

Integrating Science with Private Landowner Outreach to Increase Coastal Resilience: GIS Prioritization, Collaborative Design, Projects

Jim Johannessen, Licensed Engineering Geologist, MS

Andrea MacLennan, MS, Branden Rishel

Coastal Geologic Services, Inc, Bellingham, WA
coastalgeo.com

and Lisa Kaufman, Northwest Straits Foundation



Local beaches are maintained by bluff erosion and recession

Continued sediment supply from feeder bluffs is essential for sea level rise (SLR) resilience

Shore armor (bulkheads) are abundant throughout the region (29% of shore)

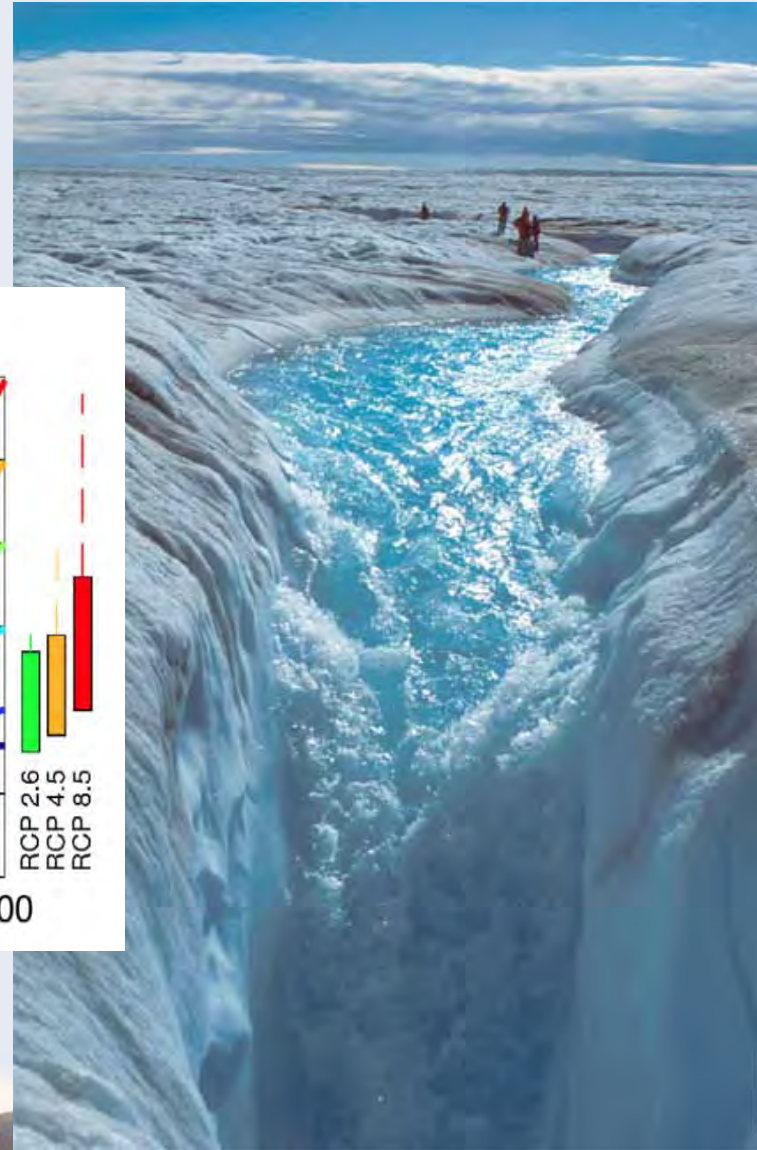
34% of feeder bluffs are armored

Most of Puget Sound shore is privately-owned (~70% of the 52,578 parcels)

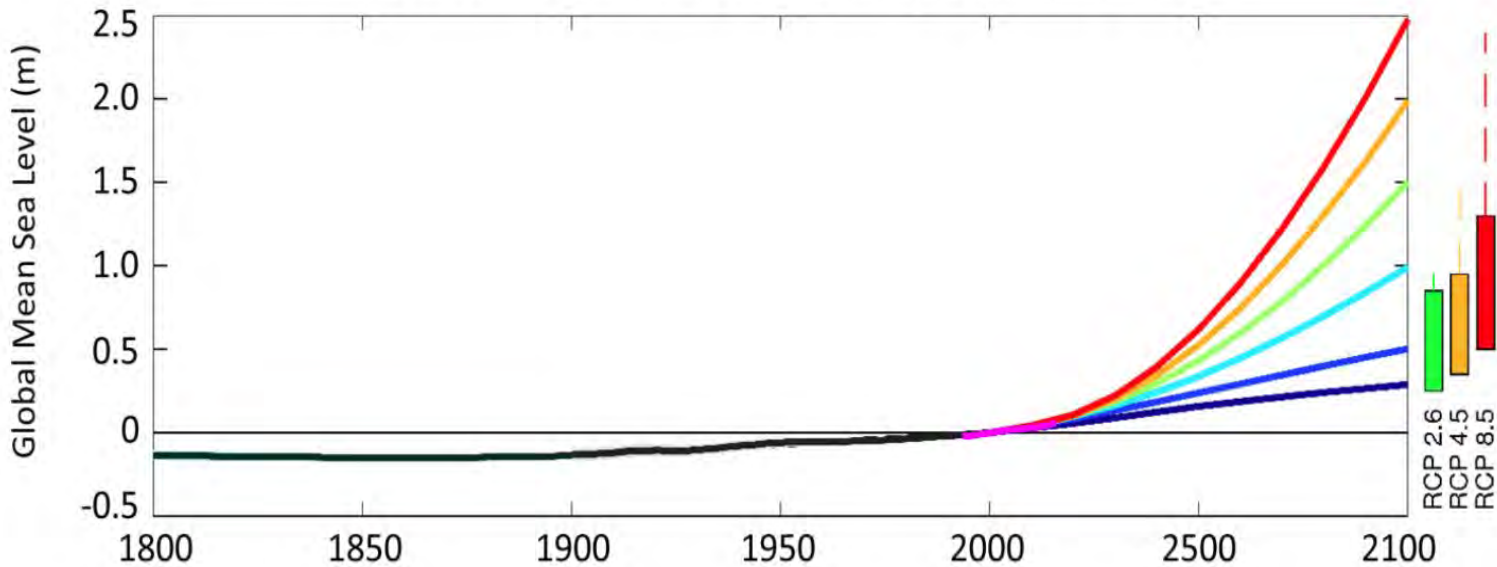
↓ Shore armor: ↑ Coastal resilience



SLR could be 2 ft, 3 ft, 6.5 ft ... or ? in this century
How bad does it have to get
... before we really change?

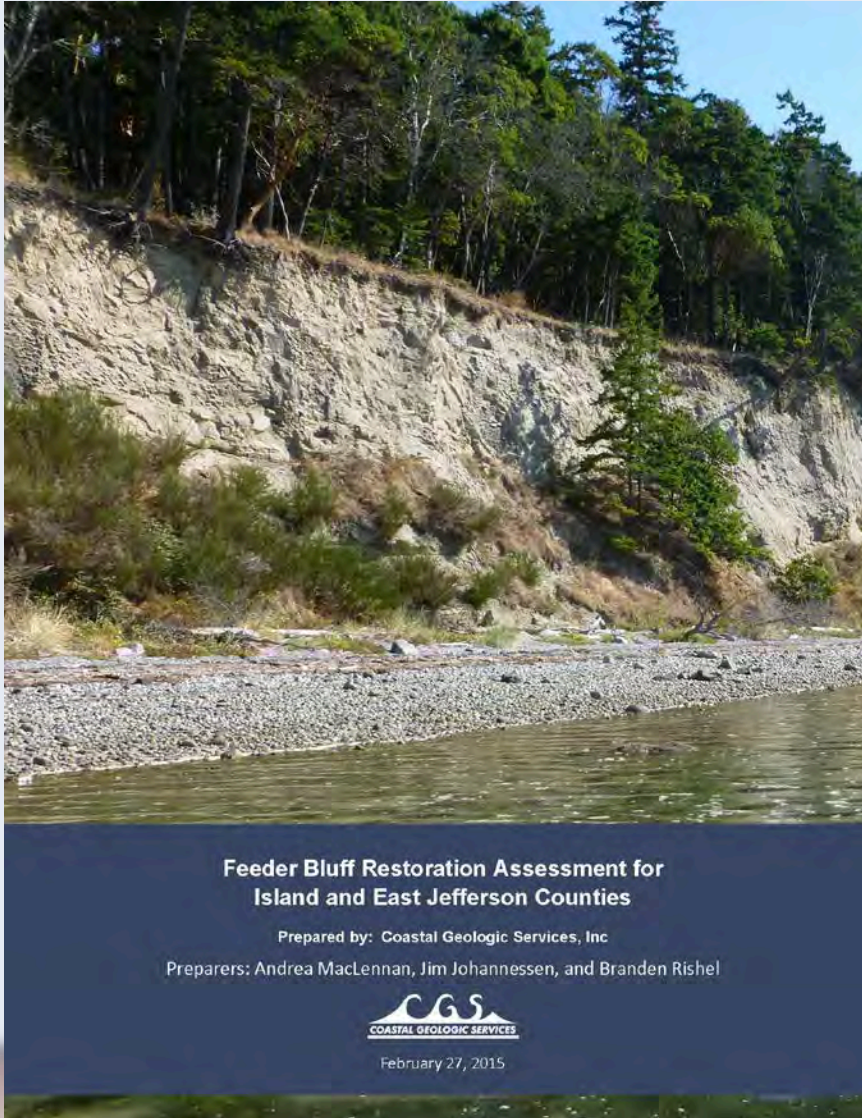


NOAA Global Mean Sea Level (GMSL) Scenarios for 2100



We need to Reimagining Shorelines

1. Feeder Bluff Restoration for Island-Jefferson counties



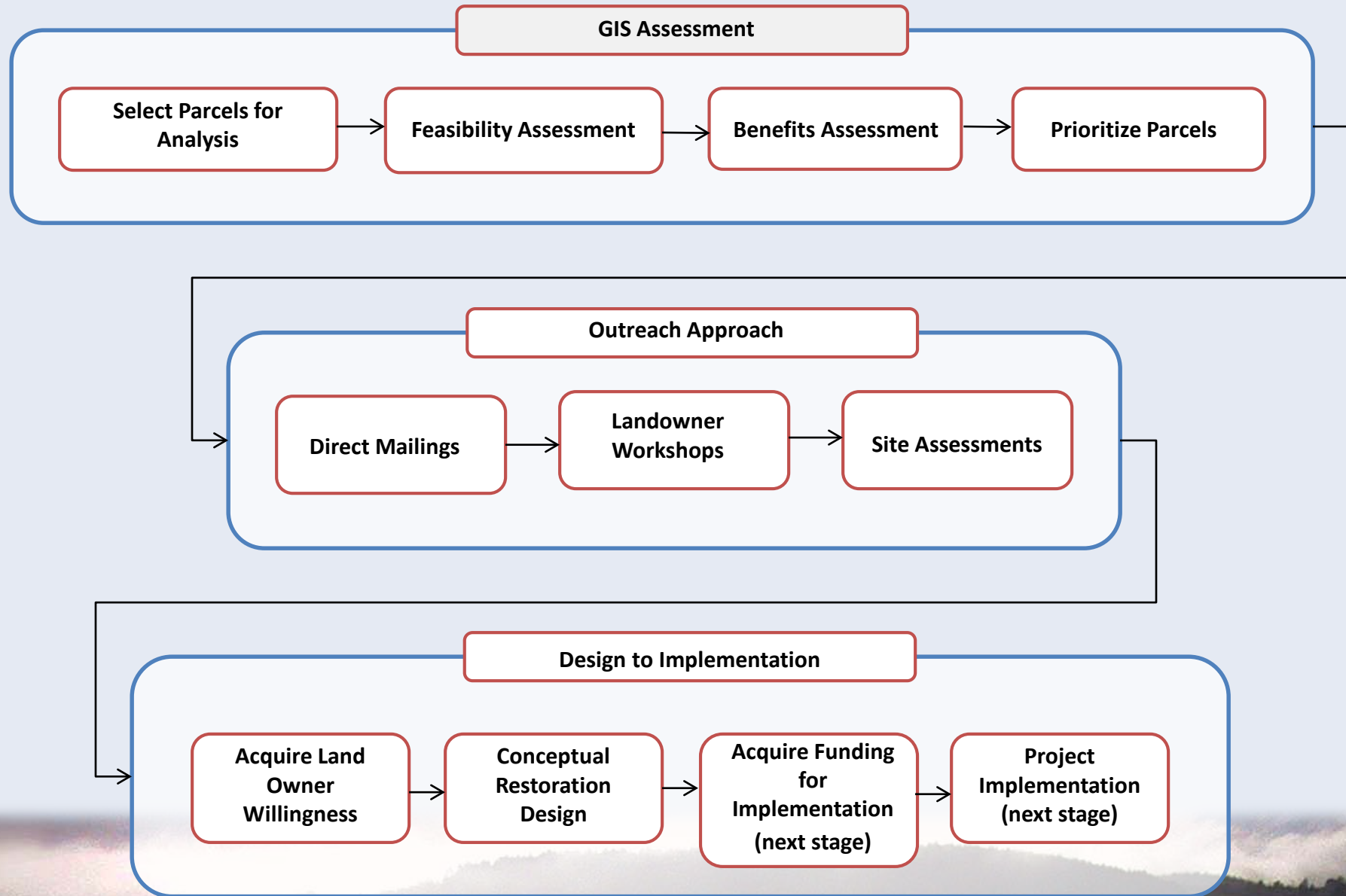
Purpose: Develop a portfolio of shore armor (bulkhead) removal projects at feeder bluffs for Island and east Jefferson Counties, with willing landowners and conceptual restoration designs that are ready to be refined and implemented

For: Northwest Straits Foundation

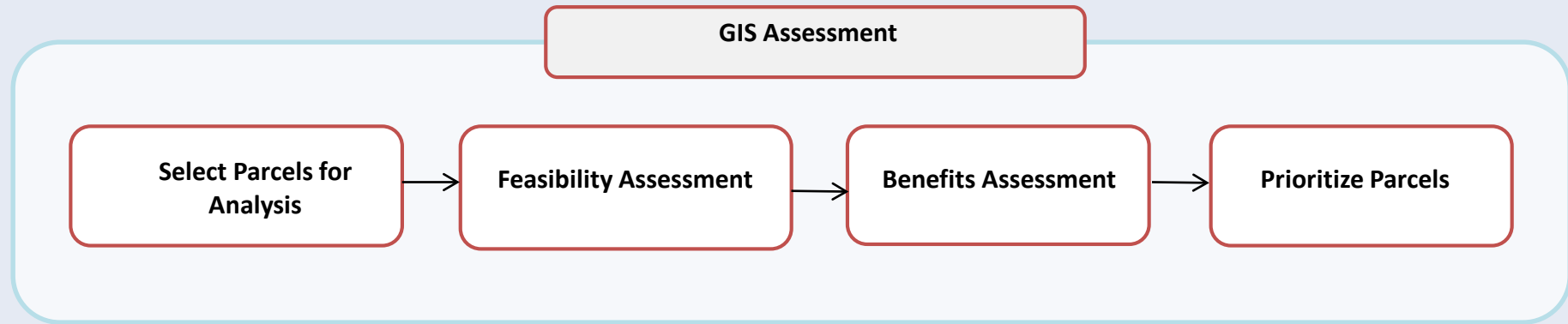
Funding:

Puget Sound Marine Nearshore Grant Program
Estuary Salmon Restoration Program

Island-Jefferson County Feeder Bluff Restoration



Armor Removal Assessment - Parcels



In GIS - Parcels:

- Puget Sound shoreline parcel database (from “Sound-side social marketing project”)
- Digitize bluff crest and buildings along feeder bluffs
- Calculate structure setback distances from bluff crest
- Measure background bluff recession rates from a stratified sample of unarmored bluffs throughout study area

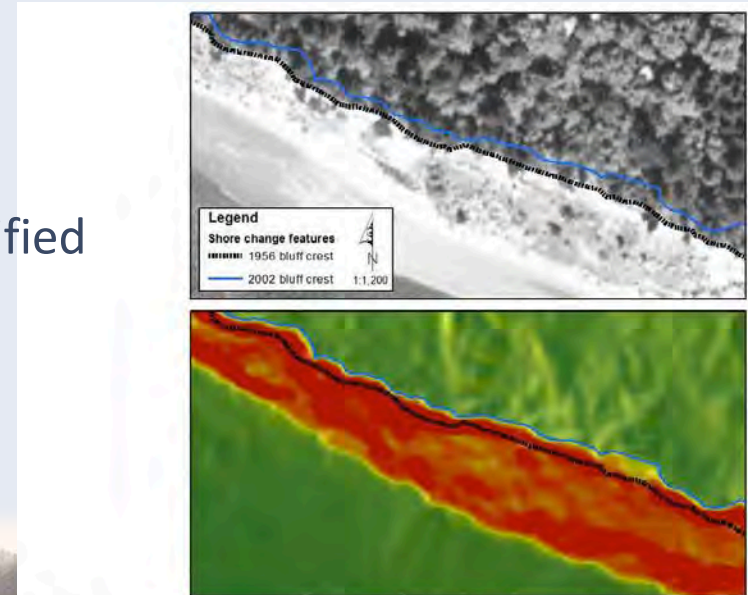
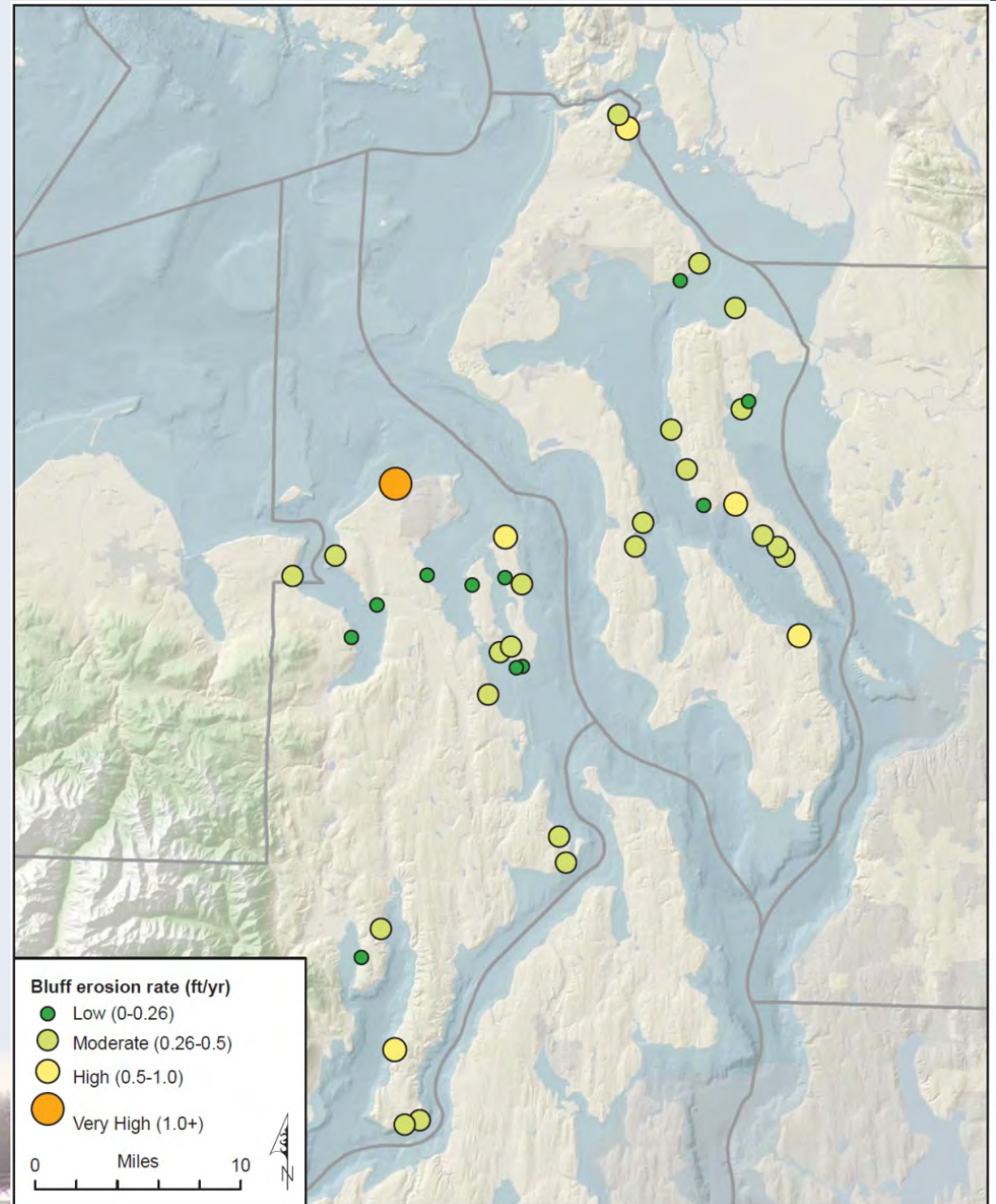


Figure 1. Bluff crest digitizing example from 1956 historical vertical image (top) and 2002 LIDAR slope change imagery of bluff (shoreform ID) 2754 on southwest Camano Island. The distance between the two bluff crest lines represents the measured bluff crest recession across the period of analysis.

Armor Removal Assessment - Feasibility

- Bluff recession, exposure, orientation, height
- Project recession rates (stratified categories) 75 years forward + 25 FT safety buffer
- Identify high priority sites – parcels with mapped landslides excluded
- Select parcels with adequate setback distance to be feasible for armor removal



Armor Removal Assessment - Benefits

- 9 benefit metrics
- Address ecologic and geomorphic benefits of armor removal for each parcel
 - Indirect and direct benefit to forage fish habitat
 - Sediment supply to down-drift shoreforms
 - Down-drift barrier embayments, coastal wetlands
 - Length of down-drift beach
 - Length of down-drift habitat
 - Volume of sediment restored
 - Adjacent opportunities
- Final scores became Priority levels

Table 6. Summary of restoration benefit data for all parcels in which armor removal was feasible. Parcels with presence/absence data summarized in Table 5.

Restoration Benefit Scoring Criteria	Average value	Min	Max
Length of down-drift shore (mi)	3.1 mi	0	14.2
Percent of cell down-drift (%)	51%	0	100%
Potential vol sediment input (cy/yr)	137	4	7,236
Restorable length (ft)	137	7	7,230
Down-drift forage fish spawning (mi)	1.6	0	10.2
Percent down-drift with forage fish spawning (%)	51%	0%	79%

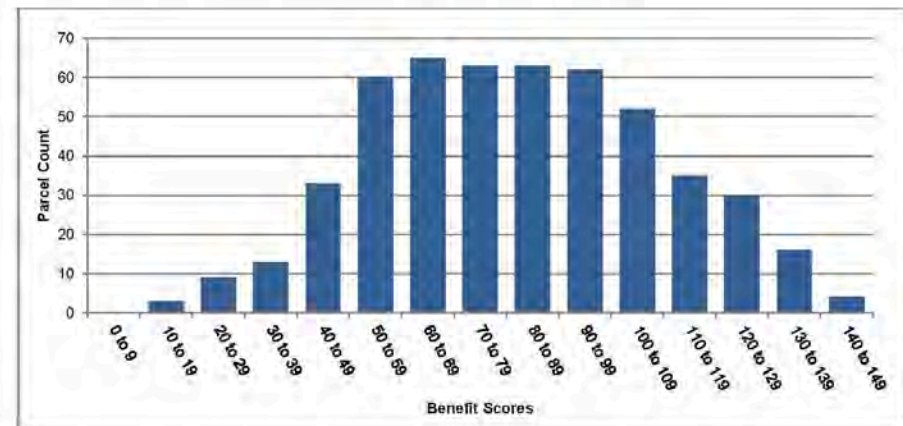


Figure 8. Frequency distribution of armor removal benefit scores for all feasible parcels.

Armor Removal Assessment – Feasible Properties

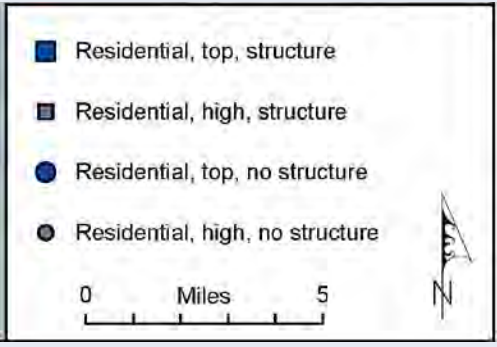
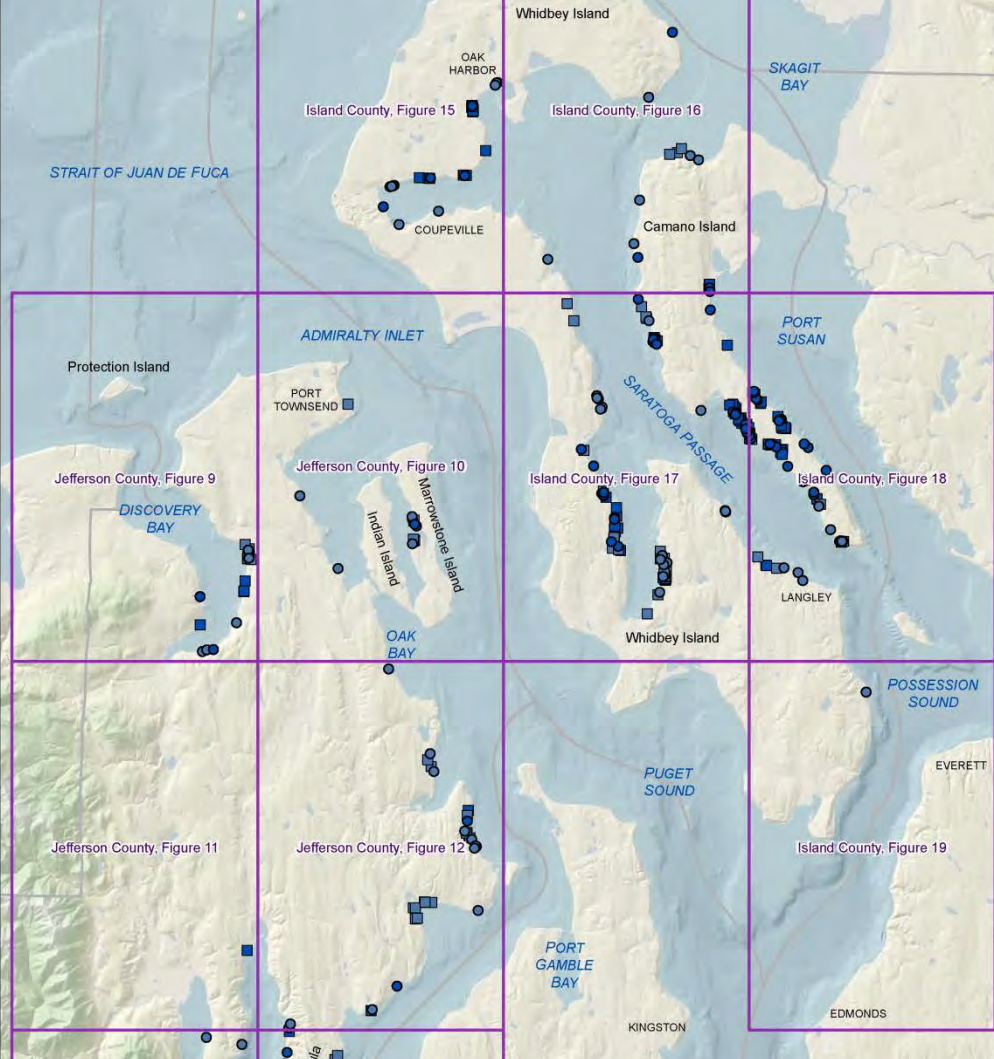
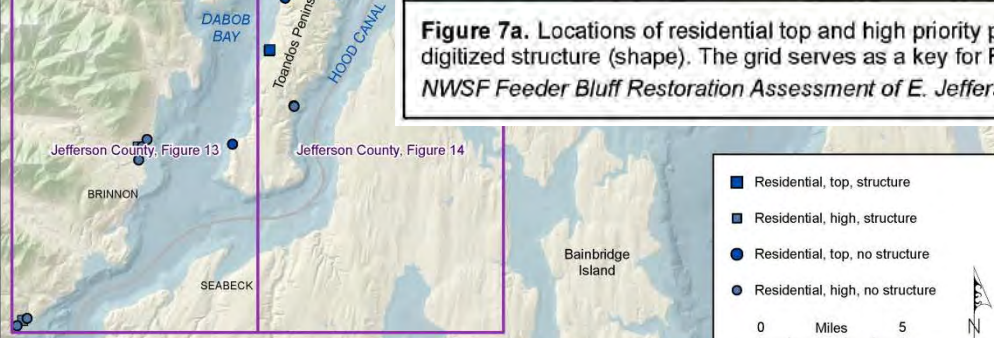


Figure 7a. Locations of residential top and high priority parcels for armor removal, by habitat benefit rank (size) and presence of a digitized structure (shape). The grid serves as a key for Figures 9-19.
NWSF Feeder Bluff Restoration Assessment of E. Jefferson and Island Counties



Shoreline Landowner Outreach

Addressed *Motivators and Barriers*
as an *Incentive*

At Parcel Unit Scale

Targeted outreach to high feasibility/ priority
sites

Feeder Bluff Parcels-received post
cards with workshop, site visit info

Beaches, Bluffs, and Your Shoreline Property Attend a FREE 'Living with the Coast' Workshop



Saturday, November 14, 2015

Jefferson County Library
620 Cedar Ave
Port Hadlock, WA

10:00-12:30pm

Presenter: Coastal Geologist
Jim Johannessen

Reserve your spot today!
Online registration at:

<https://www.surveymonkey.com/r/JeffersonFall>

or

Phone: 360-733-1725

Email: lehman@nwstraitsfoundation.org

Not available for the workshop? You can still apply for
a site visit by calling 360-733-1725.



Learn from experts about bluffs and beaches, erosion, and
alternatives to hard armoring.

This FREE workshop is for shoreline landowners who:

- Live on a bluff and want to reduce erosion, drainage, or
vegetation impacts to your property
- Have a broad beach or low bank and want tips on how to protect
your property while promoting healthy marine ecosystems
- Are considering installing, removing or repairing armoring on
your shoreline

Workshop topics include:

- Coastal and beach processes
- How to manage beach and bluff erosion
- Alternatives to hard shoreline armoring
- Benefits of bulkhead removal or reduction
- Native vegetation for slope stability and habitat

Apply for a **free technical site visit** from qualified professionals and
receive management recommendations for your property.

Free engineering design services and permitting assistance are available for a
limited number of qualified participants considering removal or reduction of hard
shoreline armoring.

Workshop and site visits are sponsored by the Northwest Straits Foundation through grants from the
Washington State Departments of Fish and Wildlife and Natural Resources Marine and Nearshore Grant
Program. Offered in partnership with the Jefferson County Marine Resources Committee.

For more information visit
www.nwstraitsfoundation.org



partners in marine conservation



partners in marine conservation

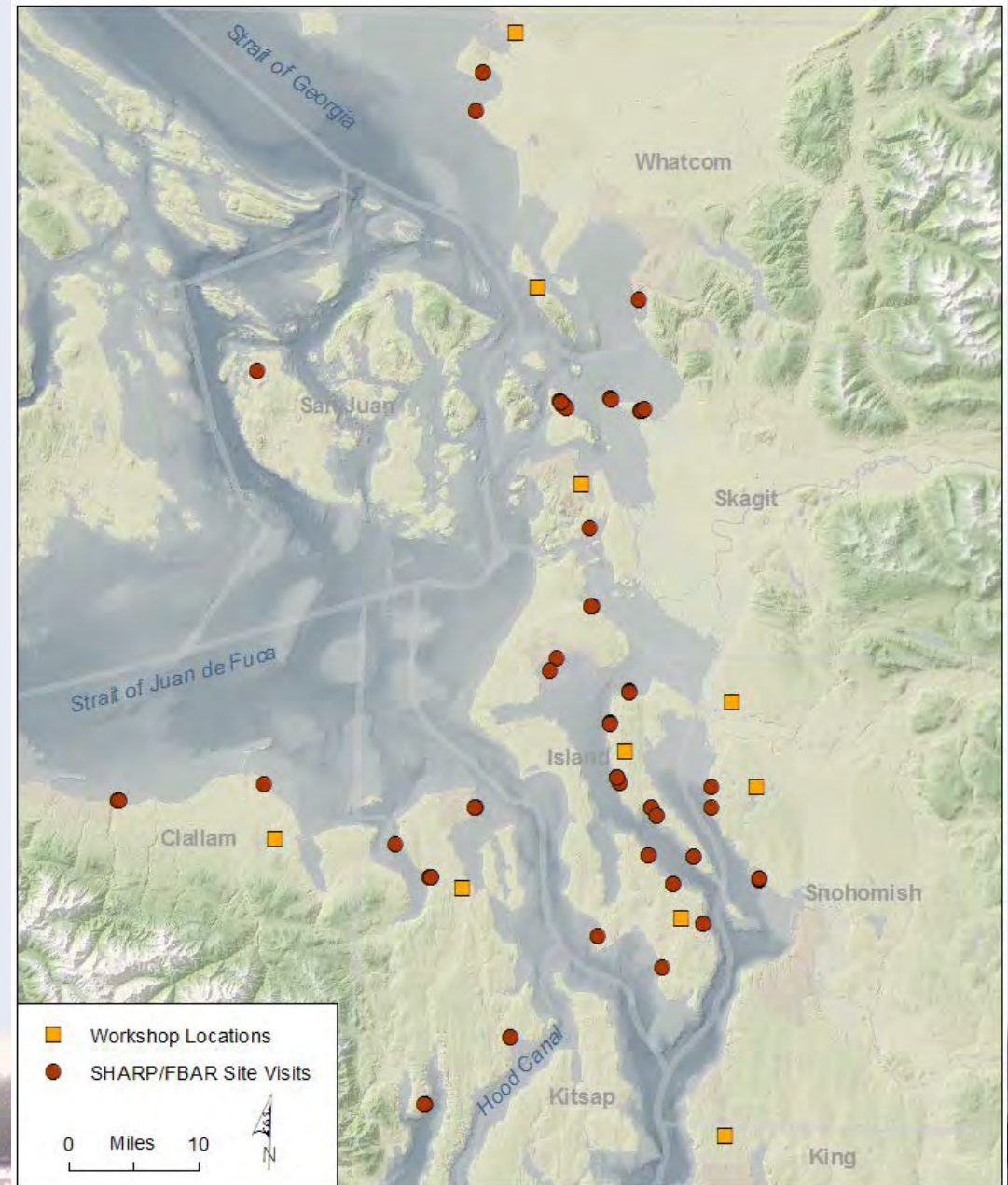
Direct Outreach – “Living with the Coast” Workshops

- Science of coastal, bluff processes
- Connect habitats to processes
- Local focus
- Characterize typically slow erosion rates
- Alternatives to hard armor case studies
- Address barriers to removal of armor



Direct Outreach - Site Assessments

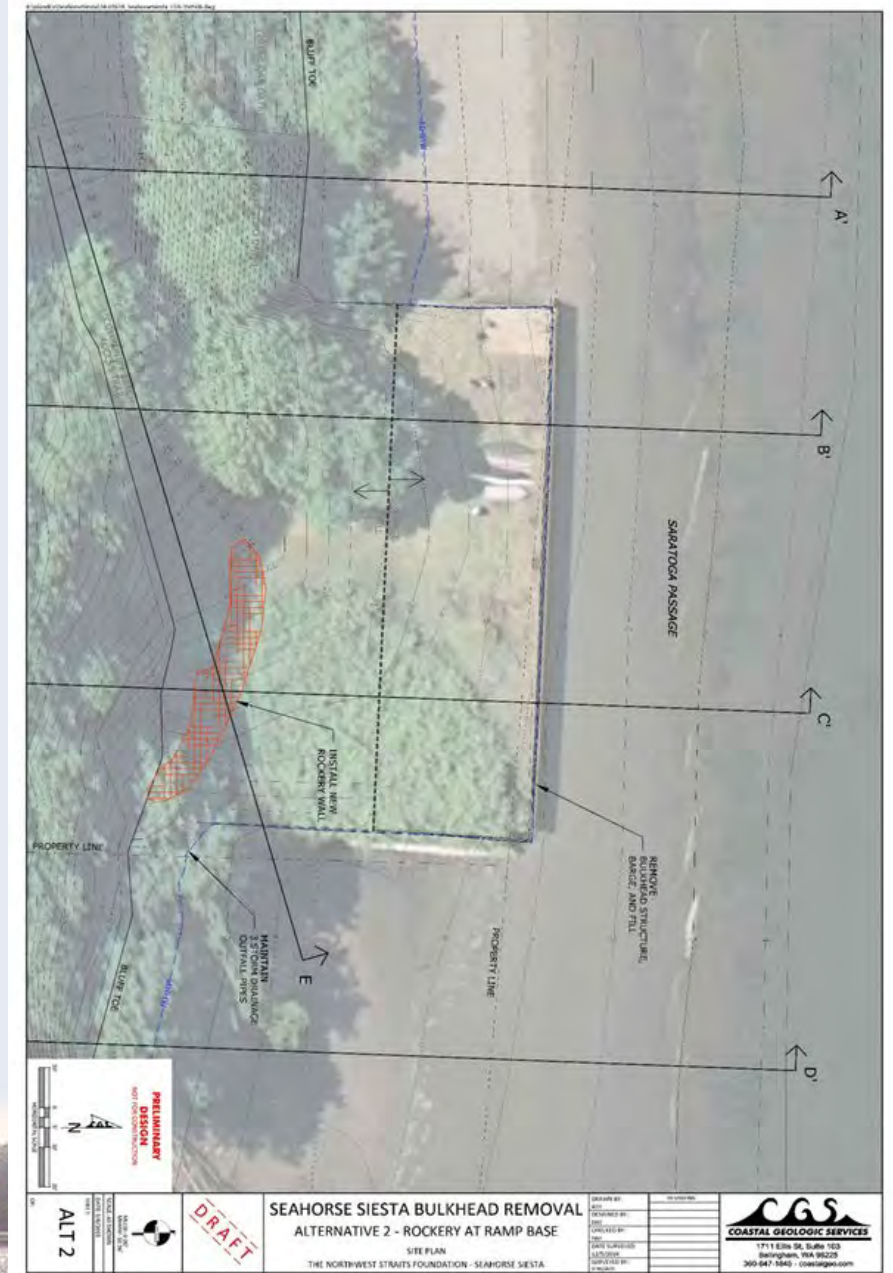
- Process needs to be cost effective
- Landowner history, knowledge and concerns
- Field form completed with parcel characteristics
- Appease concerns
 - What's normal
 - What's not
 - Drivers of erosion
- Short memo for each site



Landowner Permission, Design

Getting to Yes; Action:

- Public vs. private landowners
- Community Associations – It takes a village!
- Motivated by incentives
- One on one meetings help
 - May take more than one visit
- Conceptual approach first
- Design package completed with drawings, costs estimate, design memo with project description



Four Designs Completed

Getting to Action:



Permitting by NWSF

- Time consuming and intimidating for landowners
- Many have a negative response to working with regulators
- Costs include required biological and archaeological assessments
- Small cost share of permit fees

	PERMIT/PROCESS	AGENCY
✓	SEPA	Shoreline jurisdiction (County, City)
?	NEPA	Federal agency depending on funding
✓	Shoreline Substantial Development Permit Exemption	Shoreline jurisdiction (County, City)
✓	Clearing & Grading	County/City
?	Discharge Permit (Section 404)	USACE
?	Section 10	USACE
✓	Nationwide Permit	USACE
✓	ESA Compliance/Concurrence	NMFS/NOAA/USFWS
✓	Hydraulic Permit Approval	WDFW
✓	Section 401 Water Quality	Dept of Ecology
?	CZM Certification	Dept of Ecology
?	NPDES Construction Stormwater General Permit	Dept of Ecology
?	Aquatic Use Authorization or Right of Entry	Dept of Natural Resources
✓	EO 05-05 Cultural & Historical Review	DAHP
✓	Section 106 Cultural & Historical Review	Federal lead
✓	Biological assessment for FEMA/ESA	County/City/USACE

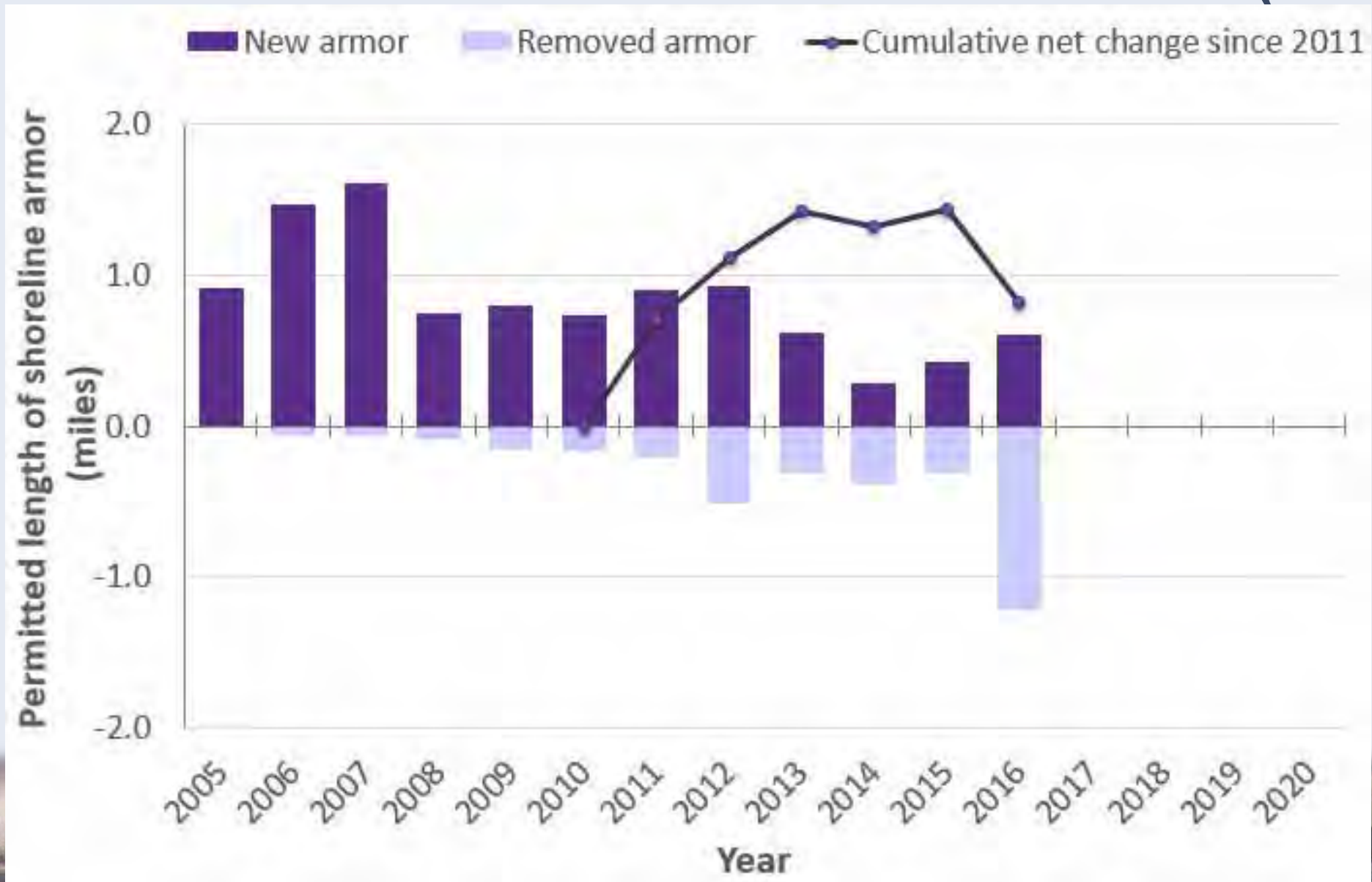
Conclusion: The Model Works!

(But... it takes time)

Lessons Learned To Date:

- Landowners respond to the science
- Sea level rise is very real to most coastal landowners
- Demonstration projects are needed
- It's challenging to take the emotions and connection to their property out of the equation – you can't, so science can bridge the gap
- Expect it to take a long time to get to “Yes”
- Important to also take the next step with the landowner...Help fund the project

Puget Sound-wide Shore Armor (Bulkhead) Trends 2005 – 2016 (WDFW)



Marine Resource Committees

Funders:

Puget Sound Marine Nearshore
Grant Program

Estuary Salmon Restoration
Program

EPA

NW Straits Commission

Puget Sound Partnership







Removal Sites Now In Progress



2. Beach Strategies

Improves on existing research and mapping

- Entire Puget Sound area
- Finer spatial resolution
- Most-recent data
- New research and mapping

Beach Strategies Phase 1 Summary Report
Identifying Target Beaches to Restore and Protect
Estuary and Salmon Restoration Program Learning Project #14-2308

Prepared for the Estuary and Salmon Restoration Program
Prepared by Coastal Geologic Services, Inc.

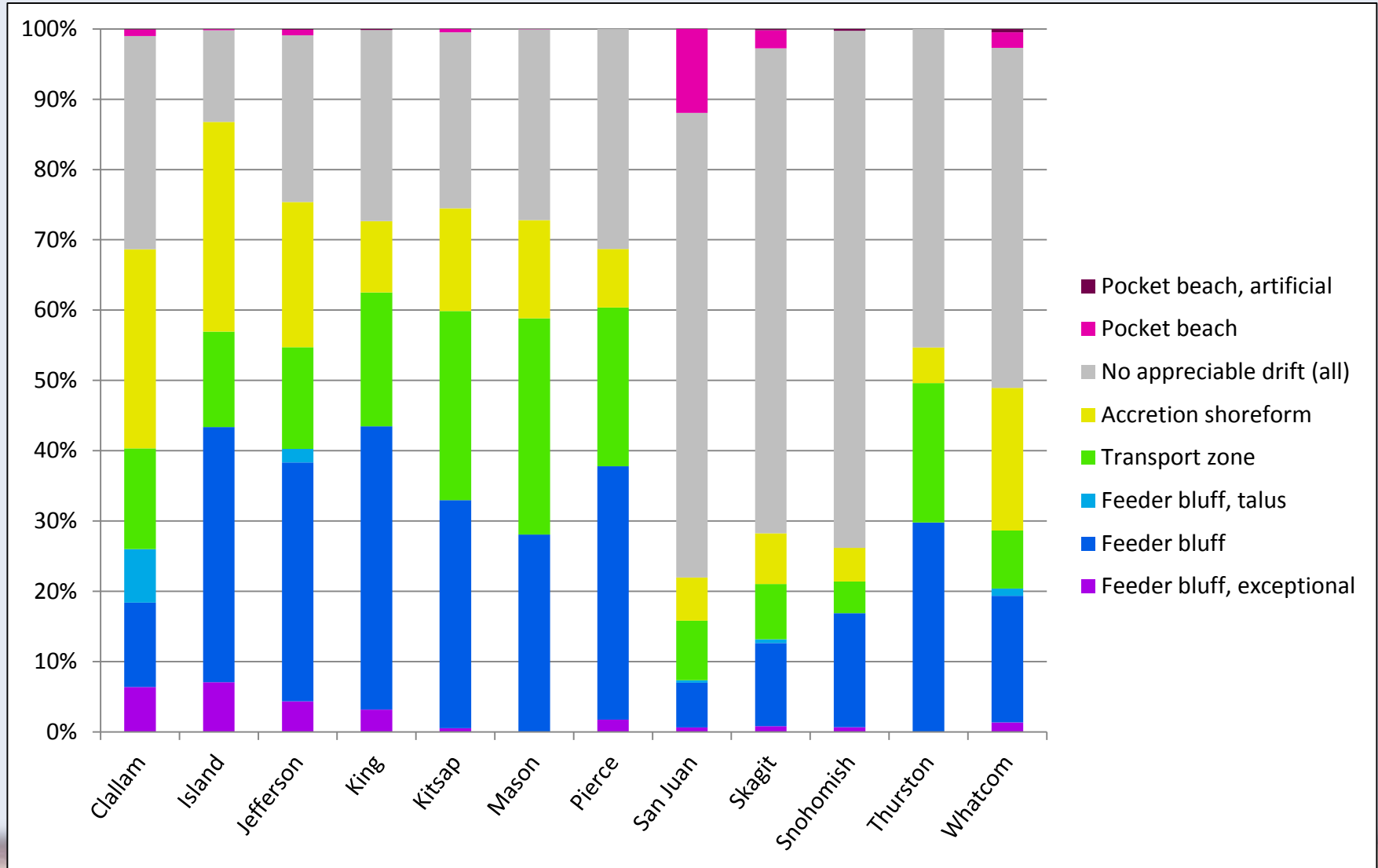
Contributors: Andrea MacLennan, Branden Rishel, Jim Johannessen, Alison Lubeck
and Lauren Øde



October 25, 2017



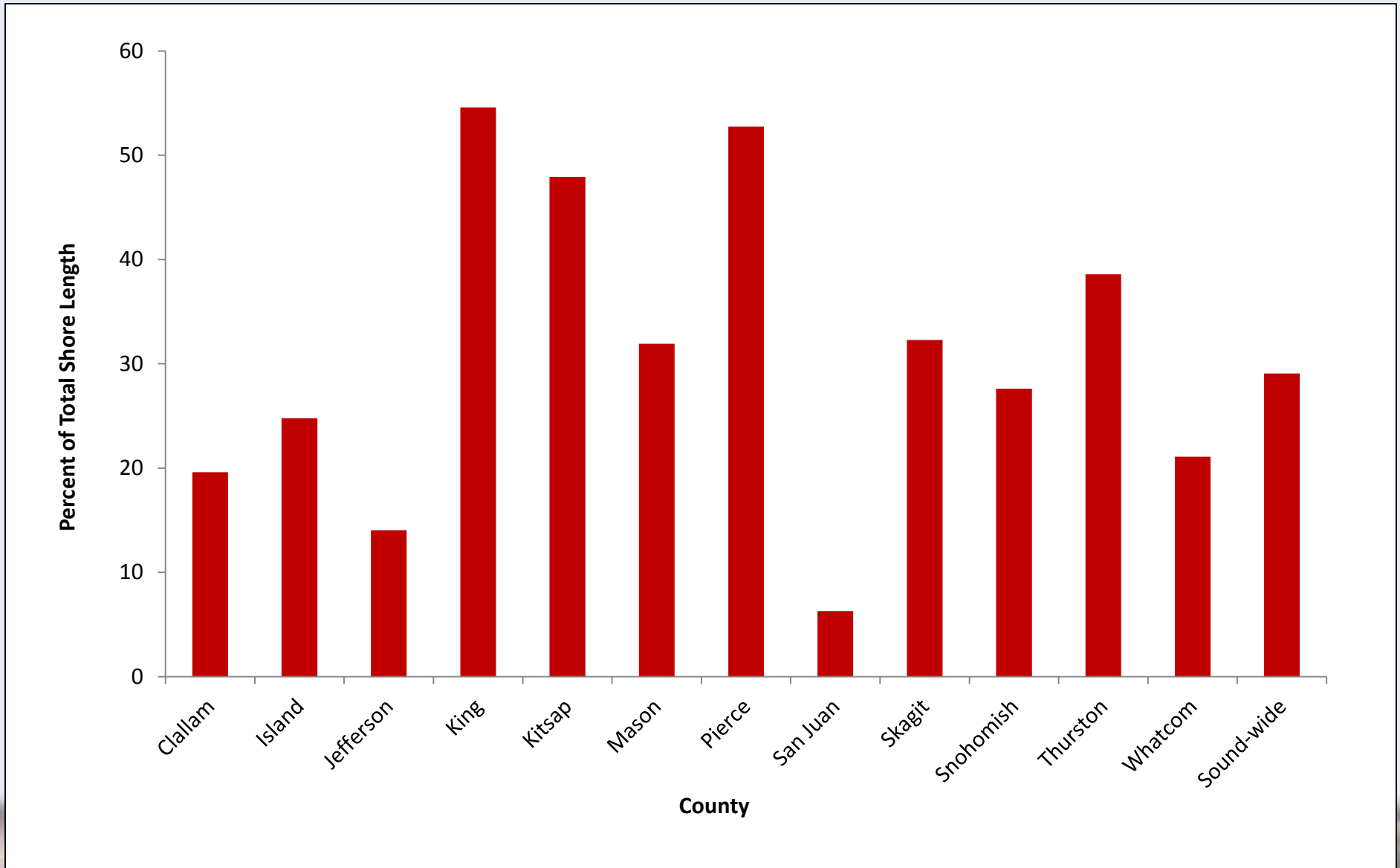
Some Data... Shoretypes: Percent Length by County



Shoretypes: Intact and Degraded Feeder Bluffs

County	FB Intact, miles	FB Armored, miles	FB Total, miles	Percent FB Armored
Clallam	33.6	7.8	41.3	18.8
Island	72.9	21.3	94.2	22.6
Jefferson	72.0	9.1	81.1	11.2
King	21.1	32.4	53.5	60.5
Kitsap	50.0	33.9	83.8	40.4
Mason	42.8	22.2	65.0	34.2
Pierce	47.8	43.1	90.8	47.4
San Juan	22.4	7.6	30.0	25.3
Skagit	21.0	9.2	30.2	30.5
Snohomish	7.5	14.9	22.4	66.6
Thurston	16.0	18.3	34.3	53.4
Whatcom	23.9	6.0	29.8	20.1
Sound-wide	430.9	225.7	656.6	34.4

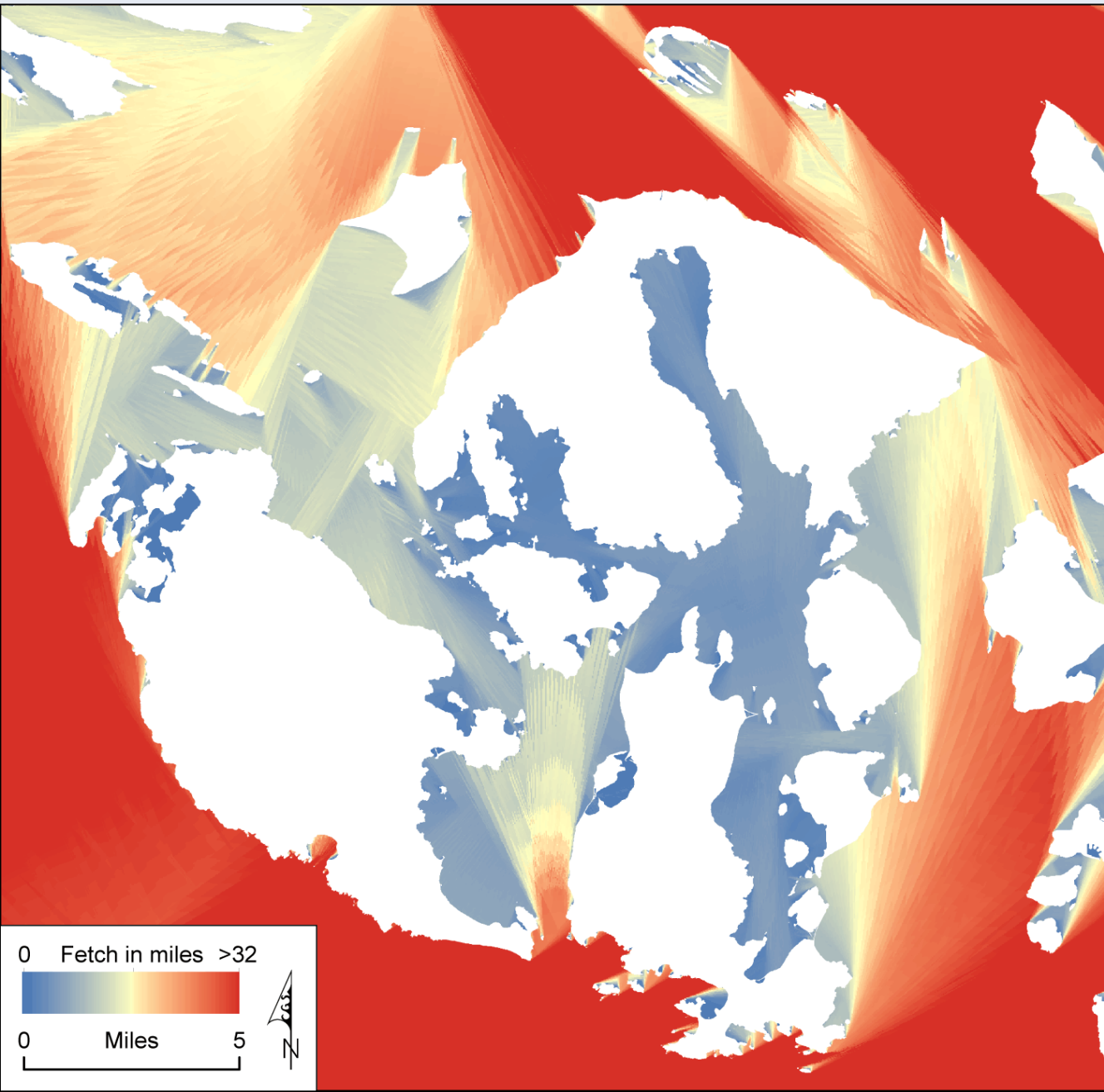
Armor: Length and Percent by County



Parcels: Ownership and Density by County

County	Residential		Nonresidential		Parcel density
	Parcel Count	Shore Length, mi	Parcel Count	Shore Length, mi	Parcels per mile
Clallam	1,032	47	400	112	9
Island	5,861	137	957	77	32
Jefferson	3,299	118	411	83	18
King	3,297	68	553	52	32
Kitsap	7,789	200	740	54	34
Mason	5,534	155	733	77	27
Pierce	5,037	139	912	84	27
San Juan	4,584	280	385	124	12
Skagit	2,044	63	1,047	164	14
Snohomish	1,694	40	508	90	17
Thurston	2,627	81	211	35	24
Whatcom	2,202	58	763	77	22
Total	45,000	1,386	7,620	1,030	22

Fetch model: San Juan Co. Example



Net Shore-Drift Cells

Percent FB Armored

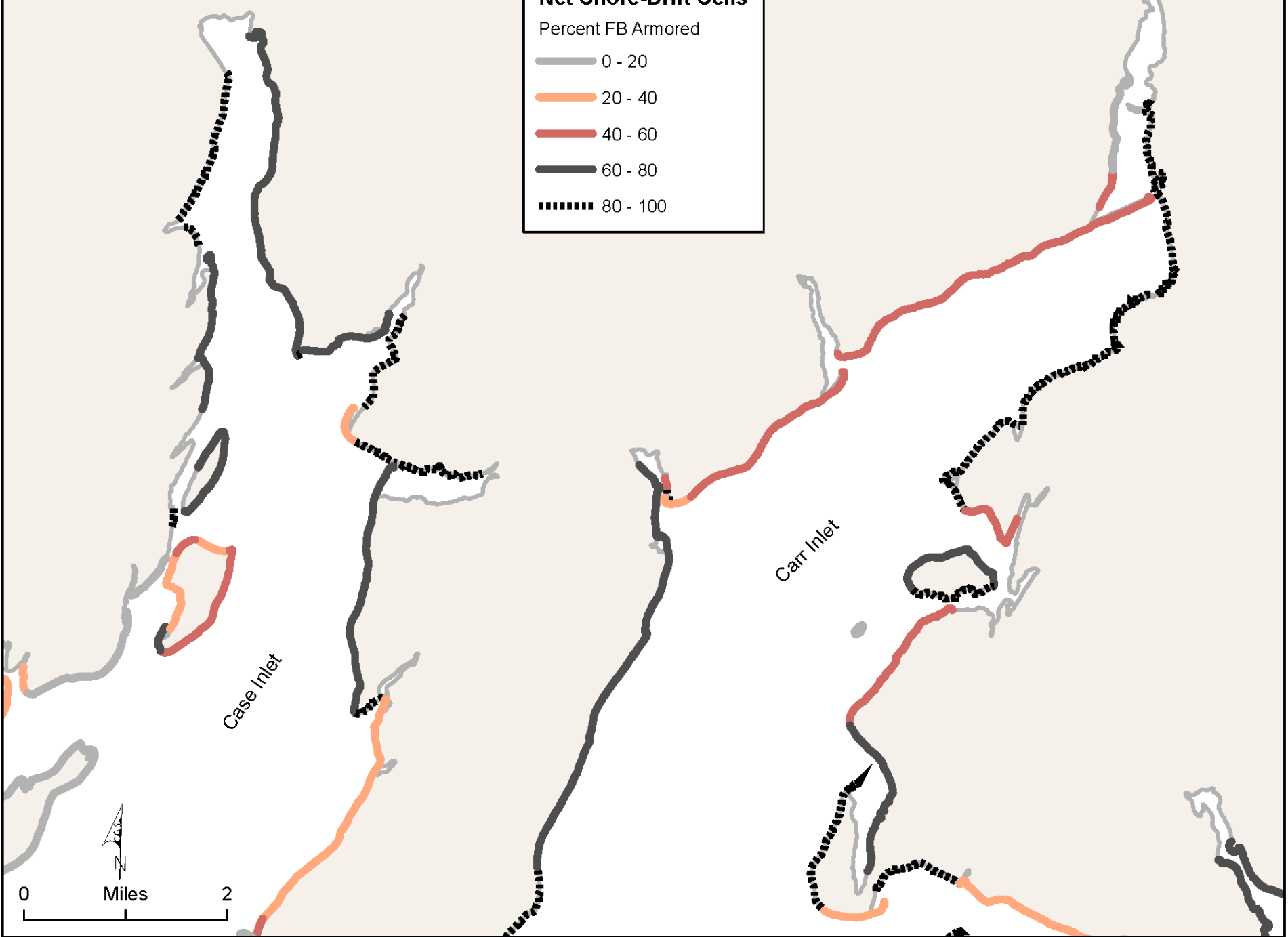
0 - 20

20 - 40

40 - 60

60 - 80

80 - 100



Case Inlet

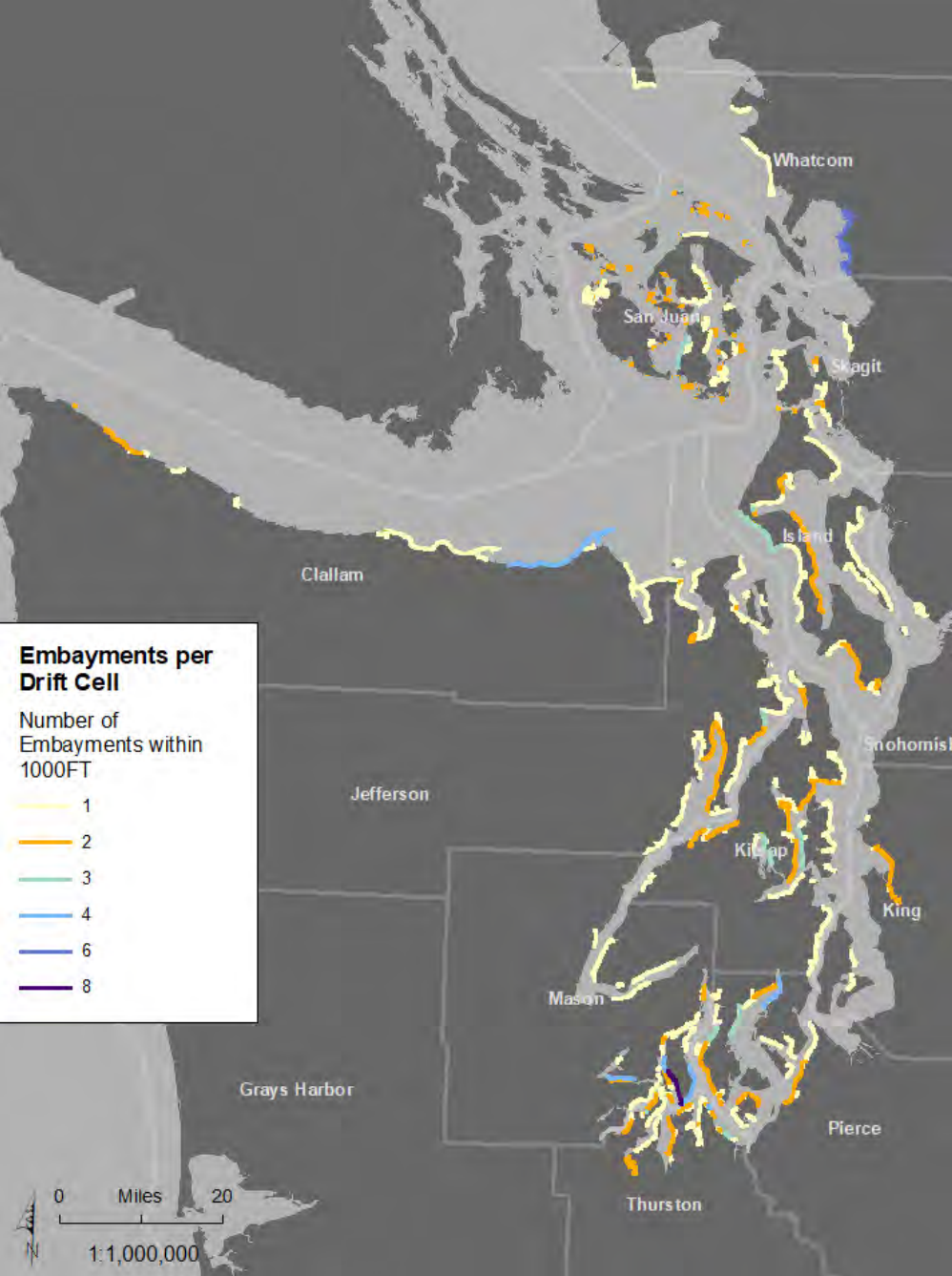
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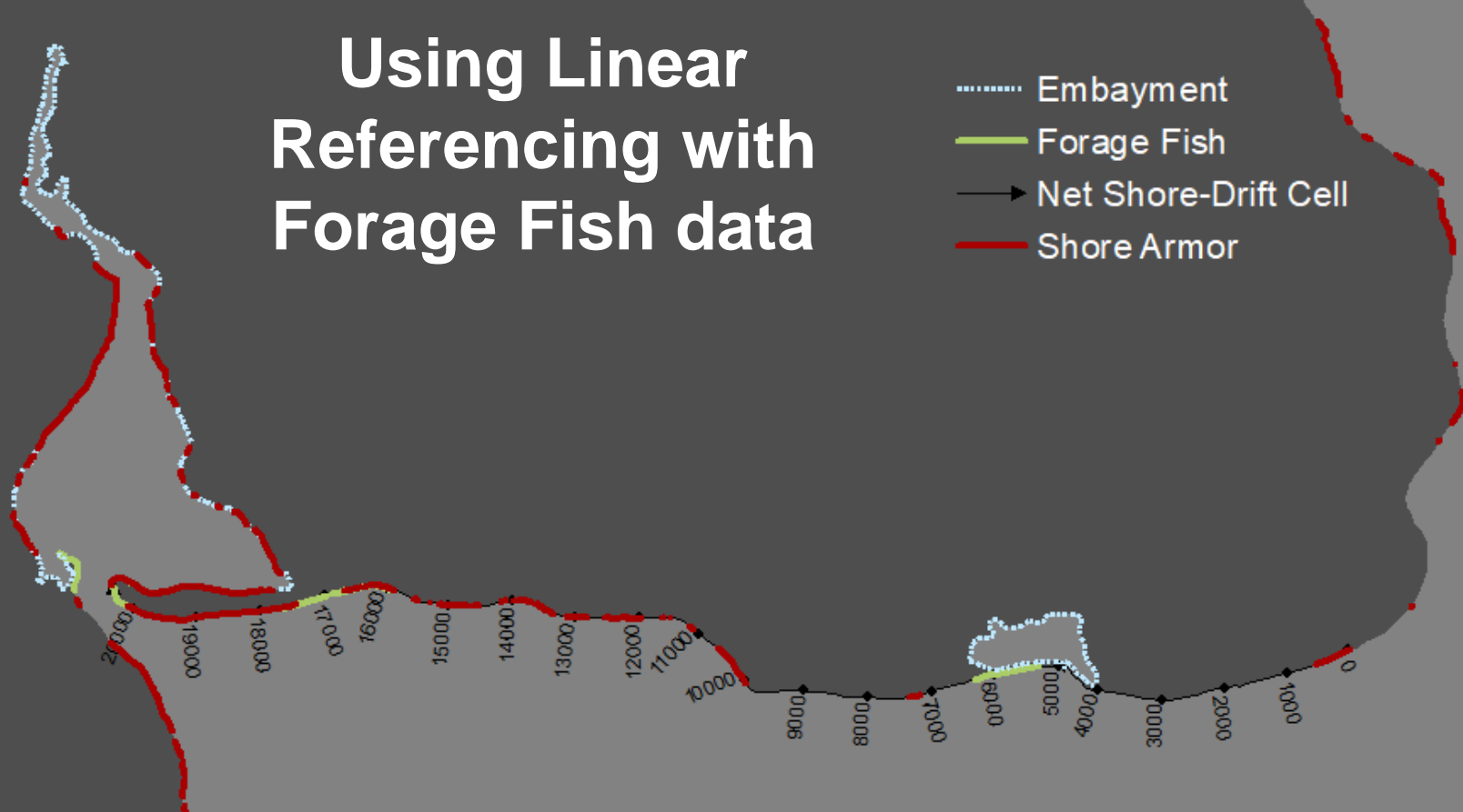
0 Miles 2

Embayments per Drift Cell/Process Unit

- ◆ Grouped by C_Type: BE, BL, and CLM
- ◆ Includes ART shores that were historically BE, BL, or CLM
- ◆ Within 1,000 feet
- ◆ Drift cell with most nearby embayments (8) located in Mason County on Hartstene Island
- ◆ Areas not shown contain no nearby embayments



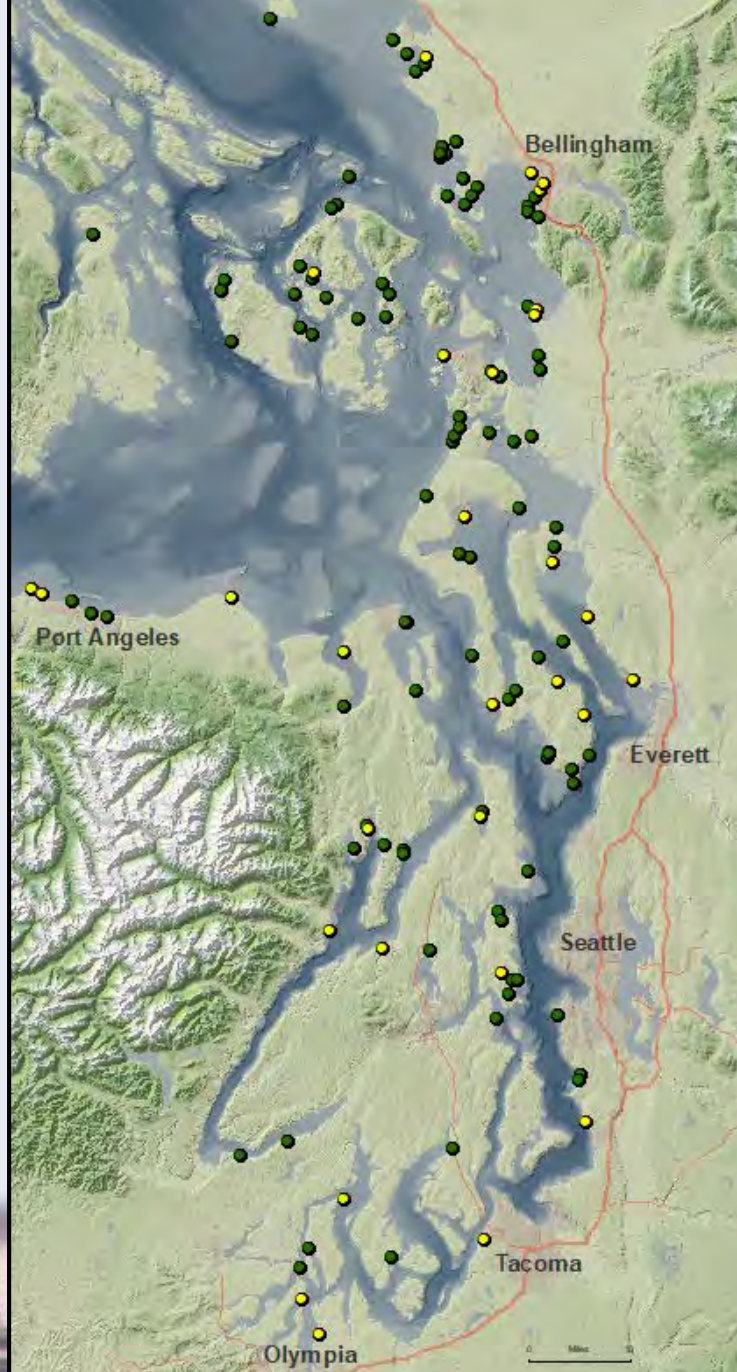
Using Linear Referencing with Forage Fish data



- ◆ Drift Cell KSMA028 (Indianola, Kitsap County)
- ◆ Line hatching allows for easy visual assessment
- ◆ WDFW forage fish spawning data

Shoretypes Present in Drift Cell	Unarmored Length (FT)	Armored Length (FT)	Total Length	% Shoretype Armored
AS	3109	2787	5896	47
FB	7253	3280	10533	31
FBE	1268	0	1268	0
TZ	1648	1195	2843	42
All	13278	7262	20540	35

3. Other Armor Removal and SLR Adaption Projects



Coastal Geologic Services, Inc.
Bulkhead Removal Projects

- Complete
- Design Phase



Weaverling Spit Armor Removal & Beach Nourishment

Phase 3: 2017

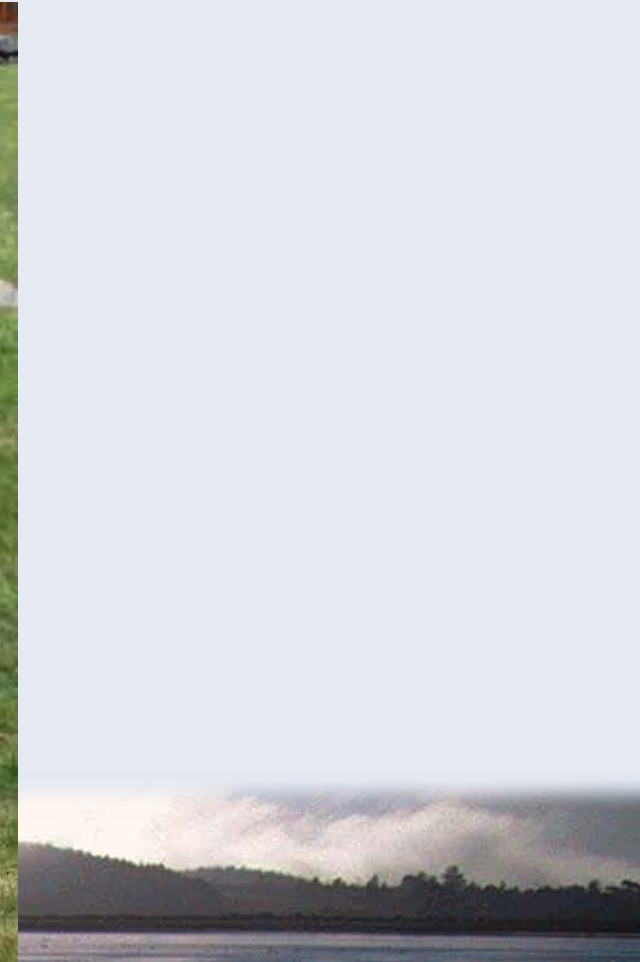
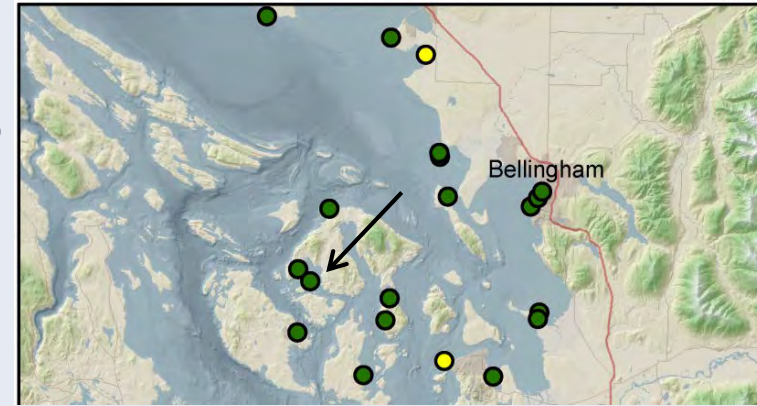
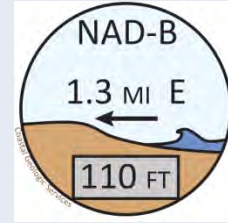
Phase 2: 2012



SLR-Ready Bulkhead Removal

Private Site, West Sound, Orcas Island - 2015

- ◆ 20 ft high marine bank
- ◆ Willing landowners, late 2015 removal
- ◆ Owner funded & Friends of San Juans organized forage fish and beach monitoring for several years



SLR-Ready Bulkhead Removal Private Site, West Sound, Orcas Island - 2015



Bulkhead Removal Private Site, West Sound, Orcas Island - 2016



Before



Bulkhead Removal Private Site, West Sound, Orcas Island - 2016



SLR-Ready Bulkhead Removal – Orcas Is.



After



Your Marine Waterfront

A guide to protecting your property while promoting healthy shorelines

Enjoy the beach. Protect your home. Improve shoreline habitat.

Washington Department of FISH and WILDLIFE



Before

Landowners on Orcas Island installed a gravel beach with logs and native vegetation in place of a rock berm. This new beach enhances storm protection, improves beach access, and provides habitat for fish and wildlife.



Thanks!

Incorporating science (GIS analysis, prioritization) with targeted outreach (much information, site visits) garners desired results

*armor removal trends show this
new coastal owners all the time*

Beach Strategies database allows for improved science and outreach

We have SLR adaptation techniques

Need to scale up!

reimagine shorelines

Need leadership, funding and improved/less cumbersome regulation

if we are to avoid the worst of SLR