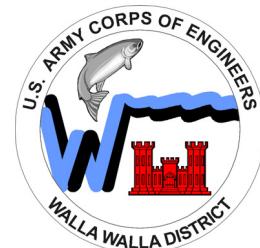


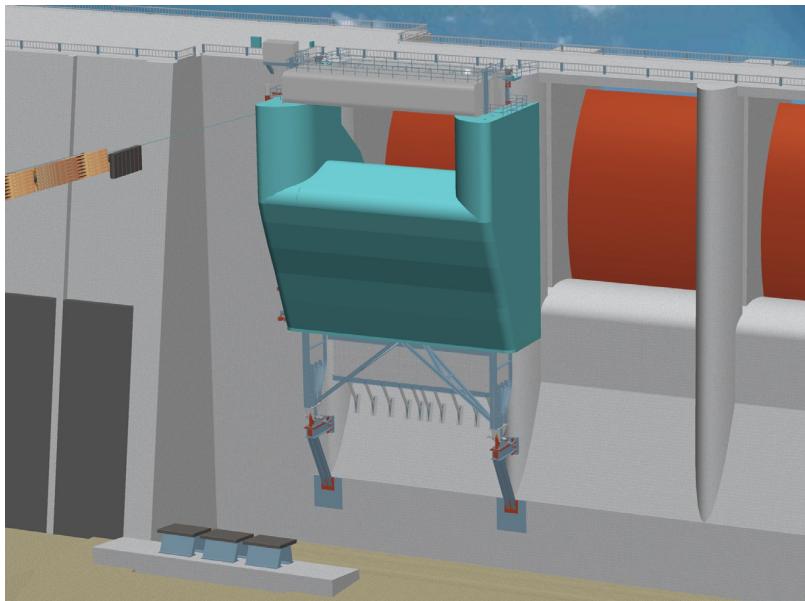


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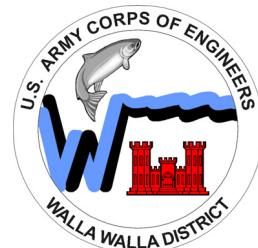
REMOVABLE SPILLWAY WEIR

FISH PASSAGE, POWER, AND WATER QUALITY SUCCESS STORY





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INTRODUCTION



Pacific Northwest

- Walla Walla District Snake and Columbia River Projects

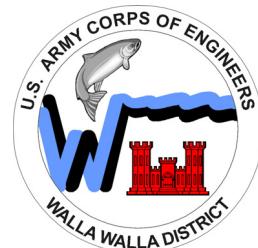


United States



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BACKGROUND

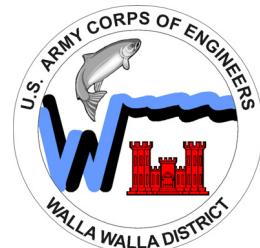


- Endangered Species / Regional Impacts
- Recovery Plan Options
 - Dam Removals
 - System Improvements





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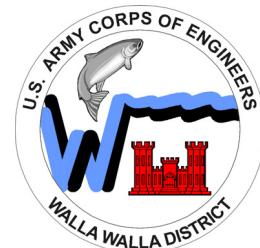
FISH PASSAGE ROUTES



- Juvenile Fish Passage Methods
 - Multiple Paths
 - Traditional Spill Favored for In-River



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TRADITIONAL FISH SPILL DRAWBACKS

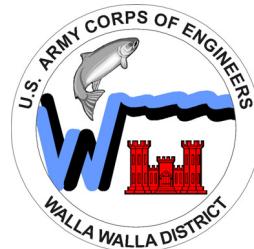
- Fish Passage
 - Deep Spill Gates
- Water Quality
 - Exceeds 110% TDG
- Forgone Power
 - \$186 Million Annually (LCR and LSR)
 - \$40 Million Annually (LSR)





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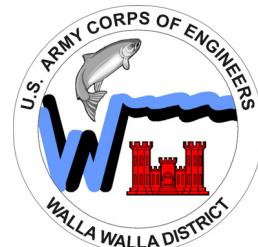
SURFACE BYPASS SPILL ALTERNATIVE



- Fish Goals
 - Increase Passage Non-Turbine Routes
 - Increase Survival
 - Reduce Delay
- Water Quality Goals
 - Lower Dissolved Gas Levels
- Power Goals
 - Higher Revenues



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SURFACE BYPASS DEVELOPMENT

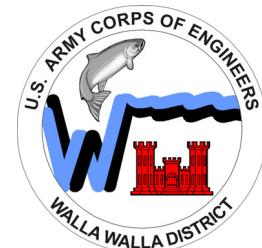


Lower Granite Dam

- Columbia and Snake River Projects
 - Numerous Prototypes (mid 1990's / early 2000's)
 - Lower Granite RSW (2001)



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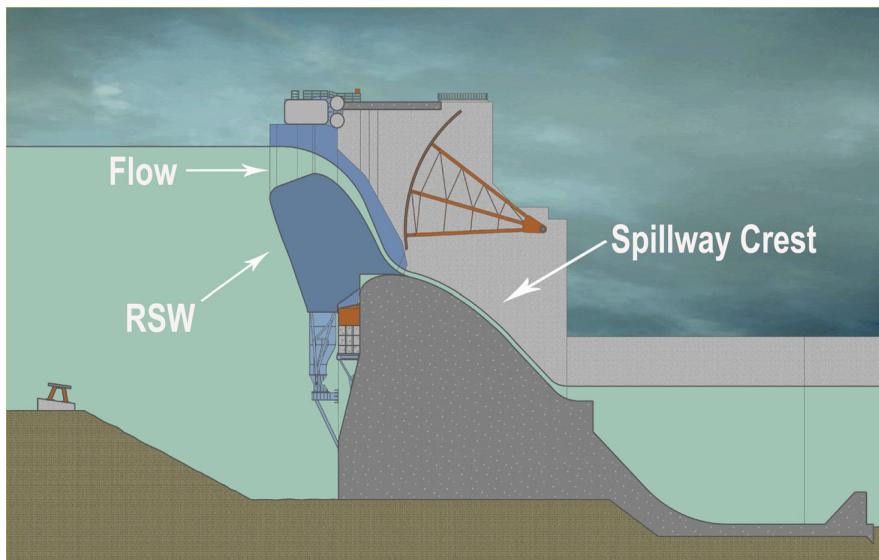
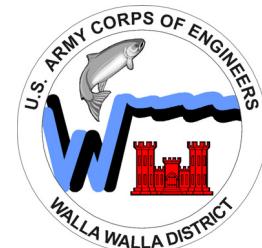
LOWER GRANITE RSW DESCRIPTION



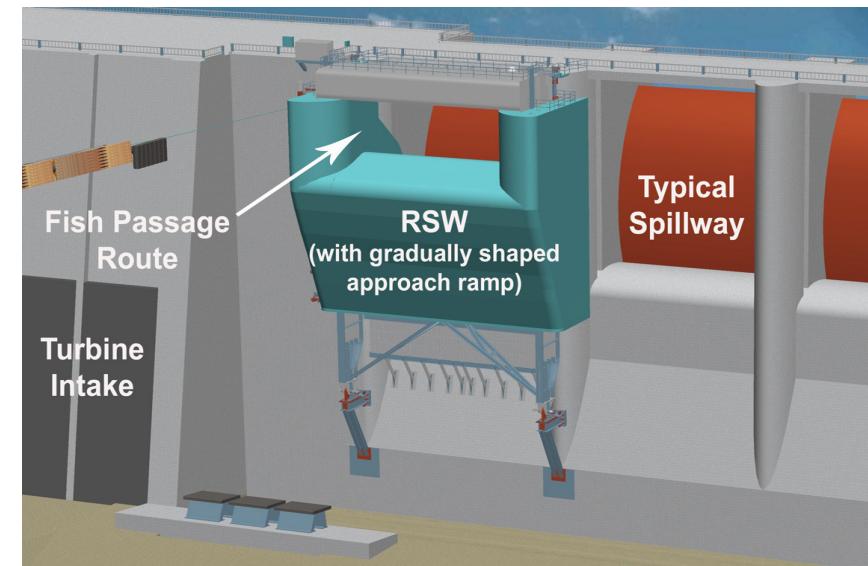


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LOWER GRANITE RSW OPERATING POSITION



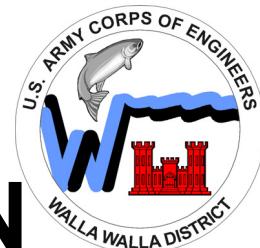
Side View



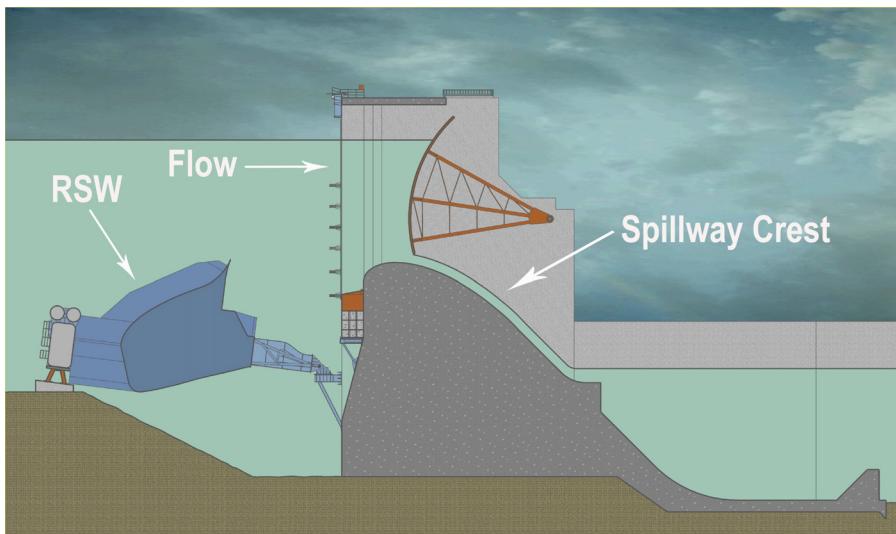
Isometric View



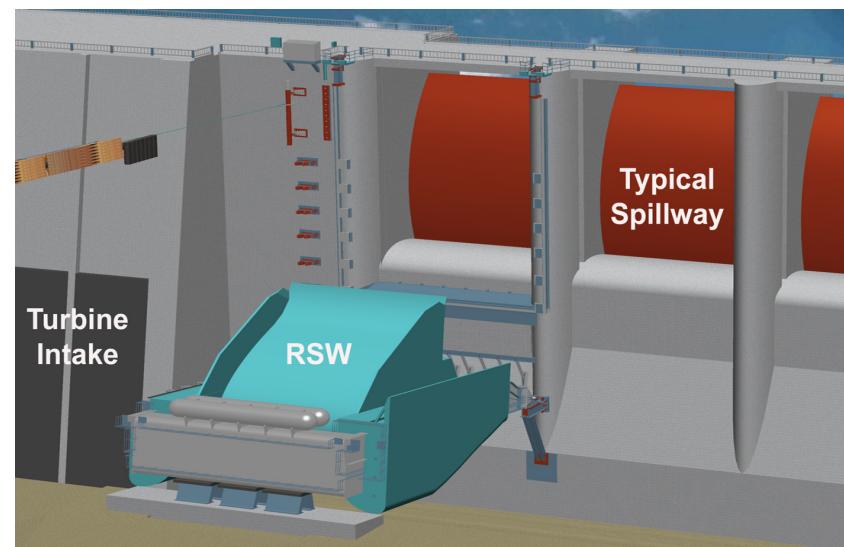
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LOWER GRANITE RSW FLOOD CONTROL POSITION



Side View

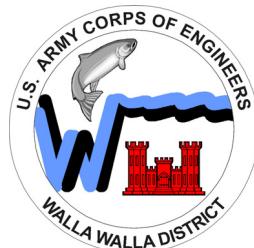


Isometric View

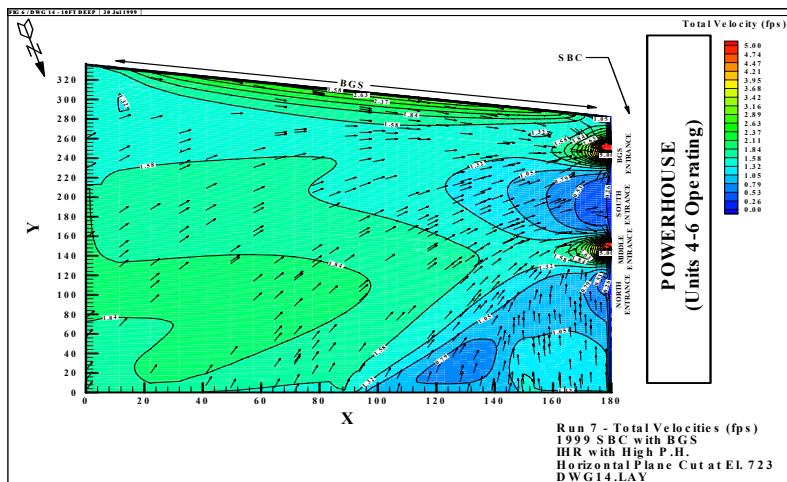
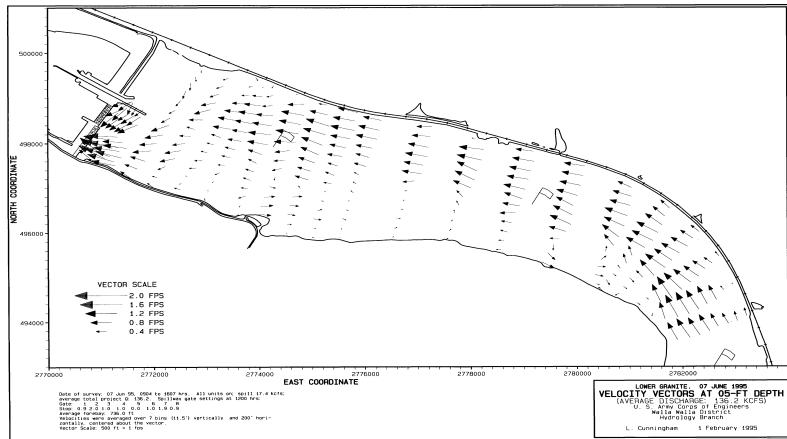


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HYDRAULIC EVALUATIONS



Field Measurements



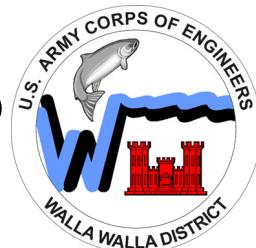
Numeric Models



Physical Models



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BIOLOGICAL EVALUATIONS

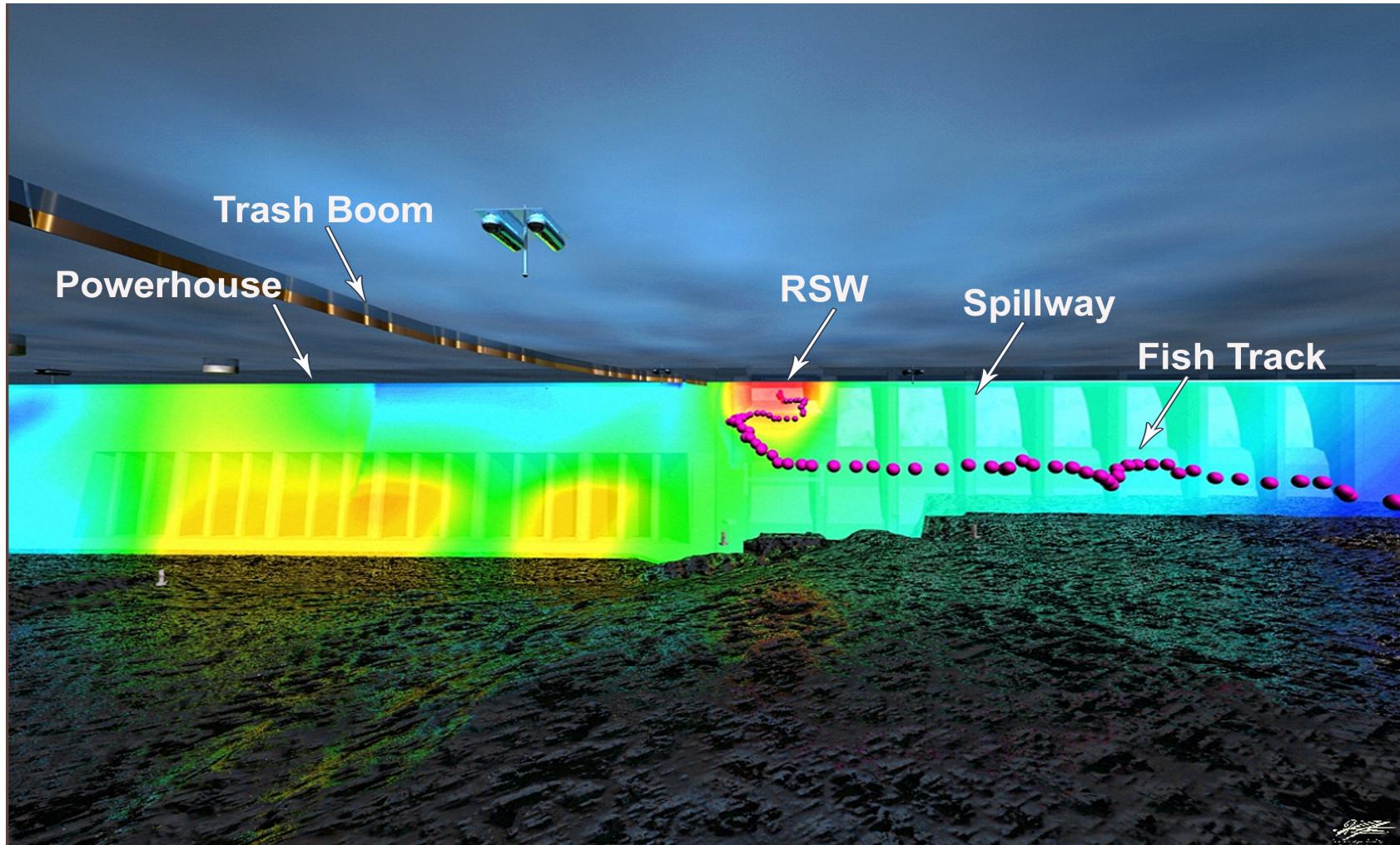
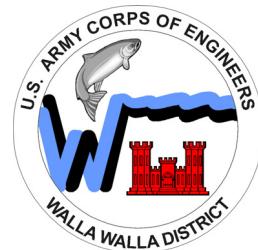


- Biological Methods
 - Radio Tracking
 - Hydroacoustics
 - Balloon Tags
 - Acoustic Tags / 3D Tracking



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CORRELATION FISH BEHAVIOR / HYDRAULICS

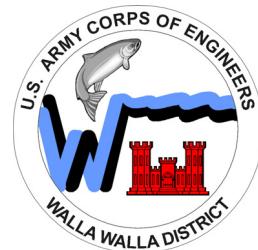




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RESEARCH AND RESULTS

2003 RSW



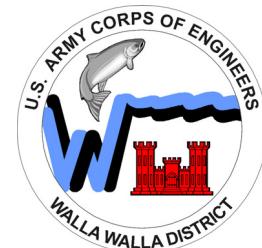
- Objectives
 - Passage Performance
 - Survival
- Test Treatments
 - 1300 cu. meters / sec.
traditional spill (12 hr.)
 - 200 cu. meters / sec. RSW
+ 300 cu. meters / sec.
training spill (24 hr.)





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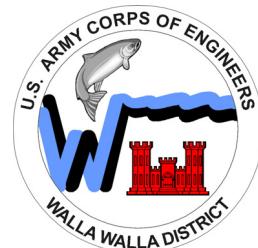
LOWER GRANITE RSW 2003 TEST RESULTS



	<u>Voluntary Spill Treatment</u> (12-hour)	<u>RSW Treatment</u> (24 hour)	
	<u>Spill Route</u>	<u>RSW</u>	<u>RSW + Spill</u>
<u>Fish Passage</u>	52% to 59%	58% to 69%	66% to 74%
<u>Survival Probability</u>	93.1% (+/- 6.0%)	98.0% (+/- 2.3%)	---
<u>Forebay Delay</u>	4.6 to 7.7 hr.	1.7 to 2.3 hr.	
<u>% Fish to Flow</u>	1.5 to 1.7	7.6 to 9.0	---
<u>TDG</u>	~120%	110% or less	



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RSW BENEFITS

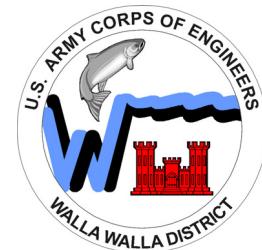


- Improved Fish Passage
 - More Efficient
 - Less Delay
 - Higher Survival Potential
- Better Water Quality
 - 120% to 110% TDG
- Increased Power Revenues
 - \$13-20 Million Annual Savings (Four LSR Dams)



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FUTURE RSW OPERATIONS AND INSTALLATIONS



- Broad Regional Support
- Lower Granite RSW Normal Operations
- Ice Harbor RSW in 2005
- High Interest for Other Projects



Ice Harbor Dam



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QUESTIONS?

