Northwestern and South Pacific Division Nearshore Placement Literature Review

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US Army Corps of Engineers
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Discussion Points

- Dredged material placement in context of the Clean Water Act vs. Ocean Dumping Act (MPRSA) – beneficial use
- Dredge equipment limitations
- Defining the depth of closure and the active sediment transport zone
- Defining the temporal scales of sediment mobility/transport
- Case studies on the West Coast
- Recommendations for Future Work

Ocean Dumping Act **(33 U.S.C. 27)**

The Congress declares that it is the policy of the United States to regulate the dumping of all types of materials into *ocean waters*[1] and to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment ecological systems, or economic potentialities

[1] MPRSA Section 103: Defined as the three-mile territorial sea and all ocean waters seaward of the territorial sea.

Clean Water Act (Section 404)

Although the scope of waters covered by CWA Section 404 and MPRSA Section 103 overlap within the three-mile territorial sea, the regulations provide that where the placement of the dredged material is for the primary purpose of fill (e.g., beach nourishment, island creation, construction of underwater berms), the activity will be regulated under CWA Section 404 (40 C.F.R. 230.2(b); 33 C.F.R. 336.0(b)).

West Coast GOVT. Hopper Dredges

ESSAYONS

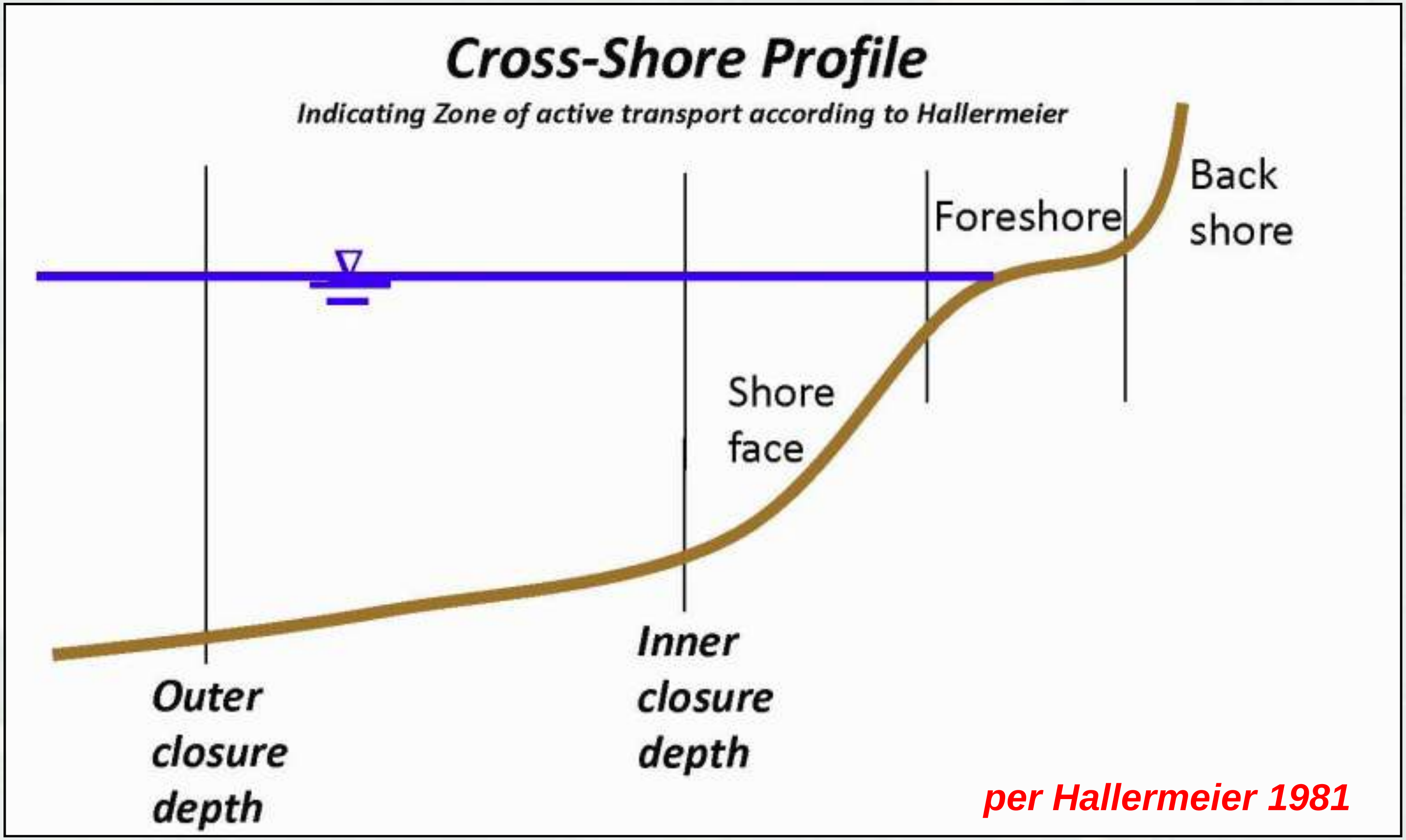
CAPACITY: 6,000 CY
LOADED DRAFT: 32'
PRODUCTION[1]: 30-50 KCY/DAY

YAQUINA

CAPACITY: 1,000 CY
LOADED DRAFT: 16'
PRODUCTION[1]: 8-12 KCY/DAY

[1] Observed production at Grays Harbor Bar/Entrance Reaches

Depth of Closure



Incipient sediment motion

The wave induced bed shear stress (τ_b) is related to the near bed orbital velocity amplitude (U_w) under a wave, and is computed as:

$$U_w = \frac{gHkT}{4\pi cos\, h\langle kd \rangle}$$

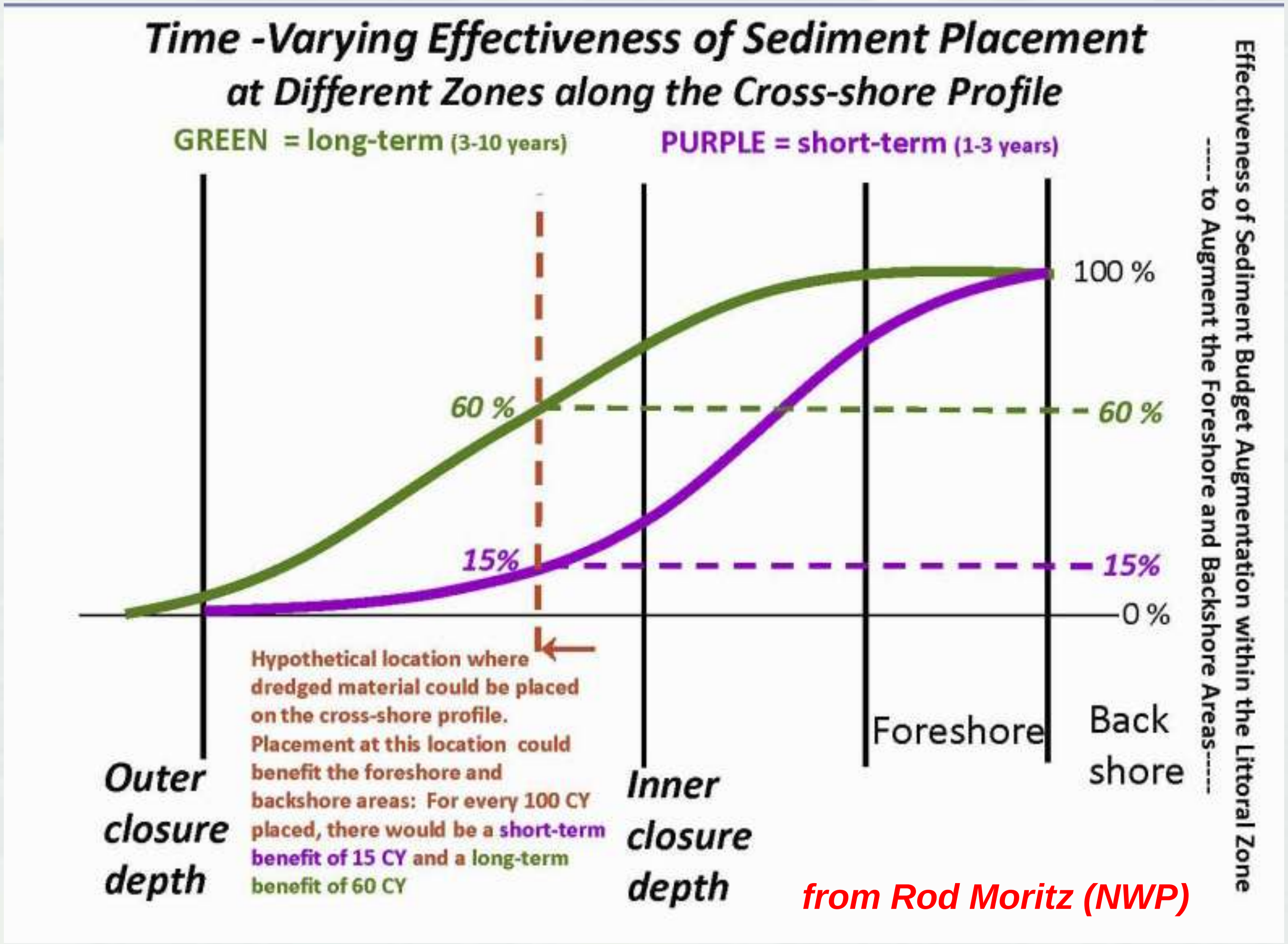
where g is gravitational acceleration, H is wave height, T is wave period, d is water depth. And k is wavenumber ($k = 2\pi/L$) where L is the wavelength. The wave induced bed shear stress is then computed as:

$$\tau_b = \frac{1}{2}\rho_w f_w {U_w}^2$$

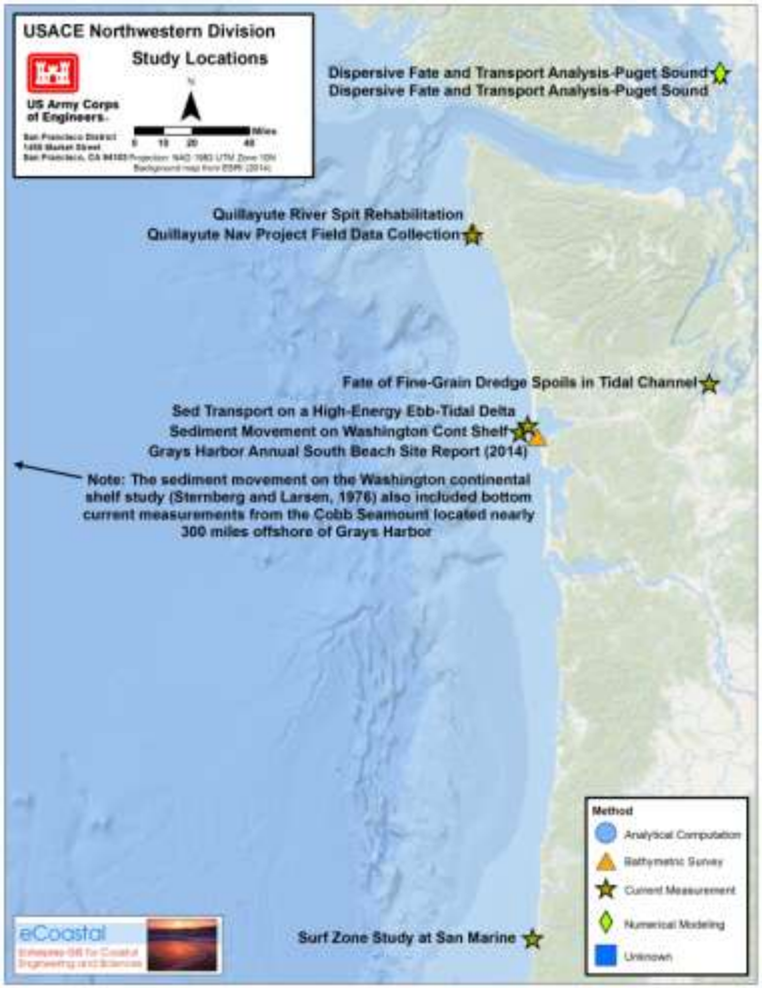
Sediment particle motion is initiated when the bed sheer stress exceeds the critical shear stress on the seabed. The critical shear stress for incipient motion is expressed as:

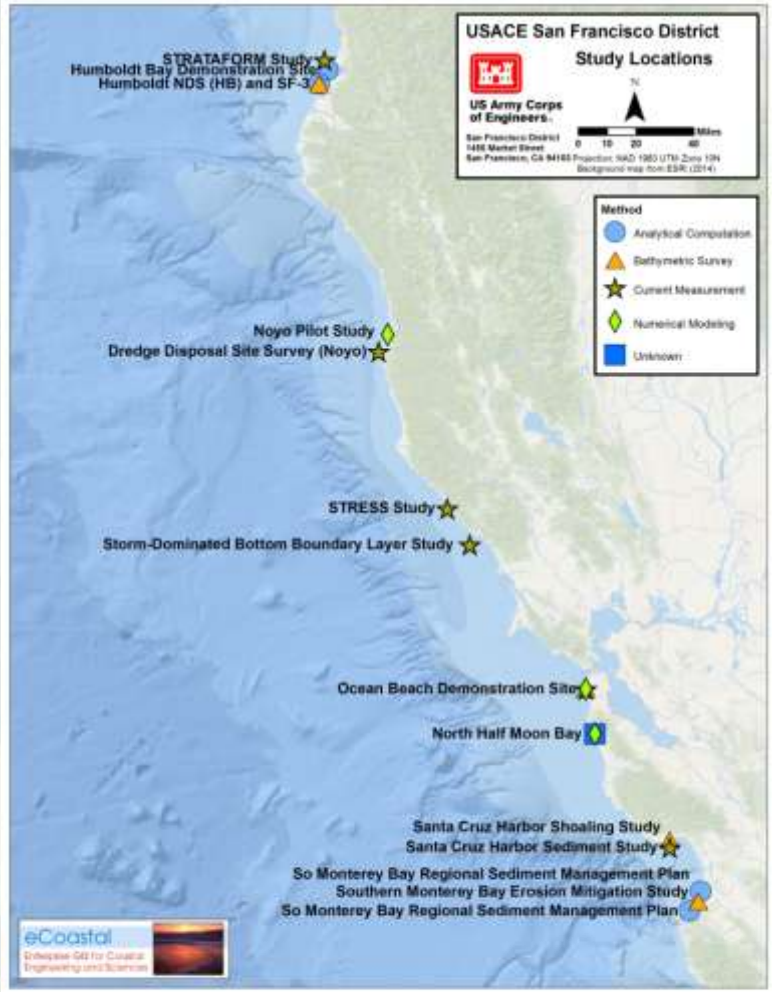
$$\tau_c = (\rho_s - \rho_w) g d_{50} \theta_c$$

Temporal scale of sediment mobility/transport

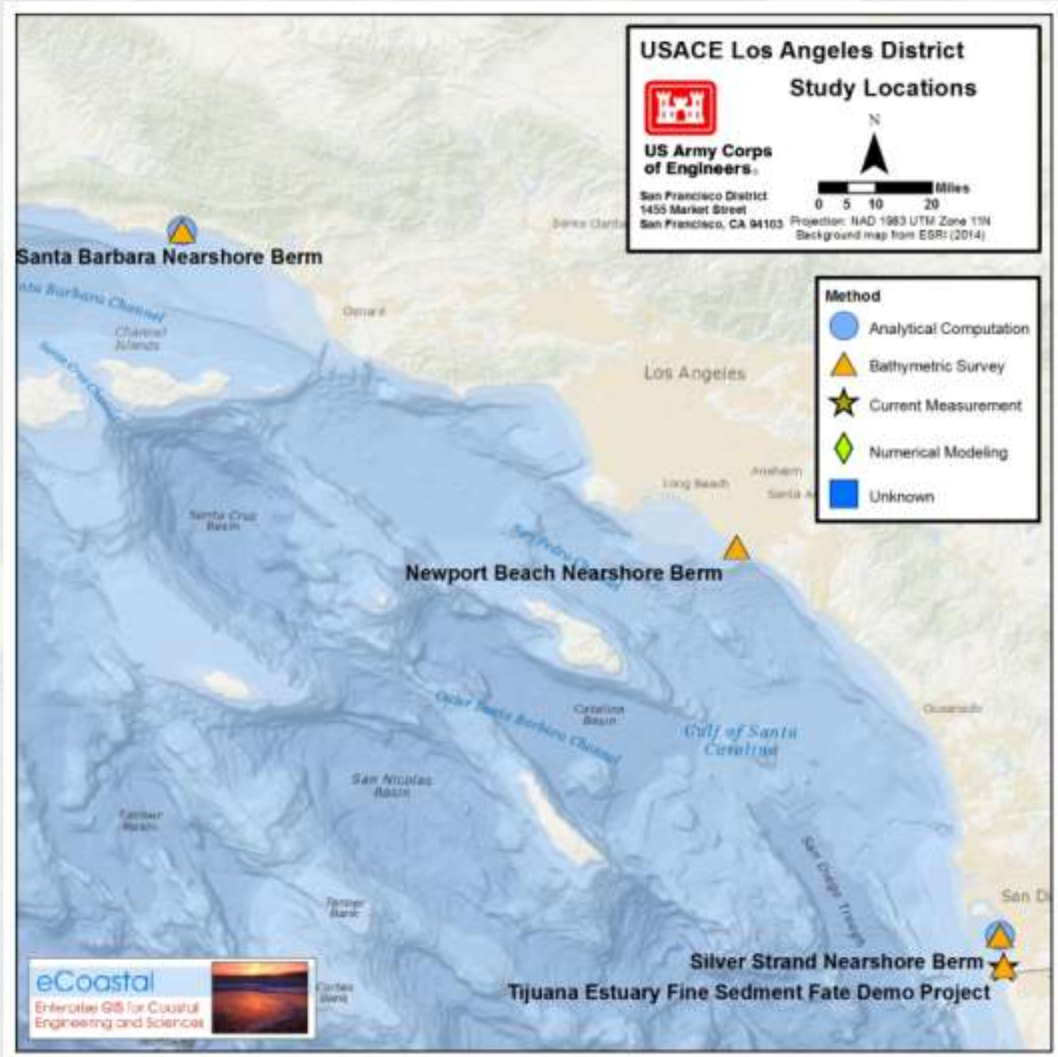


Literature Review – Case Studies





Literature Review – Case Studies



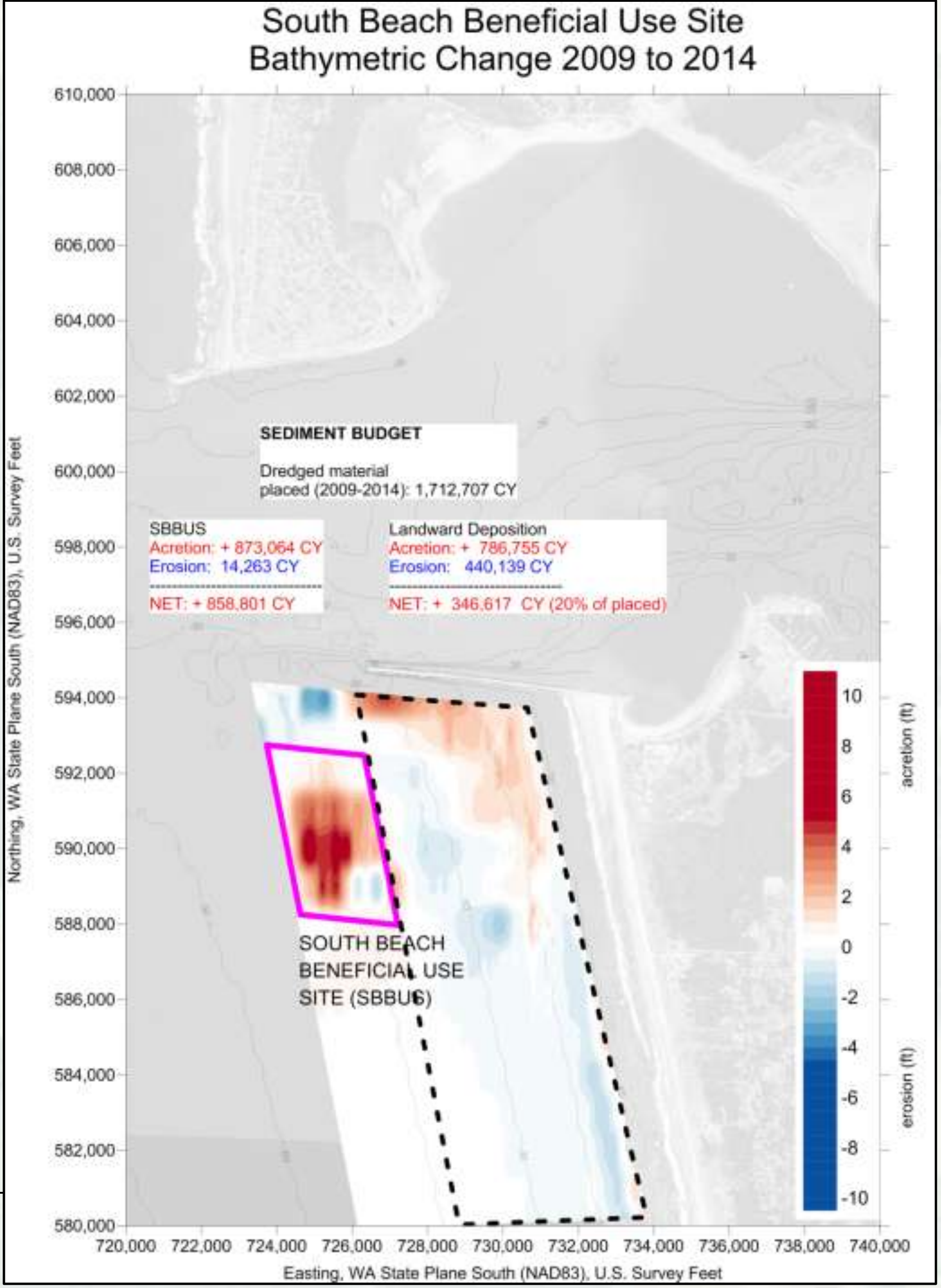
Literature Review – Field Observations

Project	District	Material type	Observed depth of Incipient motion (feet)
Quillayute River, WA (USACE, 1974)	NWS	Sand - Cobble	>-10 feet
WA Inner Continental Shelf (Sternberg & Larsen, 1976)	NWS	Silt	550 feet
San Marine, OR (Beach & Sternberg 1988)	NWS	Sand	swash zone
Grays Harbor, WA (Sherwood et al. 1999)	NWS	Sand	>79 feet
Quillayute River, WA (EHI 2010)	NWS	Sand	>69 feet
Grays Harbor, WA (USACE 2014)	NWS	Sand	>45 feet
Mouth of the Columbia River (Moritz et al. 2011)	NWP	Sand	>45 feet
San Francisco, Ocean Beach, CA (Barnard et al. 2007; 2008; 2009)	SPN	Sand	>50 feet
Stewarts Point, CA (Cacchione et al. 1994)	SPN	Sand	150 feet
CA Inner continental shelf (Cacchione et al. 1987)	SPN	Silt - Fine Sand	>280 feet
CA Inner continental shelf - Humboldt Bay (Cacchione et al. 1999)	SPN	Silt - Fine Sand	>164 feet
Humboldt Bay, CA (Hands and Allison 1991)	SPN	Sand	>70 feet
Noyo Harbor, CA (MEC 1982)	SPN	Sand	210 feet
Santa Cruz, CA (Moffatt & Nichol 1992)	SPN		>25 feet
CA Major Littoral Cells (Patsch & Griggs 2007)	SPN	Sand	66 feet
Santa Cruz, CA (Storlazzi et al. 2011)	SPN	Silt - Sand	99 feet
Newport Beach, CA (Mesa)	SPL	Sand	30 feet

Grays Harbor

South Beach Beneficial Use Site

- Established in 1993 to supply sediment to an erosion hot spot
- 3.7 MCY placed from 1993 to 2015 by dredge *ESSAYONS*
- Pre/Post placement surveys collected annually
- 50% of sediments have dispersed out of the placement site
- 20% increase in volume landward of placement area between -10 and -30 feet MLLW



Conclusions

- Literature and recent observations agree that the active zone of sediment transport extends beyond the depths hopper dredges are limited
- Recommend a change nomenclature. *Active sediment transport zone (ASTZ) vs. depth of closure (DOC).*
- Sediment placed within ASTZ should be considered beneficial use (not only beach nourishment, nearshore berms, island creation, etc.)

Recommendations

- Next Steps
  - Develop sediment mobility roses for existing open water placement sites
  - Much of the information needed is already available (grain size data, wave roses, bathymetry)
  - Sediment mobility roses can be an effective tool for communicating frequency and magnitude of active sediment transport to regulating agencies