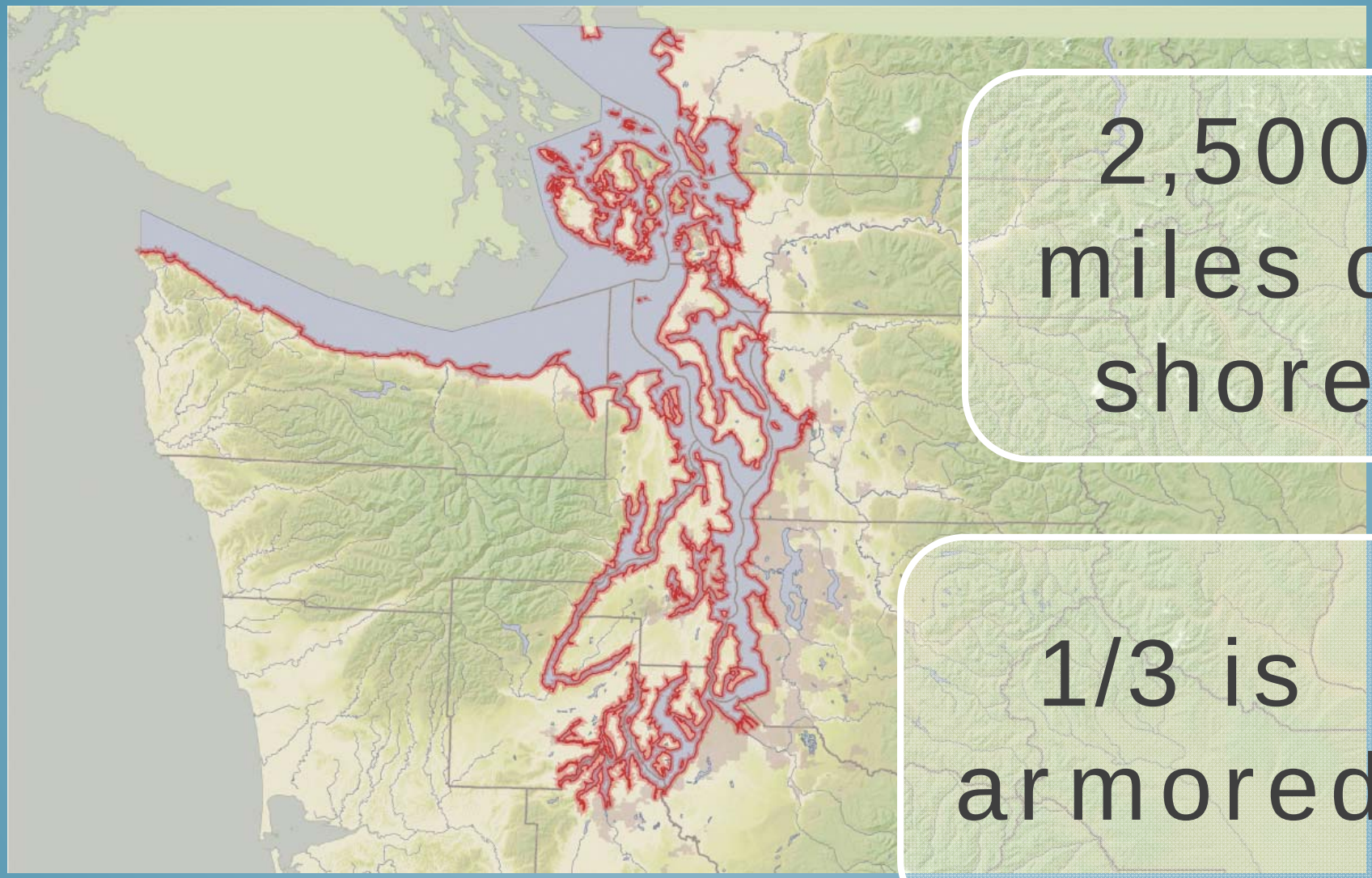
MSDG

Marine Shoreline Design Guidelines

County Coastal Caucus– 23 July 2014

Presented by: Theresa Mitchell, WA Dept. of Fish & Wildlife

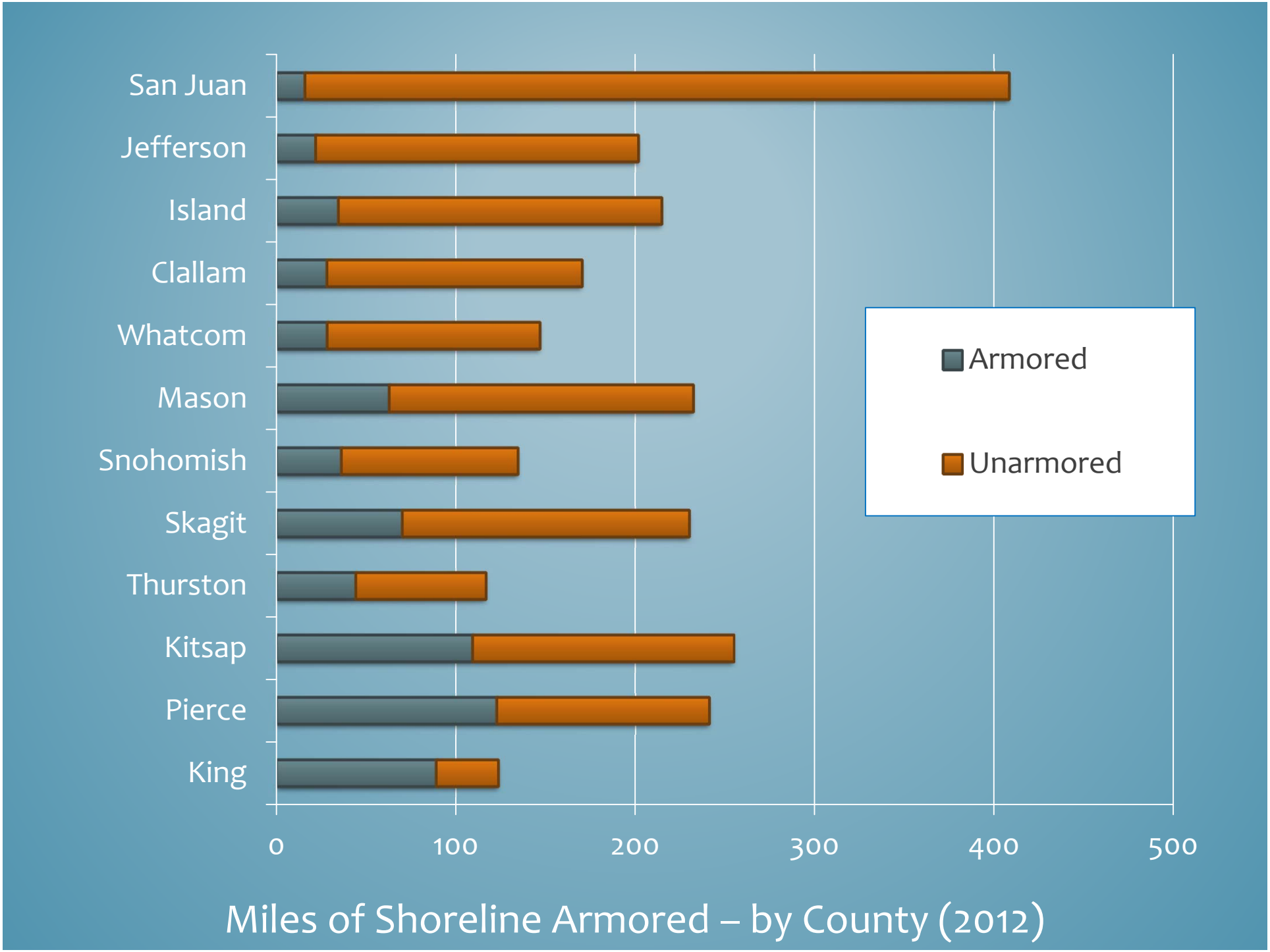


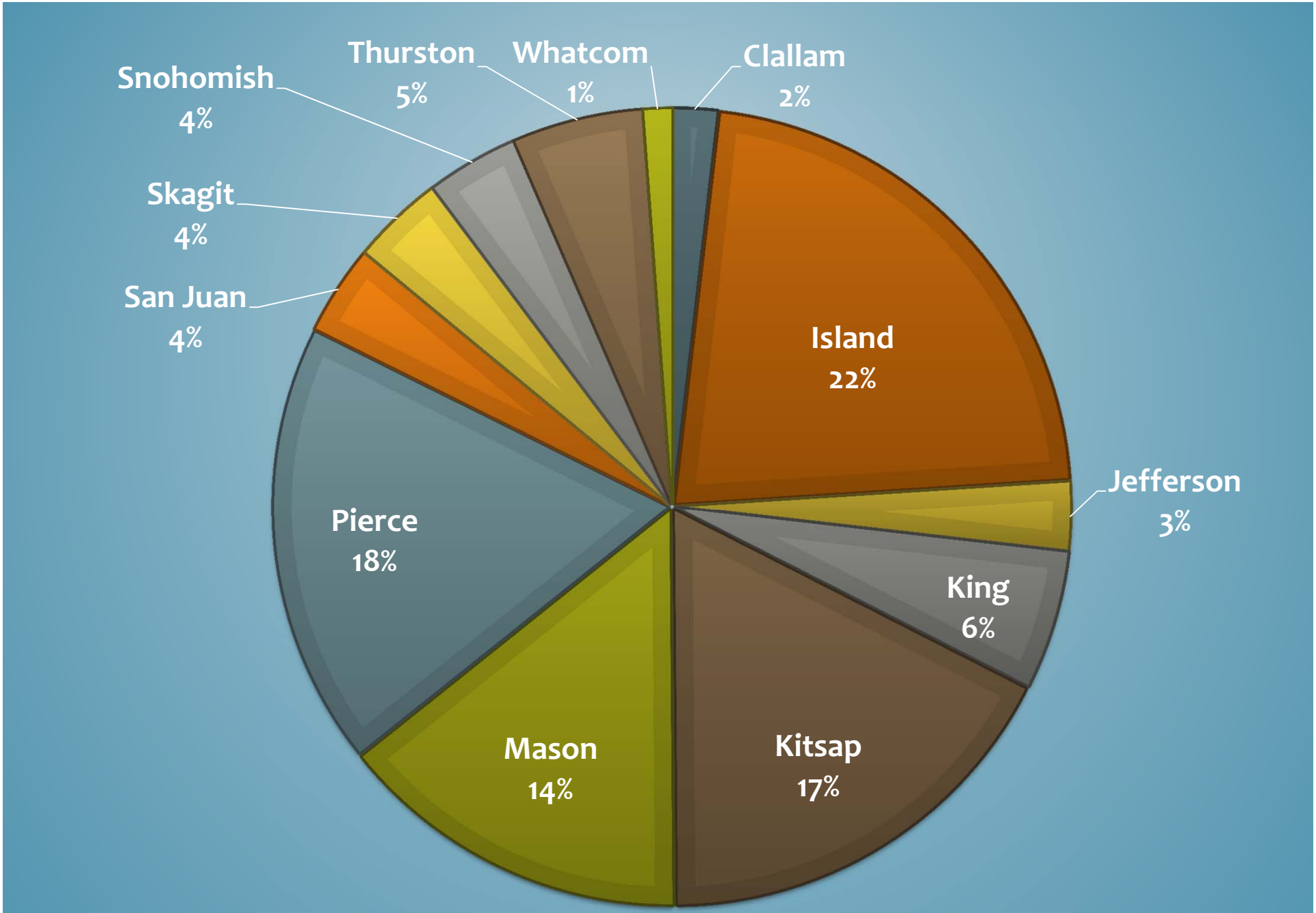
2,500 miles of shore

1/3 is armored

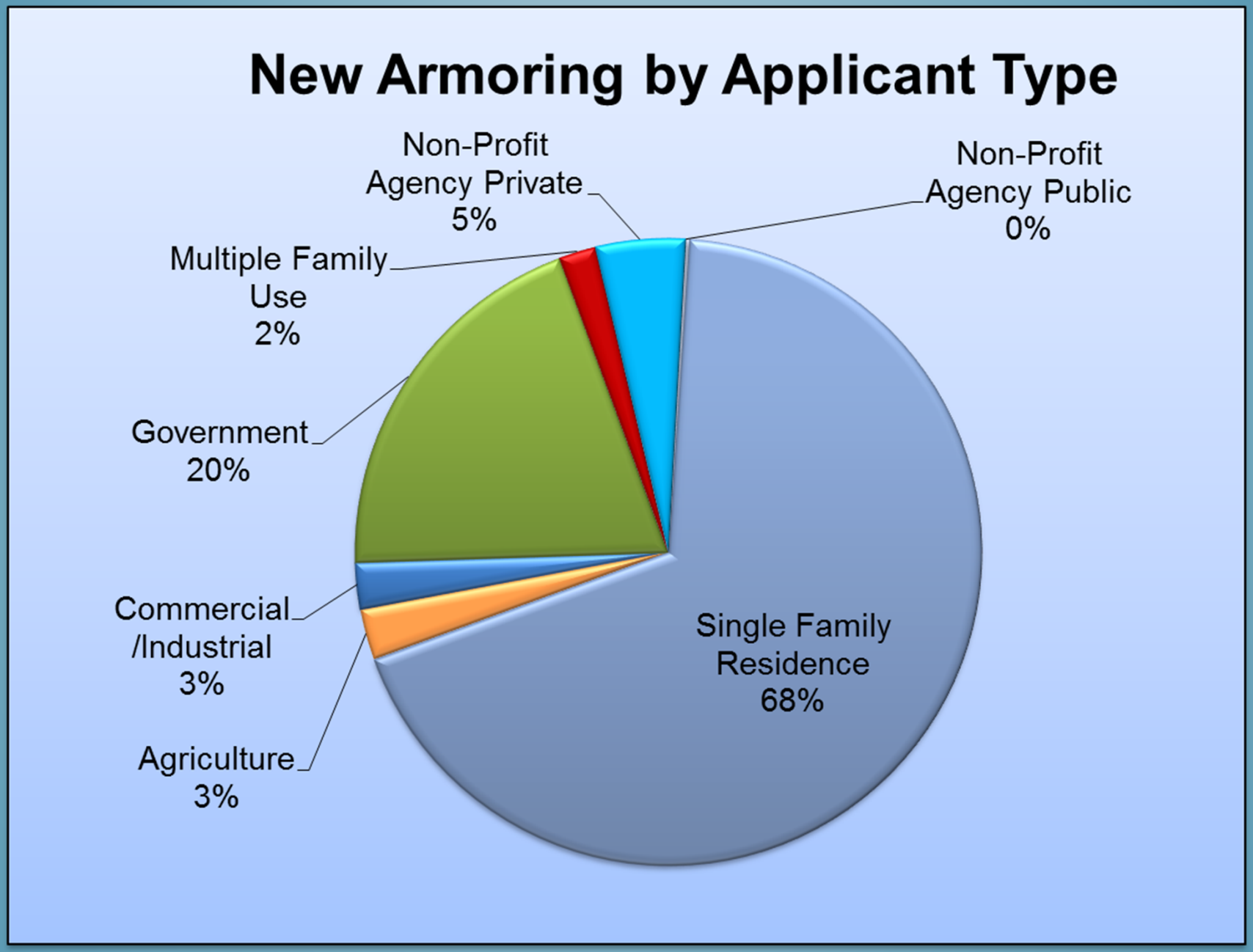
Marine Shoreline Design Guidelines

Evaluation and Design Guidance for Puget Sound shorelines

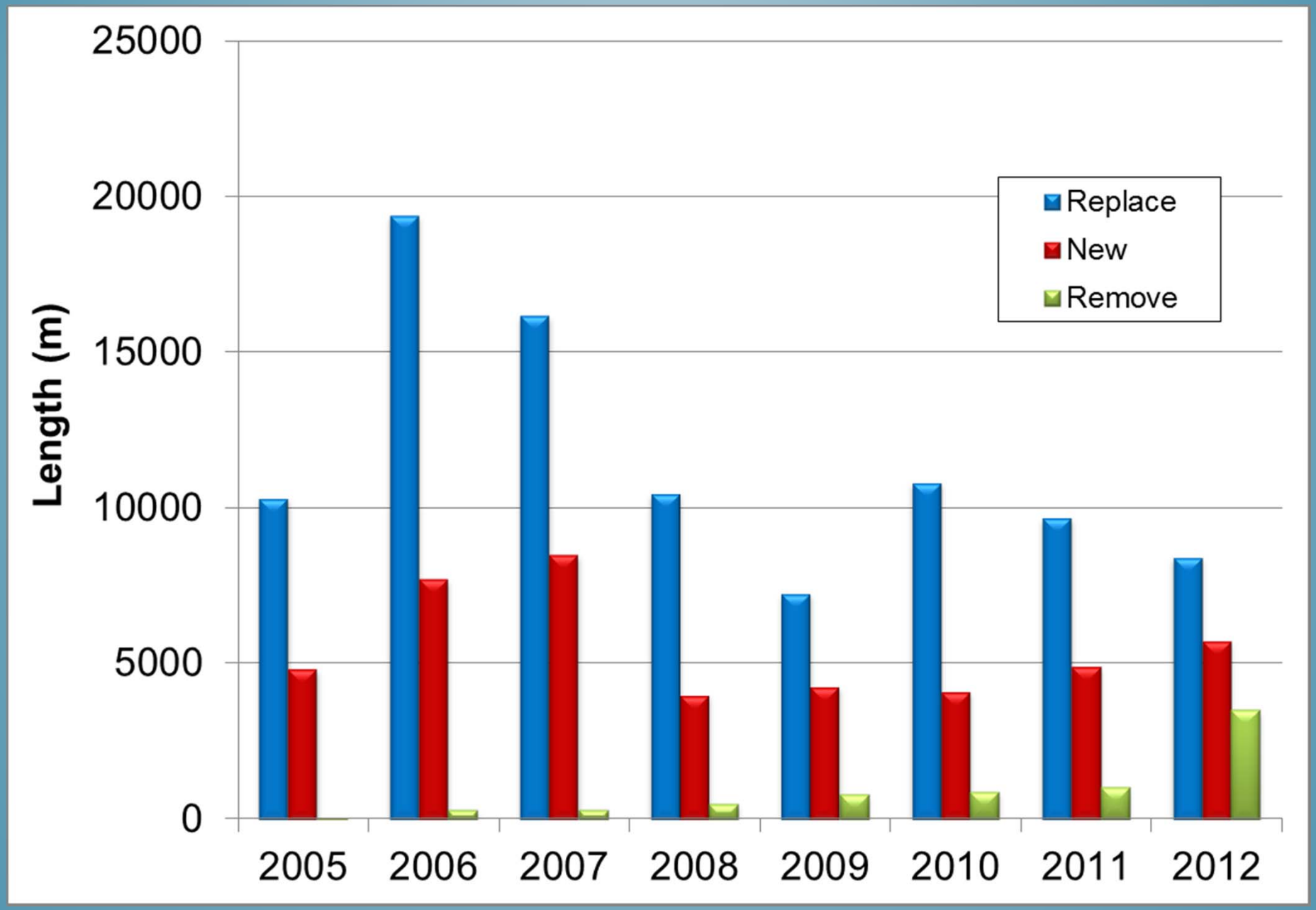

San Juan
Jefferson
Island
Clallam
Whatcom
Mason
Snohomish
Skagit
Thurston
Kitsap
Pierce
King
0
100
200
300
400
500
Armored
Unarmored
Miles of Shoreline Armored – by County (2012)



WDFW Permitted Armoring Projects 2005-2012 (Number of Projects)



New Armoring Permits by Applicant Type (# of permits)



Shoreline Armoring Permit length 2005-2012 (meters)

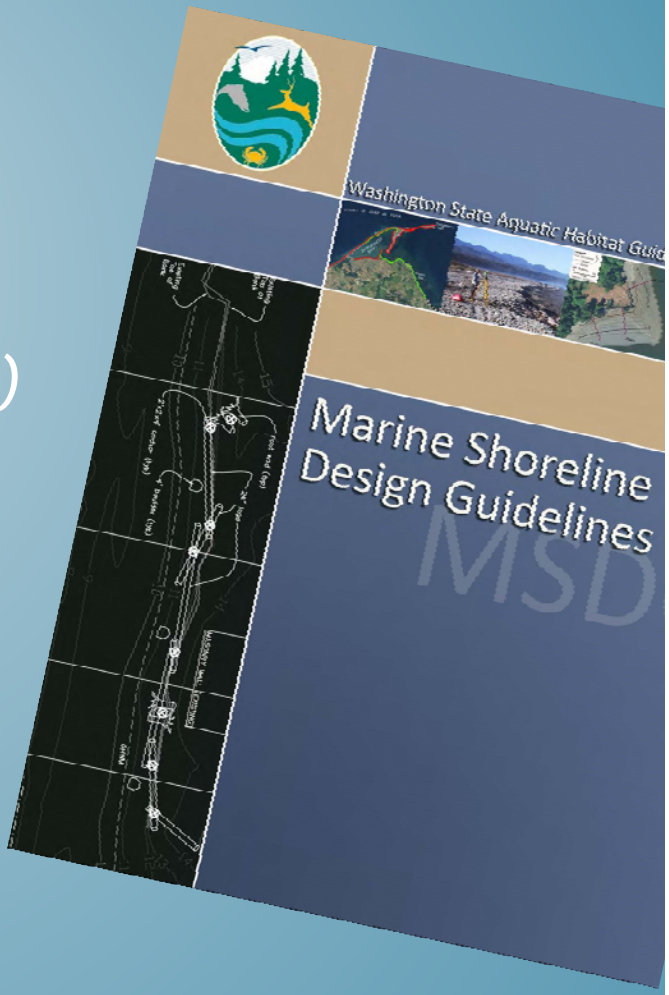
Puget Sound Partnership – Action Agenda

~ Target for 2020 ~

*"The total amount of **armoring removed** should be greater than the total amount of **new armoring** in Puget Sound."*

MSDG CHAPTERS

- *Impacts of Armoring (Ch. 1)*
- *Stewardship (Ch. 2)*
- ***Site Assessment (Ch. 3)***
- ***Coastal Process Assessment (Ch. 4)***
- ***Alternatives Analysis (Ch.5)***
- *Passive Management (Ch. 6)*
- *Alternative Techniques (Ch. 7)*
- *Monitoring (Ch. 8)*
- *Research and Development (Ch. 9)*
- ***Case Studies (Appendix A)***
- *Literature Review (Appendix B)*



Site Visit and Characterization

- Geology and Geomorphology
- Upland Surface Water Drainage
- Vegetation, Habitat, Species
- Cultural Resources
- Site Development Features
- Erosion Control Structures

Marine Shoreline Design Guidelines **Conducting a Site Assessment**

Data Collection Guide

GEOLOGY AND GEOMORPHOLOGY (pg 3-7)

- ☐ geology: units/stratigraphy, slope character
- ☐ landslide activity: year and type, potential drivers
- ☐ groundwater, relative sediment permeability, hydrophilic vegetation
- ☐ geomorphology: shoretype, localized beach features, erosion scarps
- ☐ wave climate & coastal flooding
- ☐ evidence of coastal erosion
- ☐ beach sediment & grain size
- ☐ backshore features: dimensions, LWD, vegetation
- ☐ alongshore site segments: delineation & descriptions
- ☐ cross sections: elevations, bluff top & toe, backshore features, MHHW, slope & toe of beach, water line

SITE VEGETATION, HABITAT, AND SPECIES (pg 3-12)

- ☐ native vegetation, plant species present, erosion control; indicate processes
- ☐ vegetation condition, communities
- ☐ juvenile salmon, forage fish habitat
- ☐ animal species present, animal usage

UPLAND SURFACE WATER DRAINAGE (pg 3-11)

- ☐ general watershed conditions, streams, wetlands
- ☐ seeps and springs
- ☐ drainage control: water sources: stormwater systems, discharge points, impervious surfaces

CULTURAL RESOURCES (pg 3-14)

- ☐ potential historical use, shell midden or other evidence

SITE DEVELOPMENT FEATURES (pg 3-14)

- ☐ primary structures/ locations: houses, roads, septic; setbacks, potential to relocate
- ☐ secondary features: sheds, garages, driveways, unattached patios; potential to relocate
- ☐ irrigation and water features: irrigation, ponds, fountains
- ☐ presence of fill or excavated areas
- ☐ potential for contaminated sediment or debris

EROSION CONTROL STRUCTURES (pg 3-15)

- ☐ type of structure and material used
- ☐ condition of structure
- ☐ structure elevation

(checklist on page 3-6)

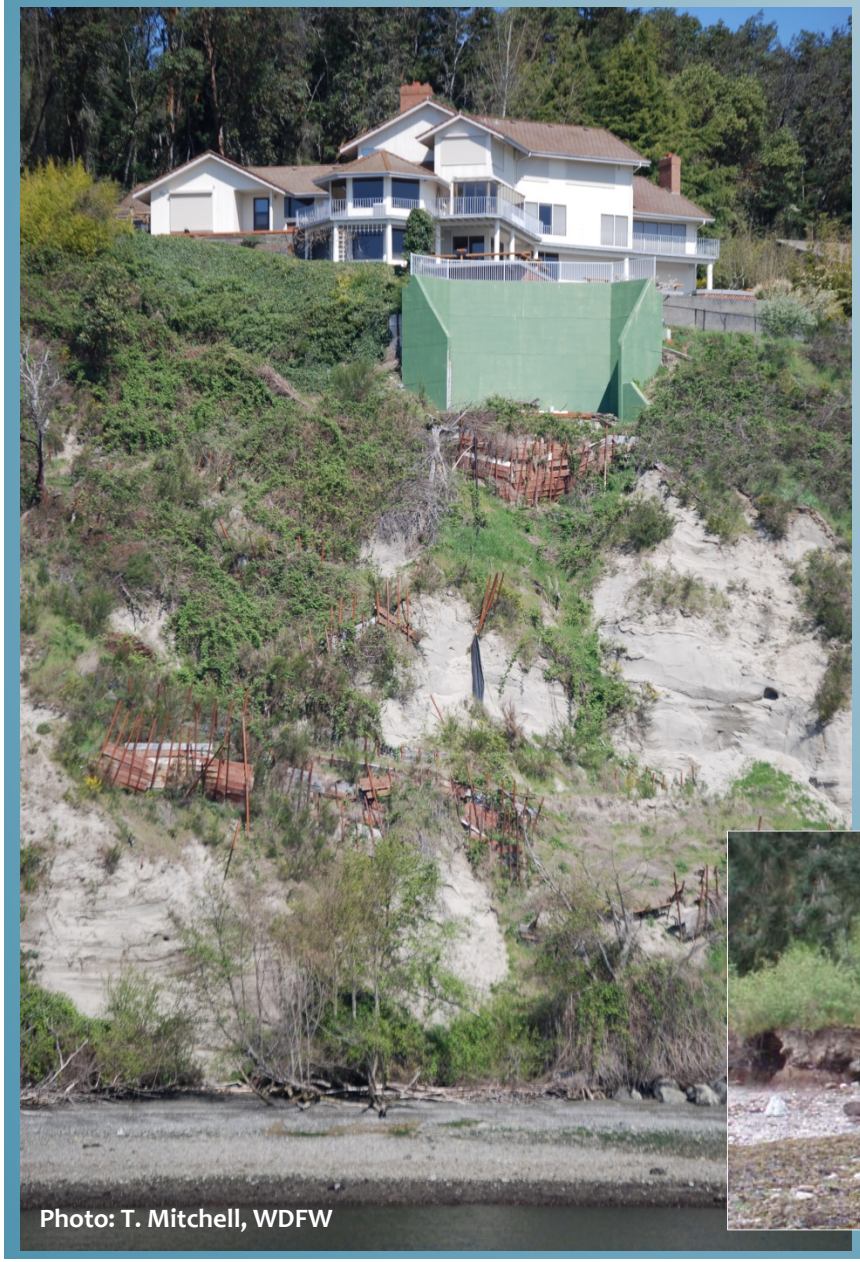


Photo: T. Mitchell, WDFW

Types of Erosion?

Different types.

Different causes.

Photo: T. Mitchell, WDFW

Identify the Problem

- Beach/ Backshore Erosion
- Bluff Toe Erosion
- Mass Wasting (landslide)
- Rilling or Gully Formation

Assessing Site-Based Erosion

- ☐ Where on the site is erosion occurring?
- ☐ What type of erosion or mass wasting is occurring?
- ☐ Why is erosion occurring?
  - Wave attack
  - Historical beach gravel mining (on site)
  - Historical fill (only) eroding
  - Bluff geology
  - Adjacent coastal structures
  - Surface/ground water management
  - Vegetation clearing
  - Site excavation or other modifications

- ☐ How fast is erosion occurring?
  - On-site evidence
  - History and type of landslides
  - Aerial photograph measurements
- ☐ Is erosion short-term or cyclical?
  - Temporary storm damage
  - Seasonal erosion/accretion
- ☐ What development or improvement is at risk?
  - Substantial, such as house or septic system
  - Roads or utilities
  - Other unsubstantial improvement

(checklist on page 3-6)

Erosion Rate?

Episodic!

Need data over long time scale

Photo: ABC News

Preliminary Risk Assessment

Helps distinguish perceived and actual need for erosion control

EROSION POTENTIAL

Shoretype	Score
No Appreciable Drift (NAD)-Bedrock/Low Energy	0
Modified, Accretion Shoreform, NAD-Delta	1
NAD- Artificial , Transport Zone, Pocket Beach	2
Feeder Bluff	3
Feeder Bluff Exceptional	4

+

Fetch	Score
0–1 mile	1
1–5 miles	2
5–15 miles	3
15+ miles	4

=

INFRASTRUCTURE THREAT

Setback	Score
>60 ft	1
36–60 ft	2
21–35 ft	3
0–20 ft	4

+

Infrastructure Type	Score
Property without structures	1
Septic drainfield or unattached residential infrastructure, not lived in	2
Home or residential building	3
Major infrastructure	4

=

X

x

Y

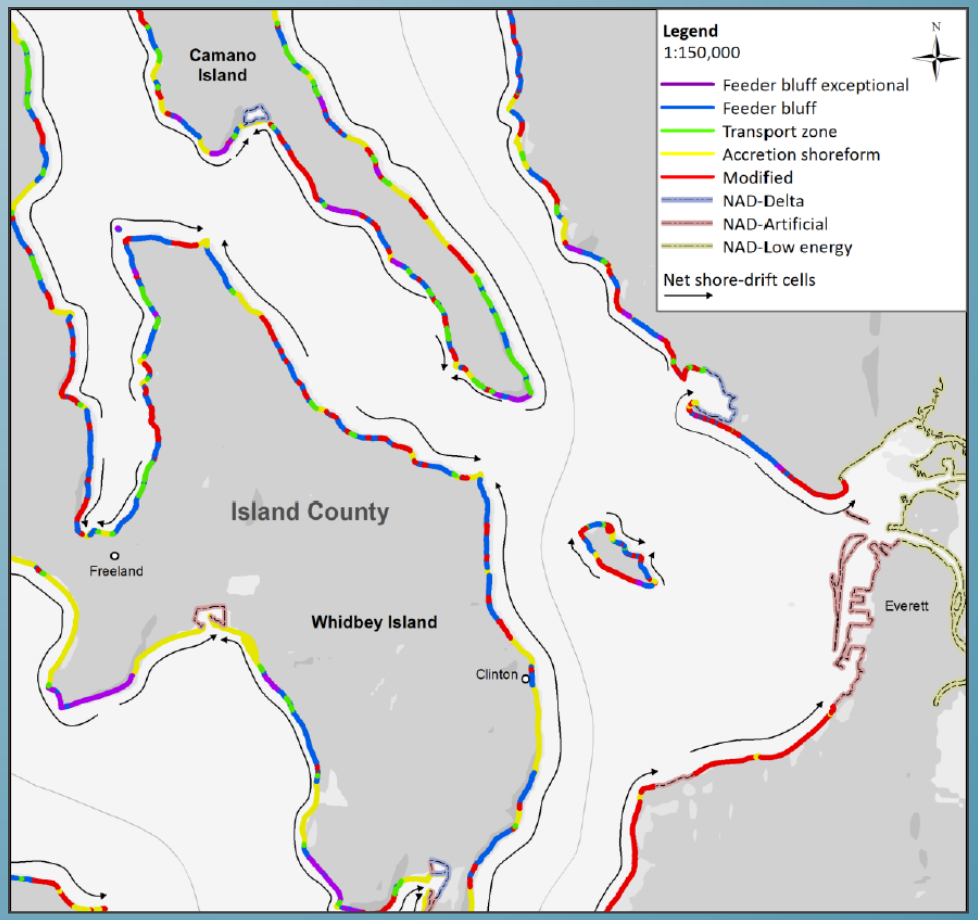
risk score

("cumulative risk model" page 3-19)

Coastal Process Assessment

Develop understanding of natural conditions at site and to inform alternatives analysis and design

1. Natural range of physical conditions
2. Assess current process degradation
3. Expected response to sea level change

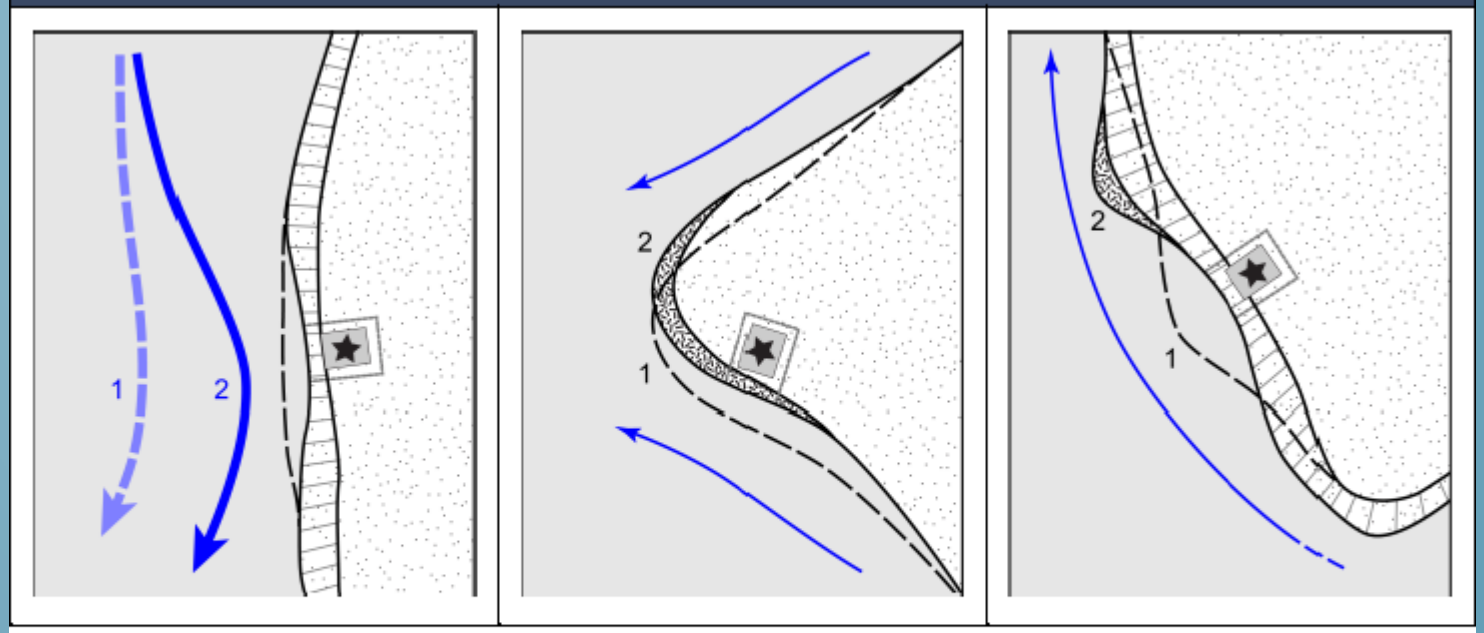


(data resources on page 4-3)

Identify the Problem

Due to **natural** trends?

Bluff or Barrier Beach Sites



Channel migration (star=site):

- Caused by tidal channel or subtidal river channel migrating closer to shore
- Waves and currents exacerbate erosional processes at the site

Northward migration of shoreform:

- South shore recedes as entire spit migrates north
- Caused by predominant southerly waves and net northward sediment transport

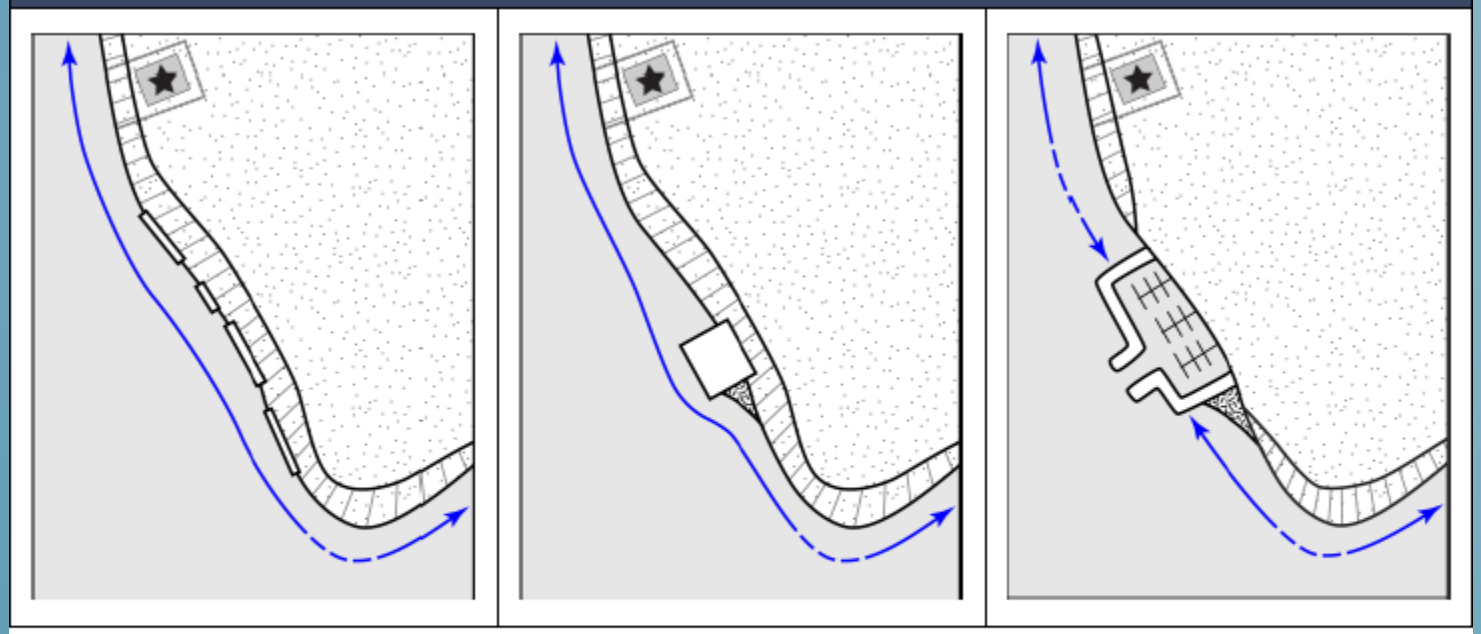
Migrating sand wave:

- Caused by a pulse of sediment migrating in the direction of net shore-drift
- The bluff toe erodes without the lobe of sediment to buffer wave attack

(questions on page 4-10)

Identify the Problem

Bluff or Barrier Beach Sites



Sediment supply degraded up-drift of site (star=site):

— Caused by cumulative impacts of numerous hard armor structures at historical feeder bluffs

Littoral drift reduced up-drift of site:

— Caused by fill and structure into the nearshore

— Not completely blocking littoral drift, but reducing volume

Net shore-drift cell shortened:

— Caused by major nearshore fill completely blocking drift

— Bifurcating historical drift cell and reducing volume of littoral drift

Due to **anthro-pogenic** trends?

(questions on page 4-11)

Design Techniques for Common Causes of Erosion

	Beach Nourishment	Large Woody Debris	Reslope/ Revegetate	Bulkhead Removal	Hard Armoring	Relocate	Best Management Practices
Site Based Causes (Natural)							
Wave Attack	●	●	●		●	●	
Bluff Geology			●			●	●
Deep Seated Landslide						●	
Site-Based Causes (Anthropogenic)							
Vegetation Clearing			●				●
Surface and Groundwater Management			●				●
On-site Beach Gravel Mine	●						
Fill or Artificial Shoreline	●	●		●	●	●	
Coastal Process Based Causes (Anthropogenic)							
Decreased Sediment Supply or Transport	●			●	●	●	
Altered Wave Action		●			●		
Boat Wakes	●	●			●		

(table on page 5-13)

Alternatives Analysis

An ideal shoreline management technique will:

1. Address the causes of erosion
2. Be appropriate for the level of risk
3. Match natural range of conditions
4. Avoid impacts to ecosystem

All Photos: T. Mitchell, WDFW

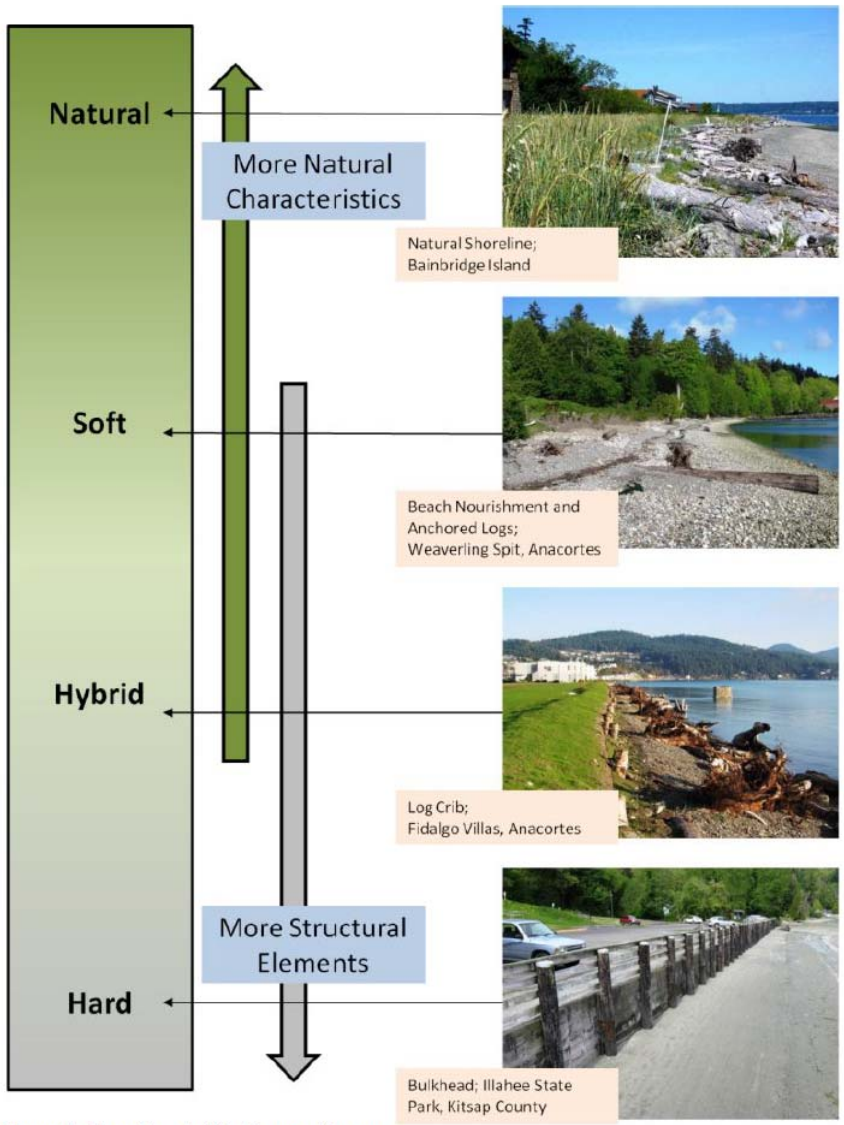


Figure 1: Shoreline stabilization continuum
(Hugh Shipman photos.)

Alt Analysis

Evaluate and select an appropriate management approach

types of approaches:

- Restoration
- Passive
- Soft Shore
- Hard Armor

Passive Management

No or minimal engineering

1. Surface and Groundwater Management
2. Vegetation Management
3. Relocation of Infrastructure

Passive Management

No or minimal engineering

1. Surface and Groundwater Management
2. Vegetation Management
3. Relocation of Infrastructure

Photo: T. Mitchell, WDFW

Photo: T. Mitchell, WDFW

Design Technique

'Restoration'

Bulkhead Removal

Photo: CGS

Design Technique

"soft" shore protection

Beach Nourishment

Photo: CGS

Design Technique

"soft" shore protection

Large Wood

Photo: CGS

Design Technique

"soft" shore protection

Reslope – Revegetation

Photo: CGS

Design Technique

'hard' armor

Vertical Bulkhead

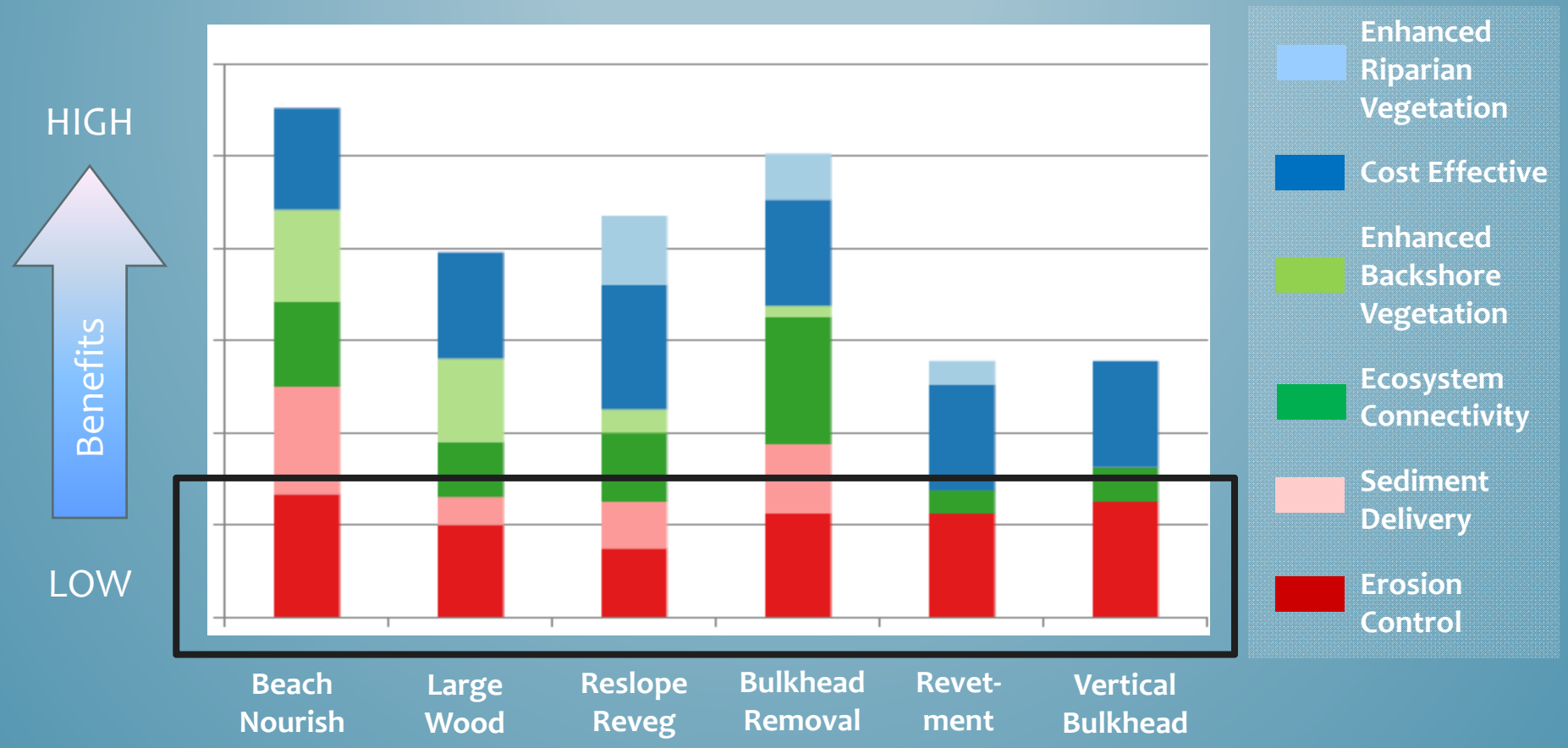
Photo: CGS

Which Design Technique is Appropriate?

- Cumulative Risk
- Wave Energy
- Beach Alignment
- Backshore Width
- Shoretype
- Project Length

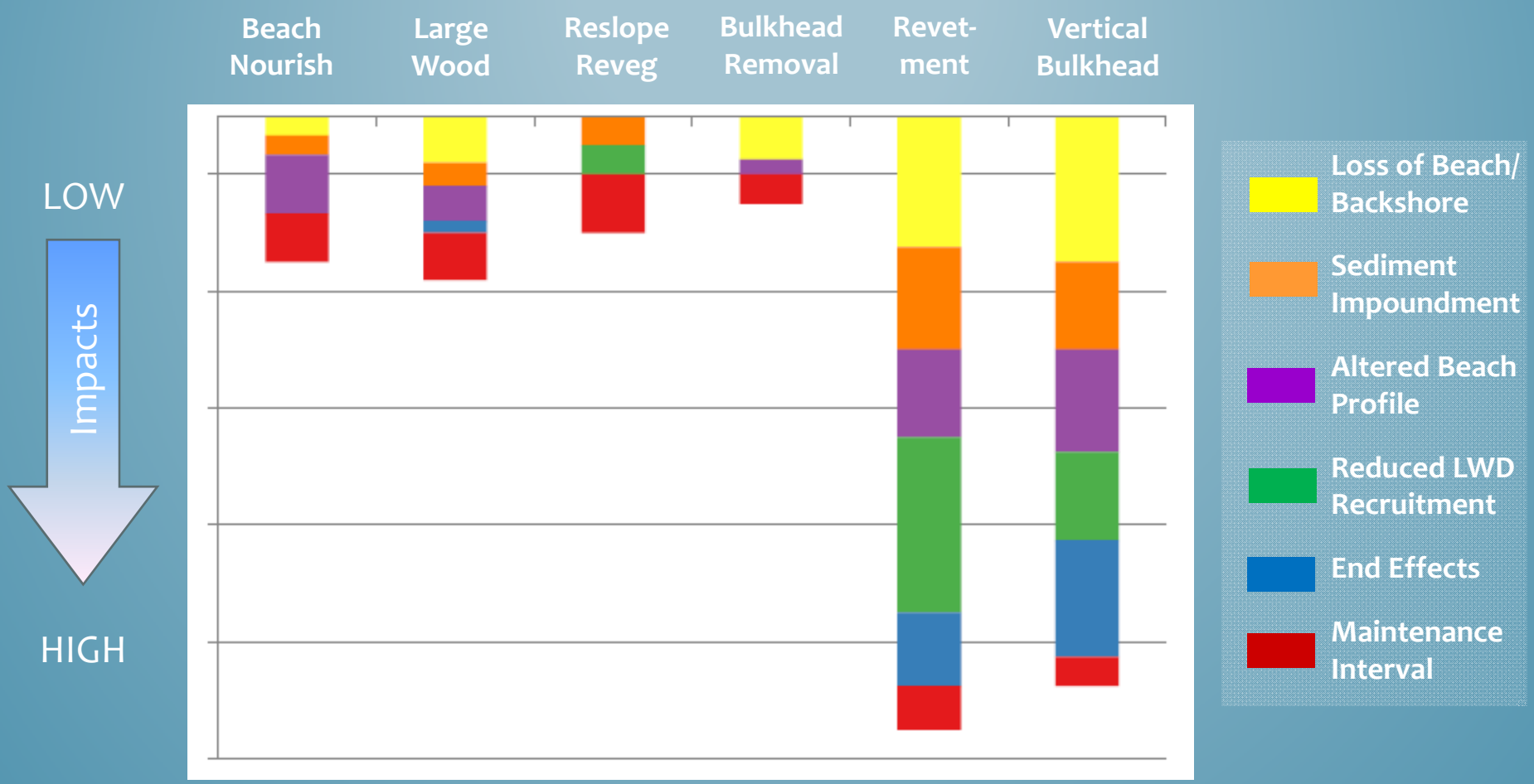
(decision tree on page 5-16)

Benefits of Design Techniques



(graph on page 5-11)

Impacts of Design Techniques



(graph on page 5-12)

How can the MSDG be used at the local level?

MSDG is a voluntary set of guidelines
(Not required by state or local codes.)

Ask applicants to submit information

Reviewers use checklists

Many technical decisions are made before regulatory staff are involved

Questions?

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Washington Department of FISH and WILDLIFE