Innovative Marina Designs

Lighter

Greener

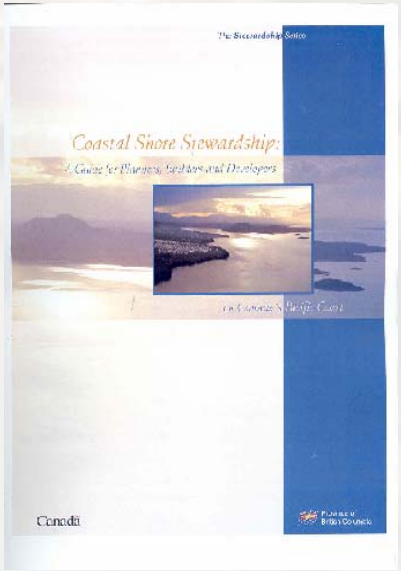
Smarter

Cleaner

Brian Emmett, Jack Cox, Shannon Kinsella, Ted Appleton
PCC Harbormasters/Port Managers Spring Conference
April 7, 2005

Green Shore Approaches to Shore Development

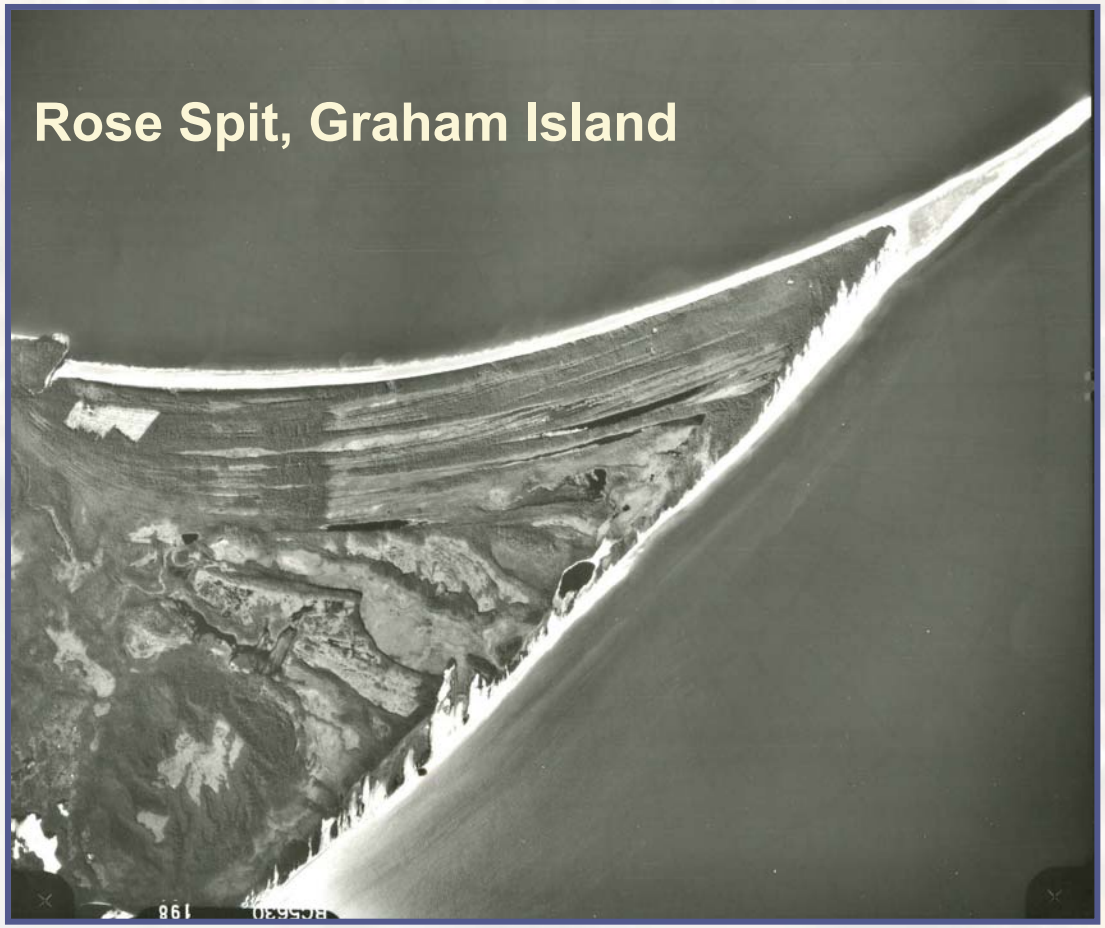
Brian Emmett
Archipelago Marine Research Ltd.
Victoria, BC



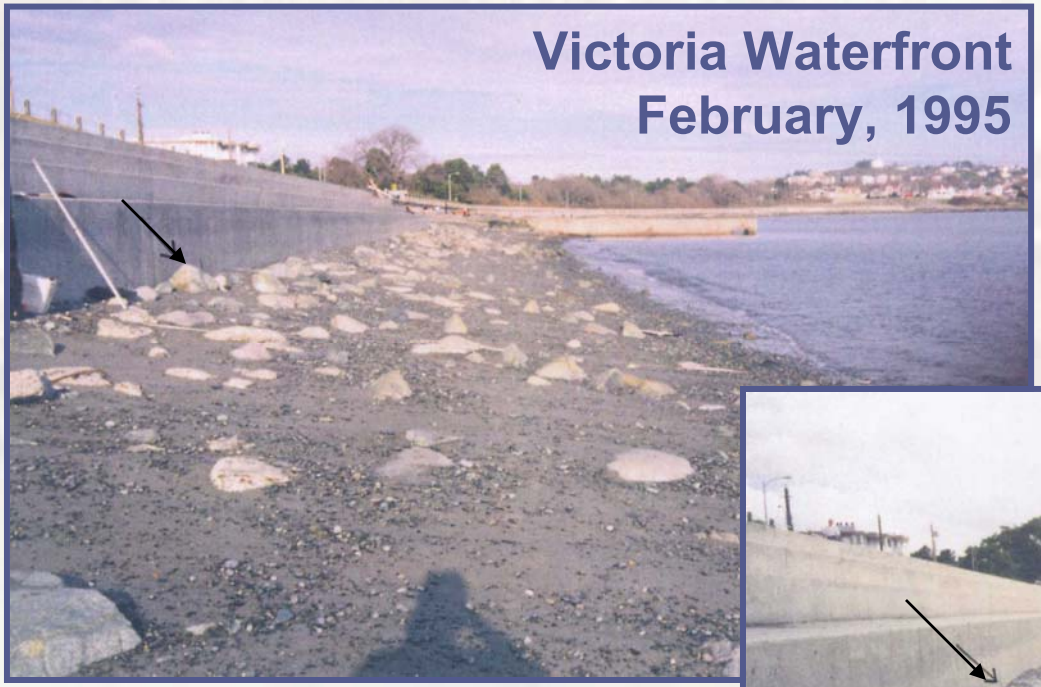
Coastal Shore Stewardship Guide
and
Green Shores Resources
www.stewardshipcentre.bc.ca

Shores are Dynamic Systems

Large scale changes occur over long time periods



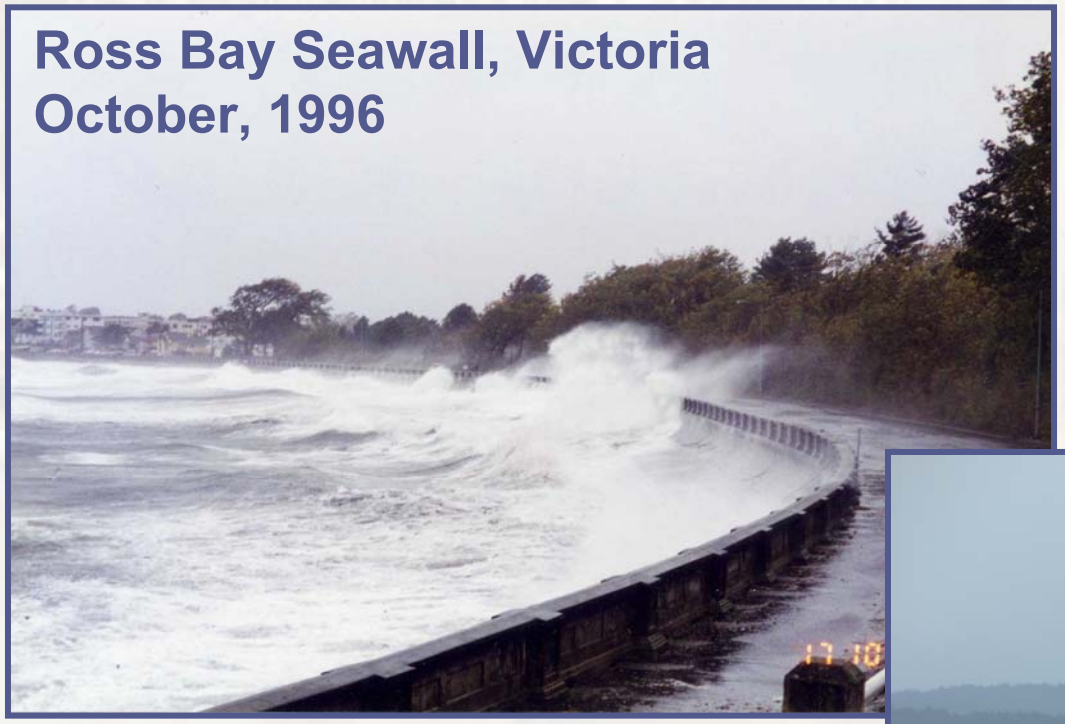
Change Occurs Seasonally



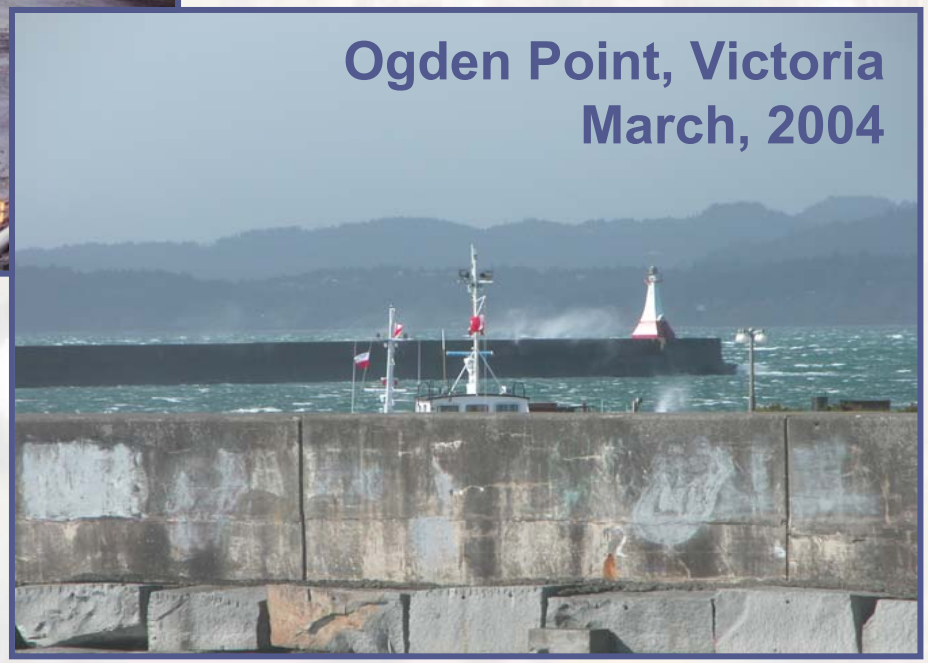
Change Occurs Episodically

Shore Protection

Ross Bay Seawall, Victoria
October, 1996



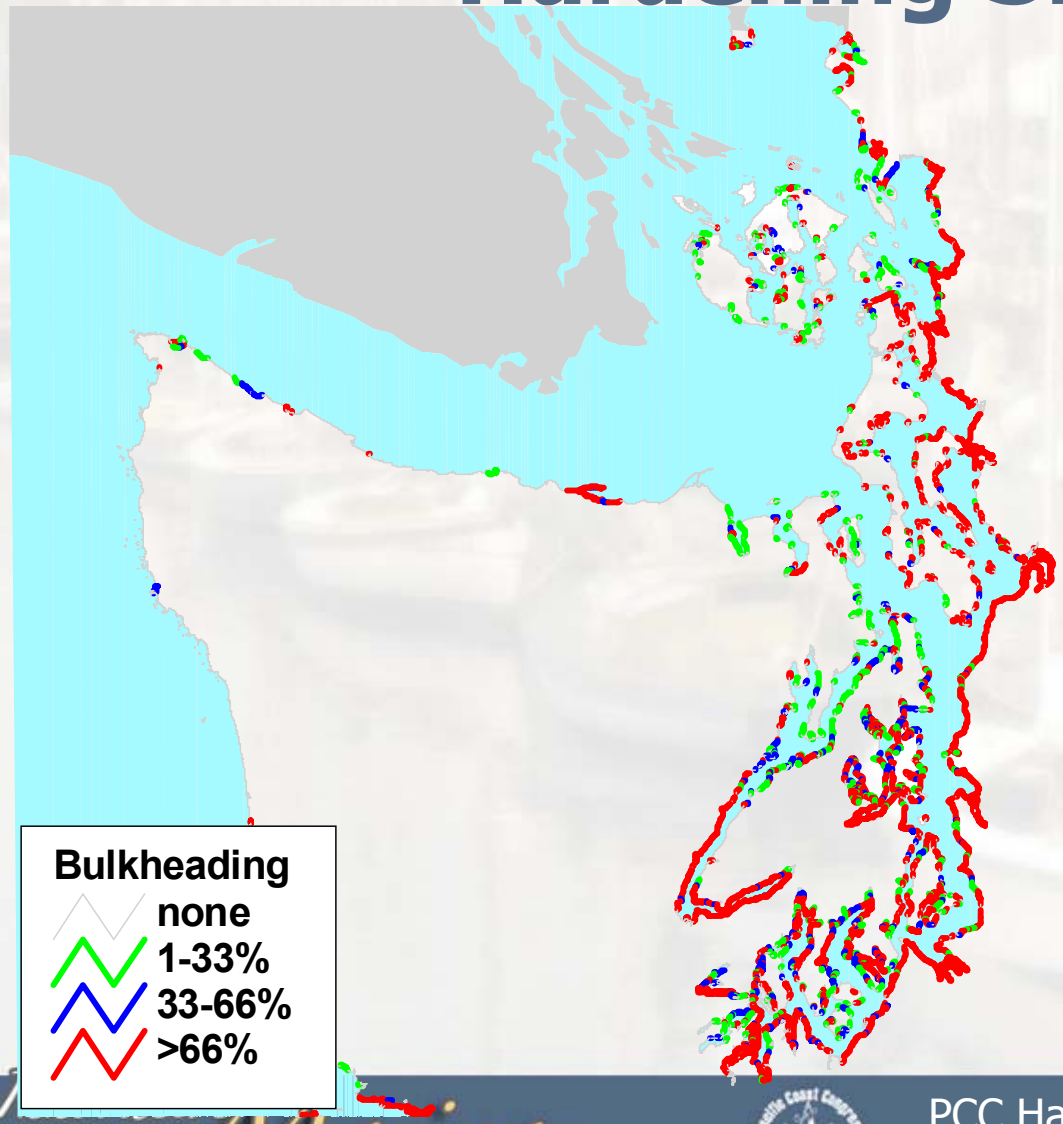
Ogden Point, Victoria
March, 2004



Shore Access

Aesthetic/Cultural Values

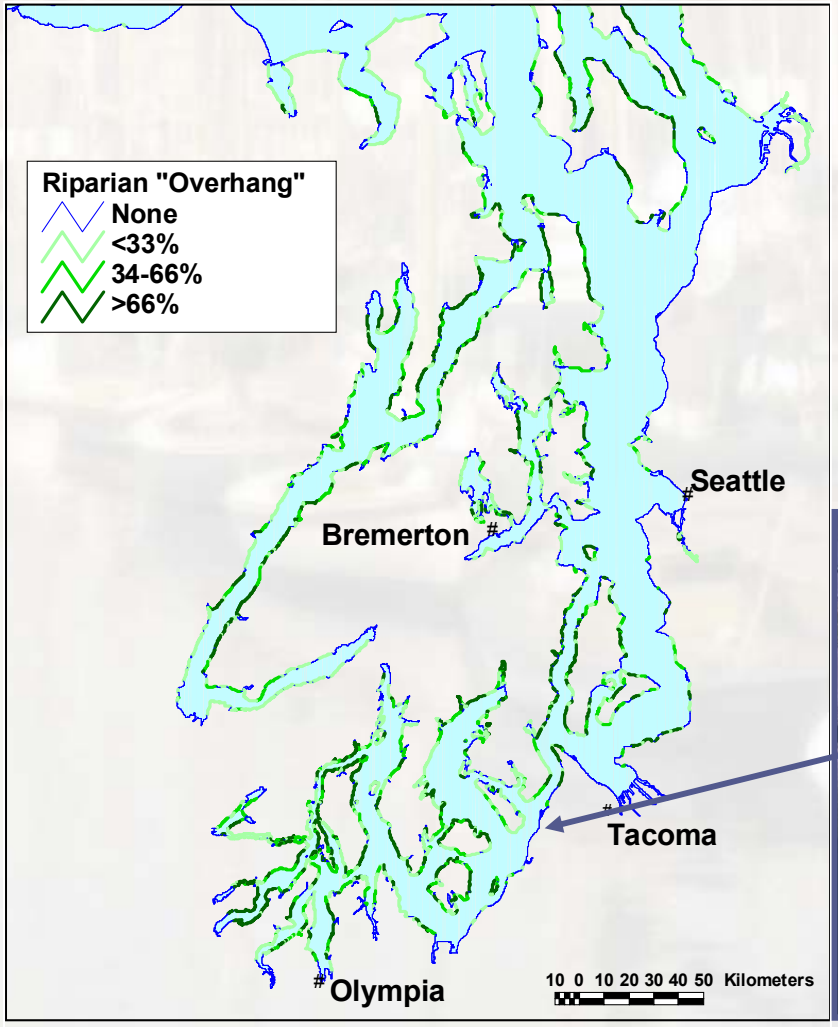
Cumulative Impacts Hardening Shores



Victoria Waterfront Seawall
Toe Erosion on Hardened Shores

Cumulative Impacts
Disruption of Coastal Processes

Cumulative Impacts
Loss of Shore Vegetation



"Working with Shores"

- Understanding Process and Function
- Integrating Design Processes (engineering which works with shores)
- Working effectively in a multi-jurisdiction environment
- Continuous learning

It is not about what you cannot do, rather what you can do differently

Different Shores, Different Concerns

Green Shores Concept

Green Shore Principles
Sustainable Approaches to Coastal Design

Principle 1. Preserve or restore connectivity

Principle 2. Preserve or restore ecological function

Principle 3. Minimize pollutants to the marine environment

Principle 4. Minimize or reverse cumulative impacts to shores

Green Shores – Pilot Projects

Two Objectives:

A. Provide Case Study Examples of *Green Shores* Design

B. Evaluate the Potential for a *Green Shores* Assessment/Certification Program

Three Sites:

Selkirk St, Gorge Waterway – residential property, restoration of shore features

Sidney: waterfront development, fill and shore protection

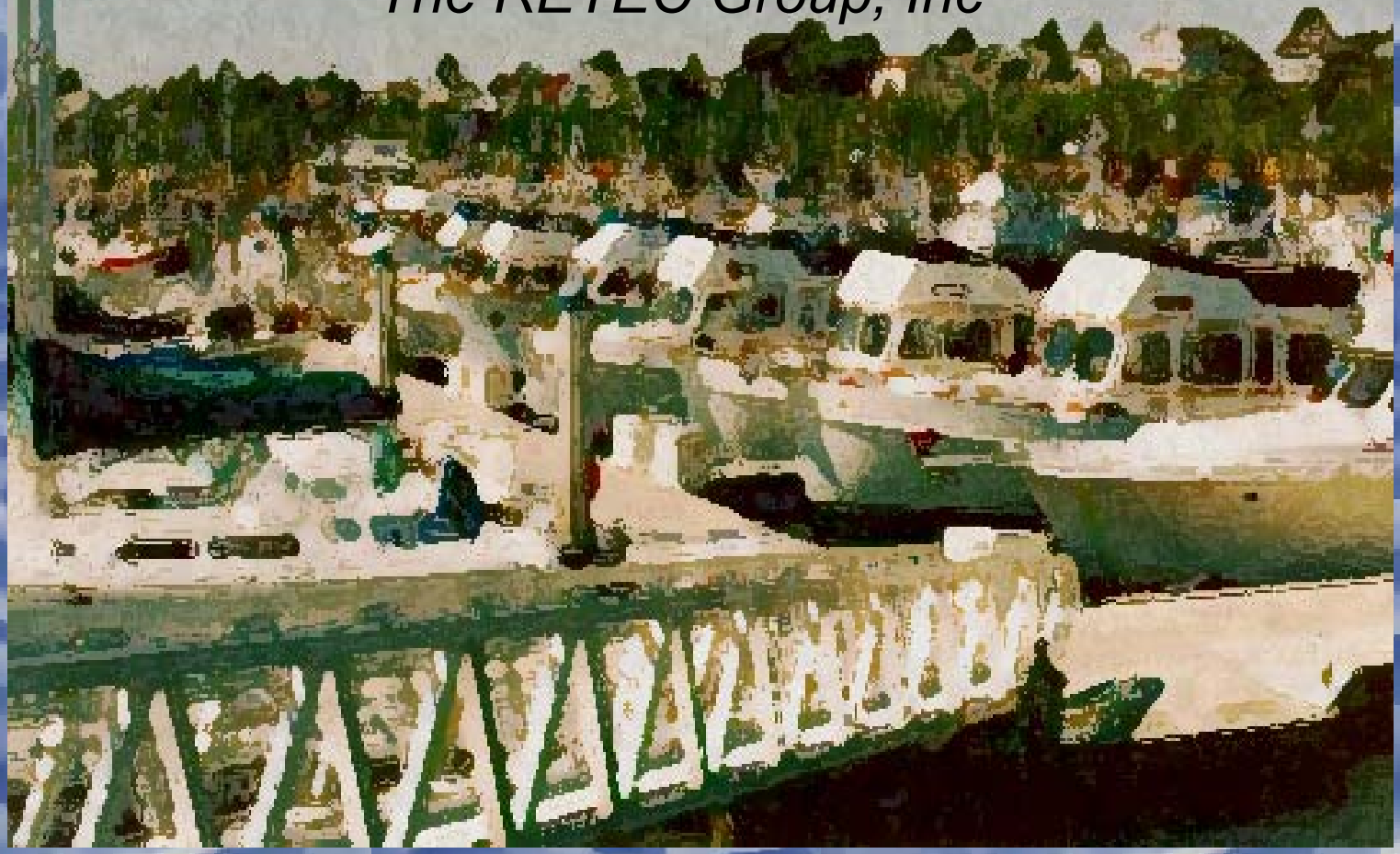
Comox: private properties owners concern about erosion control

The First Harbour Project?

Eco Friendly Marina Planning

Jack C. Cox P.E.

The RETEC Group, Inc

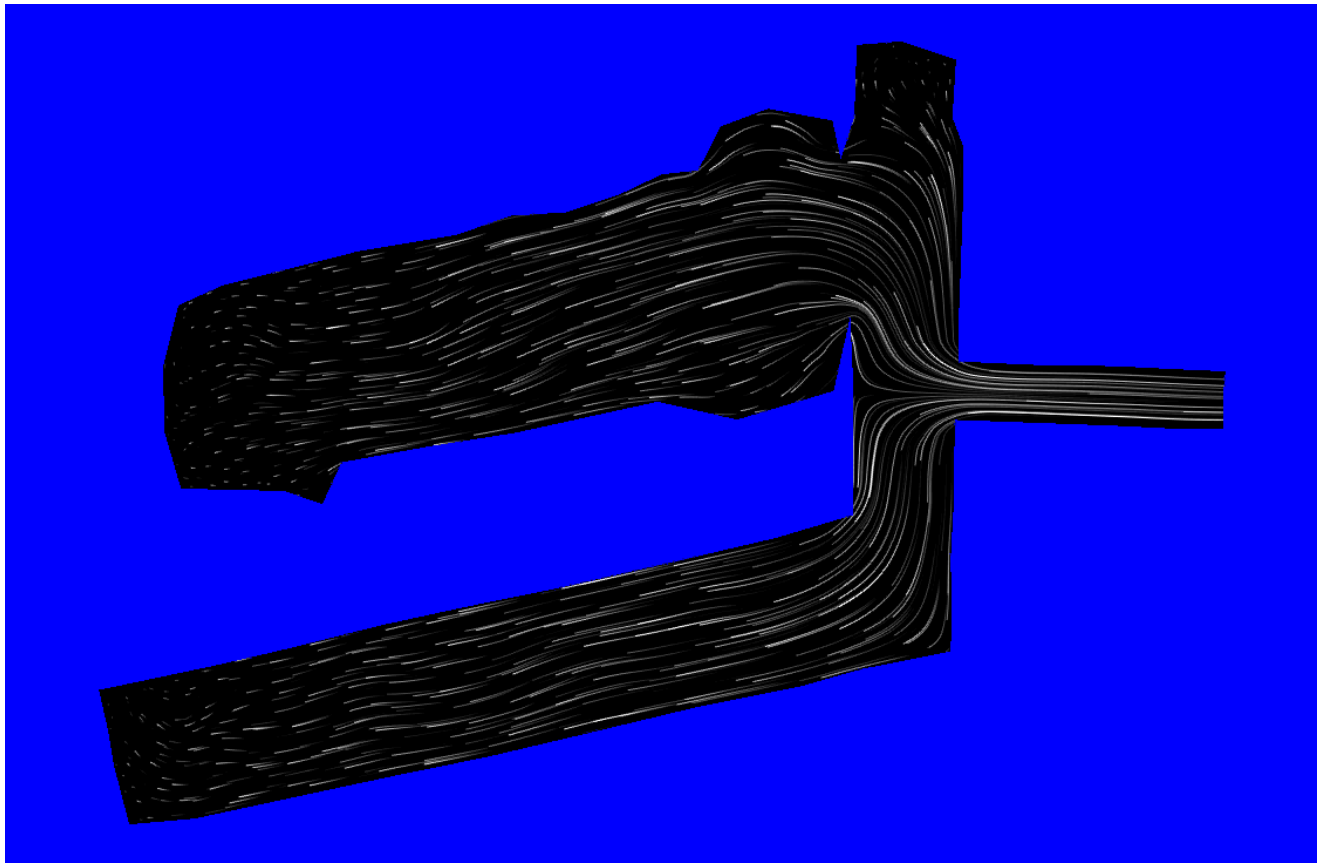


Harbor Definition

- Approach
- Entrance
- Interior
- Adjacent shore

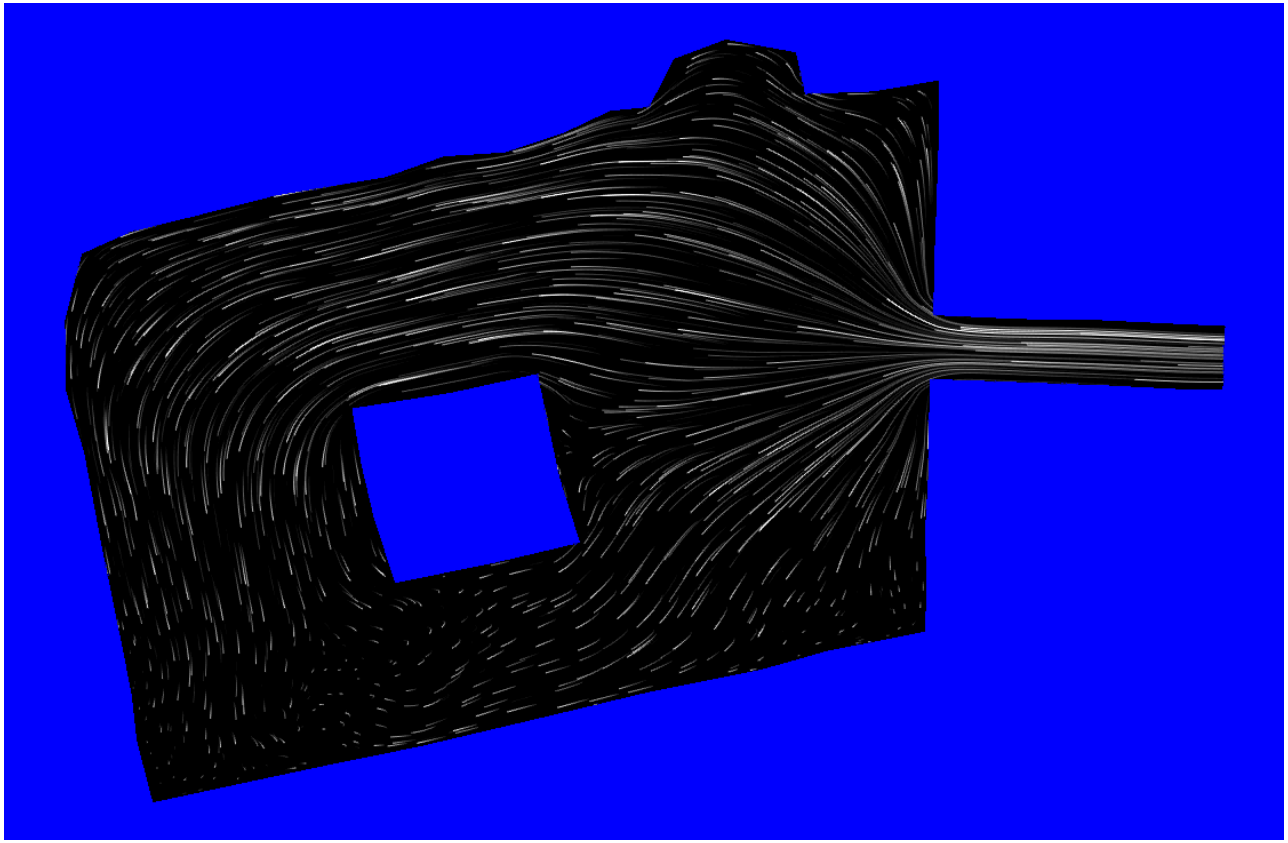
Modern Marina Design Considers Water Quality as the "Green" Standard

Linear Basin Flushing Behavior



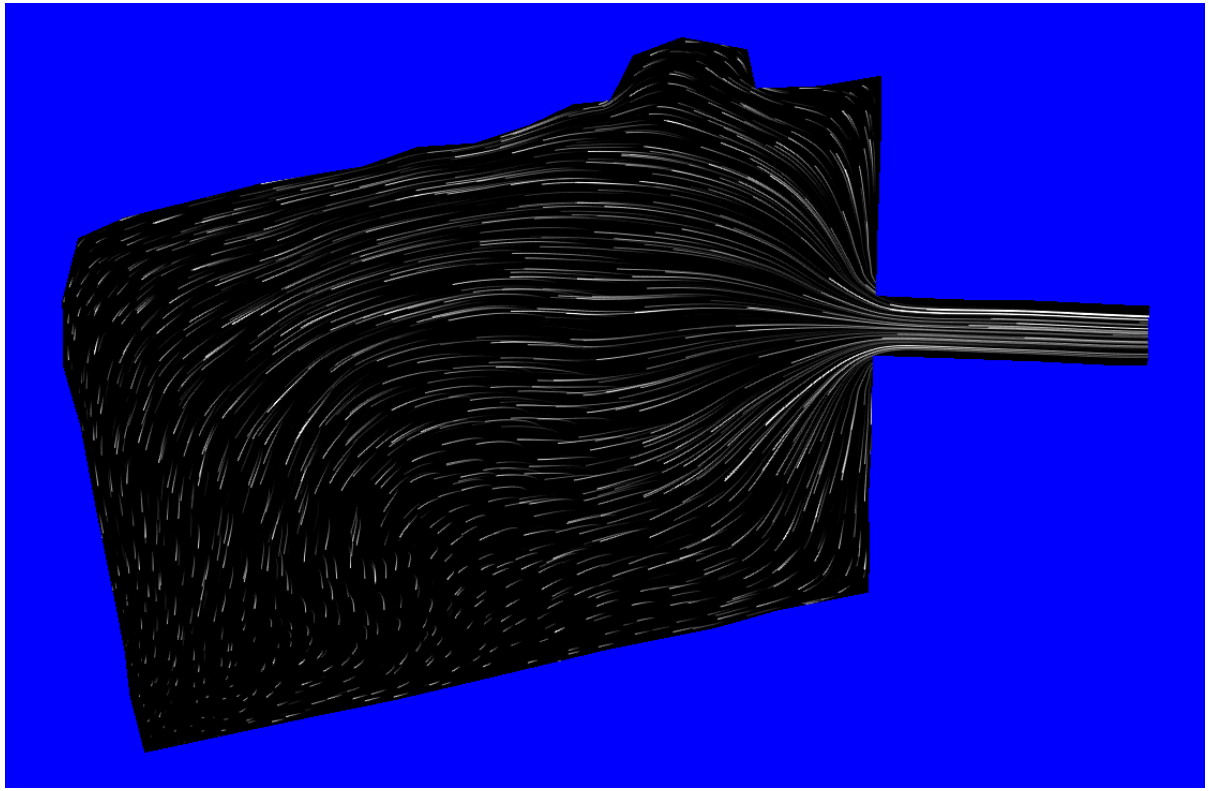
- *Poor water exchange to back of basins*

Island Basin Flushing Behavior



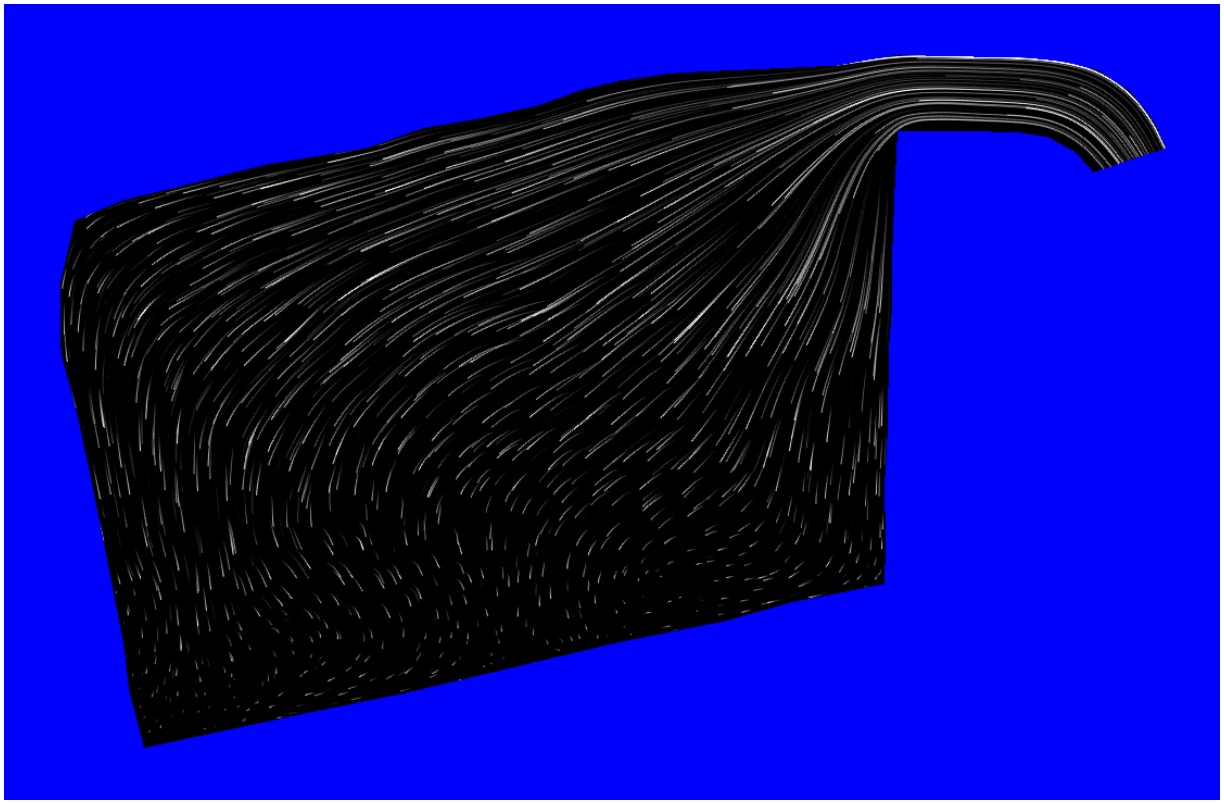
- *Reasonable circulation with 75% open basin*

Open
Low-Aspect Basin Flushing



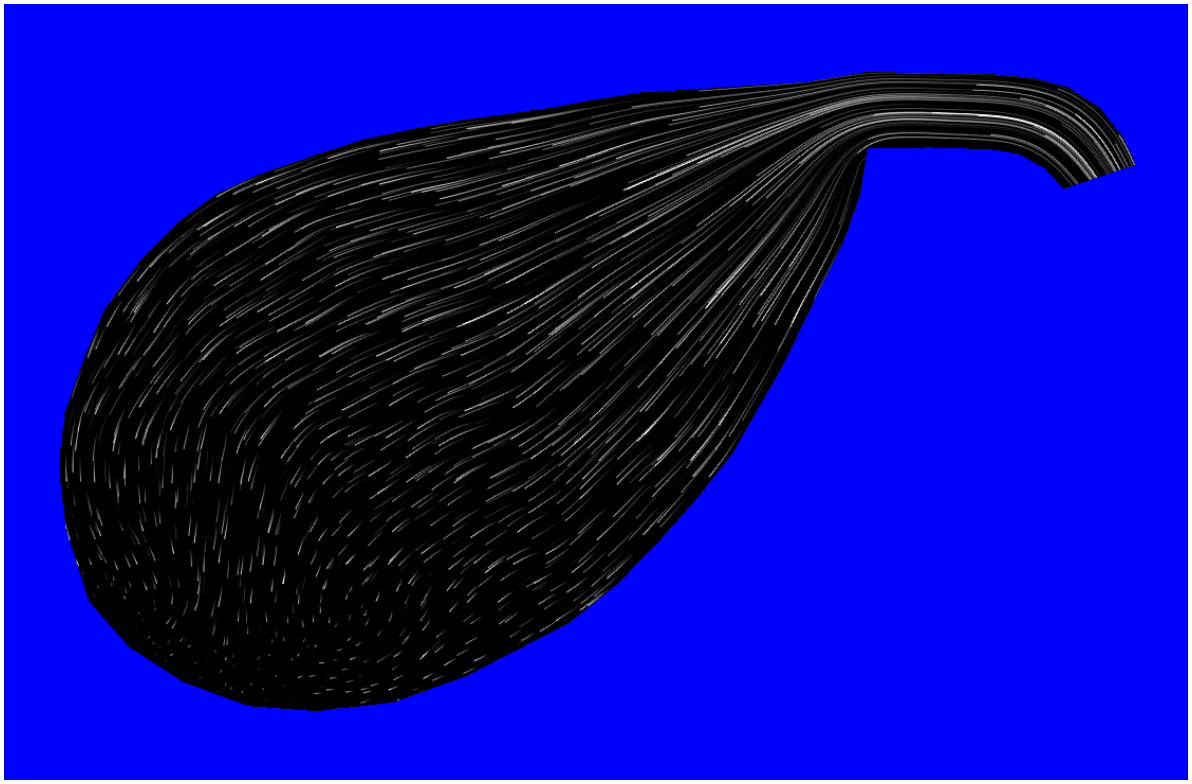
- *Better circulation except in corners*

Offset Entrance Flushing Behavior



- *Strong circulation around basin*

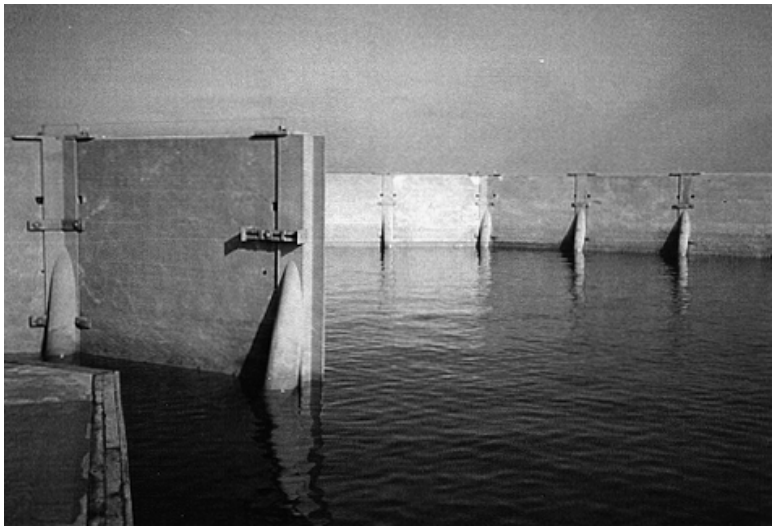
Teardrop Basin Flushing Behavior



- *Full flushing and circulation*

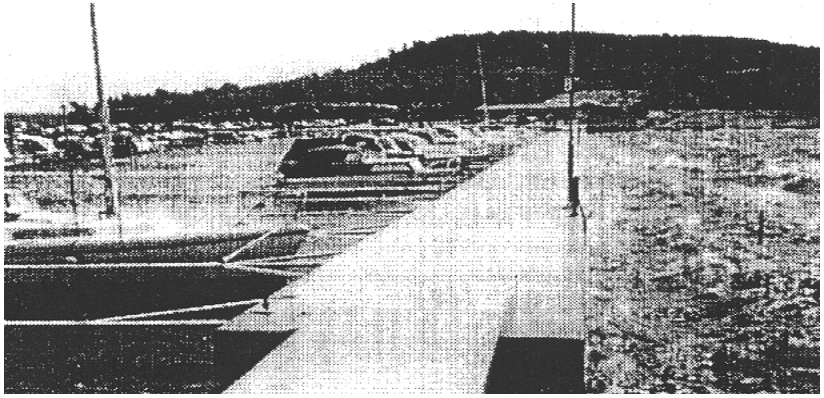
Typical Harbor Protection Needs

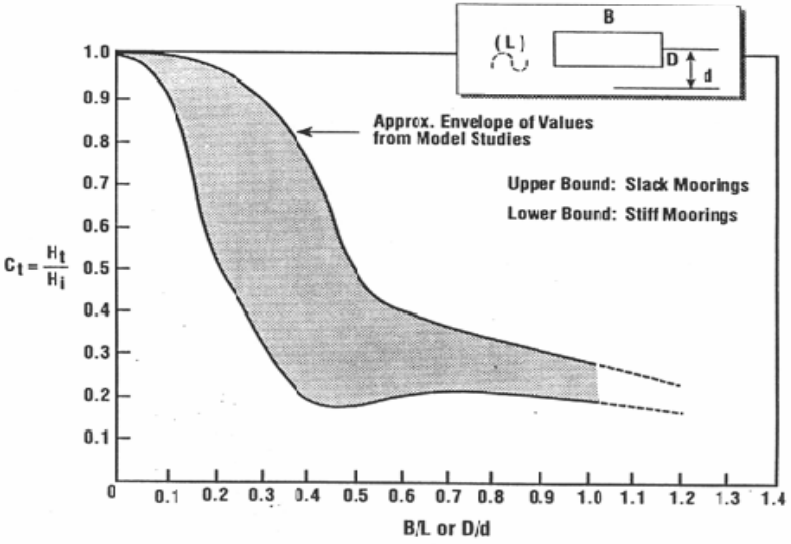
Breakwaters



- *As the Engineer wanted it*
  - *Wide footprint*
  - *Solid core/blocks waves*
  - *Rough/porous surface*
- *As the Regulators dictated it*
  - *Zero footprint/ Open/porous near bottom*
  - *Partially blocks plus reflects waves*

Floating Attenuators

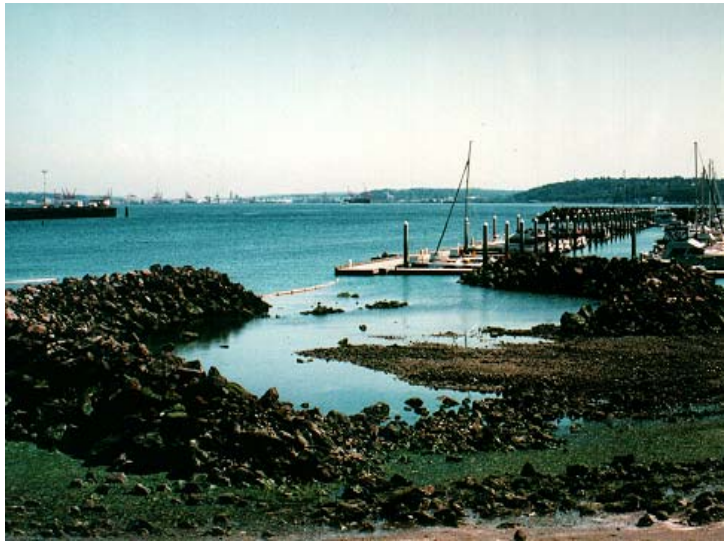




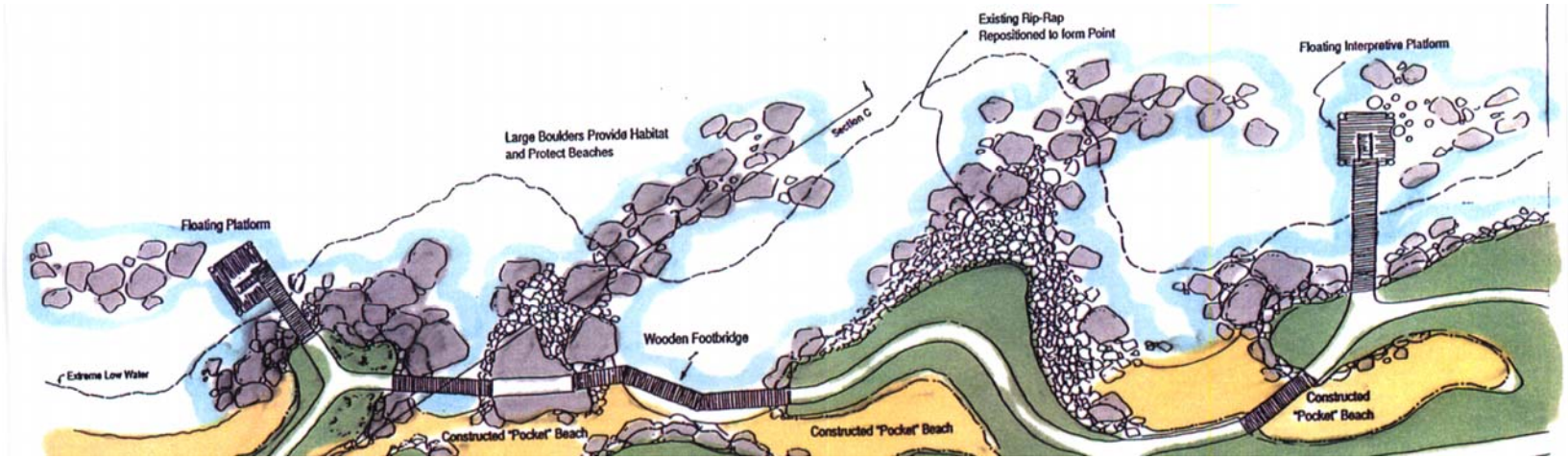
- *Partially block waves*
- *Only work up to 3 – 4 second wave periods*

- *Floats may need to reach to half the water depth to work*
- *Floats may need to be 30 ft wide to work*

Typical "Green" Shoreline Details



- *Target specific habitat types*
- *Develop 3-D solutions for hydraulics and behavioral needs*
- *Incorporate aesthetic elements*



"Green" designed Breakwaters and Shoreline Protection

- *Replace continuous walls and revetments with segmented structures and beaches*
- *Reverse engineer structure composition to conform with the biotic community needs*

Properly Detailed Harbors Offer Tranquility and Good Water Quality

- Curved basins flush better and are more tranquil

- Rectangular basins have poor circulation and are agitated

Eco Friendly Marina Planning

Planning to Reality

Innovative Marina Designs

Lighter

Greener

Smarter

Cleaner

Brian Emmett, Jack Cox, Shannon Kinsella, Ted Appleton
PCC Harbormasters/Port Managers Spring Conference
April 7, 2005

DESIGN

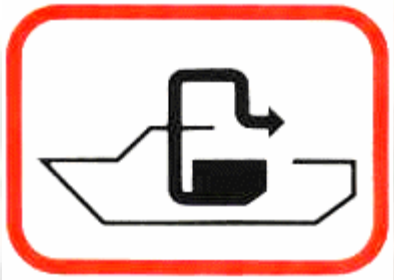
- Project Elements
  - breakwater options
  - piers and floats
  - boat sewage pumpouts
  - fuel services
- Layout
  - width
  - balance overwater coverage
  - deeper water
  - limit grounding
  - decrease shading from structures

DESIGN

- Bulkheads
  - vertical versus sloped
  - intertidal bench
  - fish rock
  - shoreline restoration opportunities
- Dredging
  - beneficial uses
  - design to minimize need for dredging

DESIGN

- Buildings
  - green design
- Amenities
  - recycle facilities
  - secure garbage containers
  - informational signage
- Security



MATERIALS

- Piling
  - Timber, Steel, Concrete, Plastic
- Pile facing and wraps
- Piers
- Floats
  - encased flotation
  - decking choices

MATERIALS

- Decking
  - Grating
- Lighting
  - Shielding

Innovative Marina Designs

Lighter

Greener

Smarter

Cleaner

Brian Emmett, Jack Cox, Shannon Kinsella, Ted Appleton
PCC Harbormasters/Port Managers Spring Conference
April 7, 2005


Pollutants, Life Cycle and Re-cycle,Relationships
Ted Appleton P.Eng
AquaTec Consultants Ltd.
North Vancouver British Columbia
E-Mail Ted@Aqtec.ca

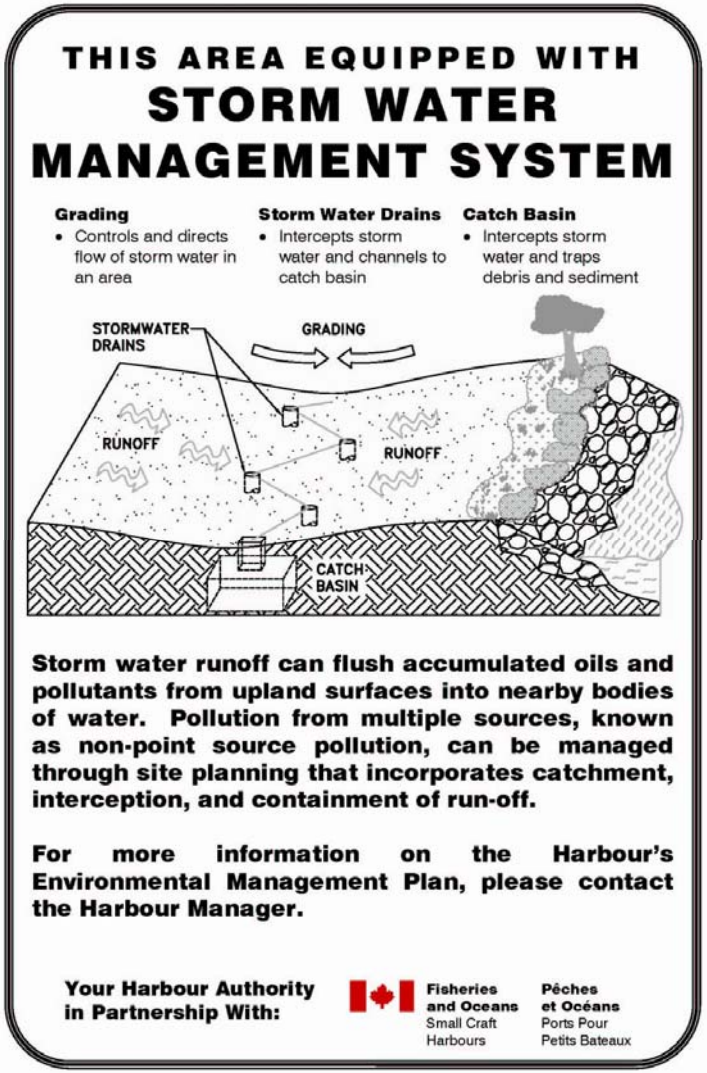
Non-Point Source Pollution

- External
  - Surface run-off
  - Drains
- Internal
  - Parking lots
  - Work and Storage Yards
  - Buildings
  - Clients

Non-Point Source Pollution

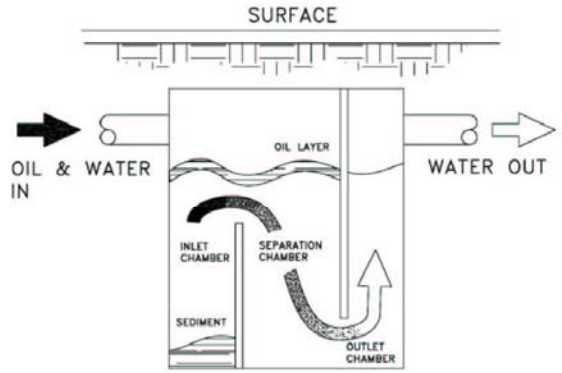
- Remedies
  - Re-route external supply
  - Intercept
  - Containment

Intercept


THIS AREA EQUIPPED WITH
STORM WATER MANAGEMENT SYSTEM
Grading
• Controls and directs flow of storm water in an area
Storm Water Drains
• Intercepts storm water and channels to catch basin
Catch Basin
• Intercepts storm water and traps debris and sediment
STORMWATER DRAINS
GRADING
RUNOFF
RUNOFF
CATCH BASIN
Storm water runoff can flush accumulated oils and pollutants from upland surfaces into nearby bodies of water. Pollution from multiple sources, known as non-point source pollution, can be managed through site planning that incorporates catchment, interception, and containment of run-off.
For more information on the Harbour's Environmental Management Plan, please contact the Harbour Manager.
Your Harbour Authority in Partnership With:
Fisheries and Oceans
Small Craft Harbours
Pêches et Océans
Ports Pour Petits Bateaux

Intercept

THIS SITE EQUIPPED WITH OIL-WATER SEPARATOR



- Oil – Water separator installed below ground in line with storm water drain
- Multiple chambers separate oil, fuel, debris, and particles from the water flow
- Operation is passive – Using only gravity, diffusion, and density characteristics of water – No power is required
- Periodic cleaning to remove sediments and oils maintains functionality

An Oil-Water Separator intercepts the flow of water through a Storm Water pipe system. A series of baffled chambers separates sediments and oils from the water, improving the quality of the water that exits the system.

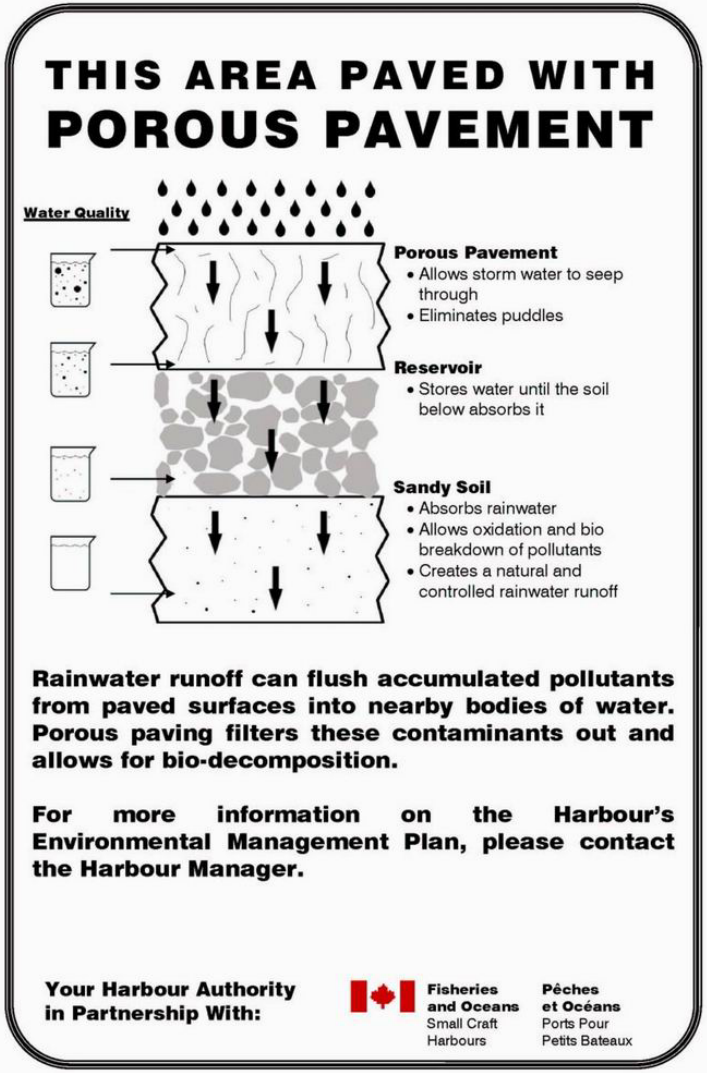
For more information on the Harbour's Environmental Management Plan, please contact the Harbour Manager

Your Harbour Authority in Partnership With:

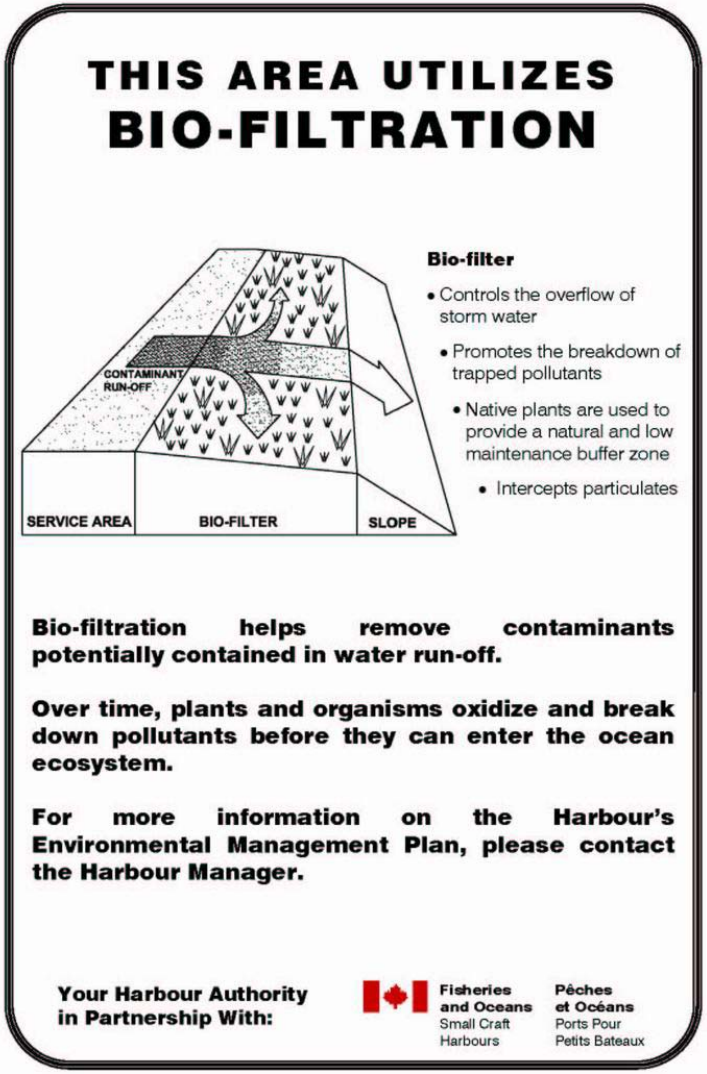
Fisheries and Oceans Small Craft Harbours

Pêches et Océans Ports Pour Petits Bateaux

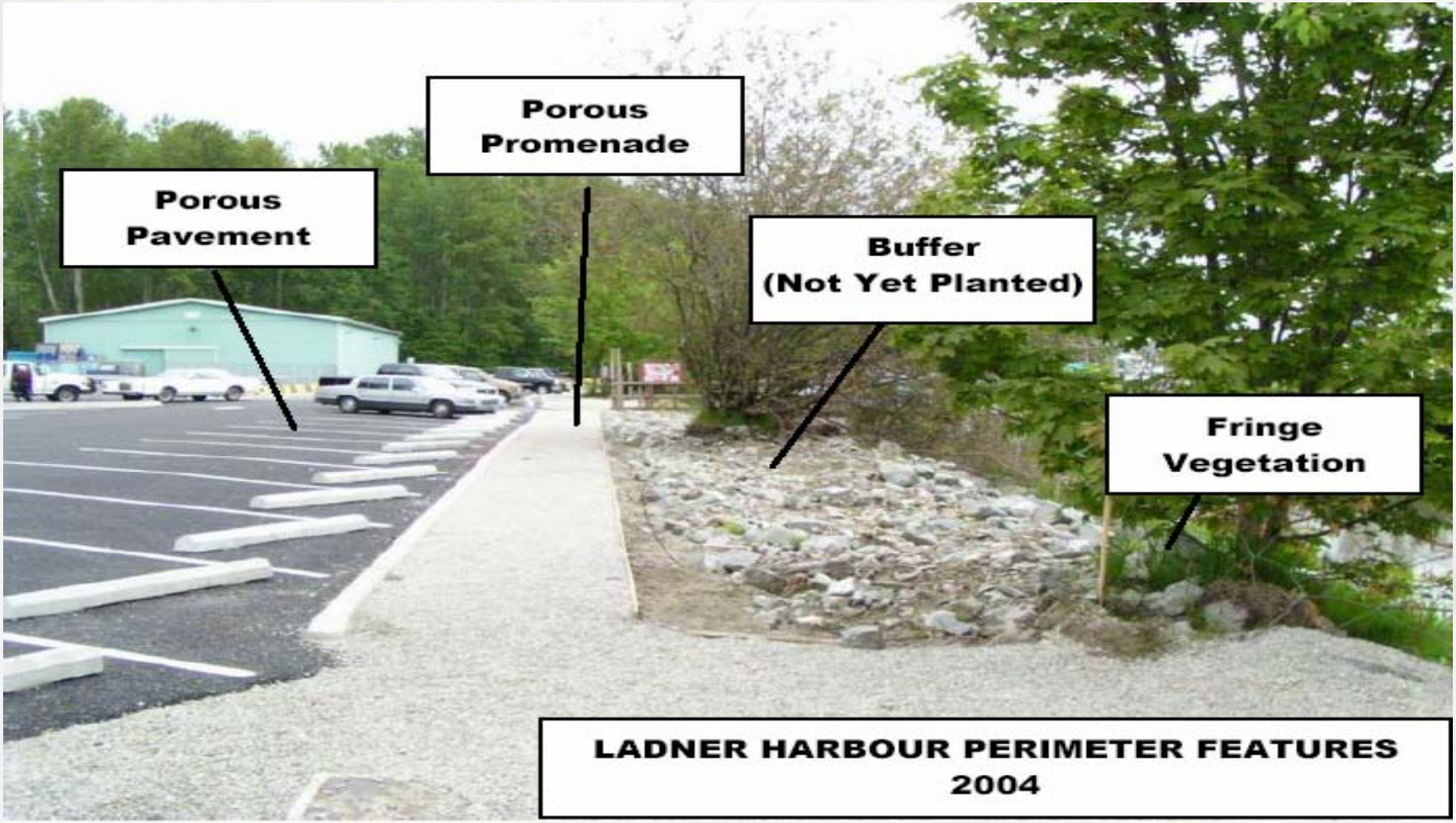
Sub Base Filtering



Edge Treatment



Edge Treatment and Porous Pavement



Life Cycle Winners

- Recycled Materials
- Recycle Structures
- Inert material relative to salt water
- All long term low cost opportunities

Recycled Materials

- Commercially available products of all kinds

Recycled Objects

- Steel Box Beams for Floating Breakwaters
- 180 ft of breakwater <$100,000 life 40 years?

Floating Box Beam Deep Bay B.C.

- 220 ft 6ft x 8ft for <$150,000 Expected life 40 yrs?

What about railway cars?

- 27 ft of breakwater for < $ 90,000 Expected life 40 yrs?

How about a fiberglass pulp silo

- 27 ft of Breakwater < $60,000 !!! Life > 40,100 yrs inert?

Just Pick'm Up

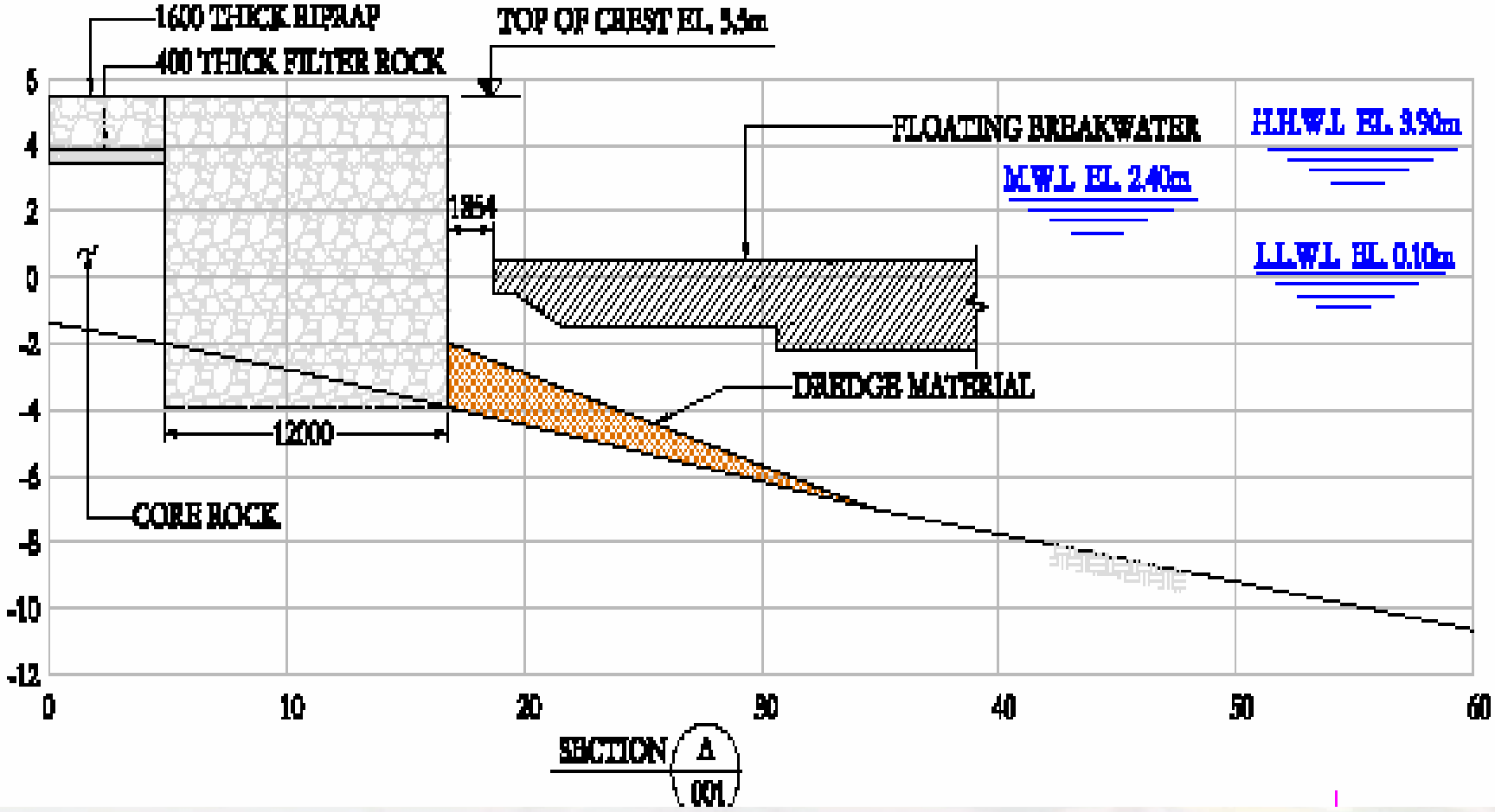
Tow'm Yourself

Put'm in Place

And Fill'm


A Harbor at Work
Fish Plant and Coast Guard Base
Storage and Work Compound
Recreation Beach
Habitat Compensation Reef
Haul-out & Dry Storage
Boat Launch Parking
French Creek Harbour
Vancouver Island B.C.

Extending Wave Protection but not the Footprint



How about Old Shipping Containers

- 8ft x 8ft x 10ft with Rock and Concrete < $35,000
- Expected life 60 yrs

Inert Material

- Recycled Plastics
- HDPE products
- UHMW
- FRP products
- Synthetic Ropes

A Floating Breakwater with no Structural Steel

- Expected life 200yrs? 25ft x 460ft no joints

Non-Steel Mooring Systems vs. Piles

- Tendered steel pile mooring system bids closed this January between $450,000 and $600,000 on the Cowichan Bay Floating Breakwater project. Steel piles have a life of 60yrs+- if cared for.

- Project was re-tendered utilizing synthetic ropes. Final costs will be less than $150,000 and may outlast the steel by several times with minimal or no maintenance expected.

- The Lund breakwater mooring system was installed in 1986. All of the synthetic part is in full working order. All of the 32mm (1 1/4 in) has just been replaced at a cost of $150,000 and only represents < 10% of the mooring system by length.

Life Cycle

- It is absolutely critical to consider life cycle costs and premature replacement of facilities to minimize detrimental affects on the environment and pocket book!

Relationships

- Who are you sharing your facility with?
- So then who are your partners?
- Do you really treat them as partners?

Try all these guys

- Federal Agencies on all kinds of legislation.
- State Agencies on all kinds more legislation.
- Municipalities with more legislation.
- Your physical neighbors.
- Your clients
- Your bank
- Your insurance company
- Oh yes and maybe other financial partners.

Relationships

- A positive working environment is enhanced by:
- Trust
- Respect and concern for partners goals and objectives
- A pro-active approach to achieve win win conclusions

Environmental Management Plans

- An inventory of potentially dangerous material in the Harbor
- An inspection program and schedule for prevention
- Details regarding capital projects planned to improve the Harbor
- *Has a plan on how the operation is going to maintain a positive relationship with partners.*
- Has a plan to deal with mishaps.


Maintain this beautiful shoreline
but still find a way to work in it.