



GRAYS HARBOR NAVIGATION PROJECT Inlet morphology and O&M strategy: Past, present, and future



CIRP Technology-Transfer Workshop
1 Dec 2009

David R. Michalsen, Coastal Engineer
Hiram T. Arden, Project Manager
U.S. Army Corps of Engineers, Seattle District

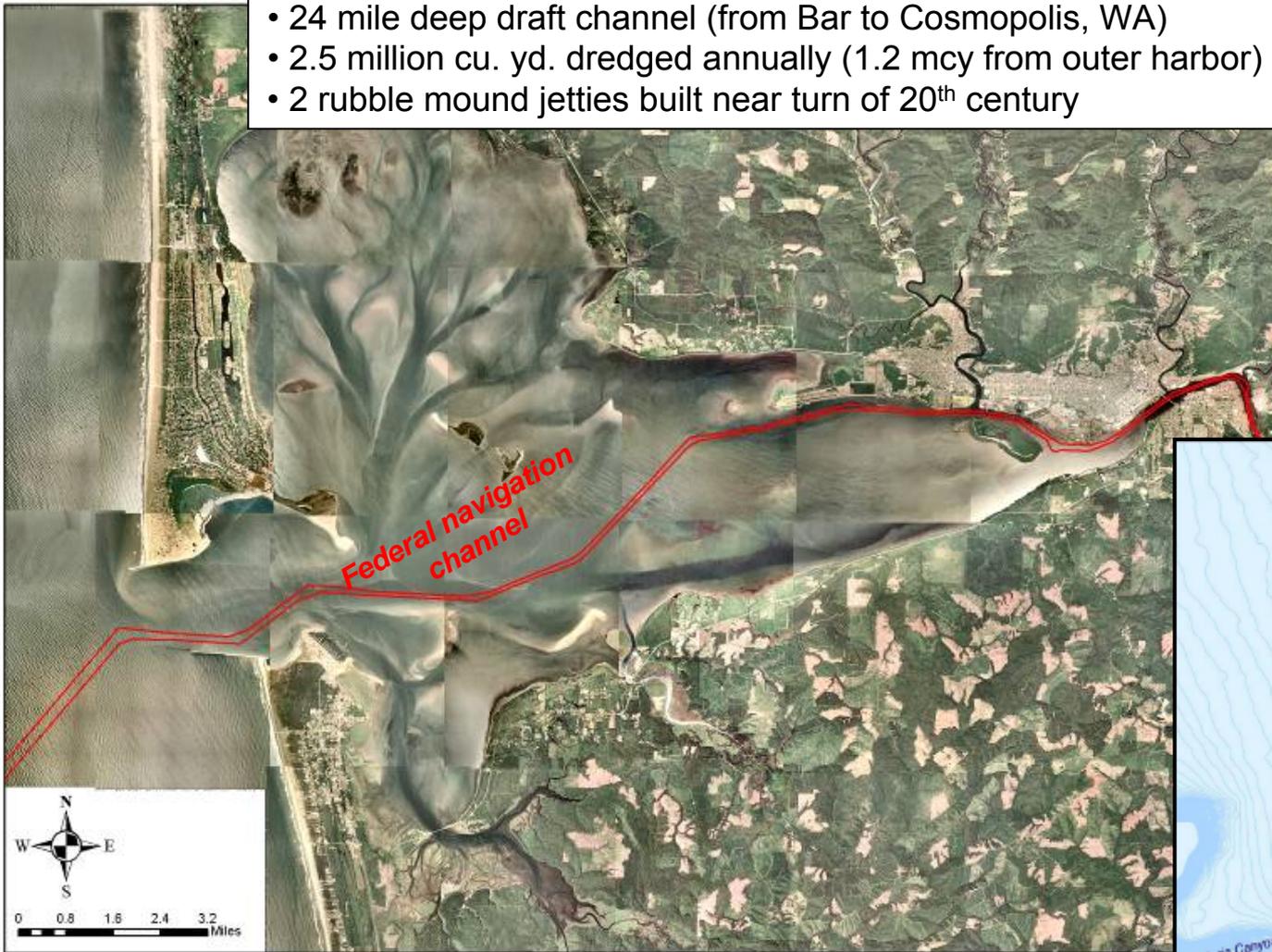




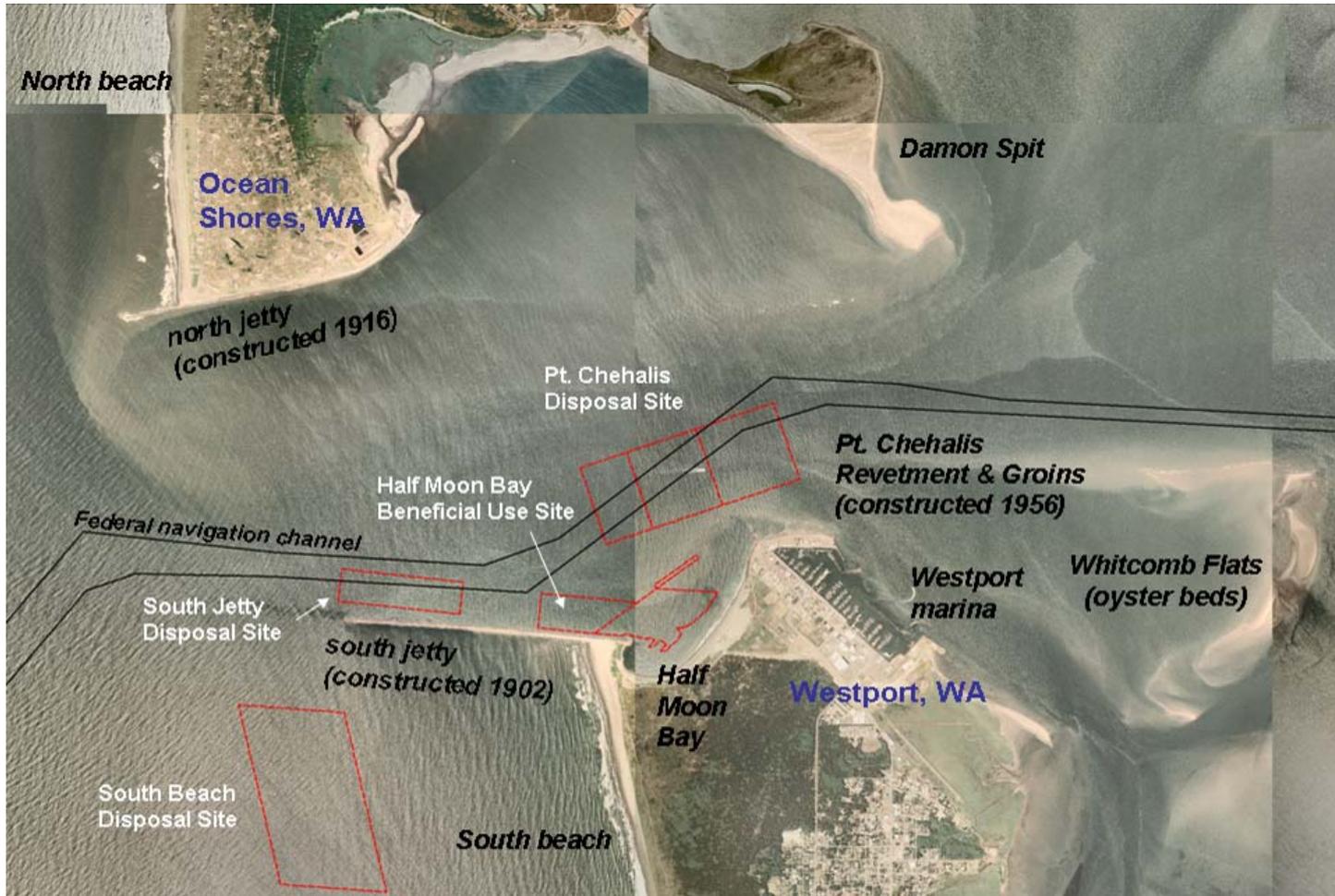
US Army Corps of Engineers



- 24 mile deep draft channel (from Bar to Cosmopolis, WA)
- 2.5 million cu. yd. dredged annually (1.2 mcy from outer harbor)
- 2 rubble mound jetties built near turn of 20th century



Grays Harbor Navigation Features



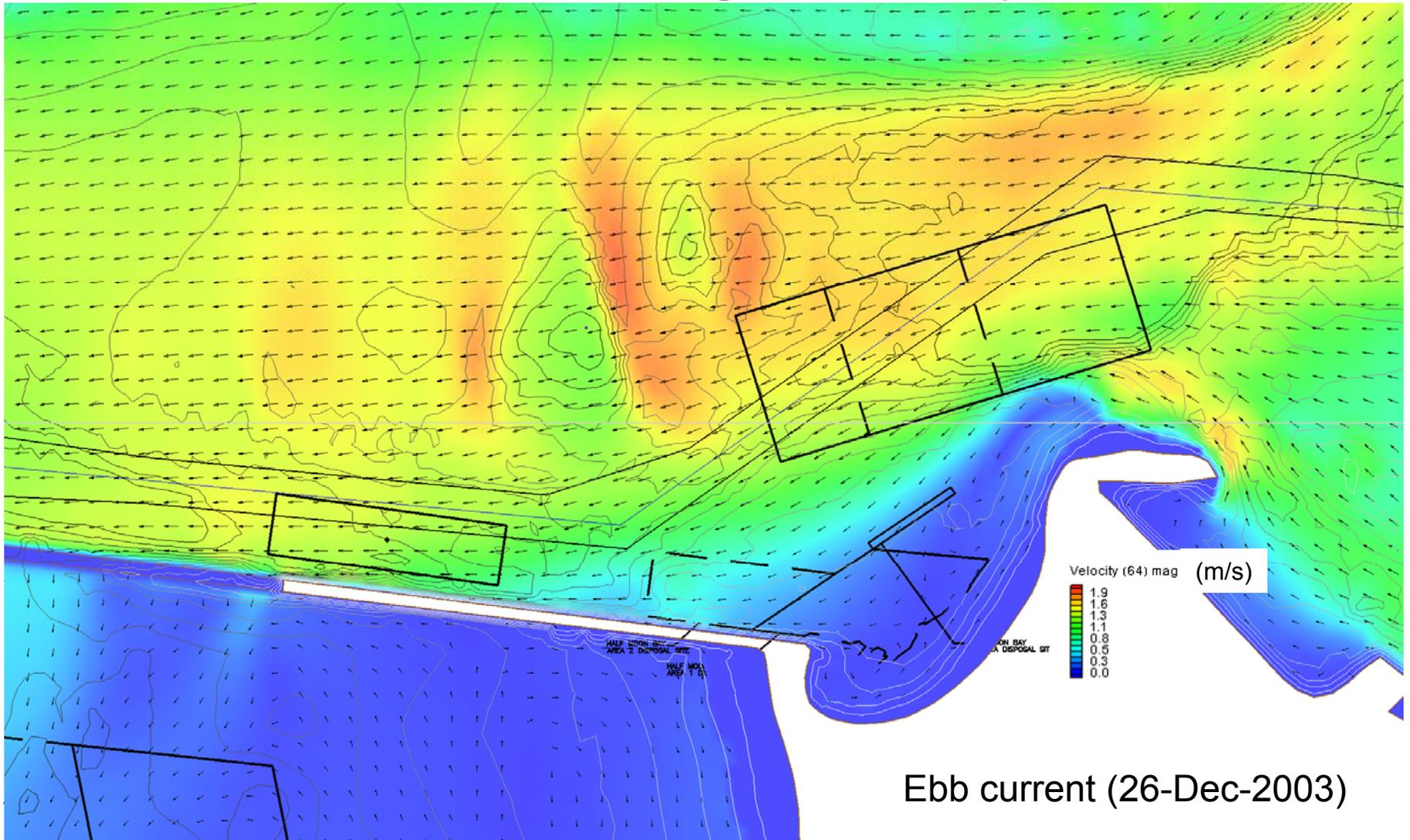


INLET DYNAMICS (SUMMARY)

- Ebb dominated currents near entrance reach of federal navigation channel dominates sed. transport
- Waves from west/northwest transports sediments from Half Moon Bay north along Pt. Chehalis
- Flood dominated currents on north side of entrance supplies bypassed sediment to Damon Spit
- As Damon Spit accretes southward, inlet throat becomes constricted and promotes scour
- ***Dredge material must be utilized effectively to limit undermining of structures while minimizing channel infilling***



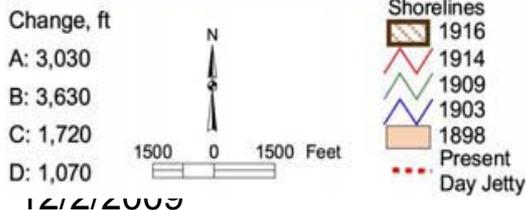
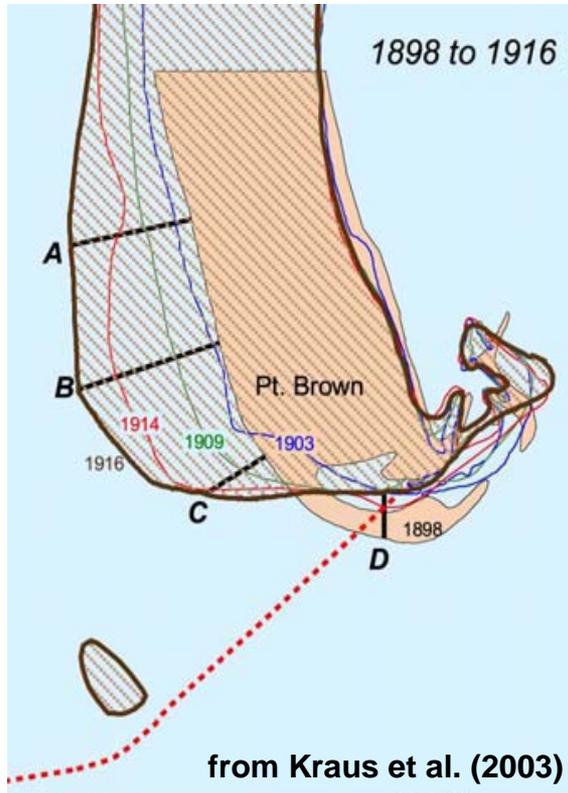
Current direction and magnitude for typical ebb flow



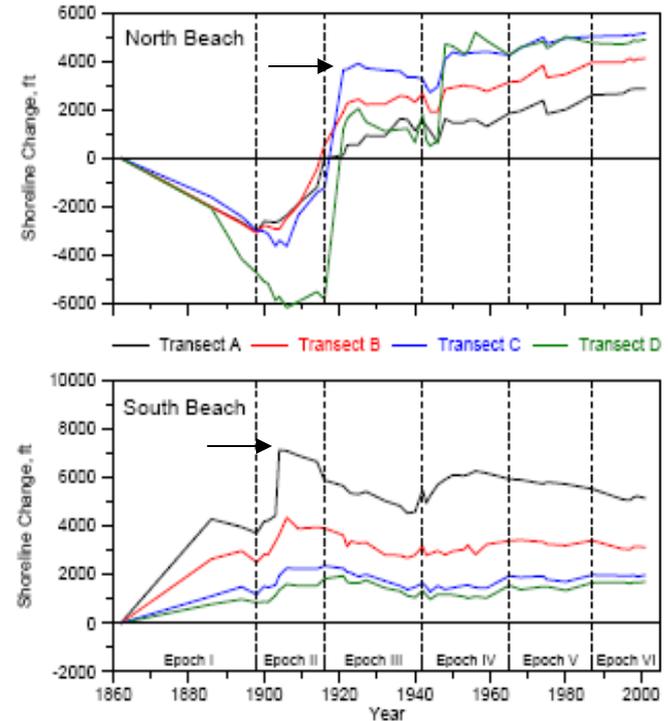
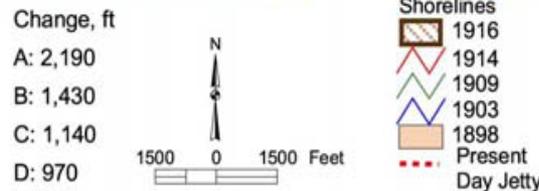
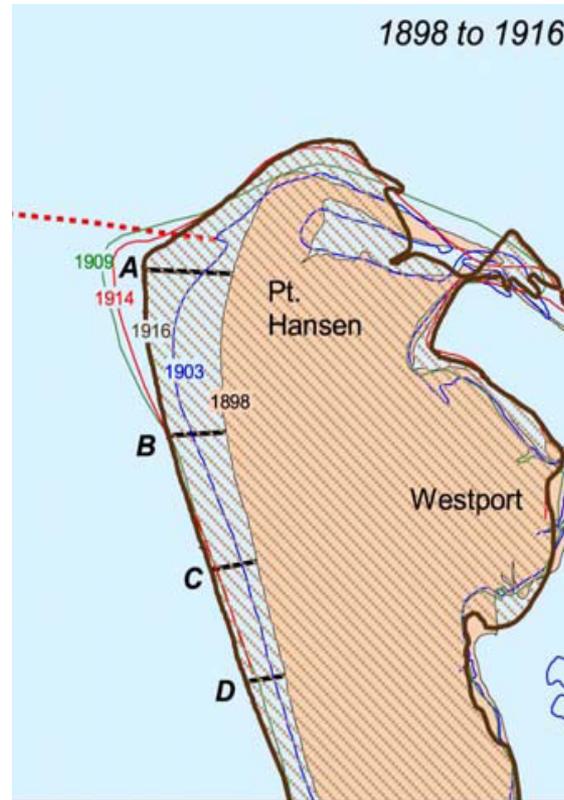
Ebb current (26-Dec-2003)

History - Morphologic changes (post jetty const.)

North Beach



South Beach



Accretion after jetty construction

North Beach \approx 3000 ft

South Beach \approx 7500 ft

EROSIONAL HOTSPOT

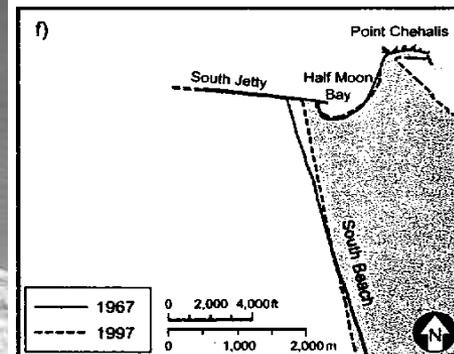
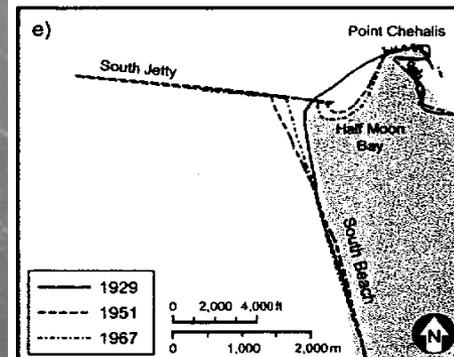
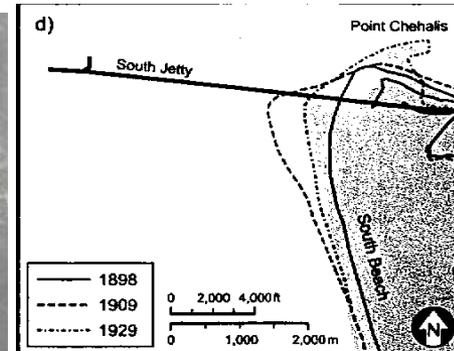
CRENULATE SHAPE BAY KNOWN AS HALF MOON BAY FORMS FOLLOWING FIRST MAJOR REHAB TO SOUTH JETTY

1949

PT. CHEHALIS

WESTPORT

ACCRETED LAND



from Buijsman et al. (2003)

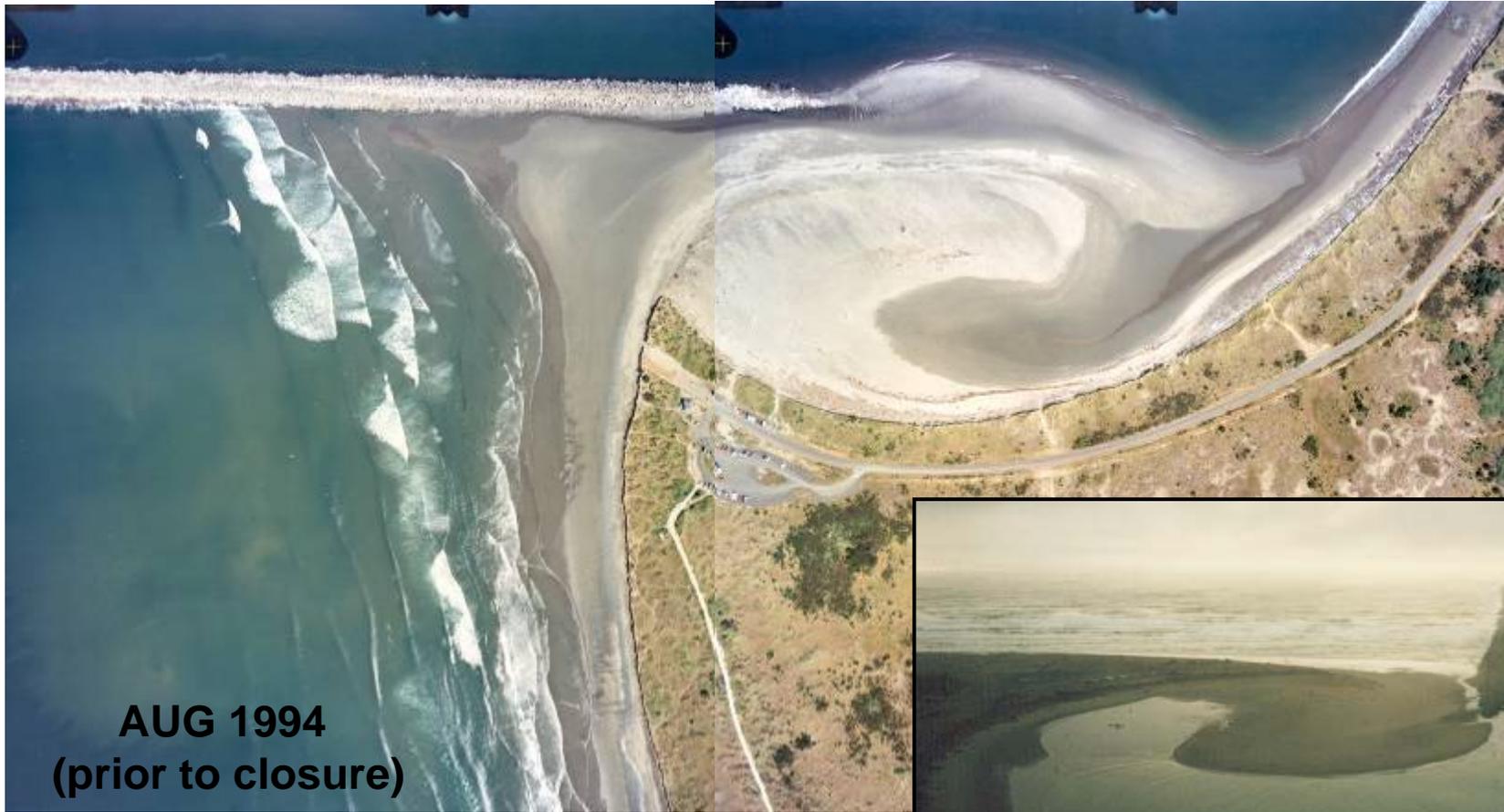


History – Breach occurs in December 1993





- Large flood tidal shoal forms in Half Moon Bay
- Scour channel adjacent to terminus of south jetty develops



**AUG 1994
(prior to closure)**





US Army Corps of Engineers



**SEP – DEC 1994 - BREACH FILLED
(600,000 CY SAND)**





US Army Corps of Engineers



TM

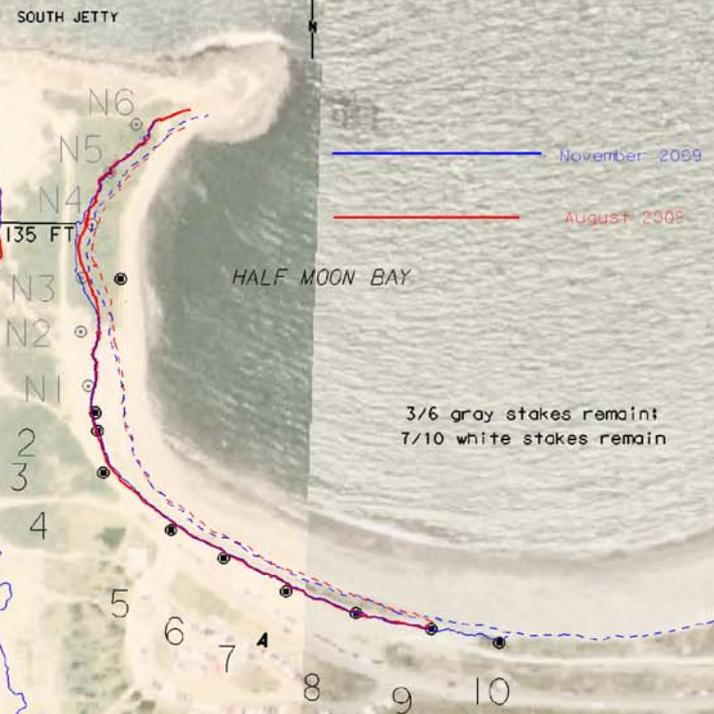
Photo AUG 2007

NOTES:

1. HORIZONTAL CONTROL IS BASED ON WASHINGTON COORDINATE SYSTEM; SOUTH ZONE; NAD 83/91.
2. VERTICAL CONTROL IS BASED ON MEAN LOWER LOW WATER (MLLW).
3. SOLID LINE REPRESENTS TOP OF SCARP
4. DASHED LINE REPRESENTS TOE OF SCARP

Now rapid erosion in NW corner of HMB

1. Approaching classic equilibrium shape
2. As of NOV 2009 spit width is < 150 ft
3. Investigating direct pump ashore to nourish in interim in summer FY10
4. Extending south jetty eastward



100' 50' 0' 100' 200'
CHECKED

REDUCED TO 60% OF FULL SIZE

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS

FY 09 BREACH FILL MONITORING
ELEVATION CHANGE FROM JAN 2005 TO APR 2009

WESTPORT	WASHINGTON
D	2 JUL 09
FILE NO. E-5-1-XXX	SCALE N.E.S.

DESIGN FILE: \afs\pccostair\breach_mon\sect_mon\trng\2009\11_12_2009\HMB_MV09_scorbk-ce_P91n.t

DATE AND TIME PLOTTED: 03-NOV-2009 16:31



LONG TERM MANAGEMENT STUDY (LTMS)

Currently evaluating 4 potential alternatives:

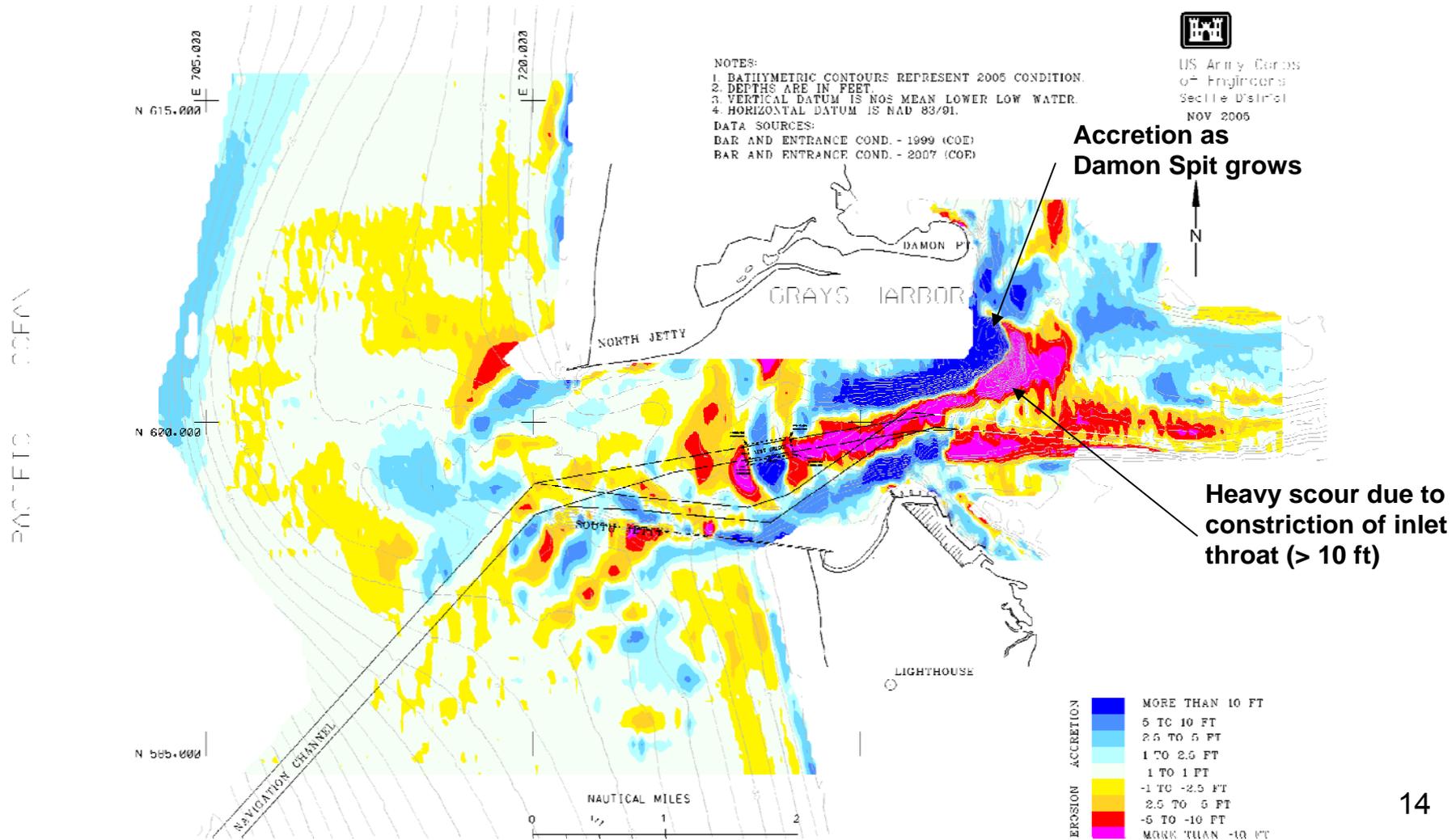
1. Perform local beach nourishment (up to 40,000 cy annually) when trigger reached
2. Extend south jetty root 500' east and perform local beach nourishment when trigger reached
3. Extend south jetty to Pt. Chehalis revetment
4. Allow spit to breach and immediately close



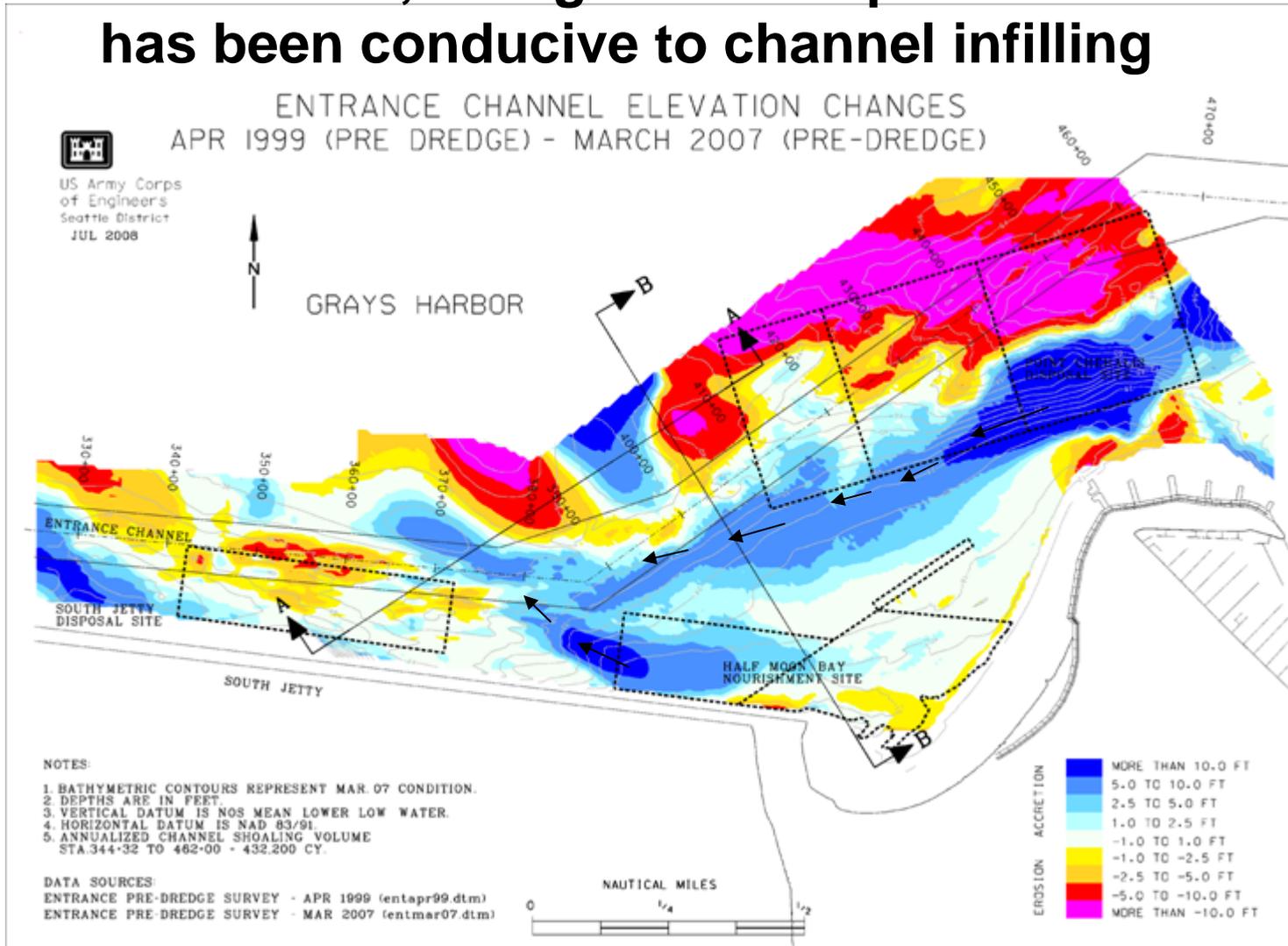
DREDGE MATERIAL MANAGEMENT (current operating norms)

- 3 estuarine disposal sites / 1 marine site
- Placement of inner harbor riverine sediments (silts/sands)
PCDS and SJDS
- Marine sands at HMBBUS and SBDS
- Typically dredges ESSAYONS and YAQUINA perform annual O&M dredging at the entrance and bar channel reaches (April-May)
- Clamshell dredge and bottom dump scow perform inner harbor work

System morphology (1999 to 2008)



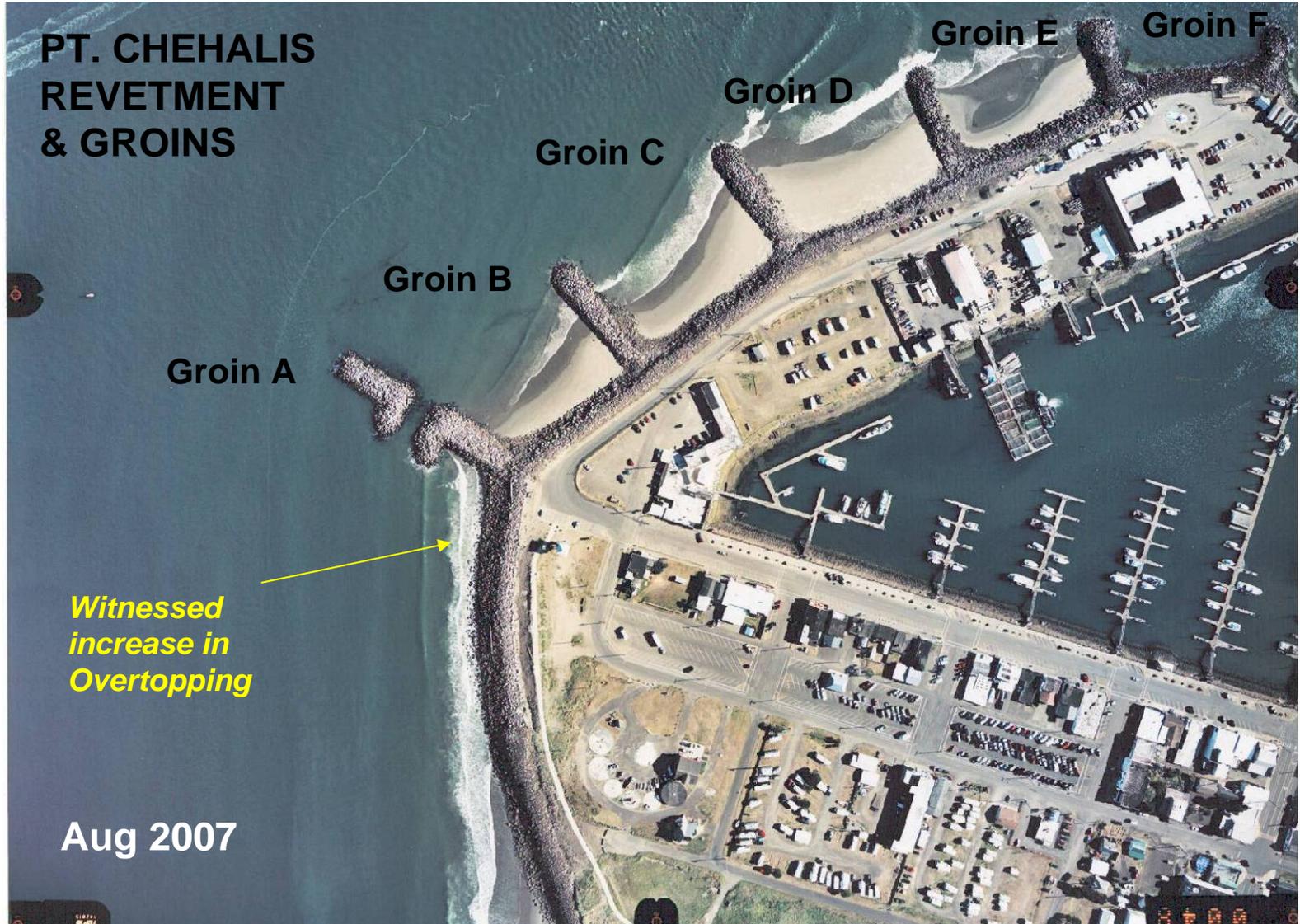
Since 1999, dredge material placement has been conducive to channel infilling





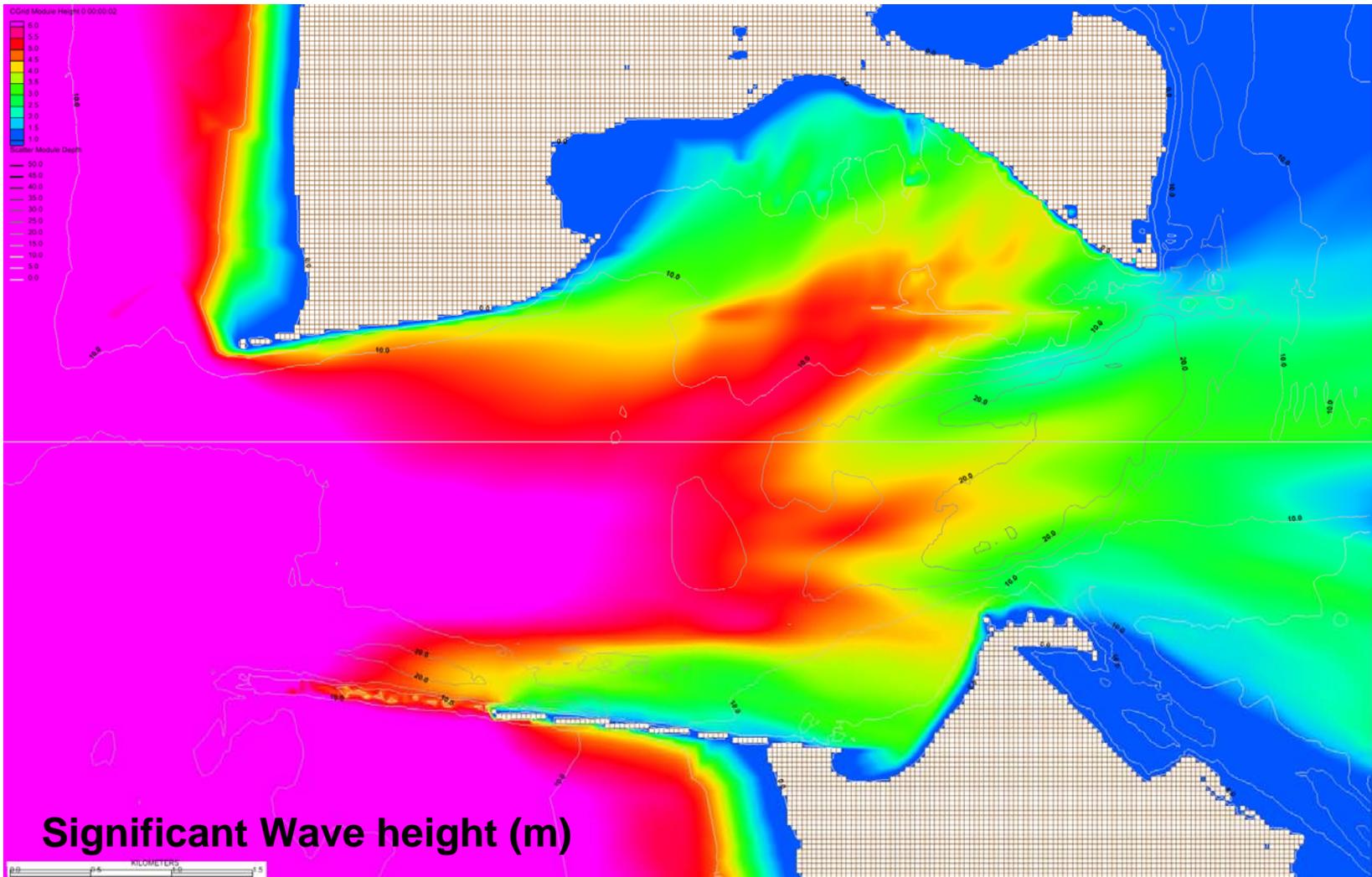
Wave climate challenges

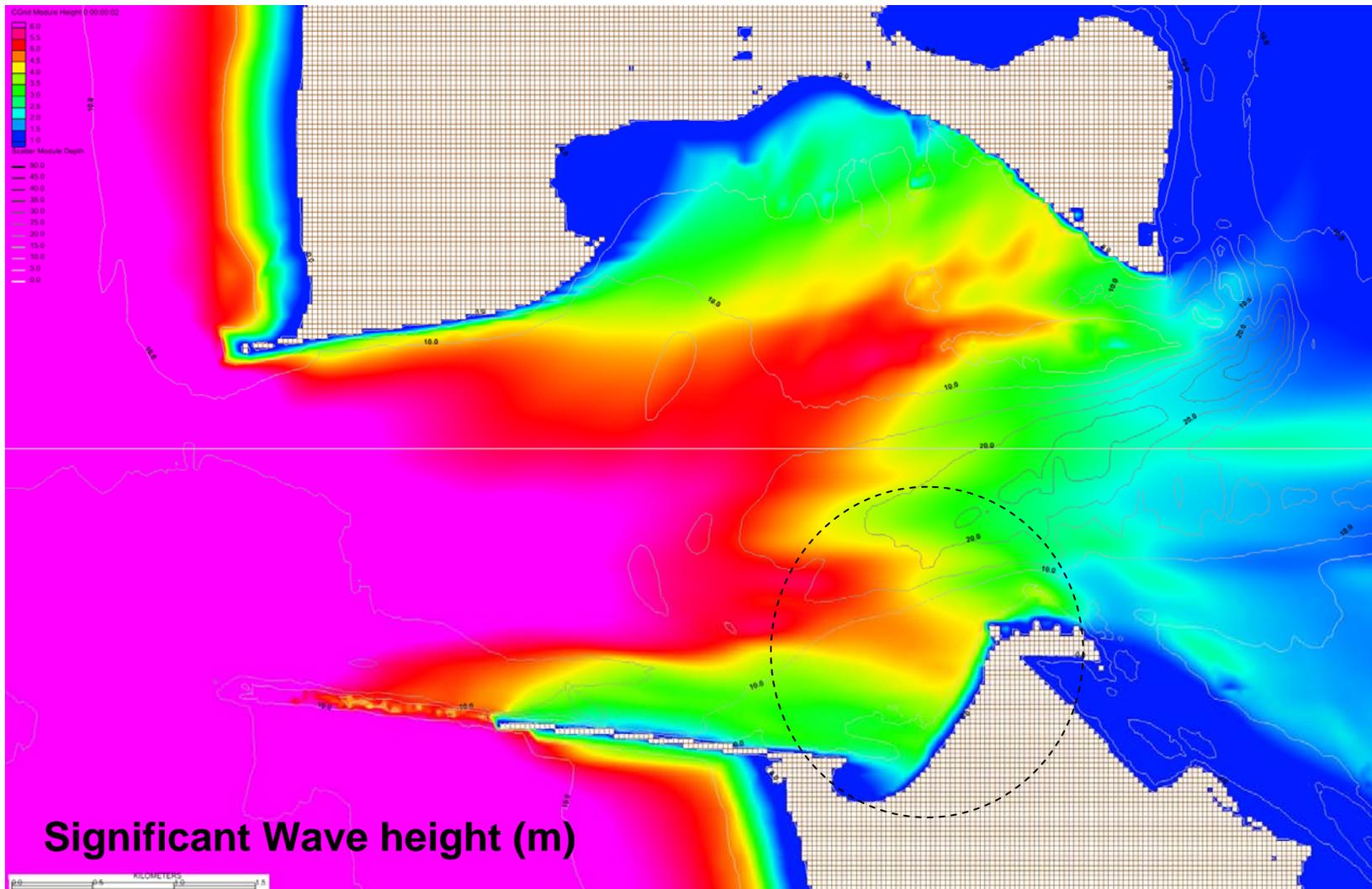
- As Damon Spit accretes sediment inlet throat constricts an channel thalweg scours downstream
- Wave energy is refracted toward Pt. Chehalis revetment
- Wave overtopping rates over revetment have increased significantly over last decade
- Need to ensure dredge material placement does not amplify waves near structure



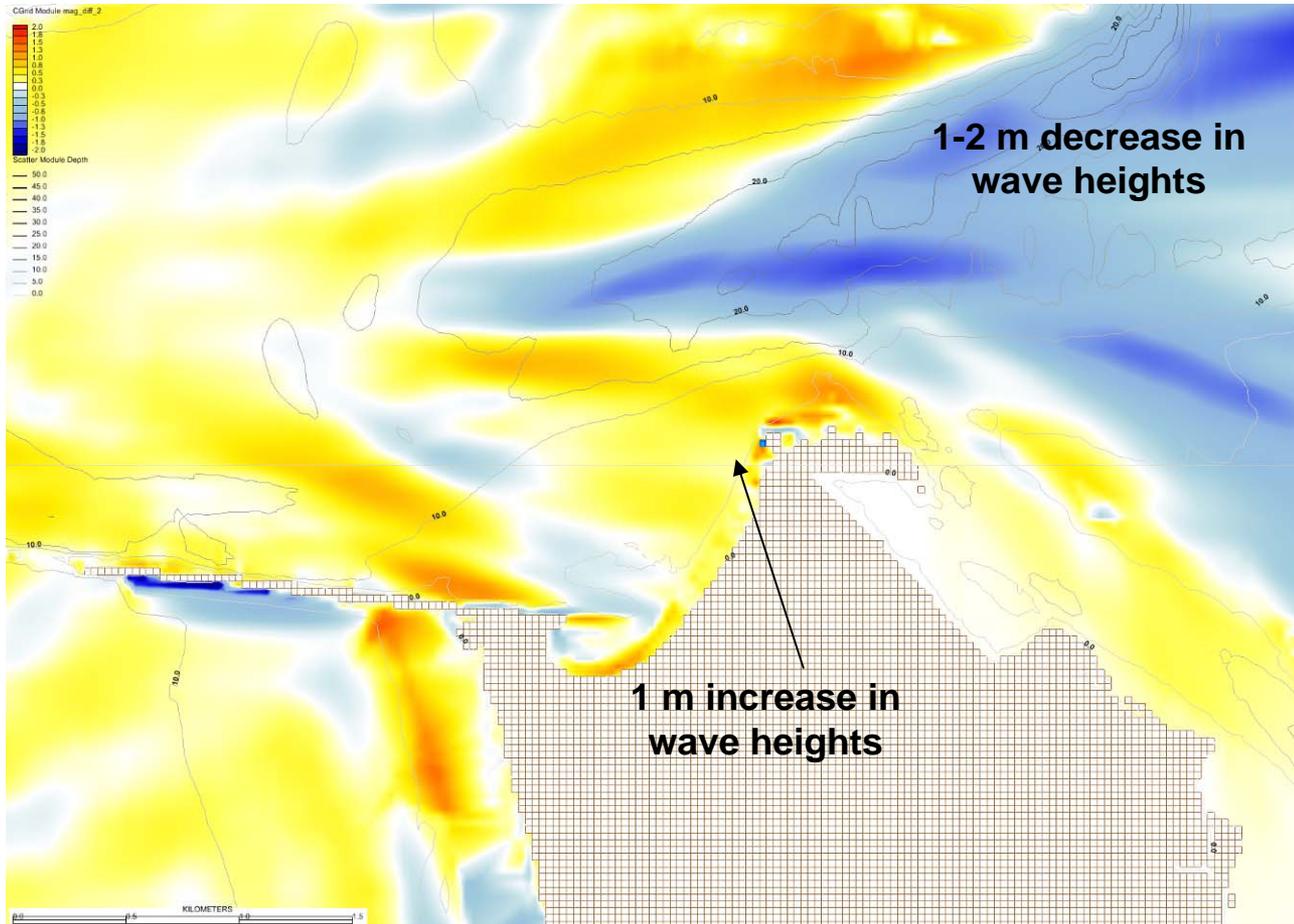


US Army Corps of Engineers



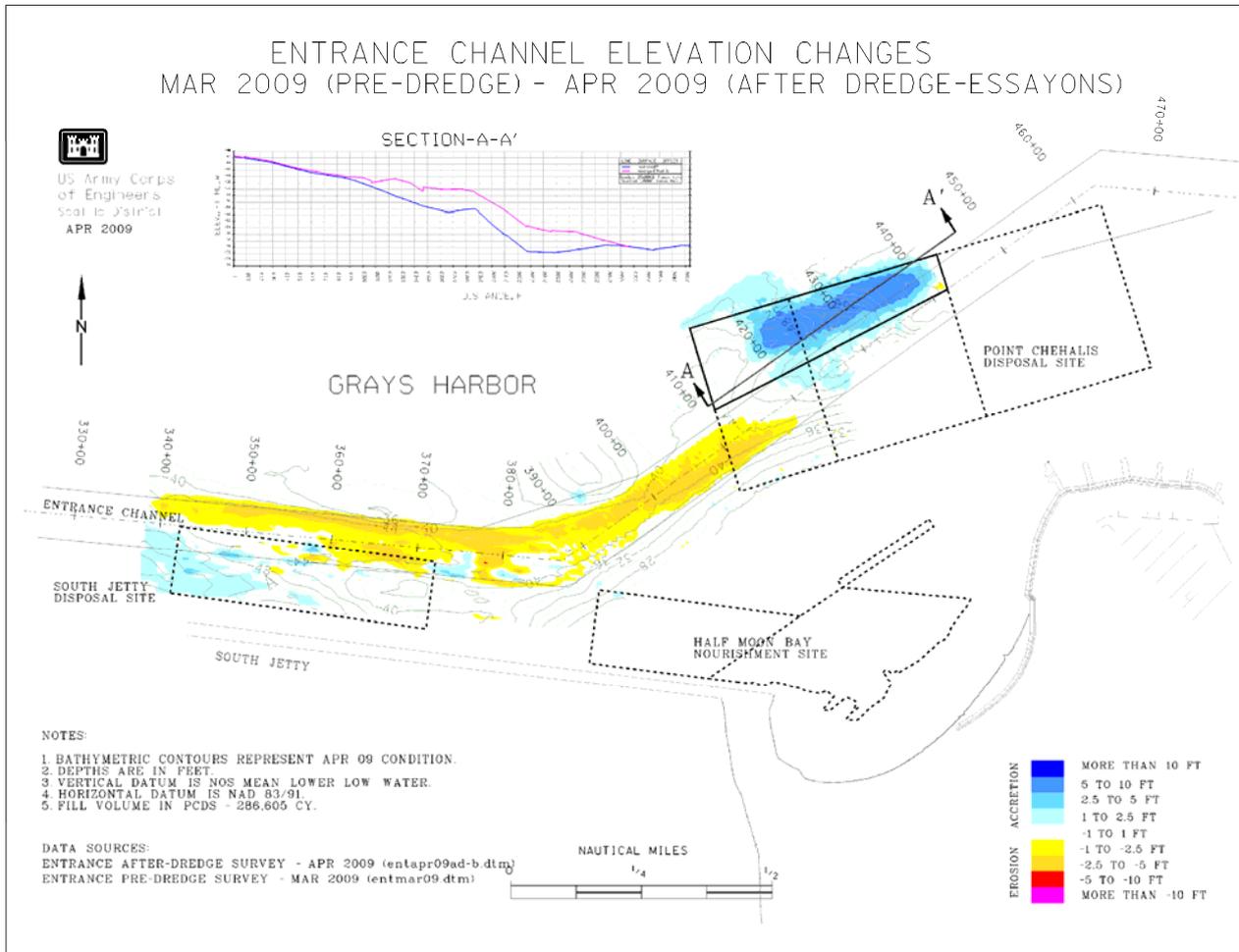


Difference in wave height magnitude due to thalweg progression since 1999





Presently exploring alternative management strategies



1. Place material north of navigation channel in thalweg to limit channel infilling and extreme wave refraction (FY09)

2. Entrance channel re-alignment (currently investigating)



On-going work

- Joint FY09 Study with ERDC-CHL Dredge Operation and Environment Research (DOER) Program / Coastal Inlets Research Program (CIRP)
 - Dredge material fate and transport placed at PCDS, SJDS, and HMBBUS
 - Study goals
 - to optimize placement quantities and locations to minimize entrance channel maintenance dredging and maintain NAV structures
 - Determine how channel re-alignment would impact available maintenance dredging quantities



FY10 Outlook

1. Determine future of
 - Entrance Channel Re-alignment
 - Modifications to Disposal Site Management
2. Initiate Channel improvement general investigation study for inner harbor channel reaches (Port of Grays Harbor is cost sharing partner)
3. Select preferred alternative for long-term maintenance to South Beach / Half Moon Bay



Questions?