Seabed Video and Photographic Survey — Nearshore Cable Route Stations

Minas Passage Tidal Energy Study Site

Based on Survey on August 4, 2009

Submitted to:

Fundy Ocean Research Centre for Energy (FORCE)

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MARINE SURVEY REPORT
FUNDY TIDAL POWER RESEARCH AND DEVELOPMENT PROJECT

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EXECUTIVE SUMMARY

In 2008-2009, the Province of Nova Scotia contracted Minas Basin Pulp and Power Limited of Hantsport, Nova Scotia, to establish a Tidal Energy Demonstration Facility to provide test facilities for tidal energy technologies in Nova Scotia's Bay of Fundy. This report contains interpretation and video images of the seabed obtained in August 2009 on the edge of a nearshore shelf at the revised cable landfall for the project. Seabed surficial geology and biological communities observed at the site were similar to those observed in surveys of the cable route located slightly to the west, conducted in 2008 & 2009, except that a kelp bed was observed in the immediate subtidal zone in the new cable route location in 2009.

INTRODUCTION

In 2007, the Province of Nova Scotia, as part of its strategy to meet Provincial renewable energy goals, initiated a process to set up a research facility develop tidal energy resources of the Bay of Fundy. In 2008-2009 Minas Basin Pulp and Power Company Limited, under contract to the Province, developed and obtained regulatory approvals for a tidal power demonstration facility in northern Minas Passage slightly west of Cape Sharp, and established an organization to run it—the Fundy Ocean Research Centre for Energy (FORCE). Three berths (circular areas of the seabed 200 m in diameter) and associated cable routes to shore were selected for use by tidal device providers/consortia initially expressing interest, including the teams of Minas Basin Pulp and Power/Marine Current Turbines; Nova Scotia Power Inc (NSPI)/OpenHydro; and Clean Current/Alstom. Each of the berths has an associated cable route to shore (International Telecom 2009), which meet in the intertidal zone, and run to a single shore facility/interpretive centre and connection point to the power grid. During 2009, a change in location of the shore facilities necessitated a relocation of the cable landfall approximately 400 m east of the initially proposed location. Video to assess seabed geology, bottom communities, and fish habitat was obtained in nearshore areas in August 2009, in anticipation of the new cable landfall. This report summarizes information on geology and benthic communities from video obtained in the August 4, 2009 survey.

METHODS

The present study was carried out to obtain detailed site-specific information on seabed characteristics and biological communities in parts of the nearshore zone in the Black Rock area[1] which were not covered in the 2008 baseline video and photographic survey (Envirosphere Consultants Limited 2008a & b) or cable route surveys carried out in 2009 (Envirosphere Consultants Limited 2009b, 2010a & b). The survey took place on August 4, 2009, from *Tide Force*, a 50’ lobster boat operated by Mr. Mark Taylor out of Halls Harbour, Nova Scotia. For positioning, a DGPS (Hemisphere, VS100 GPS Compass receiver, 0.6 m accuracy) and computer navigation software (WinFrog Integrated Navigation System, Fugro Pelagos Inc.) operated by Seaforth Geosurveys, Dartmouth, Nova Scotia, was used to both acquire and log position information.

A Sony Hi-8 handicam in an Amphibico® underwater housing (field of view of about 52.5 cm wide and 40 cm high (0.2 m^2)) and SLD10 underwater light, both mounted in a protective aluminum frame was deployed from the vessel at high tide. Five stations were selected approximately 50 m apart extending seaward from the closest possible approach to shore at high tide at the approximate proposed location of the cable landfall. Following the survey, the video was digitized, and still frame images as well as clips of video from the sites were captured using video editing software (Barra Video, Halifax).

[1] This area was identified for possible relocation of the cable route to the shore facility, which was finalized in February 2010.

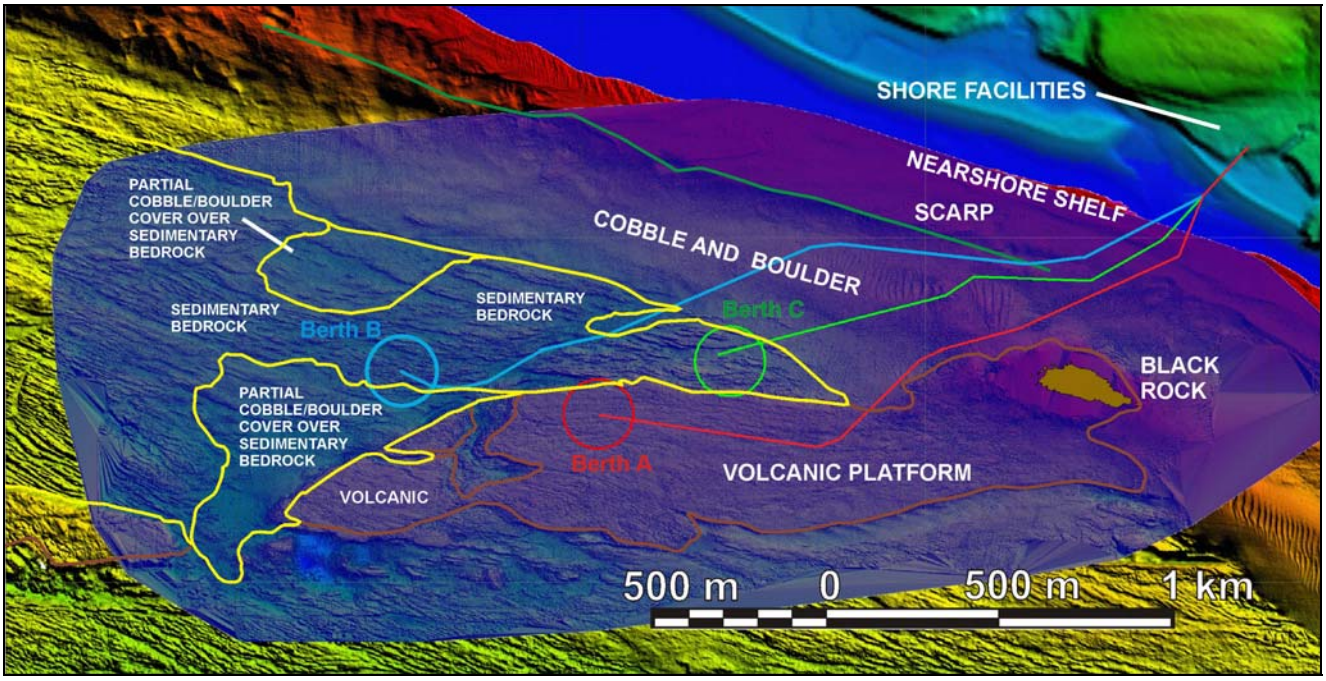

Figure 1. Surficial geology interpretation and locations of tidal turbine berths and proposed, cable routes, December 2009. Geology interpretation based on AMGC (2009). Cable routes shown are as of August 2009. New cable landfall is about 400 m east of that shown (see Figure 2).

RESULTS AND DISCUSSION

General

Maps of station locations and image captures, as well as a DVD of the video for each survey are presented in Appendix A. The approach of the transmission cable to the landfall is on the platform and outer edge of the nearshore shelf in the study area characterized by AMGC (2009)(Figures 1 & 2). The shelf is underlain by mainly stratified glaciomarine sediments with a surface layer of coarser sediments (AMGC 2009). Biological communities were similar to those observed on the shelf in the vicinity of the previous cable route to the west in 2008 (Envirosphere Consultants Limited 2009a; Stewart 2009) excepting that a kelp bed was identified at the new site in the immediate subtidal zone in 2009. Depths sampled were from mean low water (MLW) to about 8 m below MLW, determined from a digital elevation model (Seaforth Engineering, Dartmouth, Nova Scotia, personal communication).

Bottom Type

From inshore to offshore at the site, substrate changes from level, predominantly gravel bottom with cobbles present (Stations NC1 & NC2) (Figures 3-5) to increasing occurrence of clean, well-sorted cobbles and boulder (NC3 & NC4) (Figures 6-8). The outer edge of the shelf (Station NC5) has a mixed character, predominantly cobbles and small boulder, but including a gravel and sand fraction (Figures 9 & 10). Bottom types reflect the distribution observed on the shelf in 2008 (Envirosphere Consultants Limited 2008a & b), which included sites west of the study site (Figure 2).

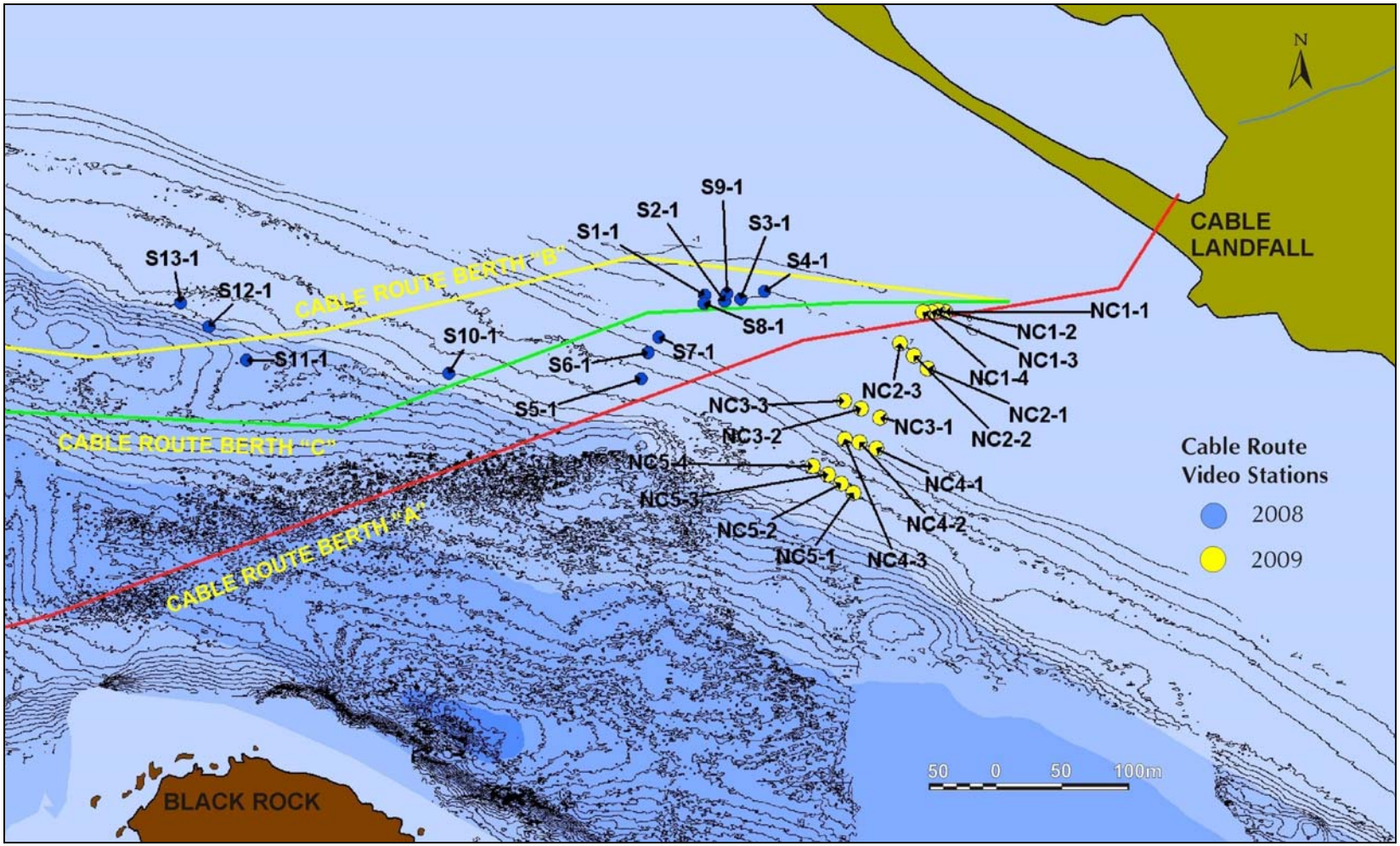

Figure 2. Nearshore cable route stations (2008 & 2009) in relation to cable route as of February 2010.

Biological Communities

Immediately below Mean Low Water (MLW) (Station NC1 and extending through Station NC2)(Figure 2), a reduced biological community including rockweed (*Fucus* sp) and sea lettuce (*Ulva lactuca*) occurs on well-sorted gravels, interspersed with a low density kelp bed (*Laminaria longicruris)* consisting of scattered fronds of *Laminaria* attached to embedded cobbles, as well as clumps of rockweed (*Fucus* sp) (Table 1) (Figure 3), and the kelp *L. digitata* (Figures 4 & 5). Further seaward, at depths of 3-5 m below MLW, seaweeds including *Fucus* sp., *Palmaria palmata* (dulse) and coralline algae (*Lithothamnium)* encrusting on rocks, occur (Figures 6-8). At the deepest site (NC5) the erect bryozoan *Flustra foliacea* (an animal), *Palmaria*, and encrusting coralline algae (*Lithothamnium* sp.) were dominant community components; slipper shells (*Crepidula* spp.) were also common video from the site. Although few animals were seen in the video, the animal community on the shelf likely includes common species for the area, such as hermit crabs (*Pagurus* sp), rock and green crabs, etc., as well as various smaller species, which cannot be seen in video images.

Figure 3. Clean gravel to cobble with attached sea lettuce (*Ulva lactuca)* and *Fucus* sp at Station NC1, August, 2009. Photo NC1-1B, Appendix A.

Figure 4. Kelp (*Laminaria longicruris*), coralline algae, and *Fucus* sp , Station NC1-2B, Appendix A.

Figure 5. *Laminaria* sp. *and Fucus* sp. over gravel to cobble bottom at Station NC2-3B.

Figure 6. Cobble to boulder bottom at Station NC3. *Fucus* sp and coralline algae on rocks. Photo NC3-1B, Appendix A.

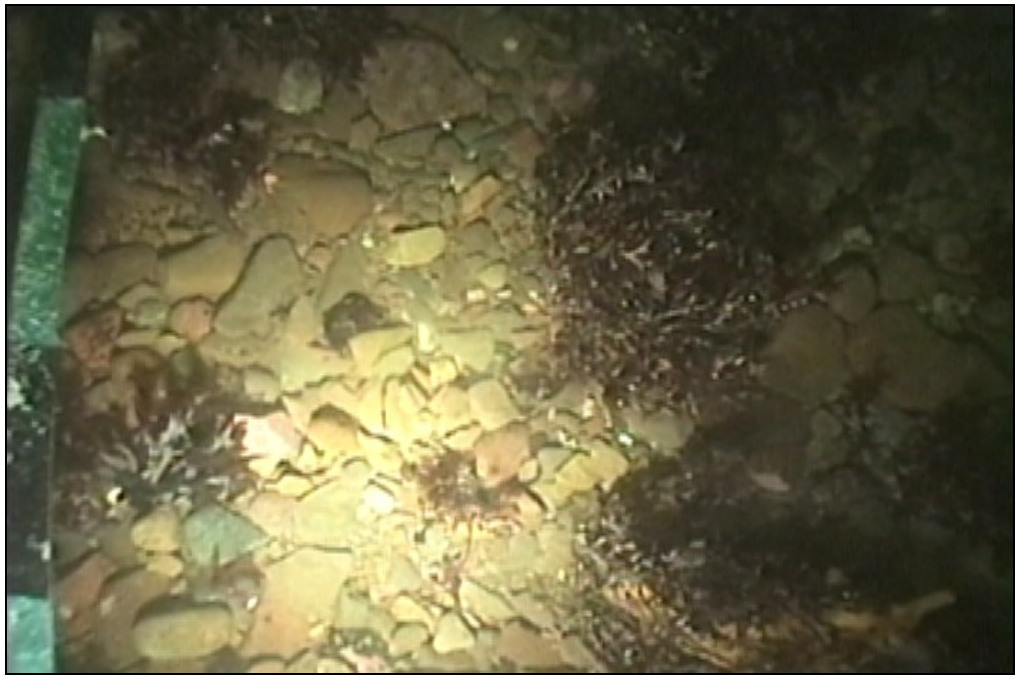

Figure 7. Cobble to boulder with attached *Fucus* sp, Station NC4. Photo NC4-1B, Appendix A.

Figure 8. Mixed cobble to boulder bottom with coarse sand and attached seaweed (*Palmaria*), coralline algae, and *Fucus* sp. Station NC4, Photo NC4-3B, Appendix A.

Figure 9. Mixed cobble to boulder bottom with coarse sand, attached *Palmaria*, seaweed *Fucus* sp. and erect bryozoan, *Flustra foliacea*., and Slipper shells, *Crepidula* sp on rocks. Station NC5. Photo NC5-1B, Appendix A.

Figure 10. Cobble bottom with attached erect bryozoans, *Flustra foliacea*, encrusting coralline algae, *Palmaria*, and slipper shells, *Crepidula* sp. Station NC5. Photo NC5-2B, Appendix A.

CONCLUSIONS

The nearshore shelf in the vicinity of the new cable landfall for the tidal energy demonstration project is similar to the shelf further to the west in terms of substrate and biological community characteristics determined in video taken in 2008 and 2009. An exception is the widespread occurrence of kelp (*Laminaria longicruris*) in the shallow subtidal zone, although at a moderate to low density. The types of communities are not particularly significant in terms of impacts of the project and bottom type conforms to earlier understanding of the area and should not change the approach to cable laying for the project.

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Stewart, P.L. 2009. Hard Bottom Sublittoral Benthic Communities in Areas Proposed for In-stream Tidal Power Development, Northern Minas Passage, Bay of Fundy. Pages 44-57, *In.*, Redden, A.M., J.A. Percy, P.G. Wells and S.J. Rolston (Eds.). *Resource Development and its Implications in the Bay of Fundy and Gulf of Maine. Proceedings of the 8th BoFEP Bay of Fundy Science Workshop, Acadia University, Wolfville, Nova Scotia, 26-29th May 2009.* Bay of Fundy Ecosystem Partnership Technical Report No. 4. Bay of Fundy Ecosystem Partnership, Wolfville, N.S. 392 p.

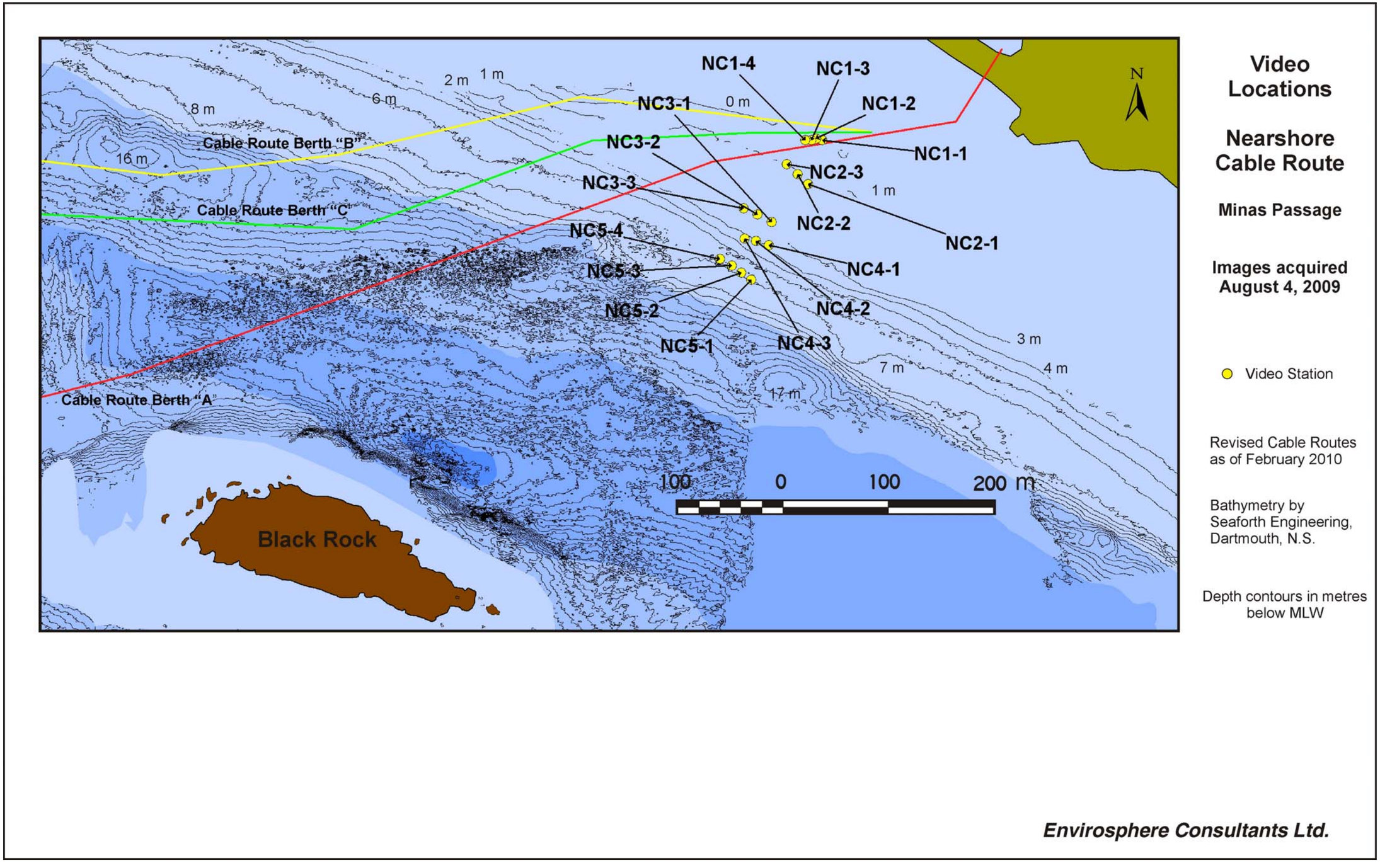
Table 1. Surficial geology observations and biological information obtained in seabed video and still photography surveys, Nearshore Cable Route stations, August, 2009. Depths below mean low water (MLW) from digital terrain model. % = % cover.

Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
August 4, 2009	NC1-1	0.0	video	gravel	patches of *Fucus* and sea lettuce (?)
	NC1-2	0.1	video	gravel	*Laminaria* and *Fucus* (with possible coralline encrustation) bed
	NC1-3	0.2	video	gravel	*Laminaria* and *Fucus* bed, small patch of yellow encrusting breadcrumb sponge
	NC1-4	0.3	video	gravel to cobble	*Fucus* (some encrusted with coralline) bed
	NC2-1	2.6	video	gravel to cobble	Small patch of *Fucus*
	NC2-2	2.5	video	gravel	*Laminaria* (with polychaete, *Spirorbis* sp) and *Fucus* bed
	NC2-3	2.7	video	gravel	*Fucus* and *Laminaria* bed
	NC3-1	3.5	video	gravel to cobble	Patches of *Fucus* and possible white sponge and barnacles
	NC3-2	3.6	video	gravel to cobble	*Fucus* sp

Table 1. Surficial geology observations and biological information obtained in seabed video and still photography surveys, Nearshore Cable Route stations, August, 2009. Depths below mean low water (MLW) from digital terrain model. % = % cover.

Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	NC3-3	3.7	video	gravel to cobble	*Fucus* sp (some encrusted with coralline algae)
	NC4-1	4.6	video	gravel to cobble	*Palmaria*, some encrusted with corallines, possible vase sponge (?)
	NC4-2	4.7	video	gravel to cobble	*Palmaria* bed (encrusted with corallines)
	NC4-3	5.1	video	gravel to cobble	*Palmaria* (encrusted with corallines) and *Laminaria*
	NC5-1	7.9	video	gravel to cobble	*Palmaria*, *Flustra* and possible polychaete *Spirorbis* sp and/or barnacles
	NC5-2	7.9	video	gravel to cobble	*Palmaria*, *Flustra*, possible polychaete *Spirorbis* sp and /or barnacles, slipper shells (*Crepidula)?*, *Anomia*
	NC5-3	7.8	video	gravel to cobble	*Palmaria*, *Flustra*, possible polychaete *Spirorbis* sp and /or barnacles
	NC5-4	7.8	video	gravel to cobble	*Palmaria*, *Flustra*, possible polychaete *Spirorbis* sp and /or barnacles

APPENDIX A- NEARSHORE STATIONS, AUGUST 4, 2009, VIDEO IMAGE CAPTURES


NC1-4
NC1-3
NC1-2
NC1-1
NC3-1
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NC5-3
NC5-2
NC5-1
NC4-1
NC4-2
NC4-3
0 m
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2 m
3 m
4 m
6 m
7 m
8 m
16 m
17 m
Cable Route Berth "A"
Cable Route Berth "B"
Cable Route Berth "C"
Black Rock
N
100
0
100
200 m
Video Locations
Nearshore Cable Route
Minas Passage
Images acquired August 4, 2009
Video Station
Revised Cable Routes as of February 2010
Bathymetry by Seaforth Engineering, Dartmouth, N.S.
Depth contours in metres below MLW
Envirosphere Consultants Ltd.

Table A1. List of video sampling stations, Minas Passage study site, Nearshore Cable Route Stations, August 4, 2009. Depths in metres below MLW.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)		TYPE OF SAMPLE
NC1 - 1	8/4/2009	12:43:1	45 22.1712	64 24.3473	0	m	video
NC1 - 2	8/4/2009	12:43:2	45 22.1717	64 24.3518	0.1	m	video
NC1 - 3	8/4/2009	12:43:3	45 22.1709	64 24.3551	0.2	m	video
NC1 - 4	8/4/2009	12:43:5	45 22.1710	64 24.3596	0.3	m	video
NC2 - 1	8/4/2009	12:46:3	45 22.1487	64 24.3564	2.6	m	video
NC2 - 2	8/4/2009	12:46:5	45 22.1536	64 24.3643	2.5	m	video
NC2 - 3	8/4/2009	12:47:1	45 22.1583	64 24.3722	2.7	m	video
NC3 - 1	8/4/2009	12:49:0	45 22.1289	64 24.3820	3.5	m	video
NC3 - 2	8/4/2009	12:49:2	45 22.1324	64 24.3925	3.6	m	video
NC3 - 3	8/4/2009	12:49:3	45 22.1354	64 24.4022	3.7	m	video
NC4 - 1	8/4/2009	12:52:1	45 22.1170	64 24.3836	4.6	m	video
NC4 - 2	8/4/2009	12:52:3	45 22.1191	64 24.3928	4.7	m	video
NC4 - 3	8/4/2009	12:52:4	45 22.1202	64 24.4010	5.1	m	video
NC5 - 1	8/4/2009	12:55:0	45 22.0993	64 24.3955	7.9	m	video
NC5 - 2	8/4/2009	12:55:1	45 22.1027	64 24.4027	7.9	m	video
NC5 - 3	8/4/2009	12:55:3	45 22.1063	64 24.4097	7.8	m	video
NC5 - 4	8/4/2009	12:55:4	45 22.1093	64 24.4184	7.8	m	video

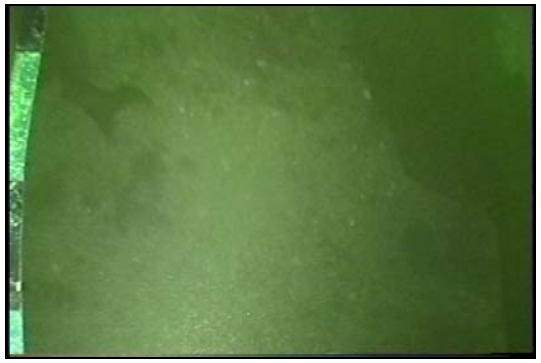

Figure A1. NC1-1-A

Figure A2. NC1-1-B

Figure A3. NC1-1-C

Figure A4. NC1-1-D

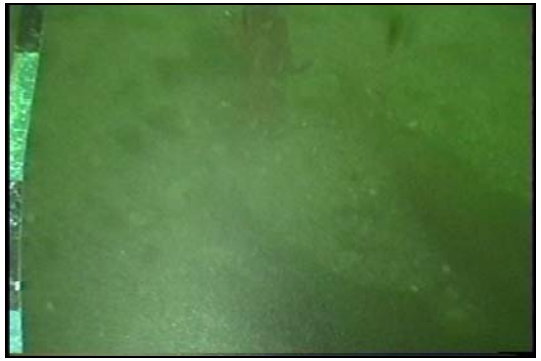

Figure A5. NC1-2-A

Figure A6. NC1-2-B

Figure A7. NC1-2-C

Figure A8. NC1-2-D

FigureA9. NC1-3-A

Figure A10. NC1-3-B

Figure A11. NC1-3-C

Figure A12. NC1-4-A

Figure A13. NC1-4-B

Figure A14. NC1-4-C

Figure A15. NC2-1-A

Figure A16. NC2-1-B

Figure A17. NC2-1-C

Figure A18. NC2-2-A

Figure A19. NC2-2-B

Figure A20. NC2-2-C

Figure A21. NC2-3-A

Figure A22. NC2-3-B

Figure A23. NC2-3-C

Figure A24. NC3-1-A

Figure A25. NC3-1-B

Figure A26. NC3-1-C

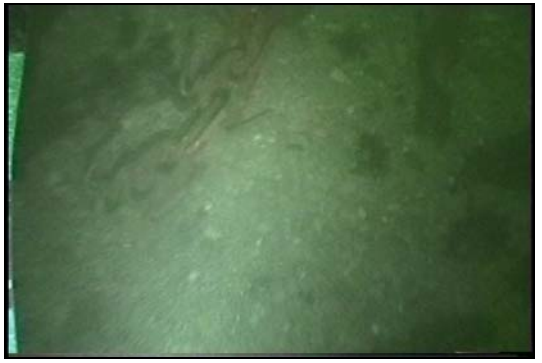

Figure A27. NC3-2-A

Figure A28. NC3-2-B

FigureA29. NC3-2-C

Figure A30. NC3-3-A

Figure A31. NC3-3-B

Figure A32. NC3-3-C

Figure A33. NC4-1-A

Figure A34. NC4-1-B

Figure A35. NC4-1-C

Figure A36. NC4-2-A

Figure A37. NC4-2-B

Figure A38. NC4-2-C

Figure A39. NC4-3-A

Figure A40. NC4-3--B

Figure A41. NC4-3-C

Figure A42. NC5-1-A

Figure A43. NC5-1-B

Figure A44. NC5-1-C

Figure A45. NC5-2-A

Figure A46. NC5-2-B

Figure A47. NC5-2-C

Figure A48. NC5-3-A

Figure A49. NC5-3-B

Figure A50. NC5-3-C

Figure A51. NC5-4-A

Figure A52. NC5-4-B

Figure A53. NC5-4-C