

The Arnold's Cove Breakwater Project

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ABSTRACT

Arnold's Cove is a small community located on the isthmus of the Avalon Peninsula in Newfoundland. It had its beginning in the early 1800's as a fishing community. The turn of the century brought the Newfoundland railway located only 3 miles from Arnold's Cove bringing economic growth through employment and trade. The resettlement of isolated communities brought 122 families to Arnold's Cove and further economic growth. The moratorium in 1992 slowed the growth of most 'outport' communities around Newfoundland. However, with close proximity to the Bull Arm construction site, the North Atlantic Refining Ltd. Oil refinery and the Newfoundland Transshipment terminal, Arnold's Cove has revived its future for many years to come.

Since the moratorium on the cod fishery, the types of watercraft that use the wharf in Arnold's Cove have changed. There are more pleasure craft and larger fishing vessels than before. With the changing climate there are now larger storms such as Hurricane Igor and greater need to protect the wharf from harsh wave action and storm undertow conditions.

To protect the wharf from these elements the Department of Fisheries and Oceans Small Craft Harbours Branch (DFO SCH) requested to construct a Rubble Mound Breakwater. This Breakwater is to protect the existing wharf infrastructure and provide safe access to the wharf and meet operations requirements of facility users. This is to comply with DFO SCH's mandate to keep harbours critical to the fishing industry open and in good repair.

The following paper will highlight the economic advantages of the breakwater, a brief project description, challenges presented with construction and environmental implications.

1 INTRODUCTION

Arnold's Cove is a small community located on the isthmus of the Avalon Peninsula in Newfoundland. Travelling by road, it is approximately 144 km from St. John's and 55 km from Clarenville. Please refer to the following map for a more visual location.

It had its beginning in the early 1800's as a fishing community. Arnold's Cove had its beginnings in the early 1800's as a fishing community. The railway and the resettlement of smaller outport's aided in the growth of this community to where it stands today. It remains as a fishing community however with less reliance on the fishery since the moratorium on the cod fishery in 1992. The harbour remains ice-free year round enabling year round operations out of the port.



Figure 1: Map of Avalon Peninsula <http://www.mapsnl.ca/>

In 1988 the Harbour Authority of Arnold's Cove was established to help stabilize the ever-increasing pressure on the harbour by vessel traffic. Arnold's Cove is the main gateway to the resettled communities of Placentia Bay. This results in a lot of vessel traffic with recreational boaters and fishermen from Arnold's Cove and other parts of the bay using the facilities.

2 BREAKWATER

Rubble-mound breakwaters are the most common type of breakwater. Moreover, it is simply a mound of stones, site-specific and large enough to resist displacements due to wave forces. With the largest stones (armour stones) placed interlocking in a manner to resist movement caused by the waves. This armour stone is placed upon smaller stone (filter stone) that is used to support the armour stone

and resist infiltration of waves and sediment if present. The filter stone is placed upon the core stone that makes up the core of the breakwater and is cheaper and smaller than both the filter and armour stone.

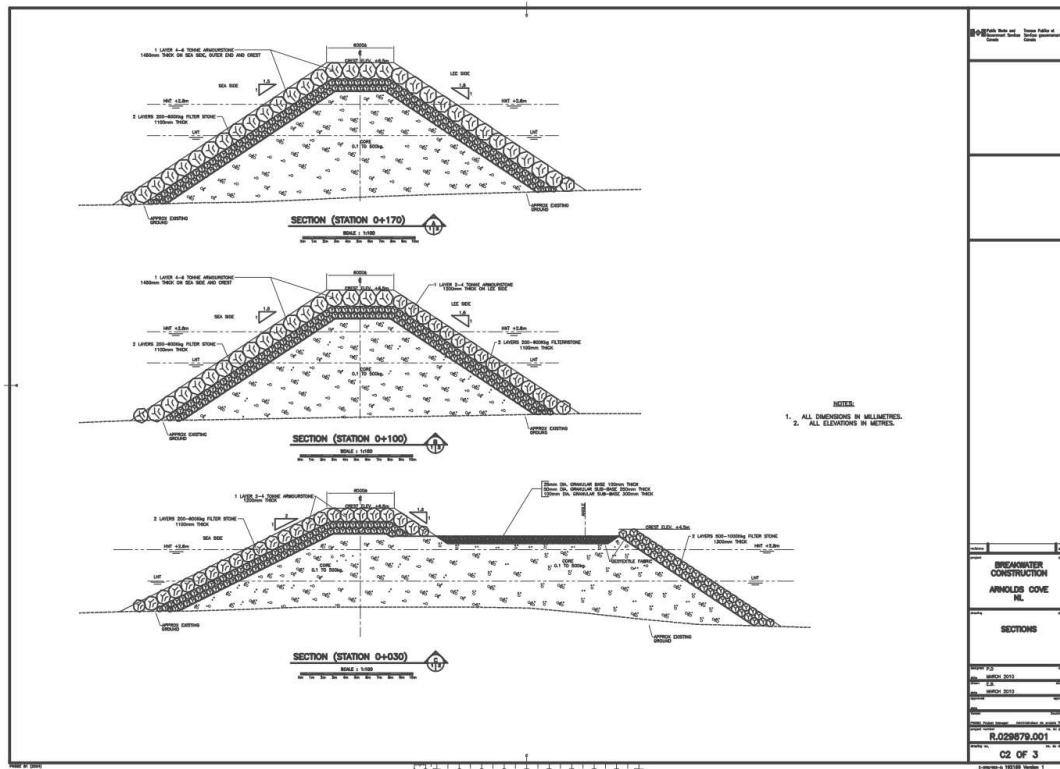


Figure 2: Breakwater Design http://www.env.gov.nl.ca/env/env_assessment/projects/Y2010

Breakwaters are built to reduce wave action to the coastal side of the structure. This wave action is reduced through a combination of turbulence and friction and reflection of inbound wave energy. For harbours, breakwaters are used to create suitably serene waters for safe harbour operations.

The size and shape of a breakwater depends upon the size and shape of the area to be protected along with the direction and magnitude of storm waves to be encountered.

2.1 Economic Advantage

The openness of the harbour to regular wave action and a strong undertow require more than regular maintenance to the existing infrastructure and can hinder the fishing and other operational requirements at the docks. The construction of a rubble mound breakwater will provide shelter to the 5 wharfs from both the wave action and undertow from the sea. This in turn will reduce the maintenance required to the facilities along with allowing for regular operations of the facilities.

Much of the northeast and east coast of Newfoundland become jammed with ice pack during the spring months. Having an ice-free port within close proximity to long harbour and the North Atlantic oil refinery definitely has its advantage during this time of year. The ice-free port also provides opportunity for fisherman located in ice jammed ports to continue fishing activities they otherwise could not during such times.

With the added benefits of protection that the breakwater will provide, other business opportunities will arise that would have once considered the location unsuitable for their operations. These opportunities will assist in providing a sustainable future for the harbour and the community.

2.2 Project Description

The proposed undertaking represents an enhancement of the existing Department of Fisheries and Oceans Small Craft Harbours (DFO SCH) facilities in Arnold's Cove, Newfoundland and Labrador. It involves the construction of a rubble mound breakwater, which will provide shelter to the existing wharf infrastructure from harsh wave action and undertow conditions. The rubble mound breakwater will provide shelter to the wharf during storm conditions and provide safer operating conditions for the facility users. As this harbour is critical to the fishing industry for the area, this proposed project complies with DFO SCH's mandate to keep such harbours open and in good repair. As the infrastructure to be protected is already in a fixed position, there is really only one feasible location for the proposed breakwater.



Figure 3: Breakwater Location http://www.env.gov.nl.ca/env/env_assessment/projects/Y2010

The proposed project is located in Placentia Bay, along the shoreline of the Avalon Peninsula, Newfoundland. Access to the site is provided by local roads through the community of Arnold's Cove, which may be assessed by the TransCanada Highway approximately 55 km south of Clarenville or 140 km west of St. John's.

To access the location of the proposed breakwater, the area next to the breakwater will be infilled to create a laydown/work area, as the shoreline is very industrialized with fishing structures and otherwise inaccessible.

The layout of the proposed breakwater will have a footprint of approximately 7000 square meters

along the seabed measuring about 160m by 45m. The breakwater will consist of core stone (24785 m³), filter stone (6930 m³) and armour stone (10005 m³) of varying sizes. This material is not readily available on site and will have to be imported from an approved quarry. After the armour stone is trucked to site an excavator working either from the shoreline, breakwater itself or atop a barge will place it.

Construction of this project is subject to DFO SCH operational priorities and funding. Construction is expected to take 5 months to complete. Commencement of the proposed project was tentatively scheduled for spring of 2012 but due to funding has been postponed until funding becomes available.



Figure 4: Laydown Area http://www.env.gov.nl.ca/env/env_assessment/projects/Y2010

Construction is expected to extend into the fishing season and with an active fishery within the vicinity minor disruptions are anticipated but should not cause significant delay to either the construction or local activities. Routine maintenance and repair is anticipated to be required at varying times during the estimated fifty year life of the structure. Inspections above the water level will give indication if repairs are necessary and to if underwater inspection would be required. The structure remains structurally sound if a few armour stones are displaced and would only require minor repair. But if too many are displaced repair costs can quickly escalate.

3 ENVIRONMENTAL IMPACTS

It will be important to minimize the effects that construction materials may have on the natural environment, which would include the seabed and the laydown area. With the use of natural material (stones), this will lessen any environmental impacts proposed by the breakwater into the project surroundings. As this harbour is ice-free year round the effects of freeze/thaw cycles will be very limited, thus improving the life expectancy of the breakwater. The removal of the regular wave action will effect the flushing and sedimentation levels to the coastal side of the breakwater and should be monitored following construction. Seabed species that may become buried during construction will be affected. However, mobile species will relocate during construction and are expected to return upon project completion. In most cases, completed coastal projects often produce viable habitat, thus compensating somewhat any negative environmental effects created by construction. Environmental impacts may be further reduced during repair and rehabilitation if materials from the original construction can be reused.

The greatest potential sources of possible pollutants will result from the use of heavy equipment. Accidental spills of fuel, engine oil, and hydraulic fluids are a possibility and immediate action to clean up spills will reduce the environmental impact. During construction, sedimentation due to the placement of rock material for the breakwater into the harbour can also be expected.

The Red Crossbill and Monarch Butterfly are some local species that could occupy the project area. However, no negative affects re anticipated for theses species.

REFERENCES

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