Portland District RSM Program Review

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USACE Portland District

August 10, 2011

National RSM Program Review,
Vicksburg, MS

US Army Corps of Engineers
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Overview

- Summary of RSM application throughout NWP
- RSM implemented as a concept rather than a project
- Strong support throughout District from top down
- Continual coordination/networking

Regional Sediment Management (RSM)

RSM is a *systems-based approach* for adaptively managing projects involving sediment.

RSM embraces the extended time-space scale as defined by *natural sediment processes*

LINK different projects and project features to sediment processes.

Sediment is viewed as a natural resource – to be CONSERVED

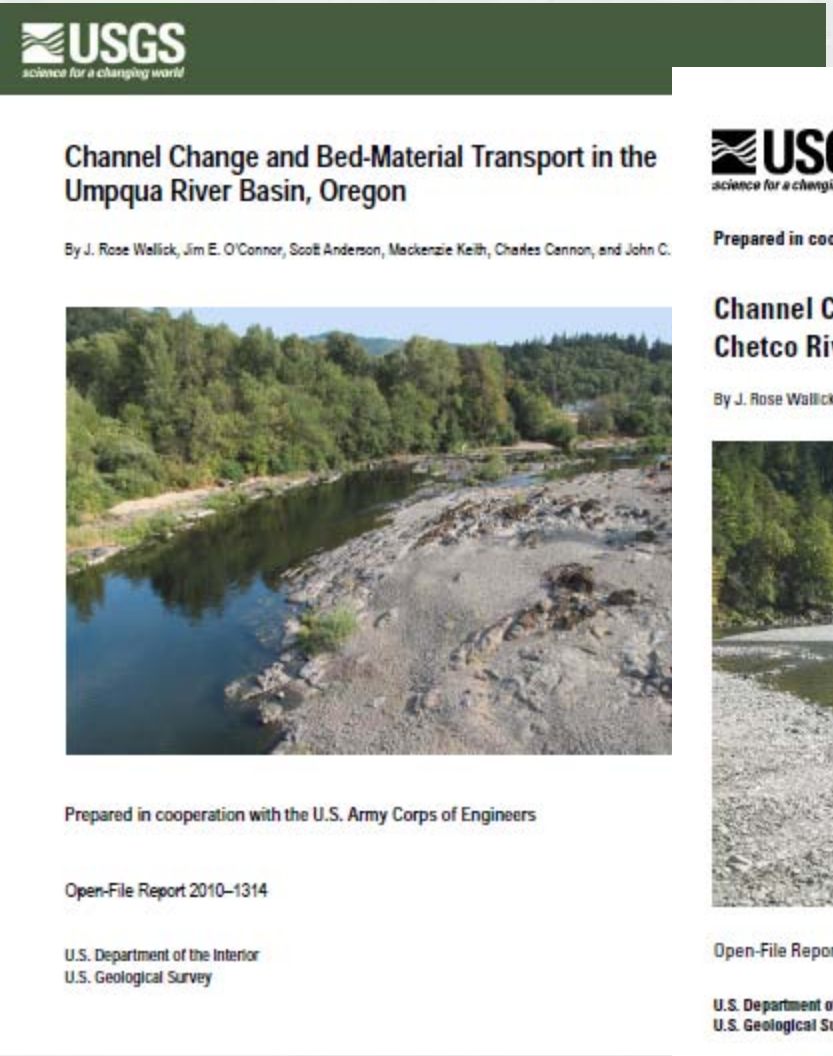
RSM fosters SUSTAINABLE balance between projects and natural system processes

Objective is to reduce project costs and achieve greater benefits.

Regulatory Gravel Initiative

- Watershed-specific evaluation of commercial gravel mining operations in Oregon
- Purpose:
  - Help determine whether mining can occur within each river system and, if so, to what extent
  - Assist agencies in completion of ESA consultation and Water Quality Certification process
- Systematic two phased approach developed by state and federal resource agencies:
  - Phase 1 - reconnaissance level geomorphic investigation
  - Phase 2 - analysis of the actual sediment budget including areas of sediment recruitment and storage
- USGS funded to complete studies

Key Reports



USGS
science for a changing world

Channel Change and Bed-Material Transport in the Umpqua River Basin, Oregon

By J. Rose Wallick, Jim E. O'Connor, Scott Anderson, Mackenzie Keith, Charles Cannon, and John C.

Prepared in cooperation with the U.S. Army Corps of Engineers

Open-File Report 2010–1314

U.S. Department of the Interior
U.S. Geological Survey

USGS
science for a changing world

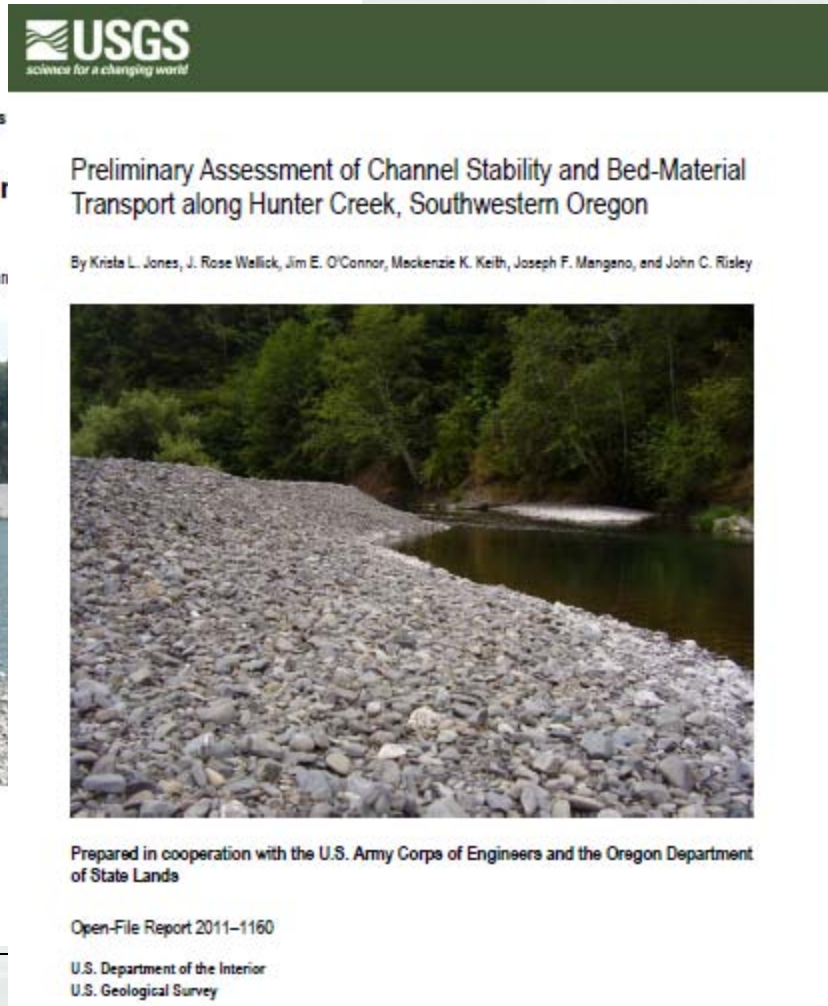
Prepared in cooperation with the U.S. Army Corps

Channel Change and Bed-Mater
Chetco River, Oregon

By J. Rose Wallick, Scott W. Anderson, Charles Cannon, an

Open-File Report 2009–1163

U.S. Department of the Interior
U.S. Geological Survey



USGS
science for a changing world

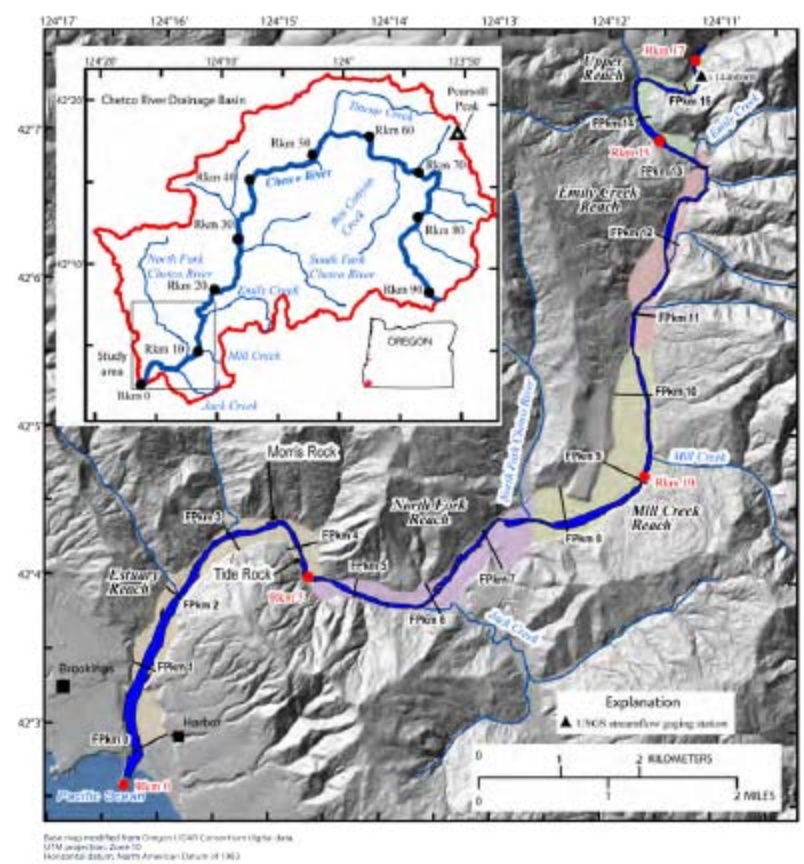
Preliminary Assessment of Channel Stability and Bed-Material Transport along Hunter Creek, Southwestern Oregon

By Krista L. Jones, J. Rose Wallick, Jim E. O'Connor, Mackenzie K. Keith, Joseph F. Mangeno, and John C. Risley

Prepared in cooperation with the U.S. Army Corps of Engineers and the Oregon Department of State Lands

Open-File Report 2011–1160

U.S. Department of the Interior
U.S. Geological Survey



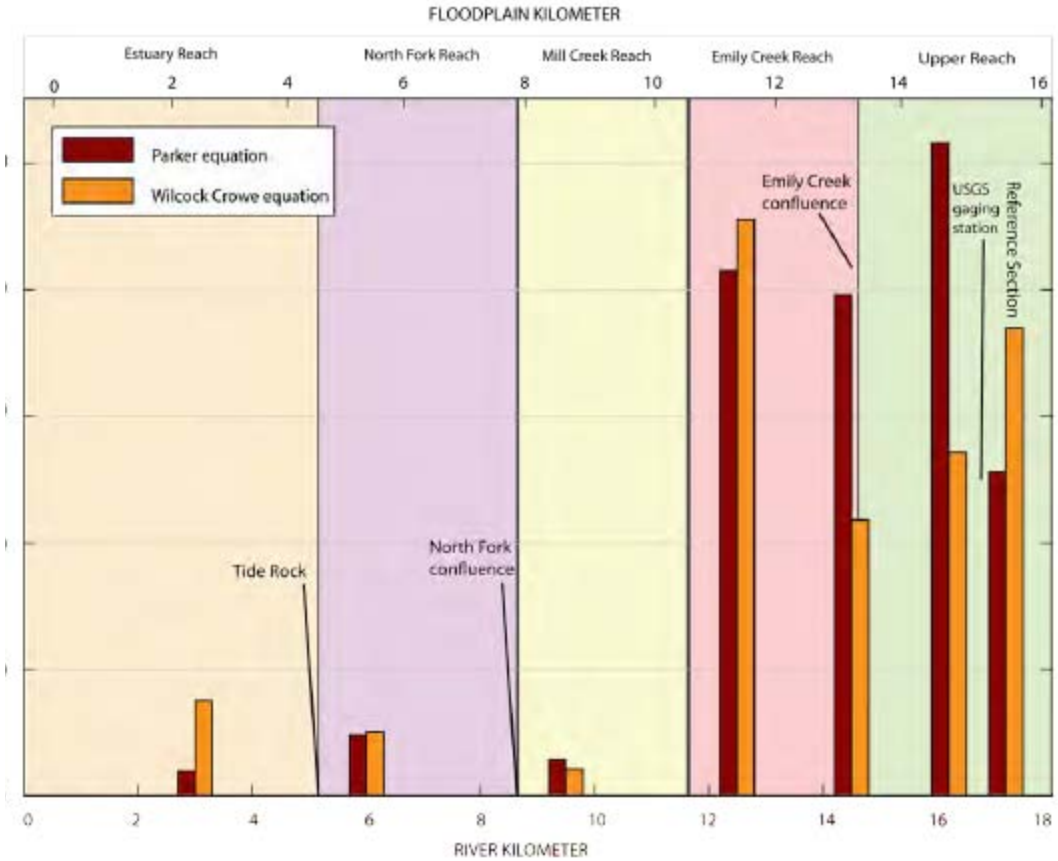


Figure 31. Graph showing mean annual predicted bed-material transport capacity for seven cross sections along the lower Chetco River, Oregon, for water years 1970–2008. Calculations based on Parker (1990, a, b) and Wilcock and Crowe (2003) transport equations. Hydraulics at each cross section from one-dimensional step-backwater hydraulic model for entire study reach.

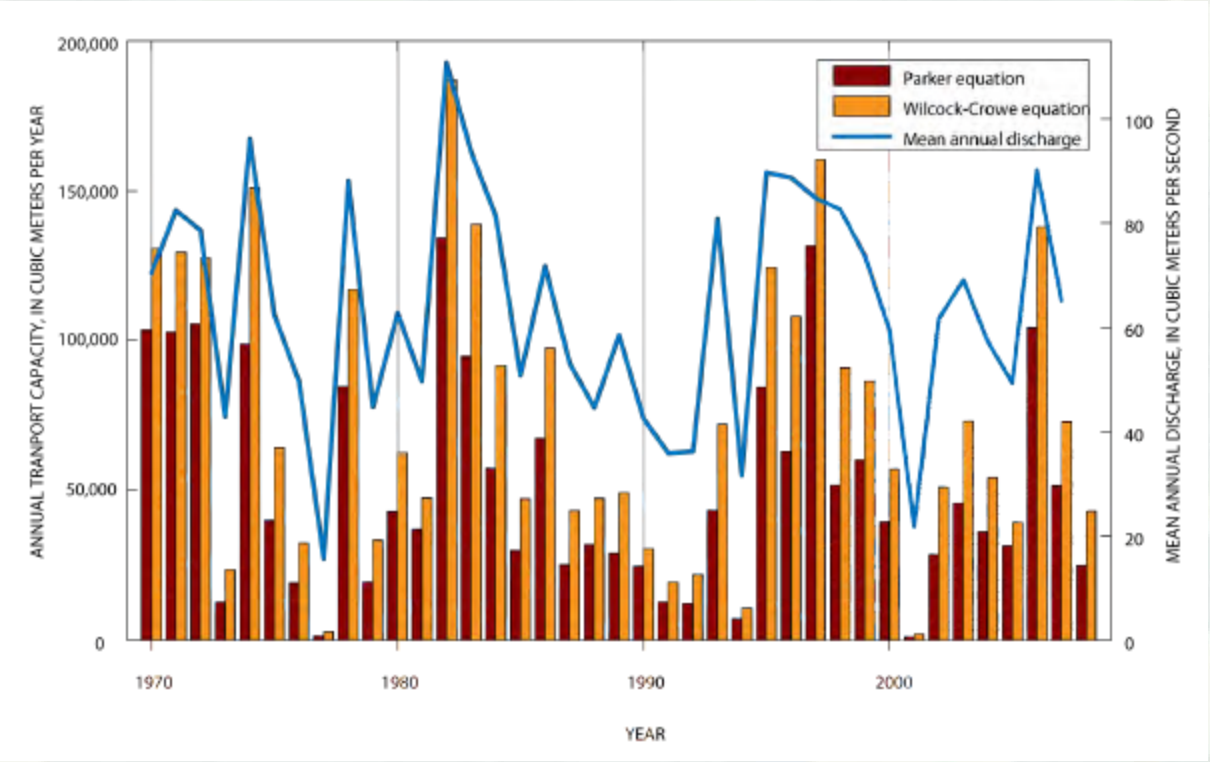


Figure 32. Graph showing mean annual discharge from USGS streamflow gaging station Chetco River near Brookings, Oregon (14400000). Annual bed-material transport capacity computed for reference cross section at floodplain kilometer 15.3 for water years 1970–2008 on basis of the Parker (1990 a, b) and Wilcock and Crowe (2003) transport relations.

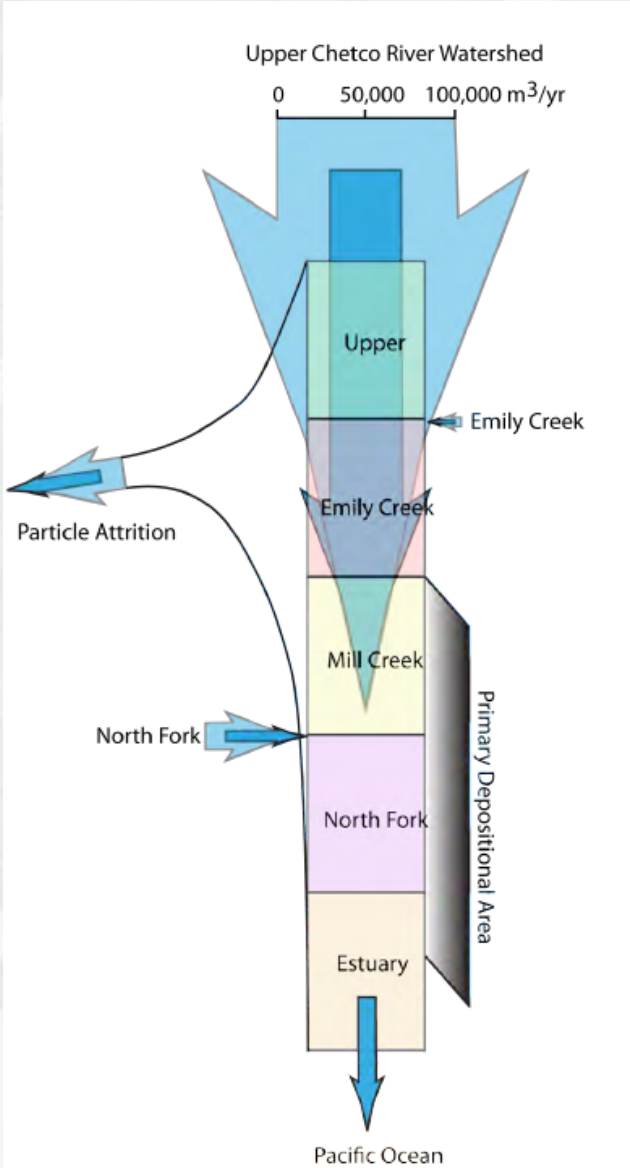


Figure 37. Schematic diagram of sediment budget for the lower Chetco River, Oregon. Arrow widths are proportional to annual flux; ranges indicate estimated uncertainty.

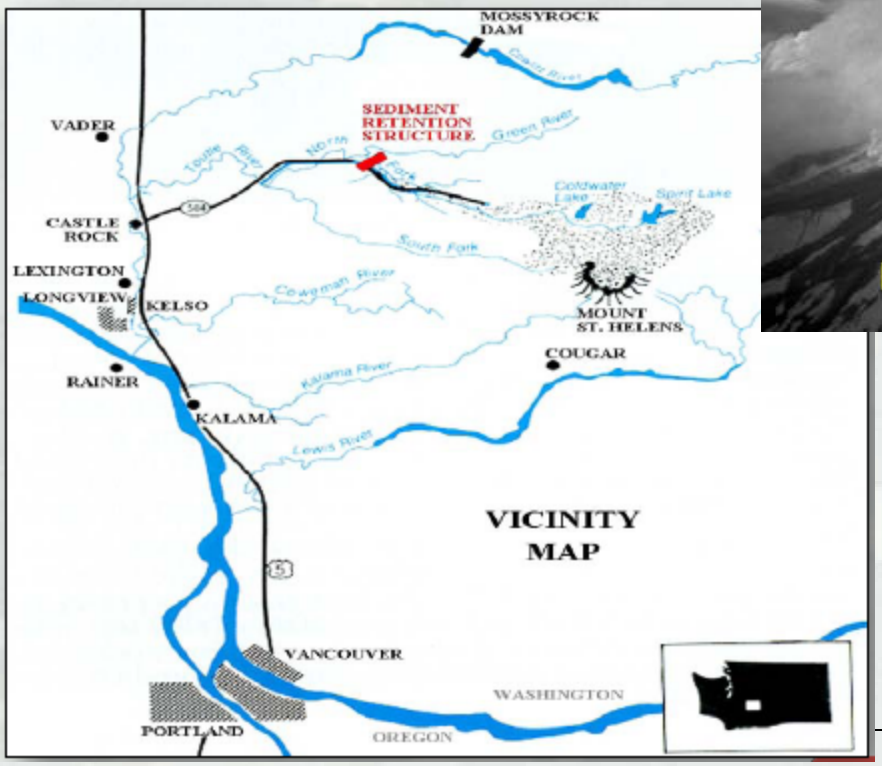
NWP Gravel Mining Initiative Key Implications

- Systematic approach to gravel mining permitting (habitat vs. commercial use)

- Sustainable approach to permitting a precious resource

Mount Saint Helens

- Provide flood damage reduction benefits to 50,000 people in communities of Longview, Kelso, Lexington and Castle Rock, Washington
- Columbia River Navigation



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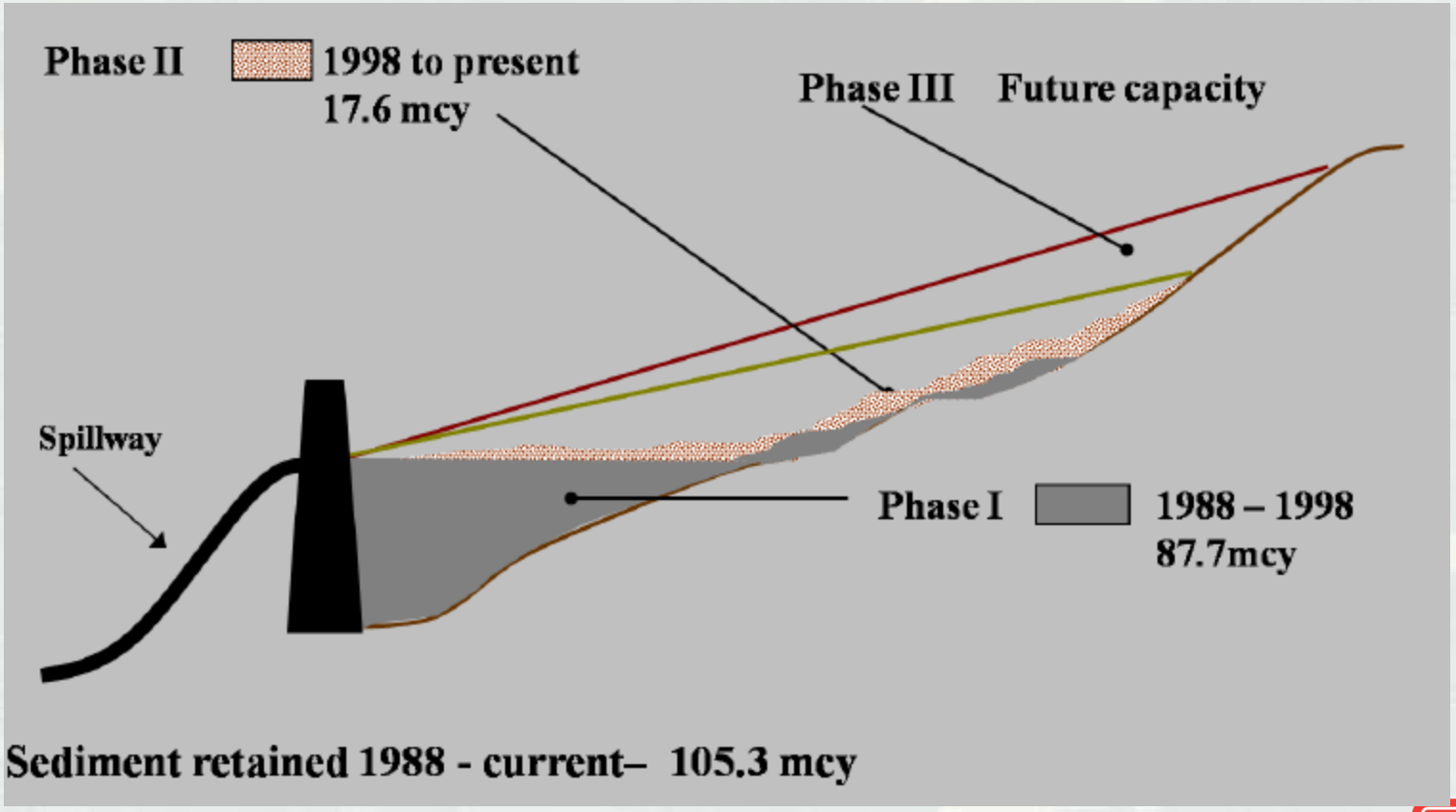
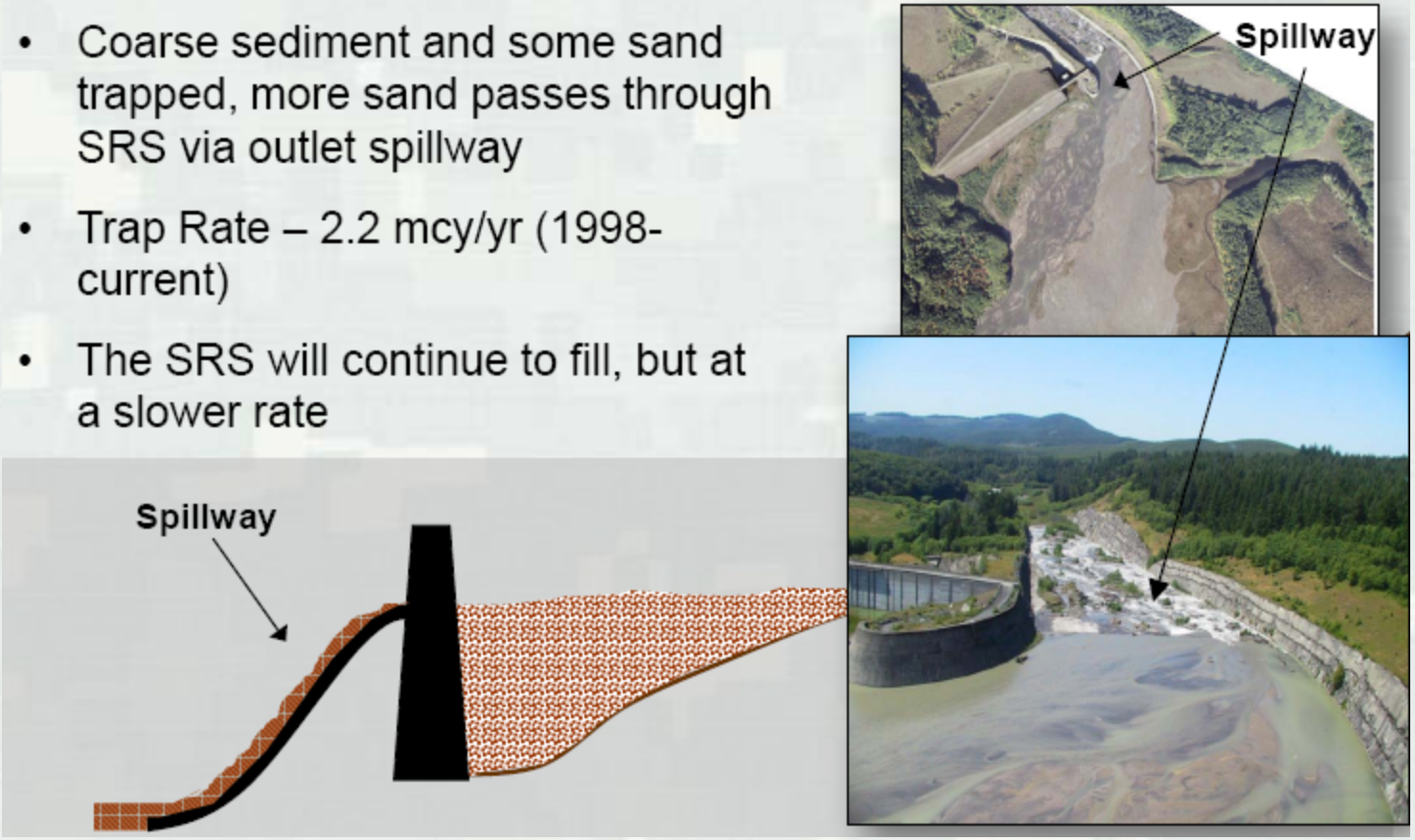
Sediment Retention Structure 1988 - Present

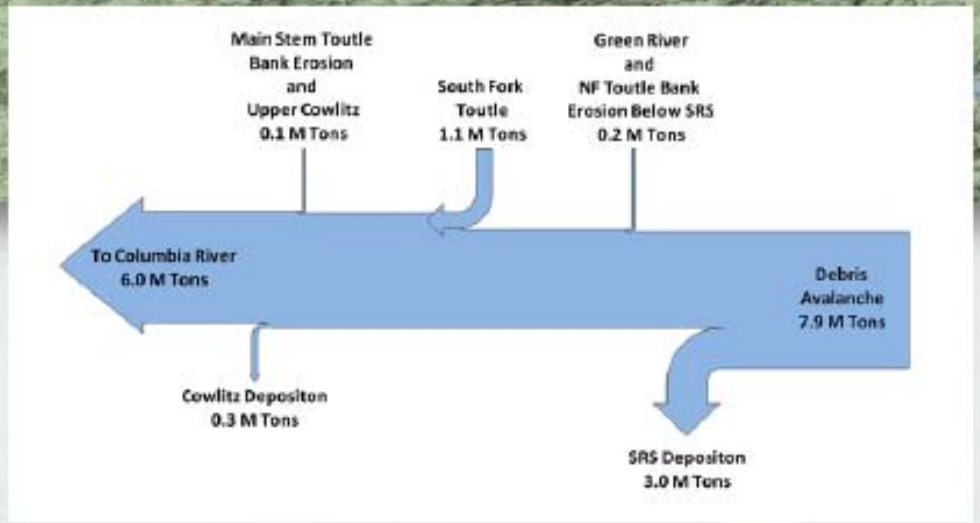


SRS Phase II and Phase III Operation
1998 - 2035

- Coarse sediment and some sand trapped, more sand passes through SRS via outlet spillway
- Trap Rate – 2.2 mcy/yr (1998-current)
- The SRS will continue to fill, but at a slower rate

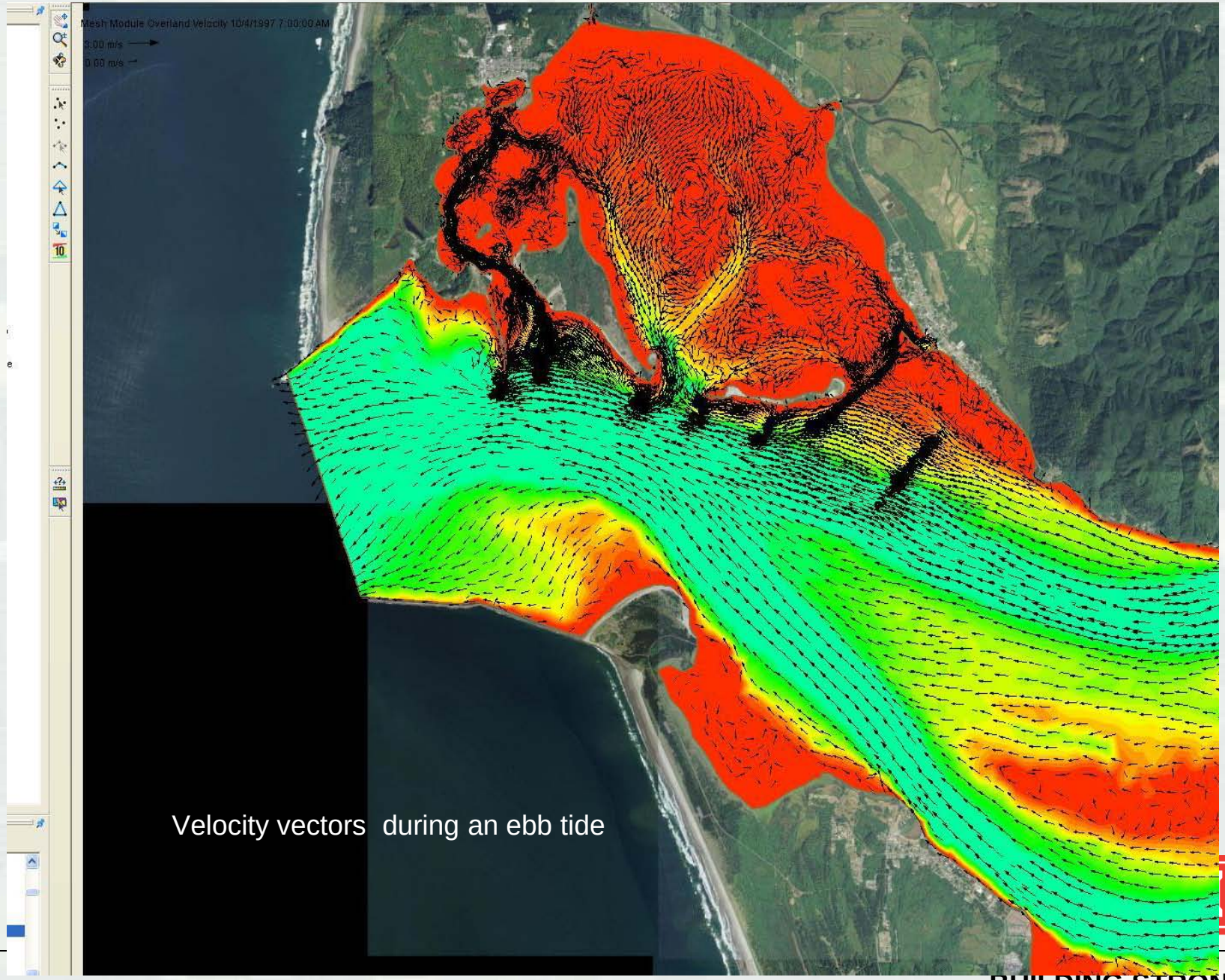


Sources and Sinks of Sediment in the System



Baker Bay PTM

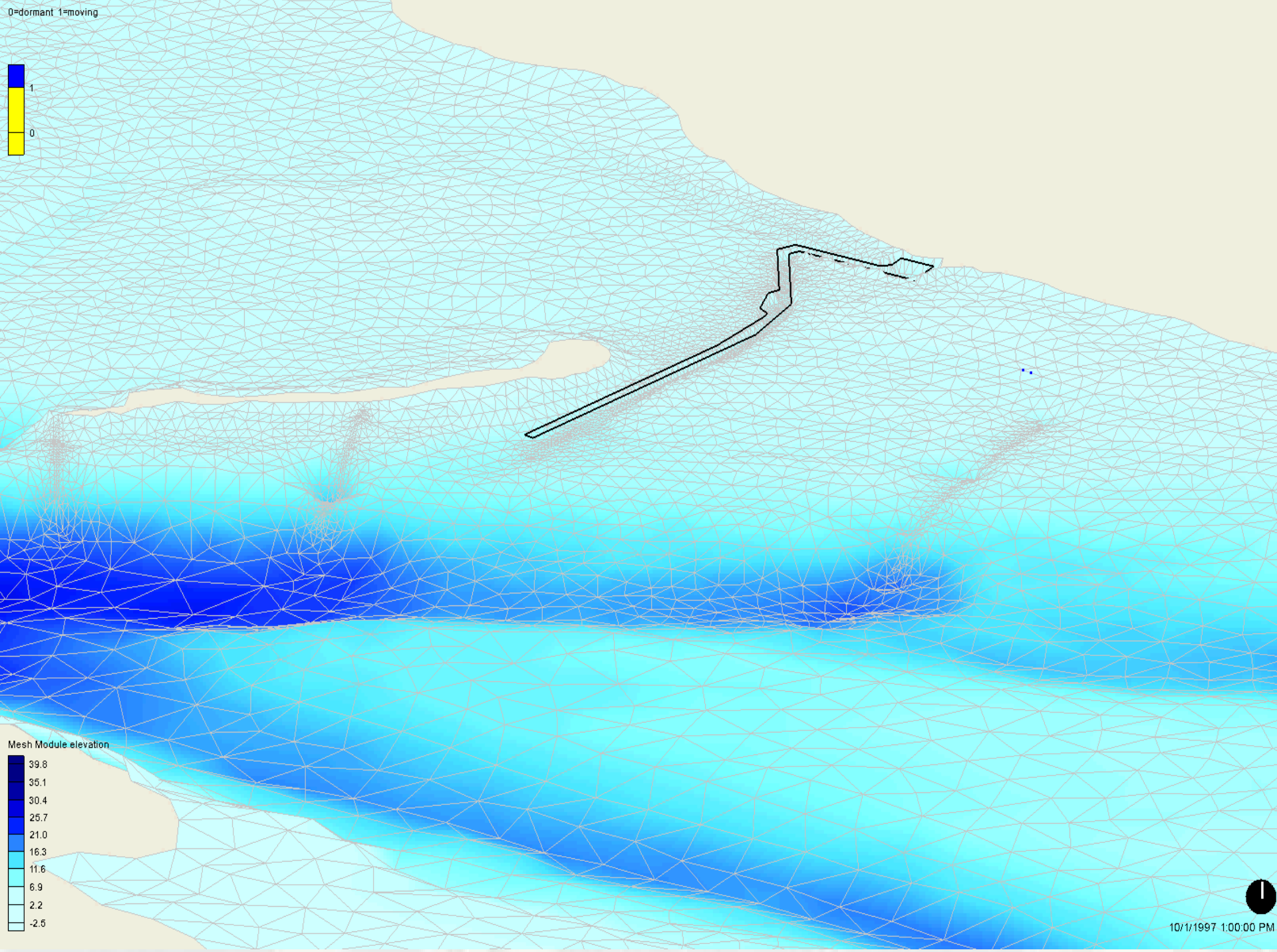
- Identify key sources affecting navigation channels within Baker Bay
- Estimate sedimentation impacts to each channel



Velocity vectors during an ebb tide

Source Identification

TRONG®


0=dormant 1=moving
1
0
Mesh Module elevation
39.8
35.1
30.4
25.7
21.0
16.3
11.6
6.9
2.2
-2.5
10/1/1997 1:00:00 PM

Output for Channel Control Volume

STEP	DATE	TIME	PARTICLE	TRAP
1946	1997/10/01	17:54:20.000	1	1
2107	1997/10/01	18:21:10.000	5	1
2325	1997/10/01	18:57:30.000	13	1
2325	1997/10/01	18:57:30.000	43	1
2327	1997/10/01	18:57:50.000	23	1
2381	1997/10/01	19:06:50.000	4	1
2426	1997/10/01	19:14:20.000	38	1
2545	1997/10/01	19:34:10.000	15	1
109693	1997/10/14	05:12:10.000	1796	1
109900	1997/10/14	05:46:40.000	772	1
110132	1997/10/14	06:25:20.000	392	1

- Trap 1 rate = 0.01716 kg/s, Trap 1 Total= 19430.000 kg

Lower Columbia ADH Model

- The need (an integrative tool):
  - BiOp requirements
  - Eco-system restoration initiative
  - Dredge material management planning
  - Legacy requirements (CRCIP)

- The coordination
  - Dr. Andy Goodwin ERDC-EL,Dr. Kevin Barry ERDC-ITL, Dr. Rob McAdory, Elvon Childs, Gurav Savant, Gary Brown ERDC-CHL, Rod Moritz NWP

- Opportunities– Columbia River Treaty, Baker Bay

Model Capability

Time-varying (or Snapshot) Patterns

- Inundation (acreage / depth)
- Velocities
- Temperature
- Motion of river bed
- Change in patterns / connectivity due to flow / breaching

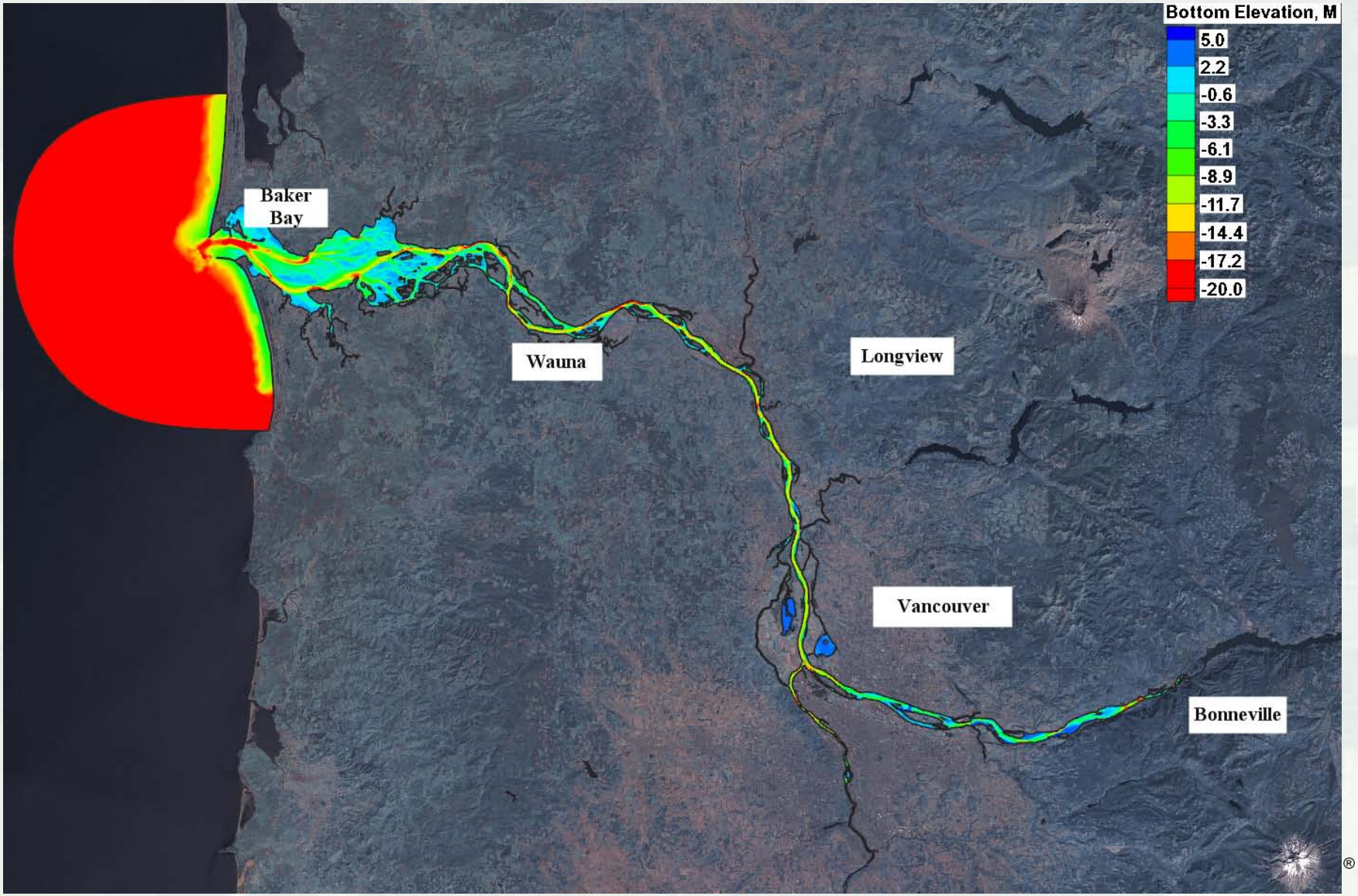
Computational Info

- Linear finite elements
- 2-D shallow water, Navier-Stokes modules
- Mass conservative
- Modular

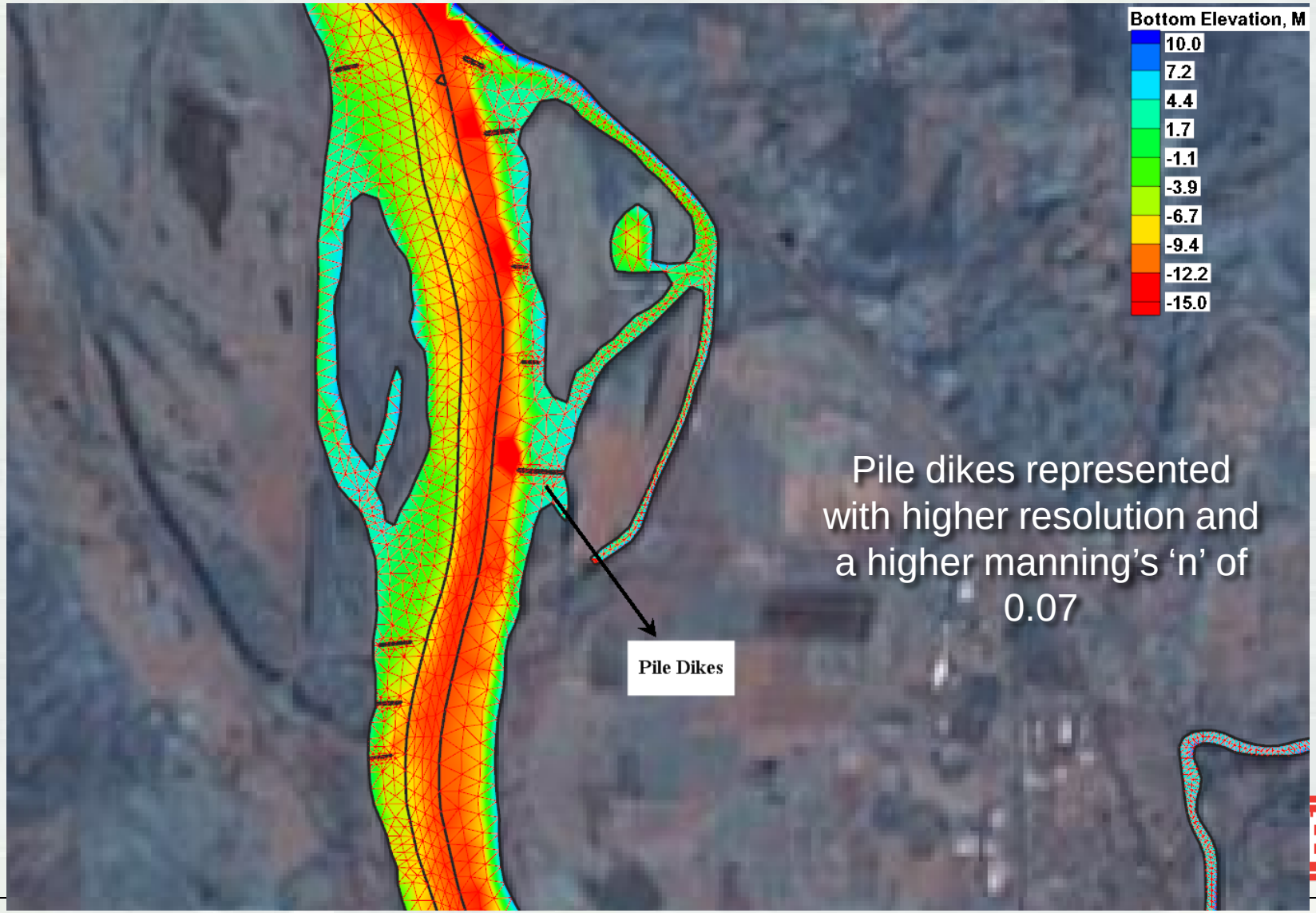
Model Description (to date)

- April – 31 December 2009
- Bathymetric data based on latest LiDAR data from Portland District
- Total area: 2500 sq. km
- Total # nodes: 101,730
- Total # elements: 179,208
- Coarsest resolution (tidal boundary): ~1000 m
- Finest resolution (pile dikes vicinity): ~2 m
- Boundary conditions
  - Offshore (ocean): NOAA
  - River: USACE discharge data for Bonneville, Willamette, James, Cowlitz, others
- Effort to add temperature and stability/motion of river bed
  - ~2-3 weeks for temperature
  - ~1 week for stability/motion of river bed
- Effort to simulate an annual hydrograph
  - ~2 months

Lower Columbia River

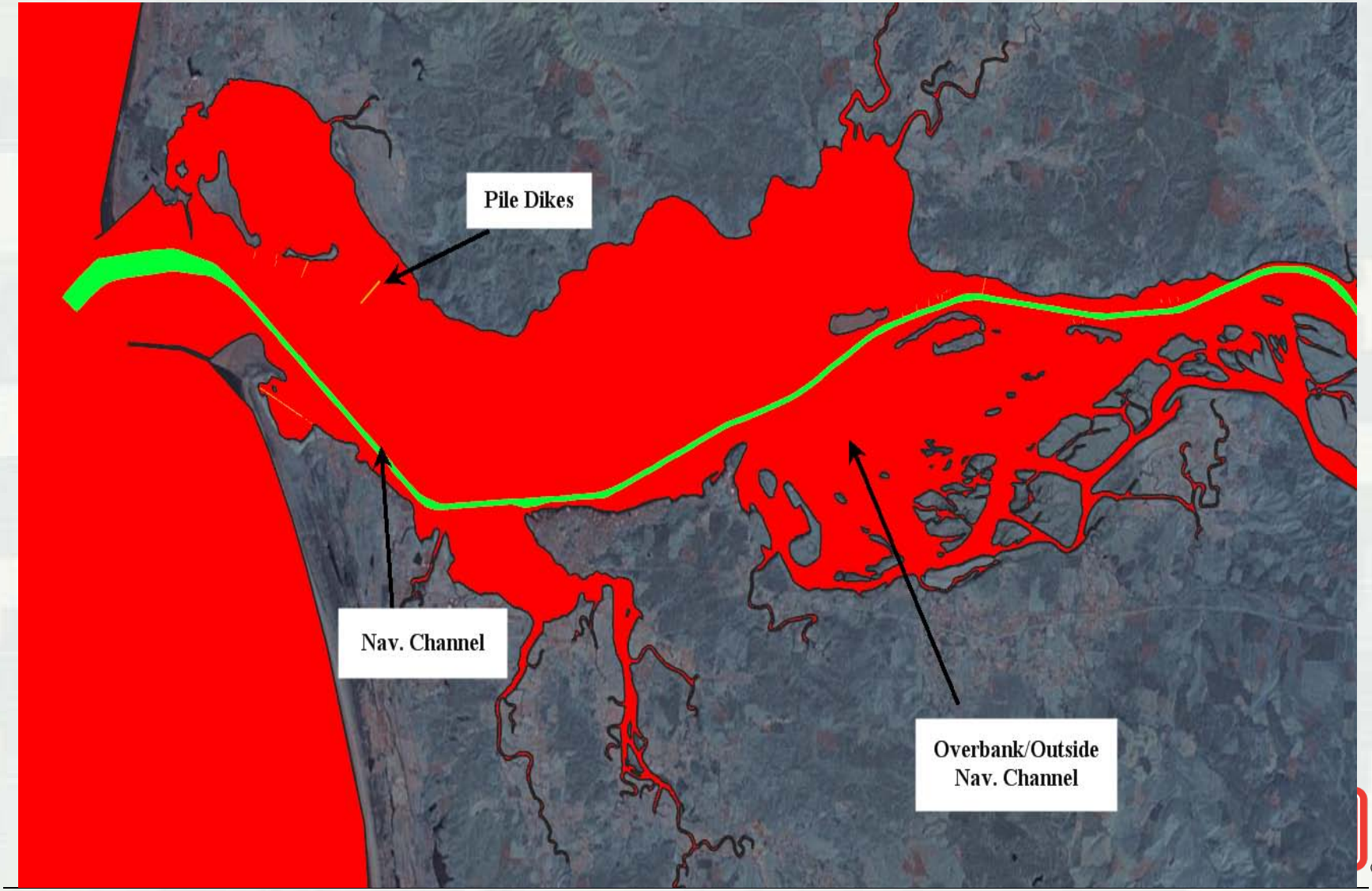


Pile Dikes



Pile dikes represented with higher resolution and a higher manning's 'n' of 0.07

ADH Materials Distribution



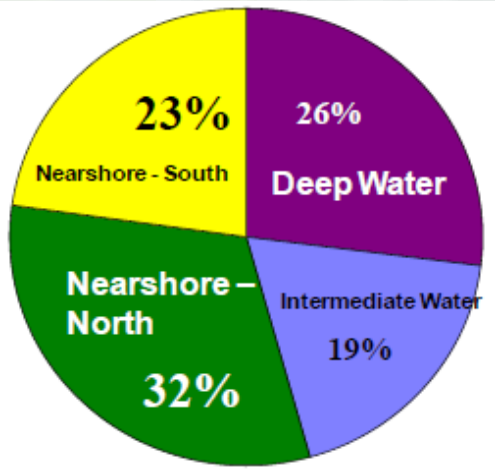
MCR RSM Plan Goals

- Plan jointly funded by USACE, EPA, and States of OR and WA
- Long term strategy for sediment management that is sustainable:
  - Economically
  - Ecologically
  - Socially
- Basis for permitting a network of beneficial use sites

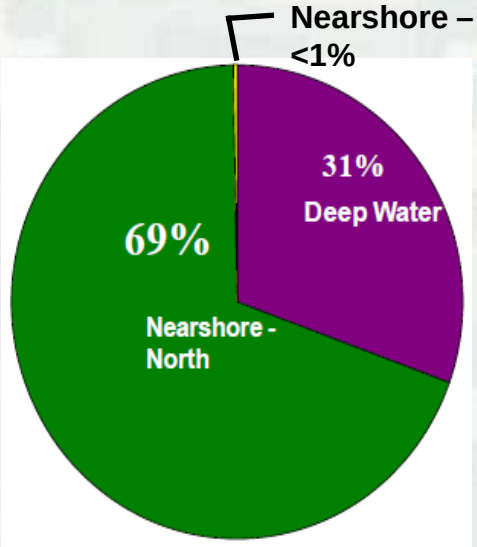
MCR RSM Plan Objectives

- Regional approach to sediment management planning
- Augment present and future sediment budget
- Increase sand shoals that support N and S Jetty foundations
- Continued understanding of Columbia littoral cell
- Ensure placement practices will not result in unacceptable adverse effects in the nearshore environment
- Implementation with the West Coast Governor's Agreement on Ocean Health (Action 7.4)

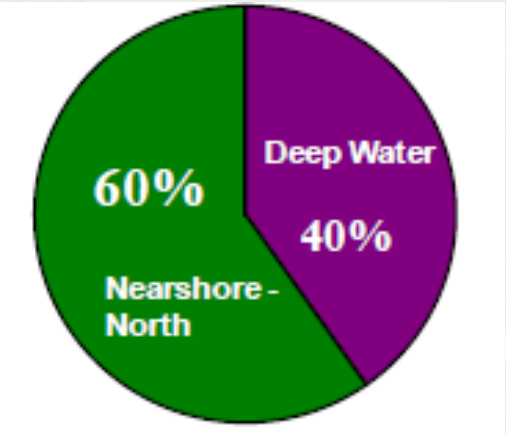
MCR Dredging Activities Before 2010



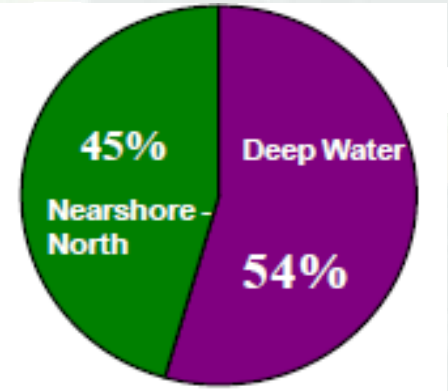
1956-1996



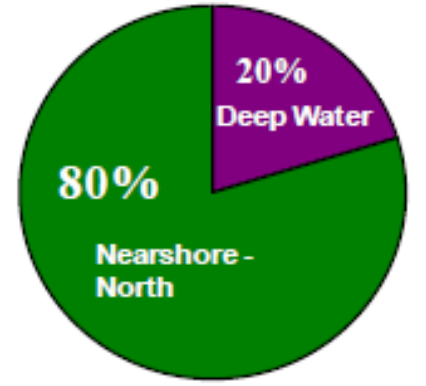
1997-2009



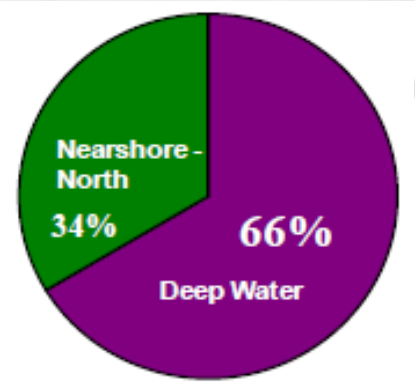
2006



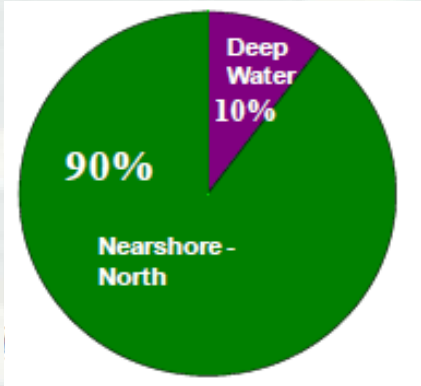
2007



2008

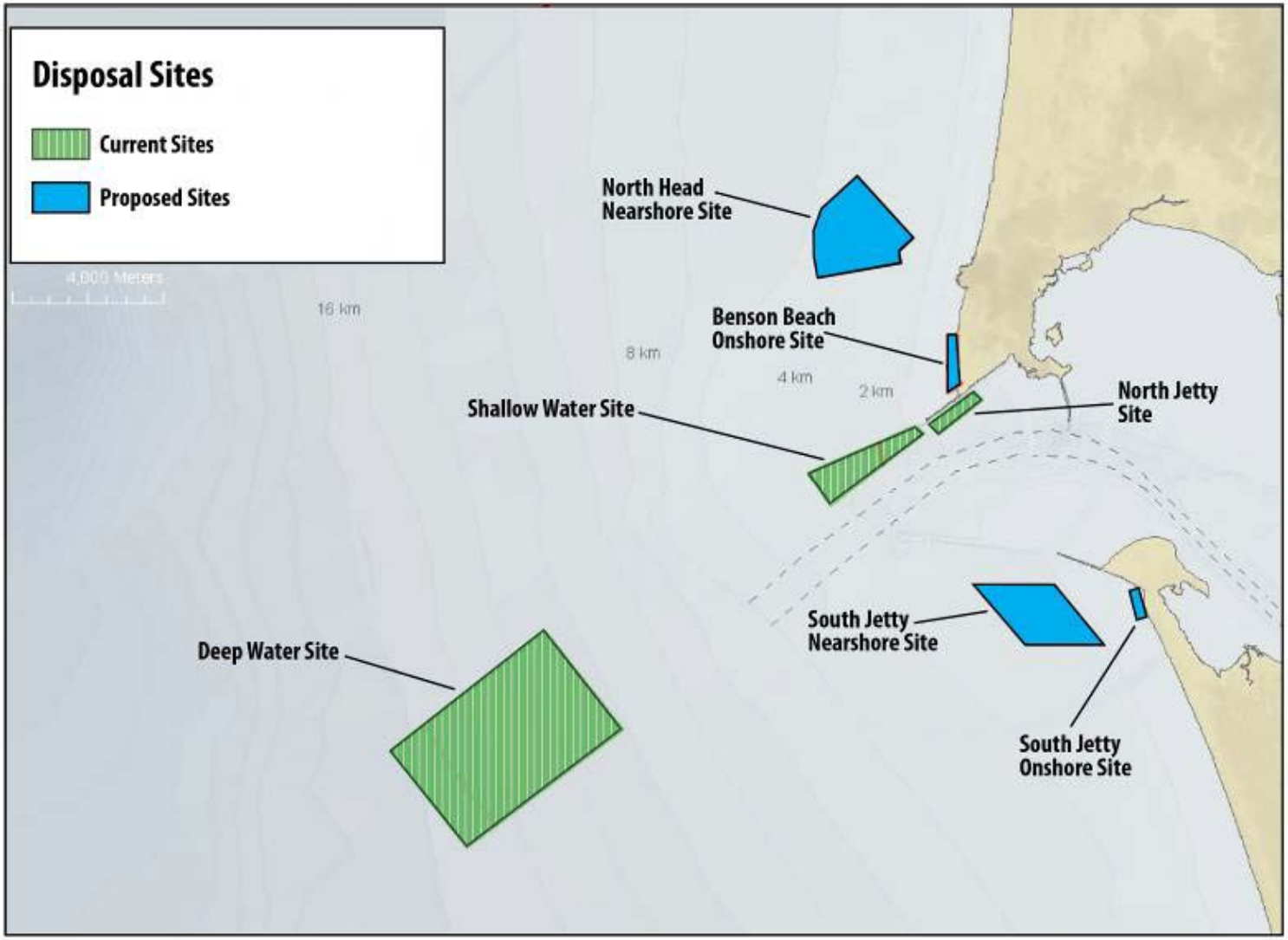


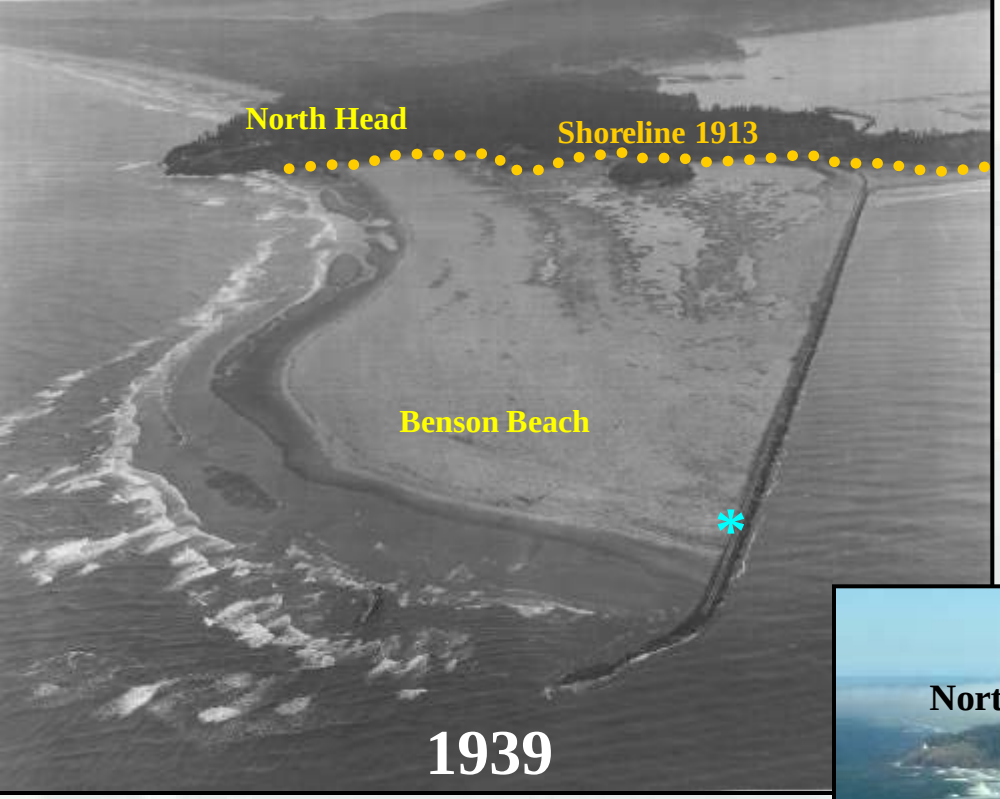
2009



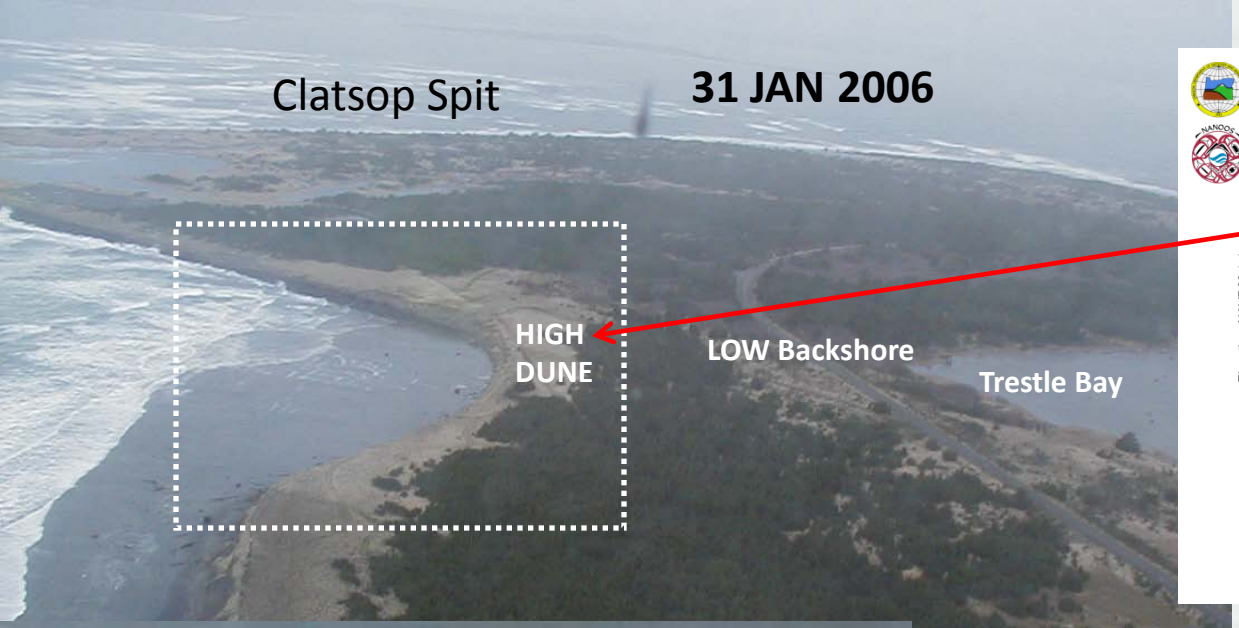
2010

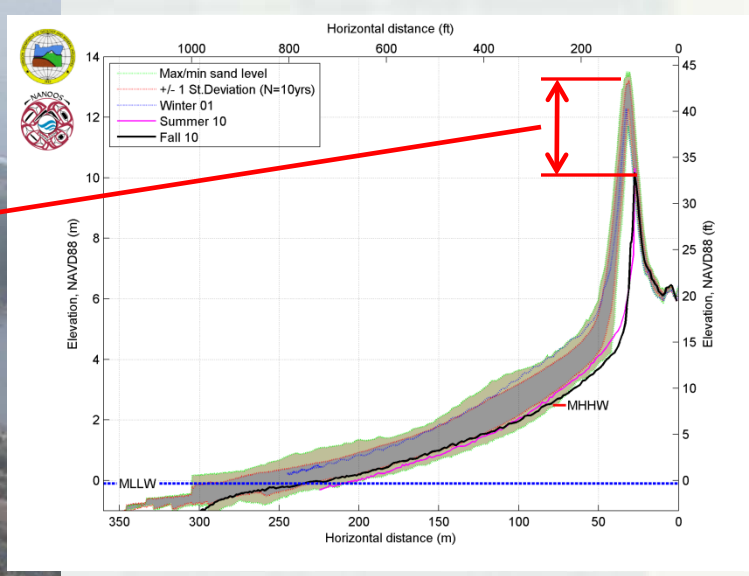
Network of Regional Disposal Sites

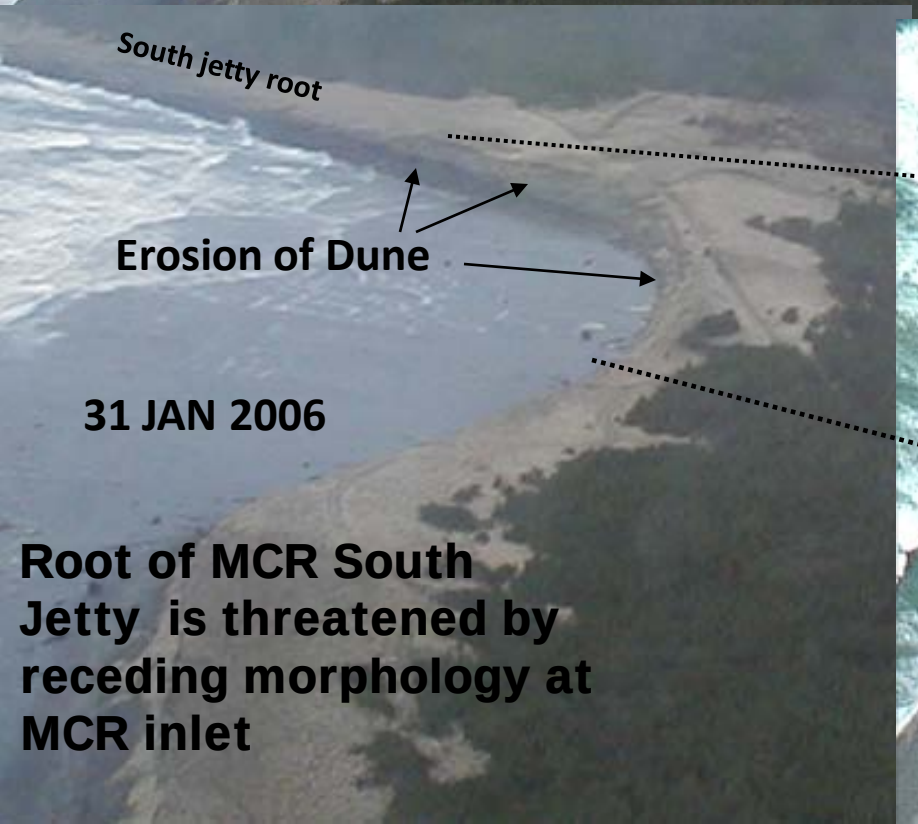



North Head
Shoreline 1913
Benson Beach
1939

North Head
Shoreline 1913
Benson Beach has receded
2,000 ft since 1939
North Jetty
2002







Root of MCR South Jetty is threatened by receding morphology at MCR inlet

The Observed Historic Movement of the Shoreline

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Mouth of the Columbia River - Bathymetry and 2011 Dredged Material Placement Sites

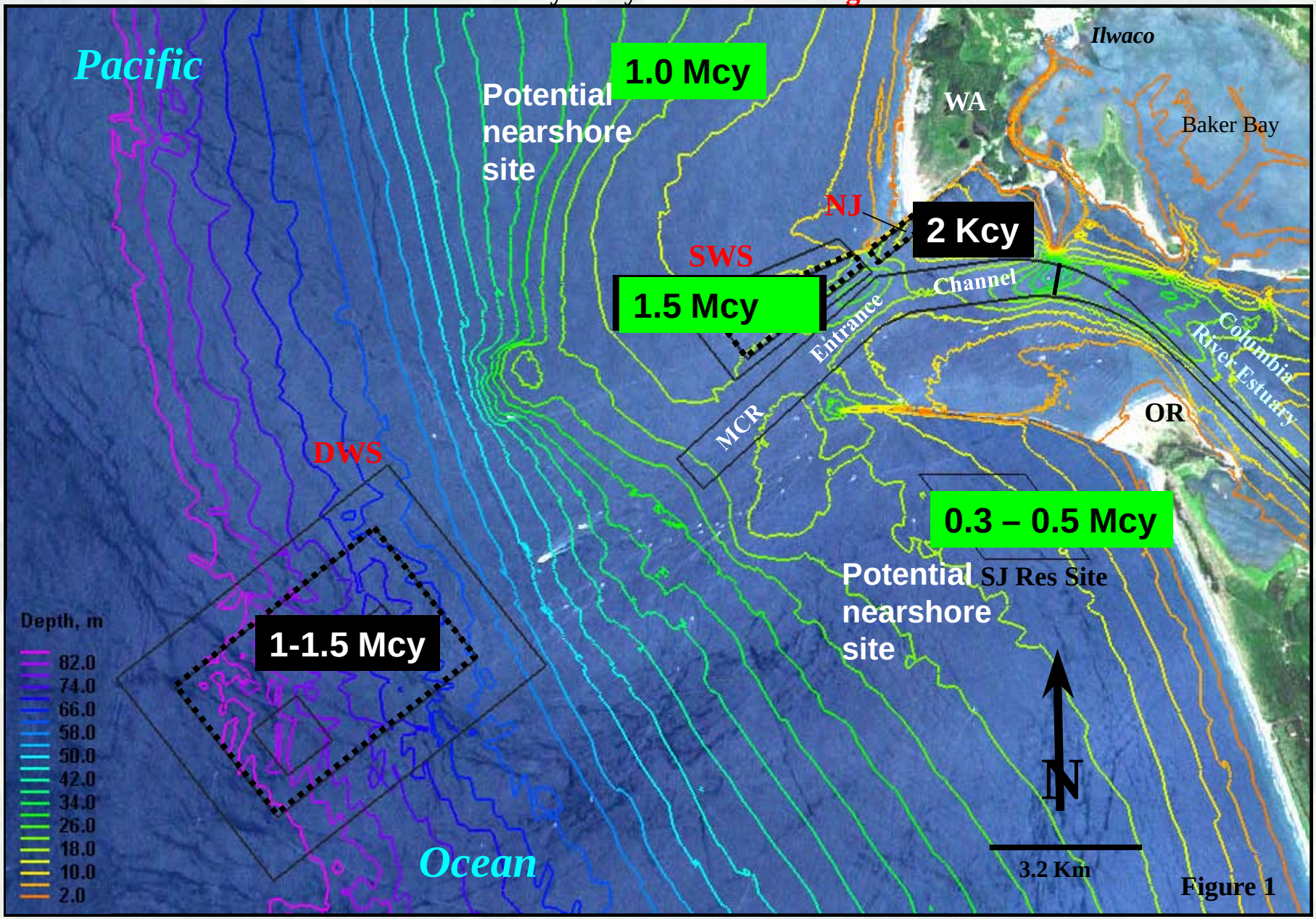

Figure 1

DWS= Deep Water Site, 102 MPRSA
SWS= Shallow Water Site, 102 MPRSA

NJ Site = North Jetty disposal site, 404 CWA

SJ Res. Site = South Jetty research site, restricted use by EPA permit

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MCR RSMP Key Implications

- Dredging cost reduction (DWS vs. nearshore)
- Streamlined regulatory process (indefinite, reduced staff time)
- Project life-cycle extension
- Stakeholder ownership
- Long-term sediment management strategy for MCR and potentially C&LW

Conclusion

- The implementation of RSM at NWP has proven to make the clear connection between need and opportunity
- Understanding of how to address areas of concern has been difficult, however the RSM framework has been highly successful
- The internal and external coordination and partnership at NWP has been rich
- Near and long term plan
- Key Benefits
  - Reduced costs
  - Reduced uncertainty related to regulatory framework
  - Streamlined processes (contracting, planning, execution)