



**Underwater Benthic Habitat
Survey of Caribou Harbour and
Pictou Harbour Pipeline Corridors**

Final Report

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Sign-off Sheet

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Executive Summary

An underwater benthic habitat survey (UBHS) was conducted May 3 to 7, 2019 in Caribou Harbour and Pictou Harbour by CSR GeoSurveys Ltd. and Stantec Consulting Ltd. The locations of the video transects were chosen based on the location of the proposed marine pipeline corridor and diffuser area in conjunction with preliminary interpretations of the surficial geology from the side-scan sonar survey that was previously carried out.

A high-level video analysis that included identifying habitat types (substrate) and benthic communities was conducted on all video collected along the causeway in Pictou Harbour and for the proposed pipeline corridor and diffuser area in Caribou Harbour. High-level video analysis in Pictou Harbour identified silt and mixed sediment (silty sand, shell hash and gravel) as the predominant substrate types; most of the survey area was silty habitat. High-level video analysis in Caribou Harbour identified four predominant substrate types: silt; silty sand; sand; and mixed sediment (sand, shell hash and gravel). Near shore in Caribou Harbour the habitat is silty with eelgrass and eelgrass beds. Silt transitions to silty sand where there is still eelgrass and eelgrass beds. Eelgrass cover was thickest near shore. Silty sand transitions to sand toward the mouth of Caribou Harbour and this continues into the Northumberland Strait where the substrate transitions to mixed sediment (sand, shell hash and gravel) near, and including, the diffuser area.

A more detailed analysis of substrate type, as well as macroflora and macrofauna present, was conducted on 4.4 km of video. This included 1.25 km of video along the causeway in Pictou Harbour and 3.15 km of video along, and perpendicular to, the proposed Caribou pipeline corridor and diffuser area, including reference areas.

The quality of the video collected was affected by currents, vessel speed, depth and visibility. In general, video collected in shallower and calmer water was better quality than video in deeper water with more current. Side-scan sonar had a higher resolution than visual assessment of substrate type from the video, and as a result, more habitat types were identified by the side-scan sonar than the video.



1.0 INTRODUCTION

Northern Pulp Nova Scotia Corporation (NPNS) is planning to replace the existing effluent treatment system at the Northern Pulp mill on Abercrombie Point, Nova Scotia. The system will be replaced with a new wastewater treatment plant, including a new marine effluent outfall. As part of the Focus Report, a marine geotechnical and harbour bottom video investigation of the proposed route for the submerged effluent outfall within Caribou Harbour and the Northumberland Strait is required. Engineering design may require a portion of the effluent pipeline to cross Pictou Harbour along the existing causeway and where a marine geotechnical and harbour bottom video investigation was also required. This report was prepared to present the results of the video analysis and underwater benthic habitat survey (UBHS) for the marine pipeline corridor in Caribou Harbour and Pictou Harbour.

1.1 STUDY OBJECTIVES

The purpose of the video analysis is to determine habitat types present along the proposed pipeline corridor in Pictou Harbour and the proposed pipeline corridor and diffuser area in Caribou Harbour. This includes identifying predominant substrate types and benthic communities present along the surveyed areas.

The purpose of the UBHS is to characterize fish and fish habitat in the footprint of the effluent pipeline route in Pictou Harbour, Caribou Harbour and the Northumberland Strait. This includes characterization of substrate type, macroflora and macrofauna in the pipeline corridor, diffuser area and reference areas.

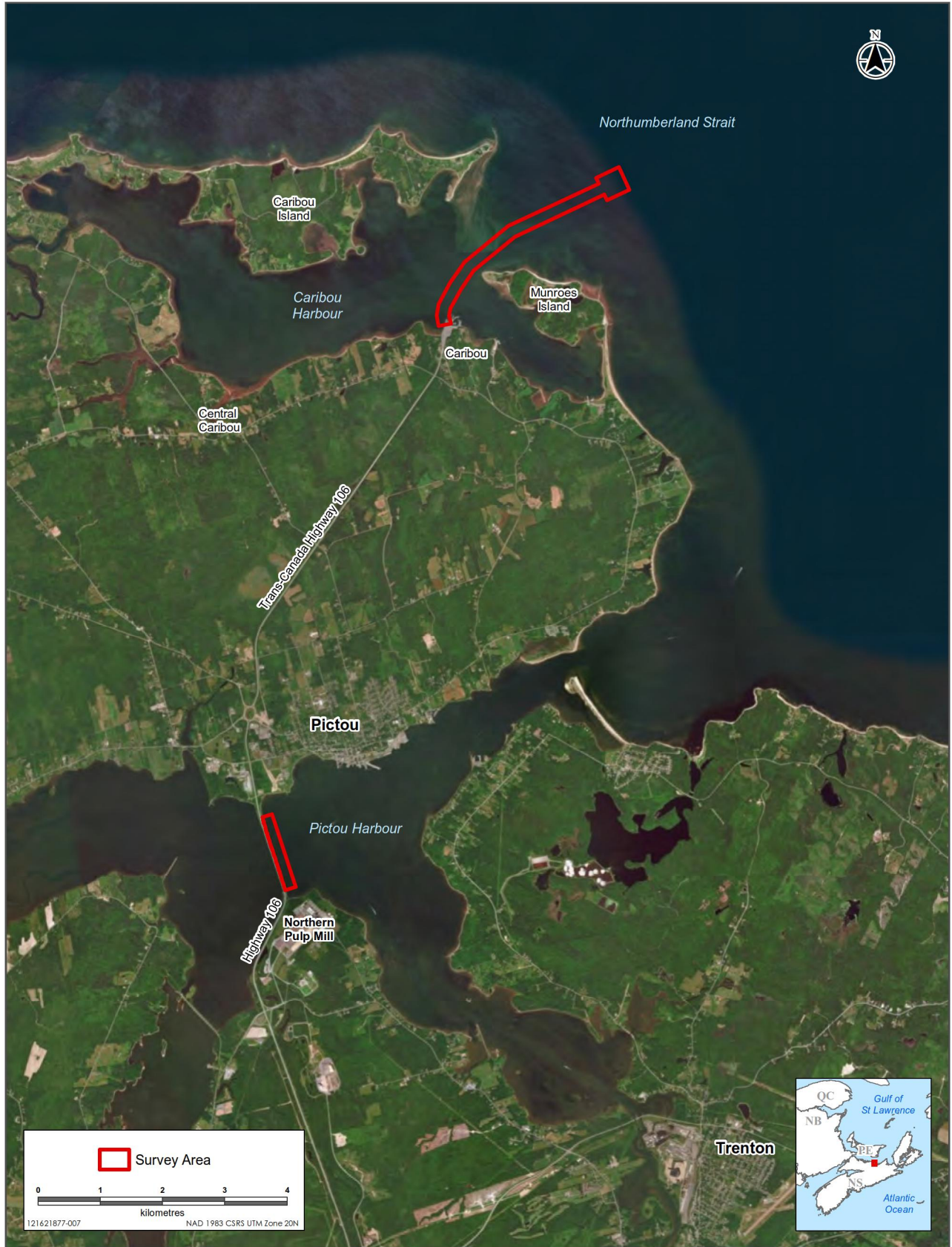
Study objectives included:

- a high-level video analysis to characterize substrate types and benthic communities along the pipeline corridor and reference areas in Caribou Harbour and Pictou Harbour;
- determining if eelgrass is present in the pipeline corridor and delineate eelgrass beds with side-scan sonar and video analysis; and
- conducting a detailed analysis of representative habitats in Caribou Harbour and Pictou Harbour to further describe substrate types and to characterize macroflora and macrofauna present.

2.0 METHODS

A UBHS was conducted from May 3 to May 7, 2019 in Caribou Harbour and Pictou Harbour by CSR GeoSurveys Ltd. (CSR) and Stantec Consulting Ltd. (Stantec) (Figure 1). The marine benthic habitat survey was conducted as per the guidance of the 1999 *Underwater Video Site Survey Guidelines* of the Department of Fisheries and Oceans Canada (DFO). Transects were video recorded using a Delta Vision high definition camera (Ocean Systems Inc., WA, USA) towed behind a CSR vessel. A Hemisphere R110 DGPS system that recorded in Hypack 2019 navigation software was used and GPS coordinates were superimposed in the video image. The collection of video close to shore was not possible because of vessel draft limitation and for safety reasons. For the Pictou Harbour pipeline corridor, the southern limit of the survey ended where a lack of depth prevented the boat from surveying (approximately 0.6 m at low tide).





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Underwater Benthic Habitat Survey Area in Caribou Harbour and Pictou Harbour

UNDERWATER BENTHIC HABITAT SURVEY OF CARIBOU HARBOUR AND PICTOU HARBOUR PIPELINE CORRIDORS

The locations of the video transects were chosen based on the location of the proposed pipeline corridor and diffuser area in conjunction with preliminary interpretations of the surficial geology from the side-scan sonar survey that was undertaken by CSR (Figures 2 and 3). CSR used a Klein System 3000 with a dual 100 kHz and 500 kHz frequency to collect the side-scan sonar data.

The underwater video was reviewed onboard the vessel by a Stantec marine scientist to confirm the quality of the video and suitability for interpretation. The quality of the video was affected by water current speed, visibility and water clarity for particularly deeper water depths. In general, video collected in Caribou Harbour and Pictou Harbour at shallower depths was better quality than video collected in deeper water. Currents were also stronger in deeper water, particularly at the proposed location of the effluent outfall off Caribou Harbour in Northumberland Strait.

For the high-level video analysis, all video collected was reviewed. For the detailed UBHS, a total of 4.4 km of video was reviewed. This included 1.25 km in Pictou Harbour and 3.15 km in Caribou Harbour. In Pictou Harbour, a transect that ran parallel to the causeway was analyzed to cover the proposed pipeline route in Pictou Harbour (Figure 2). For the detailed UBHS in Caribou Harbour, six transects were analyzed (Figure 3). One long video transect was conducted along the proposed pipeline route starting nearshore and extending into Caribou Harbour. For sections of the proposed pipeline route further out in Caribou Harbour and extending into the Northumberland Strait, including the location of the effluent diffuser, it was not possible to collect video along the same orientation as the proposed pipeline route due to strong currents and the vessel speed required to collect video. Instead, transects that ran perpendicular to the route were conducted along these sections and at the proposed location of the effluent outfall. The detailed video transects in Caribou Harbour were chosen to represent predominant substrate types observed in the high-level video analysis and surficial geology interpretations from the side-scan data. Where multiple videos were available of the same habitat type, the video with the best quality was chosen for the detailed UBHS analysis.

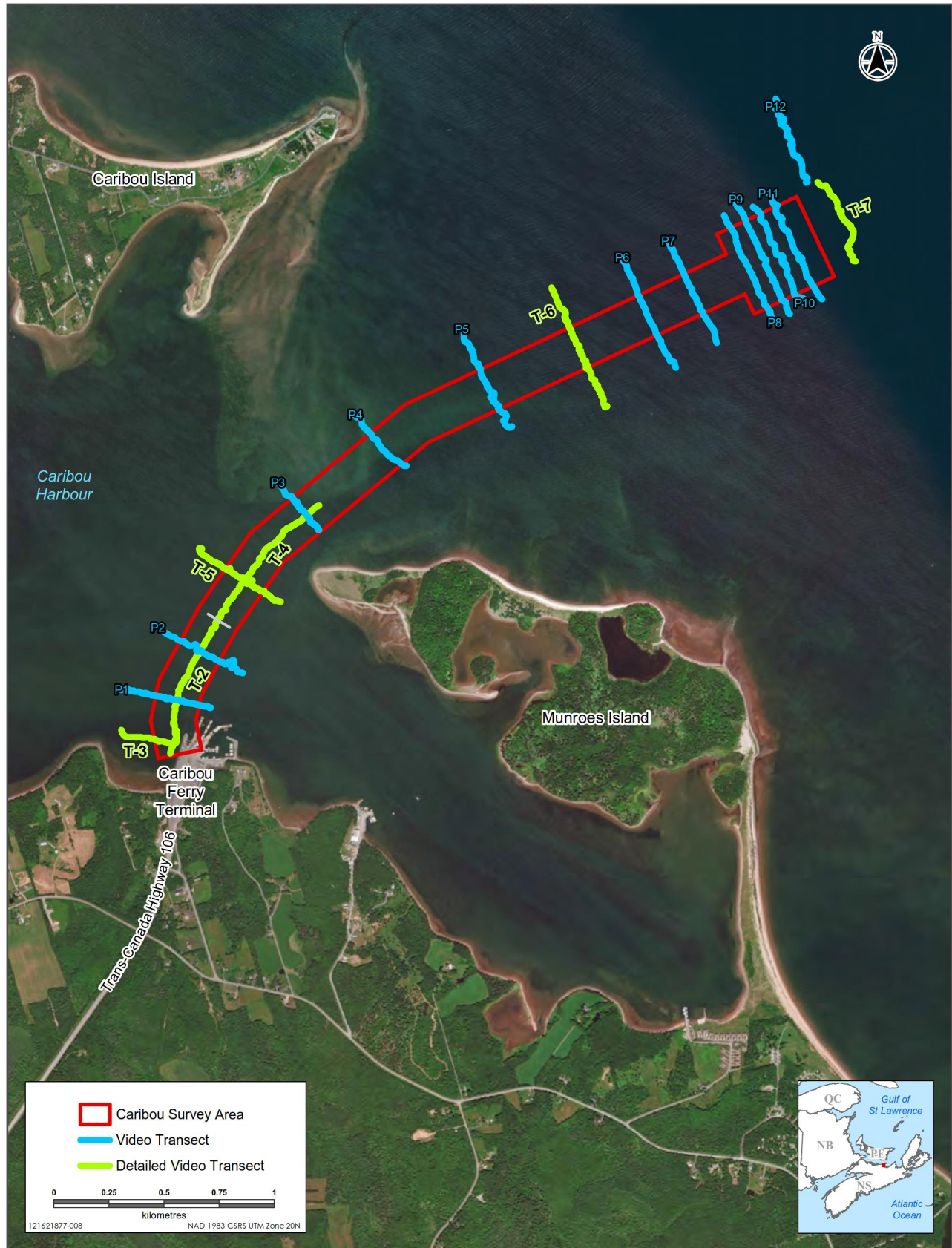




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Location of Video Transects in Pictou Harbour



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Location of Video Transects in Caribou Harbour

UNDERWATER BENTHIC HABITAT SURVEY OF CARIBOU HARBOUR AND PICTOU HARBOUR PIPELINE CORRIDORS

The GPS coordinates for the start and end points for each transect reviewed for the UBHS are provided in Table 1.

Table 1 Geographical Coordinates (NAD 83 Datum) for Video Transects Reviewed as Part of the UBHS

Transect ID	Location	Easting-start (m)	Northing-start (m)	Easting-end (m)	Northing-end (m)
T1	Pictou Harbour	521253	5057136	521628	5055957
T2	Caribou Harbour	524105	5065037	524325	5065655
T3	Caribou Harbour	523881	5065145	524133	5065144
T4	Caribou Harbour	524325	5065655	524560	5065983
T5	Caribou Harbour	524503	5065787	524236	5065971
T6	Caribou Harbour	526069	5066636	525835	5067155
T7	Caribou Harbour	527051	5067622	527214	5067272

Note: NAD 1983 CSRS UTM Zone 20N

For the detailed UBHS analysis, transects were broken down into 50 m increments. Substrate type (percentage cover) was described according to the following major classifications:

- Bedrock
- Boulder (>25 cm)
- Cobble (3-13 cm)
- Gravel (2-3 cm)
- Sand
- Silt
- Clay
- Organic
- Shell hash

Macrofaunal species distributions were classified based on the following categories:

- A = Abundant; numerous (not quantifiable) observations made in the field of view throughout the entire habitat segment.
- C = Common; numerous (not quantifiable) observations made in the field of view intermittently along the habitat segment.
- O = Occasional; quantifiable observations made in the field of view intermittently along the habitat segment.
- U = Uncommon; quantifiable observations made in the field of view infrequently along the habitat segment.

Macroflora were identified to the lowest possible taxonomic level and determined as a percentage of substrate covered, where possible.



3.0 HIGH-LEVEL VIDEO ANALYSIS

The UBHS video transects that were recorded and used for interpretation of benthic habitat and community types in the proposed pipeline corridors of Pictou Harbour and Caribou Harbour are provided in Appendix A.

A high-level video analysis that included identifying the habitat type (substrate) and benthic community was completed for all video transects collected in Pictou Harbour and Caribou Harbour. The results of the high-level video analysis, along with the coordinates and video times for each transect, are summarized in Appendix B.

3.1 PICTOU HARBOUR

Video was collected in Pictou Harbour along the causeway within the area where side-scan data was collected. One long transect ran parallel to the causeway and additional video transects ran perpendicular to the causeway. Water depths in the surveyed area ranged from 3 to 9 m, with most of video collected in less than 5 m water depth (Figure 4). Interpretation of surficial geology from side-scan sonar data identified eight substrate types in the surveyed portion of Pictou Harbour (Figure 5) The predominant substrate types identified from the high-level video analysis in Pictou Harbour were silt and mixed sediment (silty sand, shell hash and gravel) (Figure 6). In general, the area surveyed in Pictou Harbour is a silty habitat. Benthic communities along the silty sections were composed primarily of sea stars (*Asterias forbesi*) and rock crabs (*Cancer irroratus*), which were the most commonly observed macrofaunal species. Plumose anemones (*Metridium senile*) were present on hard structures (i.e., occasional boulder or wooden structure). At the southern end of the causeway there is an opening for water to pass which also contains the fastest moving water. As a result, benthic habitat closer to this opening had less silt due to the higher water velocities. In this area with less silt, blue mussel (*Mytilus edulis*) beds were observed. Elsewhere, macroflora was covered in silt and it was not possible to determine what substrate was present under the heavy silt layer. In areas with heavy silt, holes of different sizes in the sea floor for infauna were commonly observed.





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Bathymetry Near Pictou Causeway

Figure 4

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Sources: Base Data - Natural Earth; Thematic Data - ERBC
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Surficial Geology of Pictou Harbour Pipeline Corridor from Side-scan Data

Figure 5





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Predominant Substrate Types Surveyed Within the Pictou Harbour Pipeline Corridor

3.2 CARIBOU HARBOUR

Video was collected in Caribou Harbour along and perpendicular to the pipeline corridor and diffuser area. Water depths in the surveyed area ranged from 3 m close to shore to 20 m at the diffuser area (Figure 7).

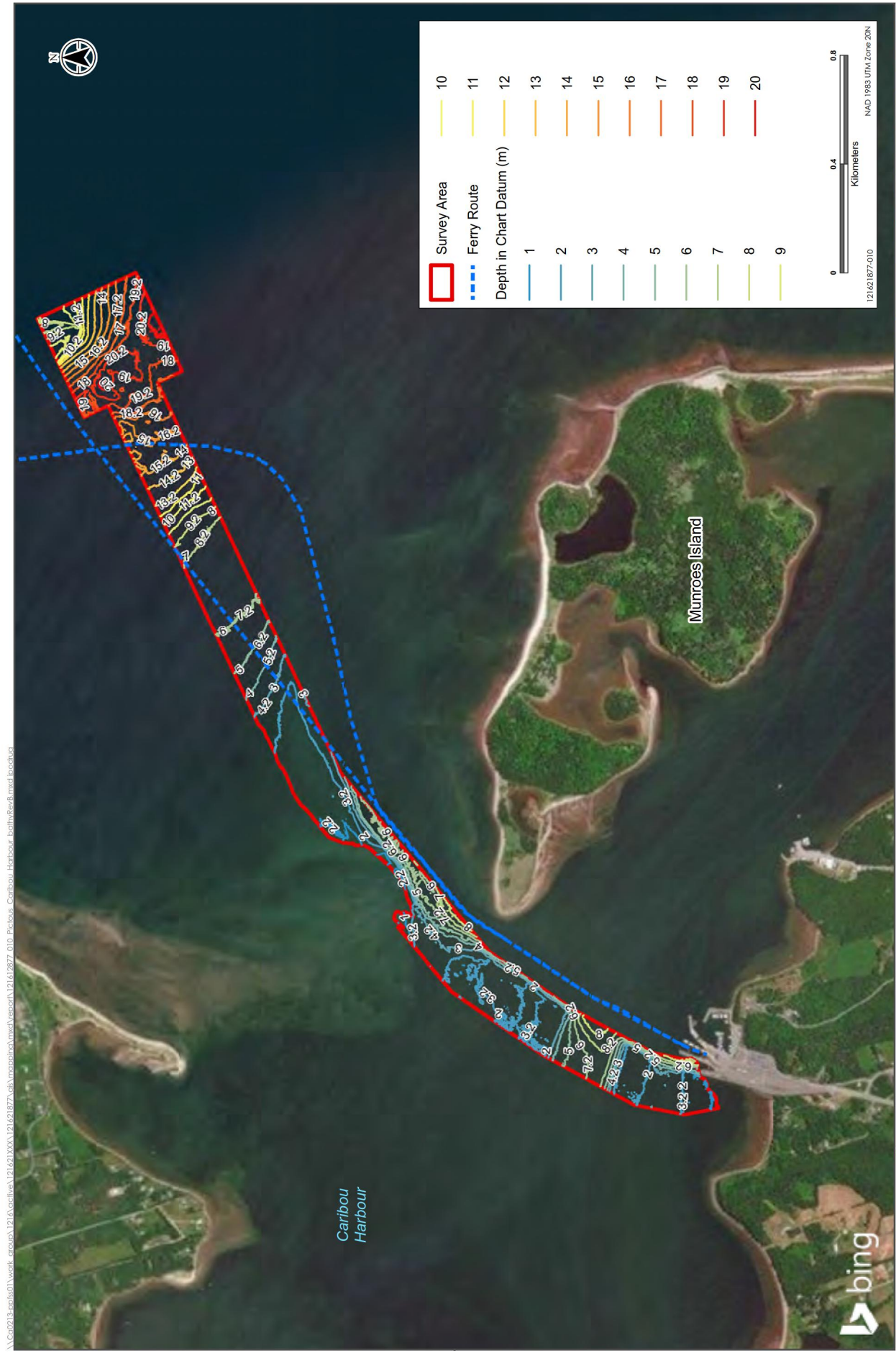
Eelgrass (*Zostera marina*) was identified in Caribou Harbour. It was not possible to discern or delineate eelgrass beds based on the results of the side-scan sonar survey data. The presence of eelgrass was noted during the high-level video analysis as well as for the detailed UBHS analysis.

Interpretation of surficial geology from side-scan sonar data identified ten substrate types in the surveyed portion of Caribou Harbour (Figure 8). Four predominant substrate types were identified from the high-level video analysis in Caribou Harbour. These included silt, silty sand, sand, and mixed sediment (sand, shell hash and gravel) (Figure 9). In general, the pipeline corridor is composed primarily of sand. Closer to shore, the habitat was silty with eelgrass; eelgrass beds were thickest near shore. Moving seawards from shore, the habitat transitions into silty sand, also with eelgrass and eelgrass beds. Silty sand transitions into sand near the mouth of Caribou Harbour and continues out to the diffuser area where it transitions into mixed sediment (sand with gravel and shell hash).

In shallower areas within Caribou Harbour, eelgrass was the most common macroflora and was present in different densities. As water depths increased, there was less eelgrass; where it transitioned into sand habitat there was very little macroflora. Rock crabs (*Cancer irroratus*) were observed in all habitat types. In the sand habitat, sand dollars (*Echinarachnius parma*) were abundant and moon snails (*Euspira heros*) were also observed. At the diffuser area there were fewer sand dollars than in the sand habitat closer to shore. The overall benthic communities observed included silt with eelgrass, silty sand with eelgrass, sand with sand dollars and mixed sediment with lower biological diversity compared to the other areas (Figure 10). Figure 10 also illustrates the extent of eelgrass in Caribou Harbour based on available video in the survey area.

Two of the more interesting things observed during the high-level video analysis in Caribou Harbour were sand dollar formations and the sponge *Haliclona oculata*. In some areas with sand waves, sand dollars were observed in striped formation on the seabed (Photo 1). *Haliclona oculata* was only observed in one location in Caribou Harbour (Photo 2).





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Bathymetry at Caribou Harbour

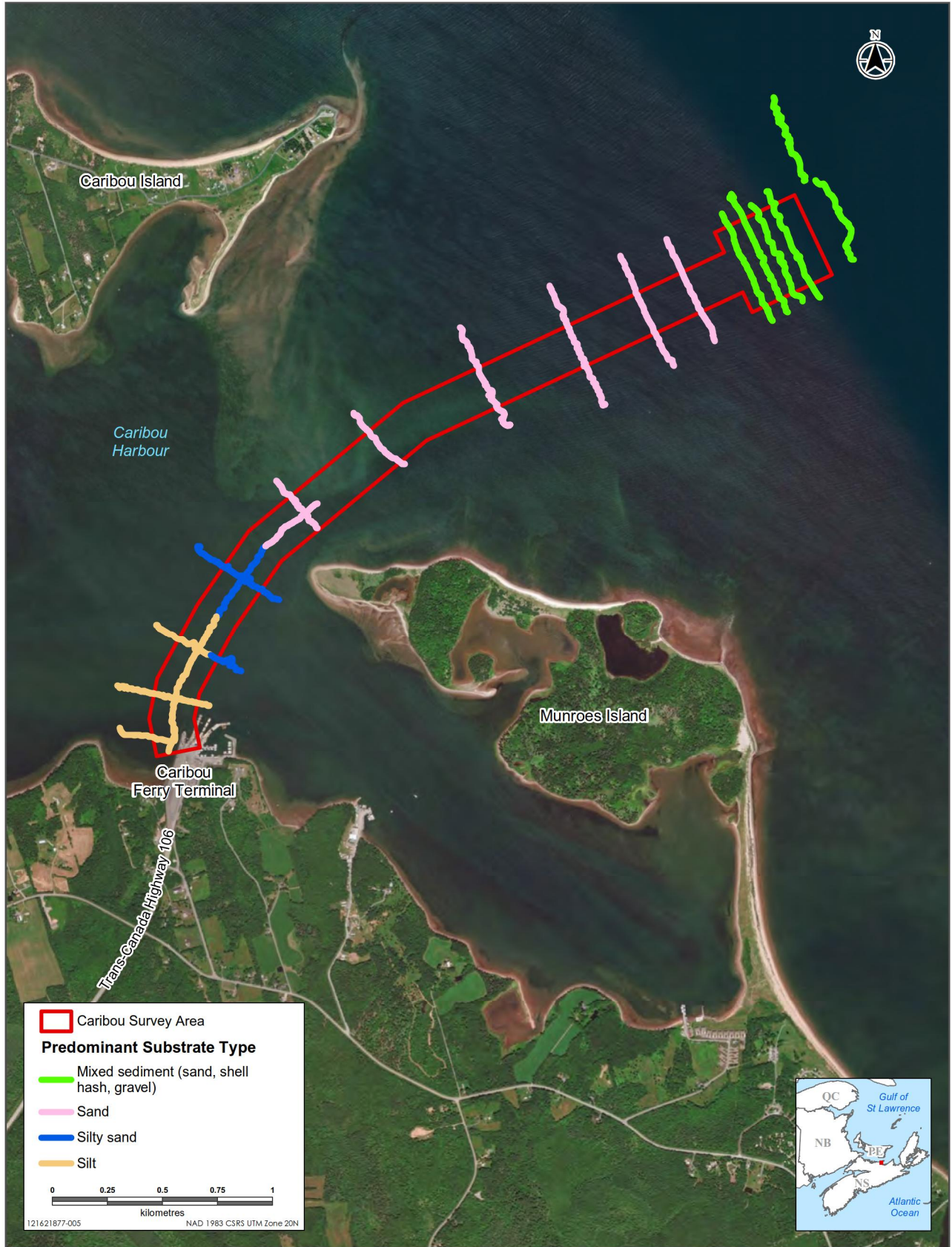
Figure 7



Surficial Geology of Caribou Harbour Pipeline Corridor from Side-scan Data

Figure 8

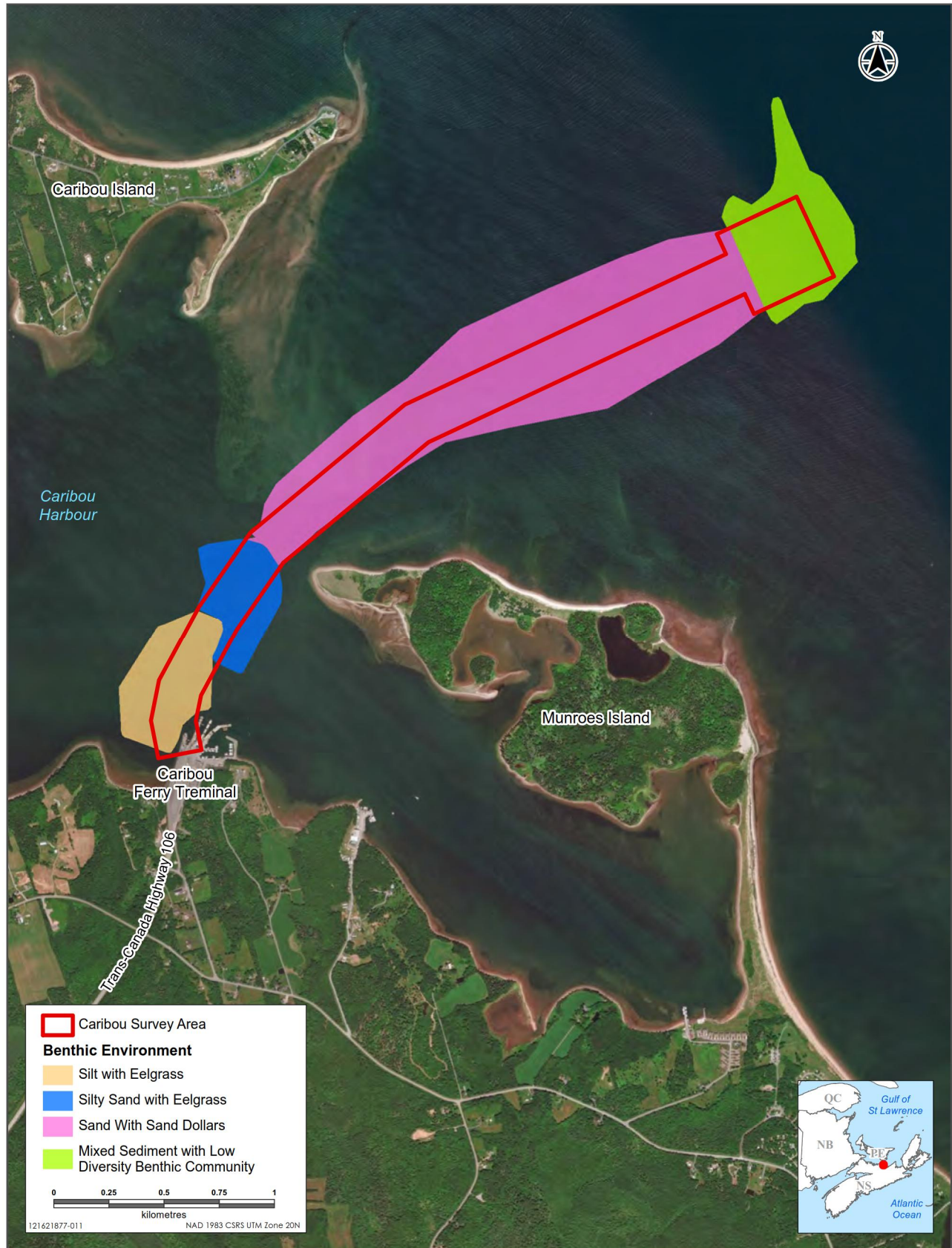




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Predominant Substrate Types Surveyed Within the Caribou Harbour Pipeline Corridor



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Benthic Communities Surveyed Within the Caribou Harbour Pipeline Corridor

UNDERWATER BENTHIC HABITAT SURVEY OF CARIBOU HARBOUR AND PICTOU HARBOUR PIPELINE CORRIDORS



Photo 1 Sand waves with sand dollars in striped formation in Caribou Harbour



Photo 2 Sponge (*Haliclona oculata*) in Caribou Harbour



3.2.1 Diffuser Area

The proposed diffuser area has strong currents and low visibility; a detailed analysis of video collected at the diffuser area for the UBHS was therefore not possible. An area adjacent to the diffuser area with similar habitat was used for the detailed UBHS due to the better quality of the video (see Section 4.2.6). This adjacent area was approximately 150 m from the edge of the pipeline corridor and was determined to have similar characteristics as the diffuser area based on high-level video analysis of substrate type and preliminary interpretations of surficial geology from side-scan sonar.

Within the diffuser area, the predominant substrate type was mixed sediment (sand, gravel and shell hash) (Photos 3 and 4). Macroflora observed included *Laminaria* sp., Rhodophyta sp., *Cladophora rupestris* and other brown algae. Macrofauna observed included rock crab (*Cancer irroratus*), sand dollar (*Echinarachnius parma*) and blue mussel (*Mytilus edulis*).

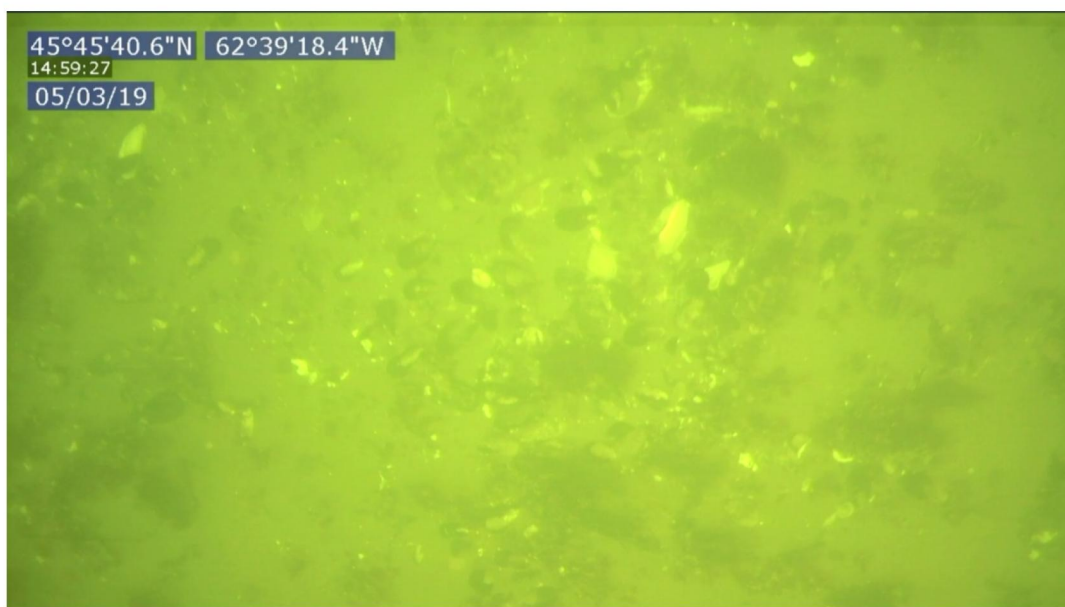


Photo 3 Mixed bottom (predominantly sand) with blue mussels in diffuser area



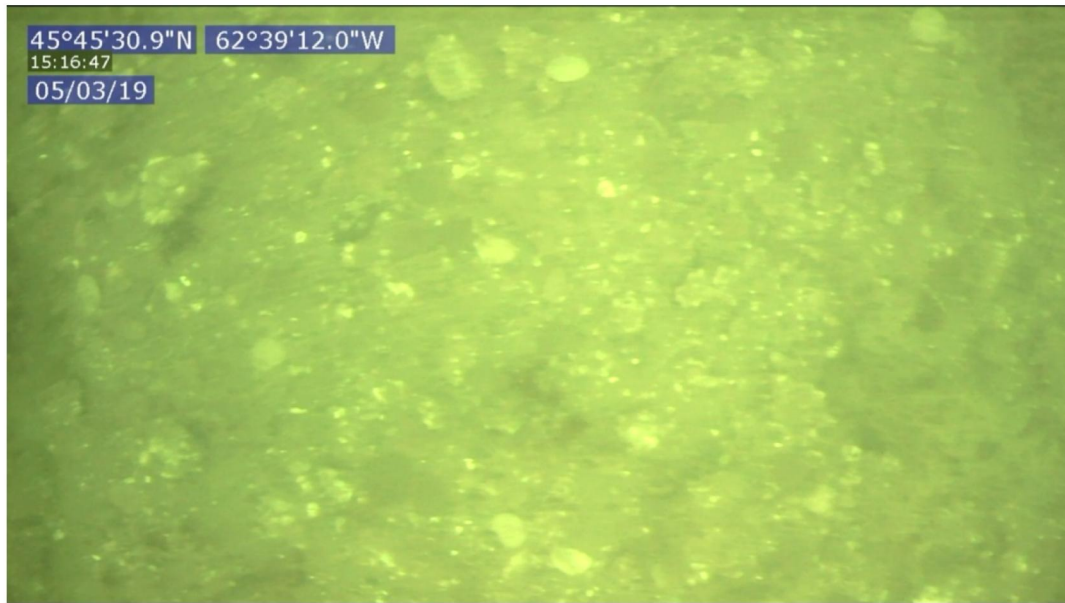


Photo 4 Mixed bottom (predominantly gravel) in diffuser area

4.0 DETAILED VIDEO ANALYSIS

4.1 PICTOU HARBOUR

One long transect in the pipeline corridor that ran parallel to the Pictou Causeway was analyzed for the detailed UBHS in Pictou Harbour. The video was reviewed in 50-m increments to characterize the overall observed changes in benthic habitat along the transect. The results of this transect in Pictou Harbour are summarized below, with full results provided in Appendix C.

4.1.1 Transect 1

Transect 1 had a total length of 1.25 km. The majority of Transect 1 was in less than 5 m water depth, with one small section that was 8 m deep. The substrate along Transect 1 consisted predominantly of silt. The first 50-75 m of the transect was composed of silty sand (50-95% coverage) with lesser amounts of gravel, shell hash and cobble (Photo 5). Silty sand transitioned into silt (100% coverage) for the remainder of the transect (Photo 6).

Macrofloral species observed in Transect 1 included unidentified brown algae (<1% to 5% cover), *Cystoseira* sp. (<1% coverage), *Chorda filum* (<1% coverage), *Fucus vesiculosus* (<1% coverage), *Laminaria longicuris* (<1% coverage) and *Ascophyllum nodosum* (<1% coverage). Macroflora cover was greater in the first 50 m of the transect in the northern end. Thereafter, macroflora was sparse and was generally covered in silt making identification difficult (Photo 7).



UNDERWATER BENTHIC HABITAT SURVEY OF CARIBOU HARBOUR AND PICTOU HARBOUR PIPELINE CORRIDORS

Macrofauna observed along Transect 1 included rock crab (*Cancer irroratus*) (uncommon), sea stars (*Asterias forbesi*) (uncommon to occasional), softshell clam (*Mya arenaria*) (uncommon), American oyster (*Crassostrea virginica*) (uncommon), and plumose anemone (*Metridium senile*) (uncommon to occasional). Plumose anemones were only present on hard substrate (i.e., occasional boulder or timber) while other species observed were in the silt. It was not possible to tell from the video if the clam and oyster were alive or if it was just the shells. Most of the macrofauna was observed in the first 250 m of the transect. There were also many holes of different sizes in the silt for infauna, though no infauna species were observed in the video.

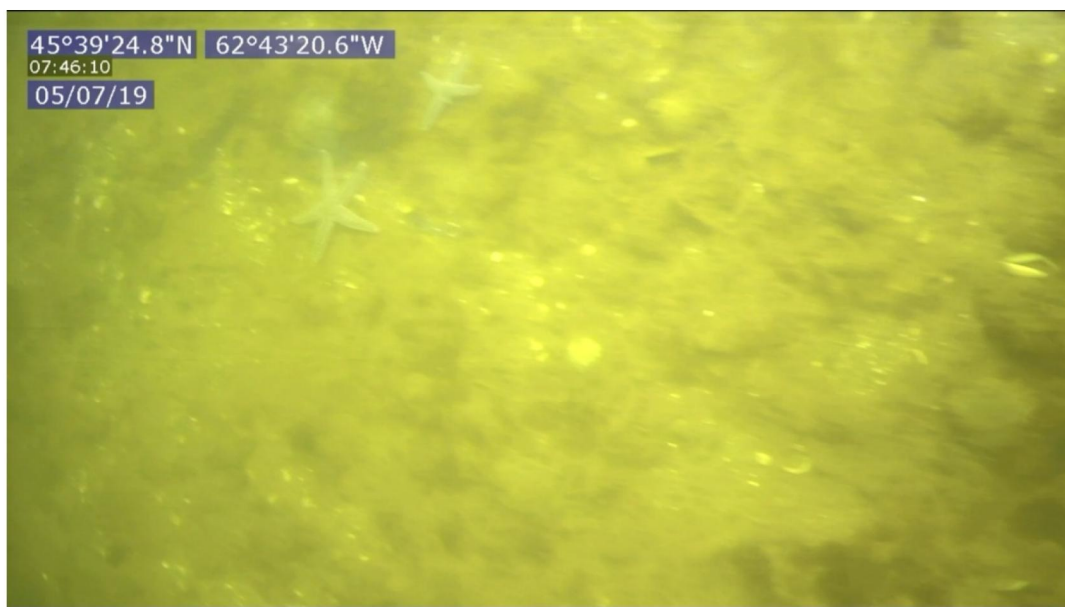


Photo 5 Mixed sediment (silty sand, gravel shell hash) with brown algae and sea stars (0-50 m on Transect 1)



UNDERWATER BENTHIC HABITAT SURVEY OF CARIBOU HARBOUR AND PICTOU HARBOUR PIPELINE CORRIDORS

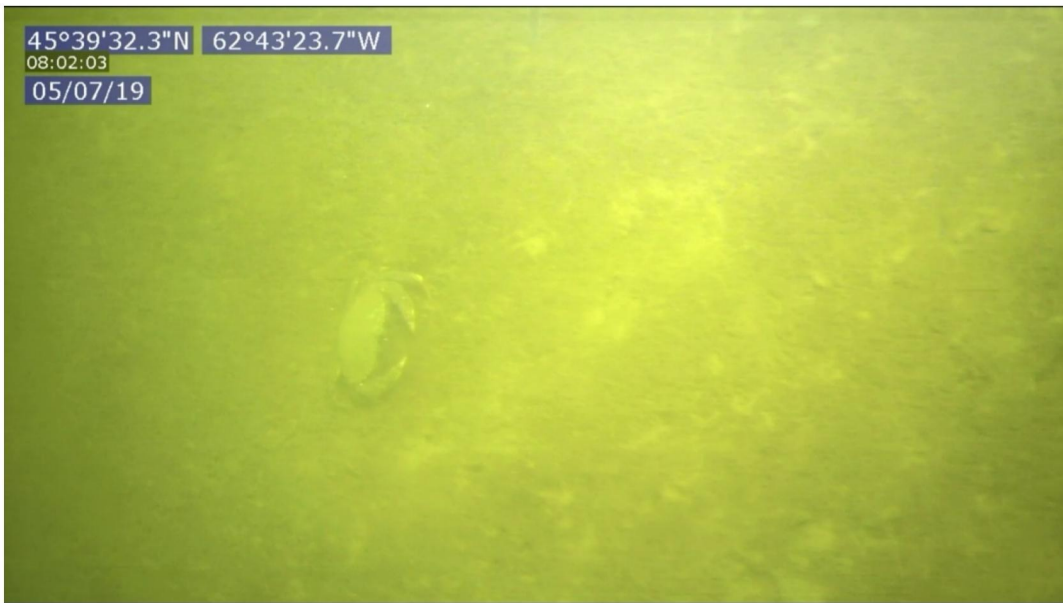


Photo 6 Silty habitat with rock crab (250-300 m on Transect 1)

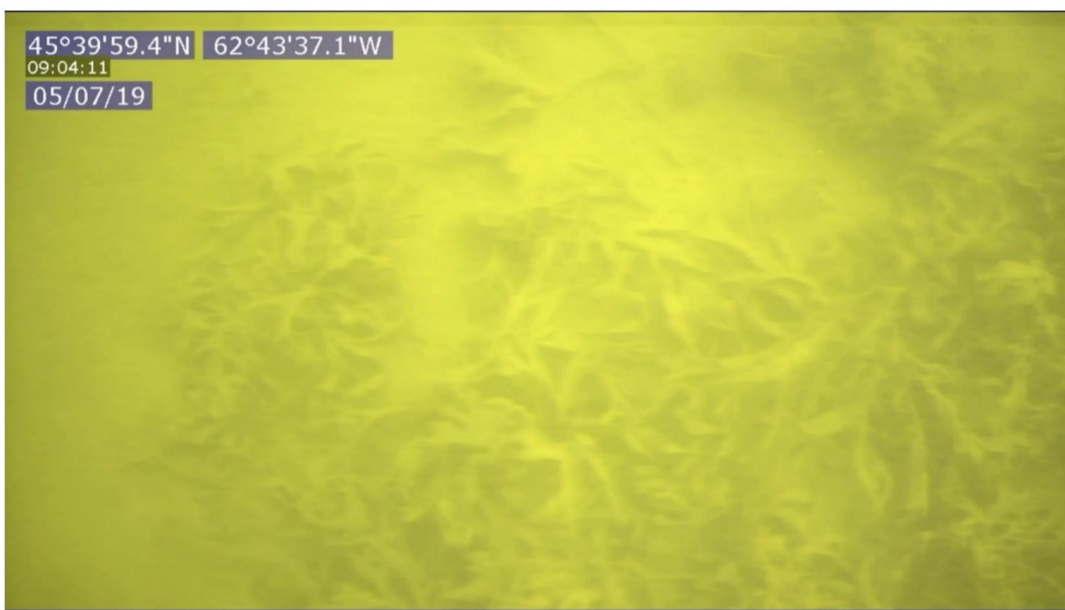


Photo 7 Silty habitat with brown algae covered in silt (1150-1200 m on Transect 1)



4.2 CARIBOU HARBOUR

A total of 3.15 km of marine habitat was surveyed in Caribou Harbour and analyzed in detail. Six transects of video ranging from 350-750 m were analyzed in detail for the UBHS to represent predominant substrate types observed in the high-level video analysis of the pipeline corridor. The video was reviewed in 50-m increments to characterize the overall changes in benthic habitat along the transect. The results of this analysis in Caribou Harbour are summarized below, with complete results provided in Appendix C.

4.2.1 Transect 2

Transect 2 had a total length of 750 m. Water depths on Transect 2 ranged from 3 to 7 m. The substrate along Transect 2 consisted predominantly of silt (100% coverage). At the end of the transect (700-750 m), the substrate started to transition into silty sand. A few pieces of cobble (<1% coverage) were observed between the 350-400 m mark of the transect.

Macroflora observed along Transect 2 was predominantly eelgrass (*Zostera marina*). Eelgrass cover was thickest at the start of the transect near shore at the beginning of the pipeline corridor. There was nearly 100% coverage in the first 50 m (Photo 8) and cover ranged from 10-90% in the first 500 m of the transect (Photo 9). Identification of other macroflora was difficult as they were generally covered in silt. These included unidentified brown algae (<1% coverage), *Fucus* sp. (<1% coverage), *Fucus spiralis* (<1% coverage), and *Fucus vesiculosus* (<1% coverage). Towards the end of the transect, there were sections with no eelgrass, just silt (Photo 10).

Macrofauna observed along Transect 2 include sea stars (*Asteria forbesi*) (uncommon), rock crab (*Cancer irroratus*) (uncommon), and hermit crab (*Pagurus longicarpus*) (uncommon). American oyster (*Crassostrea virginica*) (uncommon) and scallop (*Placopecten magellanicus*) (uncommon) shells were also observed but it was not possible to determine if they were alive or dead. The most common species encountered was rock crab, which were observed in 11 of the 50-m sections. Where there was less eelgrass, it was possible to see holes of different sizes in the silt for infauna, though no infauna were observed in the video.



UNDERWATER BENTHIC HABITAT SURVEY OF CARIBOU HARBOUR AND PICTOU HARBOUR PIPELINE CORRIDORS



Photo 8 Thick eelgrass bed (0 m on Transect 2)



Photo 9 Silty habitat with eelgrass and rock crab (150-200 m on Transect 2)





Photo 10 Silty habitat with rock crab (550-600 m on Transect 2)

4.2.2 Transect 3

Transect 3 had a total length of 350 m. Water depth along Transect 3 was approximately 3 m. The substrate along Transect 3 consisted of silt (100% coverage), with no other substrate types observed.

Eelgrass was the most common macroflora observed and was present in high densities (60-70% coverage) (Photo 11). Other macrofloral species observed included *Fucus spiralis*, *Fucus vesiculosus* and unidentified brown algae; these were present in low densities (<1% coverage) and generally covered in silt.

Rock crab (*Cancer irroratus*) (uncommon) were observed in most of the 50-m sections along this transect. Other species observed include acorn barnacle (*Semibalanus balanoides*) (uncommon) which were on a rock observed in the 100-150 m section of the transect. There were holes of different sizes in the silt for infauna, though no infauna were observed in the video.





Photo 11 Silty habitat with eelgrass (250-300 m on Transect 3)

4.2.3 Transect 4

Transect 4 had a total length of 450 m. Water depths along Transect 4 ranged from 3 to 5 m. The substrate along Transect 4 consisted predominantly of silty sand (100% coverage) and small amounts of shell hash (<1% coverage) (Photo 12). At the northern end of the transect (400-450 m) the substrate transitions to sand (Photo 13).

Eelgrass (*Zostera marina*) was the most common macroflora observed with coverage ranging between 30-60%. Other macroflora observed include unidentified brown algae (<1% coverage), *Fucus* sp. (<1% coverage), *Fucus vesiculosus* (<1% coverage), *Fucus spiralis* (<1% coverage) and *Cladophora rupestris* (<1% coverage). These were present in much lesser quantities than the eelgrass.

Macrofauna observed include American oyster (*Crassostrea virginica*) (uncommon), rock crab (*Cancer irroratus*) (uncommon) and sand dollar (*Echinarachnius parma*) (uncommon to common). It was not possible to determine from the video if the oyster observed was alive or dead. Sand dollars were only present in final two 50 m sections (350-450 m) of the transect to the north towards the mouth of Caribou Harbour where the habitat starts to transition into sand.



UNDERWATER BENTHIC HABITAT SURVEY OF CARIBOU HARBOUR AND PICTOU HARBOUR PIPELINE CORRIDORS

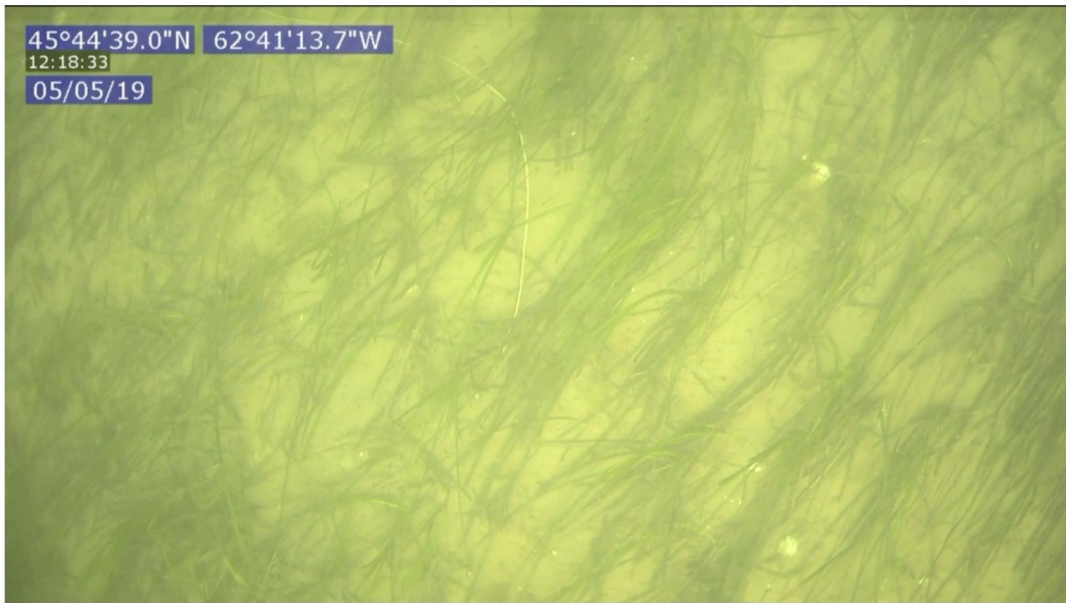


Photo 12 Silty sand habitat with eelgrass (0-50 m on Transect 4)

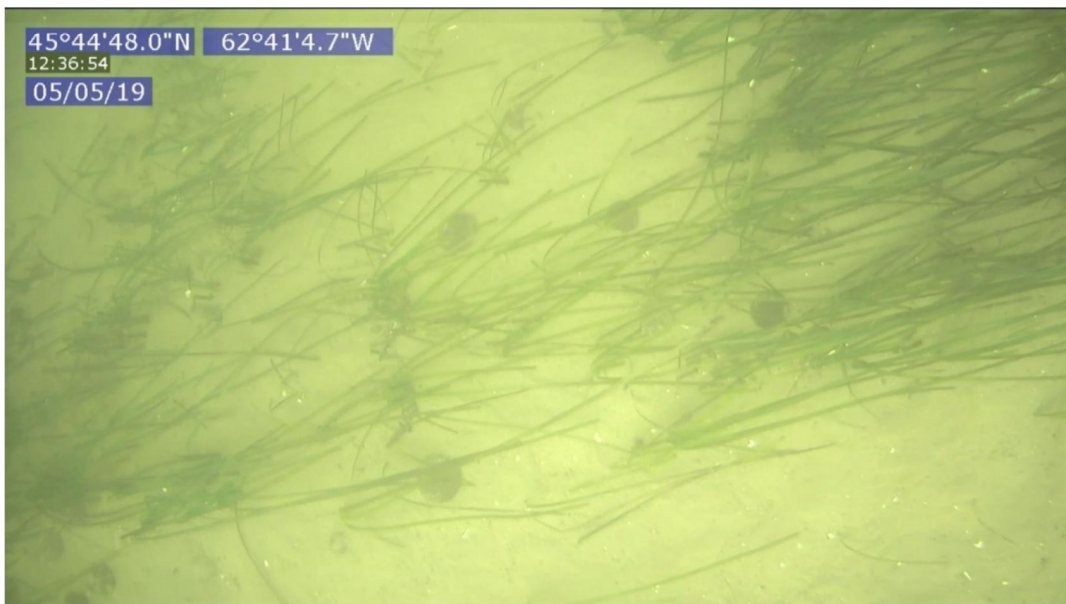


Photo 13 Transition from silty sand to sand with eelgrass and sand dollars at end of transect (400-450 m on Transect 4)



4.2.4 Transect 5

Transect 5 had a total length of 450 m. Water depth on Transect 5 was approximately 3 m. The substrate along Transect 5 consisted predominantly of silty sand (100% coverage) with some shell hash (<1% coverage). There was some gravel (<1% coverage) in the first 50 m section of the transect.

Eelgrass was the most common macroflora observed where coverage ranged from 10-60% (Photo 14). There were some small areas along the transect with no eelgrass, as well as areas with thick patches of eelgrass (Photo 15). Other macroflora observed include *Fucus spiralis* (<1% coverage), *Fucus vesiculosus* (<1% coverage) Rhodophyta sp. (<1% coverage), *Laminaria* sp. (<1% coverage), unidentified green algae (<1% coverage) and unidentified brown algae (<1% coverage).

Macrofauna was sparse along this transect. Rock crab (*Cancer irroratus*) (uncommon) was present in five of the 50 m sections. There was a sand dollar (uncommon) in the first 50 m section at the eastern end of the transect. An American oyster (*Crassostrea virginica*) (uncommon) shell was observed between 50-100 m but it was not possible to determine if it was alive. Acorn barnacles (*Semibalanus balanoides*) (uncommon) were observed on a rock between 100-150 m.

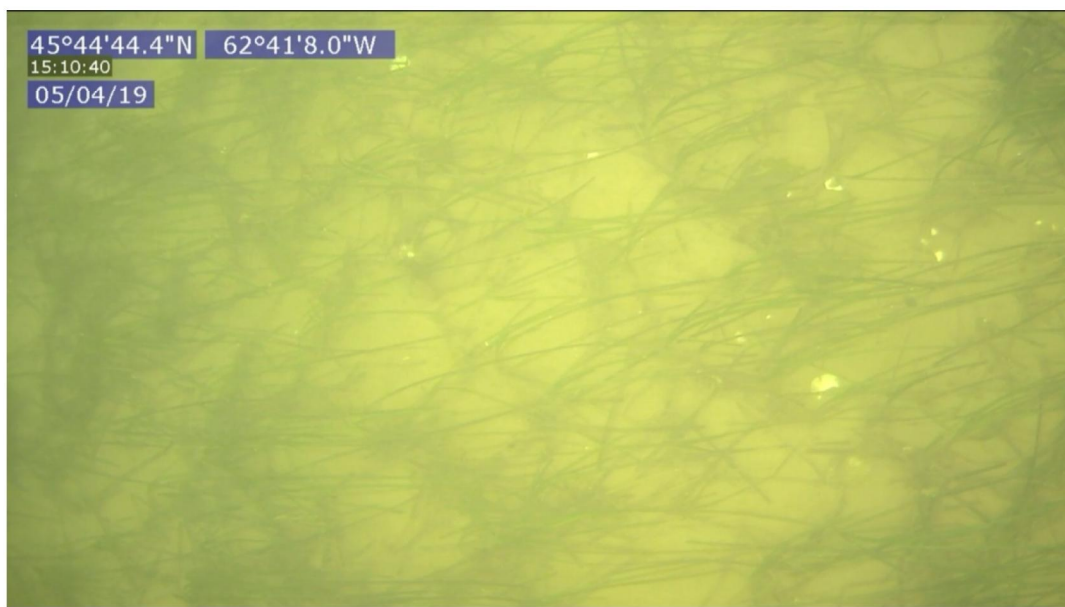


Photo 14 Silty sand habitat with eelgrass (100-150 m on Transect 5)



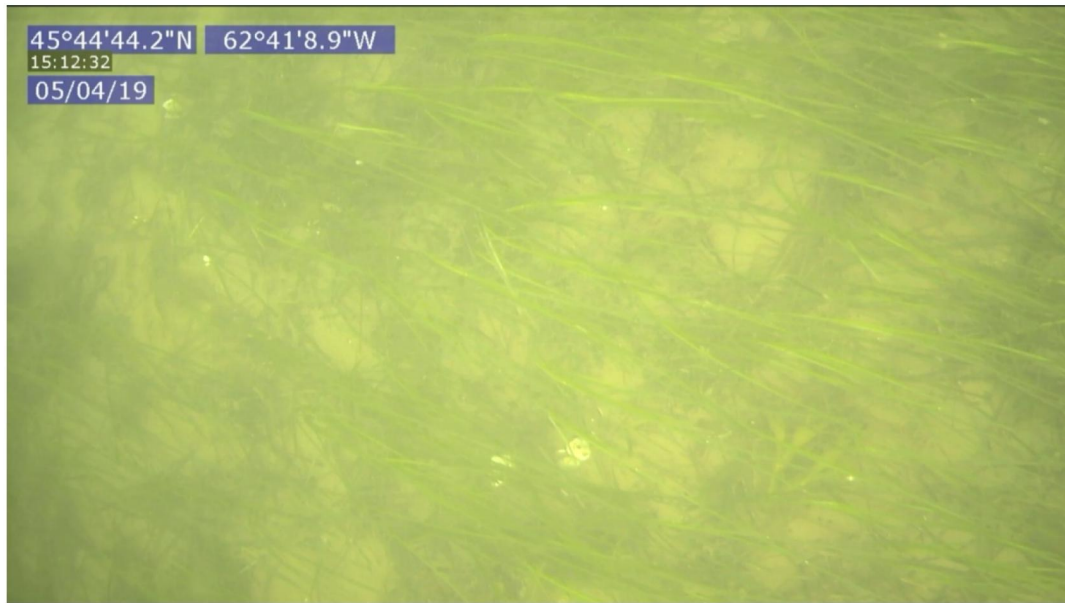


Photo 15 Silty sand habitat with thick eelgrass (150-200 m on Transect 5)

4.2.5 Transect 6

Transect 6 had a total length of 650 m. Water depth on Transect 6 was approximately 7 m. The substrate along Transect 6 consisted entirely of sand (100% coverage) with no other substrate types observed along this transect.

There was very little macroflora observed along this transect, with many 50 m sections having no macroflora. Species observed in low quantities include *Laminaria longicuris* (<1% coverage), *Fucus* sp. (<1% coverage) and unidentified brown algae (<1% coverage). While *Laminaria longicuris* was the most common macroflora observed, this had an overall low occurrence with single strands observed (no aggregations).

Sand dollars (*Echinarachnius parma*) (abundant) were abundant along the whole transect (Photo 16). There were sections with dense aggregations of sand dollars (Photo 17). Rock crab (*Cancer irroratus*) were also observed in two of the 50 m sections.



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CORRIDORS



Photo 16 Sandy habitat with sand dollars and rock crab (250-300 m on Transect 6)

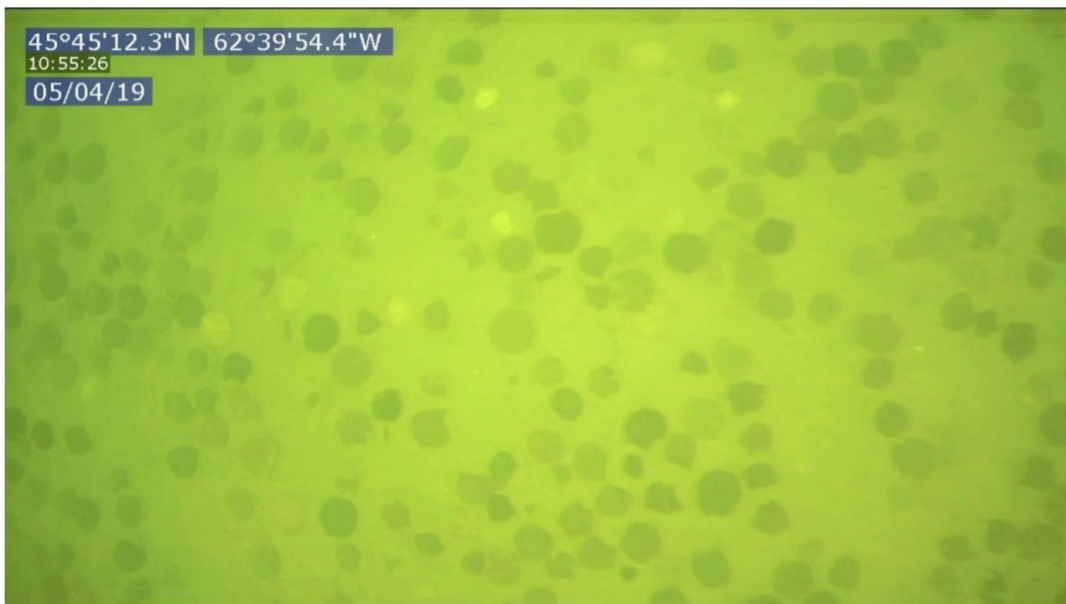


Photo 17 Sandy habitat with dense aggregations of sand dollars (50-100 m on
Transect 6)



4.2.6 Transect 7

Transect 7 had a total length of 500 m. Water depths along Transect 7 ranged from 10 m to 20 m. The substrate along Transect 7 was composed of mixed sediment (sand, shell hash and gravel). From the video it appeared to be approximately 60% sand, 30% gravel and 10% shell hash (Photo 18)

Macroflora observed included *Laminaria longicuris* (<1% coverage), unidentified brown algae (<1% coverage), Rhodophyta sp. (<1% coverage) and *Laminaria* sp. (<1% coverage). While present in low densities within each 50 m section, *Laminaria* (either *Laminaria longicuris* or *Laminaria* sp.) and unidentified brown algae were present in each of the 50 m sections of the transect. There was more macroalgae (seaweeds) present along Transect 7 than any of the other transects analyzed for UBHS.

Macrofauna observed included blue mussels (*Mytilus edulis*) (common), rock crabs (*Cancer irroratus*) (uncommon), sand dollars (*Echinarachnius parma*) (occasional) and acorn barnacles (*Semibalanus balanoides*) (uncommon). Blue mussels were the most common species observed. Acorn barnacles were observed on rocks when the camera dipped close to the seabed (Photo 19).

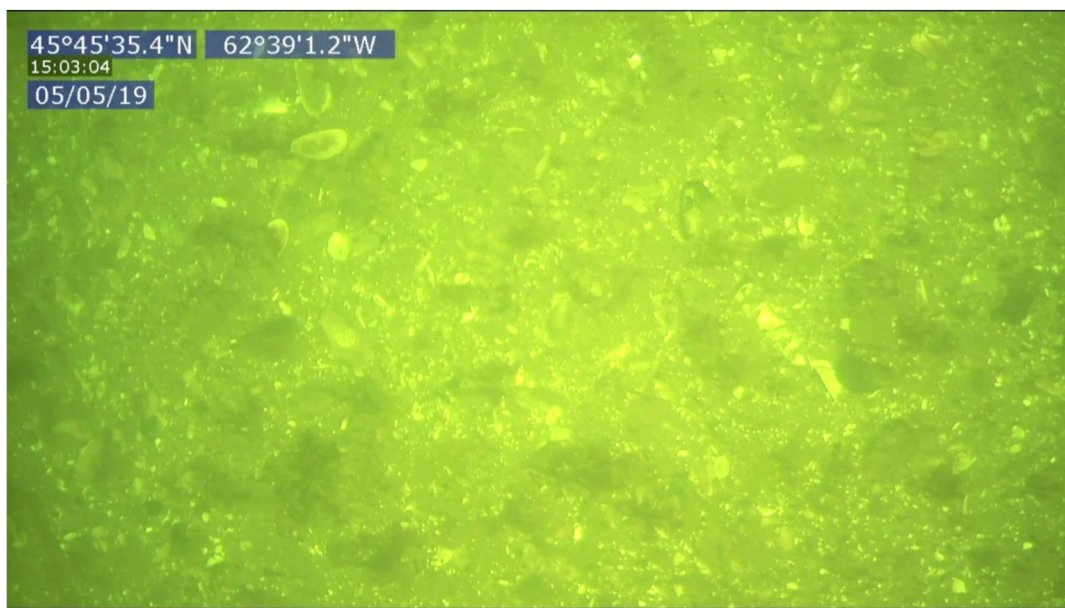


Photo 18 Mixed sediment (sand, shell hash and gravel) with blue mussels (250-300 m on Transect 7)



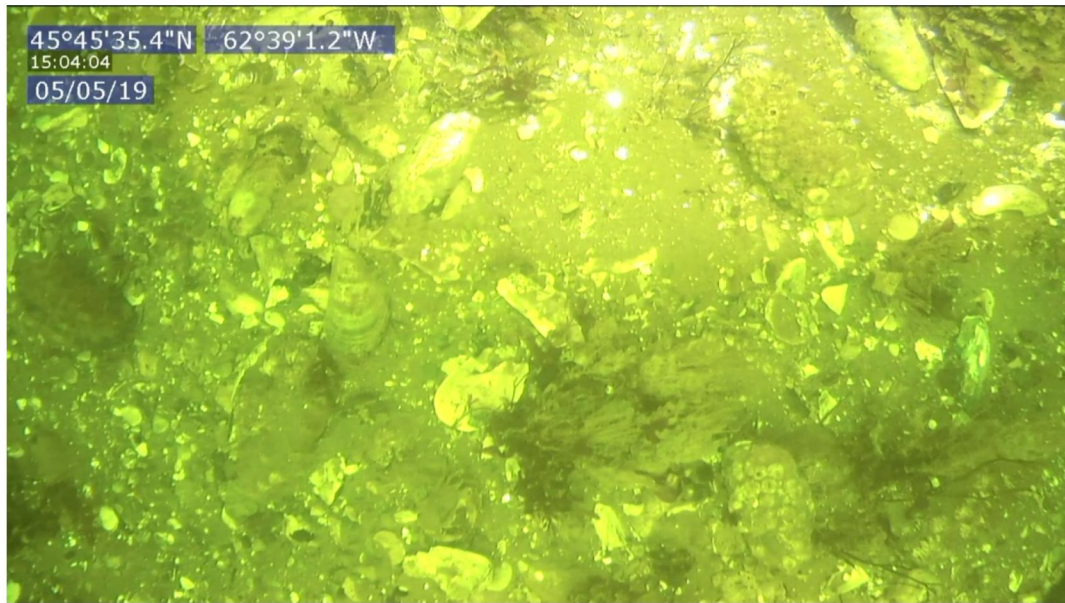


Photo 19 Mixed sediment (sand, shell hash and gravel) with acorn barnacles and blue mussels (250-300 m on Transect 7)

5.0 LIMITATIONS

The video collected in Pictou Harbour, Caribou Harbour and the Northumberland Strait was generally good quality; however, some environmental factors, such as water depth, currents and turbidity, affected the quality of the video. This was especially the case for video collected in the diffuser area. At this location, water depths were approximately 20 m and this in combination with lower visibility and strong currents made it difficult to collect underwater video suitable for detailed UBHS interpretation; however, the video collected was adequate for high-level analysis. Video from the area adjacent to the diffuser area, which had similar characteristics as the diffuser area, was collected on a different day under better conditions and the quality of the video was more suitable for detailed analysis.

In Pictou Harbour, along the causeway where video was collected, the predominant substrate type was silt and this covered most of the macroflora observed in the video, which made identification difficult. This was also the case closer to shore in Caribou Harbour.

During video review, it was not possible to determine substrate types with the same resolution as the surficial geology interpretations from the side-scan data. As a result, side-scan data identified more habitat types than were visible in the high-level video analysis and benthic habitat survey.



APPENDIX A

Underwater Benthic Habitat Survey Video

Table B1 - Video Files, Times and Coordinates for High-Level Video Analysis - Pictou Harbour

File Name	Date	Start Time	End Time	Eastings-start (m)	Northing-start (m)	Eastings-end (m)	Northing-end (m)
CSR1806_Hypack_002_0855	5/5/2019	8:56:02	9:05:55	521282	5057181	521319	5057070
CSR1806_Hypack_001_0835	5/5/2019	8:36:04	8:50:22	521451	5057166	521248	5057082
CSR1806_Hypack_003_0919	5/5/2019	9:20:02	9:35:43	521633	5056475	521456	5056404
CSR1806_Hypack_002_0805	5/6/2019	8:06:07	8:19:36	521508	5056845	521329	5056783
CSR1806_Hypack_004_0836 - 004_0856	5/6/2019	8:36:43	9:08:21	521805	5056133	521585	5056022
CSR1806_Hypack_005_0918	5/6/2019	9:18:55	9:38:14	521729	5056278	521534	5056222
CSR1806_Hypack_006_1623	5/6/2019	16:24:10	16:41:24	521775	5056065	521611	5055975
CSR1806_Hypack_007_0745 - 007_0905	5/7/2019	7:45:29	9:10:22	521628	5055957	521252	5057135
CSR_Hypack_001_0922 - 001_0942	5/7/2019	9:23:29	10:02:29	521612	5056302	521642	5056337
CSR_Hypack_002_1007 - 002_1027	5/7/2019	10:07:35	10:29:03	521571	5056238	521573	5056219
CSR_Hypack_003_1030	5/7/2019	10:31:24	10:48:55	521651	5056176	521649	5056170

Note: NAD 1983 CSRS UTM Zone 20N

Table B2 - High-level Video Analysis of Habitat Types and Benthic Communities - Pictou Harbour

File Name	Transect ID in Figure 3	Date	Habitat	Benthic Community	Notes
CSR1806_Hypack 002_0855	P1	5/5/2019	silty sand with some gravel and shell hash transitions into silt	some brown algae, rock crab	algae covered in silt
CSR1806_Hypack 001_0835	P2	5/5/2019	silt	some brown algae, holes for infauna	algae covered in silt, patch of cobble between 08:46:16 and 08:47:10
CSR1806_Hypack 003_0919	P4	5/5/2019	silt	occasional brown algae	plumose anemones at 09:33:49
CSR1806_Hypack 002_0805	P3	5/6/2019	silt	holes for infauna	-
CSR1806_Hypack 004_0836 - 004_0856	P9	5/6/2019	silty sand with some gravel and shell hash transitions into silt	some brown algae, red algae, mussel bed, sea stars, rock crab, hermit crab	-
CSR1806_Hypack 005_0918	P6	5/6/2019	silt	sea stars	-
CSR1806_Hypack 006_1623	P10	5/6/2019	silty sand with some gravel and shell hash transitions into silt	mussel bed	-
CSR1806_Hypack 007_0745 - 007_0905	T1	5/7/2019	silty sand with some gravel and shell hash transitions into silt	some brown algae, sea stars	structure with plumose anemones at 07:57:48
CSR_Hypack 001_0922 - 001_0942	P5	5/7/2019	silt	plumose anemones on structures	video taken for underwater archaeology
CSR_Hypack 002_1007 - 002_1027	P7	5/7/2019	silt	plumose anemones on structures	video taken for underwater archaeology
CSR_Hypack 003_1030	P8	5/7/2019	silt	plumose anemones and algae on piles of rocks	video taken for underwater archaeology

Table B3 - Video Files, Times and Coordinates for High-Level Video Analysis - Caribou Harbour

File Name	Date	Start Time	End Time	Eastings-start (m)	Northing-start (m)	Eastings-end (m)	Northing-end (m)
CSR1806_Hypack 020_1334	5/3/2019	13:32:05	13:41:20	526749	5067519	526899	5067254
CSR1806_Hypack 020_1356	5/3/2019	13:53:38	14:00:45	526877	5067291	526982	5067082
CSR1806_Hypack 023_1543_1603	5/3/2019	15:41:27	16:16:26	526660	5067565	526915	5067032
CSR1806_Hypack 026_1429	5/3/2019	14:27:22	14:46:16	526617	5067482	526846	5066995
CSR1806_Hypack 028_1501_1521	5/3/2019	14:59:17	15:24:37	526820	5067581	527062	5067098
CSR1806_Hypack 033_0857 - 033_0917	5/4/2019	8:57:47	9:20:01	526583	5066901	526365	5067363
CSR1806_Hypack 034_0944 - 034_1004	5/4/2019	9:44:36	10:12:49	526400	5066789	526156	5067288
CSR1806_Hypack 036_1154 - 036_1214	5/4/2019	11:55:01	12:31:13	525651	5066521	525427	5066964
CSR1806_Hypack 038_1453 - 038_1513 - 038_1533	5/4/2019	14:53:53	15:34:37	524605	5065726	524249	5065966
CSR1806_Hypack 12P50 - 12P50_0001	5/4/2019	14:18:09	14:42:44	524778	50666051	524594	5066266
CSR1806_Hypack 17P50	5/4/2019	13:23:37	13:39:37	525177	50666343	524945	5066576
CSR1806_Hypack 27P50 - 27P50_0001 - 27P50_0002	5/4/2019	10:44:02	11:35:39	526087	5066612	527133	5067157
CSR1806_Hypack 5P00 - 5P00_0001	5/4/2019	15:41:48	16:11:18	524433	5065399	524050	5065610
CSR1806_Hypack 045_1453	5/5/2019	14:53:59	15:12:34	527040	5067631	527214	5067271
CSR1806_Hypack 045_1522 - 045_1542	5/5/2019	15:22:54	16:00:04	526853	5068007	526995	5067631
CSR1806_Hypack 2P50 - 2P50_0001 - 2P50_0002	5/5/2019	13:07:44	13:49:00	524289	5065244	523871	5065335
CSR1806_Hypack 041_1356	5/5/2019	13:56:46	14:12:15	523883	5065143	524134	5065141
CSR1806_Hypack 005_1132 - 005_1152 - 005_1212 - 005_1232	5/5/2019	11:32:37	12:48:11	524106	5065036	524780	5066162

Note: NAD 1983 CSRS UTM Zone 20N

Table B4 - High-level Video Analysis of Habitat Types and Benthic Communities - Caribou Harbour

File Name	Transect ID in Figure 3	Date	Habitat	Benthic Community	Notes
CSR1806_Hypack 020_1334	C10	5/3/2019	sand with shell hash and gravel	some brown algae, blue mussels, sand dollars	concrete block observed at 13:32:40
CSR1806_Hypack 020_1356	C10	5/3/2019	sand with shell hash and gravel	some brown algae, sand dollars	patch of cobble and boulders at 13:58:50
CSR1806_Hypack 023_1543_1603	C9	5/3/2019	sand with shell hash and gravel	some brown algae, occasional <i>Laminaria</i> sp., blue mussels, sand dollars	patches of cobble between 15:57:15 and 15:59:08
CSR1806_Hypack 026_1429	C8	5/3/2019	sand with shell hash and gravel	some brown algae, blue mussels, sand dollars	transitions to sand with shell hash at 14:42:38, waves in sand
CSR1806_Hypack 028_1501_1521	C11	5/3/2019	sand with shell hash and gravel	brown algae, blue mussels, sand dollars	some cobble between 15:07:57 and 15:09:12
CSR1806_Hypack 033_0857 - 033_0917	C7	5/4/2019	sand	sand dollars very abundant	some patches with no sand dollars
CSR1806_Hypack 034_0944 - 034_1004	C6	5/4/2019	sand	sand dollars, some brown algae, some <i>Laminaria</i> sp.	-
CSR1806_Hypack 036_1154 - 036_1214	C5	5/4/2019	sand	sand dollars abundant	-
CSR1806_Hypack 038_1453 - 038_1513 - 038_1533	T5	5/4/2019	silty sand with some gravel	brown algae, red algae, some <i>Laminaria</i> sp., patches of eelgrass, <i>Haliclona oculata</i> at 14:58:06	patch of cobble and boulders between 14:54:00 and 14:57:40, transitions to silty sand at 15:04:22
CSR1806_Hypack 12P50 - 12P50_0001	C3	5/4/2019	sand with some gravel	brown algae, patches of sand dollars, patches of eelgrass	transitions to sand at 14:20:39, then to sand with shell hash and gravel at 14:2:43, then back to sand at 14:36:31
CSR1806_Hypack 17P50	C4	5/4/2019	sand	patches of sand dollars	waves in sand
CSR1806_Hypack 27P50 - 27P50_0001 - 27P50_0002	T6	5/4/2019	sand	sand dollar habitat starts at 10:48:07	-
CSR1806_Hypack 5P00 - 5P00_0001	C2	5/4/2019	silty sand transitions into silt	occasional patches of algae and eelgrass	-
CSR1806_Hypack 045_1453	T7	5/5/2019	sand with shell hash and gravel	some brown algae, <i>Laminaria</i> sp., blue mussels	-
CSR1806_Hypack 045_1522 - 045_1542	C12	5/5/2019	sand with shell hash and gravel	some brown algae, red algae, <i>Laminaria</i> sp., blue mussels	-
CSR1806_Hypack 2P50 - 2P50_0001 - 2P50_0002	C1	5/5/2019	silt	patches of eelgrass	patch of gravel and cobble between 13:10:09 and 13:14:22
CSR1806_Hypack 041_1356	T3	5/5/2019	silt	eelgrass beds	-
CSR1806_Hypack 005_1132 - 005_1152 - 005_1212 - 005_1232	T2, T4	5/5/2019	silt transitions into sand	eelgrass beds, sand dollars at end of transect	silt transitions into silty sand at 12:16:40 which transitions into sand at 12:36:40

APPENDIX C

Detailed Benthic Habitat Characterization

Table C1 - Benthic Habitat Characterization of Transect 1, Pictou Harbour, Pictou, NS - May 7, 2019 (Transect = 1.25 km)

Transect	Distance (m)	Time on Video	Substrate (%)	Macroflora (%)	Macrofauna	Notes
	0-50	07:45:21 - 07:48:57	silty sand (95), gravel (5), shell hash (<1), cobble (<1)	unidentified brown algae (5), <i>Cystoseira</i> sp. (<1), <i>Chorda filum</i> (<1)	rock crab (O), sea star (O)	macroflora covered in silt, macroflora cover greater at beginning of section, more gravel at beginning of section
	50-100	07:48:57 - 07:52:41	silty sand (50), silt (50), gravel (<1), shell hash (<1), cobble (<1)	<i>Chorda filum</i> (<1), <i>Cystoseira</i> sp. (<1)	softshell clam (U), American oyster (U), sea star (U), rock crab (U)	silty sand transitions into silt
	100-150	07:52:41 - 07:55:43	silt (100), cobble (<1)	<i>Cystoseira</i> sp. (<1)	sea star (U)	-
	150-200	07:55:43 - 07:58:40	silt (100)	<i>Cystoseira</i> sp. (<1)	plumose anemone (C), sea star (O), rock crab (U)	holes for infauna, timber structure covered in plumose anemones at 07:57:50
	200-250	07:58:40 - 08:01:59	silt (100), gravel (<1), cobble (<1)	unidentified brown algae (<1), <i>Cystoseira</i> sp. (<1)	plumose anemone (O), sea star (U), rock crab (U)	holes for infauna
	250-300	08:01:59 - 08:05:04	silt (100)	unidentified brown algae (<1)	rock crab (U), plumose anemone (U), sea star (U)	holes for infauna, macroflora covered in silt
	300-350	08:05:04 - 08:07:54	silt (100)	unidentified brown algae (<1)	rock crab (U), sea star (U)	holes for infauna
	350-400	08:07:54 - 08:10:32	silt (100)	<i>Chorda filum</i> (<1)	-	holes for infauna, macroflora covered in silt
	400-450	08:10:32 - 08:14:29	silt (100)	unidentified brown algae (<1)	-	holes for infauna, lights on camera adjusted during this section
	450-500	08:14:29 - 08:18:30	silt (100)	<i>Chorda filum</i> (<1)	-	holes for infauna, lights on camera adjusted during this section
	500-550	08:18:30 - 08:21:45	silt (100)	<i>Fucus vesiculosus</i> (<1), unidentified brown algae (<1)	-	holes for infauna, macroflora covered in silt
	550-600	08:21:45 - 08:26:05	silt (100)	<i>Fucus vesiculosus</i> (<1), <i>Laminaria longicirris</i> (<1), <i>Chorda filum</i> (<1)	-	holes for infauna, macroflora covered in silt
	600-650	08:26:05 - 08:29:46	silt (100)	<i>Chorda filum</i> (<1), <i>Fucus vesiculosus</i> (<1)	-	holes for infauna, macroflora covered in silt
	650-700	08:29:46 - 08:34:10	silt (100)	<i>Ascophyllum nodosum</i> (<1), <i>Fucus vesiculosus</i> (<1)	rock crab (U)	holes for infauna, macroflora covered in silt
	700-750	08:34:10 - 08:38:01	silt (100), cobble (<1)	-	plumose anemone (O), rock crab (U)	holes for infauna
	750-800	08:38:01 - 08:42:19	silt (100)	-	-	holes for infauna
	800-850	08:42:19 - 08:45:38	silt (100)	-	rock crab (U)	holes for infauna
	850-900	08:45:38 - 08:48:52	silt (100)	<i>Chorda filum</i> (<1)	-	holes for infauna
	900-950	08:48:52 - 08:52:38	silt (100)	unidentified brown algae (<1), <i>Chorda filum</i> (<1), <i>Fucus vesiculosus</i> (<1)	-	holes for infauna, macroflora covered in silt
	950-1,000	08:52:38 - 08:55:30	silt (100)	unidentified brown algae (<1)	-	holes for infauna, macroflora covered in silt
	1000-1050	08:55:30 - 08:58:17	silt (100)	unidentified brown algae (<1)	-	holes for infauna, macroflora covered in silt
	1050-1100	08:58:17 - 09:01:13	silt (100)	unidentified brown algae (<1)	plumose anemone (U)	holes for infauna, macroflora covered in silt
	1100-1150	09:01:13 - 09:04:07	silt (100)	<i>Fucus vesiculosus</i> (<1), unidentified brown algae, <i>Chorda filum</i> (<1)	rock crab (U)	holes for infauna, macroflora covered in silt
	1150-1200	09:04:07 - 09:06:46	silt (100)	<i>Fucus vesiculosus</i> (<1), unidentified brpwn algae (<1)	rock crab (U)	holes for infauna, macroflora covered in silt
	1200-1250	09:06:46 - 09:09:46	silt (100)	<i>Fucus vesiculosus</i> (<1), unidentified brown algae (<1)	-	holes for infauna, macroflora covered in silt

Notes:

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- C= Common, numerous (not quantifiable) observations made in the field of view intermittently along the 50-m linear segment
- O= Occasional, quantifiable observations made in the field of view intermittently along the 50-m linear segment
- U= Uncommon, quantifiable observations made in the field of view infrequently along the 50-m linear segment
- V= Video file for Transect 1: CSR1806_Hypack 007_0745 - 007_0905

Table C2 - Benthic Habitat Characterization of Transect 2, Caribou Harbour, Caibou, NS - May 5, 2019 (Transect = 750 m)

Transect	Distance (m)	Time on Video	Location	Substrate (%)	Macroflora (%)	Macrofauna	Notes
T2	0-50	11:32:37 - 11:33:43	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (100)	-	substrate barely visible through thick eelgrass
	50-100	11:33:43 - 11:35:28	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (90)	sea star (U), rock crab (U)	-
	100-150	11:35:28 - 11:37:44	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (80), unidentified brown algae (<1), <i>Fucus</i> sp.	rock crab (U)	macroflora covered in silt
	150-200	11:37:44 - 11:40:09	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (60), unidentified brown algae (<1), <i>Fucus</i> sp. (>1)	rock crab (U)	holes for infauna, macroflora covered in silt
	200-250	11:40:09 - 11:43:33	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (40), unidentified brown algae (<1), <i>Fucus</i> sp. (>1)	-	holes for infauna, macroflora covered in silt
	250-300	11:43:33 - 11:45:53	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (30), unidentified brown algae (5), <i>Fucus spiralis</i> (<1)	rock crab (U)	holes for infauna, macroflora covered in silt
	300-350	11:45:53 - 11:49:41	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (50), unidentified brown algae (<1), <i>Fucus spiralis</i> (<1)	rock crab (U)	holes for infauna, macroflora covered in silt
	350-400	11:49:41 - 11:52:46	Pipeline Corridor	silt (100), cobble (<1)	<i>Zostera marina</i> (50), <i>Fucus</i> sp. (<1)	rock crab (U), scallop (U)	holes for infauna, macroflora covered in silt, scallop observed may just be the shell
	400-450	11:52:46 - 11:55:44	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (40)	-	macroflora covered in silt
	450-500	11:55:44 - 11:59:36	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (10)	rock crab (U)	holes for infauna, macroflora covered in silt, eelgrass beds stop in this section
	500-550	11:59:36 - 12:03:11	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (>1)	rock crab (U), American oyster (U)	holes for infauna, macroflora covered in silt
	550-600	12:03:11 - 12:06:04	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (<1), unidentified brown algae (<1)	rock crab (U)	holes for infauna, macroflora covered in silt
	600-650	12:06:04 - 12:11:22	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (<1)	rock crab (U)	holes for infauna, macroflora covered in silt
	650-700	12:11:22 - 12:14:03	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (<1), <i>Fucus vesiculosus</i> (<1)	-	holes for infauna, macroflora covered in silt
	700-750	12:14:03 - 12:16:55	Pipeline Corridor	silt (70), silty sand (30)	<i>Zostera marina</i> (<1), unidentified brown algae (<1), <i>Fucus vesiculosus</i> (<1)	hermit crab (U), scallop (U), rock crab (U)	holes for infauna, macroflora covered in silt, scallop observed may just be the shell

Notes:

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 - C= Common, numerous (not quantifiable) observations made in the field of view intermittently along the 50-m linear segment
 - O= Occasional, quantifiable observations made in the field of view intermittently along the 50-m linear segment
 - U= Uncommon, quantifiable observations made in the field of view infrequently along the 50-m linear segment
- Video file for Transect 2: CSR1806_Hypack 005_1132 - 005_1152 - 005_1212 - 005_1232

Table C3 - Benthic Habitat Characterization of Transect 3, Caribou Harbour, Caribou, NS - May 5, 2019 (Transect = 350 m)

Transect	Distance (m)	Time on Video	Location	Substrate (%)	Macroflora (%)	Macrofauna	Notes
T3	0-50	13:56:44 - 13:58:05	Reference	silt (100)	<i>Zostera marina</i> (70)	rock crab (U)	macroflora covered in silt
	50-100	13:58:05 - 13:59:57	Reference	silt (100)	<i>Zostera marina</i> (70), <i>Fucus spiralis</i> (<1)	rock crab (U)	macroflora covered in silt
	100-150	13:59:57 - 14:02:15	Reference	silt (100)	<i>Zostera marina</i> (60), <i>Fucus spiralis</i> (<1)	acorn barnacle (U)	macroflora covered in silt, rock with barnacles
	150-200	14:02:15 - 14:04:41	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (60), <i>Fucus vesiculosus</i> (<1)	-	macroflora covered in silt
	200-250	14:04:41 - 14:07:40	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (70), <i>Fucus spiralis</i> (<1), <i>Fucus vesiculosus</i> (<1)	rock crab (U)	macroflora covered in silt
	250-300	14:07:40 - 14:10:39	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (70), <i>Fucus spiralis</i> (<1)	rock crab (U)	macroflora covered in silt
	300-350	14:10:39 - 14:12:17	Pipeline Corridor	silt (100)	<i>Zostera marina</i> (60), unidentified brown algae (<1), <i>Fucus spiralis</i> (<1)	-	macroflora covered in silt

Notes:

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 - O= Occasional, quantifiable observations made in the field of view intermittently along the 50-m linear segment
 - U= Uncommon, quantifiable observations made in the field of view infrequently along the 50-m linear segment
- Video file for Transect 3: CSR1806_Hypack 041_1356

Table C4 - Benthic Habitat Characterization of Transect 4, Caribou Harbour, Caribou, NS - May 5, 2019 (Transect 3 = 450 m)

Transect	Distance (m)	Time on Video	Location	Substrate (%)	Macroflora (%)	Macrofauna	Notes
T4	0-50	12:16:55 - 12:20:04	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (60), unidentified brown algae (<1), <i>Cladophora rupestris</i> (<1)	American oyster (U), rock crab (U)	Oyster maybe just the shell and not alive
	50-100	12:20:04 - 12:23:26	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (60), unidentified brown algae (<1)	-	-
	100-150	12:23:26 - 12:25:39	Pipeline Corridor	silty sand (100), shell hash (<1), gravel (5)	<i>Zostera marina</i> (40), <i>Fucus spiralis</i> (<1)	-	-
	150-200	12:25:39 - 12:28:04	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (50), <i>Fucus vesiculosus</i> (<1)	-	-
	200-250	12:28:04 - 12:30:45	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (50), <i>Fucus spiralis</i> (<1)	rock crab (U)	-
	250-300	12:30:45 - 12:32:30	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (50), <i>Fucus spiralis</i> (<1)	-	-
	300-350	12:32:30 - 12:34:32	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (50), <i>Fucus</i> sp. (<1)	-	-
	350-400	12:34:32 - 12:36:38	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (40), <i>Fucus vesiculosus</i> (<1), <i>Fucus spiralis</i> (<1), <i>Cladophora rupestris</i> (<1)	rock crab (U), sand dollar (U)	-
	400-450	12:36:38 - 12:38:23	Pipeline Corridor	silty sand (50), sand (50), shell hash (<1)	<i>Zostera marina</i> (30), <i>Fucus spiralis</i> (<1), <i>Cladophora rupestris</i> (<1)	sand dollar (C)	transition to predominantly sand in this section

Notes:

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- U= Uncommon, quantifiable observations made in the field of view infrequently along the 50-m linear segment

Video file for Transect 4: CSR1806_Hypack 005_1132 - 005_1152 - 005_1212 - 005_1232

Table C5 - Benthic Habitat Characterization of Transect 5, Caribou Harbour, Caribou, NS - May 4, 2019 (Transect = 450 m)

Transect	Distance (m)	Time on Video	Location	Substrate (%)	Macroflora (%)	Macrofauna	Notes
T5	0-50	15:02:43 - 15:06:17	Pipeline Corridor	silty sand (100), shell hash (<1), gravel (<1)	<i>Zostera marina</i> (10), unidentified green algae (<1), <i>Rhodophyta</i> sp. (<1), <i>Fucus</i> sp. (<1)	sand dollar (U), rock crab (U)	eelgrass gets thicker towards end of section
	50-100	15:06:17 - 15:09:23	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (40)	American oyster (U), rock crab (U)	not possible to tell if oyster alive or just shell
	100-150	15:09:23 - 15:12:03	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (40), <i>Laminaria</i> sp. (<1), unidentified brown algae (<1)	acorn barnacle (U)	rock with barnacles
	150-200	15:12:03 - 15:16:28	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (50), <i>Fucus</i> <i>spiralis</i> (<1)	rock crab (U)	-
	200-250	15:16:28 - 15:21:26	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (50), <i>Fucus</i> <i>spiralis</i> (<1), <i>Rhodophyta</i> sp. (<1)	rock crab (U)	-
	250-300	15:21:26 - 15:25:28	Pipeline Corridor	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (60), unidentified brown algae (<1), <i>Fucus spiralis</i> (<1), <i>Rhodophyta</i> sp. (<1)	-	thick patches of eelgrass
	300-350	15:25:28 - 15:29:08	Reference	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (60), <i>Fucus</i> <i>spiralis</i> (<1), <i>Fucus vesiculosus</i> (<1)	-	-
	350-400	15:29:08 - 15:31:31	Reference	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (40), <i>Laminaria</i> sp. (<1)	-	-
	400-450	15:31:31 - 15:33:50	Reference	silty sand (100), shell hash (<1)	<i>Zostera marina</i> (40), unidentified brown algae (<1), <i>Laminaria</i> sp. (<1)	rock crab (U)	-

Notes:

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- Video file for Transect 5: CSR1806_Hypack 038_1453 - 038_1513 - 038_1533

Table C6 - Benthic Habitat Characterization of Transect 6, Caribou Harbour, Caribou, NS - May 4, 2019 (Transect = 650 m)

Transect	Distance (m)	Time on Video	Location	Substrate (%)	Macroflora (%)	Macrofauna	Notes
T6	0-50	10:47:45 - 10:51:29	Reference	sand (100)	-	sand dollar (A)	-
	50-100	10:51:29 - 10:55:52	Reference	sand (100)	-	sand dollar (A)	-
	100-150	10:55:52 - 10:59:55	Reference	sand (100)	-	sand dollar (A)	-
	150-200	10:59:55 - 11:03:20	Reference	sand (100)	-	sand dollar (A)	-
	200-250	11:03:20 - 11:07:31	Pipeline Corridor	sand (100)	<i>Laminaria longicuris</i> (<1)	sand dollar (A), rock crab (U)	-
	250-300	11:07:01 - 11:10:33	Pipeline Corridor	sand (100)	<i>Laminaria longicuris</i> (<1)	sand dollar (A), rock crab (U)	-
	300-350	11:10:06 - 11:14:19	Pipeline Corridor	sand (100)	<i>Laminaria longicuris</i> (<1), unidentified brown algae (<1)	sand dollar (A), rock crab (U)	-
	350-400	11:14:19 - 11:18:04	Pipeline Corridor	sand (100)	<i>Laminaria longicuris</i> (<1), <i>Fucus</i> sp.	sand dollar (A)	-
	400-500	11:18:04 - 11:21:59	Pipeline Corridor	sand (100)	<i>Laminaria</i> sp. (<1), <i>Fucus</i> sp. (<1)	sand dollar (A)	-
	450-500	11:21:59 - 11:26:09	Reference	sand (100)	-	sand dollar (A)	-
	500-550	11:26:09 - 11:30:36	Reference	sand (100)	-	sand dollar (A), rock crab (U)	-
	550-600	11:30:36 - 11:32:54	Reference	sand (100)	-	sand dollar (A)	-
	600-650	11:32:54 - 11:35:39	Reference	sand (100)	<i>Fucus vesiculosus</i> (<1)	sand dollar (A), rock crab (U)	-

Notes:

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 - O= Occasional, quantifiable observations made in the field of view intermittently along the 50-m linear segment
 - U= Uncommon, quantifiable observations made in the field of view infrequently along the 50-m linear segment
- Video file for Transect 6: CSR1806_Hypack 27P50 - 27P50_0001 - 27P50_0002

Table C7 - Benthic Habitat Characterization of Transect 7, Caribou Harbour, Caribou, NS - May 5, 2019 (Transect = 500 m)

Transect	Distance (m)	Time on Video	Location	Substrate (%)	Macroflora (%)	Macrofauna	Notes
T7	0-50	14:54:19 - 14:55:48	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria longicurvis</i> (<1)	blue mussel (C)	
	50-100	14:55:48 - 14:56:45	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria longicurvis</i> (<1)	blue mussel (C)	-
	100-150	14:56:45 - 14:58:36	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria</i> sp. (<1)	blue mussel (C)	-
	150-200	14:58:36 - 15:00:14	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria</i> sp. (<1)	blue mussel (C)	-
	200-250	15:00:14 - 15:01:59	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria</i> sp. (<1)	blue mussel (C)	-
	250-300	15:01:59 - 15:04:36	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria</i> sp. (<1), Rhodophyta sp. (<1)	acorn barnacle (U), blue mussel (C)	barnacles on rock
	300-350	15:04:36 - 15:06:15	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria longicurvis</i> (<1)	blue mussel (C)	camera higher up during this section; not as many blue mussels observed
	350-400	15:06:15 - 15:08:28	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria</i> sp. (<1)	rock crab (U), sand dollar (O)	blue mussel shells
	400-450	15:08:28 - 15:11:22	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria</i> sp. (<1)	rock crab (U), sand dollar (O)	blue mussel shells
	450-500	15:11:22 - 15:12:39	Reference	sand (60), gravel (30), shell hash (10)	unidentified brown algae (<1), <i>Laminaria</i> sp. (<1)	rock crab (U)	blue mussel shells

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Video file for Transect 7: CSR1806_Hypack 045_1453