RSM FY12 IPR

Portland District

Lower Columbia River Adaptive Hydraulic Modeling (AdH)

Rod Moritz, Coastal Engineer

Jessica Stokke, C&LW Project Manager

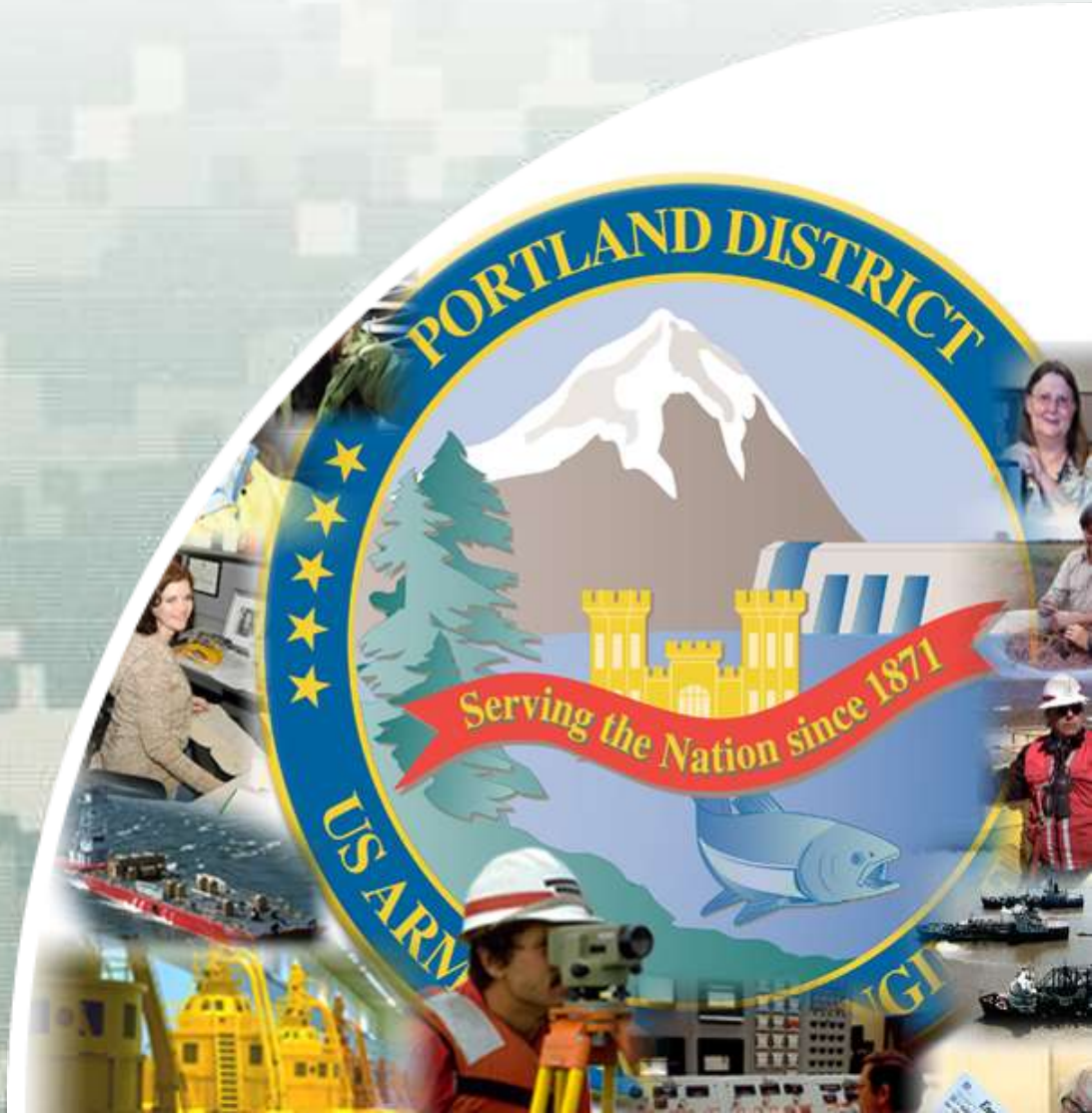
Paul Cedfeldt, Chief GIS

Jarod Norton, MCR Project Manager

USACE Portland District

August 29, 2012

Portland, OR



US Army Corps of Engineers

BUILDING STRONG®

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Portland District, AdH Modeling, Rod Moritz, Jessica Stokke, Mike Ott, and Jarod Norton

Description/Challenge

- Maintain the Columbia River nav channel with a limited budget, dredge plant constraints, and environmental work-windows.
- Remove draft restrictions in the river.
- Meet stakeholders needs.
- Post Channel Improvement Sediment Mngmt.

Goals/Issues to Address

- Limit the amount of material that is re-handled during maintenance dredging.
- Increase efficiency of the overall C&LW dredging program.
- Collaborative Approach
  - AdH as an integrative tool across multiple business lines.

BLUF: Portland District needed more information to shape the selection of C&LW disposal sites to reduce the amount of material that migrates back into the FNC, increasing efficiency of the program.

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District PDT Members

Rod Moritz, Coastal Engineer

Jessica Stokke, C&LW Project Manager

Paul Cedfeldt, Chief GIS

Mike Ott, Chief Waterways Maintenance

Jarod Norton, MCR/RSM Project Manager

Stakeholders and Partners

- Columbia River Pilots
- Jonathan Freedman, EPA
- Ports (Portland, Vancouver, Longview, Kalama)
- Tim Kuhn, Flood Risk Management
- Blaine Ebberts, Fishery Biologist
- FCRPS

Leveraging/Collaborative Opportunities

- Interplay between dredged material disposal, pile dike structures, and shallow water habitat.
- Use of the contract hopper dredge to implement use of disposal sites selected through AdH.

Milestones/Deliverables

- Adaptive Hydraulic Modeling, on-going
- Improved Selection of Dredged Material Disposal Sites, on-going
- Analysis from Portland District H&H, 8/1/12
- Update NCDB geodatabase, 9/1/12, 0%completed

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Approach

- Use new flow lane sites in FY12 based on present operational challenges and taking advantage of RSM –AdH hydro to work with nature.
- Assess the performance of these flowlane sites as using AdH with PTM with hydro survey data to inform fate and estimated volumes.
- Select areas that will allow the material to dissipate over the entire river, based on depth and velocity.
- Thin layer placement

Benefits to O&M, FRM, Environmental

- Reduced Overall O&M dredging cost
- Limit the re-handle of material, allowing the dredges to work multiple reaches instead of continuously addressing the same problem areas.

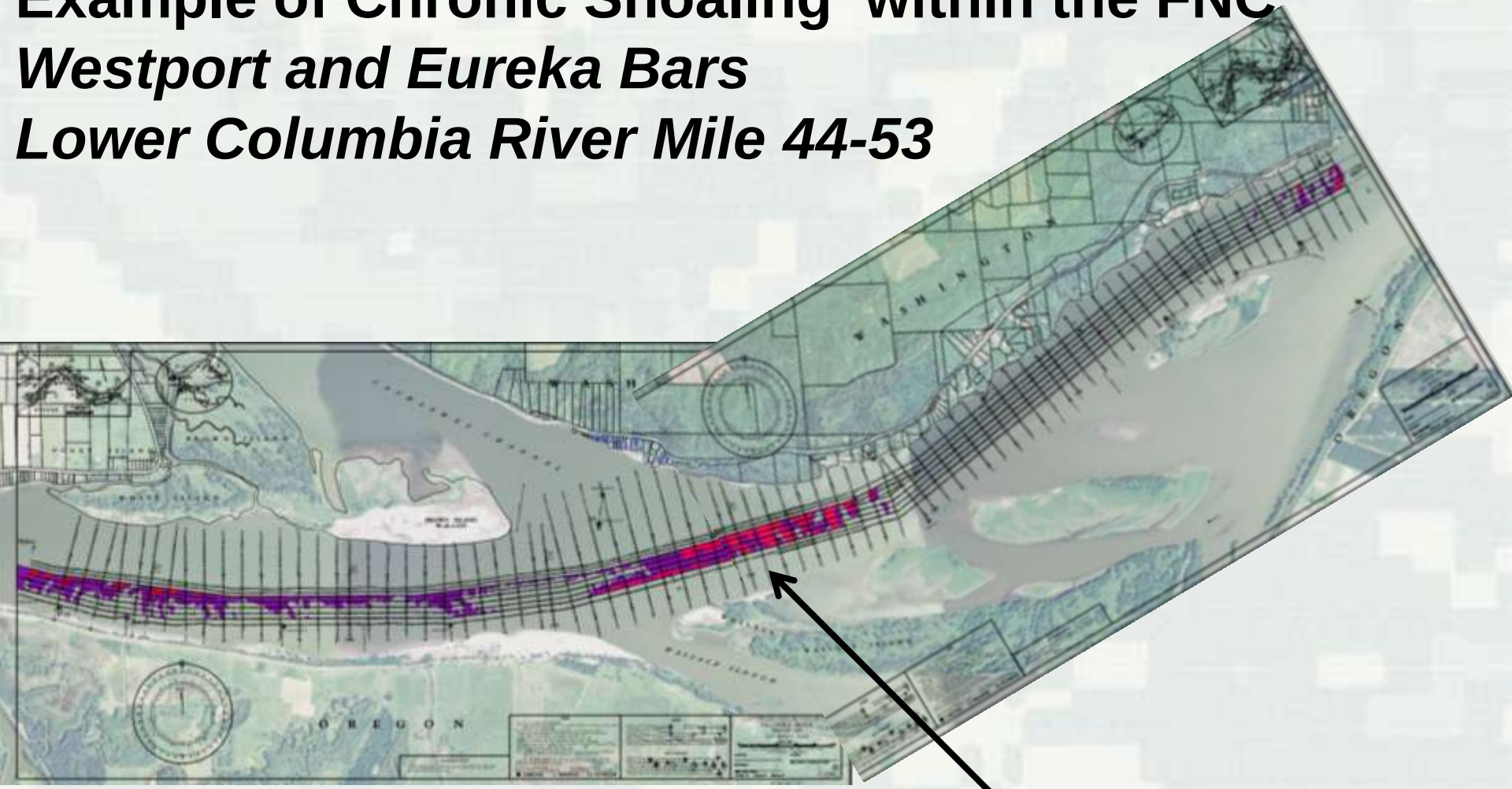
Models, Tools, Databases, etc Used

- Adaptive Hydraulic Modeling
- NCDB geodatabase
- Continuous use of hydrosurvey data
- Particle Tracking Model (PTM)
- Channel Condition

Example of Chronic Shoaling within the FNC

Westport and Eureka Bars

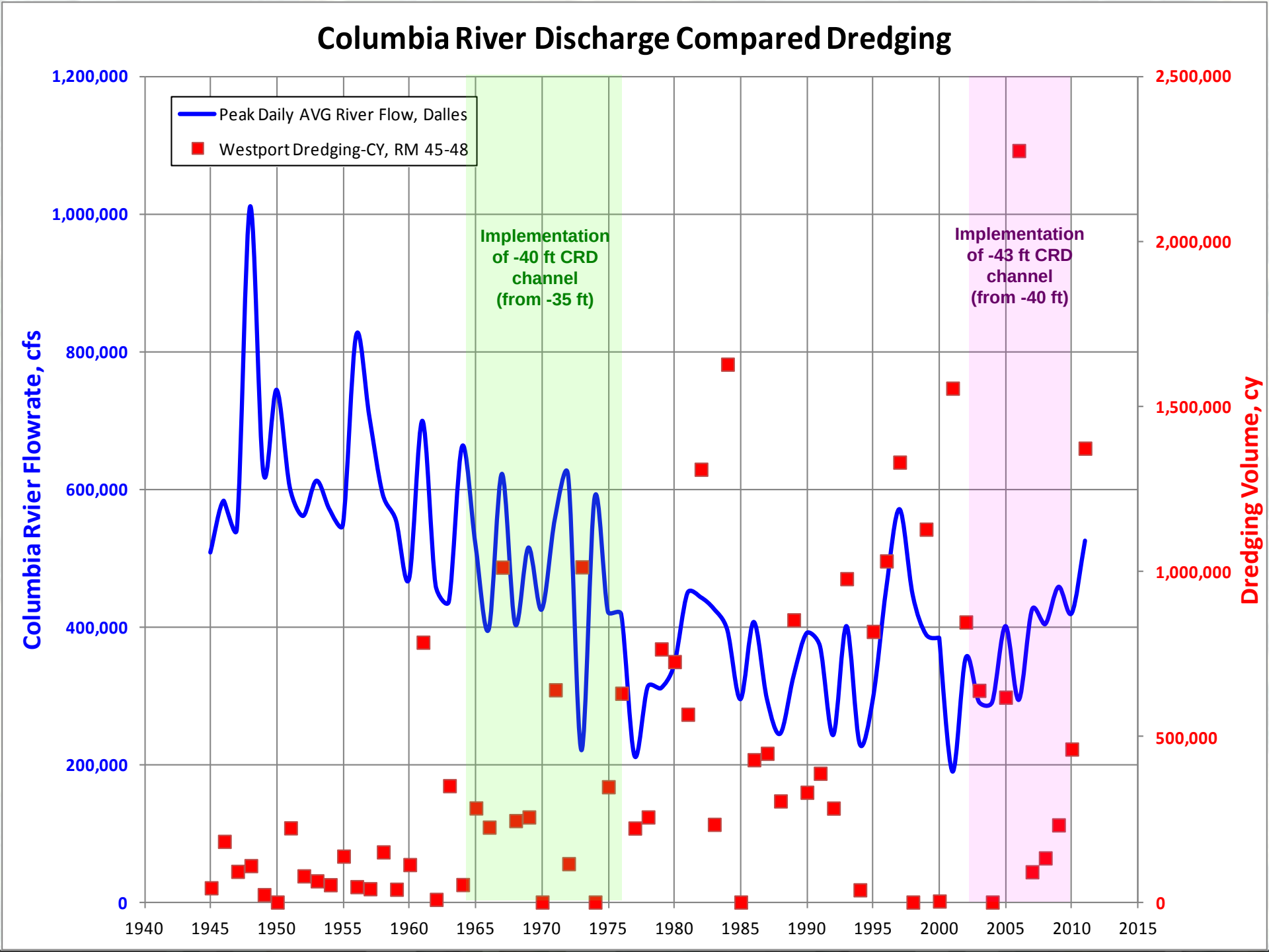
Lower Columbia River Mile 44-53

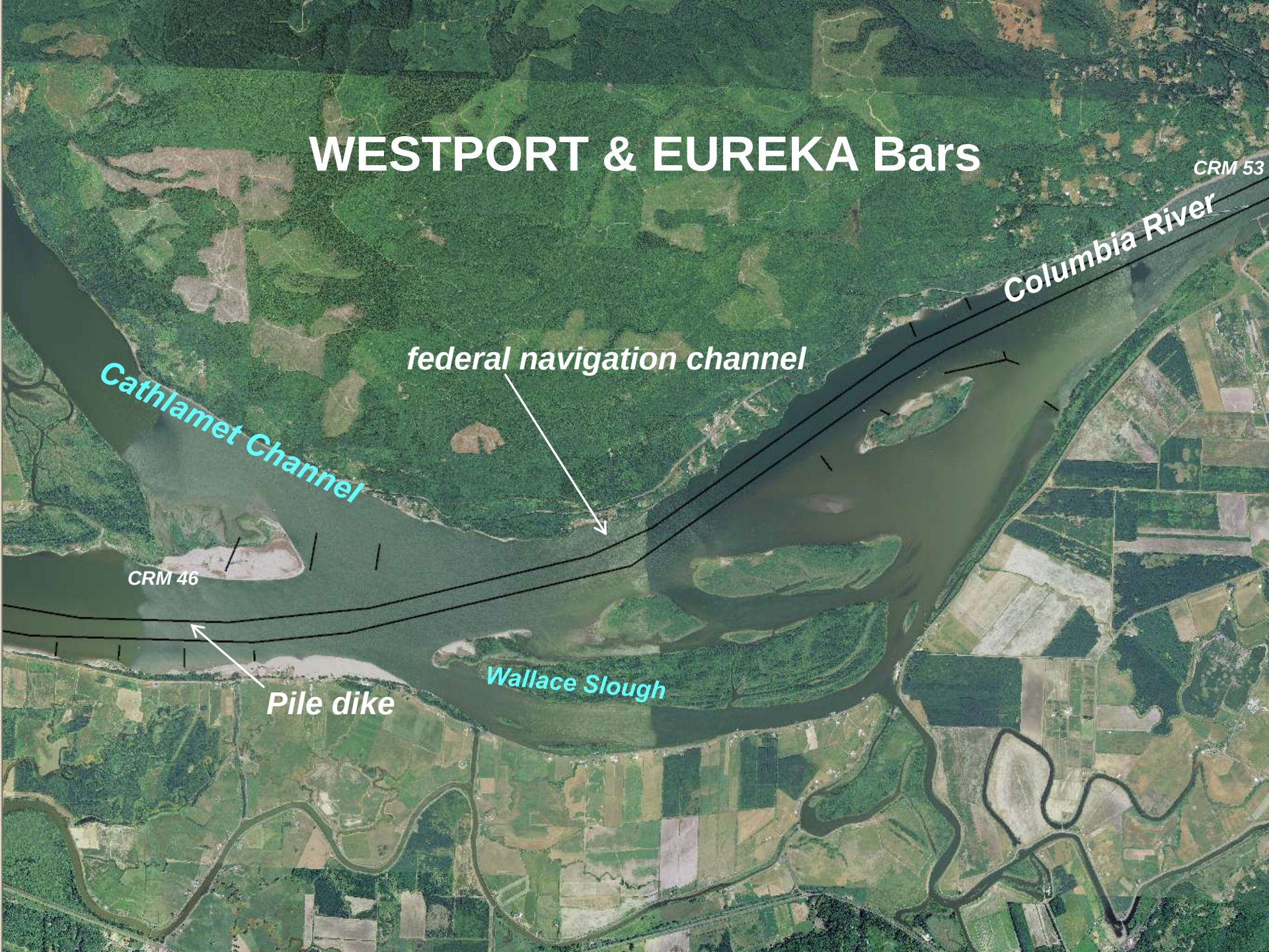


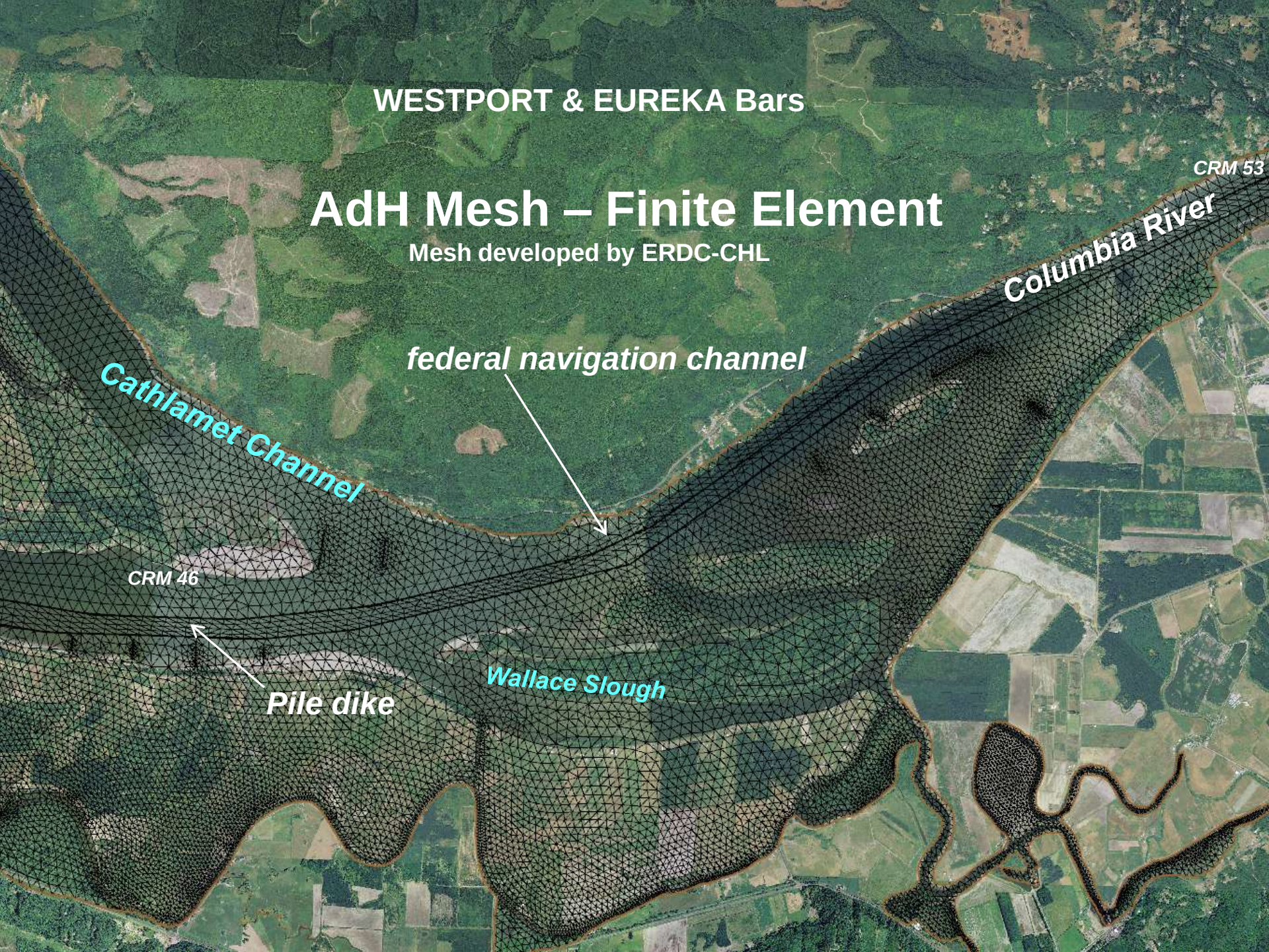
Shoaling

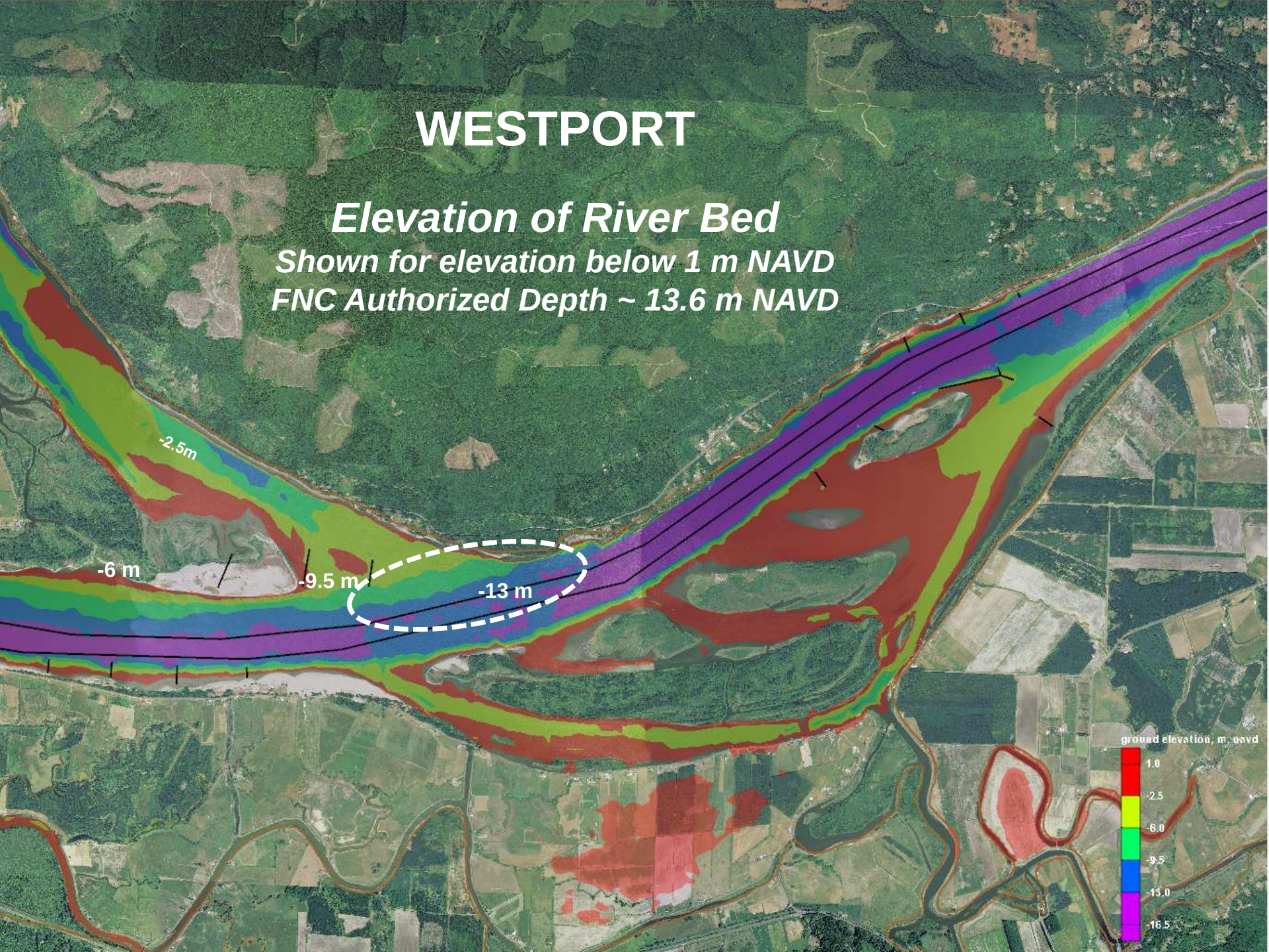
Purple =>-46 ft CRD

Red = > -43 ft CRD


Columbia River Discharge Compared Dredging
Peak Daily AVG River Flow, Dalles
Westport Dredging-CY, RM 45-48
Implementation of -40 ft CRD channel (from -35 ft)
Implementation of -43 ft CRD channel (from -40 ft)
Columbia Rvier Flowrate, cfs
Dredging Volume, cy
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

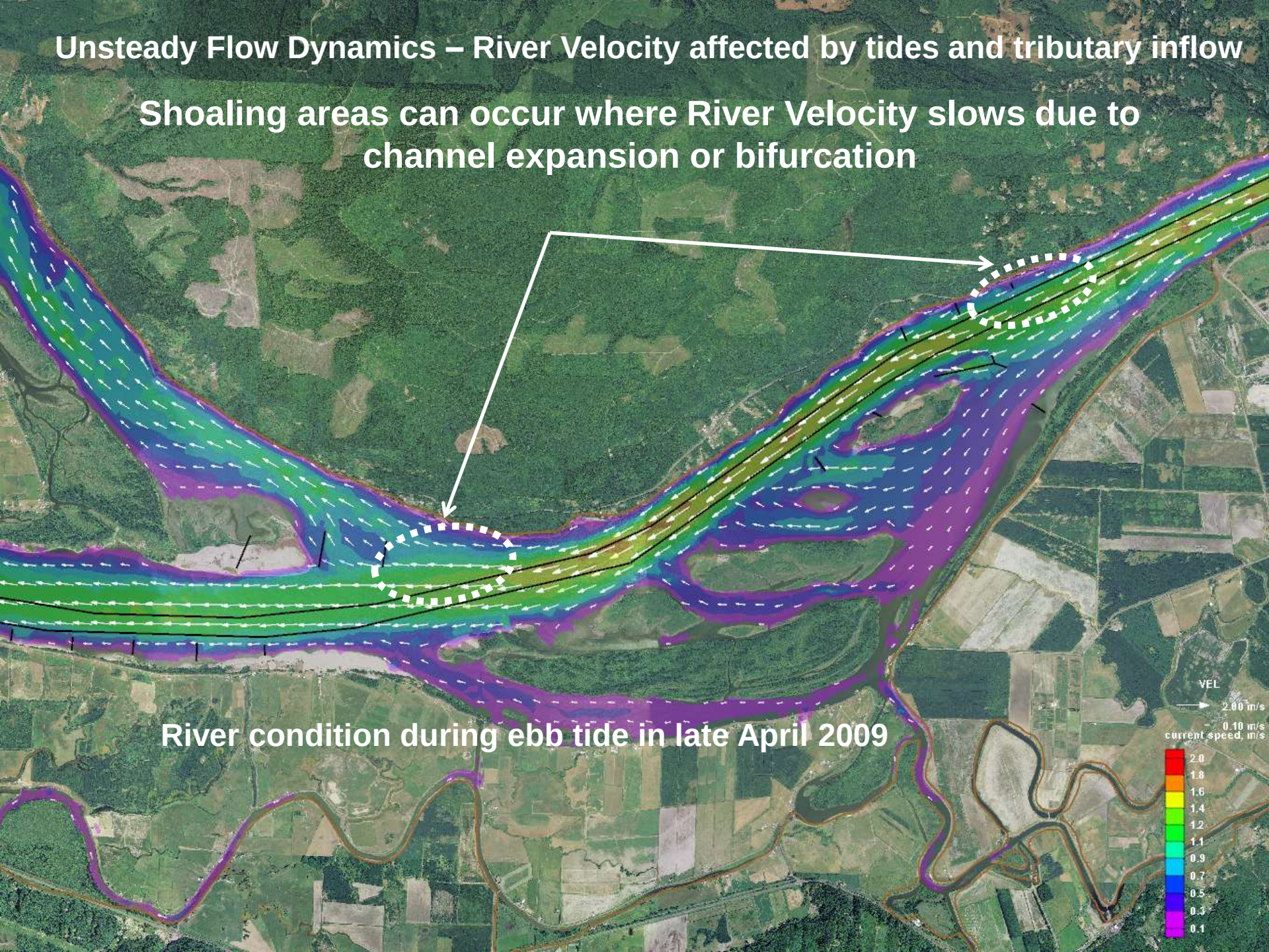

WESTPORT & EUREKA Bars
CRM 53
Columbia River
federal navigation channel
Cathlamet Channel
CRM 46
Wallace Slough
Pile dike


WESTPORT & EUREKA Bars
AdH Mesh – Finite Element
Mesh developed by ERDC-CHL
CRM 53
Columbia River
federal navigation channel
Cathlamet Channel
CRM 46
Pile dike
Wallace Slough


WESTPORT
Elevation of River Bed
Shown for elevation below 1 m NAVD
FNC Authorized Depth ~ 13.6 m NAVD
-2.5m
-6 m
-9.5 m
-13 m
ground elevation, m, navd
1.0
-2.5
-6.0
-9.5
-13.0
-16.5

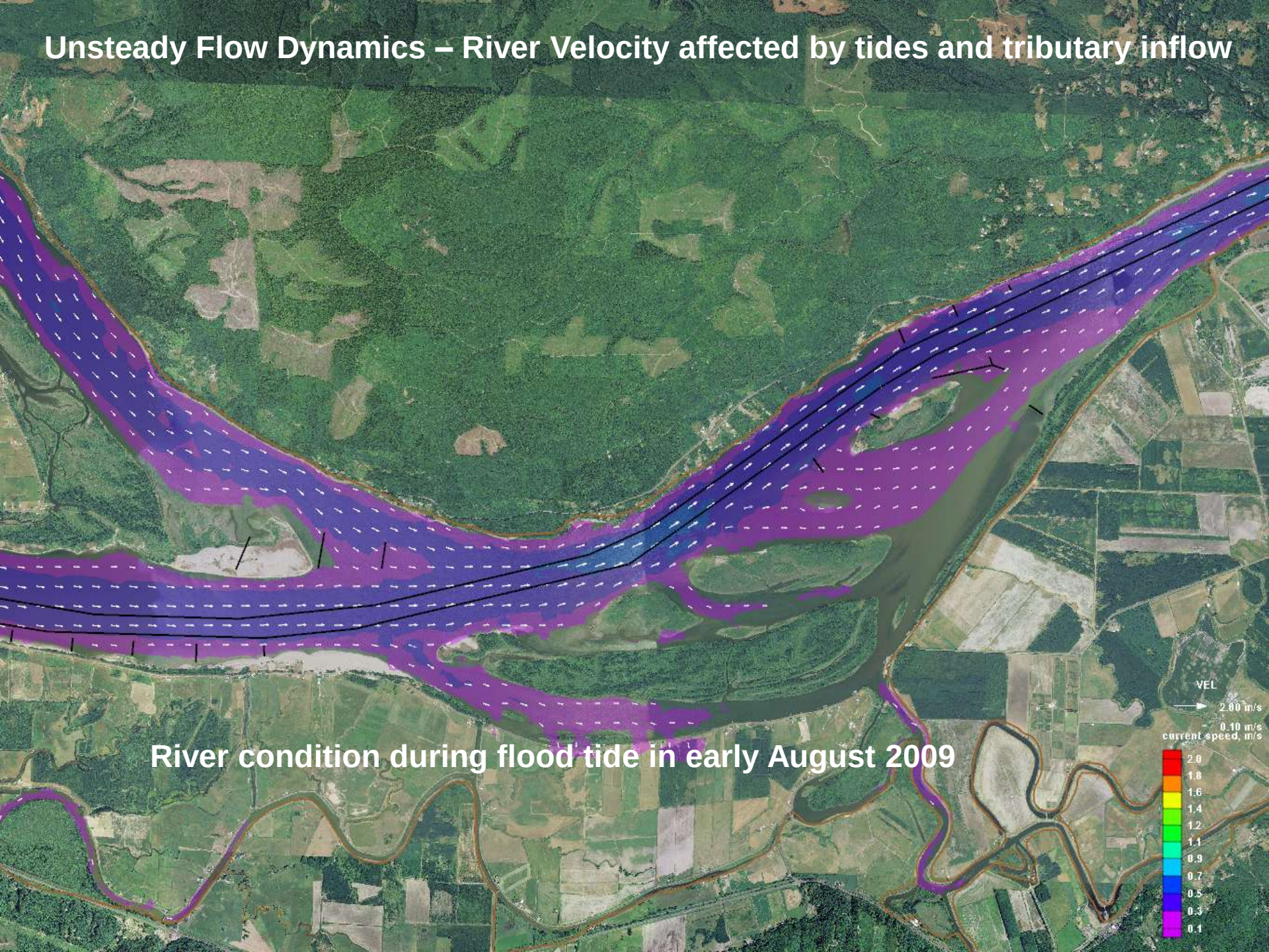
Unsteady Flow Dynamics – River Velocity affected by tides and tributary inflow

Shoaling areas can occur where River Velocity slows due to channel expansion or bifurcation



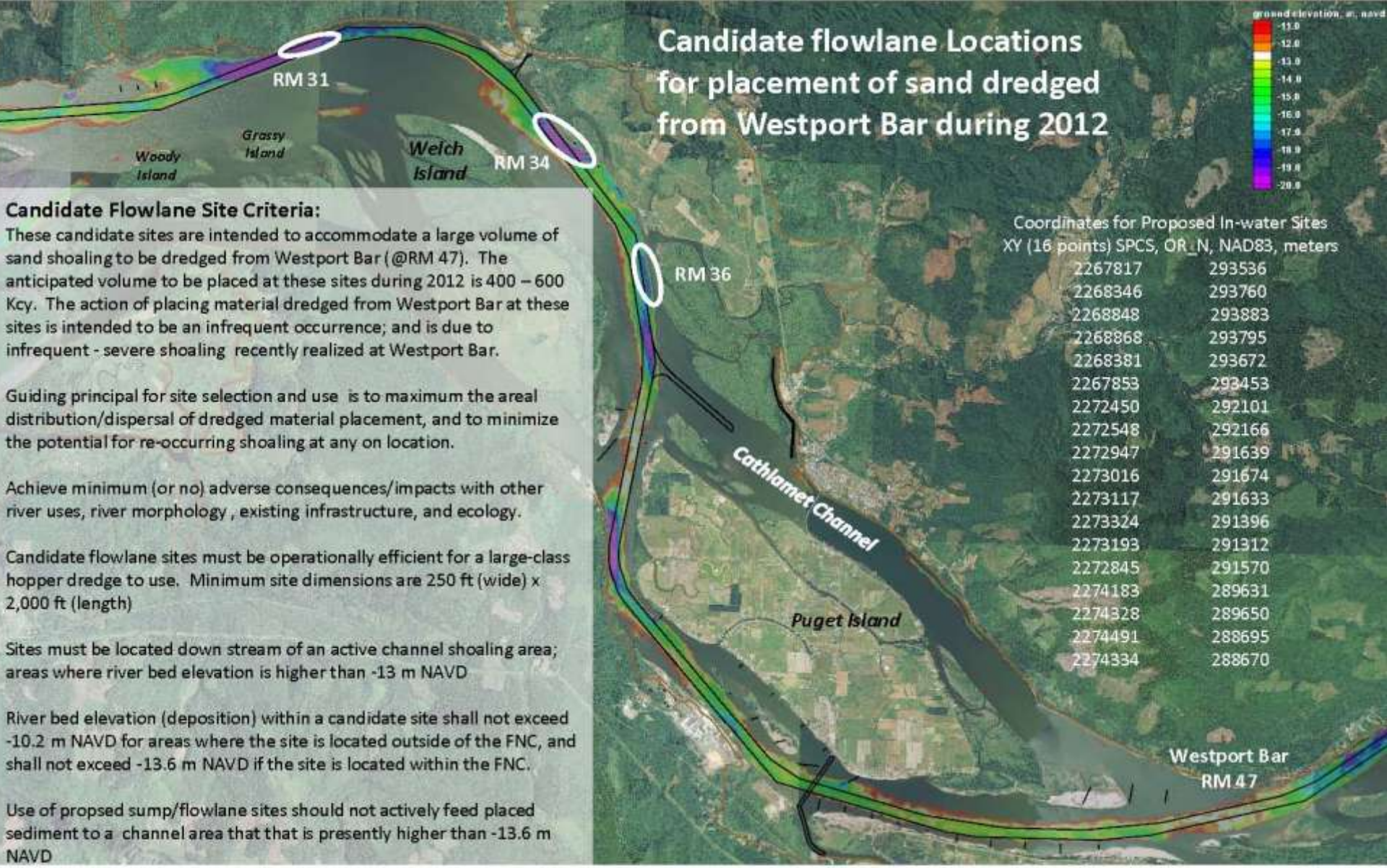
River condition during ebb tide in late April 2009

Unsteady Flow Dynamics – River Velocity affected by tides and tributary inflow



River condition during flood tide in early August 2009

Candidate flowlane Locations for placement of sand dredged from Westport Bar during 2012



Candidate Flowlane Site Criteria:

These candidate sites are intended to accommodate a large volume of sand shoaling to be dredged from Westport Bar (@RM 47). The anticipated volume to be placed at these sites during 2012 is 400 – 600 Kcy. The action of placing material dredged from Westport Bar at these sites is intended to be an infrequent occurrence; and is due to infrequent - severe shoaling recently realized at Westport Bar.

Guiding principal for site selection and use is to maximum the areal distribution/dispersal of dredged material placement, and to minimize the potential for re-occurring shoaling at any on location.

Achieve minimum (or no) adverse consequences/impacts with other river uses, river morphology , existing infrastructure, and ecology.

Candidate flowlane sites must be operationally efficient for a large-class hopper dredge to use. Minimum site dimensions are 250 ft (wide) x 2,000 ft (length)

Sites must be located down stream of an active channel shoaling area; areas where river bed elevation is higher than -13 m NAVD

River bed elevation (deposition) within a candidate site shall not exceed -10.2 m NAVD for areas where the site is located outside of the FNC, and shall not exceed -13.6 m NAVD if the site is located within the FNC.

Use of propsed sump/flowlane sites should not actively feed placed sediment to a channel area that that is presently higher than -13.6 m NAVD

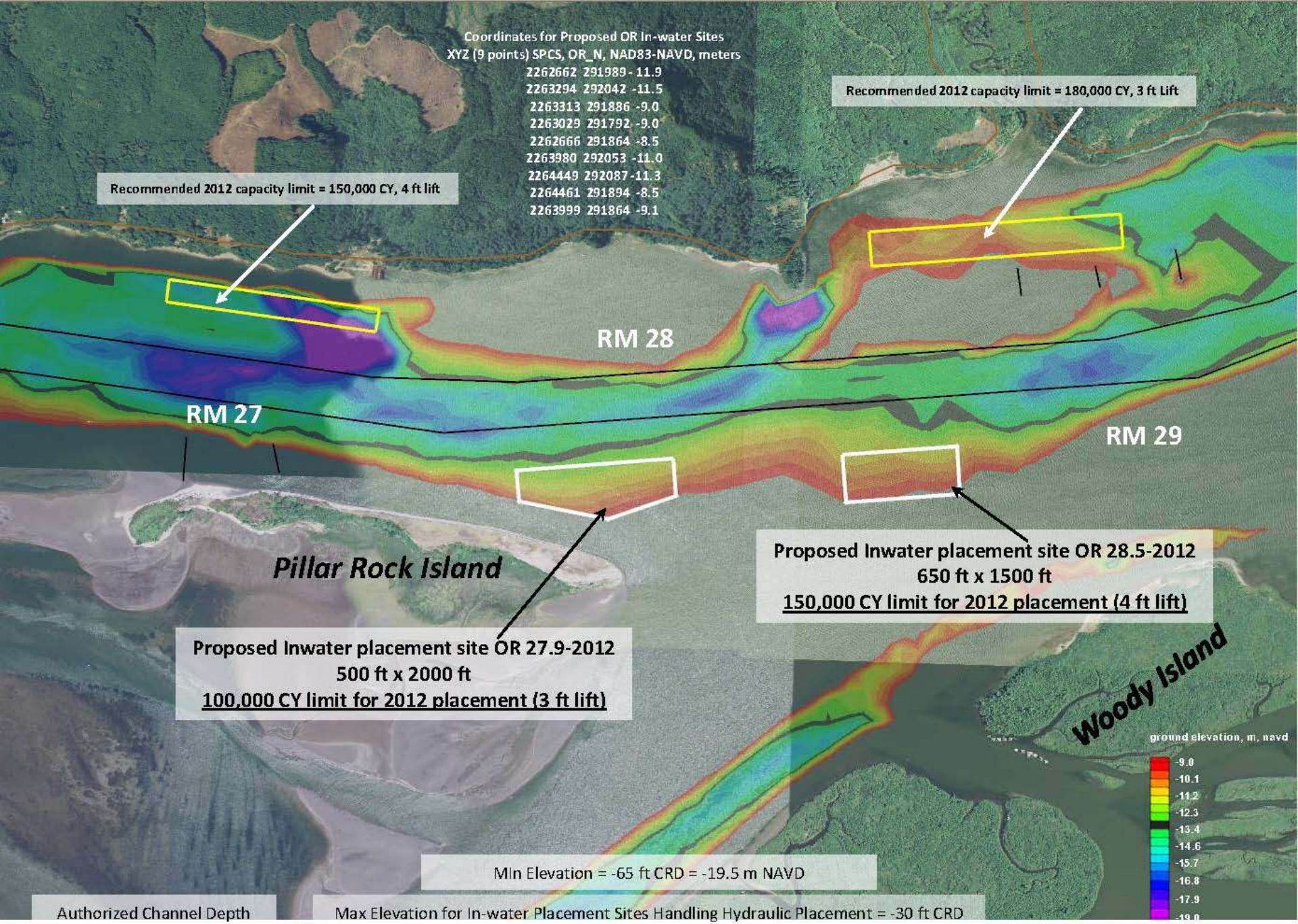
Coordinates for Proposed In-water Sites
XY (16 points) SPCS, OR_N, NAD83, meters

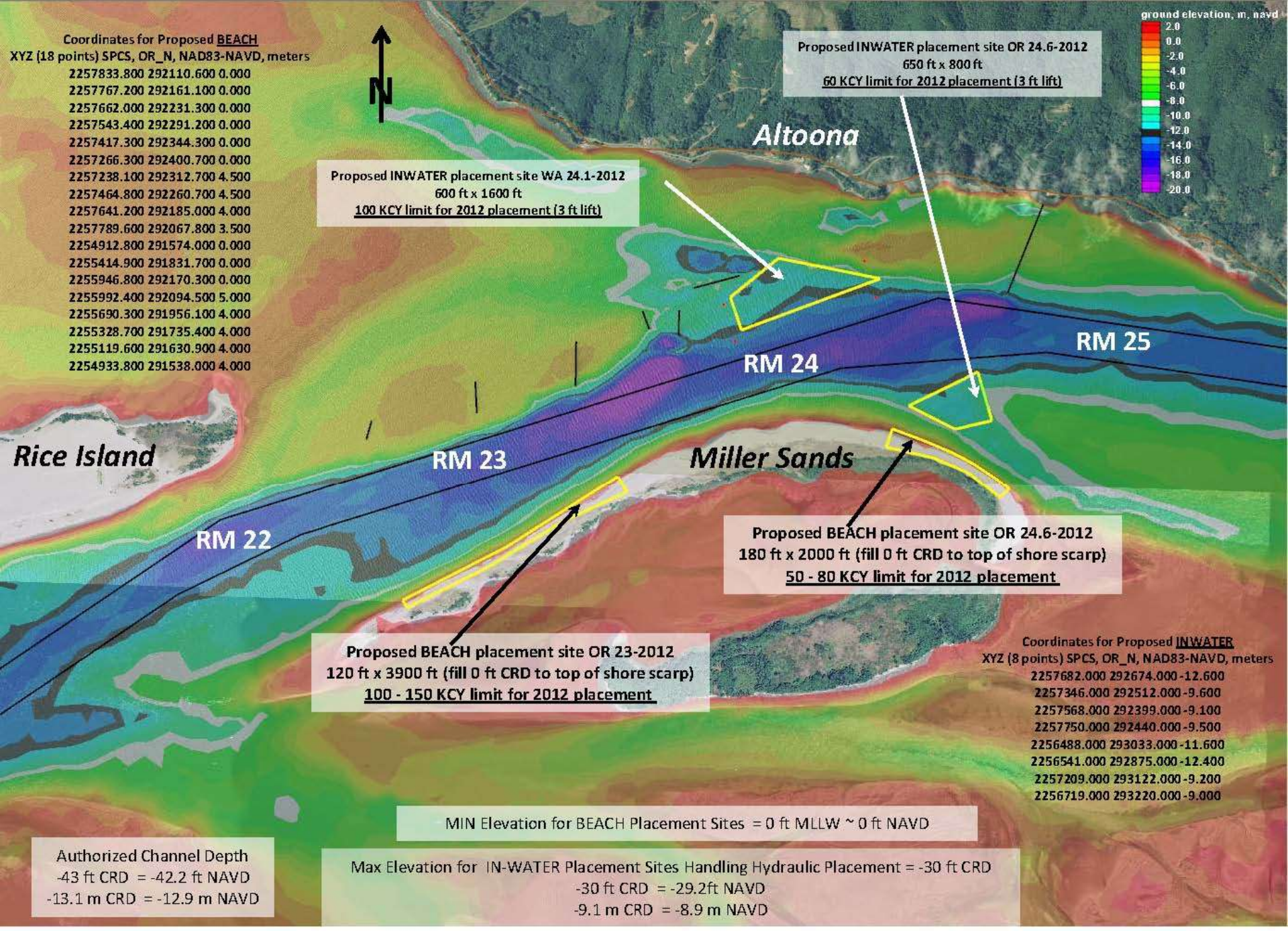
2267817	293536
2268346	293760
2268848	293883
2268868	293795
2268381	293672
2267853	293453
2272450	292101
2272548	292166
2272947	291639
2273016	291674
2273117	291633
2273324	291396
2273193	291312
2272845	291570
2274183	289631
2274328	289650
2274491	288695
2274334	288670

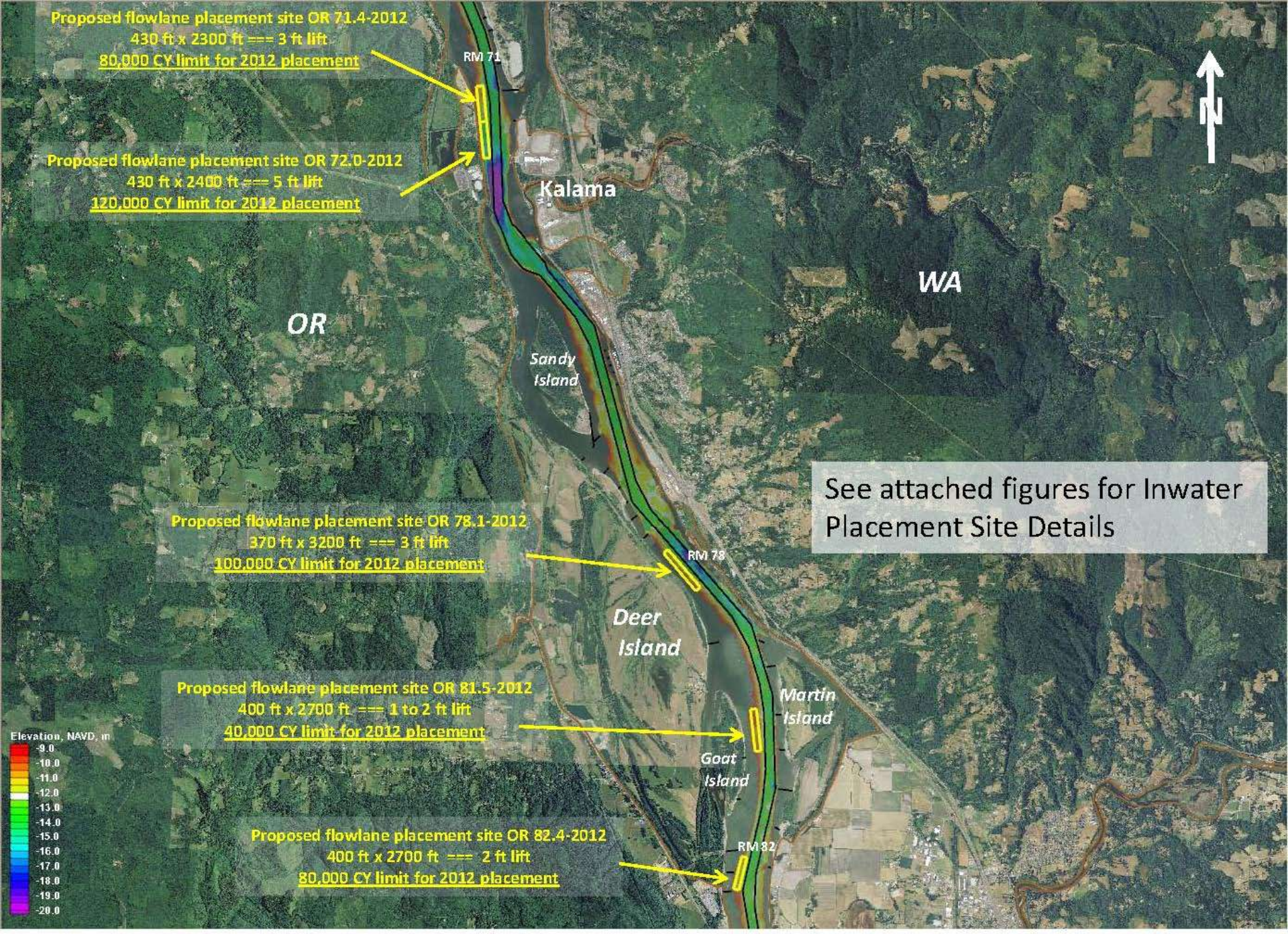
Upper Limit River Bed Elevation
For Inwater Placement Sites
(based on regulatory and operational restrictions)
-35 ft CRD = -33.5 ft NAVD
-10.7 m CRD = -10.2 m NAVD

Authorized Channel Depth
-43 ft CRD = -41.5 ft NAVD
-13.1 m CRD = -12.6 m NAVD

Upper Limit for Channel Areas
which May be Affected by
Proposed Inwater Placement Sites
-46 ft CRD = -44.5 ft NAVD
-14.0 m CRD = -13.6 m NAVD


Coordinates for Proposed OR In-water Sites
XYZ (9 points) SPCS, OR_N, NAD83-NAVD, meters
2262662 291989 -11.9
2263294 292042 -11.5
2263313 291886 -9.0
2263029 291792 -9.0
2262666 291864 -8.5
2263980 292053 -11.0
2264449 292087 -11.3
2264461 291894 -8.5
2263999 291864 -9.1
Recommended 2012 capacity limit = 150,000 CY, 4 ft lift
Recommended 2012 capacity limit = 180,000 CY, 3 ft Lift
RM 28
RM 27
RM 29
Pillar Rock Island
Proposed Inwater placement site OR 27.9-2012
500 ft x 2000 ft
100,000 CY limit for 2012 placement (3 ft lift)
Proposed Inwater placement site OR 28.5-2012
650 ft x 1500 ft
150,000 CY limit for 2012 placement (4 ft lift)
Woody Island
ground elevation, m, navd
-9.0
-10.1
-11.2
-12.3
-13.4
-14.6
-15.7
-16.8
-17.9
Min Elevation = -65 ft CRD = -19.5 m NAVD
Authorized Channel Depth
-43 ft CRD = -41.1 ft NAVD
-13.1 m CRD = -12.8 m NAVD
Max Elevation for In-water Placement Sites Handling Hydraulic Placement = -30 ft CRD
-30 ft CRD = -28.9 ft NAVD
-9.1 m CRD = -8.8 m NAVD

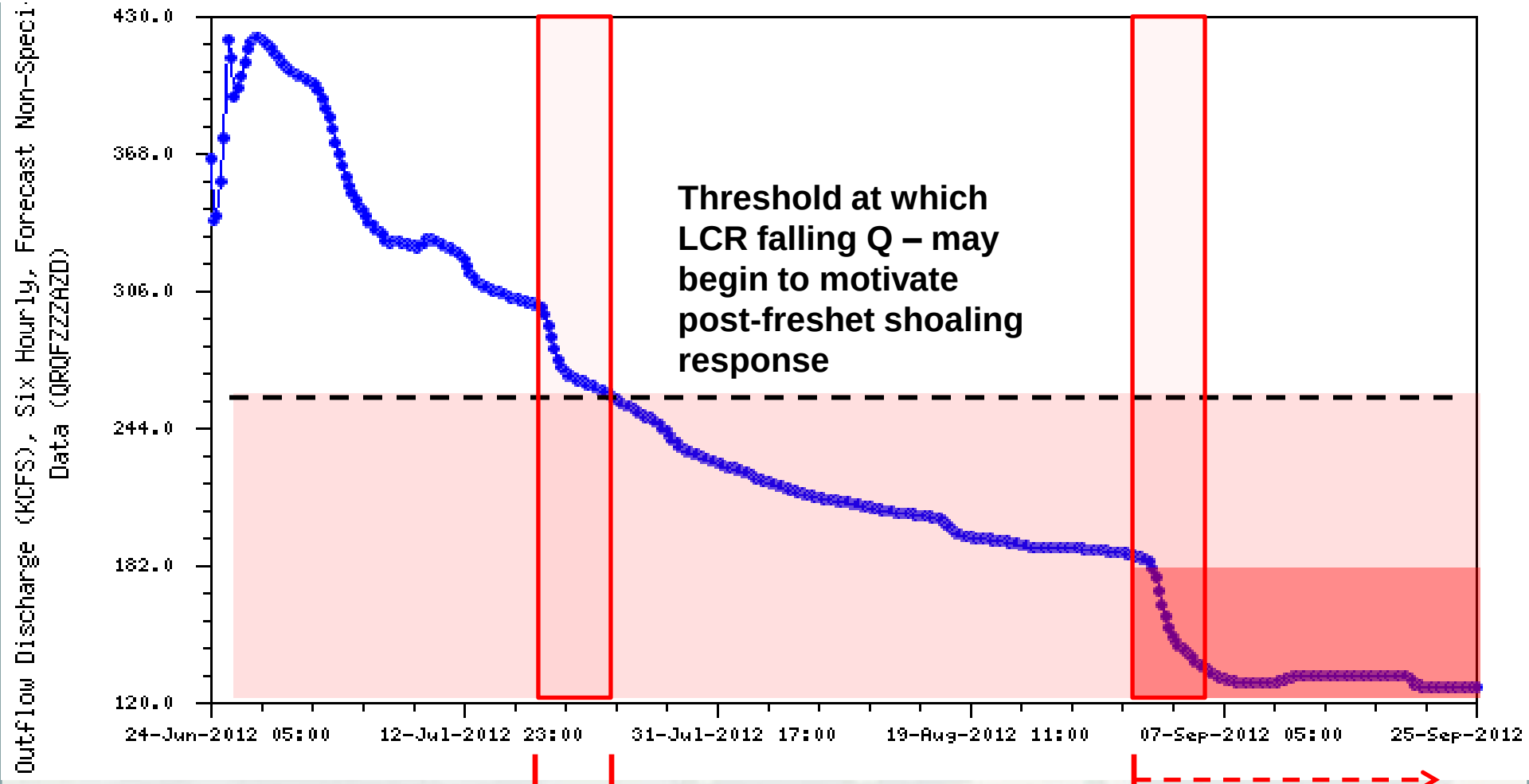

Coordinates for Proposed BEACH
XYZ (18 points) SPCS, OR_N, NAD83-NAVD, meters
2257833.800 292110.600 0.000
2257767.200 292161.100 0.000
2257662.000 292231.300 0.000
2257543.400 292291.200 0.000
2257417.300 292344.300 0.000
2257266.300 292400.700 0.000
2257238.100 292312.700 4.500
2257464.800 292260.700 4.500
2257641.200 292185.000 4.000
2257789.600 292067.800 3.500
2254912.800 291574.000 0.000
2255414.900 291831.700 0.000
2255946.800 292170.300 0.000
2255992.400 292094.500 5.000
2255690.300 291956.100 4.000
2255328.700 291735.400 4.000
2255119.600 291630.900 4.000
2254933.800 291538.000 4.000
N
Proposed INWATER placement site OR 24.6-2012
650 ft x 800 ft
60 KCY limit for 2012 placement (3 ft lift)
ground elevation, m, navd
2.0
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
-18.0
-20.0
Altoona
Proposed INWATER placement site WA 24.1-2012
600 ft x 1600 ft
100 KCY limit for 2012 placement (3 ft lift)
RM 25
RM 24
RM 23
RM 22
Rice Island
Miller Sands
Proposed BEACH placement site OR 24.6-2012
180 ft x 2000 ft (fill 0 ft CRD to top of shore scarp)
50 - 80 KCY limit for 2012 placement
Proposed BEACH placement site OR 23-2012
120 ft x 3900 ft (fill 0 ft CRD to top of shore scarp)
100 - 150 KCY limit for 2012 placement
Coordinates for Proposed INWATER
XYZ (8 points) SPCS, OR_N, NAD83-NAVD, meters
2257682.000 292674.000 -12.600
2257346.000 292512.000 -9.600
2257568.000 292399.000 -9.100
2257750.000 292440.000 -9.500
2256488.000 293033.000 -11.600
2256541.000 292875.000 -12.400
2257209.000 293122.000 -9.200
2256719.000 293220.000 -9.000
MIN Elevation for BEACH Placement Sites = 0 ft MLLW ~ 0 ft NAVD
Authorized Channel Depth
-43 ft CRD = -42.2 ft NAVD
-13.1 m CRD = -12.9 m NAVD
Max Elevation for IN-WATER Placement Sites Handling Hydraulic Placement = -30 ft CRD
-30 ft CRD = -29.2ft NAVD
-9.1 m CRD = -8.9 m NAVD


Proposed flowlane placement site OR 71.4-2012
430 ft x 2300 ft === 3 ft lift
80,000 CY limit for 2012 placement
RM 71
Proposed flowlane placement site OR 72.0-2012
430 ft x 2400 ft === 5 ft lift
120,000 CY limit for 2012 placement
Kalama
WA
OR
Sandy Island
See attached figures for Inwater Placement Site Details
Proposed flowlane placement site OR 78.1-2012
370 ft x 3200 ft === 3 ft lift
100,000 CY limit for 2012 placement
RM 79
Deer Island
Proposed flowlane placement site OR 81.5-2012
400 ft x 2700 ft === 1 to 2 ft lift
40,000 CY limit for 2012 placement
Martin Island
Goat Island
Elevation, NAVD, m
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
-15.0
-16.0
-17.0
-18.0
-19.0
-20.0
Proposed flowlane placement site OR 82.4-2012
400 ft x 2700 ft === 2 ft lift
80,000 CY limit for 2012 placement
RM 82

Forecast Discharge – Columbia River at Bonneville Dam, RM 147

25 JUNE – 25 SEP 2012

KCFS



POTENTIAL for Rate of Q-- reduction which may begin to motivate shoaling within select areas of LCR FNC

Likelihood for Rate of Q-- reduction which may begin to motivate shoaling within select areas of LCR FNC

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Opportunities to take action:

move/optimize sediment
Improve efficiencies

- Proactive approach to material placement, reducing re-handle costs.
- Future opportunities for placement to create shallow water habitat.

Accomplishments

- Effectively negotiated the use of RSM disposal sites into the annual hopper contract
- Placement into RSM sites at multiple work areas.
- Lower maintenance need/cost is expected to be seen in future years

Volume of Sediment Moved

- 1.1mcy in 2012 with contract Dredge STUYVESANT to date
- 0.8mcy DREDGE OREGON to date
- An additional 3mcy will be removed this year by the ESSAYONS, YAQUINA, STUYVESANT, and DREDGE OREGON

Lessons Learned

- Increased unit prices for material decrease overall dredging costs in the future
- AdH/PTM Modeling can be used to inform the selection of placement sites.
- Selecting disposal sites solely based on proximity to the work area is not always the most efficient practice when looking at a bigger picture.
- PTM to quantify volume of re-handle.