

Engineering With Nature / Soft Shore Protection Design and Implementation in the Salish Sea

Jim Johannessen

Licensed Engineering Geologist, MS

Coastal Geologic Services, Inc

Bellingham, WA

coastalgeo.com

**High Variability; Need
for site specific designs**



Sound-wide Guidance/ Mapping 2007 – 2013

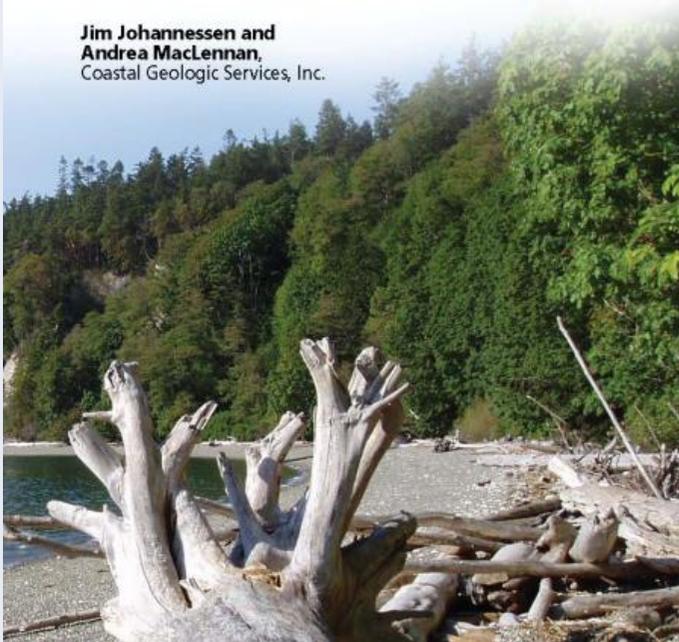
Technical Report 2007-04



Beaches and Bluffs of Puget Sound

Prepared in support of the Puget Sound Nearshore Partnership

Jim Johannessen and
Andrea MacLennan,
Coastal Geologic Services, Inc.



PSNERP

Technical Report 2009-01



Management Measures for Protecting and Restoring the Puget Sound Nearshore

Prepared in support of the Puget Sound Nearshore Ecosystem Restoration Project

Margaret Clancy¹, Ilon Logan¹, Jeremy Lowe², Jim Johannessen³, Andrea MacLennan⁴, F. Brice Van Cleave⁵, Jeff Dillon⁶, Betsy Lyons⁷, Randy Carman⁸, Paul Cereghino⁹, Bob Barnard¹⁰, Curtis Tanner¹⁰, Doug Myers¹⁰, Robin Clark¹⁰, Jacques White¹⁰, Charles Simenstad¹⁰, Miriam Gilmer¹⁰, and Nancy Chin¹⁰

1. ERA Adaption
2. Philip Williams and Associates
3. Coastal Geologic Services
4. Washington Department of Fish and Wildlife
5. U.S. Army Corps of Engineers
6. The Nature Conservancy
7. National Oceanic and Atmospheric Administration
8. U.S. Fish and Wildlife Service
9. People for Puget Sound
10. University of Washington



PSNERP

Feeder Bluff Mapping of Puget Sound



Prepared for: The Washington State Department of Ecology and Washington Department of Fish and Wildlife



Prepared by: A. MacLennan¹, J. W. Johannessen², S. A. Williams³, W. Gerstel⁴, J. F. Waggoner⁵, and A. Bailey⁶

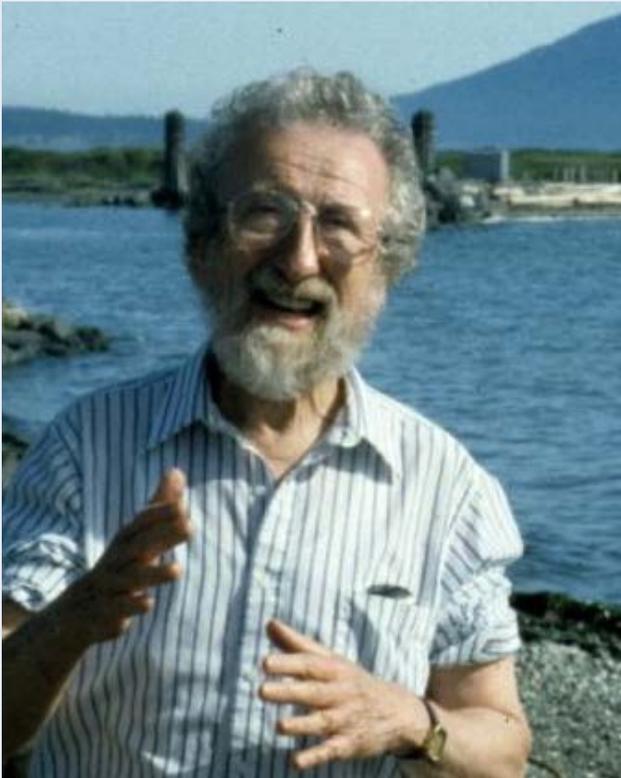
¹Coastal Geologic Services, Inc., ²Qwg Applied Geology, and ³Sound GIS

June 21, 2013



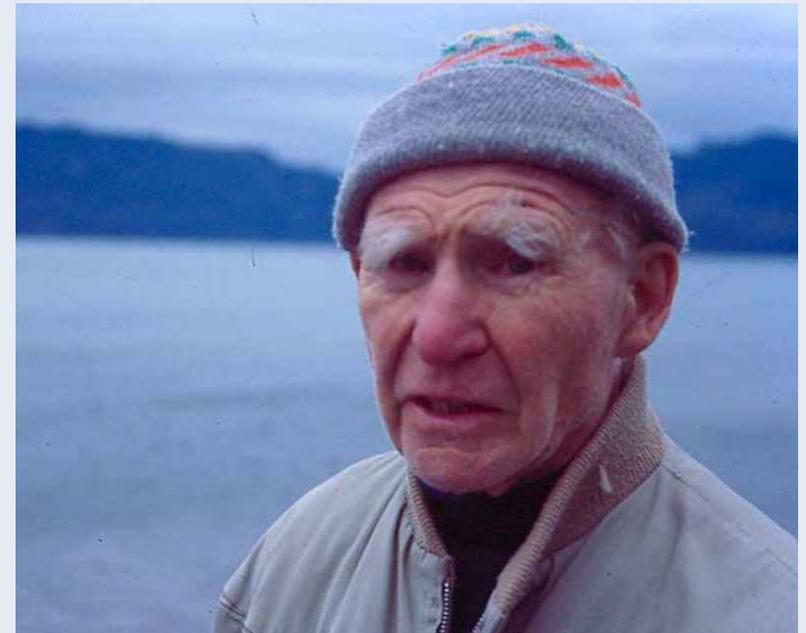
Ecology

Innovators in Puget Sound Coastal Geology and Engineering & EWN



Dr. Maury Schwartz

Wolf Bauer, PE



MSDG 2014: Range of Design Techniques

Type of Approach	Design Technique	Key Elements	Impacts to Processes
Restoration	Bulkhead removal	Removal of structures to restore the natural beach profile	Improvement
Passive Techniques	Best management practices Vegetation management Relocation	Non-engineered management practices such as planting native vegetation and managing surface and groundwater Preservation/enhancement of natural processes Infrastructure unaffected, relocated, or removed	None
Soft Shore Protection	Beach nourishment Large wood Reslope/revegetation	Preservation of natural processes and coastal dynamics Use of natural materials Slowing rather than eliminating erosion	Low
Hard Armor	Revetments Vertical bulkhead (“seawall”)	Halting natural processes, creating a static shoreline Lost beach area and substrate Attempts to eliminate erosion	Moderate-to-high

- **Design techniques can be used alone or in combination**
- **The spatial extent can vary from portion of a parcel to multiple parcels**
- **Designs should address the project needs/objectives**

Selecting an Appropriate Design Technique; Alternatives Analysis

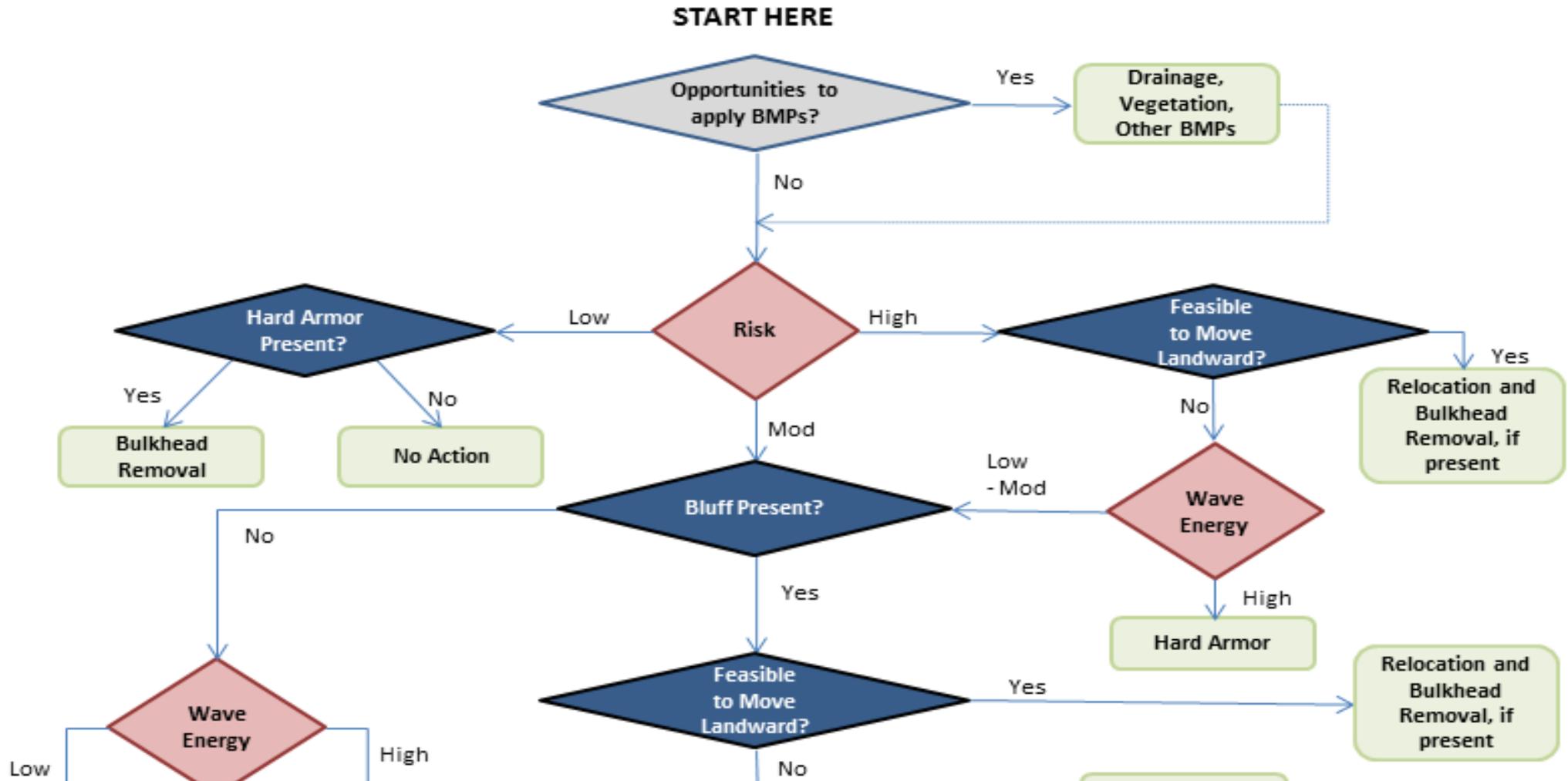
Risk	Wave Energy	Shoretype	Backshore Width	Appropriate Technique
All	All	All	NA	RELOCATION & BMPs
Low	Low to Very high	All	NA	NO ACTION
Low	Low to Very high	All	Low to High	BULKHEAD REMOVAL*
Low to Moderate	Low to Moderate	All	Moderate to High	LARGE WOOD
Low to Moderate	Low to Moderate (drift aligned)	All**	Low to High	BEACH NOURISHMENT
	Low to Very high (swash aligned)	All**	Moderate to High	
Low to Moderate	Low to Moderate	Bluff	Moderate to High	RESLOPE AND REVEG
High	High or Very high	All	Moderate to High	HARD ARMOR REVETMENT
High	Moderate to Very high	All	Low	HARD ARMOR VERTICAL

* - If not armored, then NO ACTION

** - BN on bluffs only appropriate with other measures

Selecting an Appropriate Design Technique

Decision Tree - 1



Design techniques for habitat improvements

Process-based:

- Remove or avoid shore armor at sediment sources (feeder bluffs) to maintain littoral drift inputs
- Remove structures from beach to restore alongshore & cross-shore connectivity
- Restore tidal flow, nutrient exchange, light

Site-specific:

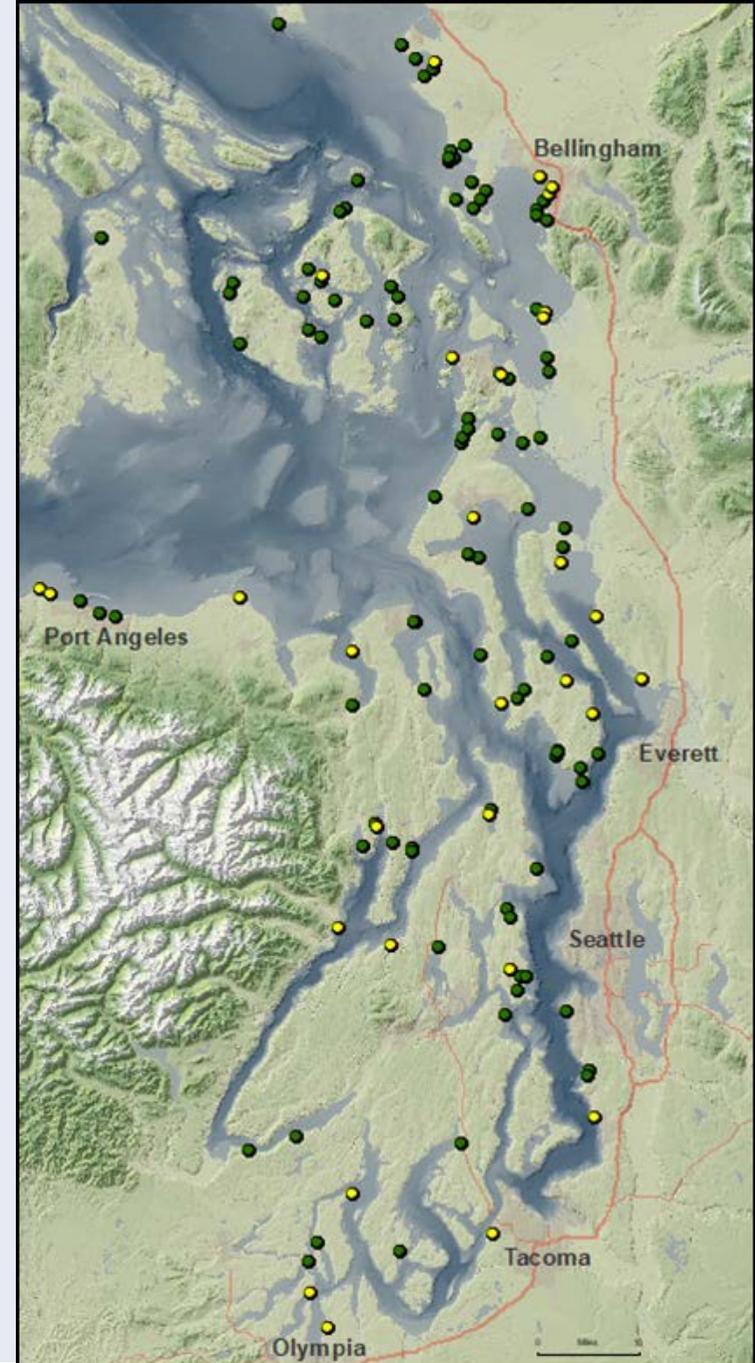
- Uncover AND re-create appropriate substrate to restore forage fish spawning habitat
 - Surf smelt and sand lance; primary food source for returning adult salmon
- Restore backshore habitats
 - Allow room for drift log and wrack deposition
 - Greater habitat complexity
 - Increased organic matter and organisms
 - Terrestrial insects for birds, other wildlife

Projects here all designed by Coastal Geologic Services

largely designed to improve resilience and habitat.

Coastal Geologic Services, Inc.

- Complete
- Design Phase

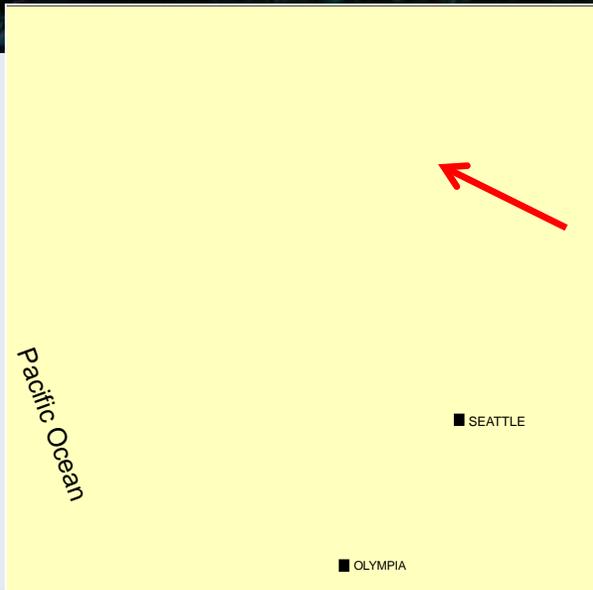




North Beach, Samish Island Skagit Co. 1996

Continuous line of bulkheads

3-4 ft. Beach lowering since
1979

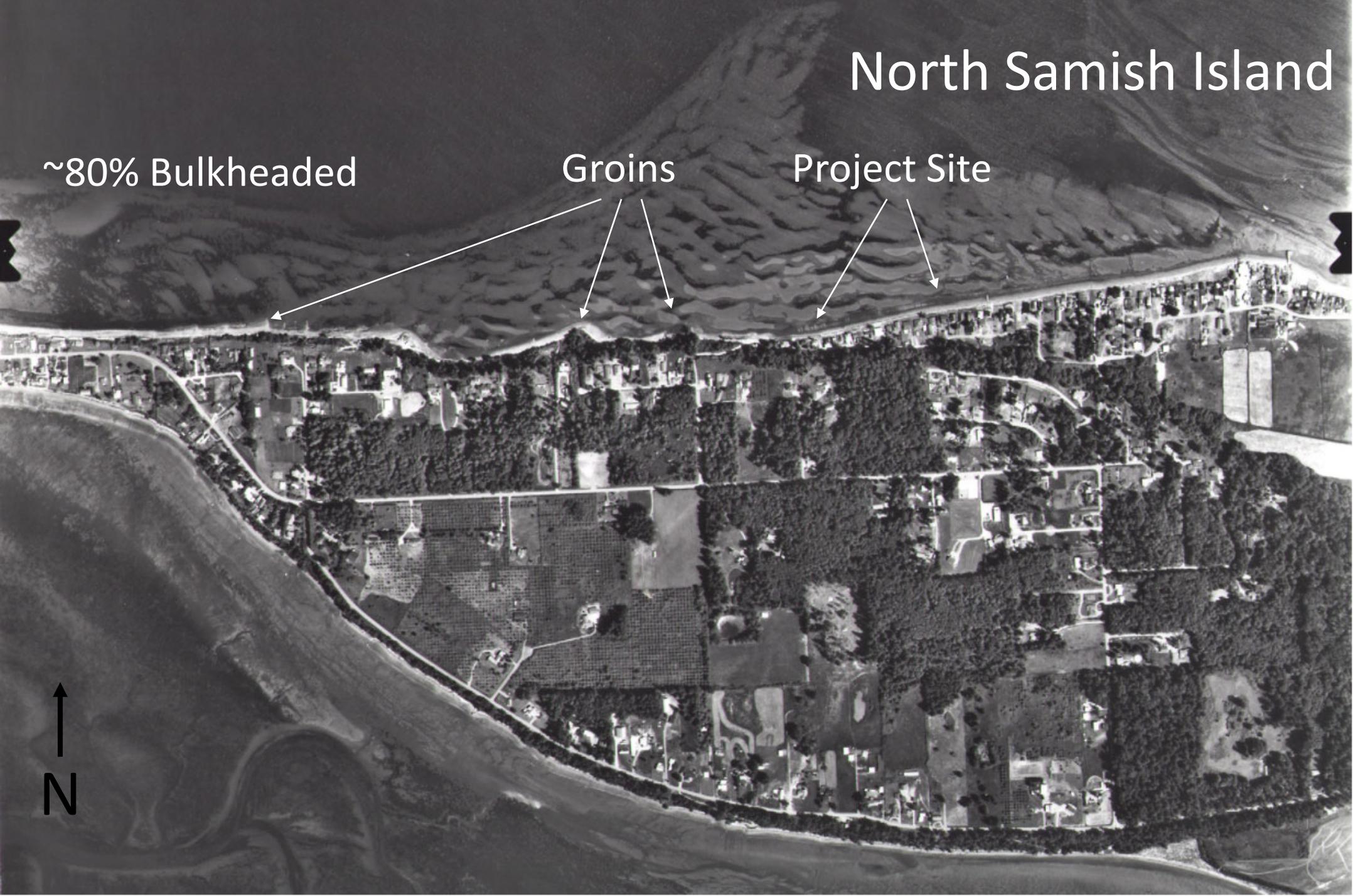


North Samish Island

~80% Bulkheaded

Groins

Project Site



Samish Island,
12 properties
Central Project

1998-
Before



1999-
After



Samish Is.
Central - 2013

*Project length was enough for
successful use of beach
nourishment
minor pullback helped*



Seahurst Park, Burien: Before ... and After (2004-2005)



Failing revetment

Master plan & design by: Anchor & CGS

Construction funds: USACE

Monitoring: CGS 2002-2016



*Long enough, Pullback,
Feeder bluff restoration*

SLR ready

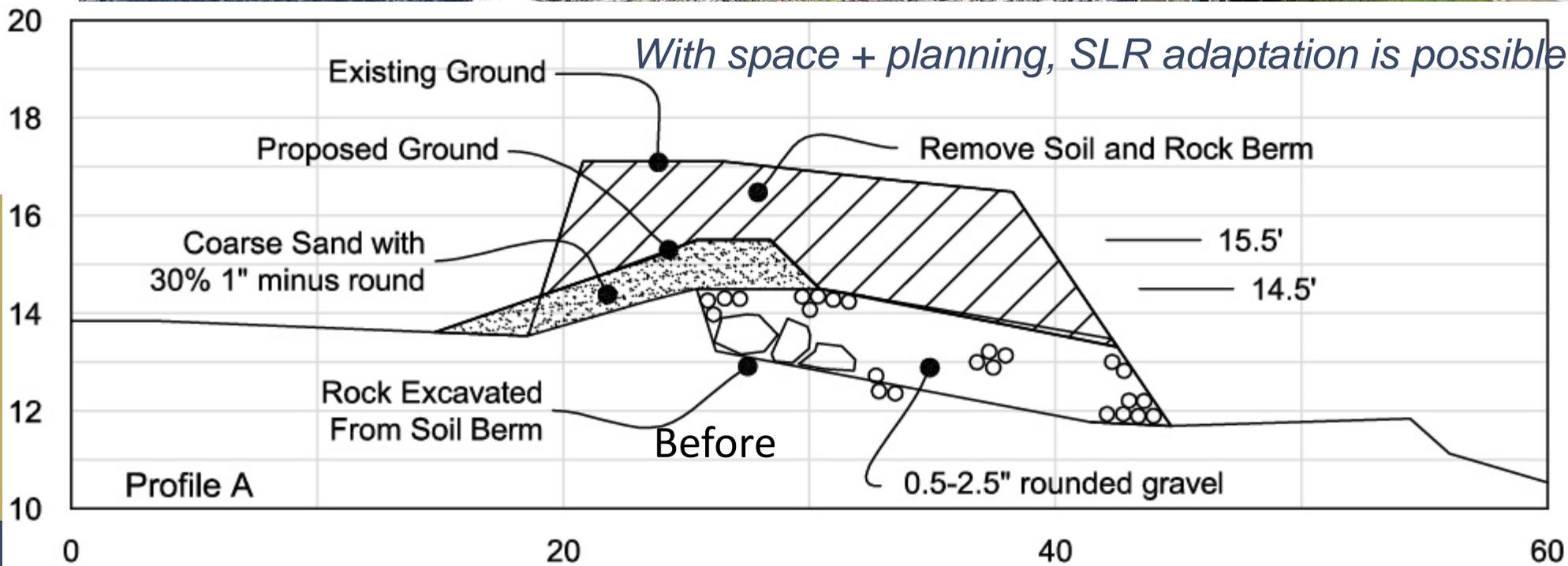
Jim Johannessen



- Shoretype
- Fetch
- Removed Hard Armor

Your Marine Waterfront

A guide to protecting your property while promoting healthy shorelines



Large wood - anchored



Large wood - anchored , after: Blakely Island, 2015



Requires:

Aadequate backshore room,

Slow long-term erosion rate

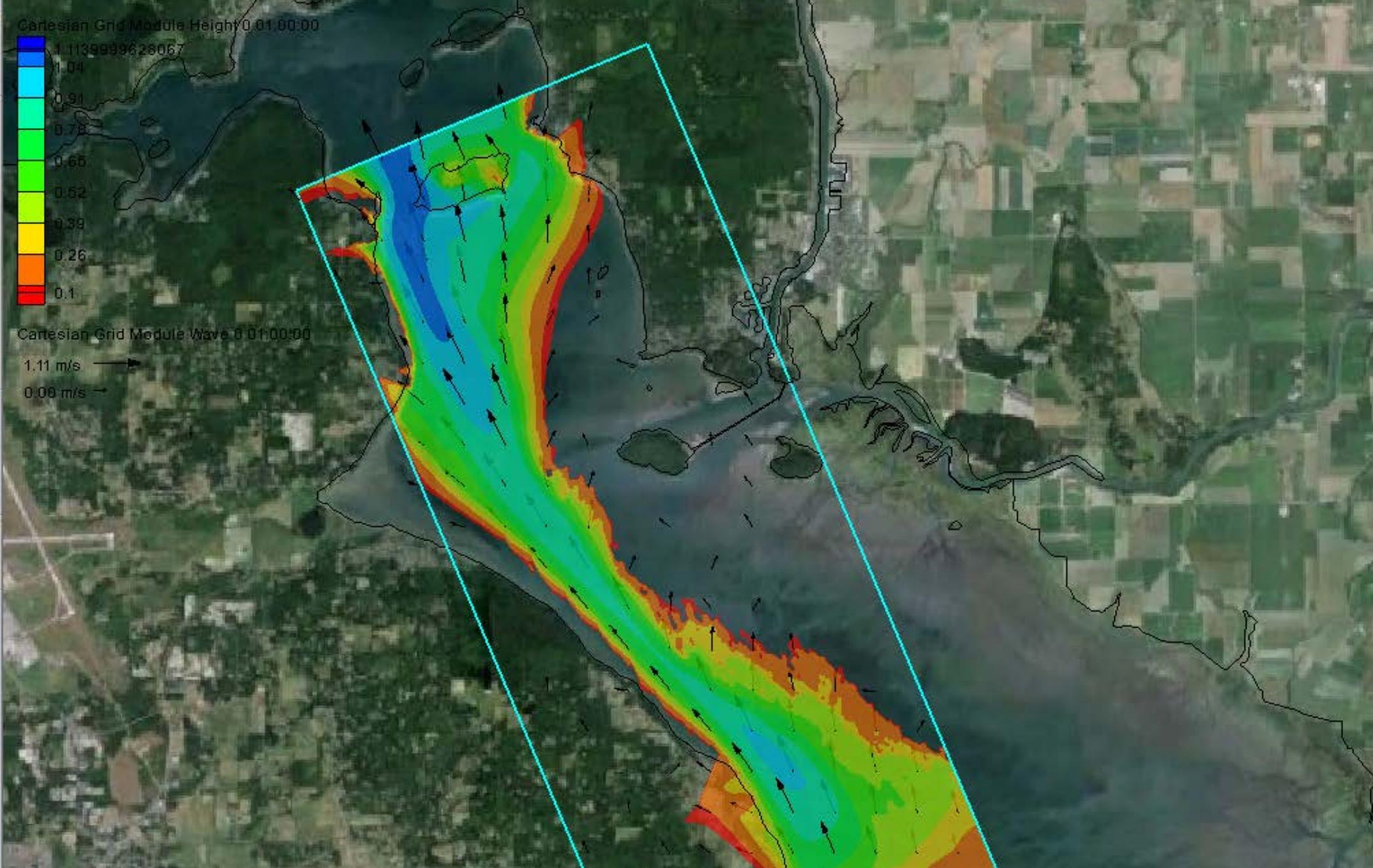


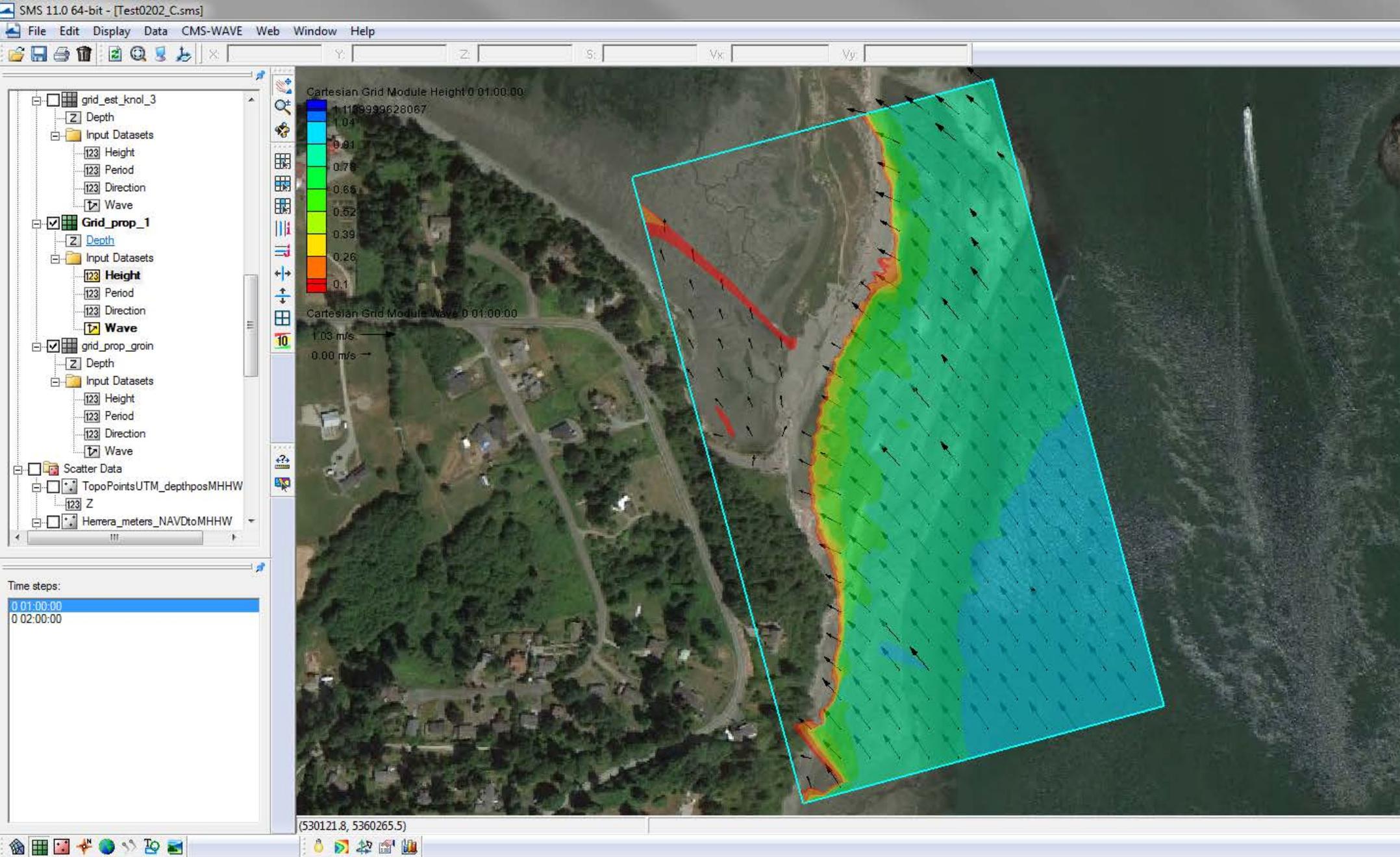
Ala Spit Co. Park, North Whidbey Is.

Spit dynamics:
Shore change

Ala Spit Co. Park, N. Whidbey Is. – Before Project







Littoral transport analysis

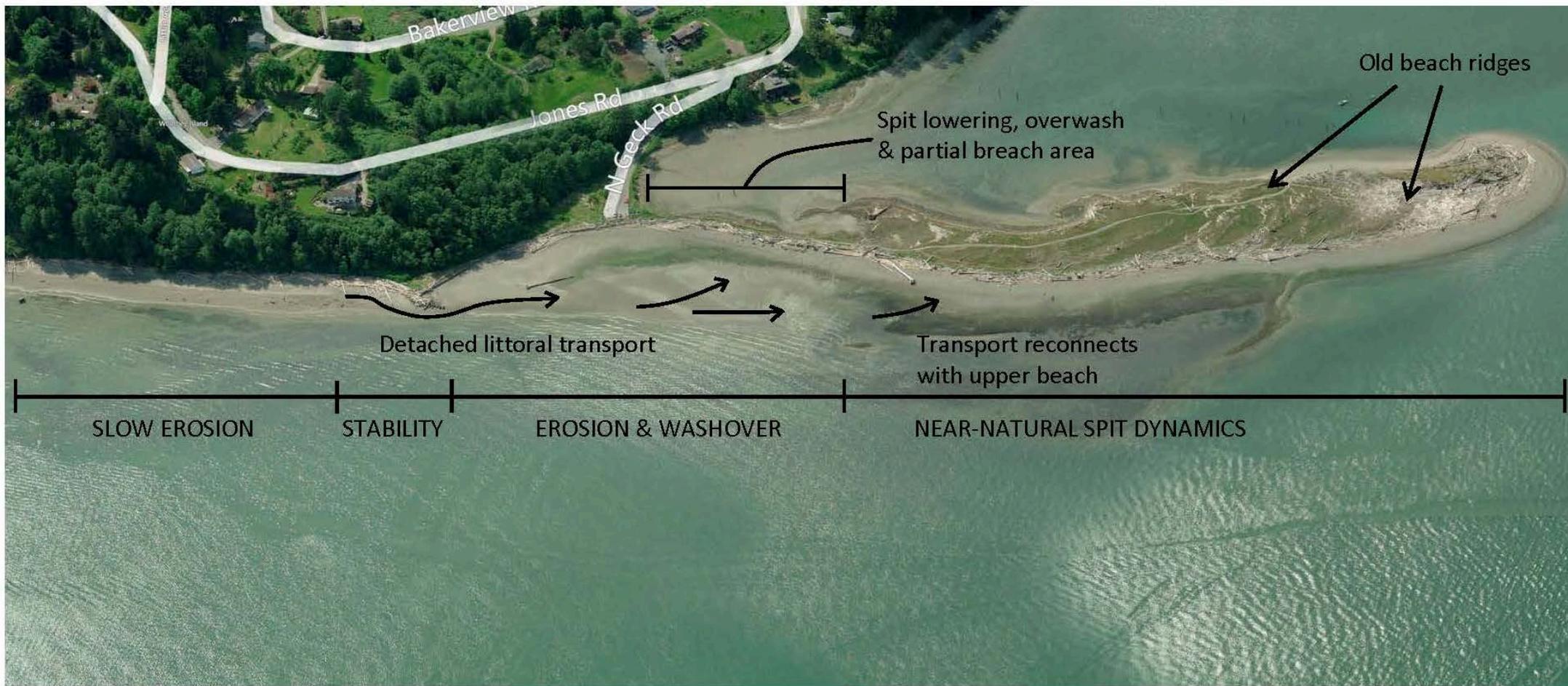
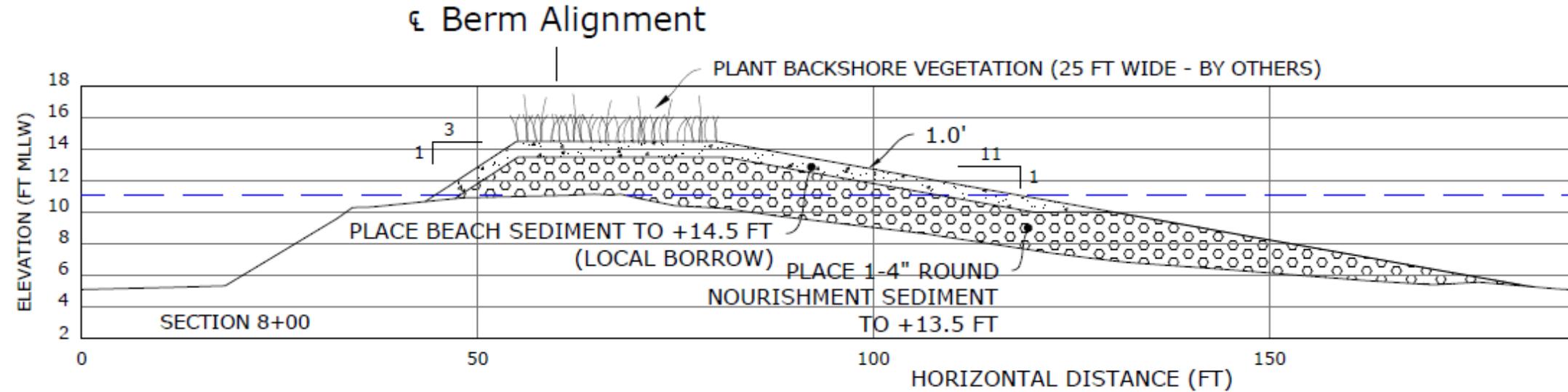


Figure 8. Ala Spit coastal geomorphic model annotated oblique aerial photograph (Bing aerials website accessed 2013).

Cross Section-Mid Project, 2014



Ala Spit – After, 2017



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Driftwood Beach, Blakely Island

San Juan Co.

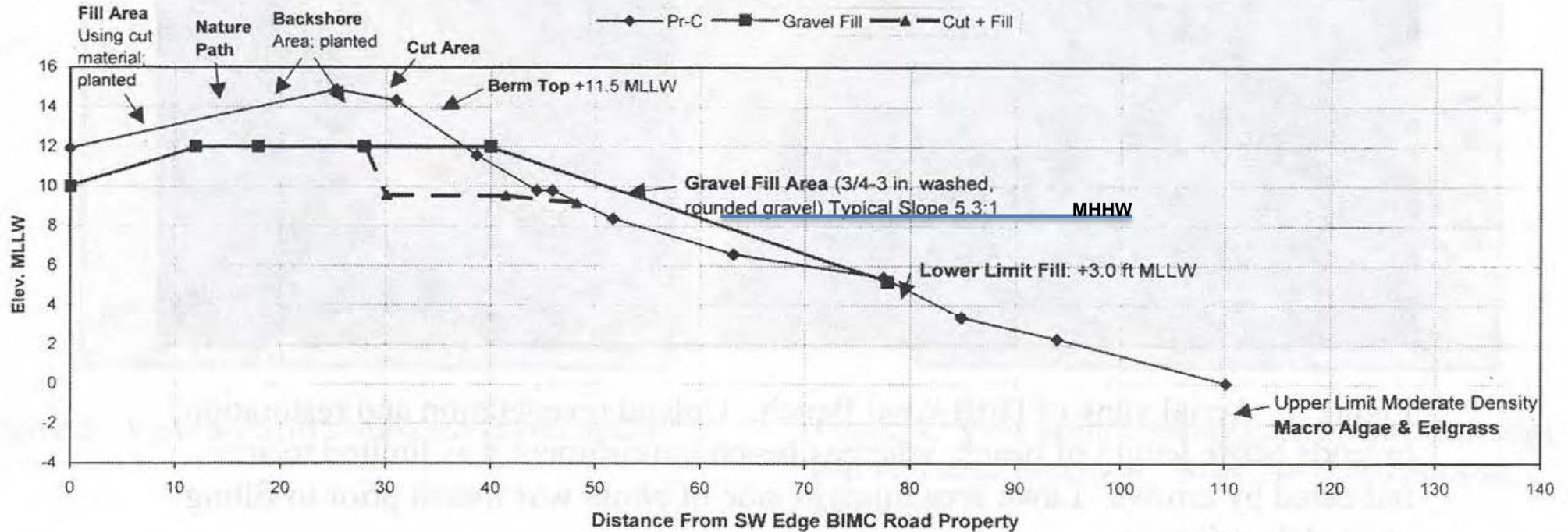


Driftwood Beach, Blakely Island: 1998, Pre-Project



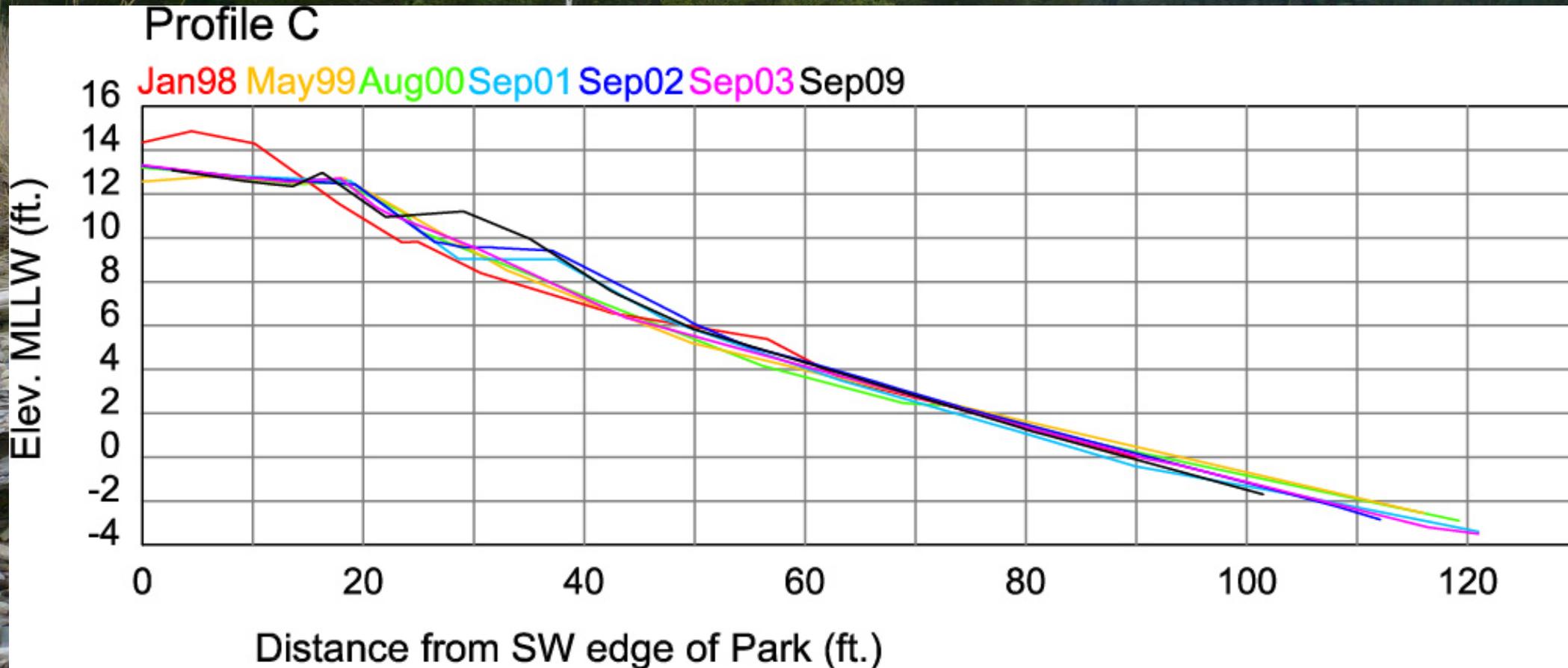
Driftwood Beach, Blakely Island 1998

Figure 2. Driftwood Beach, Blakely Island - Typical Beach Profile
Profile C, 1/9/98 (2X Vert Ex.)



Driftwood Beach, Blakely Island 2016

*Gravel mining & fill placement were reversed,
Drift cell changes minimal; self-sustaining*



Weaverling Spit, Samish Indian Reservation – Pre-project (2006)



Weaverling Spit — Construction



Weaverling Spit – 2017



URBAN SHORES: Marine Park, Bellingham, WA

Required structure: drift sill

Orientation critical

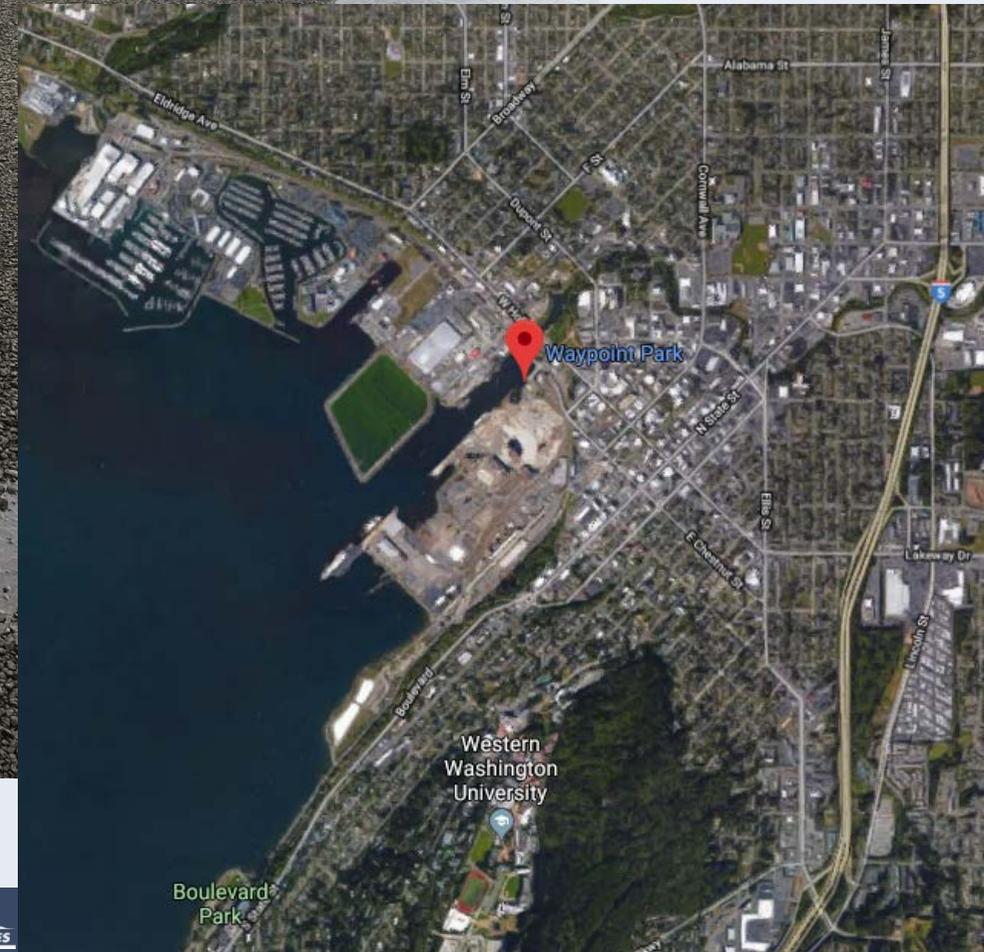
2004



Awarded one of America's Best Restored Beaches by American Shore & Beach Preservation Association (ASBPA)



Waypoint Park, GP Site, Bellingham, WA, Before – March 2017



Waypoint Park – December 20, 2017



Waypoint Park – January 16, 2018



Waypoint Park – January 24, 2018



Waypoint Park – February 13, 2018



Waypoint Park, Bellingham, WA – March 19, 2018



Project Completed Summer 2018



Before



After





- ◆ **Process-based restoration** is the priority
- ◆ **Restoration** is (almost) forever – self sustaining processes
- ◆ **Enhancement** can be temporary, and sometimes low cost and effective
- ◆ Regional **guidance documents** define best practices
- ◆ **Every site is different:** Must analyze waves, sediment sources, site history, erosion rates, constraints, habitats, SLR impacts ...
- ◆ **Complimentary techniques often needed:** Armor removal, gravel & sand beach nourishment, large wood, vegetation, regrading, tidal flow restoration ...
- ◆ Proven success in Salish Sea for both Restoration *and* Enhancement projects
- ◆ More **monitoring and synthesis** will inform future work

6/24/2017

jim@coastalgeo.com