IMPROVING THE ENGINEERING FUNCTION OF THE LOWER COLUMBIA RIVER USING DREDGED MATERIALS

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OUTLINE

The Marine Highway and goods transport

The Lower Columbia River

The thalweg, water flow and river structures

Project example

Conclusions

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THE MARINE HIGHWAY

- Signage/Markers
- Lanes
- On/off ramps
- Lights
- Alignments
- Navigable depth
- Maps
- Hazard mitigation
- Policing/Emergency Response

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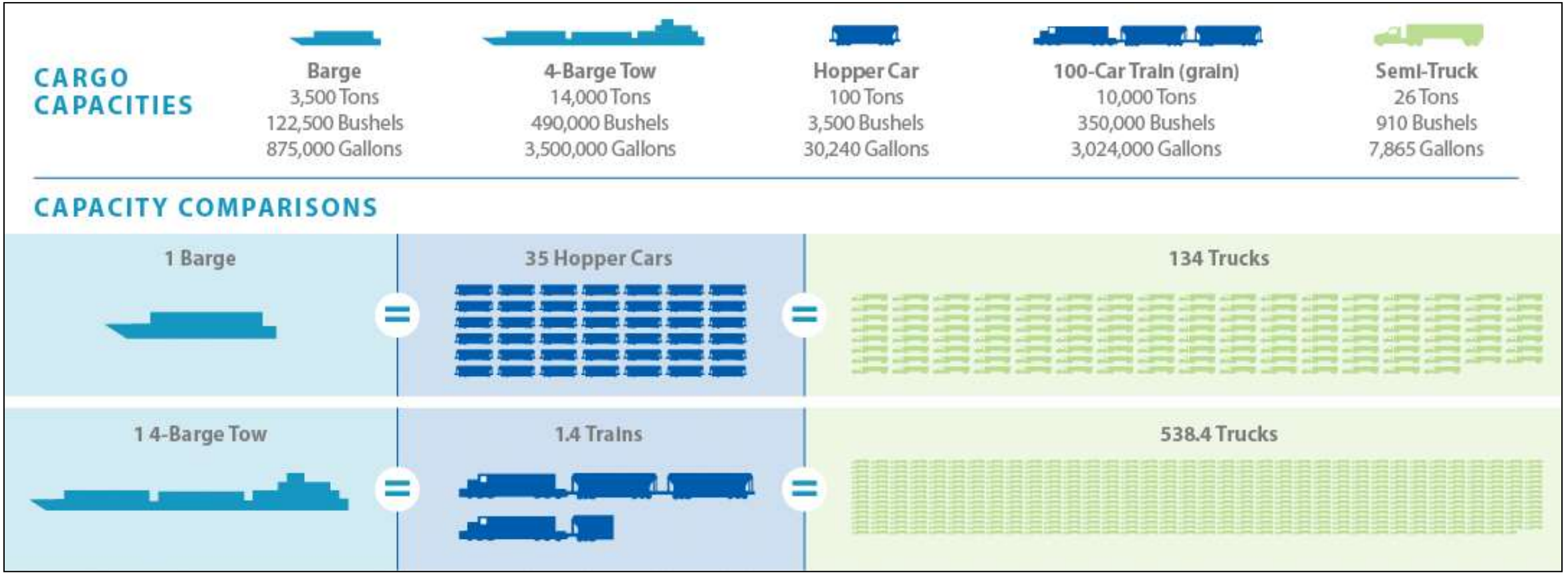
CARGO CAPACITY IN SIZES WE UNDERSTAND



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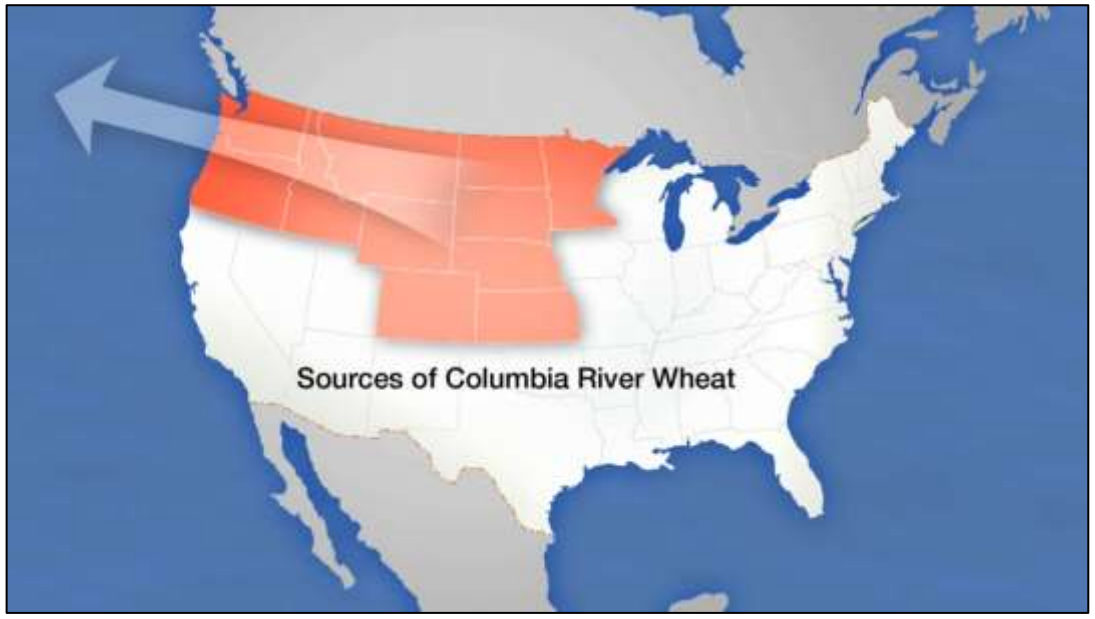
LOWER COLUMBIA RIVER COMMERCE

- 49 million tons of cargo annually, worth $24B
- Largest wheat and barley export gateway in the Nation
- Second largest soy export gateway in the World
- Over $930M in commercial investments-to-date
- Supports 40,000 local jobs



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Handysize ≈ 55,000 tons ≈ 2,100 semi trucks

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THE LOWER COLUMBA RIVER FEDERAL NAVIGATION CHANNEL

Deep Draft Navigation

- Entrance channel
  - 55/48 ft deep, 2640 ft wide, 6 mi long,
  - Average annual dredging 3.5 Mcy,
  - 2 hopper dredges working concurrently.

- Columbia and Lower Willamette channel
  - 43 ft deep, 600 ft wide, and 103 mi long,
  - Average annual dredging 6-8 Mcy,
  - 3 hopper dredges and 1 pipeline dredge.

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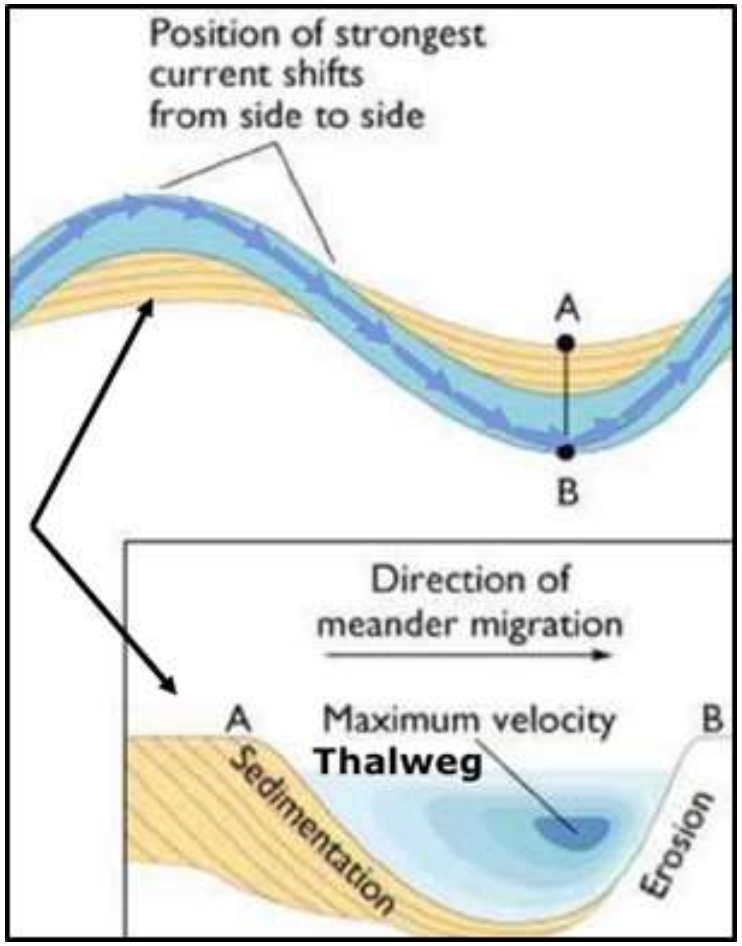
THE RIVER AND ITS THALWEG



Thalweg: the line of lowest bed elevation or maximum flow depth in a watercourse.

- So it's the fastest, deepest flow line in the river

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RIVER ENGINEERING

Pile Dikes:

- reduce x-sectional area
- increase velocity in channel
- stabilize sand outside channel (create habitat)
- improve alignment (**thalweg = channel**)

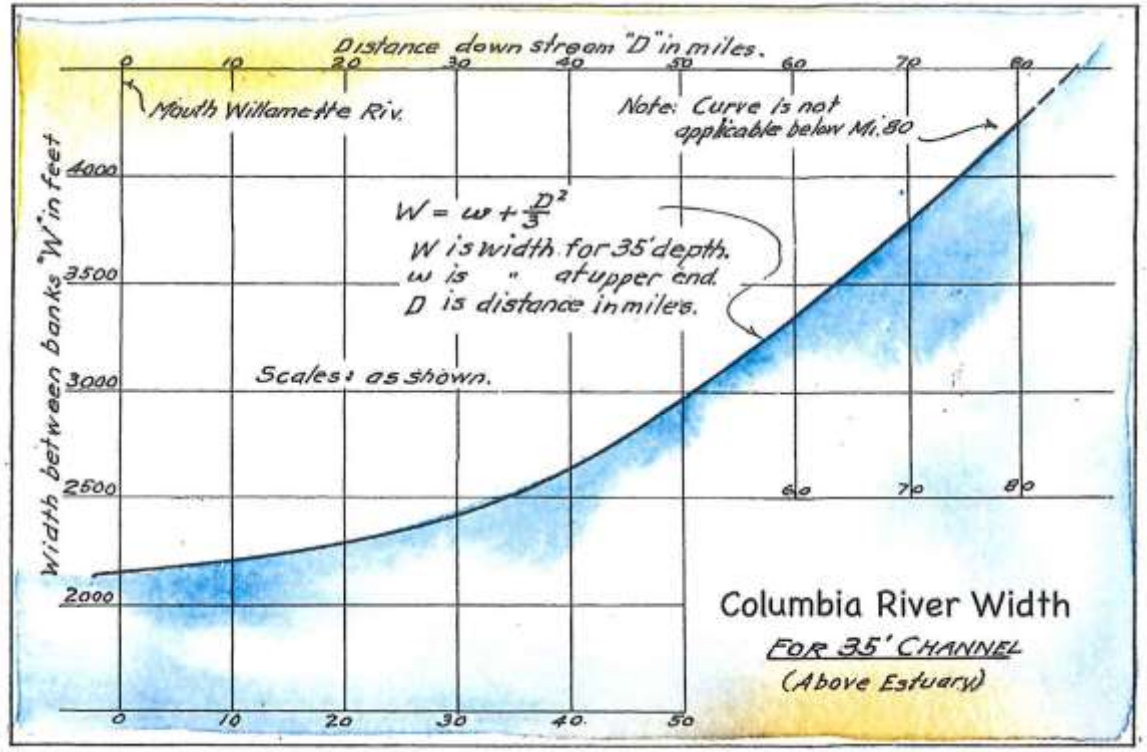

Figure 6: From Robert E. Hickson data, circa 1935.

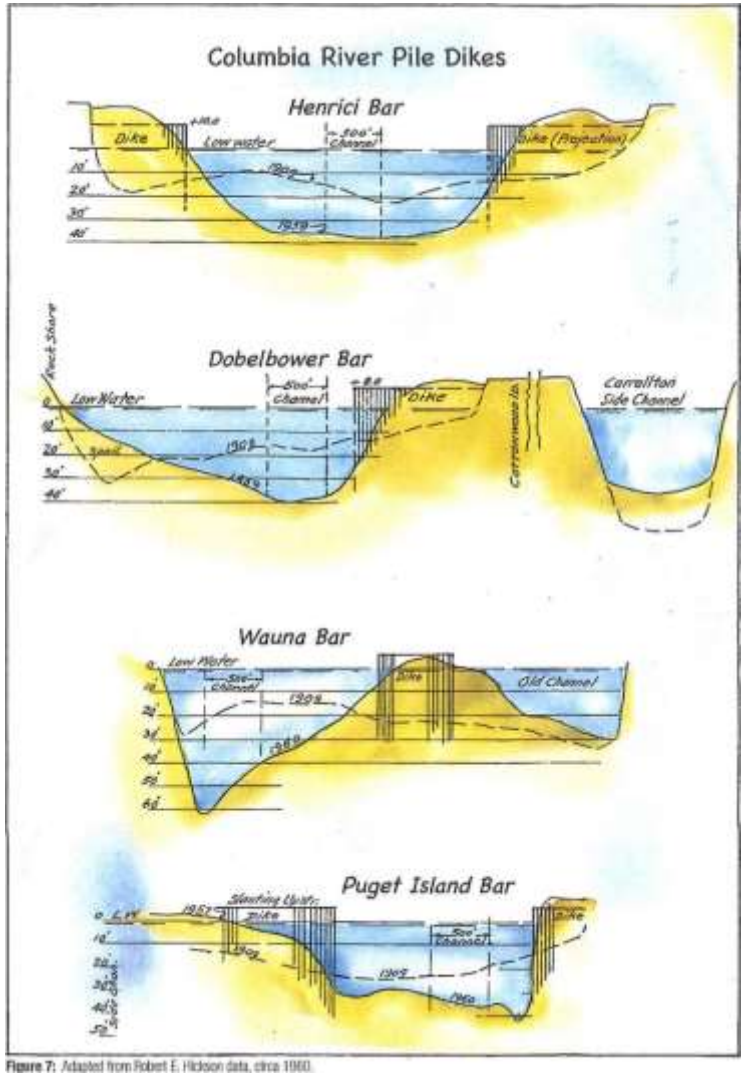

Figure 7: Adapted from Robert E. Hickson data, circa 1960.

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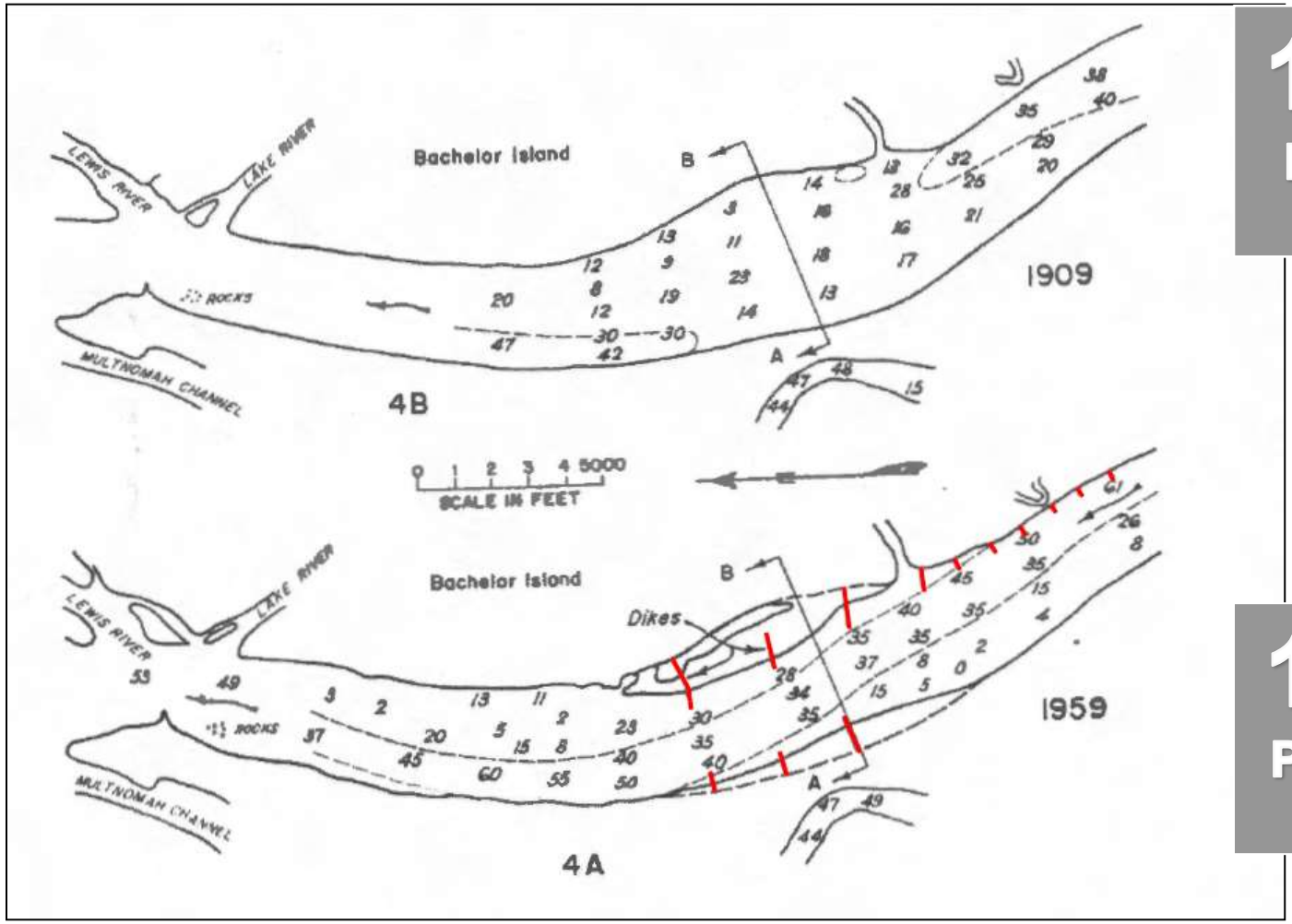
PILE DIKE / ISLAND EFFECTS



1909
Pre Pile Dikes

1959
Post Pile Dikes

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PROJECT LOCATION

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PILLAR ROCK ISLAND

Pile and island design plan, 1987

Port of Portland, 2016

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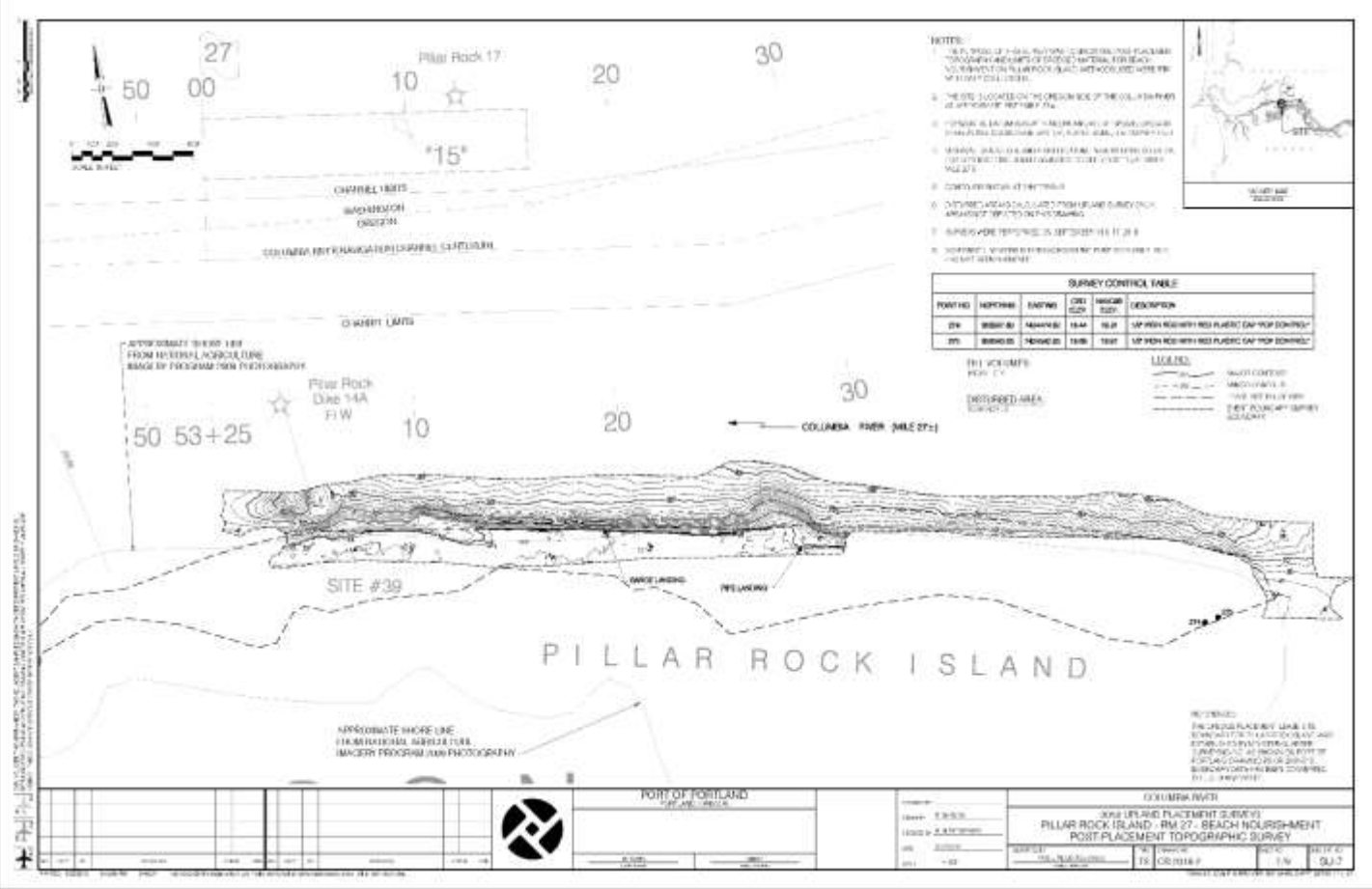
PILLAR ROCK ISLAND PILE DIKE RE-ATTACHMENT



Dredge material placed : 860,000 cy

- 300,000 cy in FY16
- 410,000 cy in FY17
- 150,000 cy in FY18

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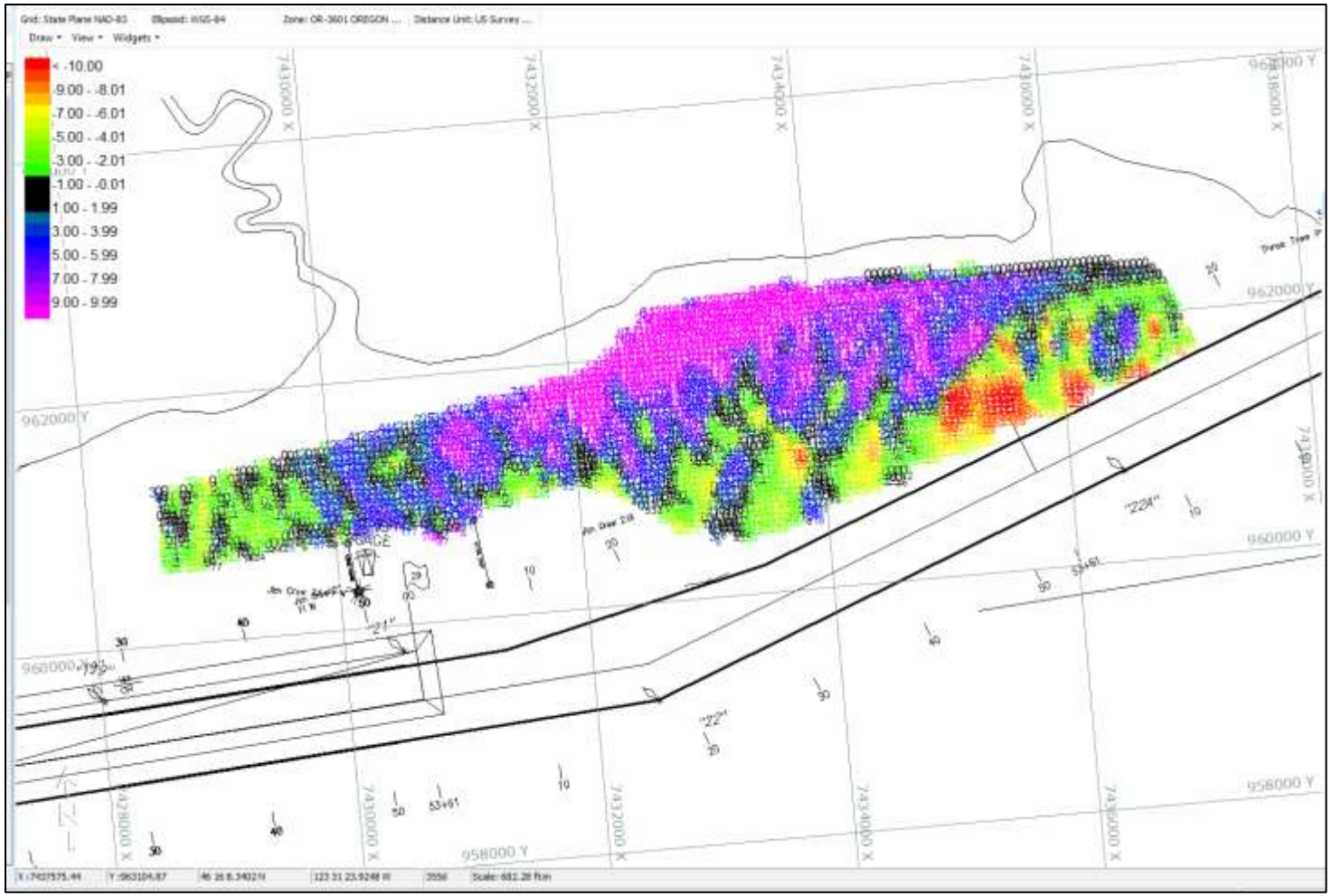
BROOKFIELD-WELCH IN-WATER PLACEMENT



Dredge material placed: 1,927,000 cy

- 435,000 cy in FY14
- 400,000 cy in FY15
- 390,000 cy in FY16
- 630,000 cy in FY17
- 72,000 cy in FY18

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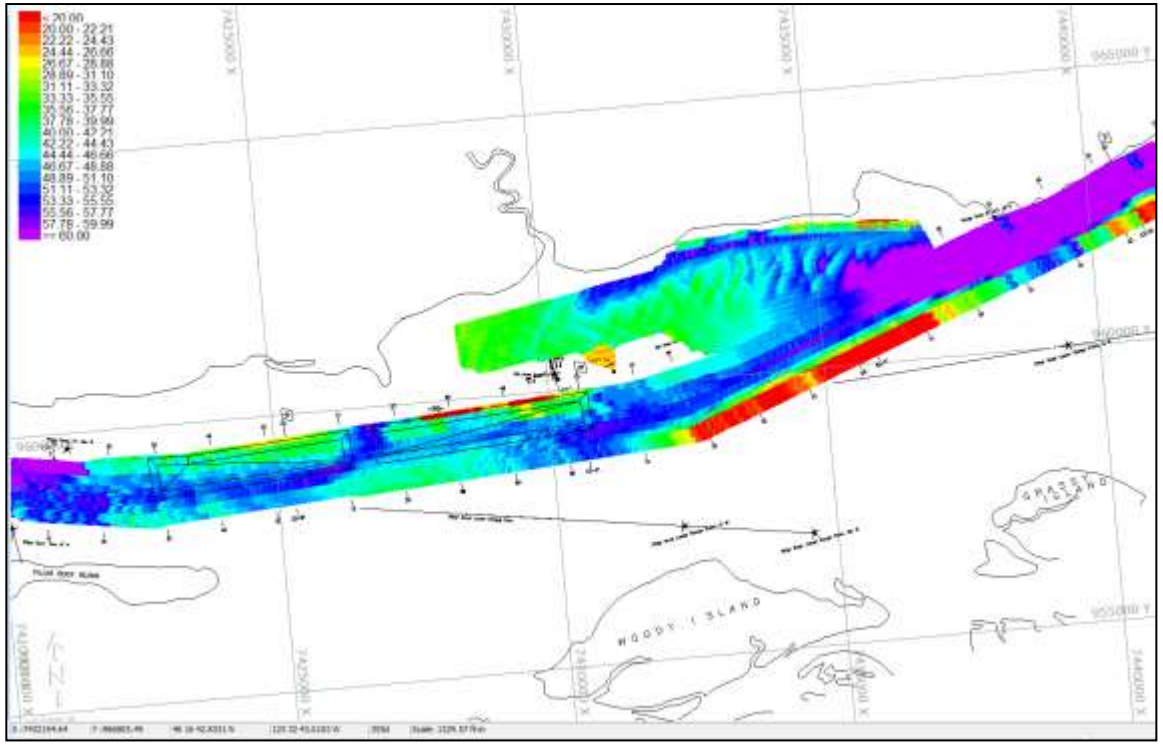
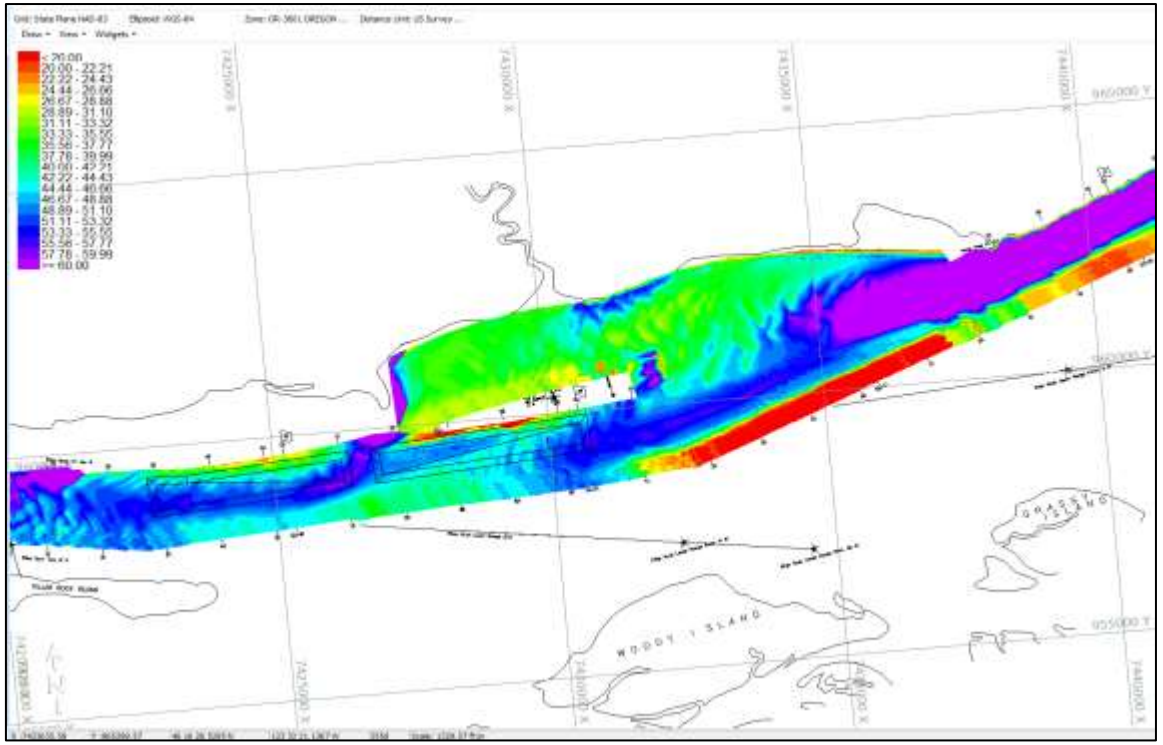
IN-WATER PLACEMENT EFFECTS

2014



2018



In water placement redirected the flow towards the channel and reduced dredging by ~200,000 cy.

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CONCLUSIONS

We have to think of the river as a system and dredge material as a resource.

The river is a marine highway that is intentional and extremely efficient for supporting commerce.

We can use piles, islands AND in-water placement as engineering structures that reduce dredging.

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