Evaluation and Design of Marine Habitat Offsetting for Multiple Projects near Esquimalt Harbour, BC

June 06, 2017

Presented By:
- Jessica Wilson, EIT, ENV SP, Project Engineer, SNC-Lavalin Inc.
- Doug McMillan, M.Sc., P.Ag, Project Manager, SNC-Lavalin Inc.
- Jeff Lainsbury, MBA, P.Geo, Manager, SNC-Lavalin Inc.
- John Readshaw, P.Eng, Manager, Coastal Engineering, SNC-Lavalin Inc.
- Cliff Robinson, PhD, R.P.Bio, Project Scientist, Formerly SNC-Lavalin Inc.
- Scott Irwin, B.Sc, Coordinator, Environmental Services, Defense Construction Canada
- Mike Waters, R.P.Bio, Environment Officer, Formation Safety and Environment, DND

Outline
- Background
- Habitat Offsetting Measures
- Engineering Design Basis
- Conceptual Design
- Take Aways
- Questions

Background

Project Drivers
- Infrastructure upgrades have been proposed at 3 locations by the DND for CFB Esquimalt Properties
  - Fleet Dive Unit
  - Esquimalt Harbour
  - Rocky Point Jetty
  - Pedder Bay
  - Small Boat Float
  - Esquimalt Harbour

Planned Upgrades
- Fleet Dive Unit (FDU)
  - Replacement of the aging jetty with a newly aligned floating jetty
  - Construction would include a new jetty, shoreline works, and pile driving
- Small Boat Float (SBF)
  - New facility required to develop mooring facilities for Orca-class vessels
  - Construction will likely include dredging, underwater blasting, foreshore infilling, pile driving, and placement of rip-rap shore protection
- Rocky Point Jetty (RPJ)
  - Existing jetty was built in 1950's
  - Refurbishment needed to upgrade the aging infrastructure and accommodate larger vessels
  - Construction could include dredging, infilling of the foreshore, and widening the deck structure

Scope of Work
- The proposed developments will result in the loss of marine habitat through construction and operation.
- To offset the loss of habitat, the DND can draw Habitat Credits from an existing habitat bank.
- SNC-Lavalin was contracted to determine what other measures could be taken to offset permanent harm to Commercial, Recreational, or Aboriginal (CRA) fish habitat according to Fisheries and Oceans Canada (DFO) requirements.
Habitat Offsetting Measures

Required Offset Area
- Total productivity unit equivalents for habitat loss were estimated at each site based on our understanding of proposed activities:
  - Spatial area affected
  - Productivity of that area
- Required productivity unit equivalents habitat offsets:
  - Rocky Point Jetty: 4285 m²
  - Fleet Dive Unit: 837 m²
  - Small Boat Float: 4009 m²

Habitat Offsetting Measures

Offsetting Options
- Six potential offsetting measures identified:
  - Creation of submerged rock mounds or reefs
  - Enhancement of hard revetments to improve ecological functions
  - Creation of mid- to upper-intertidal habitat
  - Use of soft engineering approaches consistent with Greenshores™
  - Use of mud-creting reclamation techniques
  - Substrate capping

Habitat Offsetting Measures

Framework Evaluation
- Results (out of a possible 100):
  - Selected options that would provide the most enhanced productivity potential for a variety of CRA species in the project areas.
  - Offset measures selected for further study:
    - Fleet Dive Unit: Submerged rock reef/mounds
    - Small Boat Float: Enhanced revetment design
    - Rocky Point Jetty: Creation of intertidal habitat

Engineering Design Basis

Water Levels
- Higher High Water Large Tide (HHWLT): 1.4 m
- Storm Surge
  - Higher: Storms are not always accompanied by a large storm surge
  - Lower: Storms are typically associated with negative storm surges
- Sealevel Rise
  - 1 m or less was not considered (2011 Provincial Guidelines)
- Mean record studies suggested that this may be a centroid value

Wind Waves
- Fleet Dive Unit
  - The submerged rock reefs will likely experience the highest wave forces when the water depth is lowest and wave breaking occurs.
  - Design is governed by wave conditions at a present day low water level:
    - Hs = 0.6 m, Tp = 2.3 s, and Dir = 125°
- Small Boat Float
  - Design governed by expected storm conditions at end of life (most severe):
    - Hs = 0.7 m, Tp = 2.9 s, and Dir = 310°

Engineering Design Basis

Wind Waves
- Small Boat Float
  - Design governed by expected storm conditions at end of life (most severe):
    - Hs = 0.6 m, Tp = 2.3 s, and Dir = 125°
**Take Aways**

- **Engineering Design Basis**
  - **Wind Waves**
    - Rocky Point Jetty:
      - Design governed by expected wave conditions at end of life (most severe):
      - $H_s = 1.2 \text{ m}$, $T_p = 8.0 \text{ s}$, and $\text{Dir} = 80^\circ$

- **Conceptual Design**
  - **Design Considerations**
    - **Vessel maneuvering**
      - Structures positioned to not inhibit nearby operations.
    - **Vessel wash and wave effects**
      - Used to calculate minimum stable material sizes on the structure.
    - **Wave climate**
      - Preference given to locations with milder wave climates near the project sites.
      - Structures orientated perpendicular to the dominant wave direction (if possible) to reduce erosion.
    - **Marine habitat requirements**
      - Consideration given to the size, type, and depth of material required to provide suitable habitat.

- **Conceptual Design**
  - **Fleet Dive Unit – Rock Reefs**
    - Two submerged, shore-parallel rock reefs
    - Habitat suitable for CRA species such as rockfish
    - ~1800 m² of equivalent habitat offset area (~1000 more than needed)
  - **Small Boat Float – Enhanced Revetment**
    - 2 m wide, lower-intertidal bench along entire revetment
    - Operational requirements impose strict constraints on size/location
    - Habitat suitable for CRA species such as Red Rock Crabs or White-Spotted Greenling
    - ~910 m² of equivalent habitat offset area (~3100 less than needed)
    - Additional compensation from FDU and RPJ habitat offsetting and DND Habitat Bank
  - **Rocky Point Jetty – Intertidal Beach**
    - Approximately 90 m x 55 m
    - Cobble sized beach material
    - Habitat suitable for CRA species such as Greenlings and Seaperch
    - ~4600 m² of equivalent habitat offset area (~300 more than needed)

- **Cost-Estimating**
  - **Class-C Cost Estimate**: ±30%
  - Does not include engineering fees or taxes
  - Construction of offsetting options:
    - **Investigation**
      - **Proposed Habitat Offset**
        - **RPJ Intertidal Beach**
          - Mobil / Demob: $25,000$
        - **FDU Submerged Rock Reefs**
          - Site Preparation / Cleanup: $2,000$
        - **SBF Enhanced Revetment**
          - Supply and Placement: $537,000$
          - Contingency (30%): $169,000$
          - Total: $733,000$
          - Cost per m²: $160/m²$
    - **Notes:**
      - a) No mobilization / demobilization or site preparation / cleanup costs have been included as it is assumed to be included in the concurrent facility construction.

- **Additional Surveys and Investigations**
  - **Bathymetric Survey**
  - **Substrate Mapping**
  - **Hydrodynamic Modeling**
  - **SCUBA Algal / faunal / habitat survey**
  - **Towed underwater algal / faunal / habitat video survey**
  - **Pelagic Water Quality survey**
  - **Foreshore and Intertidal Algal / Faunal / habitat survey**
  - **Geotechnical investigations**
  - **As-Built Surveys**
  - **Ecological and structural engineering monitoring**
Take Aways
- Habitat offsetting is very site specific
- Requires detailed knowledge of the marine environment, from both an ecological and engineering perspective
- Local (fish and habitats)
- Habitat under threat (quantity and quality)
- Engineering viability of solutions
- Offset is feasible - helpful to review at early stages of project (feasibility or conceptual design)

Engineering Design Basis

Vessel Wake
- Propeller wash velocities up to 6m/s could be expected
- Actual berthing conditions will likely reduce propeller wash velocities to approximately 2m/s at the offset structures.

Values that guide us
- Our values are the foundation for our actions. They provide the means and methodologies for an exceptional organization as a group, and serve as an ongoing ethical benchmark for our business.
- Respectful relationships
- Our leadership creates trust andizontality in our exceptional organizations
- Exceptional leadership
- We value our customers and their successes with interactions with our organization
- Ethical & responsible
- Being a responsible organization
- Inspiring
- We consistently demonstrate support for social sustainability
- Our values guide us in all that we do.