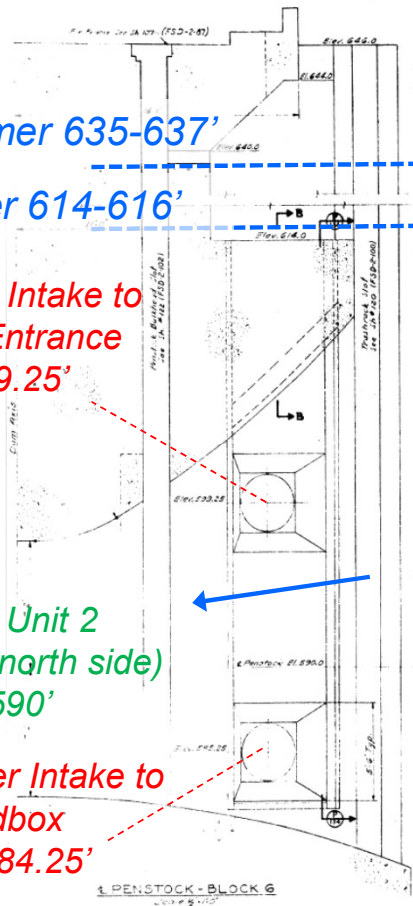
Summer 635-637'

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

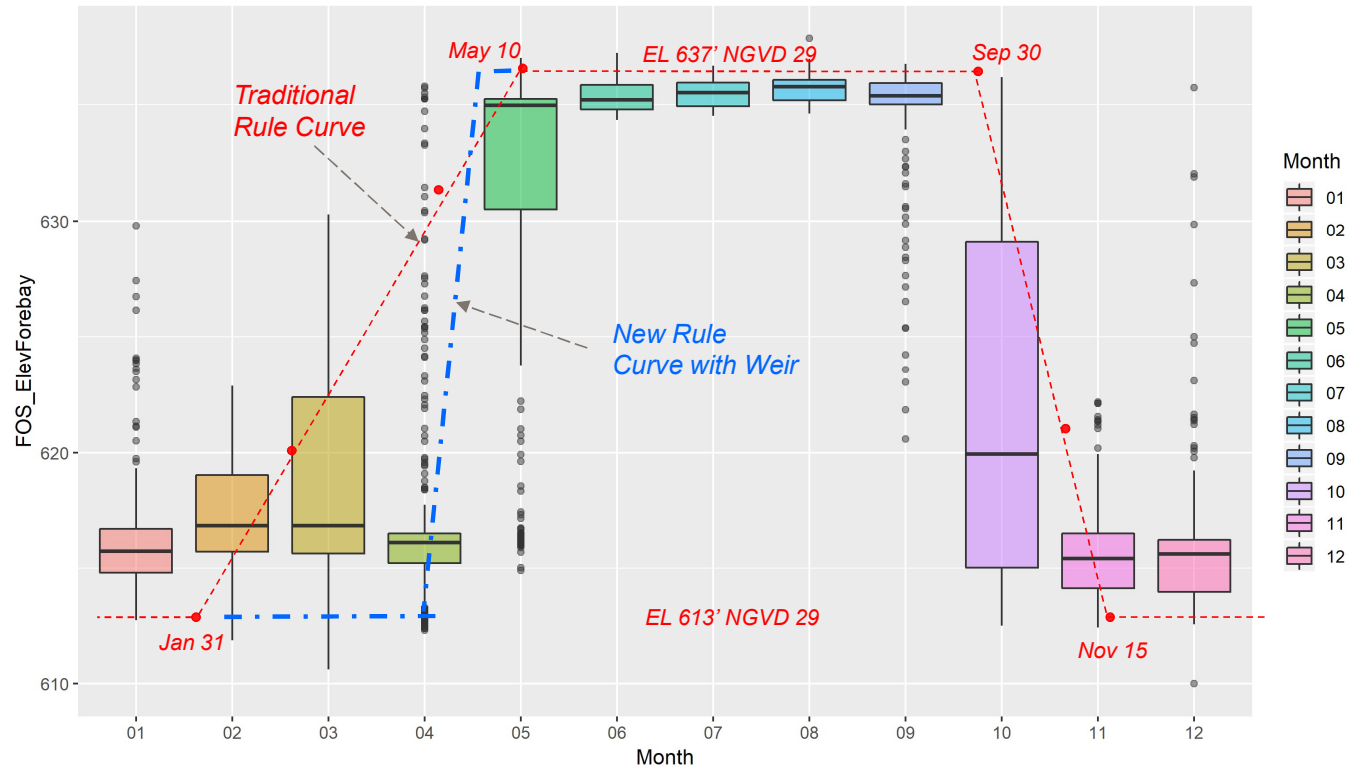


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FOSTER MONTHLY RESERVOIR ELEVATIONS (NGVD 29)

FOS Lake Level By Month 2010-2018

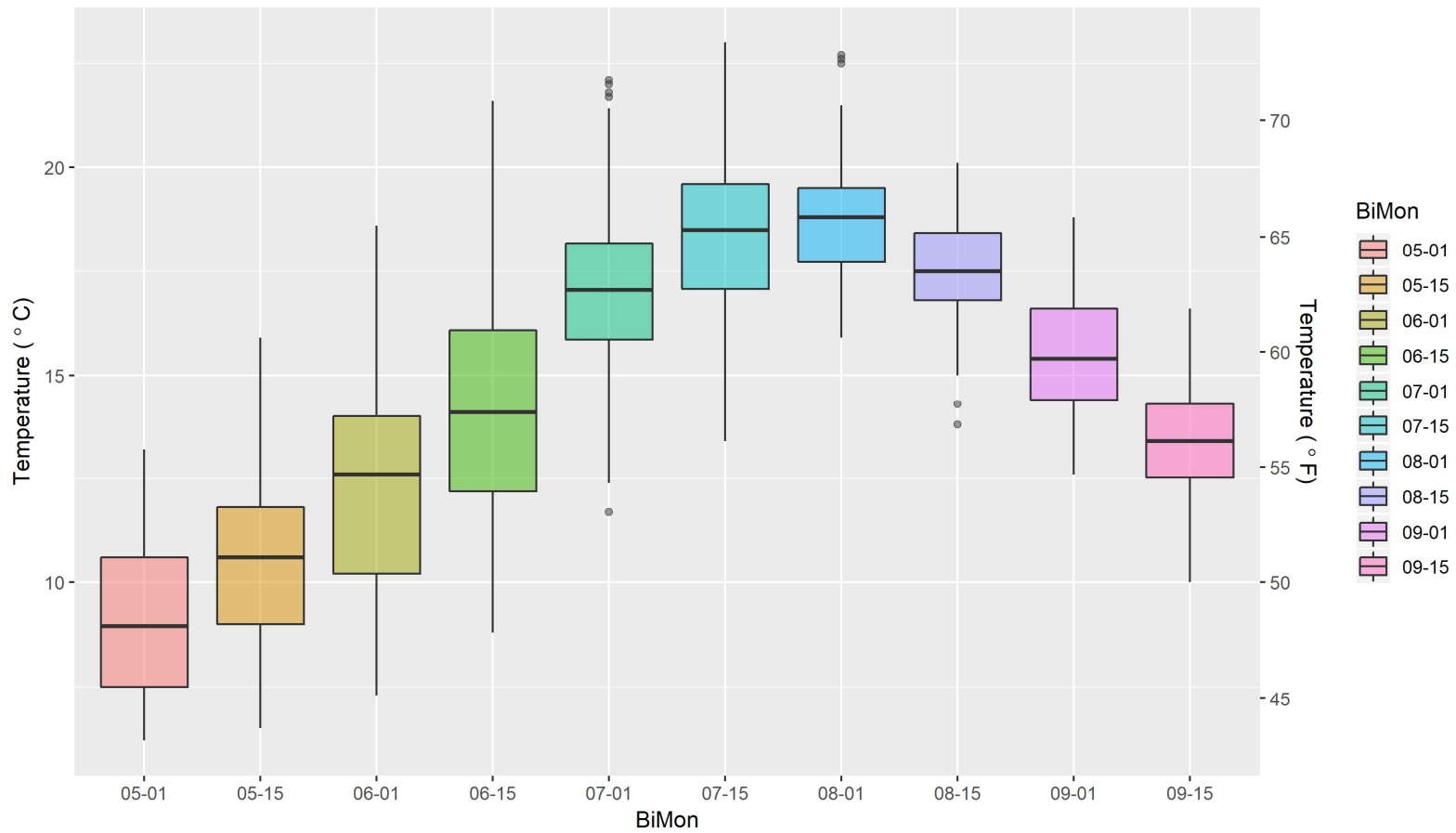


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S SANTIAM TEMPERATURES ABOVE FOSTER

S Santiam blw Cascadia Temperature 2008-2019



S SANTIAM TEMPERATURES ABOVE FOSTER

Tentative Target

	Ssantiam Target [Deg F]	Explanation (percentiles based on USGS South Santiam blw Cascadia)
1-May	51	75 th %
15-May	53	75 th %
1-Jun	55	Average of May 15 and Jun 15 Targets
15-Jun	57	50 th %
1-Jul	60	Maximum for Ladder System
15-Jul	60	Maximum for Ladder System
1-Aug	60	Maximum for Ladder System
15-Aug	60	Maximum for Ladder System
1-Sep	58	25 th %
15-Sep	55	25 th %



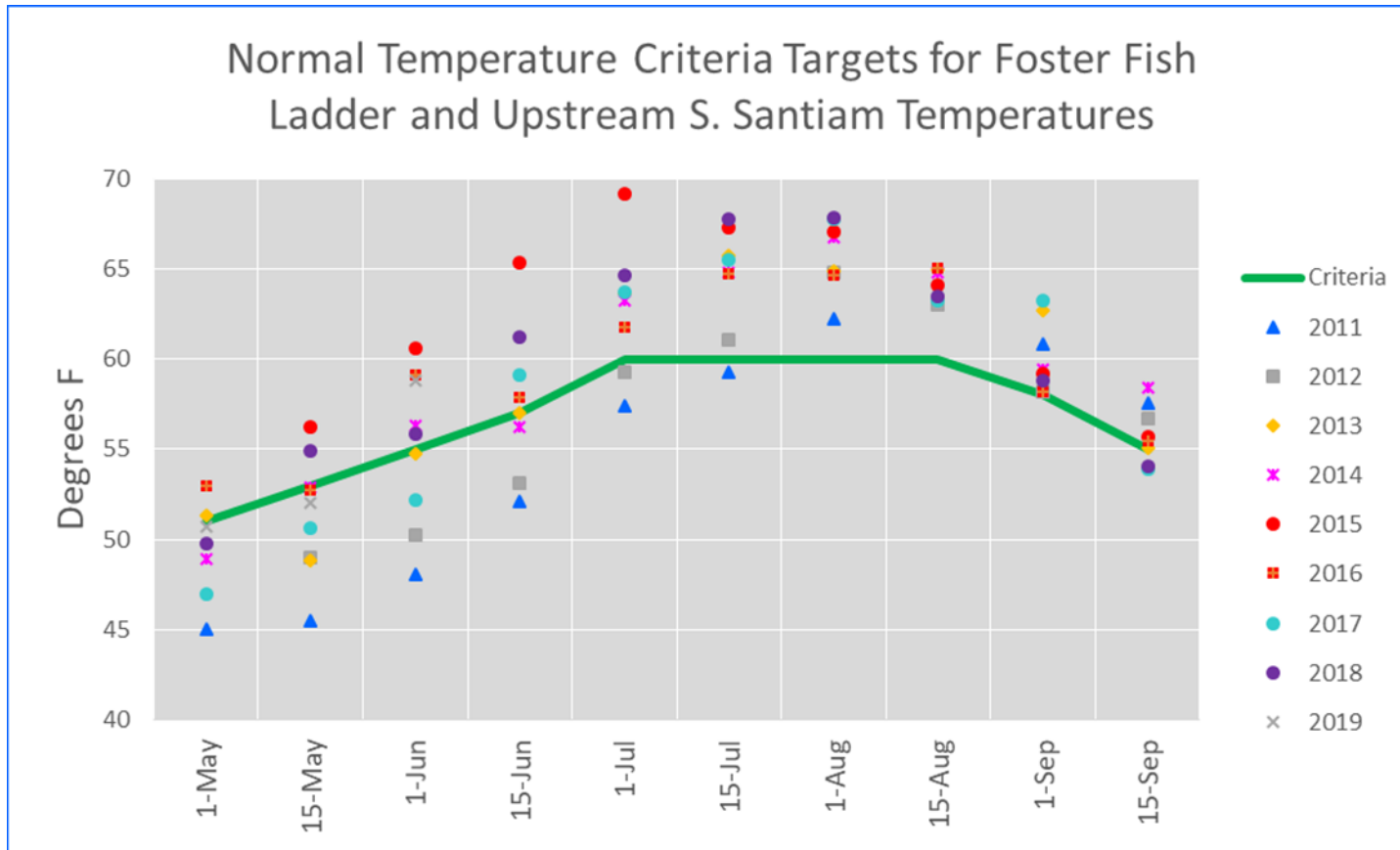
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DRAFT; PRE-DECISIONAL



TEMPERATURE TARGETS FOR THE UPSTREAM PASSAGE



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



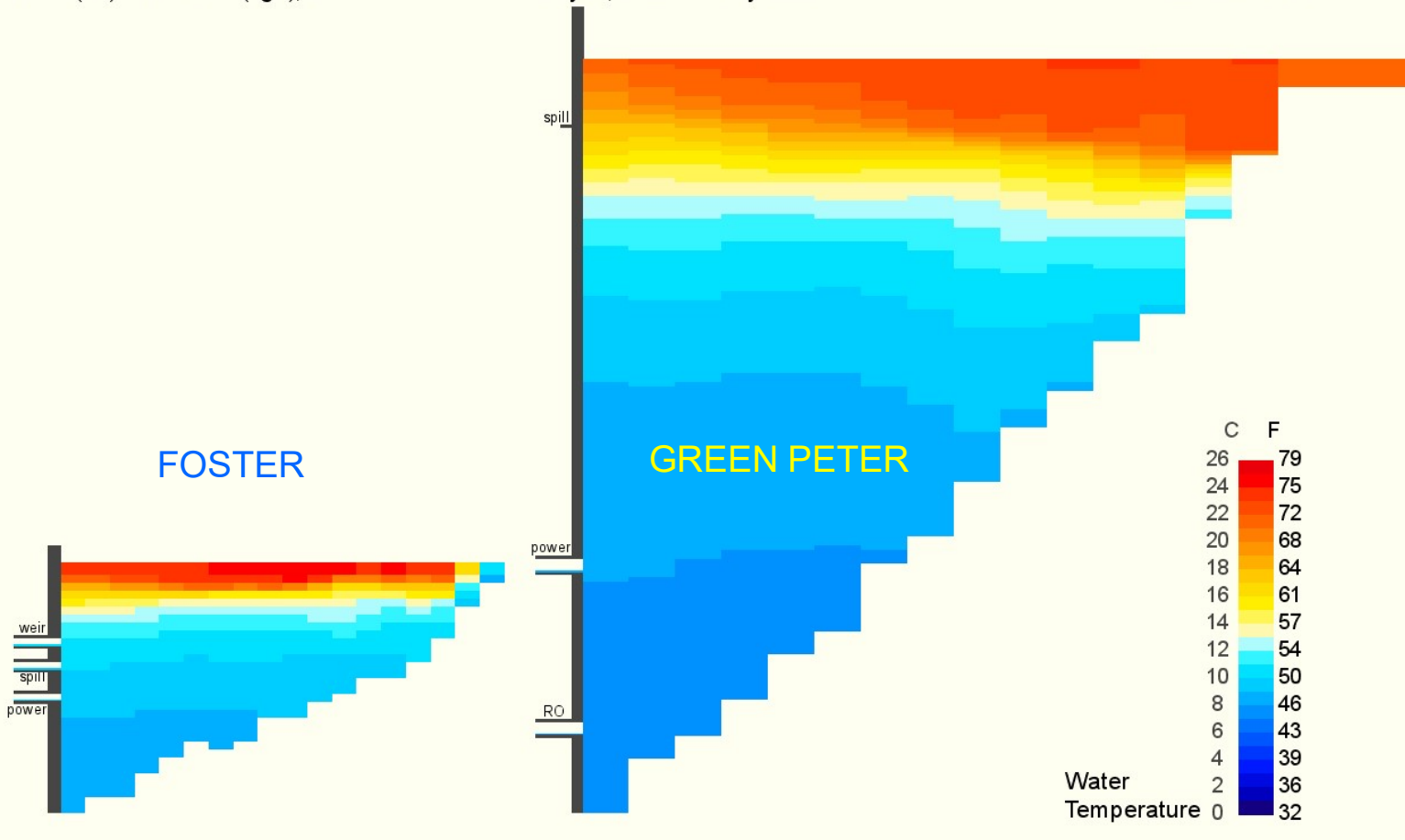
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Foster (left) Green Peter (right), OR

July 14, 2002 day 195.6

USGS - DRAFT

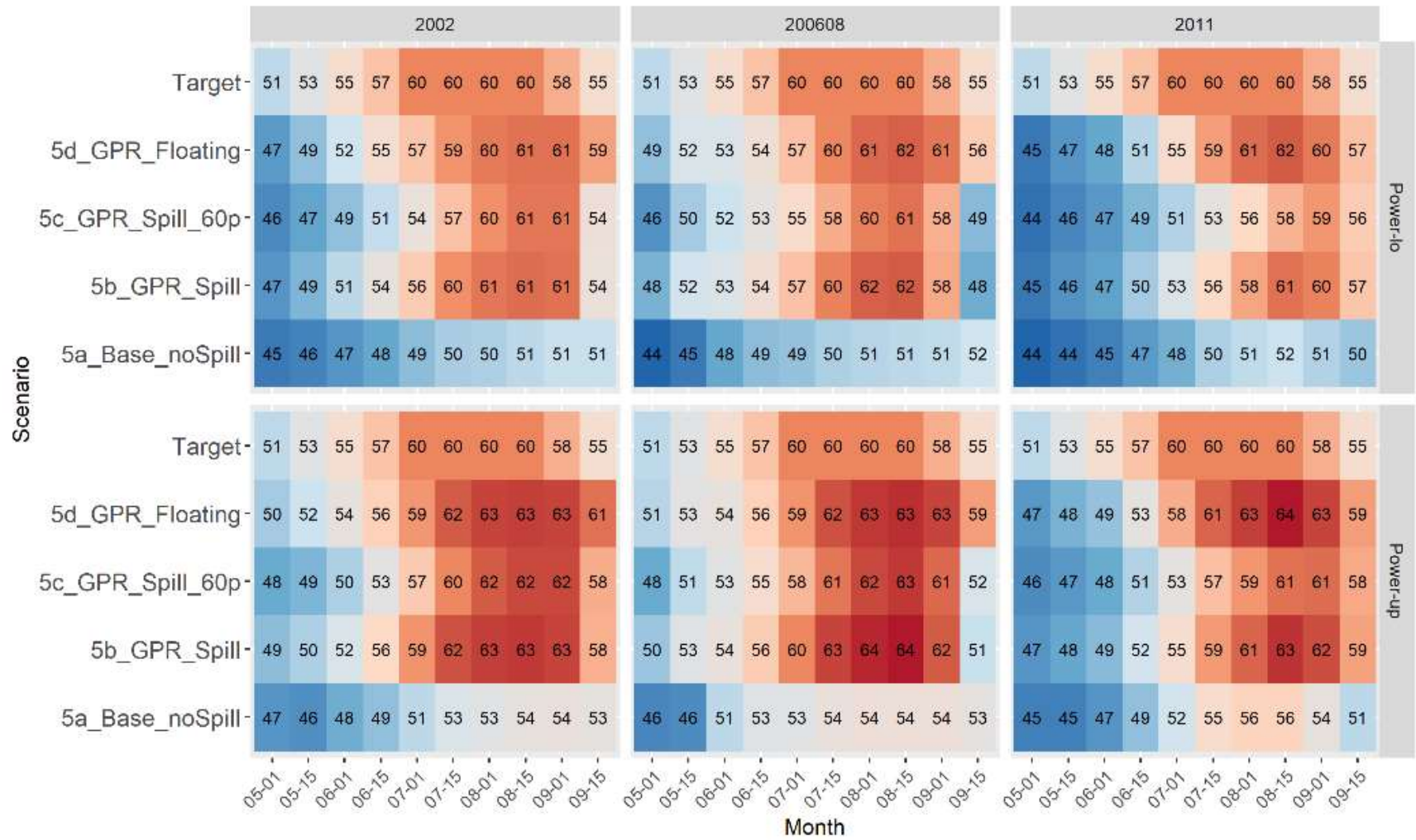


Preliminary results, subject to revision. For USGS, USACE, UI only.

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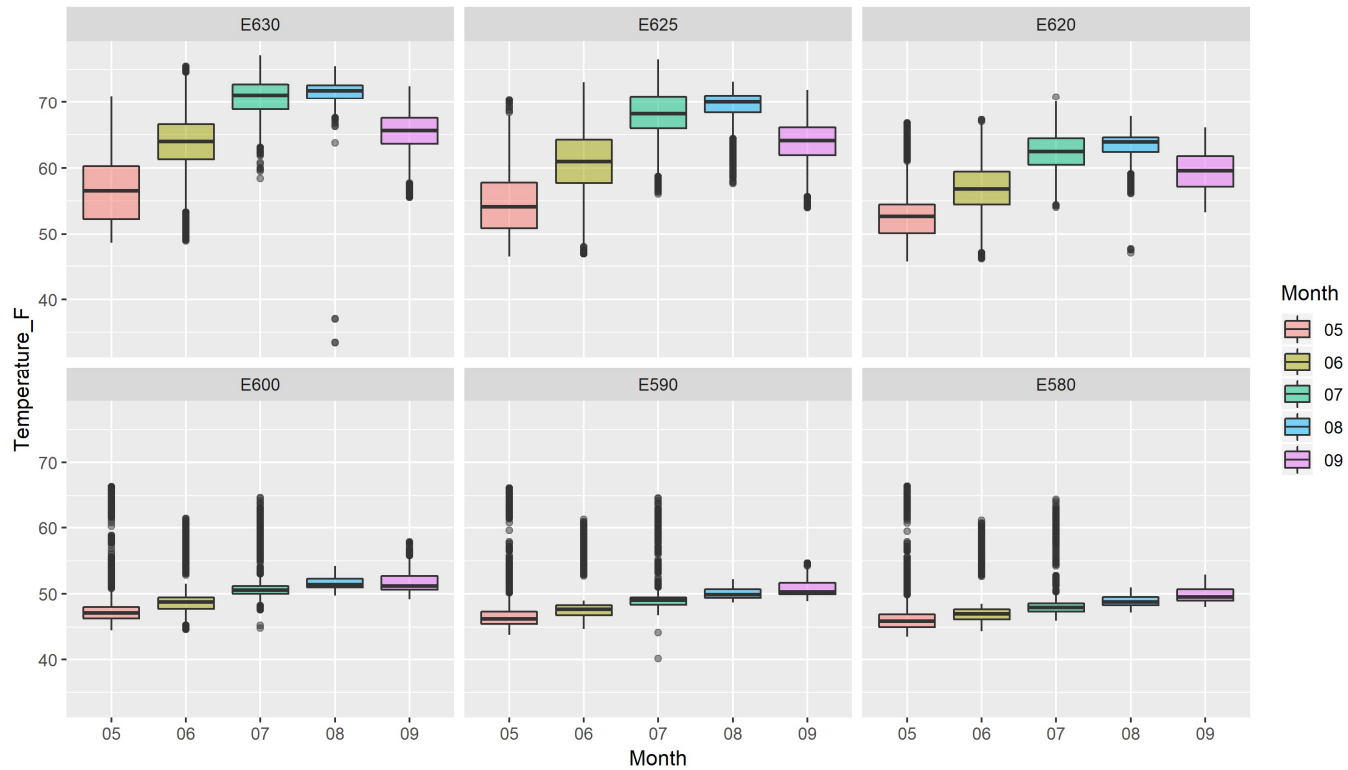
USGS MODELING OF GPR OPERATIONS



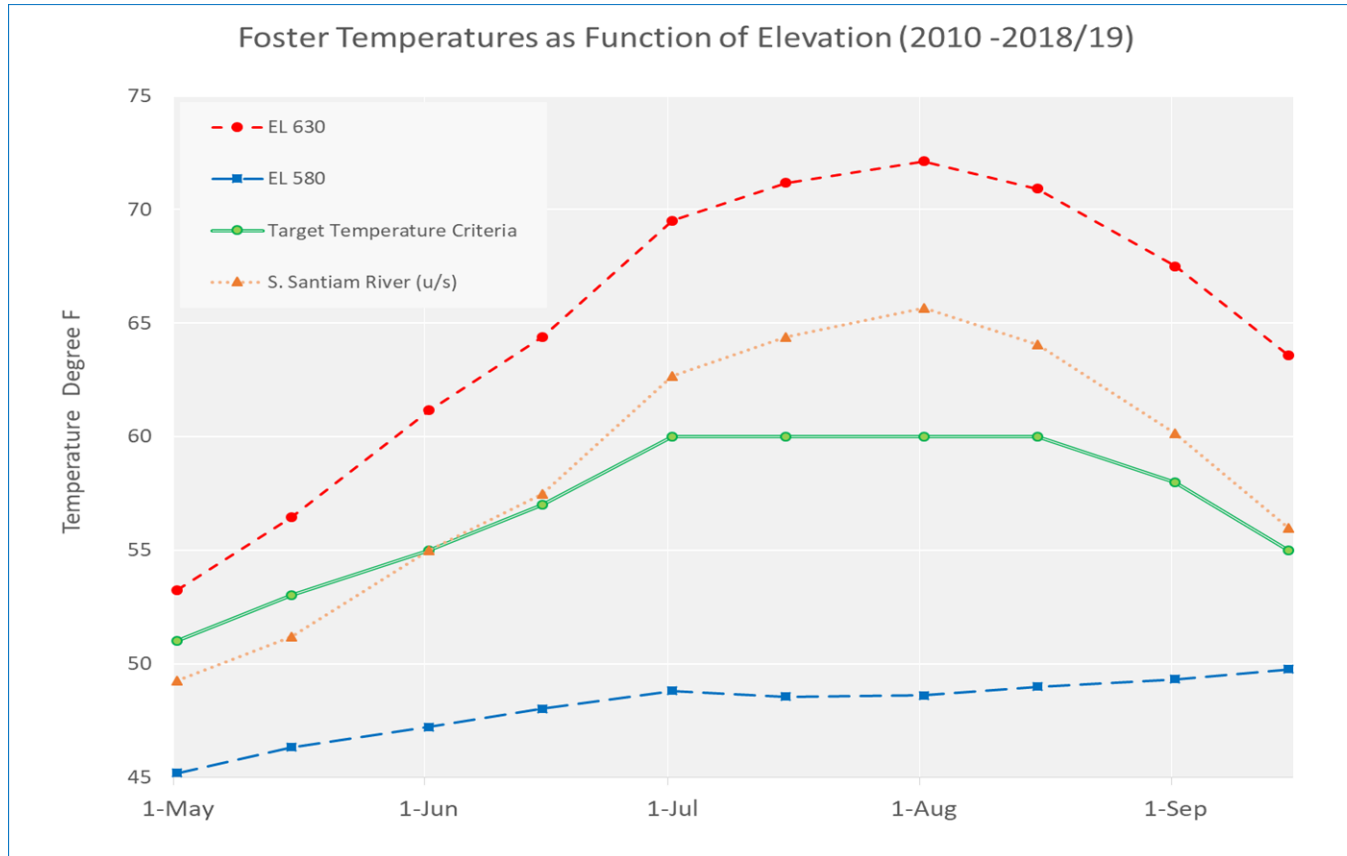
DRAFT; PRE-DECISIONAL

FOSTER RESERVOIR TEMPERATURES AS FUNCTION OF ELEVATION

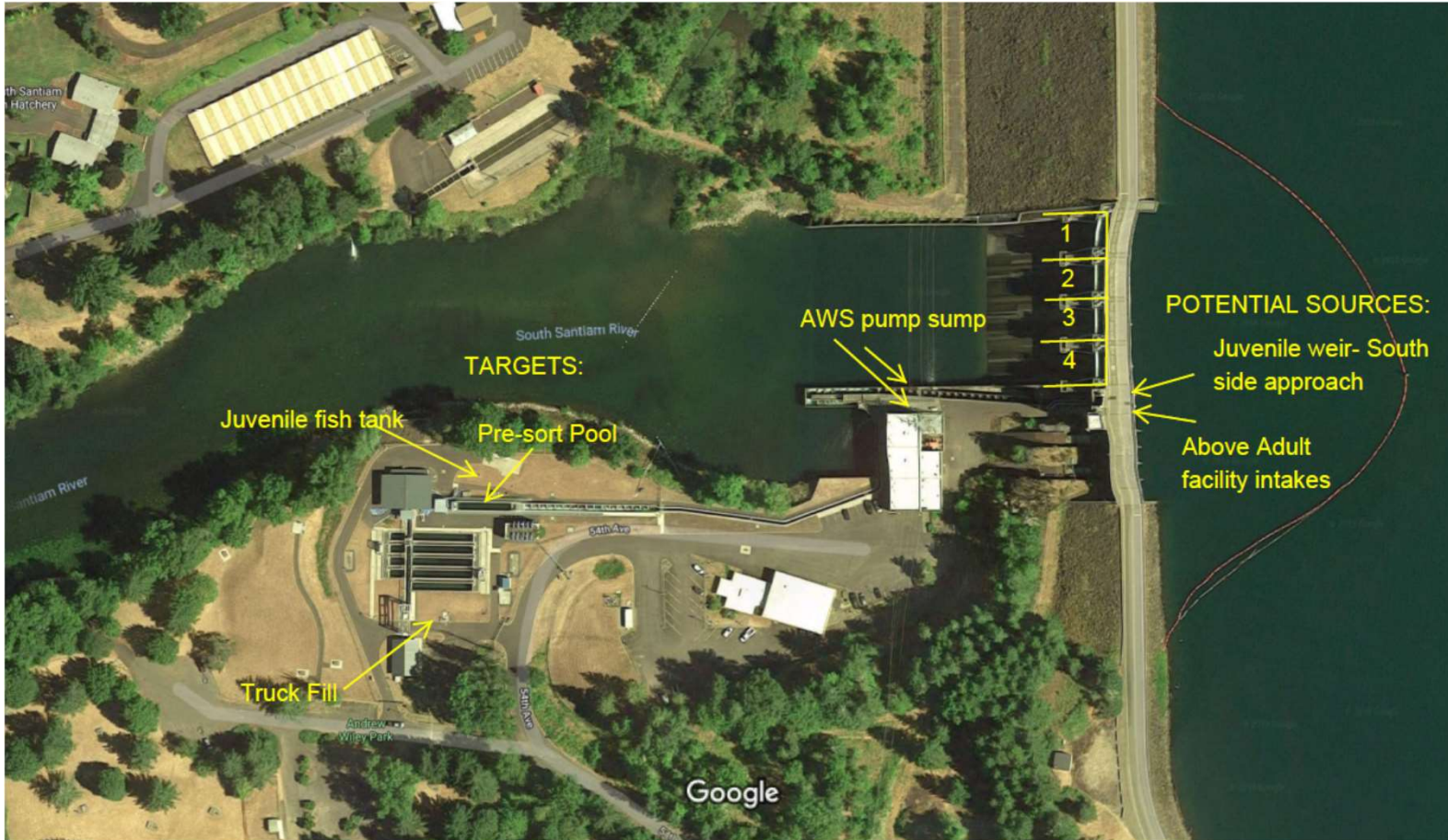
FOS Temperature at Fixed Elevations 2010-2018



FOSTER TEMPERATURES AT SOURCE LOCATIONS & S. SANTIAM RIVER



FOSTER POTENTIAL SOURCE & TARGET LOCATIONS



Imagery ©2019 Google, Map data ©2019 Google 100 ft

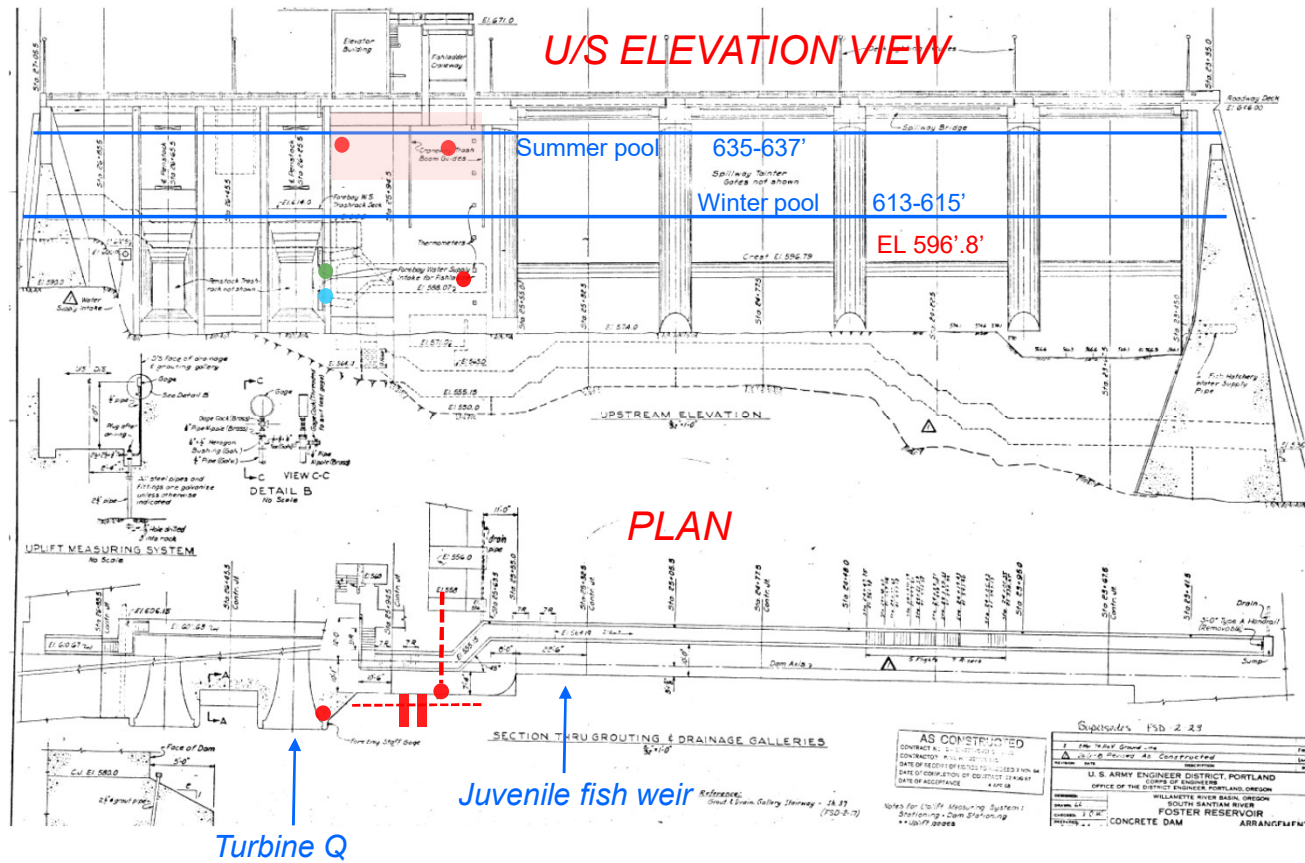


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POTENTIAL SOURCE LOCATIONS



PRELIMINARY FOREBAY SCREEN & PIPE SIZES

- Rectangular Flat Screen
 - Maximum feasible size = 60' long x 12' high
 - Passive Criteria ($V_{scr} = 0.2$ ft/s)
 - Maximum flow = 144 cfs
 - Water Jet Screen Cleaner
 - Pipe size through dam: 3 to 3.5 feet diameter (20 - 25 ft/s)
- Torpedo Screens (Un-sized at present)
 - Same criteria, possibility of higher flow capacity
 - Pros:
 - Built in brush cleaner
 - Drawbacks
 - may be more susceptible to flood damage
 - Extra cantilever weight during low pool periods



DECISION VARIABLES IN TEMPERATURE ANALYSES

SELECT DECISION VARIABLES												
		Check for limit on Forebay Source (ΣQ_{FB}) = 144 cfs limit on FB Source Flow (ΣQ_{fb})										
DT =	1	for added degrees F to Tt for year to year criteria										
		NORMAL (FIXED)										
		1-May	15-May	1-Jun	15-Jun	1-Jul	15-Jul	1-Aug	15-Aug	1-Sep	15-Sep	
F1 =	1	Target T	51	53	55	57	60	60	60	60	58	55
Select F1 = 1 for Fixed Tt		Presort	51	53	55	57	60	60	60	60	58	55
F2 =	1	delta (when F2 = 1)	2	2.5	3	4	5	5	5	5	4	3
Select F2 = 1 for $\Delta = 0$		Delta (Δ) applied	0	0	0	0	0	0	0	0	0	0
		AWS pumps	51	53	55	57	60	60	60	60	58	55
		AWS se	51	53	55	57	60	60	60	60	58	55

SELECT DECISION VARIABLES												
		Check for limit on Forebay Source (ΣQ_{FB}) = 144 cfs limit on FB Source Flow (ΣQ_{fb})										
DT =	1	for added degrees F to Tt for year to year criteria										
		NORMAL (FIXED)										
		1-May	15-May	1-Jun	15-Jun	1-Jul	15-Jul	1-Aug	15-Aug	1-Sep	15-Sep	
F1 =	2	Target T	51	53	55	57	60	60	60	60	58	55
Select F1 = 1 for Fixed Tt		Presort	51	53	55	57	60	60	60	60	58	55
F2 =	2	delta (when F2 = 1)	2	2.5	3	4	5	5	5	5	4	3
Select F2 = 1 for $\Delta = 0$		Delta (Δ) applied	2	2.5	3	4	5	5	5	5	4	3
		AWS pumps	49	50.5	52	53	55	55	55	55	54	52
		AWS se	49	50.5	52	53	55	55	55	55	54	52

SAMPLE ANALYSES WITH F1 =1 (FIXED DT) , F2 =1 ($\Delta = 0$)

		1-May	15-May	1-Jun	15-Jun	1-Jul	15-Jul	1-Aug	15-Aug	1-Sep	15-Sep
	2011										
	2011 Total Flow Requirements										
	Qps	30	30	30	30	30	30	30	30	30	30
	Qawsp	167	171	162	122	90	86	86	90	113	122
	QAWSse	58	58	58	43	29	27	27	29	39	43
	ΣQ	255	259	250	194	149	143	143	149	181	194
	2011 Input Temperatures										
s. Santiam above FD (Tss)	above FD (Tss)	45	46	48	52	57	59	62	63	61	58
(630+580)	below FD	45	45	46	49	52	53	55	56	55	53
	2011 Target Temperatures										
	Target T (Tt)	51.0	53.0	55.0	57.0	60.0	60.0	60.0	60.0	58.0	55.0
	Presort (TTps)	51.0	53.0	55.0	57.0	60.0	60.0	60.0	60.0	58.0	55.0
	delta (Δ)	0	0	0	0	0	0	0	0	0	0
	AWS pumps (TTaws)	51	53	55	57	60	60	60	60	58	55
	AWS se (Ttse)	51	53	55	57	60	60	60	60	58	55
	Composite Tt	51.0	53	55	57	60	60	60	60	58	55
	2011 Ladder Source Intake Temperature										
	EL 630	50.4	51.0	52.2	60.9	65.9	68.4	71.6	71.7	69.6	66.3
	EL 580	44.3	44.6	44.8	45.7	46.6	47.2	47.7	48.1	48.5	48.6
	2011 Forebay Source Intake Flow Requirements (No limit)										
	QFBps	30	30	30	22	21	18	15	15	14	11
	QFBawsp	167	171	162	90	62	52	44	45	51	44
	QFBawse	58	58	58	32	20	16	14	15	18	15
	ΣQ FB	255	259	250	145	104	86	73	75	82	70
	2011 Target Location Output Temperatures (No Limit to FB source)										
	TTps	50.4	51.0	52.2	57.0	60.0	60.0	60.0	60.0	58.0	55.0
	TTawsp	50.4	51.0	52.2	57.0	60.0	60.0	60.0	60.0	58.0	55.0
	TTawsse	50.4	51.0	52.2	57.0	60.0	60.0	60.0	60.0	58.0	55.0
	Ave Tout (Qout)	50.4	51.0	52.2	57.0	60.0	60.0	60.0	60.0	58.0	55.0
	delta (Δ)	-0.6	-2.0	-2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0



SAMPLE ANALYSES WITH F1 = 2 (ADJUSTED DT) , F2 =1 ($\Delta > 0$)

		1-May	15-May	1-Jun	15-Jun	1-Jul	15-Jul	1-Aug	15-Aug	1-Sep	15-Sep
2011	2011 Total Flow Requirements										
	Qps	30	30	30	30	30	30	30	30	30	30
	Qawsp	167	171	162	122	90	86	86	90	113	122
	QAWSse	58	58	58	43	29	27	27	29	39	43
	ΣQ	255	259	250	194	149	143	143	149	181	194
	2011 Input Temperatures										
S. Santiam above FD (Tss)	above FD (Tss)	45	46	48	52	57	59	62	63	61	58
(630+580)	below FD	45	45	46	49	52	53	55	56	55	53
	2011 Target Temperatures										
	Target T (Tt)	46.0	46.5	49.1	53.1	58.4	60.0	60.0	60.0	58.0	55.0
	Presort (TTps)	46.0	46.5	49.1	53.1	58.4	60.0	60.0	60.0	58.0	55.0
	delta (Δ)	2	3	3	4	5	5	5	5	4	3
	AWS pumps (TTaws)	44	44	46	49	53	55	55	55	54	52
	AWS se (Ttse)	44	44	46	49	53	55	55	55	54	52
	Composite Tt	44.3	44	46	50	54	56	56	56	55	52
	2011 Ladder Source Intake Temperature										
	EL 630	50.4	51.0	52.2	60.9	65.9	68.4	71.6	71.7	69.6	66.3
	EL 580	44.3	44.6	44.8	45.7	46.6	47.2	47.7	48.1	48.5	48.6
	2011 Forebay Source Intake Flow Requirements (No limit)										
	QFBps	9	9	17	15	18	18	15	15	14	11
	QFBawsp	0	0	28	27	32	31	26	26	29	23
	QFBawse	0	0	10	10	10	10	8	9	10	8
	ΣQ FB	9	9	55	51	60	60	50	50	53	42
	2011 Target Location Output Temperatures (No Limit to FB source)										
	TTps	46.0	46.5	49.1	53.1	58.4	60.0	60.0	60.0	58.0	55.0
	TTawsp	44.3	44.6	46.1	49.1	53.4	55.0	55.0	55.0	54.0	52.0
	TTawsse	44.3	44.6	46.1	49.1	53.4	55.0	55.0	55.0	54.0	52.0
	Ave Tout (Qout)	44.5	44.8	46.5	49.7	54.4	56.1	56.1	56.0	54.7	52.5
	delta (Δ)	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



PRELIMINARY RESULTS WITH MAX FOREBAY Q = 144 CFS

Some Preliminary Results based on a Forebay source limit of 144 cfs (2010 - 2018, 19):

- *Case 1 is the most conservative by requiring the FB source to meet fixed criteria at all times and no Delta (Δ) applied to the AWS sump targets.*
- *Case 2 allows the adjustment to S. Santiam River conditions for each month, but still no Δ applied to the AWS sump targets.*
- *Case 3 allows the adjustment to S. Santiam River conditions for each month, AND applies the delta Δ to the AWS sump targets.*

Case 1. All Fixed Criteria and 0 Delta (Δ) applied to AWS sumps with Deviance Tolerance of 1° F											
F1 =	1	Fixed Criteria Applied at All Times									
DT (°F) =	1	Degrees F if F1 \neq 1									
F2 =	1	Zero Δ Reduction for AWS sumps									
	Delta (Δ) applied	0	0	0	0	0	0	0	0	0	0
		1-May	15-May	1-Jun	15-Jun	1-Jul	15-Jul	1-Aug	15-Aug	1-Sep	15-Sep
	Count	9	9	10	9	9	9	9	9	9	9
	Qfb \leq 144 cfs?	3	5	6	7	9	9	9	9	9	9
	% Made with 144 cfs	33%	56%	60%	78%	100%	100%	100%	100%	100%	100%
Deviance Tolerance (TOL)											
1	Tt - Tout < TOL?	3	6	8	9	9	9	9	9	9	9
	% Tout within TOL	33%	67%	80%	100%	100%	100%	100%	100%	100%	100%

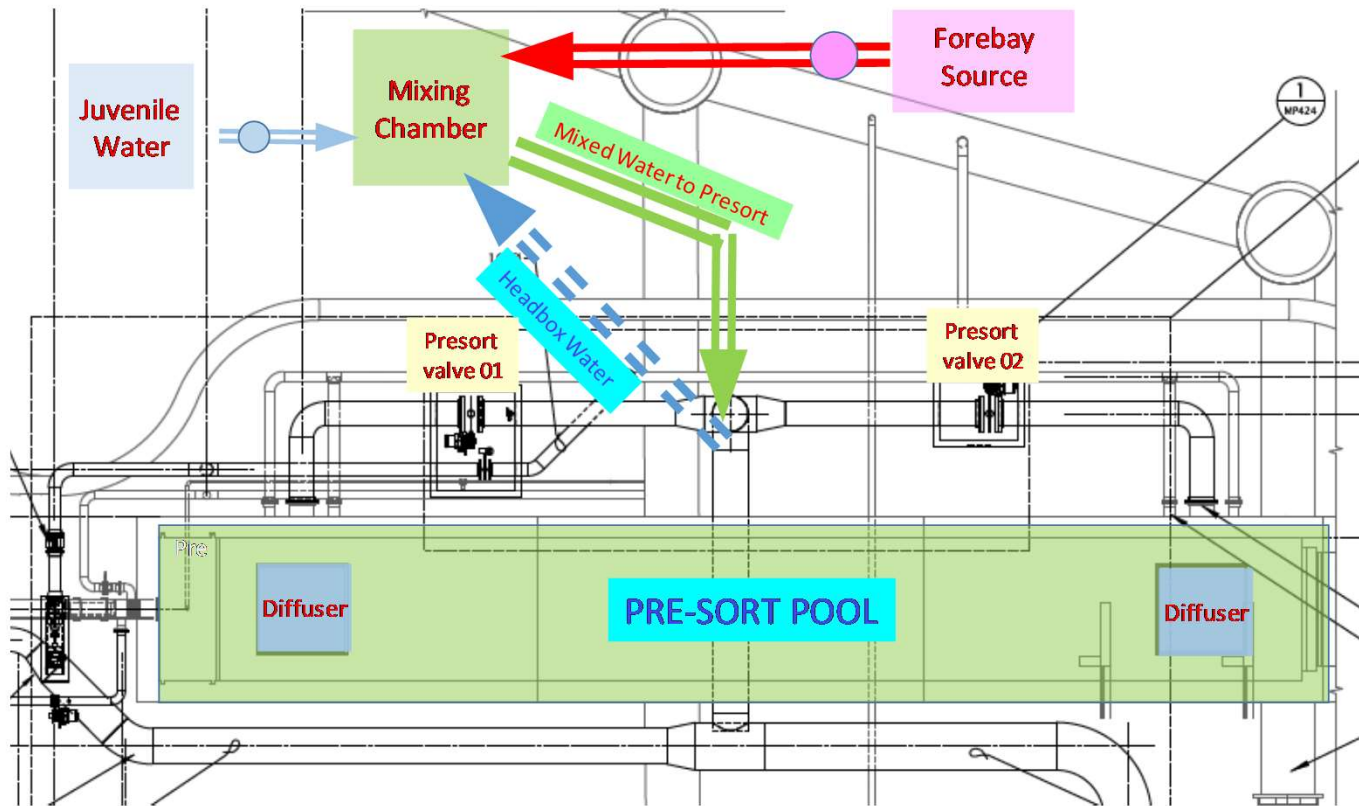
Case 3. Criteria adjusted to S. Santiam River and Delta (Δ) Reductions applied to AWS sumps with Deviance Tolerance of 1° F											
F1 =	2	Criteria = Min (South Santiam + DT, Fixed Criteria)									
DT (°F) =	1	Degrees F if F1 \neq 1									
F2 =	2	Δ subtracted from Target Temperatures for AWS Sumps									
	Delta (Δ) applied	2	2.5	3	4	5	5	5	5	4	3
		1-May	15-May	1-Jun	15-Jun	1-Jul	15-Jul	1-Aug	15-Aug	1-Sep	15-Sep
	Count	9	9	10	9	9	9	9	9	9	9
	Qfb \leq 144 cfs?	9	8	10	9	9	9	9	9	9	9
	% Made with 144 cfs	100%	89%	100%	100%	100%	100%	100%	100%	100%	100%
Deviance Tolerance (TOL)											
1	Tt - Tout < TOL?	9	9	10	9	9	9	9	9	9	9
	% Tout within TOL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%



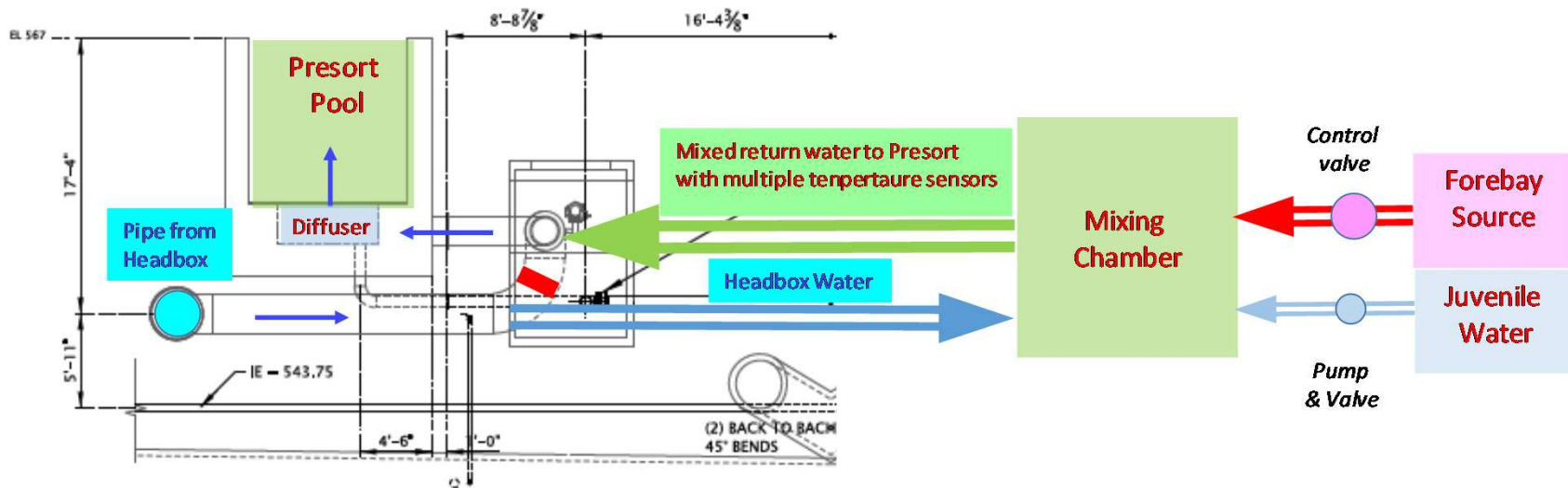
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PLAN SCHEMATIC OF MIXING CHAMBER AND ADDITION TO PRESORT POOL



ELEVATION SCHEMATIC OF MIXING CHAMBER AND RETURN TO PRESORT POOL



SCHEDULE

WFFDG Presentation	Mar 5, 2019
Develop and Screen Alternatives	<i>Mid July 2019</i>
<i>Draft assessment report complete</i>	<i>13 Sept 2019</i>
<i>--- Backcheck Report to WFDWG</i>	<i>08 Nov 2019</i>
<i>Final assessment report complete</i>	<i>20 Dec 2019</i>
Begin DDR after assessment report	



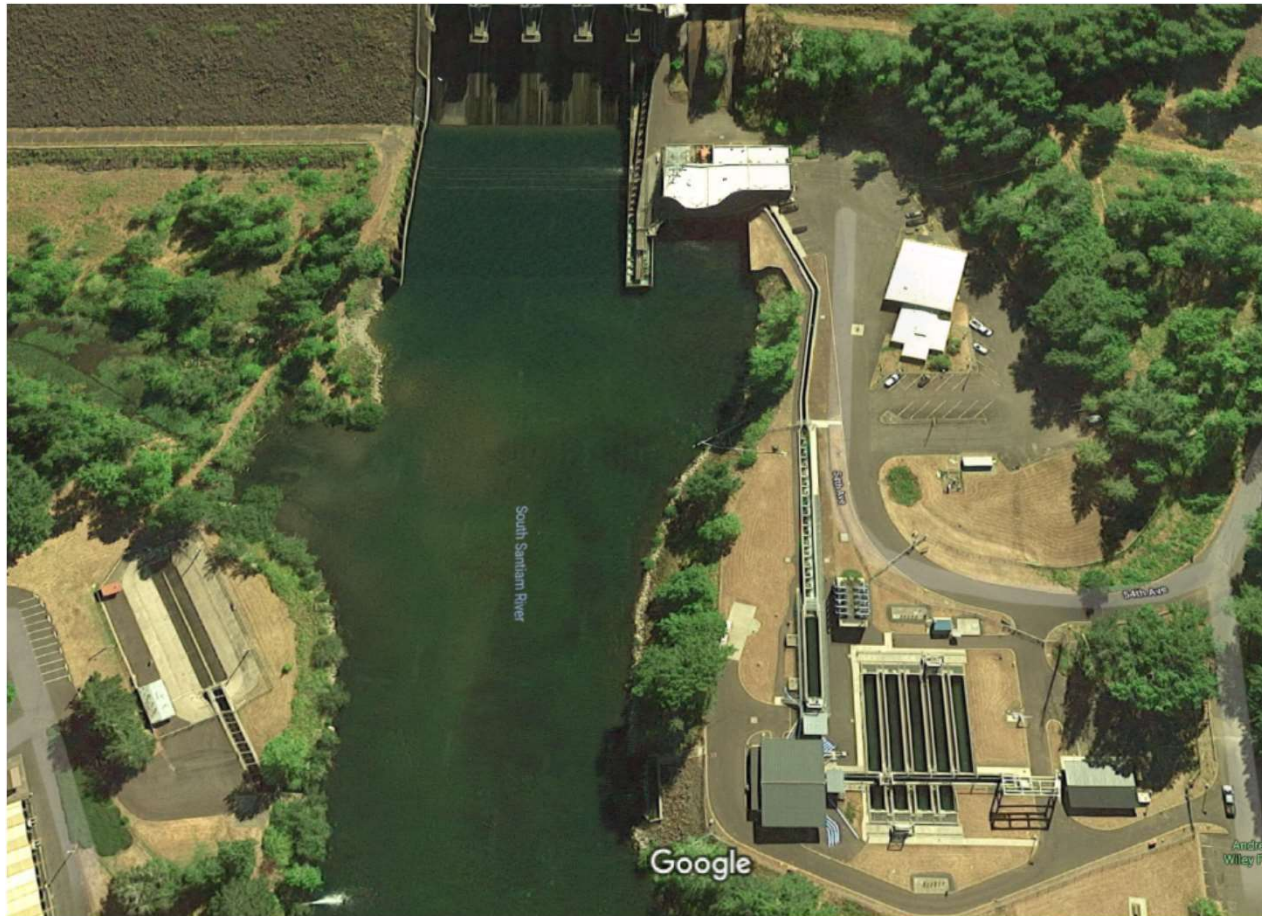
QUESTIONS



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QUESTIONS



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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 H₂O
- 10,000 juveniles (hatchery fish)
- 5-10% of Presort flow = 30 cfs (1.5 – 3 cfs)



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