Small Craft Harbours in Thompson-Okanagan Region (Draft)

Technical Guidance on Applications for *WSA* Section 11 Change Approval

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BRITISH COLUMBIA

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What is a small craft harbour?

An infrastructure accommodating a group of recreational or commercial boats and boating-related facilities

1. a harbour basin in a body of water
2. facilities (docks, breakwaters, boat launches, buildings, storage yards, and parking)

Also called a marina in some circumstances

Why do we need this Guidance?

Statutory Decision Makers (SDMs)

- sufficient understandings on the impacts
- design by QPs based on industry-standard codes/guidelines and practices
- uniform criteria

Proponents

- basic understandings on SDM's requirements
- practical guidance for documents, and QP selection

Qualified Professionals (QPs)

- practical guidance for work scope, and efficient client service

Outline

1. Fundamentals
2. Scope of the Guidance
3. Qualified Professionals (QPs) & Professional Design
4. Primary Considerations
5. Example
6. FAQs
7. Summary

1. Fundamentals: *Applicability of this Guidance*

Major components of a small craft harbour:

- Piers
- Platforms
- Walkways
- boat lifts
- boat launches/ramps
- breakwaters/wave attenuators
- & associated elements (piles, mooring systems)
- dredging


A marina on Okanagan Lake

Minor maintenance work for an existing small craft harbour may be processed as an **Authorized Change**, which requires a **Notification**; please contact Regional Water Management (RWM) for clarification.

1. Fundamentals: *Applicability of this Guidance*

In this Guidance, a small craft harbour means:

a) **marina**
- commercial activity

b) **private group moorage**
- > 3 berths (or slips)

c) **strata or condominium moorage**
- > 3 berths

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1. Fundamentals: *Other Regulatory Requirements (not exhaustive)*

Federal

- *Fisheries Act*
- *Navigation Protection Act*
- *Species at Risk Act*

Provincial

- *British Columbia Fire Code*
- *Engineers and Geoscientists Act*
- *Heritage Conservation Act*
- *EMA*
- *Land Act*
- *Riparian Areas Regulation*
- *Wildlife Act*

Regional and Municipal

- *Local Government Act*


A marina on Okanagan Lake

2. Scope of the Guidance

Engineering / Hydrotechnical

- site conditions
- wave climate
- sediment transport
- water circulation
- layout
- other components


Marina construction on Okanagan Lake

Beyond scope

- CEMP
- First Nations concerns
- ecosystems requirements
- Crown Land permit or tenure
- other permits

3. Qualified Professionals (QPs) & Professional Design

QPs for project design and studies

a) **primarily, Professional Engineers (PEng) registered with EGBC**
- qualified
- experiences in coastal or marine structural engineering

b) **others (e.g. PGeo registered with EGBC)**
- contact RWM for clarification

Section 22 (Prohibition on practice), *Engineers and Geoscientists Act*

22 (1) Except as permitted under this Act, an individual or corporation, partnership or other legal entity must not do any of the following:

(a) engage in the practice of professional engineering or professional geoscience;

(b) assume, verbally or otherwise, the title of professional engineer or professional geoscientist;

(c) advertise or use, or permit to be advertised or used, in any manner whatsoever, in connection with the name of the individual, corporation, partnership or other legal entity, or otherwise,

(i) the title of professional engineer or professional geoscientist,

(ii) any word, name, title or designation mentioned in the definition of "practice of professional engineering" or "practice of professional geoscience", or any combination or abbreviation of them, or

(iii) any other word, name, title, designation, descriptive term or statement implying, or calculated to lead any other person to believe, that the individual, corporation, partnership or other legal entity is a professional engineer or professional geoscientist or is ready or entitled to engage in, or is engaged in, the practice of professional engineering or professional geoscience as defined in section 1 (1);

(d) act in a manner that leads any person to believe that the individual, corporation, partnership or other legal entity is authorized to fill the office of or act as a professional engineer or professional geoscientist;

(e) advertise, use or display a sign, card, letterhead or other device representing to the public that the individual, corporation, partnership or other legal entity is a professional engineer or professional geoscientist or an individual, corporation, partnership or other legal entity ready or entitled to engage in the practice of professional engineering or professional geoscience or holding out the individual, corporation, partnership or other legal entity to be a professional engineer, professional geoscientist or certificate holder.

(2) Subsection (1) does not apply

(a) to an individual who is a member of the association or holds a licence, other than a limited licence, issued by the association, or

(b) to a corporation, partnership or other legal entity that has on its active staff members or licensees who directly supervise and assume responsibility as this Act provides for the practice of professional engineering or professional geoscience undertaken by the corporation, partnership or other legal entity.

(3) An individual who holds a limited licence must not engage in the practice of professional engineering or professional geoscience except in a manner consistent with the scope of the limited licence and according to the provisions of that limited licence.

3. Qualified Professionals (QPs) & Professional Design

Design and studies must be in compliance with:

- Industry practice and design protocols
- Regulations/Ministry standards
- Practice in Thompson Okanagan Region
- SDM may require independent peer reviews at the proponent's cost

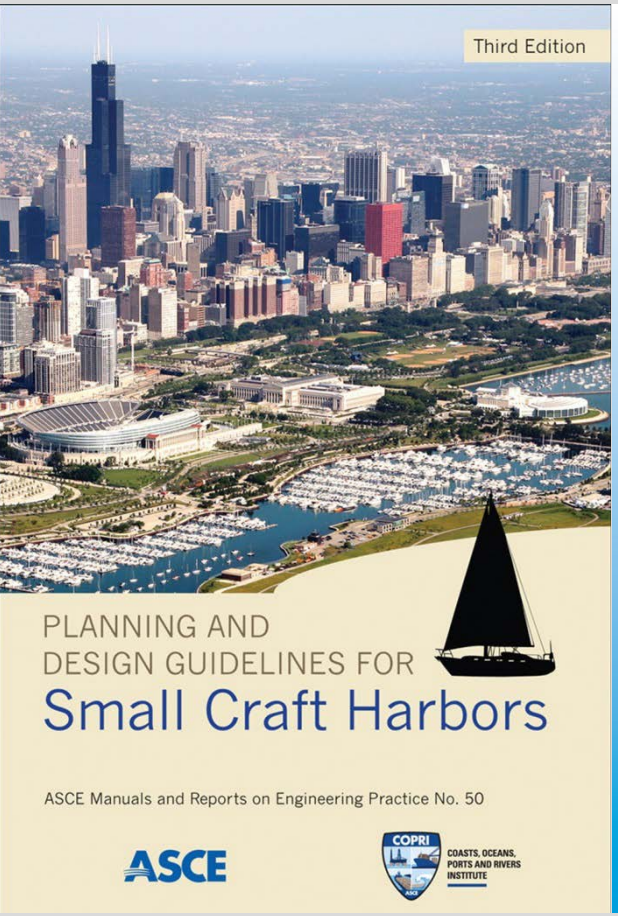
What does a professional design look like?

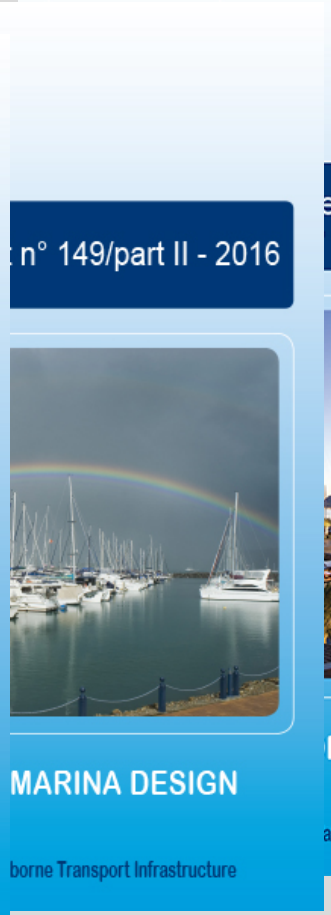
- thorough demonstration of a project's impacts
- protection of public safety and other public values
- lasting protection of the environment
- potential to reduce client's long-term costs for operation and maintenance

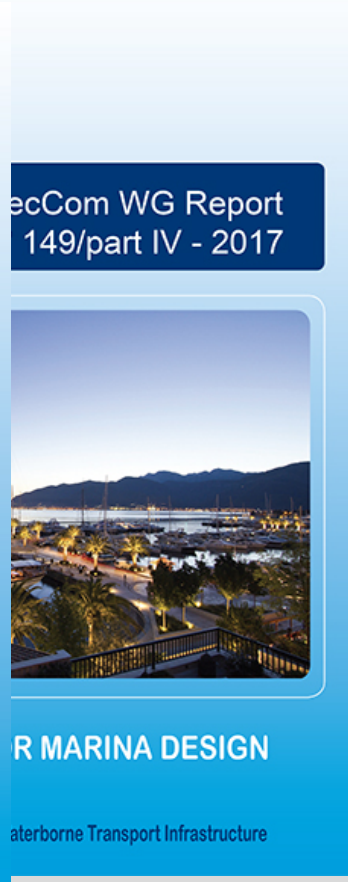
Breakwater damages at a marina on Okanagan Lake (Source: ????? *Marina Expansion and Breakwater Repairs - Environmental Assessment*, Ecoscape Environmental Consultants Ltd., 2016)

Failure of a marina on Okanagan Lake

Sediment deposition due to a marina on Okanagan Lake





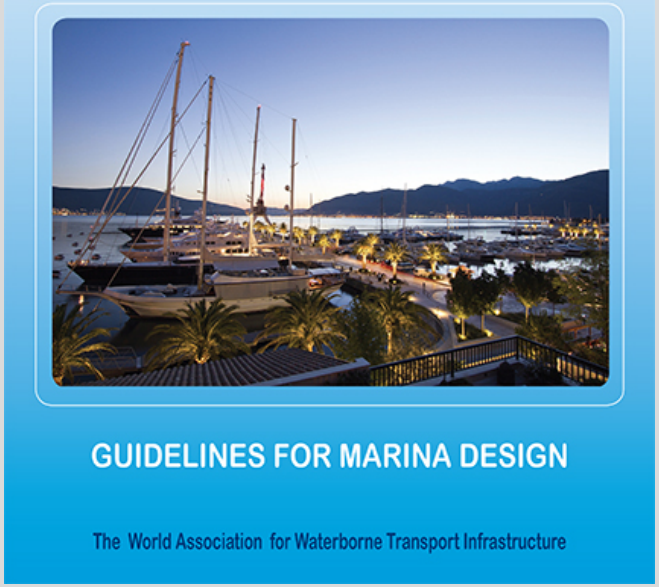


American Society of Civil Engineers (2012): *Planning and Design Guidelines for Small Craft Harbors (Third Edition)*, ASCE Manuals and Reports on Engineering Practice No. 50.

World Association for Waterborne Transport Infrastructure (2016): *Guidelines for Marina Design (Part I)*, PIANC RecCom WG 149.
World Association for Waterborne Transport Infrastructure (2016): *Guidelines for Marina Design (Part II)*, PIANC RecCom WG 149.
World Association for Waterborne Transport Infrastructure (2017): *Guidelines for Marina Design (Part IV)*, PIANC RecCom WG 149.

Design guidelines for reference

for example



World Association for Waterborne Transport Infrastructure (2017): *Guidelines for Marina Design (Part IV)*, PIANC RecCom WG 149.

4. Primary Considerations

- Site conditions
- Layout
- Impact on Wave Climate
- Impact on Water Circulation and Mixing
- Impact on Sediment Transport
- Others

A marina on Shuswap Lake

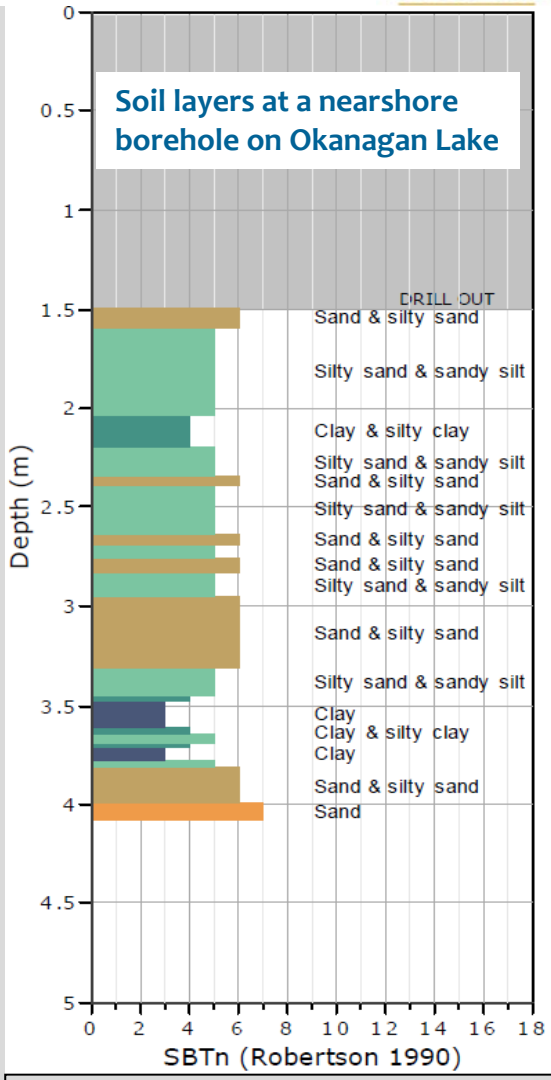
4. Primary Considerations - *Site Conditions*

Common site conditions:

- weather - wind, precipitation, ice
- hydraulic / hydrologic - water levels, waves, currents, ice
- bathymetry / topography
- geotechnical
- erosion and sediment transport regime

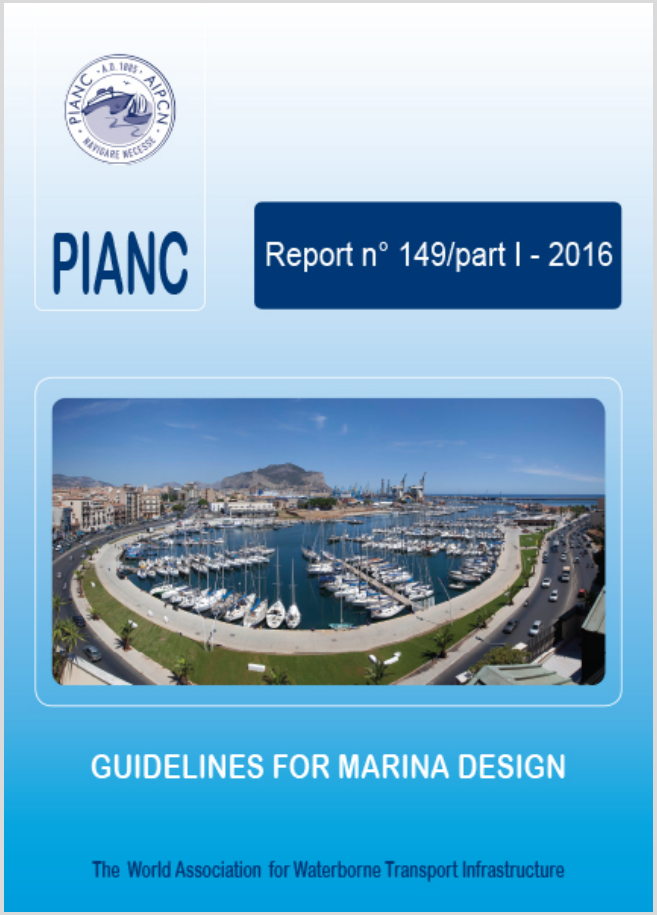
Notes

- Site conditions must be developed by QPs.
- If unsure, QPs should contact RWM, and then determine site conditions to be investigated.



Example
Geotechnical investigation provides key parameters for pile foundation design, submarine slope stability analysis, and foundation liquefaction assessment.

for example



World Association for Waterborne Transport Infrastructure (2016): ***Guidelines for Marina Design (Part I)***, PIANC RecCom WG 149.

4. Primary Considerations - *Site Conditions*

- **Design conditions**
  - *water levels, waves, and currents*
  - *normal operational and extreme conditions; return periods*
- **A detailed wave study to develop design waves**
  - *wind-wave generation*
  - *near-shore wave propagation*
- **Effects of climate change**
- **Boat-generated waves**


A marina on Okanagan Lake

Notes

- The SDM may request an assessment of site suitability for the proposed project.

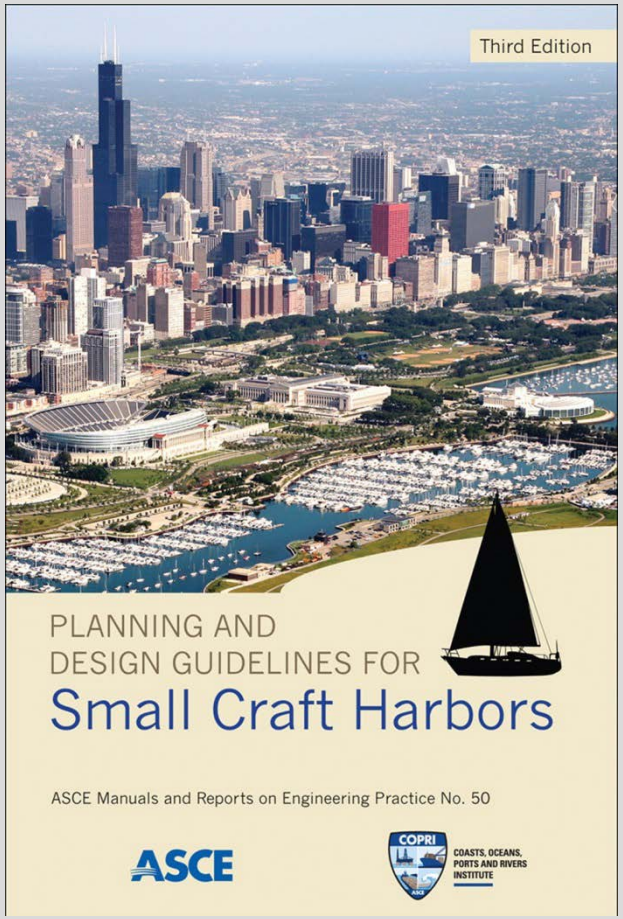
4. Primary Considerations – *Layout*

- **locations, configuration, elevations, and dimensions**
- **safe operational environment: berthing tranquility and boat traveling safety**
  - design criteria (mostly related to wave or wind)
  - engineering measures (breakwaters or wave attenuators), and management mitigations (wind speed limits)

Notes
- The safe operational environment must be evaluated quantitatively.

Story
The entrance configuration show in the figure demonstrates ineffective entrance geometry, with insufficient overlap. Waves diffract around the end of the outer breakwater and enter the small craft harbour. The entrance opening is oriented in a direction that allows unabated waves to enter the calm water area behind.

Reference
World Association for Waterborne Transport Infrastructure (2016): *Guidelines for Marina Design (Part II)*, PIANC RecCom WG 149.



American Society of Civil Engineers (2012): *Planning and Design Guidelines for Small Craft Harbors (Third Edition)*, ASCE Manuals and Reports on Engineering Practice No. 50.

Table 2-5. Generalized Harbor Tranquility Goals

Provisionally Recommended Criteria for a "Good" Wave Climate in Small Craft Harbors[a]

Direction and Peak Period of Design Harbor Wave	Wave Event Exceeded Once in 50 Years	Wave Event Exceeded Once a Year	Wave Event Exceeded Once Each Week
Head seas <2 sec	These conditions not likely to occur during this event	Less than 1-ft wave height	Less than 1-ft wave height
Head seas between 2 and 6 sec	Less than 2-ft wave height	Less than 1-ft wave height	Less than 0.5-ft wave height
Head seas >6 sec	Less than 2-ft wave height or 4-ft horizontal wave motion	Less than 1-ft wave height or 2-ft horizontal wave motion	Less than 0.5-ft wave height or 1.5-ft horizontal motion
Oblique seas	Less than $(2 - 1.25\sin\theta)$ ft where θ is the wave angle from head sea	Less than $(1 - 0.5\sin\theta)$ ft where θ is the wave angle from head sea	Less than $(0.5 - 0.25\sin\theta)$ ft where θ is the wave angle from head sea
Beam seas <2 sec	The conditions not likely to occur during this event	Less than 1-ft wave height	Less than 1.0-ft wave height
Beam seas between 2 and 6 sec	Less than 0.75-ft wave height	Less than 0.5-ft wave height	Less than 0.25-ft wave height
Beam seas >6 sec	Less than 0.75-ft wave height or 2-ft horizontal motion	Less than 0.5-ft wave height or 1-ft horizontal motion	Less than 0.25-ft wave height or 0.75-ft horizontal motion

[a]For criteria for an "excellent" wave climate, multiply by 0.75; for a "moderate" wave climate, multiply by 1.25.
Source: Cox (2003)

Notes

- Conditions apply to the Table.

4. Primary Considerations: *Impact on Wave Climate*

a) to assess changes in wave conditions caused by

- *breakwater or wave attenuator*
- *bulkhead structure*
- *panel wall*
- *rubble-mound structure (groyne)*
- *floating structure*
- *gravity structure*

b) may be also required for:

- *structures with densely-spaced piles*
- *dredging*

Story
Although protecting a marina, breakwaters may cause impacts on wave conditions in adjacent waters: 1) increased wave action due to their reflection effect in some waters, and 2) decreased wave action due to their shielding effect in others.

4. Primary Considerations: *Impact on Wave Climate*

d) detailed near-shore wave study
- *numerical modeling*
- *near-shore wave behaviors*

e) to compare wave characteristics
- *pre- and post-project conditions*
- *typical return periods*
- *at representative locations*

d) no increase to wave loadings on other works

e) A foundation for further studies (sediment transport, water quality)

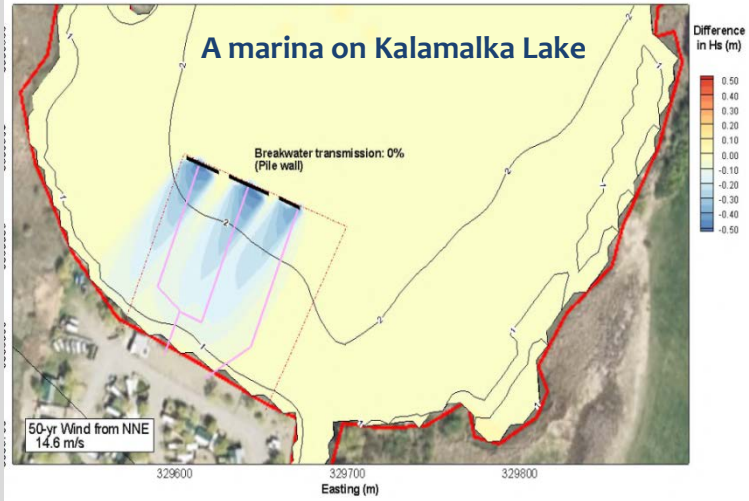


Figure 2.1 Differencing of Wave Height

Story
Today, numerical modeling has become a standard tool in simulating nearshore wave propagation. This picture shows numerical modeling results on the changes of wave height caused by a proposed breakwater wall on Kalamalka Lake.

Notes
- An allowable change in wave conditions around the project site may be considered at RWM's discretion based on the assessment.

4. Primary Considerations: *Impact on Water Quality*

a) A study may be required if

- *water circulation is limited*
- *proposed project location is heavily enclosed*
- *the project may obstruct or limit existing water circulation*
- *densely-spaced piles are proposed*
- *dredging is proposed*


A marina on Mara Lake

4. Primary Considerations: *Impact on Water Quality*

b) Must include:

- *pre- and post-project comparison of relevant water quality parameters (at representative locations)*
- *full consideration of site conditions*
- *seasonal variability of water quality*

c) Numerical modeling for water quality

b) no adverse impact on water quality

Figure 5.47: Physical model investigation of hydrodynamics in a new marina (National Research Council Canada)

Story
In complicated situations, the impact of a small craft harbour may have to be investigated by physical modeling.

Reference
World Association for Waterborne Transport Infrastructure (2016): *Guidelines for Marina Design (Part II)*, PIANC RecCom WG 149.

Notes

- Provincial Water Quality Guidelines and site-specific water quality objectives may apply. Please contact RWM for clarification.

4. Primary Considerations: *Impact on Sediment Transport*

a) to assess changes in sediment transport caused by

- *breakwater or wave attenuator*
- *bulkhead structure*
- *panel wall*
- *rubble-mound structure (groyne)*
- *floating structure*
- *gravity structure*

b) may be also required for:

- *structures with densely-spaced piles*
- *dredging*

Story
A marina with bulkhead can significantly affect sediment transport around site. The photo shows that, on a shoreline subjected to a substantial long-shore transport of coarse materials (gravels), sediments are blocked off by a cross-shore bulkhead.

4. Primary Considerations: *Impact on Sediment Transport*

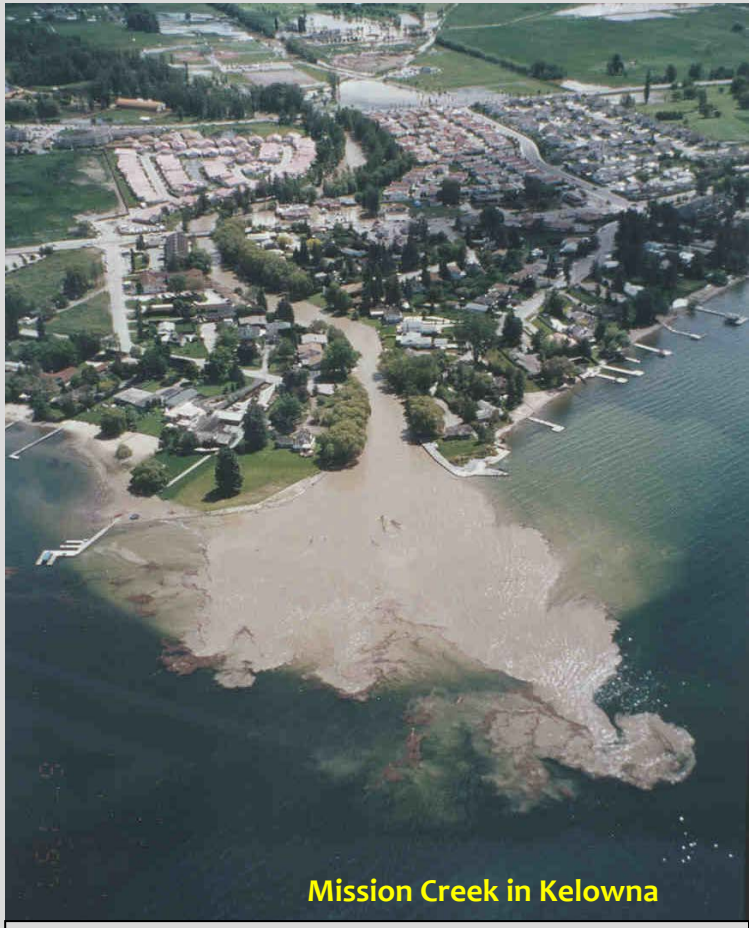
c) Impact on shoreline processes (erosion, deposition, and transport)
- *long-shore*
- *cross-shore*

d) Special concern: sites around stream mouth

e) No scouring and deposition to existing structures

f) Numerical (and even physical) modeling **coupled with wave actions**

Notes
- Quantified results are required to assess the impacts appropriately.



Story
Mission Creek carries a substantial amount of sediments to Okanagan Lake. Sites around the delta are subjected to a strong sediment process. Moreover, newly-deposited sediments may provide a unstable foundation for small craft harbours, affecting site suitability.

4. Primary Considerations: *Others*

a) mostly related to structural and geotechnical designs, or major safety concerns

b) independent peer reviews at the proponent's cost
- *piles*
- *pile-decking connections*
- *mooring systems*

c) proprietary designs must address site conditions

d) submarine slope stability

e) fueling station

2. DESIGN WAVE:
   2.1. 30 YEAR OCCURRENCE
      2.1.1. HEIGHT: 0.4 m
      2.1.2. LENGTH: 5.1 m
   2.2. 0.87% EXCEEDENCE
      2.2.1. HEIGHT: 1.5 m
      2.2.2. LENGTH: 31.0 m
   2.3. DESIGN WAVE HEIGHT HAS BEEN ADOPTED BASED ON WIND/WAVE STUDIES COMPLETED AT NEARBY SITES ON THE LAKE.
   2.4. THE DESIGN WAVE HEIGHT HAS BEEN AGREED UPON BY THE OWNER.
   2.5. SITE SPECIFIC WIND WAVE DATA HAS NOT BEEN COLLECTED FOR THIS SPECIFIC SITE. ANY UNIQUE WAVE FACTORS DUE TO LOCATION HAVE NOT BEEN ASSESSED AND OR ACCOUNTED FOR.
   2.6. THE DESIGN WAVE HAS BEEN REVIEWED AS A LATERAL FORCE ON THE PILES AND PILE CAPS PER CAN/CSA S6–14, CLAUSE 3.11.5.
   2.7. THE STRUCTURE HAS NOT BEEN DESIGNED FOR UPWARD WAVE FORCES ON THE SUPER STRUCTURE.
      2.7.1. IT IS ANTICIPATED THAT IF A SIGNIFICANT STORM EVENT OCCURS AT MEAN OR HIGH WATER LEVELS THE DECKING MAY EXPERIENCE DAMAGE AND THE PILES MAY EXPERIENCE UPLIFT FORCES EXCEEDING THE STRUCTURE DEADLOAD.
      2.7.2. THE OWNER IS AWARE OF THE RISK NOTED AND ACCEPTS THIS WITHIN THE DESIGN CRITERIA OF THE STRUCTURE.

3. THE STRUCTURE HAS NOT BEEN DESIGNED FOR ICE FORCES. THIS IS A RISK ITEM UNDERSTOOD BY THE OWNER. BASED ON THE HISTORY OF THE SITE OVER THE PREVIOUS 30 YEARS, IT IS UNDERSTOOD THAT THE OWNER IS FAMILIAR WITH THE SITE AND ICE CONDITIONS

Story
As required by the SDM in a WSA Section 11 *Change Approval* application, the QP elaborated the structural design of a marina, and addressed structural risks for the marina. This interaction helps the SDM in identifying potential risks in decision making, the Proponent in realizing risks with the property, and the QP in clarifying professional liability.

5. Example

Main required studies

- *layout design (berthing tranquility)*
- *wave study*
- *sediment transport study*
- *water quality study*

5. Example

Completed work

- *Design of a floating breakwater design (to ensure berthing tranquility at the marina)*
- *Numerical modeling of wave process by MIKE21*
- *Long- and cross-shore sediment transport analysis based on wave modeling*
- *Numerical modeling of water quality by AQUATOX, in conjunction with MIKE3 and EMC*

FIGURE 4-2: WITH PROJECT CONDITIONS FOR THE 50-YEAR RETURN PERIOD WAVE EVENT (LEFT TO RIGHT) - HEAD SEAS, QUARTER SEAS, BEAM SEAS

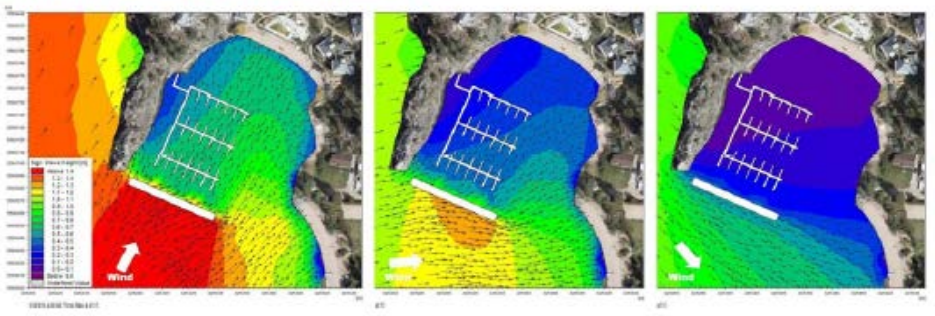


FIGURE 4-3: WITH PROJECT CONDITIONS FOR THE 1-YEAR RETURN PERIOD WAVE EVENT (LEFT TO RIGHT) - HEAD SEAS, QUARTER SEAS, BEAM SEAS

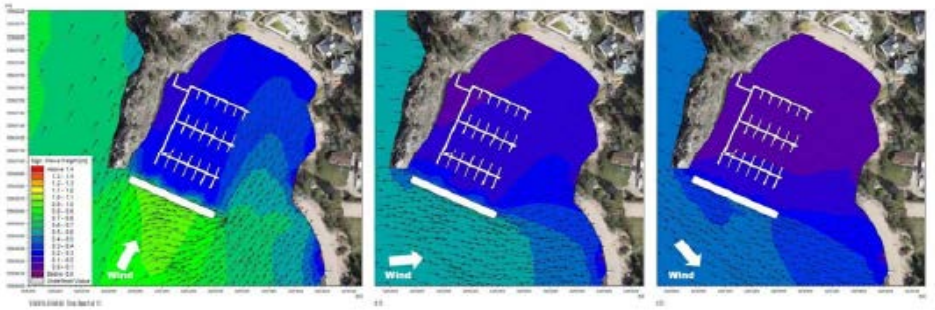
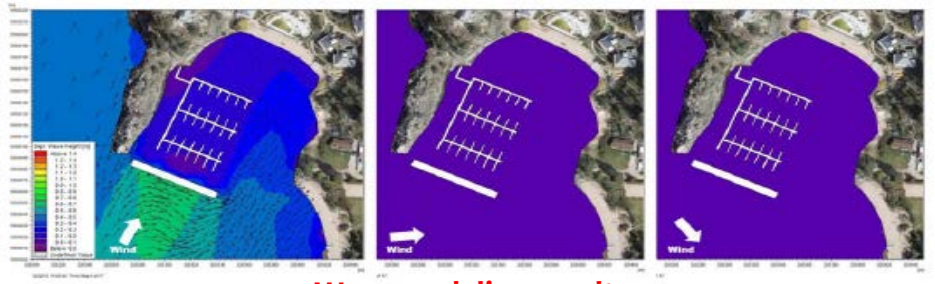


FIGURE 4-4: WITH PROJECT CONDITIONS FOR THE WEEKLY RETURN PERIOD WAVE EVENT (LEFT TO RIGHT) - HEAD SEAS, QUARTER SEAS, BEAM SEAS



Wave modeling results

6. FAQs

a) The review process looks complicated, where can we start as a proponent?

b) How long will the review process take?

c) Do we need to complete every study addressed in the Guidance?

d) Where to find QPs?

Ministry staff from Crown Land, RWM, and Ecosystems visiting a marina on Shuswap Lake

Story
At the beginning of a S11 review process, Ministry staff normally visit the site along with the Proponent and the QP. Ministry staff will specify required documents and studied.

6. FAQs

e) **I own a small marina, and take all safety responsibilities of the marina by myself. In this case, do I still need to engage a PEng to design?**

f) **I just want to repair my marina, do I still need to follow this Guidance?**

g) **I have lived at the site for 30 years. I have never seen any wave damage on my marina. How does this Guidance apply to my work?**

Story
During construction, Ministry staff may also visit the site, and inspect the compliance of the work with the issued *Change Approval*.

7. Summary

1. Qualified professionals for project design and studies
2. Professional project design and studies in compliance with applicable industry standards and government regulations/standards
3. Specified design criteria
4. Well-developed site conditions
5. Wave actions: a key foundation
6. Must not cause adverse impacts on water quality and sediment transport

Team for *WSA* Section 11 Change Approvals

Regional Water Management

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Thank You!