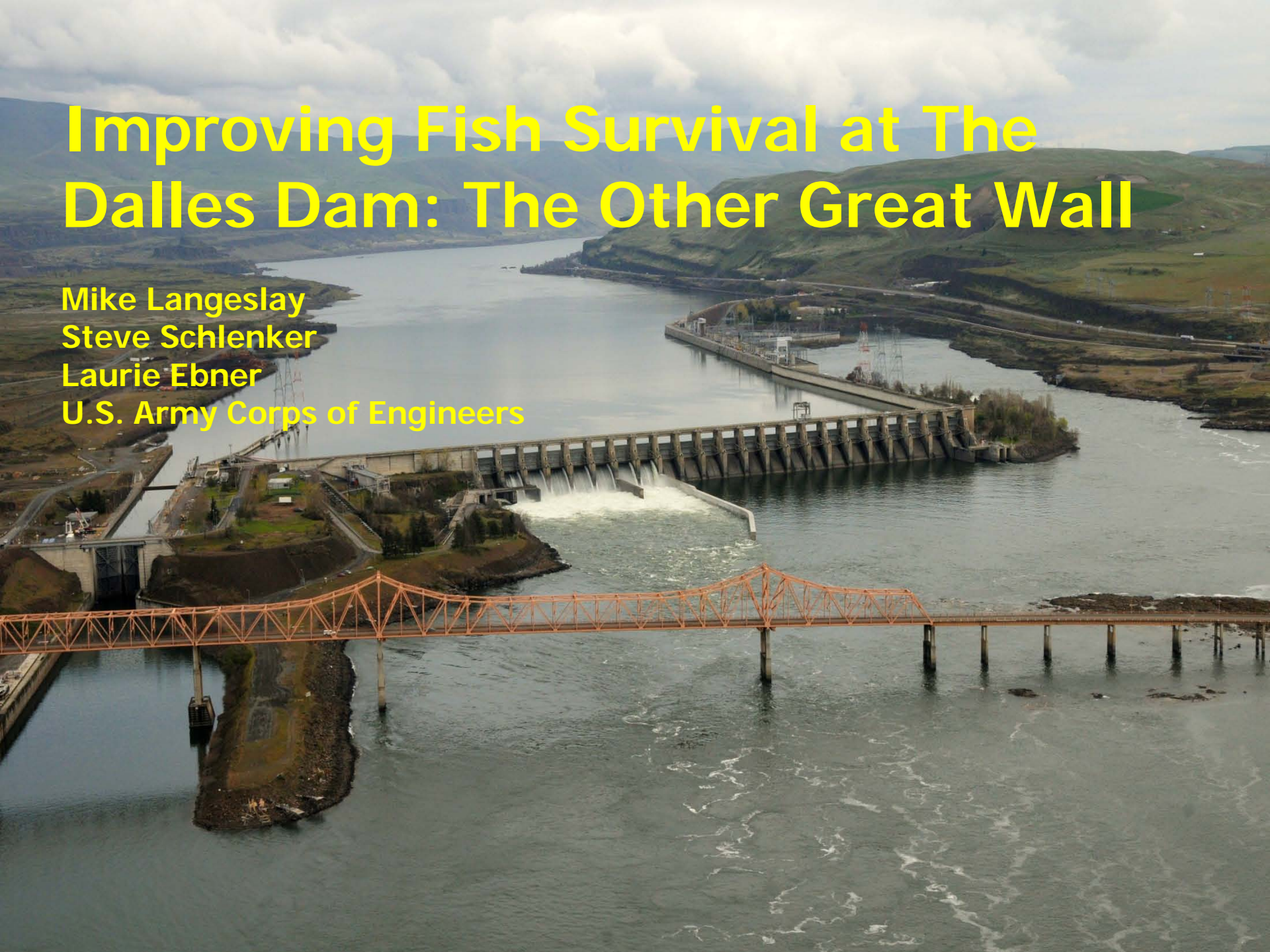


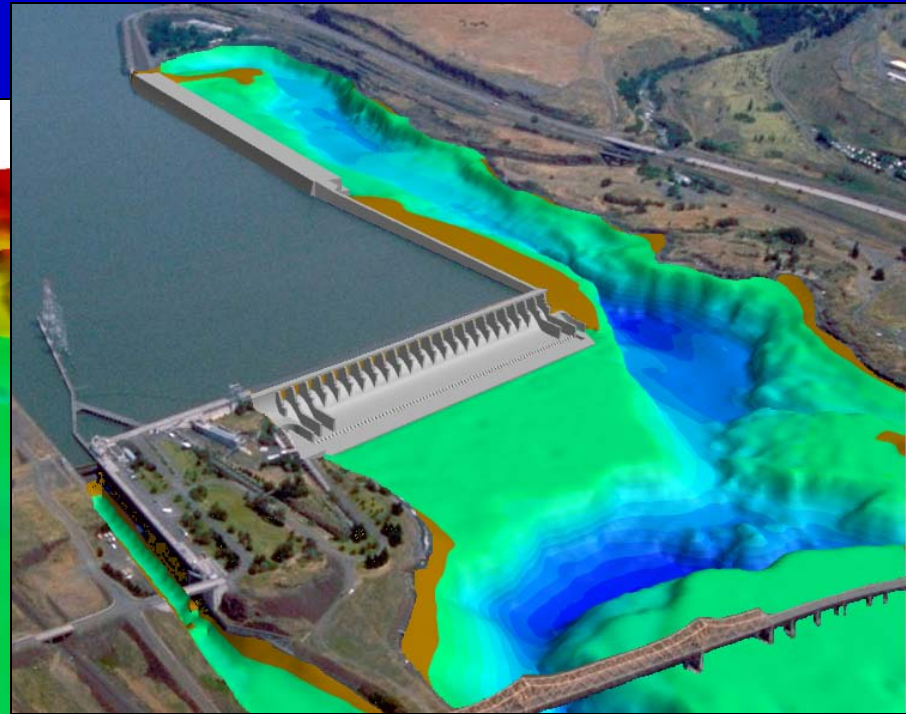
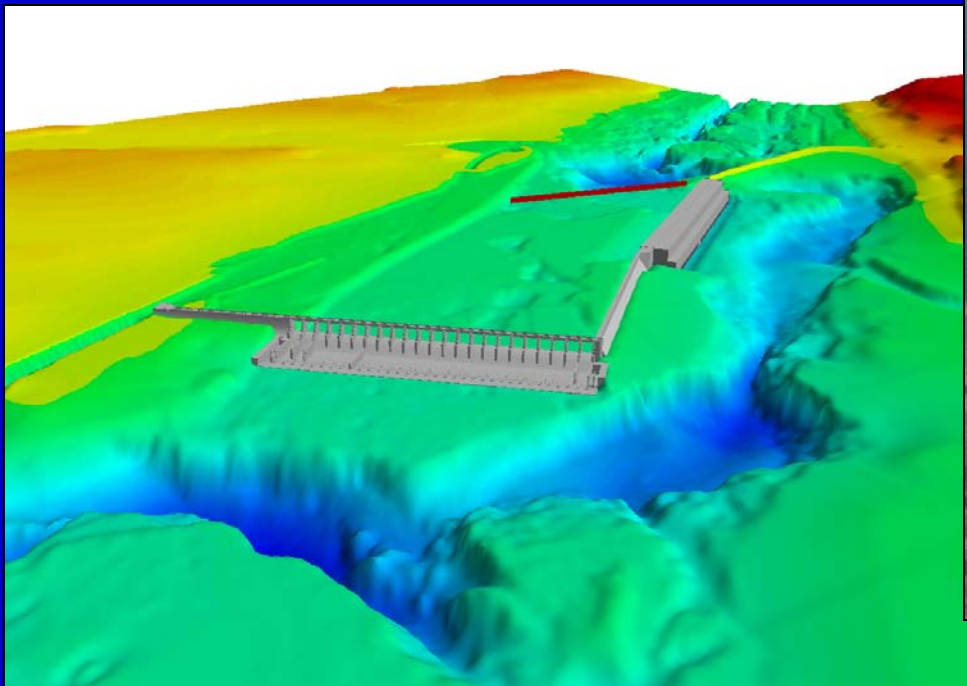
Improving Fish Survival at The Dalles Dam: The Other Great Wall

Mike Langeslay
Steve Schlenker
Laurie Ebner
U.S. Army Corps of Engineers



TDA Features

- "L" shape
- Bathymetry
 - Big Eddy
 - Meandering thalweg
 - Shallow stilling basin/shelf
- Bridge & islands
- No JBS

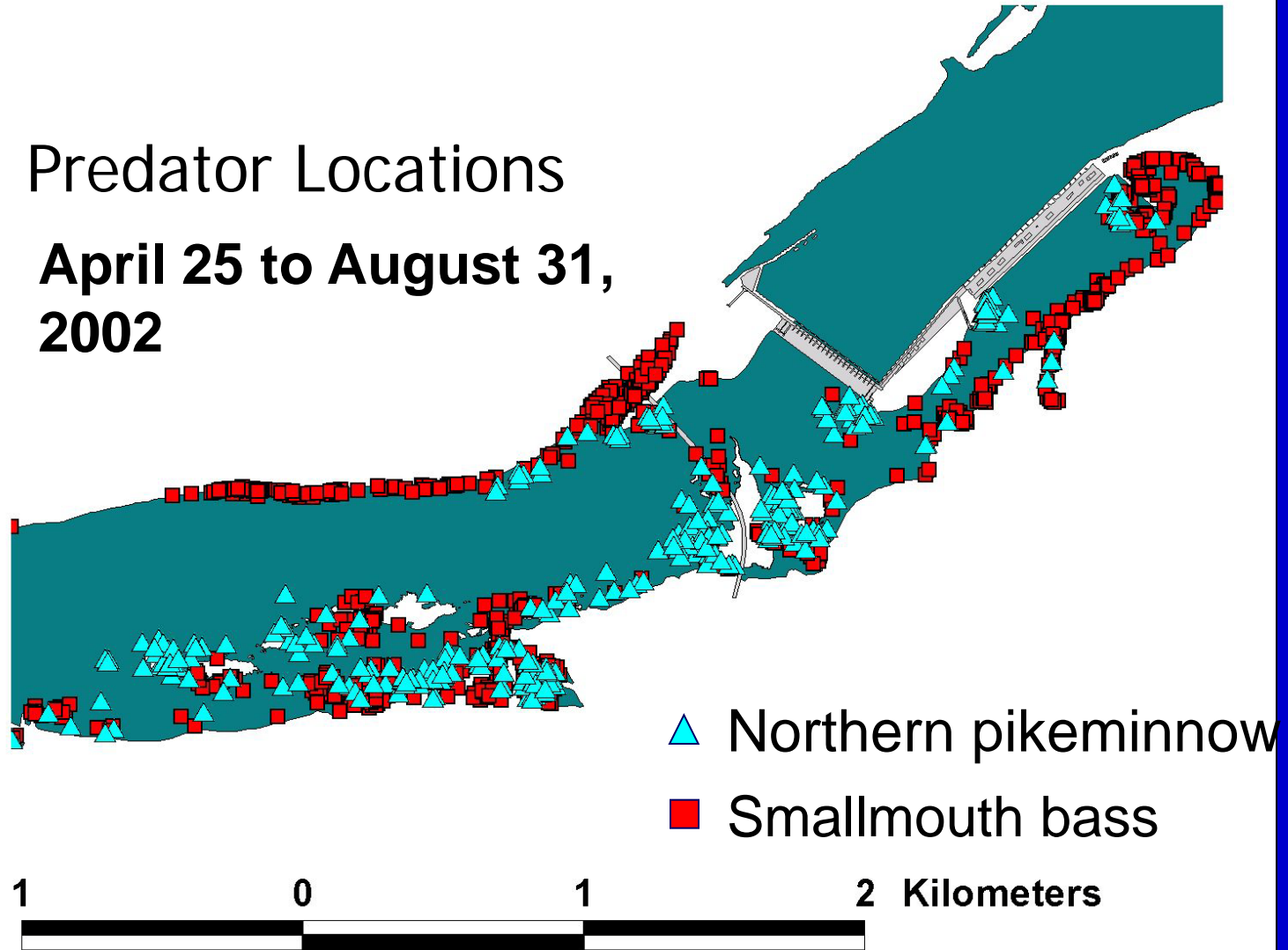




Predation by Fish

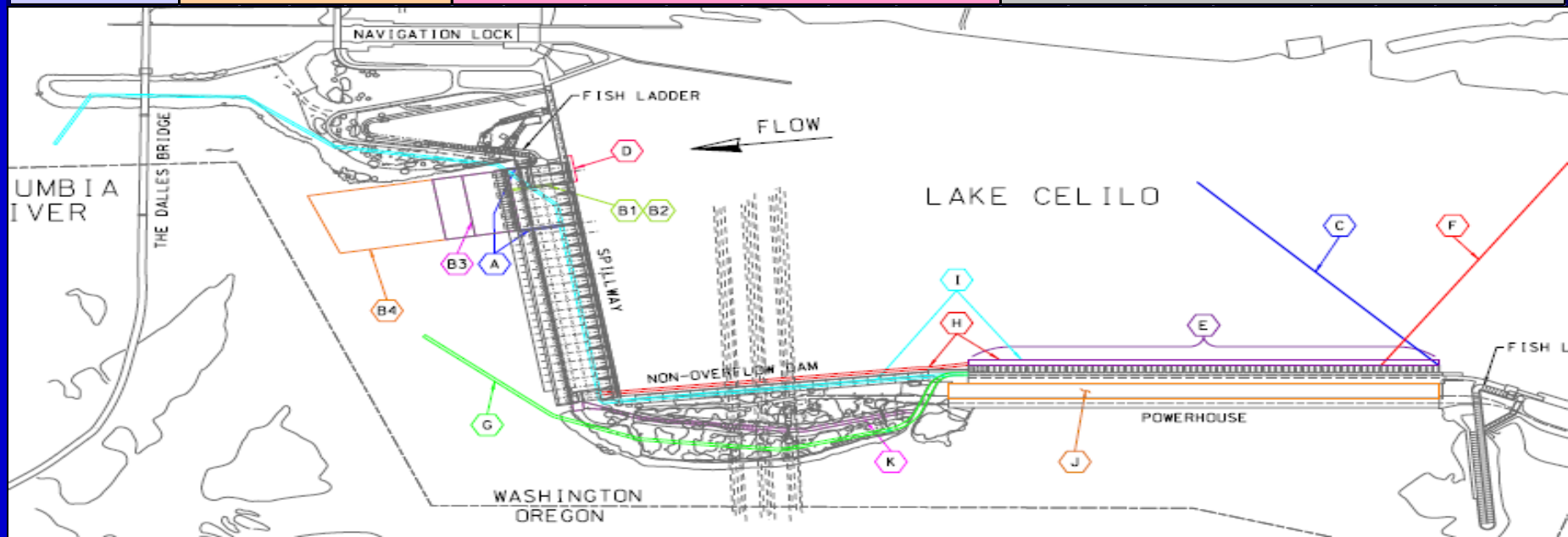
Predator Locations

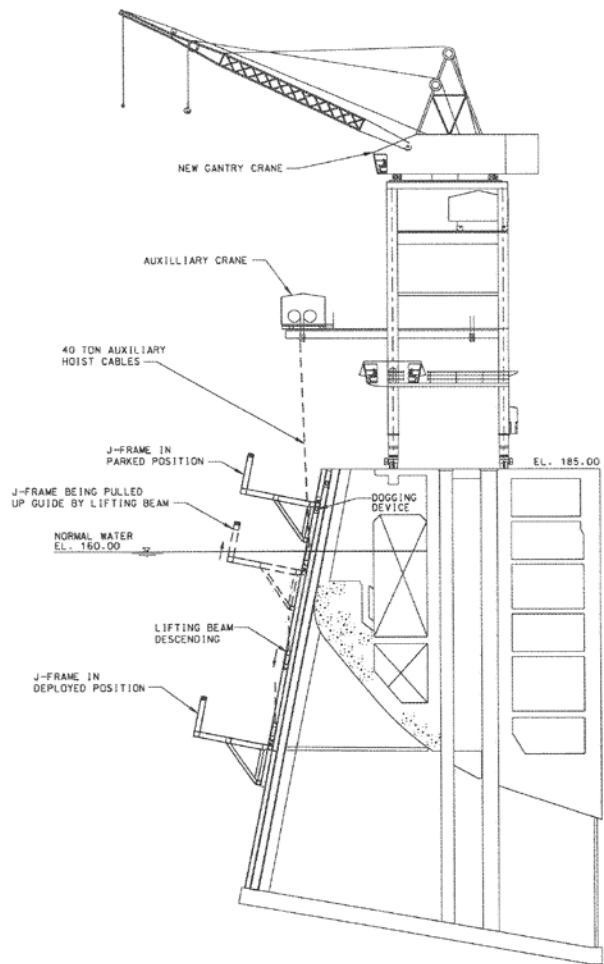
April 25 to August 31,
2002



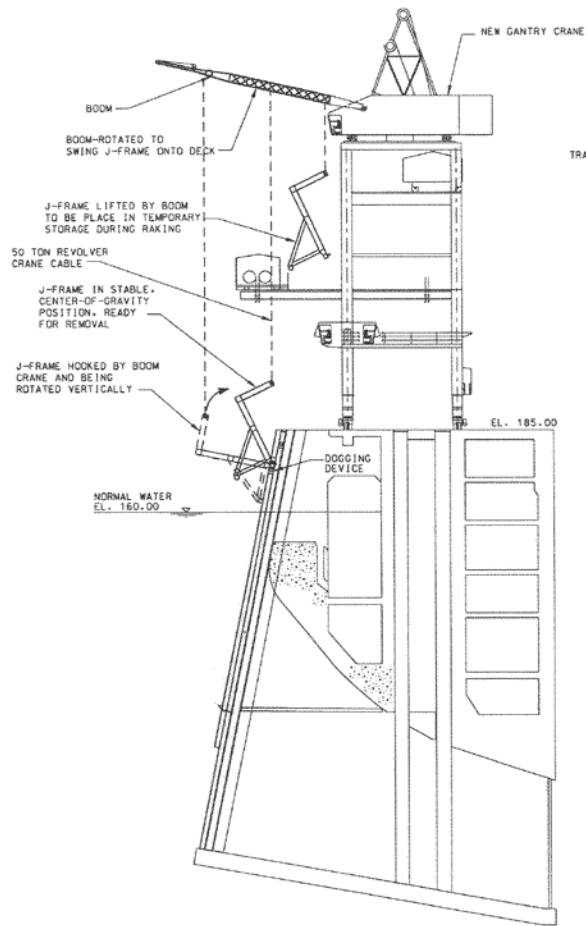
Things We Tried....

| Year | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
|----------------------------------|---------------------------------|----|----|----|----|---|----|----|----|----|--|----|----|----|----|--|----|----|----|----|
| TDA Spill Patterns | Sluiceway + PH (& forced spill) | | | | | Juvenile - night; adult - day 30% - 64% river Across most of spillway | | | | | Juvenile 40% spill, 24hr Northern bays, 1-17 | | | | | Juvenile 40% spill, 24 hr Bays 1 - 6 + 7,8,9..... | | | | |
| Regional Passage Priority | Juvenile Bypass Sys. | | | | | Surface Collection/Bypass | | | | | | | | | | Spill (BGS, RSW) | | | | |
| TDA Focus | JBS Design | | | | | Outfall Sluiceway Relocation PH J-Blocks Spillway Operations | | | | | | | | | | Spillway Structural Improvements (Walls, Excavation, Guidance Curtain, Spillway Weirs) | | | | |

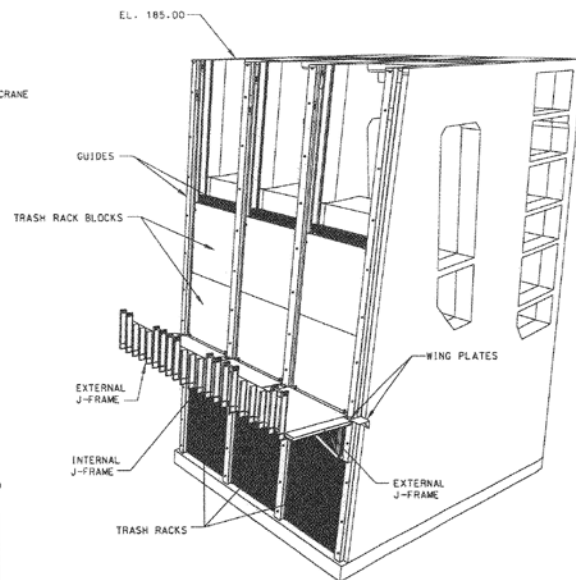




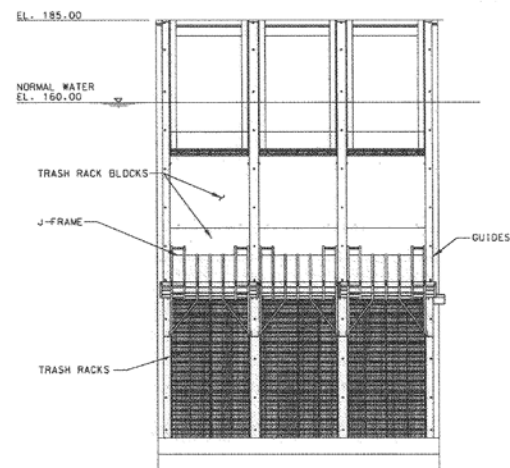
J-FRAME - DEPLOYED & STORED POSITIONS



J-FRAME REMOVAL



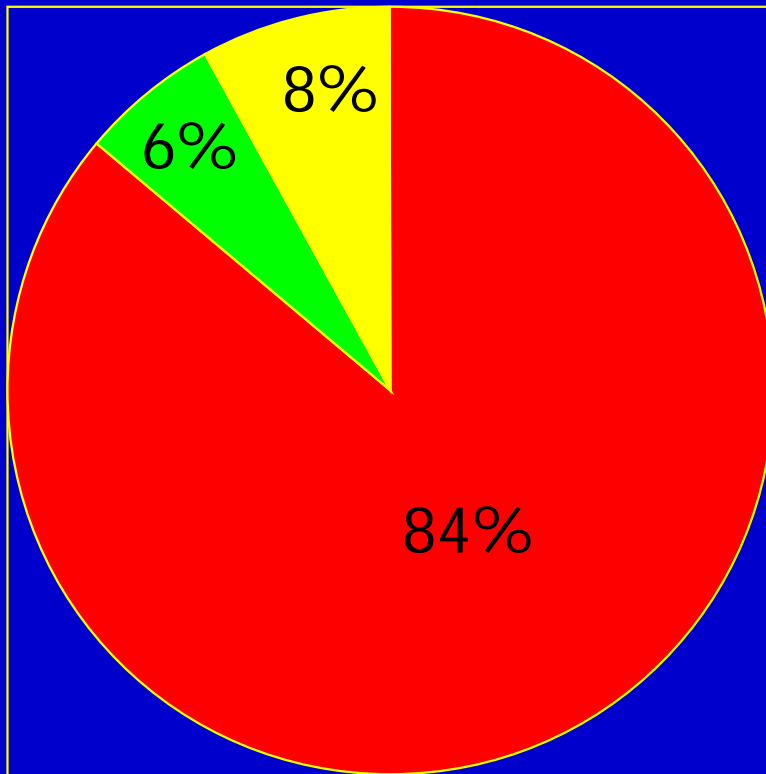
ISO VIEW OF MAIN UNIT SHOWING EQUIPMENT DEPLOYED



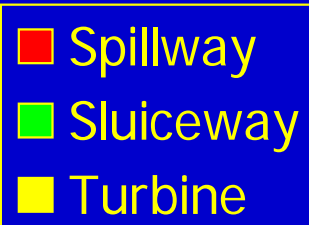
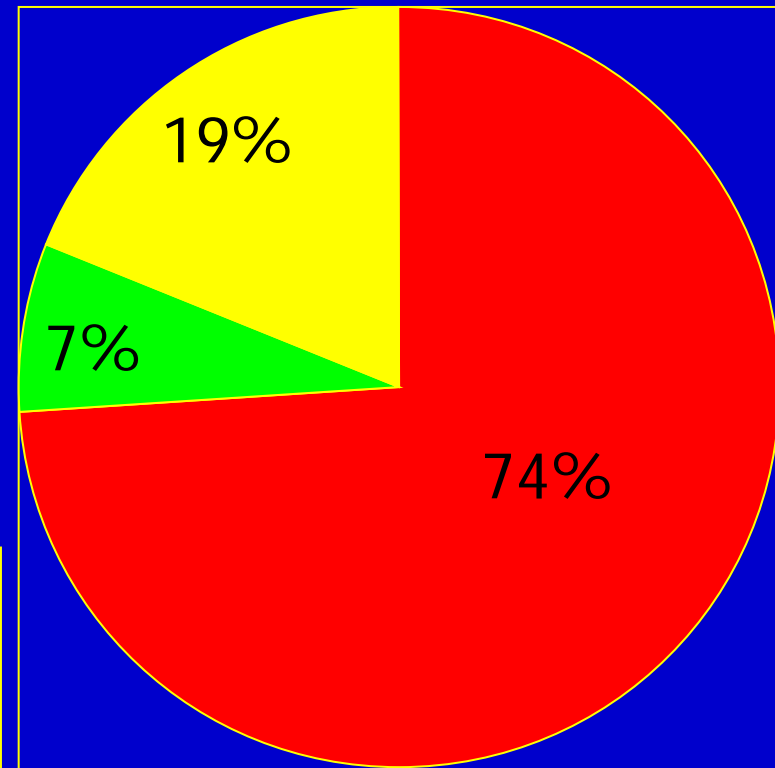
TYPICAL FRONT VIEW OF ONE MAIN UNIT SHOWING EQUIPMENT DEPLOYED

Juvenile Passage Distribution: Pre-Spillwall

Spring

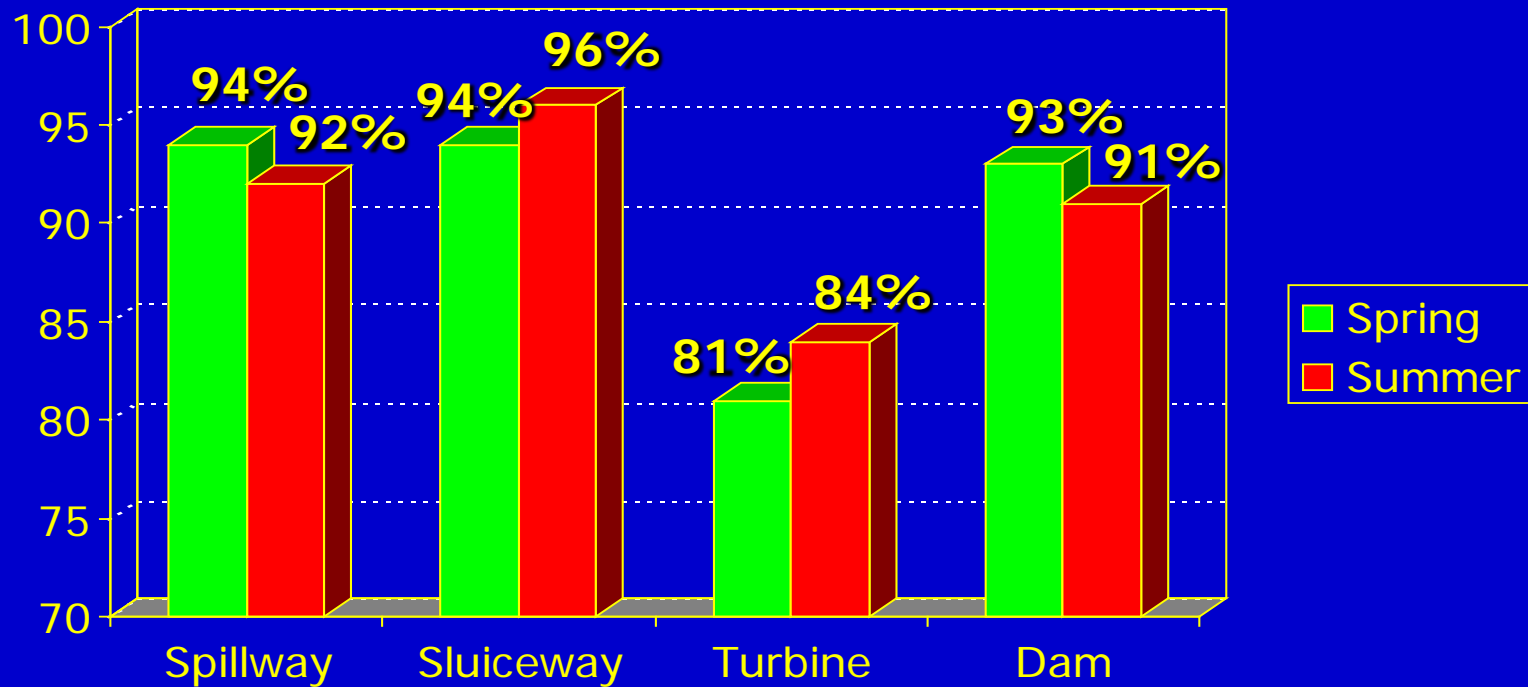


Summer



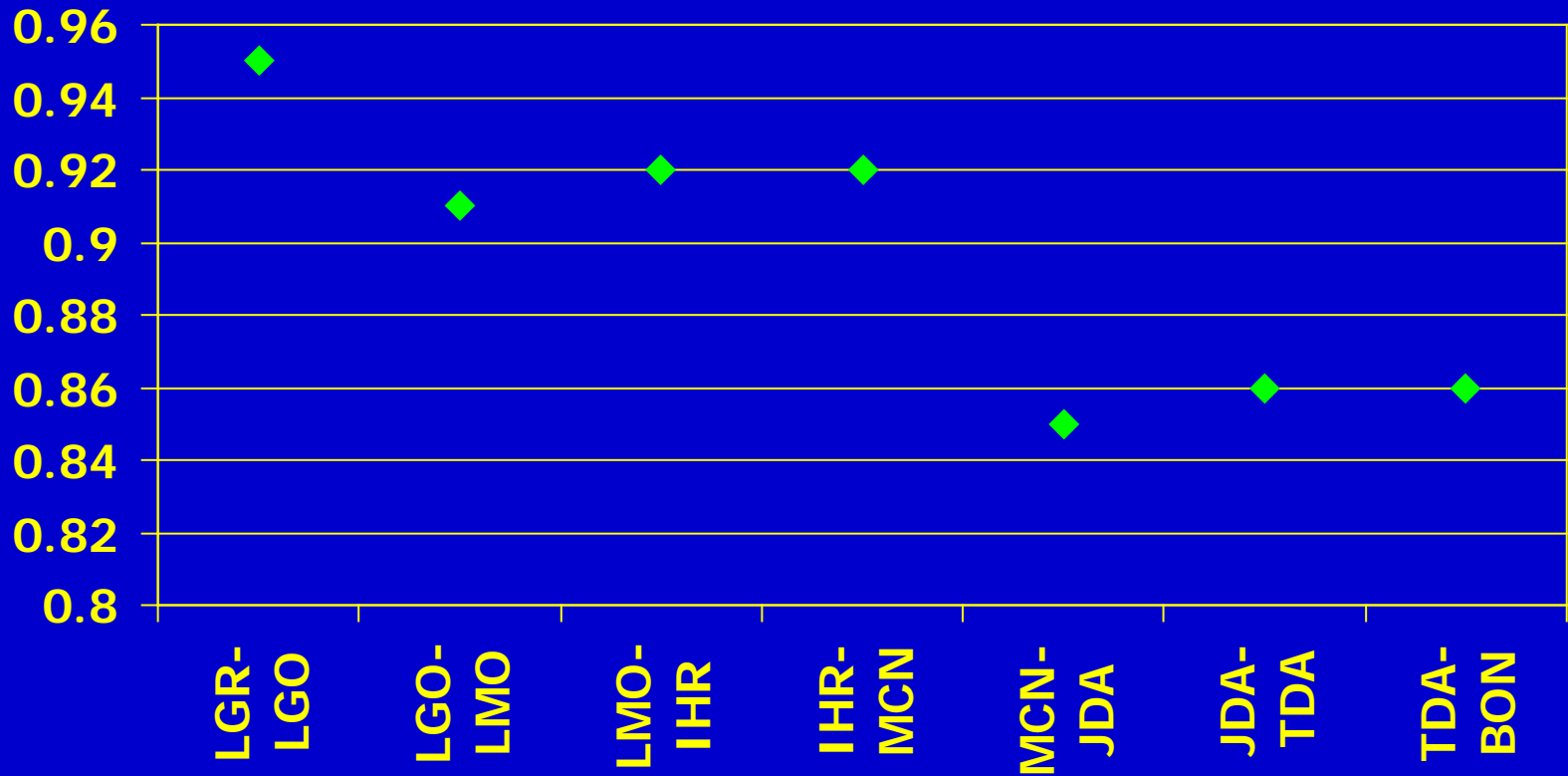
Percent Passage by Route for 40% Spill, Juvenile Pattern

Survival



Survival Rates at 40% Spill, Juvenile Pattern

Average Reach Survival Estimates for Yearling Chinook, 1999-2002



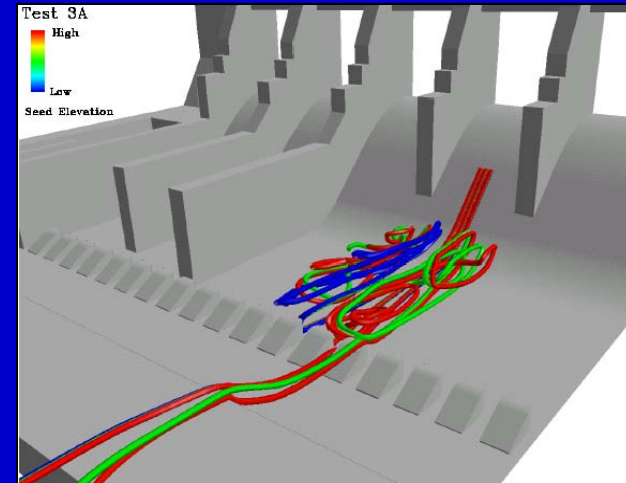
From NOAA Fisheries PIT analysis results

New Direction: Structural Spillway Improvements

- Direct Effects
 - Gate Opening / Volume
 - Spill Pattern Effects
- Egress and Predation
 - Pattern
 - Spill Volume
- Adult Passage – shoreline velocities
- TDG

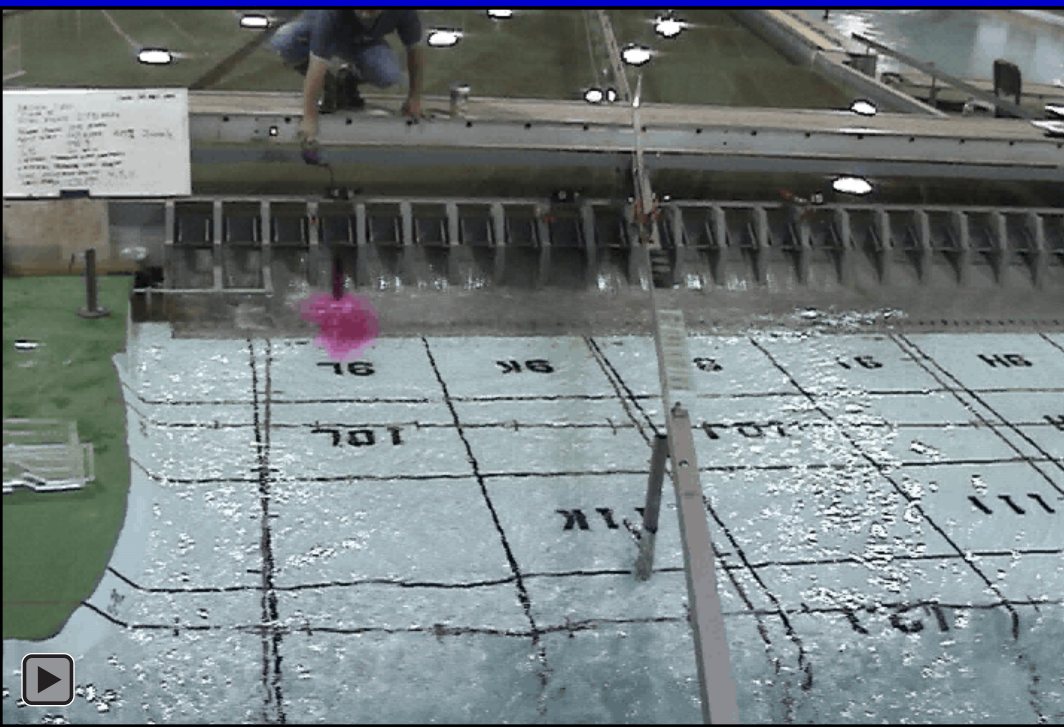
Fish Passage and Hydraulic Model Studies

- 1:80 Physical Hydraulic Model
- Computational Fluid Dynamics Model
- Radio Telemetry
- Balloon Tags
- Sensor Fish



North-Bulked Spill Pattern

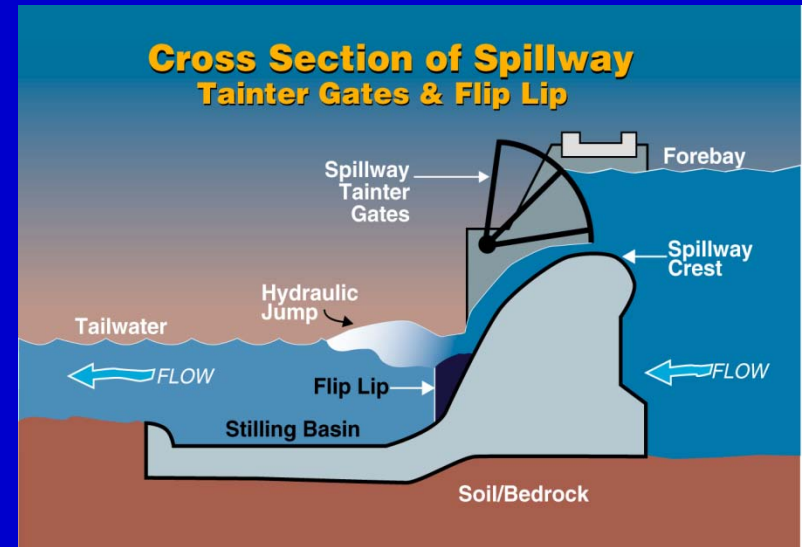
Bay 9 →

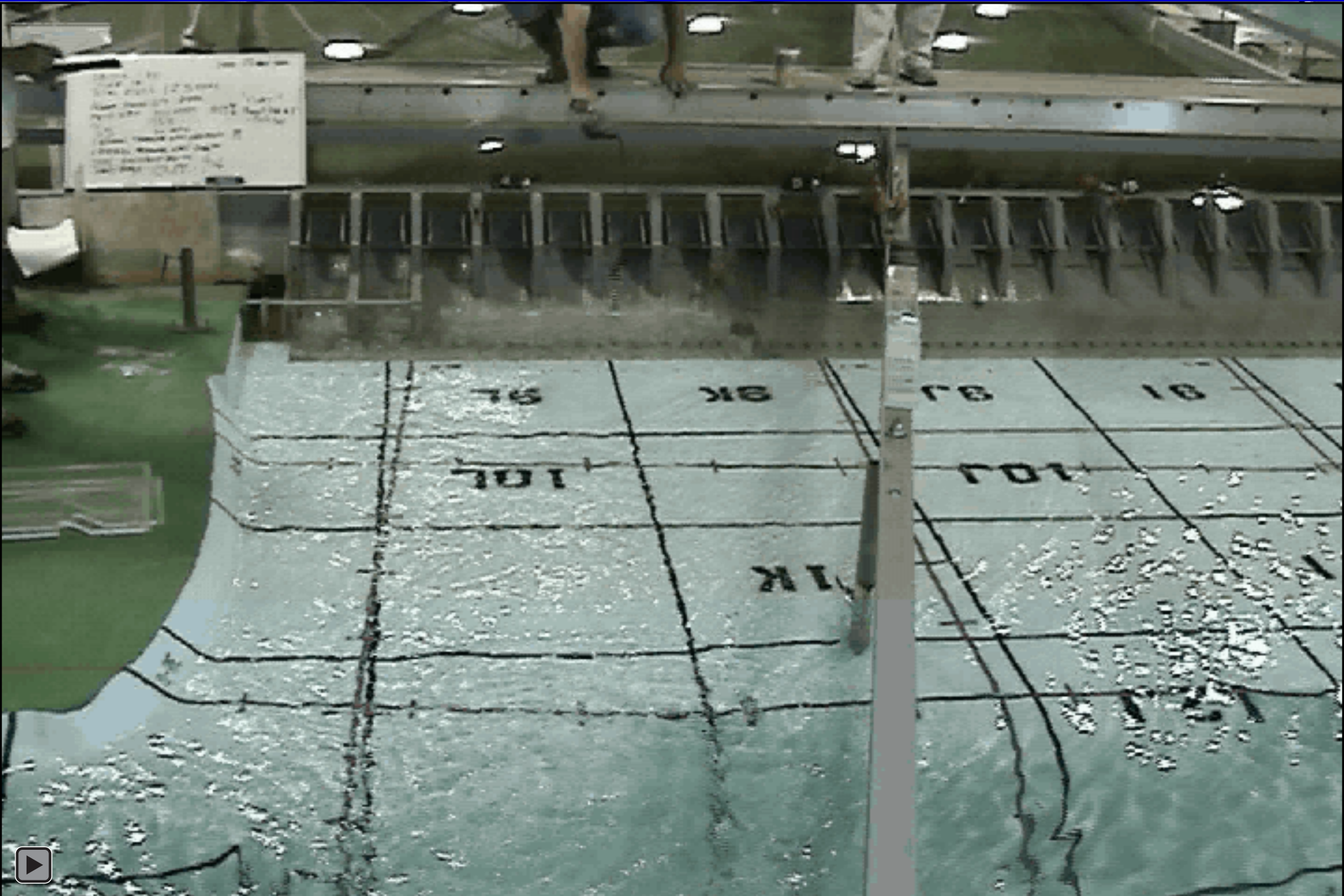


← Bay 4

Alternatives

- Flow Deflectors
- Short Spillwall
- Long Spillwall
- Guidance Curtain
- Spillway Weirs
- Longer Stilling Basin
- Deeper Stilling Basin





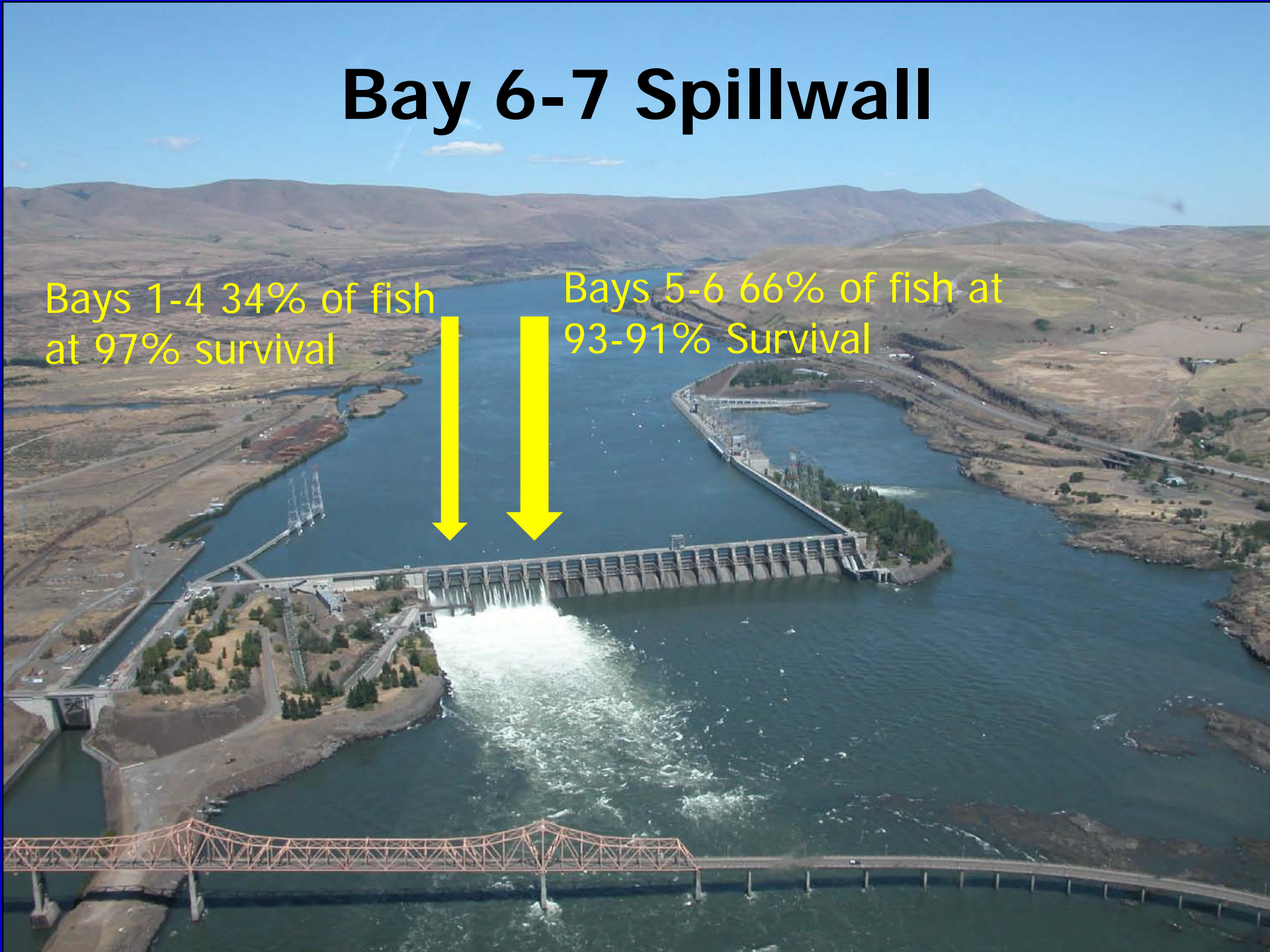
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Bay 6-7 Spillwall

Bays 1-4 34% of fish
at 97% survival

Bays 5-6 66% of fish at
93-91% Survival



Spillway Improvements Phase II

- Longer Stilling Basin
- Longer Spillwall
- Guidance Curtain
- Spillway Weirs

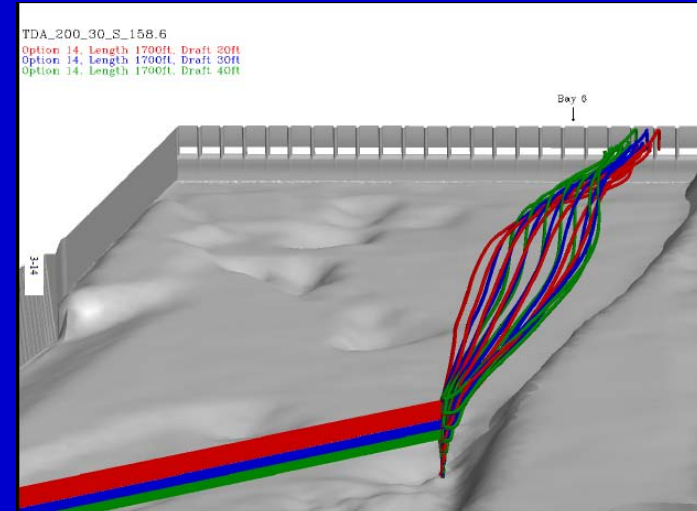


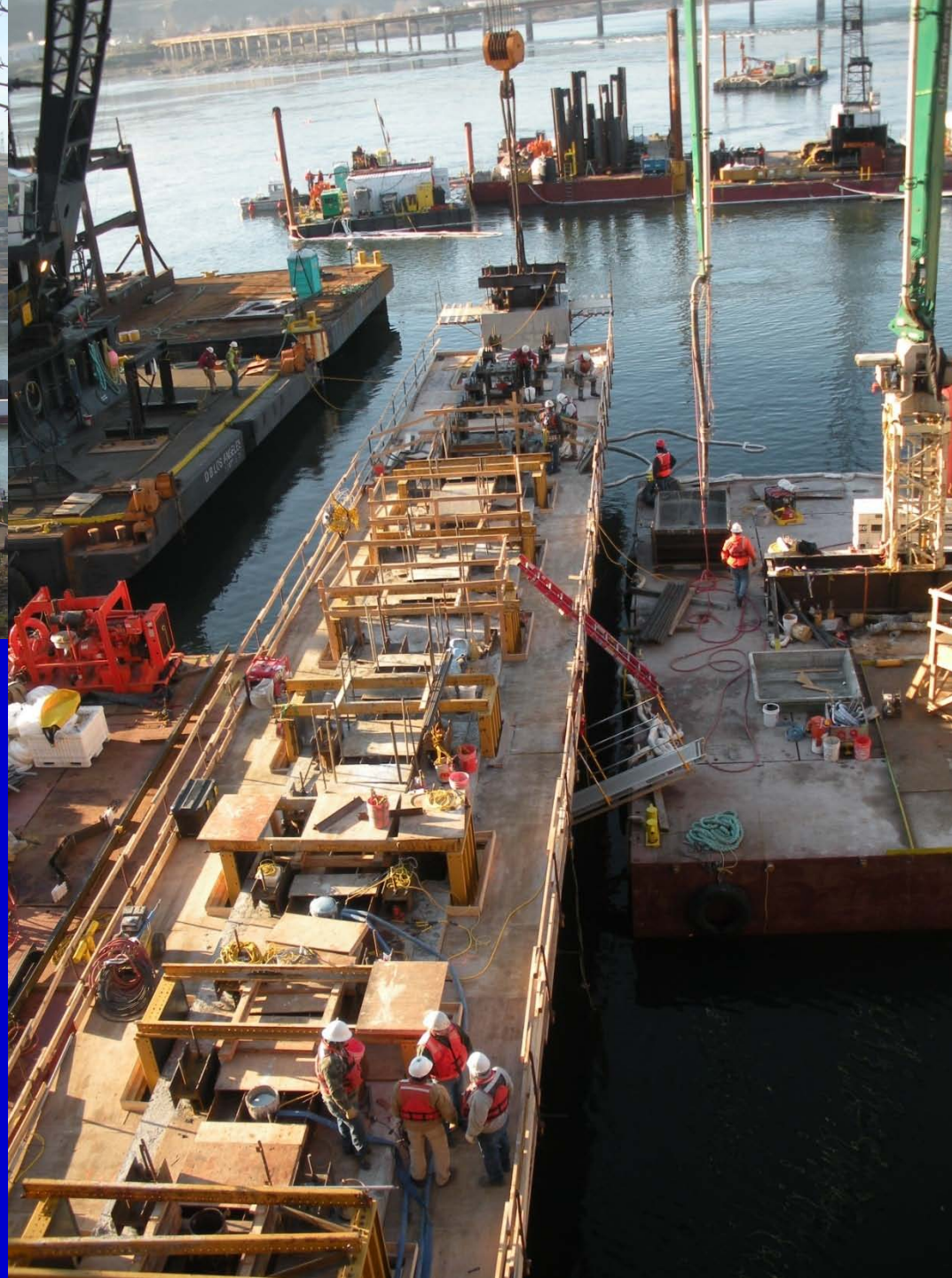
Figure 3-4. Stream Traces for 1700-Foot BGS on Option 14 Alignment





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Spillwall Construction



2010 Acoustic Telemetry Results

| Species | % Spill + Sluice Passage | 2010 Dam Survival | Baseline Survival* |
|---------------------|--------------------------|-------------------|--------------------|
| Yearling Chinook | 94.7% | 96.4% | 91.4% |
| Steelhead | 95.3% | 95.3% | 92.3% |
| Subyearling Chinook | 83.0% | 94.0% | 85.9% |

* Baseline survival from FCRPS BiOP for yearling Chinook and steelhead; 2004-05 telemetry studies for subyearling Chinook

Other Factors

- Adult Passage Improved
- Juvenile Passage Time Short
- TDG Performance OK
- Avian Predation Was High
 - Wires not fully reinstalled in 2010



Great Walls throughout History