Edgewater resources

Waterfronts Worldwide

# Wave Attenuation Strategies: How to Protect Your Marina from Mother Nature

Docks Expo 2025

December 2025

**Alejandra Lira, CE**
**Edgewater Resources**

**Jack C. Cox,** P.E.; BC.CE, BC.PE, BC.NE
**Edgewater Resources**

# Overview

SECTION 1

## Why Attenuation Matters

SECTION 2

## Fundamentals of Wave Exposure

SECTION 3

## Choosing the Right System

SECTION 4

## Case Studies: What works

SECTION 5

## Putting It All Together: Your Wave Protection Playbook

SECTION 1

# Why Wave Attenuation Matters

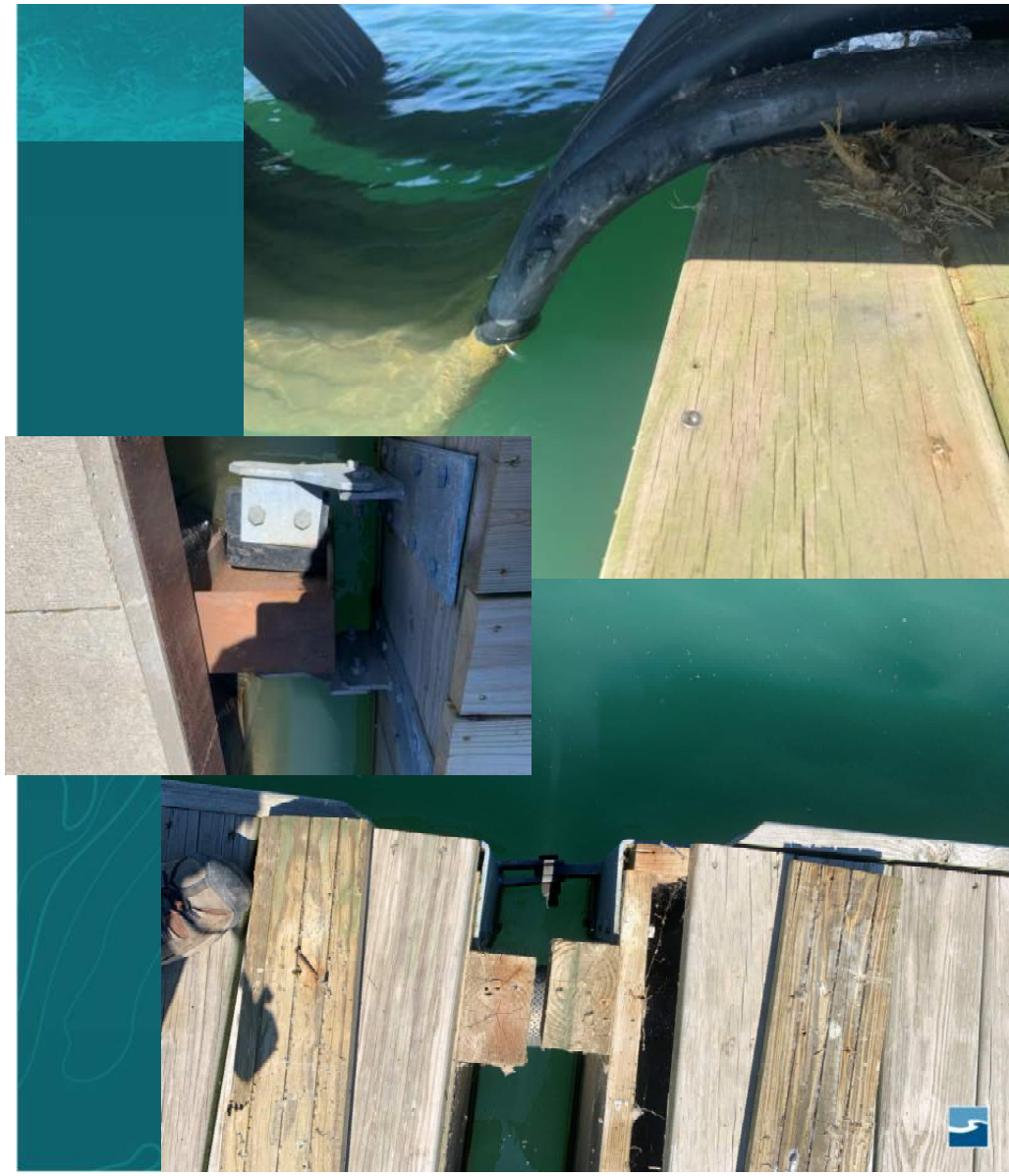
# The Real Impact of Wave Action on Marinas

- Even “small” waves can cause big headaches
- Floating docks start feeling uncomfortable at 0.5-1.0 ft
- Repeated motion accelerates wear on docks, anchors, utilities
- Comfort and safety directly influence occupancy and revenue

0.5 ft = Noticeable
1.0 ft =Uncomfortable
>1 ft = Damaging

# What Happens When Waves Aren't Managed

- Dock movement & misalignment:
  - Tripping hazards
  - Damaged fingers
- Utility fatigue:
  - Electrical conduit breaks, water lines fail
- Increased maintenance
- Vessel impacts:
  - Boats hitting slips, fenders overstressed
- Customer dissatisfaction:
  - "Never calm", "rough weekends" = low slip renewal



# The Hidden Cost of Doing Nothing

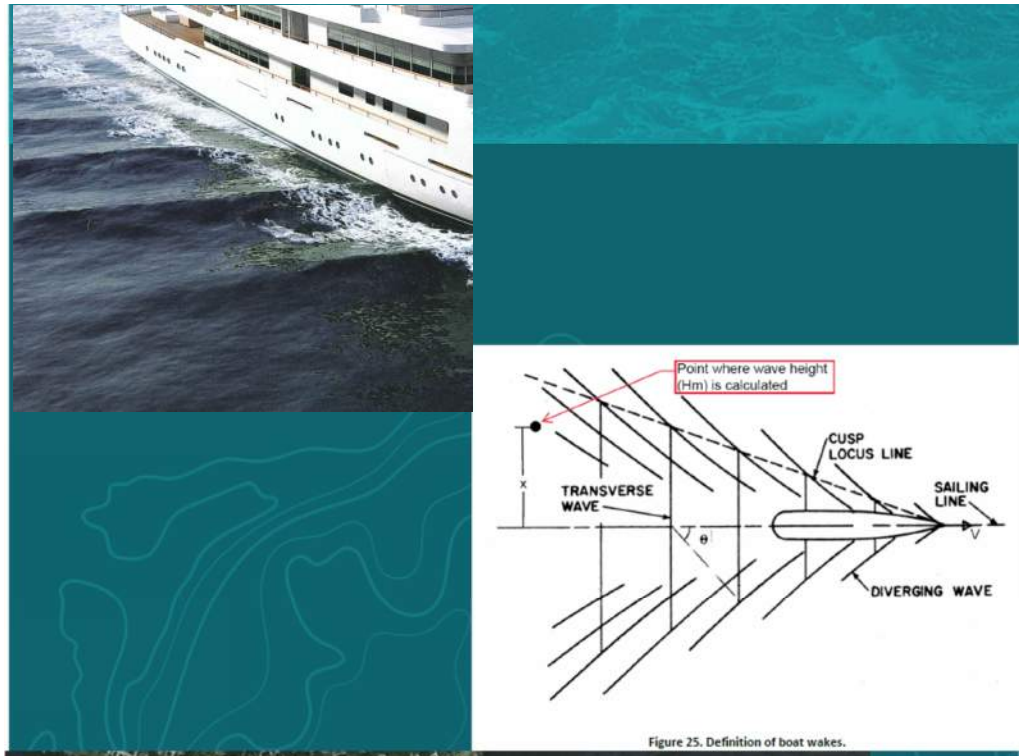
- Without Protection, marinas face:
  - Higher annual repair budgets
  - Shortened lifespan of docks & floats
  - Lost slip revenue due to poor comfort
  - Risk of damage during storms or heavy boating days
- Wave attenuation is an investment. Ignoring waves is often more expensive long-term

SECTION 2

# Understanding Your Site's Wave Climate

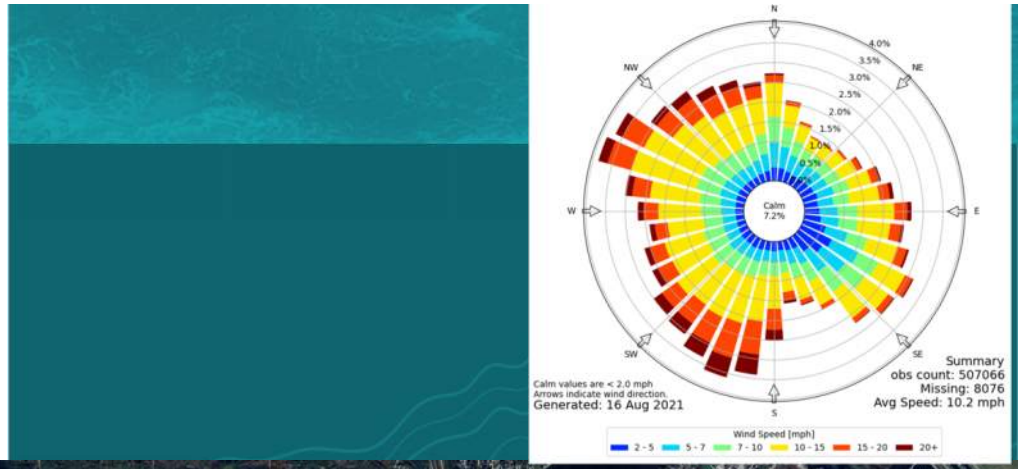
# What Drives Waves at Your Marina?

- **Wind waves:** generated by wind over open water (fetch + duration)
- **Boat wakes:** often the largest waves in otherwise sheltered areas
- **Seasonal conditions:** storms, seiches, cold fronts, convection winds
- **Bathymetry:** shallow areas amplify or break waves
- **Orientation:** the direction your marina faces matters as much as exposure.

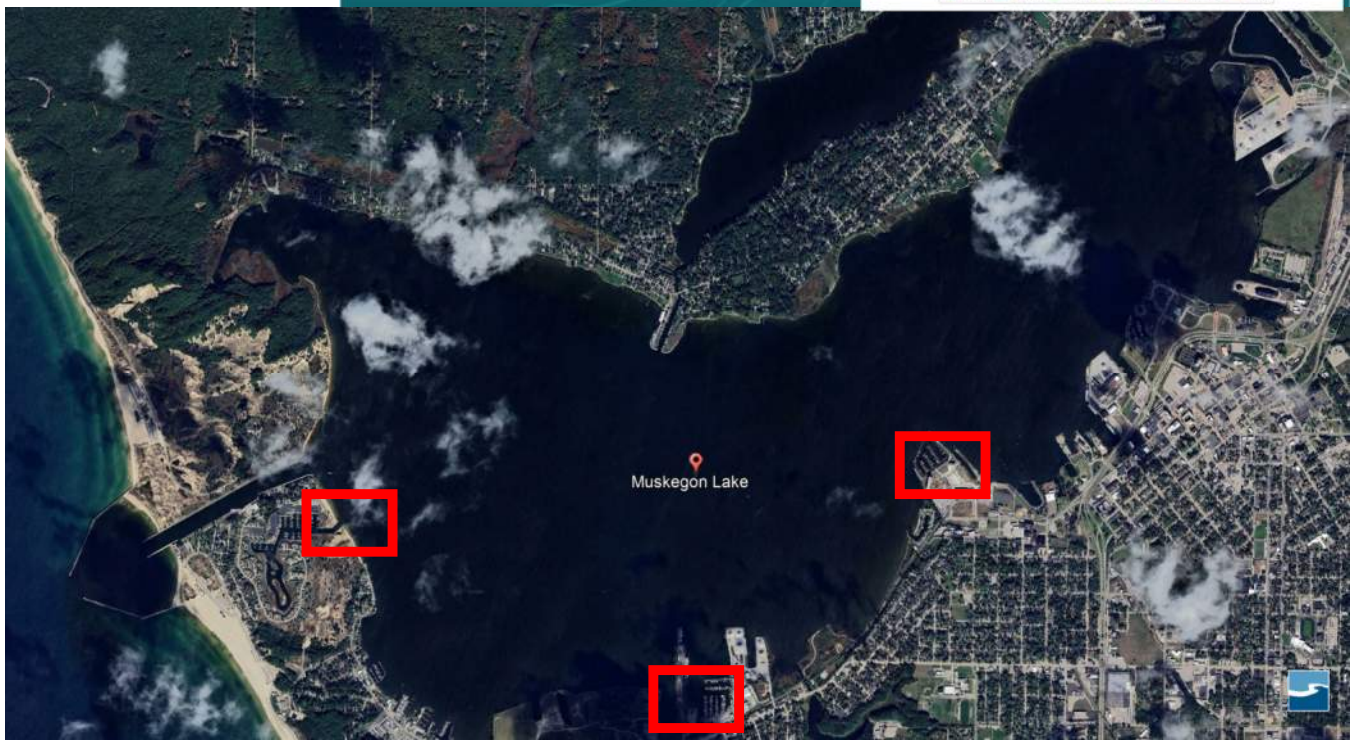



# Why Two Similar Sites Behave Completely Differently

- Fetch length
- Wind alignment
- Depth variations
- Shoreline geometry
- Man-made structures nearby

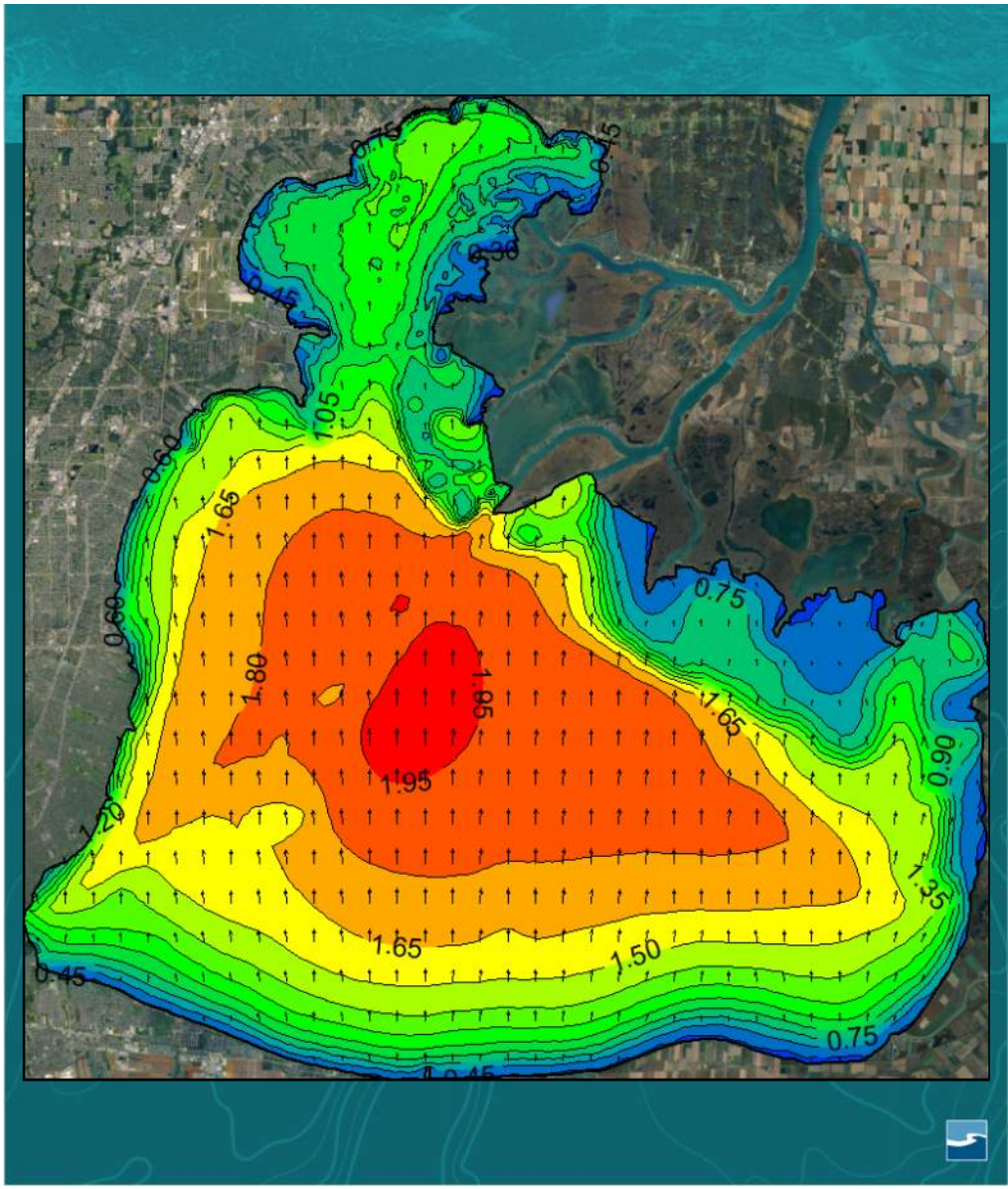




# Identifying Your "Design Waves"

- What are the dominant directions?
- Understand typical daily conditions *and* storm-driven conditions
- Pay attention to peak boating traffic
- Most important question:
- FROM WHAT DIRECTION DO THE BIGGEST WAVES ACTUALLY REACH MY DOCKS?

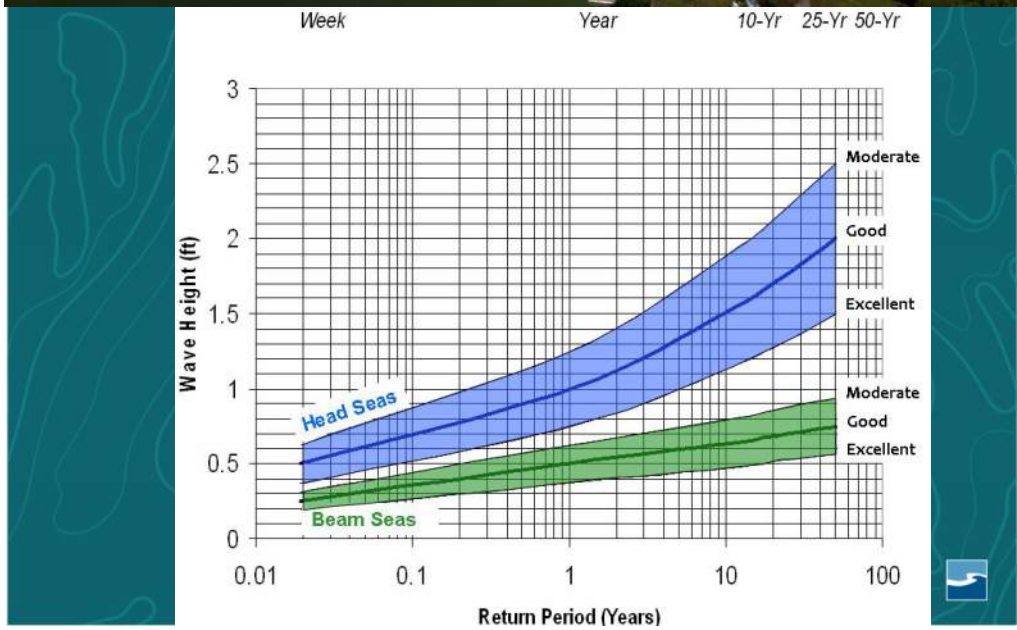


SECTION 3

# Marina Layout: Frist Line of Defense

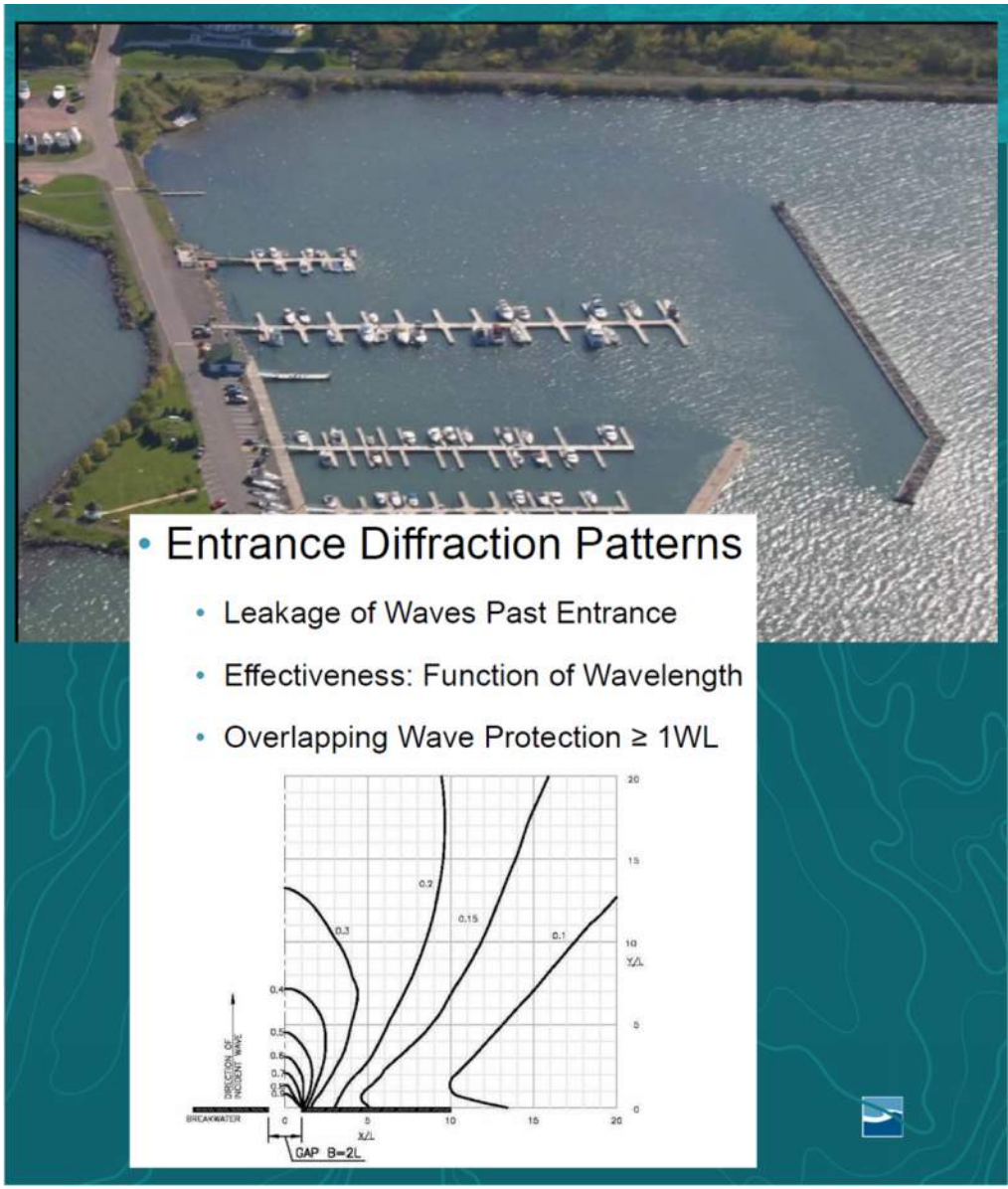
# Good Layout = Less Wave Energy

- Orient slips and fairways away from dominant waves
- Place marina entrances on the sheltered side when possible
- Use natural landforms (points, spits, coves) to block exposure
- Reduce long “runways” of open water inside the basin
- Small layout adjustments can reduce wave height without major structures



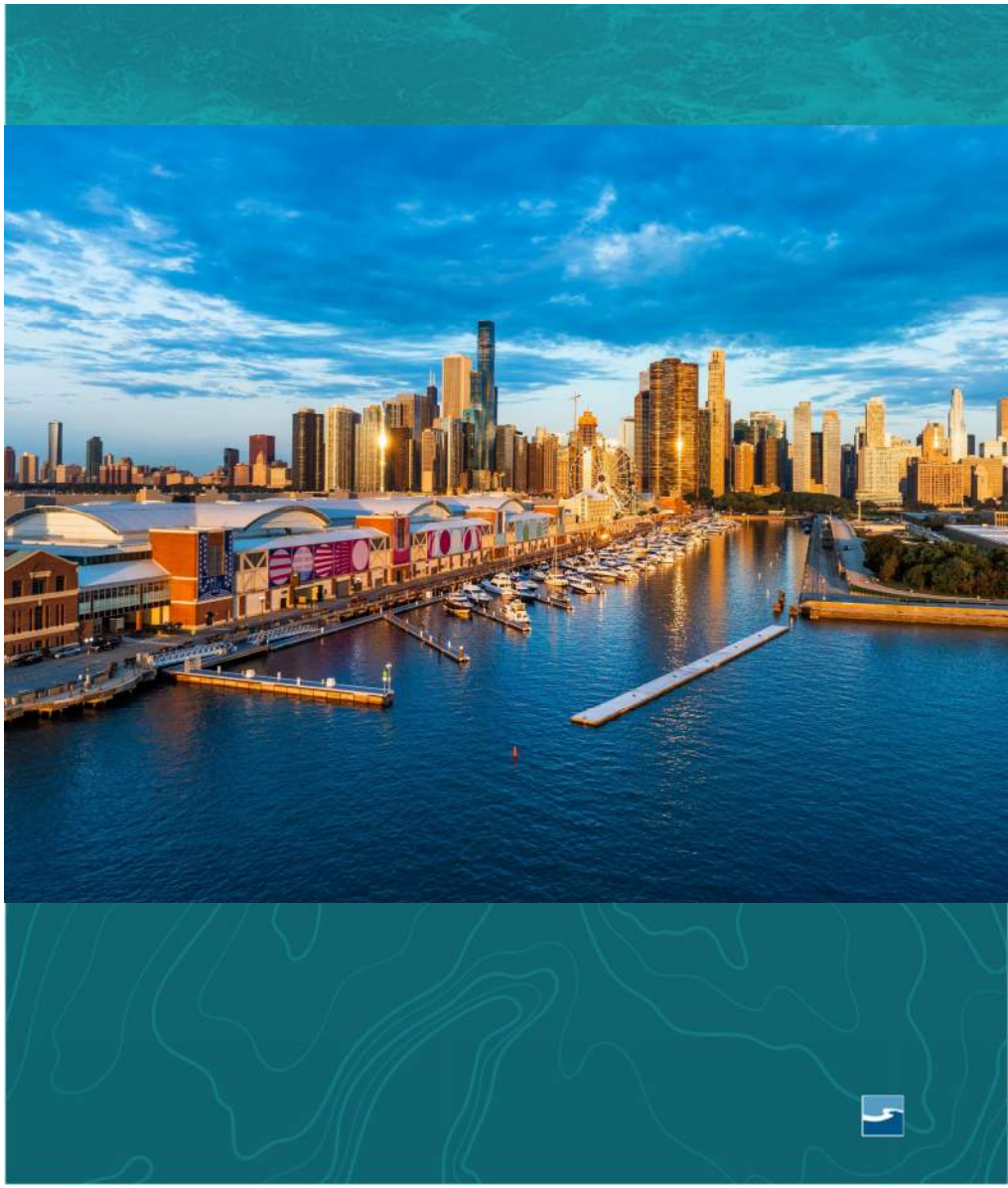
# Common Layout Mistakes

- Entrance aligned directly with the wave direction
- Long, straight interior channels that amplify surge
- Slips oriented perpendicular to wave approach (increases vessel motion)
- Narrow basin areas that reflect waves instead of dissipating them



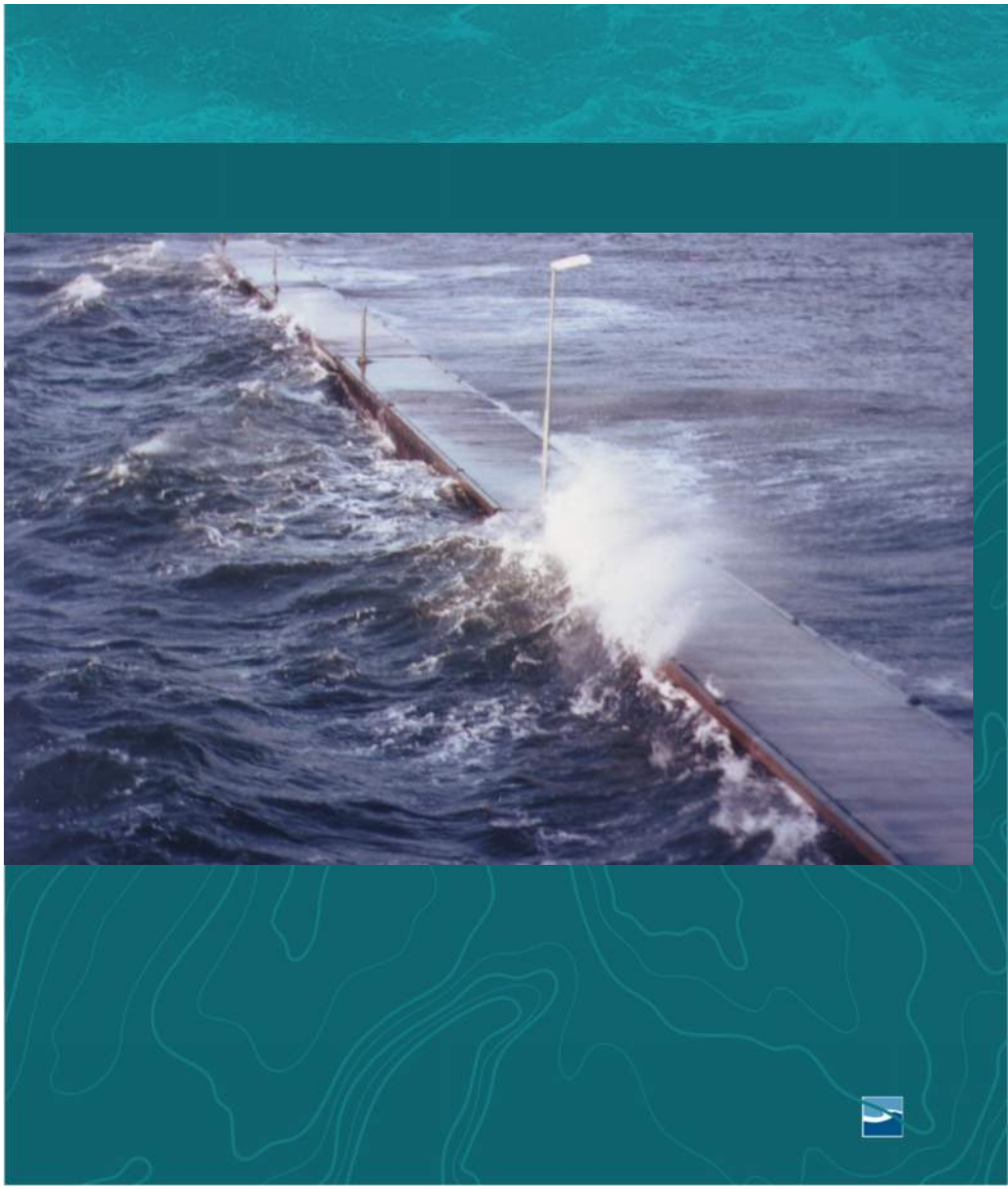
# When Layout Alone Is not Enough

- Some sites have no sheltered orientation (open-water exposure)
- Deep water may prevent strategic placement of docks
- High boat traffic with wakes exceeding what layout adjustments can handle
- Strong seasonal storms require additional protection
- Layout informs the strategy but does not always solve wave agitation



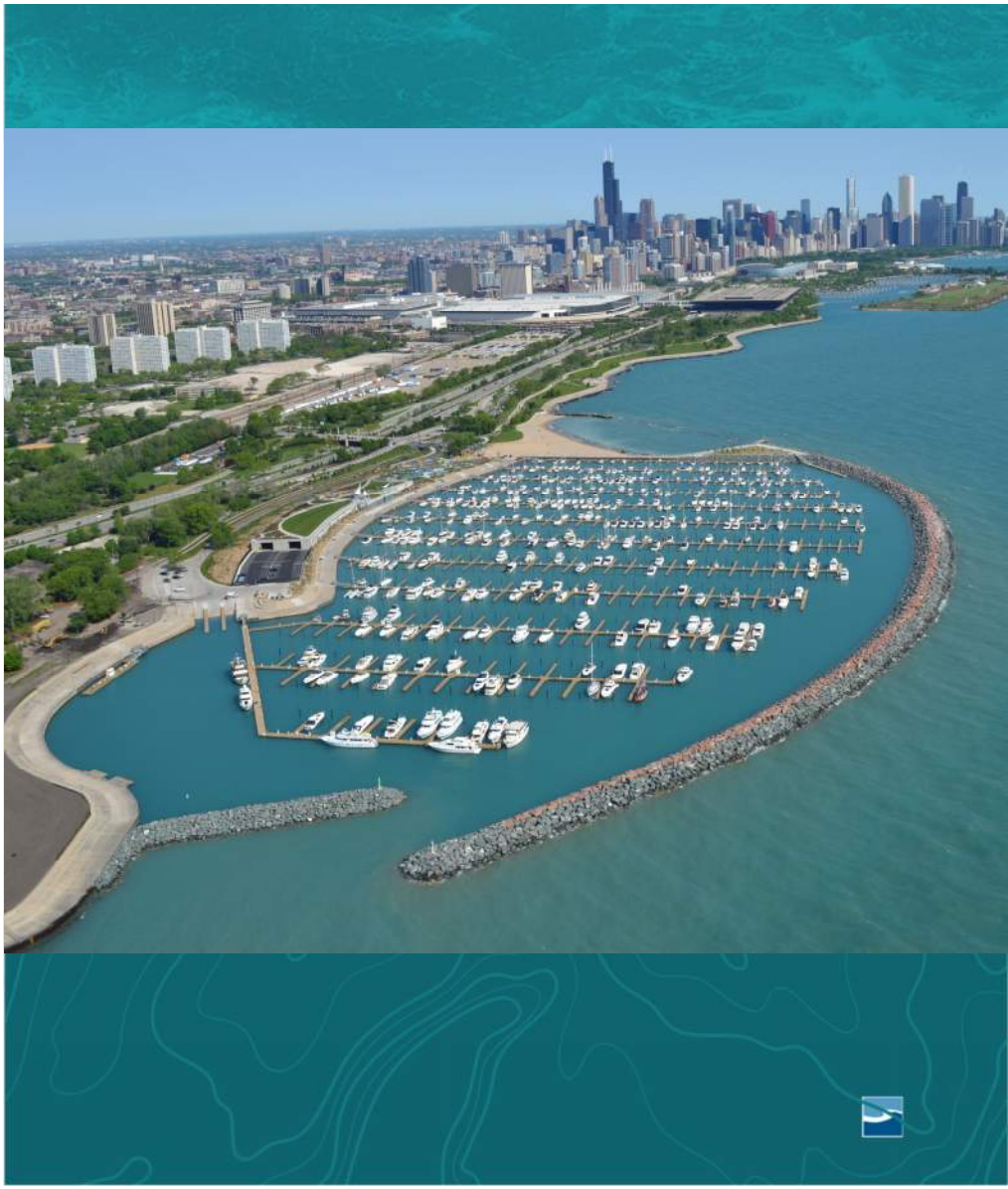
# Fixed vs Floating Attenuation: When & Why

- Fixed structures: breakwaters, revetments, groynes
- Floating attenuators: concrete pontoons, floating walls
- Both reduce wave energy but in very different ways
- Choosing the right one depends on your site's exposure, depth, and operational needs



# Fixed Structures: Best for High-Energy Sites

- Ideal when waves are large, frequent, or long-period.
- Most effective in open-water or coastal environments
- Long service life & predictable performance
- Can incorporate habitat features, public access, or walkways

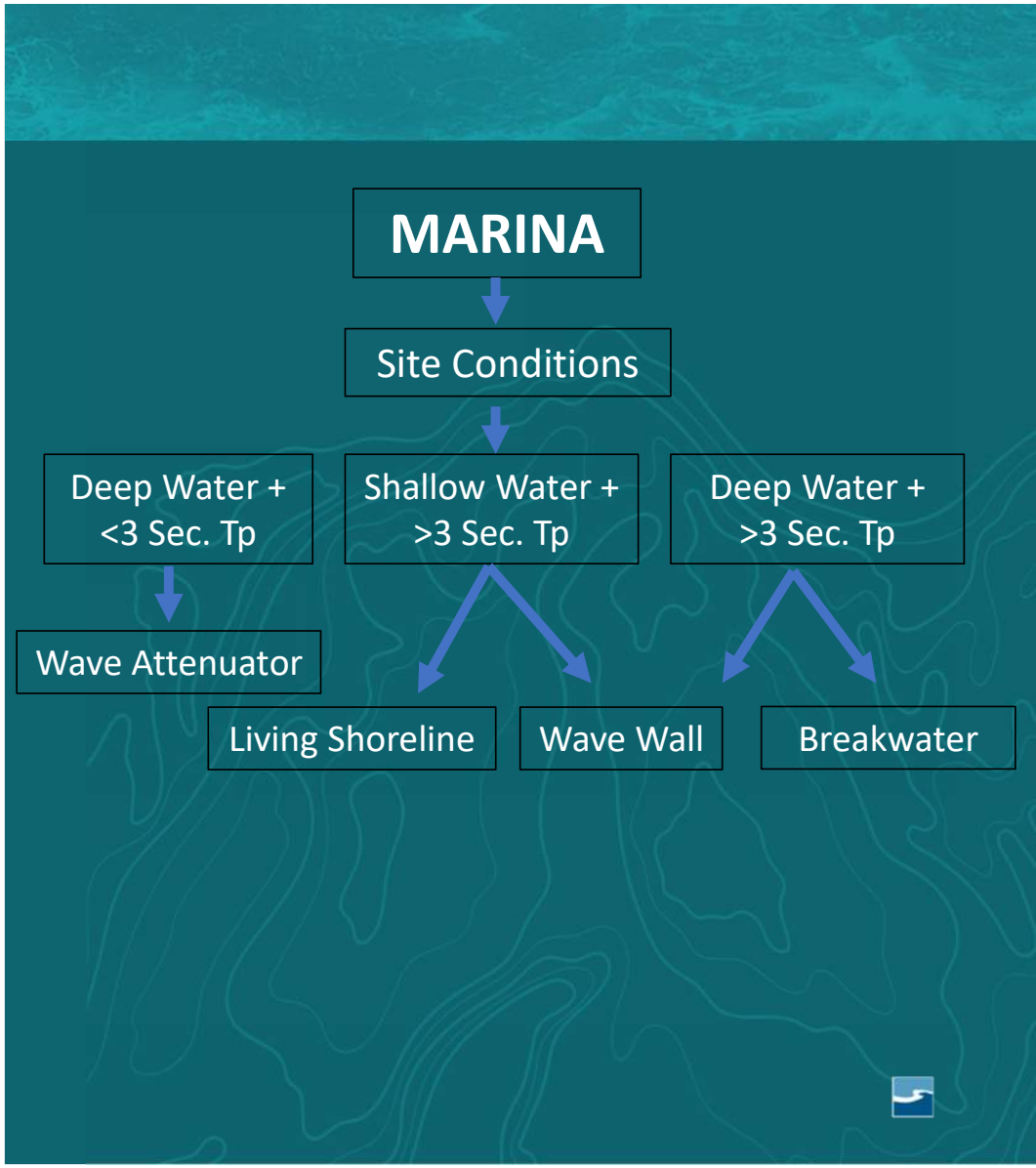


# Floating Attenuators: Flexible Protection for Moderate Sites

- Ideal for moderate wave climates or deep water
- Easy to install, replace, and align with existing docks
- Less intrusive visually + adds usable moorage space
- Cost-effective alternative where fixed is not feasible
- Performance decreases as wave height and period increase

# How to Choose?

1. How exposed is your site?
2. What are your wave heights and directions?
3. How deep is the water where attenuation is needed?
4. What are your operational needs?
    1. Navigational access
    2. Future expansion
    3. Dredging constraints
5. Timeline & budget



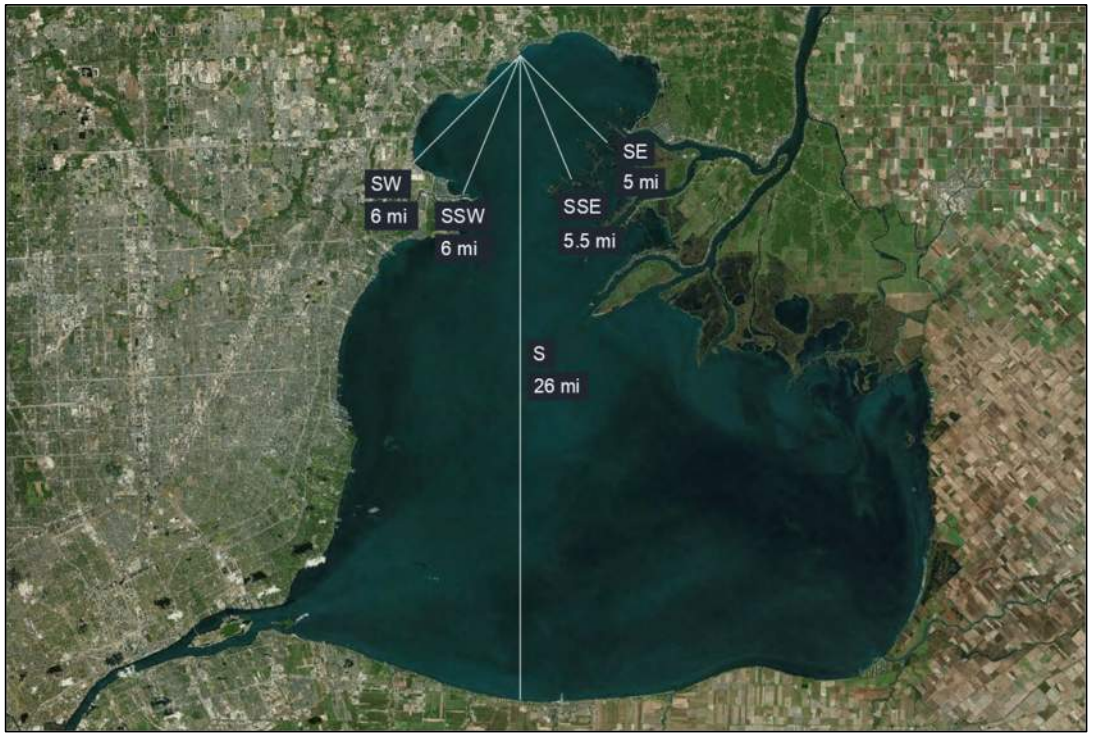
# Wave Attenuator for Longer Periods

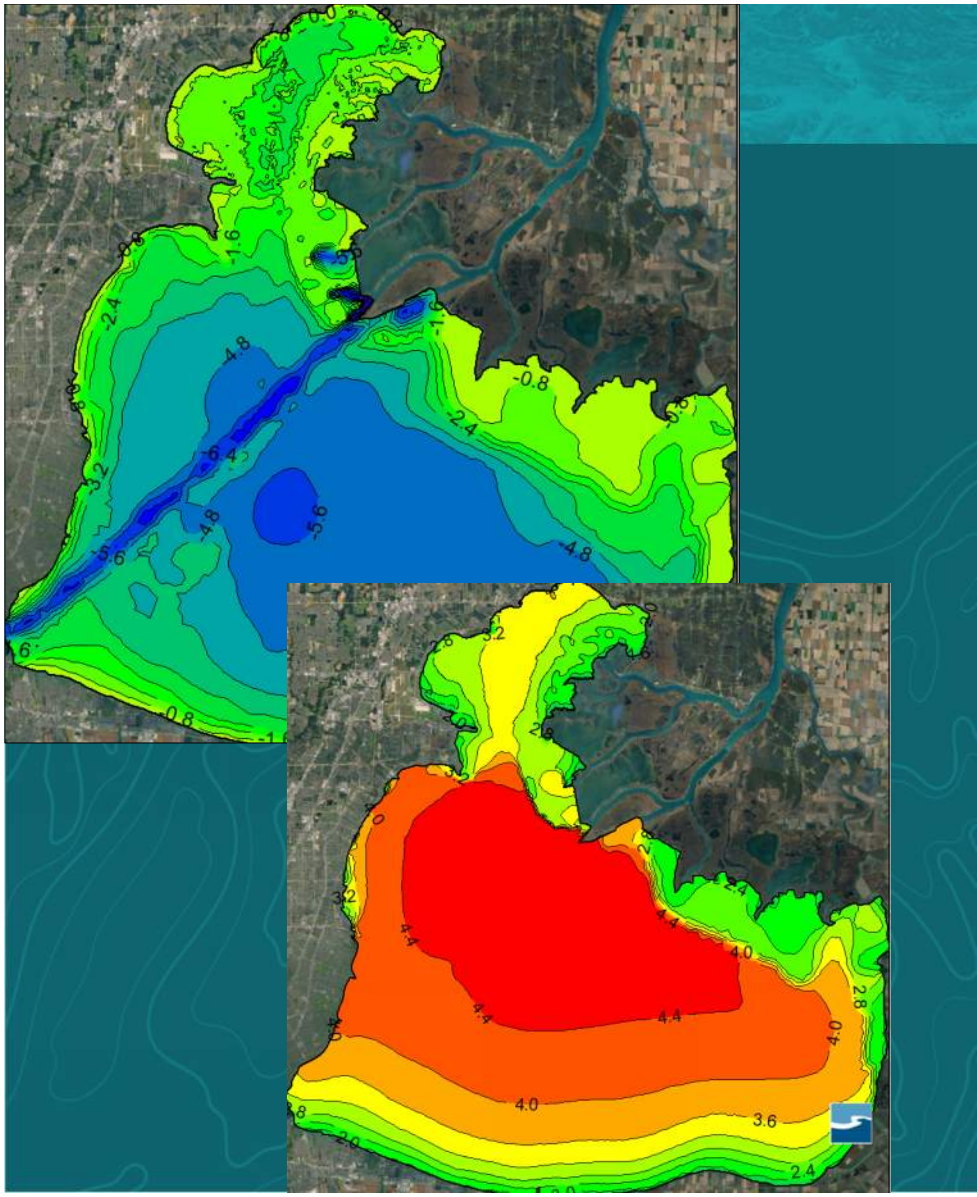
Edgewater resources

SECTION 4

# Case Studies: What works

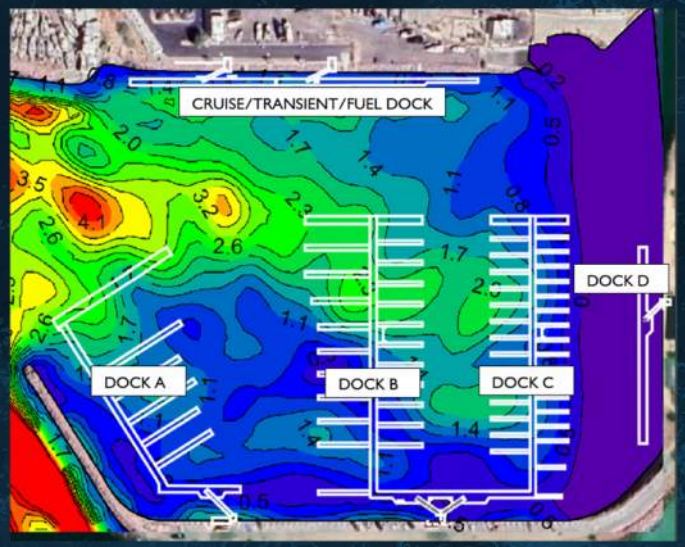
# Case Study #1: Deceptive conditions

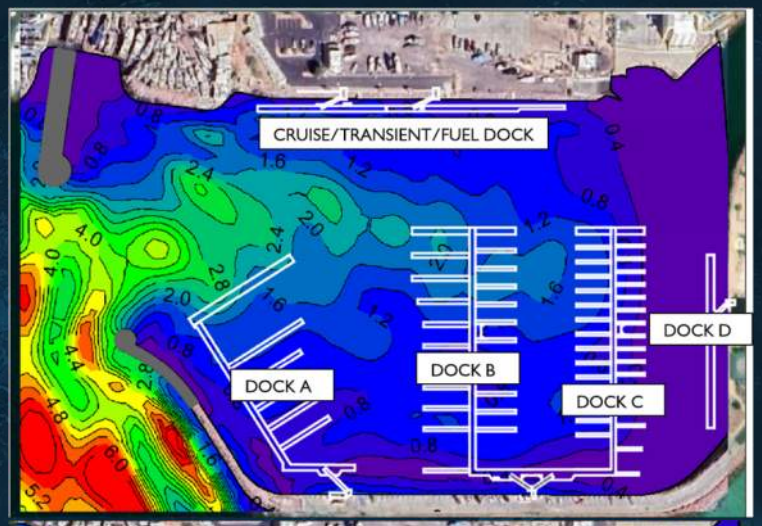


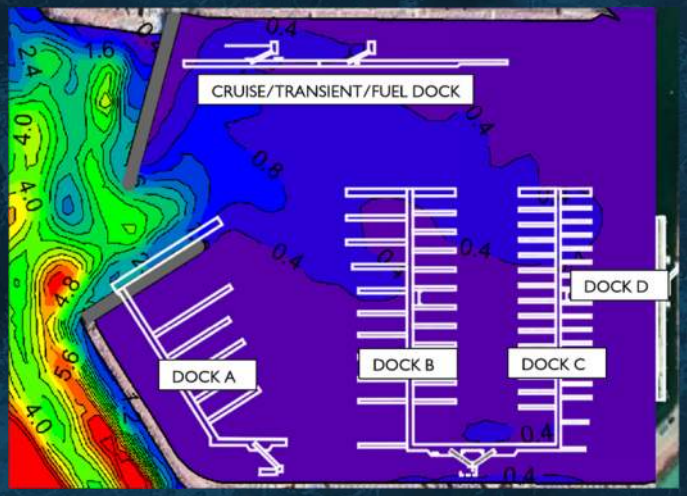



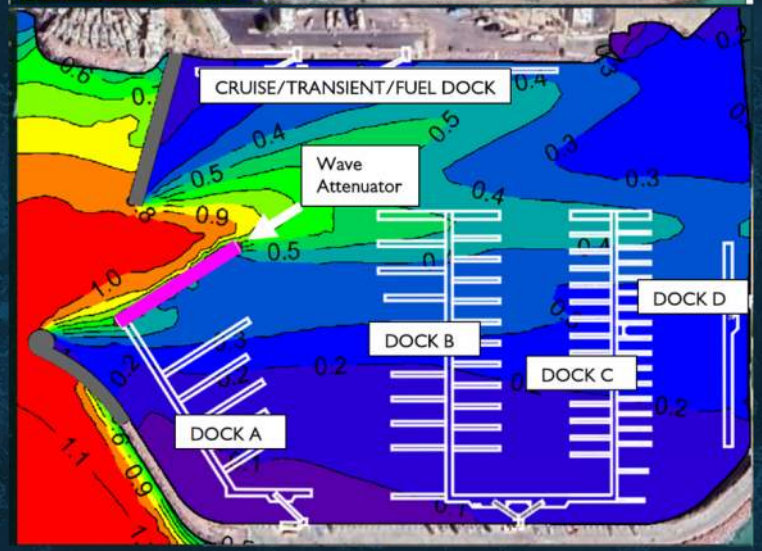
# Case Study #2: Combination of Solutions

BAJA CALIFORNIA, MX
COSTA BAJA MARINA

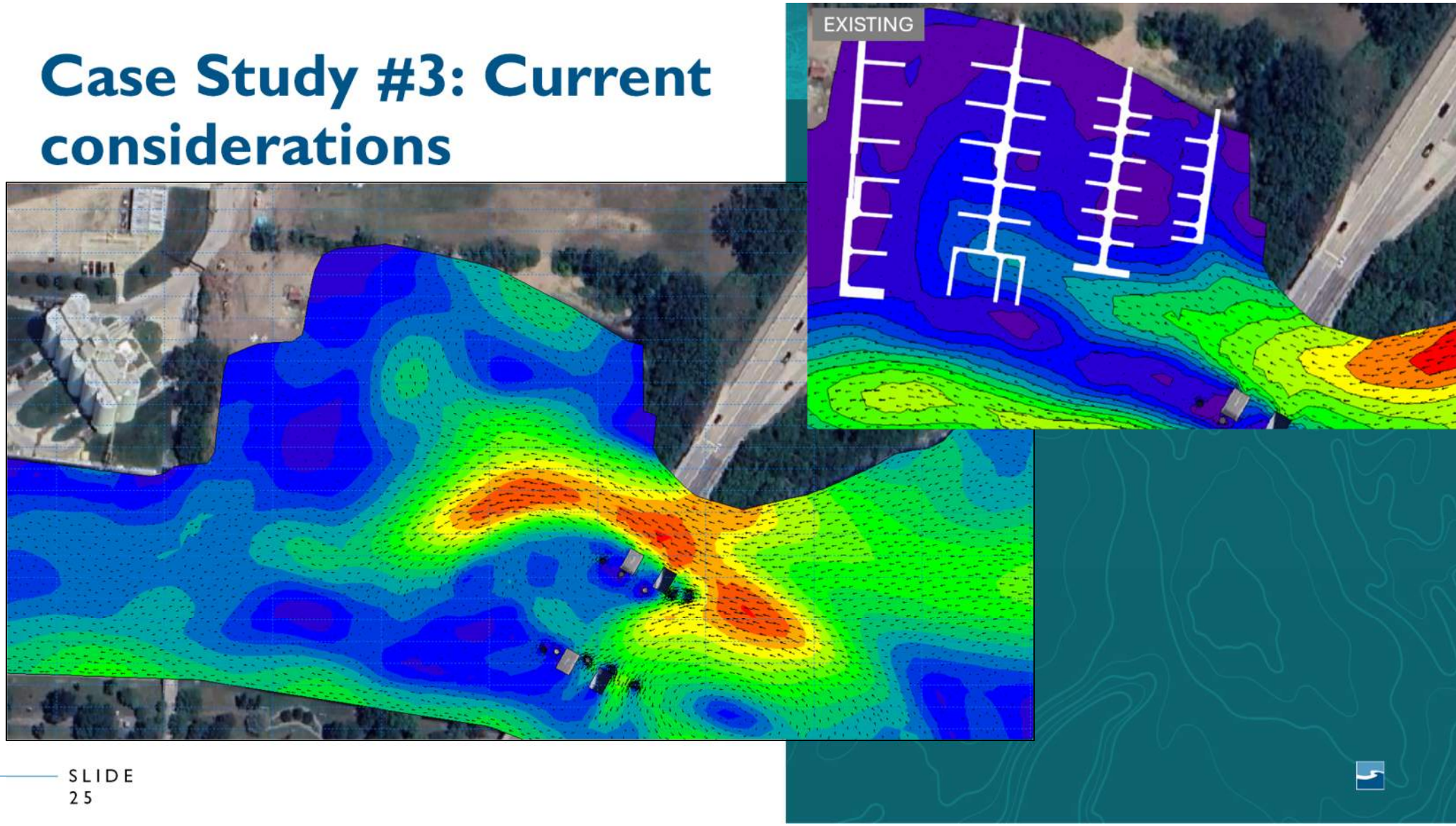

CRUISE/TRANSIENT/FUEL DOCK
DOCK A
DOCK B
DOCK C
DOCK D


CRUISE/TRANSIENT/FUEL DOCK
DOCK A
DOCK B
DOCK C
DOCK D

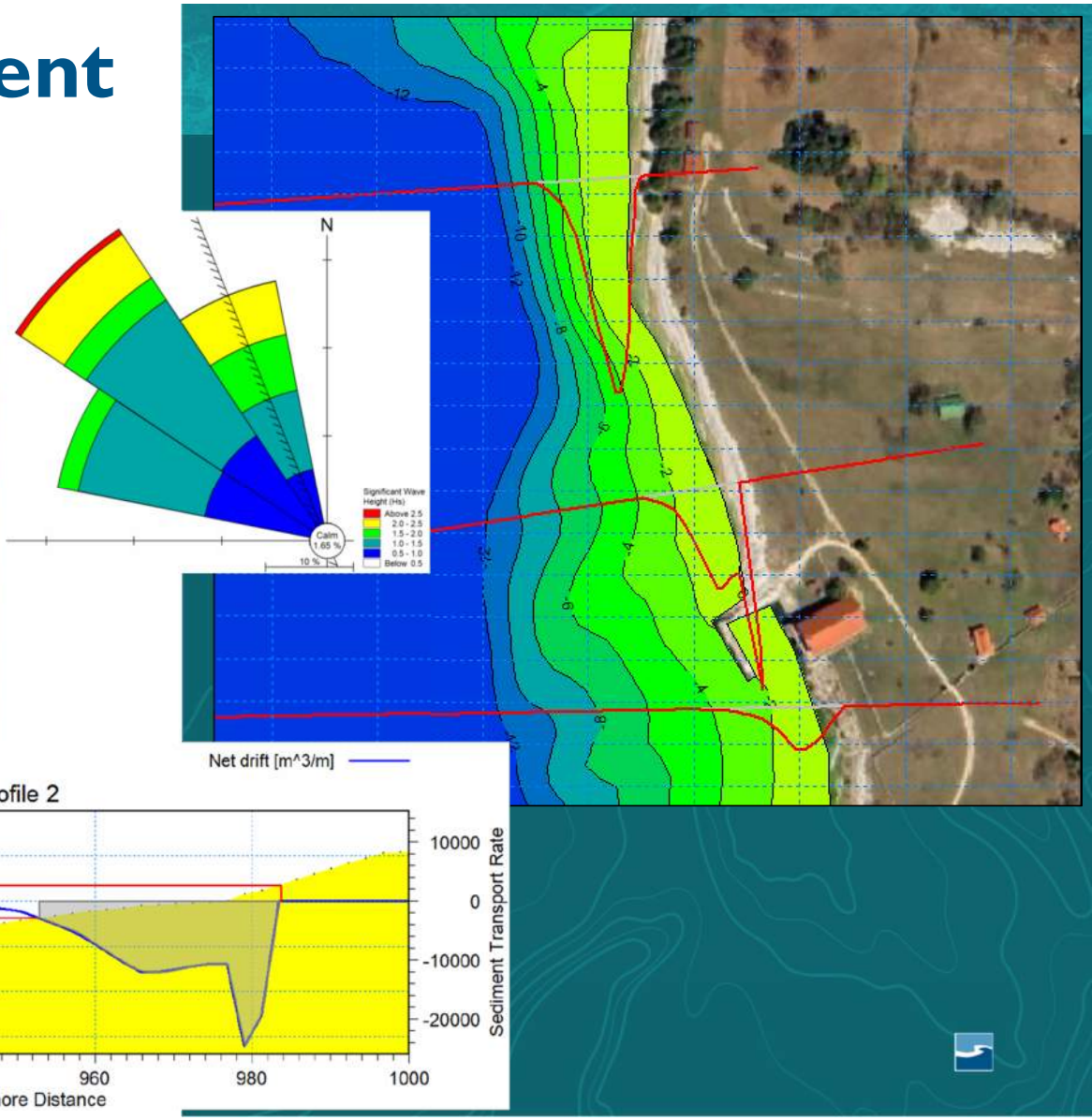

CRUISE/TRANSIENT/FUEL DOCK
DOCK A
DOCK B
DOCK C
DOCK D

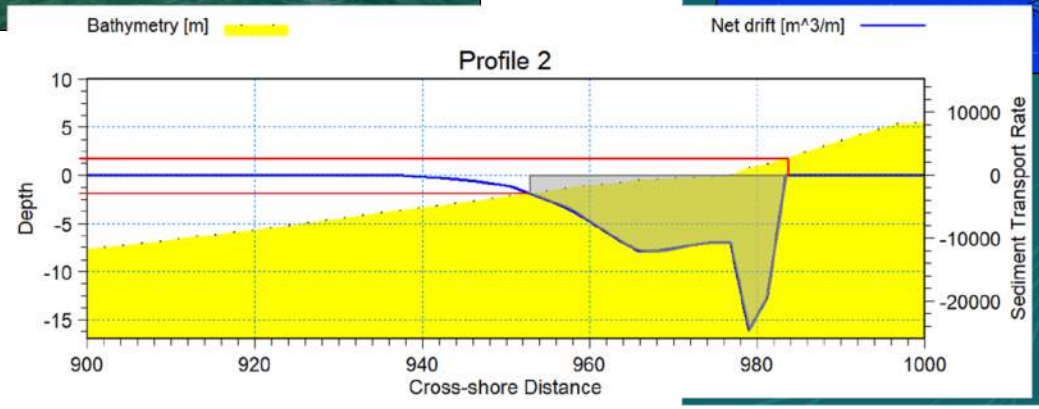

CRUISE/TRANSIENT/FUEL DOCK
Wave Attenuator
DOCK A
DOCK B
DOCK C
DOCK D

# Case Study #3: Current considerations



# Case Study #4: Sediment Considerations



SECTION 5

# Putting It All Together: Your Wave Protection Playbook

# What We Want You To Remember

1. Small waves cause big problems:
   - Even 0.5–1.0 ft of agitation can damage docks, utilities, and the customer experience.
2. Understand your exposure.
   - Wave direction, fetch, depth, and wakes — these are your true design drivers.
3. Layout matters more than most people think.
   - A well-placed entrance or dock reconfiguration can dramatically reduce agitation.
4. Choose the right attenuation tool for the energy.
   - Fixed = high exposure
   - Floating = moderate exposure
   - Hybrid = flexibility + performance

5. COMFORT MEANS REVENUE
   - Protecting your marina reduces maintenance, extends dock life, and keeps users happy

Edgewater resources

# Thank You

Interested in Starting a Project?


COASTAL ENGINEER/PM

## Alejandra Lira

608 422 2882

alira@edgewaterresources.com