Development and use of lamprey passage systems (LPS) at Bonneville and John Day dams, 2014

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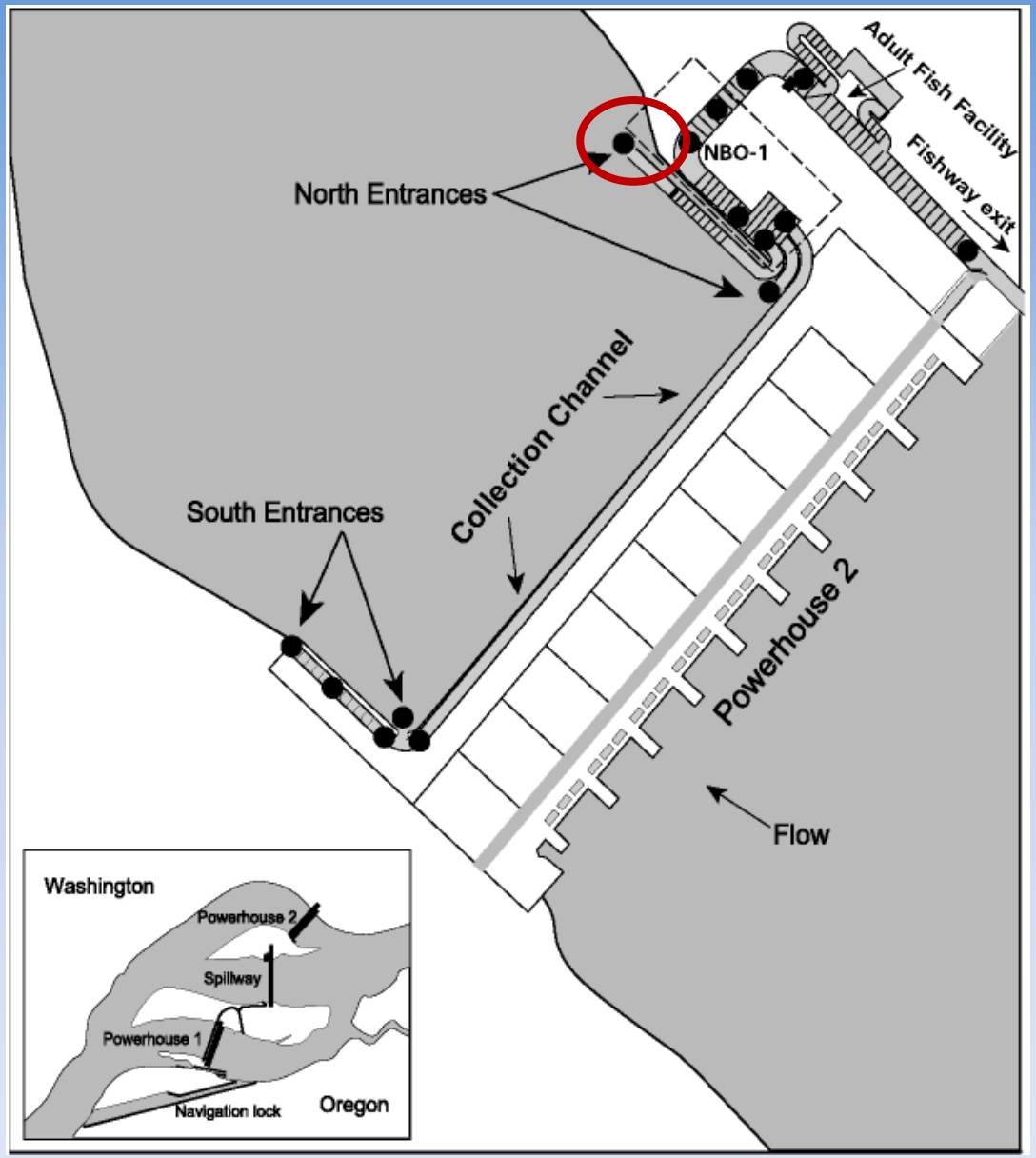
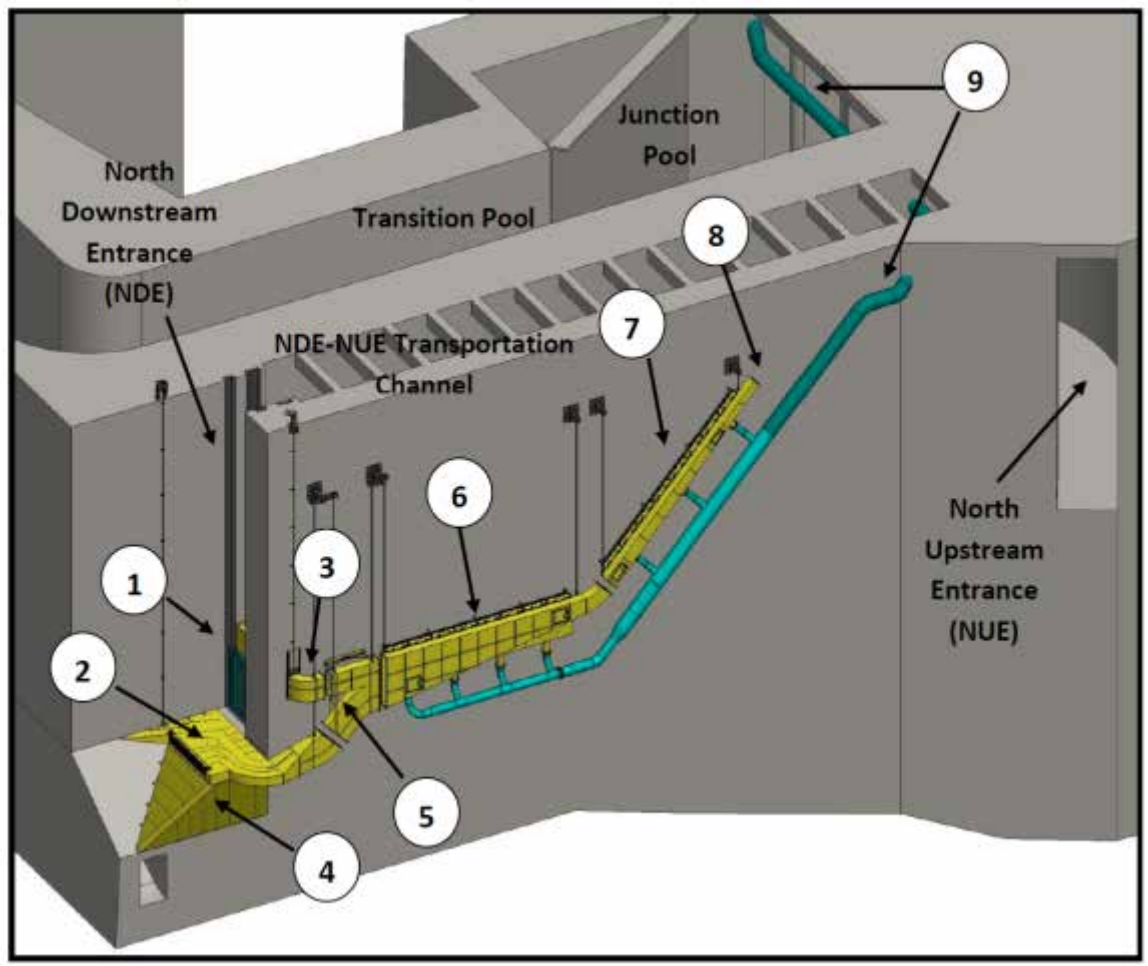
Bonneville Dam WA Shore LFS/LPS



Lamprey Flume System (LFS)

Lower Unit

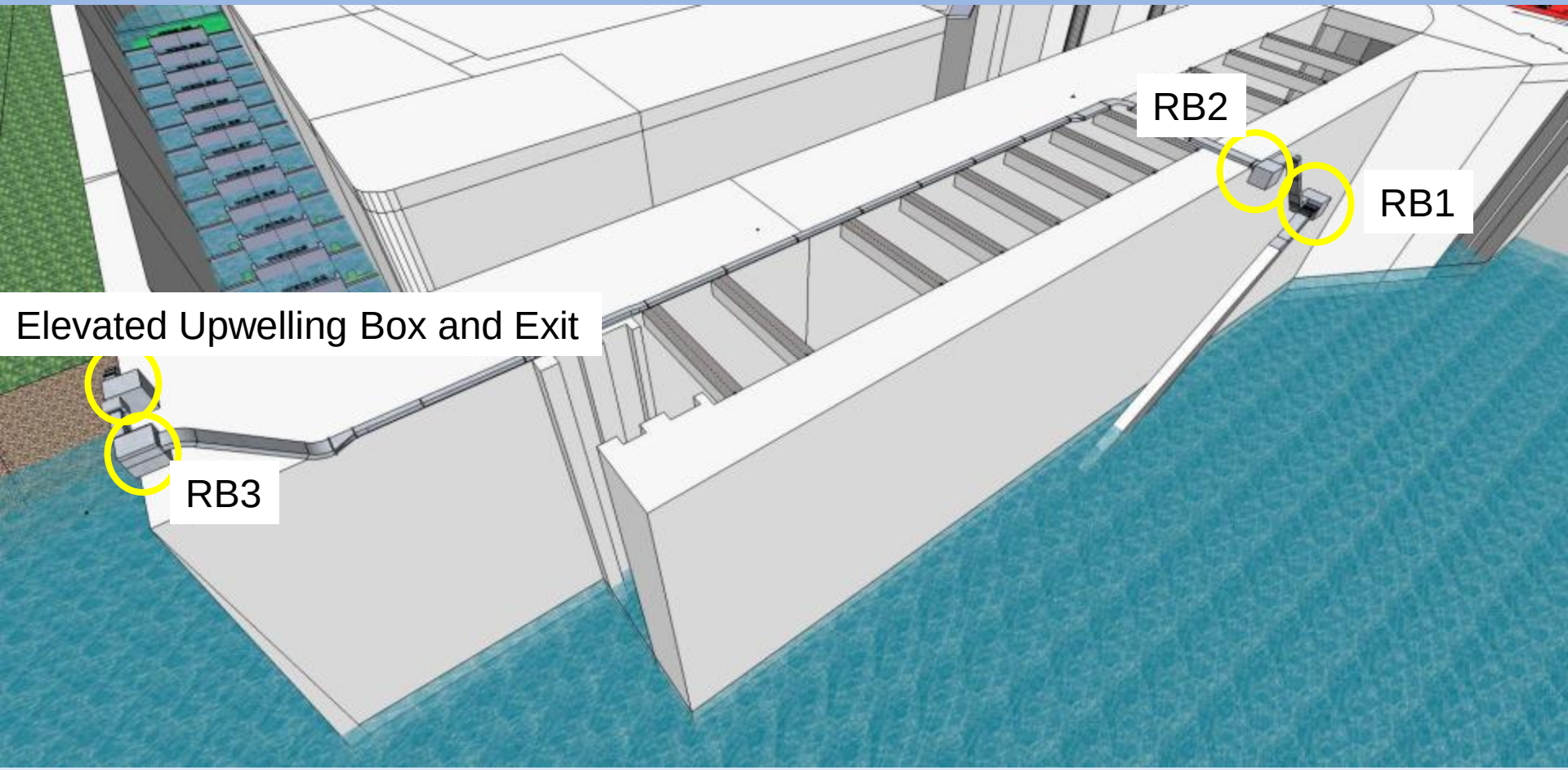
USACE Design/Contractor Built



LFS Lamprey Passage System (LPS)

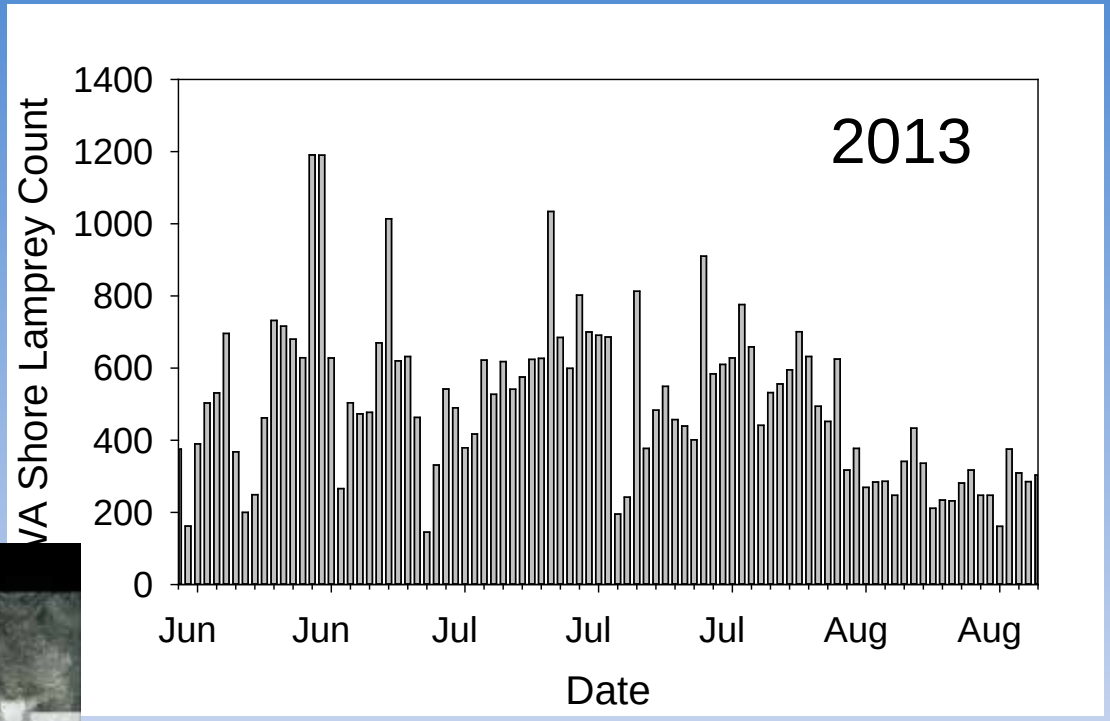
Upper Unit

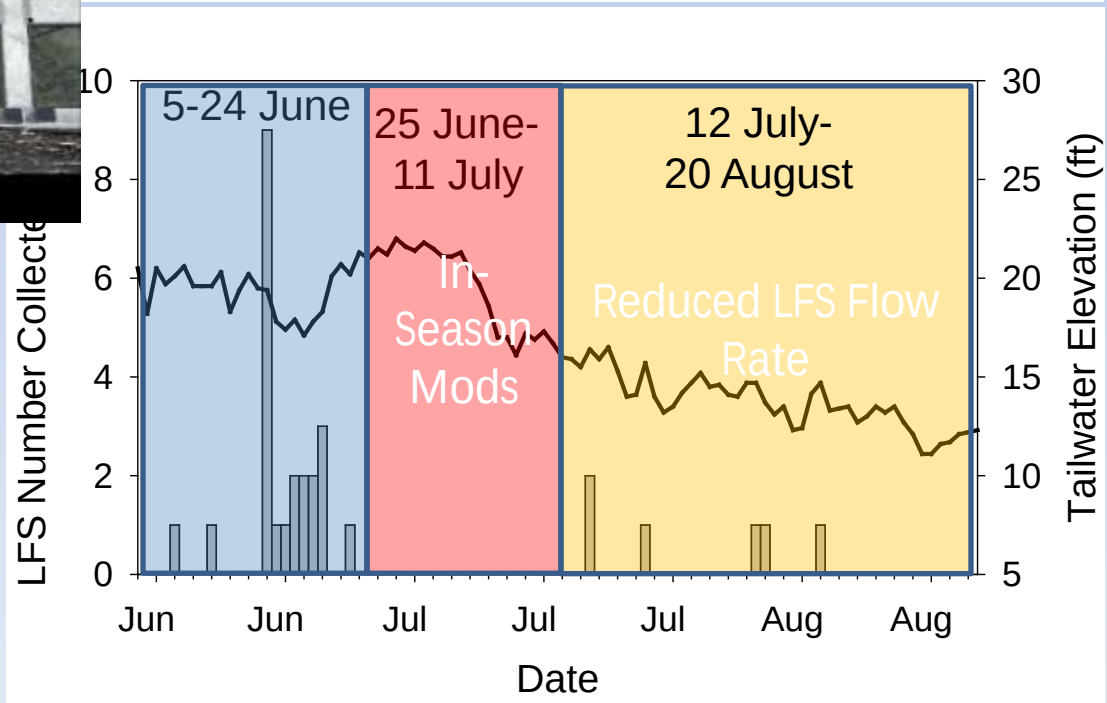
UI / USACE Design/Contractor Built



LFS Day One: 5 June 2013

Boil


2013
VA Shore Lamprey Count
1400
1200
1000
800
600
400
200
0
Jun
Jun
Jul
Jul
Jul
Aug
Aug
Date


5-24 June
25 June-
11 July
12 July-
20 August
In-
Season
Mods
Reduced LFS Flow
Rate
LFS Number Collecte
10
8
6
4
2
0
Tailwater Elevation (ft)
30
25
20
15
10
5
Jun
Jun
Jul
Jul
Jul
Aug
Aug
Date

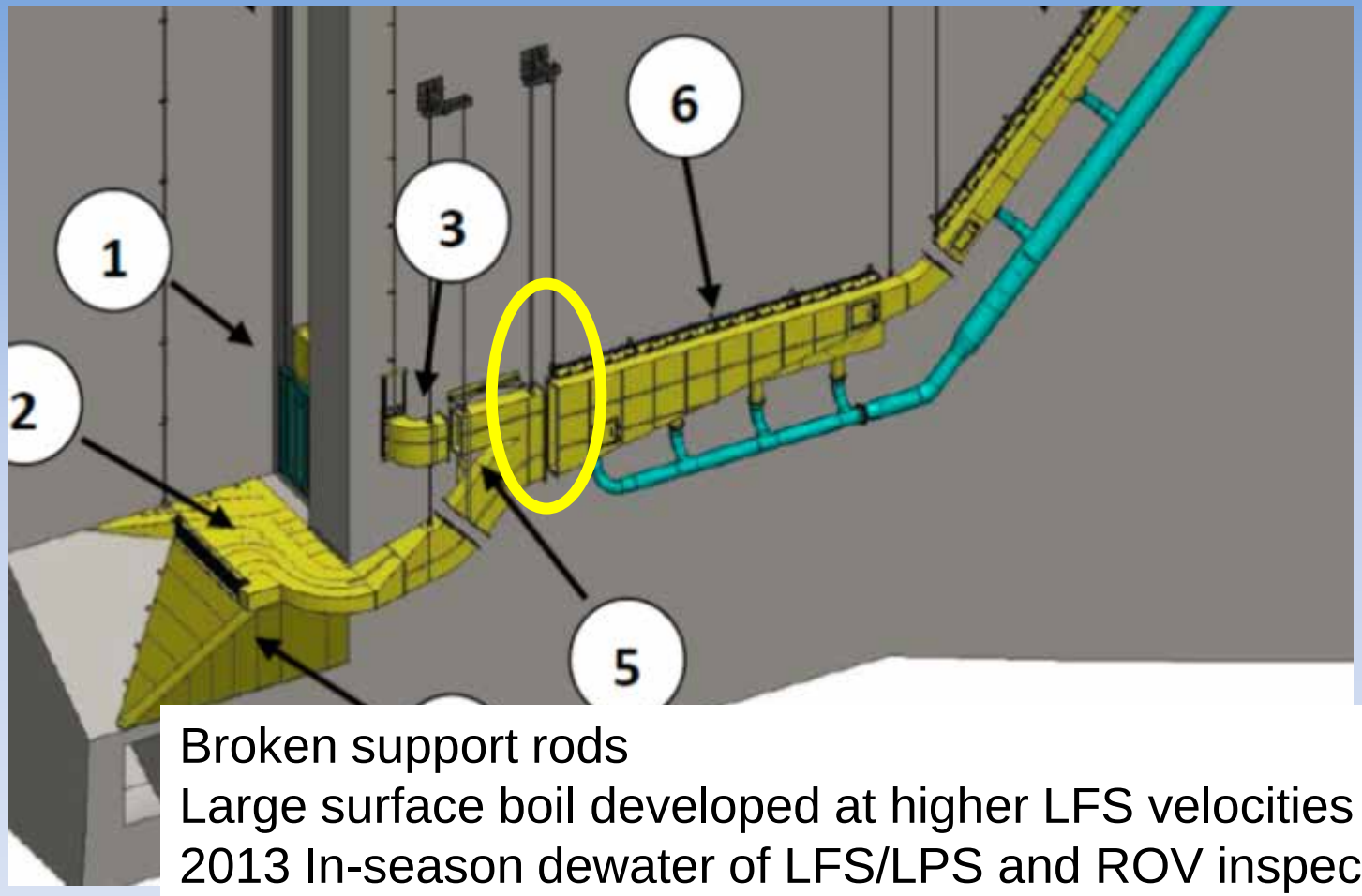
$\sum = 29$

Bonneville Dam PH2 LFS

- LFS Passage = **29 (0.09%)** of Washington Shore passage in 2013

	LFS	WA Shore Total	LFS:Total
LFS Period 1	23	12477	0.18%
LFS Period 2	Dewatered	7235	N/A
LFS Period 3	6	20373	0.03%

Lamprey Flume System (LFS)
USACE Design, contractor built (Fowler)



Broken support rods
Large surface boil developed at higher LFS velocities
2013 In-season dewater of LFS/LPS and ROV inspection
Fall 2013 Repairs including HD-PIT antennas
Entrained air in LFS water supply persists = “Bubble Curtain”

UI Modifications to LPS 2013-2014

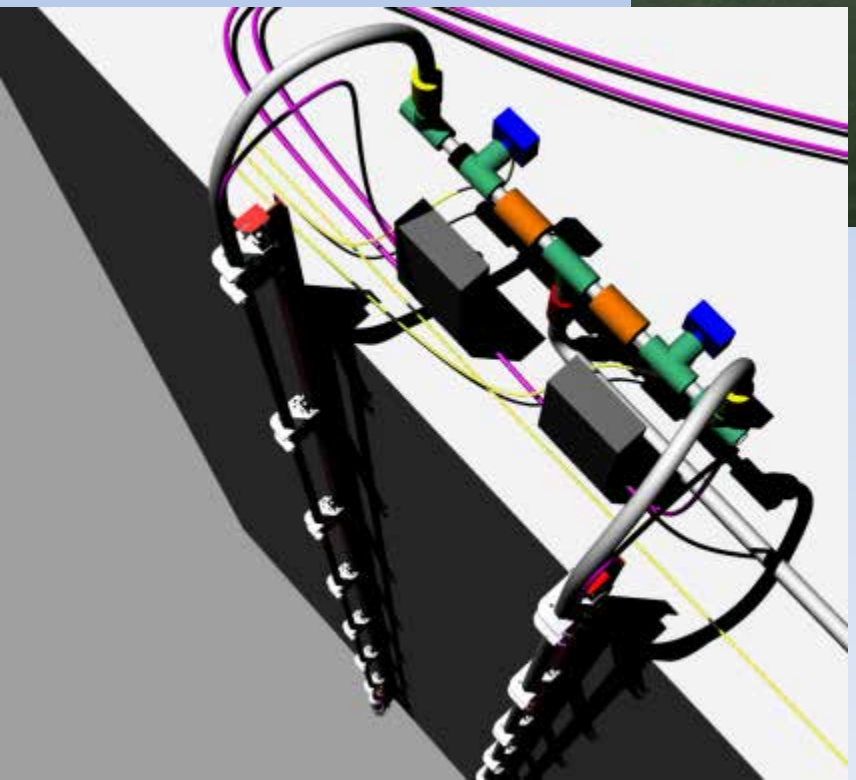
- Improved LPS pumps and screens
- Improved access to LPS terminus (lowered platform)
- Additional minor modifications

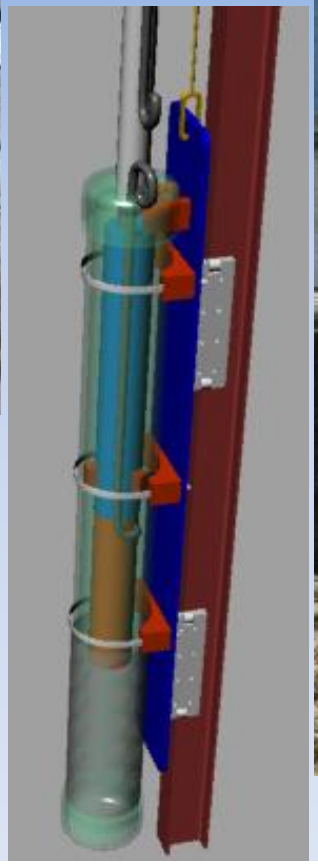
LPS Terminus Modifications

- High platform = poor access
- Potential trade-off with handling

Improved LPS Water Supply

Paired Pumps



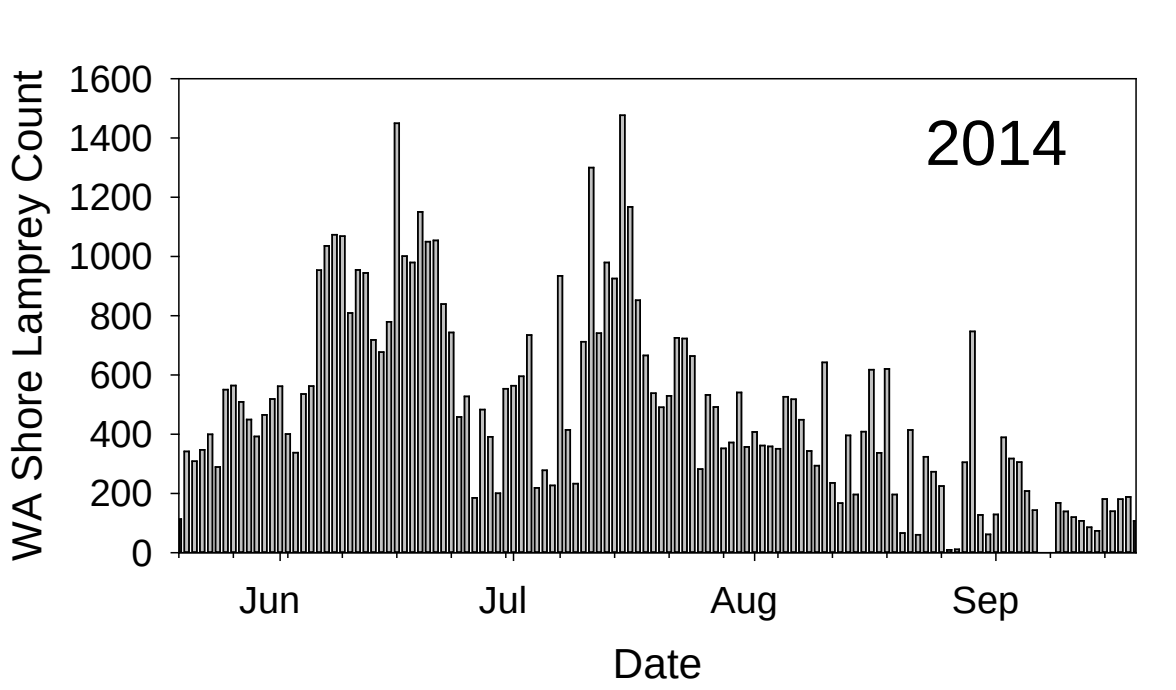


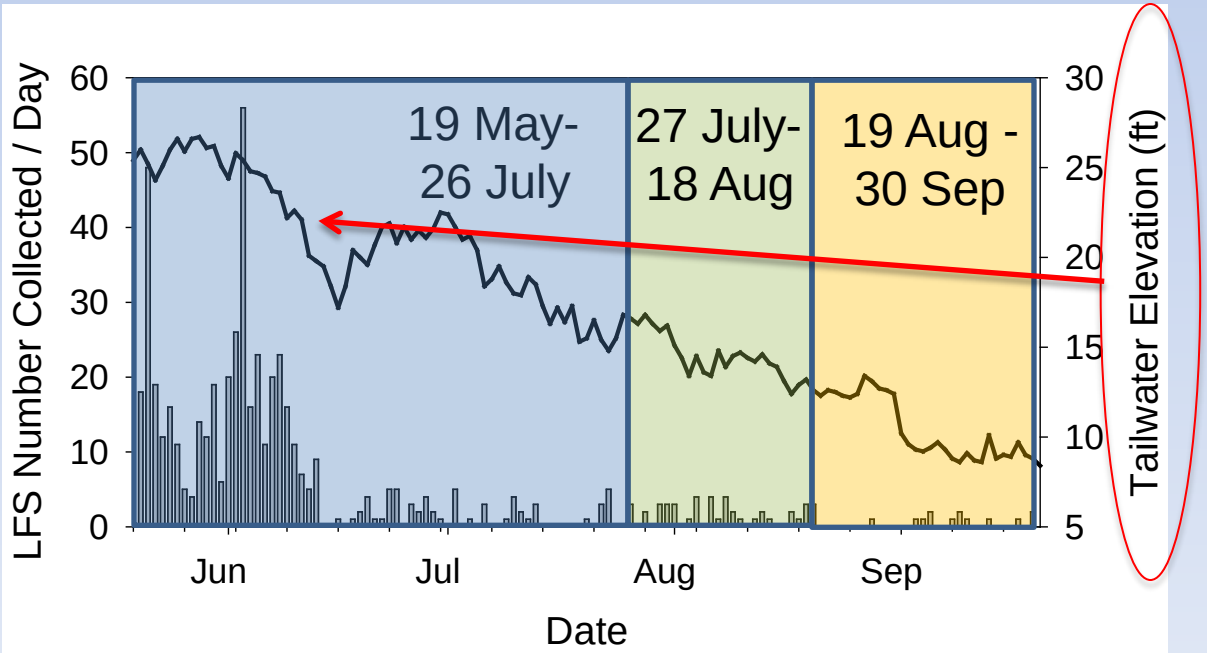
Screened Pump On I-beam Trolley

LFS 2014 Day One:

LFS Settings	LFS
Period 1 (1 fps)	491
Period 2 (~1.0 – 3.0 fps)	35
Period 3 (1.25 fps)	19

$\sum = 545$





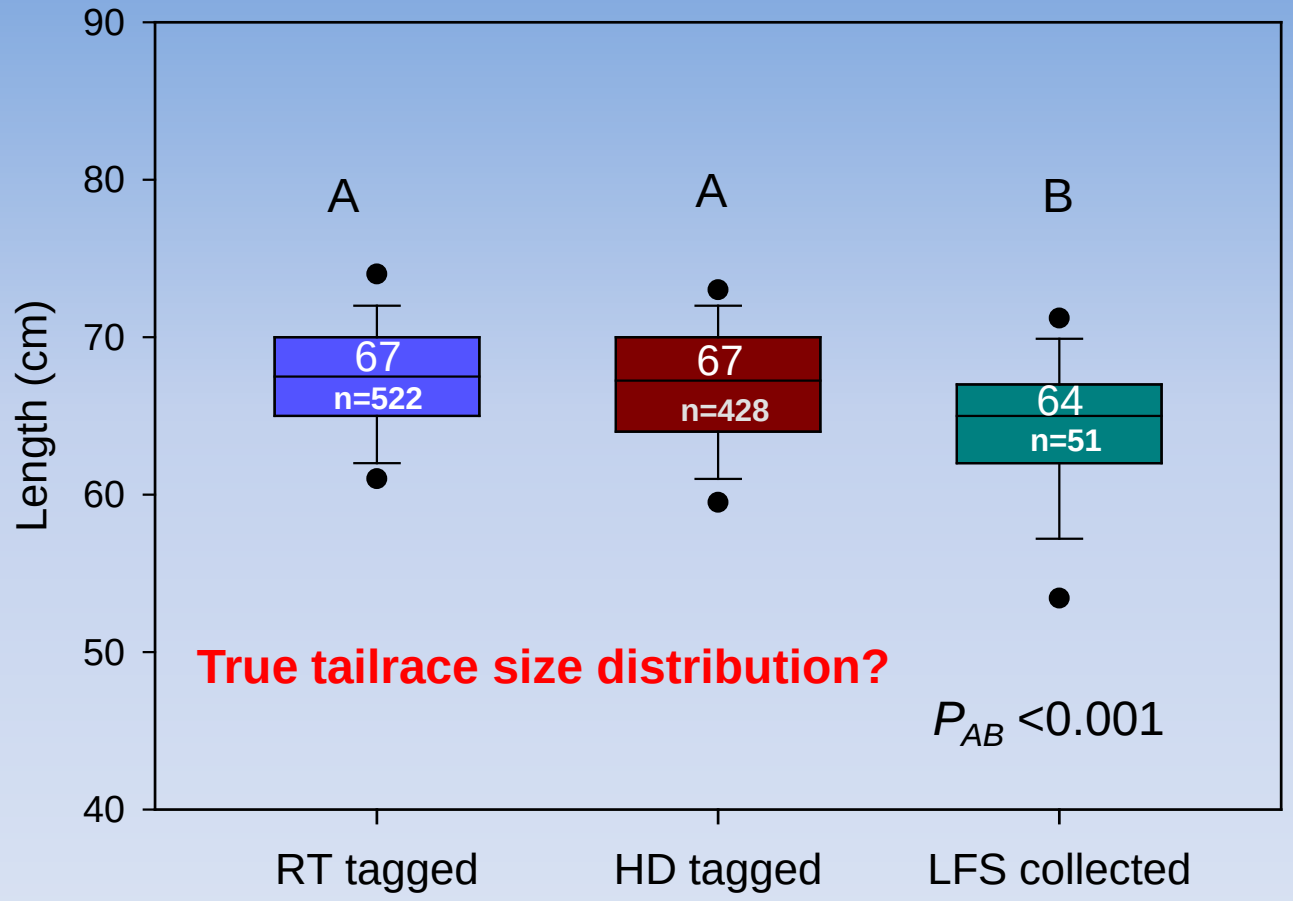
Bonneville Dam PH2 LFS

- LFS Passage = 545 (**0.89%**) of Washington Shore passage in 2014

LFS Settings	LFS	WA Shore Total	LFS:Total
Period 1 (1 fps)	491	45227	1.09%
Period 2 (~1.0- 3.0 fps)	35	9340	0.37%
Period 3 (1.25 fps)	19	6465	0.29%

- Treatment: HDHN=7 (6 days); HDLN=5 (5 Days); LDHN= 11 (5 days); LDLN=12 (7 days);
- low night = 1.42 lamps/day; high night = 1.64 lamps/day

Bonneville Dam PH2 LFS Fish Lengths

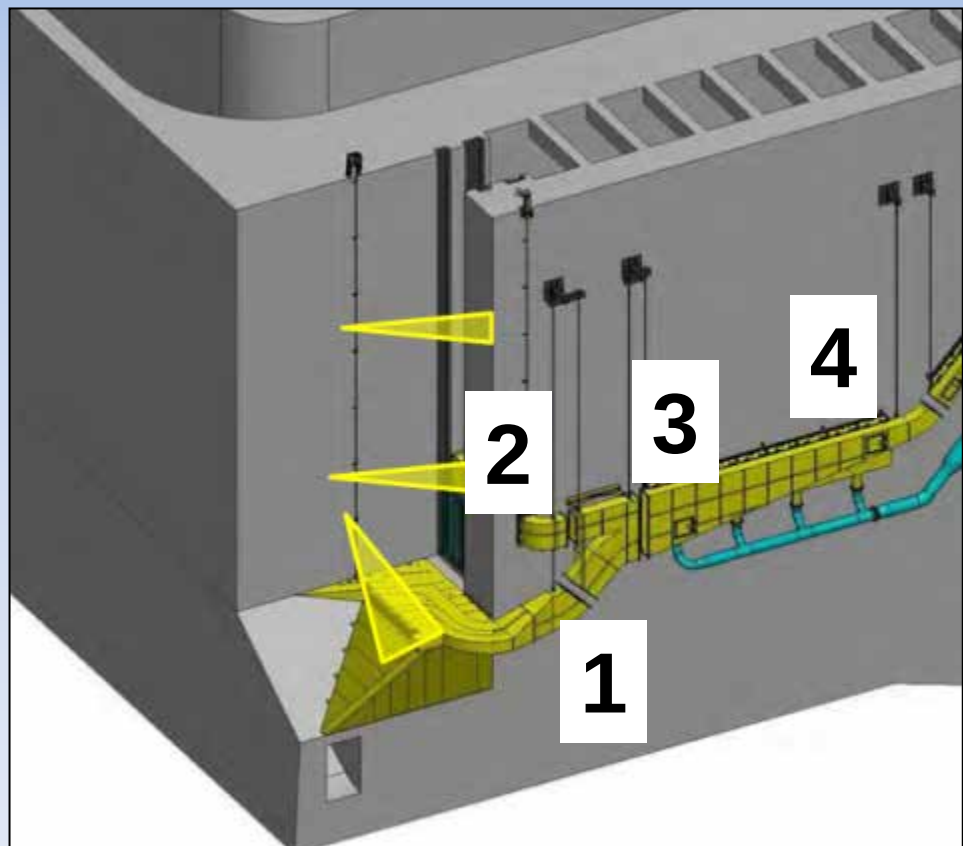


LFS Lengths sampled 10 June – 8 August , 2014 ~ Period 1

LFS HD Detections

- **10 Fish detected at Lower LFS HD antennas (20-May installed)**
- **1 collected at terminus**
- **7 of 10 Detected before 15 June**
- **% Detection by Antenna**
  1=70%; 2=90%;
  3=70%; 4=30%
- **Detection times**
  Median= 0.17 h
  Range= 0.01- 1.32 h
  Lower LFS passage time =
  0.17 h (N=1)

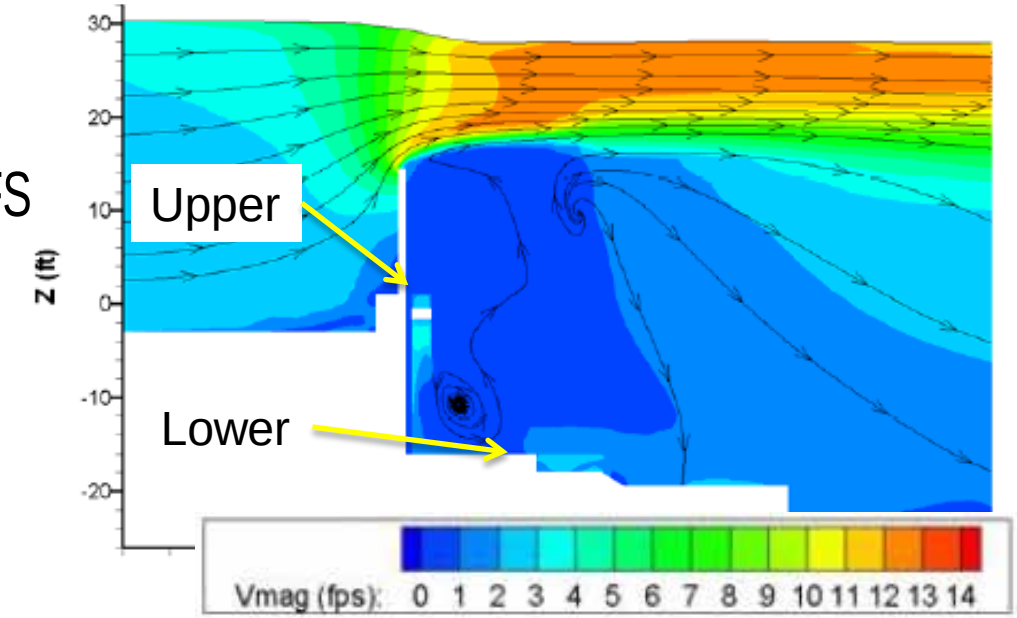
RT Data ~ Low Collection Eff.
High Detect. Efficiency?
Low Passage Efficiency



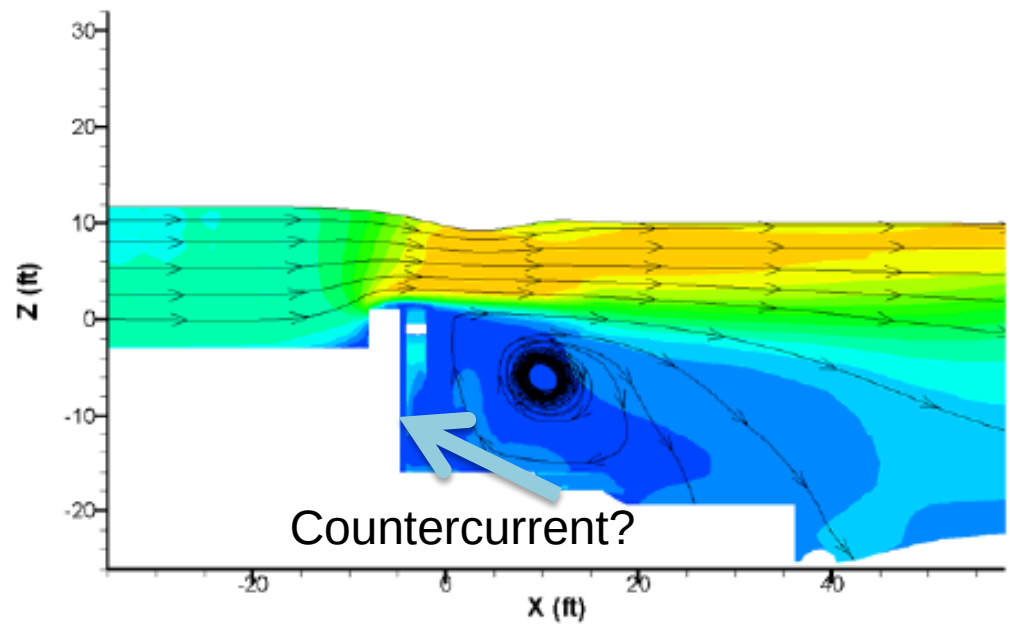
Guidance/Attraction?

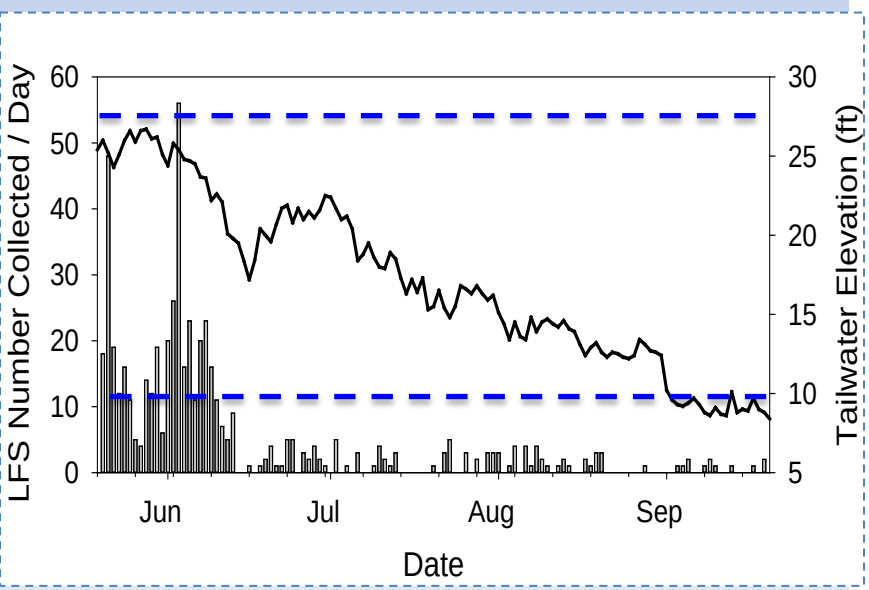
- Relationship between tailrace elevation and conditions at LFS entrance (cold spell 2014)
- CFD models suggest potential countercurrent as tailrace elevation declines
- Increased importance of high LFS flow later in season?

AECOM 2012 Figure H-7, Tailwater 28'



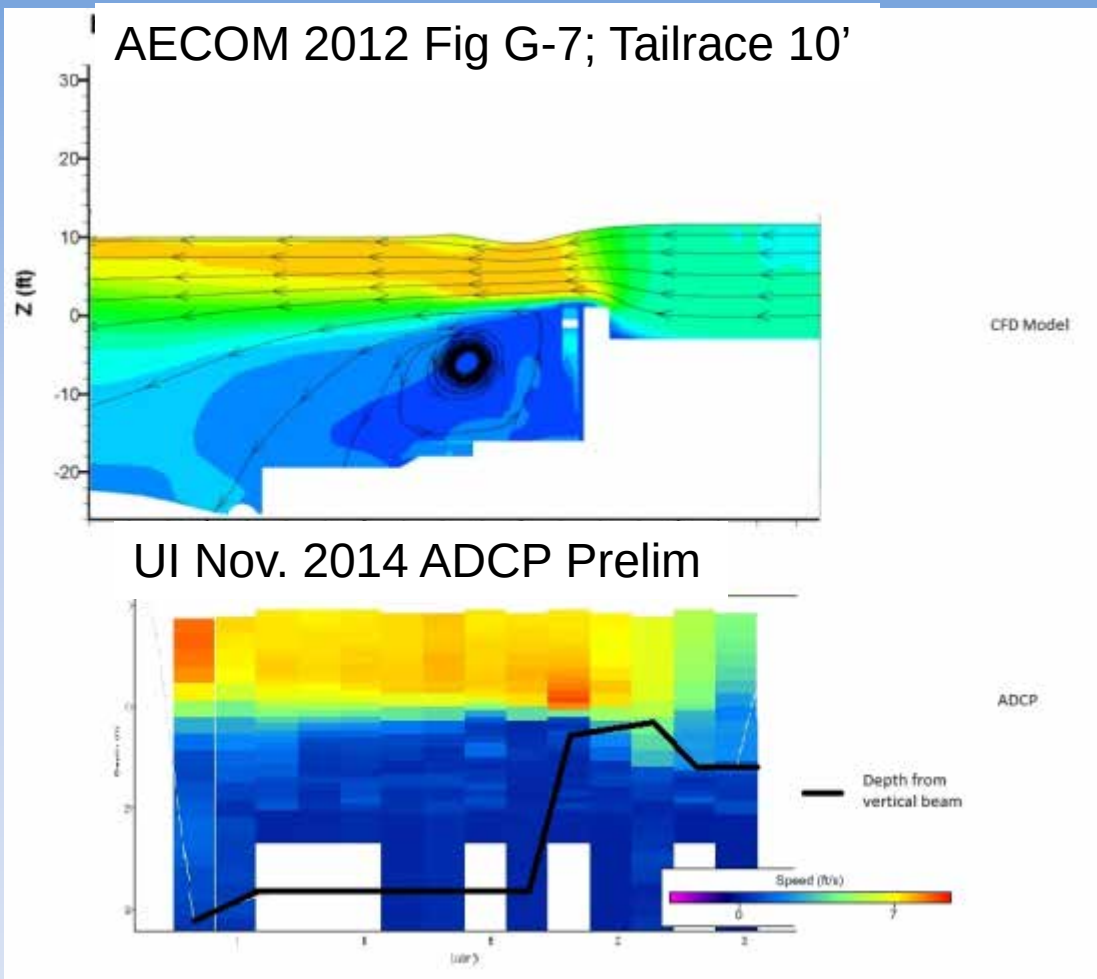
AECOM 2012 Figure H-7, Tailwater 10'





- ADCP measurements at lower (Fall 2014) and higher (Spring 2015) at NDE. Comparing to AECOM CFD model results

- DIDSON observations of “bubble curtain” to determine best acceptable operation (Closed upper entrance vs. both open; acceptable flow rate, etc.)

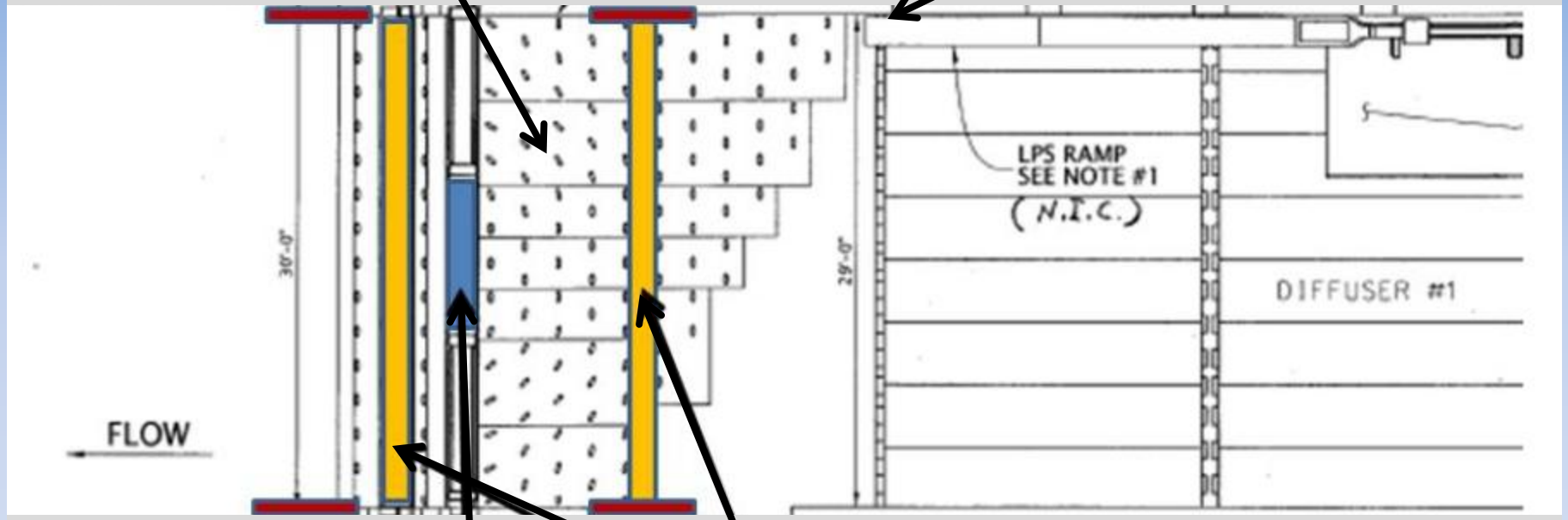


Operational Recommendations LFS/LPS for 2015

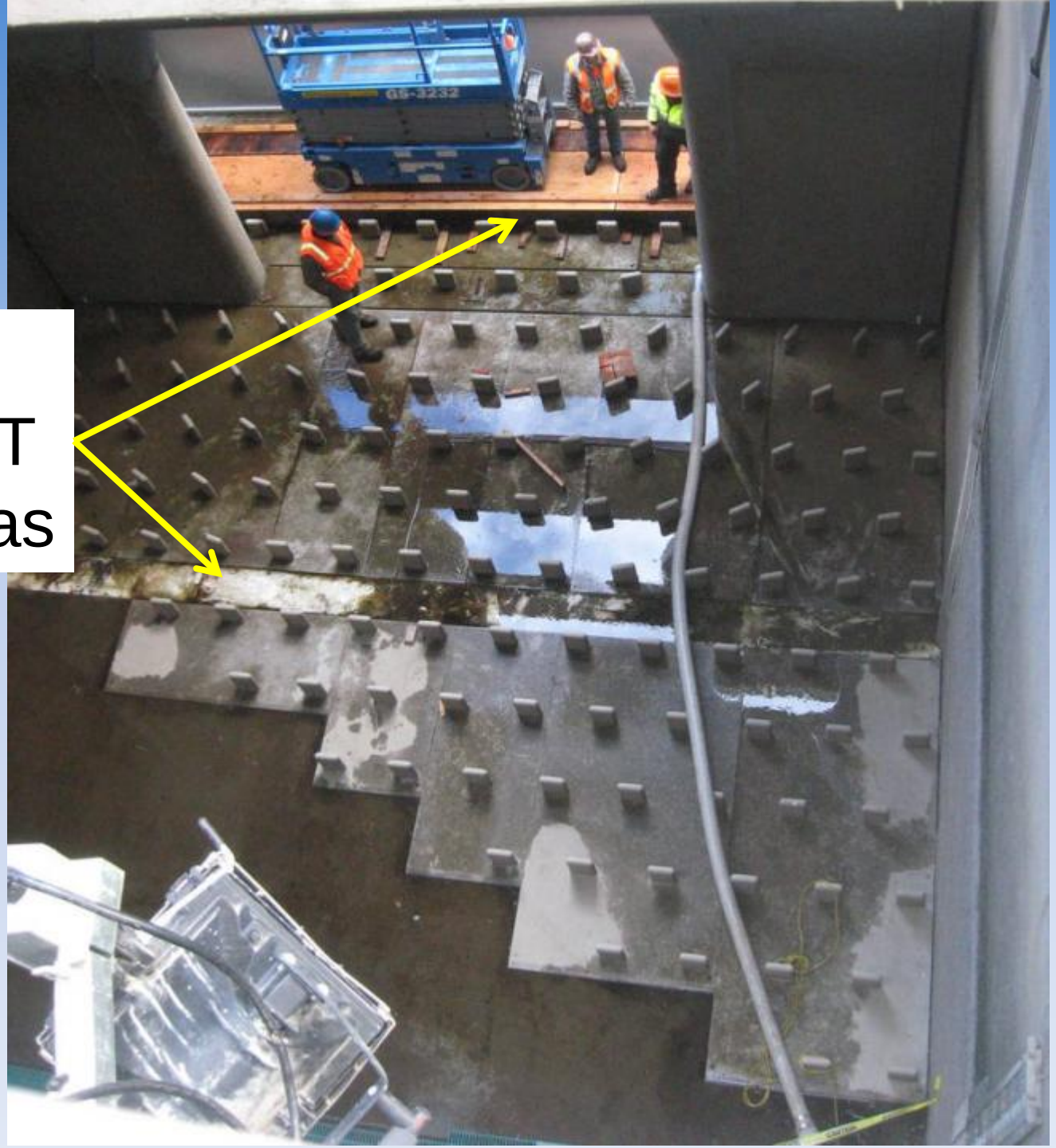
- Continue diagnosis of declining capture rates
- Reduction of entrained air
  - Reduction of bubble curtain
  - Allow higher flow rates at entrance(s)
  - Reduce potential for drop-out of LFS?
- Flow setting experiment to optimize LFS flow rate
- Continued monitoring of size structure entering LFS

John Day North Fishway Entrance Modifications 2011-2013

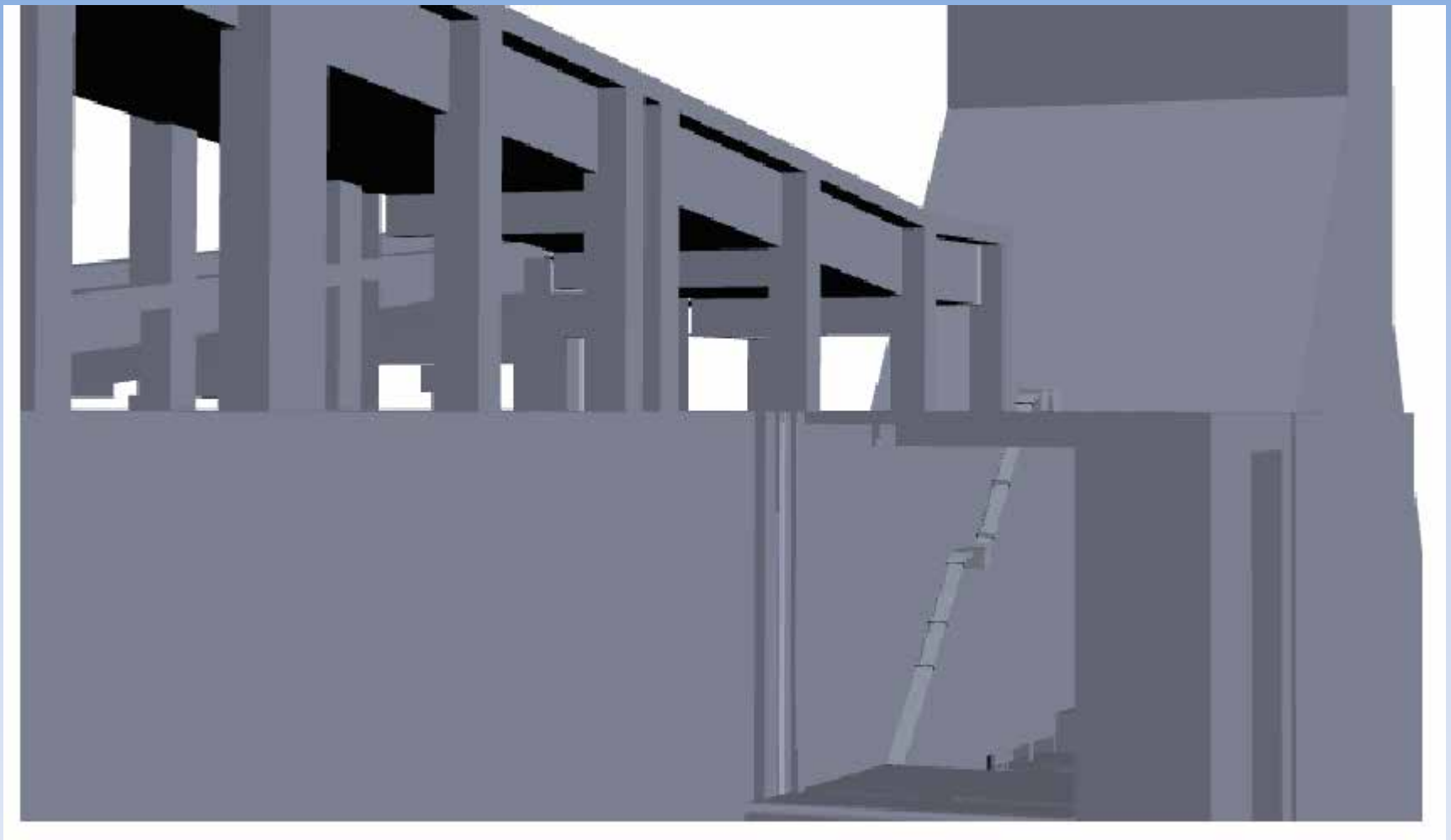
John Day North Fishway



Four
HDX PIT
Antennas

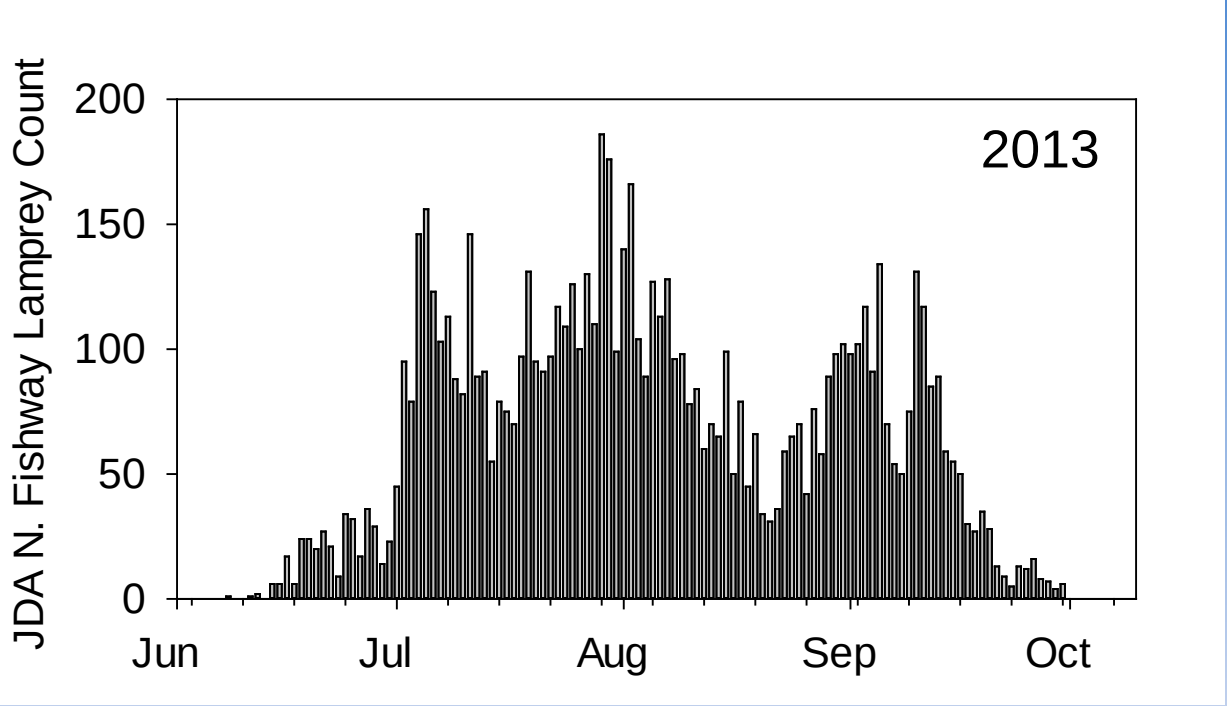


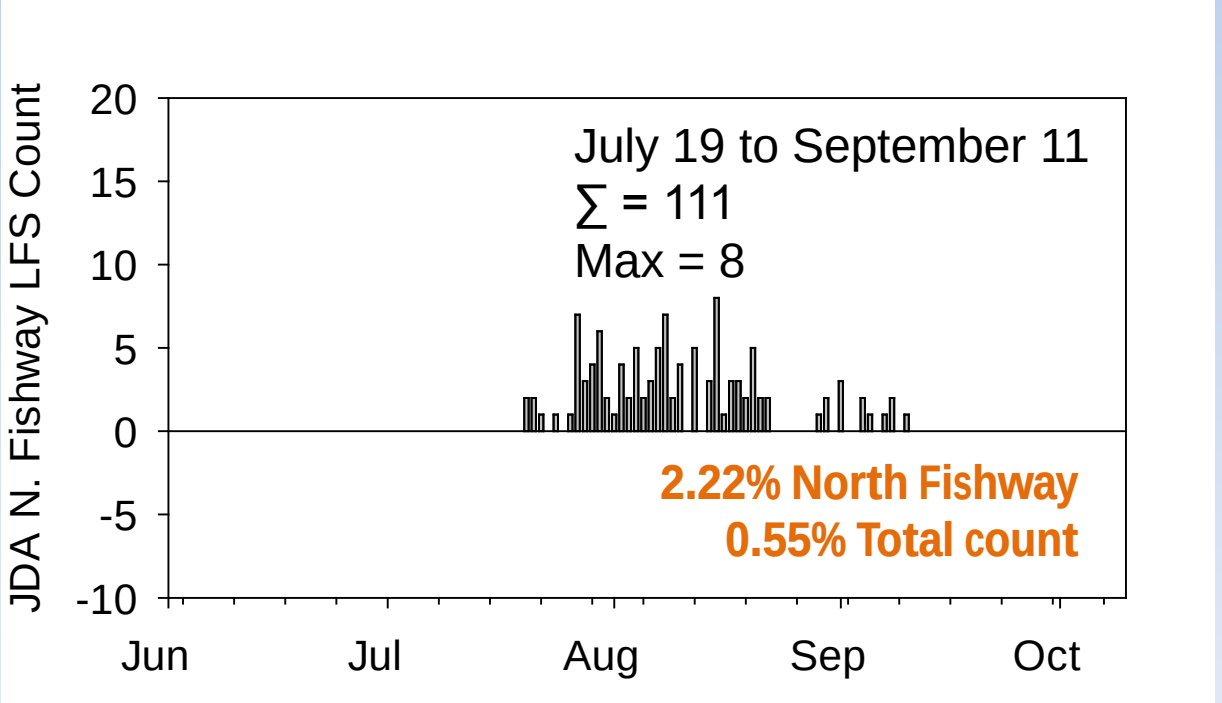
John Day Dam North Fishway Entrance LPS



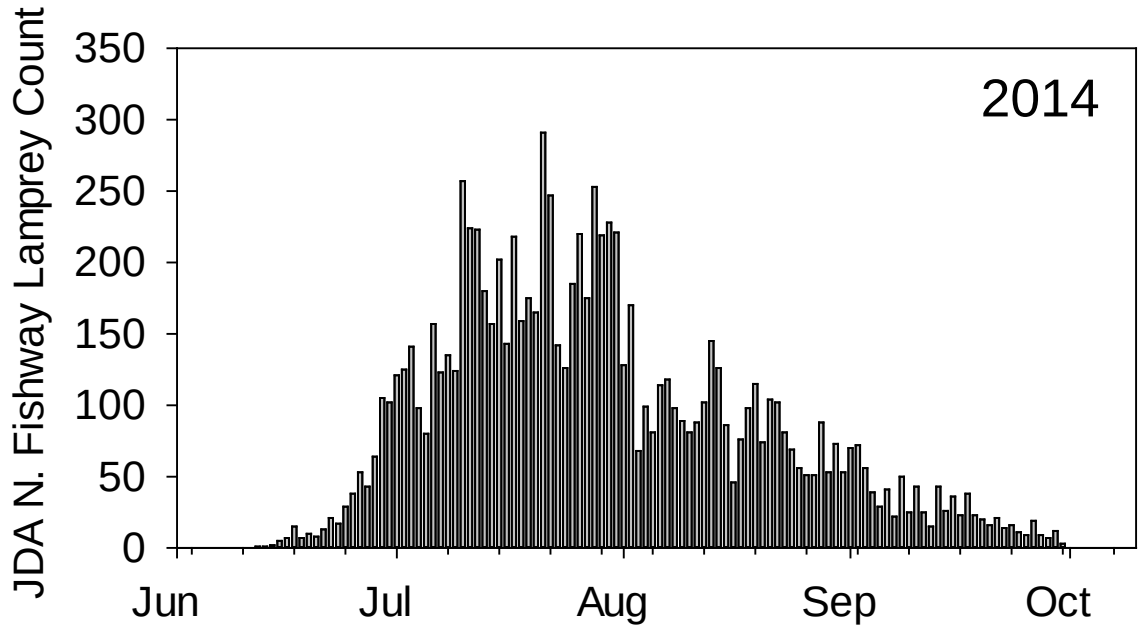
CAUTION

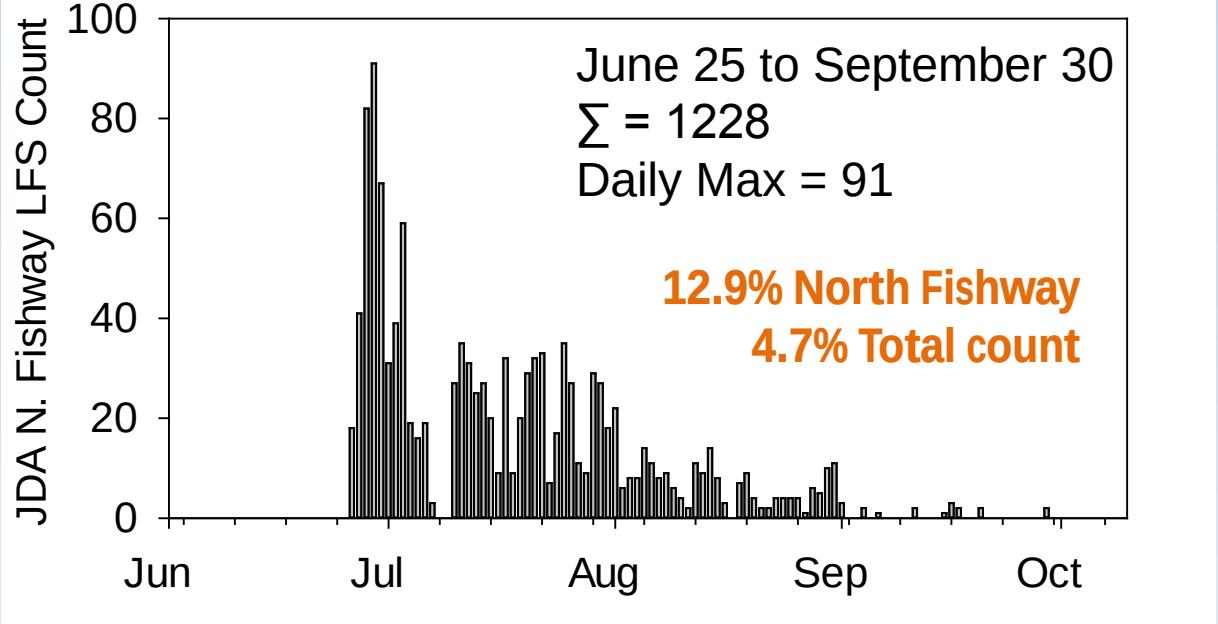
- **2013** July 19 to September 11



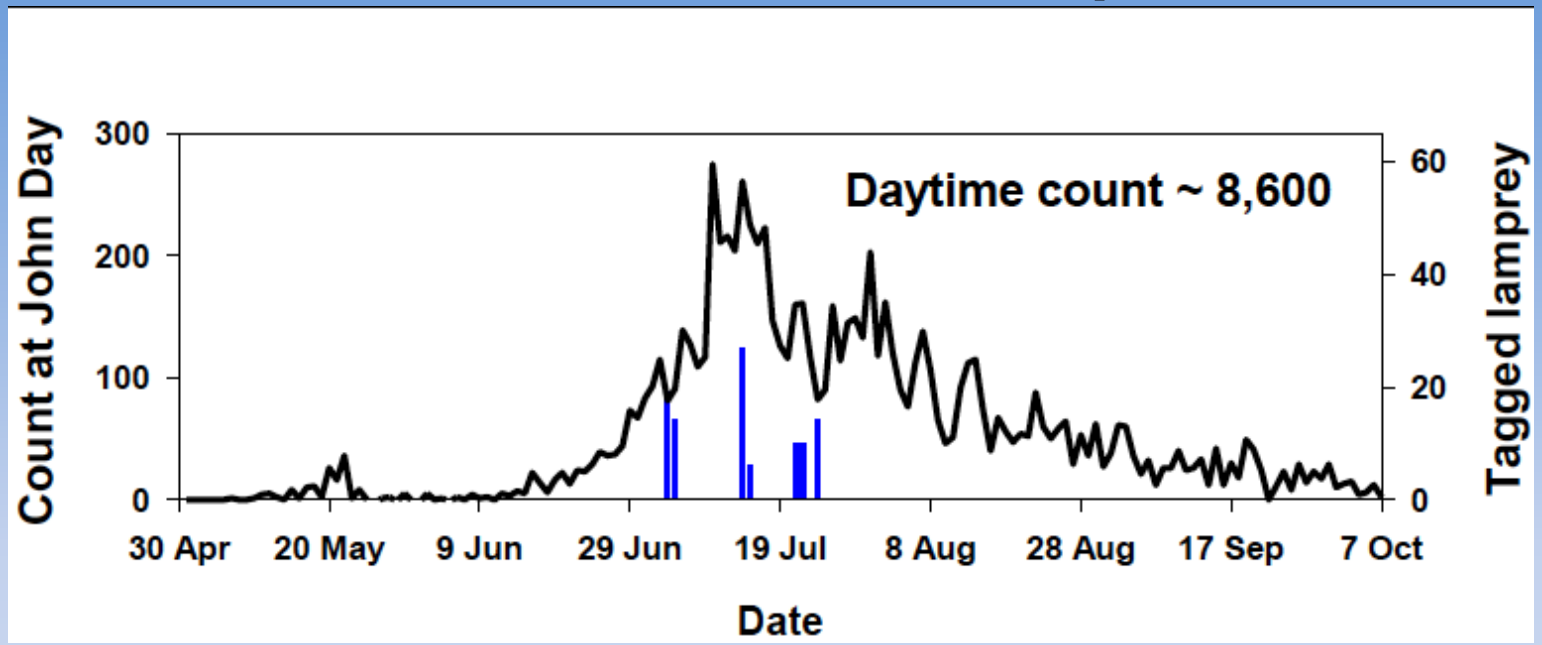


- **2014** June 25 to September 30
  - 1228 fish collected





JDA HD-PIT Sample



- 100 HDX-PIT tagged
- Released to forebay
- Analyses on-going:
  - High fallback rate (N=36 lamprey)
  - High Deschutes River Entry (N=6; 37.5% of FBs)

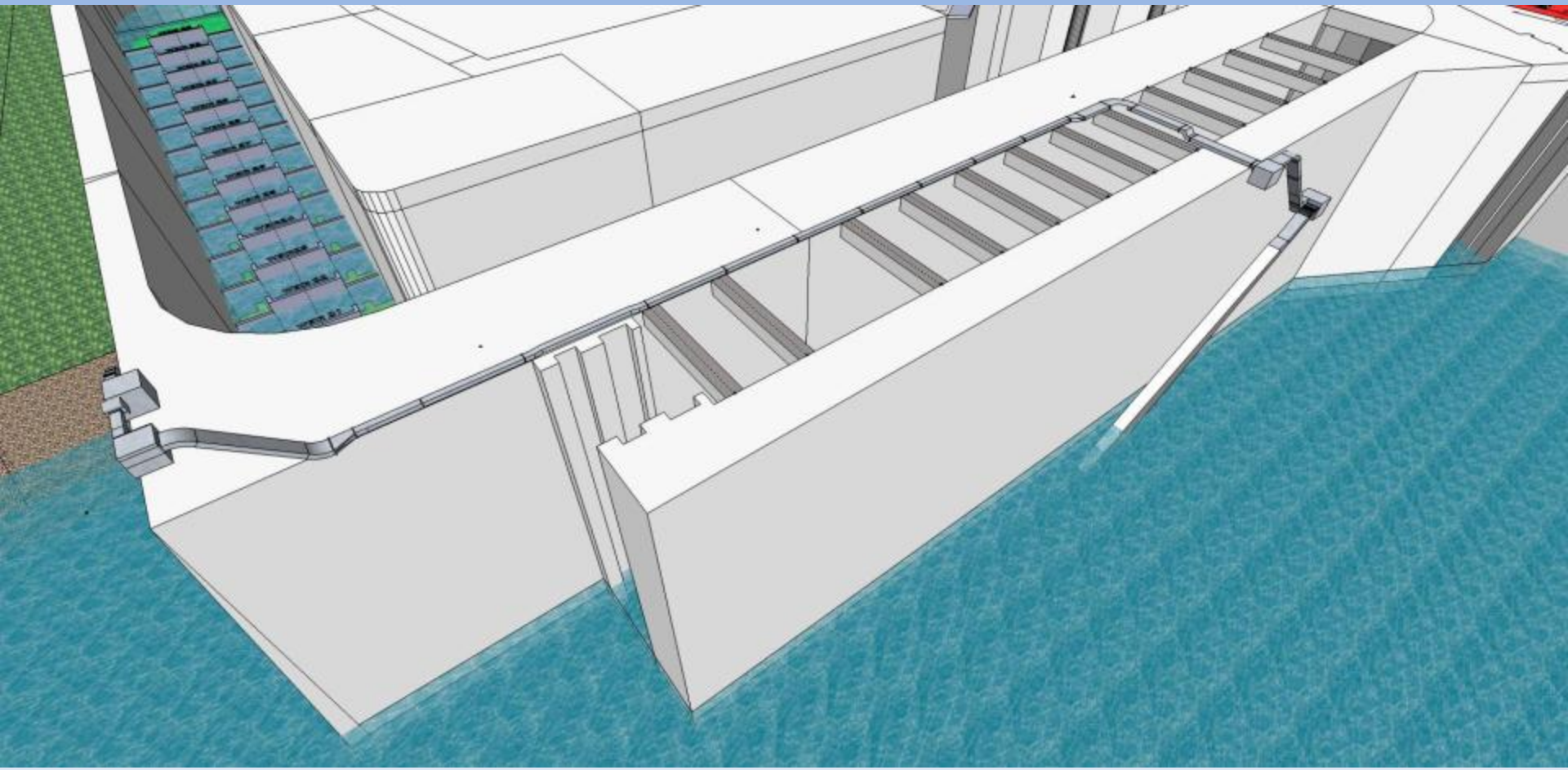
John Day Release Site

Summary

- **Bonneville Dam LFS/LPS** collection efficiency improved ~10X from 2013 (0.09%) to 2014 (0.89%).
- Continuing work on entrained air, diagnosis of apparently low entry rate in mid- and late season

- **John Day NFE LPS** collection efficiency improved ~5x from 2013 (2.2%) to 2014 (12.9%)
- Apparent high fallback suggests need for new release site, careful consideration of future LPS exit site

Questions?



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