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Innovative Fish Passage: A Cost-Effective Solution for High-Head Hydro

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INNOVATIVE FISH PASSAGE

A Cost-Effective Solution for High-Head Hydro

Mead&Hunt

Ryan Greif, PE

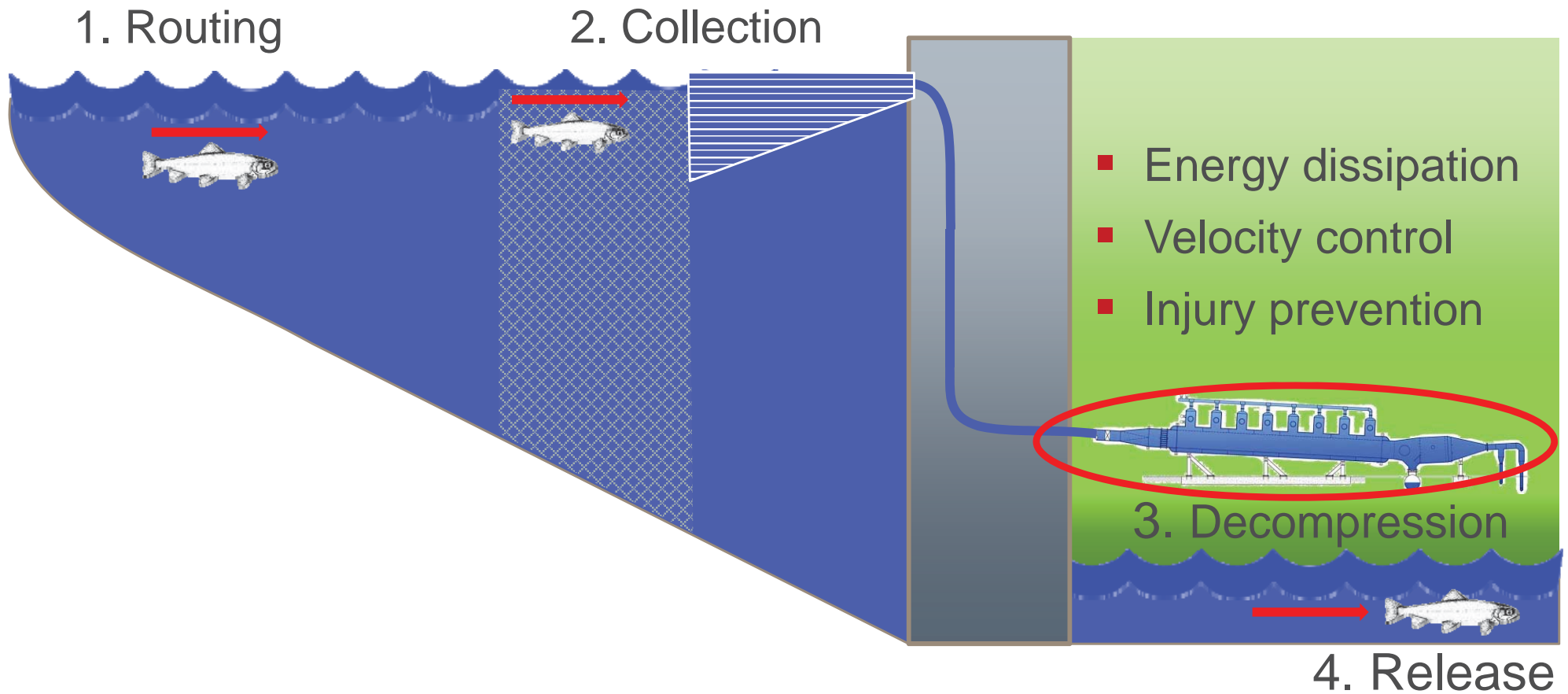
Mead & Hunt

Sacramento, California

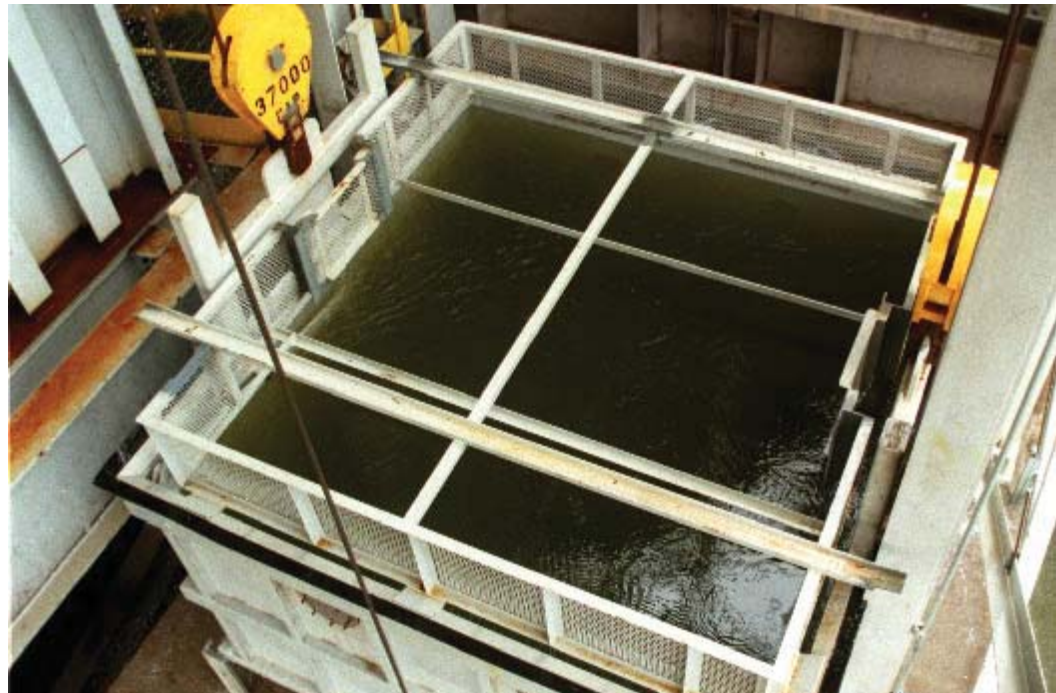
ryan.greif@meadhunt.com

CONTEXT

Downstream passage of juvenile fish

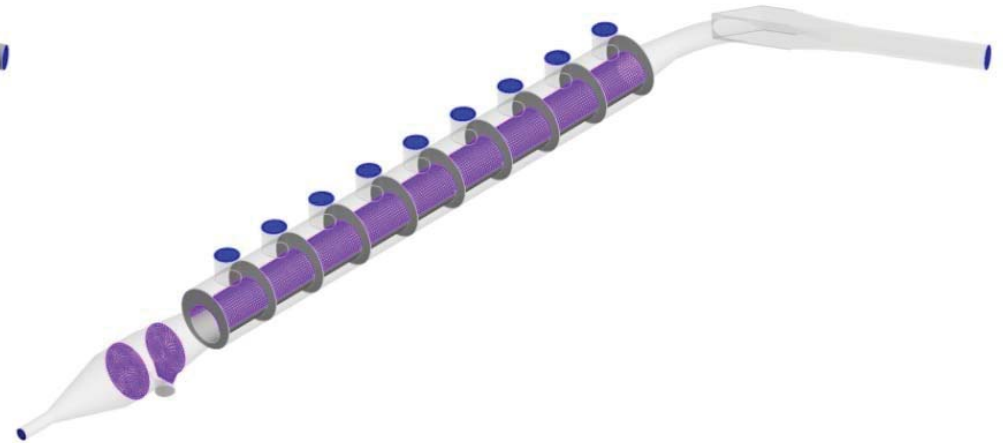
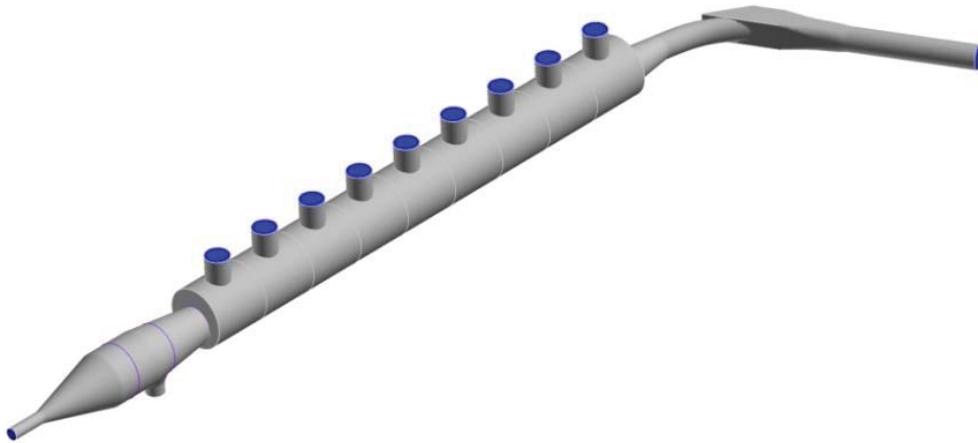


TRADITIONAL METHODS

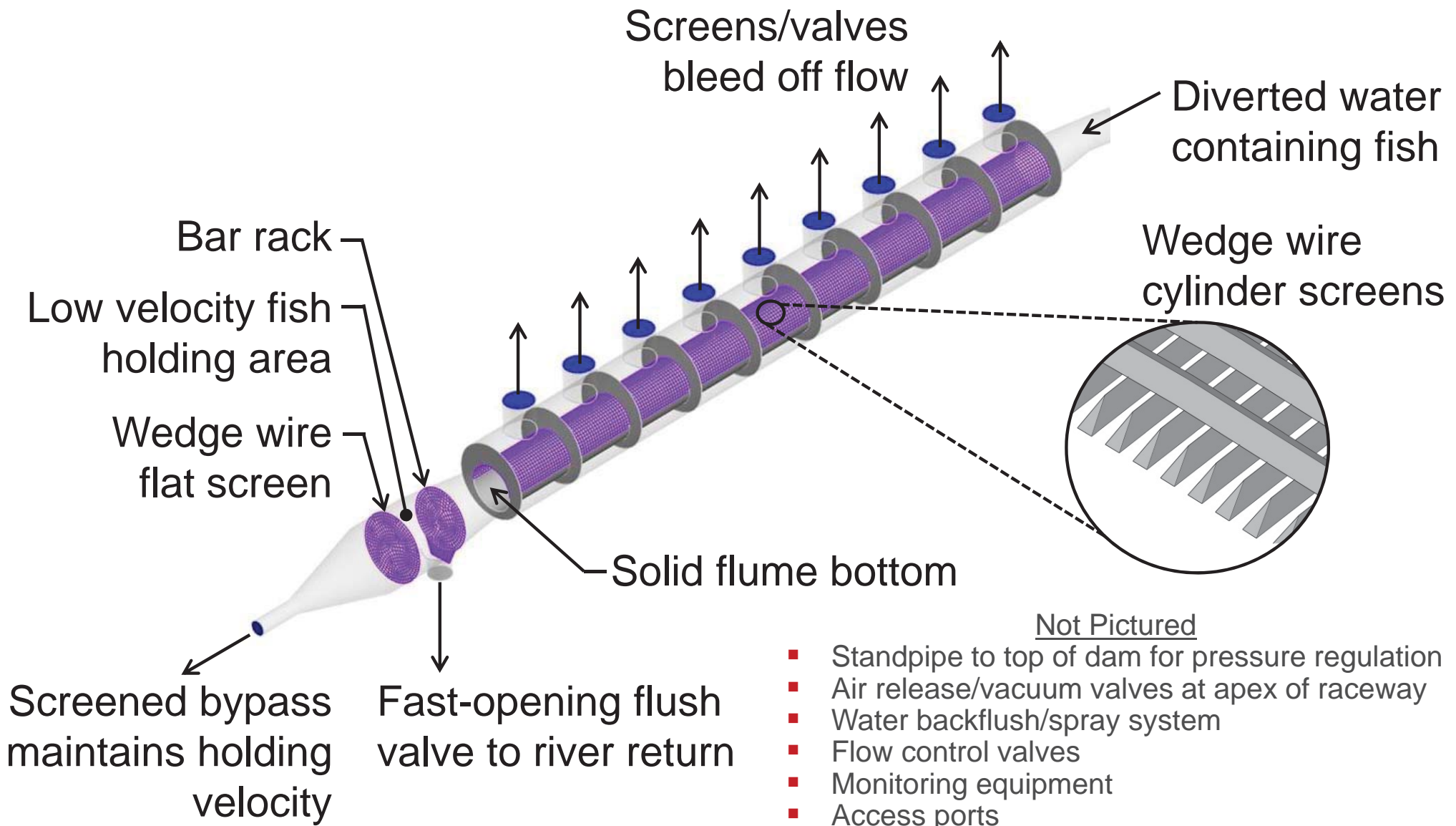


INNOVATIVE DESIGN

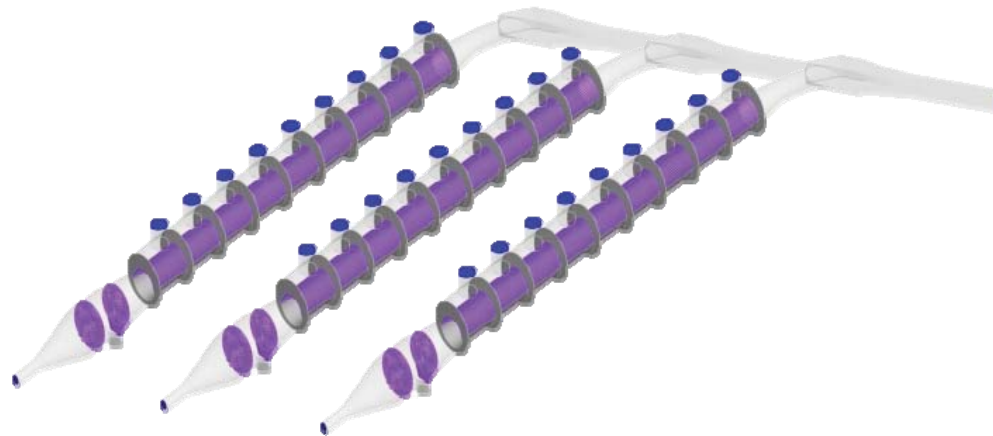
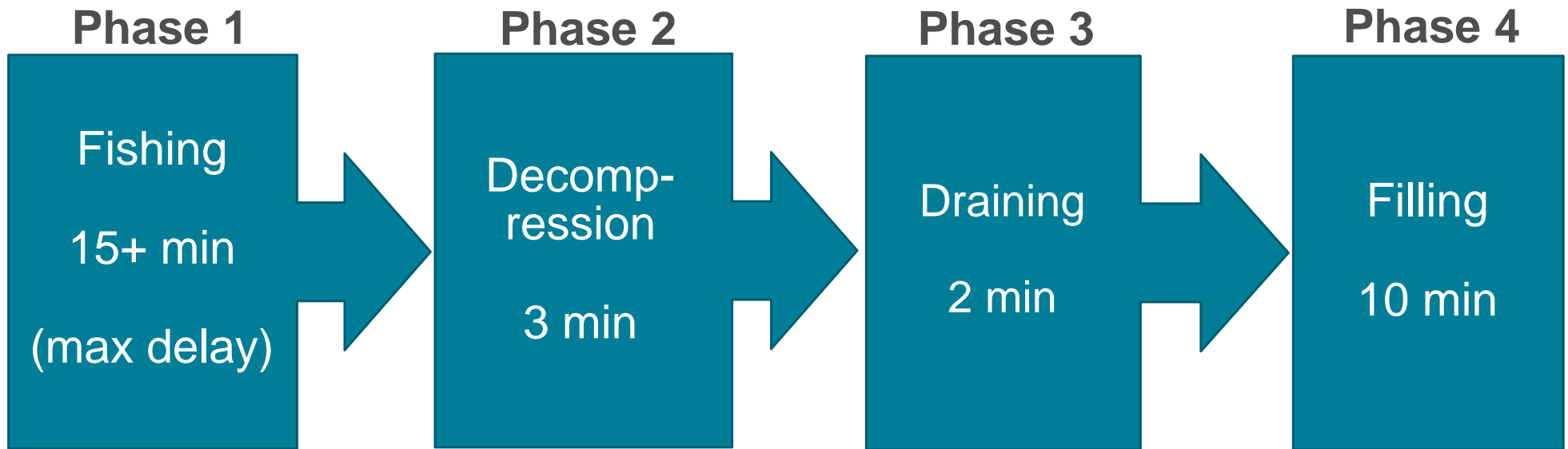
- Pressure vessel for fish collection and decompression
- Controlled decompression minimizes barotrauma
- Velocities within “fish-friendly” limits
- Precise bypass flow control
- Fish protected from valves by wedge-wire screens



DECOMPRESSION RACEWAY

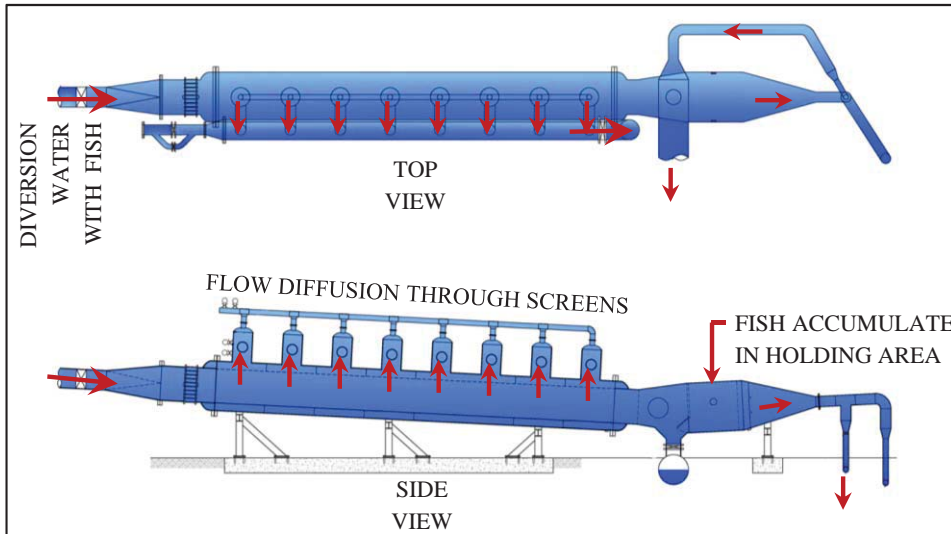


DECOMPRESSION RACEWAY OPERATION

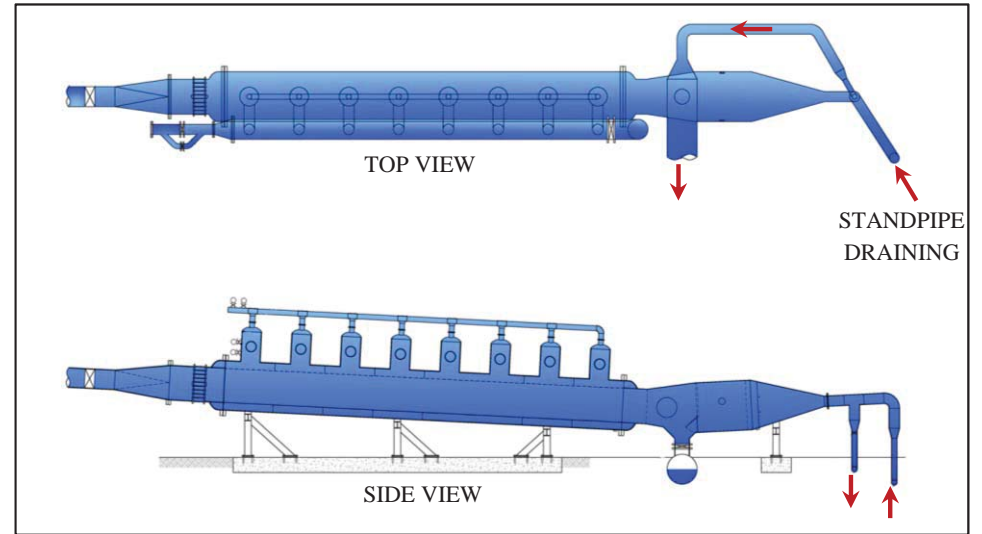


DECOMPRESSION RACEWAY OPERATION

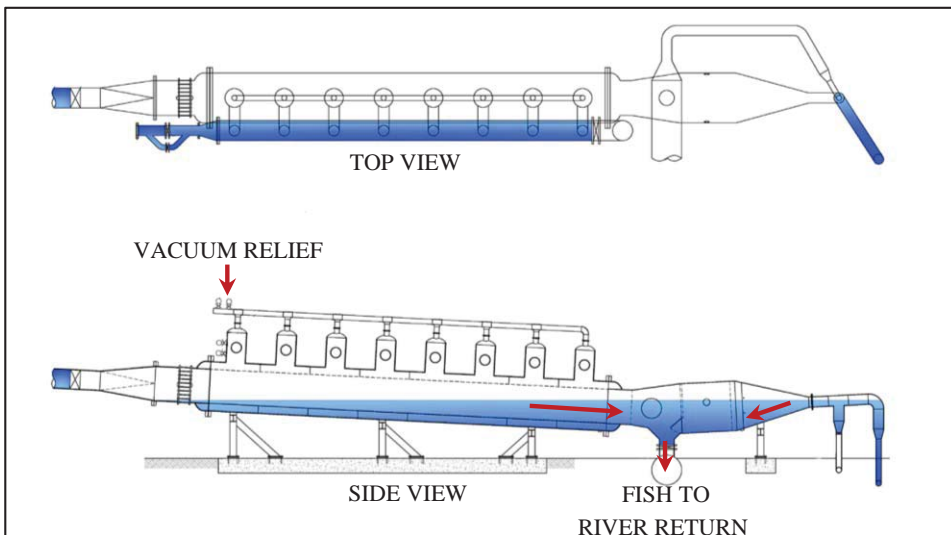
1. FISHING



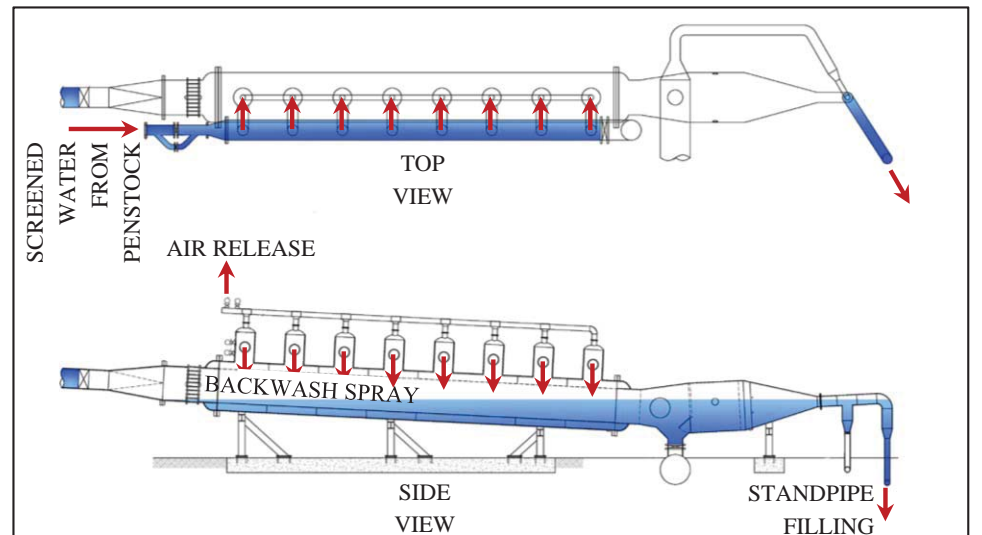
2. DECOMPRESSION



3. DRAINING

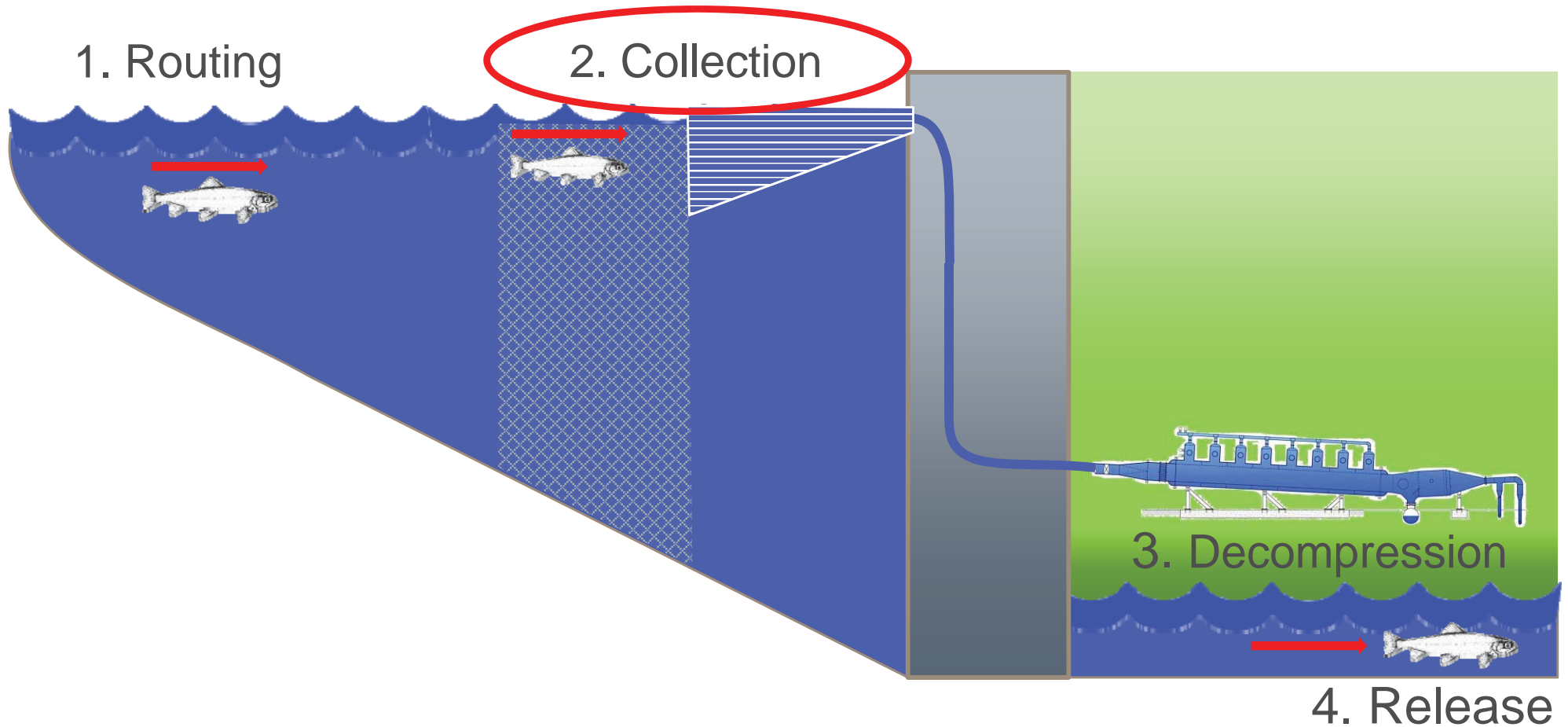


4. FILLING

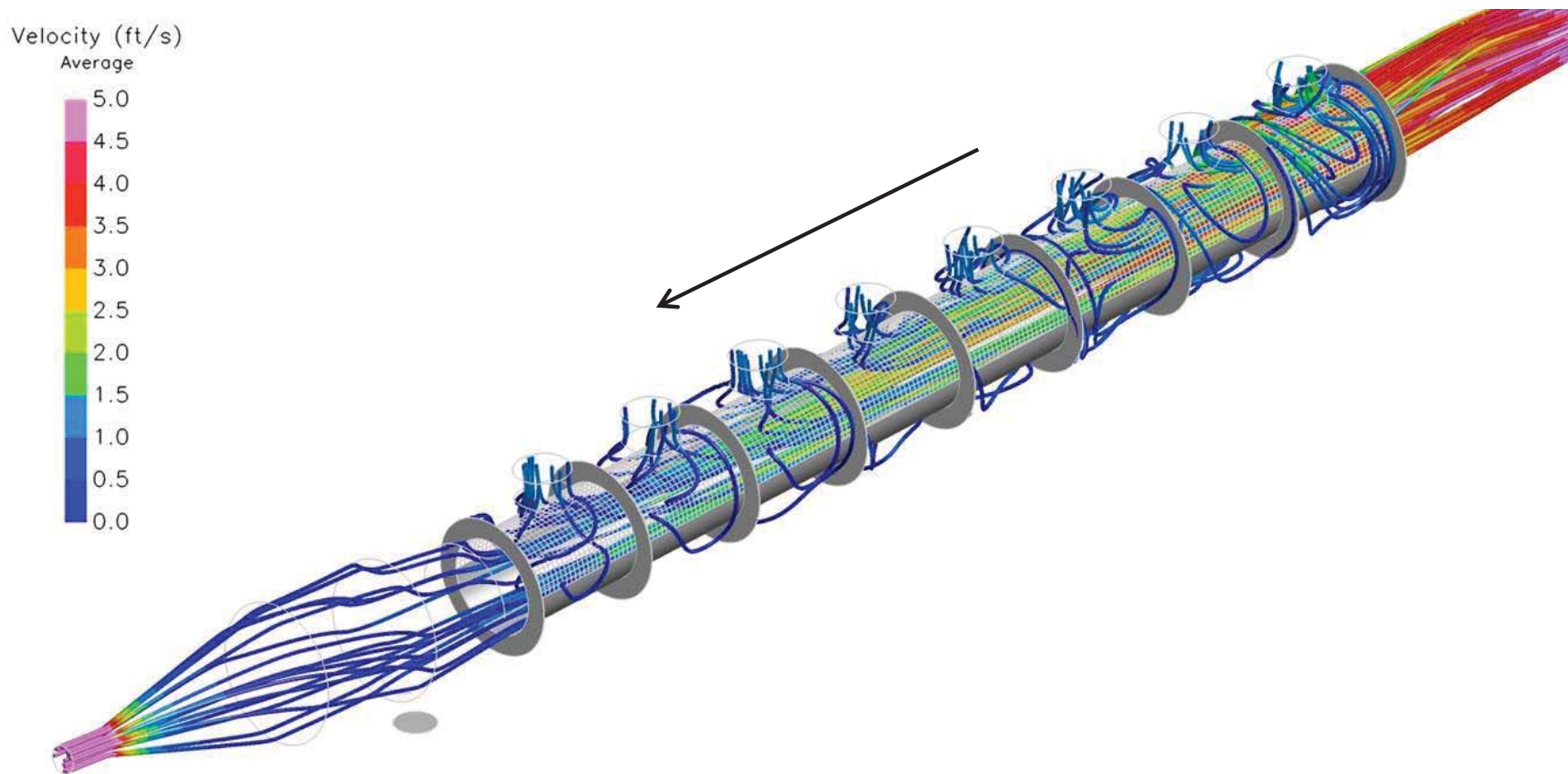


UPSTREAM COLLECTION

- Floating surface collector or fixed weir
- Multi-port intake tower
- Penstock with Eicher or MIS-type screen retrofit



- Verified hydraulic performance of final design
- Smooth, gradual deceleration into holding area
- Verified protective conditions along raceway



Hyperbaric Pressure Testing

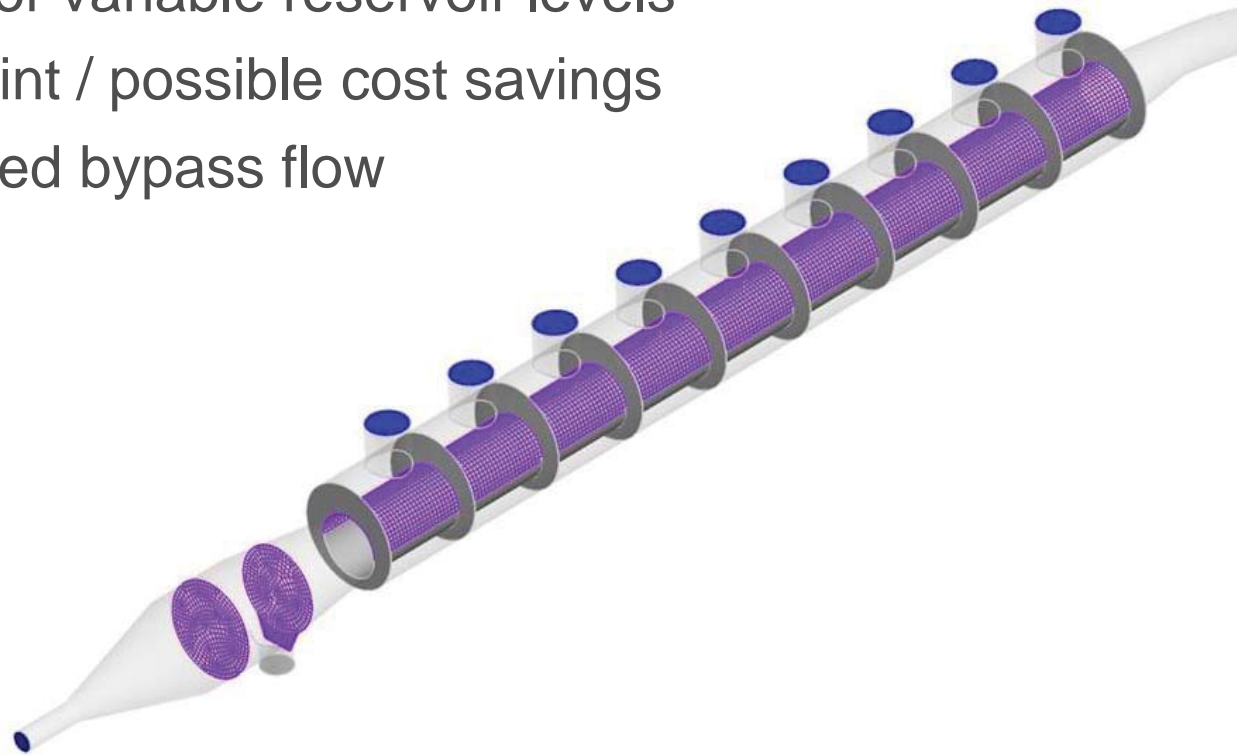
- Juvenile salmonids subjected to controlled, gradual decompression
- Simulated 90 psig to atmospheric
- 3-minute decompression: no injuries or abnormal behavior observed



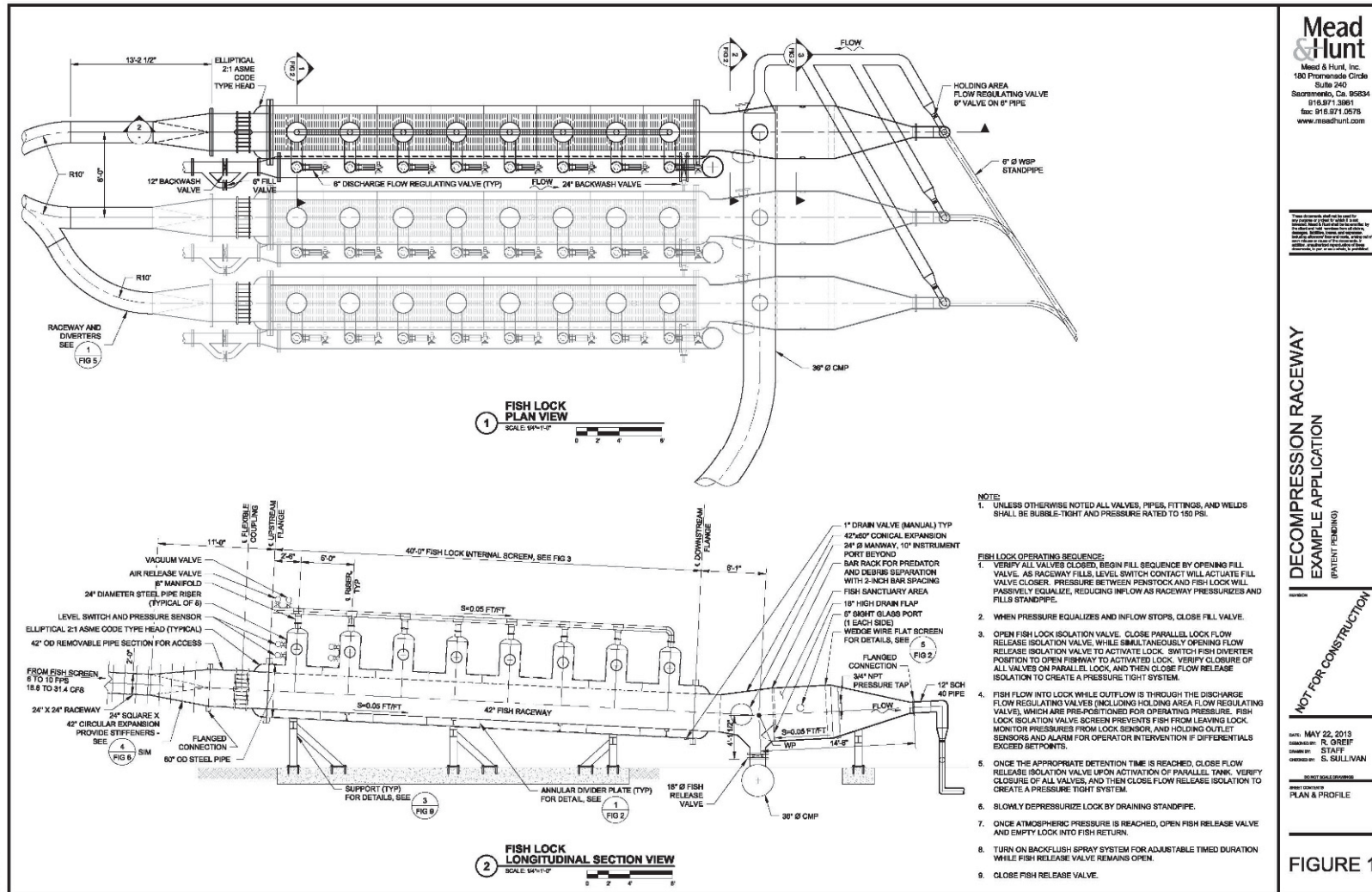
CONCLUSION

Decompression Raceway Advantages:

- Continuous passage with minimal delay
- Adjustable for variable reservoir levels
- Small footprint / possible cost savings
- Well-regulated bypass flow
- Adaptable



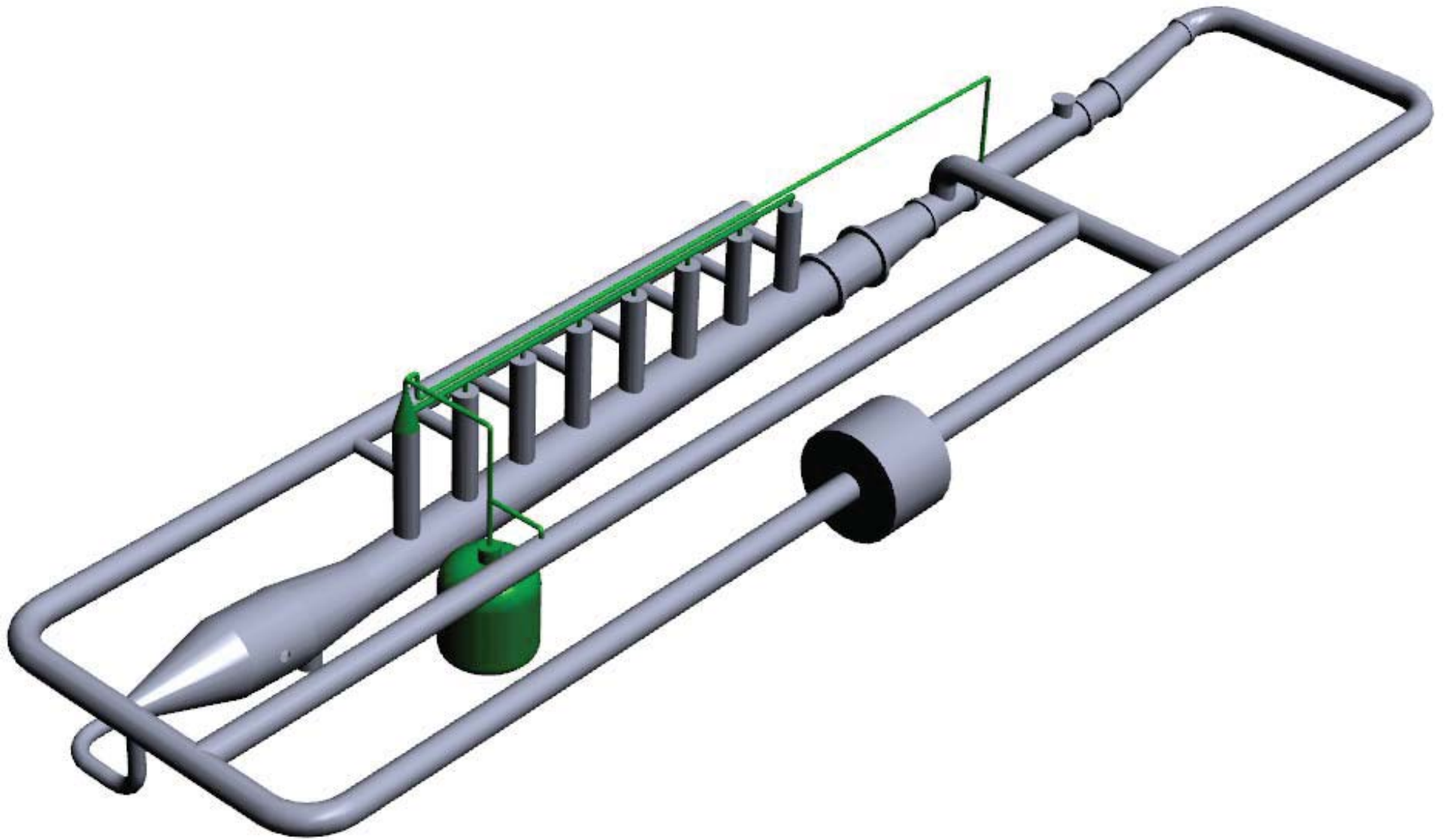
PROTOTYPE DESIGN COMPLETE



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(Patent-Pending)

NEXT STEP - PROTOTYPE TESTING



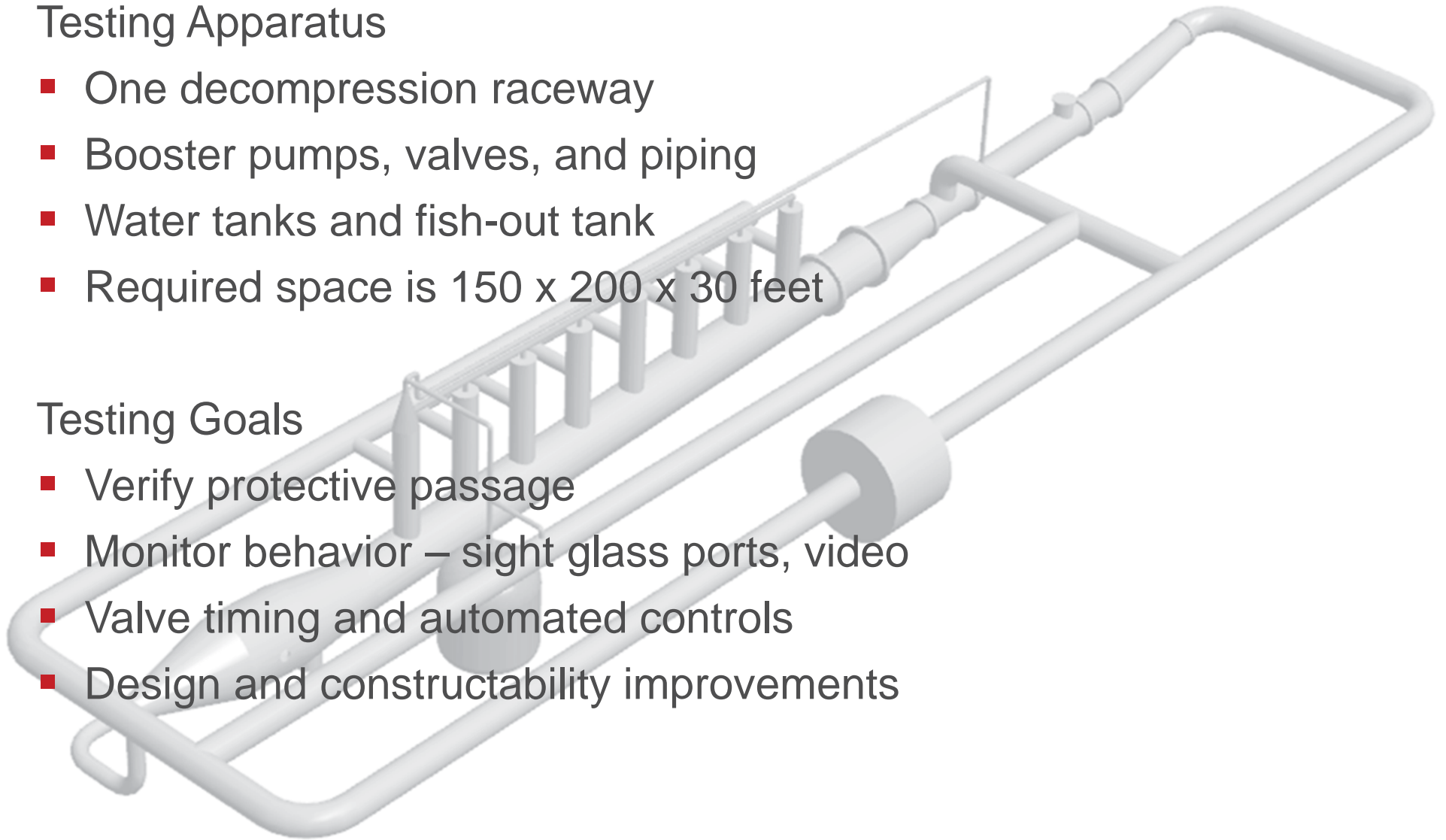
NEXT STEP - PROTOTYPE TESTING

Testing Apparatus

- One decompression raceway
- Booster pumps, valves, and piping
- Water tanks and fish-out tank
- Required space is 150 x 200 x 30 feet

Testing Goals

- Verify protective passage
- Monitor behavior – sight glass ports, video
- Valve timing and automated controls
- Design and constructability improvements



ACKNOWLEDGEMENTS

Battelle

Fish pressure testing by
Dr. Rich Brown at [Battelle Labs](#)



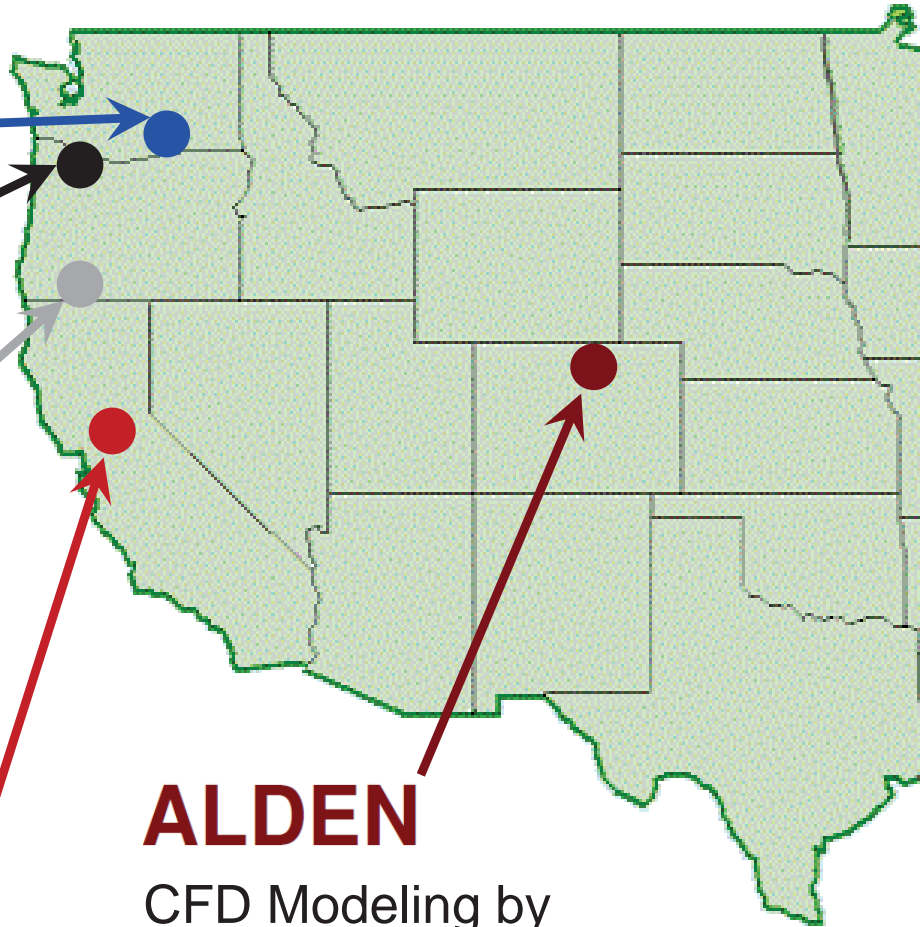
Fisheries biology by
Kai Steimle at R2
Resource Consultants, Inc.



Funded by
AG Hydro, LLC

**Mead
& Hunt**
Design by
Mead & Hunt

ALDEN
CFD Modeling by
Alden Research Laboratory, Inc.



Review by the Applegate Fish Passage
Technical Working Group with representatives
from NOAA Fisheries, ODFW, and USFWS

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The logo for Battelle, consisting of the word "Battelle" in white text on a blue rectangular background.

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