



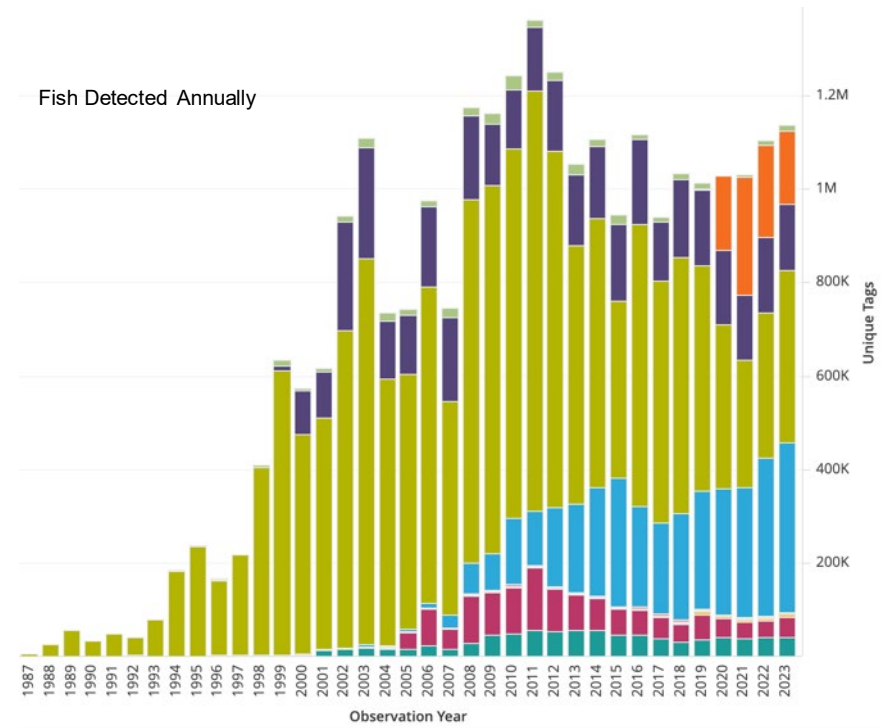
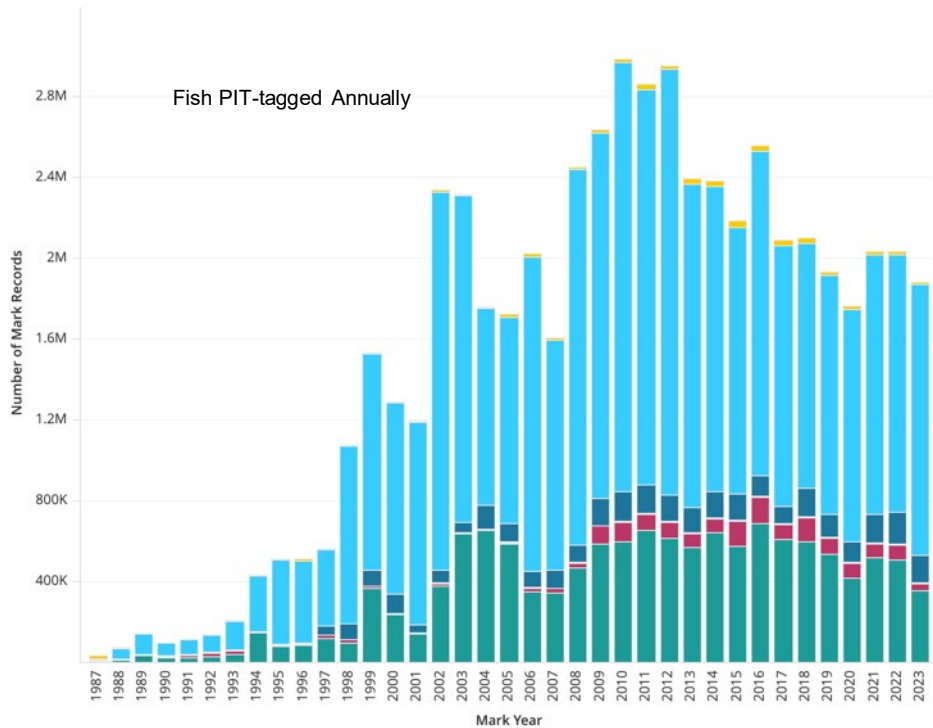
NOAA
FISHERIES

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NOAA NMFS NFSC
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NOAA - A Brief Summary of NOAA Fisheries PIT Tag Technology Advancements (since 2015)

January 30, 2024

CRB PIT Overview



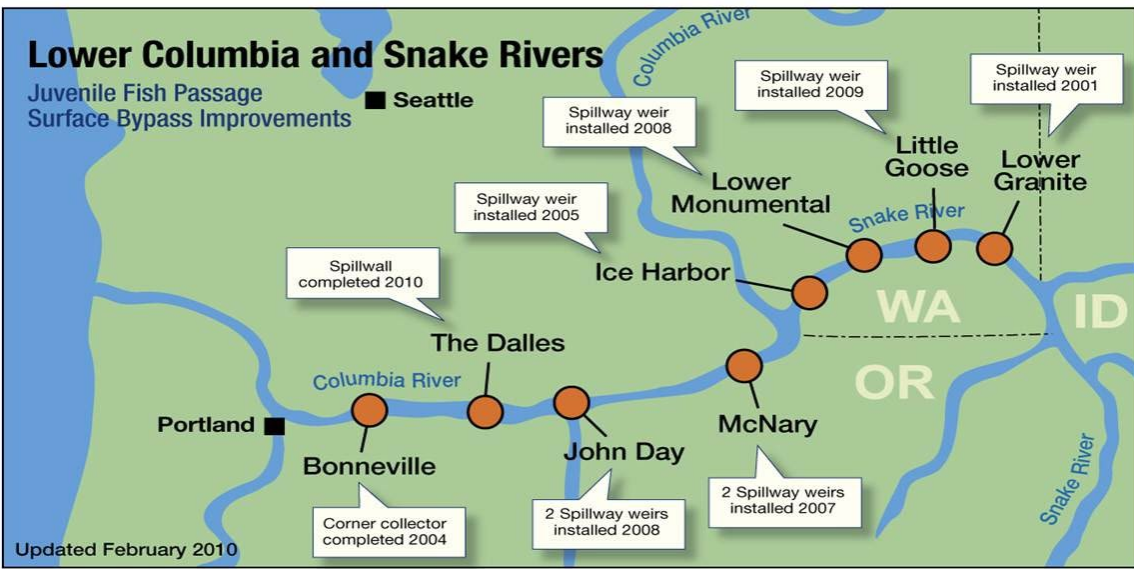
- Species**
- All Others
 - Chinook
 - Coho
 - Lamprey
 - Sockeye
 - Steelhead

- Site Type**
- Trawl Net
 - Spillway
 - Monitored Fish Release
 - Juvenile Fish Bypass Fac...
 - Instream Remote Detec...
 - Instream Juvenile Fish T...
 - Hatchery Returns
 - Hatchery Releases and ...
 - Combined Dam Location
 - Adult Fishway

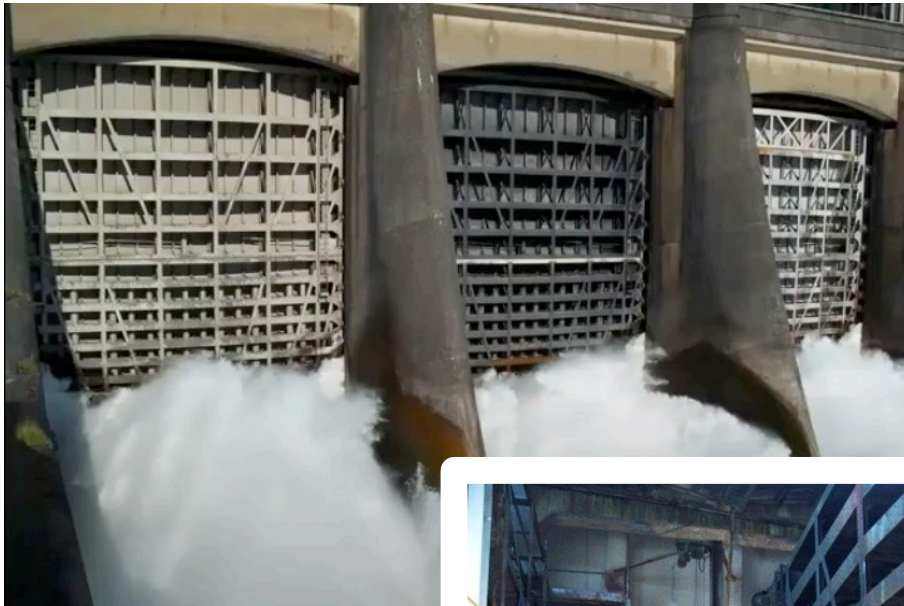
- Detections are increasing while tagged fish are decreasing
- GRS and Instream sites are providing significant data
- Spillway detection has been falling off

Lower Granite Spillway Detector

Unique Tags Detected per Year



Spillway Detection Evolution



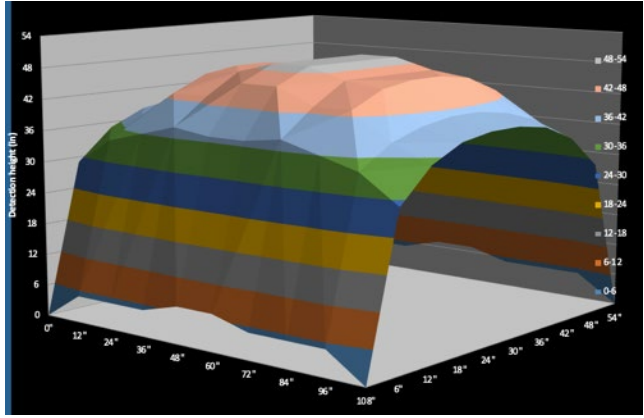
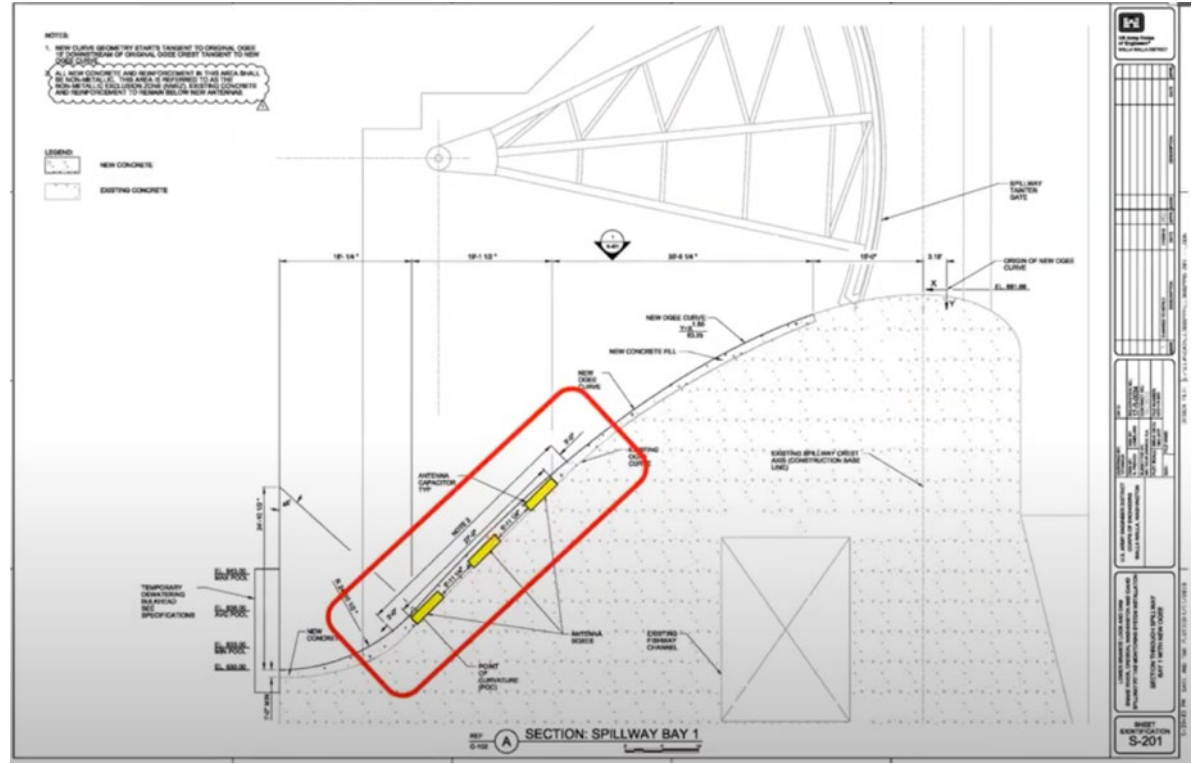
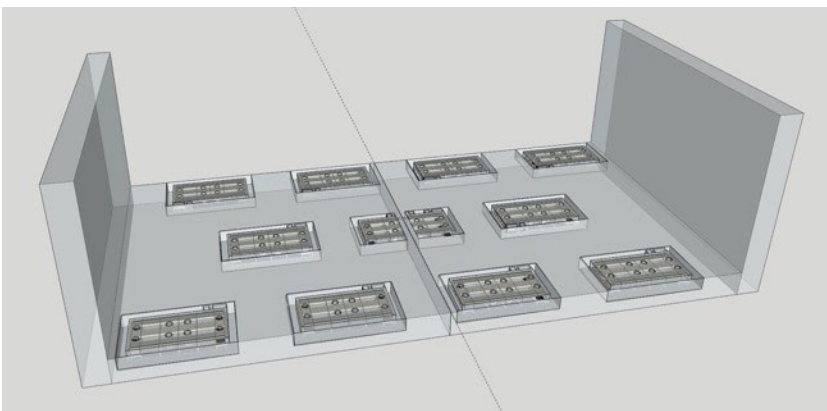
2006 – 2008
Bonneville
Spillway
Detection



Prototype Ice Harbor
Spillway Detection
Antennas (2016)

Lower Granite Spillway

- Imbedded in concrete
- ~24" of water (~7" of concrete cover)
- 50' wide with an expansion joint
- 75 fps water velocity
- Potentially noisy environment
- 27' of exclusion zone (ferrous)



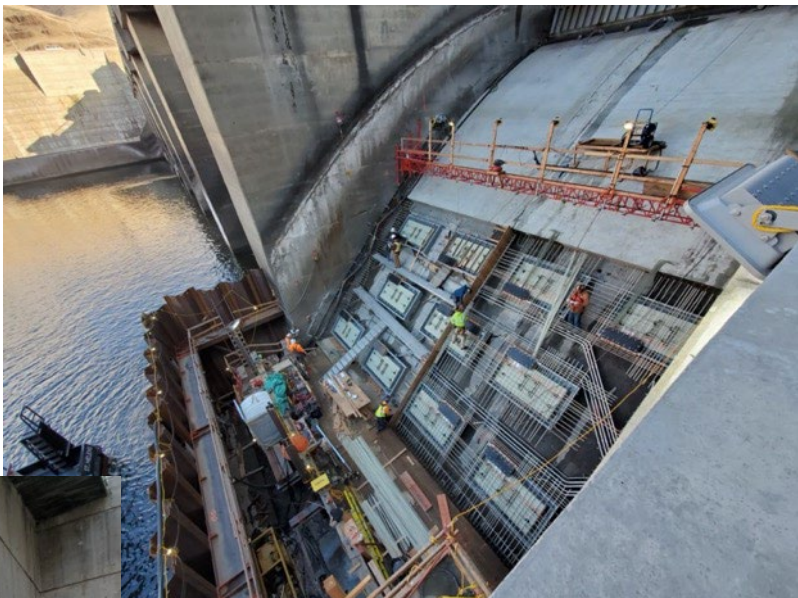
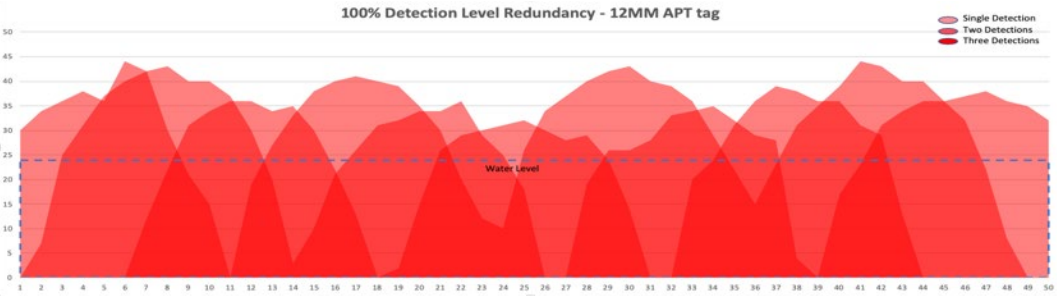
Lower Granite Spillway Development

- FS3001 fully developed
- Custom remotely adjustable power supply (0v - 50v)
- Concrete testing (standard vs. non-magnetic aggregate)
- High power exciter cable in SS conduit
- Permanent prototype/test antenna entombed in Pasco

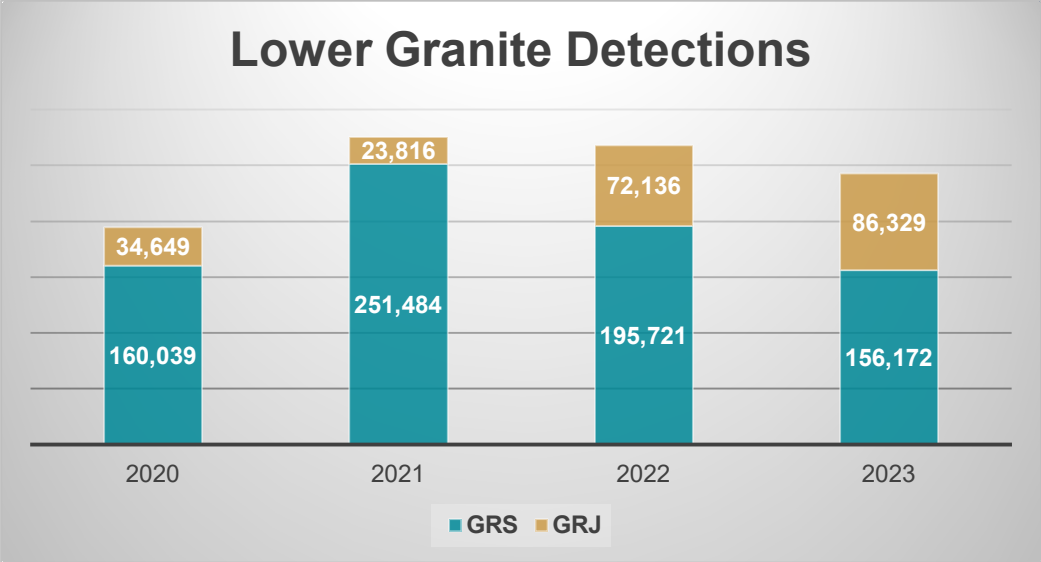


Lower Granite Spillway Installation - 2019

- 11 antennas with access to capacitor banks
- Dedicated data collection structure
- Conditioned transceiver room



Lower Granite Spillway Performance



- **763,416 total unique detections in four season**

Estuary Detection

- Estimate survival by estimating the number of unseen survivors
- Counting the number released and number detected at Bonneville Dam is easy
- But what proportion of all survivors is represented by the count?

- Statistical sampling: Estimate population parameter by sampling the population
- Population = All (live) fish passing BON // Parameter = Probability of being detected
- Sample = Fish detected downstream (we know they were alive when they passed Bonn.)

Sources of "Post-Bonneville Sample"

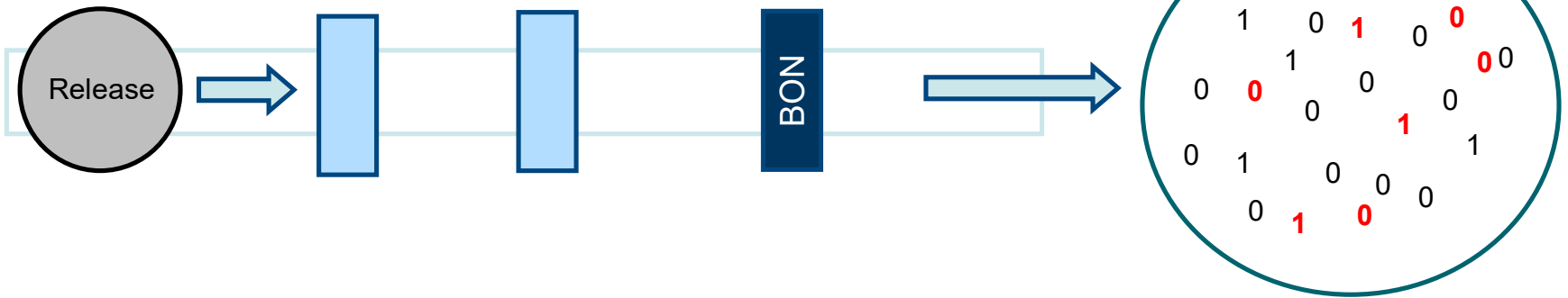
Estuary Trawl (1998-present, exc 2020)
Flex array antenna (2019, 2023, etc.)

Pile Dikes (2011-present, exc 2021)
#7 (2011-present, exc 2021)
#6 (2022-present)
#5 and 8 (2023-present)

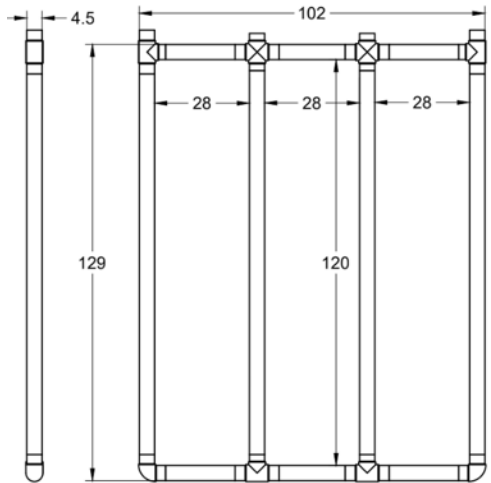
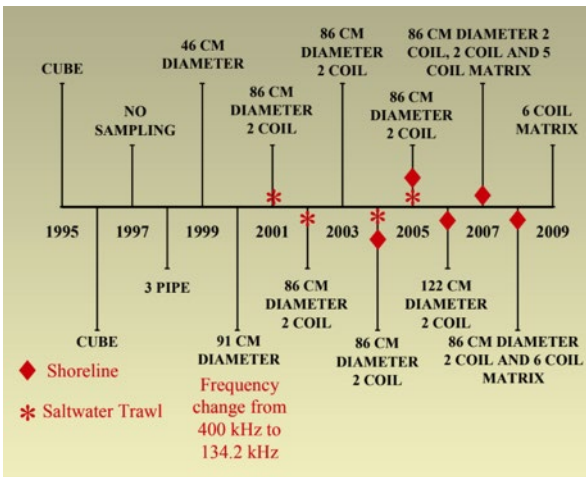
Bonneville Ladders (2002-present) (chinook mini-jacks)

Various avian nesting, loafing, etc. sites (1996-present*)

Returning adults?
(Lower Granite 1987-present; Bonneville 2002-present)

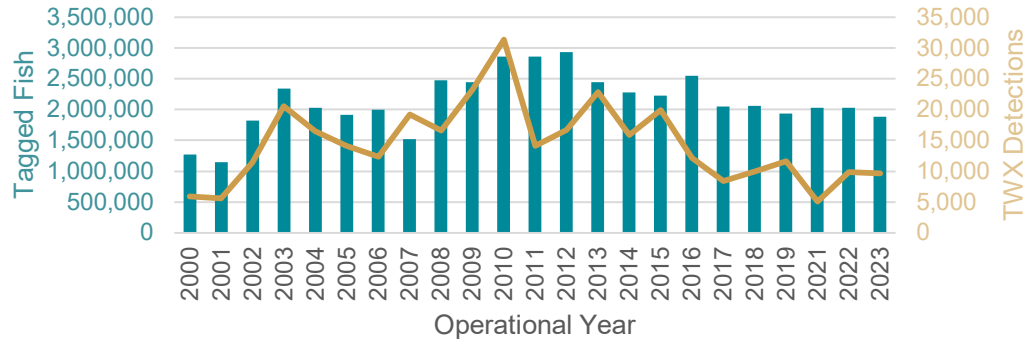


Pair Trawl (TWX)



- Historic method of estuary PIT detection
- Replaced both matrix antennas
- Upgraded to the IS1001-M while maintaining backward compatibility

Tagged Fish to TWX Detections



PIT Barge



2018 – Feasibility Test

- 2m fins
- Installation procedures
- Anchoring and drift
- Pinniped exclusion (fencing)
- Basic operations and maintenance

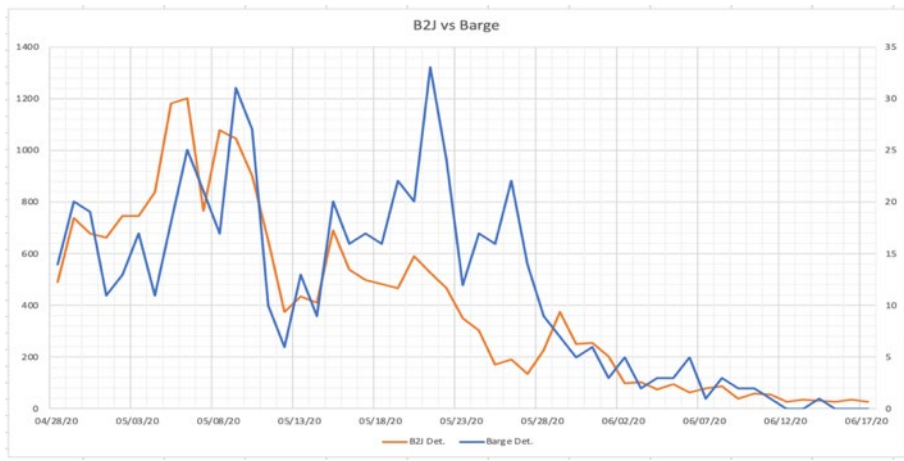
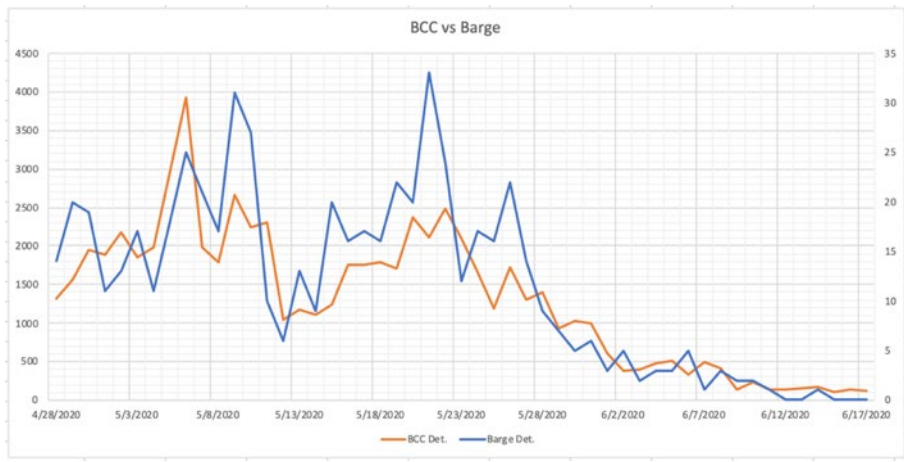
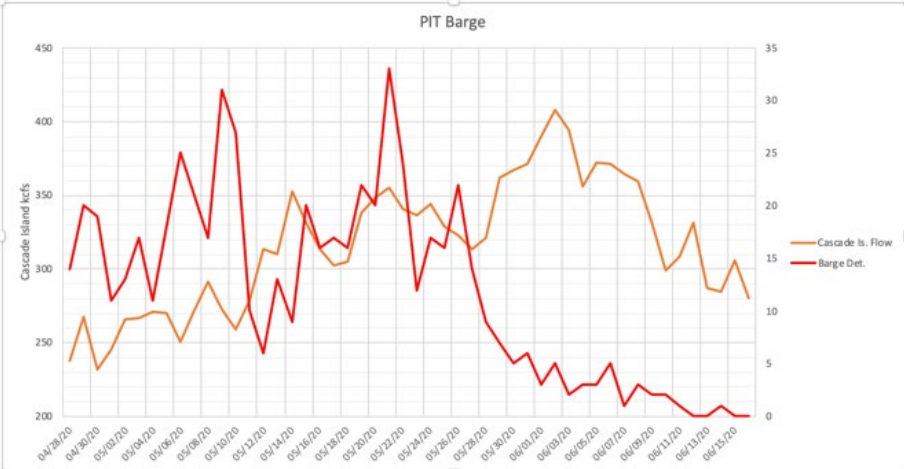
2019 – Feasibility Test

- 4m fins
- Automated debris shedding every 12 hours
- Near Bonneville
- High velocity water
- Pinniped exclusion redesign
- Missed the season from gov. shutdown

2020 – Feasibility Test

- Moved fins aft to prevent wandering
- Sample season
- Closer to Bonneville

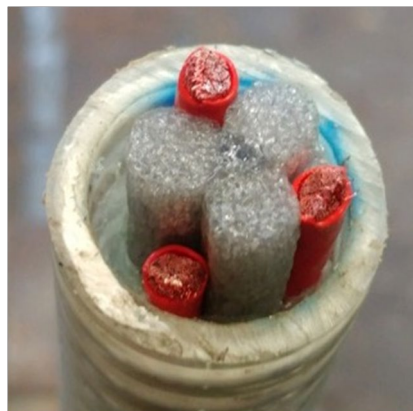
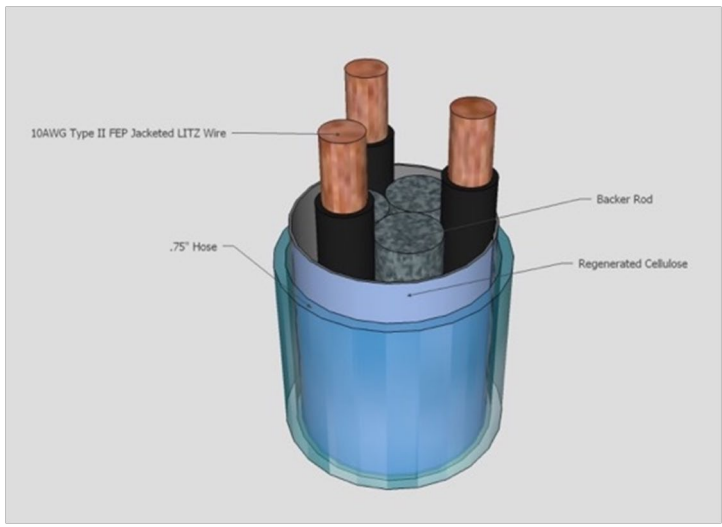
PIT Barge



- 625 unique detections (4/27/20 – 7/21/20)
- Detections we similar to ROR BCC detections
- Potential bias from mooring ball surface disturbance
- Debris shedding worked as designed
- Upgraded anchor mid-season after “dragging”

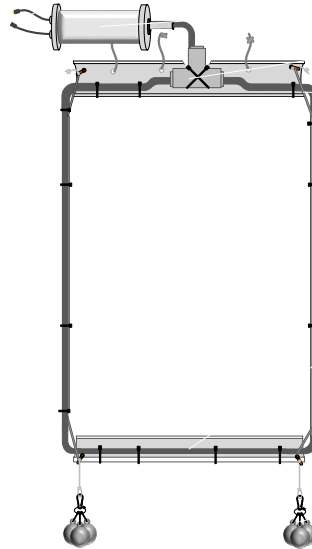


Flexible Antenna Cable



- Hand built flexible antennas
- Pasco testing
- Designed cable specs for manufacture
- Two revisions for use as a flexible array
- Side-by-side testing showed improved performance

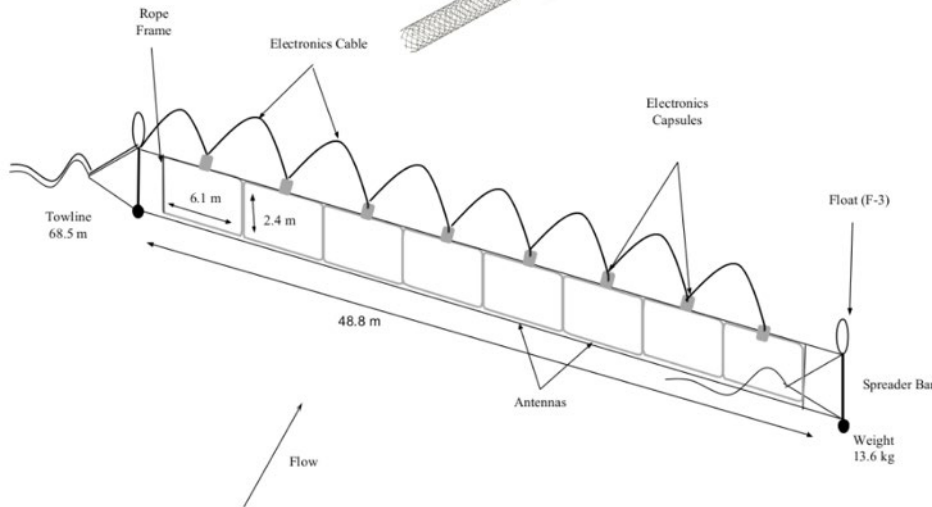
Flexible Antenna Cable



- Currently used as FACA antennas
- Used for Pile Dike antennas
- 20' x 8' at ~ 7 amps
- Used in BON slot antennas
- Used as large pass-through antennas

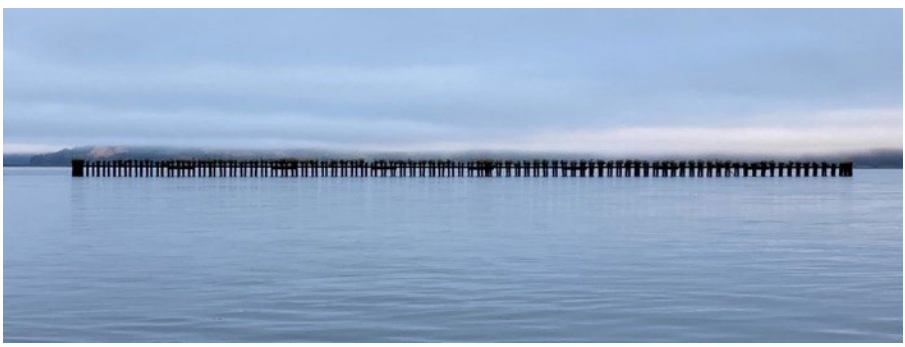


2023 – Flexible Array



- Operated the FLX system horizontally and during daylight hours to target steelhead
- Developed new aluminum enclosures to work with our cable
- Installed and operated a net reel to ease deployment and retrieval, reducing staffing requirements and increasing operational safety

Pile Dikes



“... approximately 233 CENWP pile dikes located between the mouth of the Columbia River and Bonneville Dam. These pile dikes were constructed between 1885 and 1969, typically in a coordinated program of pile dike construction coupled with channel dredging. Although the specific functions of the individual pile dikes vary the original purpose of the pile dikes, in general, was to support the establishment of a stable navigation channel and/or to minimize the maintenance dredging requirements.”

-Structural and Hydraulic Analysis of Columbia River Pile Dikes Final Report

Figure 2-4 Typical Pile Dike Cross-Sections (USACE, 1988)

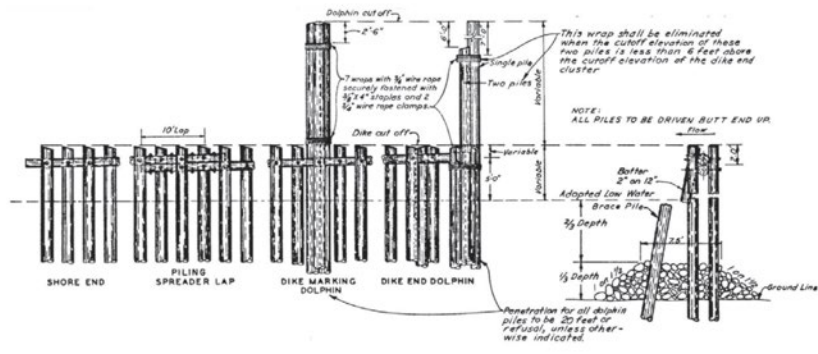
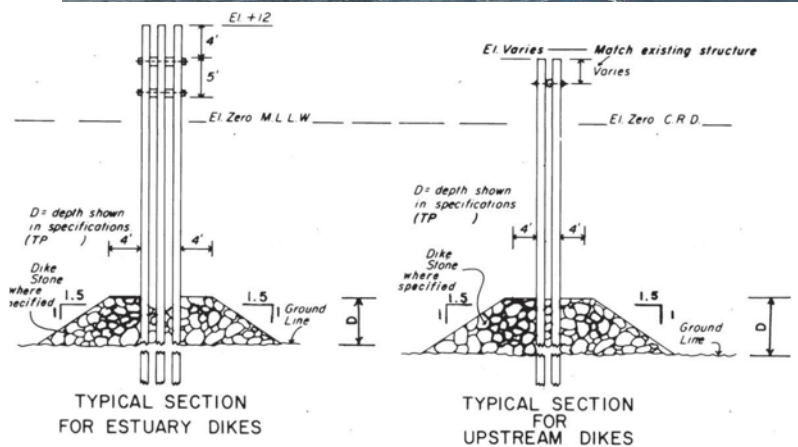
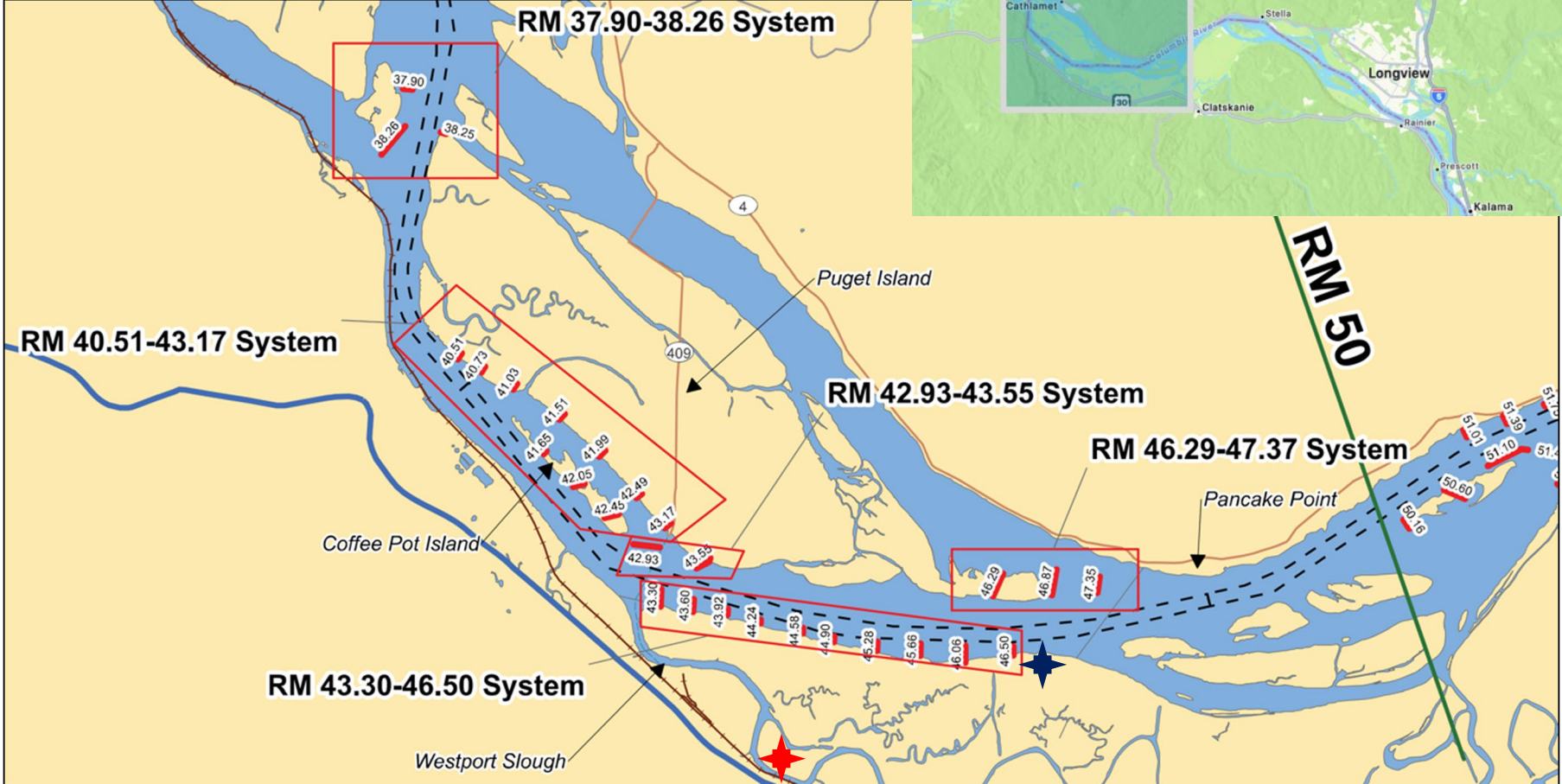




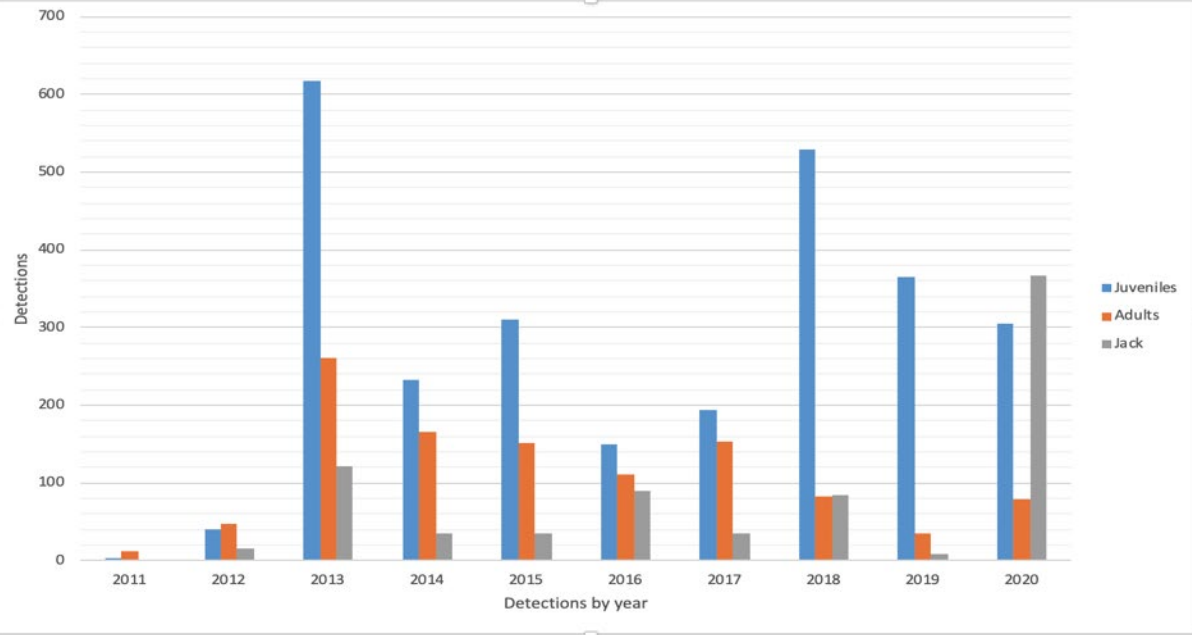
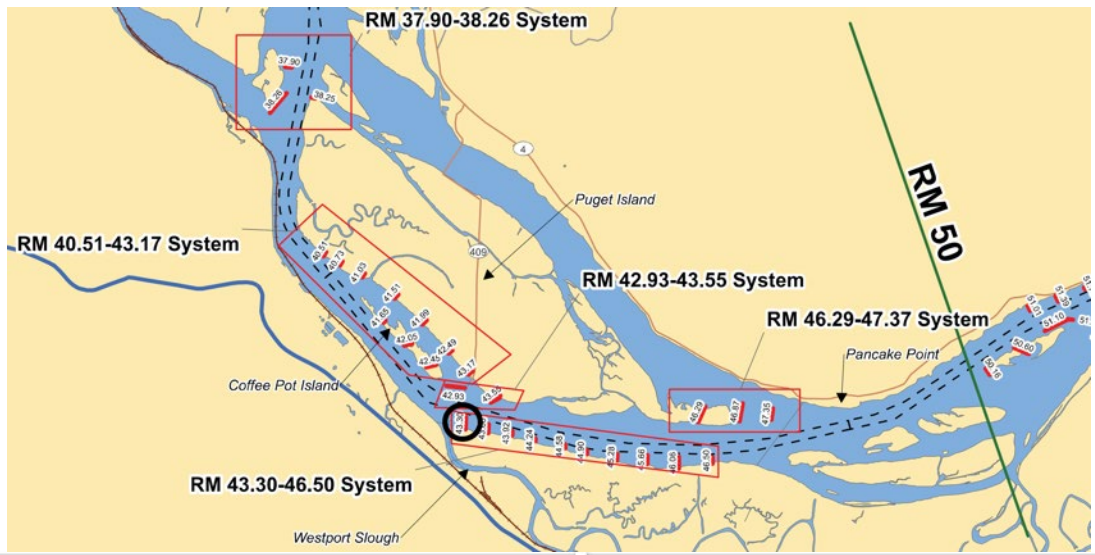
Figure 2-5 Typical Pile Dike Elevation (USACE, 1988)

Pile Dike Site Availability



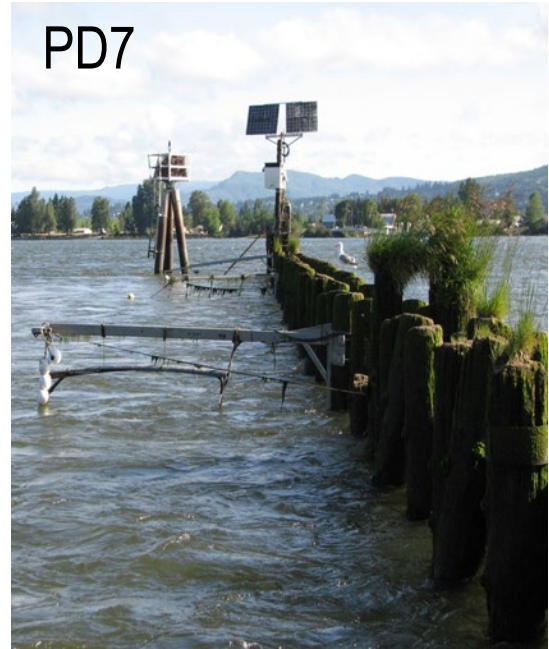
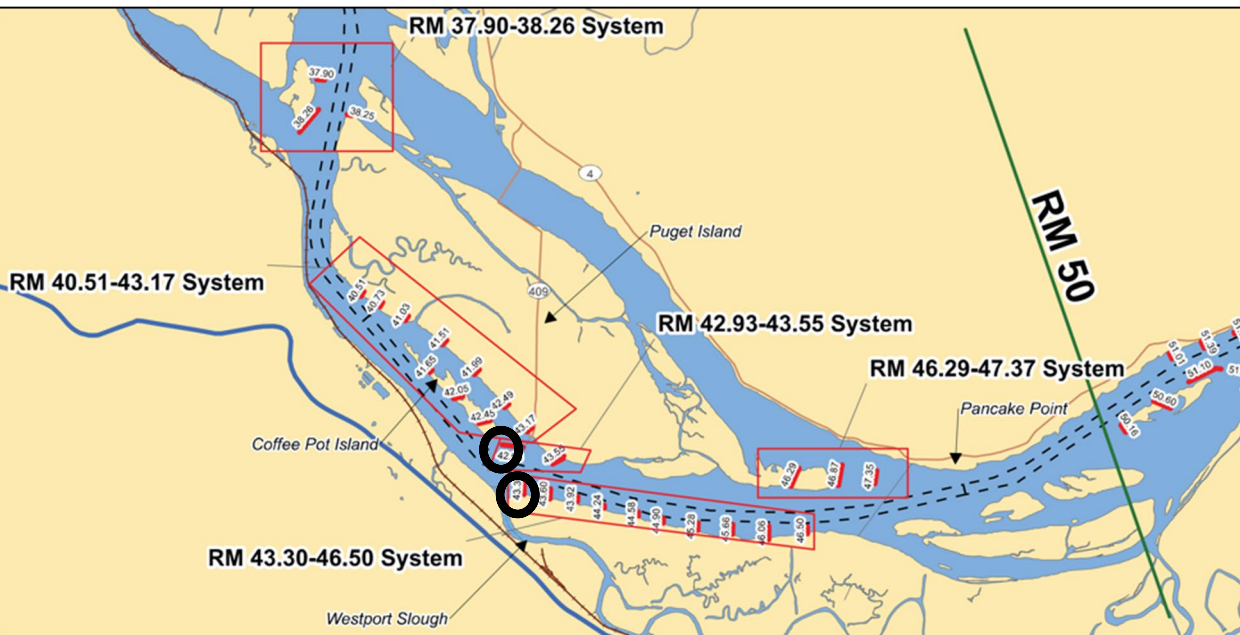
-  Jones Beach NOAA Facility
-  Boat moorage

PD7 from 2011 - 2020

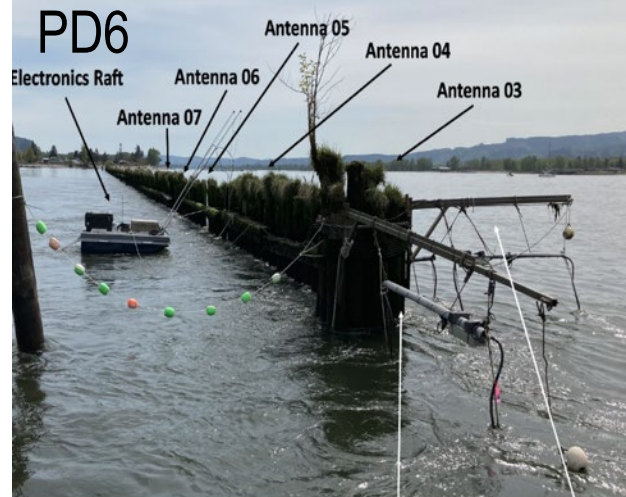


- 1,098 - Total adult detections
- 2,747 - Total juvenile detections

2022 – Estuary Detections

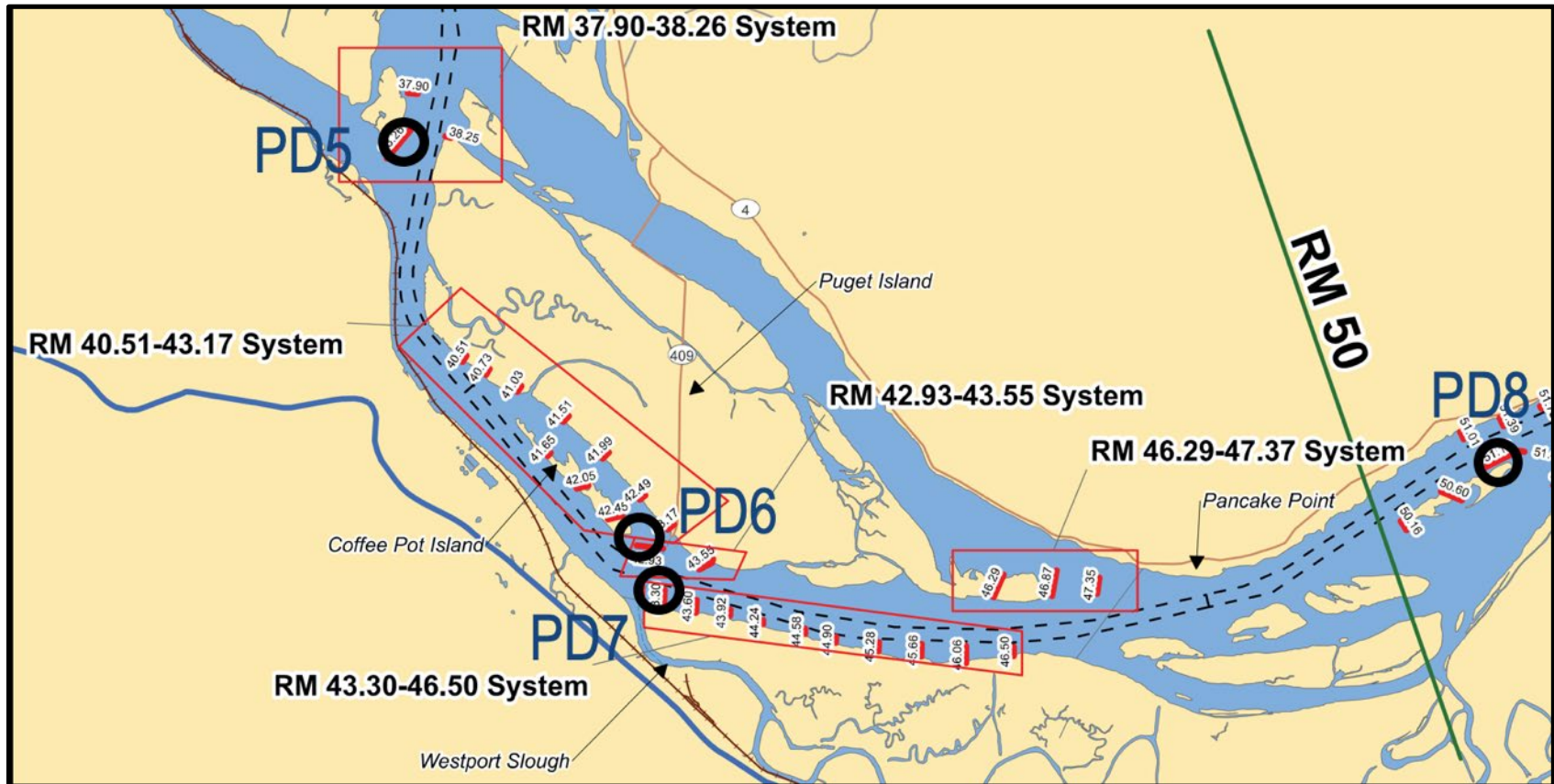


- Pile Dikes – 3,723
- Trawl – 9,838



Antenna 01
Antenna 02
(Removed)

2023 Pile Dike Season

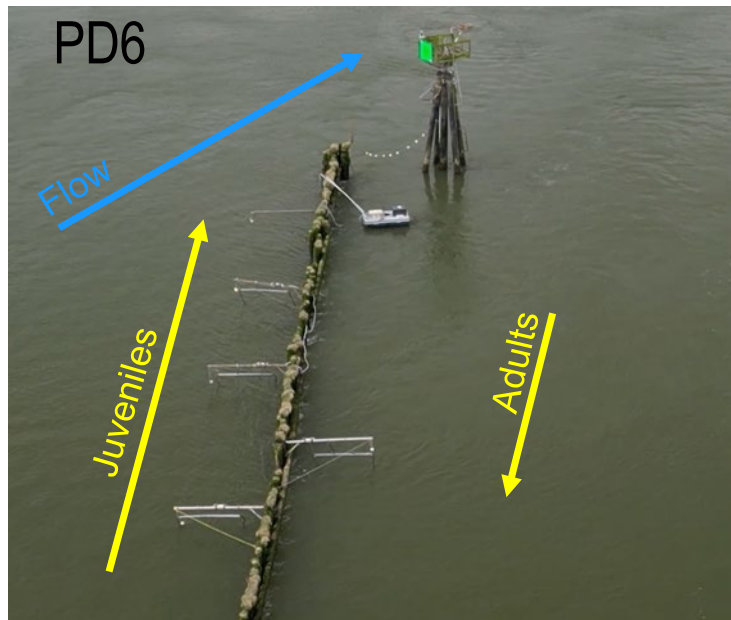


- Funding for MCN and ITS stalled, worked with BPA to move R&D funds to estuary work
- Expansion to four sites, permits allow for up to seven
- Supplemental funding provided by WDFW for adult detections

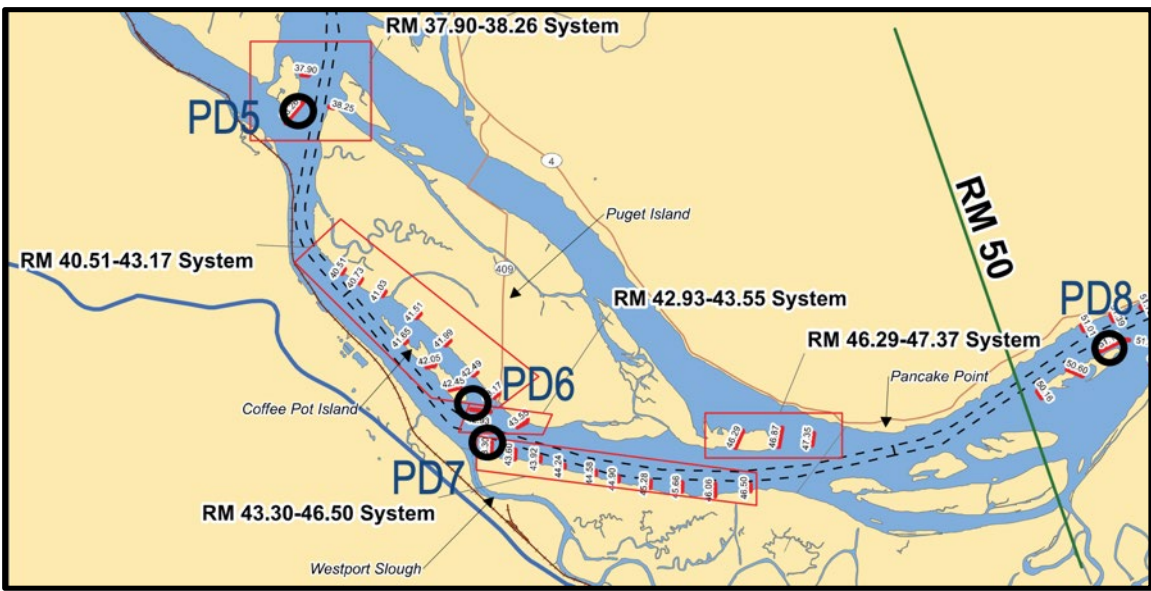
2023 – Pile Dike Sites



PD8



PD6

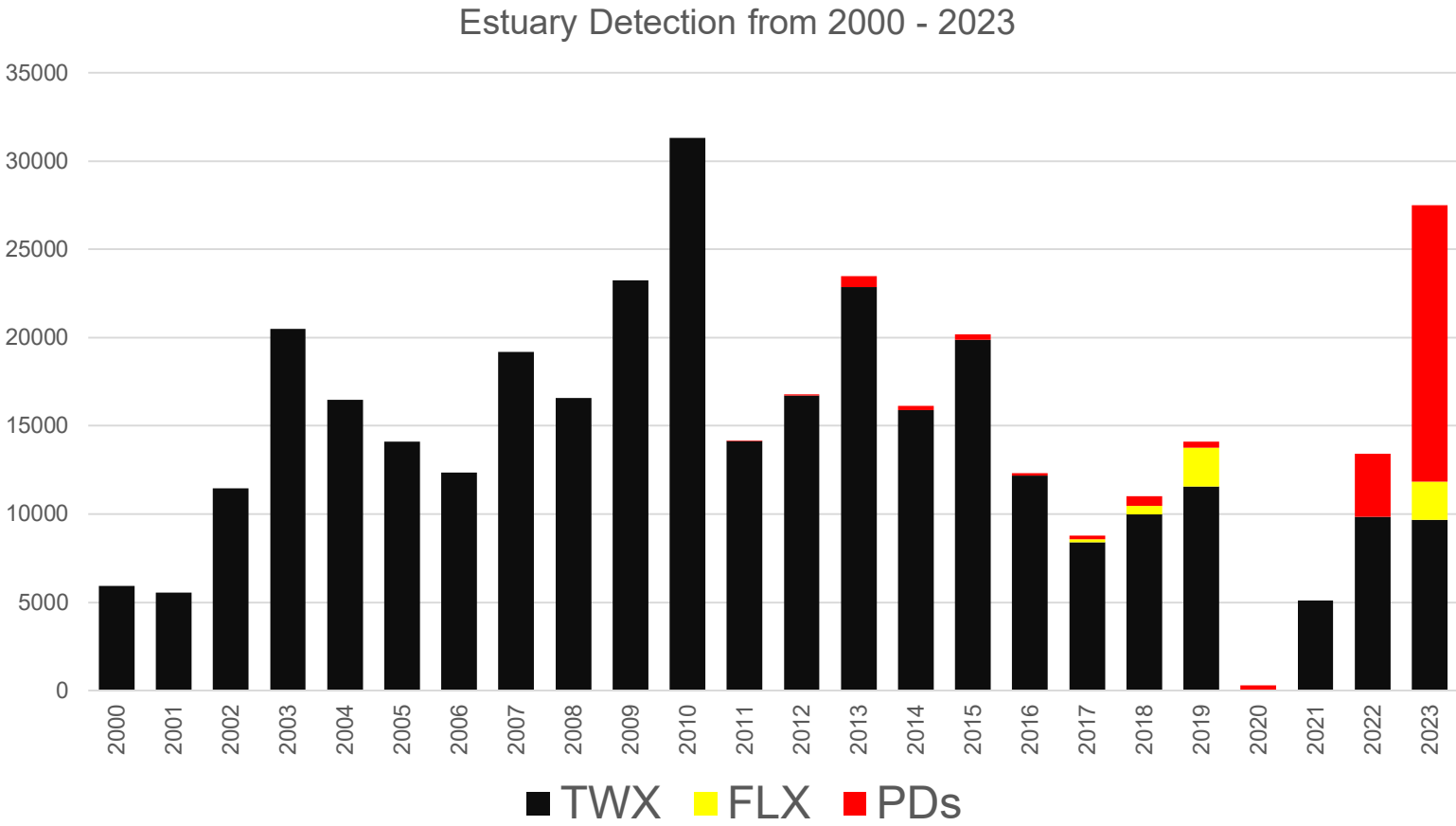


PD5



PD7

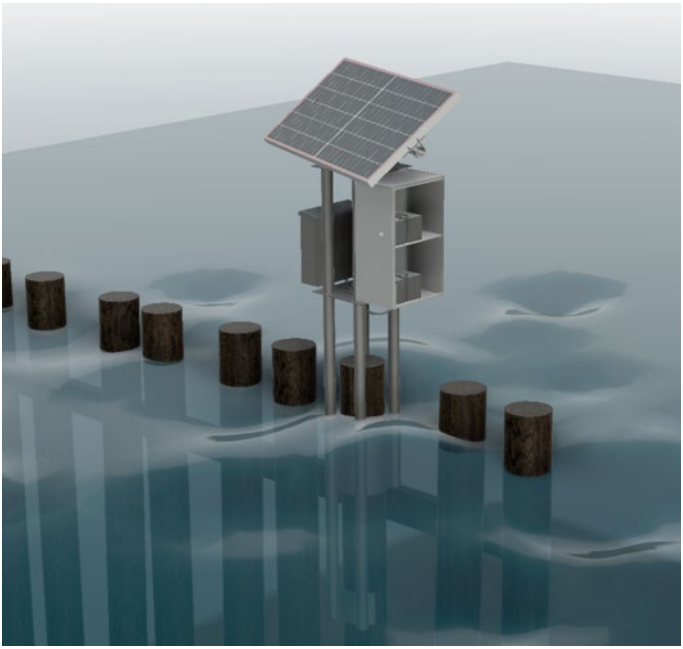
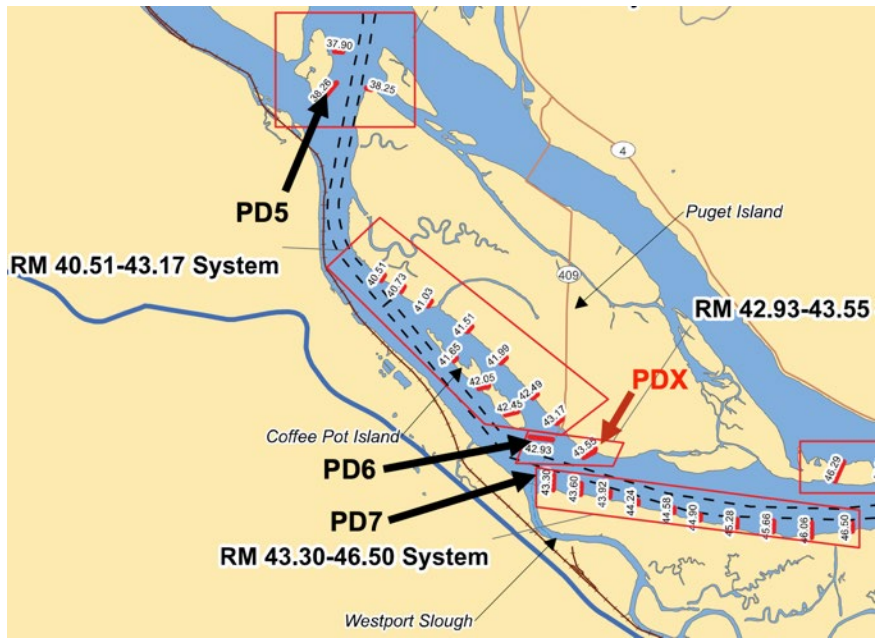
Estuary Detections – 2000 to 2023



2024 – Pile Dike Season Proposal

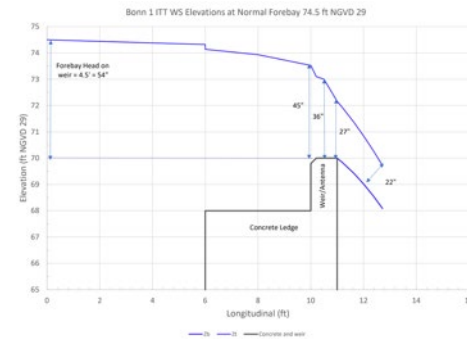
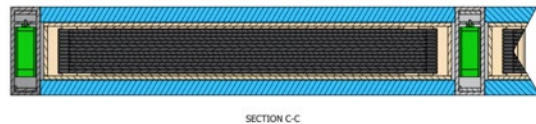
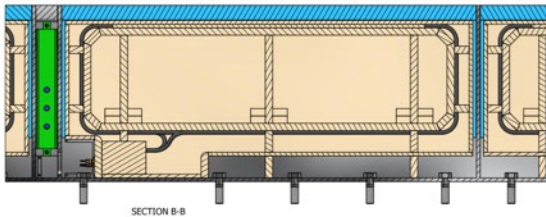
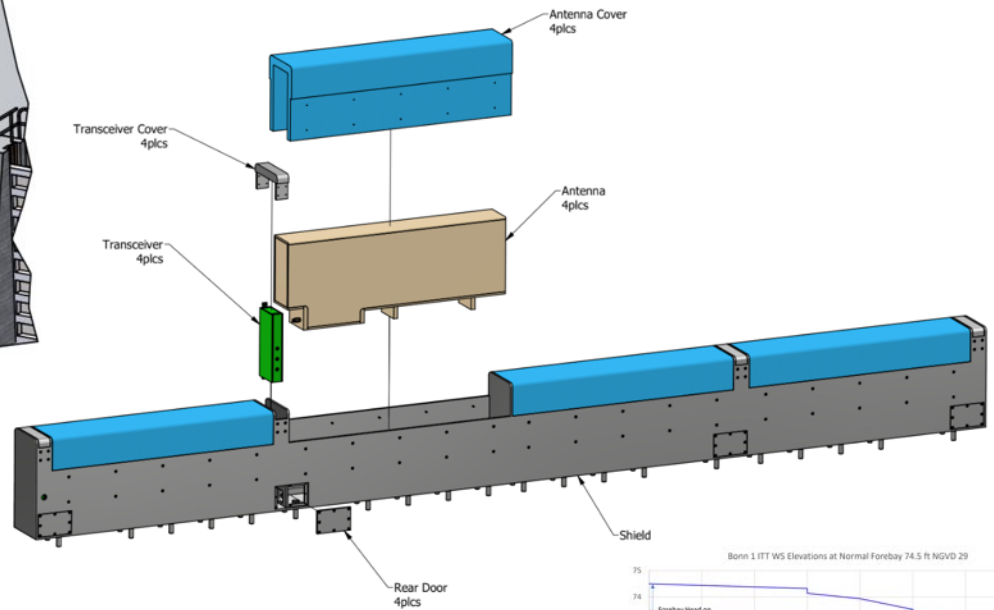
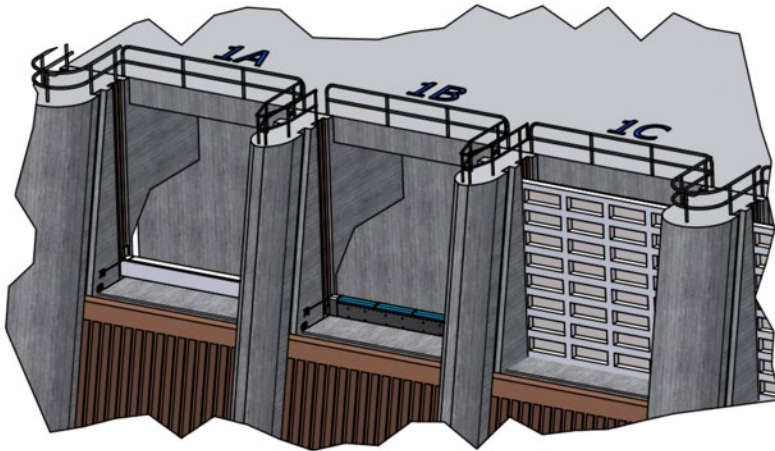
PD5	01	02	03	04	05	06	07	Total
# first detection (unique)	945	388	1,772	630	3,350	212	160	7,457
# tags with subsequent detection	18	32	302	217	782	79	96	1,526
# 'true' unique tags	927	356	1,470	413	2,568	133	64	5,931
% Duplicate (overlap)	1.90%	8.25%	17.04%	34.44%	23.34%	37.26%	60.00%	20.46%
% unique	98.10%	91.75%	82.96%	65.56%	76.66%	62.74%	40.00%	79.54%

PD6	01	02	03	04	05	06	07	08	Total
# first detection (unique)	904	897	363	2040	2279	115	37	99	6,734
# tags with subsequent detection	3	53	86	658	980	16	17	40	1,853
# 'true' unique tags	901	844	277	1,382	1,299	99	20	59	4,881
% Duplicate (overlap)	0.33%	5.91%	23.69%	32.25%	43.00%	13.91%	45.95%	40.40%	27.52%
% unique	99.67%	94.09%	76.31%	67.75%	57.00%	86.09%	54.05%	59.60%	72.48%

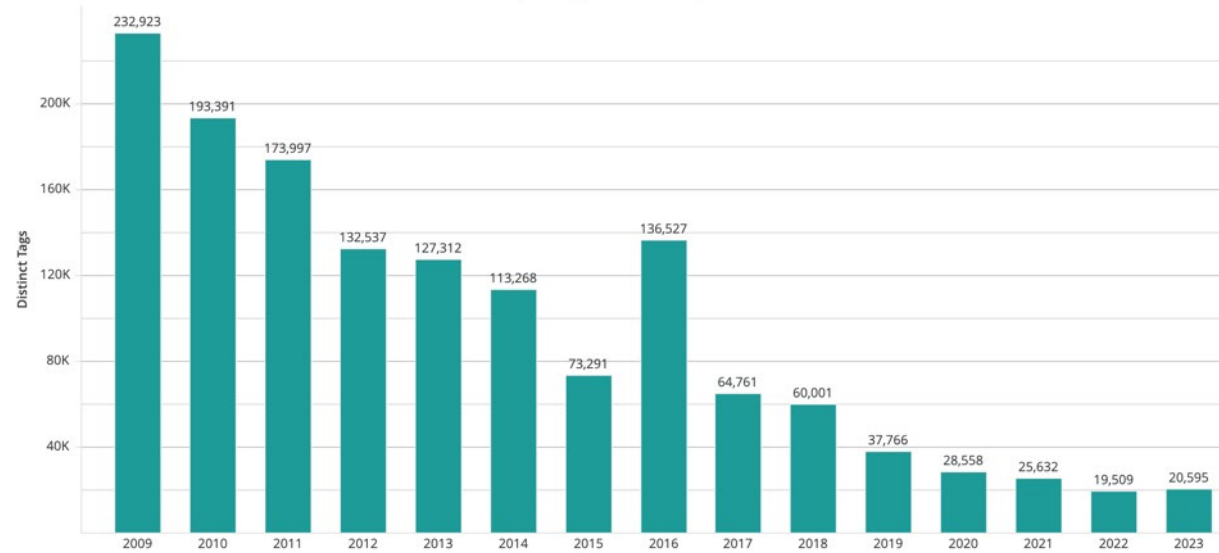


2024 Bonneville ITS Development

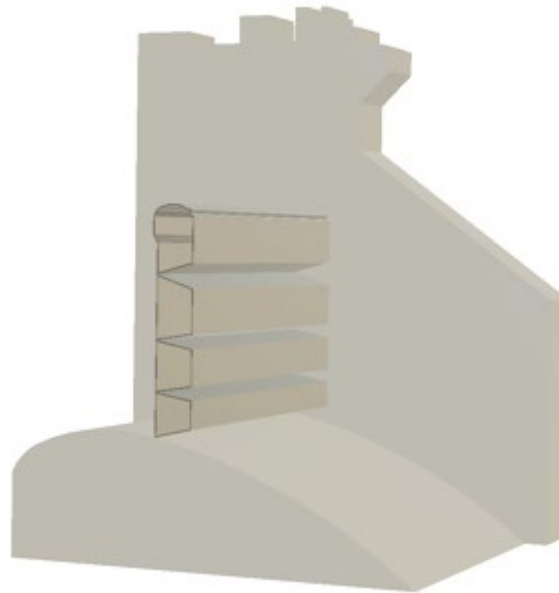
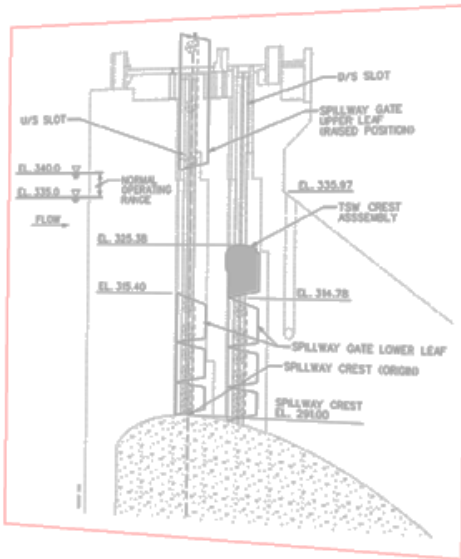
BONNEVILLE PH1 ICE AND TRASH SLUICeway PIT TAG ARRAY FOR GATE 1B



Unique Tags Detected per Year



McNary

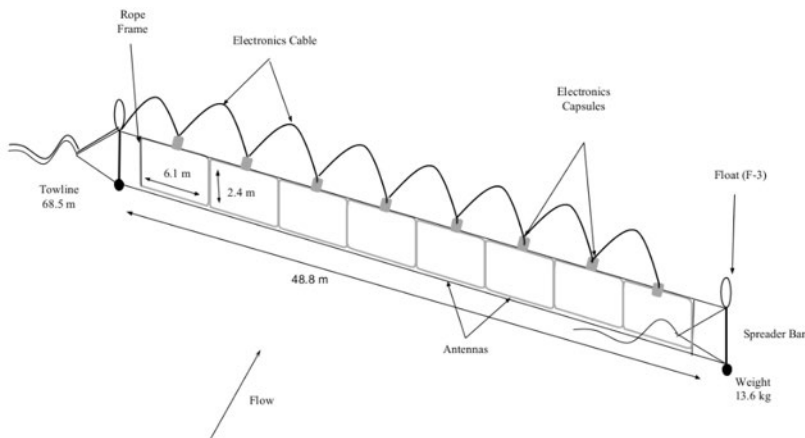
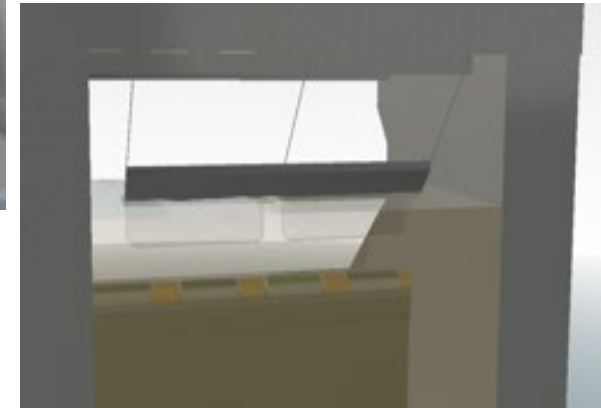
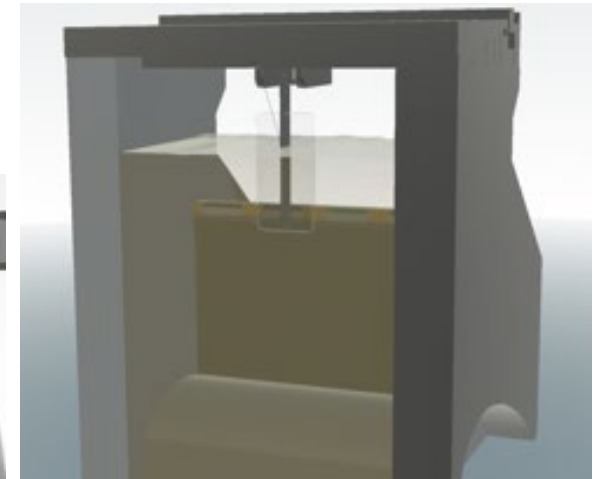
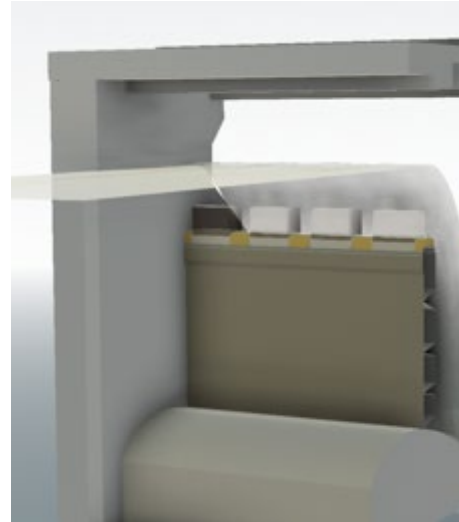


- Awaiting funding (ACOE) for a PDT
- 2024 – EDR
- 2025 – Design selection and review
- 2026 – Install
- Take lessons learned from GRS, BON ITS and develop an antenna system for use atop TSWs and ASWs
- Utilize the FS3001 readers and an ITS style antenna
- Stainless steel structural housings/shields

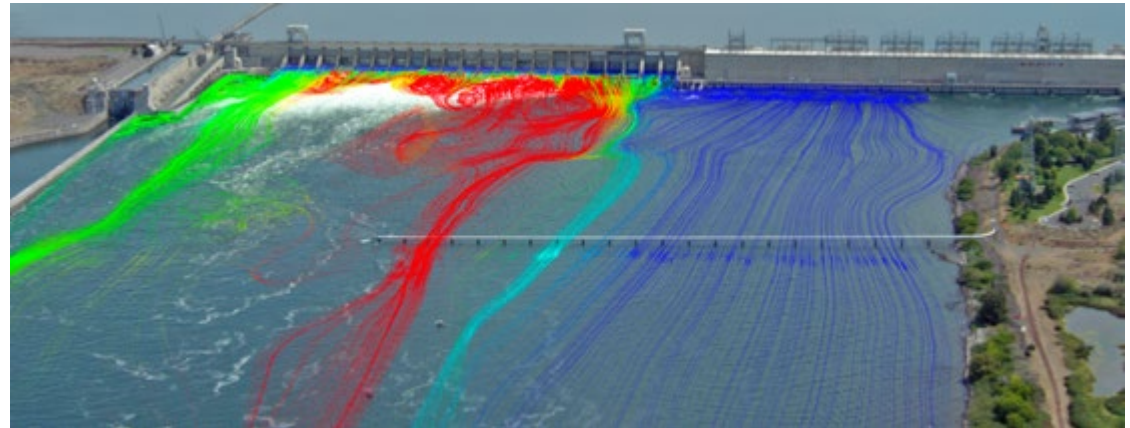
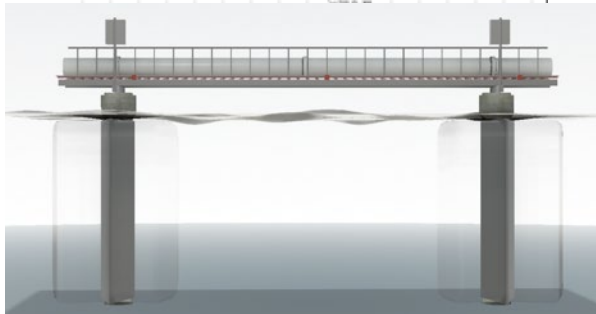
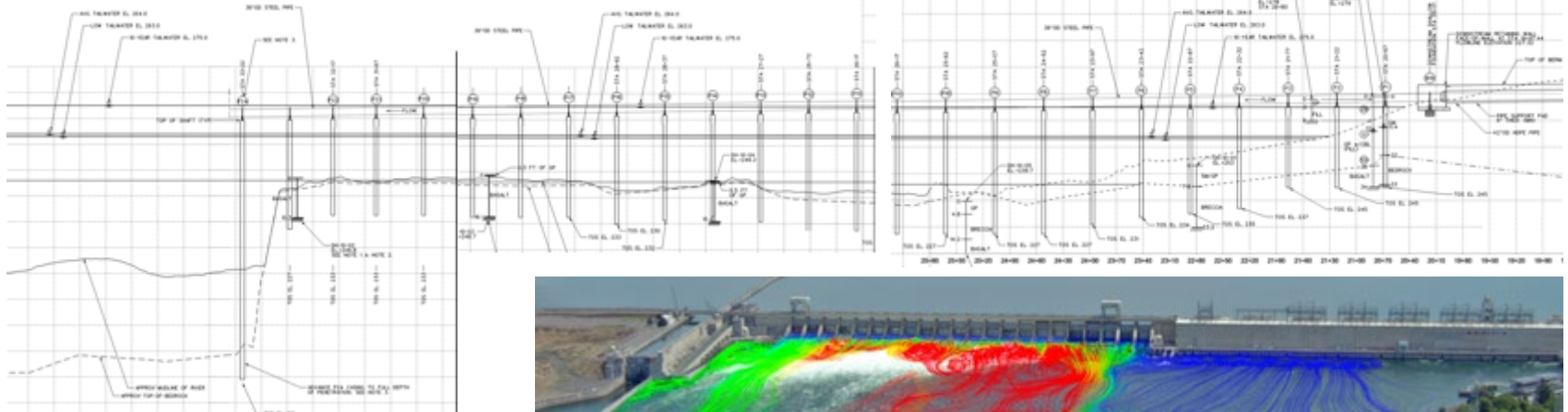


McNary

- TSW cap antennas
- GRS style spillway detector
- Fin antenna(s)
- Floating antenna(s)
- Flexible array deployment
- PIT Barge deployment



McNary PIT Proposals



IHR-Hydroscience & Engineering, University of Iowa

- 24 – 48” concrete pilings with 50’ spacing extending 1200’ into the river
- Option to target certain passage routes based on previous hydraulic and active tag studies

Questions?

Acknowledgments:



Bonneville
POWER ADMINISTRATION



Washington
Department of
**FISH &
WILDLIFE**



**US Army Corps
of Engineers®**

