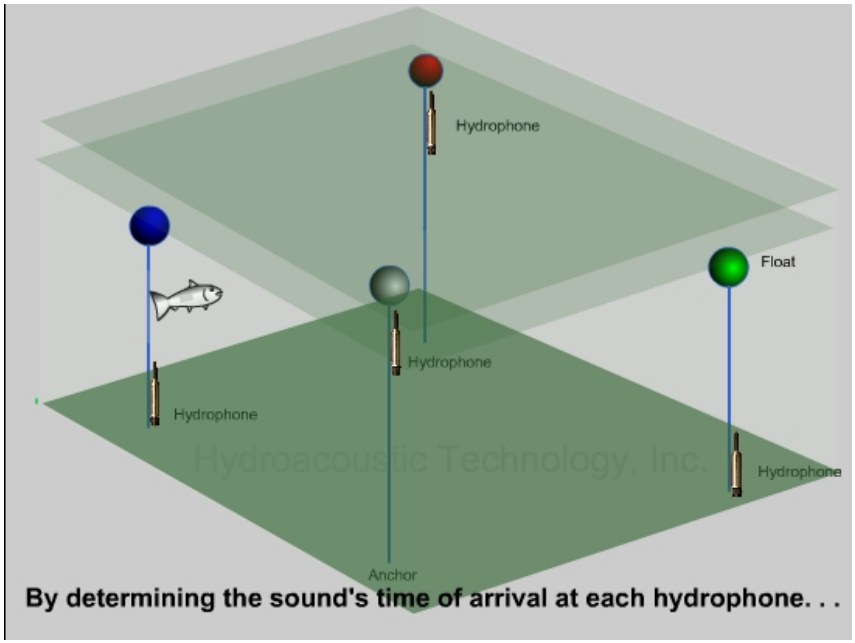
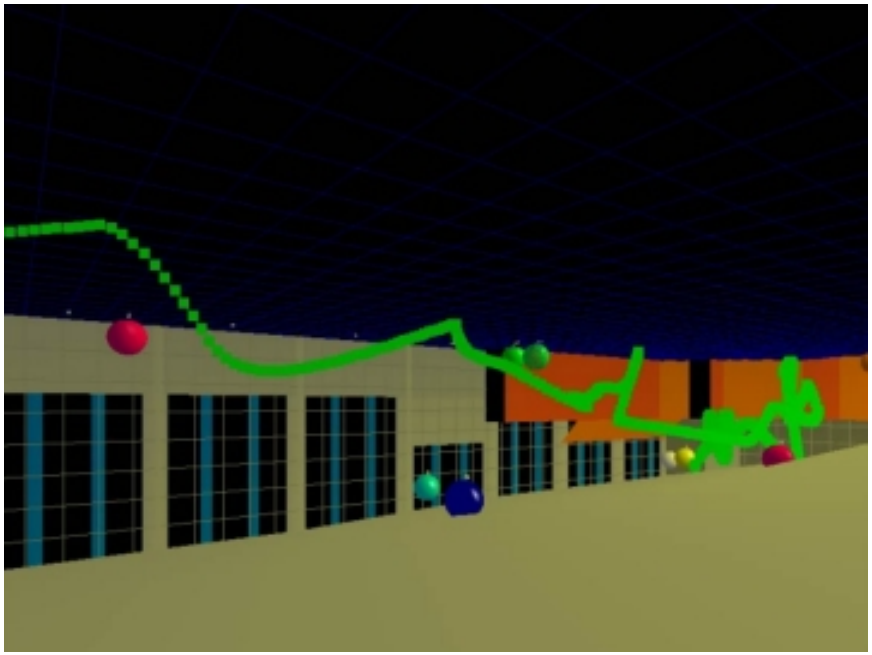
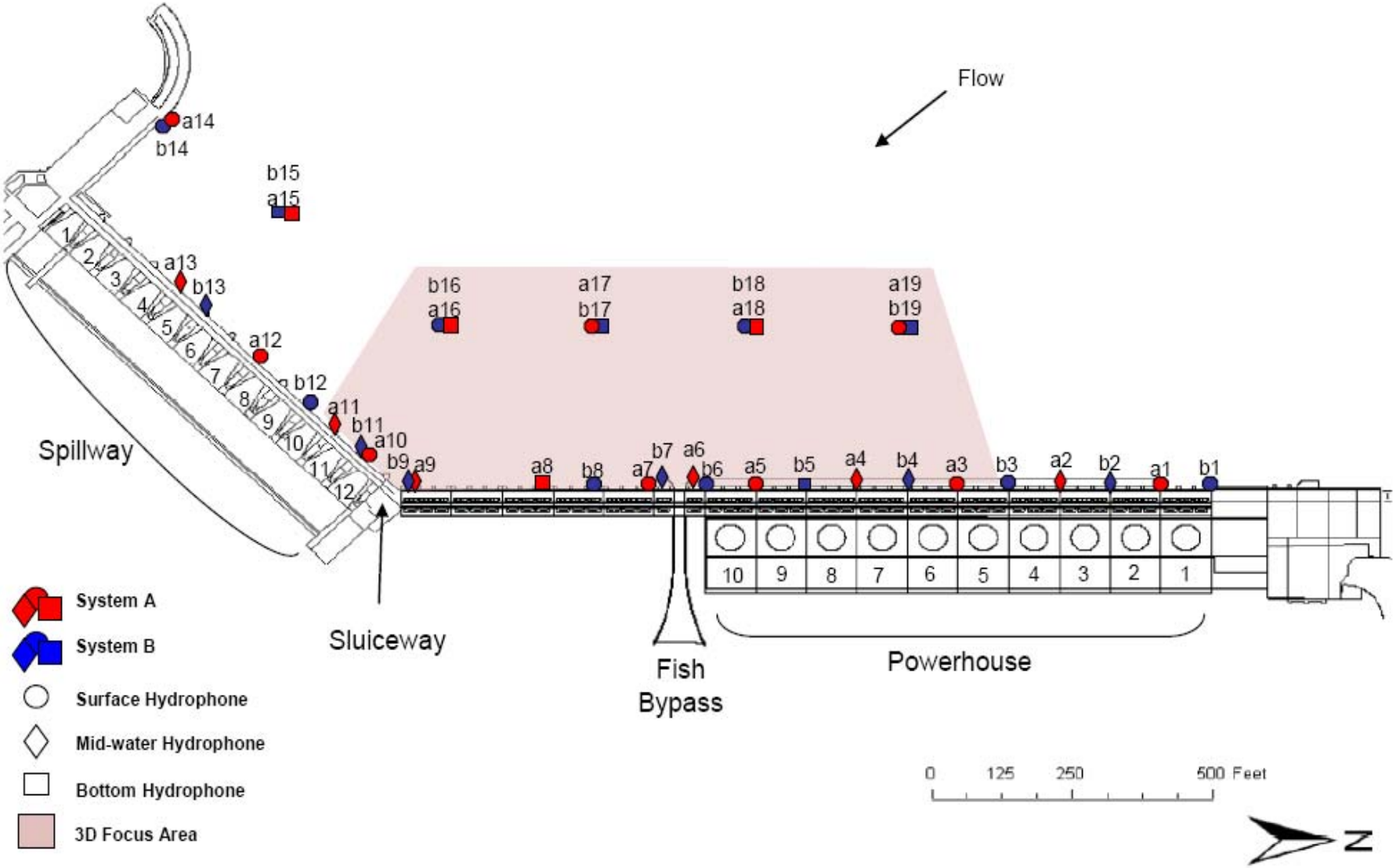
April 30, 2008

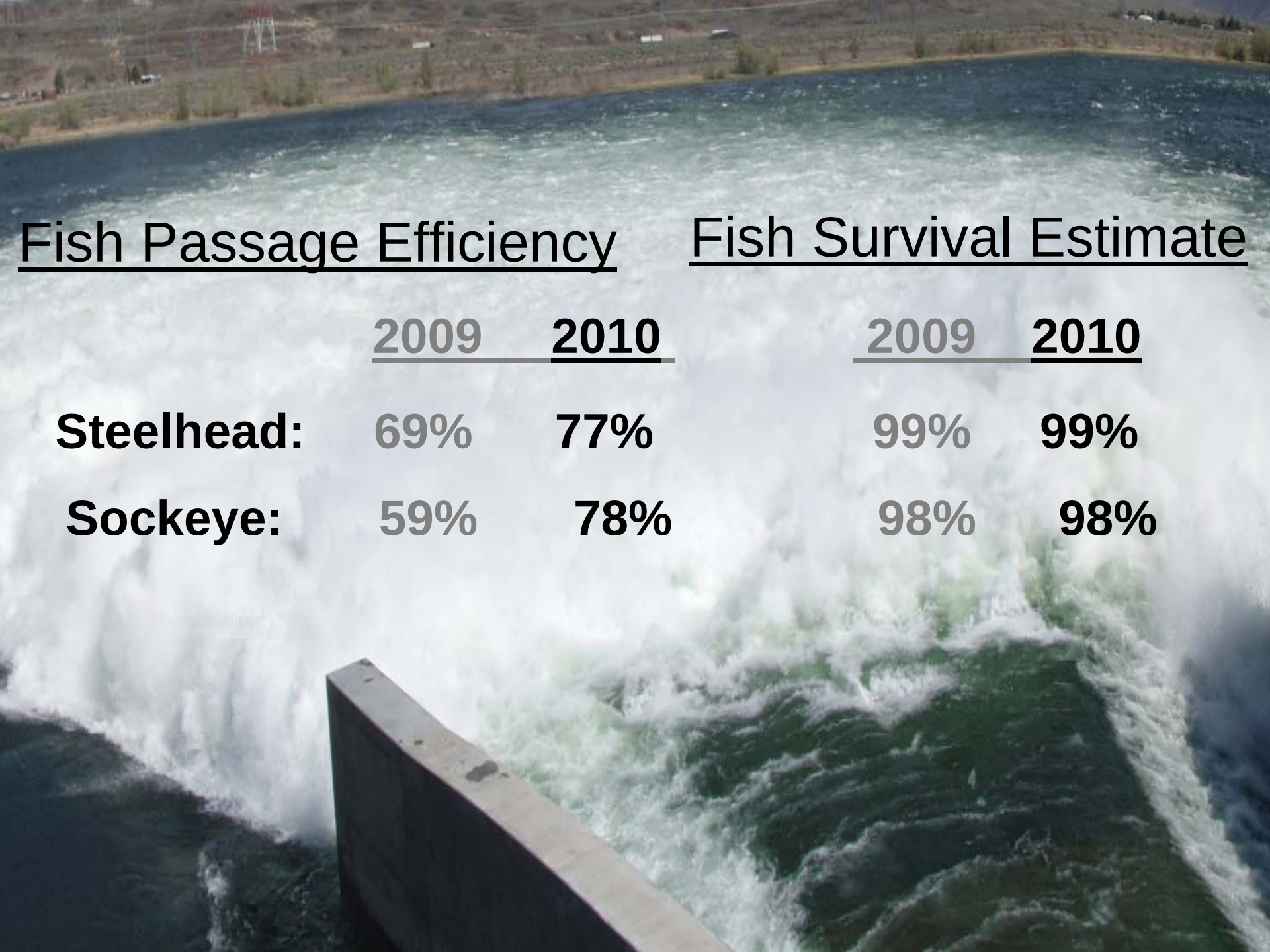
Acoustic Tags for Tracking







Hydrophone layout for Wanapum forebay



Fish Passage Efficiency

	2009	2010
Steelhead:	69%	77%
Sockeye:	59%	78%

Fish Survival Estimate

	2009	2010
Steelhead:	99%	99%
Sockeye:	98%	98%

How Did We Do?

Year	Powerhouse	Surface Spill	Spillway	**Total Dam Passage**
2006	45% pass. 83% surv.	9% pass. 98% surv.	17% pass. 90% surv.	87.3%

How Did We Do ??

Year	Powerhouse	Surface Spill	Spillway	**Total Dam Passage**
2006	45% pass. 83% surv.	Top-spill Bulkhead 9% pass. 98% surv.	17% pass. 90% surv.	87.3%
2010	21% pass. 92% surv.	WFUFB 77% pass. 99% surv.	n/a% pass. n/a% surv.	96.6%

Benefits from the WFUFB

- Increased survival rates for juvenile salmon past Wanapum Dam
- Fulfils requirements of the License and its associated mandates and obligations
- Lower TDG levels when fish spill is taking place
- More water available for power generation during the salmonid smolt out-migration

Future Unit Fish Bypass Cost Estimate

Item Description	**Estimated Cost**
Bulkheads and Dewatering	$4,720,000
Demolition	$1,120,000
Future Unit Area Construction	$4,430,000
Tailrace Chute Area Construction	$11,040,000
Gates and Equipment	$4,150,000
Miscellaneous (Electrical mods, Galleries, Access, etc.)	$5,690,000
Total	**$31,150,000**

Generation Benefits from the New Wanapum Bypass

Generation Difference with New Bypass

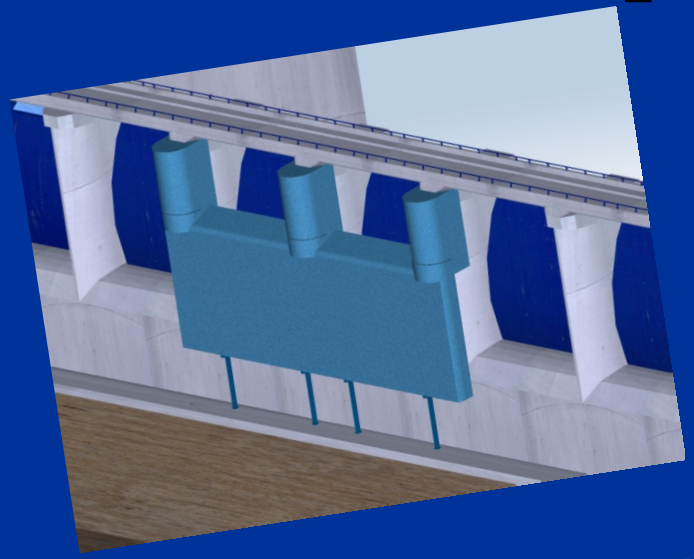
263,520 MWh

Value of Increased Generation

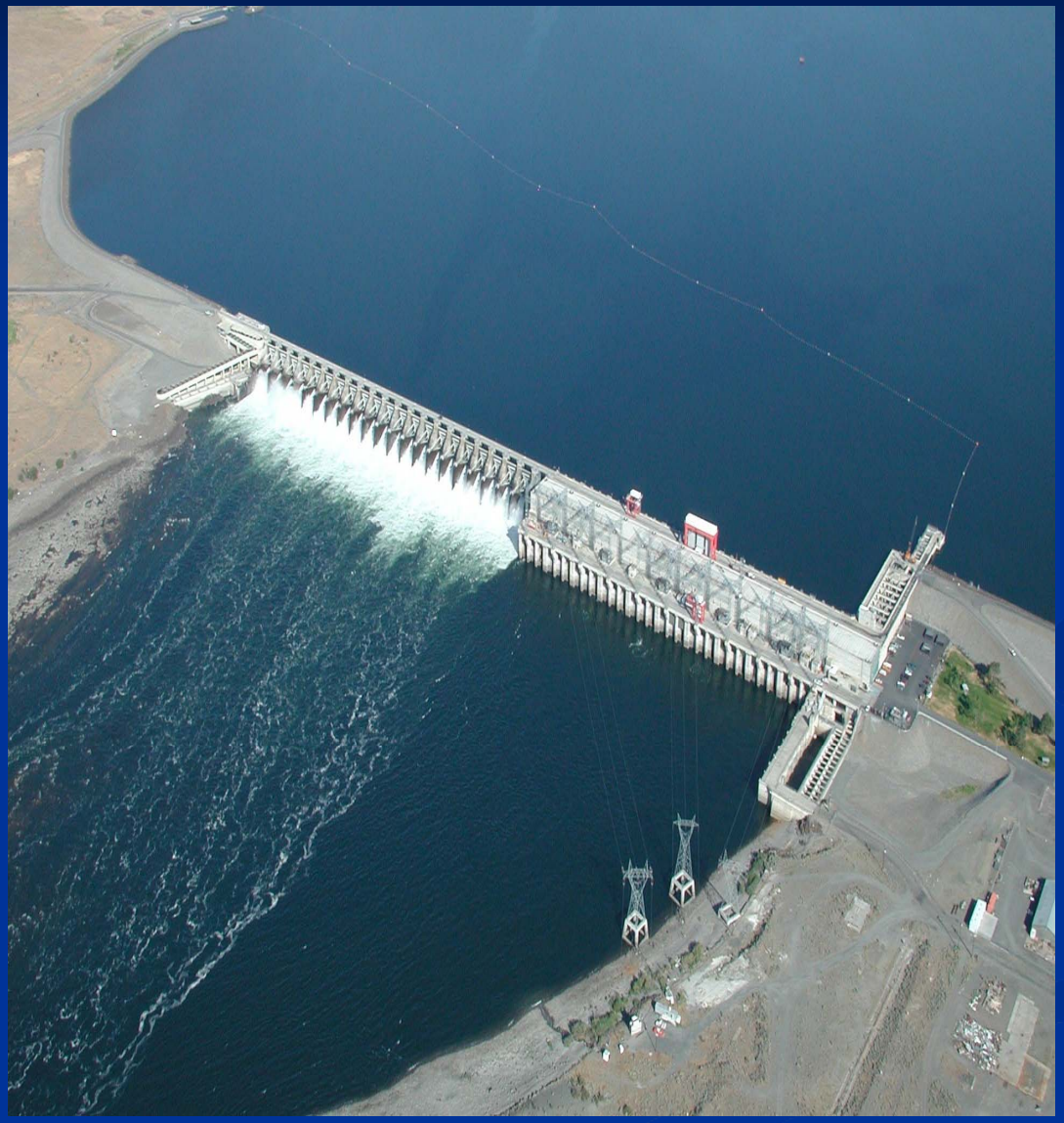
$10,540,800

Conclusion - New Bypass would pay for itself in less than 4 years

Priest Rapids Fish Bypass



Priest Rapids Dam MOA Spill



61% of total daily river flow (spring spill)

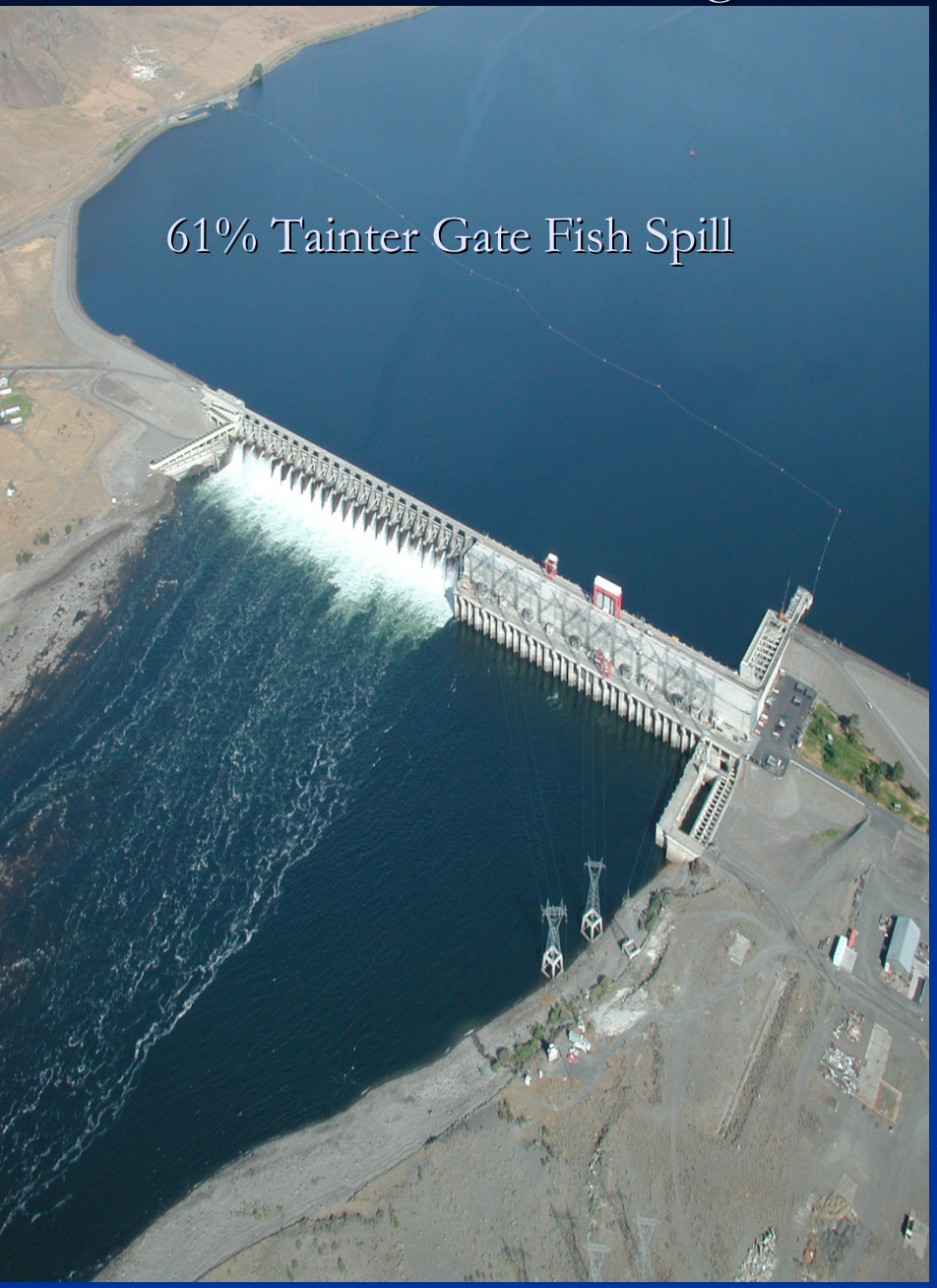
39% of total daily river flow (summer spill)

Grant PUD's FERC License (April 17, 2008) incorporates the Biological Opinion (2008) and the SSSA (2006)

- Bi Op – Section 2.9.6, Action 1.13 and SSSA states that the primary juvenile salmonid passage will be tainter gate spill of 61% of total daily river flow….

- …..Grant PUD may replace interim spill at PRD if more biologically efficient and effective measures are designed, tested and implemented.

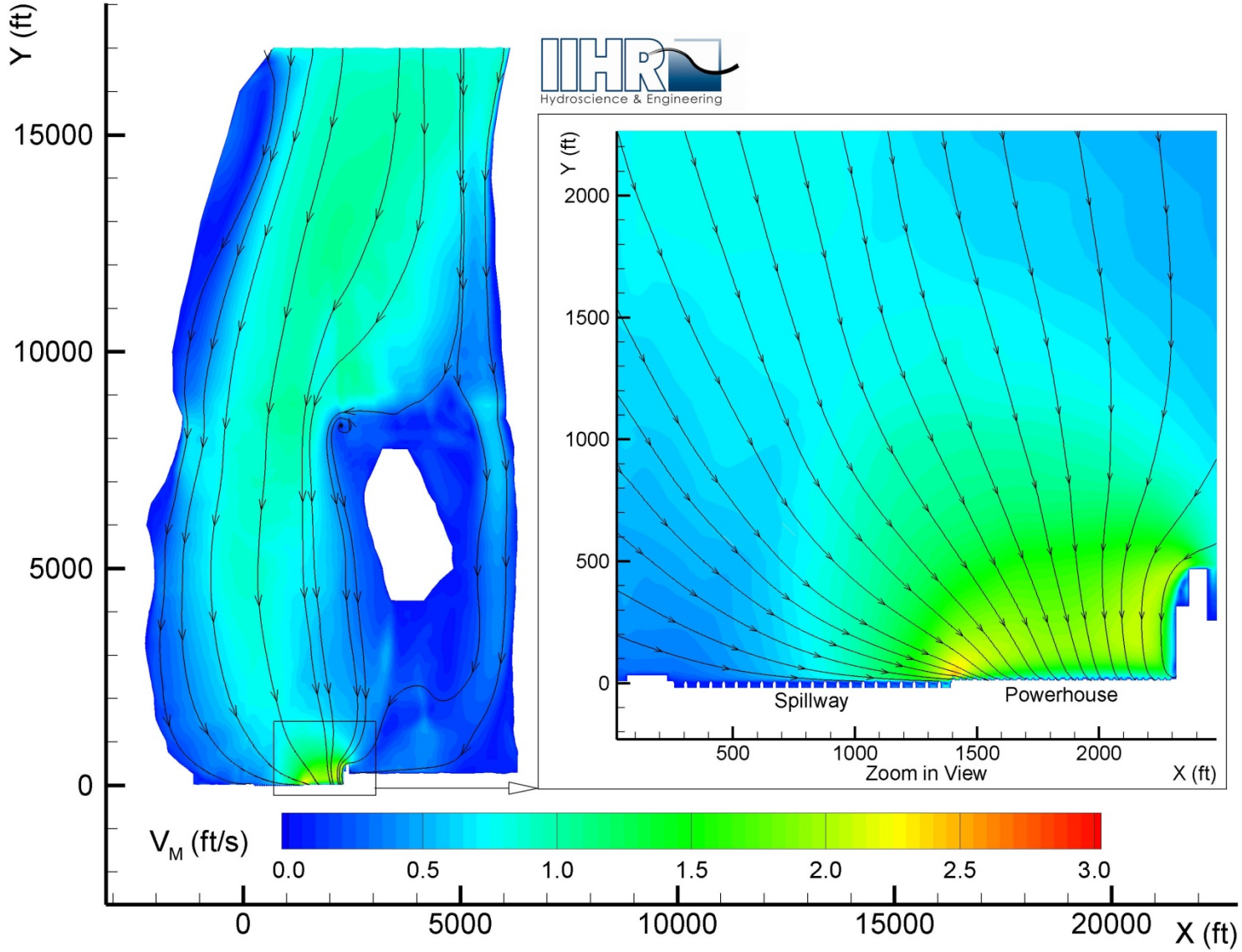
Fish Passage at Priest Rapids Dam



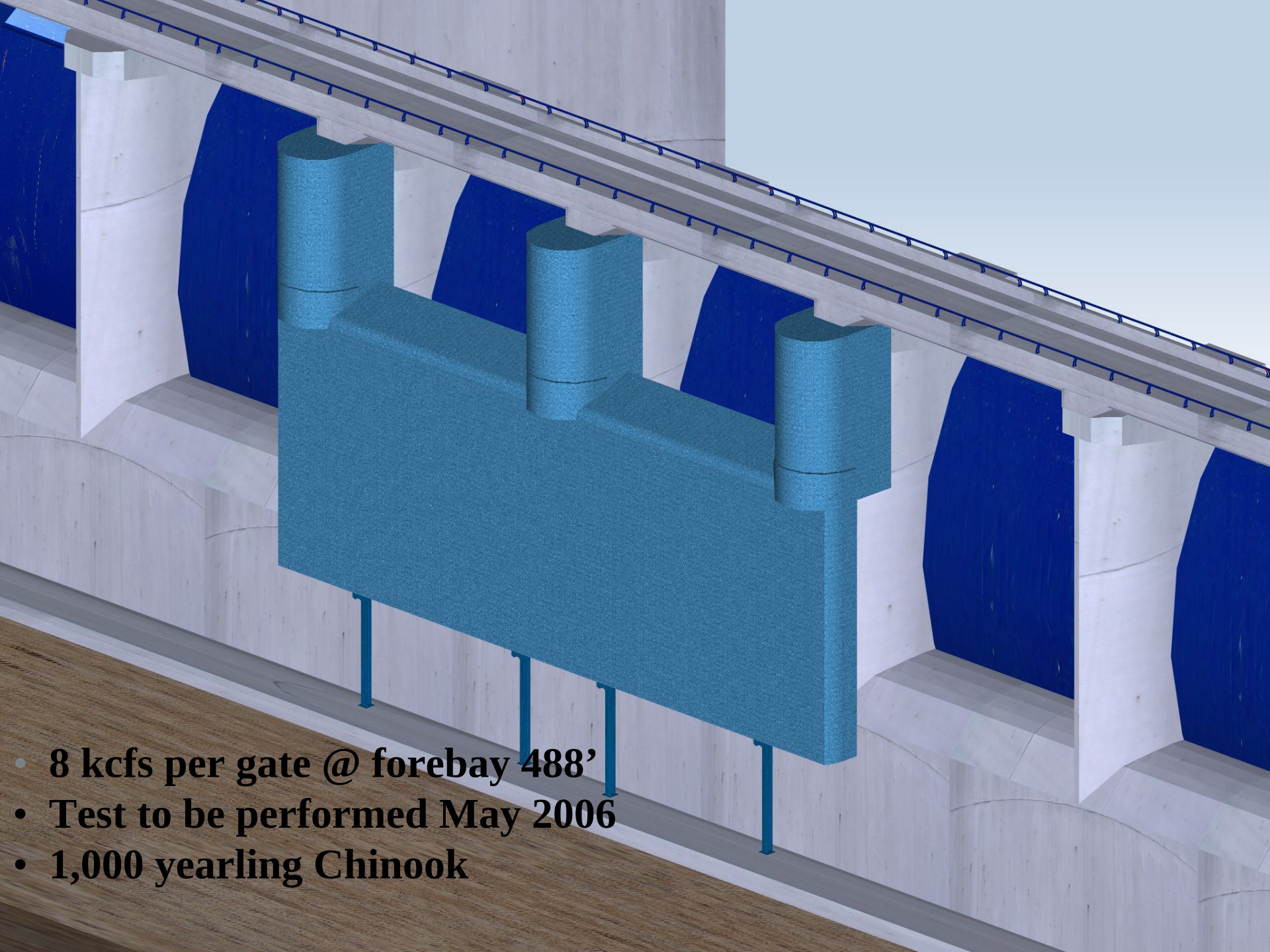
MOA Spill vs. Bypass

Priest Rapids Fish Bypass Objectives:

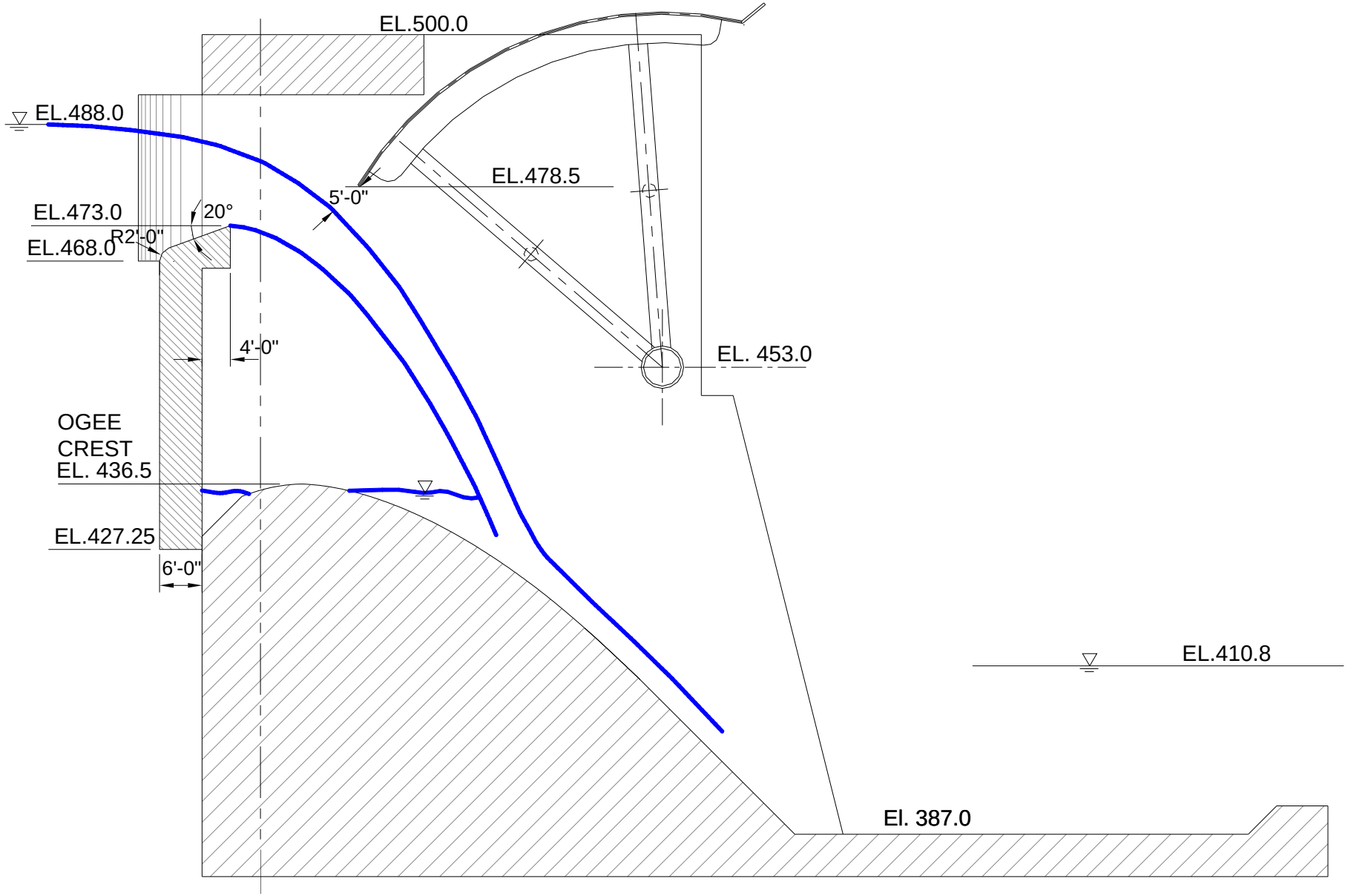
- Assist Grant PUD in meetings the requirements of the NMFS 2004 BIOP, which were included in the FERC License Order
- Increase smolt survival, reduce spill, increase generation potential, reduce total dissolved gas.



Priest Rapids Dam Forebay Velocities and Streamlines
Powerhouse Units 1 to 10 at 16 Kcfs each
Total Flow 160 Kcfs



- 8 kcfs per gate @ forebay 488’
- Test to be performed May 2006
- 1,000 yearling Chinook

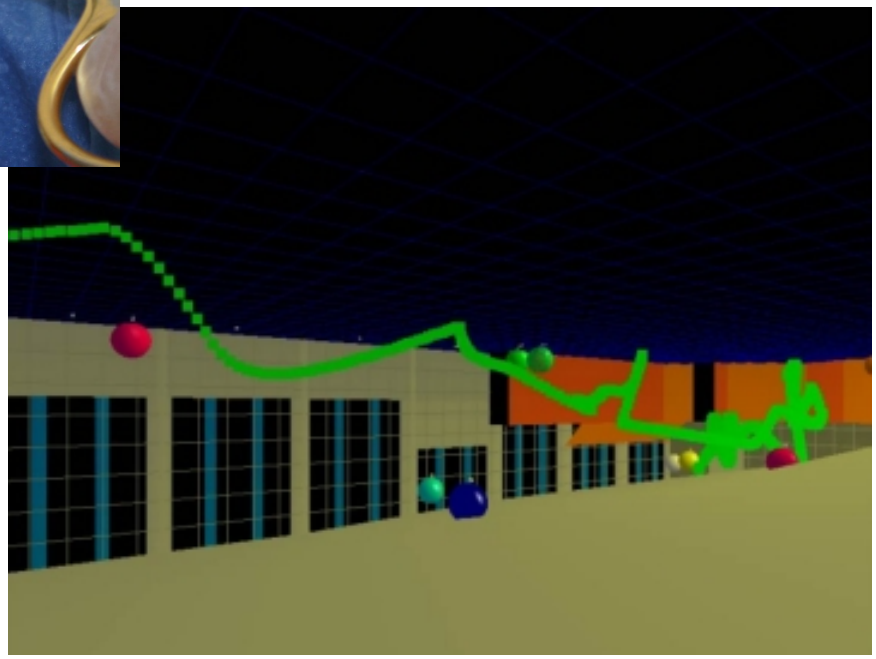


Priest Rapids Dam

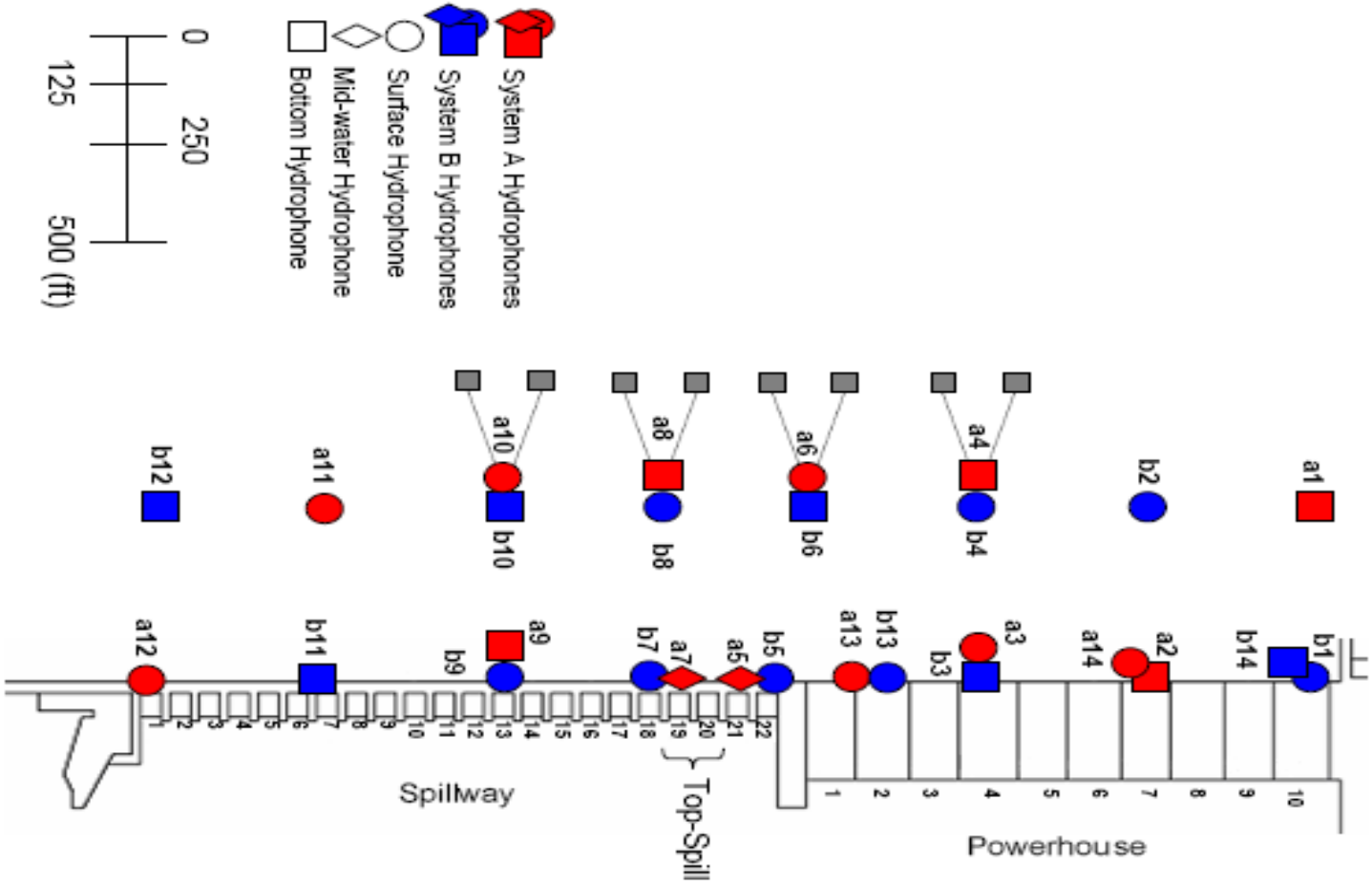
Topspill Configuration for Testing in 2006, 2007 and 2008

TOP-SPILL BULKHEAD AT PRIEST RAPIDS DAM

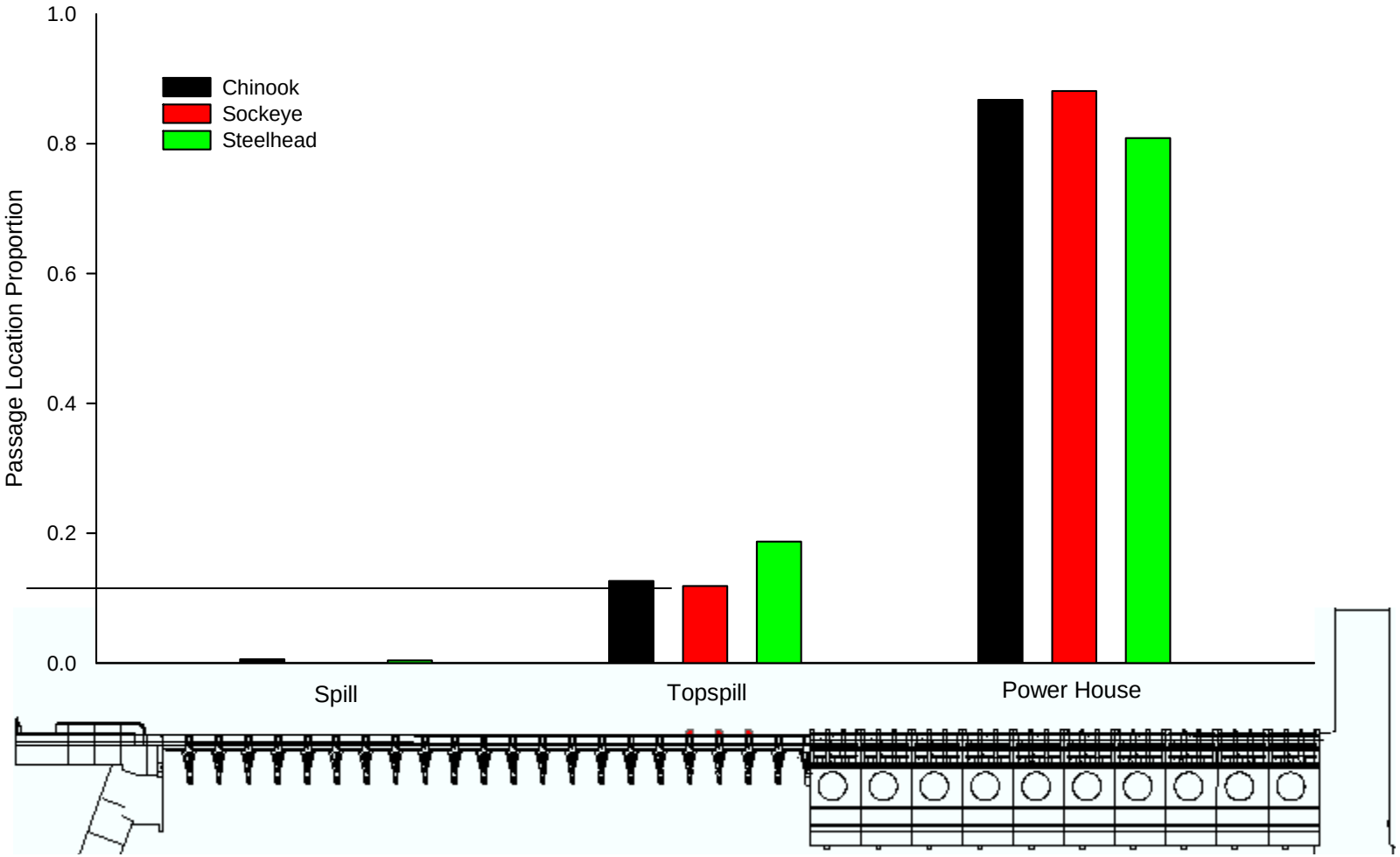
Acoustic Tags for Tracking



Hydrophone Deployment at Priest Rapids Dam in 2006



2007



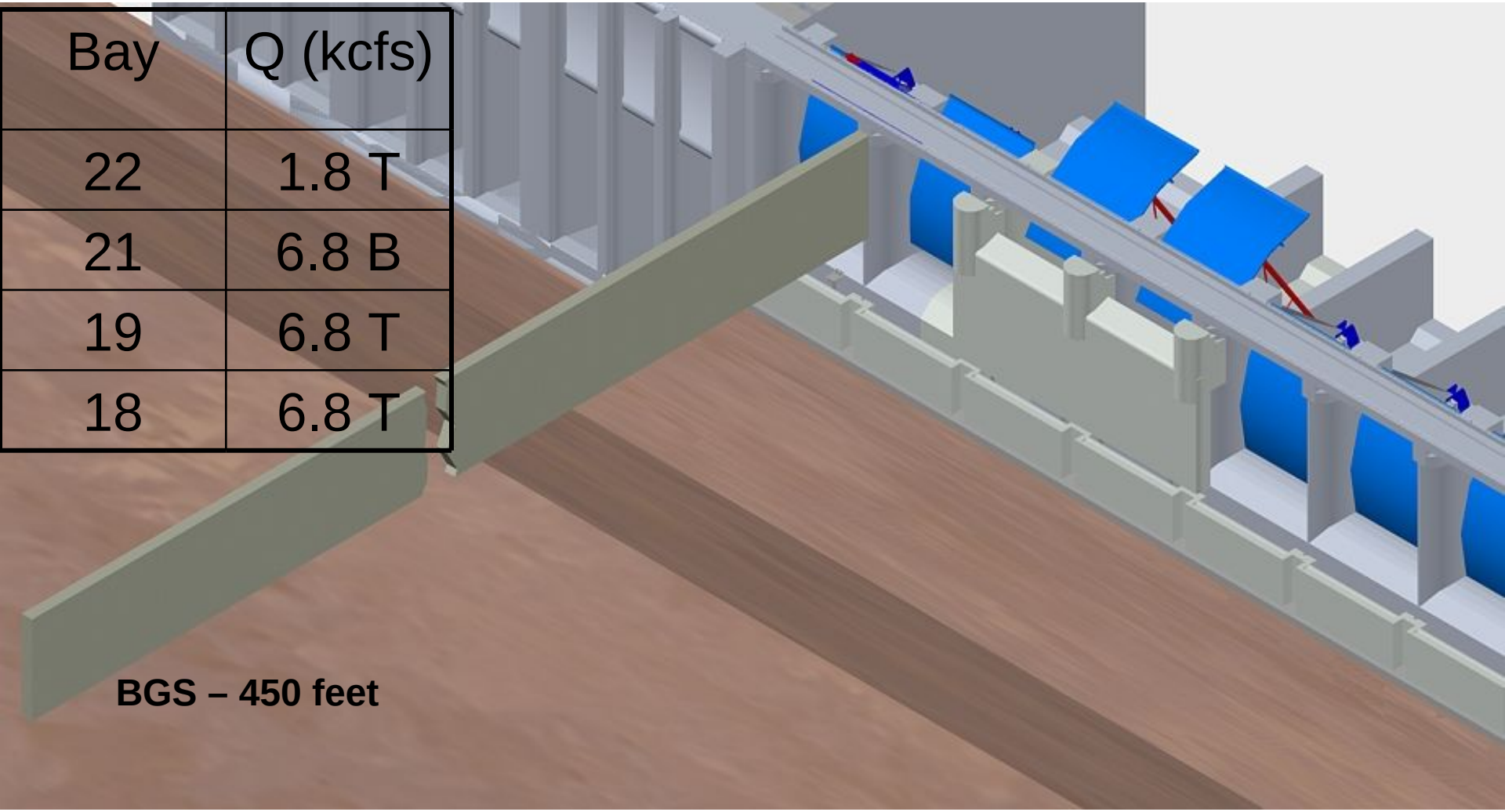
The proportion of fish by species that used each passage route at Priest Rapids Dam. The powerhouse route includes fish that were captured in the gatewells. Yearling Chinook are indicated by black, steelhead by green and sockeye by red

Top-Spill Bulkhead Percent Fish Passage

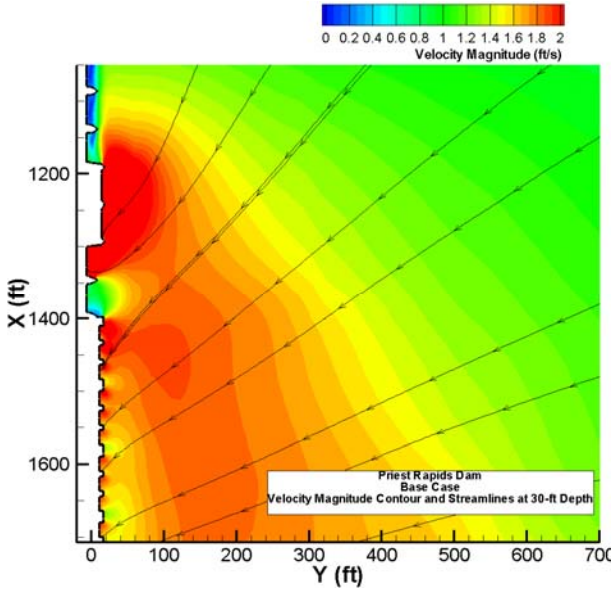
Date	Chinook	Steelhead	Sockeye
2006	12%	15%	20%
2007	13%	19%	12%

NFS Model - Case 14

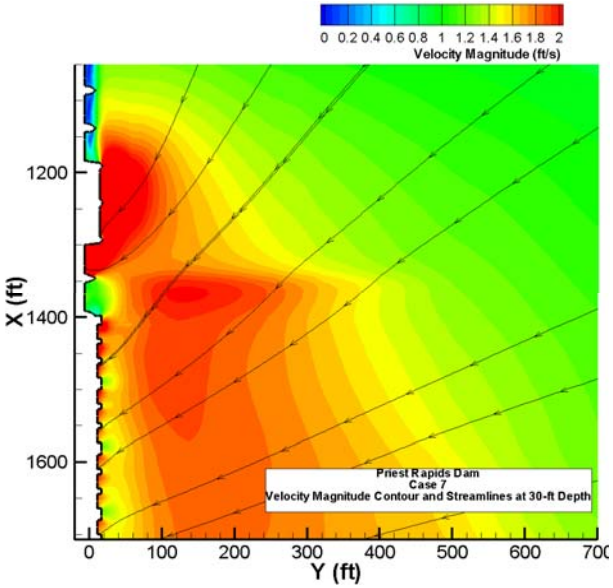
Bay	Q (kcfs)
22	1.8 T
21	6.8 B
19	6.8 T
18	6.8 T



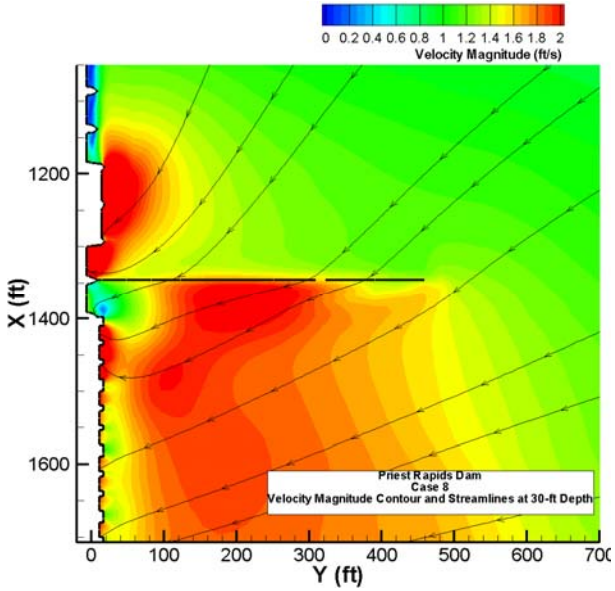
BGS – 450 feet



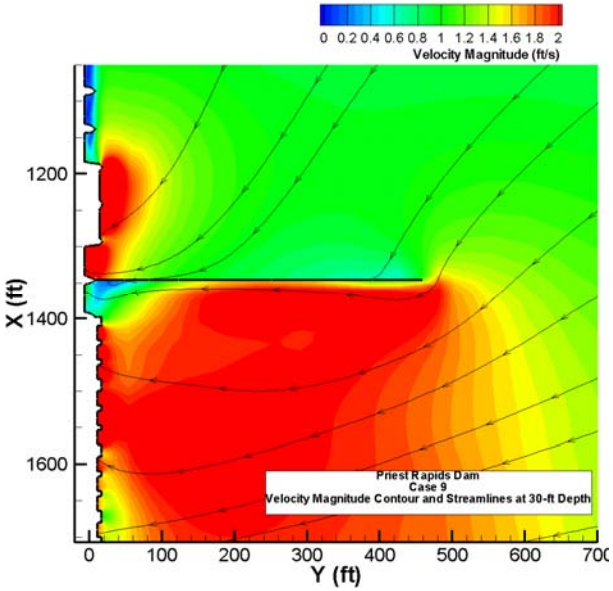
Base Case – Section at 30 ft depth



450 ft Training Wall – 10 ft deep



450 ft Training Wall – 30 ft deep

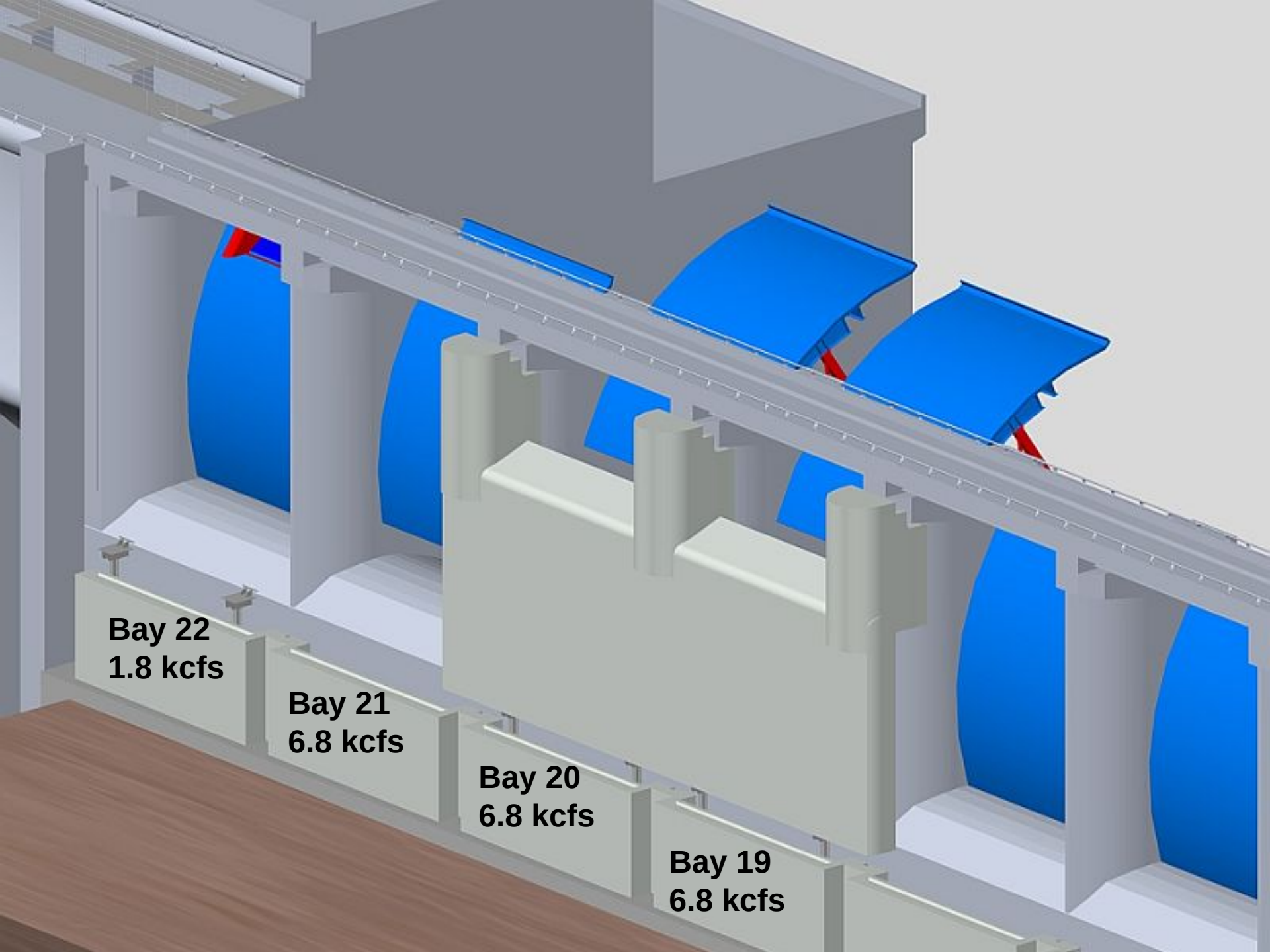


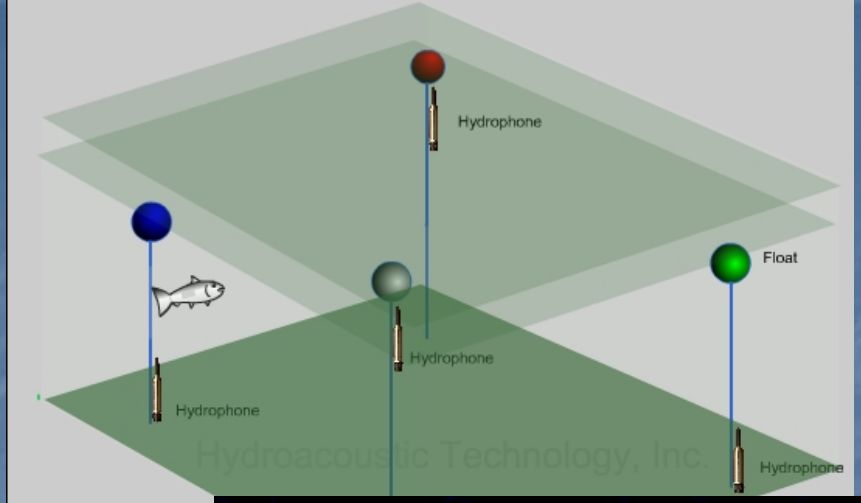
450 ft Training Wall – 50 ft deep

UPDATE OF WORK AT PRIEST RAPIDS DAM – 2008 MODEL RUNS

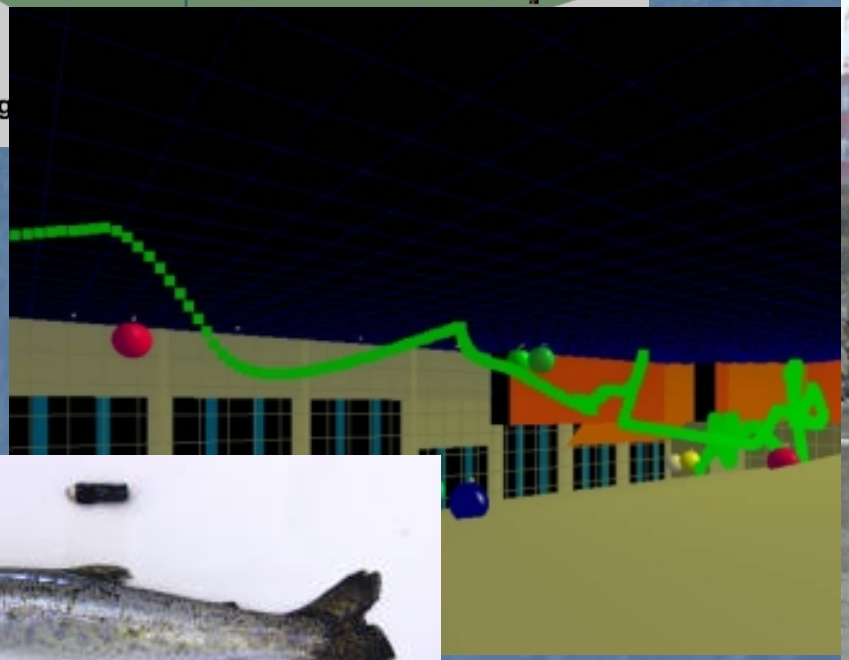
Flows in kcfs for Spill and Powerhouse Units						
Case	**Spillbay 22**	**Spillbay 21**	**Spillbay 20**	**Spillbay 19**	**Powerhouse**	**Comments**
14	1.8 Top	6.8 Bottom	6.8 Top	6.8 Top	1 to 10 at 14.95	450 ft BGS perpendicular to pier 21-22
15	1.8 Top	6.8 Bottom	6.8 Top	6.8 Top	1 to 10 at 14.95	450 ft BGS with 1st 100 ft to bottom
16	1.8 Top	6.8 Bottom	6.8 Top	6.8 Top	1 to 10 at 14.95	900 ft BGS perpendicular to pier 21-22
17	1.8 Top	6.8 Bottom	6.8 Top	6.8 Top	1 to 10 at 14.95	900 ft BGS with 1st 100 ft to bottom
18	1.8 Top	6.8 Top	6.8 Bottom	6.8 Top	1 to 10 at 14.95	450 ft BGS perpendicular to pier 21-22
19	1.8 Top	6.8 Top	6.8 Bottom	6.8 Top	1 to 10 at 14.95	450 ft BGS with 1st 100 ft to bottom
20	1.8 Top	6.8 Top	6.8 Bottom	6.8 Top	1 to 10 at 14.95	900 ft BGS perpendicular to pier 21-22
21	1.8 Top	6.8 Top	6.8 Bottom	6.8 Top	1 to 10 at 14.95	900 ft BGS with 1st 100 ft to bottom

Fish bypass configurations run on the CFD and NFS models with a training wall


Bay 22
1.8 kcfs
Bay 21
6.8 kcfs
Bay 20
6.8 kcfs
Bay 19
6.8 kcfs



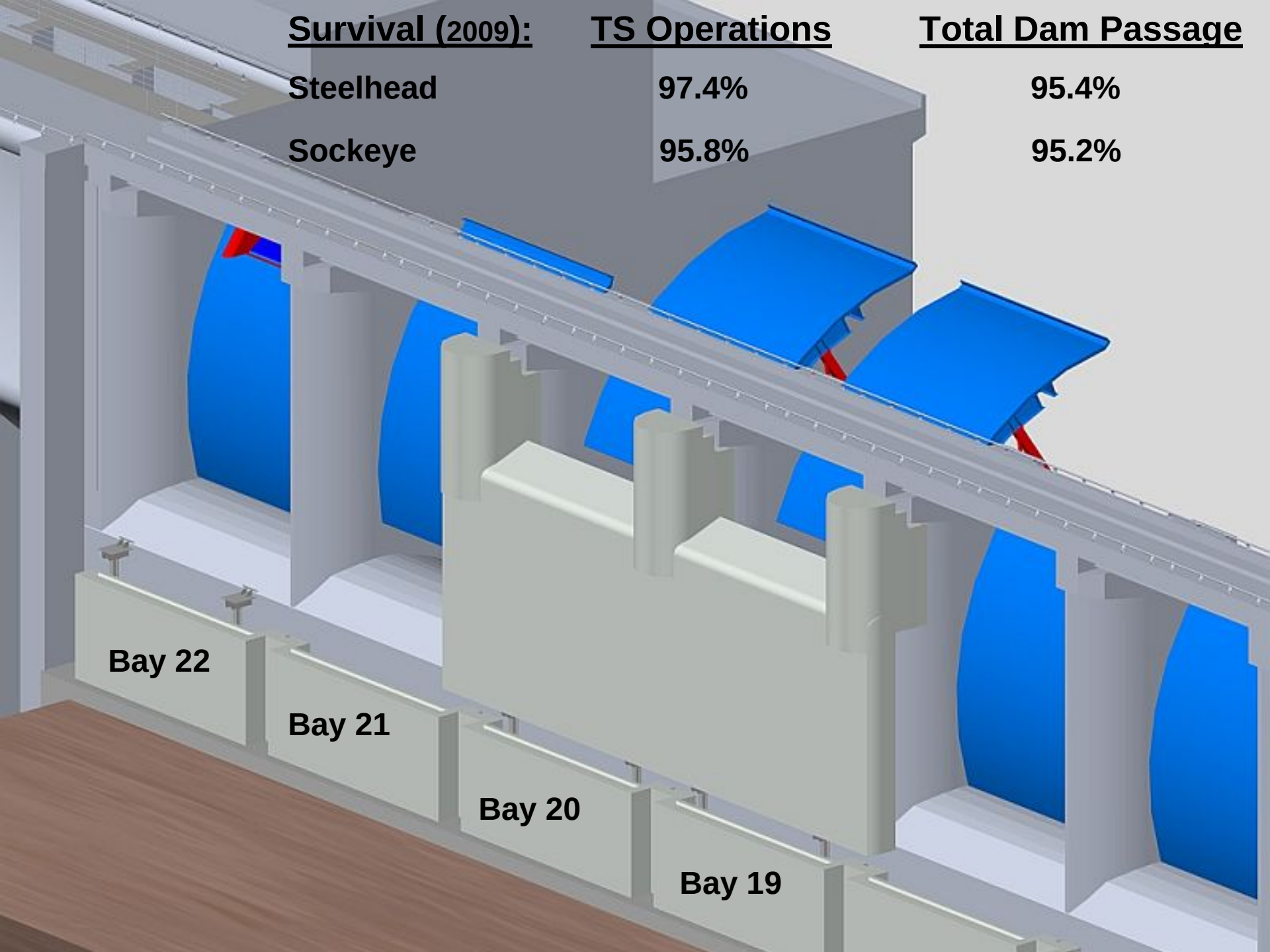
By determining



Top-Spill Bulkhead Percent Fish Passage

Date	Chinook	Steelhead	Sockeye
2006	12%	15%	20%
2007	13%	19%	12%
2008	23%	33%	22%
2009	n/a	50%	39%
2010	n/a	64%	52%

Survival (2009):	TS Operations	Total Dam Passage
Steelhead	97.4%	95.4%
Sockeye	95.8%	95.2%



Priest Rapids Dam

Prototype Fish to Flow Percentages 2006 to 2009

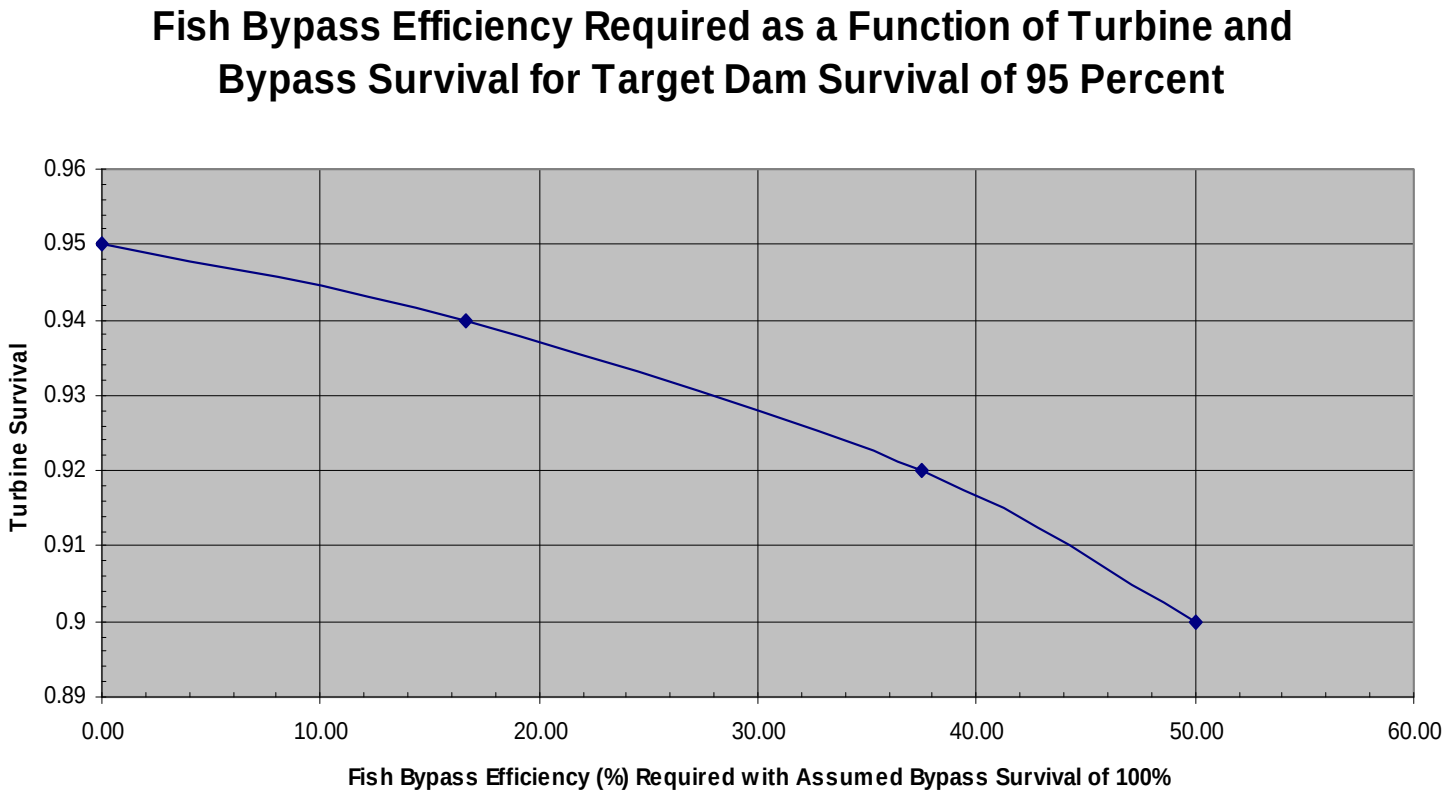
Year	% Fish to Flow by Top Spill	% Fish to Flow by Bottom Spill
Steelhead		
2006	2.1	0.7
2007	2.3	0.3
2008	2.7	1.3
2009	3.4	1.5
Average	2.6	0.95
Sockeye		
2006	2.6	0.6
2007	1.2	0.0
2008	1.8	1.3
2009	3.2	0.8
Average	2.2	0.68

Factor by which top spill is more effective than bottom spill

For Steelhead 2.7

For Sockeye 3.2

My “How Many Do I Need?” graph



Priest Rapids Dam

Factors in Development of Production Design

Bypass Location

- entrance near high concentration of fish which is adjacent to the powerhouse
- exit near additional flow and away from areas of high concentrations of predators
- bypass located at spillbays 20 to 22

Entrance

- no deceleration or upwelling
- based on prototype data no need for special control of accelerations

Priest Rapids Dam

Factors in Development of Production Design

Bypass Flow

- select a value to achieve required survival goal through top spill or combination of top and bottom spill
- single spillbay limited to 10 Kcfs to minimize TDG and maximize tailrace survival
- crest elevation of 471.4 ft +/- passes 9 kcfs at a forebay elevation of 486.6 ft

Priest Rapids Dam

Factors in Development of Production Design

Exit

- no adverse impacts or shear to minimize mortality
- no plunging of flow to minimize uptake of dissolved gas - apron elevation set to keep flow near the surface

Dam Safety

- must be able to pass Probable Maximum Flood (PMF) of 1400 Kcfs at a forebay elevation of 491.5 ft
- could likely dedicate three topspill bays to pass target fish bypass flow and also pass the PMF through the entire spillway
- must not result in reduction of dam stability

Operations

- gate design

Modeling Work

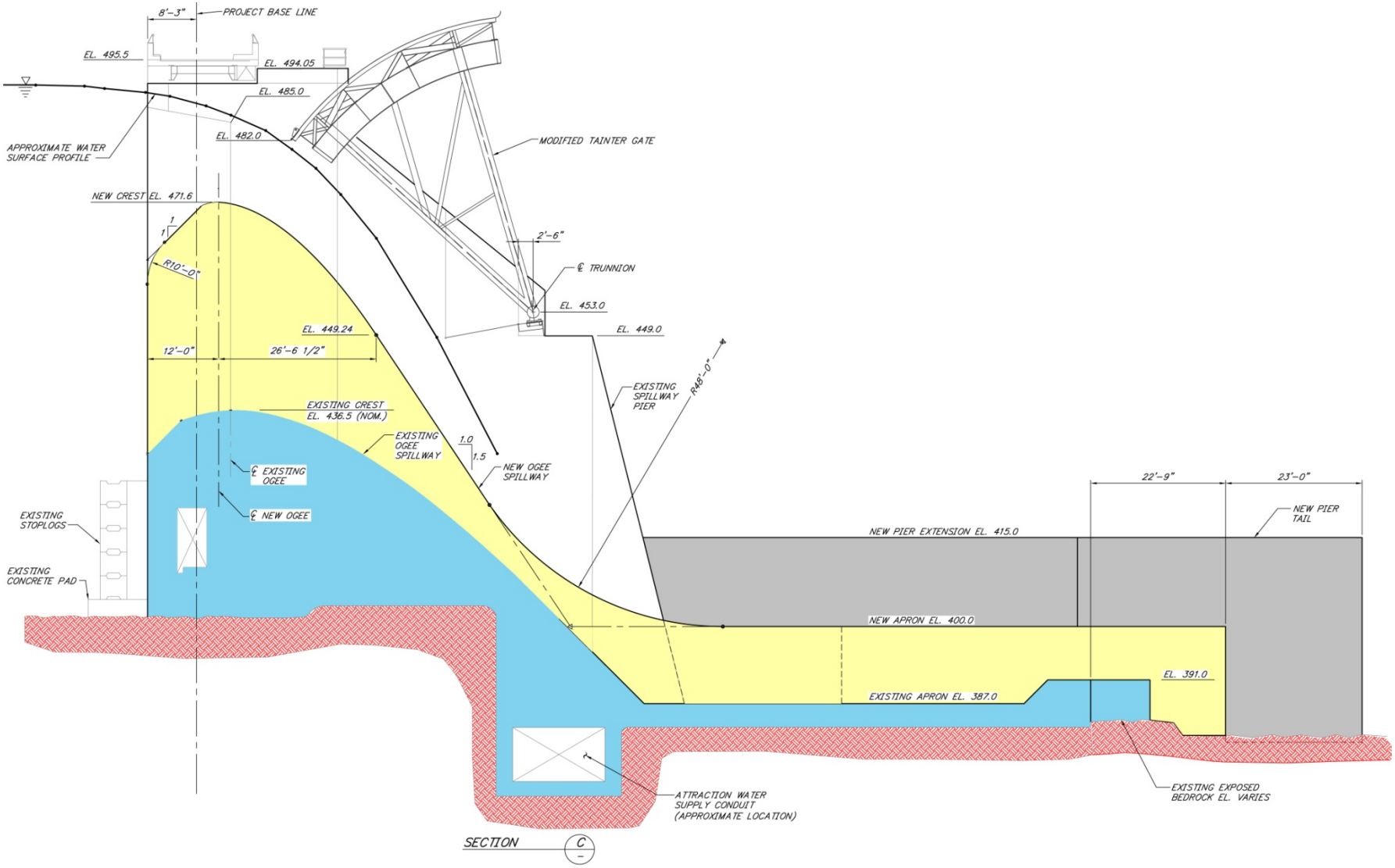
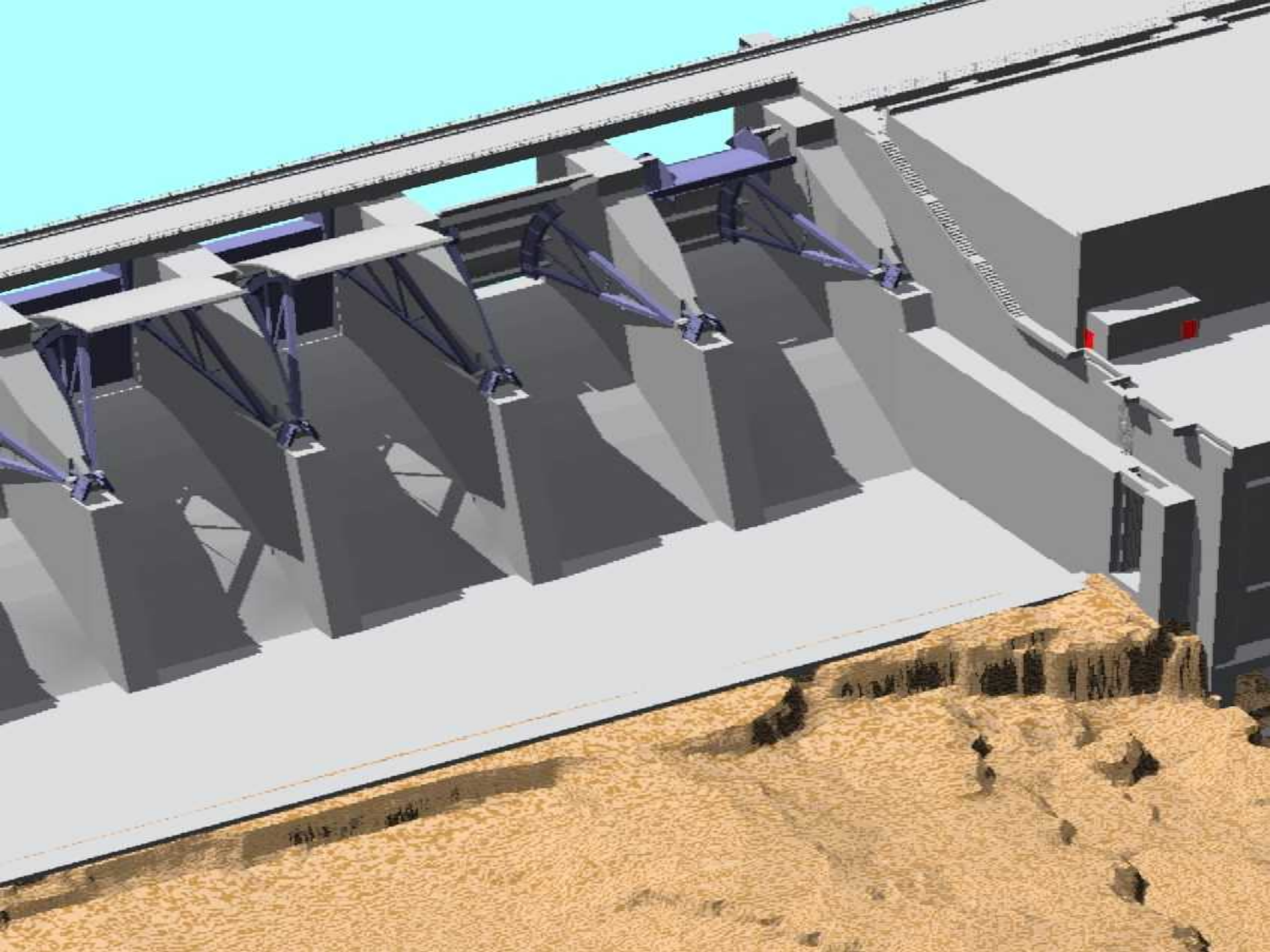
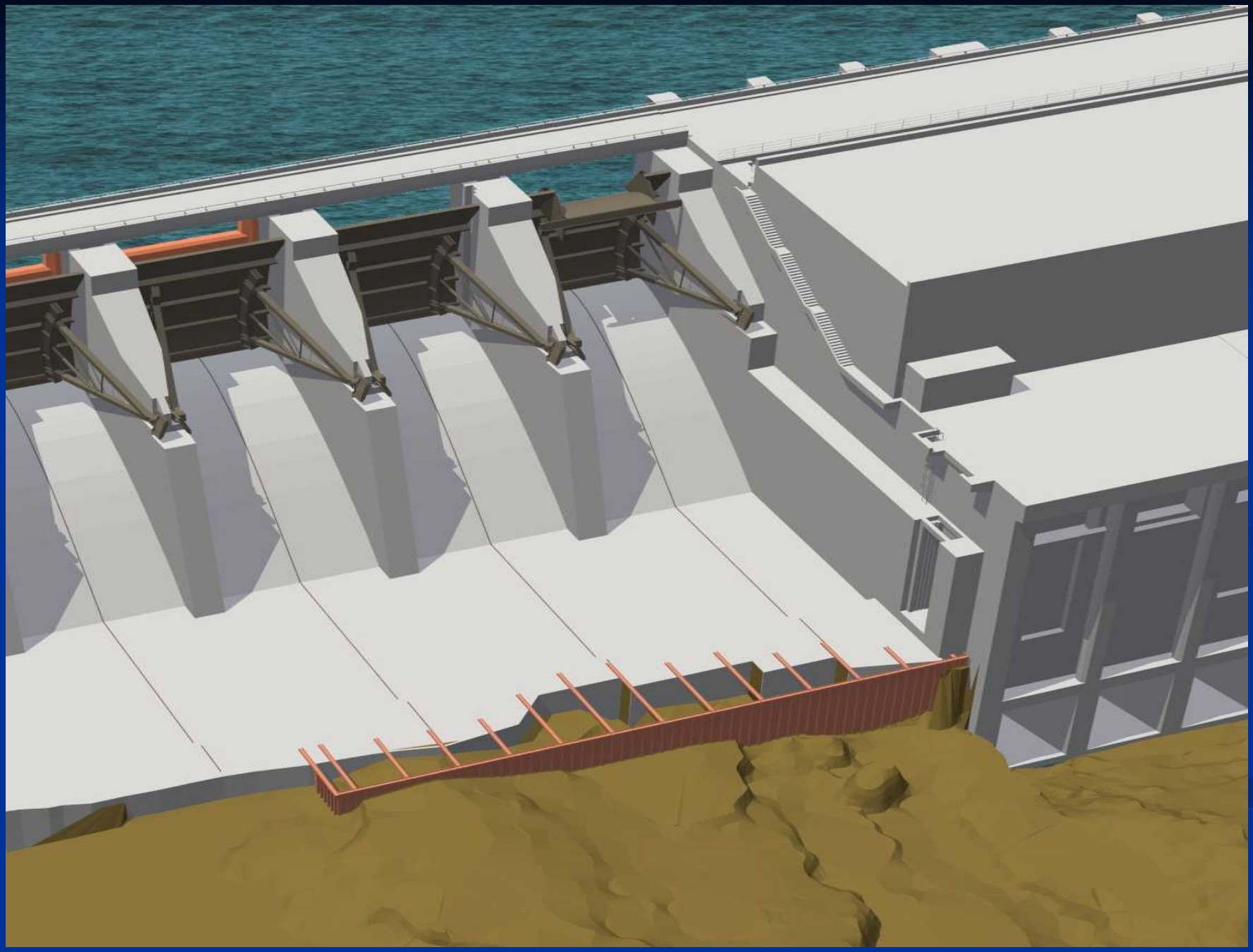
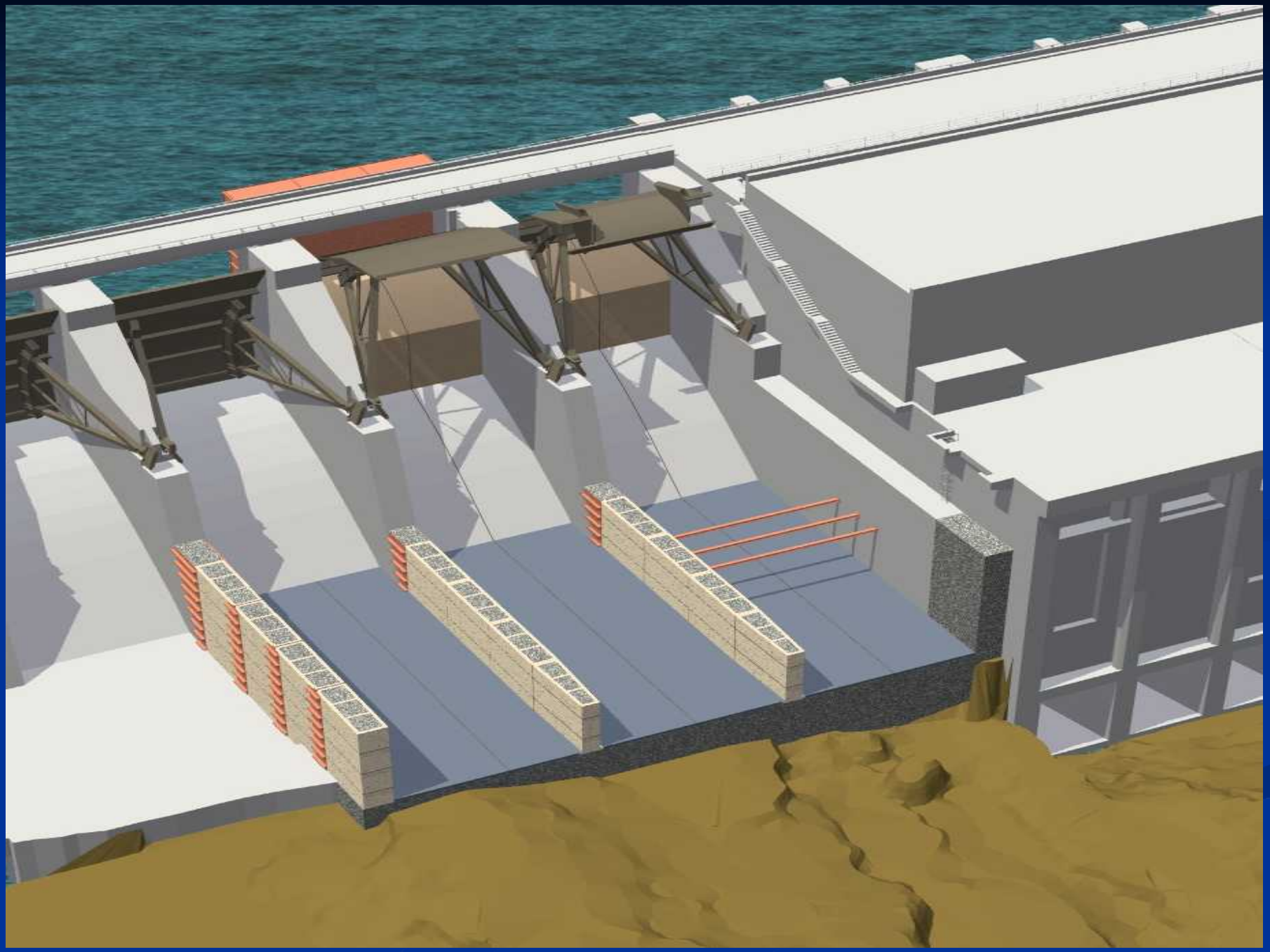
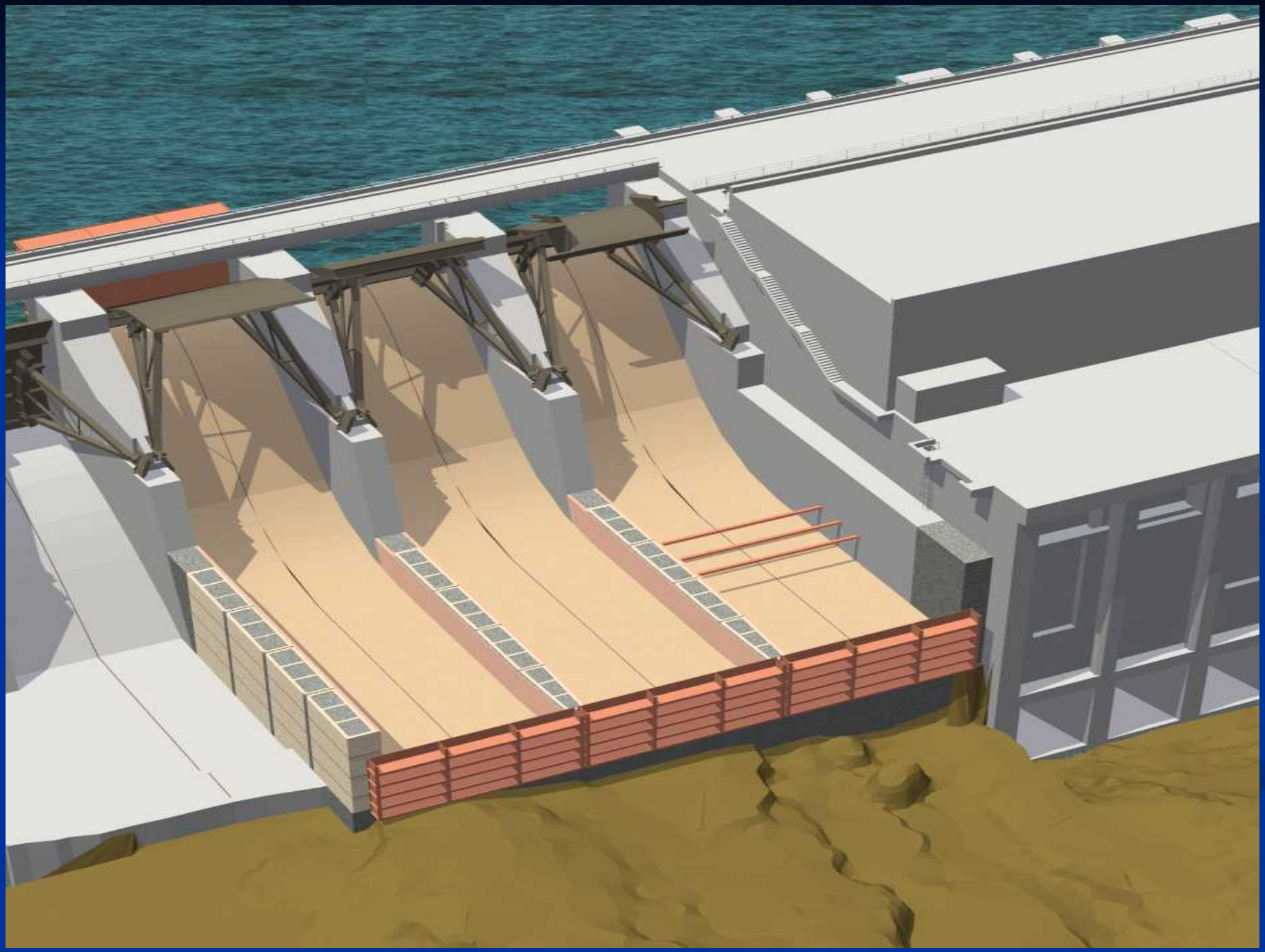
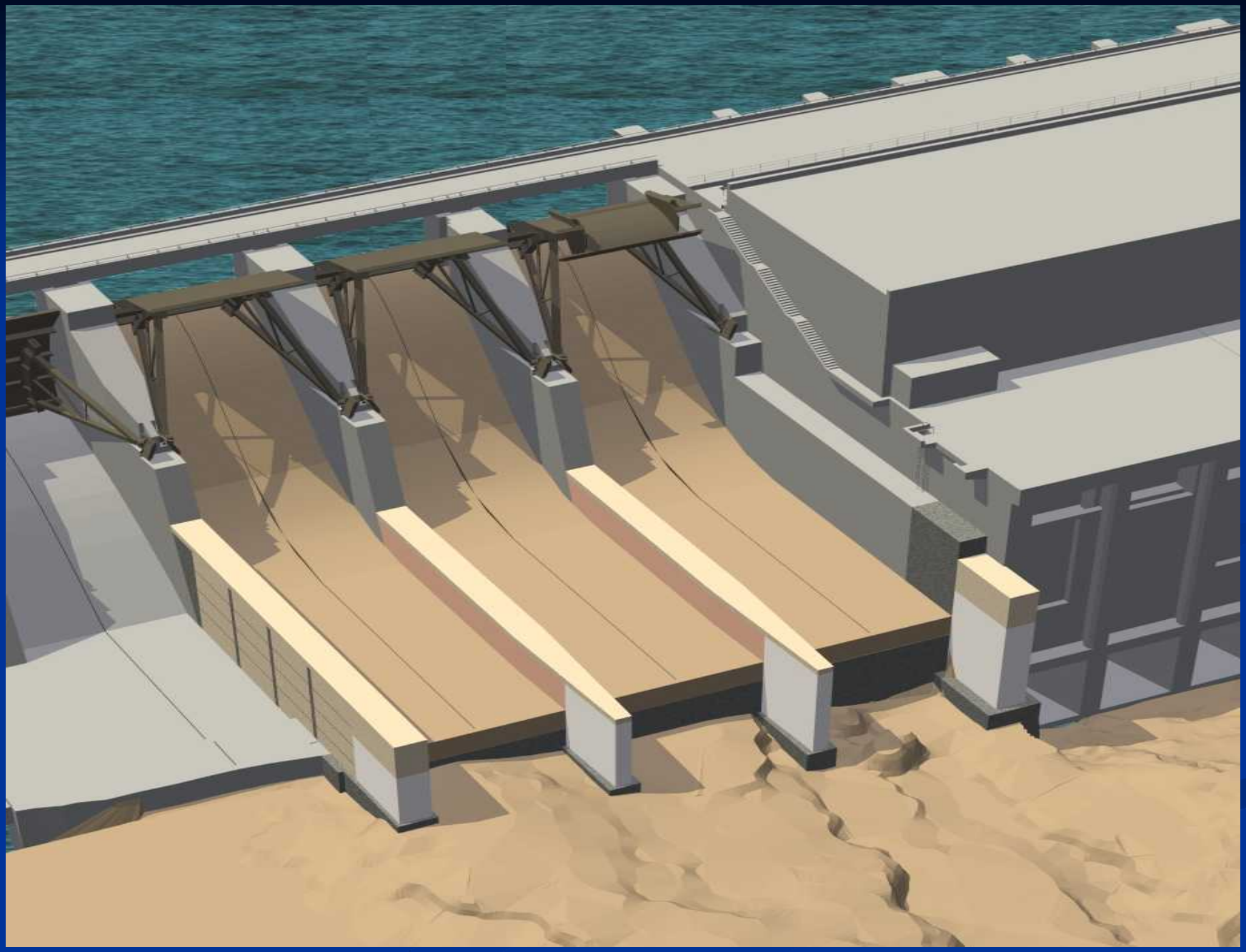
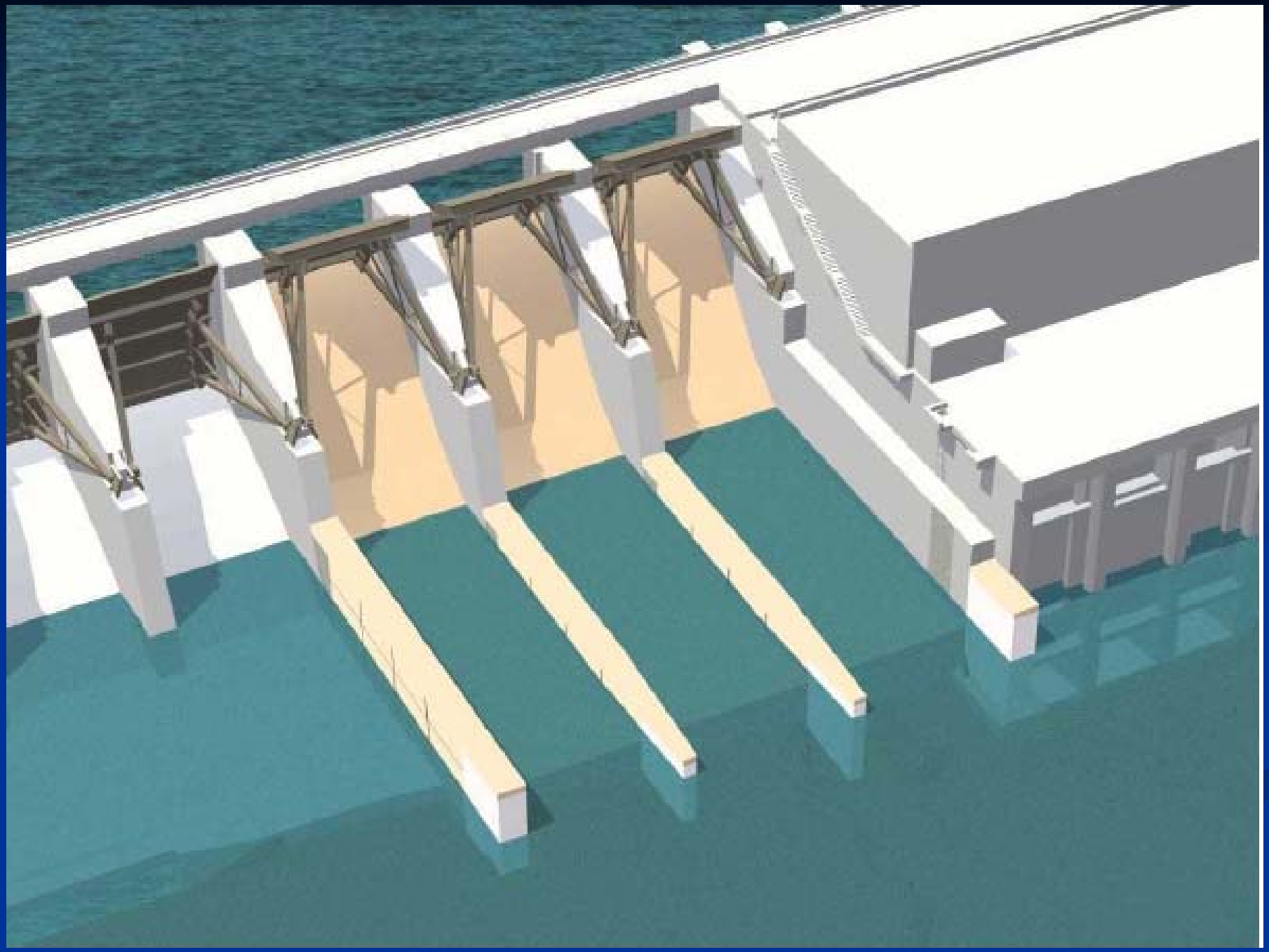
PRFB shown in 1:64 Tailrace Model

Agencies & Tribes (PRCC) in Iowa

1:20 scale Priest Rapids Bypass Model

Priest Rapids Fish Bypass

Grant County PUBLIC UTILITY DISTRICT



Bypass Location