SIDESCAN SONAR INTERPRETATION, EVALUATION AND REGIONAL INTEGRATION: OFFSHORE DIGBY NECK, BAY OF FUNDY

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TABLE OF CONTENTS

Introduction

A sidescan sonar and seismic reflection survey was conducted in the nearshore of the Bay of Fundy by Canadian Seabed Research Ltd. covering the area to be occupied by the offshore terminal of the Whites Point Quarry, Digby Neck. It also extends to the northwest of the marine terminal location in deeper water. This is an assessment of the local area surveyed with sidescan sonar and subbottom profiler. A secondary purpose is to determine how the site geology relates to the overall surficial and nearshore geology of the Bay of Fundy. A detailed interpretation of the sidescan sonar data and the seabed video was undertaken to determine the presence of bedforms, current directions and seabed scour around features and to assess the characteristics of the bedrock surface.

Seismic Reflection Data

The seismic reflection data showed no penetration of the seabed throughout the study indicating exposed hard bedrock. It however provides a measure of the roughness of the seabed which ranges up to 6 m over short distances (Figure 1).

Bedrock and Coarse Sand

The sidescan sonar data indicate that the seabed of the area is largely bedrock outcrop. The bedrock surface is very rough and irregular and exhibits joints and fractures and areas that consist of flat lying massive slabs (Figure 2). Video transects across this surface show the presence of small local patches of coarse sand and gravel and broken and whole shells are common. Further seaward, sand overlies the bedrock and small areas of bedrock protrude through the thin sand. The sand is very coarse bordering on the fine-gravel size using the Wentworth scale. Broken shell fragments and pebbles/cobbles occur with the sand.

Boulders

Boulders are widespread across the bedrock surface and some are larger than 5 m in diameter. Some are well-rounded in shape confirming passage through a transgressing beach zone. Boulders also protrude from beneath the sand in places indicating that the sand in not thick (less than 2 m in thickness). The boulders appear to occur in clusters as well as singularly. The coarse texture of the sediments and the bedrock outcrop indicate that the seabed is very hard and that there are no fine-grained (silt and clay) sediments in the area.

Seabed Video and Currents

Bottom video shows particulates and organic detritus in transit in the water column above the bottom resulting from strong currents that are strong enough to move these materials in suspension. During the sidescan sonar survey, the sidescan towfish was was crabbing (oriented at an angle to the ships track) across the seabed particularly on shoreline normal tracks. This presents a streaking pattern on the imagery but also confirms the presence of strong currents parallel to the shoreline. Based on surveys in other areas of Atlantic Canada such a pattern on the imagery occurs in areas where the currents are approximately 2 knots and greater and the survey is conducted normal to flow.

Seabed Scour, Currents and Bedforms

A close examination of the sidescan sonograms and video imagery indicates that there are no scour features associated with either the large boulders within the local coarse sand patches. This provides information on the stability of the seabed and an indication that currents are not strong enough to scour within the existing sediments. This indicates that they will also not result in scour around seabed marine terminal infrastructure which will be founded on more stable hard bedrock. As discussed under the section on Bedrock and Surficial Geology, there are also no sandy bedforms such as megaripples, sandwaves, comet marks and sand ribbons that can occur in areas of strong currents with similar sized sediments. Based on a classification and study of bedforms by Amos and King (1984), they demonstrate that seabed bedforms are formed by near bed water flow and that bedform characteristics such as height, shape and distribution can be used to infer the magnitude of current velocity. The most common bedforms of sandy seabeds are ripples and megaripples. Megaripples in coarse sand, such as occur in the Bay of Fundy, form by currents ranging from 40 to 60cm/sec. A lack of bedforms off Whites Point in coarse sandy sediments indicates that the currents are generally less that 40cm/sec along this coastal segment.

Relationship to Proposed Quarry

The character of the seabed at the offshore terminal location is very hard and mostly exposed bedrock with gravel including boulders. Gravel clasts that could be lost to the seabed in the event of a delivery system failure or spillage from the quarry would not change the character of the seabed. The lithology of the gravel (basalt) to be extracted from the quarry is the same as the lithology of the material at the present seabed of the marine terminal.

Setting of Whites Cove Area

Based on previous seabed mapping in the Bay of Fundy, information on the nearshore from hydrographic charts, and knowledge of the sea level history of the region, the nature of the seabed in the nearshore off Digby Neck is typical of the nearshore zone all along the south shore of the Bay of Fundy. Exceptions occur in areas off Sandy Cove

and Digby Gut where the surficial geology varies as a result of the presence of constructional glacial features such as eskers and drumlins.

Figures

Figure 1. Seismic reflection profile from the nearshore area off Whites Point. The seabed is very hard and there is no penetration of the acoustic energy.

Figure 2. A sidescan sonogram from an area of bedrock in the nearshore off Whites Point. The seabed consists largely of exposed bedrock with boulders. Note the fractures and joints within the bedrock.

Figure 1

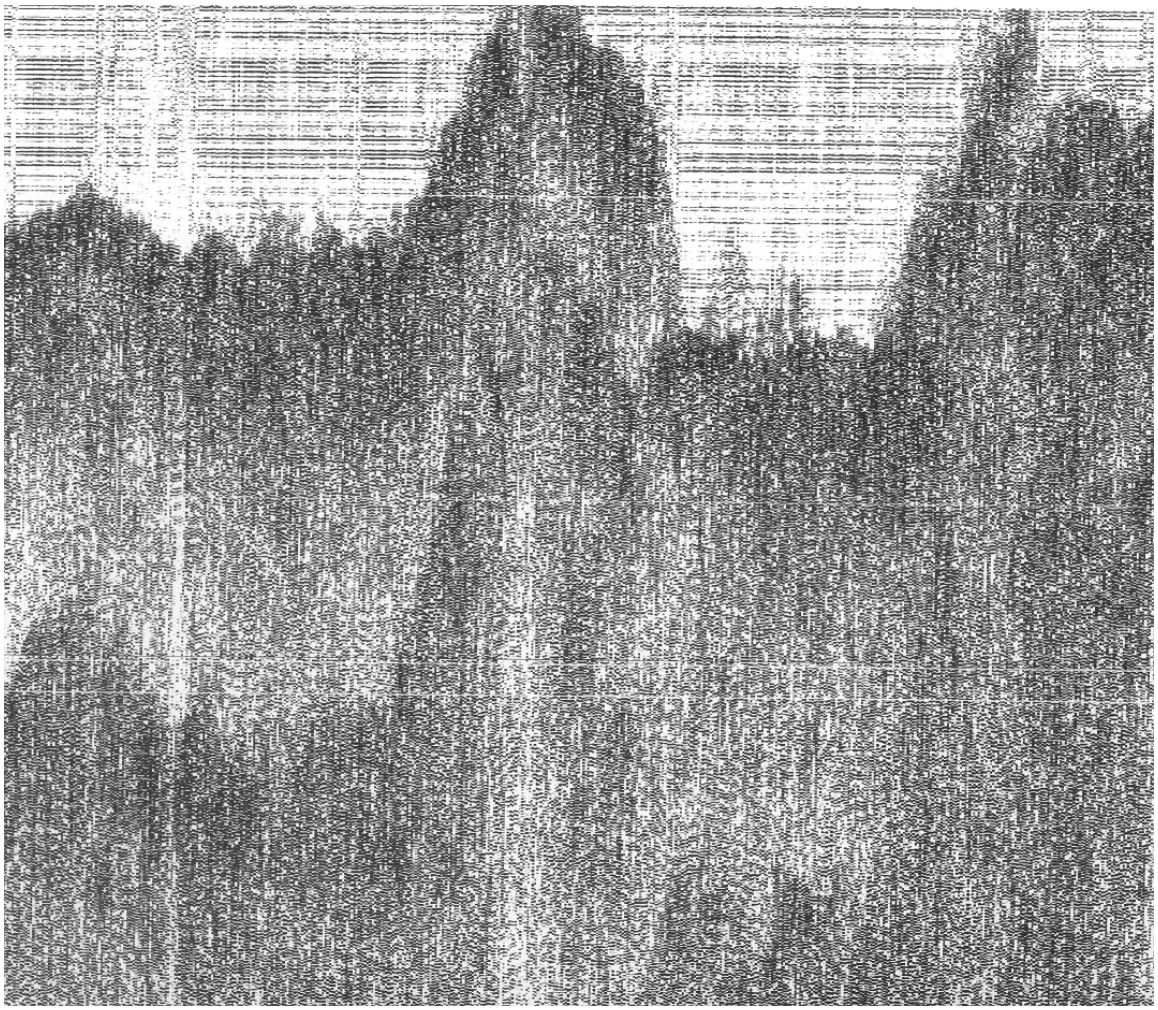

Figure 2