Jun 20th, 5:00 PM - 5:15 PM

Pushing and Pulling II: Survey of Two Behavioral Fish Guidance Systems (FGSs) Designed to Improve Safe Downstream Passage of Anadromous Salmonids

Shane Scott
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Survey of Two Behavioral *Fish Guidance Systems (FGSs)* Designed to Improve Safe Downstream Passage of Anadromous Salmonids

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Juvenile Fish Passage Behavior

In general, juvenile anadromous salmonids and clupeids (herrings and shads):

- Follow bulk flow in the river thalweg
- Are surface oriented
- Cue on flow and turbulence
- May respond to changes in water quality

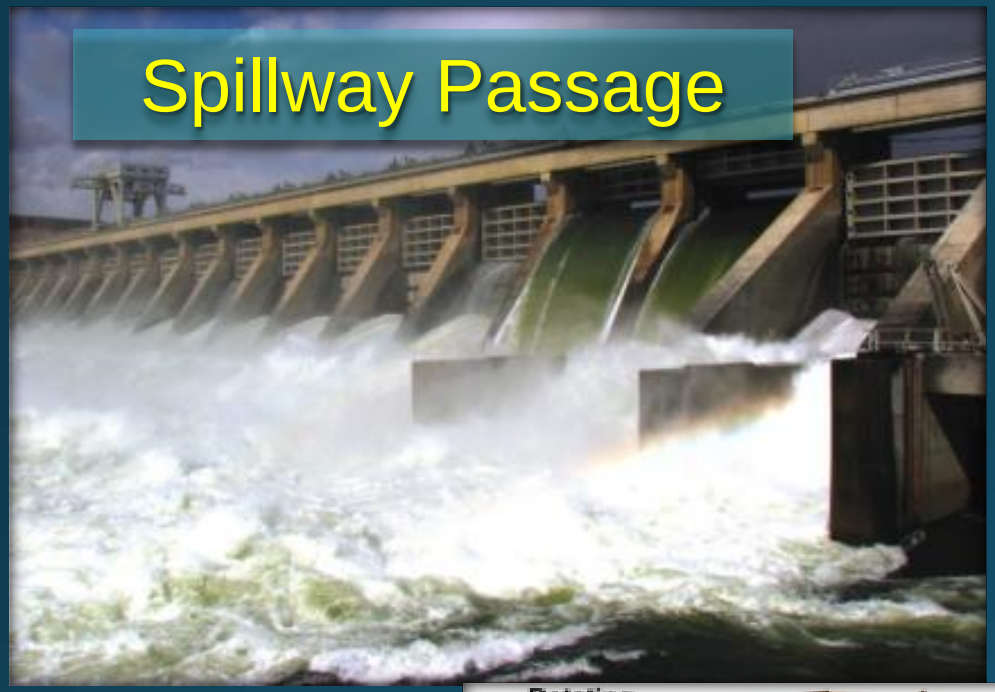
Migratory cues are disrupted in reservoirs

Problem

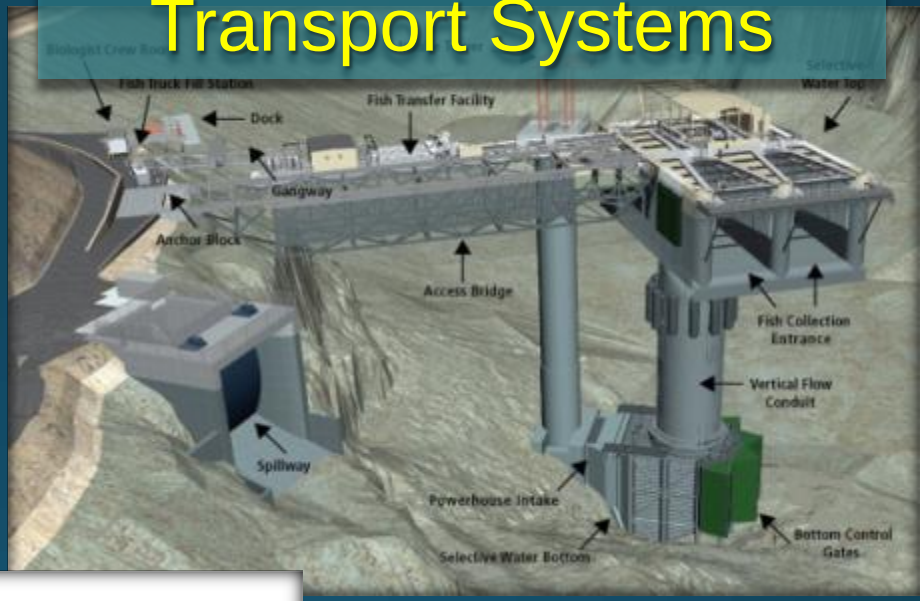
How to get downstream migrants safely past a dam or intake???

Physical Bypass Systems

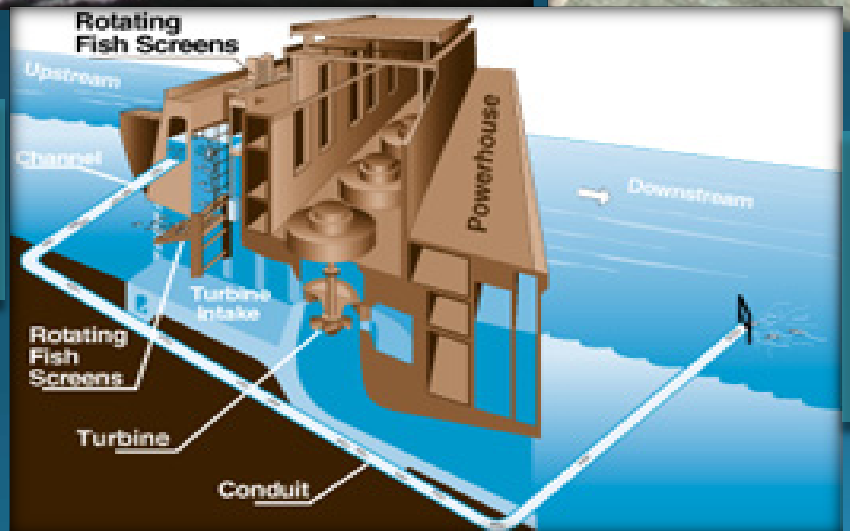
Spillway Passage



Collection and Transport Systems



Turbine Passage



Screened Intake and Bypass

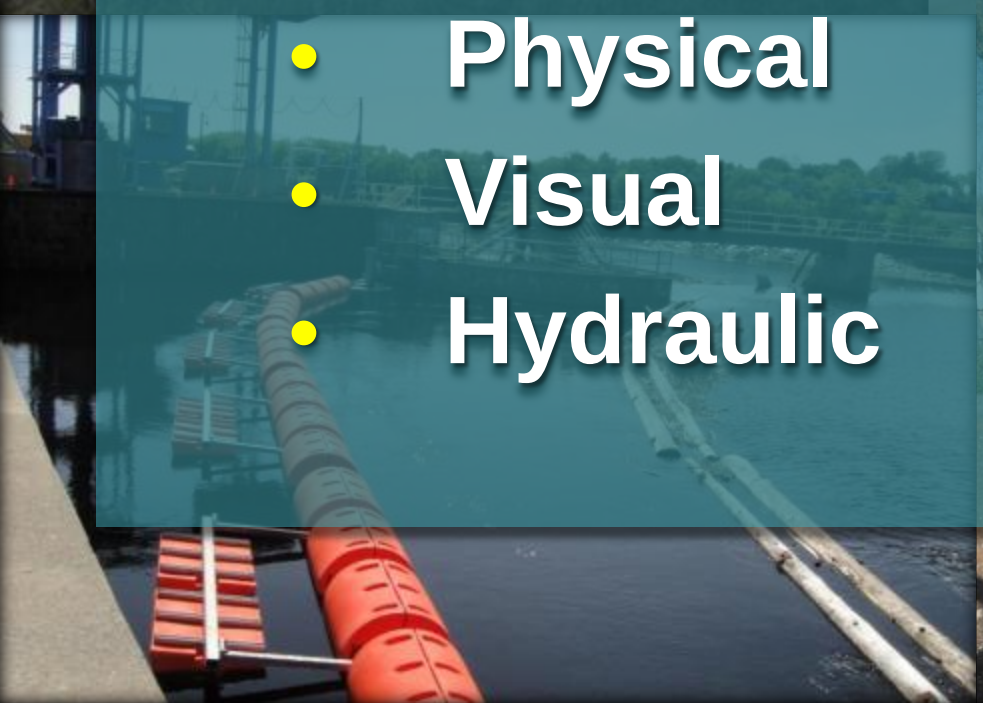
Non-Physical Guidance

Fish Guidance System (FGS)

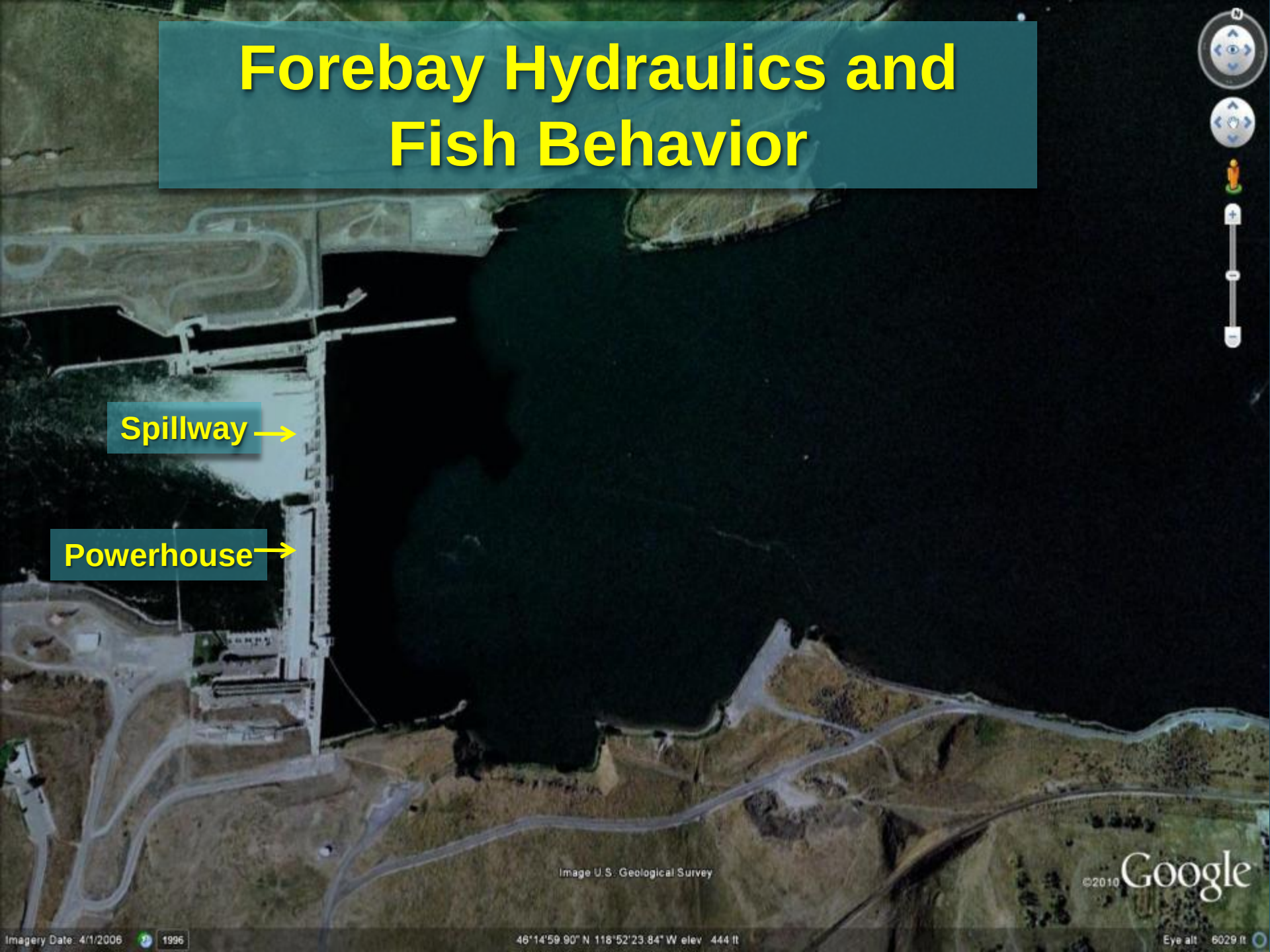
Fish Guidance System (FGS)

- **Provides several cues to alter fish migration routes**
  - **Physical**
  - **Visual**
  - **Hydraulic**






Forebay Hydraulics and Fish Behavior



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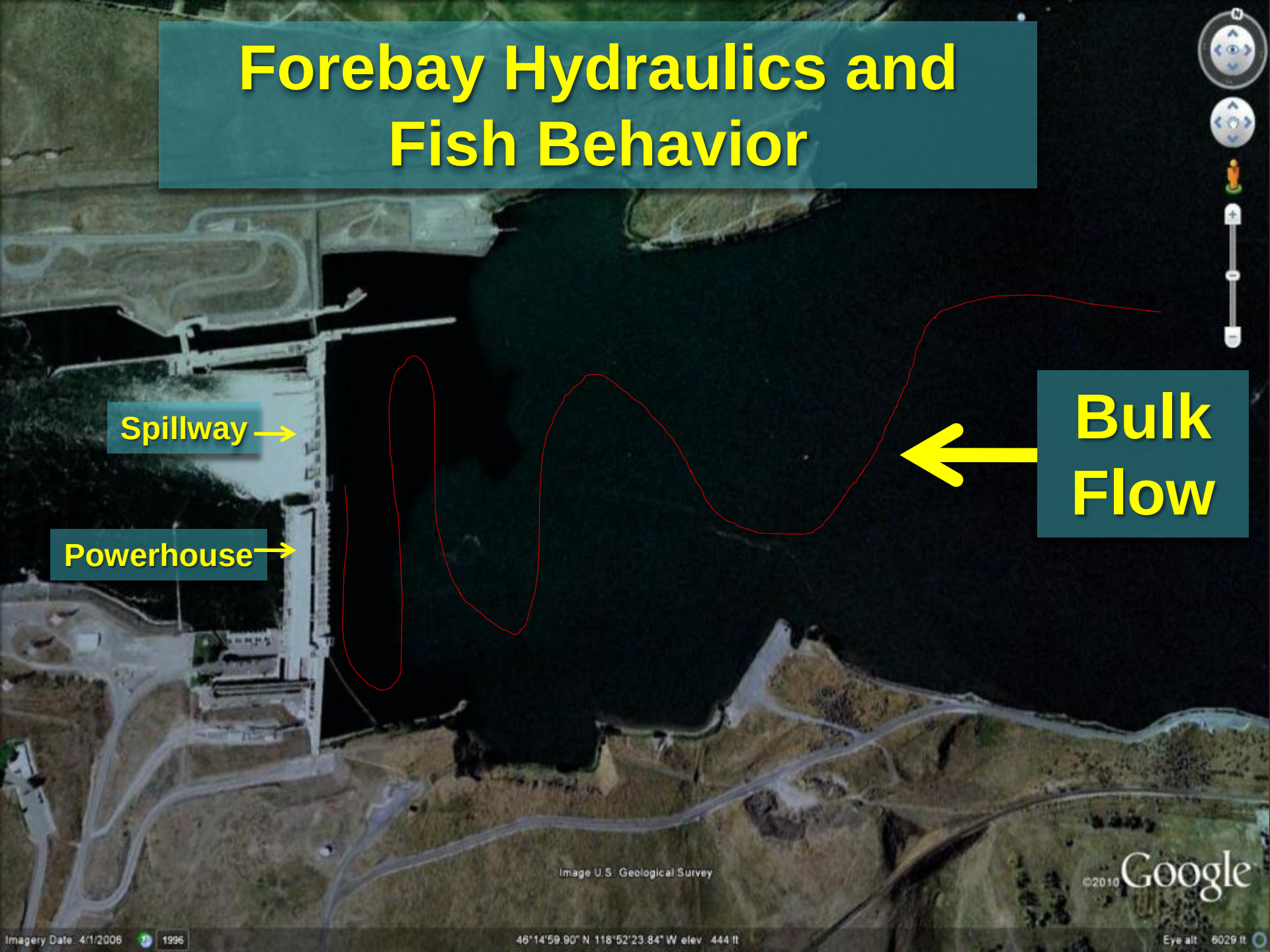

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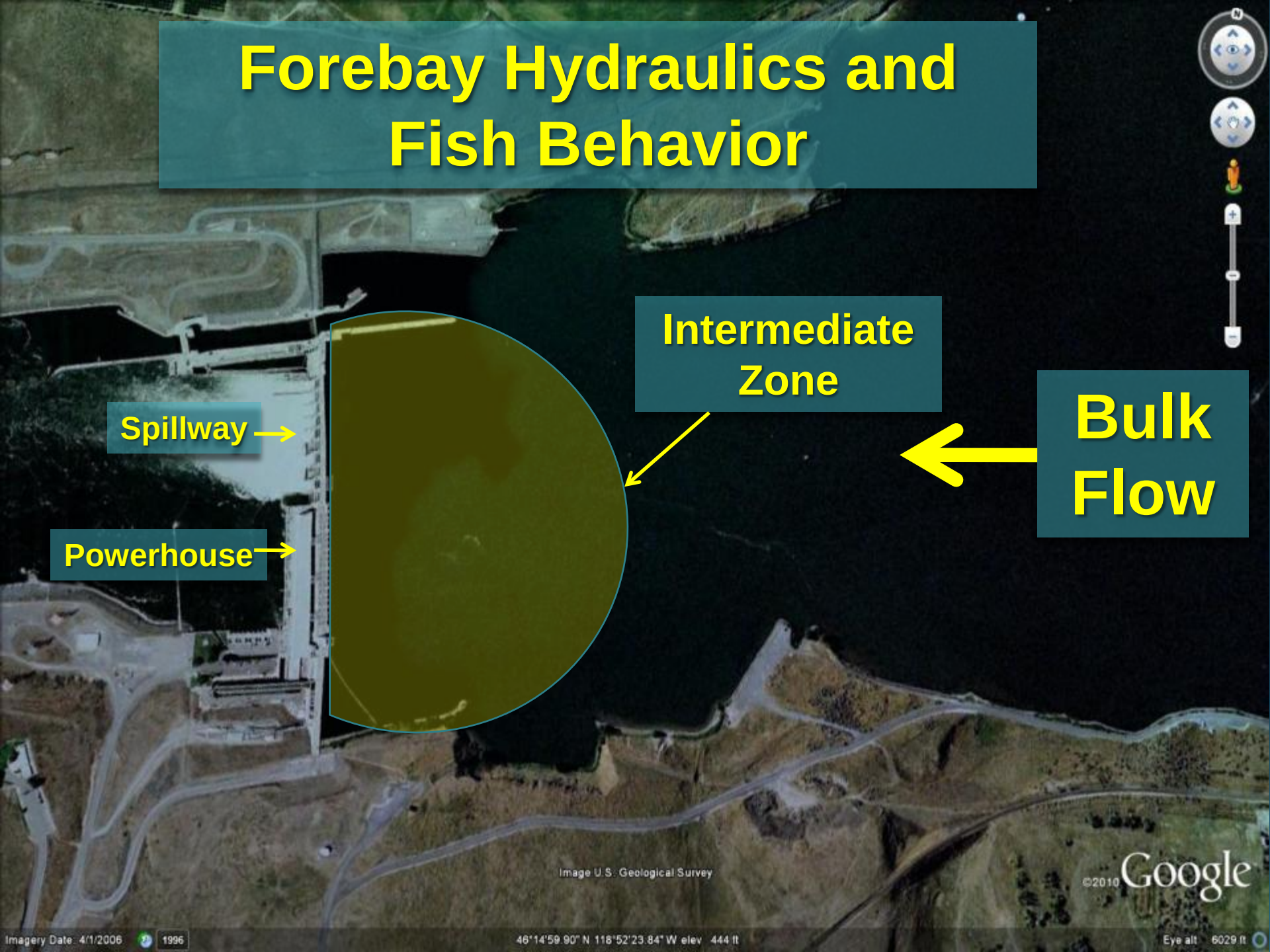

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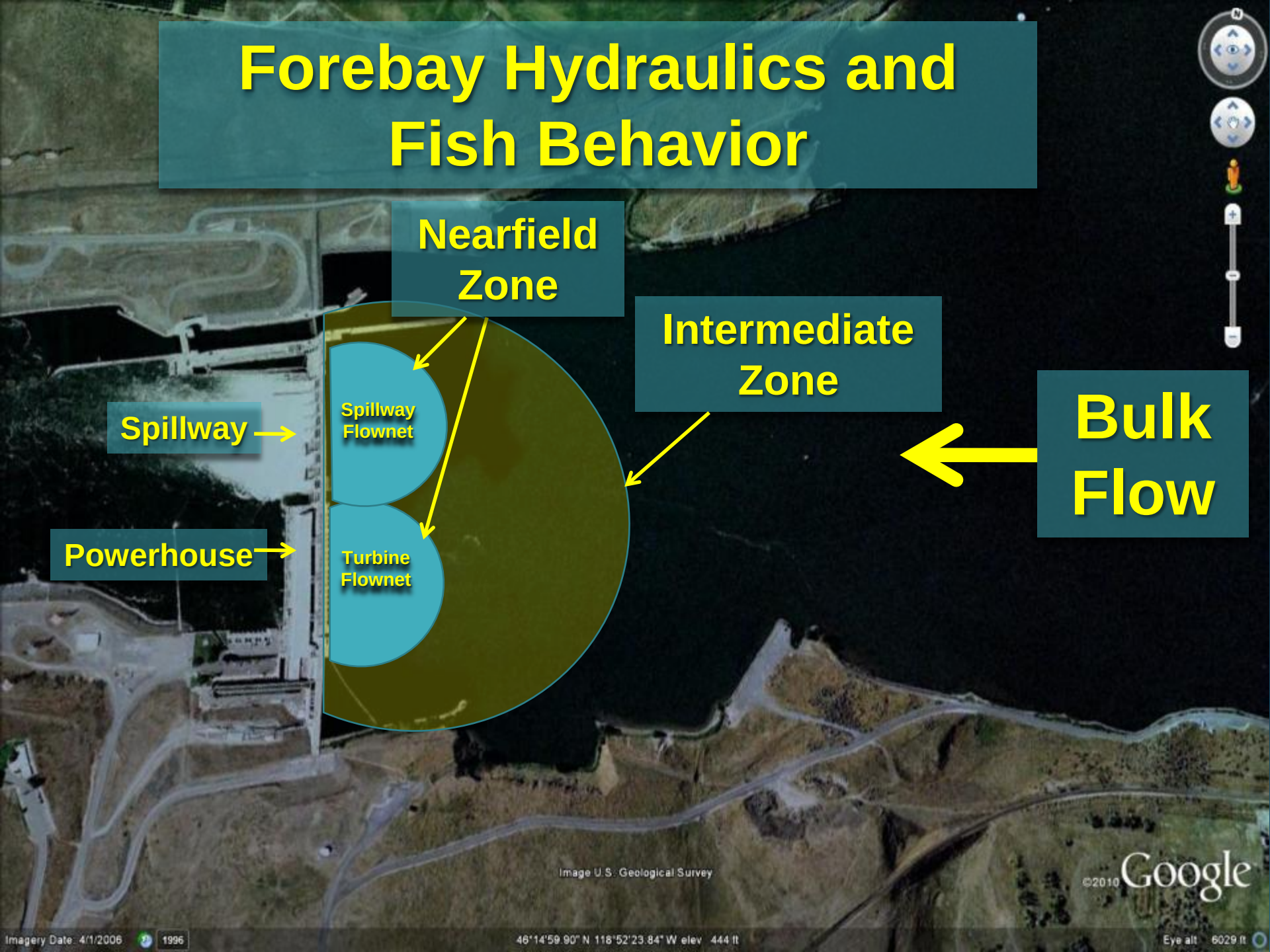

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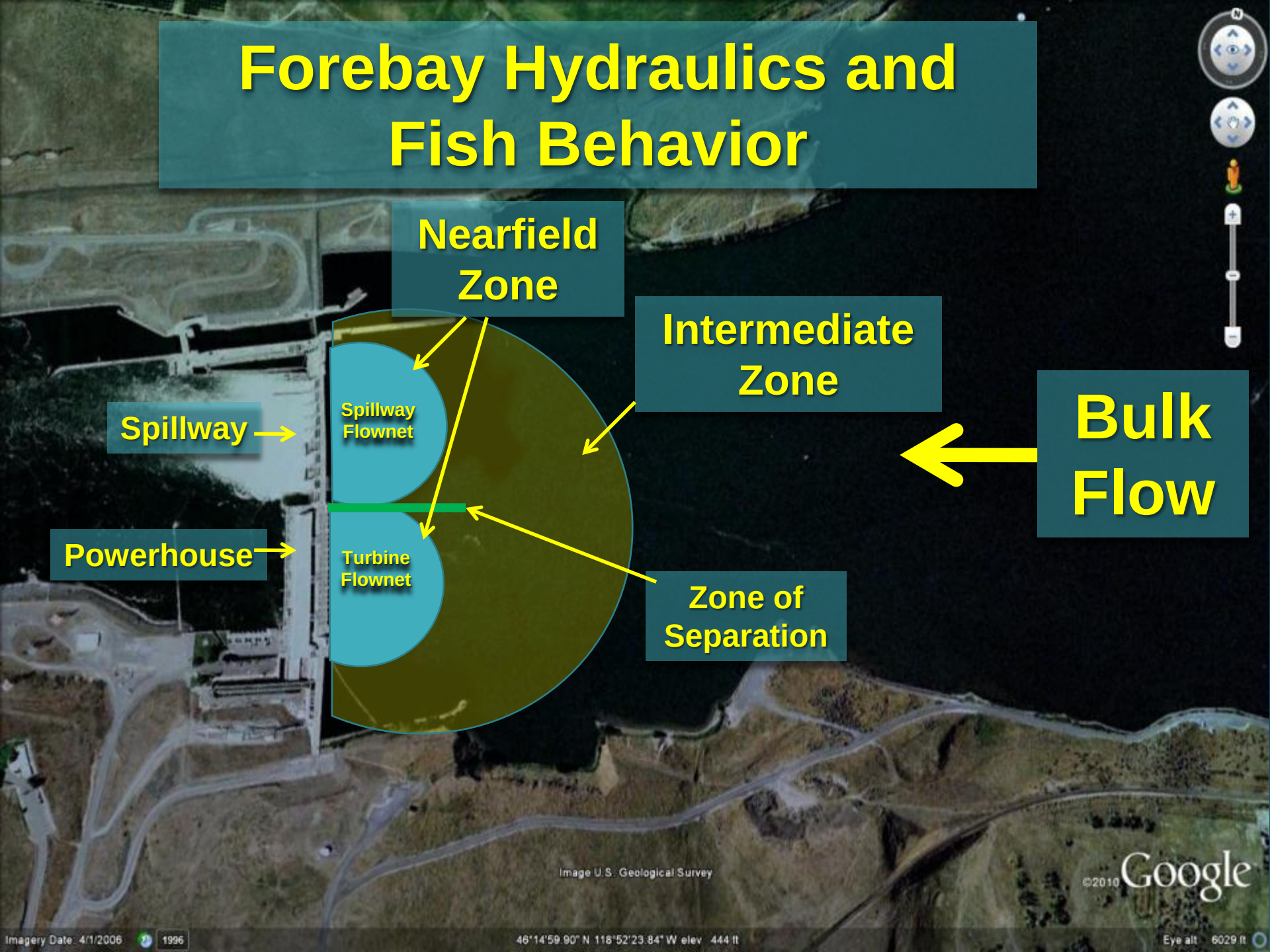

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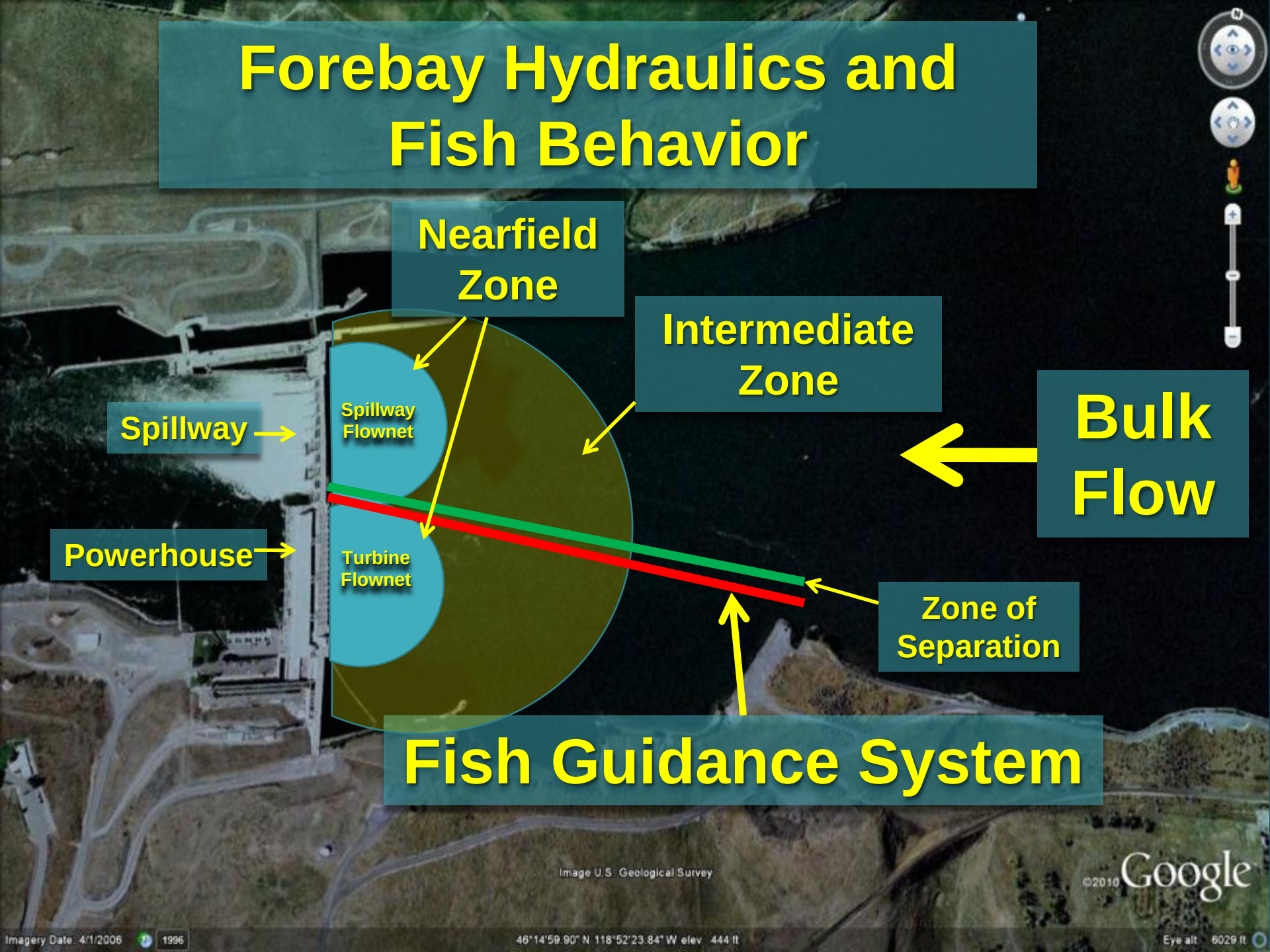
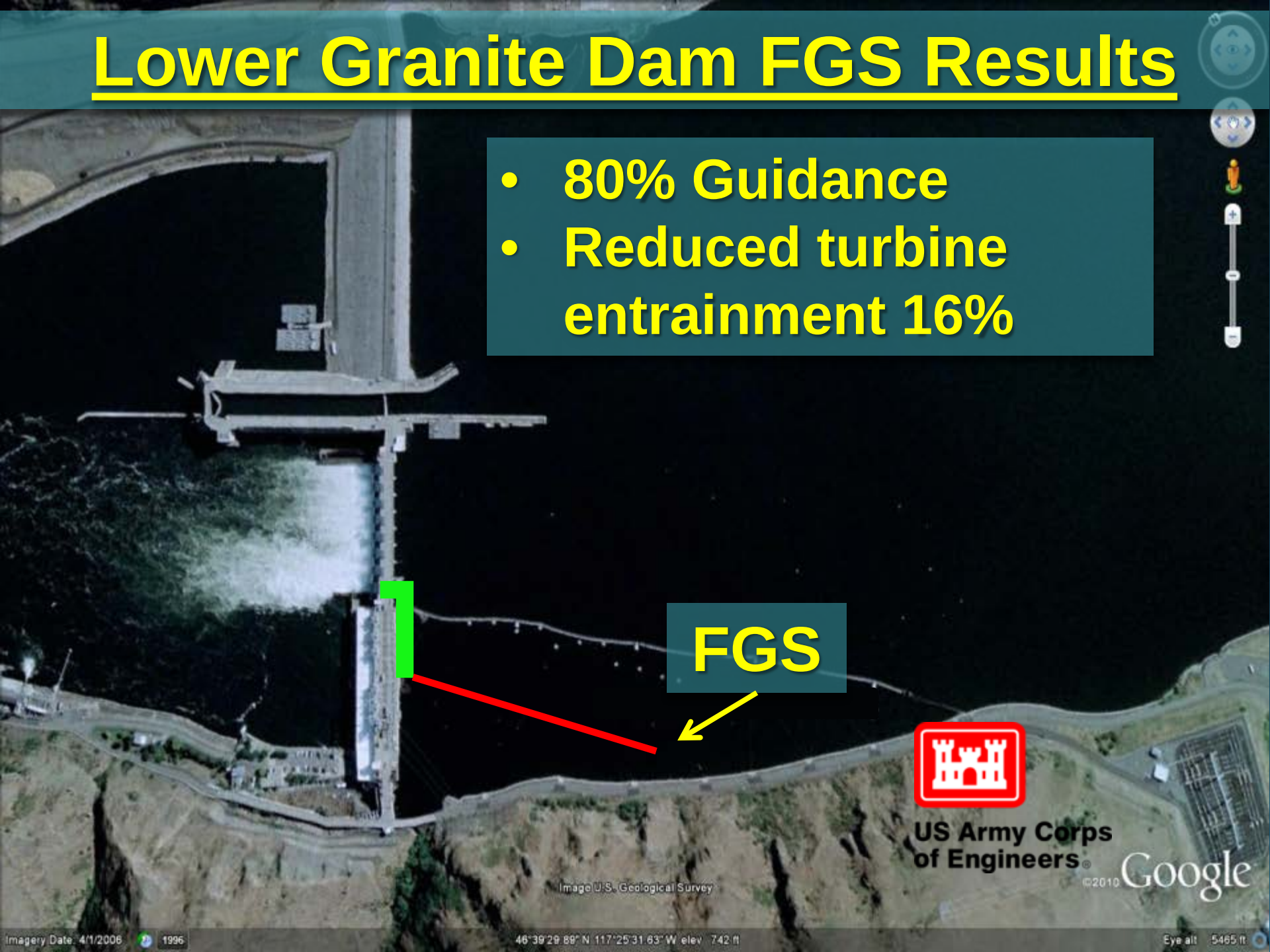
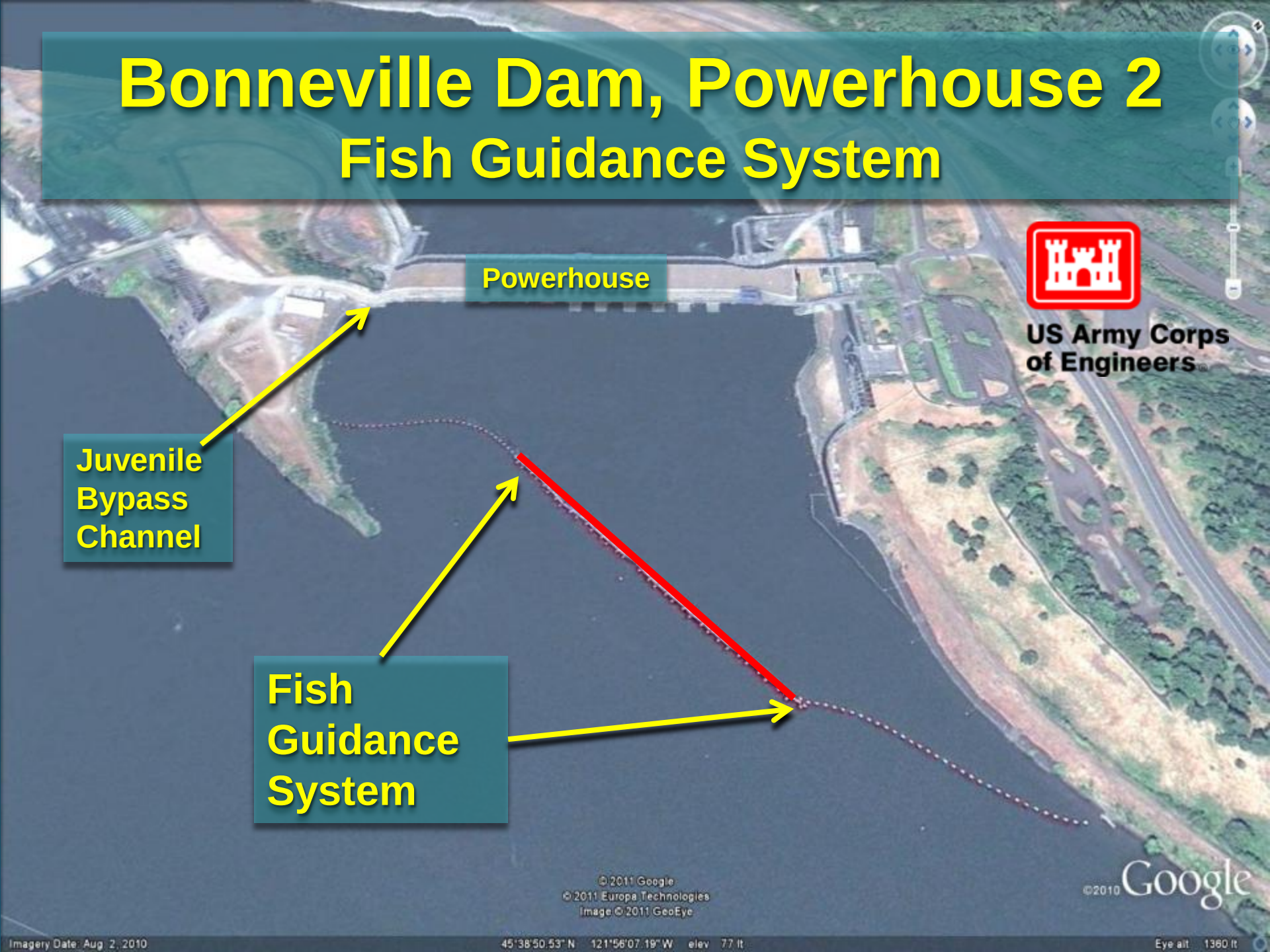


Lower Granite Dam FGS Results

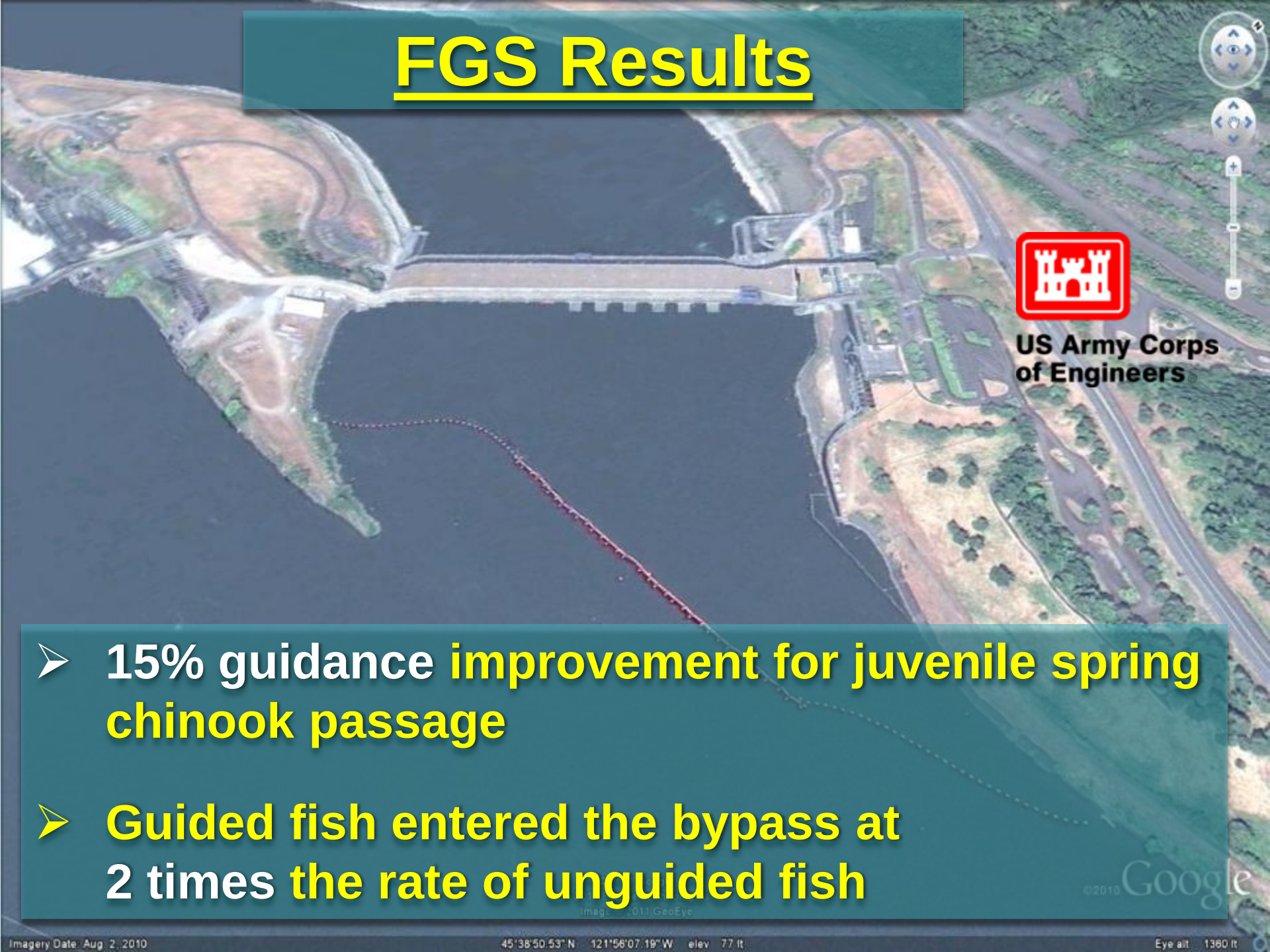
- 80% Guidance
- Reduced turbine entrainment 16%



Bonneville Dam, Powerhouse 2
Fish Guidance System



FGS Results

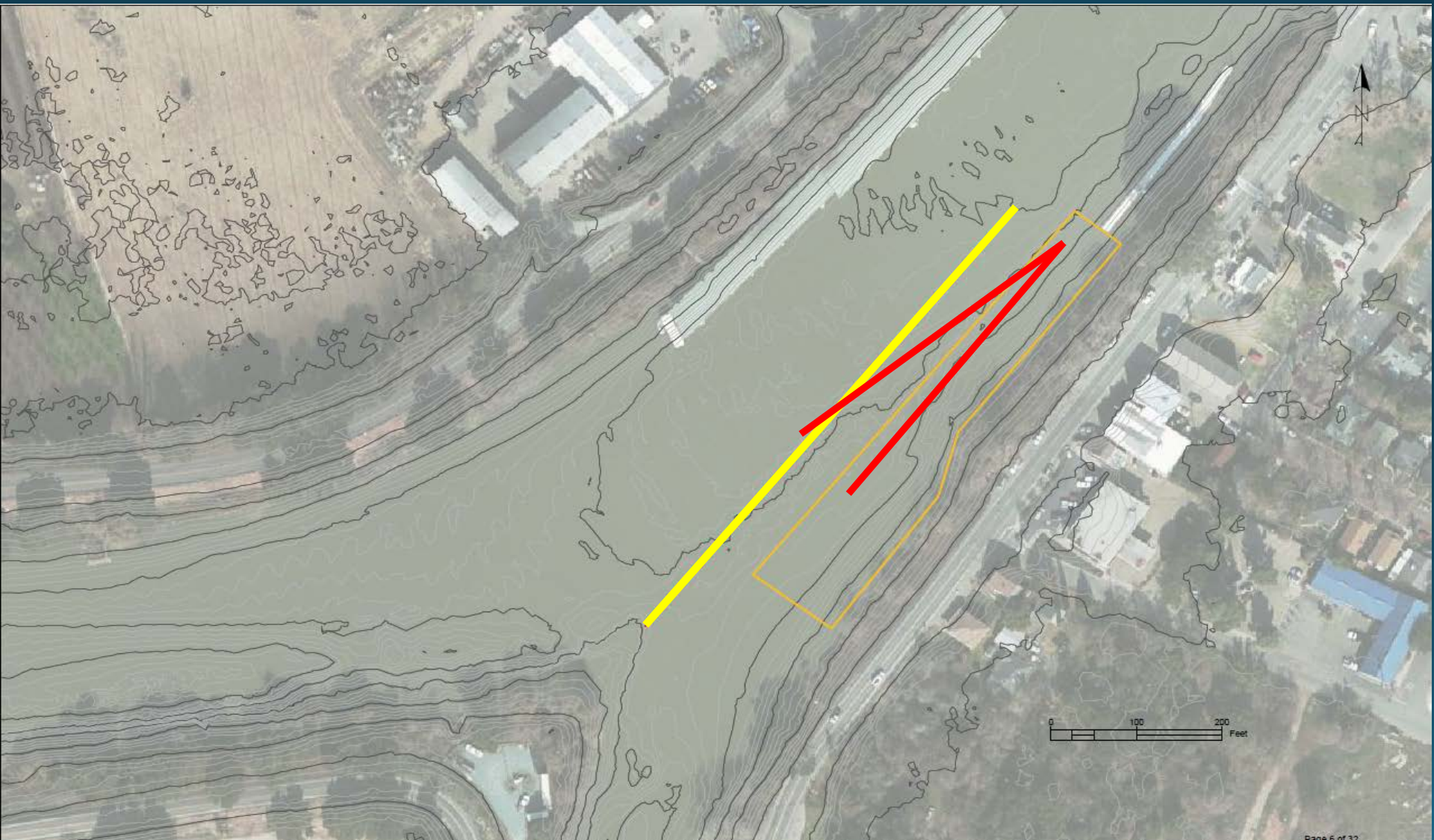


- 15% guidance improvement for juvenile spring chinook passage
- Guided fish entered the bypass at 2 times the rate of unguided fish

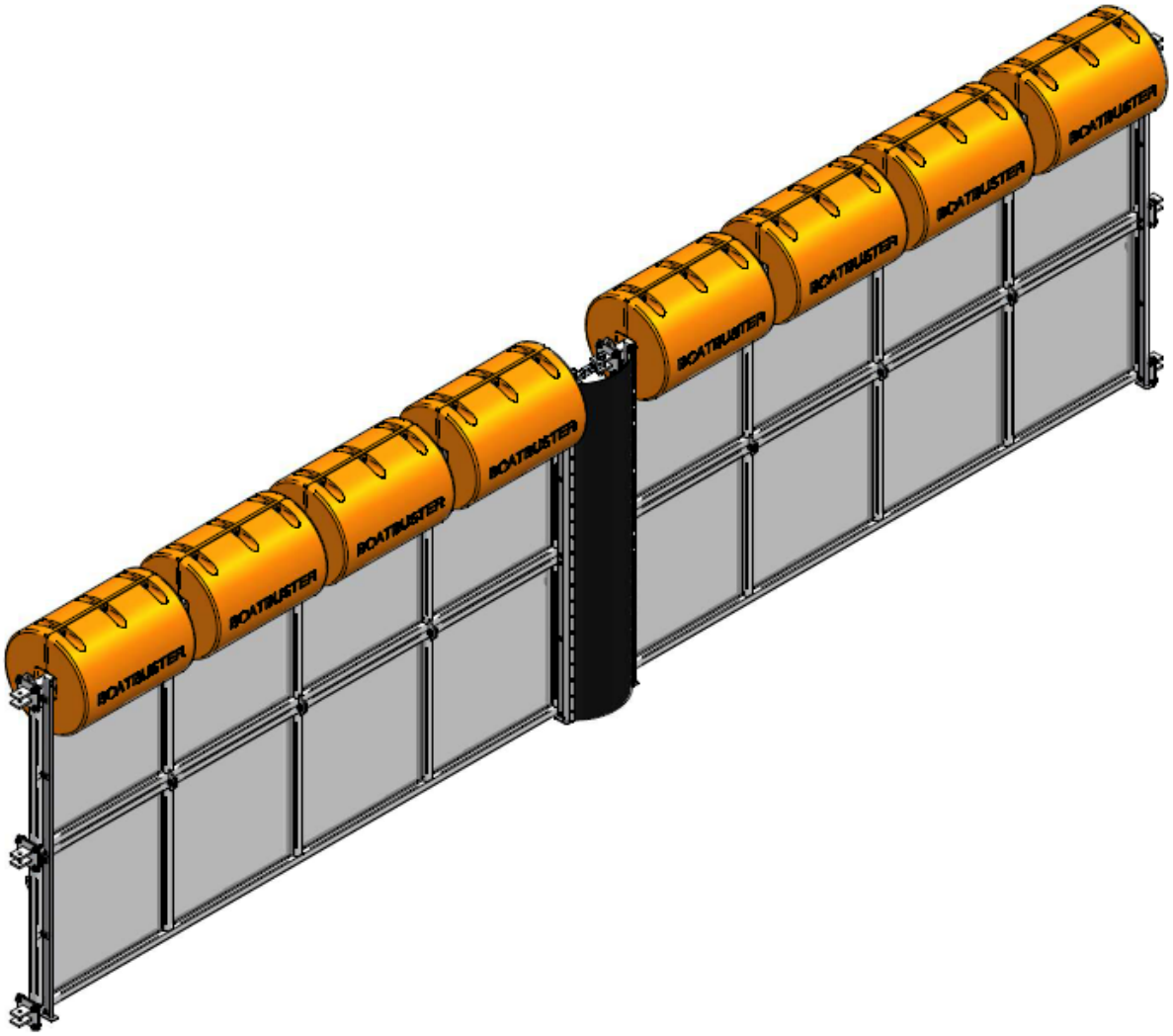

FGS Installations
Weston Dam
Cowlitz Falls Dam
Hydro Kennebec
Lower Granite Dam
Lockwood Dam
Bonneville Dam
Gilman Dam
Georgiana Slough, Sacramento River
Los Padres Dam
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2016 Google
Image Landsat
US Dept of State Geographer
Google earth
Imagery Date: 12/13/2015 39°08'24.94" N 95°27'26.92" W elev 1051 ft eye alt 3289.93 mi


Georgiana Slough
Sacramento River, CA

Georgiana Slough
Sacramento River, CA



Georgiana Slough
Sacramento River, CA



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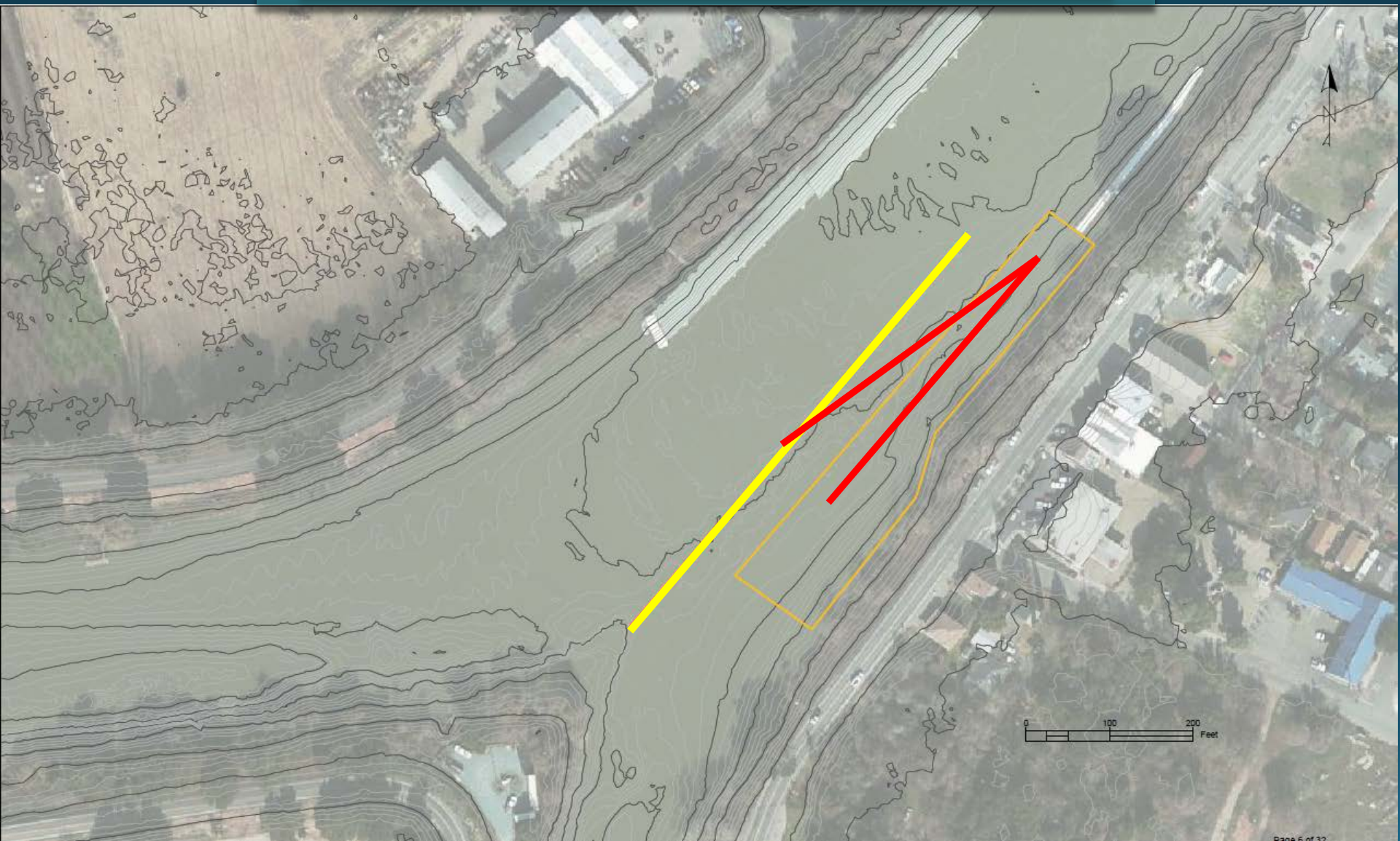


Los Padres Reservoir
Carmel River, CA

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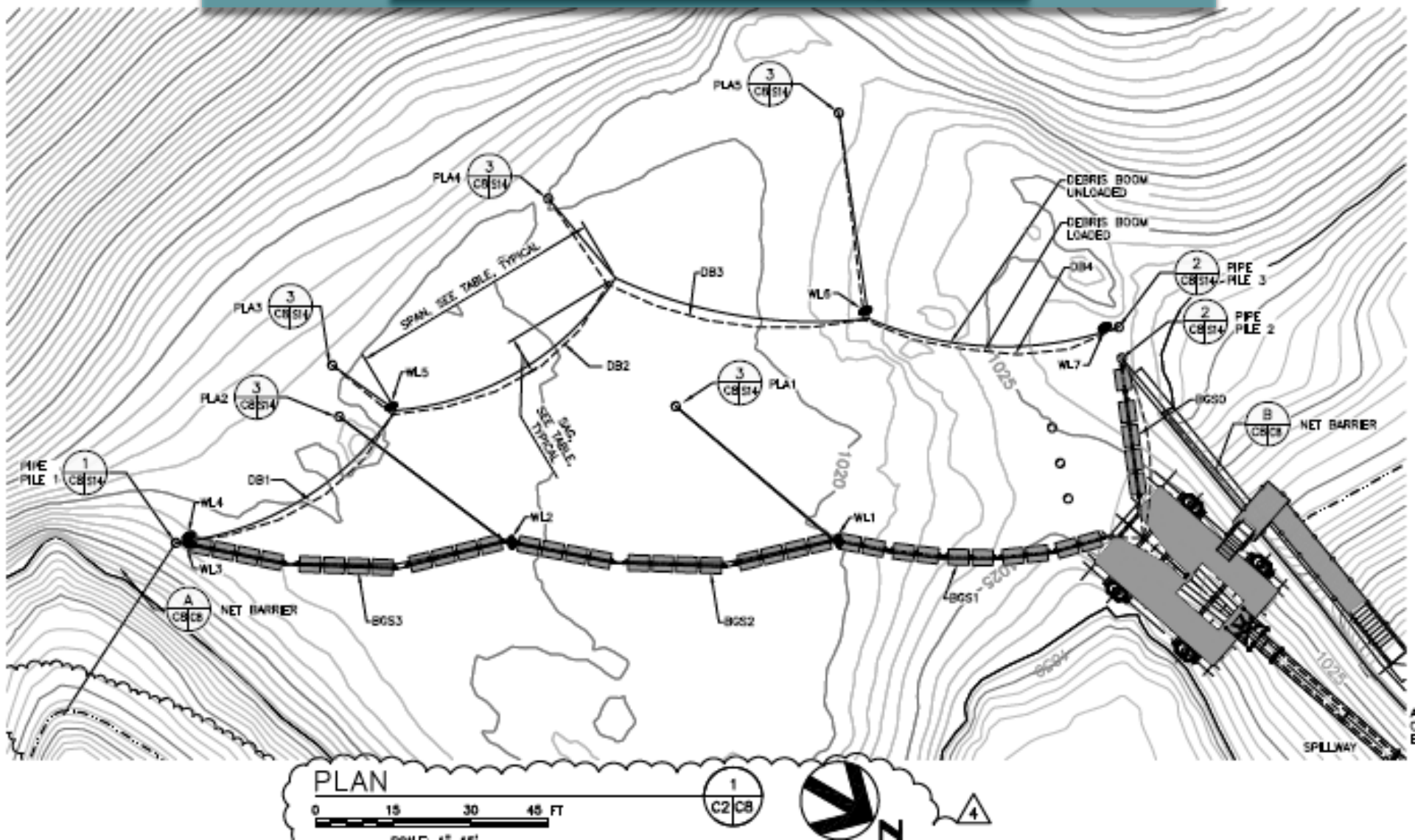

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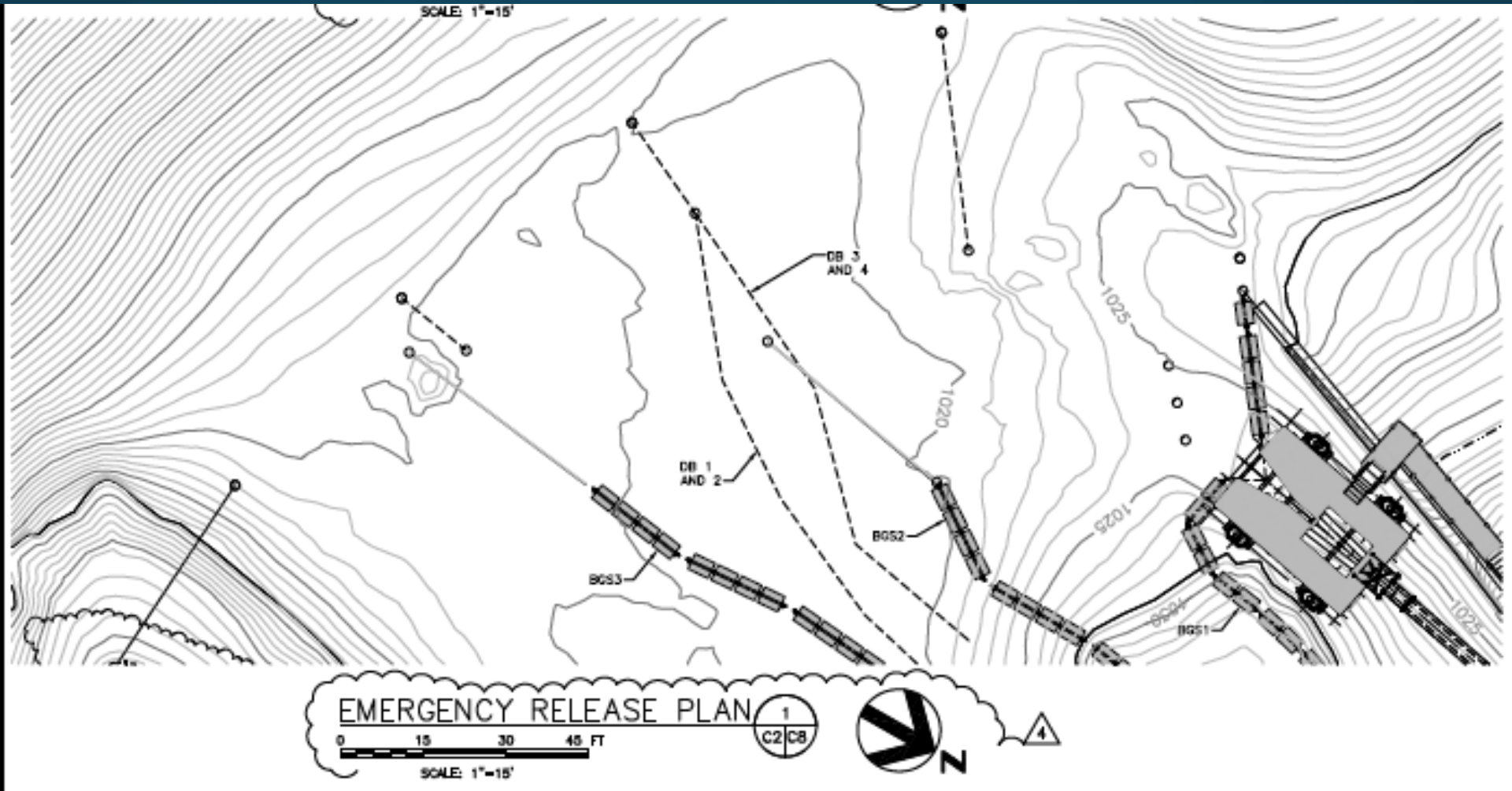

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Summary

- Permanent Physical Structure
- Significantly Improves Juvenile Fish Guidance and Survival
- Flexible Configuration to Allow Improvements
- Can Reduce Operations Costs

Recommendations

- Know Site Specific Conditions
- Provide Adequate Bypass
- Address Debris
- Work With Manufacturer
- Be Flexible – Modifications Will Further Improve FGS Performance

Fish Guidance System

WORTHINGTON
waterway barriers

QUESTIONS?