Yr 2 Results and Designs for Adult Passage Study Plan

WHOOSHH: ROZA STUDY

JUNE 16,2016

Roza Dam: Yakama Nations Controlled Study

"The fish fly right through without so much as a scratch. Also, you won't have to divert water, as you do in a ladder system. Out here, the economy is all about agriculture, and water is gold. That's what makes Whooshh such a great concept."

--Mark Johnston, Research Scientist – Yakama Nation Fisheries

WHOOSHH INNOVATIONS

Roza Dam Study Design Yr 1 and Yr 2

2015 –Y2

Study Design: Identical to 2014 -Demonstrate Reproducibility of Outcomes

- **Total 562 Spring Chinook Collected (Wild & Hatchery)**
- **Hand Haul or 40' WFTS Transport into Haul Truck**
- **13.9% of total collected transported via WFTS**

- **Collected Roza May-June**
- **Held Cle Elum Hatchery May-October**
- **Spawned September – October**

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Roza Dam Study Results

Chinook Sampled*	H&H**	WHOOSHH
2014 TOTAL= 466		
Females	218	43
Males	183	22
Ratio female/male	1.19/1	1.95/1
2015 TOTAL = 562		
Females	301	51
Males	103	27
Ratio femalel/male	1.64/1	1.89/1

*Acct'd w/ known/ true sex

** Hand & Haul = Non-Whooshh

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Measurements of Whooshh Transported Chinook

2014 Whooshh Transported Chinook					2015 Whooshh Transported Chinook			
Female	Forklength	Pohlength	Weight	Age	Forklength	Pohlength	Weight	Age
Ave	70.23	60.19	4.73	~4	70.76	60.69	4.17	~4
Max	80	70	6.8		78	67	5.3	
Min	64	54	3.4		62	52	3	
Count	43	43	43		51	51	51	
Male								
Ave	71.18	59.91	4.78	~4	71.44	60.33	4.13	~4
Max	78	66	5.9		77	66	5.4	
Min	63	52	3		62	52	3	
Count	22	22	22		27	27	27	
Total								
Ave	70.55	60.09	4.74	~4	71	60.56	4.16	~4
Max	80	70	6.8		78	67	5.4	
Min	63	52	3		62	52	3	
Count	65	65	65		78	78	78	

WHOOSHH INNOVATIONS

Adult Mortality *

2014 CHINOOK	H&H	WHOOSHH
Mortality Females	4.6%	2.3%
Mortality Males	15.3%	9.1%
Mortality Total	9.5%	4.6%

2015 CHINOOK	H&H	WHOOSHH
Mortality Females	26.8%	29.4%
Mortality Males	27.9%	11.1%
Mortality Total	27.5%	23.1%

* Includes pre-spawn and sort mortality

WHOOSHH INNOVATIONS

Wild/Natural Females Collected/ Spawners

2014 Female: Wild	Counts	Percentage
Total	196	
Whooshh	29	14.8%
Non-Whooshh	167	85.2%
2015 Female: Wild		
Total	257	
Whooshh	38	14.8%
Non-Whooshh	219	85.2%
2014 Spawner: Wild		
Total	188	
Whooshh	29	15.4%
Non-Whooshh	159	84.6%
2015 Spawner: Wild		
Total	181	
Whooshh	25	13.8%
Non-Whooshh	156	86.2%

WHOOSHH INNOVATIONS

Egg Viability – Survival Post Shock

2014 CHINOOK	H&H	WHOOSHH
Hatchery Control	98.3%	98.7%
Wild/Natural	94.6%	92.1%
2015 CHINOOK	H&H	WHOOSHH
Hatchery Control	NA	NA
Wild/Natural	94.2%	92.8%

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Outcomes

The study generated reproducible results in two consecutive years.

The study demonstrated non-inferiority (new treatment equivalent to standard treatment) for all three study outcome measures:

- Adult Survival
- Production Spawners
- Egg Viability

- Outcomes suggest the Whooshh Fish Transport System is a viable alternative to standard hand haul methods from the fish safety perspective, with a reduced risk benefit to the fish of damage due to accidental dropping.

- From the fish handler perspective, the WFTS is easy to use, fast, may reduce injury, and adds a measure of safety for the fish handler.

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What's Coming Up…

Long Tube Feasibility/Viability Study:

Evaluate efficacy of WFTS to transport live fish across a distance and elevation that models high head dam passage

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Long Tube Study in brief

- ~1100 ft in distance and ~100 ft rise in elevation
- 2016 at Roza to simulate Cle Elum Dam
- Designed as an additional arm to current study
- Fish transported into a haul truck
- Fish hauled to Cle Elum Hatchery

Outcome measures: adult survival
production spawners
egg viability

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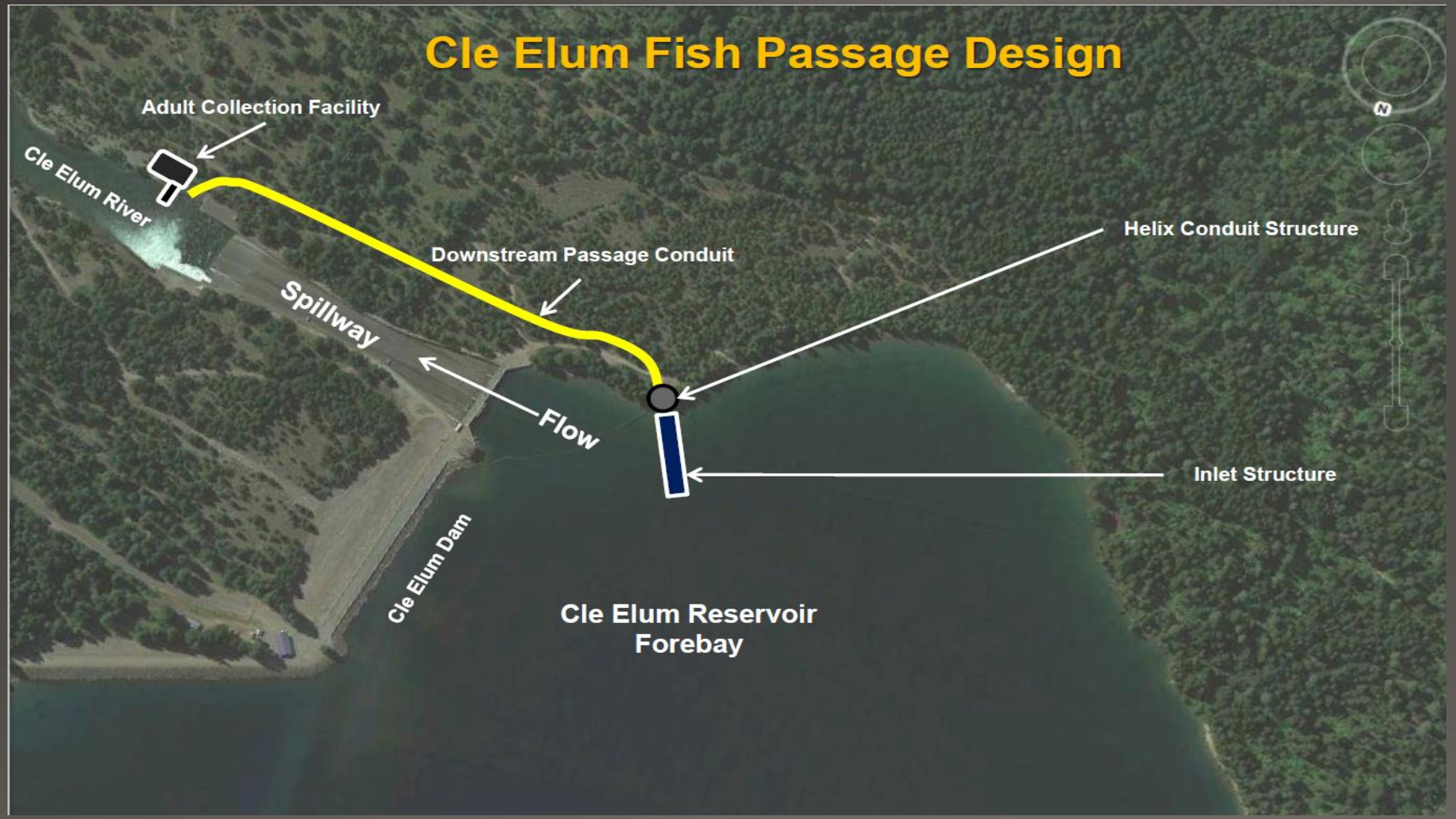
1100’ X 100’

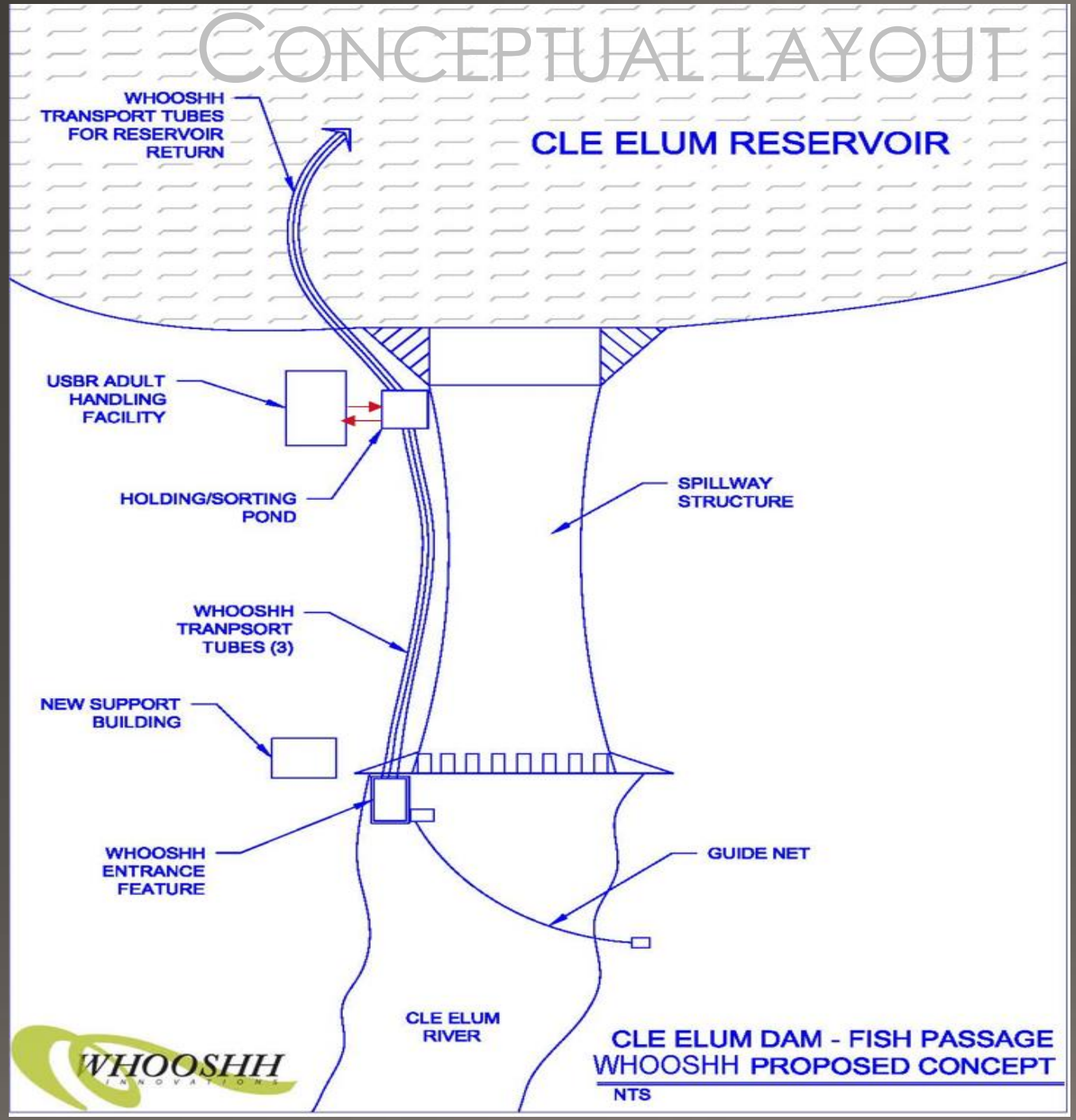
WHOOSHH INNOVATIONS

VIDEO

WHOOSHH
INNOVATIONS


Cle Elum Fish Passage Design
Adult Collection Facility
Cle Elum River
Downstream Passage Conduit
Helix Conduit Structure
Spillway
Flow
Inlet Structure
Cle Elum Dam
Cle Elum Reservoir
Forebay
N

CONCEPTUAL LAYOUT



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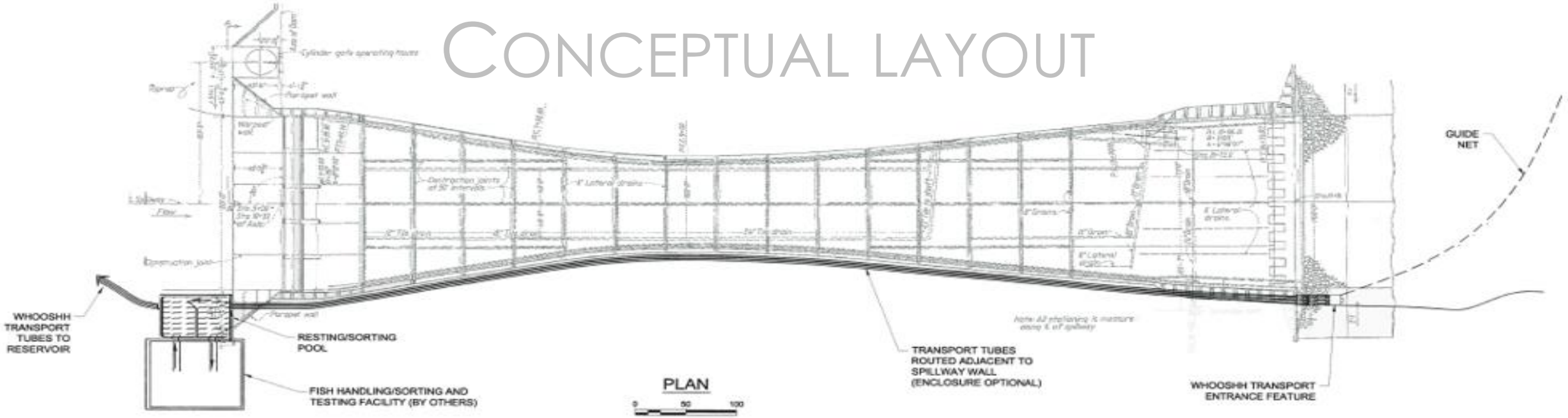
CONCEPTUAL LAYOUT



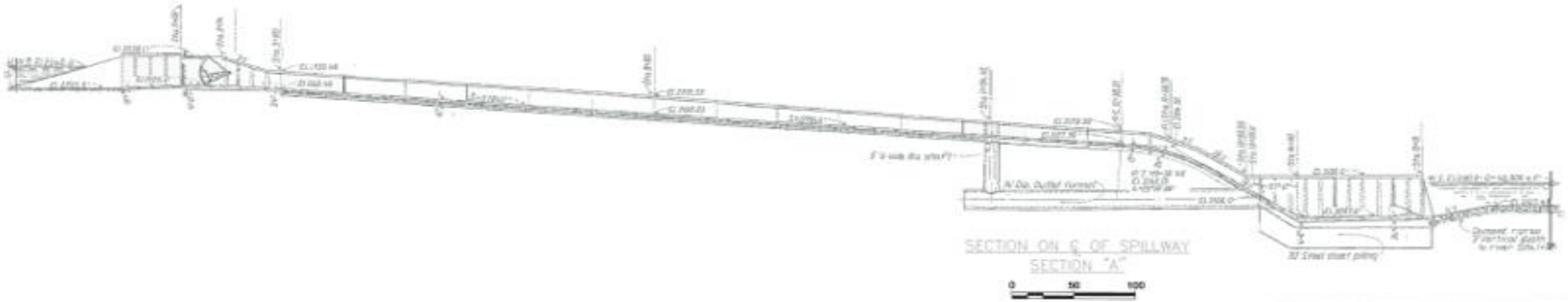


Figure 2

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PART NAME:	OWNER:
CLE ELUM DAM SPILLWAY	J-OTTEN

SIZE:	PART NUMBER:	REV:
B	G-001	01

SCALE: 1" = 50' | SHEET 1 OF 1

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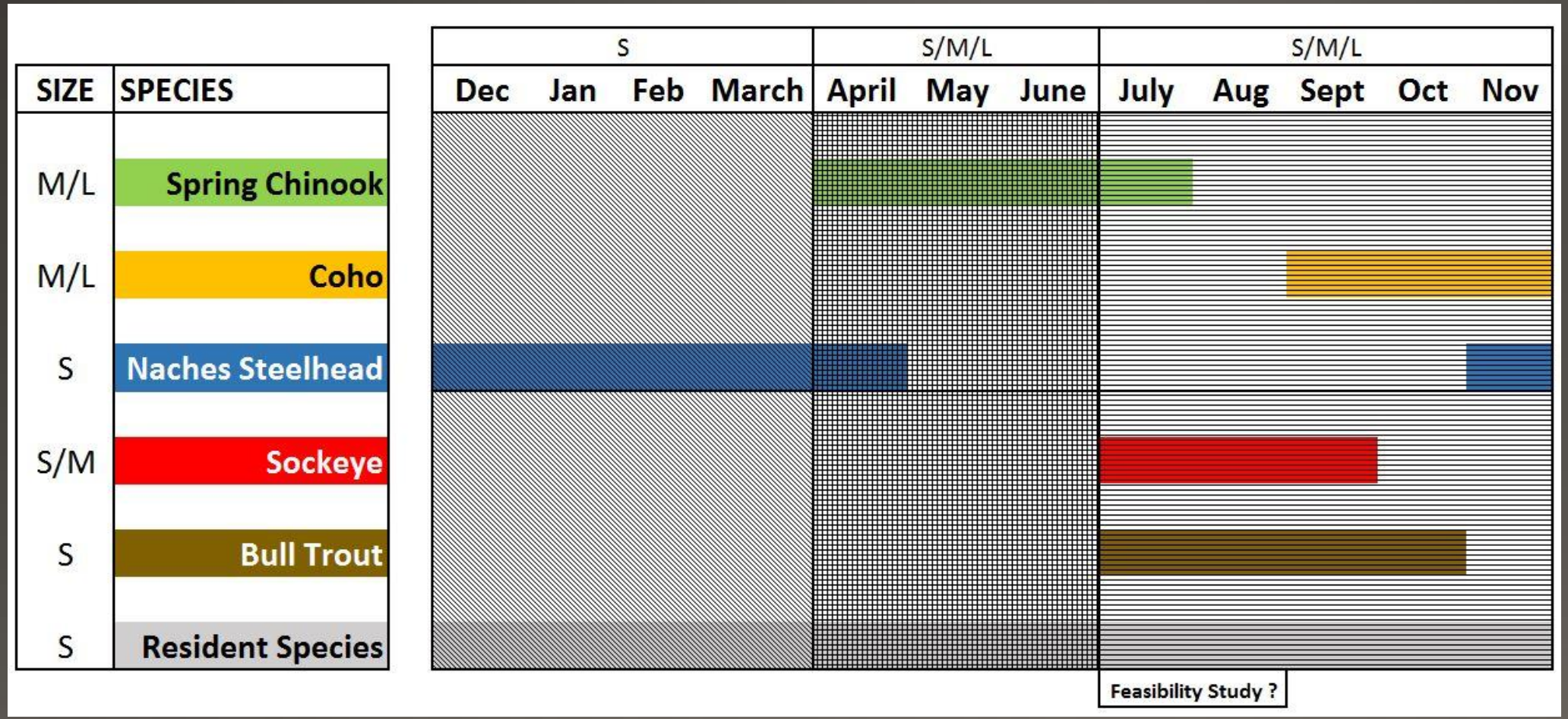
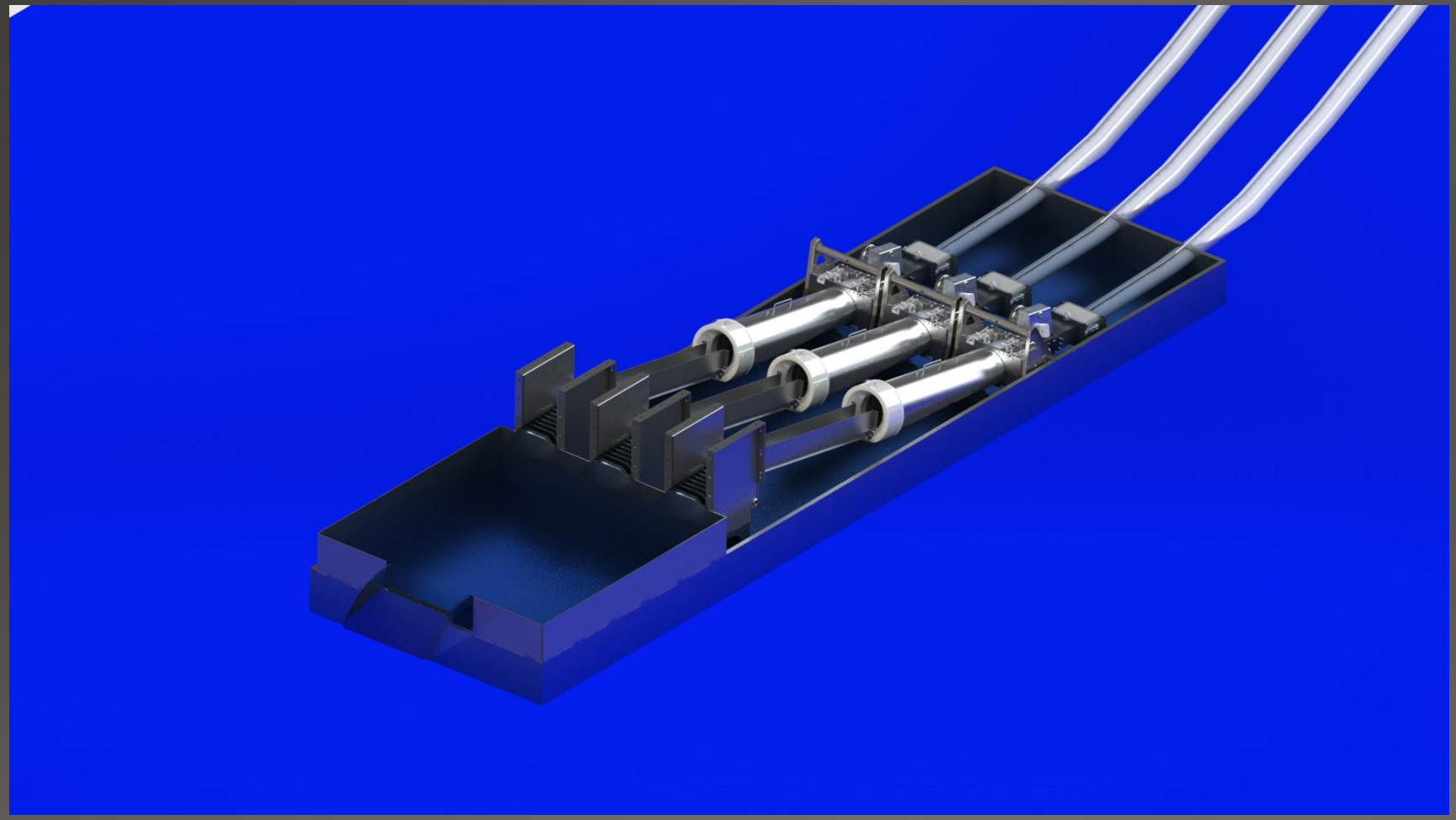
Prospective Fish Species for Transport



Concept Multiple Tube Design



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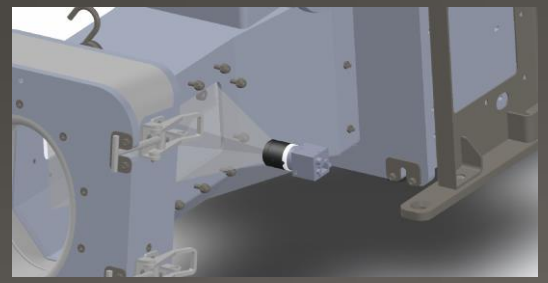
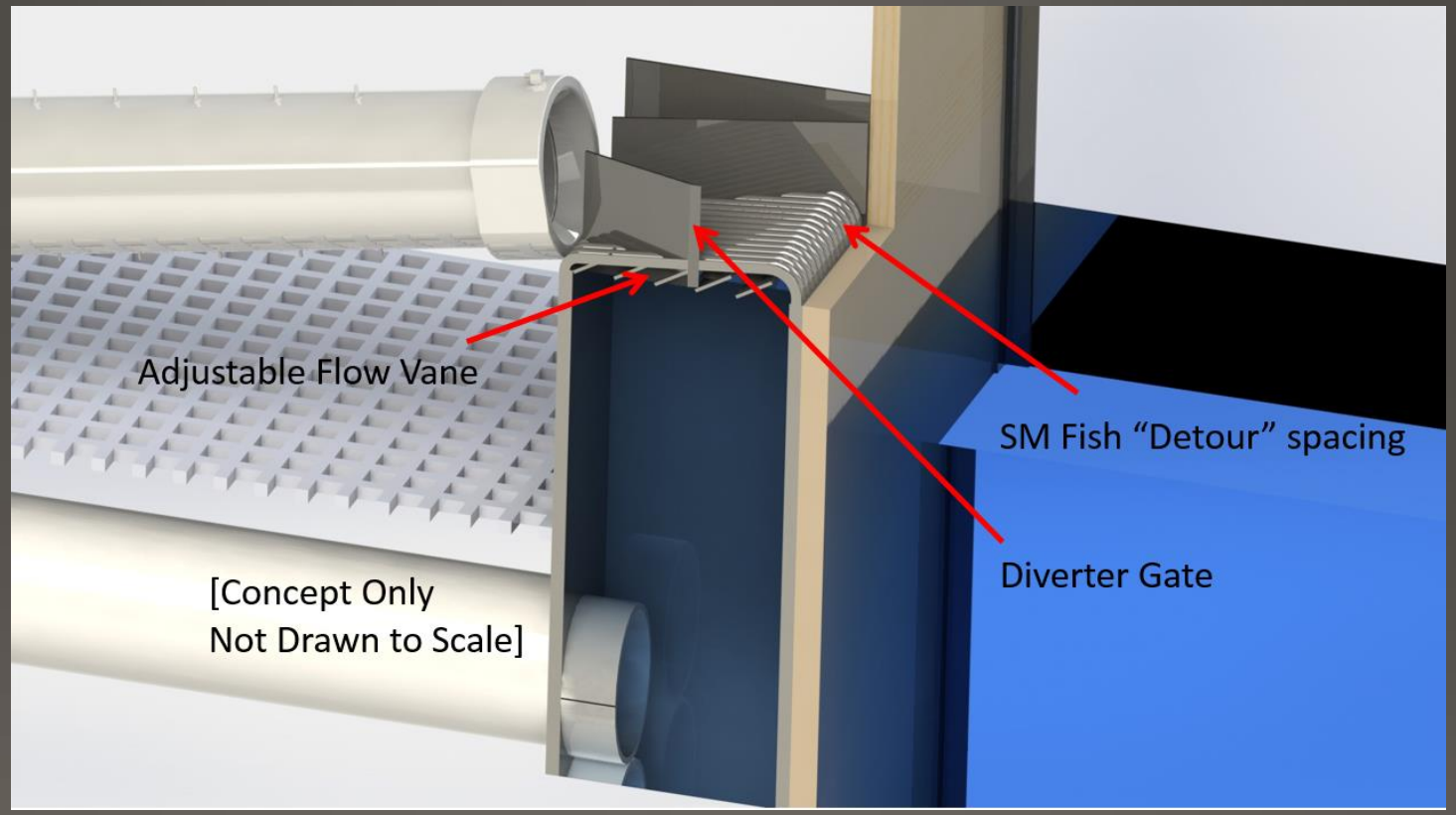
Size sorting and automated exclusion system

Manual

Mechanical



Magical



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Size Sorting and automated Exclusion System

Double Sorting

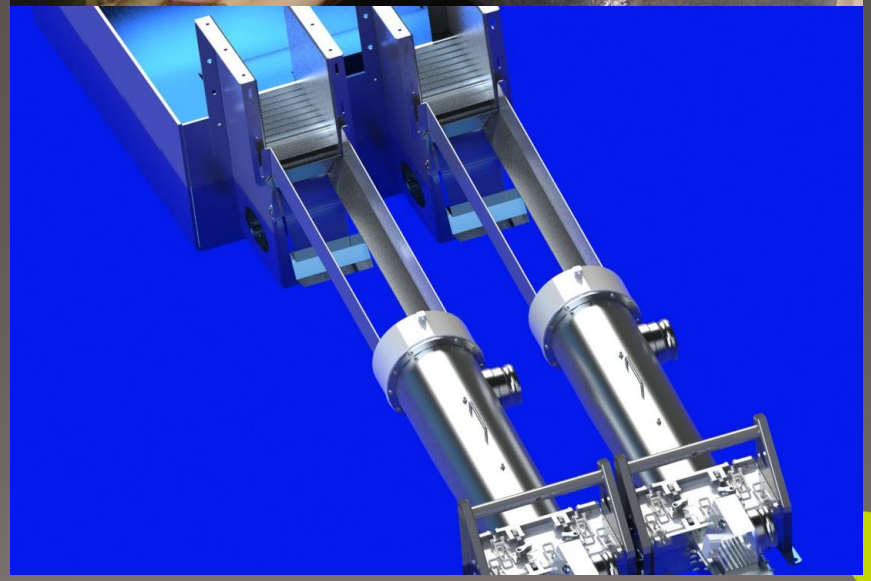
- Large sizes prevented through mechanical blocking
- Small sizes must be excluded

Sorting Options Mechanical

- ✓ Bottomless chute
- ✓ Behavioral (flow rate & jump height)
- Sensor Based
  - ✓ Profile Scan
  - ✓ Machine Vision

Exclusion Options

- Prior to false weir (in-water)
- Attraction flow shutoff
- Pneumatic Gate



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THE BEST WAY TO MOVE FISH

- Fast deployment (first system in instead of last thought – saves years)
- Faster fish migration (saves fish)
- Lower adult mortality prior to spawning
- Forebay or tailrace variability ok
- Easy to adapt to changes caused by climate change
- Less Ops & Maintenance costs
- Place system directly in migration path – easy fish entry
- No passage delay in ladder
- No temperature gradients from top to bottom of ladder
- No unnecessary spilling
- No injury during passage
- Low risk of disease transfer -sanitize

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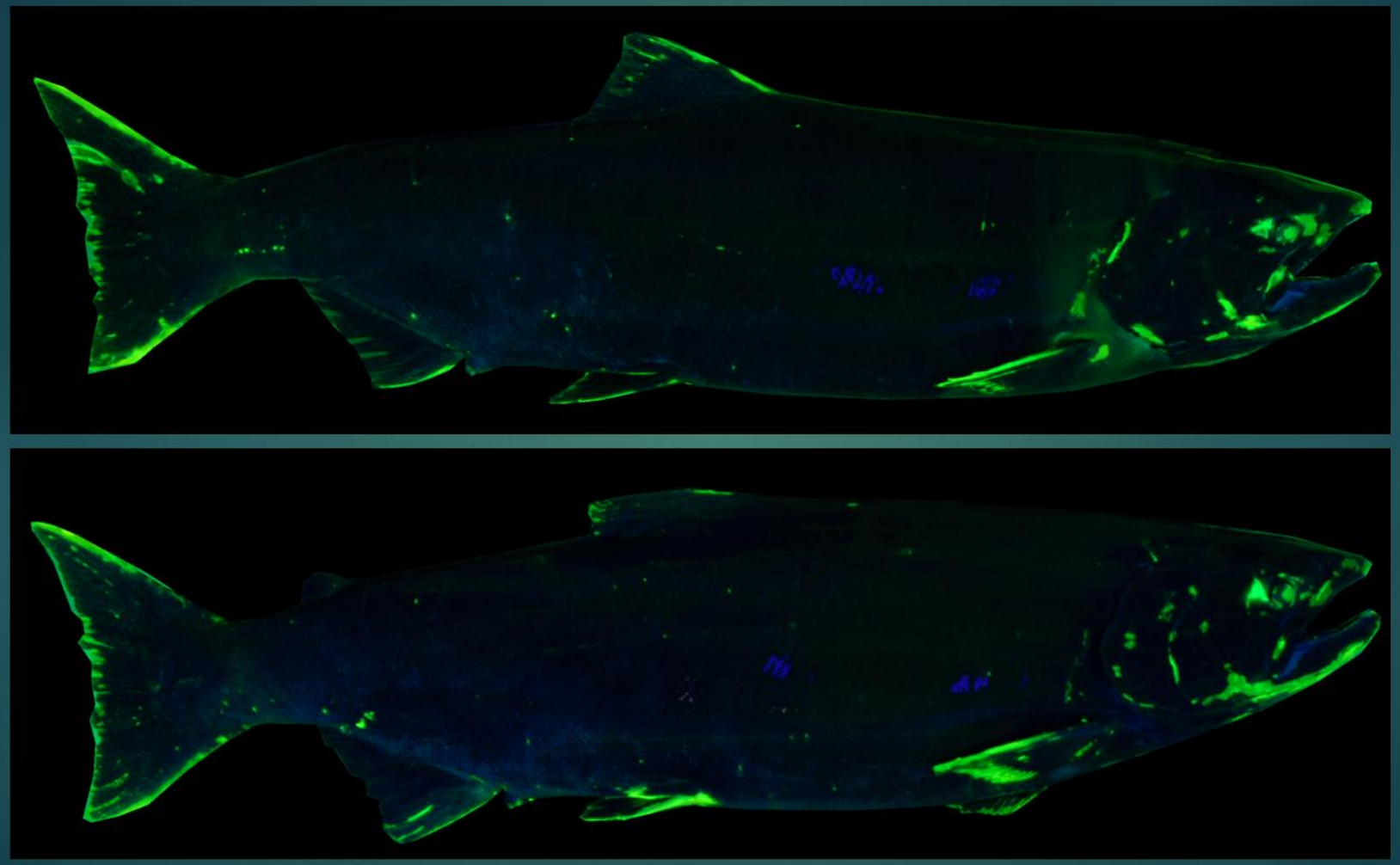
QUESTIONS

EXTRAS

PNNL Example Comparison Whooshh v Control



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WHOOSHH TUBES

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Site Conditions

Entry System

- Floating Design allows for a range of tail race elevations
- Lack of “fixed” connections allows for flexibility
- Exact nature of connection to fixed line will depend on routing and fluctuation

Tube Routing

- Path does not need to be straight
- Path will be dictated by exact site requirements

Spilling Considerations

- High flow event requirements need to be understood
- Entry feature could be designed to be submerged during spilling

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Multiple Tube Design

Whooshh System Maximum Fish Capacity for 1100 ft length					
Tube #	**Tube Size**	**Max Capacity/ Minute**	**Max Capacity/ hour**	**Max Capacity/ 24hr**	**Fish Species**
1	T123 (small)	3.8	228	5,472	Coho, Sockeye, Bull Trout, Steelhead, Jacks
2	T147 (med)	4.8	288	7,488	Coho, Sockeye, Bull Trout, Spring Chinook
3	T195 (large)	6.1	366	8,784	Coho, Spring Chinook
Total		17.7	882	21,168	ALL

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