Fisheries and Aquaculture
1575A Lake Rd
Sandy Point, Nova Scotia
B0T 1W0
novascotia.ca

Public Notice – Adjudicative Application Posted

These documents have been submitted with respect to four (4) New Marine Aquaculture Licence/Lease applications. The applications follow a Scoping period, during which the applicant collected information to support their applications. The information in these documents is provided as part of the routine disclosure of information by the Department of Fisheries and Aquaculture (NSDFA, the "Department"). Some information may be redacted as business confidential information or personal information.

These documents were provided to the Department by the applicant. The Department is not responsible for the content of these documents, including, but not limited to, the accuracy, reliability, or currency of the information contained within.

Adjudicative Application for a New Aquaculture Licence and Lease	
Applicant: Canadian Salmon Limited	**Species:** Atlantic salmon, Rainbow trout
Location: St. Mary's Bay, Digby County	**Method of Cultivation:** Marine Cage Cultivation
Application File Numbers: AQ#1449, 1450, 1451, 1452	**Application Received On:** February 18, 2022

To learn more about the marine aquaculture lease and license application process, please visit https://novascotia.ca/fish/aquaculture/licensing-leasing/Aqua-Licensing-and-Leasing-Overview.pdf

For information on the Nova Scotia Aquaculture Review Board, please visit https://arb.novascotia.ca/

Posting Date of this Notice: August 15, 2022

Please note that this application is being reviewed pursuant to the *Canadian Navigable Waters Act* by Transport Canada (TC). Written comments regarding the effect of this work on marine navigation may be submitted to Transport Canada as follows, for a period of 30 days following the posting date of this notice.

1. On line at : http://cps.canada.ca/ under the following Registry and NPP numbers:

NSDFA AQ#	TC Registry #	TC NPP File#
1449	5887	2022-206936
1450	5885	2022-206934
1451	5060	2022-206196
1452	5889	2022-206937

2. By Mail at: Manager
Transport Canada - Navigation Protection Program
P.O. Box 42, Moncton, NB E1C 8K6

Table of Contents (Page 1 starts after this table)

Document	Page(s)
Aquaculture Applications	1-12
Development Plan (February 17, 2022)	13-152
Appendix A: Farm Management Plan	Redacted
Appendix B: Canadian Salmon Ltd. Business Plan	Redacted
Appendix C: Financial Viability	Redacted
Appendix D: Maritime Region Fisheries Atlas: Catch Weight Landing Mapping from 2014-2018	153-229
Appendix E: AKVA Group Site and Equipment Plans	230-262
Appendix F: Outreach and Engagement Report	263-264
Appendix G: DSA Reports	265-360
Appendix H: Design Point Report	361-365
Appendix I: Definitions	366
Additional Information Submitted to NSDFA (April 14, 2022)	367-500
Standard Operating Procedures – Fish Health Management (August 2022)	501-518
Standard Operating Procedures – Delicing (August 2022)	519-526
Standard Operating Procedures – Counting and Reporting of Sea Lice (August 2022)	527-533
Additional Information Submitted to NSDFA (September 16, 2022)	534-657

NOVA SCOTIA

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Aquaculture Licence/Lease Application

Applicant Information:

Applicant: Canadian Salmon Limited Contact Person: Martin Karlsen

Nova Scotia Registry of Joint Stocks Number: 3327832

Revenue Canada Business Number: [redacted]

Telephone No. (Work): 9024492594 (Home): _____ (Cell): [redacted]

Fax No.: _____ E-mail: martinkarlsenhalifax@gmail.com

Mailing Address: 44 Bedford Highway

Halifax, NS Postal Code: B3M 2J2

Civic Address: 44 Bedford Highway

Halifax Postal Code: B3M 2J2

Proposed Site Information:

Location of Site: St. Mary's Bay County: Digby Site Size (Ha): 80

Site Dimensions: 1000m x 800 m

Hydrographic Chart No.: CHS4118

Approximate Center Coordinates: Latitude: 44°27.600'

Longitude: 66°4.900'

Type of Licence Application

(Check appropriate boxes):

- ☒ Commercial licence/lease
- ☐ Experimental licence/lease

- ☐ Marine Plants
- ☒ Finfish
- ☐ Shellfish
- ☐ Other

Submit completed applications to: **Nova Scotia Department of Fisheries and Aquaculture, Aquaculture Division**
1575 Lake Road, Shelburne, NS B0T 1W0
E-mail: aquaculture@novascotia.ca

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- ☐ Nursery Facility
- ☐ Growout

☐ Marine
- ☒ Cage culture
- ☐ Suspended shellfish or marine plants
- ☐ Bottom shellfish with gear
- ☐ Bottom shellfish without gear

Application Materials

A complete application includes the following:

- Application fee (payable to Minister of Finance) according to Section 77 of the Aquaculture Licence and Lease Regulations for Nova Scotia made under Section 64, Chapter 25 of the Acts of 1996, *the Fisheries and Coastal Resources Act*
- Application Form
- Development Plan according to application
- Report on Public Engagement during Scoping (for all Marine applications and for other applications, as applicable)
- Copy of up-to-date Shareholder's Register which sets out the shareholdings of the company (if applicable, and if not already provided during the Option to Lease application process.

Public Notice and Disclosure

As part of the process for deciding on an aquaculture application, the Nova Scotia Department of Fisheries and Aquaculture ("Fisheries and Aquaculture") will disclose application information to other government bodies, including, if applicable, the Nova Scotia Aquaculture Review Board for use at an adjudicative hearing relating to the application.

In accordance with departmental policy, which seeks to promote public involvement in the process for deciding on aquaculture applications, Fisheries and Aquaculture may disclose application information – not including, however, personal or business confidential information – on the departmental website.

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By signing and submitting this form, I acknowledge that I have read, understand, and accept the above statements regarding the collection, use, and disclosure of the information provided on this form.

Signature of Applicant [redacted]

Date 17.02.2022

Signature of Nova Scotia Department of Fisheries and Aquaculture Designate

Date

Submit completed applications to:

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1575 Lake Road, Shelburne, NS B0T 1W0
E-mail: aquaculture@novascotia.ca

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Fax No.: _____ E-mail: martinkarlsenhalifax@gmail.com

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Halifax, NS Postal Code: B3M 2J2

Civic Address: 44 Bedford Highway

Halifax Postal Code: B3M 2J2

Proposed Site Information:

Location of Site: St. Mary's Bay County: Digby Site Size (Ha): 80

Site Dimensions: 1000m x 800 m

Hydrographic Chart No.: CHS4118

Approximate Center Coordinates: Latitude: 44°26.164'

Longitude: 66°6.700'

Type of Licence Application

(Check appropriate boxes):

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Halifax, NS Postal Code: B3M 2J2

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Halifax Postal Code: B3M 2J2

Proposed Site Information:

Location of Site: St. Mary's Bay County: Digby Site Size (Ha): 80

Site Dimensions: 1000m x 800 m

Hydrographic Chart No.: CHS4118

Approximate Center Coordinates: Latitude: 44°22.915'

Longitude: 66°10.400'

Type of Licence Application

(Check appropriate boxes):

- ■ Commercial licence/lease
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☐ Marine Plants ■ Finfish ☐ Shellfish ☐ Other

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Civic Address: 44 Bedford Highway

Halifax Postal Code: B3M 2J2

Proposed Site Information:

Location of Site: St. Mary's Bay County: Digby Site Size (Ha): 80

Site Dimensions: 1000m x 800 m

Hydrographic Chart No.: CHS4118

Approximate Center Coordinates: Latitude: 44°19.606'

Longitude: 66°14.186'

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[redacted]

Date

17.02.2022

Signature of Nova Scotia Department of Fisheries and Aquaculture Designate

Date


GROUP
A-E-N
CONSULTING INC

CONTENTS

1 THE OPTIMUM USE OF MARINE RESOURCES 1

1.1 Importance of Salmon Aquaculture in Food Security 1

1.2 Canadian Salmon Limited 2

1.3 Proposed Site 3

1.4 Innovative and Sustainable Production Plan 3

1.5 Socio-Economic Benefits 4

1.6 Opportunity for Aquaculture in Nova Scotia 5

1.7 Closing Statement 5

2 COMMUNITY AND PROVINCIAL ECONOMIC DEVELOPMENT 7

2.1 Production plan 7

2.2 Market Plan 12

2.3 Infrastructure 13

2.3.1 Site Development Plan Linked to Infrastructure Requirements 13

2.3.2 Seawater On-growing Facility 14

2.3.3 Feed Barge 15

2.3.4 Service Vessels 15

2.4 Services and Suppliers 16

2.5 Employment 19

2.6 Other Economic Contributions to the Local Community and Province 20

2.6.1 Operational impacts 21

2.6.2 Construction Impacts 22

2.6.3 Observations 23

2.7 Financial Viability 24

2.8 Adverse economic impacts 24

3 FISHERIES ACTIVITIES IN THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION 28

3.1 Status of Fisheries Activities 28

3.1.1 Recreational Fishing Activity 28

3.1.2 Indigenous Fishing Activity 28

3.1.3 Commercial Fisheries Activity and Species Fished 29

3.1.4 Aquaculture Operations 33
3.2 Impacts on Fisheries Activities 35
3.2.1 Impact on Lobster Fisheries 35
3.2.2 Impact on Other Commercial Fisheries 38
3.3 Impacts Addressed Through Scoping/Engagement Process 39
4 OCEANOGRAPHIC AND BIOPHYSICAL CHARACTERISTICS OF THE PUBLIC WATERS 42
4.1 Oceanographic Environment 42
4.1.1 Maximum Wind Speed 43
4.1.2 Maximum Wave Height 47
4.1.3 Direction of Maximum Wave 51
4.1.4 Minimum Tide 51
4.1.5 Maximum Tide 51
4.1.6 Current Speed Range 51
4.1.7 Minimum / Maximum Salinity 53
4.1.8 Minimum / Maximum Temperature 54
4.1.9 Water Depth / Site Bathymetry 59
4.1.10 Ice Potential 61
4.2 Baseline Environmental Monitoring 63
4.3 Site Design 63
5 THE OTHER USERS OF THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION 68
5.1 Description of Other Users 68
5.1.1 Adjacent Property Owners 68
5.1.2 Pleasure Craft and Commercial Boat Traffic 71
5.1.3 Processing Plants (within 20 KM) 72
5.1.4 Public Parks and Campgrounds 74
5.1.5 Communities (Including Cottage Communities) 76
5.1.6 Municipal, Industrial and Agricultural Users Around St. Mary's Bay 77
5.1.7 Tourism or Recreational Operations 80
5.1.7.1 Aquaculture as Tourism Opportunity 85
5.1.8 Private and Public Wharves and Anchorages 86

5.1.9 First Nations Territories/Reserves 87
5.1.10 Pre-contact or Historical Archaeological Resource 88
5.1.11 Important Habitats and Conservation Areas 89
5.1.12 Other Known Potential Projects (confirmed or proposed) and Activities 91
5.1.13 Other Potential Users 91
5.2 Significance of proposed area to wildlife 92
5.3 Impacts to other users including wildlife 94
5.3.1 Other operations in the area 94
5.3.2 Wildlife listed in SARA or COSEWIC 95
5.4 Impacts by other users including wildlife 96
5.4.1 Boat Traffic 96
5.4.2 Fishery and Aquaculture Operations 96
5.4.3 Public Users of St. Marys Bay 97
6 THE PUBLIC RIGHT OF NAVIGATION 99
6.1 Navigation Protection Act approval 99
6.1.1 Notice of Works 99
6.1.2 Location Map 99
6.1.3 Legal Site Description and Work Position 101
6.1.4 Plan View Drawings (Top Down) 102
6.1.5 Profile View Drawings (Side View) 103
6.1.6 Project Description 105
6.1.7 Construction Methodology 105
6.1.7.1 Feed Barge Composition 108
6.1.8 Anticipated Start and End Dates 108
7 THE SUSTAINABILITY OF WILD SALMON 110
7.1 Identification of Local Salmon Populations 110
7.2 Support of the Sustainability of Wild Salmon 112
7.2.1 Mitigation of Impacts to Support Sustainability of Wild Salmon 112
7.2.2 Wild Salmon Recovery Efforts in St. Mary's Bay Area and beyond 116
8 THE NUMBER AND PRODUCTIVITY OF OTHER AQUACULTURE SITES IN THE PUBLC WATERS SURROUNDING THE PROPOSED AQUACULTURAL LOCATION 118

8.1 Identification of Other Aquaculture Sites 118
8.2 Interactions with Other Aquaculture Operations 120
8.2.1 Shellfish and Finfish Aquaculture 120
8.2.2 Fish Health and Welfare 120
8.2.3 Biosecurity Risks and Measures 122
8.2.4 Monitoring 124
REFERENCES 125
APPENDIX A: FARM MANAGEMENT PLAN 132
APPENDIX TO THE FARM MANAGEMENT PLAN 141
APPENDIX B: CANADIAN SALMON LIMITED BUSINESS PLAN 151
APPENDIX C: FINANCIAL VIABILITY 226
Haugland Gruppen AS 226
CSL Viability 228
APPENDIX D: MARITIME REGION FISHERIES ATLAS 235
APPENDIX E: AKVA GROUP SITE AND EQUIPMENT PLANS 312
APPENDIX F: OUTREACH AND ENGAGEMENT REPORT 345
APPENDIX G: DSA REPORTS 347
APPENDIX H: DESIGN POINT REPORT 443
APPENDIX I: DEFINITIONS 448

Tables

Table 1. Production Plan 9
Table 2. CSL's Expected Staffing Requirements 19
Table 3. Summary of Operational Impacts 22
Table 4. Summary of Construction Impacts 23
Table 5. 2020 Commercial Landings in Nova Scotia 29
Table 6. Aquaculture Sites in and around St. Mary's Bay 34
Table 7. Maximum wind speeds from MSC50 hindcast model 44
Table 8. 1 in 10 year extreme wind speed and significant wave height at southernmost site. 48
Table 9. 1 in 10 year extreme wind speed and significant wave height at northernmost site 49
Table 10. Current speed maximum recorded and averages for flood and ebb directions 53
Table 11. List of ADCP models with their deployment locations and dates 53
Table 12. Water depths at Sites 60
Table 13. Freeze-up and break-up dates for St. Mary's Bay as per weekly historic ice charts 62
Table 14. Nearby Landmarks, Wharfs and Towns 70
Table 15. Property Owners and Distance to the Site 70
Table 16. Number of Registered Fishing Vessels in Digby 71
Table 17. Processing Plants within 20 km of St. Marys Bay 72
Table 18. Campgrounds Near St. Marys Bay 74
Table 19. Cottages for Rent Near St. Marys Bay 77
Table 20. Industry Breakdown for the Municipalities of Digby and Clare 79
Table 21. Agriculture in Digby 80
Table 22. Harbour Authorities Around St. Mary's Bay 86
Table 23. List of Species at Risk, designated under SARA or COSEWIC as endangered, threatened, or vulnerable that inhabit NS or Atlantic waters 93
Table 24. Location Coordinates of Site 3 101
Table 25. Location Coordinates of Feed Barge for Site 3 102
Table 26. Aquaculture Sites in St. Marys Bay 118

Figures

Figure 1. Location map for the four proposed Canadian Salmon Limited sites in St. Mary's Bay ... 7
Figure 2. Production Plan ... 9
Figure 3. Feed Barge ... 15
Figure 4. Service Vessel ... 15
Figure 5. Growth by Industry in Nova Scotia and Canada ... 16
Figure 6. Heat Map of Groundfish Landings (2014-2018), Nova Scotia ... 31
Figure 7. Heat Map of Herring Landings (2014-2018), Nova Scotia ... 32
Figure 8. Heat Map of Scallop Landings (2014-2018), Nova Scotia ... 33
Figure 9. Aquaculture Site Map of St. Mary's Bay ... 35
Figure 10. Lobster catch and salmon production from 2000-2018 in Nova Scotia, New Brunswick, and Newfoundland ... 36
Figure 11: The St. Mary's Bay, Nova Scotia, Canada ... 43
Figure 12. Wind rose – 1 hour mean speed at 10m – Brier Island (2001-2020) – Annual ... 45
Figure 13. Wind rose – 1 hour mean speed at 10m elevation – Brier Island – October to March 46
Figure 14. Wind rose – 1 hour mean speed at 10m elevation – Brier Island – April to September ... 47
Figure 15. Southerly waves propagating into the bay ... 50
Figure 16. ADCP 3 during deployment ... 52
Figure 17. Expected variation in annual salinity in the outer Bay of Fundy ... 54
Figure 18. Variation in salinity during key months within inner St. Mary's Bay ... 54
Figure 19. Sampling temperature stations in St. Mary's Bay ... 55
Figure 20. Temperature data from 1979 to 2017 using ERA5 model ... 56
Figure 21. Temperature data from 2009 to 2021 using Satellite data ... 56
Figure 22. Long Beach temperature data from July 2020 to November 2020 ... 57
Figure 23. Long Island temperature data from January 2019 to May 2019 ... 57
Figure 24. Long Island temperature data from July 2020 to November 2020 ... 58
Figure 25. Long Island 2 temperature data from July 2020 to November 2020 ... 58
Figure 26. Sandy Cove temperature data from July 2020 to November 2020 ... 59
Figure 27. Bathymetry at site on hydrographic charts – Depth reported in meters ... 60
Figure 28. St. Mary's Bay (circled in black) was not well represented in the A) weekly ice chart (Eastern Coast), or B) daily ice ... 62
Figure 29. Leases within the bay ... 64
Figure 30. Surface ebb speed at the St.Mary's Bay (FVCom modeling results). ... 65
Figure 31. Subsurface containment net with weight ring to prevent deformation under currents ... 66
Figure 32. CSL Development Sites on the Northwestern Shore of St. Mary's Bay ... 68
Figure 33. Key Landmarks and Distance from Site 3 ... 70
Figure 34. CSL Development Site 1 ... 70
Figure 35. Map of Producers in St. Marys Bay Area ... 74

Figure 36. Campgrounds Near St. Marys Bay 76
Figure 37. Communities Around St. Marys Bay 77
Figure 38. Balancing Rock, Digby, NS 81
Figure 39. Hiking Trails Along the Coast of Nova Scotia 81
Figure 40. The St. Mary's Bay Trail System 82
Figure 41. Historical Lighthouses 83
Figure 42. Church Point Lighthouse 84
Figure 43. Composite View of Assets 86
Figure 44. Map of Nature Reserves and Conservation Areas 90
Figure 45. Aquaculture Sites Including Proposed Projects 91
Figure 46. Map of Full St. Marys Bay Operation 100
Figure 47. Map of Site 3 Location 100
Figure 48. Top Down View of Site 3 102
Figure 49. 3-D Side View of Net Pens 103
Figure 50. 2-D Side View 103
Figure 51. Anchoring System Plan 104
Figure 52. Net Containment System 104
Figure 53. Top Down Component View of Site 3 with Item List 106
Figure 54. Polarcirkel 500R Design 107
Figure 55. Salmon Fishing Areas in Atlantic Canada (DFO SFA) 110
Figure 56. Salmon Rivers, indicating LeHave 112
Figure 57. Number of registered escaped fish per year for 2001–2019 115
Figure 58. St. Mary's Bay Aquaculture Site Map 119

1 THE OPTIMUM USE OF MARINE RESOURCES

1.1 Importance of Salmon Aquaculture in Food Security

The world's appetite for fish and fish products shows no sign of slowing. Since 1990, global fish consumption has grown by 122%, and as a result, total production and trade in the fisheries and aquaculture sector has significantly expanded. However, since the early 1990s, capture fisheries production has remained relatively stable, despite the significant increase in fish consumption. Aquaculture is meeting that demand, with an increase in production of 527% in the past 30 years (FAO, 2020).

The main reason for the stagnant catch levels by capture fisheries is because the percentage of fish stocks within biologically sustainable levels have decreased from 90 percent in 1974 to 65.8 percent in 2017. It seems unlikely that the world's fisheries can rebuild, in the very near future, the 33.1% of stocks that are currently overfished (FAO, 2020).

Salmon is an exceptional source of digestible protein, essential fatty acids and amino acids, micronutrients (e.g., iron and zinc) and vitamins (for example, B12; Golden et al. 2021; Colombo and Mazal, 2020). They are well known for their high omega-3 fatty acid content, especially EPA and DHA, which are critically important for human neurological and cardiovascular health. Atlantic salmon is one the most successfully farmed fish, which means there is a high potential for growth as the demand for sustainably produced food increases.

In terms of resource use, compared to other animal-sources of protein, farmed salmon are actually a net producer of fish protein and essential fats (Campton et al. 2010), meaning they use less resources to produce more nutrients for us to consume. Fish are extremely efficient in converting feed into high quality protein, with a 1:1 feed to gain ratio, compared to 1.7 for poultry and 6.6 for cattle. Salmon also have a very high harvest yield, meaning the proportion of edible meat is high related to the whole fish. This highlights the important role of the efficiency and sustainability of farmed salmon to help solve the global nutrition security issue we are faced with a growing population.

Canada is the world's fourth-largest producer of farmed salmon globally, after Norway, Chile and the UK (Canadian Aquaculture Industry Alliance, 2020). Salmon is Canada's top aquaculture export which accounts for 90 per cent of volume and value of total finfish produced by Canada's aquaculture industry (Statistics Canada, 2021). In 2019, the industry produced 118,630 metric tons of salmon, valued at approximately $914 Million CAD (Statistics Canada, 2021). The industry also provides local employment opportunities in rural, coastal communities and contributes to the rural economy and tax base. On the Atlantic Coast, salmon farming employs over 8,000 workers; an estimate that is expected to increase to approximately 10,400 with future growth in the sector (RIAS Inc., 2020).

Over the past 30-40 years, salmon aquaculture has evolved tremendously regarding technology and farm operations. Issues that were a concern in the 1990s are no longer relevant, preventable, or are easily resolved. For example, net technology has significantly decreased escape risks, feed formulations and feeding systems have reduced waste and improved nutrient utilization, artificial intelligence systems have been developed to improve fish welfare, reduce handling, and improve worker safety, etc. These innovations will continue to evolve and new technologies that are developed and adopted in the sector will further improve the sustainability and efficiency of salmon production.

At a time when climate change and green house gas emissions is front of mind, aquaculture's performance on that front is significantly less than other terrestrial farm operations. Globally, food production accounts for one-quarter of all greenhouse-gas emissions. Some forms of farmed aquatic foods have lower greenhouse gas emissions and environmental effects than industrial crop and livestock production (Gephart et al. 2021). Farmed fish provide opportunities to reduce the environmental footprint of animal protein (compared with terrestrial animal production), based on studies that have reviewed of land use and carbon footprints from life cycle assessments of animal food products (Gephart et al. 2021). Aquaculture already has great potential for reducing food system environmental stressors. Farmed finfish aquaculture outperforms industrial chicken production which is the most efficient major terrestrial animal-source food. Salmon and trout have the lowest freshwater use compared to any other fish species (Gephart et al. 2021).

Furthermore, traceable, nutritious, sustainable seafood, wild caught or aquaculture produced is paramount to food production. Another serious problem may be illegal, unreported, and unregulated fisheries exploitation at sea, which has linked to the decline and impending collapse of the North Atlantic salmon, as reviewed in a recent Canadian study (Dadswell et al. 2021). Aquaculture is a responsible use of our resources to legally supply seafood and reduce the demanding pressure to augment catches through illegal fishing, that are harmful to wild fish populations.

Aquaculture provides a consistent, safe, traceable, and sustainable source of seafood that is produced in a controlled environment, to provide a nutritious food source for Canadians. Nova Scotia has a unique opportunity to be a leader in salmon aquaculture in Canada, to participate in a global strategy to achieve food and nutritional security, using our marine resources sustainably and effectively.

1.2 Canadian Salmon Limited

The proposed aquaculture sites in St. Mary's Bay will be owned and operated by Canadian Salmon Ltd. Project principal and industry veteran, Martin Karlsen, together with Haugland Gruppen of Norway, formed Canadian Salmon Ltd. as a sustainable, innovative, environmentally conscious salmon operation. Balancing eco-efficiency with technological advancements, the

project aims to build on the already vibrant sector and further enhance the soio-economic impact of aquaculture in the region.

Considering the importance of aquaculture to future global sustainable food security, CSL's approach is on doing it right, modelling strong environmental practices and relying on science, evidence and data. Company principals have a history of involvement in highly successful family-run, multi generational fisheries and aquaculture operations in Nova Scotia and internationally

This application documents CSL's approach to this development and the values it brings to this proposed aquaculture farm. These include:

- First and foremost, support for the strong regulatory structure Nova Scotia has put in place to mitigate and manage risk in building a sustainable aquaculture industry in Nova Scotia.
- Taking a slow, steady developmental approach to the farm – start with one site, get to know the area and farming conditions and do it right.
- Leveraging CSL's partners' deep experience in aquaculture development, operations that are focused on a modern, innovative approach to aquaculture development that models best practices and advances in lock-step with the evolution of the industry globally.
- Focusing on building the 'local' value chain and a commitment to optimizing local economic benefits.

CSL believes that Nova Scotia is well positioned to create an industry cluster around aquaculture, supporting the further development of the supply chain and the overall value chain the sector brings.

1.3 Proposed Site

The region of St. Mary's Bay offers a protected zone where significant storm activity, such as waves and wind, are blocked to some extent by the Digby Neck land peninsula. The met-ocean conditions (significant wave height, etc.) are less than other sites which are routinely operated in the Maritimes. This is beneficial for CSL's operation for safety reasons, as well as preventing negative impacts on the operation's infrastructure and equipment, such as the risk of escaped salmon. The site is not within close proximity of returning wild salmon populations or other at-risk species that congregate within St. Mary's Bay specifically to feed or reproduce.

1.4 Innovative and Sustainable Production Plan

CSL is proposing a smaller operation compared to other salmon producers in Canada and in the region. We propose to start with a low density to begin (10-25 kg/m^3) and somewhat smaller cages than industry standard. This is approximately 50,000-60,000 fish/cage, with 12 cages at the first site. The most aggressive (typical) salmon farm contains up to 150,000 salmon per cage.

Smaller cages will ease the farm operation and reduce operational risks. Low density will help to ensure minimal impacts on other users of St. Mary's Bay and on the surrounding ecosystem.

Our operation, proposed to start with only one cage site at low density, will be low impact and low risk to other users (e.g., aquaculture or fishing operations, tourism, public use), wildlife, and the ecosystem. In fact, our operation will use state-of-the-art technology and innovations to ensure minimal impacts on surrounding species and the environment. For example, the latest mooring grid and pen design will be used (e.g., high-density polyethylene mesh and stainless steel wire, coupled with frequent net and equipment inspections). This technology significantly minimizes the risk of salmon escaping their pen. Also, the feed system to be utilized is state-of-the-art, and is integrated with cameras and sensor systems, which significantly improves feed efficiency and prevents over feeding and waste nutrient load in the surrounding waters. The latest feed formulations will be used, with new innovations like prebiotics and antioxidants, which help reduce the need for antibiotics and optimize salmon health.

Good practices with focus on fish health and welfare not only mitigate risk for any health issues on farm, but also support healthy animals on other aquaculture operations within the vicinity. We will strictly follow the Code of Practice for the Care and Handling of Farmed Salmonids and will have detailed standard operating procedures for fish health and welfare, such as biosecurity, fish health assurance, health management plans, and mitigation and treatment of pests and pathogens. We plan to have an integrated approach with other aquaculture operations to coordinate and effectively optimize our efforts.

1.5 Socio-Economic Benefits

The level of operational and construction employment demand, particularly in Digby NS, is very significant and should be encouraging to residents, municipal, and provincial leaders alike, including those tasked with providing career services. The Digby region already has an active aquaculture supply chain and CSL's added demand on this supply chain will diversify the customer base, while the increase in demand may have a catalytic impact on up-scaling this supply chain. Investments of over [redacted] province-wide, are anticipated with the majority of this investment focused on capital and supporting infrastructure supplied from Digby/South-West Nova Scotia. This Site application is for 4 sites in St. Mary´s Bay and the attached Business plan addresses includes the development / installments of these 4 sites. The Business plan also partly covers investments in processing facilities, a hatchery, well-boat, post smolt facility and value-added processing facility primarily to cover the immediate needs for the St. Mary´s Bay development. Over time, the goal is to build an efficient, complete and well-balanced value chain including -processing facilities, hatchery, smolt- /post smolt facility and a value-added processing facility over an 8–10-year horizon. Beyond fish farming, CSL is committed to building the industry in ways that will enhance the aquaculture innovation ecosystem and innovation quotient in Nova Scotia.

1.6 Opportunity for Aquaculture in Nova Scotia

Aquaculture supplies over 50% of our seafood. We can no longer fully source our nutritional needs solely from capture fisheries; the future will demand both forms of production for global food security. Salmon aquaculture has evolved considerably in the past decade. The challenges that the industry faced 10-20 years ago have largely been addressed as a result of innovative technology and effective farm operations that are rooted in a science-based foundation. With Nova Scotia becoming well known nationally and internationally as the 'ocean-tech hub', it aligns perfectly with the efficient and sustainable salmon production in the province alongside ocean-tech innovators. This is an industry of the future that will continue to evolve, and Nova Scotia has an opportunity to lead a science-based, and environmentally conscious approach to sustainably producing highly nutritious food.

1.7 Closing Statement

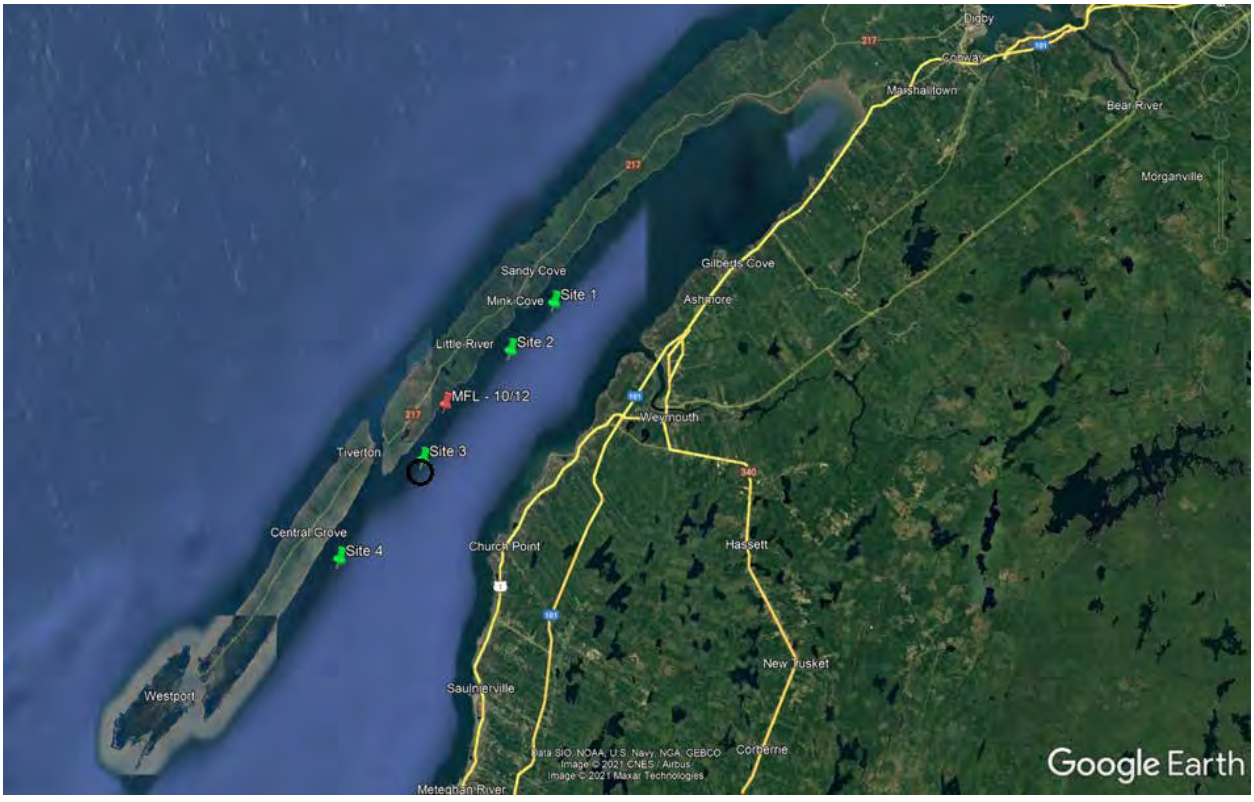
In a world that is faced with many challenges, like climate change and global pandemics, Nova Scotia has an opportunity to be resilient and self-sustaining to achieve food security (regionally, nationally, and potentially beyond) by using our ocean resources effectively. The operation we are proposing is a sustainable use of our coastline, with low (minimal) risks and impacts, and significant opportunity and benefits (social, economic and environmental) for our region.

2 COMMUNITY AND PROVINCIAL ECONOMIC DEVELOPMENT

This section of the application addresses the financial and operational impacts of the proposed farm development over the first five years of its operation. CSL is taking a developmental approach in its proposed aquaculture activities in Nova Scotia, focusing on development of the site associated with its Option Agreement and earning social license through exemplary performance as it relates to corporate social responsibility, environmental practices, the level of innovation, the local economic benefits generated and its openness and transparency.

This will involve utilizing its knowledge and applying the majority partner's practiced approach to innovation that has made its Norwegian farms so successful.

Over time, the goal is to build an efficient, complete and well-balanced value chain including - processing facilities, hatchery, smolt- /post smolt facility and a value-added processing facility over an 8–10-year horizon. As the operation grows and scales, CSL will explore further valued-added opportunities.



2.1 Production plan

In support of this version, our production plan includes the following key features:

- **Species and strain (if applicable):** Atlantic Salmon (*Salmo salar*), Saint John River strain.
- **Maximum site biomass (kg)**: The maximum will be approximately 5,000-6,000 metric tons (5,000,000 – 6,000,000 kg), eventually resulting in annual output of about 6,000 – 7,000 metric tons (7,000,000 kg), head on gutted salmon. However, first harvest is expected to be lower, at approximately 2,500 metric tons (2,500,000 kg).
- **Maximum cage density (kg/m^3)**: 25 kg/m^3 would be the maximum; however, initial density in the exploration phase will be 10-20 kg/m^3.
- **Expected time to achieve maximum production**: 3 to 4 years.
- **Size(s) of cages, including net volumes (m^3)**: CSL will use circular cages constructed of PEH-pipes. The anchoring system allows for using cages / rings with diameter up to 50 m in diameter (Ø160m) which has become an industry standard. Smaller rings with diameter 38 – 41 m (Ø120 – 130m) will be installed on the first site as these are easier to handle until crews are more experienced. These rings will gradually be replaced by larger rings if the natural environment (current) allows for it, and as necessary crew-experience has been achieved and necessary equipment is available. Considering the use of nets with average depth of 15 m these rings represent a total net volume of approximately 200,000 – 360,000 m^3 per site (12 rings).
- **Maximum cage number, maximum total net volume (m^3)**: We will operate 12 cages per site, with a maximum total net volume of 240,000 m^3.
- **Maximum number of fish per cage**: The maximum will be 80,000 – 125,000 fish/cage depending on cage size; however, initial stocking will be 40,000-50,000 fish/cage for Site 3.
- **Intended initial stocking date and seed source**: Initial stocking of first site is targeted for May 2023, with the seed source as Saint John River strain/smolt, from contract rearing producer.
- **Expected grow out period**: 10 to 18 months in salt water depending on smolt size and timing of stocking.
- **Expected fallow (regeneration) period**: 1-3 months according to SOP agreed with veterinarian provider.

This production plan information is understood to be based upon the information available at the time of the application. In future years, the actual numbers stocked may be higher or lower than the projections and will be determined by operational performance outcomes experienced at the site, including, but not limited to, environmental monitoring and fish health. Other production plan requirements, such as maximum cage numbers and fallow period, will be similarly determined for future years.

The production plan is illustrated in Figure 2 below.



Figure 2. Production Plan

The production plan varies over time, beginning with a limited smolt stocking of 500,000 fish at Site 3 in April/May 2023, followed by another stocking of 720,000 smolts per site at each of Sites 1, 2 and 4 in April 2024.

The overall production activity is shown in the following tables to May 2027. This reflects the staggered development of the sites, beginning with Site 3 in the spring of 2023, and production at Site 1, 2 and 4 added in the spring of 2024. The period includes five smolt introductions and four harvests as explained below.

The first harvesting and fallowing period runs from December 2024 until March 2025. Harvesting takes place in November / December 2024 with an expected biomass of 2.5 million kgs at the end of the month (EoM). The next smolt stocking is planned for April 24 and sees the stocking of 2.16 million smolts. The second harvest and fallowing period occurs in August / September 2025. The following table provides the details with respect to:

- The number of fishes (pcs) at the end of the month (EoM),
- The average weight at EoM in grams per fish (g/pcs),
- Total biomas weight at EoM (metric tons),
- Mortality counts,
- Growth per month in (metric tons); and
- Feed used per month in (metric tons).

Table 1. Production Plan

Production Plan Canadian Salmon Ltd.												
	St. Mary's Bay Site 3						St. Mary's Bay Site 1, 2 & 4 combined					
Month	No. fishes EoM (pcs)	Av. Weight EoM (g/pcs)	Total bio-mass EoM (mt)	Mort-ality counts (pcs)	Growth month (mt)	Feed mth (mt)	No. fishes EoM (pcs)	Av. Weight EoM (g/pcs)	Total bio-mass EoM (mt)	Mort-ality counts (pcs)	Growth month (mt)	Feed month (mt)
Jan 23	Preparation, site installation											
Feb 23												
Mar 23	Stocking 23-6: 500.000 pcs / 120 g											

Apr 23	500,000	120	60									
May 23	499,250	234	117	750	57	71						
Jun 23	498,150	352	175	1,100	59	73						
Jul 23	497,000	525	261	1,150	86	107						
Aug 23	495,756	826	409	1,244	149	186						
Sep 23	494,537	1,181	584	1,219	175	218						
Oct 23	493,367	1,577	778	1,170	194	242						
Nov 23	492,267	1,800	886	1,100	108	135						
Dec 23	491,148	2,032	998	1,119	112	140	Preparation, site installation					
Jan 24	490,148	2,250	1,103	1,000	105	131						
Feb 24	489,138	2,446	1,196	1,010	94	117						
Mar 24	488,118	2,600	1,269	1,020	73	91	Stocking 1/1 of 24 - G: 720.000 pcs / 200 g each site					
Apr 24	487,099	2,732	1,331	1,019	62	77	2,160,000	200	432	-		
May 24	485,969	2,900	1,409	1,130	79	98	2,156,400	328	706	3,600	274	343
Jun 24	484,850	3,074	1,490	1,119	81	101	2,151,120	493	1,060	5,280	354	442
Jul 24	483,744	3,362	1,626	1,106	136	170	2,145,600	735	1,577	5,520	517	646
Aug 24	482,556	3,719	1,795	1,188	168	210	2,139,629	1,156	2,474	5,971	897	1,122
Sep 24	481,356	4,264	2,053	1,200	258	322	2,133,778	1,594	3,402	5,851	928	1,160
Oct 24	480,236	4,716	2,265	1,120	212	265	2,128,162	2,129	4,531	5,616	1,129	1,411
Nov 24	479,046	5,218	2,500	1,190	235	294	2,122,882	2,520	5,350	5,280	819	1,024
Dec 24	Harvest 23-G / Fallowing						2,117,510	2,845	6,024	5,371	674	843
Jan 25							2,112,710	3,150	6,655	4,800	631	789
Feb 25							2,107,862	3,424	7,218	4,848	563	704
Mar 25	Stocking 1/1 of 25-G: 2.160.000 pcs / 300 g						2,102,966	3,640	7,655	4,896	437	546
Apr 25	2,160,000	300	648				2,098,075	3,825	8,025	4,891	370	462
May 25	2,156,400	459	989	3,600	341	426	2,092,651	4,060	8,496	5,424	471	589
Jun 25	2,151,120	665	1,431	5,280	442	553	2,087,280	4,304	8,983	5,371	487	608
Jul 25	2,145,600	992	2,129	5,520	698	872	2,081,971	4,707	9,799	5,309	817	1,021
Aug 25	2,139,629	1,561	3,340	5,971	1,211	1,514	Harvest 24-G/ Fallowing					
Sep 25	2,133,778	2,152	4,593	5,851	1,252	1,566						
Oct 25	2,128,162	2,874	6,117	5,616	1,524	1,905						
Splitting 25-G from Site 3, stocking equally into Site 1,2,3 & 4												
Nov 25	530,721	3,402	1,806	1,320	276	345	1,592,162	3,402	5,417	3,960	829	1,036
Dec 25	529,378	3,840	2,033	1,343	228	284	1,588,133	3,840	6,099	4,028	683	853

Jan 26	528,089	4,253	2,246	1,289	213	266	1,584,266	4,253	6,737	3,867	638	797
Feb 26	526,853	4,623	2,436	1,235	190	237	1,580,560	4,623	7,307	3,706	570	712
Mar 26	Harvest 1/4 of 25 - G / Fallowing						Harvest 3/4 of 25 - G / Fallowing					
Apr 26	Stocking 1/4 of 26-G: 720.000 pcs / 400 g						Stocking 3/4 26-G: 720.000 pcs / 400 g each site (1/4)					
May 26	720,000	400	288				2,160,000	400	864			
Jun 26	719,100	560	403	900	103	128	2,157,300	560	1,208	2,700	308	385
Jul 26	717,780	841	604	1,320	201	251	2,153,340	841	1,811	3,960	603	754
Aug 26	716,400	1,177	843	1,380	240	299	2,149,200	1,177	2,530	4,140	719	898
Sep 26	714,907	1,648	1,178	1,493	335	419	2,144,722	1,648	3,535	4,478	1,005	1,256
Oct 26	713,444	2,143	1,529	1,463	351	438	2,140,333	2,143	4,587	4,388	1,052	1,315
Nov 26	712,022	2,786	1,984	1,422	455	568	2,136,066	2,786	5,951	4,267	1,364	1,705
Dec 26	710,675	3,482	2,475	1,347	491	614	2,132,024	3,482	7,424	4,042	1,473	1,841
Jan 27	709,402	4,353	3,088	1,273	613	767	2,128,207	4,353	9,264	3,818	1,840	2,300
Feb 27	708,204	5,006	3,545	1,198	457	572	2,124,613	5,006	10,636	3,593	1,372	1,715
Mar 27	Harvest 1/4 of 26 - G / Fallowing						Harvest 3/4 of 26 - G / Fallowing					
Apr 27												
May 27	Stocking 27-G: 720.000 pcs / 450 g						Stocking 27-G: 720.000 pcs / 450 g					
Thereafter: parallel harvesting, fallowing and stocking of each site witin 12 month cycles.												

Significant milestones / actions include the following:

- The first smolt stocking occurs in April, 2023 with 500,000 smolts deposited at Site 3.
- The second smolt stocking occurs on April 2024 with a combined 2,160,000 smolts stocked in Site 1, 2, and 4.
- The first harvest at Site 3 is planned for December 2024 with an estimated weight of 2,499,662 kgs (2500 tons).
- The third smolt stocking at Site 3 occurs in April 2025 with the stocking of 2,160,000 smolts.
- The second harvest occurs at Sites 1, 2, and 4 in August 2025 with a biomass of 9,799,422 kgs (9,800 tons); and
- Splitting of the third salmon-generation (25-G) occurs in October / November 2025 where the approximate 2,128,162 fish are split across all 4 sites to adjust for the staggered start and redistributes the number of fish in the cages in order to have the same numbers/volume of fish in each site (stocked at 530,721 fish per site in November 2025).

The Farm Management Plan is included in **Appendix A**. In support of this document, operational *Codes of Practice* (including site Standard Operating Procedures) are under development in consultation with DFA veterinarians, and will be shared by June 1st, 2022.

2.2 Market Plan

Global events over the past two years have illuminated the vulnerability of many sectors to disruptions in market access. While disruptions may be short term or episodic, we have seen the impact on the area's lucrative lobster fisheries which were significantly disrupted by COVID-19 for the 2019/2020 season. Leading up to the start of the 2021/22 season affordable access to bait has been reported as a major issue by some harvesters.

This contributes to the case for greater sectoral diversification and is a selling feature of the growth of the aquaculture sector in the area. In particular, CSL's parent company provides a significant advantage in that they already have established global market channels and access for their aquaculture products. It is this earned experience that sets the course for CSL to focus on moving whole head on gutted (HOG) salmon directly to customers, mainly throughout North America, but also, over time, to export markets beyond North America. Moving HOG fish offers CSL the highest potential yield in the near term, until production reaches a level where more value-added opportunities exist.

Farmed salmon is very attractive in many advanced markets due to its health benefits (Omega 3, vital amino acids etc.), traceability and regularities in supplies and tastefulness. The North American salmon market is sourcing substantial amounts of fresh salmon from Chile, Norway, Iceland and Faroe Island in addition to supplies from North American producers.

The short distances from Nova Scotia to the larger North American market can be a competitive advantage considering lead time to market, cost of transport, and environmental impacts.

CSL's HOG fish can reach major distribution nodes throughout North America with 24 hours of harvest, so that high-value fresh (never frozen) meat reaches value added processors, restaurant wholesalers, and major retail chains. The distance to major North American markets is one of the site's principal advantages as a significant portion of competing product comes from abroad and is, to a large extent, typically frozen. Existing Canadian salmon producers have leveraged the geographical advantage of producing prime products relatively close to strong markets.

As a high-value fresh product, the price is expected to range between CDN$10 to $12 per kilogram, based on a scan of current spot price per kg HOG salmon. This price level is also expected to be stable and even strengthen going forward due to favorable balance in the supply and demand for farmed salmon in the foreseeable future.

CSL fish will be distributed by truck from the company's future packaging facility in South West Nova Scotia and moved to distribution markets throughout eastern North America.

After first product distributions have been made, CSL will seek customer feedback as part of its quality assurance and product evaluation efforts based on a corporate policy of continuous process and product improvement.

2.3 Infrastructure

Canadian Salmon Limited is focused on the development of sustainable and fully integrated salmon farming activities in Nova Scotia. Over time, this encompasses a value chain reaching from the hatching of salmon eggs to sales and distribution of ready- to- eat salmon products.

The Canadian Salmon Limited Business Plan, included in **Appendix B**, outlines the full development over that 8-10-year horizon. As noted, CSL is taking a developmental approach to its proposed aquaculture farming operations within the area of its Option Agreement. The development plan is to gradually build knowledge in respect to farming conditions in the area and leveraging this knowledge to reduce the risk of unexpected incidents and set backs in the production phase. CSL will take an enterprise risk management approach to this development, including the development, maintenance and regular updating of a risk register.

These investments, considering annual operations, as well as site work / construction / capital investment necessary to provide the supporting infrastructure (for initial and subsequent site development in the Option Agreement area) create beneficial economic impacts on the St. Mary's Bay area and, indeed, the Province. In addition to the economic impact of annual processing, supply chain and workforce impacts, these include development of:

- A proposed hatchery, eventually including a post smolt facility.
- Farm sites within the area encompassing the Option Agreement; and
- Feedbarge / vessel(s) construction/acquisition.

Infrastructure investment is an important part of developing the fully integrated value chain as detailed in this section of the application document.

CSL's approach to infrastructure investment is to utilize local supply chain partners wherever possible.

2.3.1 Site Development Plan Linked to Infrastructure Requirements

The site development plan will drive the construction and infrastructure investment requirements. To be undertaken over a period of three years, the following outlines the phased development timeline:

1. **Phase 1/Year 1**: One site is fully installed (site 3). This involves establishing a fully equipped salmon production facility at sea, including a feeding barge, anchoring system and cages. Expected production of 2,500 metric tons per site. Servicing this site will require one 15-18 m service boat. This can take place within 3-6 months of license being granted with smolt being obtained from an existing producer.

- Open plastic pens – sizes using high density plastic, stainless steel fastenings and net mesh customized to the area conditions.
- Feeding barge with storage capacity of 250-500 tons – the size of the barge will depend on logistics like distribution systems for feed, among other factors.
- Polarcircle (120-160M) cages – 12 per site
- Circular cage (constructed of PEH-pipes, stainless steel fastenings) approximately 38 - 50 m in diameter
- Potential temporary processing facility – if external services are not available
- Onshore base to hold vessels and equipment

2. **Phase 2/Year 2**: Three more sea-based salmon production sites (1, 2 and 4) fully installed and equipped, including with feeding barges.
3. **Phase 3/Year 3**: Acquisition of an appropriately sized wellboat.
4. **Phase 4: Smolt production and hatchery**: Designed to positively enhance the timeline for development if smolt from external suppliers is not available in sufficient qualities and quantities..

    - Will be based on newest recirculation technology for production of smolt in freshwater phase
    - Annual production of 3,000,000 smolts between 80-120 g

5. **Phase 5:** Post smolt production. Processing/harvesting facility.

    - Smolts from 80-120 g up to 500-1000 g initial stocking size ("post smolt")
    - Based on newest and best technology within this type of production
    - To commence after salmon and smolt productions are in operation
    - Done in one or two steps – either build complete capacity, or start with half and replicate once module is tested and proven
    - Planned capacity is approximately 3,000,000 post smolt/year
        - Allows for expansion or future sale of post smolt
        - Location to be expansion to the smolt facility or close to avoid unnecessary cost and any environmental impacts (reduction of GHG emissions for transport). Extensive transport can have a negative impact on quality of smolt

2.3.2 Seawater On-growing Facility

The sea-water on-growing sites will primarily consist of floating circular cages. The circular cage rings will be constructed using the latest technology for cage construction, providing sufficient buoyancy for holding salmon nets and other containment equipment. The diameter of a single ring is up to 50 m. The corresponding net can have a depth of 15 to 20 m, which will contain 30 - 40,000 m^3 of seawater. These nets can support the feeding and nursing of up to 500 metric

tons of live salmon per net. The net allows for the exchange of seawater and provides a continuous flow of fresh seawater and oxygen for optimal fish health.

2.3.3 Feed Barge

The feed barge will contain automated feeding machines which automatically provides feed to the salmon. It will also hold feed-storage, a site office or control room, and crew facilities to allow crew to live and work on site for a period if required.

The feed barge will utilize the best current technology, including underwater video scanning using remote cameras for monitoring and adjusting the feeding of salmon. As the operation grows and scales, the live video scanning will be transferred directly to a control center where operators can adjust the feeding through on-line control of the site feeding system. In addition, a backup feeding control system will provide another layer of protection through inspection of the flow of wastes pumped from the bottom of the nets by on-site operators who can adjust the feeding machine at site if there are traces of un-eaten feed pellets in the waste. Finally, the daily feed consumption will be checked against theoretical calculations based on several factors including temperature and light-duration.



Figure 3. Feed Barge

2.3.4 Service Vessels

Over its phased development, CSL will require a number of vessels.



Figure 4. Service Vessel

GETTING IT RIGHT FROM THE OUTSET

The latest mooring grid and pen design will be used to prevent escapes, e.g., high-density polyethylene mesh and stainless steel wire, and the use of frequent net and equipment inspections. The mooring grid and pen design will be provided by AKVA group, a global technology and service partner that deliver technology and services that helps solve biological challenges within the aquaculture industry. The net pen design follows the requirements stated in the Salmonid Code of Practice (2021) for rearing system and unit design (pg. 12). Routine inspections of containment and mooring systems will be conducted according to AKVA specifications and protocols for inspection. Therefore, the risks of escapes are significantly reduced due to improved net technology, which include nets that are composed of high-density polyethylene mesh and stainless steel wire, and the use of frequent net and equipment inspections.

Section 7.2.1 of this document

Initially, a service vessel will be required for the first phase development to service the seawater site facilities. This vessel will have a large deck for transporting feed and equipment as well as cranes to handle the nets and other large on-site equipment, both during and post construction and to support the development of subsequent phases. Wherever possible, it is CSL's intention to source required vessels locally. Advance discussions have been undertaken with potential suppliers who have enthusiastically endorsed these potential partnerships.

Other vessels that will be required through the phases noted above include:

- **Working vessels** – smaller vessels up to 15 m long and 8 m wide – used for anchoring the pens and feeding stations, putting out nets, changing and washing the nets, various inspections and to support feeding operations.
- **Well-boat** – live fish carrier – needed to transport smolt (or post smolt), treating fish, transport grown-out fish from pens, among other uses.
    - It is anticipated that the well-boat will be rented in the beginning.
    - As the operation evolves, a specialized vessel for on-site processing may be used instead for transporting grown-out fish.

2.4 Services and Suppliers

Sustainable supply chains are a critical success factor in aquaculture, enabling operators to effectively and consistently assure food safety and quality while optimizing social and economic impacts.

Foundational to successful aquaculture operations are four main supply chain components:

- Seed and smolt supply,
- Production/processing,
- Distribution/logistics; and
- Market.

CSL has completed an economic impact assessment of its proposed operations. A key objective in CSL's phased approach is focusing, wherever possible, on utilizing and enhancing the local supply chain across all supply chain components. As Nova Scotia's aquaculture sector

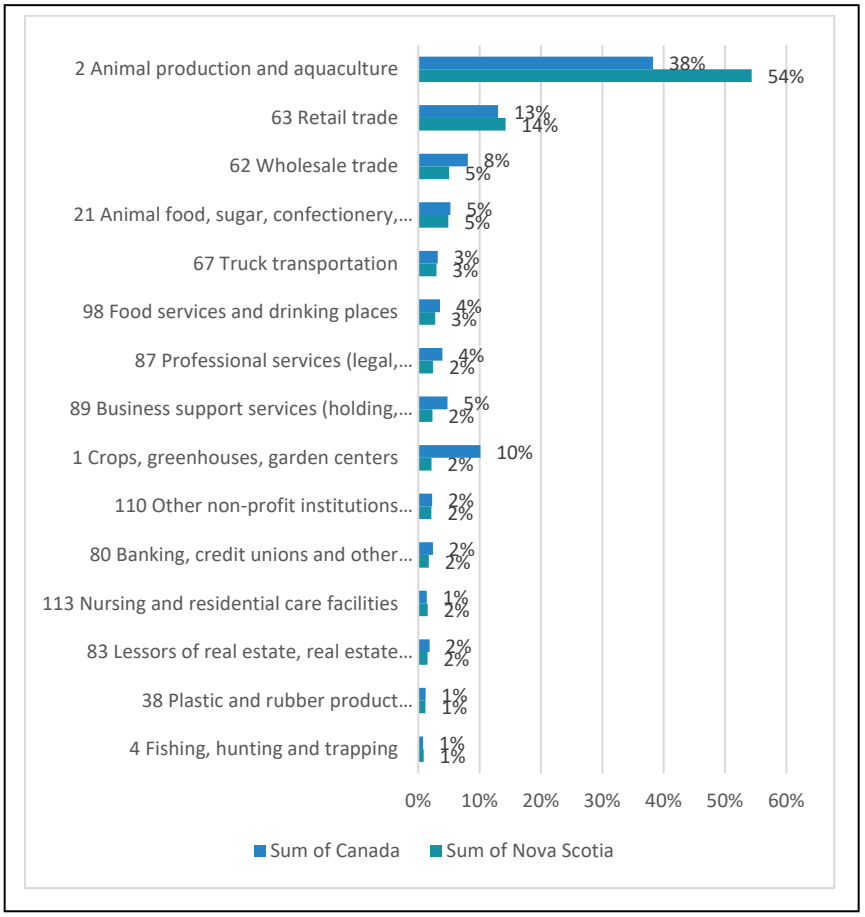


Figure 5. Growth by Industry in Nova Scotia and Canada

grows and scales, CSL believes that there is an opportunity for cluster development in aquaculture which includes supply chain opportunities for Nova Scotian and Atlantic companies to even reach beyond the local market. This is an objective that is within reach as the aquaculture industry achieves greater critical mass.

CSL also places a high value on bringing strong environmental management practices to its operations and so will be careful in selecting supply chain partners that align with similar values. This is particularly important at a time when all companies need to proactively address climate change.

As CSL is taking a phased approach to this development, annual supply chain opportunities will track against the requirements of the specific phase, although there are commonalities across all phases.

An initial summary of primary supply chain opportunities are outlined below. This forecast will be continuously updated as the various phases proceed. The resulting benefits will be accordingly amplified across each incremental phase as detailed above.

In summary, supply chain opportunities include:

- **Seed and Smolt supply –** initially CSL will source smolts from existing hatcheries and producers within Atlantic Canada. This will enable CSL to determine the current and evolving capacity of hatchery and smolt facilities. As part of the broad outreach and engagement undertaken by CSL prior to submission of the application for a license, advance discussions have been held with Atlantic smolt producers. CSL has been encouraged with the partnership opportunities these discussions have revealed. Over time, as outlined in the phased approach referenced above, CSL is interested in investing in seed, smolt and post smolt production to supply its own needs and as a value-added business opportunity, potentially in partnership with current producers or with potential First Nation collaborators.
- **Infrastructure** – Section 2.2 above details a range of infrastructure requirements including site development and build-out; feeding barges; and various purpose built vessels. As noted, in an effort to positively impact local economic development, CSL's intent is to source and/or produce these vessels in Canada, with Norwegian state of the art design elements.
- **Supply of Vessels** – Three types of vessels will be required in the early stages of the site development. As noted in Section 2.2, these include the Feeding Barge (potentially sourced at AF Theriault ship yard outfitted with Akva Group's automated feeding equipment); a well-boat (to be rented until company reaches yearly production of ~15,000 metric tons, then building a new vessel); and working vessels (smaller boats up to 15 m long X 8 m wide) used for anchoring up pens and feeding stations, putting out net, servicing, changing, and washing nets, various inspections and assisting with feeding.

- **Services -** Phase 1 will require a broad and diverse range of talent including engineers; contractor and subcontractors to construct facilities; land lease/development services; smolt supply; vessel rentals and/or construction; barge rental or construction; equipment supply and/or rentals; producers of nets and marine deployment equipment; equipment servicing, among other requirements. As with all proposed procurement activities within the CSL operation, sourcing of these services will be focused on local and Nova Scotia-based supply wherever possible.
- **Development of an Onshore Base** – There are several options under consideration for this development. These include leasing premises from local landowners and or, purchasing real estate and construction of purpose - built facilities. To be utilized for offices, feed monitoring, testing and lab space and materials/equipment storage, this development will also require shore side access for vessel storage and access and transiting equipment to the farm site. Details will be worked out pending license acquisition.
- **Harvesting and Processing** – CSL will begin with conventional onshore processing. After reaching a volume threshold, CSL will consider the potential for the acquisition of a purpose-built processing ship.
- **Internet of Things (IOT) and Information Technology** – CSL is aiming to achieve a high innovation quotient in its operations. The company is focused on regulatory compliance through use of high-quality data and evidence. Automation is an underlying feature of modern aquaculture, a factor that creates both a diversity of high quality jobs, as well as significant supply opportunities. Use of cameras and sensors to monitor fish health and fish behaviour will be a hallmark of the CSL approach. CSL will require IT services to create a fully functional farm operation primed to mitigate risk and to enable early intervention when challenges do arise. As in other areas, CSL will be focused on state of the art equipment sourced lically and use of local talent in building this system.
- **Transportation and Logistics** – Timely supply of materials and goods requires effective transportation links. CSL has assessed the local supply capacity in this regard and finds it to be well-developed; in part, a reflection of the robust fishery and well-established existing supply chain in South Western Nova Scotia. An important consideration in transportation is the importance of minimizing GHG emissions. CSL is focussed on development that minimizes the need for excess transportation. This can often be achieved by simple things like co-locating operations eliminating the need for transit of goods and services between sites or partnering with others for more efficient load critical mass and delivery opportunities. CSL has also examined the logistics management opportunities associated with its proposed development. This important aspect of supply chain management relates to the planning, implementation and control of effective of forward and reverses flows and storage of goods, services and related information. The initial assessment is that its requirements will be similar to other fisheries operations in the area, a capacity that is expected to be able to be effectively leveraged within the CSL operations. In fact, CSL officials have been encouraged by the spontaneous level of

response from potential suppliers following its website going live. A number of potential suppliers have reached out to indicate an interest in becoming a supply partner in this development. CSL, itself, in its outreach and engagement has also reached out to potential suppliers to have an initial converstion on possible collaborations. These discussions are ongoing with a number of potential suppliers. The focus is on securing partnership agreements or letters of intent in respect to possible supply arrangements.

As a result of the finding arising from the initial outreach and engagement with potential suppliers , CSL has concluded that a strong supply chain exists in the area that will fully meet its needs and that its presence will indeed contribute to building greater critical mass in that supply chain while, at the same time, creating a compelling value chain of local economic benefits.

2.5 Employment

The economic impact analysis completed on this development identifies a broad range of benefits and where these will accrue. Employment opportunities are an important element of this value chain.

Principal employment impact will accrue to the "animal production and aquaculture" industry componet. It is important to note, however, that other related industries across both Nova Scotia and Canada, will also be positively impacted. These include: retail

Table 2. CSL's Expected Staffing Requirements

Step 1 - Administration:

ADMINSTRATION	#
CEO	1
CFO	1
Office manager / Accounting	3
HMS/Fish health Manager	1
Total	6

Step 1 – Sea production (St. Mary¨s Bay):

Fish Farming Production	#
Area managers (1 per area)	1
Site Managers (1 per site)	4
Fish Health Manager	1
Farmers (2 per site)	8
OT/Service Managers	1
Apprentices	2
Total	17

Step 2 – Hatchery and smolt production:

Hatchery and smolt production	#
COO	1
Farmers	8
Service/technicians manager	1
Service workers	2
Apprentice	2
Total	14

Step 3 – Post–smolt production:

Post – smolt production	#
COO	1
Farmers	8
Service/technicians manager	1
Apprentice	2
Total	12

Step 4 – Slaughtering facility:

Slaughtering facility	#
COO	1
Sales Manager	2
Technical manager	1
Quality manager	1
Workers	20
Total	25

Step 5 – Value added products:

Value added products	#
COO	1
Production manager	1
Sales Manager	1
Technical manager	1
Quality manager	1
Workers	20
Total	25

trade, wholesale trade, animal food, sugar, confectionery, cereals and canning manufacturing, and truck transportation, among others as illustrated in the adjoining graph.

At full production, by about year 3, CSL is projecting a total workforce of about 130 full time equivalents (FTEs). Specific positions are outlined in the above table and cover a mix of occupations including professional, technical, highly skilled and farm and aquaculture technicians. These include:

- 6 in Administration,
- 17 in sea production,
- 14 working in the hatchery and smolt production roles,
- 12 in post–smolt production activities,
- 25 in the slaughtering facility/operations; and
- 25 working in value-added products.

As the operation grows and scales, additional projected positions include:

- Accounting,
- Apprentices,
- Area managers (1 per area),
- CEO,
- CFO,
- COO,
- CTO,
- Deputy COO,
- Farmers/aquaculture technicians,
- HMS/Fish health Manager,
- Office Manager,
- Production manager,
- Quality manager,
- Sales Manager,
- Service Managers,
- Service officers,
- Service workers,
- Service/technicians manager,
- Site Managers (1 per site); and
- Technical manager.

2.6 Other Economic Contributions to the Local Community and Province

CSL undertook an economic impact analysis of this proposed development. Economic impacts were calculated using a proprietary Input-Output (I-O) model that is based on Canada's National System of Accounts and reflective of the latest Interprovincial trade flows. The model used

Statistics Canada Input-Output tables and other data (such as salaries, tax coefficients, among other factors) to present an aggregate of potential economic impact (Economic Accounts, 2018).

The main outputs of the I-O models are reported for direct and spinoff (indirect and induced) effects. This I-O model considers inter-provincial flows of goods and services among all ten Canadian provinces.

Unlike impact models that rely on multiplies or previous studies, the I-O simulation model used in this project was tailored to the Nova Scotia economy to generate all economic impacts at the county level, provincial level, and for the rest of Canada.

The results of this I-O analysis provides a detailed measure of the impact of the annual operations of CSL and their relationship to the Nova Scotian economy including economic impact in terms of direct, indirect and induced activity reflecting the entire supply chain, on[1]:

- Employment (jobs),
- Household income,
- Contribution to federal, provincial and local taxes; and
- GDP.

The resulting analysis is provided for both **operations** and **construction**, based on CSL data. This included detail expenditure and revenue data.

This following presentation of impacts addresses the economic value of two streams associated with the proposed aquaculture development:

- Annual operations: based on a year of full operations.
- Capital spending during construction (one-time only effects).

2.6.1 Operational impacts

Operational impacts are based on the annualized average of the first five years of operations. CSL proposed average annual operations are expected to trigger $[redacted] of total spending, averaged over the first 5 years of activity. This will have considerable economic impacts, affecting employment, GDP, income, government revenues, and tax revenues. Expected direct and spin-off[2] impacts include for Nova Scotia:

- 349 person-years in direct and spinoff employment,
- $[redacted] in direct and spinoff GDP,
- $[redacted] in direct and spinoff household income; and

[1] Additional definitions are provided in **Appendix I.**

[2] Spinoff impacts include both indirect and induced economic effects. See the section above on "Definitions".

- $[redacted] in direct and spinoff government tax revenues, including $[redacted] in direct and spinoff federal tax revenues, and $[redacted] in direct and spinoff provincial tax revenues.

A summary of operational impacts is presented in Table 3 below.

Table 3. Summary of Operational Impacts

SUMMARY	Digby	Rest of NS	Total NS	Canada
[redacted]				

2.6.2 Construction Impacts

The project economic impact is expected to go beyond operational impacts as new facilities, vessels and equipment will be required, including a hatchery / smolt-facility, processing facilities, acquisition of a well-boat, among other capital outlays on gear and equipment necessary to support the production activity. Estimated direct and spin-off impacts on Nova Scotia resulting of CSL's one-time only construction investment of over $[redacted] in the Digby area include:

- 1,660 person years in direct and spinoff employment,
- $[redacted] in total GDP,
- $[redacted] in total household income; and
- $[redacted] in total government tax revenues through $[redacted] in total federal tax, and $[redacted] in total provincial tax.

A summary of construction impacts is presented in Table 4.

Table 4. Summary of Construction Impacts

SUMMARY	Digby	Rest of NS	Total NS	Canada
[redacted]				

2.6.3 Observations

The level of operational and construction employment demand, particularly in Digby NS, is very significant and should be encouraging to residents, municipal, and provincial leaders alike, including those tasked with providing career services.

In general, the demographic challenges in Nova Scotia are considerable. The population is older and outmigration from rural areas continues to erode the labour force and tax base in these communities: Digby County is experiencing these challenges more acutely than the rest of Nova Scotia. This development will help address this worrisome trend.

The Digby Region already has an active aquaculture supply chain and CSL's added demand on this supply chain will diversify the customer base, while the increase in demand may have a catalytic impact on up scaling this supply chain to the extent that cluster development may be a possibility, enhancing the overall value chain and its future development.

Inevitably, there will be challenges. The industry is relatively new in the Atlantic region, especially when compared to traditional sectors. It is also evident that public perception of safety, environmental stewardship, and benefit is deeply influenced by resident's awareness/understanding of sector operations, global food supply and access. Perceptions are also shaped by individual's understanding of their connection to the aquaculture benefits. Accordingly, ongoing strong communication, sector leadership, industry championship will be critical in debunking the many myths that revolve around aquaculture development.

Recent global events illuminate the vulnerability of many sectors to disruptions in market access. While disruptions may be short term, the area's lucrative lobster fisheries has been significantly impacted by COVID-19. This contributes to the case for greater sectoral diversification.

The negative perception of aquaculture is most often based on misinformation and pre-conceived ideas, which results in an anachronistic view of the industry. Often referred to as the blue revolution, as a global industry, aquaculture is a complex, sophisticated and innovation-driven sector.

Automation, use of sensor technology to monitor fish health and behaviour and IOT technology to enable precision feeding and to send alerts when challenges occur means that the human resource requirements for the industry create a diversity of opportunities for all people.

The modern aquaculture technician is a highly skilled individual, knowledgeable about fish health and production technology, who understands and cares about the ocean environment. As illustrated above, there are countless other career opportunities in hatchery operations, R&D collaborations and in information technology.

CSL offers a compelling and principled value proposition for host communities. Now more than ever, communication needs to be augmented with plain language metrics on the range of high-quality jobs, income and the strategic benefits the sector offers in respect to food security, adaptation to changes in the capture fishery, innovation and workforce strategy.

CSL notes the high interest in the ocean sector and the innovation agenda as a driver of economic prosperity in Nova Scotia and Atlantic Canada. With this proposed development, CSL offers a unique and compelling value proposition to the regional and provincial economy as both a large export focused employer, as well as a proven innovator aligned with the imperative to advance STEAM (science, technology, engineering, arts and math) occupations and entrepreneurship.

The leadership in advancing this depth of analysis underscores the critical importance of tracking economic benefits and communicating the positive contribution of the industry over time. Accordingly, estimates established during this study can become benchmarks against which progressive community benefits are tracked over time, thereby contributing to an enhanced understanding of the value this industry offers to the Province.

The potential for collaboration across sectors is also significant. At a policy level, Canada's Ocean Supercluster is focused on the sustainable and inclusive development of Canada's ocean resource.

Beyond fish farming, CSL is committed to building the industry in ways that will enhance the aquaculture innovation ecosystem and innovation quotient in Nova Scotia. CSL's Norwegian majority shareholder's aquaculture operations in Norway are leading edge in terms of innovation, skills and capabilities that will be applied to proposed operations in Nova Scotia.

2.7 Financial Viability

In the preparation of the Production Plan (Section 2.1) associated with CSL's proposed development of the St. Mary's Bay Aquaculture site, financial information has been updated to reflect the analysis and planning undertaken during the period of the Option Agreement granted for this site. As per the requirements, this information is included in **Appendix C**.

2.8 Adverse economic impacts

As illustrated in sea farming globally, this industry is **additive** to economic capacity and output everywhere it operates. Moreover, farmed salmon is one of the most eco-efficient and sustainable forms of protein characterized by:

- Better feed conversion ratios,
- Less fresh water consumption,
- Lower carbon footprint; and
- Nutritious – high level of protein / rich in omega-3 essential fatty acids.

At a time when the capture fishery has been impacted by declining supply, disruptions associated with migrations related to climate impact and a variety of other complex factors, sustainable aquaculture addresses food security in an environmentally responsible manner.

As an industry of tomorrow, its evolution over the past decades contemplates a future that will continue to innovate, including with completely closed systems – on land and at sea – designed to continue to address protein needs in an increasingly innovative and efficient manner.

Norway has developed the early-stage salmon farming in cold seawater into a high-tech industry with a strong and growing global market for its products. The Norwegian salmon farming industry has grown from a 10.000 metric ton business 40 years ago to a 1,250,000 metric ton business today. Innovative distribution systems have been developed making it possible to supply fresh salmon products in all the most important global markets. Norwegian companies have also developed most of the required technology for exposed, ocean farming of salmon which continues to expand in Norway.

Norwegian salmon farming companies have also taken lead positions in developing salmon farming in other countries like Chile, Scotland, Faroe Island and Iceland and, to a certain extent, also in Canada. There are not many areas with satisfactory, natural sea-water conditions left not utilized for salmon farming. Nova Scotia may be one of these areas with a good potential for a sound development of a new industry. Through its well-established and successful Norwegian partner, CSL is leveraging this industry leadership, innovation, know-how and maturity in this proposed development. Adverse economic impacts are not anticipated as a result of this development. Rather the potential benefits are noteworthy and include:

- Significant economic benefits associated with construction, ongoing operations, investments in smolt/post smolt production, vessel construction and processing/value-added activities.
- Amplified economic impact through export.
- Employment creation in a diversity of highly skilled jobs as detailed above.
- Community partnerships – with educators and citizens.
- Enhanced supply chain opportunities, building critical mass and potentially leading to cluster development.
- Research and development opportunities; and
- A strong innovation quotient.

Leveraging operational experience in Norway where all data is publicly available, one of the values that CSL brings to this development is its reliance on data and evidence and its openness and transparency in this process – with the community and the regulator. CSL is keen on developing observational sites for educators, youth, ecotourists and the community to observe and learn about aquaculture. We see this as an important element in enhancing understanding of the sector and building a well-informed public that will understand the inherent benefits and value of this sector.

3 FISHERIES ACTIVITIES IN THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

3.1 Status of Fisheries Activities

St. Marys Bay, Nova Scotia hosts commercial and recreational fisheries, as well as Indigenous/First Nations fishing operations. The commercial fishing activities are outlined in Section 3.1.2 below.

3.1.1 Recreational Fishing Activity

Recreational fishing activities in the Digby area fall under Recreational Fishing Area 4. In RFA 4, most commonly fished are bass, trout and pickerel, and perch (Anglers' Handbook, 2021). According to the Nova Scotia Anglers Handbook, bag limits are 5 bags per fisher for bass and trout, and 25 for pickerel. There is no closed season for tidal waters. There is no available data on catches and landings from recreational fishers as this information is not recorded.[3]

3.1.2 Indigenous Fishing Activity

Bear River First Nation is involved in fishing in the areas surrounding St. Marys Bay. However, no statistics on fishing effort are available. Additionally, Sipekne'katik First Nation holds a moderate lobster fishing operation out of St. Marys Bay, for which they were granted food, social and ceremonial licenses for the summer of 2021 and have indicated intention to continue and expand to at least 20 boats (Tutton, 2021). However, as will be explored in Section 3.2.1 and further throughout the application, recent studies do not support a link between salmon farming and a decline or negative impact on lobster landings (Grant et al, 2019).

Acadia First Nation have substantial fisheries activity as detailed below (Acadia First Nation, 2021/22). Their intentions for the 2021/2022 season are laid out in their Netukulimk Fish Harvest Plan and apply to their operations under their food, social, and ceremonial licenses. This plan shows their allowable lobster catch – 3 tags per member in LFA 32, 33, 34, or 35 between June 1 to May 31. The allowable catch, location, and timeline for the remaining 33 species are largely similar. Many of the remaining species have an alloweable catch of the amount required for bait, food, social, and ceremonial purposes. The allowed location is tidal or inland waters of Nova Scotia, and the timeline is from June 1 to May 31. Species fished by Acadia First Nation to which these stipulations generally apply are as follows:

[3] CSL made several attempts to locate this information through provincial and federal fisheries sites, anglers' associations, and other fishing associations.

- Trout (Rainbow, Brook, Brown, Lake, Artic Char),
- Smallmouth Bass,
- Herring,
- Mackerel,
- Bar clams,
- Quahaug,
- Clams (Razer, Soft-shell, Arctic Surf, etc),
- Mussels,
- Gaspereau,
- Eels,
- Smelt; and
- Scallops (limited to SFA 28 and 29).

3.1.3 Commercial Fisheries Activity and Species Fished

Commercial fisheries activities can be found along Long Island and Briar Island, as well as in Meteghan and other surrounding areas. A list of producers including commercial fishers within proximity of St. Mary's Bay can be found in Section 5.1.3. This list provides the location and description of local producers such as Comeau Seafoods, Gidney Fisheries Ltd., and DB Kenney Fisheries Ltd. Some of the species and types of fish handled by these producers include scallops, herring, salmon, lobster, periwinkles, haddock and other groundfish.

Table 5 contains the Atlantic Canada Commercial Landings for 2020 (Commercial Landings, 2020). This data shows that the most heavily fished species include haddock, herring and scallop in metric tons. However, landings of certain species considered in the commercial fishing analysis, such as Atlantic Salmon, have been suppressed or non-existant.

Table 5. 2020 Commercial Landings in Nova Scotia[4]

2020 Atlantic Coast Commercial Landings, Nova Scotia			
Species	**Maritimes**	**Gulf**	**Total**
Groundfish			
Atlantic Cod	1,010	5	1,015
Haddock	16,953	0	16,953
Redfish spp.	7,656	22	7,678
Halibut (Atlantic)	4,504	51	4,556
Flatfishes	x	x	717
Greenland turbot	26	x	x
Pollock	x	x	3,082
Hake	3,662	3	3,664
Cusk	146	0	146

[4] x – suppressed for confidentiality

Catfish	0	0	0
Skate	x	x	79
Dogfish	x	0	x
Other	x	x	651
Total groundfish	**38,487**	**82**	**38,569**
Pelagic & other finfish			
Herring	41,807	2,619	44,426
Mackerel	1,182	133	1,315
Swordfish	1,334	0	1,334
Tuna	471	51	522
Alewife	471	318	789
Eel	x	1	x
Salmon (Atlantic)	x	0	x
Smelt	0	0	0
Silversides	0	0	0
Shark	x	0	x
Capelin	0	0	0
Other	11	0	11
Total pelagics	**45,282**	**3,122**	**48,404**
Shellfish			
Clams / quahaug	21,303	27	21,330
Oyster[5]	x	x	29
Scallop[6]	57,687	92	57,780
Squid	x	0	x
Mussel	0	0	0
Lobster	15,271	4,881	20,151
Shrimp	19,209	0	19,209
Crab, Queen	8,862	5,428	14,290
Crab, Other	239	x	x
Whelks	x	0	x
Cockles	x	0	x
Sea cucumber	x	0	x
Sea urchin	x	0	x
Other	0	0	0
Total shellfish	**125,807**	**10,743**	**136,550**

Additional information on commercial landings can be found in **Appendix D**, the Maritime Region Fisheries Atlas: Catch Weight Landings Mapping from 2014-2018 from the Department of Fisheries and Oceans. Heatmaps of catch weight landings in Nova Scotia for this time period can be found from pages 7 to 66 of that document.

The Maritimes Research Vessel Survey Trends on the Scotian Shelf and Bay of Fundy report from 2020 was used to assess wild fish trends in the surrounding waters. Though the St. Mary's Bay is

[5] Oyster – Atlantic includes wild and farmed data

[6] Scallop – includes meat with roe

not specifically analyzed in the report, it speaks to the wild fish trends in Northwest Atlantic Fisheries Organization (NAFO) division 4X, the monitored area surrounding St. Mary's Bay and western Nova Scotia (Vessel Survey Trends, 2020).

Groundfish

The most commonly fished species of groundfish around the St. Mary's Bay are haddock, halibut and redfish, with the most active portion of the season taking place during the summer, running from July to September. As seen in Table 5 above, haddock led the commercial landings in 2020 with 16,953. Redfish saw commercial landings in Nova Scotia of 7,678 and Atlantic halibut was 4,556. Figure 6 shows a heatmap of groundfish landings between 2014-2018, which indictates locations of fishing activity. Heatmaps of the landings of specific groundfish can be found in **Appendix D** beginning on page 7.

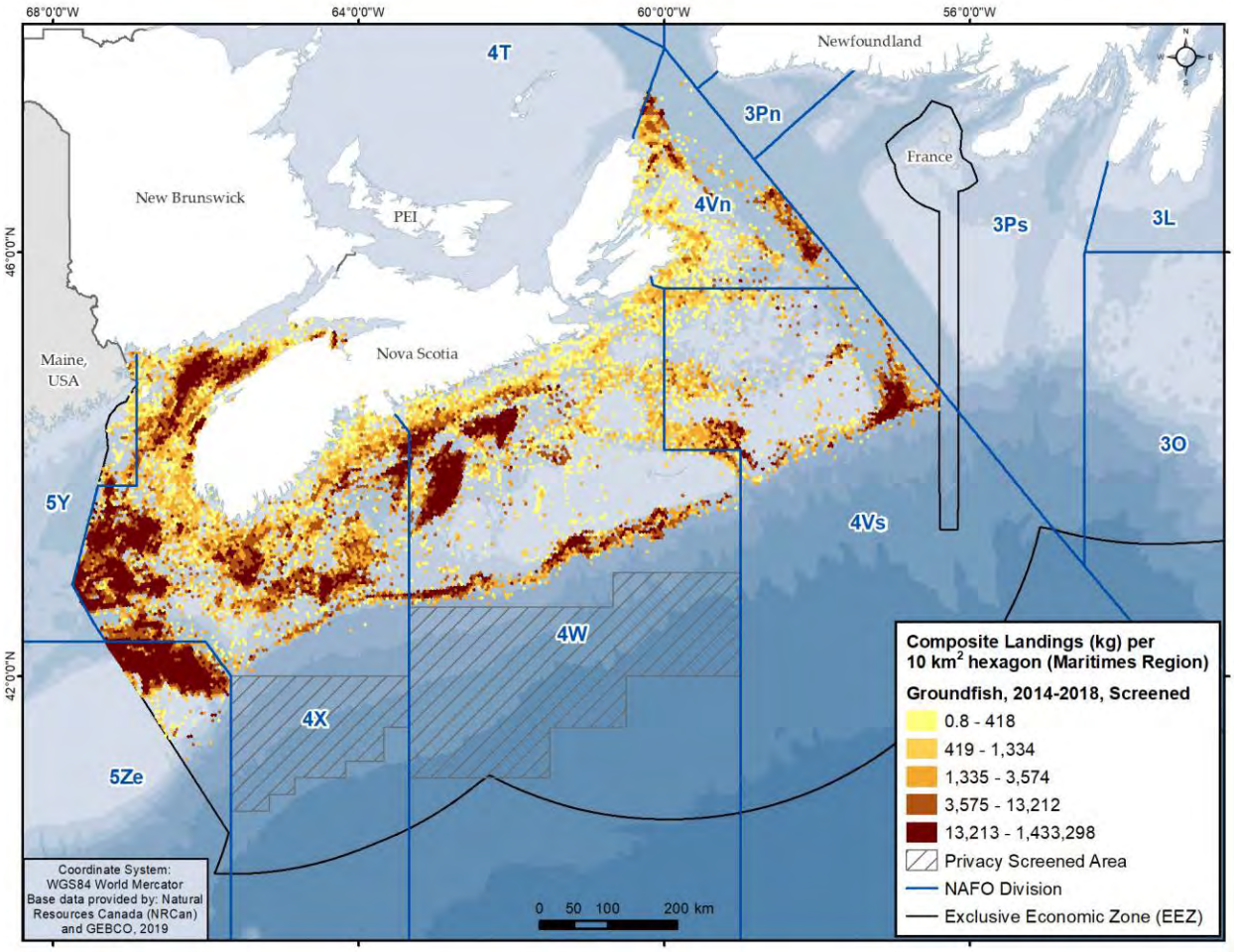


Figure 6. Heat Map of Groundfish Landings (2014-2018), Nova Scotia

Herring

Herring is a type of pelagic fish found in the St. Marys Bay area, and has the largest commercial capture fisheries presence of all finfish. In 2020, Nova Scotia's herring landings were 44,426 total. The season for herring spans from April to November. The heat map for herring landings in the province between 2014-2018 has been included in Figure 7 (Atlantic Herring, 2021). The heatmaps for other types of pelagic fish are included in **Appendix D**.

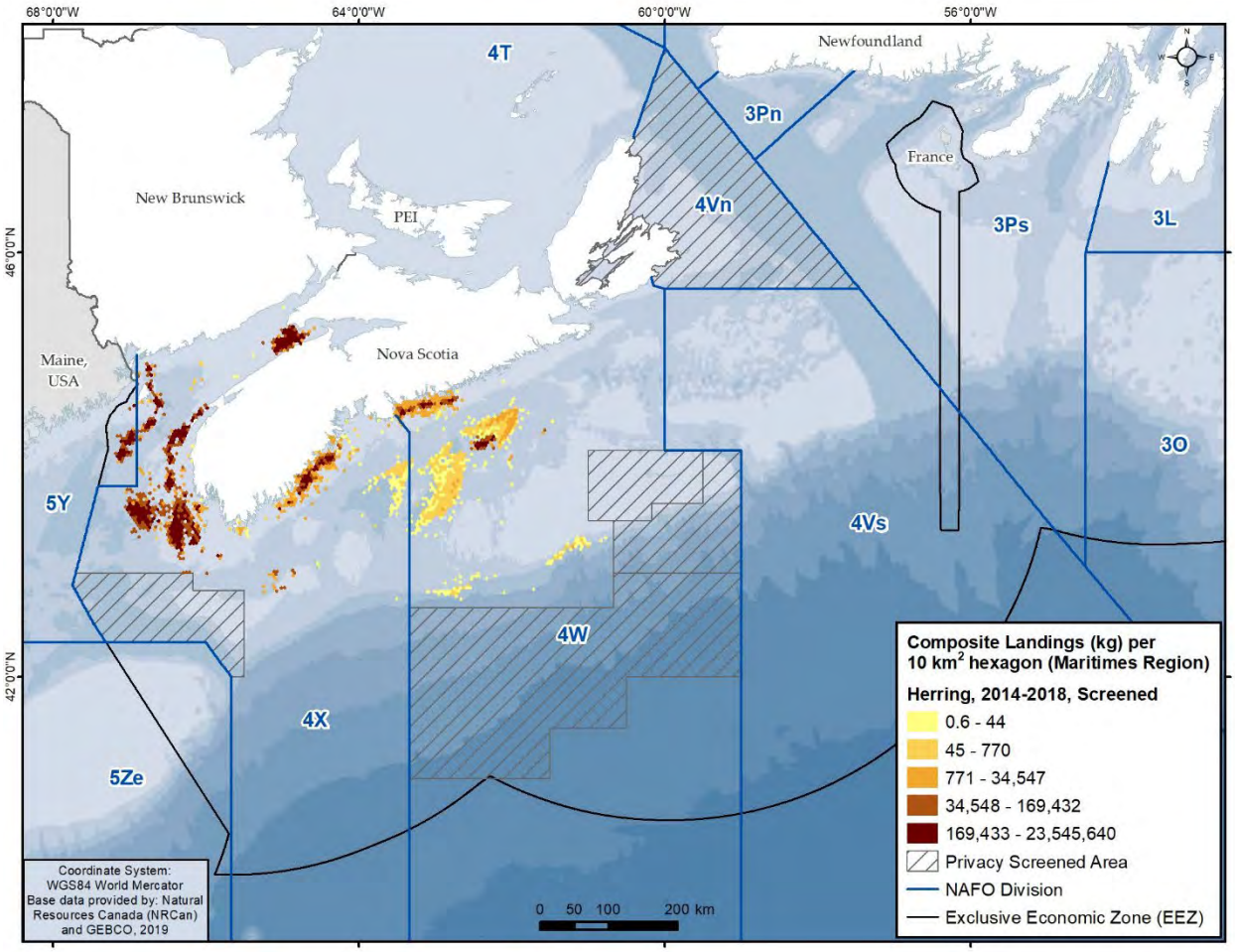


Figure 7. Heat Map of Herring Landings (2014-2018), Nova Scotia

Shellfish and Other Invertebrates

St. Mary's Bay is part of Scallop Production Area (SPA) 3. Observations of scallop stock in this area has shown fluctuations dating back to 1994 with potential for growth (Scallop Production Areas, 1998). Heatmaps for scallop landings in Nova Scotia can be found beginning on page 52 in **Appendix D**. This zone has not been thought to be a high producing SPA in the immediate Bay area, though in 2020 the province had total scallop landings of 57,780. In Figure 8 below is a heatmap displaying scallop landings from 2014-2018.

Lobster fisheries are discussed in Section 3.2.1.

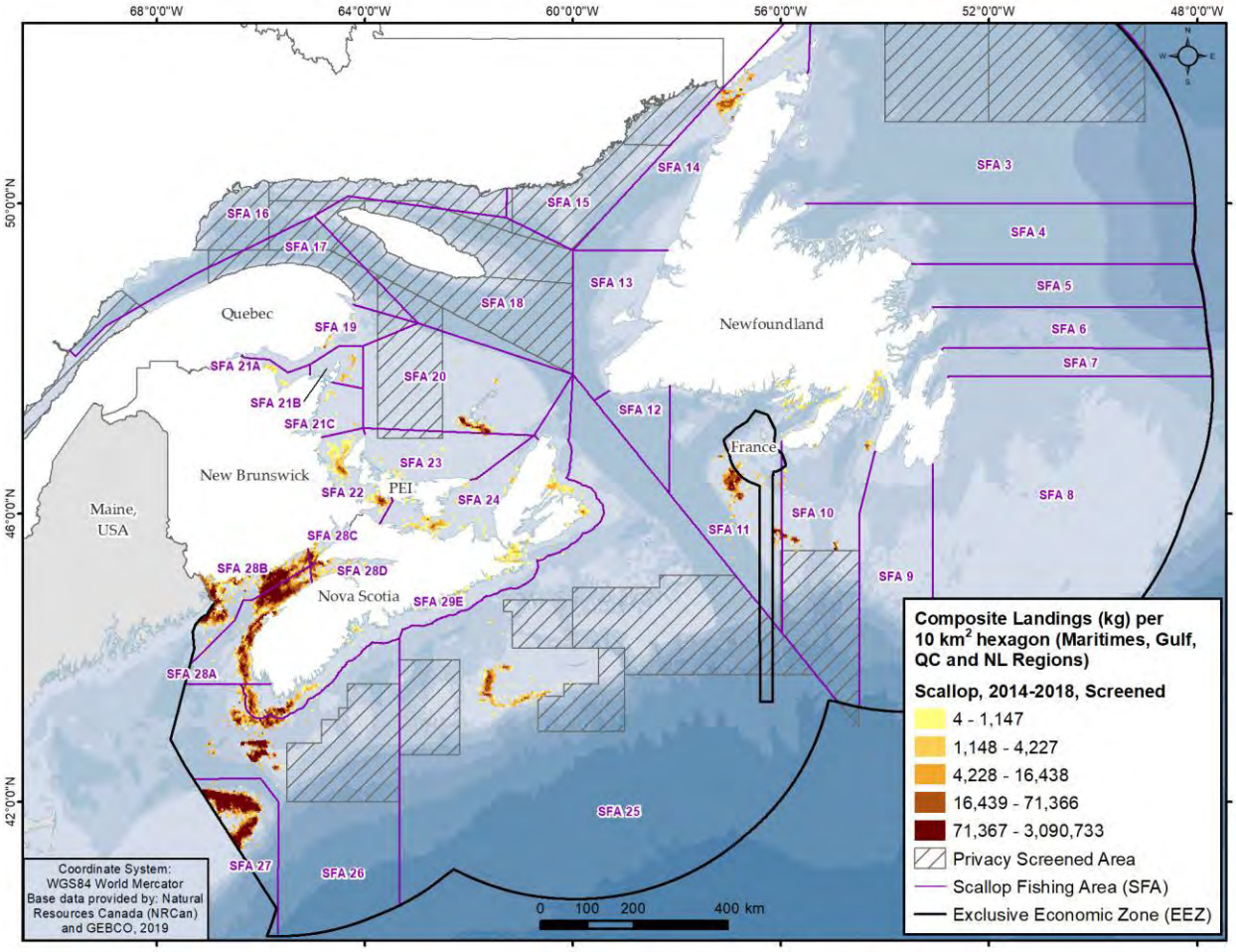


Figure 8. Heat Map of Scallop Landings (2014-2018), Nova Scotia

Emerging Species

There are emerging developments to bring new commercial species to market harvested from capture fisheries. This includes a small sea urchin fishery along with interest in periwinkles and an emerging interest in dogfish for the pharmaceutical industry. Clam digging also remains as a niche operation. The area also supports the emergence of a marine vegetable/ sea plants industry, with rockweed harvesting and processing taking place. Some dulse is also harvested.

3.1.4 Aquaculture Operations

The aquaculture operations recorded by the Nova Scotia Fisheries and Aquaculture site mapping tool are listed in Table 6 (Aquaculture Site Mapping Tool, 2022). These operations consist of both finfish and shellfish aquaculture operations. Locations of these sites can be seen on Figure 9, corresponding to the indicated site number and coordinates.

Further information on nearby aquaculture operations and CSL's proposed mitigation plans for any potential interaction with other aquaculture sites can be found in Section 8.

Table 6. Aquaculture Sites in and around St. Mary's Bay

No.	Lease Holder	Species	Approx. Lat.	Approx. Long.
		Inside Option Area		
1012	Long Beach Farms Ltd.	Atlantic Salmon, Rainbow Trout	44° 24' 26.580"	-66° 9' 38.550"
1037	Paul Belliveau	European Oyster, Blue Mussel, Sea Scallop, American Oyster, Soft-Shell Clam	44° 24' 6.188"	-66° 3' 36.632"
828	Vince Stuart	Soft-Shell Clam, Sea Scallop, European Oyster, Blue Mussel, Bay Quahaug, Sugar Kelp	44° 24' 32.137"	-66° 3' 6.5"
		Outside Option Area		
1354	Kelly Cove Salmon Ltd.	Atlantic Salmon	44° 16' 19.907"	-66° 17' 23.528"
1353	Kelly Cove Salmon Ltd.	Atlantic Salmon	44° 15' 29.157"	-66° 18' 20.569"
829	Innovative Fishery Products Inc.	Atlantic Salmon, Arctic Char, Rainbow Trout	44° 16' 26.834"	-66° 20' 37.654"
742	Kelly Cove Salmon Ltd.	Atlantic Salmon, Rainbow Trout	44° 15' 41.346"	-66° 20' 48.969"
5009	Keith Amero	Giant Sea Scallop	44° 28' 26.071"	-66° 0' 30.874"
5008	Bear River First Nation	American Oyster	44° 30' 29.506"	-65° 55' 39.863"
5007	Bear River First Nation	American Oyster	44° 32' 17.204	-65° 56' 49.642"
1228	Innovative Fishery Products Inc.	Bay Quahaug	44° 33' 51.949"	-65° 52' 40.369"
		Land-based		
1185	Innovative Fishery Products Inc.	Razor Clams, Soft-Shell Clam, Bay Quahaug, Bar/Surf Clam, European Oyster, American Oyster	44° 23' 56.663"	-66° 3' 1.246"
999	Kelly Cove Salmon Ltd.	Atlantic Salmon, Atlantic Cod	44° 28' 4.348"	-66° 6' 32.994"
1437	Mike Mullen Smolt Inc.	Atlantic Salmon	44° 24' 40.421"	-66° 59' 54.457"

263	Mike Mullen	Atlantic Salmon	44° 19' 40.800"	-65° 56' 4.802"
1436	Kelly Cove Salmon Ltd.	Atlantic Salmon	44° 32' 27.252"	-66° 0' 18.933"

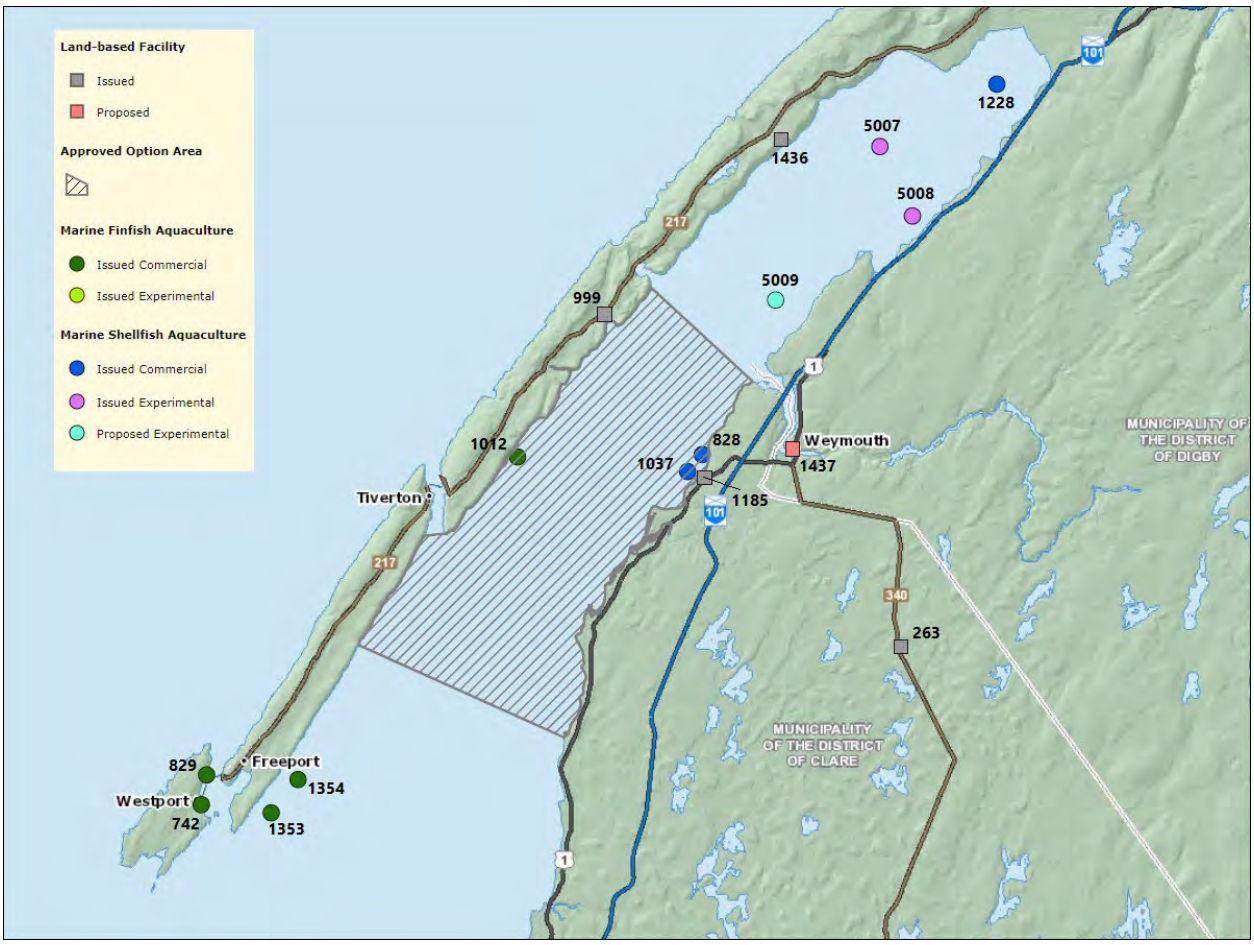


Figure 9. Aquaculture Site Map of St. Mary's Bay

3.2 Impacts on Fisheries Activities

CSL intends to perform all operations within the guidelines established in the Standard Operating Procedures for the Environmental Monitoring of Marine Aquaculture in Nova Scotia – June 2017 (Standard Operating Procedures, 2021). CSL will develop its sites so that no adjacent or nearby operations will be impacted as a result of their development. The closest development to the proposed site is located at a distance of 3.45 km (Aquaculture Site #1012 in Fig. 9 above) and is therefore at a sufficient distance to largely avoid any interaction.

3.2.1 Impact on Lobster Fisheries

Salmon aquaculture often overlaps with lobster fishing locations. For some, this causes concern that salmon farming may have a negative impact on the lobster fishery. However, salmon

production and lobster landings do not coincide or share relationships or trends over time. In fact, lobster landings have fluctuated over time, relative to the low, consistent salmon production across Atlantic Canada. This is clearly observed in the Nova Scotia data, where lobster catch is highest and salmon production is lowest compared to the other Atlantic provinces shown here. Reinforced by Susan Farquharson of the Atlantic Fish Farmers Association in her article *The best conversations about aquaculture are based on facts*, a recent peer-reviewed study from Grand Manan, New Brunswick (NB) "found that aquaculture operations had no impact on lobster abundance, size, or growth" (Farquharson, 2017).

That study by Grant et al. (2019) monitored lobster abundance over an 8-year period in Grand Manan, NB demonstrated that there was no significant difference between the number of lobsters inside the salmon farming area versus a nearby reference site and no significant difference in the number of berried females (lobster with fertilized eggs held on the underside of her abdomen) inside or out of the farm lease area (Grant et al, 2019). These results indicate that the salmon operation had no obvious impact on lobster abundance at any point in the salmon production cycle and that lobster abundance was similar to those of the general fishery of LFA 38 during the same period of time. Overall, considering lobster landings between 1990 and 2017, landings grew more than 50% in Atlantic Canada (Luck, 2021; Lobster Landings, 2020). According to the numbers, there is no indication that the growth of aquaculture has negatively impacted lobster farming.

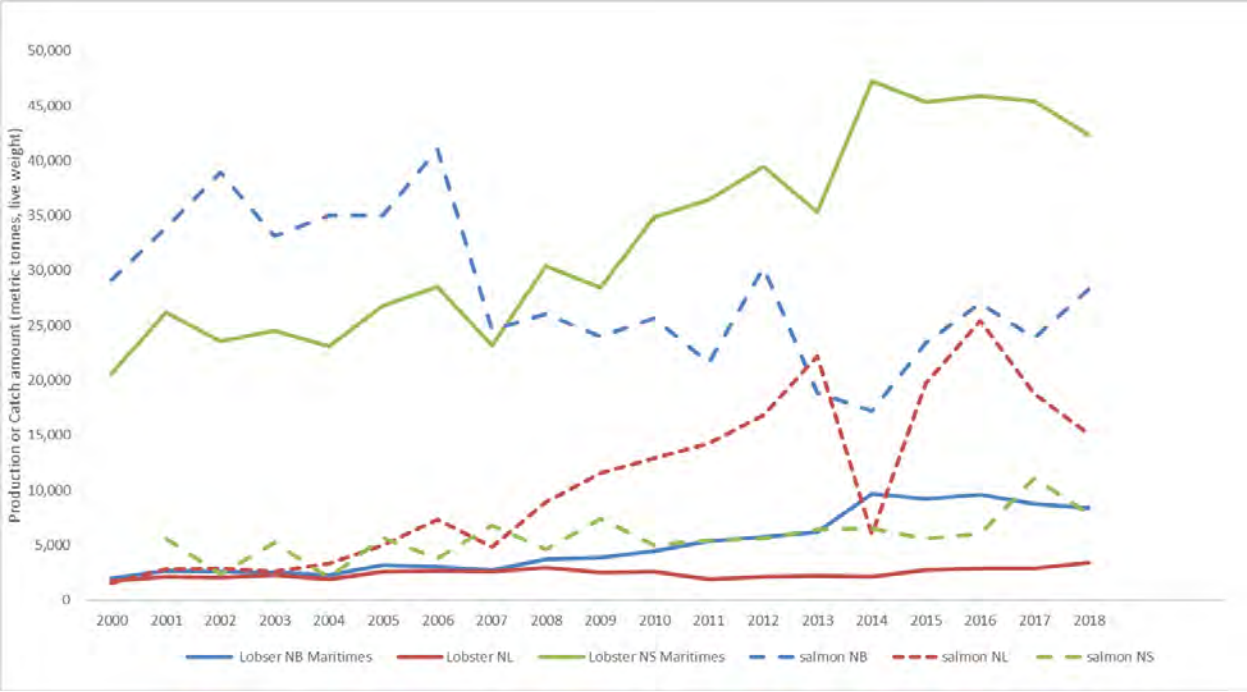


Figure 10. Lobster catch and salmon production from 2000-2018 in Nova Scotia, New Brunswick, and Newfoundland. Salmon production are dashed lines, lobster catch are solid lines for each province.

Another study from 2020 has shown that there is no impact to lobster growth in an Integrated Multi-Trophic Aquaculture system due to the trophic relationship between lobster and salmon. The study found that the lobsters were making use of the deposits from the salmon operation, but that there was no substantial difference between the growth of the lobsters at the control site and the salmon cages (Baltadakis et al, 2020).

A study from Port Mouton, on Nova Scotia's south shore, showed that most conditions created by a fish farm do not extend beyond the boundaries of the farm, and are therefore negligible when accounting for any type of change in lobster numbers (Grant, J. et al, Marine Pollution Bulletin, 2016).

A report on the lobster fishery in St. Marys Bay in December 2020 found that commercial lobster landings in the area had declined (Beswick, Aaron, 2020). 2020 data from the Department of Fisheries and Oceans reveal a 63% decline in commercial lobster landings in St. Marys Bay from the all-time high in 2017. The 2020 numbers also represented a 50% decrease from the cumulative average landings since 2003. The intention behind the revelation of this data was to combat rumours of an unregulated commercial fishery occurring during the off-season. The data confirmed that fisheries activities in the area are down, while lobster stock numbers appear to remain stable. While the latest data is showing a downward trend in landings, these types of fluctuations in catch have been observed in the data since at least year 2000 (Fig. 10) and cannot be attributed to salmon production activity in the province. Lobster populations are prone to natural fluctuations and population dynamics can be the result of many different factors, sampling time, LFA, bottom temperature, water depth and lobster size (Koepper et al. 2021). A recent study on Nova Scotia lobster populations in LFA 33 and 34 revealed that differences in the male:female ratio in the population based on LFA suggested a significant influence of fisheries on lobster population dynamics, and the authors suggest this could lead to management issues if catch regulations are kept the same but the population dynamic and distribution changes regionally (Koepper et al. 2021). Furthermore, expected fluctuations will continue. Climate change is expected to impact lobsters as increases in benthic marine temperatures over their optimal thermal range can negatively impact growth, recruitment and survival and eventually population dynamics in Atlantic Canada (Greenan et al. 2019). While ocean temperature change and fishing pressure are determining factors that influence lobster distribution, impacts on early life stages are also important. For example, newly hatched planktonic lobster life near the surface and consume zooplankton, such as copepods, which make up the bulk of their diet (Lawton and Lavalli, 1995; DFO, 2009). It has been identified that a correlation between abundance of young lobster and the copepod Calanus finmarchicus suggests a link between the declining trend in lobster recruitment and deviations in zooplankton assemblages within the Gulf of Maine (Carloni et al. 2018). Therefore, it is critical that management and rigorous monitoring of lobster populations in the region continue; however, that fluctuations are not due to single-point factors, such as aquaculture activities.

Atlantic Canada is split into various fisheries management zones called lobster fishing areas – St. Mary's Bay is located in lobster fishing area 34. Landings from other parts of LFA 34 show a more modest decline in activity of around 31% below 2017 numbers, and just 3% from the cumulative average from 2003. This indicates that lobster fisheries as a whole are not on a sharp decline and are still flourishing in other zones, but that the St. Marys Bay is not a predominant location for lobster fishing.

CSL plans to have low density pens with a significant distance between sites, which will result in very low to no impacts on the lobsters in the vicinity. CSL is using the expertise of biologists, oceanographic specialists, and veterinarians to ensure a sustainable, low impact operation with attention to fish health and the health of wild organisms surrounding the farm.

3.2.2 Impact on Other Commercial Fisheries

Canadian Salmon Limited will be employing the industry best practices and highest standard of risk mitigation to ensure minimal impact on surrounding fisheries. Although the distance between sites is not regulated in Nova Scotia, the CSL site is at least 3.45 km away from any neighbouring site, surpassing New Brunswick's minimum distance of 300 m (Application Guide, 2011). For example, previous research has shown that nutrient output from salmon farms does not influence local invertebrate species beyond 750 radius of the site (Colombo et al. 2016).

CSL will use the latest mooring grid and pen design to prevent fish escapes. The net pens are designed by AKVA Group, a global leader in aquaculture equipment and technology. These installations will use high density polyethylene mesh and stainless steel wire, along with frequently scheduled net inspections and the latest technology available to monitor for and prevent escapes. Further information on this design can be found in Section 7 in the discussion around risk mitigation for the wild salmon population, as well as in the plans provided by AKVA Group in **Appendix E**.

CSL will employ state of the art risk mitigation strategies to avoid contamination of water and surrounding species to be achieved through regular monitoring and strict adherence to compliance requirements. Initial low stocking density will help to avoid potential incidence. Some risk mitigation methods may vary depending on the nature of the case. For example, to manage an algae bloom, oxygen is added to the cages which can be achieved in a variety of ways depending on what may be best in the situation. Feed and nutrient delivery will be monitored using technology provided by AKVA Group. These procedures and further information on Canadian Salmon Limited's Biosecurity Measures can be found in Section 8.2.

CSL's risk mitigation plans are outlined in the Farm Management Plan in **Appendix A**. Full risk mitigation plans for CSL operations are being developed for implementation based on local regulations, best industry practices and HG's current protocols which have been proven successful in their current operations.

Overall, particularly considering CSL's extensive risk mitigation and biosecurity measures, as well as a low density, eco-conscious approach to our operation, the proposed site largely serves to enhance seafood production in the region, rather than have a detrimental impact on surrounding populations and operations. As opposed to being negatively impactful to other fisheries in the area, the type of aquaculture development proposed by CSL and the methods to be employed are likely to compliment surrounding ecosystems. Further to this point, an operational Code of Practice (including site Standard Operating Procedures, that address biosecurity, etc.) is under development, with consultation of DFA veterinarians, and will be shared by June 1st, 2022.

3.3 Impacts Addressed Through Scoping/Engagement Process

In advance of tabling its application for an aquaculture license for development in the area of its *Option Agreement* within St. Mary's Bay, CSL undertook an extensive outreach and engagement process. The focus of this process was threefold:

- To brief a broad range of stakeholders on CSL's proposed plans for this site.
- To identify any issues and concerns that fishers and citizens may have; and
- To identify potential supply chain partners and collaborators, including among Indigenous communities within the area.

This outreach and engagement process took a variety of approaches including group briefing sessions, as well as bi-lateral meetings with supply chain partners, political leaders, community members, public officials, outreach to Chiefs and Indigenous fishers and industry proponents.

Two public meetings were held; these were essentially briefing sessions to explain CSL's proposed plans and its approach to aquaculture development in St. Mary's Bay. Because these briefing sessions were required to be conducted virtually as a result of health restrictions related to COVID-19, CSL took extra steps to ensure that community issues/concerns/input were canvassed so they could be addressed both in the license application document and in response to any concerns raised.

A website was established through which individuals could register for the virtual sessions. Registrants were invited to identify any questions or issues they wished to see addressed through these briefings. The virtual meetings were held on February 8th and 9th. Videos of the virtual sessions undertaken were posted on the website following the virtual meetings.

CSL is presently completing a new video focused on addressing questions that had come forward during the virtual sessions. These questions/issues are also addressed throughout this document.

Broadly, the questions/issues raised included:

- The potential impact on the wild fishery in St. Mary's Bay and, particularly, the lobster fishery.

- Potential tourism impacts.
- Questions respecting the use of antibiotics and parasite management.
- Various observations on land-based aquaculture.
- Comments in respect to plastic detritus associated with sea facilities following storms.
- Comments in respect to the wild salmon population.
- Issues related to environmental practices and potential environmental impacts.
- General antipathy toward aquaculture development.

In an effort to enhance input, registrants were invited to complete an online survey following the briefing sessions enabling them to offer further comment (provisions were made to include those who preferred a print format for completing the survey). Further input was received through an 'info@' modality available on the project website or through direct outreach to the CSL lead whose name and contact information is included on the site.

Nine respondents completed the survey – 56% of the respondents found the briefings helpful in understanding the project.

CSL recognizes the importance of Indigenous engagement and potential collaborations with First Nations fisheries. Outreach to First Nations (Acadia, Bear River and Annapolis Valley First Nation) was undertaken to inform them of the proposed development and to discuss potential opportunities for collaboration. CSL was deliberate in framing these discussions as 'information sharing' and not as 'consultation' as the duty to consult is under the purview of the Province as enshrined in the inter-governmental Tri-Partite Process.

Briefings of government officials, elected officials, fishing organizations, smolt producers (in Nova Scotia and Prince Edward Island) and potential supply chain partners were similarly focussed on information sharing and considering opportunities for potential collaborations.

Response from potential supply chain partners was enthusiastic, with many reaching out to declare an interest in potential partnership development.

CSL also received much encouragement from many who took the time to reach out and offer their observations on the importance of aquaculture development to future food security and to express their support for an ethical and sustainable approach to this development.

A detailed list of those consulted during the outreach process is included in **Appendix F**.

CSL's outreach and engagement is ongoing and will continue following submission of the license application.

4 OCEANOGRAPHIC AND BIOPHYSICAL CHARACTERISTICS OF THE PUBLIC WATERS

4.1 Oceanographic Environment

St. Mary's Bay is located between Digby Neck and mainland southwestern Nova Scotia, as illustrated in Figure 11. It is adjacent to the Gulf of Maine and the Bay of Fundy, a well developed fish farming and fishing region. St. Mary's Bay is a well known lobster fishing zone, but haddock, herring, mackerel, clams and scallops are also fished in the bay. It has high tidal ranges (6 to 7m), strong currents (excess of 2 m/s in areas), and remains essentially ice free throughout the year. St. Mary's Bay is protected from ocean swell waves by Digby Neck to the north, and southwestern Nova Scotia to the east. The option area under consideration is exposed to ocean swell from south and southwest which will travel directly into the bay. These waves are expected to lose energy by travelling into shallower waters. From a containment system perspective, feasibility of fish farming directly in the option region is very dependent on ensuring that current speeds are not excessive. Additionally, it is important that water temperatures are moderate and the sites remain essentially ice free.

The following sections review the key metocean conditions at the site, baseline environmental monitoring information and review the site design. An initial assessment of the metocean conditions at the site, and assessment of engineering feasibility is provided in **Appendix G** within the document entitled *Environmental Conditions Report – 3327832 Nova Scotia Limited – St. Mary's Bay*, DSA Ocean, 2021-10-18.

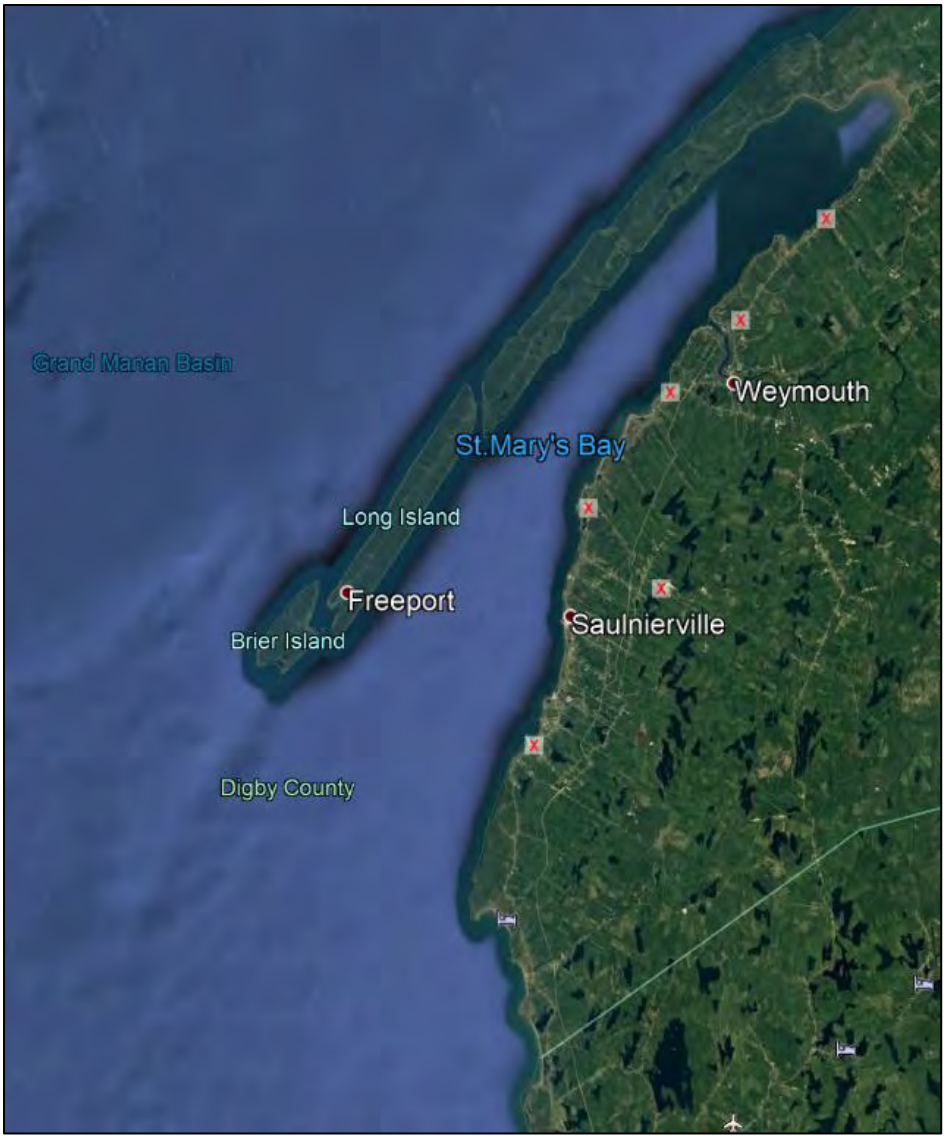


Figure 11: The St. Mary's Bay, Nova Scotia, Canada

4.1.1 Maximum Wind Speed

The estimated annual maximum wind speed, in terms of the 1 hour mean speed at 10m elevation, was determined to be 23.4 m/s (84 km/h). The wind speed near the 4 leases was assessed by processing MSC50 hindcast model data, in addition to local weather stations located at the northern end of Brier Island, which is more exposed to northerly winds than the proposed finfish farm site locations. A maximum wind speed of 29.72 m/s was recorded on March 26, 2014 from direction 330 degrees at Brier Island. Table 7 presents the maximum 1 hour average wind speeds at 10m elevation. These are approximated from MSC50 model of the area. Wind gusts are typically observed to be 30-35% higher than these values. Figure 12 shows a wind rose based on data collected between 2001-2020 from the Environment Canada weather station on Brier Island. This shows the strongest winds come from the south. The prevailing

winds, however are from the northwest across the Bay of Fundy and Gulf of Maine. Figure 13 and Figure 14 show the predominant winds during winter and summer months, respectively. Predominant winds out of the west-northwest are found in winter, and predominant winds from the south are common in summer.

Table 7. Maximum wind speeds from MSC50 hindcast model – in terms of 1 in 10 and 1 in 50 yr return periods

Direction [from] [°]	$U_{wind,10year}$ [m/s]	$U_{wind,50year}$ [m/s]
N	20.39	24.33
NNE	20.99	25.18
NE	22.17	27.13
ENE	21.69	27.33
E	23.39	25.03
ESE	19.88	24.22
SE	19.45	23.26
SSE	19.97	24.06
S	19.91	23.48
SSW	19.75	23.29
SW	18.8	21.88
WSW	19.6	23.15
W	19.56	23.1
WNW	20.5	24.2
NW	19.99	23.39
NNW	19.67	23.34

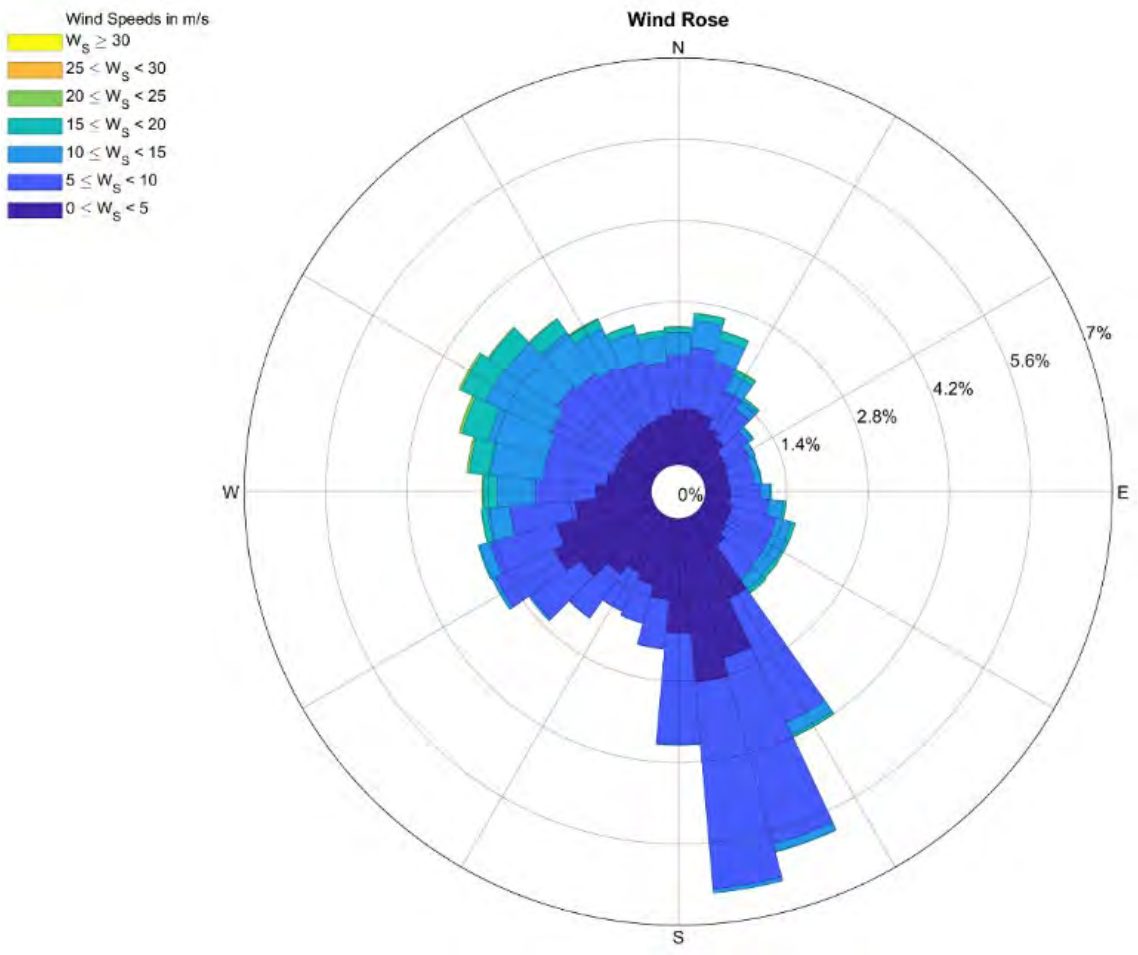


Figure 12. Wind rose – 1 hour mean speed at 10m – Brier Island (2001-2020) – Annual

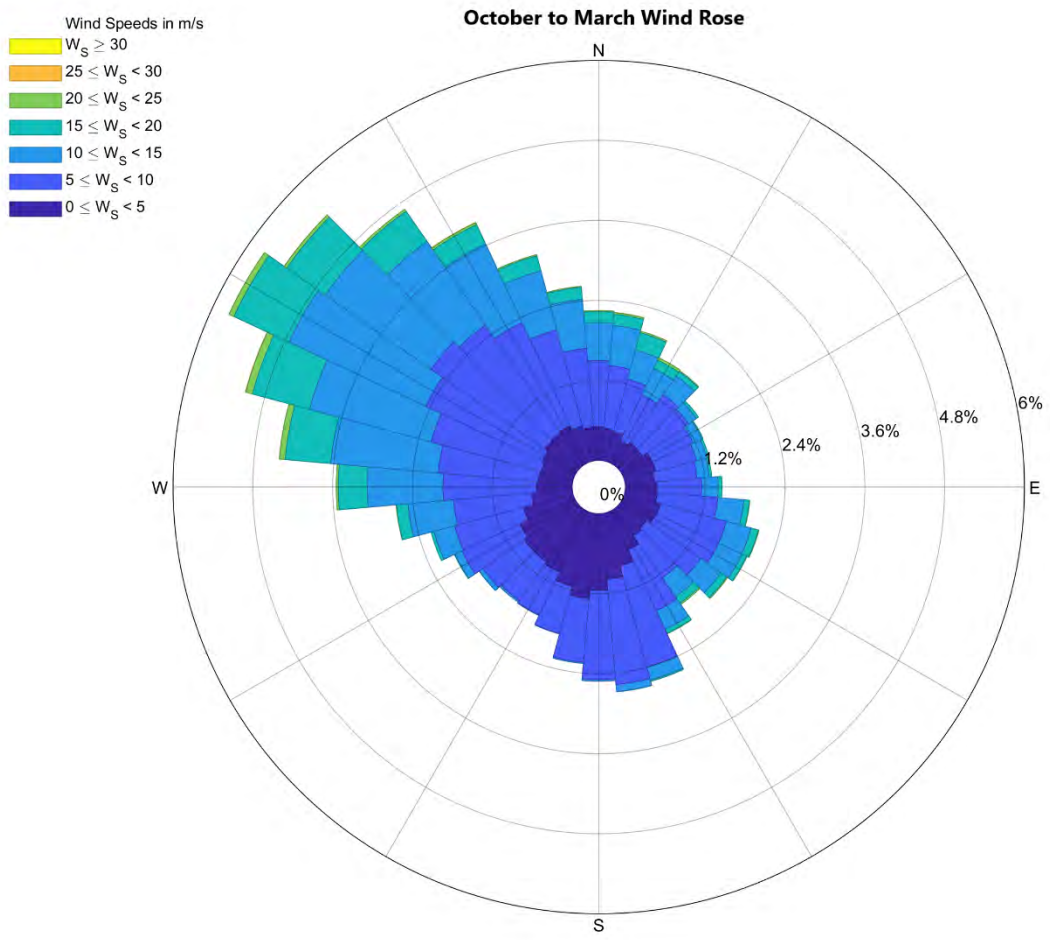


Figure 13. Wind rose – 1 hour mean speed at 10m elevation – Brier Island – October to March

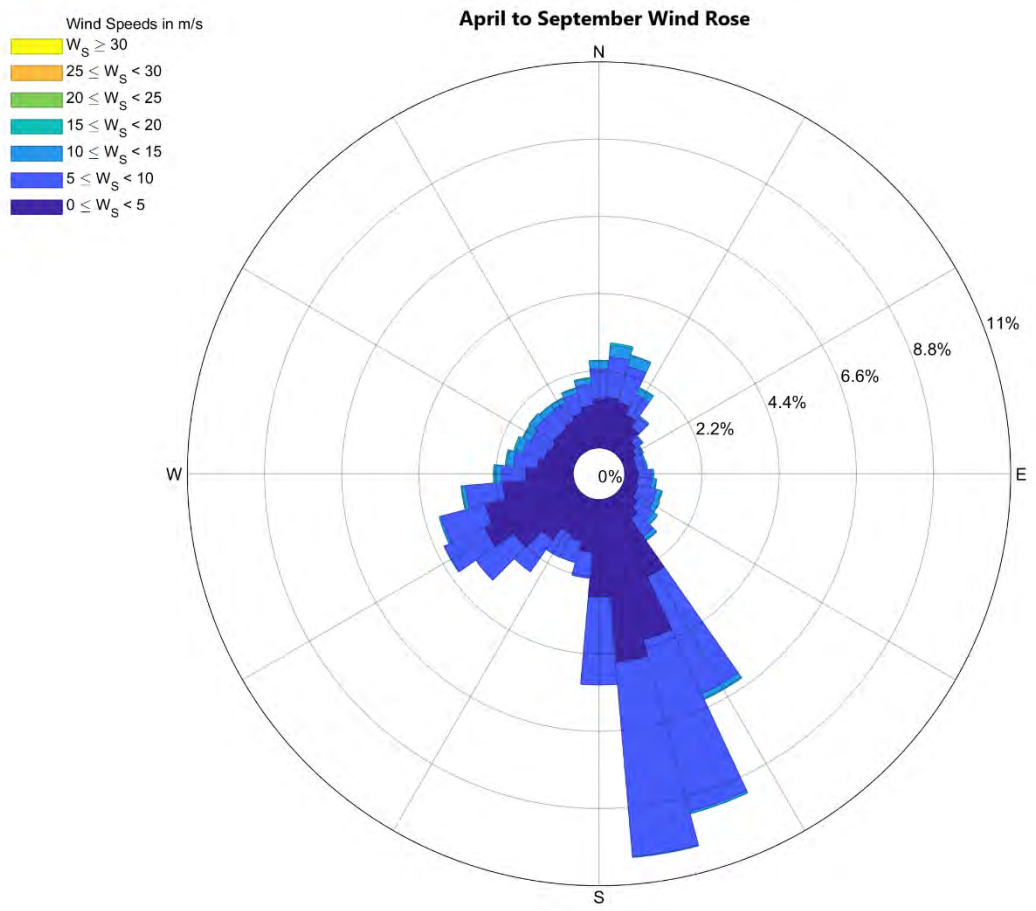


Figure 14. Wind rose – 1 hour mean speed at 10m elevation – Brier Island – April to September

4.1.2 Maximum Wave Height

The maximum significant wave height in the area is due to offshore swell which propagates into the bay from the south, and due to the fetch in the south-southwest direction. Propagation and dissipation of swell into the site is shown in Figure 15. The sites are generally protected from northerly wind-waves, although there are strong north-westerly winds expected at the sites through the winter months. Table 8 provides the maximum significant wave height as calculated using a shallow water wave-propagation model of the area. At the southern most site under consideration, the waves will be highest. At this location, the maximum annual significant wave height is expected to be 1.9 m (~6 ft), and the maximum peak to trough wave height to be approximately 3.6 m. Wind-waves from the northeast are also significant due to the open fetch in this direction, whereas waves due west and to the north are limited due to fetch limitation of Long Island and Digby Neck.

At site 1, the northernmost potential site, the maximum annual significant wave height is expected to be 1.2 m (~4ft). The reduction in significant wave height is primarily due to dissipation of swell as you move further into the bay.

Table 8. 1 in 10 year extreme wind speed and significant wave height at southernmost site – the most exposed of the four proposed sites.

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.64	2.37
	23	NNE	20.99	0.73	3
	45	NE	22.17	1.64	3.88
	68	ENE	21.69	1.39	3.53
	90	E	23.39	1.4	3.53
	113	ESE	19.88	0.84	3.14
	135	SE	19.45	1.1	4.57
	158	SSE	19.97	1.54	5.25
	180	S	19.91	1.62	7.1
	203	SSW	19.75	1.92	5.42
	225	SW	18.8	1.57	5.78
	248	WSW	19.6	0.74	3.97
	270	W	19.56	0.47	2
	293	WNW	20.5	0.34	1.87
	315	NW	19.99	0.41	2.62
	338	NNW	19.67	0.48	2.38

Table 9. 1 in 10 year extreme wind speed and significant wave height at northernmost site – the least exposed of the four proposed sites

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.6	2.28
	23	NNE	20.99	0.71	2.87
	45	NE	22.17	1.19	3.48
	68	ENE	21.69	1.28	3.32
	90	E	23.39	1.19	3.23
	113	ESE	19.88	0.64	2.65
	135	SE	19.45	0.78	3.47
	158	SSE	19.97	0.97	3.24
	180	S	19.91	1.2	3.5
	203	SSW	19.75	1.23	2.93
	225	SW	18.8	1.27	3.64
	248	WSW	19.6	0.71	2.5
	270	W	19.56	0.54	2.2
	293	WNW	20.5	0.33	1.85
	315	NW	19.99	0.39	2.38
	338	NNW	19.67	0.45	2.22

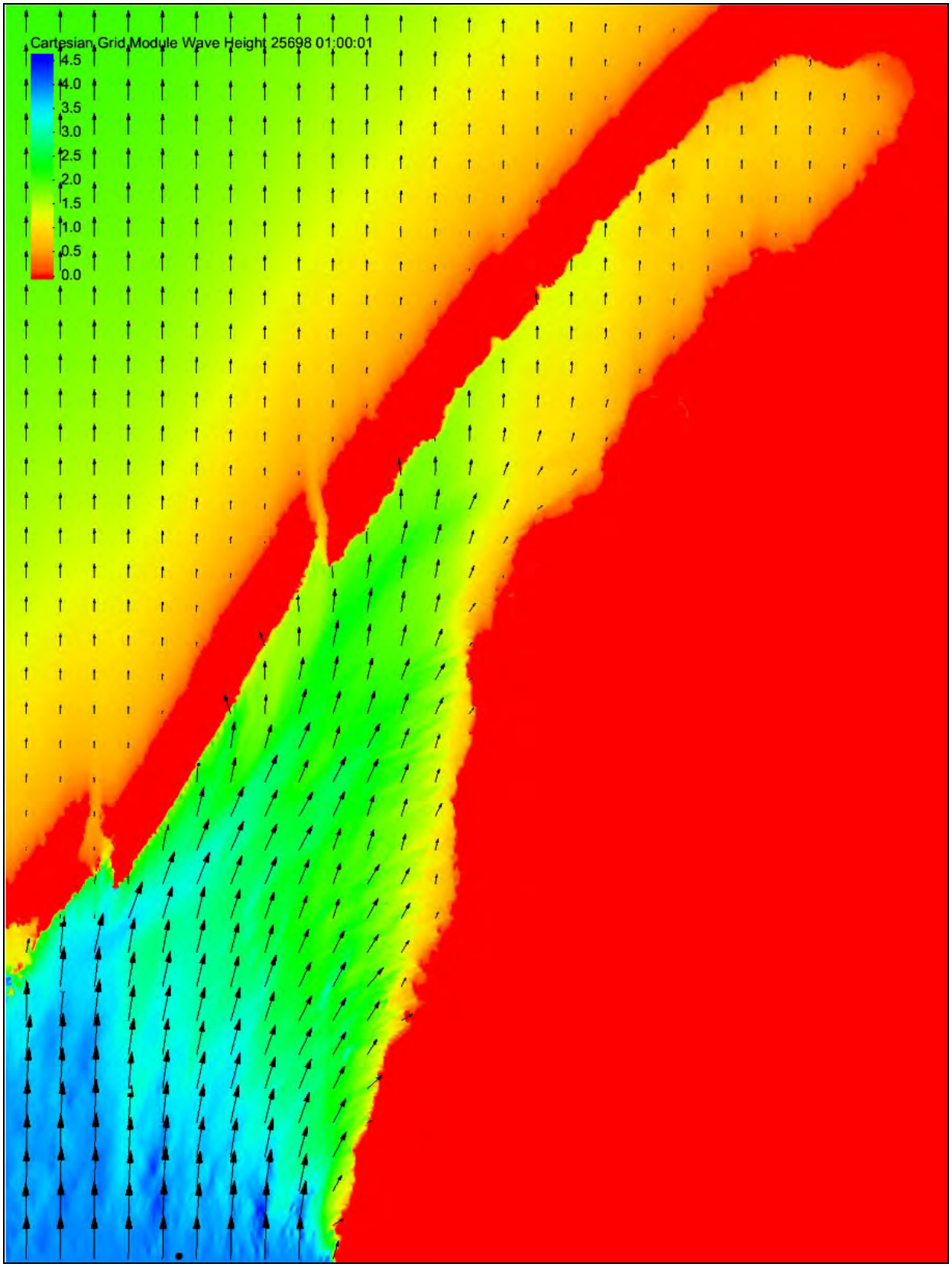


Figure 15. Southerly waves propagating into the bay

4.1.3 Direction of Maximum Wave

As discussed in the previous section, the direction of the maximum waves is from the southwest and south-southwest. Wind-waves from the northeast are significant as well due to the fetch across inner St. Mary's Bay.

4.1.4 Minimum Tide

Based on Webtide and acoustic Doppler current profiler (ADCP) measurements, the minimum annual tide elevation is expected to be ~0.3 m. The tidal range in St. Mary's Bay in the option area was measured to be 6.8 m, over a 3 month span. A realistic storm surge of 1 m is expected and should be used for design purposes.

4.1.5 Maximum Tide

The maximum annual tide elevation is expected to be 7.5 m.

4.1.6 Current Speed Range

Three bottom-moored ADCPs were deployed in the area during the summer of 2021 to determine the current speed ranges and averages at the four sites within the option area, as shown in Figure 16. The current speed ranges and averages are provided in Table 10 for the predominant current directions. The ADCP deployment information is provided in Table 11. In general, the averages at the four sites are approximately 40 cm/s in both flood and ebb, while the maximum expected values range between 118 and 207 cm/s. Site 4 is the most energetic, and has slightly higher max current speed, but these high values are not sustained, as time series of the current speeds shows (see *Environmental Conditions Report* found in **Appendix G**).



Figure 16. ADCP 3 during deployment

Table 10. Current speed maximum recorded and averages for flood and ebb directions

	Ebb			Flood		
Site	**Predominant direction [to] (deg)**	**Maximum recorded current (cm/s)**	**Average current (cm/s)**	**Predominant direction [to] (deg)**	**Maximum recorded current (cm/s)**	**Average current (cm/s)**
Site 1	235	114	40	80	118	43
Site 2	235	114	40	80	118	43
Site 3	235	133	27	80	131	36
Site 4	240	196	38	80	207	33

Table 11. List of ADCP models with their deployment locations and dates

Site	ADCP	ADCP model	Deployment location	Water depth (Low water)	Deployment dates
Site 3	1	Teledyne RDI Workhorse Sentinel 300kHz	44° 23.134'N, 66° 10.118'W	44m	Deployed June 18, 2021 for 90 days
Site 1 and Site 2	2	Teledyne RDI Workhorse Sentinel 600kHz	44° 26.325'N, 66° 6.475'W	22m	Deployed June 18, 2021 for 90 days
Site 4	3	Teledyne RDI Workhorse Sentinel 300kHz	44° 19.621'N, 66° 14.346'W	40m	Deployed August 4, 2021 for 50 days

4.1.7 Minimum / Maximum Salinity

The annual minimum salinity expected at the site is 28.8 PSU/PPT. This estimate of the minimum annual salinity is based on data collected by Centre for Marine Applied Research (CMAR) at shellfish lease 5008, which is located further into St. Mary's Bay relative to the leases proposed. The Bay of Fundy and Gulf of Maine tend to see higher minimum annual salinities as you move outwards into the center of the bay, as shown in Figure 17. Thus, 28.8 PSU/PPT is expected to be a lower reasonable limit of salinity. The salinity data set used to verify estimates is plotted in Figure 18.

The annual maximum salinity expected at the site is 32.5 PSU/PPT. This is in line with observations and measurements in the outer Bay of Fundy (Maritimes Region, 2013; Physical Oceanographic Conditions, 2020).

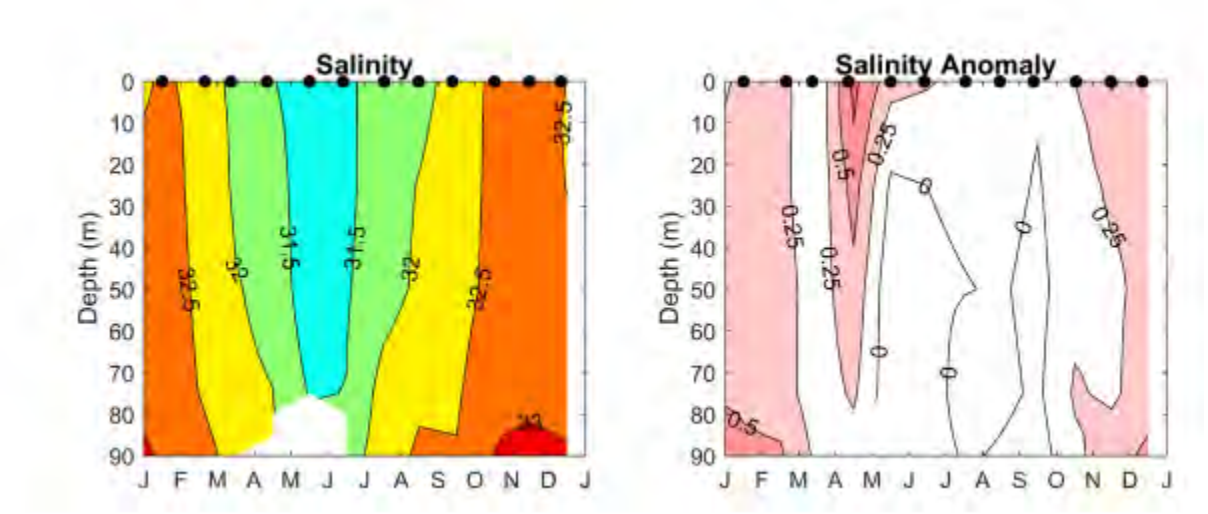


Figure 17. Expected variation in annual salinity in the outer Bay of Fundy

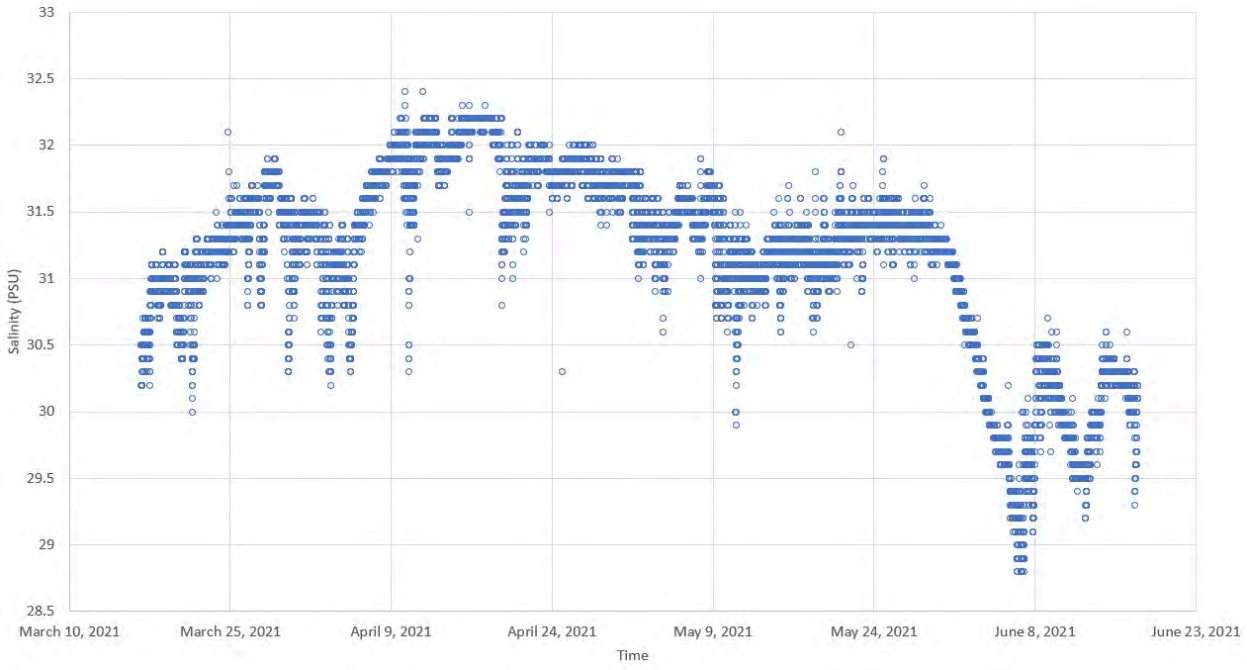


Figure 18. Variation in salinity during key months within inner St. Mary's Bay

4.1.8 Minimum / Maximum Temperature

Water temperature was assessed by analyzing measurement, satellite and hindcast models of St. Mary's Bay. The minimum expected water temperature was expected to be 1°C for all 4 sites. The maximum annual water temperature expected at the leases is 17°C. The data shows up to 20°C is possible in shallower areas of the bay, but these temperatures are not expected within the lease areas.

The location of 6 sampling stations for water temperature in St. Mary's Bay is shown in Figure 18. The presented data includes 4 short-term data measurements which are publicly available in Nova Scotia Open Data Portal (see Figure 22 to Figure 26). Long-term historical temperature data is also provided using ERA5 model (see Figure 20). In addition, another long-term temperature data point at the northern boundary of the St. Mary's Bay is measured using satellite data (see Figure 21).

In this report, water temperature information is presented for six sampling stations:

- ERA5 model data from 1979 to 2017: 44° 15.000'N, 66° 18.601'W
- Satellite data from 2009 to 2021: 44° 32.716'N, 65° 57.370'W
- Long Beach data from July 2020 to November 2020: 44° 24.104'N, 66° 9.576'W
- Long Island data from January 2019 to May 2019: 44° 21.007'N, 66° 13.458'W
- Long Island data from July 2020 to November 2020: 44° 21.007'N, 66° 13.458'W
- Long Island 2 data from July 2020 to November 2020: 44° 19.986'N, 66° 12.125'W
- Sandy Cove data from July 2020 to November 2020: 44° 29.140'N, 66° 3.575'W



Figure 19. Sampling temperature stations in St. Mary's Bay

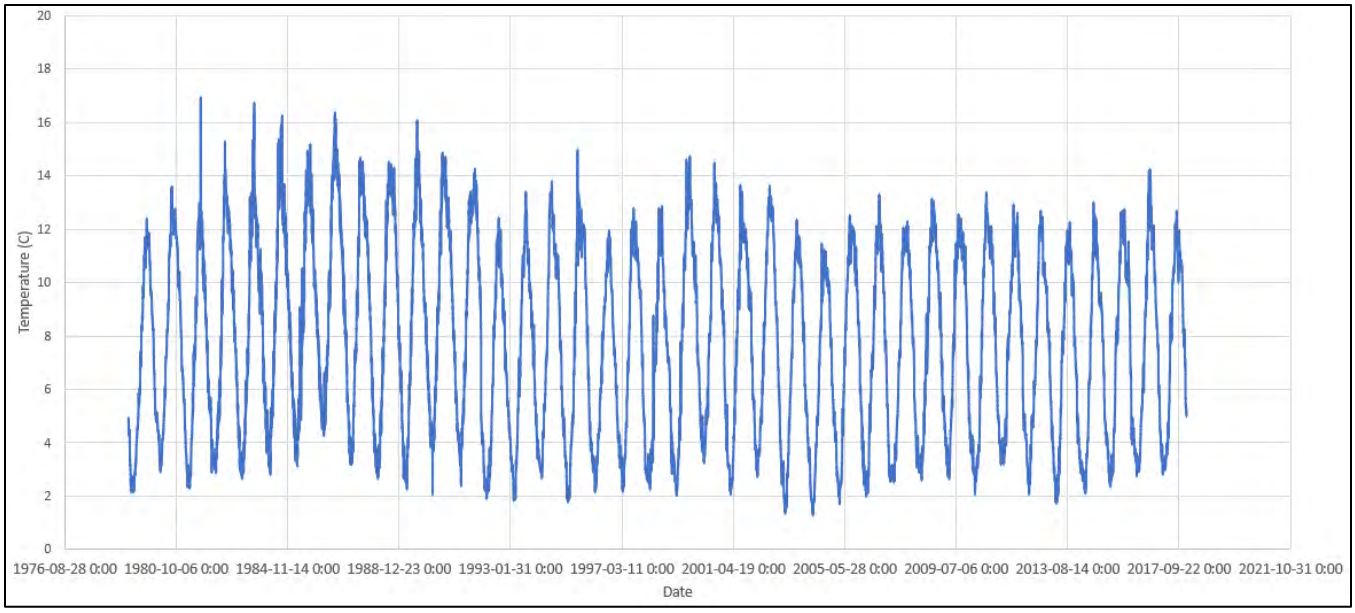


Figure 20. Temperature data from 1979 to 2017 using ERA5 model – Coordinates: 44° 15.000'N, 66° 18.601'W

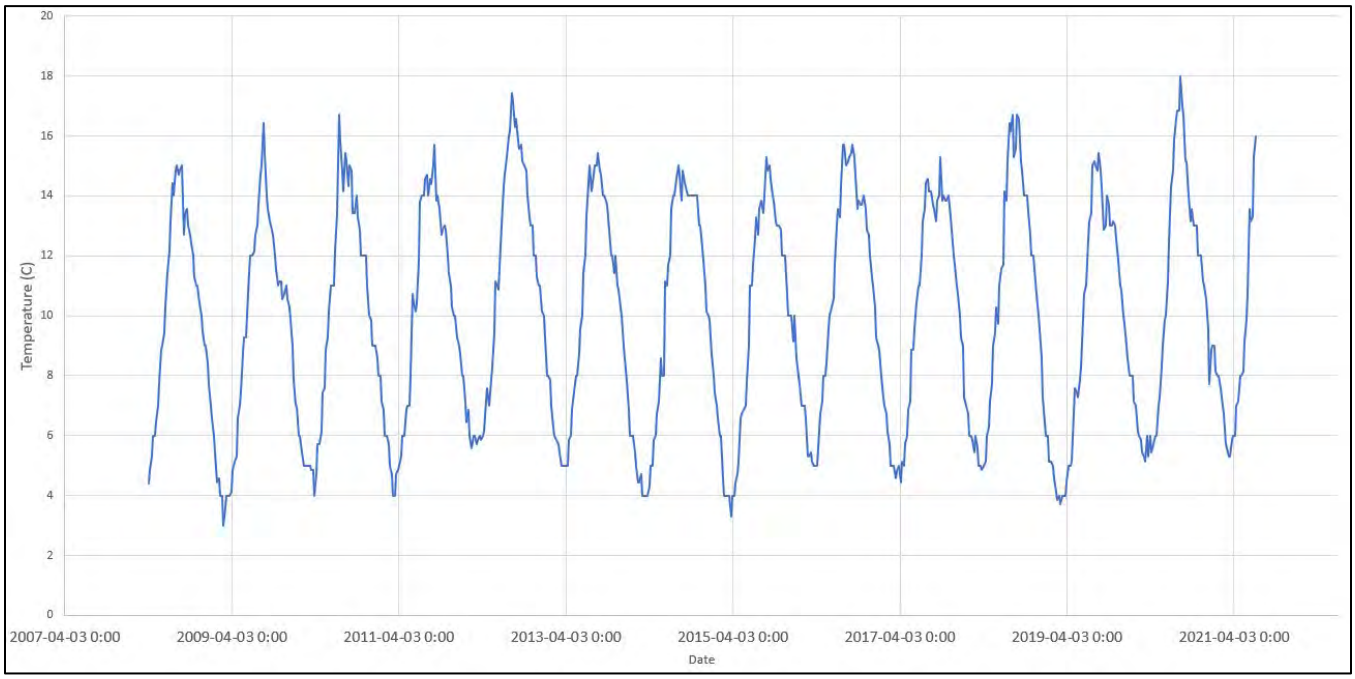


Figure 21. Temperature data from 2009 to 2021 using Satellite data – Coordinates: 44° 32.716'N, 65° 57.370'W

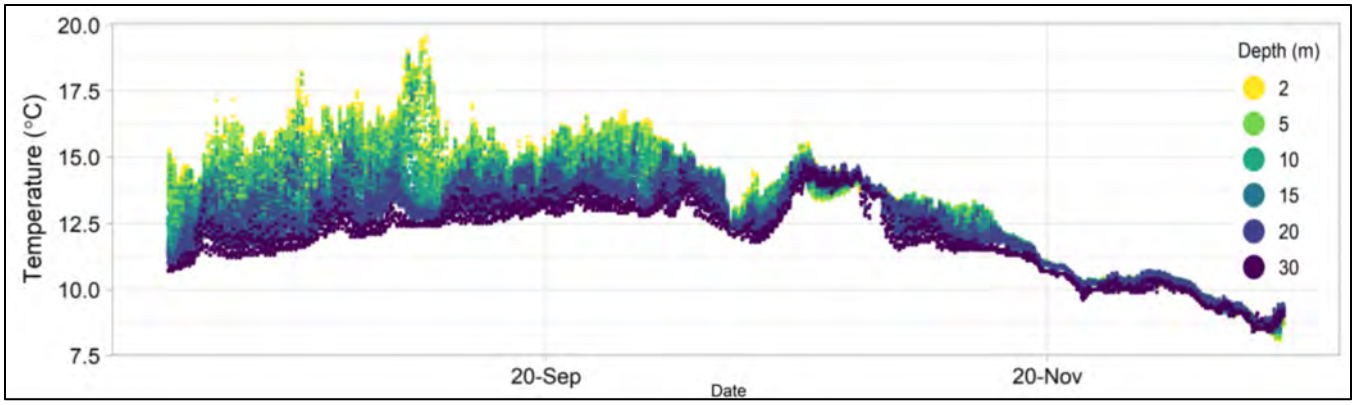


Figure 22. Long Beach temperature data from July 2020 to November 2020 – Coordinates: 44° 24.104'N, 66° 9.576'W

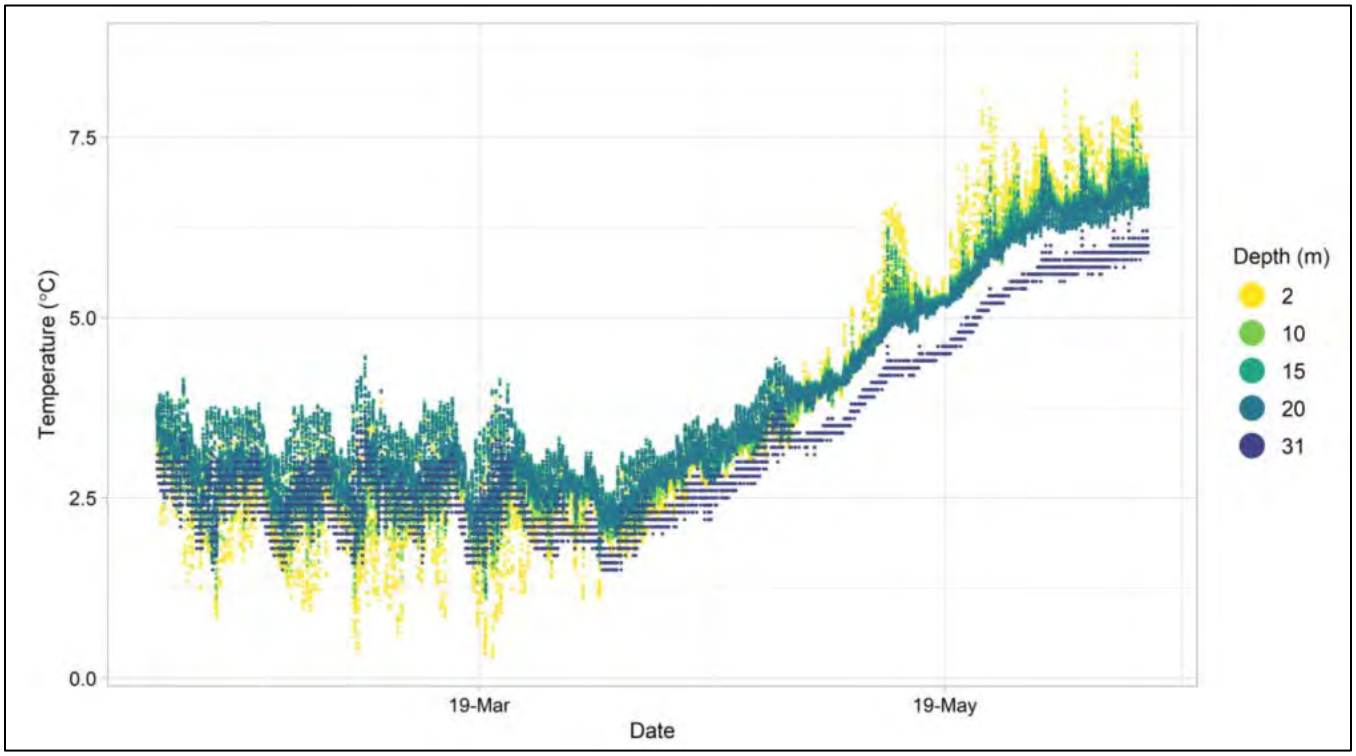


Figure 23. Long Island temperature data from January 2019 to May 2019 – Coordinates: 44° 21.007'N, 66° 13.458'W

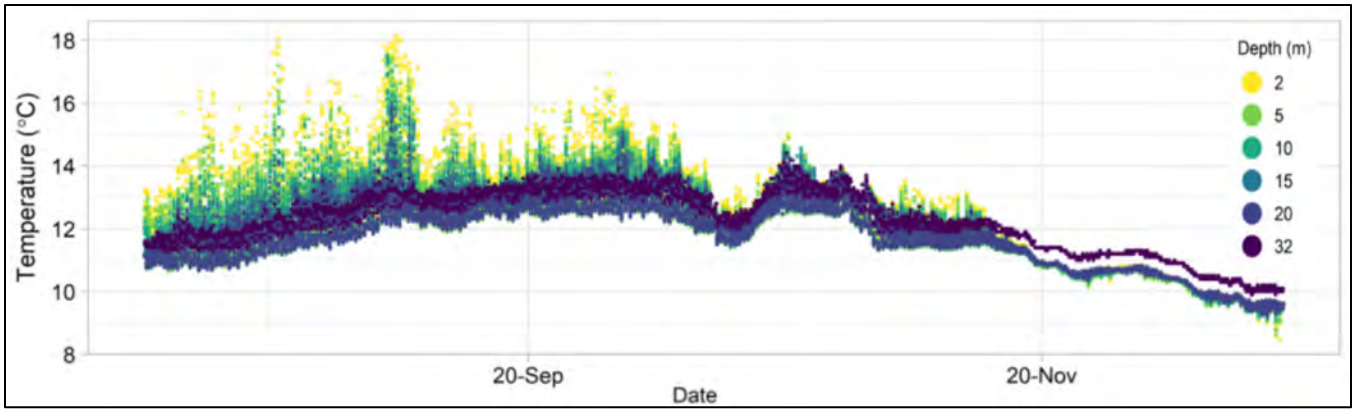


Figure 24. Long Island temperature data from July 2020 to November 2020 – Coordinates: 44° 21.007'N, 66° 13.458'W

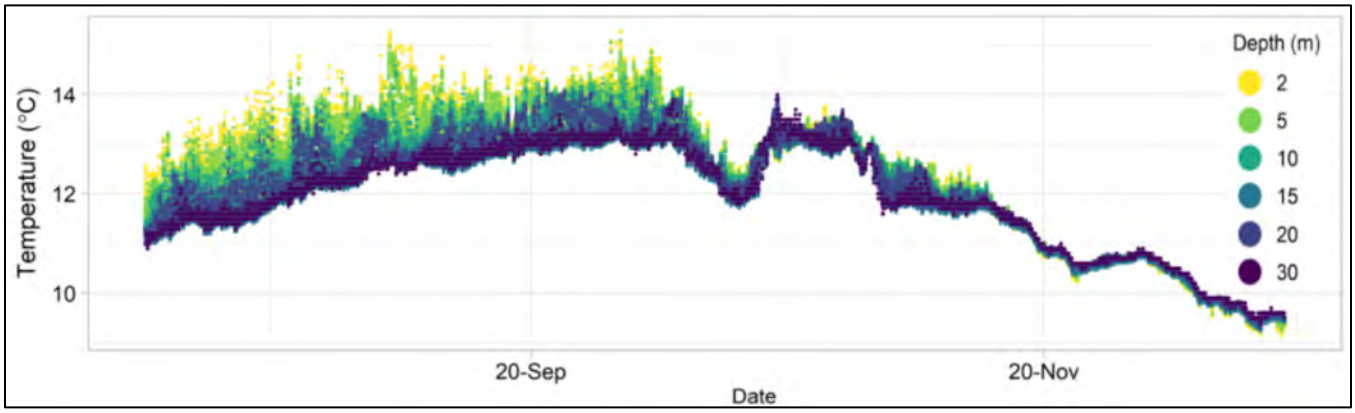


Figure 25. Long Island 2 temperature data from July 2020 to November 2020 – Coordinates: 44° 19.986'N, 66° 12.125'W

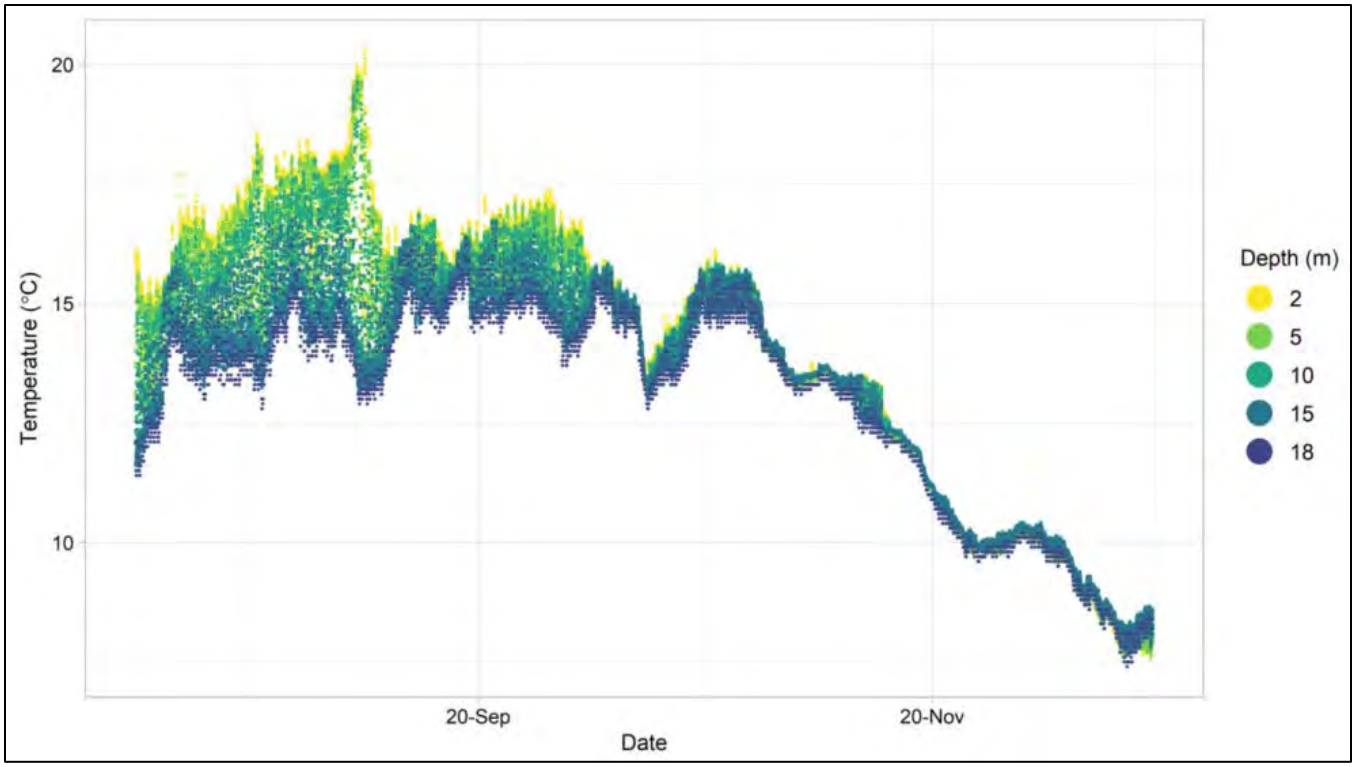


Figure 26. Sandy Cove temperature data from July 2020 to November 2020 – Coordinates: 44° 29.140'N, 66° 3.575'W

4.1.9 Water Depth / Site Bathymetry

Canadian Hydrographic Service (CHS) data was extracted for the region for the purposes of wave modeling, and to develop site plans which allowed for sufficient clearance of the nets. Figure 27 shows the water depths throughout the bay, which is generally 30-50 m deep. The water depths at each of the 4 corners of the sites are provided in Table 12. Site 1 is the shallowest, with depths approaching 11 m at some areas of the lease, while site 3 and 4 are generally deeper with depths typically between 30 and 40 m.

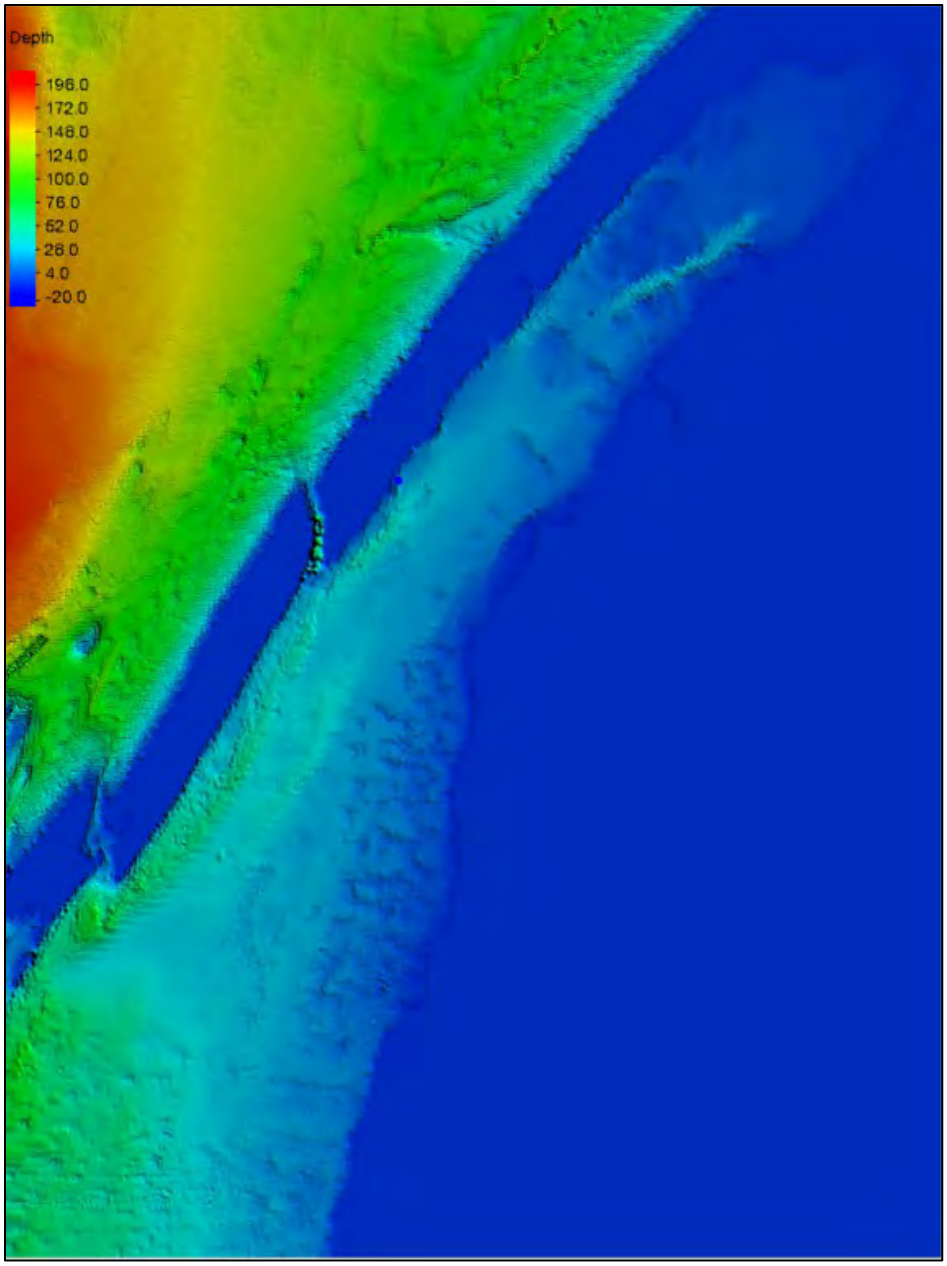


Figure 27. Bathymetry at site on hydrographic charts – Depth reported in meters

Table 12. Water depths at Sites – based on CHS 10m resolution non-navigational data – Low water

	Site 1	Site 2	Site 3	Site 4
Site Corner	**Depth (m) – at LLW**			
NW	**28**	**20**	**31**	**37**
NE	**11**	**24**	**38**	**41**
SE	**19**	**26**	**35**	**43**
SW	**26**	**21**	**39**	**37**

4.1.10 Ice Potential

Between 2004 and 2019, the Canadian Ice Service (CIS) ice maps indicate presence of ice in St. Mary's Bay during four of these years: 2004-2005, 2008-2009, 2014-2015, and 2018-2019. In all of them, the ice conditions are classified as "open water", which is defined by the World Meteorological Organization (WMO) as ice covering less than 10% of the surface. In practice, the classification of "open water" indicates that there is potential for ice to be present but does not necessarily indicate the actual presence of ice. For example, although open water was indicated for 2009, all the historical temperature data (Satellite data and ERA5 data) presented in the previous section, show the mean daily water surface (2 m depth) temperature for 2009 from mid January until May remained above 1℃ throughout the entire winter, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter of 2009. Some ice may be present

Additionally, St. Mary's Bay is not well represented in both weekly and daily ice charts (Fig. 28). However, some efforts were made by CMAR to interpret the weekly charts which indicated that the bay did not freeze during 2003-2004, 2005-2006, 2006-2007, 2009-2010, 2011-2012, 2013-2014 and 2015-2018. Freeze-up and break-up dates for the Eastern Coast of St. Mary's Bay are presented in Table 13.

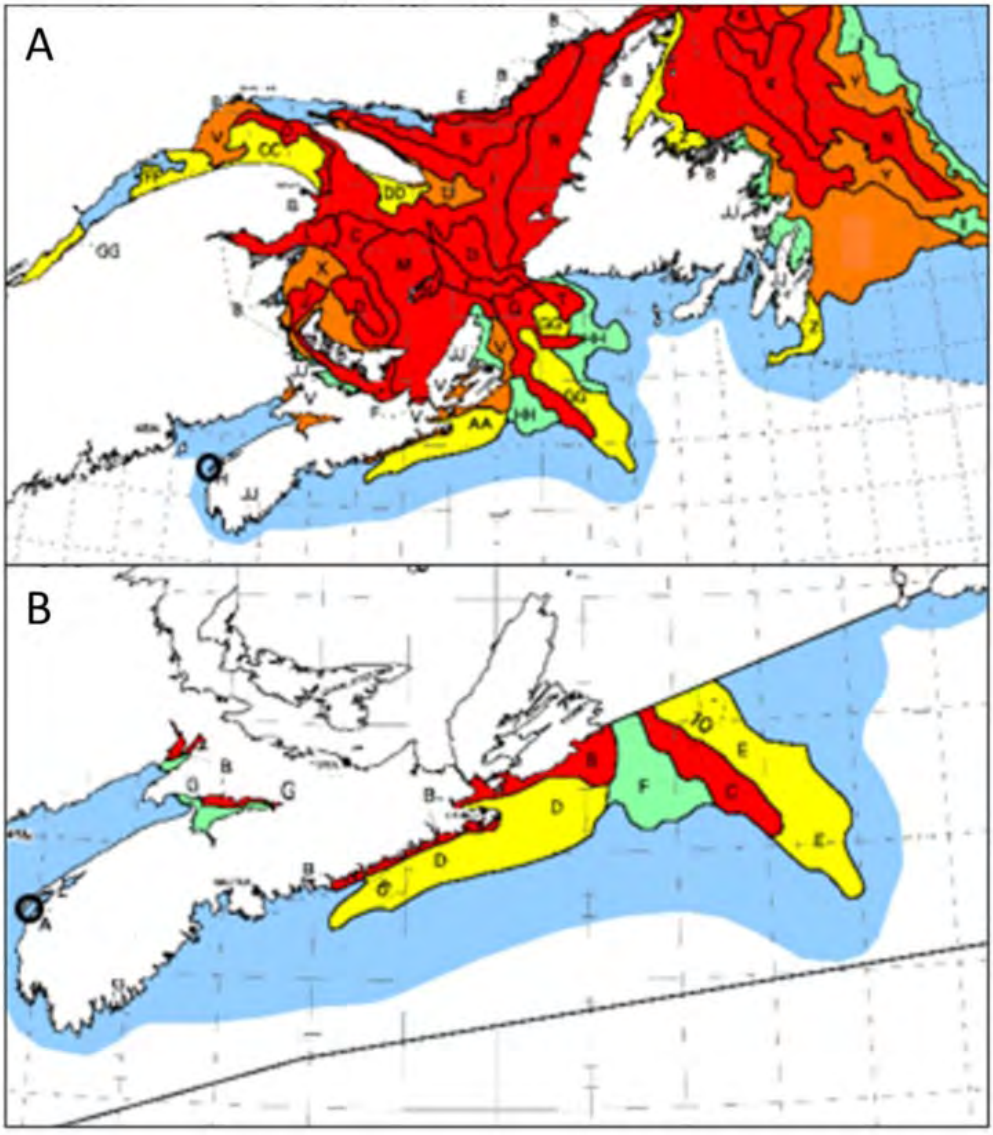


Figure 28. St. Mary's Bay (circled in black) was not well represented in the A) weekly ice chart (Eastern Coast), or B) daily ice

Table 13. Freeze-up and break-up dates for St. Mary's Bay as per weekly historic ice charts

Area of Interest	Extent	Season	Freeze-up	Legend Value	Break-up
St. Mary's Bay	Eastern Coast	2004-2005	07/02/2005	< 1/10	14/02/2005
St. Mary's Bay	Eastern Coast	2008-2009	26/01/2009	< 1/10	09/03/2009
St. Mary's Bay	Eastern Coast	2014-2015	23/02/2015	< 1/10	20/04/2015
St. Mary's Bay	Eastern Coast	2018-2019	14/01/2019	< 1/10	25/03/2019

According to the presented data and the location of potential marine fish farms (Western Coast), we can conclude that there will be a low chance of sea ice during the winter.

4.2 Baseline Environmental Monitoring

Baseline Environmental Monitoring was unable to be completed in advance of submission of the licence applications due to inclement weather and mechanical challenges related to the vessel chartered.

Discussions with officials of the Department of Fisheries and Aquaculture confirmed that the baseline monitoring could be submitted later. CSL confirmed that this analysis will be completed and submitted no later than April 15th, 2022.

This baseline environmental monitoring will be completed in compliance with the July 2021 *"Standard Operating Procedures For the Environmental Monitoring of Marine Aquaculture In Nova Scotia"* and in accordance with the DFO Aquaculture Monitoring Standard 2018.

A baseline monitoring report for all four sites is will be provided upon completion. This report will summarize:

1. Sampling Location
2. Video Surveys
3. Bathymetric Data
4. Current meter (ADCP) Data Collected
5. Sediment Collection and Analysis
6. Deposition Modeling
7. Fish and Fish Habitat Survey

4.3 Site Design

The 4 leases have been placed along the southeastern shore of Digby Neck and Long Island, as shown in Figure 29. The sites have been oriented longitudinally with the current. This reduces total hydrodynamic loading on the cage and anchoring system, and allows the system to better handle the direction of the periodic larger waves from the south.

Site 1 and 2 are approximately 4 km apart, while Sites 2 and 3, and 3 and 4 are ~7.5 km apart. Site 4 has been placed as far south as reasonable within the option area to avoid turbulent outflows of Petite Passage.

Finite-Volume, primitive equation Community Ocean Model (FVCOM) modeling of the flows in the area was reviewed to understand the extents of the flow patterns coming out of Petite Passage. This is shown in Figure 30.

The sites are placed onlong the northern side of the bay, as in the winter, any sediment-laden ice which forms on beaches tends to be deposited along the southern shore. The sites are more

protected from winter northwesterly winds; the reduced fetch will protect the site from wind-waves.

The sites have been selected due to strong flows into and out of the outer Bay of Fundy, which maintain water quality and reduce the likelihood of exterme lower water tempeatures which could result in superchill, which is a challenge in shallower more protected areas of the province.

The planned site equipment is to be supplied by AKVA Group. Further details on the typical anchoring patterns of the 2x6 arrays is provided in Section 6.1. As the site has strong currents, the net pen selected has a steel weighted collar which prevents deformation under currents. The net pen total depth with be 15 m, with the side wall 12m and the cone – as indicated in Figure 31. Robust floating collars with high load capacity have been selected due to the predicted load combinations expected by the detailed engineering load analysis. Each of the sites will be able to support the full 15 m net pen depth expected.

The containment nets will normally be changed once or twice during the production cycle starting with nets for smolts (100 -500g) with 30 mm (stretched) mesh size (#24 twine size). As the fish grow, larger mesh sizes will be used such as 36mm and 50mm mesh sizes with twine sizes of #36 and #42 respectively. When larger post smolts (+500g) are available, the 36 mm nets will be used from stocking. Predator nets will be used to prevent interaction with marine mammals.



Figure 29. Leases within the bay

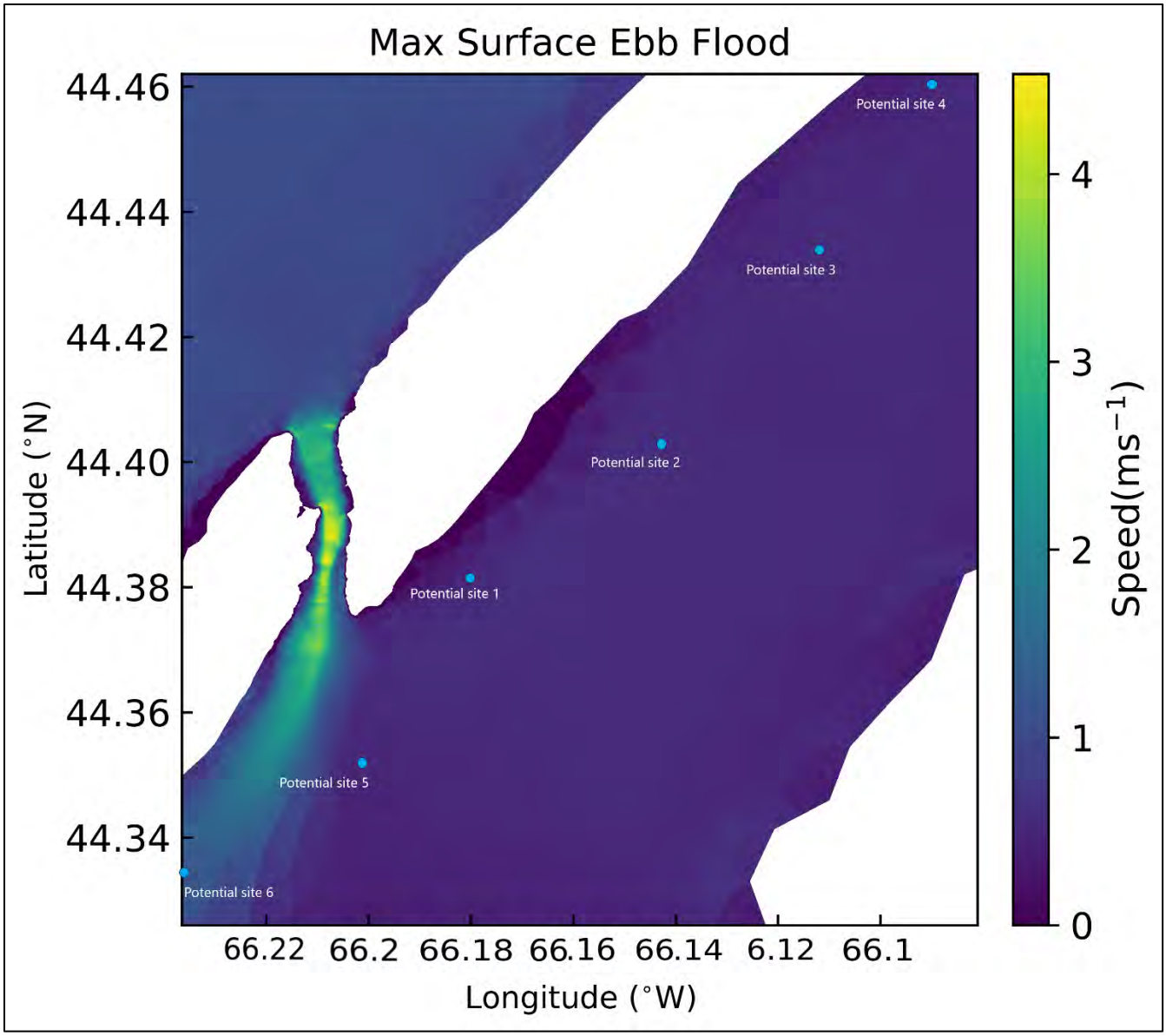


Figure 30. Surface ebb speed at the St.Mary's Bay (FVCom modeling results). NOTE: The sites numbers 1-6 were those considered as part of early stage scoping activities, and sites 1, 3, 4 and 6 were advanced.



Figure 31. Subsurface containment net with weight ring to prevent deformation under currents

5 THE OTHER USERS OF THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

5.1 Description of Other Users

St. Mary's Bay, a sub-basin of the Gulf of Maine, is a long narrow bay. Its southeastern shore is formed by mainland Nova Scotia. Its northwestern shore is formed by the Digby Neck, Long Island and Brier Island.

The bay is part of the outer zone of the Bay of Fundy and is about 590 square kilometers (227 square miles) in size. It is a narrow inlet of water approximately 60 kilometers (48 miles) long and only about 15 kilometers (10 miles) wide.

Major communities situated on St. Mary's Bay include Sandy Cove, Weymouth, Belliveau's Cove, Comeauville, Saulnierville, and Meteghan.

5.1.1 Adjacent Property Owners

Figure 32 below, shows Canadian Salmon Limited Development Sites on the Northwestern Shore of St. Mary's Bay. This is an area that is largely uninhabited in respect to residential and property development.

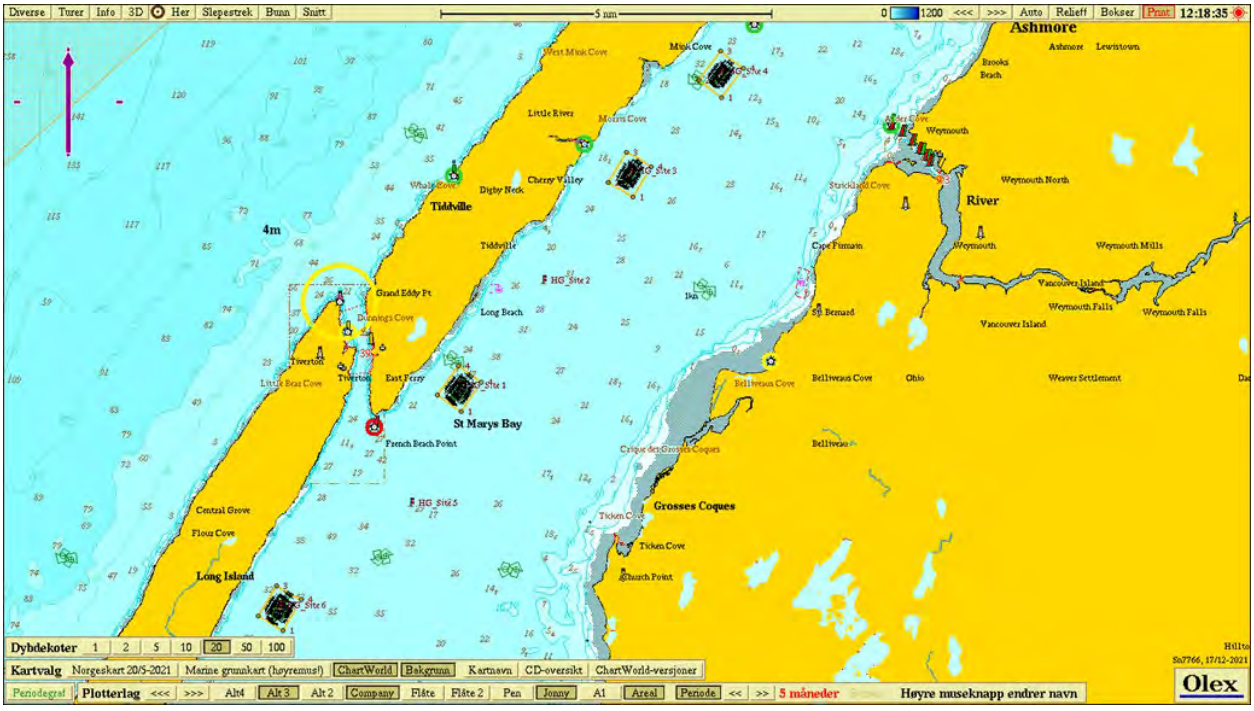


Figure 32. CSL Development Sites on the Northwestern Shore of St. Mary's Bay



DESIGNPOINT
engineering • surveying • solutions

DRAFT

ST MARY'S BAY
SITE 3
POTENTIAL AQUACULTURE LOCATION

ST. MARY'S BAY
COUNTY OF DIGBY
PROVINCE OF NOVA SCOTIA

100 0 50 100 200 400
Scale: 1:1000 (Metric)

DATE: JANUARY 20, 2022

Figure 33. Key Landmarks and Distance from Site 3 (previous page)

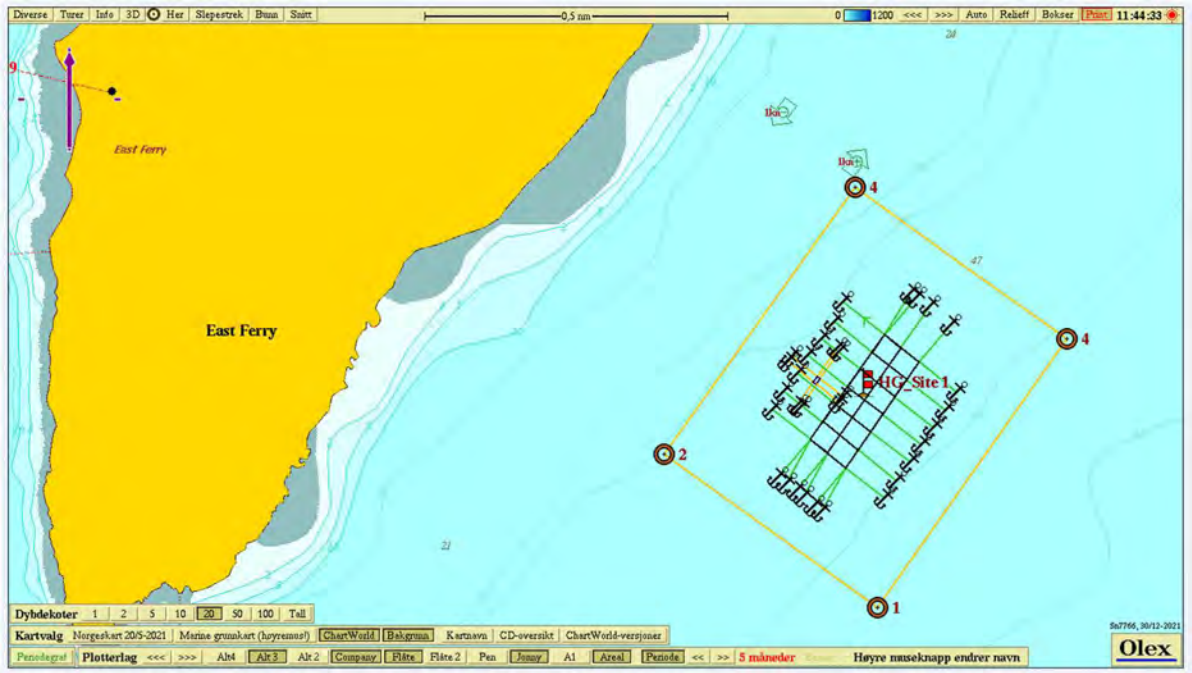


Figure 34. CSL Development Site 1

Canadian Salmon Limited commissioned Design Point Engineering to undertake an inventory of land-based property ownership, tourist attractions, towns and local ports/harbours where fish processing operations are concentrated. Table 14 and 15 below summarize the distances between the proposed CSL site development and local land marks. The complete report is included in **Appendix H**.

Table 14. Nearby Landmarks, Wharfs and Towns

Nearby Landmarks	Distance
East Ferry (Tiverton)	3.3 km
Balancing Rock	4.2 km
Sandy Cove Wharf	14.1 km
Little River Wharf	8.2 km

Neighbouring Towns	Distance
Saulnierville	13 km
Belliveau Cove	9 km
New Edinburgh	14.2 km

Table 15. Property Owners and Distance to the Site

Nearby Land Owners	Distance
[redacted]	1.3 km
[redacted]	2.15 km
[redacted]	2.5 km
[redacted]	2.65 km
[redacted]	1.35 km
[redacted]	1.45 km
[redacted]	1.95 km
[redacted]	2 km

There is not extensive residential development of the lands nearest to CSL's proposed development site.

The sites do not interfere with vessel transit or create a navigation hazard. Development of the CSL sites will not adversely impact adjacent property owners or their access to the water.

5.1.2 Pleasure Craft and Commercial Boat Traffic

Boat traffic within St. Mary's Bay is primarily fishing vessels. As detailed in Section 3, St. Mary's Bay has a variety of commercial fisheries, including for lobster, scallops, clams, herring, haddock and several ground fish species. The seafood processing plants along the bay produce smoked, pickled, dried and frozen fish, fish pâtés, fish pastes and roe.

The lobster fishery is an important economic generator for the area. Located in LFA 34, the lobster season operates from the last Monday in November of one year until May 31st of the following year.

In respect to the lobster fishery, the data show commercial landings have declined More detail on this is provided in Section 3.1.3.

The scallop fishery in St. Mary's Bay is included in *Scallop Production Area* 3 – Briar Island/Lurcher Shoal, St. Mary's Bay. There are three main beds in this area around Lurcher Shoal, those below Brier Island and in St. Mary's Bay.

A directed fishery for Longhorn Sculpin in St. Mary's Bay began in 1999 and has continued though to 2019, with the exception of 2007 and 2008 when the fishery was closed. The fishery occurs over a 6-week period during April and May, and the sculpin catch is sold for lobster bait. Based on a DFO evaluation, Longhorn Sculpin fishery landings from St. Mary's Bay peaked at 235 t and 229 t in 2011 and 2012 but declined to 29 t in 2019 (Bedford Institute of Oceanography, 2020). At the same time, landings of Winter Flounder bycatch increased and currently exceed those of Longhorn Sculpin.

Whale and bird watching excursions add to the vessel traffic in St. Mary's Bay, principally during the peak whale watching season – summer and early fall. This is explored further in 5.1.7 below.

There are no marinas in St. Mary's Bay listed in the Nova Scotia - Boating Atlantic 2021 (maritimeboating.com) list of marinas and yacht clubs. The nearest recreational boating facilities are in Digby and Yarmouth.

Table 16. Number of Registered Fishing Vessels in Digby

Location	Fishing Vessels
Digby Area	193
Nova Scotia	5,496
Atlantic Canada	12,714
Canada	17,750

5.1.3 Processing Plants (within 20 KM)

Fish and seafood producers within the St. Mary's Bay area include the following:

Table 17. Processing Plants within 20 km of St. Marys Bay

Processing Plant	*Address*	*Distance from CSL Site*	*Description*
Innovative Fishery Products Inc. (IFPL)	3569 Highway 1, St. Bernard, NS	10.3 km	Predominantely a clam harvester, processor, and exporter, Innovative Fishery Products Inc. operates a Processing Area, Q&A Lab, Depuration systems, a Shellfish Hatchery, and Aquaculture Lease Areas in Digby County, NS. IFP harvests is also in scallp fishery and other seafood imports and exports.
Ocean Trawlers Ltd (OTL)	217 Little River Rd, Little River, NS	8.2 km	Located in Little River, NS, Ocean Trawlers Ltd. is a smaller operation working with haddock, cod, redfish, halibut, dogfish and pollack.
Clare Fisheries Ltd (CFL)	4 Comeauville Wharf Rd, Saulnierville, NS	10.3 km	Clare Fisheries Ltd. is a seafood preparation and packaging plant located in Saulnierville, NS. They deal primarily with canned and cured fish.
Rocky Coast Seafoods Ltd (RCSL)	739 Highway 1, Comeauville, NS	10.4 km	Rocky Coast Seafoods Ltd. specializes in the quick freezing of products such as haddock and ocean perch fillets, scallops, whole fish, and more using the Individual Quick Freezing method.
Comeau's Sea Foods Ltd (CSFL)	60 Saulnierville Rd, Saulnierville NS	13.4 km	Comeau's Sea Foods processing plant in Saulnierville, NS processes, freezes, and packs scallop, herring, salmon, and other fish. Located next to the plant, CSFL uses Danish curing and smoking methodologies at their smokehouse to produce both hot and cold smoked products.
Gidney Fisheries Ltd (GFL)	136 Dakin Park Rd, Digby, NS	23 km	A lobster producer out of Digby, NS, Gidney Fisheries Ltd. has been built up over four generations. GFL uses high-pressure processing to maintain the lobster's natural

			moisture and flavour and enhance their lobster products.
L J Robicheau and Sons Fisheries (LJR)	219 Little River Rd, Little River, NS	8.25 km	Family owned and located in Little River, NS, L J Robicheau and Sons Fisheries has been operating since the 1970s. They offer a variety of seafood including catfish, redfish, halibut, haddock, scallops and more.
D B Kenney Fisheries (DBK)	301 Water St, Westport, NS	18.7 km	With their main operation in Westport and a storage facility in Tiverton, NS, D B Kenney Fisheries operates two lobster pounds and a fish processing plant. They participate in a variety of seafood markets including scallops, lobster, halibut, and periwinkles.
Synergy Seafoods (SS)	803 Nova Scotia Trunk 1, Saulnierville, NS	10 km	Synergy Seafoods is located in Saulnierville, NS, and is involved in groundfish processing and lobster wholesale.

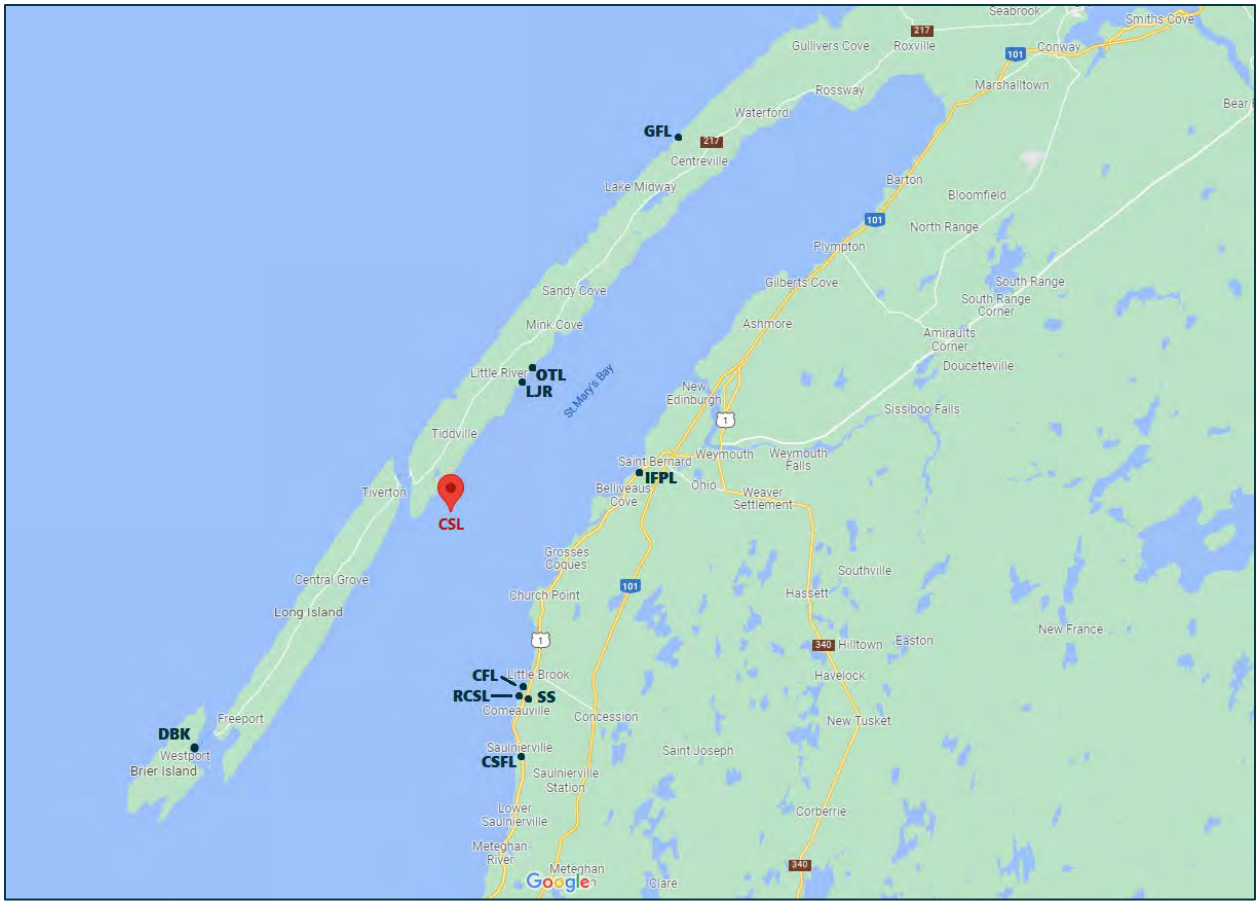


Figure 35. Map of Producers in St. Marys Bay Area

No negative interactions with the processing plants are expected as a result of the CSL operations. CSL is exploring potential collaboration with processing plants for the salmon produced. This will be additive to their current processing volumes and enhance the overall economic impact.

5.1.4 Public Parks and Campgrounds

Public parks in the St. Mary's Bay area are located at Meteghan (Smuggler's Cove Provincial Park), Cape St. Mary's, (Mavillette Beach), and Plympton (Savary Picnic Park).

Campgrounds in proximity to St. Mary's Bay include:

Table 18. Campgrounds Near St. Marys Bay

Campground	*Address*	*Distance from CSL Site*	*Description*
Church Point Campground	164 Bonnenfant	8 km	Immersed in Acadian culture, Church Point Campground has nearby Acadian festivals that

	Rd, Church Point, NS		its guests may attend, as well as clam digging expeditions, all-day bonfires, and a games area.
Whale of a Time Camping	271 Nova Scotia 217, Freeport, NS	16.20 km	Whale of a Time Camping is known by its guests for being flexible and accommodating, with fully equipped cabins, surrounded in beautiful Long Island scenery.
Belle Baie Park	Route #1, Church Point, NS	6.35 km	With water, electric, and sewer hook ups for campers, sites for tents, a laundromat and heated outdoor pool, guests of Bell Baie Park find themselves very comfortable. There is no shortage of activities to participate in whether on the beach or playground.
Mavillette Beach RV Park	182 John Doucette Rd, Mavillette, NS	32.8 km	Mavillette Beach RV Park offers waterfront lots for a view of the Atlantic Ocean right from the RV. They offer a dog park, wifi, and a fire pit for the guests.
Whale Cove Campground	50 Whale Cove Rd, Digby County, NS	6 km	Whale Cove Campground offers a variety of accommodations ranging from tent and trailer hookups to motels and a four bedroom cottage. Located on the Digby Neck, guests can partake in nearby whale watching, bird watching, and lobster tours.

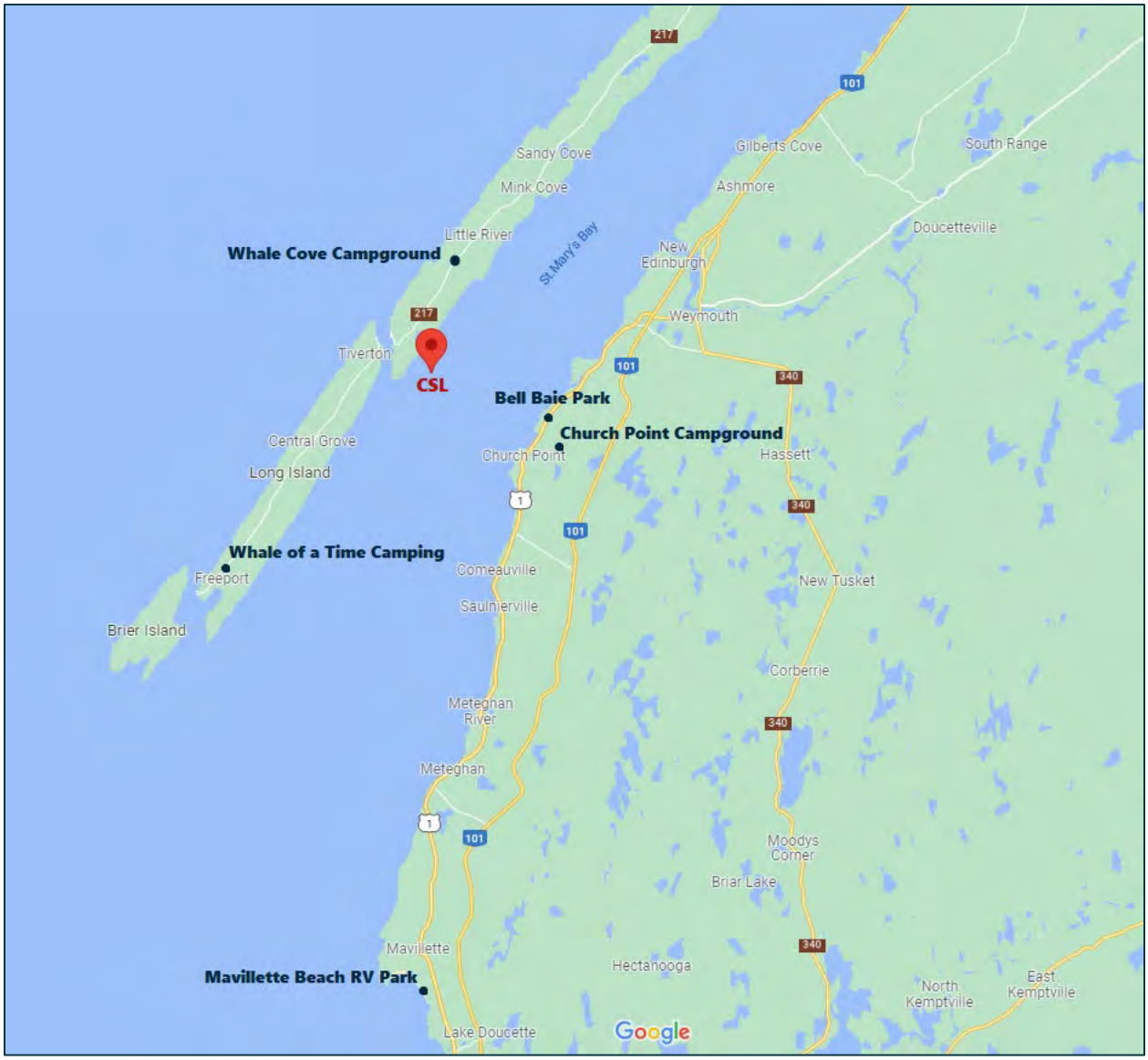


Figure 36. Campgrounds Near St. Marys Bay

5.1.5 Communities (Including Cottage Communities)

The bay bifurcates the two municipal districts in Digby County, with the bilingual Clare Municipal District located on the mainland portion (southeastern shore) and the Digby Neck being part of the Digby Municipal District, which also occupies the eastern half of the county.



Figure 37. Communities Around St. Marys Bay

Major communities situated on St. Mary's Bay include Sandy Cove, Weymouth, Belliveau's Cove, Comeauville, Saulnierville, and Meteghan.

As noted in the report commissioned from Design Point Engineering specifically for this application, the area of CSL's proposed site development on the northwestern side of St. Mary's Bay has historically been largely undeveloped and continues to be so.

There are cottages for public rental located around St. Mary's Bay.

Best known are:

Table 19. Cottages for Rent Near St. Marys Bay

Cottage for Rent:	*Address*	*Distance from CSL Site*
Baie Ste. Marie Oceanfront Cottages	Riverside Rd, New Edinburgh, NS	14.35 km
Bayside Farm & Cottages	580 Fort Point Rd, Weymouth, NS	16.1 km
Lake Midway Cottage	7806 Highway 217, Lake Midway, NS	20.4 km

Tourist accommodations in the immediate St. Mary's Bay area include:

- St. Mary's Bay Vacation Rentals & Homes - Nova Scotia, Canada | Airbnb
- Cape Saint Mary's, NS Vacation Rentals: house rentals & more | Vrbo
- Our Cottage Rentals on St. Mary's Bay (baysidefarm.com)
- Au Havre Du Capitaine (google.com)
- Graham's Cottage Retreat (google.com)

Those visiting the St. Mary's Bay area also avail themselves of accommodations in adjoining communities including the Yarmouth and Digby areas.

5.1.6 Municipal, Industrial and Agricultural Users Around St. Mary's Bay

Break this section out into:

Municipal

St. Mary's Bay bifurcates the two municipal districts in Digby County:

- The bilingual Clare Municipal District located on the mainland portion (southeastern shore); and
- Digby Neck, which is part of the Digby Municipal District, also occupies the eastern half of the county.

Major communities situated on St. Mary's Bay include Sandy Cove, Weymouth, Belliveaus Cove, Comeauville, Saulnierville, and Meteghan. These communities can be seen here.

Industrial

The primary industries associated with the St. Mary's Bay area are commercial fishing and fish processing. While the coastal communities of the area are largely dependent on the fishery, other economic activities include forestry, agriculture, tourism and a variety of small commercial enterprises. Table 20 below shows an industry breakdown for Digby and the surrounding areas.

Within the fishery, there are emerging developments to bring new commercial species to market. This includes a small sea urchin fishery along with interest in periwinkles and an emerging interest in dogfish for the pharmaceutical industry (Simon, 2017). Clam digging also remains as a niche operation.

The area also supports the emergence of a marine vegetable/plants industry, with rockweed harvesting and processing taking place. Some dulse is also harvested.

There is a ship building tradition in the District of Clare with boat building continuing to be an economic driver in several shipyards in the area. These include:

- A. F. Theriault & Son Limited, located in Meteghan River has 150 total employees across all of its locations.
- Southwest Fiberglass Products Ltd., located in Church Point, is a custom boat builder.

Digby also offers a service industry including maintenance and repair of fishing gear and vessels.

In the district of Clare, mink ranching had been a strong economic driver, although this industry has undergone a precipitous decline in recent years.

Table 20. Industry Breakdown for the Municipalities of Digby and Clare

Industry - North American Industry Classification System (NAICS) 2012	Municipality of Digby, Nova Scotia			Municipality of Clare, Nova Scotia			Nova Scotia		
Characteristics	Total	Male	Fema	Total	Male	Fema	Total	Male	Femal
Agriculture; forestry; fishing and hunting	590	460	130	680	560	125	17775	14165	3610
Mining; quarrying; and oil and gas extraction	10	10	0	0	0	0	4025	3630	390
Utilities	25	20	0	10	10	0	2880	2115	760
Construction	200	185	20	280	250	30	33555	30185	3370
Manufacturing	455	275	180	690	490	200	32375	23565	8810
Wholesale trade	120	95	30	70	50	25	13345	9650	3690
Retail trade	475	215	255	400	160	245	59570	26295	33280
Transportation and warehousing	150	110	45	100	85	15	19660	14980	4680
Information and cultural industries	0	0	10	65	15	50	9310	5250	4055
Finance and insurance	55	15	45	120	25	95	15240	5690	9545
Real estate and rental and leasing	25	15	10	10	10	10	6870	3890	2980
Professional; scientific and technical services	95	60	40	85	35	55	26065	14090	11975
Management of companies and enterprises	0	0	0	0	0	0	625	255	365
Administrative and support; waste management and remediation services	95	45	45	70	40	35	22240	12950	9295
Educational services	150	55	90	335	85	255	35480	11705	23780
Health care and social assistance	390	45	350	490	55	435	64390	10435	53955
Arts; entertainment and recreation	55	15	40	35	10	25	9385	4555	4835
Accommodation and food services	280	70	215	165	40	130	33115	12095	21025
Other services (except public administration)	110	55	60	180	115	65	19195	8875	10320
Public administration	145	75	70	145	60	95	40225	23590	16635
All industry categories	3440	1825	1615	3955	2080	1870	465330	237975	227350
Classification not applicable	50	20	35	50	20	30	9265	4795	4465
Total labour force population aged 15 years and over by Industry - 25% sample	**3490**	**1845**	**1650**	**4000**	**2100**	**1905**	**474595**	**242775**	**231820**

Agriculture

Land-based aquaculture is also found in the area. Table 21 below documents land-based agriculture surrounding Digby (Stats Can, Farms, 2016).

Table 21. Agriculture in Digby

Farms classified by farm type, 2011 and 2016		
Digby, Nova Scotia	**2011**	**2016**
Cattle ranching and farming	11	14
Hog and pig farming	0	2
Poultry and egg production	2	2
Sheep and goat farming	3	2
Other animal production	100	68
Oilseed and grain farming	0	1
Vegetable and melon farming	2	7
Fruit and tree nut farming	14	21
Greenhouse, nursery and floriculture production	12	10
Other crop farming	6	10
Total number of farms	**150**	**137**

Michael J. Mullen operates a land-based Aquaculture site (Aquaculture License - #0263) at Haslett, Hour Glass Lake in Digby County for salmon smolt production.

Overall, there is no evidence of effluent entering St. Mary's Bay that would have a negative impact on water quality.

5.1.7 Tourism or Recreational Operations

The tides In St. Mary's Bay are among the highest in the world, spanning 50 feet (16 metres) in places, creating tremendous flushing action, a benefit for the proposed development. The rich and varied flora and fauna of the waters and internal coves and bays are a result of this tidal action. Regularly exposed swaths of wet ocean floor create a special environment for the species that inhabit these regions. Tidal action also causes a stirring up of the water, allowing whales to feed easily on agitated plankton. This is one reason why the Bay of Fundy has become a storied site for whale watching.

The Bay of Fundy and the St. Mary's Bay region is among the best whale watching areas in Canada. It is also one of the most important birding destination in North America.

The locaus of whale watching takes place largely in the Bay of Fundy. This along with bird watching are important economic drivers for the area and a source of significant tourism interest. There are a number of whale watching companies which base their operations in the St. Mary's Bay area including:

- Brier Island Whale Watch - About Us | Brier Island Whale Watch
- Mariner Cruises Whale and Seabird Tours - Facebook
- Petit Passage Whale Watch - Petit Passage Whale Watch – Personal Service Guaranteed (ppww.ca)

- Bay of Fundy Scenic Lobster Tours - Contact & Location | Mysite (bayoffundylobstertours.com)
- Ocean Explorations - Ocean Explorations
- Dockside Charters - Dockside Charters

Birdwatching is a popular activity along the shores of St. Mary's Bay. In some cases, bird watching is combined with whale watching tours. There is a wide variety of bird species to be seen in the areas surrounding St. Mary's Bay.

The Toymaker's Marsh Wildlife Sanctuary is located at the head of St. Mary's Bay, near Digby, Nova Scotia, which is within the boundaries of the UNESCO designated Southwest Nova Biosphere Reserve Area.



Figure 38. Balancing Rock, Digby, NS

A notable geological feature of the area is the Balancing Rock, on the northwestern shores of St. Mary's Bay. This column of rock, situated at the edge of the cliff, looks like it could fall over at any time. A 2.5 kilometre hiking trails leads into the site with boardwalks to transit through wet and fragile areas.. On the walk in, there are several interpretive panels that describe the vegetation in the area. There is also a very steep descent to the coast and the rock itself via a 235-step staircase.

It provides visitors with interpretative panels detailing the history of the site, as well as the local marine life. It also offers a miniature lab for sample analysis of animal and plant identification.

There is also an extensive trail system in the area on the southeastern side of St. Mary's Bay. The Le Petit Bois Interpretive Trail is a destination for adventure tourists and hikers. Located in the Acadian Region of Clare, in a 1-2 hour walk it leads hikers through a shaded Acadian forest of mixed coniferous and deciduous trees to the waters of St. Mary's Bay and its rocky coastline.



Figure 39. Hiking Trails Along the Coast of Nova Scotia



Figure 40. The St. Mary's Bay Trail System

St. Mary's Bay is also home to a number of historical lighthouses as illustrated below.

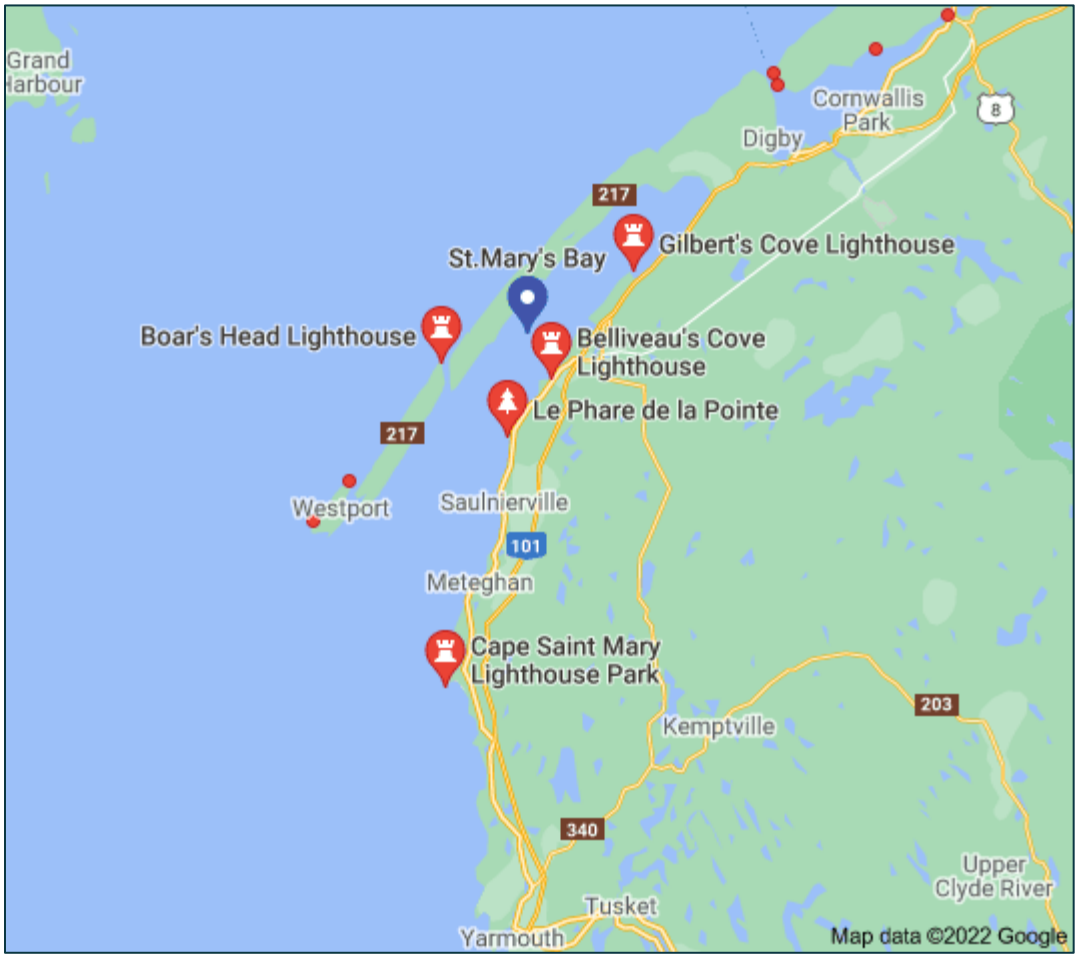


Figure 41. Historical Lighthouses

These include Cape Saint Mary Lighthouse Park, Gilbert's Cove Lighthouse, Belliveau's Cove Lighthouse, among others.

Notable among these is the Church Point Lighthouse. The original lighthouse was built in 1874. The new building is modeled on the shape of the original lighthouse and keeper's house. Interpretive panels inside the lighthouse tells interesting facts and stories about the previous lighthouse as well as the local marine life. Tours may also involve walks on the beach including sample gathering, animal and plant identification followed by sample analysis in the site's miniature lab.

Université Sainte-Anne's biology department use this building as a laboratory for their bird banding activities. They study a number of bird species, set up nesting boxes in Le Petit Bois and also participate in a Pan-American study that tracks the migratory patterns of the tiny northern saw-whet owl (Aegolius Acadicus).



Figure 42. Church Point Lighthouse

Shipbuilding, once an economic force in the area, was facilitated by the tides. Dry docks allowed ships to be built and floated without moving them, a significant advantage considering the size and weight of a large boat. Section 5.1.6 above details current boat and ship-building operations in the area. Canadian Salmon Limited intends to use these services to construct infrastructure and vessels which will be required to support this aqua farm development.

The ongoing use of weirs in the St. Mary's Bay fishery also sparks an interest among those interested in history. The Mi'kmaw originally used a fishing weir system for catching mackerel and herring. They taught these skills to the new settlers, which they continued to use until well into the 1900s, and fish drying techniques that continue today. Weir fishing benefits from the tides. At high tide the weir is submerged, fish swim into the weir and, at low tide, the fishermen are able to retrieve the fish that are trapped at low tide.

St. Mary's Bay offers a number of public beaches including Sandy Cove Beach, French Beach, Victoria Beach, Barres a Pointe Noire, and Mavillette Beach.

Considering the growing interest in environmental stewardship and climate change, like many other areas, St. Mary's Bay is enjoying an interest in ecotourism. Digby Neck and the Islands has a number of thriving whale watching operations and a growing number of bed and breakfast facilities based on the attractiveness of the natural environment.

Also, leveraging the strong cultural and linguistic identity of the Acadians, a cultural industry has developed around the community institutions of the French Shore. The Universite Sainte Anne and College de L'Acadie have. provided much of the driving force for this development

5.1.7.1 Aquaculture as Tourism Opportunity

Experiential tourism connects the traveller with the essence of a place and its people. It engages visitors in a series of memorable travel adventures that are inherently personal, engage the senses, and make connections on an emotional, physical, spiritual or intellectual level.

> For [redacted], an extension associate with Maine Sea Grant, the opportunities for seafood and tourism match up well judging by her long experience with the tourism industry and coastal communities. "Visitors these days are really into the personal experience. They don't want to sit around. They want to do something," she said. "It's all about getting that firsthand experience and coming home with a great memory," [redacted] continued. "Fortunately for us, Mainers are really well known for having a lot of expertise, wonderful humor, and for being connected to the natural environment. Visitors want to share in that.

Experiencing aquaculture farms and operations is a growing area of interest. There are many examples of farms that work frequently with tour boats, kayaking groups, or outfitters on an informal basis, as well as some that have become more organized about this new ecotourism sector. Hog Island Oyster Co. of Marshall, California has made oyster farm tourism a main part of its business. Other examples include in Greece where the aquaculture farm managers, together with the local scuba diving center Blue Planet, are working together to strengthen the synergies among the two activities, transforming the fish farm into yet one more tourism asset for the area.

Similarly, Agritours Ireland organize marine and aquaculture tours around Ireland's rugged and scenic coastline. According to a 2016 aquaculture survey by the Irish Sea Fisheries Board(BIM) the salmon sector produced output worth €94.7 million, directly employing 191 people. 142 people were employed in processing salmon and over 80 employed in associated services such as diving and maintenance. Salmon production provides mainly full-time employment. It has the biggest economic knock on effect when it comes to job creation, product range and value and other services required.

Nova Scotia can benefit from this growing niche area of experiential tourism and ecotourism.

5.1.8 Private and Public Wharves and Anchorages

St. Mary's Bay is well served by a number of public and private wharves and harbours.

Figure 43 below shows a composite view of existing assets and infrastructure throughout St. Mary's Bay (Marinas.com, 2022).



Figure 43. Composite View of Assets

St. Mary's Bay is also well served by a number of Harbour Authorities listed below in Table 22 (Harbour authorities, 2022).

Table 22. Harbour Authorities Around St. Mary's Bay

Name	Managed By
Authorities along the Digby/Long Island side of St. Mary's Bay:	
Little River (Digby County)	Harbour authority of little river (digby county)
Sandy Cove Harbour	Harbour authority of sandy cove east
Passage between Tiverton and Tiddville:	

Tiverton -fishermen's Wharf	Harbour authority of tiverton
McClafferty & Frost Fisheries	Not listed on Small Craft Harbours
Passage between Westport and Freeport:	
Westport (Irishtown)	Westport harbour authority
Freeport (South Cove)	Harbour authority of freeport
Freeport-fish Point Wharf	Harbour authority of freeport
On the Bay side of Digby/Long Island:	
Centreville (Trout Cove)	Harbour authority of centreville (trout cove)
On the mainland side of St. Mary's Bay:	
Meteghan	Harbour authority of meteghan
Saulnierville	Saulnierville harbour authority
Weymouth North Wharf Harbour	Not listed on Small Craft Harbours

5.1.9 First Nations Territories/Reserves

First Nations communities in proximity to the proposed CSL site includes:

- **Acadia First Nation** – Acadia, a community of 1,725 residents across five reserve areas including Yarmouth, Medway River, Ponhook Lake, Wildcat and Gold River, with additional approved Reserve Status for Hammonds Plains and an additional off-reserve office in Shelburne. Acadia First Nation has been largely active in the Indigenous fishery, referenced in **Section 3**.
- **Bear River First Nation –** Bear River, a community of 103 residents, is also involved in the Indigenous Fishery. The community has been focused on economic development including assuming majority ownership of Digby Pines, an historic resort hotel in Digby. Bear River has also launched an eco-tourism project – Seven Paddles - launched to re-establish traditional Mi'kmaq canoe routes for ecotourism in Nova Scotia and to strengthen their ties with their land and culture.
- **Annapolis Valley First Nation –** Annapolis Valley, a community of 295 residents, has also historically involved in the Indigenous Fishery. Chief Gerald Toney is also Fisheries Portfolio Lead for the Assembly of Nova Scotia Mi'kmaq Chiefs.

Since the launch of the Mi'kmaw Treaty Rights-based fishery in Nova Scotia, Mi'kmaw communities in the traditional Mi'kmaw district of Kespukwitk – Acadia, Annapolis Valley, Bear River and Glooscap First Nations – have been working together on a livelihood plan for their shared waters and resources. On October 14, 2021, understanding that not all communities will

be launching their fisheries on that date, the *Kespukwitk District Netukulimk Livelihood Fisheries Plan* took effect.

These agreements relate to the moderate livelihood in Lobster Fishing Areas (LFAs) 33, 34 and 35. Acadia First Nation joined Bear River and Annapolis Valley First Nations as part of the previously announced interim understanding reached with DFO, which operationalizes the Livelihood Fisheries Management Plan (Kespukwitk Plan) and permits the sale of lobster.

Acadia, Bear River and Annapolis Valley First Nations will designate community members to harvest lobster under the Kespukwitk Plan, which they jointly developed.

During the preparation of the Scoping Document, CSL officials reached out to all three of these First Nations to brief them on the proposed aquaculture site in St. Mary's Bay. During this outreach CSL officials made it clear that they are very open to collaboration with area First Nations in this development .

5.1.10 Pre-contact or Historical Archaeological Resource

The St. Mary's Bay *Wikipedia* page documents and provides a compelling account of pre-contact history of the Mi'kmaw in St. Mary's Bay, as detailed below:

> *The native Mi'kmaw have occupied and used Oostitukum (Digby Neck) and the mainland shore and the waters between since before the arrival of Europeans, and the bay is known by the Mi'kmaw as Wagweiik. The mouth of Salmon River is thought to be a traditional summer settlement of the Mi'kmaw and several artifacts have been found there, as well as at Meteghan, Major's Point and other sites.[2] Place names like Hectanooga, Mitihikan (Meteghan), and Chicaben (Church Point) are found in the area. They also had a principal settlement by River Allen near Cape Sainte-Marie used for fishing and as a canoe route.[3] The Mi'kmaw also used a fishing weir system for catching mackerel and herring that they taught to the new settlers, which they continued to use until well into the 1900s, and fish drying techniques that continue today. They also caught eels, seals, clams, urchins and other sea life, as well as berries, medicinal plants and other coastal resources. As new settlers arrived in the 1760s-1780s, the Mi'kmaw were instrumental in helping the new Acadians survive and become skilled in surviving the harsh winters along the coast. By the 1800s most Mi'kmaw had left the area to live on the Reserve in Bear River, while still returning for fishing, hunting, trade and ceremony throughout the year.*

The Confederacy of Mainland Mi'kmaq (CMM) conducted a study in 2006 associated with the development of a proposed Basalt Quarry. The focus of the Mi'kmaq Ecological Knowledge Study (MEKS) was on the historical use of the area by Mi'kmaq *before living memory* (pre-contact) and *after living memory* (post contact).

While the study was primarily focused on the area proximate to the proposed quarry (Digby Neck) the analysis extended to the Mainland Shore of St. Mary's Bay.

The MEKS provides rich detail on both the historical and current Mi'kmaq uses of St. Mary's Bay. Notably fishing is a prominent element of that story.

Another traditional ecological study related to tidal power in the waters surrounding Digby and including St. Mary's Bay was commissioned in 2012 (Membertou Geomatic Solutions, 2012). Similar to the foregoing example, it also documents historic and current use by the Mi'kmaw in the areas surrounding St. Mary's Bay, as detailed below:

> *"Based on the data documentation and analysis, it was concluded that the Mi'kmaq have historically undertaken traditional use activities in the Study Area, and that this practice continues to occur today. These activities primarily involve the harvesting of fish species, but also include plants and animals; all of which occurs in varying locations throughout the Study Area and at varying times of the year. Lobster was found to be the most fished species in the Study Area. Mackerel and clam were also found to be harvested in the area, but at a somewhat relatively lesser degree. Seal, deer, partridge, pheasant and porpoise were all found to be hunted in the Study v Area, but not in enough numbers to determine a primary hunted species. Dulse and sweetgrass were the most harvested plant species that was found within the Study Area".*

As noted in the MEKS Reports, archaeological evidence is scarce for a period of 10 to 5 thousand years ago which is thought to be due to the rise in sea levels that submerged former coastal sites. The studies do note, however, various archaic artifacts found within area surrounding Digby Neck.

Other relevant archaeological finds include the submerged finds offshore in the Bay of Fundy and Gulf of Maine.

Historically, there have been a number of shipwrecks in the area. As the coordinates of their last known location are not available, their position relative to the proposed aquaculture farm are not known. Shipwrecks documented in St. Mary's Bay are included in On the Rocks: Shipwrecks of Nova Scotia - Maritime Museum of the Atlantic, Halifax, Nova Scotia. Within this reference document there are many historical shipwrecks and sinkings in Bay of Fundy including one in Petit Passage.

5.1.11 Important Habitats and Conservation Areas

There are seven Nova Scotia parks and protected areas surrounding St. Mary's Bay: Tiddville Nature Reserve (30 hectares), Boar's Head Conservation lands (35 hectares, near Tiverton), Central Grove Provincial Park (13 hectares, near Long Island), and Brier Island Conservation Lands (402 hectares, southern tip of Digby Neck), Savary Provincial Park (11 hectares, near Plympton), Lake Midway Provincial Park (2 hectares, near Centreville) and Smugglers Cove Provincial Park (8 hectares, near Meteghan). The closest park within the vicinity of CSL's operation is the Tiddville Nature Reserve, which is approximately 5 km from the nearest proposed site. CSL operations will not overlap in this region.

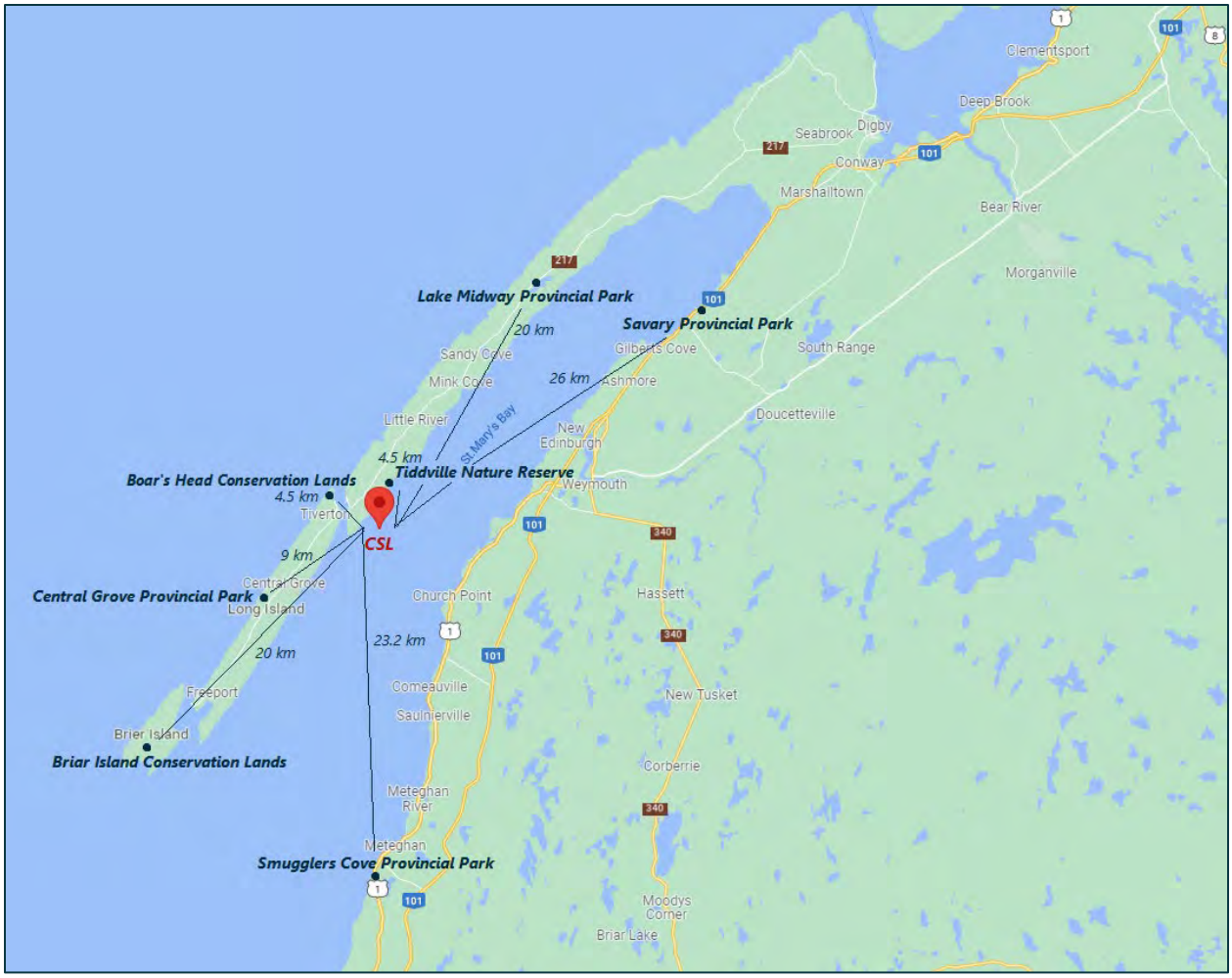


Figure 44. Map of Nature Reserves and Conservation Areas

The Brier Island/Digby Neck area has been identified as an Ecologically and Biologically Significant Area (EBSA) by Fisheries and Oceans Canada and is one of four marine areas within the Bay of Fundy recognised by Parks Canada as of national significance for marine conservation planning (DFO, 2019). The area is also representative of the outer Bay of Fundy and typically features significant marine mammal, bird, and benthic diversity. However, this area is outside of the proposed site area. To date, this EBSA is not considered a marine protected area.

There are also two two marine protected areas (MPA) in Nova Scotia: the Gully near Sable Island and St. Anns Bank off Cape Breton. There is one MPA in NB, Musquash Estuary, located on NB's side of the Bay of Fundy. These MPAs are not located near CSL's proposed operations at St. Mary's Bay.

5.1.12 Other Known Potential Projects (confirmed or proposed) and Activities

In addition to the existing aquaculture operations around St. Marys Bay, there are a few projects in the area that have been proposed or are just underway. These projects are taken into account in the ecosystem of aquaculture operations outlined in Section 3 and Section 8.1. They can be found by the corresponding number on the map in Figure 45 and are highlighted below:

- #742 – a lease for finfish aquaculture in Petit Passage, owned by Kelly Cove Salmon Ltd.;
- #1037 and #828 - two shellfish projects on the Weymouth side of St. Marys Bay, one owned by Paul Belliveau and the other by Vince Stewart; and
- #999 – a proposed land-based post smolt salmon operation, owned by Kelly Cove Salmon Ltd (Ryan, 2021).

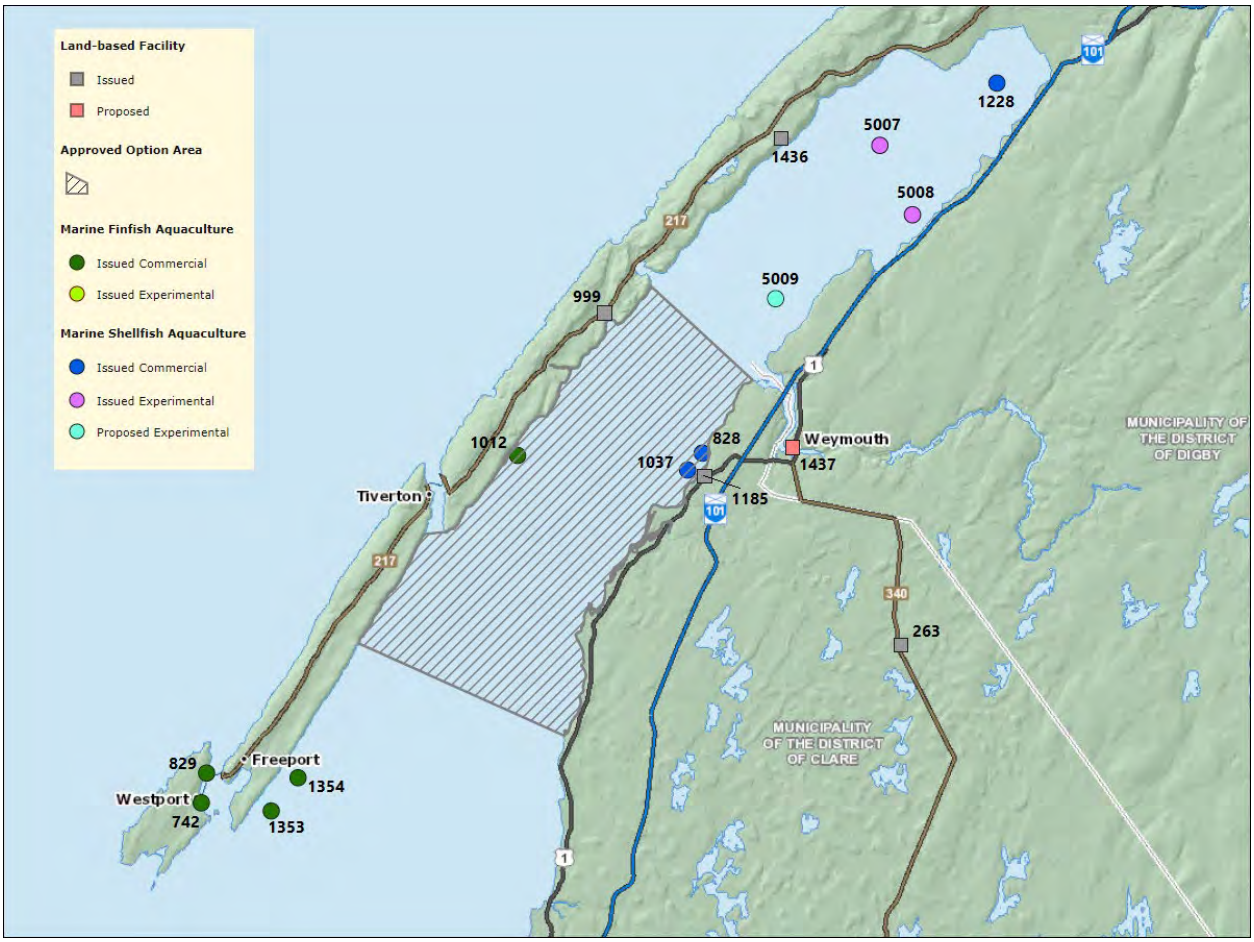


Figure 45. Aquaculture Sites Including Proposed Projects

5.1.13 Other Potential Users

Beyond fishers, including Indigenous fishers; tourism and ecotourism operators; and pleasure boat operators the St. Mary's Bay area is included as an ocean research site. Sustainable Oceans Applied Research (SOAR) includes St. Mary's Bay as one of its areas of interest.

SOAR is a not-for profit organization based in Freeport and Lunenburg, Nova Scotia. Its mission acknowledges that the organization is part of coastal communities sustained by fishing, ocean tourism, aquaculture, tidal energy, and oceanographic research.

SOAR provides services and infrastructure to assist researchers and technology developers with access to the coastal ocean, including the entrance to the Bay of Fundy, eastern Gulf of Maine, St. Mary's Bay, and two high energy tidal channels that are a global focal point for marine energy and smart-grid innovation (Grand Passage and Petit Passage). In addition to advancing research needed for sustainable industry development, SOAR has important roles in a) training and education, b) tourism, and c) communication with government.

The Centre for Marine Applied Research (CMAR) established to support the Nova Scotia Department of Fisheries and Aquaculture's growth strategy, is a division of Perennia Food & Agriculture Inc. It leads and supports research projects in collaboration with industry, government, community and other marine user groups that support the sustainable development of coastal resources in Nova Scotia. CMAR collects and analyzes biophysical and socio-economic data that provide the foundation for science-based decision making and foster innovation necessary to advance the long-term sustainable development of fisheries and aquaculture industries.

CMAR has created a dataset on St. Mary's Bay, collected by a 3 metre tall, 1 metre in diameter meteorological/oceanographic buoy from Xeos Technologies Inc., (Dartmouth, NS). Deployed in St. Mary's Bay, the buoy measures wave data (Maximum Wave Height, Significant Wave Height, Peak Wave Period, Mean Wave Direction, and Mean Wave Spread) using a Brizo wave sensor manufactured by Xeos, sea temperature using a T Node sensor, and meteorological data (Wind Speed, Wind Direction, Air Pressure, Humidity, Air Temperature, Rain Intensity, and Hail Intensity) using Vaisala sensors. The data is streamed to CIOOS every 20 minutes. The data will be used to support science-based decision making and advancement of Nova Scotia's coastal resources.

5.2 Significance of proposed area to wildlife

There are currently two marine protected areas (MPA) in Nova Scotia: the Gully near Sable Island and St. Anns Bank off Cape Breton. There is one MPA in NB, Musquash Estuary, located on NB's side of the Bay of Fundy. These MPAs are not located near the proposed site at St. Mary's Bay.

St. Mary's Bay offers habitat to a variety of waterbirds, including gulls, sea ducks (e.g., eiders, scoters, long-tailed ducks), plovers, sandpipers, grebes, cormorants, and loons at different times of the year. The Bay of Fundy is also the feeding ground for over a dozen species of baleen and toothed whales, including Humpbacks and Minkes.

During winter and spring, one sees the Red-breasted Mergansers on the water. They are among the mist distinctive of the sea ducks. They have a unique spikey crest on the back of their heads. The male has a shiny dark green head, broad white ring around its neck and a chestnut band across the breast. The female has a chestnut-coloured head with crests.

In August and September, plovers are common along the shore. A wading bird, the plovers dart around on the sand flats, zigzagging as they go. A more common plover seen in the St. Mary's Bay area during late summer is the Black-bellied Plover. It has a white head and patterned wings and back over a black underbody. They are usually around 26-34 cm in size (10 ½" to 13 ½"). The Semipalmated Plover is smaller, around 6 ½" – 7 ½" in height, with brown backs, white undersides, a black arc on its lower neck and bright orange beak and legs can also be seen.

The principle species of commercial groundfish are cod, haddock, pollock, hake, and halibut. The pelagic fishery consists of herring and mackerel, but these fish have declined in commercial importance. Most herring and mackerel are used as bait for lobster traps. Lobster is the only healthy commercial resource, which many fishermen attribute to the fact that there has never been a quota system for lobsters. It is lobster landing that has buffered much of the loss from reduced groundfish catches. Lobster landings have generally remained stable, but an increased price and buoyant market has offset some losses from the declining groundfish fishery. The region also support a scallop dragger fleet, although there have been indications that this fishery also threatens to be unstable.

The Species at Risk Act (SARA) is part of the National Strategy for the Protection of Species at Risk. The purposes of the Species at Risk Act (SARA) are to prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened. There are several species found in Nova Scotia and in the Atlantic Ocean and Bay of Fundy that are listed by COSEWIC or SARA that are listed as either endangered, threatened, or vulnerable/special concern. Table 23 outlines the species and their threatened status. It is entirely possible that CSL's operation will not interact with any of these species. However, we have carefully considered any potential impacts to these species, and have outlined the risks and mitigation strategies in Section 5.3.2.

Table 23. List of Species at Risk, designated under SARA or COSEWIC as endangered, threatened, or vulnerable that inhabit NS[7] or Atlantic[8] waters

Aquatic Species	Designatable Unit	Status
Atlantic whitefish	Not applicable	Endangered
Blue whale	Atlantic population	Endangered
Atlantic salmon	Inner Bay of Fundy	Endangered
Leatherback sea turtle	Atlantic population	Endangered

[7] Species that are known to specifically inhabit areas outside that of the proposed site on the Digby Neck and St. Mary's Bay area (i.e., Western region of NS) were excluded (for example, Cape Breton).

[8] Note: aquatic species are listed under SARA and protected by the Fisheries Act.

Loggerhead Sea turtle	Not applicable	Endangered
North Atlantic Right whale	Not applicable	Endangered
White shark	Atlantic population	Endangered
Atlantic wolffish	Not applicable	Special concern
Fin whale	Atlantic population	Special concern
Sowerby's Beaked whale	Not applicable	Special concern
Shortnose Sturgeon	Nova Scotia (freshwater)	Special concern
Terrestrial species		
Bank swallow	Nova Scotia	Endangered
Barn swallow	Nova Scotia	Endangered
Common nighthawk	Nova Scotia	Endangered
Olive-sided flycatcher	Nova Scotia	Threatened
Canada warbler	Nova Scotia	Endangered
Chimney swift	Nova Scotia	Endangered
Harlequin duck	Nova Scotia	Endangered
Rusty blackbird	Nova Scotia	Endangered
Short-eared owl	Nova Scotia	Endangered
Piping plover	Nova Scotia	Endangered
Red knot	Nova Scotia	Endangered
Roseate Tern	Nova Scotia	Endangered

5.3 Impacts to other users including wildlife

In terms of the proposed CSL aquaculture development, installation will be done within boundaries of approximately 900m / X 600m wide including cages, feed barge, moorings and anchors for each site (Section 6.1.7, Figure 53). Our perspective is that as stewards of the sea, we are dependent on good environmental conditions for sustainable production. This approach has been demonstrated in Norway, with use of innovative technology that is non-invasive to wildlife and is more environmentally conscious and efficient for production, for example the 'Norwegian Gannet', a floating processing plant.

In general, however, St. Mary's Bay is a low risk area for impacting others, since there is relatively minor use of the Bay with human activity. Therefore, we have mainly highlighted impacts on other organisms that inhabit these waters.

5.3.1 Other operations in the area

Lobsters and lobster fishery – While lobsters are not considered a protected species, the fishery in this area (LFA 34) is important and therefore impacts on this sector have been carefully considered. Based on regional and national data on the impact of salmon aquaculture on lobsters and the lobster fishery, there is negligible impact, (e.g., Grant et al. 2016, 2019, Baltadakis et al 2020), although it can depend on size and intensive activity of the farm (Milewski

et al. 2021). Because we are proposing a low-density operation, this should not have any impact on LFA 34. For more information, see Section 5.1.

Other aquaculture operations – There is another existing salmon aquaculture site within the vicinity, as well as other shellfish aquaculture sites within St. Mary's Bay. For information on how our operation will minimize interactions and to minimize any possible negative impacts between farms, see Section 8.

Fishery operations – There are other fishing operations that exist within the area, such as LFA 34, and various processing plants. We do not expect that their activities will impact our operation, nor do we expect that our operation will interact or impact their fishing activities or the population of wild animals that are harvested. For more information on this, see Section 5.1.

5.3.2 Wildlife listed in SARA or COSEWIC

The Species at Risk Act (SARA) prevents species from becoming threatened, endangered, or extirpated by preventing destruction of their habitat and prohibiting disturbance, capture, or harming of these species. There are several species found in NS and the Atlantic Ocean that are listed as protected under SARA or listed by the *Committee On the Status of Endangered Wildlife In Canada* (COSEWIC), as either endangered, threatened, or of special concern/vulnerable.

Migratory Birds – The *Migratory Birds Convention Act* ensures that most species of birds in Canada are protected, and disturbing a nest, egg, or shelter of a migratory bird, or possessing any part of a migratory bird is considered an illegal offense. We do not expect any disturbance to migratory birds in the development or operation of our site. If any migratory birds or habitats are encountered by our staff, they will be knowledgeable of the *Migratory Birds Convention Act* and will abide by the regulations. There are certain bird species of special interest. For example, the Piping Plover. This species is protected under SARA and the above-mentioned *Migratory Birds Convention Act*. Piping plovers inhabit the space within the proposed area, normally along beach sand and dunes, away from any vegetation. There is no known piping-plover beach in the direct vicinity of the proposed site.

Whales – Certain whale species are protected under the Marine Mammals Regulations of the *Fisheries Act*. The Fundy coast side of the Digby Neck is a known area for whale watching, however, whale watching tourism operations do not operate within St. Mary's Bay (see Section 5.1). We will comply with these regulations and will not attempt any interaction with any whales that are seen during our aquaculture activities. We will also ensure that our vessel fleet will travel at a no-wake speed (9 knots maximum) to prevent potential collision with a whale, which is below the recommended speed for ships travelling in whale areas (9.9 knots). Any observations of whales in distress will be immediately reported to DFO. Currently, the Atlantic population of Blue whales and the North Atlantic Right whale are the only species listed on the SARA. COSEWIC: Sei whale, grey whale (Atlantic population)

Other Species (Protected or Endangered) – There are several known species at risk (listed under SARA) that may inhabit St. Mary's Bay at a given time). For example, Atlantic Whitefish, Leatherback Sea Turtle, etc. These animals are protected and have regulations around prohibited interactions with the animal and its habitat. We do not expect any disturbance to any of these species, should they be present. None of these species are known to inhabit and congregate within St. Mary's Bay, within the vicinity of our proposed site. For example, while the Atlantic Whitefish is endangered on SARA, and it is a species endemic to Nova Scotia, it is only found in the Tusket and Petite Riviere watershed, and in fact, may already have been extirpated from the Tusket River System. There is a recovery strategy for the species (Nova Scotia Department of Lands and Forestry, 2021), which we are supportive of, and do not expect to interfere with this effort.

The purpose of SARA is to protect wildlife species at risk in Canada. Within the Act, COSEWIC was established as an independent body of experts responsible for identifying and assessing wildlife species considered to be at risk. This is the first step towards protecting wildlife species at risk. The following species are listed as Endangered under COSEWIC: Leatherback Sea Turtle, Loggerhead Sea Turtle, Bluefin Tuna, Atlantic Cod, cusk, porbeagle shark, White shark, Shortfin Mako. While COSWEIC lists these species as endangered within the Atlantic Region or NS, St. Mary's Bay, specifically, is not listed as a critical region for any of these species in particular.

5.4 Impacts by other users including wildlife

5.4.1 Boat Traffic

Boat traffic within St. Mary's Bay is primarily fishing vessels. St. Mary's Bay has a variety of commercial fisheries, including, as noted, lobster, scallops, clams, herring, haddock and several ground fish species. CSL vessels will follow navigation regulations and be mutually respectful of surrounding operations and boat traffic.

5.4.2 Fishery and Aquaculture Operations

There is another existing salmon aquaculture site within the vicinity, as well as other shellfish aquaculture sites within St. Mary's Bay. For information on how our operation will minimize interactions and to minimize any possible negative impacts between farms, see Section 8.

There are other capture fishing operations that exist within the area, such as lobster fishery LFA 34, and various processing plants. We do not expect that their activities will impact our operation based on their activities or output in the bay, nor do we expect that our operation will interact or impact their fishing activities or the population of wild animals that are harvested. For more information on this, see Section 5.1.

5.4.3 Public Users of St. Marys Bay

Interactions with people and organizations outside of our operation can be a biosecurity risk and has potential to cause environmental impacts on our site and potential safety concerns for our operation and staff.

Biosecurity is critical to the functioning of CSL's operation to avoid pathogen spread. Strict biosecurity standard operating procedures will be adhered to in order to minimize this risk and reduce the potential for pathogen spread. Other aquaculture operations within St. Mary's Bay also must adhere to regulations for biosecurity risk. Other users in St. Mary's Bay (e.g., harbour authorities, processing plants, as well as tourism and recreation operators - see Section 5.1) must also be attentive to the regulations for biosecurity.

Although environmental parameters, such as low oxygen, extreme temperatures, algal blooms and other biotic/abiotic factors cannot be controlled, CSL has contingency plans to respond to such situations when they reach levels that may affect fish health and welfare. CSL will be using sensitive data loggers that record temperature and oxygen at various points on site, which provides us with real time data 24 hours a day.

Pollution and other environmental hazards due to public use of St. Mary's Bay also have potential to impact the operation. While there is relatively low commercial activity in St. Mary's Bay, and therefore low risk of contamination of the CSL sites with pollutants, CSL will actively monitor sites for any potential contamination risks or events. Water quality and routine environmental monitoring will provide data to make informed decisions regarding the site, specifically considering health and welfare of our fish and staff. Mitigation plans are in place for the possibility of water quality issues related to oxygen, temperature, and harmful algal blooms. For example, adding oxygen into the net pens to increase oxygen level in the seawater by generators pumping compressed air to the bottom under the cages. This will increase the oxygen level and in addition create a water current away from the cages. Pure oxygen may also be added directly to the pens from tanks of liquid oxygen through dispensers at the bottom of the nets. These methods may also be used in cases of low oxygen level in seawater in periods with no current/tides.

6 THE PUBLIC RIGHT OF NAVIGATION

6.1 Navigation Protection Act approval

6.1.1 Notice of Works

Canadian Salmon Limited submitted a completed and signed application with supporting documentation to Transport Canada on February 11, 2022, file number to be obtained**.** The Notice of Works is currently in progress.

Submitted with the application were the following documents:

- Site map showing location of site
- Top down view of net pen and site plan
- Side view of net pen
- General arrangement drawing of construction plan
- Canadian Salmon Limited Business Plan (**Appendix B**)
- DSA Report – 2021 (**Appendix G**)
- The AKVA Group site plans (**Appendix E**)
- The AKVA Group equipment quotes (**Appendix E**)
- Atlantic Canada Hydrographic Chart showing St. Mary's Bay map 4118

6.1.2 Location Map

Canadian Salmon Limited contracted AKVA Group to create the site mapping and specifications for the operation. AKVA Group has provided a full overview of the four currently planned aquaculture sites in St. Mary's Bay, as well as a map of each site location. Figure 46 shows the map of all four sites, followed by the location map of Site 3, which is expected to be the first site constructed in Figure 47. The full document including specifications for future anticipated sites is attached in **Appendix E**.

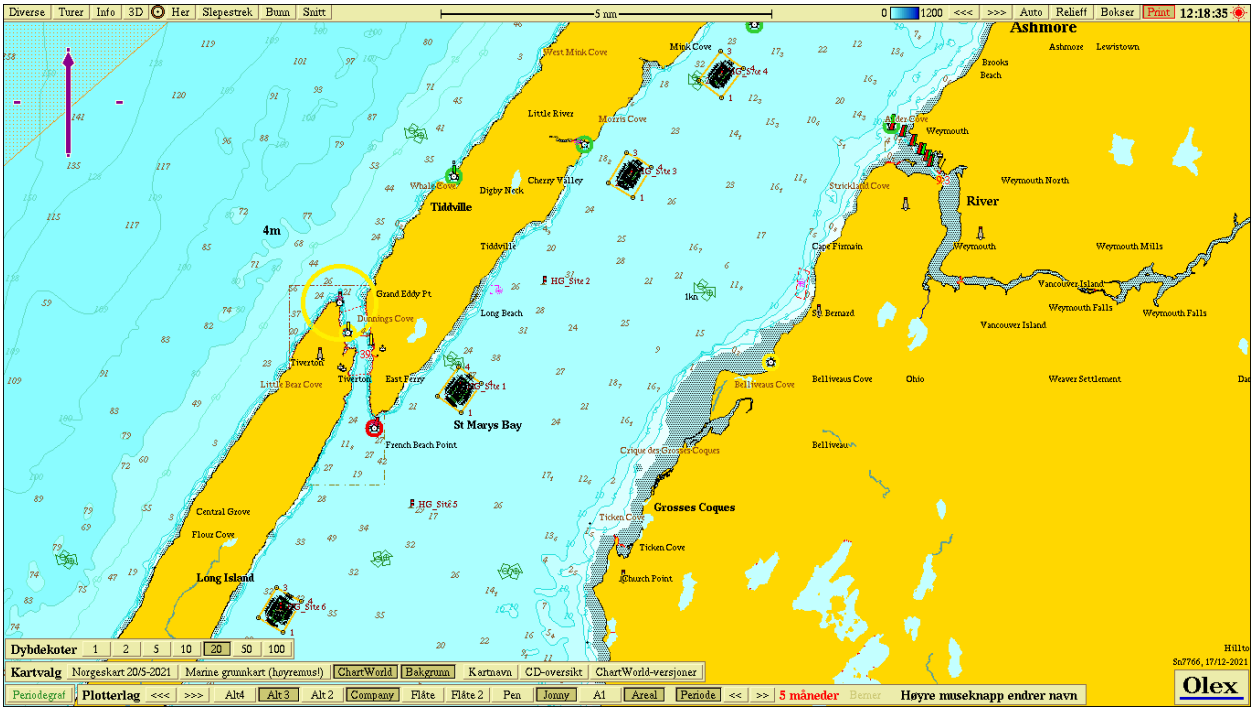


Figure 46. Map of Full St. Marys Bay Operation

First site to be developed (Site 3):

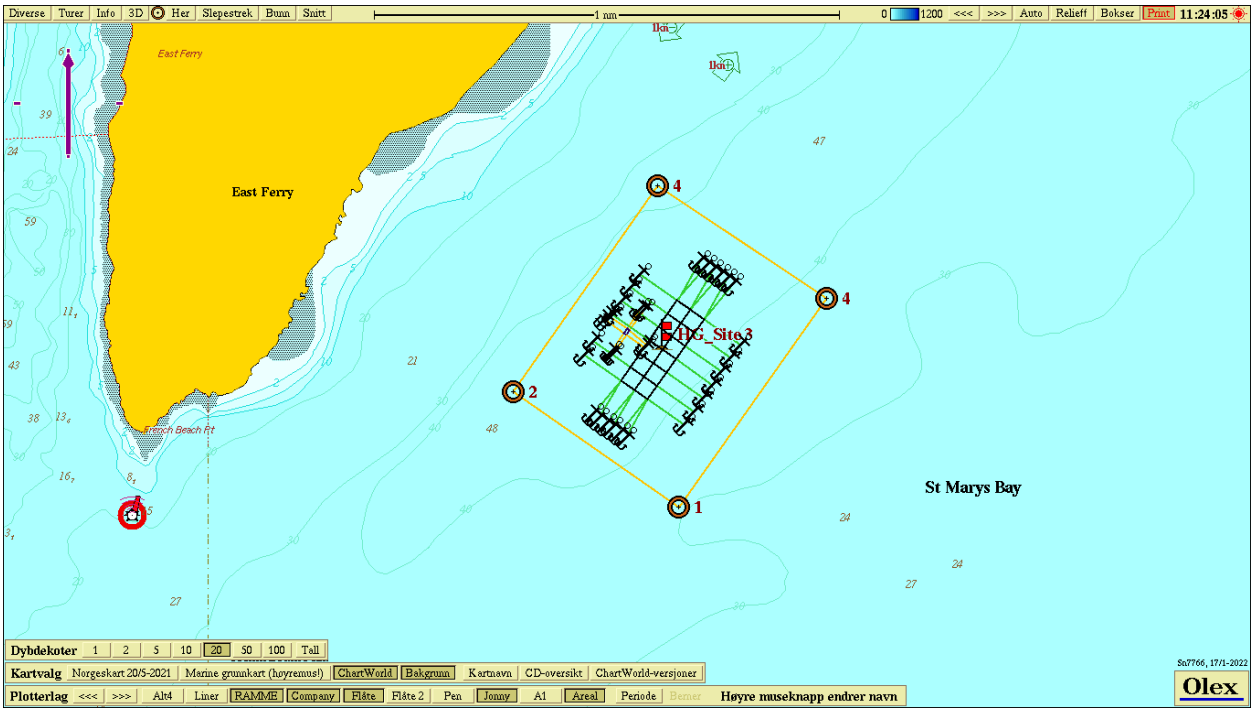


Figure 47. Map of Site 3 Location

6.1.3 Legal Site Description and Work Position

The legal site description and work position for Site 3 is as identified by the latitudinal and longitudinal coordinates provided by AKVA Group in Table 24. The midpoint of the site as well as each corner and anchor point are indicated. The coordinates for the feed barge are included in Table 25.

Table 24. Location Coordinates of Site 3

COORDINATES								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line-ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint		44°22.706'	66°10.605'					
Corner	1	44°22.600'	66°10.649'					
	2	44°22.640'	66°10.730'					
	3	44°22.812'	66°10.561'					
	4	44°22.772'	66°10.480'					
1		44°22.600'	66°10.649'	44°22.517'	66°10.716'	40	210	25 %
2		44°22.600'	66°10.649'	44°22.526'	66°10.735'	40	220	25 %
3		44°22.620'	66°10.689'	44°22.537'	66°10.756'	40	210	25 %
4		44°22.620'	66°10.689'	44°22.546'	66°10.776'	40	220	25 %
5		44°22.640'	66°10.730'	44°22.557'	66°10.797'	40	210	25 %
6		44°22.640'	66°10.730'	44°22.567'	66°10.816'	40	220	25 %
7		44°22.640'	66°10.730'	44°22.695'	66°10.839'	40	305	25 %
8		44°22.669'	66°10.701'	44°22.724'	66°10.811'	40	305	25 %
9		44°22.697'	66°10.673'	44°22.752'	66°10.783'	40	305	25 %
10		44°22.726'	66°10.645'	44°22.781'	66°10.755'	40	305	25 %
11		44°22.755'	66°10.617'	44°22.810'	66°10.727'	40	305	25 %
12		44°22.784'	66°10.589'	44°22.839'	66°10.699'	40	305	25 %
13		44°22.812'	66°10.561'	44°22.867'	66°10.671'	40	305	25 %
14		44°22.812'	66°10.561'	44°22.895'	66°10.494'	40	30	25 %
15		44°22.812'	66°10.561'	44°22.886'	66°10.475'	40	40	25 %
16		44°22.792'	66°10.521'	44°22.875'	66°10.454'	40	30	25 %
17		44°22.792'	66°10.521'	44°22.866'	66°10.434'	40	40	25 %
18		44°22.772'	66°10.480'	44°22.855'	66°10.413'	40	30	25 %
19		44°22.772'	66°10.480'	44°22.845'	66°10.394'	40	40	25 %
20		44°22.772'	66°10.480'	44°22.717'	66°10.371'	40	125	25 %
21		44°22.743'	66°10.509'	44°22.688'	66°10.399'	40	125	25 %
22		44°22.715'	66°10.537'	44°22.660'	66°10.427'	40	125	25 %
23		44°22.686'	66°10.565'	44°22.631'	66°10.455'	40	125	25 %
24		44°22.657'	66°10.593'	44°22.602'	66°10.483'	40	125	25 %
25		44°22.628'	66°10.621'	44°22.573'	66°10.511'	40	125	25 %
26		44°22.600'	66°10.649'	44°22.545'	66°10.539'	40	125	25 %

Table 25. Location Coordinates of Feed Barge for Site 3

COORDINATES BARGE								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line-ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint								
Corner	1	44°22.738'	66°10.713'	Farming Area	3	NW	44°23.274'	66°10.412'
	2	44°22.742'	66°10.720'		4	NE	44°23.023'	66°09.924'
	3	44°23.750'	66°10.711'		2	SW	44°22.852'	66°10.852'
	4	44°22.747'	66°10.704'		1	SE	44°22.363'	66°10.363'
1		44°22.738'	66°10.713'	44°22.911'	66°10.537'	40	210	25 %
2		44°22.742'	66°10.720'	44°22.914'	66°10.545'	40	220	25 %
3		44°22.742'	66°10.720'	44°22.987'	66°10.566'	40	210	25 %
4		44°23.750'	66°10.711'	44°22.995'	66°10.556'	40	220	25 %
5		44°23.750'	66°10.711'	44°23.007'	66°10.453'	40	210	25 %
6		44°22.747'	66°10.704'	44°23.004'	66°10.448'	40	220	25 %
7		44°22.747'	66°10.704'	44°22.928'	66°10.440'	40	305	25 %
8		44°22.738'	66°10.713'	44°22.919'	66°10.449'	40	305	25 %

6.1.4 Plan View Drawings (Top Down)

AKVA Group has provided detailed drawings that match site coordinates with the components involved in the infrastructure at each point. Figure 48 shows each anchor and pen position for Site 3.

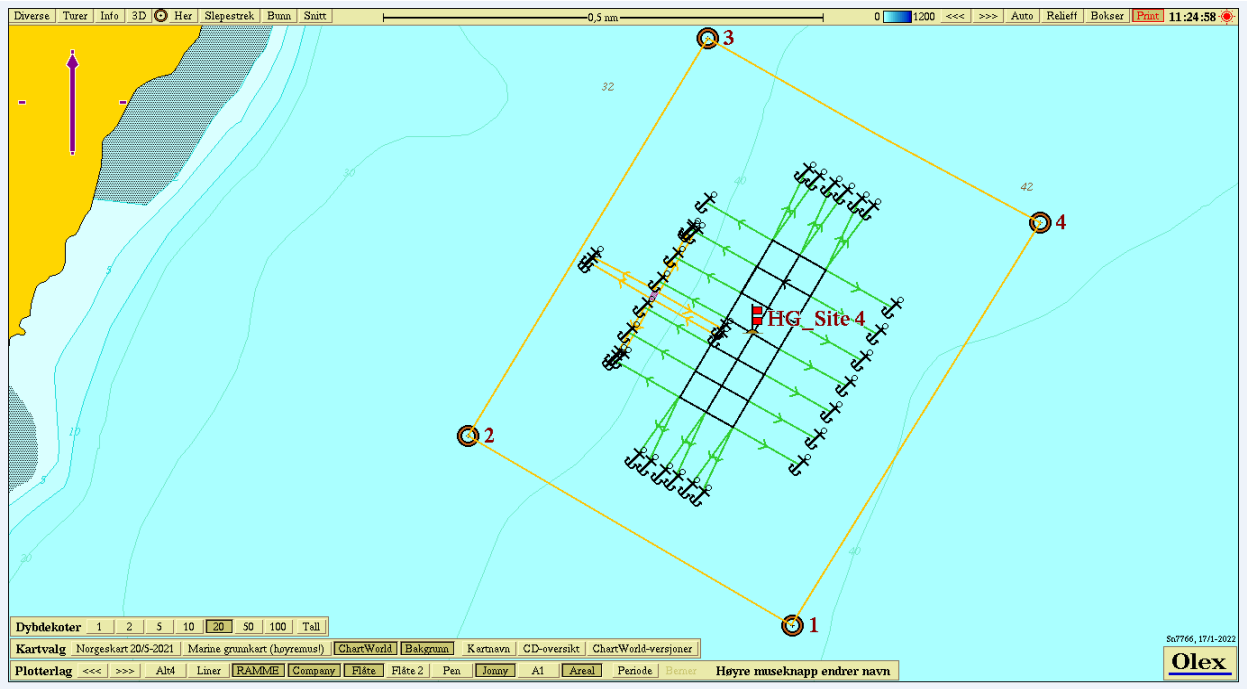


Figure 48. Top Down View of Site 3

6.1.5 Profile View Drawings (Side View)

The sides of the site are shown in Figure 49 which demonstrates a series of net pens and their design and interaction.

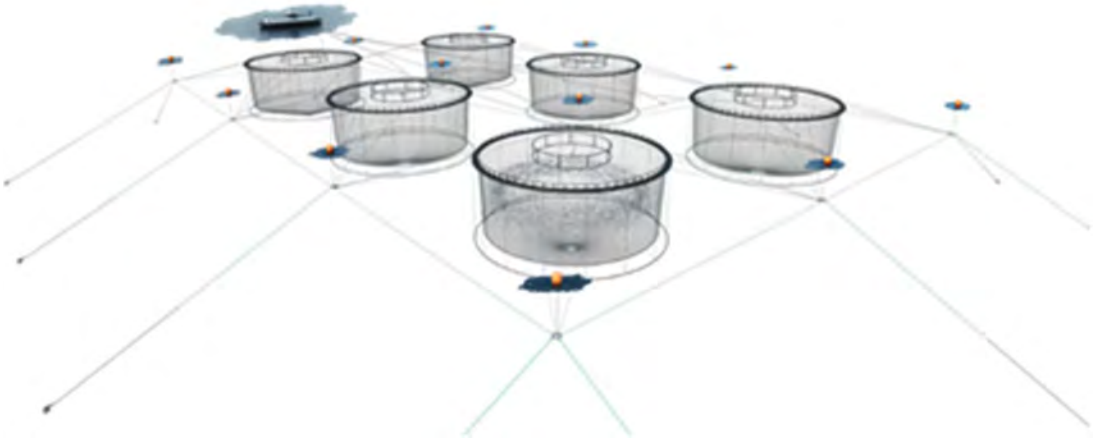


Figure 49. 3-D Side View of Net Pens

Figure 50 shows a 2-D view of the design and anchoring.

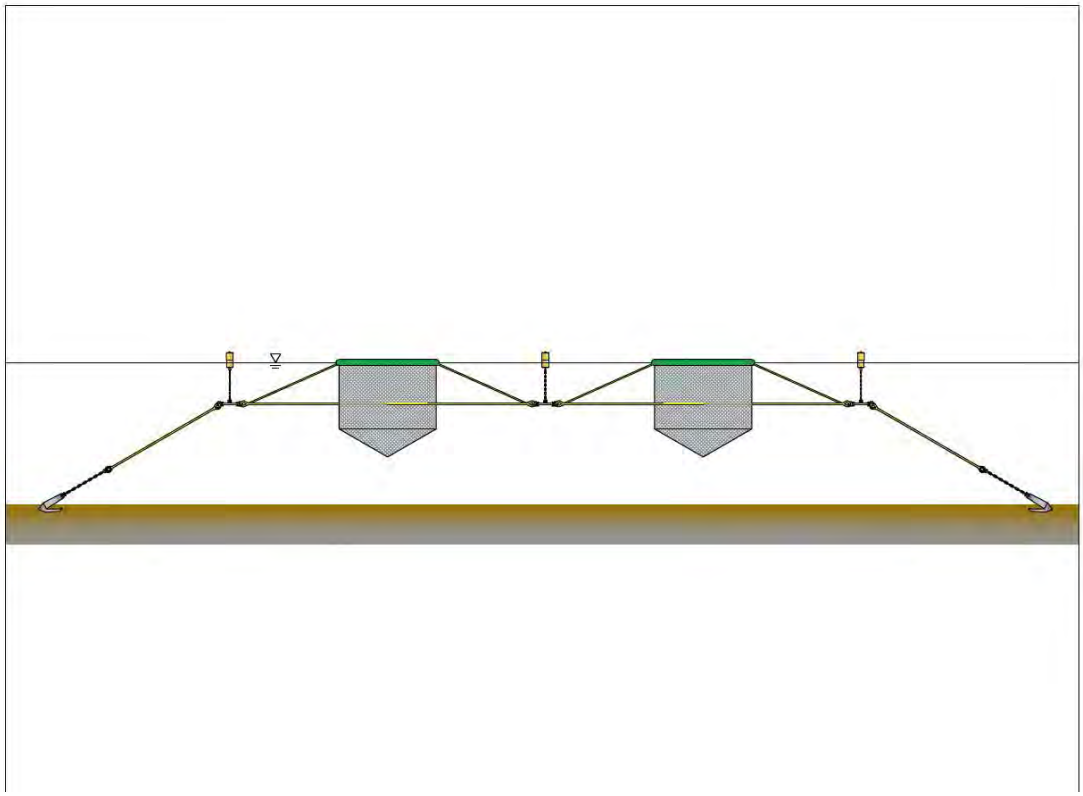


Figure 50. 2-D Side View

Figure 51 below shows the anchoring system around the sides of a site.

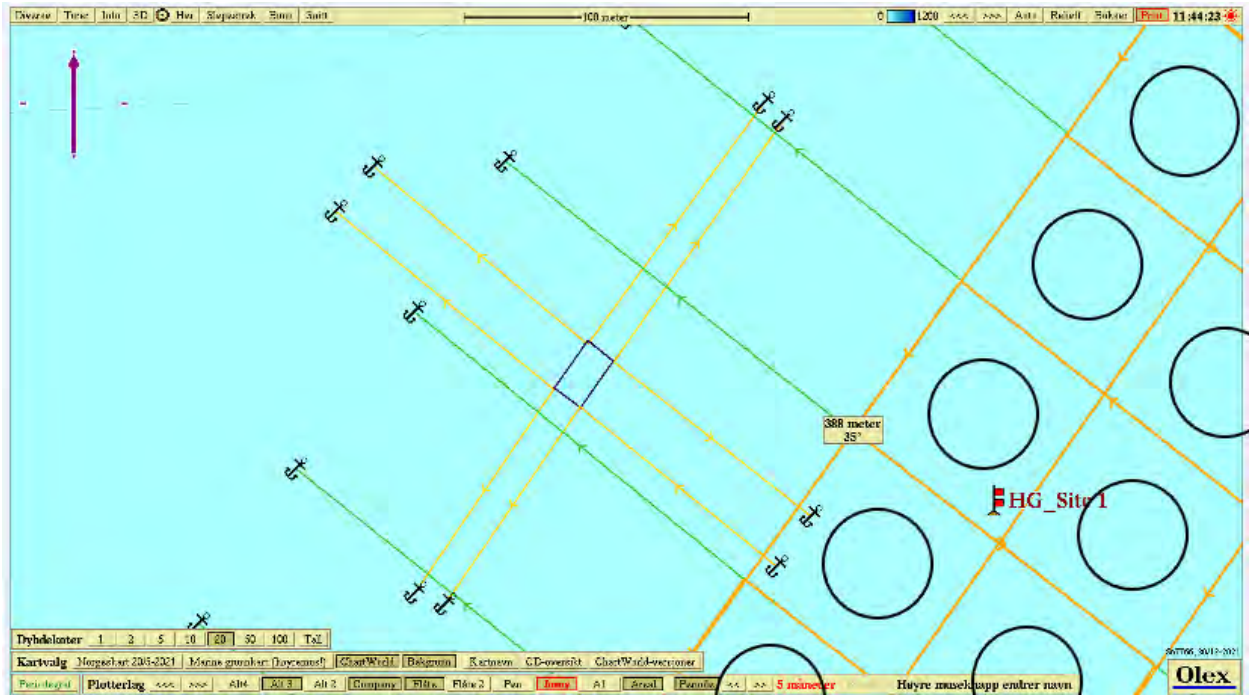


Figure 51. Anchoring System Plan

Finally, a side view of the net containment system is shown in Figure 52, below.



Figure 52. Net Containment System

6.1.6 Project Description

The project is currently in the planning and application phase. Upon approval of the project, a conventional salmon production aquaculture facility at sea will be built or put in place, consisting of 12 floating circular cages and a feeding barge. The circular rings are constructed of PEH-plastic which are of sufficient buoyancy for holding salmon-nets and other equipment to contain, feed and nurse up to 500 tons of live salmon per net. Each ring may have a diameter up to 60 meters and the corresponding net may have a depth of up to 20 meters, containing up to 50,000 cubic meters of seawater. The natural seawater current / tides provides for a comprehensive exchange of seawater in the nets and secure a continuous flow of fresh and oxygen-rich water for the salmon.

The sea-water site facilities are primarily served by a workboat with a large deck for transportation of feed and equipment to the sites and heavy cranes for handling the nets and other heavy equipment on site.

Further information on the nature of the project and description are contained in **Appendix B** and **Appendix E** – the CSL Business Plan and AKVA Group Site and Equipment Plans.

6.1.7 Construction Methodology

Figure 53 contains a list of components involved in the construction of the site and measurements, with a coordinating top down view showing the placement of various components in the design. The diagram contains a list of materials with corresponding line length or item quantity needed, as well as a legend connecting the materials to the drawing. It displays the 12 Polarcirkel rings with connecting bridle and grid lines, the layout of the buoys at each point of the grid, as well as the placement of anchors.

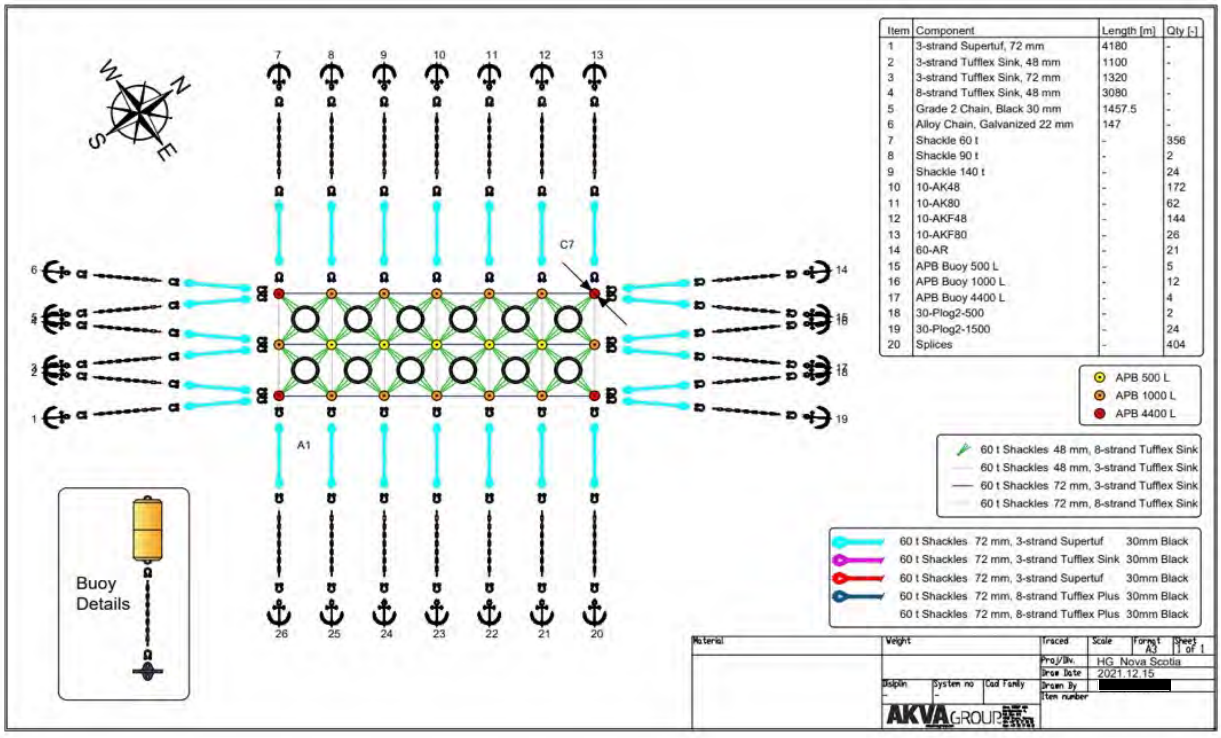


Figure 53. Top Down Component View of Site 3 with Item List

AKVA has also provided an overview of the Polarcirkel rings used to hold the nets, demonstrating its design. Figure 54 shows the placement of the brackets used to connect the nets to the rings, the bridle line connectors, and various other specifications.



Figure 54. Polarcirkel 500R Design

6.1.7.1 Feed Barge Composition

Canadian Salmon Limited will be using the AKVA Group AKVAMaster 240 ton "Classic" feed barge. The barge has proportions of 21.5 m long and 10 m wide. It is designed to be more stable on the water, having a lower centre of gravity. This creates a more comfortable environment for the workers and reduces the strain on the feed pipes due to motion.

The barge has increased deck storage and a crane pedestal. It contains a living area with office space and a bathroom, and is fully heated in occupied spaces. The feed barge will contain the AKVAMarina CCS 8 silo Quattro Feed System. It contains 6 silos and 4 feeding lines of 90mm.

A full overview of the feed barge design can be seen in **Appendix E**.

6.1.8 Anticipated Start and End Dates

Canadian Salmon Limited intends to start construction for the operations within 4-6 months of approval of this application. They expect construction to be complete and the first site to be operational at least one year or less after construction begins.

7 THE SUSTAINABILITY OF WILD SALMON

7.1 Identification of Local Salmon Populations

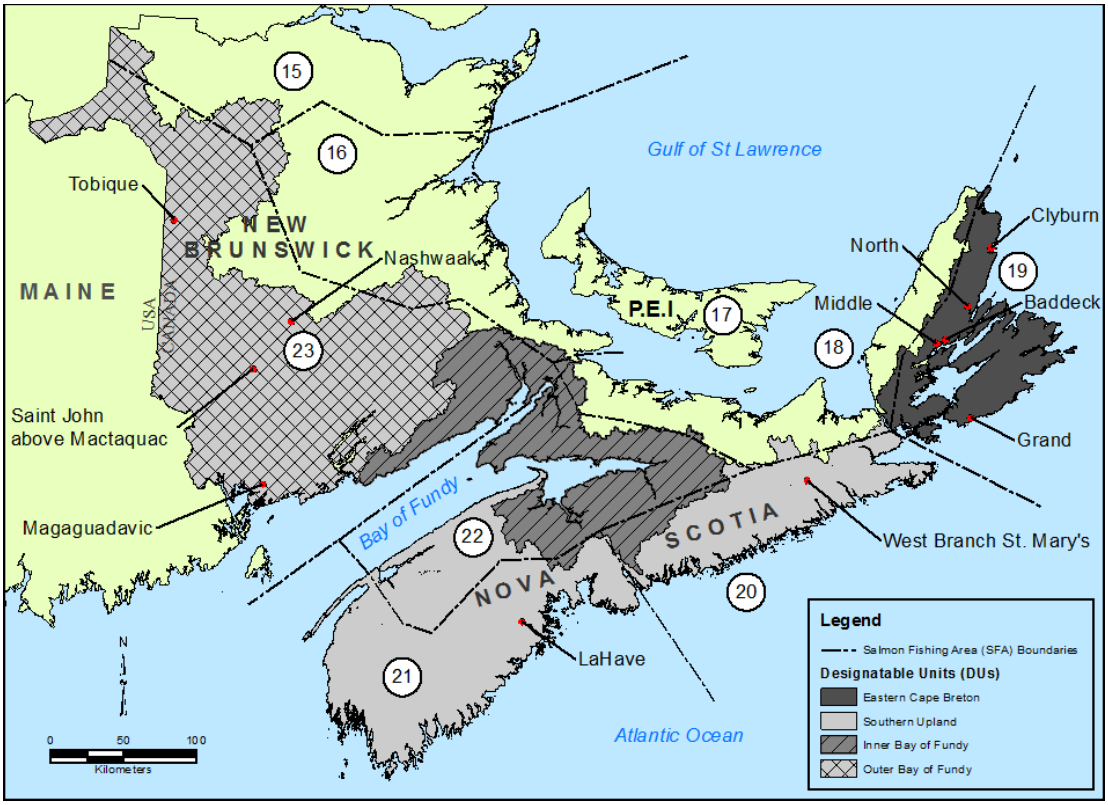


Figure 55. Salmon Fishing Areas in Atlantic Canada (DFO SFA)

Atlantic salmon (*Salmo salar*) is an important and iconic fish species in Canada. Salmon are anadromous species, meaning mature adult salmon reproduce in freshwater, generally in the same river in which they were born, and they hatch in freshwater (rivers), grow and mature in seawater, and then return to freshwater again to reproduce. Juveniles usually spend two to four years in freshwater before migrating to seawater and adults usually return to freshwater to spawn after one to three years at sea (DFO 2019).

It is well known that the wild Atlantic salmon population in the Maritimes Region has been considered fragile, and in decline, for at least >20 years. As such, salmon in the region have been protected under the *Species as Risk Act* (SARA) and the COSWIC, and as such, the fishery (commercial and recreational) has been placed on a moratorium since the 1990s.

Atlantic Salmon are managed under the *Fisheries Act*, via the Atlantic Fisheries Regulations 1985, Maritime Provinces Fishery Regulations, Fishery (General) Regulations, as well as through

licenses issued under the Aboriginal Communal Fishing Licence Regulations (DFO 2019). Atlantic Salmon habitat is protected from serious harm under the fisheries protection provisions of the *Fisheries Act.* Fisheries and Oceans Canada (DFO) has completed scientific Recovery Potential Assessments (RPAs), socio-economic analyses, and public consultations for these DUs to inform the decision on whether or not they will be listed under SARA (DFO 2020).

The causes of the widespread decline of Atlantic Salmon are not well understood. There are several reasons that have been proposed to explain the population decline for salmon in this region. Multiple studies have postulated that the recent widespread occurrence of low adult returns may be caused by climate change, food availability at sea, or marine predators but these possibilities are unsupported by stocks that persist near historic levels, loss of stocks remote from farm sites, a diverse marine prey field, and scarcity of large offshore predators (Dadswell et al. 2021).

Abundance of Atlantic Salmon in the Maritimes Region has been in decline for more than two decades. There are four designatable units (DUs) of Atlantic Salmon are identified in the Maritimes Region: Eastern Cape Breton (ECB), Nova Scotia Southern Upland, Outer Bay of Fundy (OBOF), and Inner Bay of Fundy (IBOF). The proposed aquaculture site expansion is located in the Southern Upland DU. Salmon from OBOF and IBOF populations move in and out of the Bay of Fundy and, therefore, have the potential to migrate in the vicinity of the proposed site, although interaction would likely be limited. The general Bay of Fundy area is considered to be used as a salmon migratory corridor and feeding ground in support of wild salmon growth and maturation. The IBoF population is listed as Endangered pursuant to the Species at Risk Act. The oBoF and SU DUs have been recommended for listing as Endangered by the COSEWIC.

The Recovery Potential Assessment (RPA) identified numerous threats to the OBOF and IBOF DU Atlantic Salmon. The threats identified as highest concern in freshwater were habitat alteration due to hydroelectric dams and illegal fishing. In the estuarine and marine environment, threats of high concern include shifts in marine conditions, salmon aquaculture, depressed population phenomenon, and uncertainties around the occurrence of disease and parasites. Note that some activities identified may not represent a threat, or may be ranked at a lower severity, after the application of mitigation measures.

Salmon assessment activities in the SU region are currently focused on two populations: the St. Mary's River, the index population for SFA 20, and the LaHave River, the index population for SFA 21. Beginning in 2010, all rivers within SFA 20 and SFA 21 were closed to recreational fishing for Salmon (DFO 2020). In general, considering the most recent data, all salmon index populations within DFO's Maritimes Region were assessed to be below conservation egg requirements in 2019 (DFO 2020), meaning that recruitment for the population is low.

Considering spawning and recruitment within the vicinity of the proposed site,. the nearest identified salmon rivers are not significant reproduction sites for the OBOF and IBOF populations. The main rivers that flow into St. Mary's Bay are the Sissiboo River and the

Meteghan River. A fish passage facility is not present at the Sissiboo River, which prevents significant migration between St. Mary's Bay and this river (DFO, 1996). Salmon may be present in the Meteghan River, however, it is not an index population. Although a few salmon rivers in the SU region are located in or near the Bay of Fundy (the Annapolis and the Tusket Rivers are the largest), most are located on the Atlantic coast of Nova Scotia and salmon from the Atlantic populations (particularly the northerly rivers) are expected to be in the vicinity of the proposed sites infrequently (DFO 2011). However, returning adults from at least the IBOF, OBOF and SU DUs would be expected to pass nearby the proposed aquaculture sites, and potentially more than one time (DFO 2011).

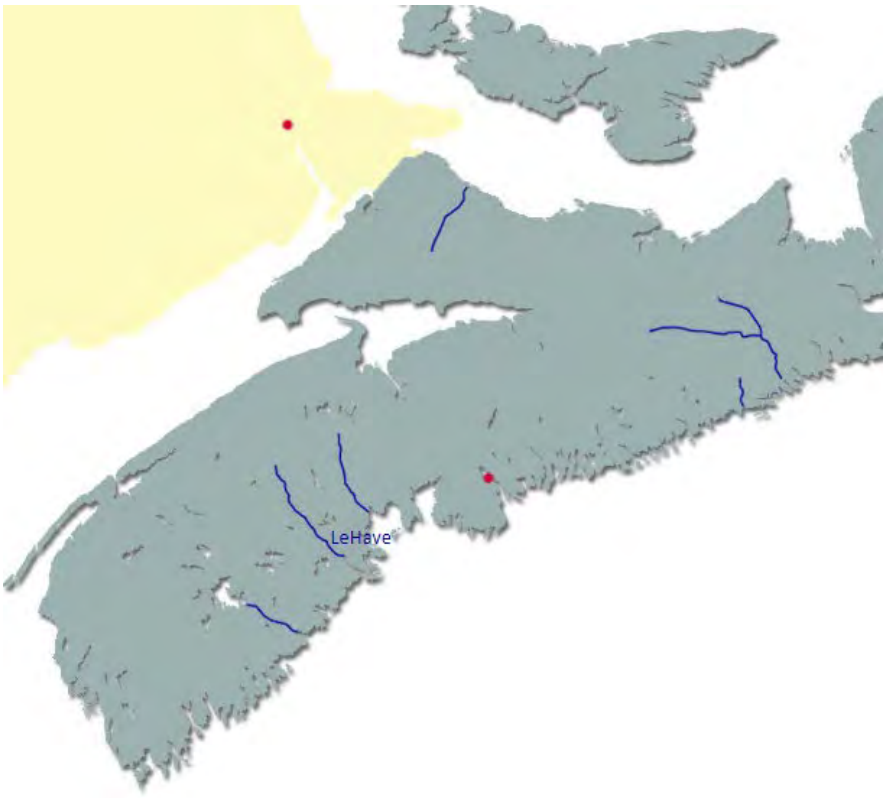


Figure 56. Salmon Rivers, indicating LeHave

7.2 Support of the Sustainability of Wild Salmon

7.2.1 Mitigation of Impacts to Support Sustainability of Wild Salmon

Adult returns to many Atlantic salmon wild and hatchery stocks of the North Atlantic have declined or collapsed since 1985 (Dadswell et al. 2021). While salmon farming has been listed as a potential reason for wild salmon declines in the North Atlantic, a plethora of studies have postulated that the recent widespread occurrence of low adult returns may be caused by many other reasons, such as climate change, food availability at sea, or marine predators. Another

serious problem may be illegal, unreported, and unregulated fisheries exploitation at sea, which has linked to the decline and impending collapse of the North Atlantic salmon, as reviewed in a recent Canadian study (Dadswell et al. 2021). These reasons suggest that wild salmon decline is not solely a direct result of the impact of farmed salmon operations. CSL's proposed operation will start with only one cage site at low density and is expected to have a low impact on wild salmon. CSL unreservedly supports the sustainability of wild salmon. With that considered, CSL will employ mitigation efforts to reduce any possible impacts, and also support wild salmon recovery efforts.

One of the most significant issues, concerning the impact of farmed salmon on wild salmon population, is the incidence of escapes. It has been established that escaped farmed salmon can lead to interbreeding and genetic introgression with wild salmon populations in Atlantic Canada (e.g., Wringe et al. 2018). However, it is critical to point out that escape events of farmed Atlantic salmon have declined over the last decade, as a result of improved net design and technology. For example, a study was conducted to examine farmed finfish escapes in Norway from 2010-2018 (Føre and Thorvaldsen 2021) indicated that the incidence of escapes has significantly decreased overtime (see Figure 57). The data showed a reduction in the number of escaped fish from an average annual value of 700,000 around year 2006 to below 300,000 during 2012–2016. This is also considering that the total number of farmed salmon in Norwegian fish farms has increased from year to year since the start of the salmon farming industry in the 1970s (Føre and Thorvaldsen 2021).

Most escape incidents were directly caused by technological factors, with holes in the net as the most common cause of escape (Føre and Thorvaldsen 2021). Bad weather or handling of weights and net prior to delousing have been associated with increased probability of escape incidents. This led the industry to make technological investments that reduced the number of escapees in the following years (Jensen et al. 2010). The latest mooring grid and pen design will be used to prevent escapes, e.g., high-density polyethylene mesh and stainless steel wire, and the use of frequent net and equipment inspections. The mooring grid and pen design will be provided by AKVA Group, a global technology and service partner that deliver technology and services that helps solve biological challenges within the aquaculture industry. Akva Group is the marked leader on a global basis as constructor and supplier of cages. Their cages are under continuous technical development and are considered among the best in the industry. The net pen design follows the requirements stated in the Code of Practice for Salmonids rearing system and unit design (pg. 12 of Code of Practice). Routine inspections of containment and mooring systems will be conducted according to AKVA specifications and protocols for inspection. Therefore, the risks of escapes are significantly reduced due to improved net technology, which include nets that are composed of high-density polyethylene mesh and stainless steel wire, and the use of frequent net and equipment inspections.

The study also showed that the more complex the operation, the greater the risk of escape (Holmen et al. 2021). The typical salmon farm consists of a feed barge and 10–12 net cages,

each containing up to 200,000 salmon (Holmen et al., 2018). We are proposing a smaller operation. We propose to start with a density of 25 kg/m^3 maximum, with an initial exploration phase at a lower density of 10-15 kg/m^3, then we will consider if it can be higher in the future. This is approximately 40,000-50,000 fish/cage, with 12 cages at the first site.

At present, generally, escape events are largely a result of extreme weather events, like storms that disrupt the cage systems. The region of St. Mary's Bay offers a protected zone where significant storm activity, such as waves and wind, are protected by the Digby Neck land peninsula. The met-ocean conditions (significant wave height, etc.) are less than other sites which are routinely operated in the Maritimes (CMAR, 2021). The site that will be constructed first is likely to be Site 3, which is the most protected from swell and has reduced currents compared with those closer to Petite Passage. The planned equipment delivered from Akva Group is constructed based on experiences from operating sites under same or even more exposed locations and has proven to perform satisfactory under such conditions. In addition, the long-term business plan is aiming at developing a production structure in St. Mary based on post smolts (smolts with an increased average weight of 500 - 1000 g). This will reduce/eliminate need for using nets with small mech-sizes which are most exposed for strong current. Post smolt based production will reduce the necessary production time in exposed sites to less than 12 months and thereby reduce the risk of mortality/escapes due to heavy weather. This site will build on the experience of the CSL engineering and operations team, to reduce further risk of fish escapes as more energetic sites are constructed.

Location and size of the aquaculture facility affects the magnitude of risk to wild salmon populations from escaped farmed salmon. Location in relation to nearby rivers is also important, and river size can also predict impact; whereby larger rivers increase the chance for genetic introgression with the wild population (Keyser et al. 2018). Since the proposed plan is to start with reduced cage numbers and low density, and given the location is not within significant reproducing populations of the DU, the proposed site is favourable for Atlantic salmon aquaculture regarding very limited potential interaction and impact with wild salmon.

Also, several mitigation measures were included in the Development Plan that will be used to mitigate impacts of the operation on wild salmon. Furthermore, it is a legislated requirement that we conform to the aquaculture management regulations specific to containment management through the Farm Management Plans. In the event of an escape, we would follow the Farm Management Plan precisely, and follow up on escape reporting, auditing and mitigation. Developments toward improved traceability for escaped salmon is currently underway by DFO (e.g., DFO 2021), which can help manage and mitigate the issue of escapes.

Furthermore, good health and welfare practices on the farm minimizes impacts on wild salmon populations, such as pests and pathogens. Fish health and welfare, biosecurity, and pests and pathogens and our approach to these issues are discussed in Section 8.2. Regarding inputs into the marine environment, which at times me be necessary, the company will strictly follow the minimum compliance requirements for marine finfish aquaculture operations in Nova Scotia

(Marine Finfish Farm Management Plan Minimum Compliance Requirements). It is important to note that antibiotic use in aquaculture in Atlantic Canada is trending downwards from 2016-2019 (based on the most recent data available; DFO 2021). CSL's low initial stocking density will lend well to avoiding incidence of pathogens and parasites. Further, new feed designs are being optimized to reduce incidence of infection and/or include additives that can prevent and reduce the need for antibiotic use that will be considered in our operation.

The proposed design, with a low density and low impact approach, along with mitigation strategies for potential impacts (such as escapes) support a sustainable practice of farming salmon and promote restoration and sustainable growth of wild Atlantic salmon.

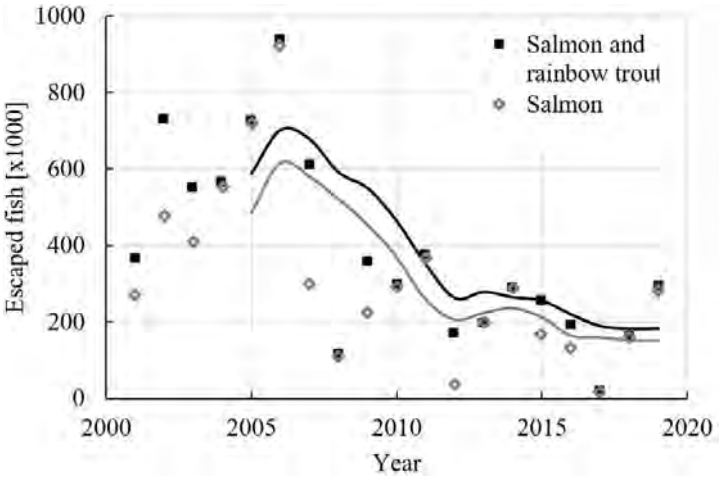


Figure 57. Number of registered escaped fish per year for 2001–2019. Trend lines based on 5-year average values are given for escape of salmon and rainbow trout combined (black) and salmon only (grey). Adapted from Føre and Thorvaldsen (2021).

A DFO review of practices used by the aquaculture industry in the Scotia-Fundy region outlined the priority objectives that could help reduce the risk of interactions between wild and farmed fish (DFO, 1999; Amiro et al. 2008). The objectives will be included in CSL's Farm Management Plan, as will the new and any upcoming regulations that should be provided. The priority objectives include:

- Improving containment, starting with the development and implementation of Codes of Practice, including contingency plans and a reporting system for escapees.
- Improving fish health management, beginning with the completion of the major amendments to the Fish Health Protection Regulations and completion and implementation of provincial Codes of Practice, including contingency plans and a reporting system for specified diseases.

- Upgrading policy for introductions and transfers of fishes and improving related enforcement.
- Enhancing education and training of aquaculture workers, particularly relative to containment and farm/hatchery management.
- Ensuring the maintenance of wild stocks at or above their conservation requirements.
- Continuing the use of local stocks as donors, where possible, for currently practiced aquaculture, or using other strains if rendered sterile or properly contained.
- Continue incorporating risk analysis into the review process for the location of hatcheries and salmon farms.

7.2.2 Wild Salmon Recovery Efforts in St. Mary's Bay Area and beyond

Recovery of wild salmon is an important national issue and strategy. The Nova Scotia Salmon Association (NSSA) is a local organization that represents the interests of native trout and salmon in Nova Scotia, to maximize the likelihood of survival and sustainability of fish in the natural aquatic ecosystem. The NSSA have several initiatives in support of restoration of wild salmon populations and their habitat.

Adopt a Stream Program. NSSA Adopt A Stream is a program designed to encourage and assist community groups across Nova Scotia protect and restore their local waterways by providing technical support and project funding. Within the vicinity of the proposed site, the Tusket River Watershed project is led by the Tusket River Environmental Protection Assoc. Fish passage improvement is also a directive of this Adopt a Stream Program, which helps to solve a fragmentation issue in NS aquatic environments.

Restocking and rehabilitation efforts are also underway. For example, the NSDFA in collaboration with Dalhousie Agricultural Campus rehabilitated wild salmon in West River by capturing smolts, rearing them to adults in captivity, and then releasing them back in the river to spawn in fall 2021 (Dal News, 2021). Based on observations of gravel nests where salmon lay their eggs observed near the release site far exceeded observations in other stretches of the West River. This suggests that the released salmon were spawning near the release site, indicating that the program was successful.

There a national strategy for wild Atlantic salmon conservation, with an implementation plan consisting of 18 action plans to be completed within the period from 2019-2021 (DFO 2019). There is also a national strategy for the IBOF population, specifically, with a detailed action plan of 5 specific objectives with the goal of conservation and recovery (DFO 2019).

Our company supports these conservation and restoration projects and the recovery of wild Atlantic salmon. The proposed site will have no foreseeable impact on the restoration efforts in the St. Mary's Bay region.

8 THE NUMBER AND PRODUCTIVITY OF OTHER AQUACULTURE SITES IN THE PUBLC WATERS SURROUNDING THE PROPOSED AQUACULTURAL LOCATION

8.1 Identification of Other Aquaculture Sites

There are 16 aquaculture sites within 32 kilometres of the proposed site development (Aquaculture Site Mapping Tool, 2022). These include:

Table 26. Aquaculture Sites in St. Marys Bay

No.	Lease Holder	Species	Distance	Approx. Lat.	Approx. Long.
		Inside Option Area			
1012	Long Beach Farms Ltd.	Atlantic Salmon, Rainbow Trout	3.45 km	44° 24' 26.580"	-66° 9' 38.550"
1037	Paul Belliveau	European Oyster, Blue Mussel, Sea Scallop, American Oyster, Soft-Shell Clam	9.5 km	44° 24' 6.188"	-66° 3' 36.632"
828	Vince Stuart	Soft-Shell Clam, Sea Scallop, European Oyster, Blue Mussel, Bay Quahaug, Sugar Kelp	10 km	44° 24' 32.137"	-66° 3' 6.5"
		Outside Option Area			
1354	Kelly Cove Salmon Ltd.	Atlantic Salmon	15.2 km	44° 16' 19.907"	-66° 17' 23.528"
1353	Kelly Cove Salmon Ltd.	Atlantic Salmon	17.2 km	44° 15' 29.157"	-66° 18' 20.569"
829	Innovative Fishery Products Inc.	Atlantic Salmon, Arctic Char, Rainbow Trout	17.8 km	44° 16' 26.834"	-66° 20' 37.654"
742	Kelly Cove Salmon Ltd.	Atlantic Salmon, Rainbow Trout	19 km	44° 15' 41.346"	-66° 20' 48.969"
5009	Keith Amero	Giant Sea Scallop	17.3 km	44° 28' 26.071"	-66° 0' 30.874"
5008	Bear River First Nation	American Oyster	24.5 km	44° 30' 29.506"	-65° 55' 39.863"
5007	Bear River First Nation	American Oyster	25.6 km	44° 32' 17.204	-65° 56' 49.642"
1228	Innovative Fishery Products Inc.	Bay Quahaug	31.3 km	44° 33' 51.949"	-65° 52' 40.369"
		Land-based			

1185	Innovative Fishery Products Inc.	Razor Clams, Soft-Shell Clam, Bay Quahaug, Bar/Surf Clam, European Oyster, American Oyster	9.75 km	44° 23' 56.663"	-66° 3' 1.246"
999	Kelly Cove Salmon Ltd.	Atlantic Salmon, Atlantic Cod	11 km	44° 28' 4.348"	-66° 6' 32.994"
1437	Mike Mullen Smolt Inc.	Atlantic Salmon	14.5 km	44° 24' 40.421"	-66° 59' 54.457"
263	Mike Mullen	Atlantic Salmon	20.7 km	44° 19' 40.800"	-65° 56' 4.802"
1436	Kelly Cove Salmon Ltd.	Atlantic Salmon	22.5 km	44° 32' 27.252"	-66° 0' 18.933"

These sites are identified in the map in Figure 58 below:

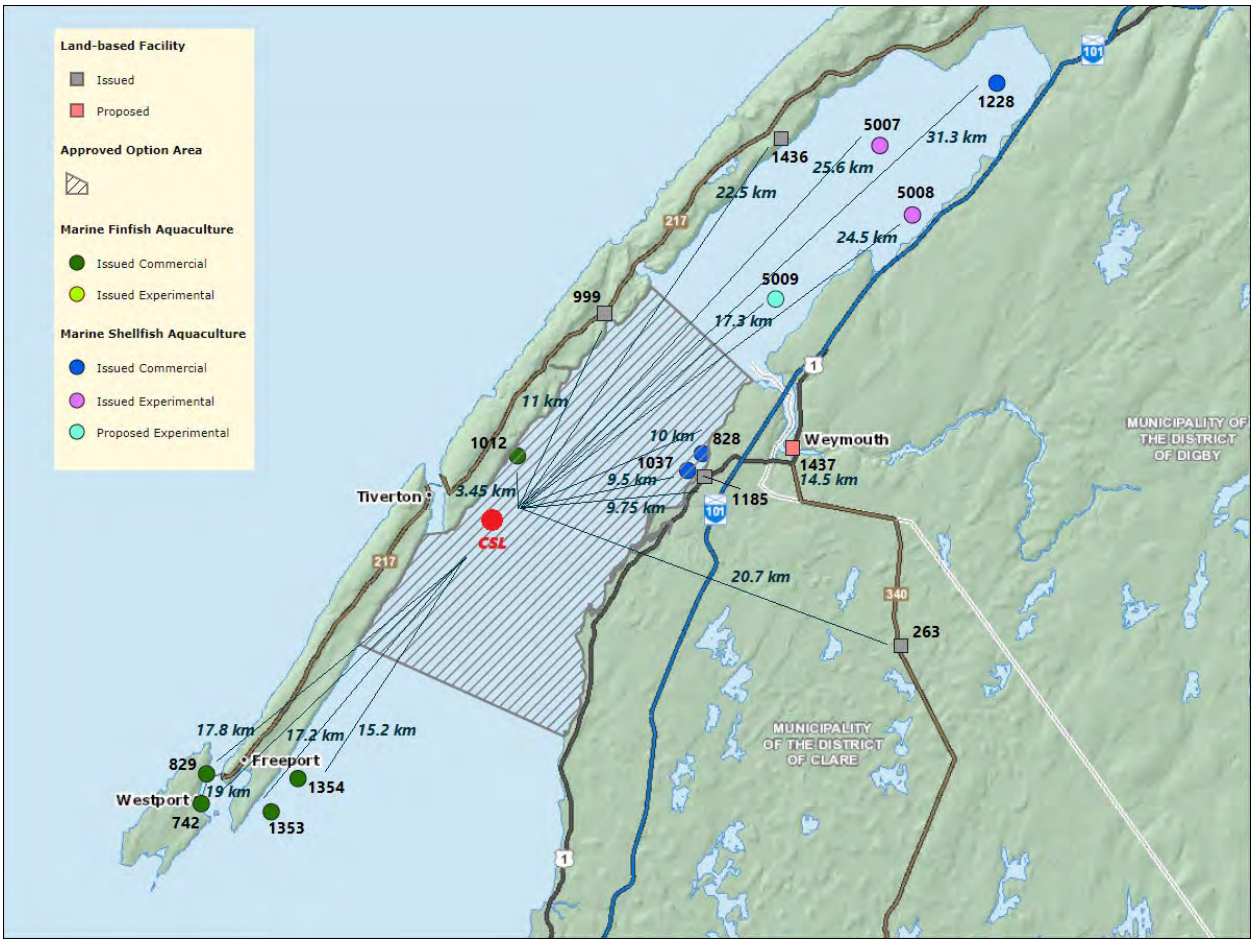


Figure 58. St. Mary's Bay Aquaculture Site Map

8.2 Interactions with Other Aquaculture Operations

8.2.1 Shellfish and Finfish Aquaculture

A total of seven shellfish and two Atlantic salmon net pen aquaculture sites are present in St. Mary's Bay (Figure 58). There are no direct interactions between shellfish and Atlantic salmon aquaculture, specifically related to disease transfer.

The closest development to the proposed site is located at a distance of 3.45 km. We will establish a stock and fallowing plan for all sites in St. Mary's Bay to synchronize production cycles. The grow out period of salmon will be 12-15 months, depending on size of smolts and timing of introduction. CSL expects a fallow period of 3 months to start, depending on regulation for the area and biological status of the site. There is no plan to share infrastructure with others, and a minimum distance between any site will be maintained at least 2.5 km.

8.2.2 Fish Health and Welfare

Good practices with focus on fish health and welfare not only mitigate risk for any health issues on farm, but also support healthy animals on other aquaculture operations within the vicinity. CSL will strictly follow the Code of Practice for the Care and Handling of Farmed Salmonids (National Farm Animal Care Council 2021), which will be referred to as the Code of Practice from here on. The following information details on-farm practices that will help to reduce interactions with other farms and mitigate any health and biosecurity issues. These practices are also reflected in the Farm Management Plan (**Appendix A**). In support of this document, an operational Code of Practice (including site Standard Operating Procedures) is under development, with consultation of DFA veterinarians, and will be shared by June 1st, 2022.

Feeding

Feed provides nutrient requirements and can be considered preventative to disease and infection with optimal good health. In addition to feed quality, feeding regime and delivery is also important. The feed system will be delivered with the latest version of AKVAConnect feeding software. This platform allows for continuous development of the system and improvements to be added. The system is designed with capacity to give greater feeding flexibility and control, including time restrictions on feeding. An improved feeding analysis output using Fishtalk feeding technology is also included. The system is also integrated with cameras and sensor systems, which significantly improve feed efficiency and prevents over feeding and waste nutrient load in the surrounding waters. Live video scanning is transferred directly to control centers where the operators can adjust the feeding through on-line control over the feeding machines at sites. Appropriate feeding strategies will be used, as stated on pg. 27-28 of the Code of Practice. Daily feed consumption are checked against theoretical calculations based on biomass, temperature, light-durations, etc. New feed and developing feed formulations and new feed additives can optimize optimal salmon health, such as new innovations like prebiotics, antioxidants, and can help reduce the need for antibiotic use.

Fish assessments

As stated in the Code of Practice, fish density will be assessed at least once a month in all rearing units to ensure it remains appropriate relative to fish growth and environmental conditions. This will also ensure growth rate and/or welfare issues (fin or skin erosion, excessive size variation, or reduced feeding response. All personnel will be trained and competent in techniques used to handle fish and will be handled in a humane manner that minimizes stress and the risk of injury.

Health management

A written health management plan is being developed and will be implemented and kept up to date. Daily fish health and welfare checks will include the following routine assessments and records will be kept up to date (Code of practice pg. 32):

- fish appearance (size, body condition, skin, fin, eye and gill integrity and colour),
- departure from normal schooling behaviour,
- loss of equilibrium, slow swimming, or unusual vertical position,
- unstructured swimming near the bottom of the rearing unit,
- increased respiration or problems with buoyancy,
- change in feed intake or feeding behaviour; and
- presence of moribund fish.

Some behaviour modifications may be associated with pathogens, parasites, or other environmental stressors (e.g., flashing on the water surface, decreased activity, lethargy). Personnel will be trained to recognize normal fish behaviour and signs of injury or disease during routine checks. Use of underwater cameras as part of our feeding system will assist in observing fish throughout the water column with minimal disruption. If there is an increase in expected daily mortality or change in health indicators (e.g., fin or skin erosion), personnel will take action as outlined in the health management plan. It is also important to note that the production plan eventual stocking of post smolts to be 500-1000 g to start, (12 months in water) which are larger in size (compared to other operations). This improves the robustness of the fish upon entry to the site, which can reduce the risk associated with disease.

In relation to this, CSL procedural documentation on fish health and welfare, in accordance with regulations, including the aquaculture management regulations and internationally applicable standards. The main purpose is to establish a living health plan that is an active part in production and adapts with new priorities and challenges related to the production of salmon at sea. This plan applies to the Code of Practice, which has set standards for improving fish health and welfare. For example, the farm will not have a mortality of more than 10% from smolt phase to processing. Any mortality above this level should be reviewed and explained. The health plan is regulated to notify the NSDFA in the event of suspicion of health issues, such as disease. Good communication with the NSDFA veterinarians shall ensure better care and effective treatments for fish.

8.2.3 Biosecurity Risks and Measures

Biosecurity is based on the principles of keeping infectious diseases out of the aquatic environment (exclusion) and preventing disease from spreading within the farm (management) and to other sites (containment). This can be done through traceability and the control of animals, water, equipment and conveyances, feed, people, and other materials (pg. 32 of Code of Practice). A written biosecurity protocol is being developed and will be implemented and kept up to date.

Effective strategies for cleaning and disinfecting tools, equipment, and rearing units help to minimize the spread of infectious diseases. CSL's biosecurity protocol will cover specific strategies, however in general will include cleaning and disinfection, typically followed by rinsing and drying. Written protocols for cleaning and disinfection will be developed and followed. Cleaners and disinfectants will be stored and used following manufacturer's directions (using Material Safety Data Sheets) to ensure efficacy and safety for personnel and for fish.

During production in seawater, there is potential for pathogens and parasites to be spread through interactions of farmed and wild fish, and transfer of animals between and within the farm. Within the water column, it is impossible to completely contain any transfer of microscopic organisms; however, it is critical to note that biosecurity protocols at the operation, coupled with low density within the cage will drastically minimize potential for pathogen and parasite spread to wild animals and transfer to other salmon farms in the area. Examples of biosecurity protocols and standard operating procedures include: disinfection of infrastructure and equipment between and within cages/sites, regular fish health and welfare checks, disinfection mats provide an effective external biosecurity (such as Virkon® and/or ethanol when appropriate), physical barriers at the pedestrian entrance.

Leveraging the deep experience of its Norwegian partner and in strict compliance with Nova Scotia's regulatory structure, CSL's biosecurity measures will include best practices tailored to the Nova Scotia context and regulatory requirements.

Pest Control and Management

Pests and predators can introduce diseases into the rearing environment, and some predators have been known to cause stress and injury in fish (pg. 34 in the Code of Practice). While pests and predators cannot be fully eliminated from rearing environments, several prevention and management strategies will be implemented. For the prevention of predators, physical barriers and resilient netting will be used. Netting and screens will be regularly checked for holes and maintained in good condition. Our strategy for pest and predator control will be developed and adhered to.

Knowing the status of lice on a farm is crucial in order to be able to assess which measures should be put in place, when they should inserted, and to be able to coordinate actions in a zone or in an area. This knowledge is the starting point, not only to be able to control and limit lice levels, and to ensure good fish welfare and good slaughter quality in own facility, but also to

reduce infection to wild salmonids, to own facility and to surrounding facilities with salmonids. Proper counting of salmon lice before and after a treatment is a prerequisite for being able to assess the effect of implemented measures.

Pest management will follow the Code of Practice (pg. 36). Sea lice management in particular requires an integrated approach that focuses on prevention and best husbandry practices to minimize the need for treatment. The plan eventually is to limit time at sea (12-15 months total) that minimizes any incidence of sea lice problems. CSL will develop an integrated pest management plan that includes good husbandry practices, monitoring, record keeping, setting action levels, proper selection and use of both chemical and non-chemical controls, and resistance monitoring. Trained personnel will monitor any lice levels and records will be kept regarding numbers, seasonal trends, controls and results. Chemical controls are considered safe and effective when used according to the manufacturer's instructions and under veterinary supervision.

De-licing procedures will be based on implemented systems in Norwegian salmon farms. For example, pathogens like sea lice, amoebas etc. are treated by use of well-boat where live fish are bathed/treated in the well-boat tanks in fresh water or in slightly heated seawater. There are also mechanical methods for sea-lice treatment where the salmon is flowed (in seawater) through a tunnel on board the well-boat in which the sea-lice are literally brushed or high-pressure flushed off the salmon. This ensures that salmon that are being treated are contained and treatments will not impact surrounding wildlife or other operations.

In the case of potential algae bloom, adding oxygen into the cages to increase oxygen level in the seawater, may be an option. This can either be achieved by generators pumping compressed air to the bottom under the nets or via liquid oxygen through dispensers at the bottom of the nets. These methods may also be used in cases of low oxygen level in seawater in periods with no current/tides. These procedures are in place to protect fish health and spread of disease, particularly under warm water conditions.

CSL is also working on a coordinated area-based management plan. has also evolved as a best practice for sea lice control (56). The goal is to coordinate production practices (e.g., stocking, treating, harvesting, fallowing) with other sites in the vicinity to ensure that sea lice are not moving amongst sites, in order to optimize our control efforts together. An integrated pest management plan for the control of sea lice at the Canadian site will be based on these protocols and will be developed with the NSDFA veterinarians.

Quarantine

Fallowing, quarantine, and year-class separation help prevent disease transmission between groups. New fish entering the site may require quarantine prior to introduction to the farm. With the fish transfer process, it is also ensured that new fish have received health checks by a NSDFA veterinarian to approve the transfer to our site. Fallowing procedures will be developed and will consider risk factors and disease history.

8.2.4 Monitoring

Aquaculture operations in Canada are required to report on chemical use since 2015, with 2016 being the first full year of reporting. If, in the absolute necessary case, that any bath pesticide must be used in the future, only those approved for use in bath treatments will be conducted on our operation and typically will be used in closed-containment (i.e., well boats). CSL will follow Health Canada's Pest Management regulatory guidelines. These approved chemicals are unlikely to persist in the environment, and considering the approved dose, are unlikely to cause harmful impacts to surrounding organisms and the environment.

Regarding impacts on the surrounding environment, annual environmental monitoring will be conducted as part of the DFA's standard operating procedures for Environmental Monitoring of Marine Aquaculture Sites in Nova Scotia.

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APPENDIX D: Maritime Region Fisheries Atlas: Catch Weight Landings Mapping from 2014-2018

Maritimes Region Fisheries Atlas: Catch Weight Landings Mapping (2014–2018) on a Hexagon Grid

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2020

Canadian Technical Report of
Fisheries and Aquatic Sciences 3373

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Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

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Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. II n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

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Les numéros 1 à 456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

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TABLE OF CONTENTS

LIST OF FIGURES iv
LIST OF TABLES v
ABSTRACT vi
RÉSUMÉ vi
INTRODUCTION 1
METHODS 2
Data Processing 2
Missing and Erroneous Geographic Coordinates 2
Privacy Screening 3
Data Aggregation and Map Production 5
FISHERIES DESCRIPTIONS AND CATCH WEIGHT LANDINGS MAPS 6
ACKNOWLEDGEMENTS 67
REFERENCES 67

LIST OF FIGURES

Figure 1.—Groundfish Landings (All Species), 2014–2018
Figure 2.—Groundfish Bottom Trawl Landings, 2014–2018
Figure 3.—Groundfish Gillnet Landings, 2014–2018
Figure 4.—Groundfish Bottom Longline Landings, 2014–2018
Figure 5.—Seasonal Groundfish Landings, January–March, 2014–2018
Figure 6.—Seasonal Groundfish Landings, April–June, 2014–2018
Figure 7.—Seasonal Groundfish Landings, July–September, 2014–2018
Figure 8.—Seasonal Groundfish Landings, October–December, 2014–2018
Figure 9.—Atlantic Cod Landings, 2014–2018
Figure 10.—Atlantic Cod, Haddock and Pollock Landings, 2014–2018
Figure 11.—Flatfish Landings, 2014–2018
Figure 12.—Atlantic Halibut Landings, 2014–2018
Figure 13.—Greenland Halibut (Turbot) Landings, 2014–2018
Figure 14.—Hagfish Landings, 2014–2018
Figure 15.—Cusk Landings, 2014–2018
Figure 16.—Dogfish Landings, 2014–2018
Figure 17.—Redfish Landings, 2014–2018
Figure 18.—Red Hake Landings, 2014–2018
Figure 19.—Silver Hake Landings, 2014–2018
Figure 20.—White Hake Landings, 2014–2018
Figure 21.—Monkfish Landings, 2014–2018
Figure 22.—Sculpin Landings, 2014–2018
Figure 23.—Skate Landings, 2014–2018
Figure 24.—Wolffish Landings, 2014–2018
Figure 25.—Squid Landings, 2014–2018
Figure 26.—Herring Landings, 2014–2018
Figure 27.—Mackerel Landings, 2014–2018
Figure 28.—Large Pelagics Landings, 2014–2018
Figure 29.—Bluefin Tuna Landings, 2014–2018
Figure 30.—Other Tuna Landings, 2014–2018
Figure 31.—Swordfish Landings, 2014–2018
Figure 32.—Porbeagle, Mako and Blue Shark Landings, 2014–2018
Figure 33.—Snow Crab Landings, 2014–2018
Figure 34.—Other Crab Landings, 2014–2018
Figure 35.—Scallop Landings, 2014–2018
Figure 36.—Seasonal Scallop Landings, January–March, 2014–2018
Figure 37.—Seasonal Scallop Landings, April–June, 2014–2018
Figure 38.—Seasonal Scallop Landings, July–September, 2014–2018
Figure 39.—Seasonal Scallop Landings, October–December, 2014–2018
Figure 40.—Offshore Clam Landings, 2014–2018
Figure 41.—Shrimp Landings, 2014–2018
Figure 42.—Offshore Lobster Landings, 2014–2018
Figure 43.—Disputed Zone Area 38B Lobster Landings, 2014–2018
Figure 44.—Whelk Landings, 2014–2018

LIST OF TABLES

Table 1.—Summary of landed weights of logbook records with missing and erroneous coordinates, and data excluded due to privacy screening

ABSTRACT

K. Rozalska and S. Coffen-Smout, 2020. Maritimes Region Fisheries Atlas: Catch Weight Landings Mapping (2014–2018) on a Hexagon Grid. Can. Tech. Rep. Fish. Aquat. Sci. 3373: vi + 68 p.

This report shows commercial fisheries catch weight landings maps of directed fisheries and bycatch from the Scotian Shelf, the Bay of Fundy, and Georges Bank from NAFO Divisions 4VWX and the Canadian portions of 5Y and 5Z. Atlantic Canadian inter-regional maps of four species (Atlantic Halibut, Bluefin Tuna, Redfish and Scallop) are also included from NAFO Divisions 4RST, 3KLMNOP, and 2GHJ. Five-year composite maps (2014–2018) that aggregate catches for each map series are publicly available and included in this report. The maps aggregate catch weight (kg) per 10 km^2 hexagon grid cell for selected species, species groupings and gear types to identify important fishing areas. These maps may be compared with 2010–2014 landings maps in Butler and Coffen-Smout (2017) and 1999–2003 landings maps in *The Scotian Shelf: An Atlas of Human Activities* (DFO, 2005). These maps may be used for decision making in coastal and oceans management, including marine spatial planning, environmental emergency response operations and protocols, Marine Stewardship Council certification processes, marine protected area networks, and ecological risk assessment.

RÉSUMÉ

K. Rozalska and S. Coffen-Smout, 2020. Maritimes Region Fisheries Atlas: Catch Weight Landings Mapping (2014–2018) on a Hexagon Grid. Can. Tech. Rep. Fish. Aquat. Sci. 3373: vi + 68 p.

Le présent rapport montre les cartes des débarquements par poids des prises issues de la pêche commerciale en tenant compte des pêches dirigées et des prises accessoires pour la plate-forme Néo-Écossaise, la baie de Fundy et le banc de Georges des divisions 4VWX de l'OPANO et les portions canadiennes des divisions 5Y et 5Z. Les cartes interrégionales de l'Atlantique canadien sont également incluses pour quatre espèces (flétan de l'Atlantique, thon rouge, sébaste et pétoncle) dans les divisions 4RST, 3KLMNOP et 2GHJ de l'OPANO. Les cartes composites sur cinq ans (2014 à 2018) qui regroupent les prises pour chaque série de cartes sont accessibles au public et incluses dans le présent rapport. Les cartes incluent le poids des prises (en kilogrammes) par cellule de carte quadrillée hexagonale de 10 km^2 pour les espèces ou les groupes d'espèces choisis et les types d'engins afin de cibler les zones de pêche importantes. Ces cartes peuvent être comparées avec les cartes des débarquements de 2010 à 2014 dans Butler et Coffen-Smout (2017) et aux cartes des débarquements de 1999 à 2003 dans *La plate-forme Néo-Écossaise : atlas des activités humaines* (MPO 2005). Elles peuvent être utilisées à des fins décisionnelles relativement à la gestion des côtes et des océans, notamment la planification spatiale marine, les opérations et les protocoles d'intervention en cas d'urgence environnementale, les processus de certification du Marine Stewardship Council, les réseaux d'aires marines protégées et l'évaluation de risque écologique.

INTRODUCTION

The fisheries catch weight landings maps in this report show commercial fisheries landings (directed fisheries and bycatch) for the Scotian Shelf, the Bay of Fundy, and Georges Bank from NAFO Divisions 4VWX and the Canadian portions of 5Y and 5Z. Atlantic Canadian inter-regional maps of four species (Atlantic Halibut, Bluefin Tuna, Redfish and Scallop) are also included from NAFO Divisions 4RST, 3KLMNOP, and 2GHJ. These four species were selected for inter-regional mapping because they feature inter-regional stock assessment and/or management practices. Landings were combined for the years 2014–2018. The commercial fisheries logbook data sources include four regional databases maintained by DFO Policy and Economics Branch: the Maritime Fishery Information System (MARFIS) database in Maritimes Region, as well as data from Gulf Region, Quebec Region, and Newfoundland and Labrador Region. This report includes offshore Lobster and Disputed Zone Area 38B Lobster, but not inshore Lobster. Inshore Lobster fishery landings are recorded using a statistical grid rather than with geographic coordinates. A separate atlas was created for inshore Lobster fished from 2012–2014 (Serdynska and Coffen-Smout, 2017). An updated inshore Lobster atlas is currently in progress to display 2014–2018 data.

Five-year composite maps were created that aggregate landed catch weight (kg) per 10 km^2 hexagon grid cell for selected species, species groupings and gear types to identify important fishing areas. Erroneous data were removed to address missing and incorrect geographic coordinates e.g., data on land, data for bottom fisheries in depths > 1,500 m, and data on the U.S. side of the Gulf of Maine international maritime boundary. Logbook records were also screened for privacy to comply with the Government of Canada's privacy policy (known as the "Rule of Five") on vessel-specific fishing locations (Treasury Board Directive, 2010). For each map layer, the logbook records within NAFO unit areas containing data from fewer than five vessel IDs, licence IDs or fisher IDs were excluded. The percentage of total live weight associated with missing or incorrect coordinates and privacy screened data is presented in Table 1. Each map is publicly available and included in this report, and the corresponding digital data containing aggregated catch weight per hexagon grid cell will be published on the Open Data portal.[1]

These maps may be compared with 2010–2014 landings maps in Butler and Coffen-Smout (2017) and 1999–2003 landings maps in *The Scotian Shelf: An Atlas of Human Activities* (DFO, 2005). These spatial depictions of human activity do not represent biological distributions of species as species' range distributions are broader than fishing intensity footprints. In addition, management measures influence the fishing effort distribution and thus landings. These maps may be used for decision making in coastal and oceans management, including marine spatial planning, informing environmental emergency response operations and protocols, informing Marine Stewardship Council certification processes, planning marine protected area networks, and ecological risk assessment.

[1] See Open Data portal online: <https://open.canada.ca/en/open-data>.

METHODS

Data Processing

The first step in processing logbook data was to standardize the tabular datasets received from four regions. Variables in the datasets included: catch latitude and longitude, species landed, live weight, date caught, date landed, NAFO unit area, gear type, vessel ID, licence type, licence ID (not available for Newfoundland and Labrador Region), and fisher ID. While similar information is reported and stored in these regional databases, the data is organized using different formats that needed to be standardized before merging them into a single dataset.

Individual logbook entries typically include a reported geographic location. The four regional databases store geographic coordinates using various formats that needed to be recalculated into a single, consistent coordinate format. Maritimes and Gulf Region's logbook entry locations were stored in degrees decimal minutes. Newfoundland and Labrador Region locations were stored in degrees minutes seconds. Quebec Region locations were provided as decimal degrees. All coordinates were converted to decimal degrees in preparation for converting the tabular data to spatial data in ArcGIS software.

Non-spatial data fields also required standardization prior to combining the datasets. The data fields in the MARFIS (Maritimes Region) database were used as the template table structure, as it contained the majority of the logbook records used in this analysis. The Newfoundland and Labrador Region stored landed weight values in pounds, which needed to be converted to kilograms to be consistent with the other three regions.

The four regional datasets were then converted to ArcGIS point feature classes using a WGS 1984 coordinate system. The data from all four regions were merged into a single feature class, from which all future data products would be created. Logbook entries were parsed based on species, species groupings and gear type to create individual feature classes. For select fisheries (groundfish and scallop), quarterly datasets were also produced based on the fished date. Two dates (fished date and landed date) were provided by all regions except for Quebec, which provided only the landed date. For Quebec records, and those missing a fished date, the landed date was used instead to derive quarterly maps.

Missing and Erroneous Geographic Coordinates

Logbook entries provided by all four regions contained records with missing or erroneous geographic coordinates. Known errors and records with missing coordinates were excluded, and their corresponding weights are summarized in Table 1. Not all erroneous coordinates could be detected, therefore it is assumed that additional errors exist in the database.

Groundfish, crustacean and mollusc points that were located in depths of greater than 1,500 metres were assumed to be errors, as the gear used to fish those species is not used at those depths. A bathymetry dataset obtained from the General Bathymetric Chart of the Oceans (GEBCO Compilation Group, 2019) was used to overlay landings points to determine which ones were in depths greater than 1,500 m. In addition, some points were located on land. All points located more than one kilometre inland from the coast were excluded. A one kilometre buffer inland of the coastline was created to include points that were on land, but still close to the water. This allowed some additional points to be included in the maps that may have had minor inaccuracies or rounded coordinates. Points located on the U.S. side of the Gulf of Maine

international maritime boundary, in NAFO divisions 5Y and 5Z were also removed. All of the regional logbook datasets listed the NAFO unit area for each record; however, some points were located particularly far from their reported unit area. For example, points listed as being fished in unit areas within the Gulf of Saint Lawrence, but were located on the Scotian Shelf were assumed to have erroneous coordinates and were removed. A review of the maps by the DFO Commercial Data Division staff revealed a small number of additional errors consisting of isolated points and records in areas that are known not to have fishing activity. The percentage of total live weight associated with missing or incorrect coordinates (Table 1) ranged from 0.3 percent (Silver Hake, offshore clam, and shrimp) to 44.1 percent for crab (other than Snow Crab), with an average of 6.6 percent. Presentation of sea urchin landings was considered, however, 84 percent of the logbook records did not have coordinates.

Privacy Screening

To comply with the Government of Canada's privacy policy on vessel-specific fishing locations (Treasury Board Directive, 2010), privacy assessments were conducted for maps to identify NAFO unit areas containing data from fewer than five vessel IDs, licence IDs or fisher IDs, known as the "Rule of Five." If this threshold was not met, confidential information such as catch weight has been withheld from these unit areas to protect the identity or activity of individual vessels or companies.

In order to conduct privacy assessments against the Rule of Five, each logbook record was first assigned to a NAFO unit area. NAFO unit areas were derived by DFO for fisheries management and stock assessment purposes, and are subsets of larger NAFO subdivisions (NAFO, 2017). Although each of the regional logbook databases already included the NAFO unit area, there was inconsistency between how the regions assigned unit areas to each record. To maintain consistency, a spatial data layer that is maintained by DFO was used to assign each record to a NAFO unit area. If points landed on a line between two unit areas, the reported unit area was used from the original logbook database. The number of unique occurrences of vessel ID, licence ID and fisher ID per NAFO unit area was tabulated for each species, species grouping and gear type. If all three variables passed the Rule of Five in a given unit area, the data within that unit area were included in the final map. NAFO unit areas failing to meet the privacy screening threshold are symbolized by grey-shaded hatching in catch weight maps and are labelled as privacy screened areas. Digital data published to the Open Maps portal will not include personal information such as fisher ID, vessel ID or licence ID.

Adjustments were made to the privacy assessments of inter-regional maps for Bluefin Tuna, Atlantic Halibut, Scallop, and Redfish to account for the lack of licence IDs in data from Newfoundland and Labrador Region. For these species, logbook entries in NAFO divisions 0, 2, 3 and 4R passed the privacy screening if there were more than five unique fisher IDs and vessel IDs. The total weight of landings for all species, species groupings and gear types that were removed due to privacy screening are listed in Table 1.

For Hagfish, offshore Lobster and offshore clam fisheries with low numbers of licence holders, consent was sought from licence holders to publicly release map products. Consents from Sea Cucumber licence holders were not sufficient to warrant including a regional Sea Cucumber map.

Table 1.—Summary of landed weights of logbook records with missing and erroneous coordinates, and data excluded due to privacy screening. Logbook entries per species include all gear types. Weights are provided in metric tonnes (t). Percentages may not total 100 due to rounding. (* = Inter-regionally mapped fishery)

	Data included in map		Missing or erroneous coordinates		Privacy Screened	
	Live Weight (t)	%	Live Weight (t)	%	Live Weight (t)	%
Groundfish	199,811	98.6	2,860	1.4	5.1	0.003
Groundfish Bottom Trawl	173,222	99.3	1,132	0.6	141	0.08
Groundfish Gillnet	2,635	52.5	501	10.0	1,886	37.6
Groundfish Bottom Longline	16,356	94.5	951	5.5	1.6	0.01
Atlantic Cod†	6,433	-	251	-	-	-
Atlantic Cod, Haddock, Pollock	105,781	98.9	1,137	1.1	0.1	0.0001
Flatfish	5,792	95.7	254	4.2	7.1	0.1
Halibut*	18,423	86.0	2,782	13.0	207	1.0
Greenland Halibut	98	97.8	1.9	1.9	0.2	0.2
Hagfish	5,383	97.9	114	2.1	Permission obtained	
Cusk	783	93.9	50	6.1	0.04	0.004
Dogfish	175	94.4	8.9	4.8	1.5	0.8
Redfish*	45,713	84.1	841	1.5	7,785	14.3
Red Hake	2,221	98.8	11	0.5	16	0.7
Silver Hake	32,771	98.4	106	0.3	434	1.3
White Hake	2,580	95.5	122	4.5	0.5	0.02
Monkfish	430	98.0	8.1	1.9	0.8	0.2
Sculpin	1,275	94.0	74	5.5	6.9	0.5
Skate	206	93.3	2.5	1.1	12	5.6
Wolffish	14	86.0	2.0	12.0	0.3	2.0
Squid	169	96.6	1.1	0.6	4.9	2.8
Herring	271,962	92.0	23,664	8.0	108	0.04
Mackerel	4,324	64.3	2,015	30.0	381	5.7
Large Pelagics	8,513	95.7	379	4.3	2.6	0.03
Bluefin Tuna*	1,942	80.1	451	18.6	31	1.3
Other Tuna	1,492	96.3	56	3.6	1.9	0.1
Swordfish	5,712	97.4	151	2.6	3.7	0.06
Porbeagle, Mako, Blue Shark	327	97.3	6.9	2.1	2.1	0.6
Snow Crab	47,490	97.7	985	2.0	132	0.3
Other Crab	2,043	45.6	1,975	44.1	463	10.3

Scallop*	290,755	98.0	3,791	1.3	2,222	0.7
Offshore Clam	132,042	99.7	440	0.3	Permission obtained	
Shrimp	16,814	99.7	51	0.3	7.4	0.04
Offshore Lobster	3,469	97.2	98	2.8	Permission obtained	
Disputed Zone Lobster Area 38B	2,624	67.9	1,242	32.1	0	0
Whelk	1,737	98.2	31	1.8	Permission not required	

† Only one unit area did not pass the privacy screening criteria for Atlantic Cod. To protect the confidentiality of fishers in this area, the weight fished in this unit area was not included.

Data Aggregation and Map Production

Data aggregation methods were used to depict fishing intensity and distribution for a public audience. Aggregation methods group the data to illustrate spatial patterns and trends. The simplest and most common method to aggregate fisheries data involves binning spatial data into grid cells. Grids are an array of cells of equal size, with each cell containing a summary of the values of interest (live weight) of the points that land within it.

Hexagon grid cells of 10 km^2 were used for all maps in this report to ensure consistency with DFO's guidance in the Atlantic Canadian Protocol on Mapping Fishing Activity (Koropatnick and Coffen-Smout, 2020). The hexagon grid was created using the Canada Albers Equal Area Conic Projection to minimize grid distortion. Square or fishnet grids are prone to edge effects, require an offset grid to capture data within cells rather than on boundary lines, and create perceived linear patterns. Hexagon grids are preferred for several reasons: (1) they reduce edge effects and sampling bias as a hexagon grid has the lowest perimeter to area ratio of any regular tessellation of the plane; (2) all adjacent cells share the same shared boundary length and the distance between centroids is the same for all neighbouring cells; (3) they are a better fit to curved surfaces and along coastlines; and (4) they are better for connectivity and movement paths.[2] There is potential for points that land on the boundary between two grid cells to be included in both cells. However, this did not occur, therefore none of the logbook entries were duplicated during the aggregation process.

After data aggregation of each map layer, cells with values less than 0.5 kg were excluded from the maps. Blank log records in the Maritimes Region's MARFIS database are assigned a value of 0.001 kg by DFO's Commercial Data Division to avoid calculation errors that would result from zero values. As such, these values do not significantly affect overall calculations or the data aggregation, except where a single hexagon grid cell has a very low binned weight value resulting in spurious map symbolization. Therefore, all hexagon grid cells with a total binned weight of < 0.5 kg were excluded, i.e., the smallest approximate weight of a single fish. The percent of grid cells removed per species, species grouping or gear type data layer ranged from 0 to 20.9 percent, with an average of 1.6 percent. The majority of the map layers (31 of 44) had less than one percent of grid cells removed.

Following data aggregation, a map was created for each species, species grouping or gear type. Hexagon grid cells for each map were divided into five intervals based on their aggregated catch weight using quantile breaks, where each class has an equal number of grid cells. This means that the breaks on each map are different and the coloured cells have different values on

[2] See Fishnets and Honeycomb: Square vs. Hexagonal Spatial Grids: <https://strimas.com/post/hexagonal-grids/>.

each map. For seasonal maps (groundfish and scallop), the same break values were selected for each season so that maps can be compared more easily. Therefore, seasonal maps were not divided by quantile breaks. Digital data published on the Open Data portal will only include the aggregated catch weight per hexagon grid cell.

FISHERIES DESCRIPTIONS AND CATCH WEIGHT LANDINGS MAPS

Fisheries are managed using various measures, e.g., quotas, gear restrictions, seasons, area closures, size restrictions, and other characteristics of the targeted species. Management measures outlined in the following brief species, species grouping, or gear type descriptions are incomplete and may change at any time. Information in the descriptions is based on integrated fisheries management plans (IFMPs) and input from DFO Resource Management advisors. Updated descriptions of current fisheries management measures and practices are available in the species-specific IFMPs, conservation harvesting plans (CHPs), fisheries licence conditions, and variation orders available from DFO Resource Management.[3] The following species descriptions include, where applicable, the status of Species at Risk Act (SARA) designations,[4] Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessments,[5] and Marine Stewardship Council (MSC) fishery sustainability certifications.[6] The following maps show catches from directed fisheries and bycatch.

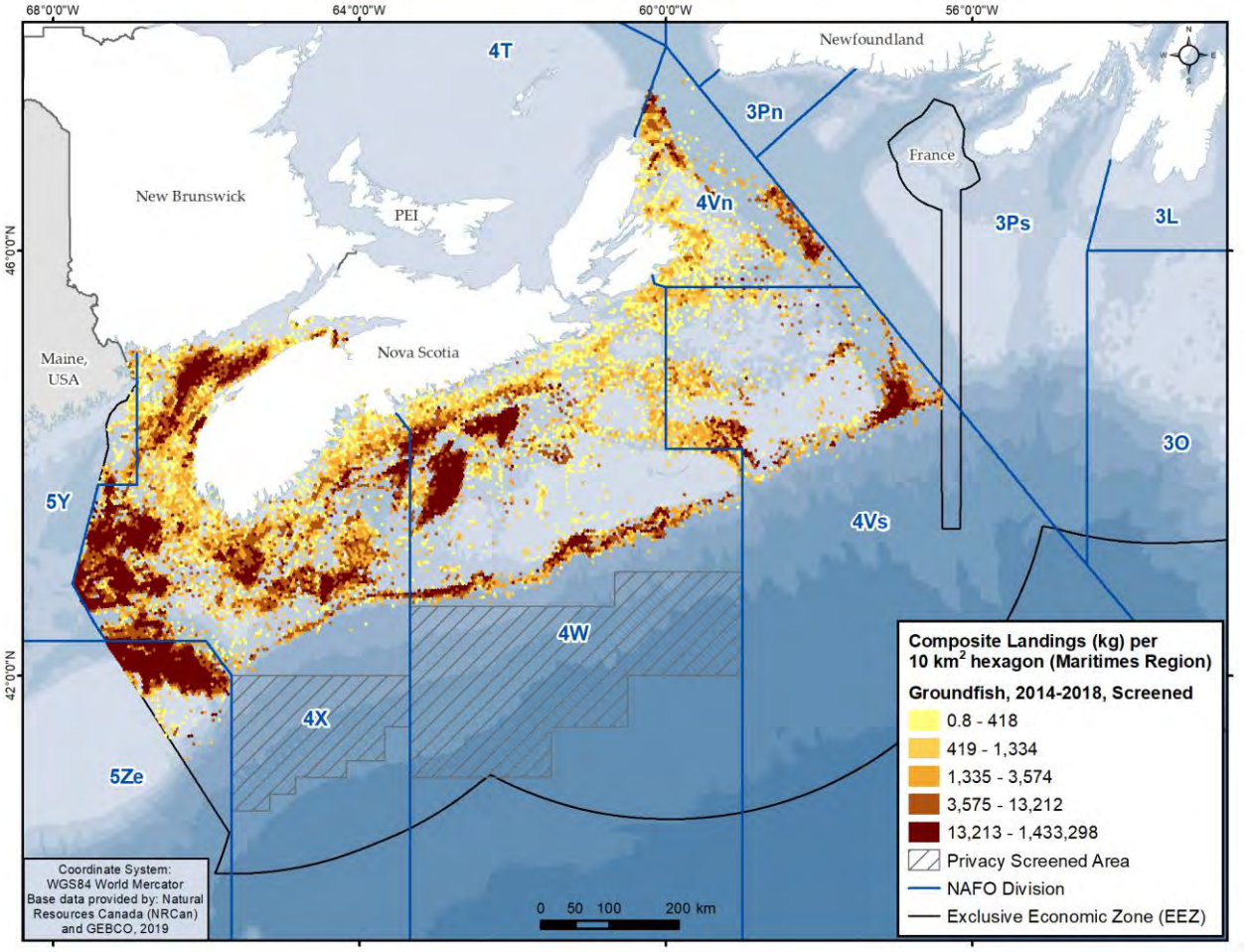
DFO monitors commercial fish stocks on the Scotian Shelf and publishes stock status reports on individual species available from the Canadian Science Advisory Secretariat (CSAS).[7] The State of the Atlantic Ocean Synthesis Report (Bernier et al., 2018) and the State of the Scotian Shelf theme paper, *Fish Stock Status and Commercial Fisheries* (O'Boyle, 2012), provide information on key fish stocks, harvest control rules, and trends in commercial fisheries in Atlantic Canada.

[3] See IFMPs and Fishery Openings and Closures online: <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/index-eng.html> and <http://www.inter.dfo-mpo.gc.ca/Maritimes/Commercial-Fisheries>.
[4] See SARA Registry: <http://www.sararegistry.gc.ca>.
[5] See COSEWIC assessments: <http://www.cosewic.gc.ca>.
[6] See Marine Stewardship Council: <http://www.msc.org>.
[7] See DFO CSAS publications online: <http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm>.

Groundfish (Figure 1)

Figure 1 shows all groundfish species landings (directed fisheries and bycatch), including Atlantic Cod, Atlantic Halibut, Greenland Halibut, Haddock, Pollock, flatfishes (e.g., Yellowtail, Witch and Winter Flounders, and American Plaice), Silver Hake, dogfish, Atlantic Hagfish, wolffish, and redfish. Lesser known species include White Hake, Red Hake, Cusk, skate sp., Arctic Skate, Monkfish, butterfish, tomcod, lumpfish, Roundnose Grenadier, tilefish and sculpin. All groundfish species landed have been mapped regardless of whether they are defined as groundfish under the *Atlantic Fishery Regulations*. The map in Figure 1 shows directed groundfish catch and bycatch in other fisheries. Most groundfish are caught by mobile trawl gear and bottom longline vessels.[8]

Figure 1.—Groundfish Landings (All Species), 2014–2018

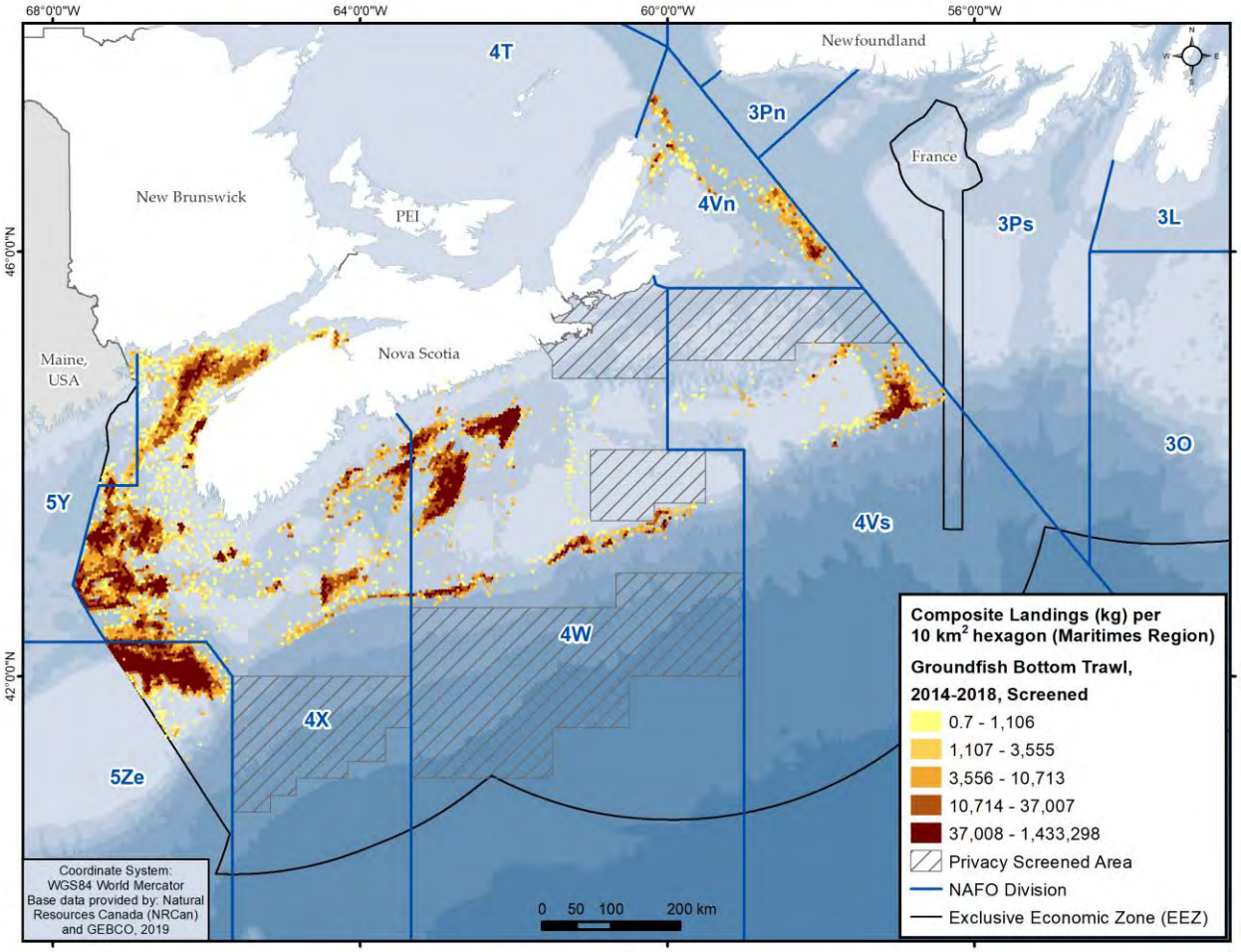


[8] Groundfish 4VWX5 Integrated Fisheries Management Plan, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/groundfish-poisson-fond/groundfish-poisson-fond-4vwx5-eng.html>.

Groundfish Bottom Trawl (Figure 2)

Figure 2 shows groundfish landings (directed fisheries and bycatch) from otter trawl, stern and side trawl, shrimp trawl, and Danish and Scottish seine. Otter trawls are used across the Scotian Shelf, with the relative lack of fishing activity on the eastern Scotian Shelf due to the 1993 Atlantic Cod and Haddock moratorium. Otter trawlers have higher landings in mid-shelf basins due to the Silver Hake fishery that uses trawl gear in that area. Groundfish trawl landings include Atlantic Cod, Haddock, Pollock, Cusk, flatfish, Halibut, Monkfish, redfish, Red Hake, Silver Hake, White Hake, dogfish, butterfish, Roundnose Grenadier, sculpin, tilefish, skate, and wolffish.

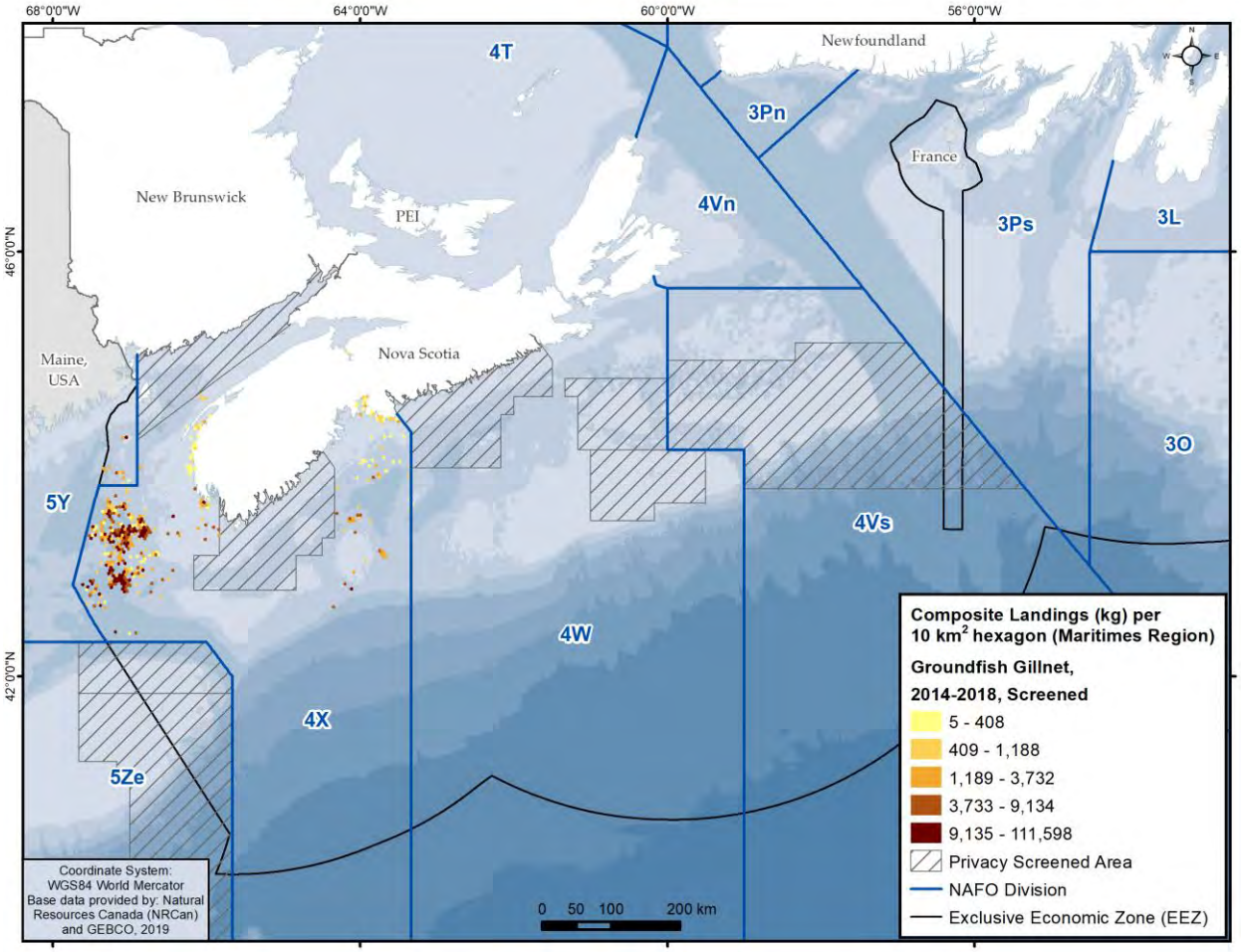
Figure 2.—Groundfish Bottom Trawl Landings, 2014–2018



Groundfish Gillnet (Figure 3)

Gillnet landings in Figure 3 are from the Scotian Shelf off southwestern Nova Scotia and in the Gulf of Maine. Gillnet landings are scattered, with few areas reporting landings. Many areas do have relatively high landings, suggesting effort is patchily distributed based on important areas. Catch includes Atlantic Cod, Haddock, redfish, Atlantic Halibut, Winter Flounder, skate, Arctic Skate, dogfish, Pollock, White and Silver Hake, Cusk, Monkfish and sculpin.

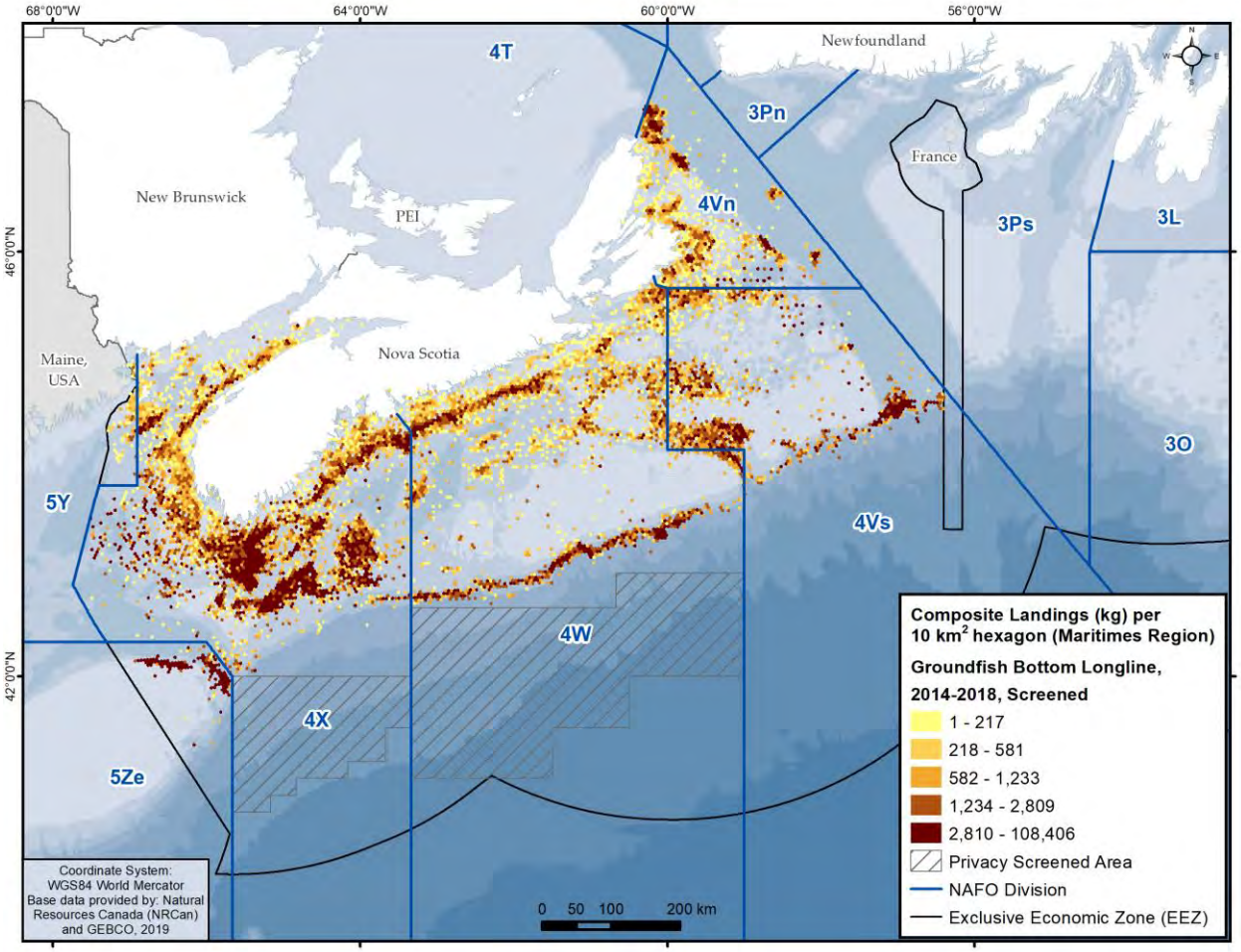
Figure 3.—Groundfish Gillnet Landings, 2014–2018



Groundfish Bottom Longline (Figure 4)

Figure 4 shows groundfish landings from bottom longline gear. While overlap exists in the areas used by the different groundfish gears, differences are evident. Longline gear is used across the Scotian Shelf, with the relative lack of fishing activity on the eastern Scotian Shelf due to the Atlantic Cod and Haddock moratorium in NAFO areas 4VW. Longliners target Atlantic Halibut along the shelf edge and deeper channels, with fewer landings from the mid-shelf basins.

Figure 4.—Groundfish Bottom Longline Landings, 2014–2018



Seasonal Groundfish Q1–Q4 (Figures 5 to 8)

Groundfish are caught during all seasons of the year (Figures 5 to 8), with different areas being more or less important depending on the season. Seasonal patterns reflect seasonal fish migrations, management regulations, patterns of activity in other fisheries, and weather and climatic conditions. Some groundfish fisheries run year-round, with higher catches occurring at certain times of the year. From July to September, fishing activity is relatively widespread, particularly on the western Scotian Shelf and in the Bay of Fundy. Georges Bank is closed from the first Sunday in February until June 1 and an active winter fishery occurs in January. A Browns Bank seasonal closure from February 1 to June 15 protects spawning 4X5Y Haddock.

Figure 5.—Seasonal Groundfish Landings, January–March, 2014–2018

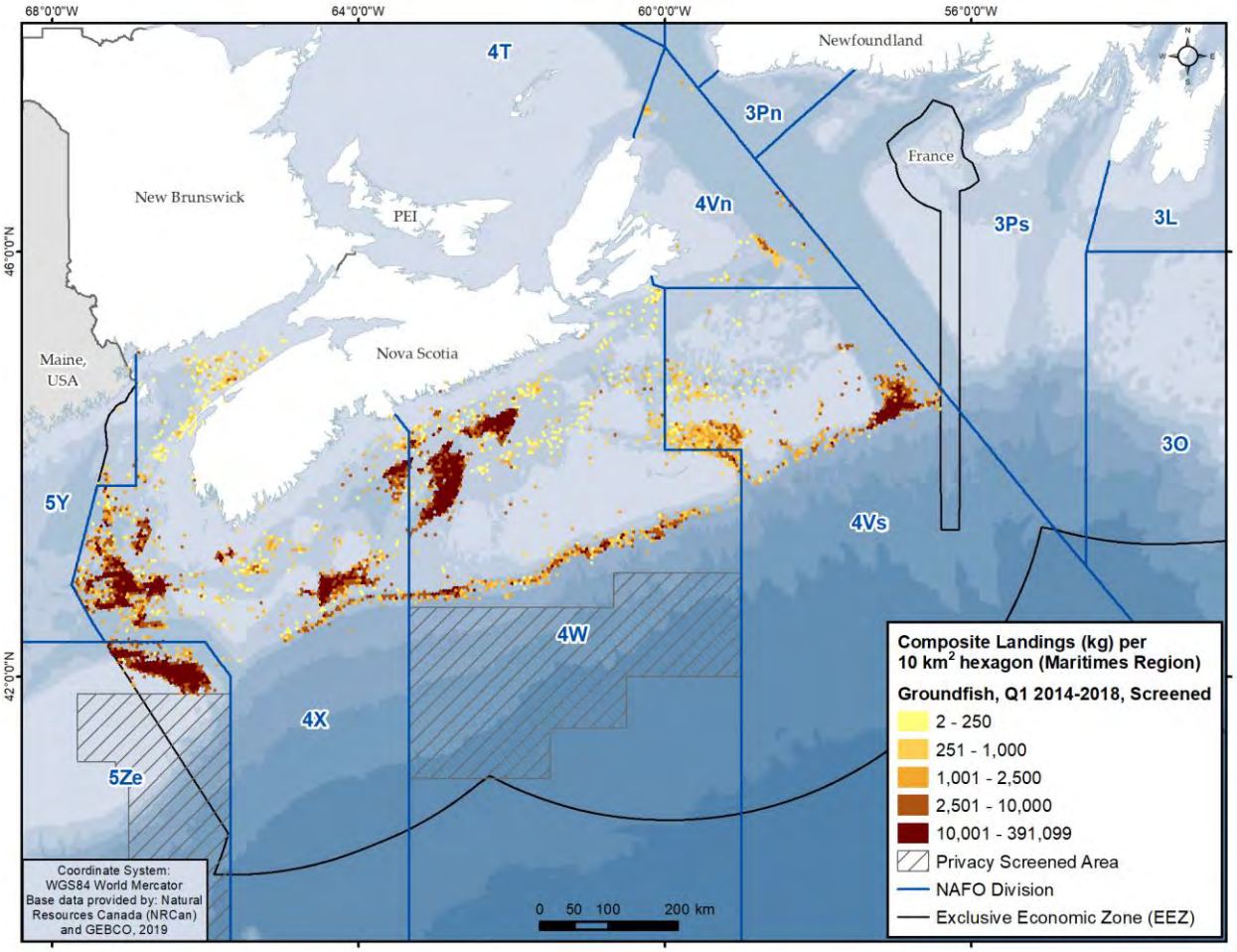


Figure 6.—Seasonal Groundfish Landings, April–June, 2014–2018

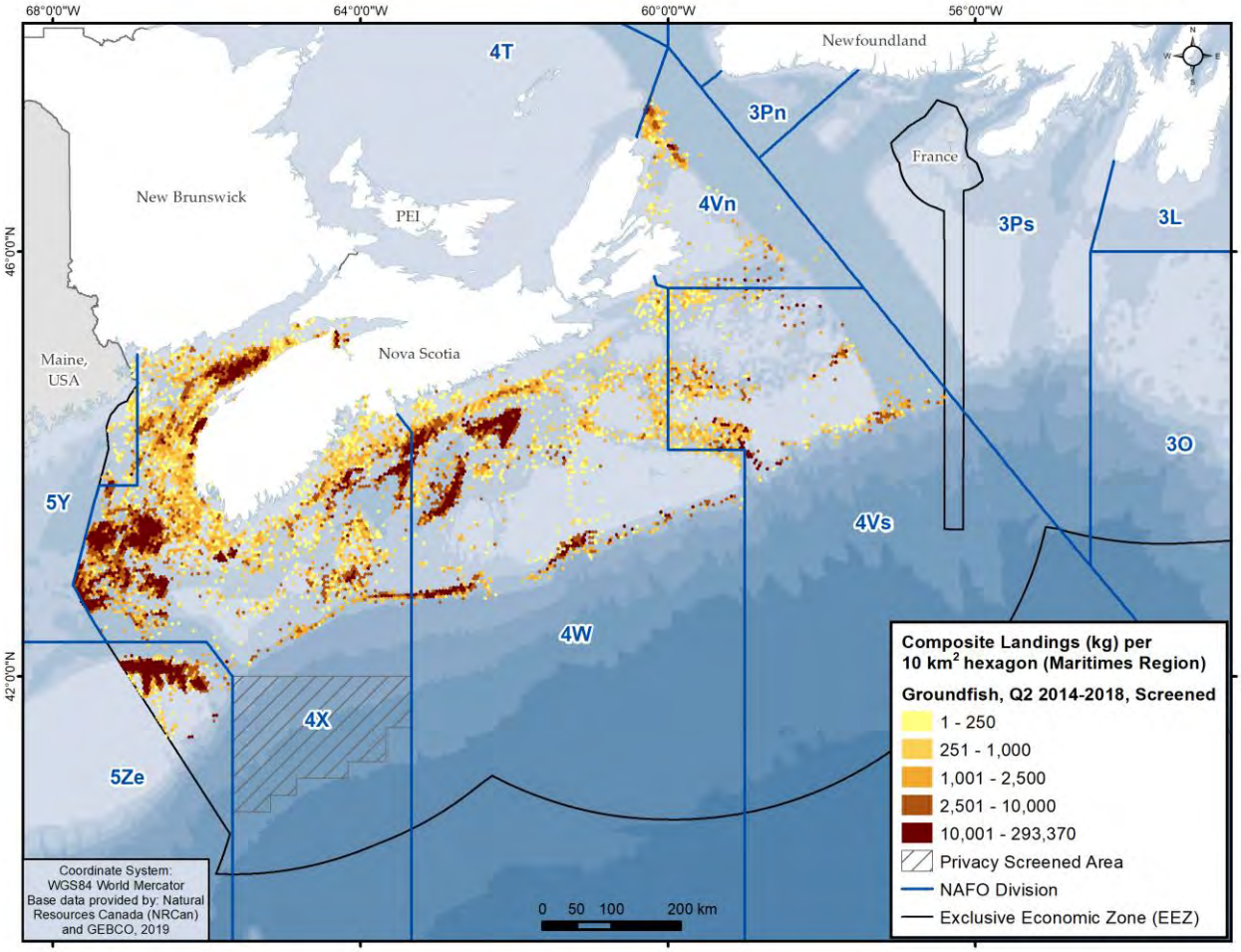


Figure 7.—Seasonal Groundfish Landings, July–September, 2014–2018

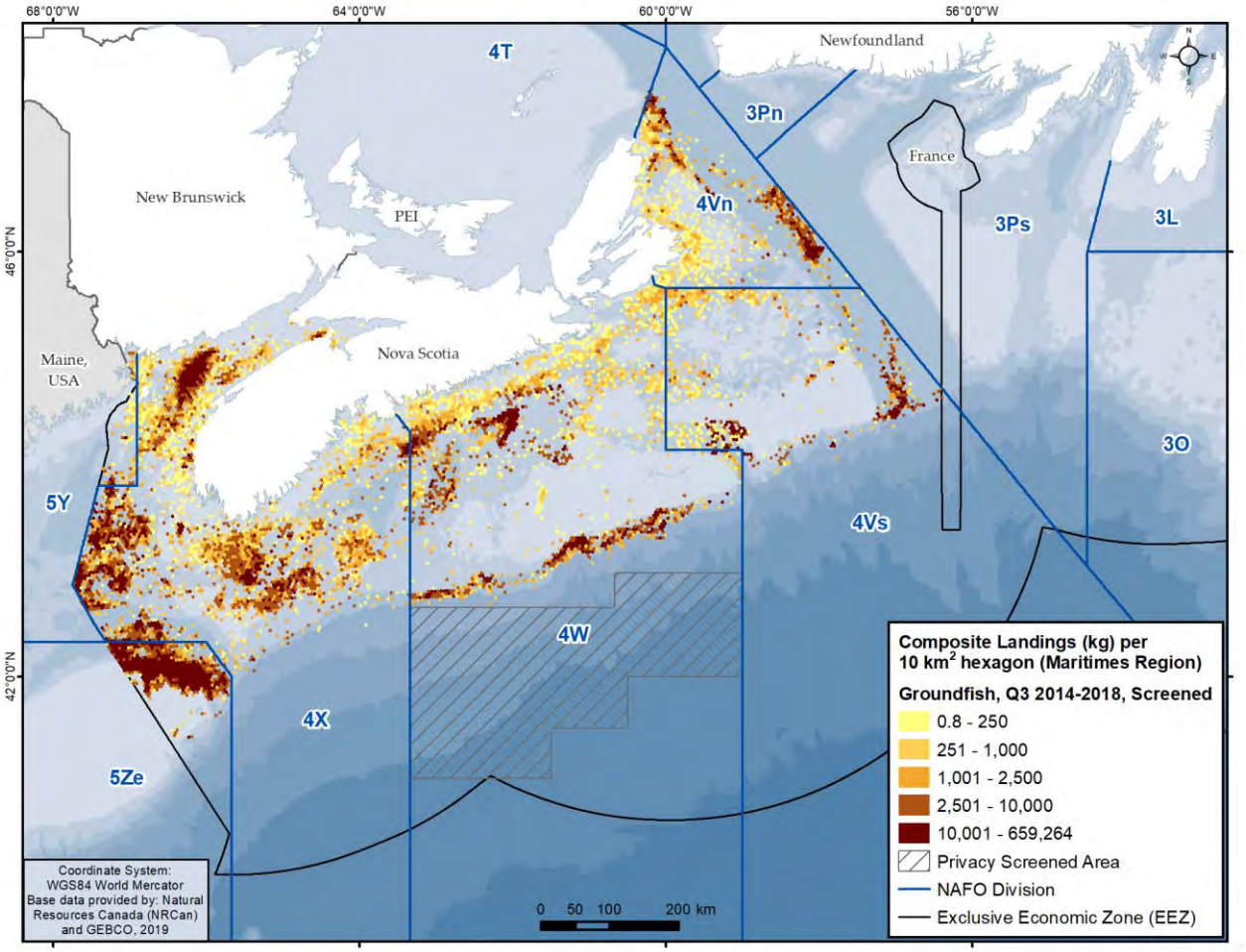
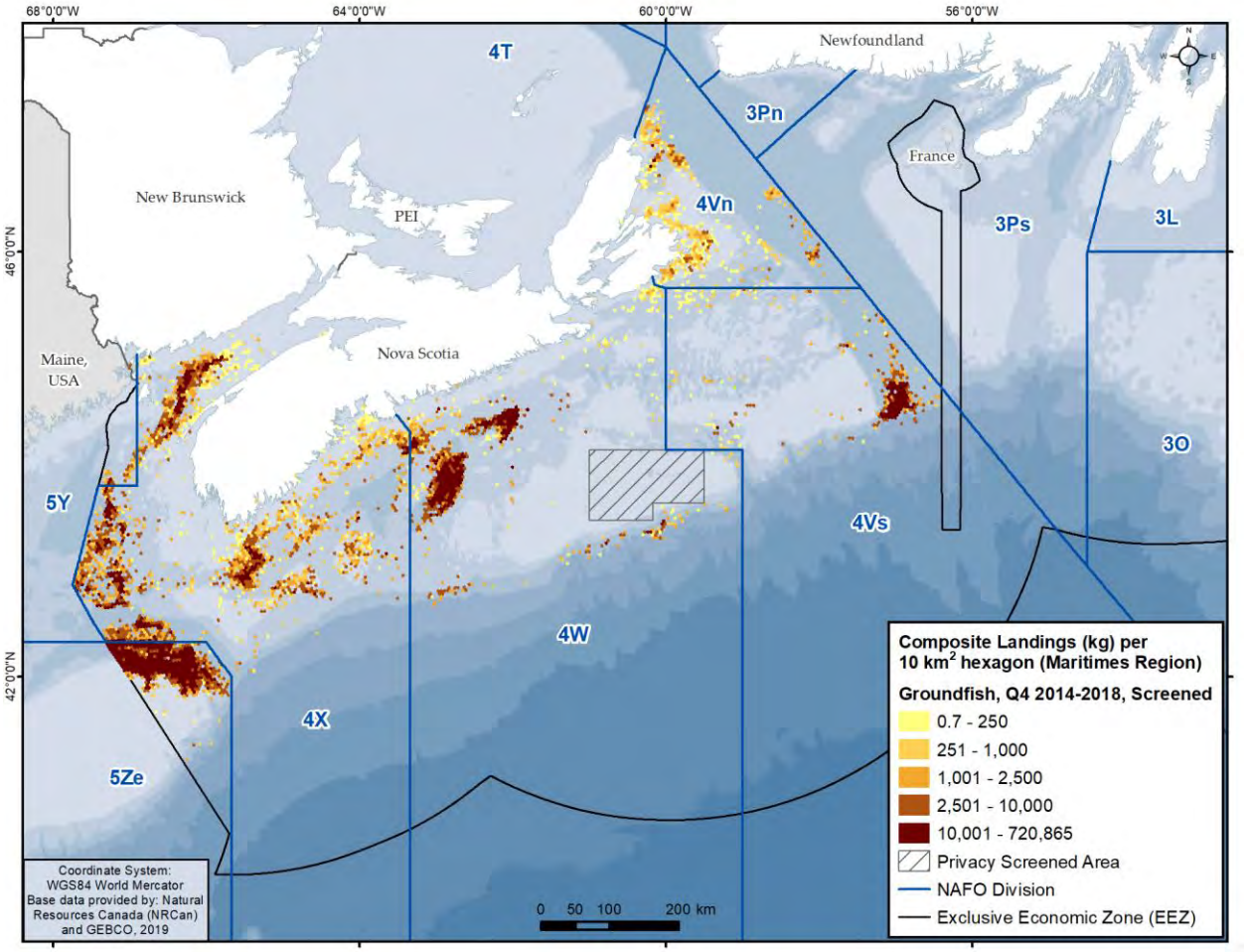


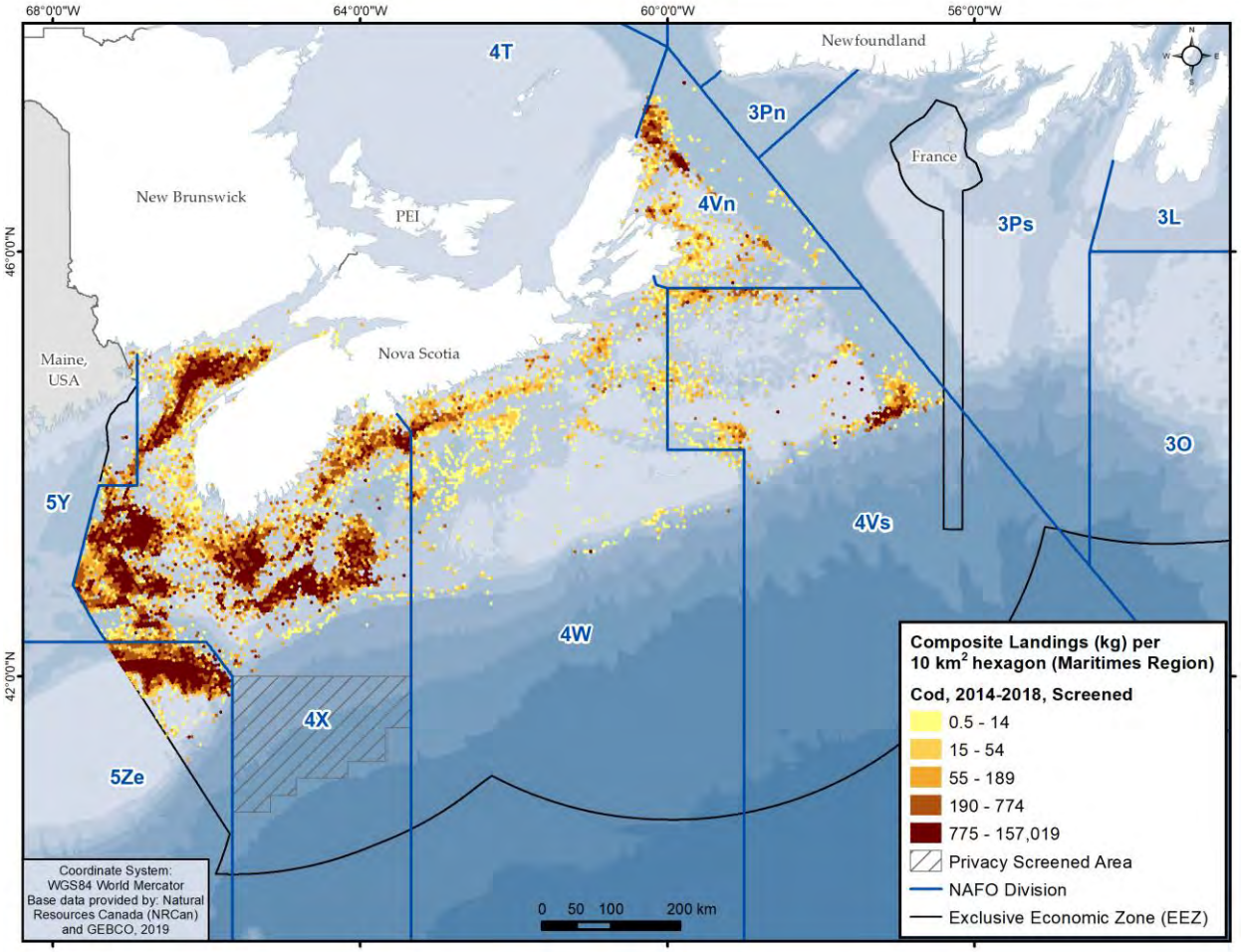
Figure 8.—Seasonal Groundfish Landings, October–December, 2014–2018



Atlantic Cod (Figure 9)
SARA Status: Under consideration for addition to SARA Schedule 1.
COSEWIC Status: Southern and NL Populations, Endangered.
MSC Status: Not in MSC program.

Figure 9 shows Atlantic Cod (*Gadus morhua*) catch as part of a larger multi-species groundfish fishery directing for Atlantic Cod, Haddock, and Pollock using fixed and mobile gear. Landings have declined in the last three decades in areas that have experienced changes in ecosystem trophic structure. With directed fisheries for Atlantic Cod and Haddock closed on the eastern Scotian Shelf (NAFO Divisions 4VW), landings of Atlantic Cod, Haddock and Pollock on the western Scotian Shelf (4X and 5Y) are much higher than on the eastern Scotian Shelf. While there are fishing net mesh size and hook size restrictions in place, there are no minimum size limits for Atlantic Cod in the groundfish fishery.

Figure 9.—Atlantic Cod Landings, 2014–2018

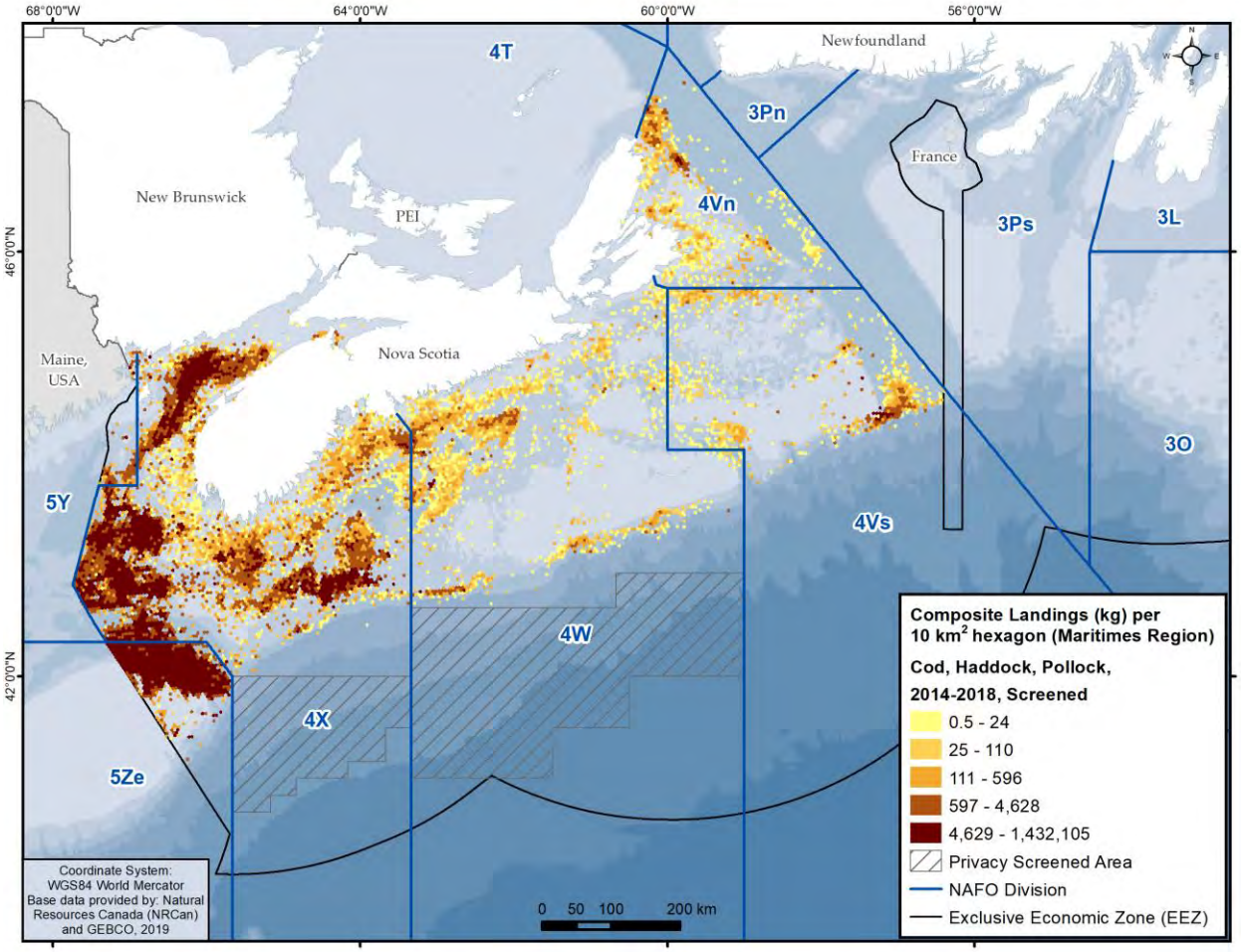


Atlantic Cod, Haddock, and Pollock (Figure 10)
SARA Status: No Status. Atlantic Cod under consideration for addition to SARA Schedule 1.
COSEWIC Status: Atlantic Cod Southern and NL populations, Endangered.
MSC Status: Scotia-Fundy Haddock certified as sustainable in October 2010.

Atlantic Cod, Haddock (*Melanogrammus aeglefinus*) and Pollock (*Pollachius pollachius*) have been the dominant groundfish species landed off Nova Scotia. Landings of these species have declined over the last three decades as other species became abundant. With directed fisheries for Atlantic Cod and Haddock closed on the eastern Scotian Shelf (NAFO Divisions 4VW), Atlantic Cod, Haddock, and Pollock landings on the western Scotian Shelf are much higher than on the eastern Scotian Shelf. The Pollock fishery on the eastern Scotian Shelf remains open; however, little effort for Pollock is made in that area due to closures for the other two species. In many parts of the region, fishers catch these three species together.

Atlantic Cod, Haddock, and Pollock fisheries occur mainly on the Scotian Shelf banks and in the Bay of Fundy (Figure 10). The fishery is conducted using otter trawls, bottom longlines, and gillnets. Parts of Browns and Georges Banks are closed seasonally to protect spawning Haddock. In NAFO 4W, the Western/Emerald Banks Conservation Area has been closed to groundfish fishing using mobile gear since 1987 and to all groundfish gear since 1993. The Western/Emerald Banks Conservation Area closure protects a nursery area for spawning and juvenile Haddock and other groundfish and invertebrate species.

Figure 10.—Atlantic Cod, Haddock and Pollock Landings, 2014–2018

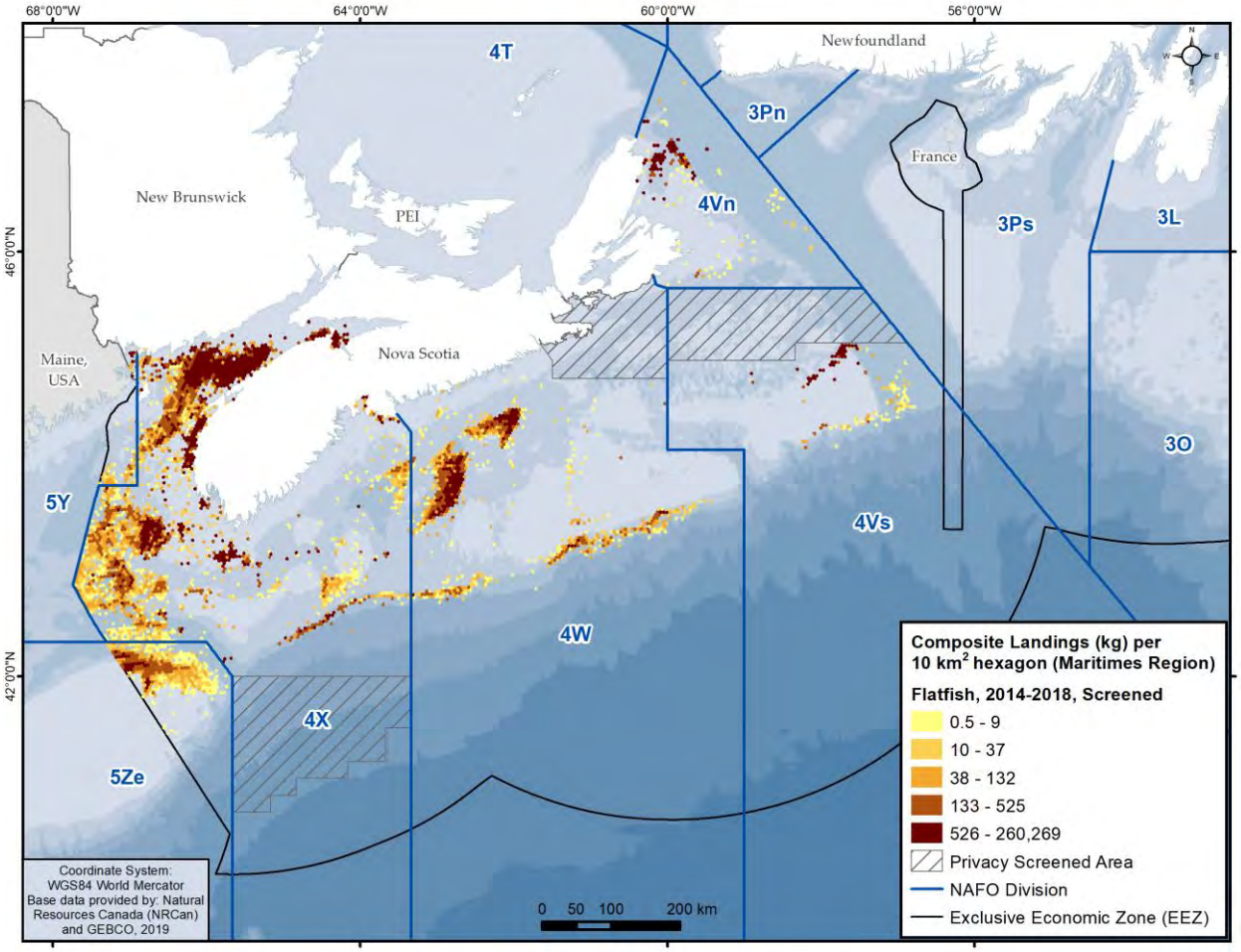


Flatfish (Figure 11)
SARA Status: American Plaice, No Status. Under consideration for addition to Schedule 1.
COSEWIC Status: American Plaice, Maritime and NL Populations, Threatened.
MSC Status: Not in MSC program.

Several flatfish species are managed under the 4X5Y total allowable catch (TAC), including Yellowtail Flounder (*Limanda ferruginea*), American Plaice (*Hippoglossoides platessoides*), Winter Flounder (*Pseudopleuronectes americanus*) and Witch Flounder (grey sole) (*Glyptocephalus cynoglossus*). In 4VW, the species are American Plaice, Yellowtail Flounder, and Witch Flounder. On Georges Bank (5Z), Yellowtail Flounder is the primary species caught and this stock is managed separately.

The 4X5Y flatfish TAC was changed to a 4X Winter Flounder TAC in 2015. Figure 11 shows landings from the four species mentioned above, as well as from unspecified flounder. In general, the shelf banks are important for the Yellowtail Flounder and American Plaice fisheries, while deeper areas are more important for Witch Flounder. Winter Flounder is uncommon on the eastern Scotian Shelf, and on the western Scotian Shelf it is concentrated in only a few areas. Historically, the eastern Scotian Shelf (4VW) was more important than the western Scotian Shelf (4X), not including Georges Bank, for Yellowtail Flounder and American Plaice fisheries. However, a general reduction in the groundfish fishery on the eastern Scotian Shelf and a declining abundance of flatfish resulted in low catches in the east (O'Boyle, 2012).

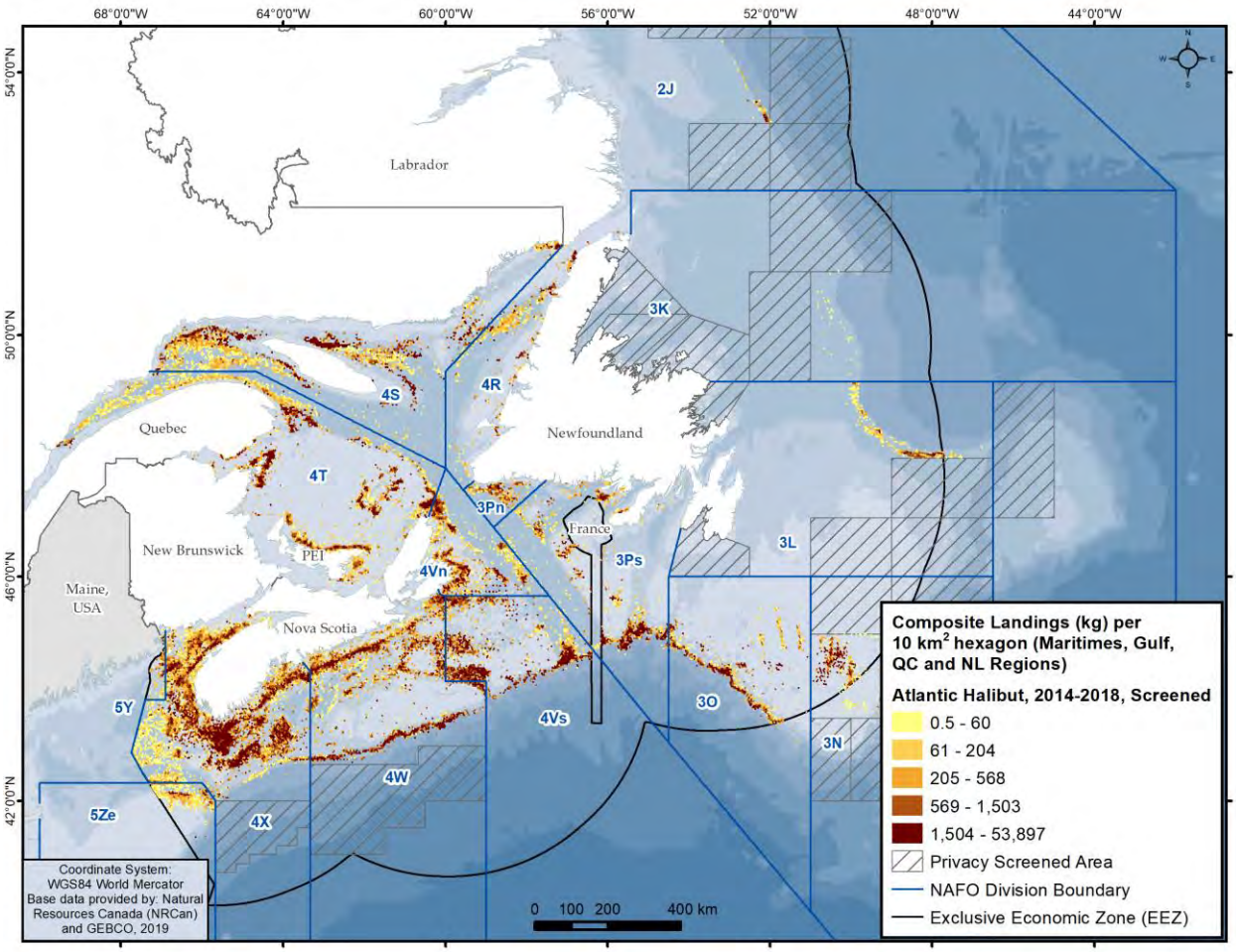
Figure 11.—Flatfish Landings, 2014–2018



Atlantic Halibut (Figure 12)
SARA Status: No Status
COSEWIC Status: Not at Risk
MSC Status: Certified as sustainable in May 2013.

Atlantic Halibut (*Hippoglossus hippoglossus*) is the most valuable groundfish species in Atlantic Canada. The Atlantic Halibut fishery was unregulated until 1988, at which time a TAC was implemented for the Scotian Shelf and southern Grand Banks management unit (3NOPs-4VWX5Zc). In 1994, a minimum legal size limit of 81 cm was adopted. On the Scotian Shelf and the southern Grand Banks most landed Halibut is from a directed bottom longline fishery. Halibut is also landed by other bottom longline, trawl, gillnet and handline fisheries. Figure 12 shows inter-regional Halibut catches primarily caught in deep channels and along the shelf edge, but in southwest Nova Scotia (4X) Halibut catch is broadly distributed. There are restrictions on fishing Halibut in the Western/Emerald Banks Conservation Area and in the Gully Marine Protected Area. As well, Halibut fishing is not permitted in the Lophelia Coral Conservation Area and the Northeast Channel Coral Conservation Area. Trip limits and bycatch restrictions are not imposed in the directed Halibut fishery. The Halibut TAC in 2018 was 4,170 tonnes.

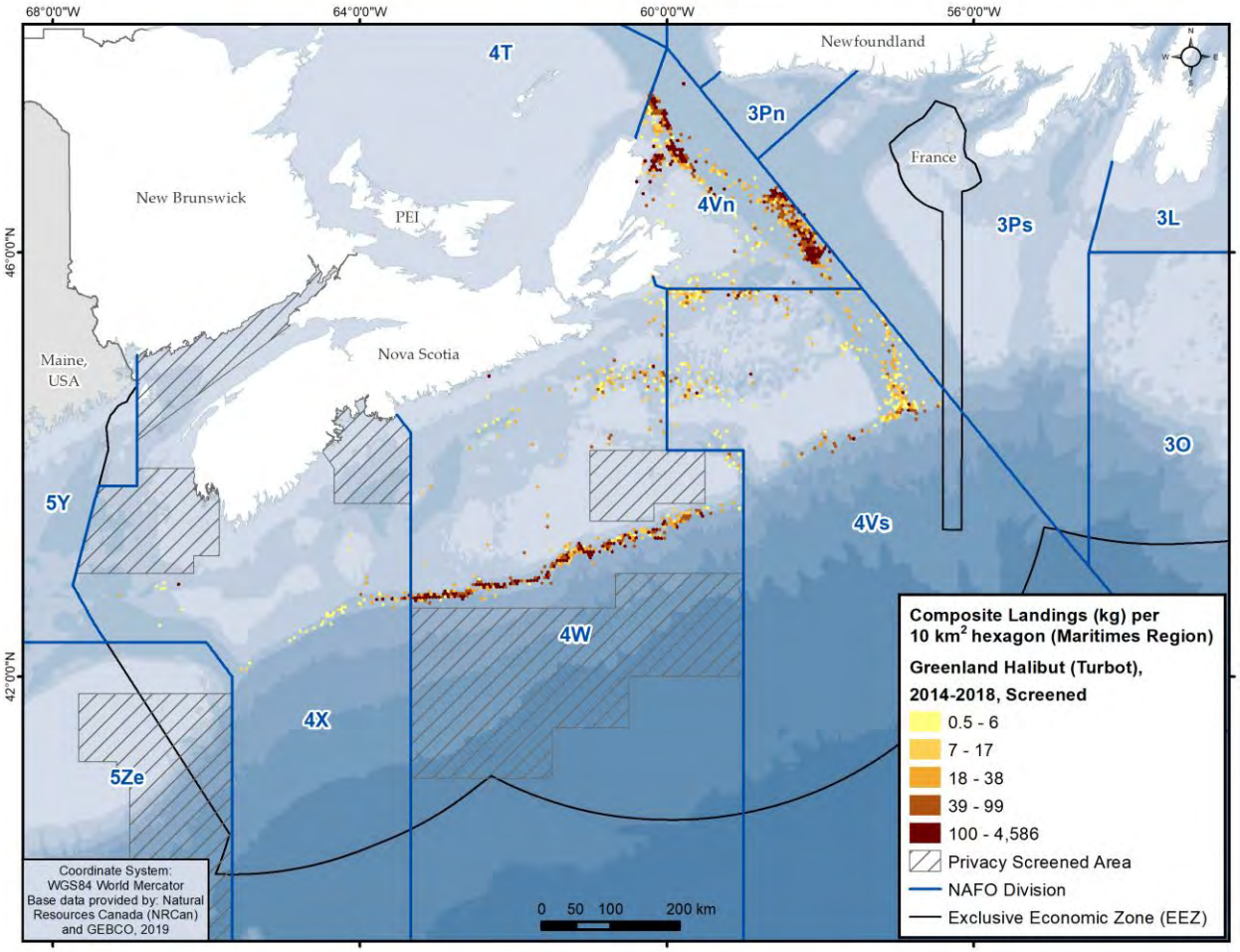
Figure 12.—Atlantic Halibut Landings, 2014–2018



Greenland Halibut (Figure 13)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Greenland Halibut (*Reinhardtius hippoglossoides*) (also called turbot) are highly migratory in the Northwest Atlantic and are generally found north of the Scotian Shelf in the Gulf of St. Lawrence, although they occur as far south as the Gulf of Maine. The occurrence of Greenland Halibut on the eastern Scotian Shelf may be an extension of the stock inhabiting the Gulf of St. Lawrence. Figure 13 shows Greenland Halibut are caught in deeper waters especially near the Stone Fence and along the Laurentian Channel and Scotian Shelf slope. There is no directed fishery for Greenland Halibut in 4VWX and 5YZ as they are only caught as bycatch.

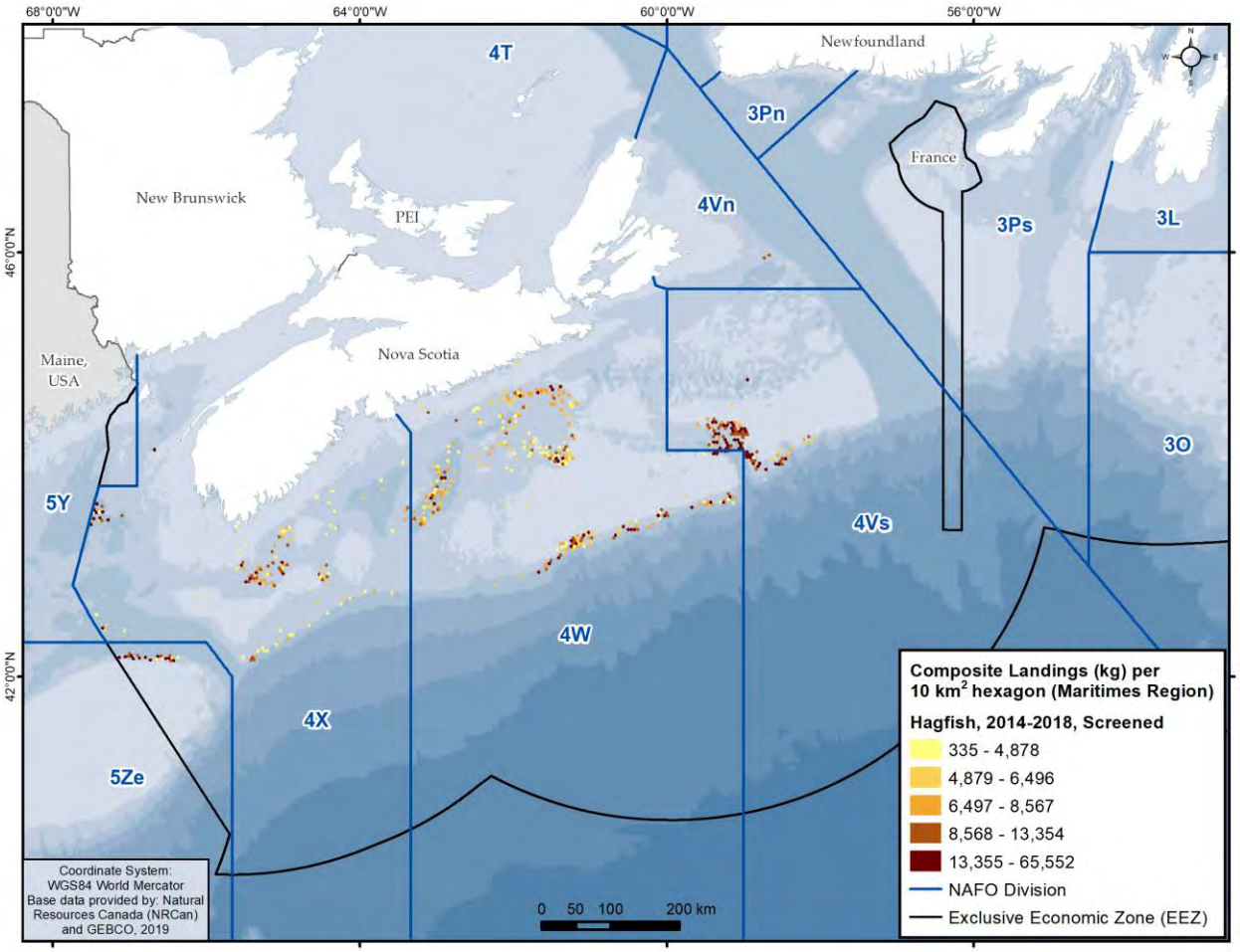
Figure 13.—Greenland Halibut (Turbot) Landings, 2014–2018



Hagfish (Figure 14)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Atlantic Hagfish (*Myxine glutinosa*) is widely distributed throughout the Northwest Atlantic. There has been a directed fishery for Hagfish off Nova Scotia since the late 1980s. The Hagfish trap fishery consists of modified plastic barrels deployed in strings of 30–35 barrels, with a maximum of 450 traps per licence. The fishing season runs from April 15 to October 15. The fishery is closed in coral and sponge conservation areas, the Gully Marine Protected Area, the Western/Emerald Banks Conservation Area, and is subject to two seasonal groundfish closures on Georges and Browns Banks from March 1 to May 31. Figure 14 shows the landings distribution along the Scotian Shelf edge, in Roseway Basin, and north of Georges Bank. There are few participants (n = 6) in the Scotian Shelf fishery, resulting in the majority of unit areas not meeting the criteria for privacy screening. Therefore, participants were contacted and each provided permission to display catch data.

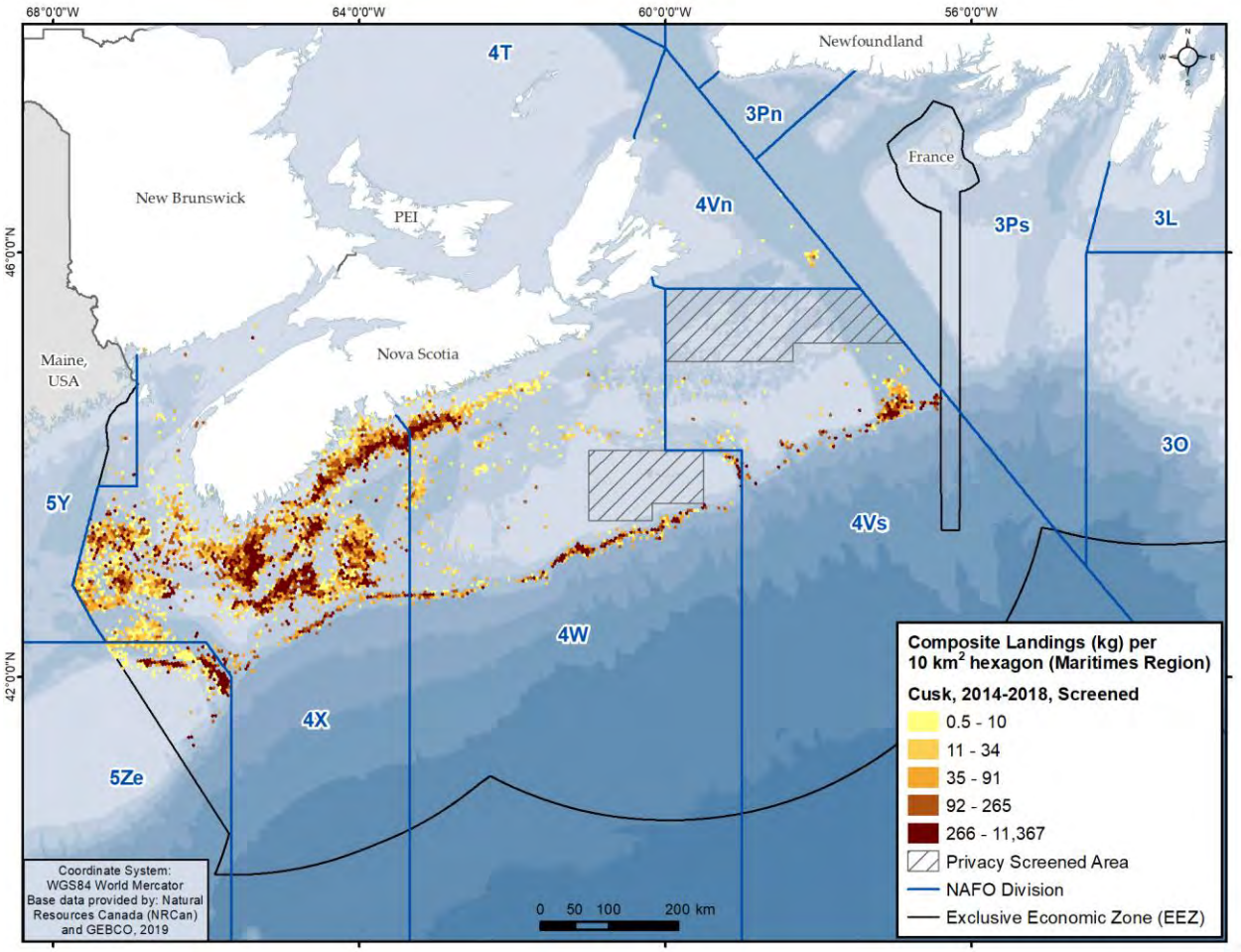
Figure 14.—Hagfish Landings, 2014–2018



Cusk (Figure 15)
SARA Status: No Status. Under consideration for addition to Schedule 1.
COSEWIC Status: Endangered.
MSC Status: Not in MSC program.

Cusk (*Brosme brosme*) is a non-target bycatch species incidentally harvested in the multi-species groundfish fishery (Figure 15). Cusk are most commonly caught in the Gulf of Maine, western Scotian Shelf, and along the Scotian Shelf edge to Banquereau on bottom longline and in mobile trawl gear. Cusk range from Cape Cod to Labrador, but are rare in the Gulf of St. Lawrence and inner Bay of Fundy. Cusk are also caught in Lobster and crab trap fisheries. Post-capture survival of Cusk is zero percent as they evert their stomach upon surfacing. Bycatch limits are in place so that catch of non-quota species are not to exceed 10 percent of all directed groundfish combined and a cap on the total annual catch of Cusk is also in place. Community and fleet-level caps exist for Cusk, and DFO prohibits Cusk retention once a group reaches their cap.

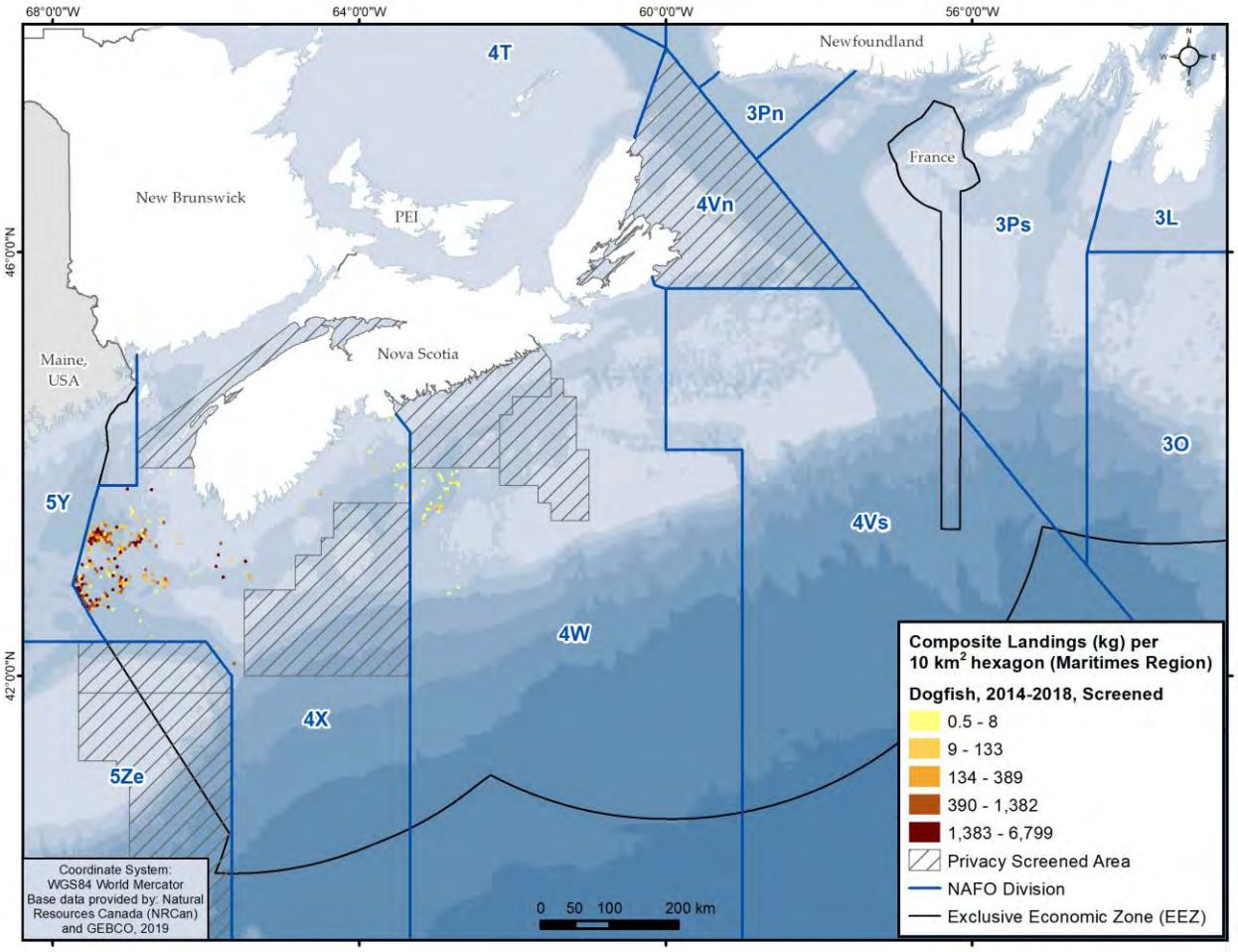
Figure 15.—Cusk Landings, 2014–2018



Dogfish (Figure 16)
SARA Status: No Status. Under consideration for addition to Schedule 1.
COSEWIC Status: Spiny Dogfish *(Squalus acanthias)*, Atlantic population, Special Concern.
MSC Status: Not in MSC program.

Spiny Dogfish *(Squalus acanthias)* and Black Dogfish (*Centroscyllium fabricii*) are landed as bycatch in the multi-species groundfish fishery (Figure 16). Directing for dogfish is only permitted through fixed gear groundfish fisheries. In other groundfish fleets, the bycatch limit is no more than 10 percent. In 2018, a TAC of 4,000 tonnes was in place for the fixed gear <45-feet fleet and another 4,000 tonnes were available to cover landings and discards in other fleets and regions.

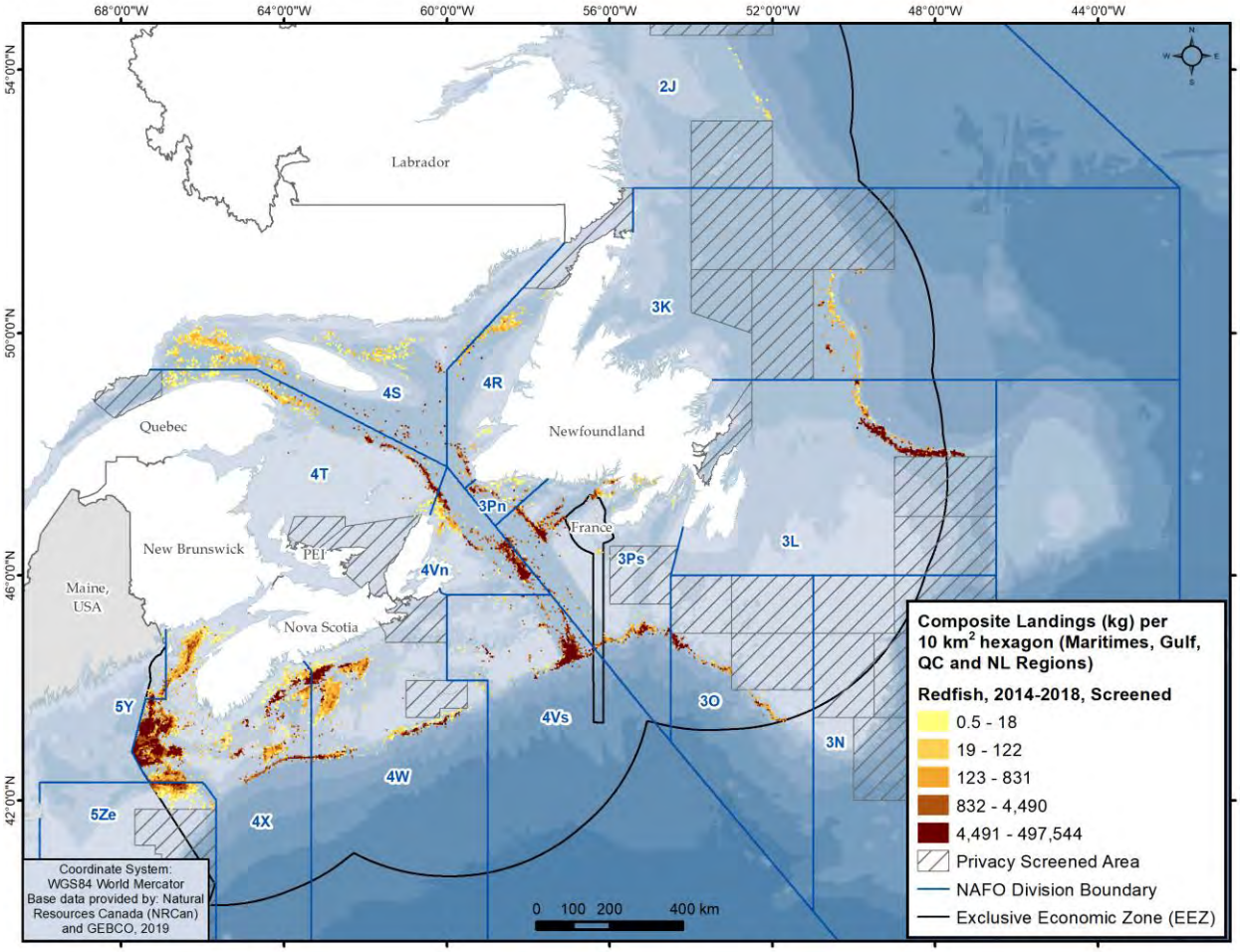
Figure 16.—Dogfish Landings, 2014–2018



Redfish (Figure 17)
SARA Status: No Status. Under consideration for addition to Schedule 1.
COSEWIC Status: Acadian Redfish (Atlantic population), Threatened. Deepwater Redfish (Gulf of St. Lawrence and Laurentian Channel population), Endangered.
MSC Status: Canada 3LN redfish certified sustainable in May 2017.

Three species of redfish are found in the Northwest Atlantic, namely *Sebastes mentella* and *S. fasciatus* that are dominant in commercial fisheries, and the less abundant *S. marinus*. Redfish (*S. fasciatus* and *S. mentella*) are targeted with otter trawls along the shelf edge, in the Northeast and Laurentian Channels, and in other deep areas of the Scotian Shelf and Bay of Fundy. Figure 17 shows inter-regional landings in the Northwest Atlantic. Since the 2010 stock assessment, redfish managed as Units 1 and 2 (Gulf of St. Lawrence and Laurentian Channel, respectively) are assessed as one stock for each species, i.e., one *S. mentella* stock for Units 1 and 2 combined, and one *S. fasciatus* stock for Units 1 and 2 combined. The Scotian Shelf Unit 3 redfish stock includes portions of 4WX and 5Y. The fishery uses small mesh gear and many management restrictions prevent bycatch of small fish. A special management area in Unit 3 is the Bowtie, which is closed to small mesh gear (110–115 mm diamond mesh) to protect small redfish. The Second Closure in 4Xmn was implemented in 2013 due to catches of undersized redfish. Small mesh gear is also not permitted in waters shallower than 50 fathoms (91 metres), in the Bay of Fundy north of 43°30', and in NAFO Area 5Y and 5Z. The Browns Bank Haddock spawning area has an extended redfish closure from January 1 to June 30.

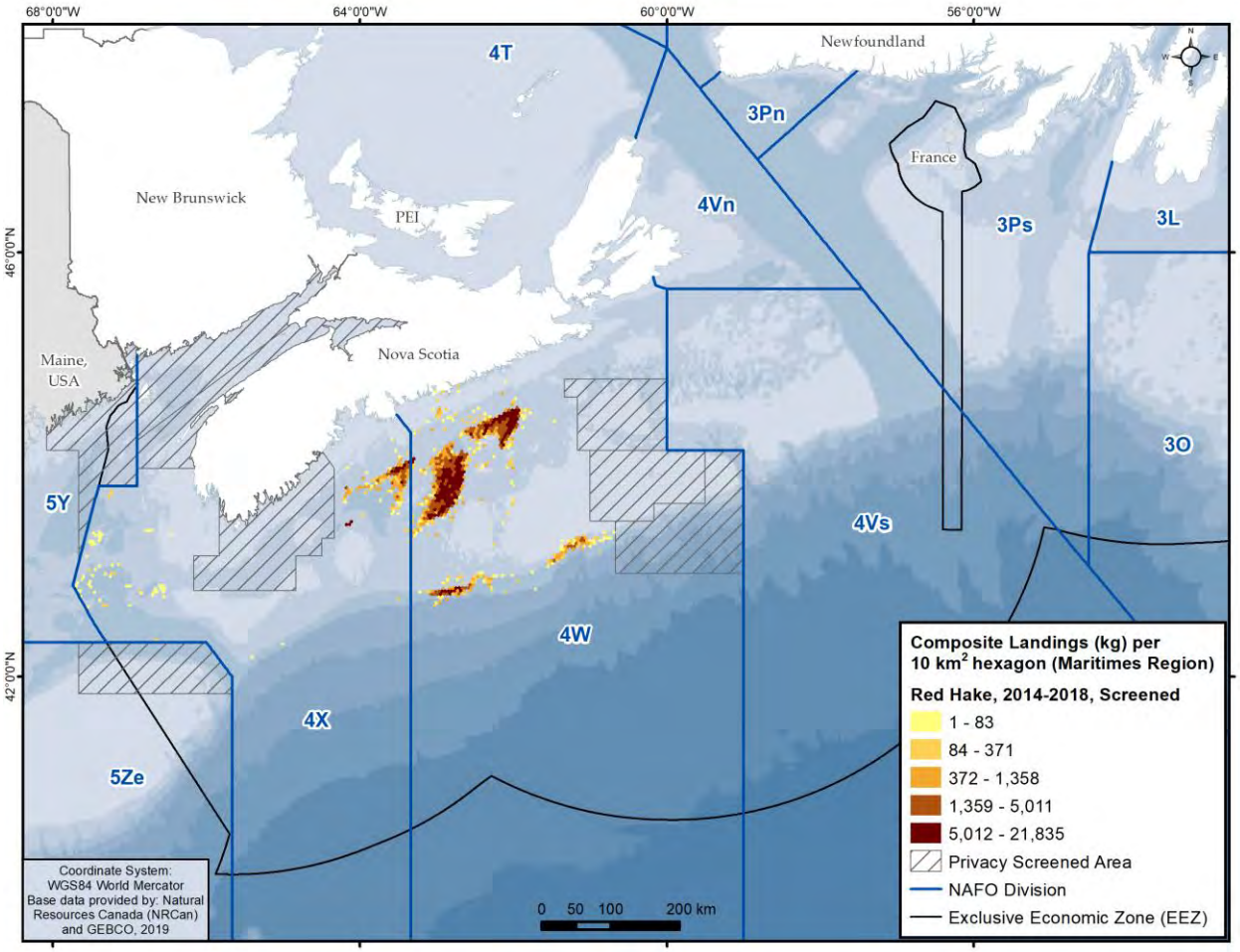
Figure 17.—Redfish Landings, 2014–2018



Red Hake (Figure 18)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Red Hake (*Urophycis chuss*) are distributed in the Northwest Atlantic from North Carolina to southern Nova Scotia, straying into the Gulf of St. Lawrence. Throughout the spring and summer, they migrate into more shallow waters to spawn. During winter, they tend to move to deeper waters offshore in the Gulf of Maine and along southern New England and Georges Bank. Red Hake are primarily landed as bycatch in the Silver Hake fishery that occurs on the central Scotian Shelf and in other bottom trawl fisheries (Figure 18).

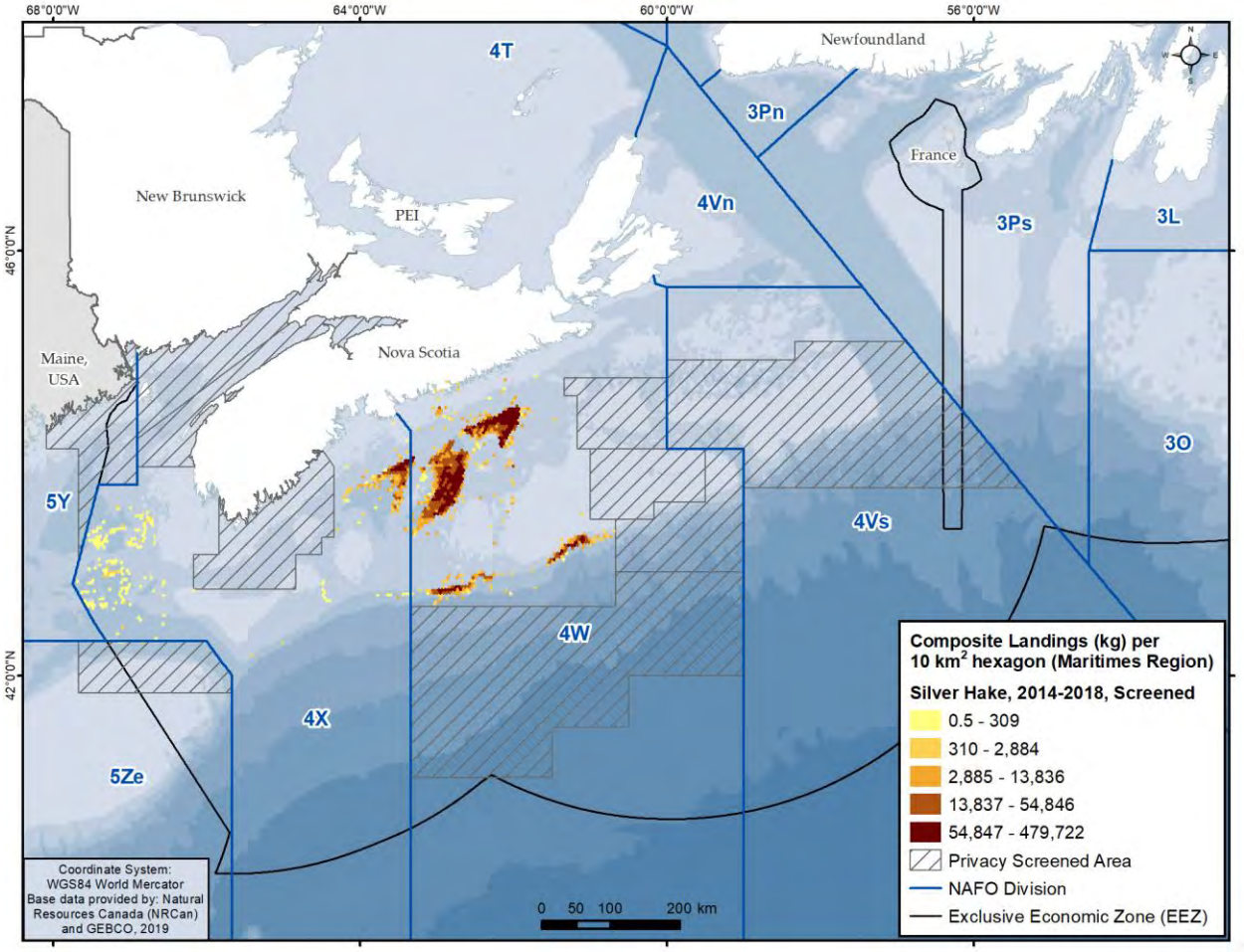
Figure 18.—Red Hake Landings, 2014–2018



Silver Hake (Figure 19)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Silver Hake (*Merluccius bilinearis*) is a demersal-pelagic gadid fish found in shallow waters to 400 m depth from Cape Hatteras to the southern Grand Banks and Gulf of St. Lawrence. The distribution of Silver Hake juveniles and adults is associated with warm bottom temperatures of 5–12° C and 7–10° C, respectively. A population of Silver Hake occurs on the Scotian Shelf in NAFO Divisions 4VWX and is considered to be a self-reproducing stock. This population aggregates in the deep-water depressions of the Scotian Shelf in Emerald and LaHave Basins, and in the warm slope water, except during the spawning period from July to September when large numbers occur on the shelf in shallow waters around Sable Island Bank. From 1995 to present, a commercial fishery has been conducted by mobile gear groundfish fleets in Emerald and LaHave Basins (Figure 19). The fishery is restricted to areas with depths greater than 190 m and uses small-mesh trawl gear that also captures other bycatch species. The fishery uses bottom trawls with 55–60 mm square mesh cods ends and trawls equipped with Nordmore grates to reduce bycatch.

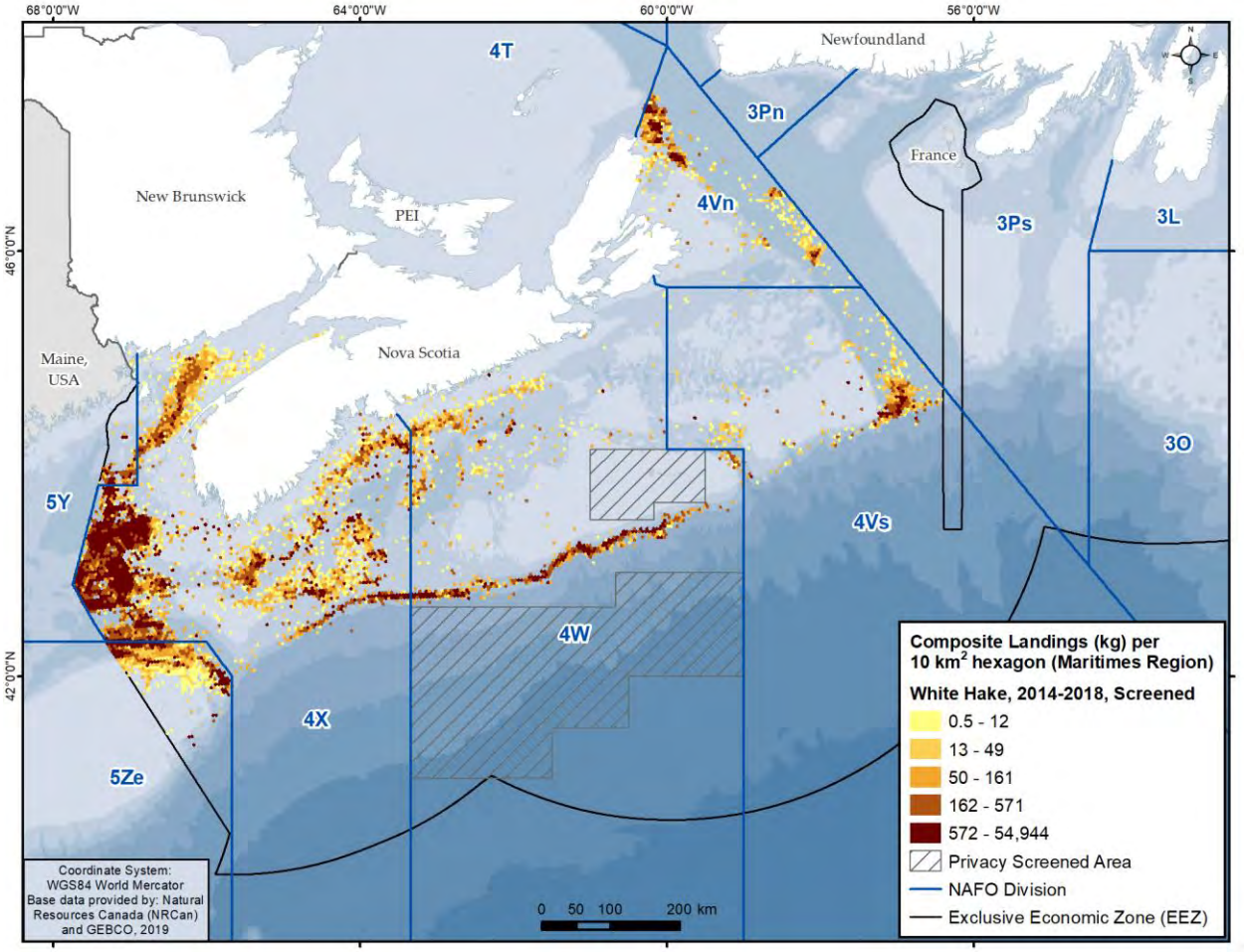
Figure 19.—Silver Hake Landings, 2014–2018



White Hake (Figure 20)
SARA Status: Atlantic and Northern Gulf of St. Lawrence population and Southern Gulf of St. Lawrence population, Under consideration for addition to Schedule 1.
COSEWIC Status: Atlantic and Northern Gulf of St. Lawrence population, Threatened. Southern Gulf of St. Lawrence population, Endangered.
MSC Status: Not in MSC program.

White Hake (*Urophycis tenuis*) is a bycatch species only in DFO Maritimes Region, with fleets operating within bycatch caps. White Hake landings are broadly distributed across the Scotian Shelf and into the Bay of Fundy, with a number of concentrated areas: the Gulf of Maine, Georges Bank, the edge of the Scotian Shelf, and parts of Laurentian Channel (Figure 20).

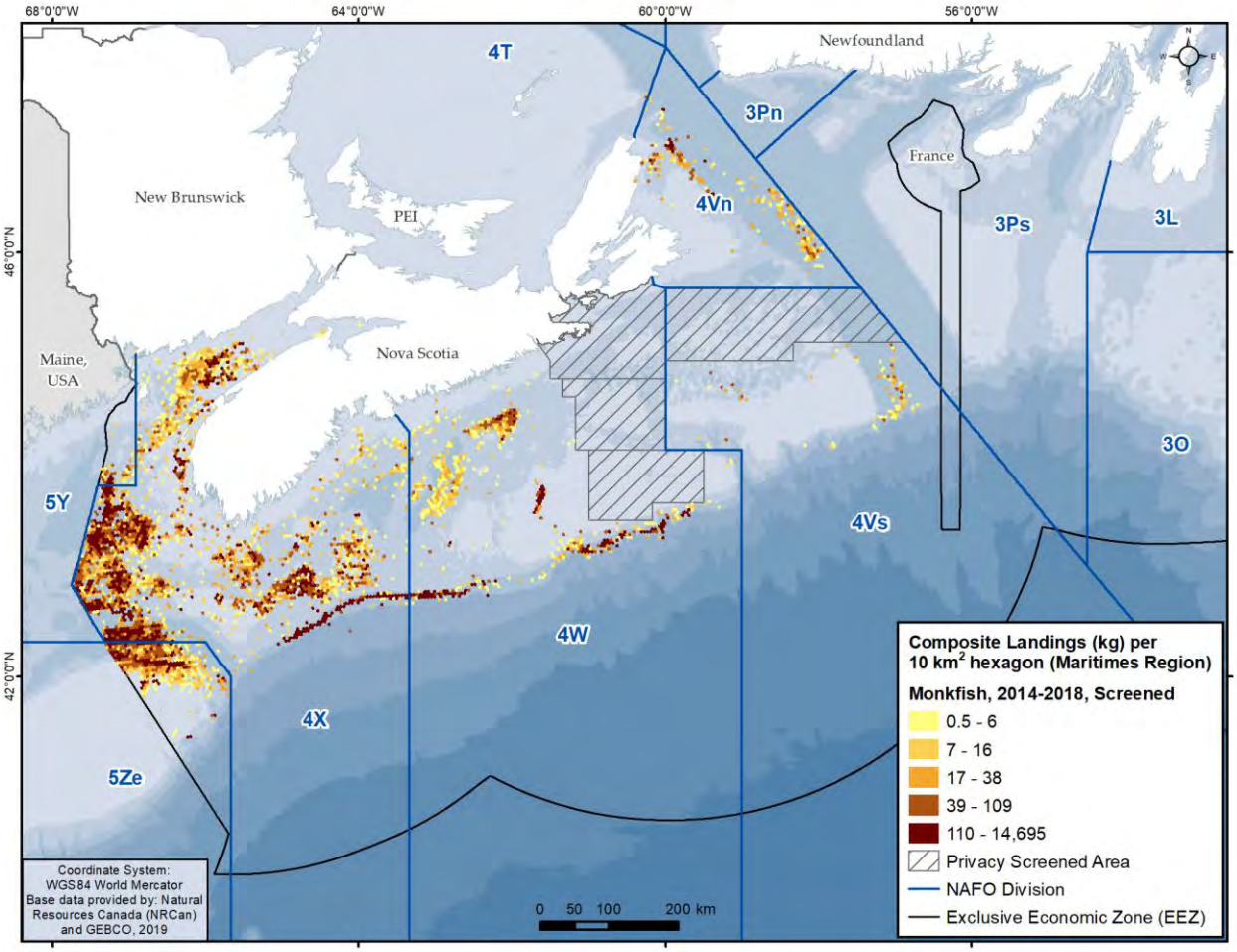
Figure 20.—White Hake Landings, 2014–2018



Monkfish (Figure 21)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Monkfish (*Lophius americanus*), also called goosefish or anglerfish, is a benthic fish distributed from the northern Gulf of St. Lawrence to Cape Hatteras. Monkfish are typically a bycatch in groundfish and scallop fisheries on the Scotian Shelf and Georges Bank. Figure 21 shows that Monkfish are mainly caught along the edge of the Laurentian Channel, in the Bay of Fundy and its approaches, and on the Scotian Shelf, particularly along the edges of banks.

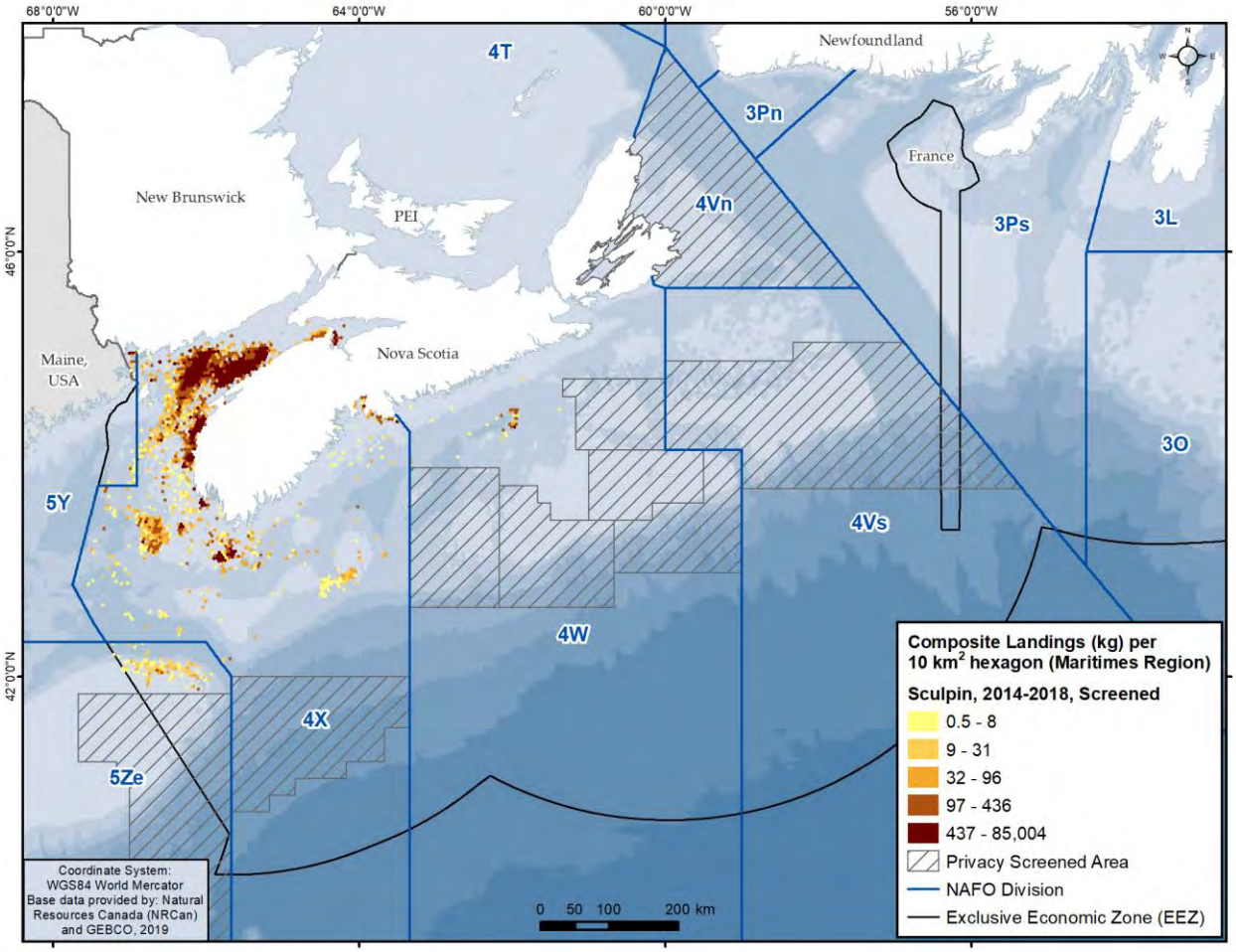
Figure 21.—Monkfish Landings, 2014–2018



Sculpin (Figure 22)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Sculpins are bottom dwelling, opportunistic feeders distributed throughout coastal shelf seas of the Northwest Atlantic. Common sculpin species in the Maritimes Region include Longhorn Sculpin (*Myoxocephalus octodecemspinosus*), Moustache Sculpin (*Triglops murrayi*), and Sea Raven/Sea Sculpin (*Hemitripterus americanus*). A directed fishery for Longhorn Sculpin began in 1999 in St. Mary's Bay in southwest Nova Scotia using otter trawl, bottom longline and handline. All other sculpin landings in Figure 22 are bottom longline and trawl bycatches. Sculpin bycatches in the inshore Lobster fishery are not displayed in the map due to lack of geographic coordinates.

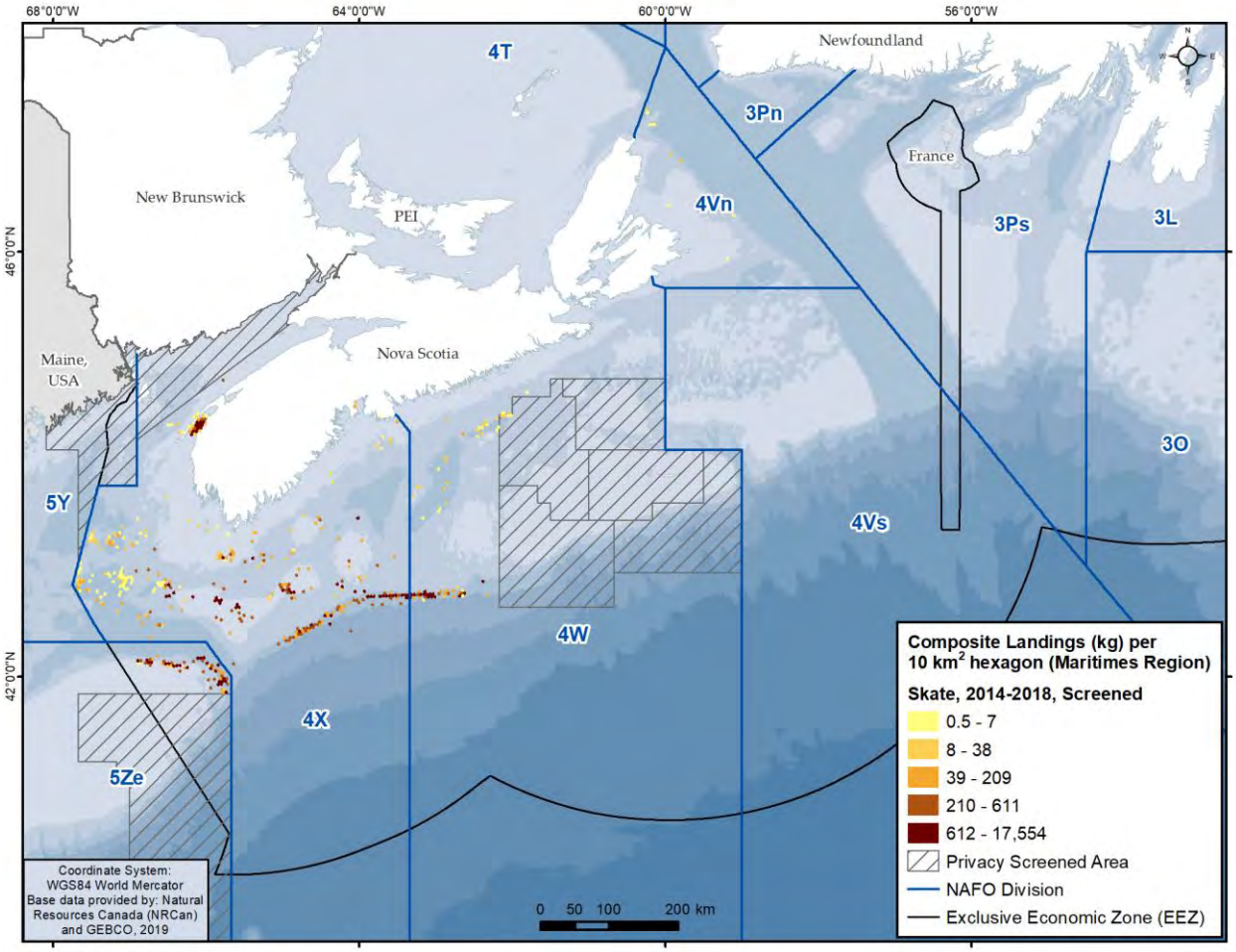
Figure 22.—Sculpin Landings, 2014–2018



Skate (Figure 23)
SARA Status: Smooth Skate, Laurentian-Scotian population, Under consideration for addition to Schedule 1. Thorny Skate, Atlantic Ocean, Under consideration for addition to Schedule 1. Winter Skate, Eastern Scotian Shelf - Newfoundland population and Gulf of St. Lawrence population, Under consideration for addition to Schedule 1.
COSEWIC Status: Winter Skate (*Leucoraja ocellata*), Georges Bank-Western Scotian Shelf-Bay of Fundy population, Not at Risk; Eastern Scotian Shelf-Newfoundland population, Endangered. Gulf of St. Lawrence population, Endangered. Smooth Skate (*Malacoraja senta*), Laurentian-Scotian population, Special Concern. Thorny Skate (*Amblyraja radiata*), Atlantic Ocean, Special Concern.
MSC Status: Not in MSC program.

There is no directed skate fishery in the Maritimes Region. All 4VW skates, except Barndoor Skates, must be returned to the water. Thorny Skate (*Amblyraja radiata*) must be returned to the water throughout the region. Other skates in 4X5 can be retained or discarded. There are no quotas or bycatch caps on skates, but a general bycatch provision applies for the inshore fleets (fixed gear <45', fixed gear 45–65', and mobile gear <65') in which no more than 10 percent of the catch at the fleet level should comprise skates. If catches exceed 10 percent, fleet closures or other measures to reduce skate capture are considered. This does not apply to the mid-shore and offshore fleets (fixed gear 65–100', mobile gear 65–100', and >100'). A voluntary move-away protocol exists for thorny skates. Figure 23 depicts the distribution of landed skates primarily on the Western Scotian Shelf in 4X and on Georges Bank in 5Ze.

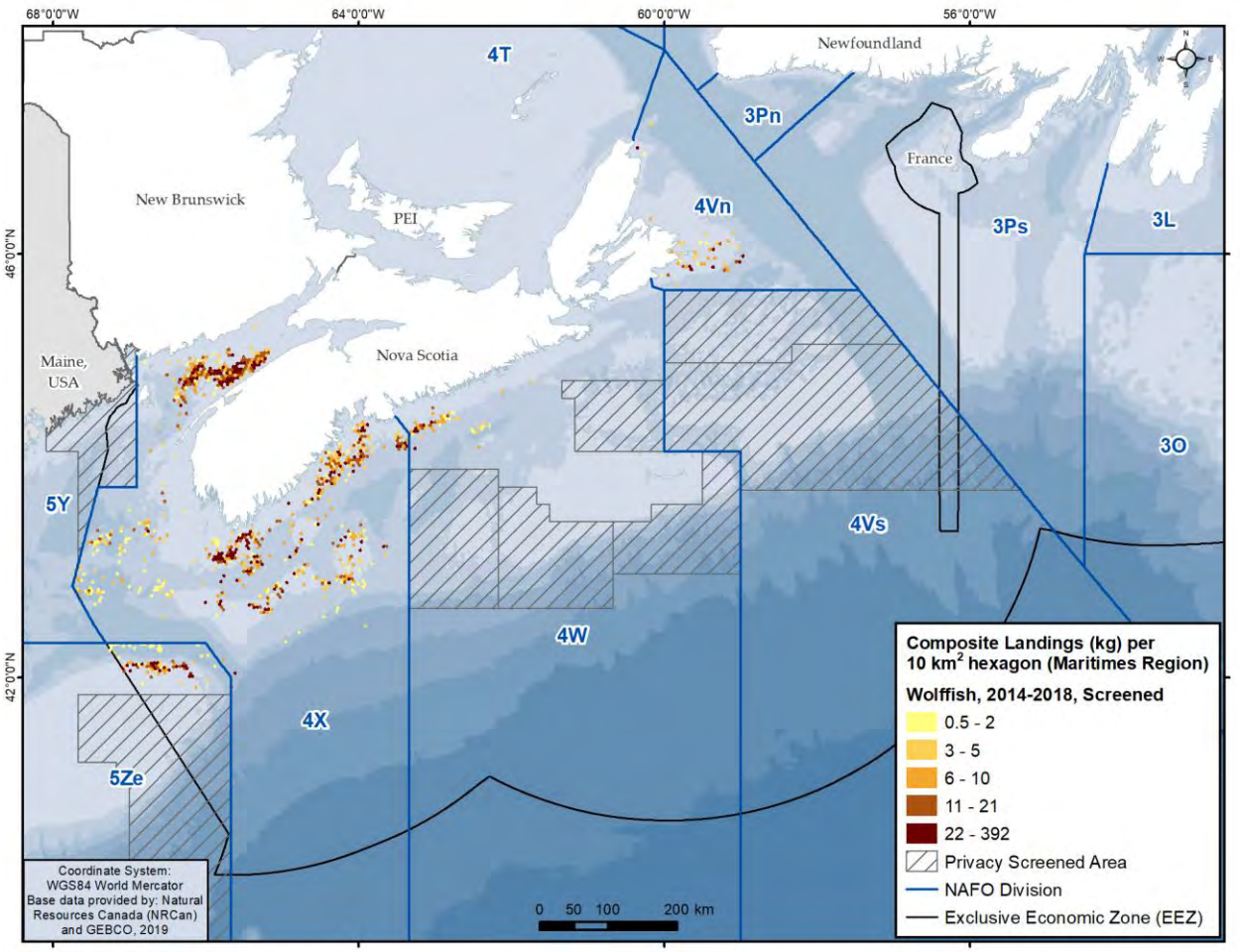
Figure 23.—Skate Landings, 2014–2018



Wolffish (Figure 24)
SARA Status: Atlantic Wolffish (*Anarhichas lupus*), Special Concern. Northern Wolffish (*Anarhichas denticulatus*), Threatened. Spotted Wolffish (*Anarhichas minor*), Threatened.
COSEWIC Status: Atlantic Wolffish (*Anarhichas lupus*), Special Concern. Northern Wolffish (*Anarhichas denticulatus*), Threatened. Spotted Wolffish (*Anarhichas minor*), Threatened.
MSC Status: Not in MSC program.

The Atlantic Wolffish is a large bottom-dwelling predatory marine fish widely distributed across the North Atlantic. It occurs off the west coast of Greenland and southern Labrador, in the Strait of Belle Isle, and the Gulf of St. Lawrence. It is also found off the east and west coasts of Newfoundland, on the Grand Banks, and from the Scotian Shelf to the Gulf of Maine. The Atlantic Wolffish is found in commercial catches, at one time as a target species but now only as bycatch. The Northern Wolffish is found across the North Atlantic from Norway to southern Newfoundland, primarily off northeast Newfoundland. The Spotted Wolffish is found across the North Atlantic from Scotland to Cape Breton and in the Arctic Ocean. In the Northwest Atlantic it occurs primarily off northeast Newfoundland. Wolffish are not targeted by the fishing industry, but are occasionally caught incidentally. Figure 24 shows catch weight landings for Atlantic Wolffish.

Figure 24.—Wolffish Landings, 2014–2018

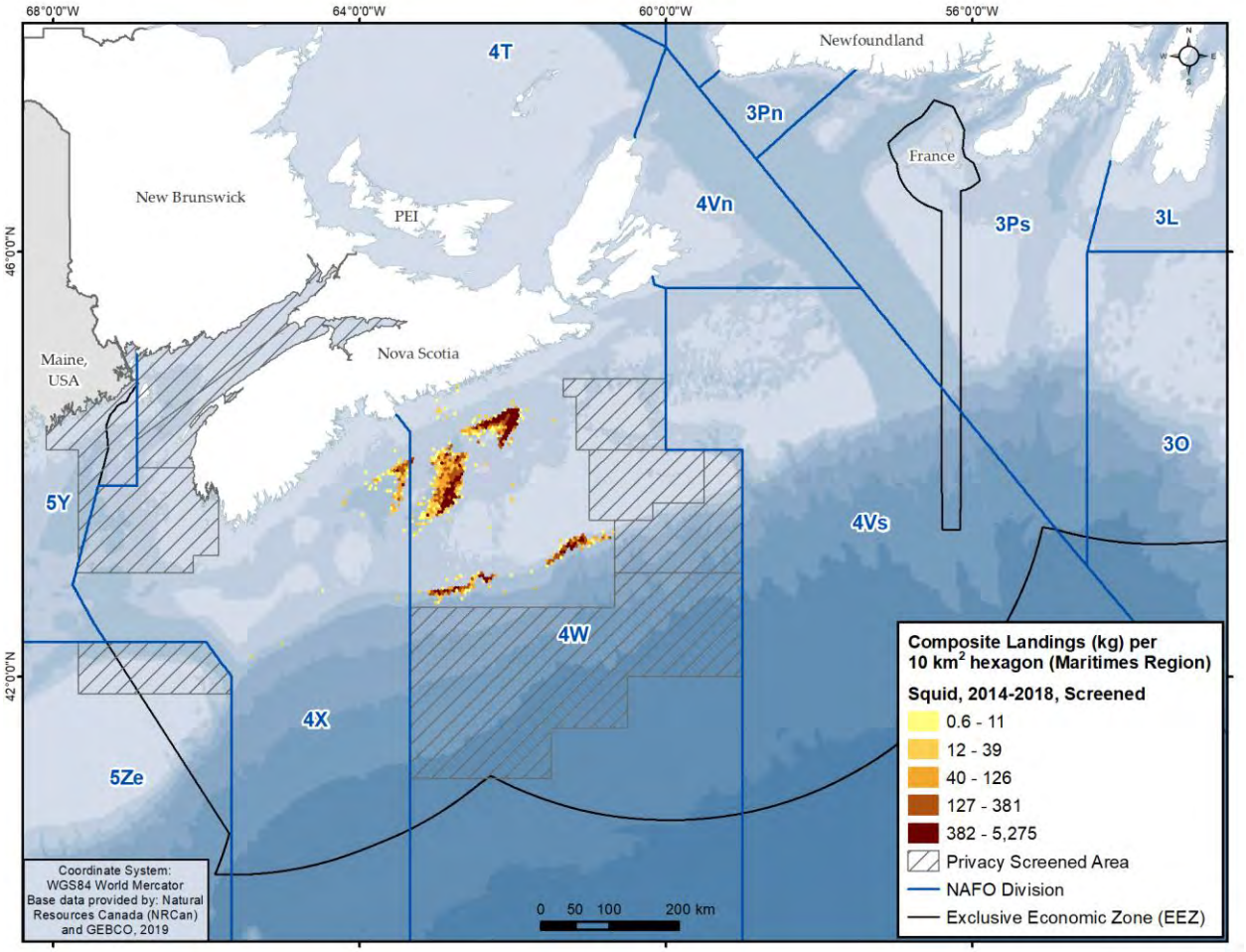


Squid (Figure 25)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

The Short-finned Squid (*Illex illecebrosus*) fishery is conducted from April 1 to December 31 using jiggers and handlines as per squid licence conditions; however, individual licences may also permit the use of otter trawl and purse seine. Gillnets and trap nets may land squid as bycatch. Section 74 of the *Atlantic Fishery Regulations* on squid states that no person shall fish for squid with an otter trawl with a mesh size less than 60 mm and that closure times may be set.[9] Squid fishing is permitted with jiggers and handlines in squid fishing areas 17–21. Fishing for squid with otter trawl may only be carried out in Division 4WX in specific fishing areas outlined in licence conditions (i.e., Silver Hake fishing areas). Prohibited areas include the Gully MPA and the Lophelia and Northeast Channel Coral Conservation Areas. Figure 25 shows the majority of squid landings on the Scotian Shelf includes bycatch in the Silver Hake trawl fishery in Emerald and LaHave Basins. Red Squid, *Loligo*, as well as unspecified squid are also included in the map.

[9] Atlantic Fishery Regulations, 1985 (SOR/86-21), <https://laws-lois.justice.gc.ca/PDF/SOR-86-21.pdf>.

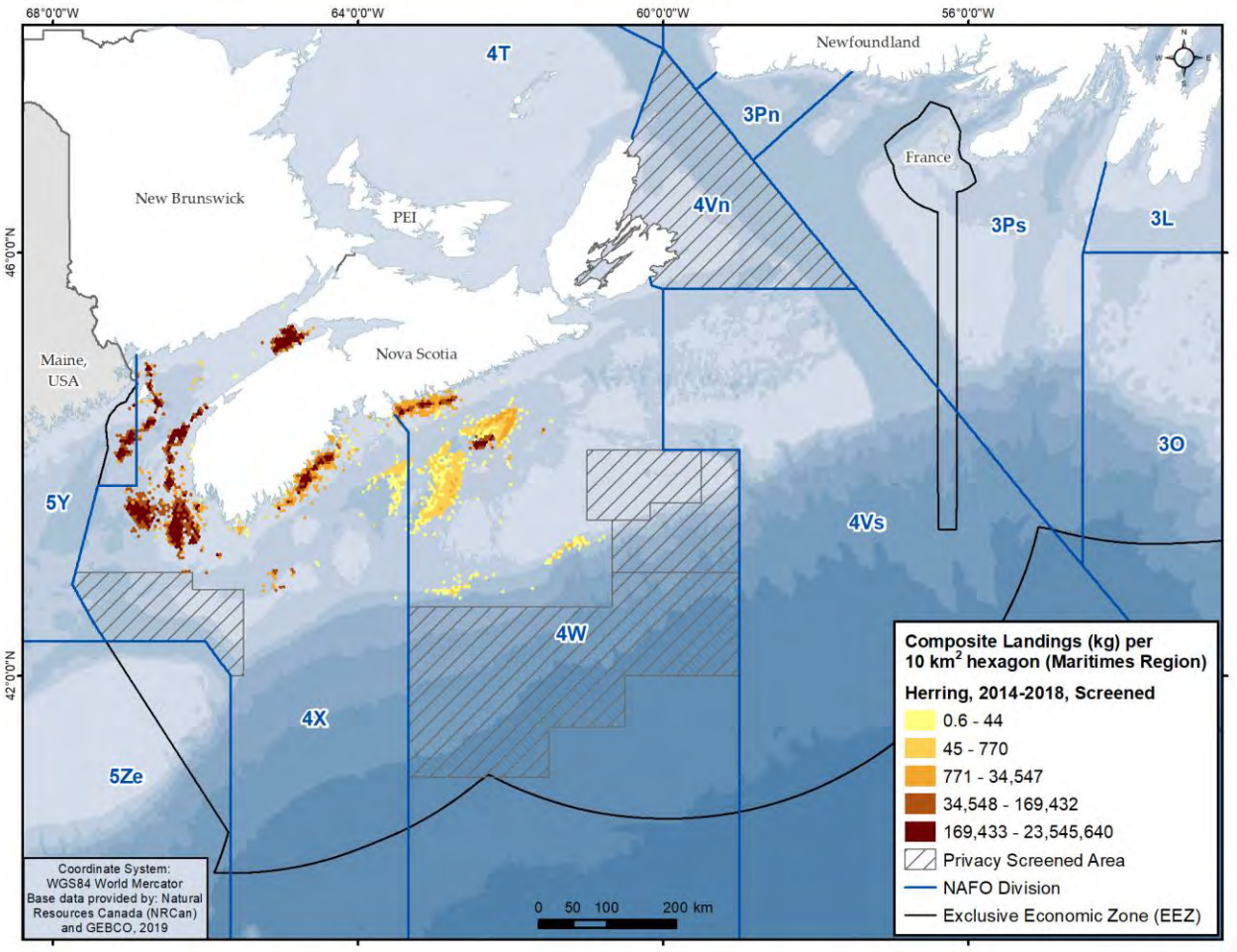
Figure 25.—Squid Landings, 2014–2018



Herring (Figure 26)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: The 4VWX purse seine Herring fishery was certified in November 2016 and voluntarily suspended in April 2019.

The 4VWX Atlantic Herring (*Clupea harengus*) fishery is comprised of five spawning components: 1) Southwest Nova Scotia/Bay of Fundy; 2) Offshore Scotian Shelf Banks; 3) Coastal Nova Scotia; 4) Georges Bank; and 5) Southwest New Brunswick migrant juveniles. Each component has several spawning areas and a mixing of fish among the spawning components. The 4VWX Herring fishery is open year-round, with the majority of the landings occurring in the summer purse seine fishery from May to October in the Bay of Fundy area. Figure 26 shows Herring landings off Scots Bay (Upper Bay of Fundy), German Bank, Trinity Ledge, Port Mouton, Eastern Shore, and Herring bycatch in the Silver Hake fishing areas in Emerald and LaHave Basins.[10]

Figure 26.—Herring Landings, 2014–2018

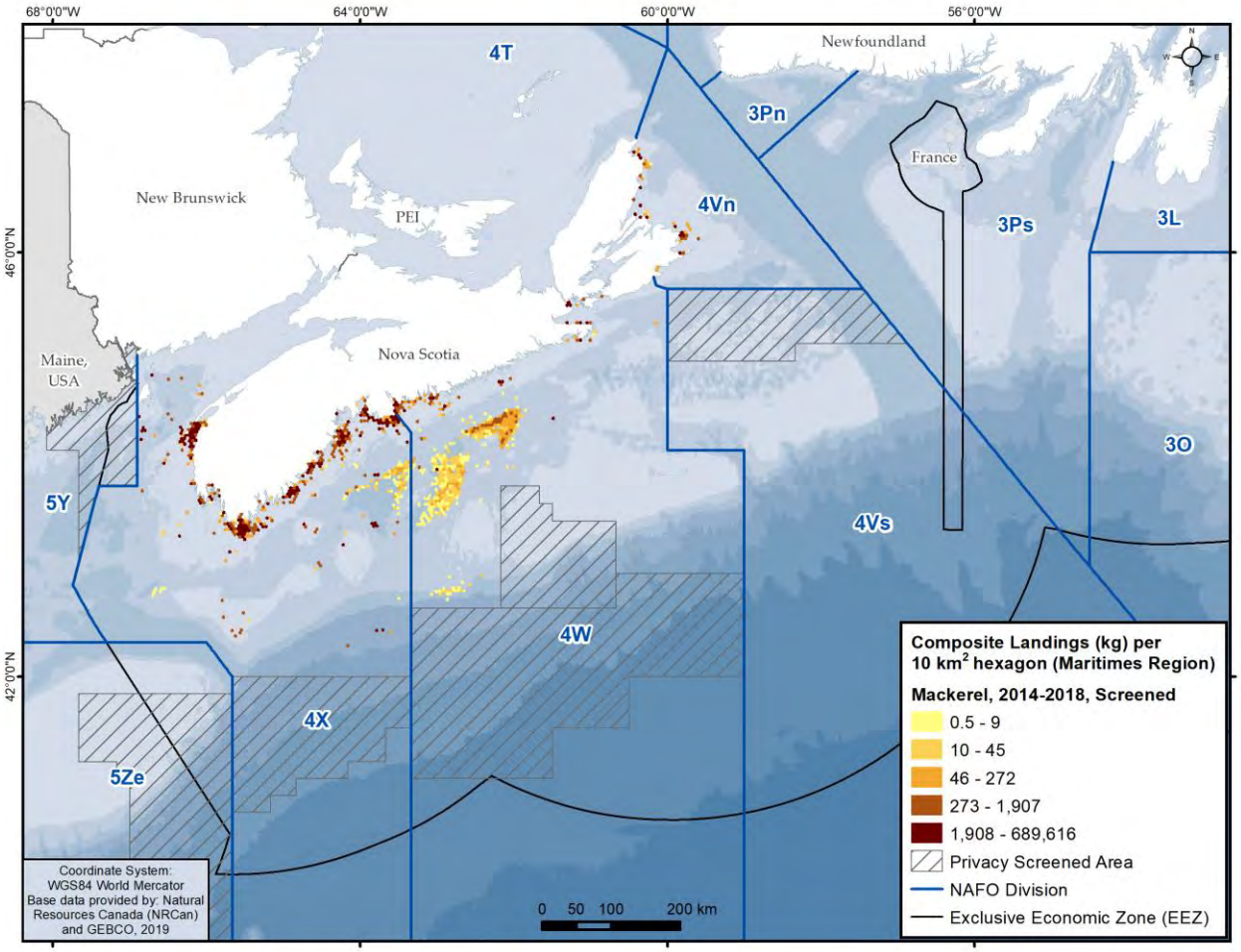


[10] Atlantic Herring Integrated Fisheries Management Plan, 2013, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/herring-hareng/herring-hareng-2013-eng.html>.

Mackerel (Figure 27)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Inshore gillnet and trap fisheries for Atlantic Mackerel (*Scomber scombrus*) take place primarily in June and July in Nova Scotia, with the main trap net fishery for Mackerel being in St. Margaret's Bay (Figure 27). In late summer and fall, a Mackerel handline fishery operates and a Herring purse seine fishery also lands Mackerel. Mackerel is also a bycatch of the Silver Hake fishery in Emerald and LaHave Basins. Patterns in Figure 27 may not represent the full extent of the coastal Mackerel bait fishery.[11]

Figure 27.—Mackerel Landings, 2014–2018

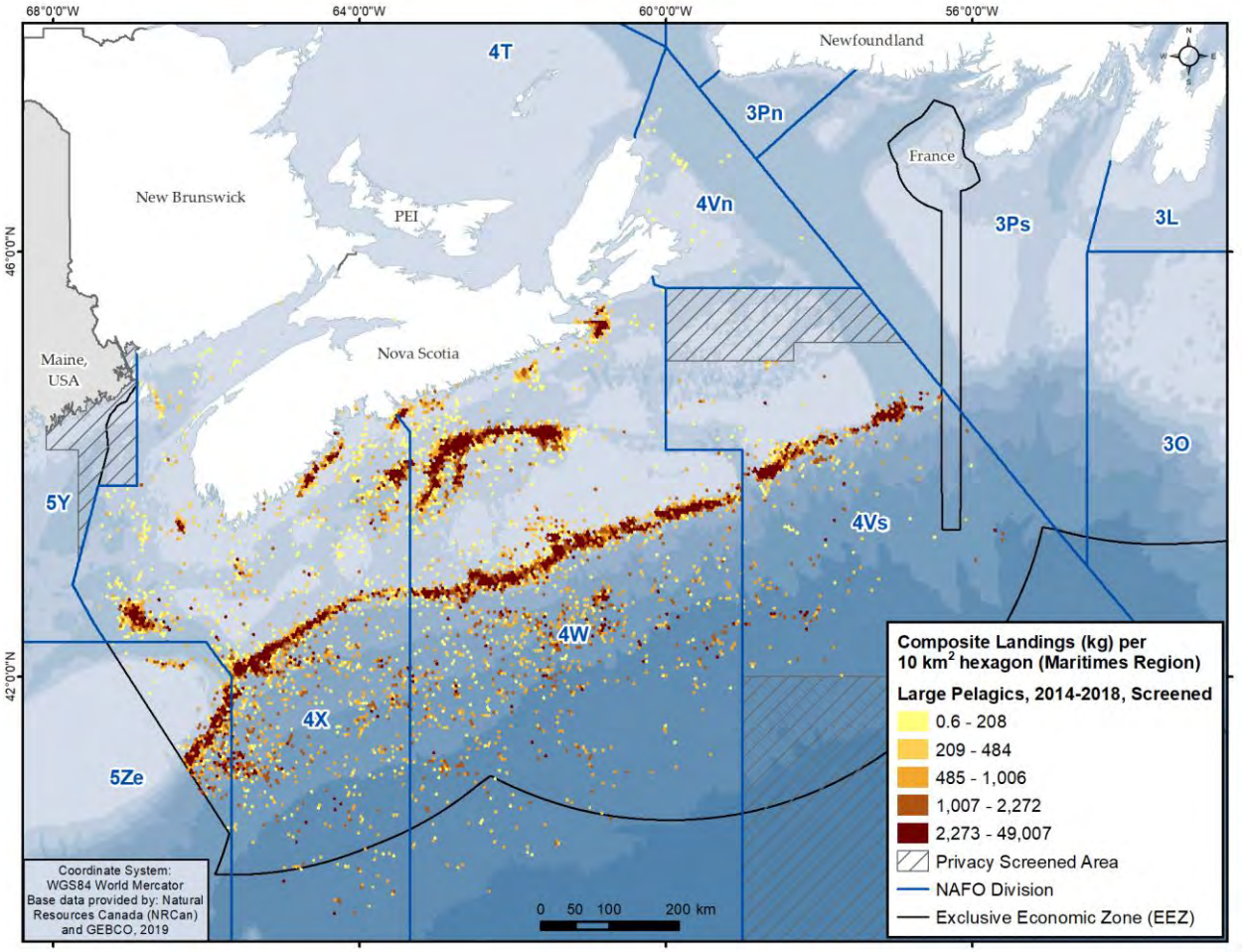


[11] Atlantic Mackerel Integrated Fisheries Management Plan, 2007, <https://waves-vagues.dfo-mpo.gc.ca/Library/348914.pdf>.

Large Pelagics (Figure 28)

The large pelagics species grouping shown in Figure 28 includes Swordfish (*Xiphias gladius*), Albacore Tuna (*Thunnus alalunga*), Bigeye Tuna (*Thunnus obesus*), Bluefin Tuna (*Thunnus thynnus*), Yellowfin Tuna (*Thunnus albacares*), as well as Skipjack Tuna, Mahi-mahi, Blue and White Marlin, and sharks (Blue, Mako, and Porbeagle). Pelagic longlines and harpoon gear are permitted to operate from Georges Bank to Flemish Cap east of Newfoundland when Swordfish migrate inside and beyond Canada's exclusive economic zone (EEZ). The pelagic longline fishery is a multi-species fishery as Swordfish longline licence conditions are used in conjunction with licence conditions for the other tunas (e.g., Albacore, Bigeye, and Yellowfin) and together identify authorized directed species, as well as permitted bycatch species (e.g., shark and marlin). As the fishing season progresses, longline fishing effort generally moves from west to east and back again, and from the offshore to the inshore along the edge of the continental shelf. This pattern occurs as a result of following Swordfish movements associated with seasonal surface water warming trends, and a northward flow of the Gulf Stream. The Canadian large pelagic longline fisheries that direct for, or incidentally catch, Swordfish operate from April to December. Swordfish harpooning occurs from June to late August primarily along the edge of Georges and Browns Banks, targeting large females basking in surface waters during daylight. The Bluefin Tuna fishery directs using the following gear: angling, tended line, electric harpoon and trap net. Only Maritimes Region landings are shown in Figure 28.

Figure 28.—Large Pelagics Landings, 2014–2018



Bluefin Tuna (Figure 29)
SARA Status: No status.
COSEWIC Status: Endangered.
MSC Status: Not in MSC program.

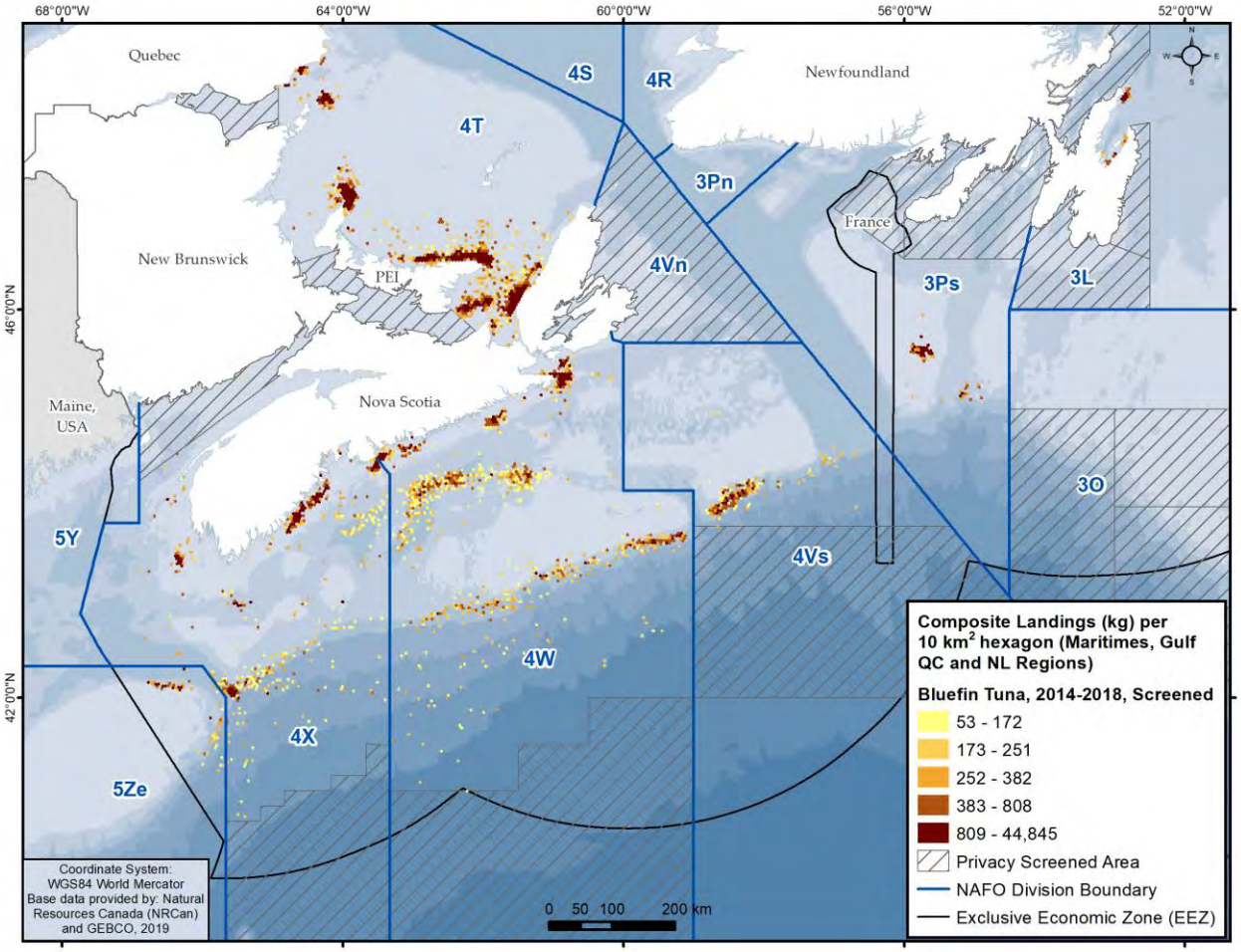
The Atlantic Bluefin Tuna (*Thunnus thynnus*) fishery is conducted inter-regionally (Figure 29) in the following areas: the Hell Hole between Browns and Georges Banks off southwest Nova Scotia; off Grand Manan, NB; St. Margaret's Bay, NS; south of the Canso Causeway, NS; off Cape George in the eastern part of the Northumberland Strait; off North Cape and East Point, PEI; in St. Georges Bay north of the Canso Causeway; and off the southern coast of Newfoundland. Since 1996, Bluefin Tuna have been taken off the coast of Nova Scotia between the Hell Hole and Canso fisheries, particularly off Halifax. Bluefin are also taken along the Scotian Shelf edge as a bycatch of the pelagic longline fleet directing for Swordfish and tuna species other than Bluefin Tuna. NAFO area 4Vn (east of Cape Breton) is closed to Bluefin Tuna harvests, with the exception of two licences.

Bluefin Tuna gears include: angling gear (rod and reel with single line and hook); tended line (line with one hook attached at all times to a fishing vessel); trap nets (only used in St. Margaret's Bay, Nova Scotia); electric harpoon (barbed lance or spear connected to an onboard electrical device); and pelagic longline (3.5 mm line suspended by floats, with a series of baited hooks attached at regular intervals fishing the upper water column). Pelagic longlines are 30 to 50 miles long, have 600–1,100 baited hooks per set, and are used by offshore tuna licence and Swordfish and other tuna licence holders. There is no directed Bluefin Tuna fishery using longline, as it is only caught as bycatch; however, bycatch landings exceed tended line landings.

Canadian catch limits for Bluefin Tuna are set by the International Commission for the Conservation of Atlantic Tunas. The Bluefin Tuna fishing season runs from June 24 to June 23 annually, with the main directed fishery running from late July until mid-to-late November. A catch and release charter fishery is also permitted during the commercial catch and retain season for existing Bluefin Tuna licence holders. The charter fishery takes place during September and October off Nova Scotia, July to October in the Gulf of St. Lawrence, and July 15 to December 31 in Newfoundland and Labrador.[12]

[12] Atlantic Bluefin Tuna Integrated Fisheries Management Plan, 2017, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/bluefin-tuna-thon-rouge/bluefin-tuna-thonrouge2017-eng.html>.

Figure 29.—Bluefin Tuna Landings, 2014–2018

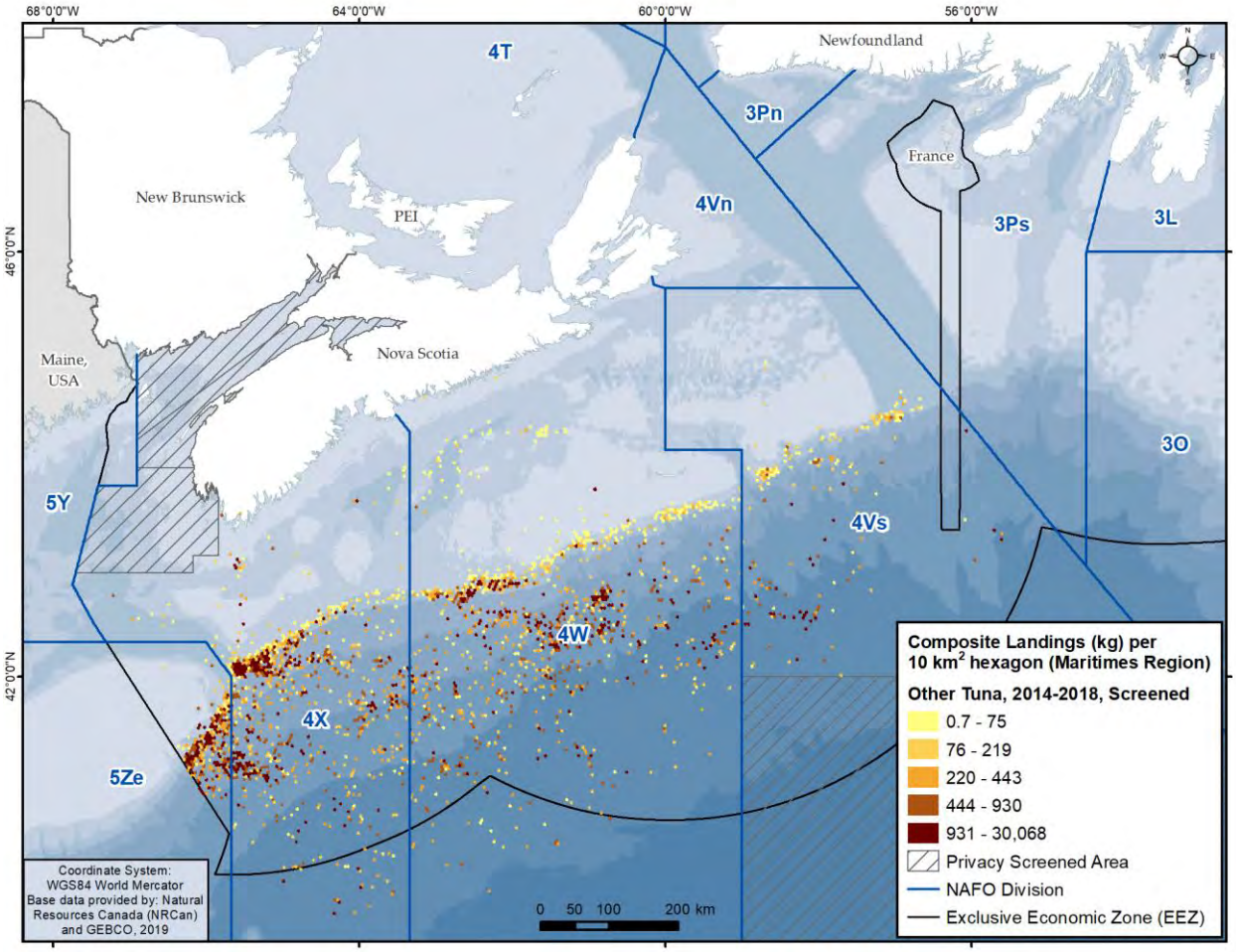


Other Tuna (Figure 30)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

The Albacore, Bigeye, Skipjack and Yellowfin Tuna fishery is known as the "Other Tuna" fishery. The fishery occurs from June to late November. Tunas are highly migratory and catch limits are set by the International Commission for the Conservation of Atlantic Tunas. The directed other tuna fishery began in the mid-1990s, as these species were previously bycatch in the Swordfish fishery. In addition to longline, trolling gear is used where multiple lines with hooks are towed behind a vessel. The fishery occurs along the shelf edge and slope and in the area known as the Hell Hole. The slope of the western Scotian Shelf is more important for this fishery than the eastern Scotian Shelf slope (Figure 30). The same management areas are in place as for the Swordfish longline fishery. Fishing Zone 1 (Gulf of St. Lawrence) and Fishing Zone 2 (Bay of Fundy) are closed to the fishery. Fishing with longline gear is not permitted in the Hell Hole (Northeast Channel) from July to November to reduce Bluefin Tuna bycatch, however, trolling for other tunas is permitted year-round in the Hell Hole. The Bluefin Exclusion Zone along coastal Nova Scotia is closed from August 1 until the end of the season to prevent Bluefin Tuna bycatch.[13]

[13] Atlantic Swordfish and Other Tunas, Integrated Fisheries Management Plan, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/swordfish-espadon/NEW-swordfish-2013-espado-eng.html>.

Figure 30.—Other Tuna Landings, 2014–2018

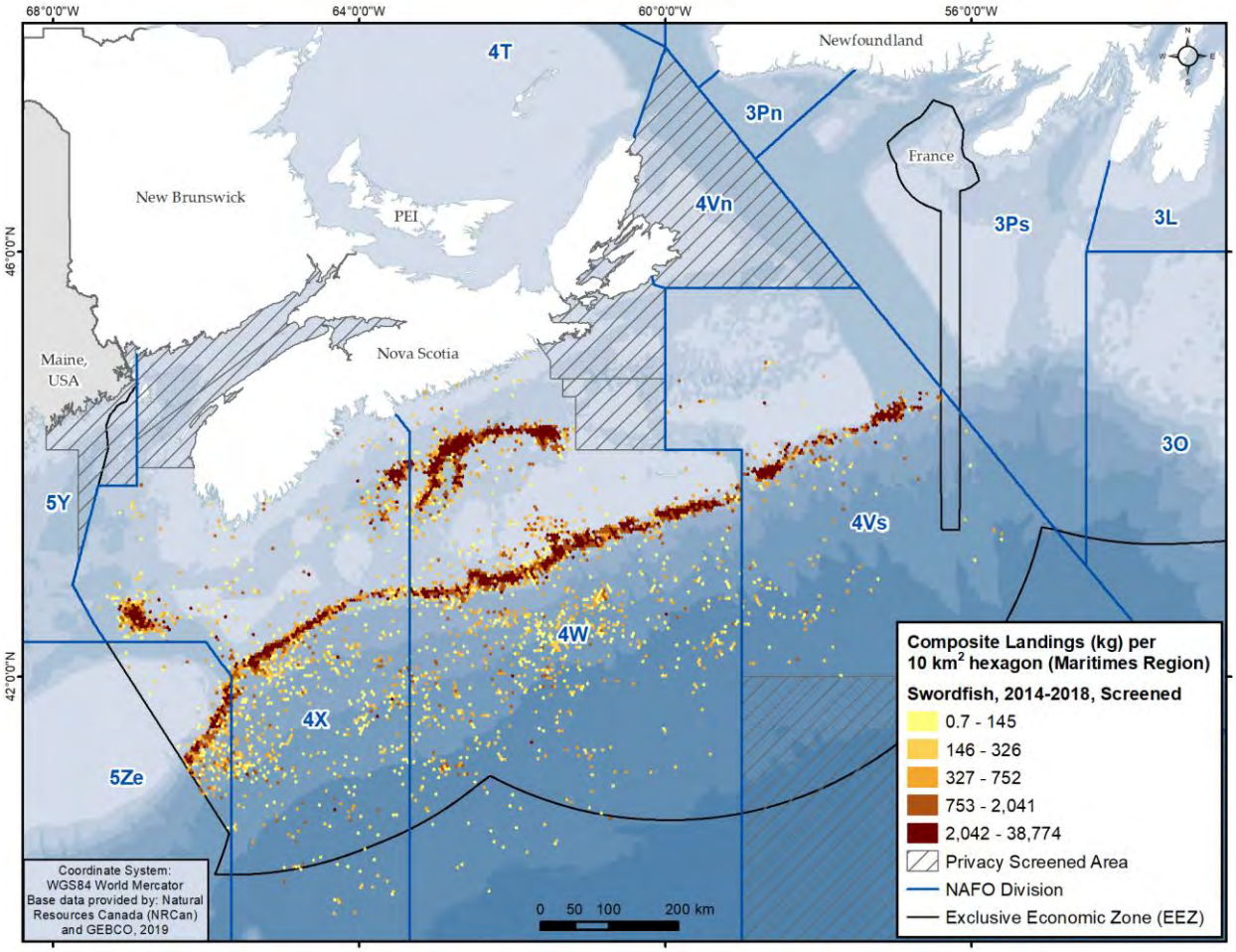


Swordfish (Figure 31)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Longline Swordfish certified sustainable in April 2012. Harpoon Swordfish certified sustainable in June 2010.

North Atlantic Swordfish and tuna stocks are under the management of the International Commission for the Conservation of Atlantic Tunas. Pelagic longlines and harpoon gear are permitted in this fishery off Nova Scotia and Newfoundland. Swordfish longline licence conditions are used in conjunction with licence conditions for the other tunas (e.g., Albacore, Bigeye, and Yellowfin) and together identify the authorized directed species as well as permitted by-catch species (e.g., shark and marlin). The longline fishery extends from Georges Bank to the Flemish Cap east of Newfoundland when Swordfish, the main species targeted, migrate inside and beyond Canada's EEZ (Figure 31). As the fishing season progresses, longline fishing effort generally moves from west to east and back again and from offshore to inshore along the edge of the continental shelf. This pattern occurs as a result of following Swordfish migrations associated with seasonal warming trends of surface water temperature, and the northward flow of the edge of the Gulf Stream. Canadian large pelagic longline fisheries that direct for, or incidentally catch, Swordfish operate from April to December. Swordfish longline licences are also able to use harpoon gear. The harpoon fishery occurs from June to late August, along the edges of Georges and Browns Banks, targeting large female Swordfish basking in surface waters during daylight.[14]

[14] Atlantic Swordfish and Other Tunas, Integrated Fisheries Management Plan, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/swordfish-espadon/NEW-swordfish-2013-espado-eng.html>.

Figure 31.—Swordfish Landings, 2014–2018



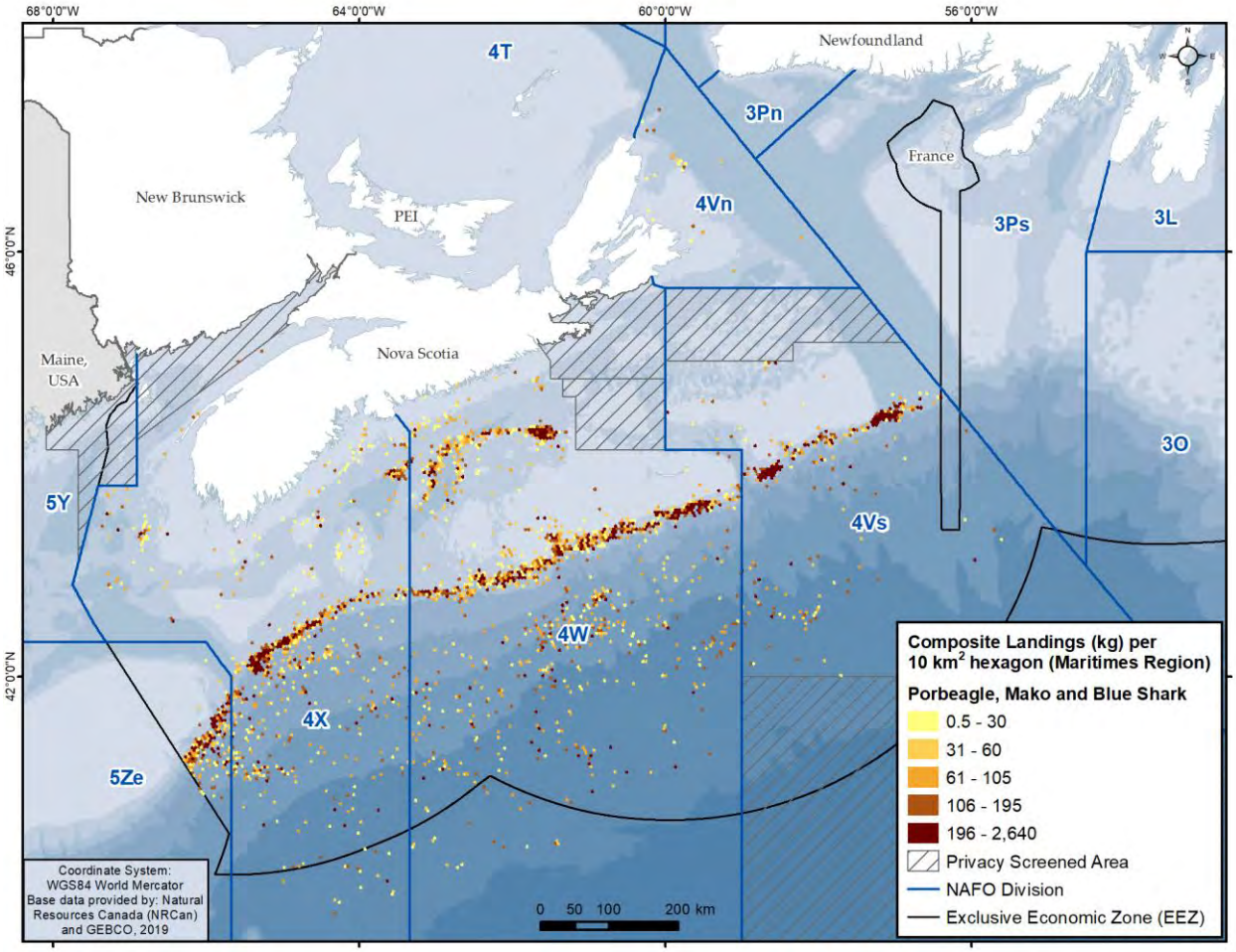
Porbeagle, Shortfin Mako and Blue Sharks (Figure 32)
SARA Status: Porbeagle Shark, Under consideration for addition to Schedule 1; Shortfin Mako Shark, No Status; Blue Shark, No Status.
COSEWIC Status: Porbeagle Shark, Endangered; Shortfin Mako Shark, Endangered; Blue Shark, Not at risk.
MSC Status: Not in MSC program.

The Porbeagle Shark (*Lamna nasus*) is a cold-temperate species that ranges in the northwestern Atlantic from Newfoundland and Labrador to the Sargasso Sea, inhabiting inshore and offshore waters below 18 °C. Individuals from this population move onto the Scotian Shelf in early spring and into the Gulf of St. Lawrence and onto the Grand Banks during the late spring and summer (Figure 32). They move into deeper water in late fall and in winter are found off the continental shelf and in deep basins such as Emerald Basin and the Gulf of Maine. Although there is no longer a directed Porbeagle Shark fishery, a 185-tonne TAC is applied to all incidental bycatch landings. The licence holder/operator must promptly release all live Porbeagle Sharks in the manner that causes the least harm to the shark and are only authorized to retain dead Porbeagle Sharks.

The Shortfin Mako Shark (*Isurus oxyrinchus*) is a warm-temperate, tropical species that occurs in the Atlantic, Pacific and Indian Oceans. The species' range in the western Atlantic extends from Newfoundland to Argentina in water temperatures from 17 to 22 °C. Shortfin Mako Sharks occur primarily off the continental shelf, but may be found in Canadian Atlantic coastal waters during summer months. In Canadian waters, Shortfin Mako Shark is a valuable bycatch with a higher price per pound than Blue Shark. It is caught incidentally in the same fisheries as Porbeagle and Blue Sharks, though because of a preference for warmer water temperatures, not in the same proportions. Fisheries with a bycatch of Shortfin Mako include Swordfish longline, other tunas longline, groundfish gillnet, and groundfish longline, with bycatch in groundfish occurring mostly in areas south of shelf waters off Nova Scotia near the Gulf Stream. DFO applies a precautionary Shortfin Mako allocation of 100 tonnes annually based on a recovery potential assessment. As of 2020, the Swordfish longline fleet is prohibited from retaining all Shortfin Mako Sharks, whereas during the time series for this analysis the fleet only released live Shortfin Mako Sharks to reduce mortality. In addition, all landings are 100 percent dockside monitored at the time of offloading.

Blue Sharks (*Prionace glauca*) are probably the most widely distributed of all large pelagic shark species and are found globally. The species' range extends from Newfoundland to Argentina in the western Atlantic. They prefer water temperatures in the range of 13–21 °C, but can tolerate from 7–27 °C. They move onto the Scotian Shelf in the late spring and into the Gulf of St. Lawrence and onto the Grand Banks during the summer and early fall. In late fall they move into deeper water, and in winter they are found off the continental shelf. Other than dogfish, Blue Sharks are the most common shark bycatch in Canadian waters with the most significant catches in the large pelagic longline fishery (e.g., the Swordfish fleet where the number of Blue Sharks caught can exceed Swordfish caught). Blue Sharks are currently almost always discarded, but when retained there is a precautionary allocation of 250 tonnes.

Figure 32.—Porbeagle, Mako and Blue Shark Landings, 2014–2018

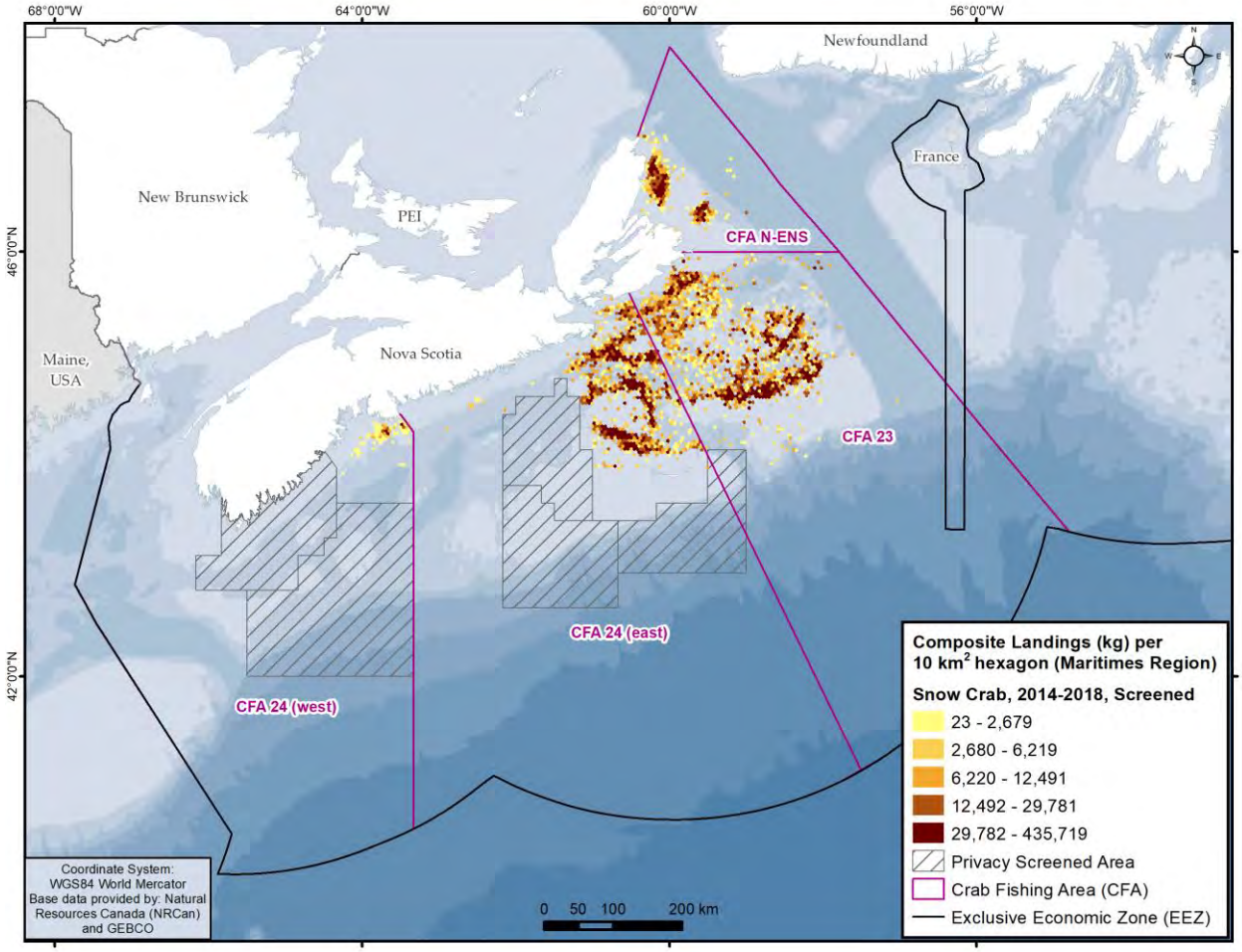


Snow Crab (Figure 33)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Scotian Shelf snow crab trap fishery certified sustainable in July 2012.

The Snow Crab (*Chionoecetes opillio*) fishery operates in NAFO Divisions 4VW in Crab Fishing Areas (CFAs) known as North-Eastern Nova Scotia (N-ENS), CFA 23, CFA 24 East and CFA 24 West (Figure 33). Snow Crab fishable bottom can be patchy within areas. In the nearshore areas of N-ENS the habitat is continuous from within five miles of shore out to 15–20 miles. In southern areas of CFA N-ENS and CFAs 23-24 the fishable bottom is not evenly distributed and extends further offshore. Snow Crab is found here in gullies 15–20 miles from shore extending to 120 miles offshore. The Snow Crab fishery uses baited conical traps. In N-ENS the fishery historically operated with a spring season from early April to mid-to-late May and a summer season from mid-July to mid-August, but since 2019 has operated with a continuous early April to mid-August season. In CFAs 23–24 the season runs from early April until the end of August. The CFA 24 West season typically opens November 1 and closes March 31.[15]

[15] Snow Crab Integrated Fisheries Management Plan, 2013, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/snow-crab-neige/snow-crab-neiges2013-eng.html>.

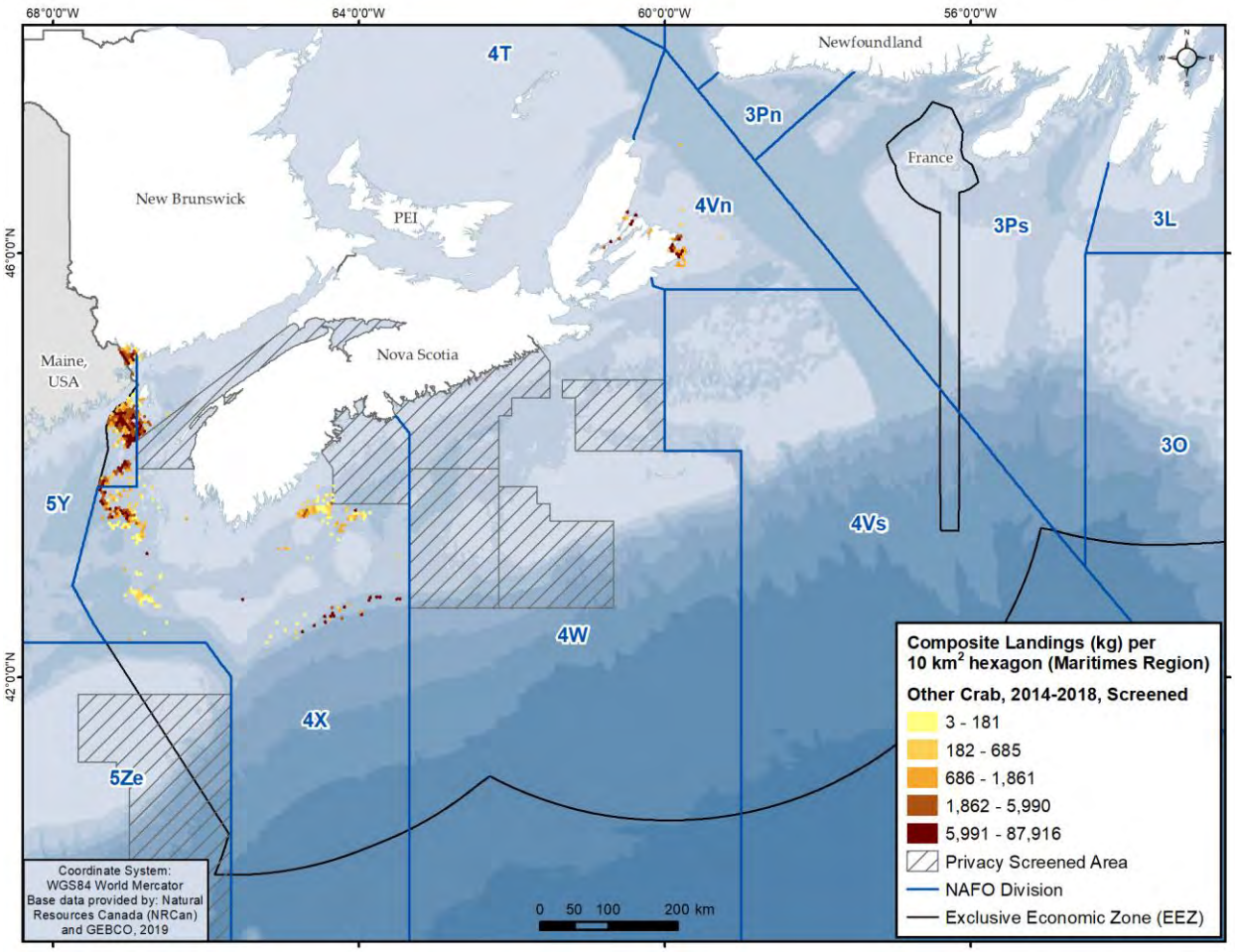
Figure 33.—Snow Crab Landings, 2014–2018



Other Crab (Figure 34)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Fisheries for Red Crab, Jonah Crab, and Rock Crab are smaller in scale than the Snow Crab fishery. There are few licence holders in each fishery and a variety of management units are used, which are different in each crab fishery, including Crab Fishing Areas, Lobster Fishing Areas (LFAs), and NAFO divisions. Offshore Jonah crabs are landed with offshore Lobster in LFA 41 with a TAC of 720 tonnes. Most landings in the Jonah crab fishery are from the Bay of Fundy, Crowell Basin and Browns Bank, with landings also from Georges Basin and Bank (Figure 34). A Red Crab fishery exists in deep waters along the shelf edge, with an annual TAC of 300 tonnes. Exploratory fisheries for Stone Crab and Toad Crab have existed on the eastern Scotian Shelf since the mid-1990s, with few licence holders and low catches. No experimental crab fisheries are currently operating. Figure 34 includes bycatch landings of other crab species.

Figure 34.—Other Crab Landings, 2014–2018



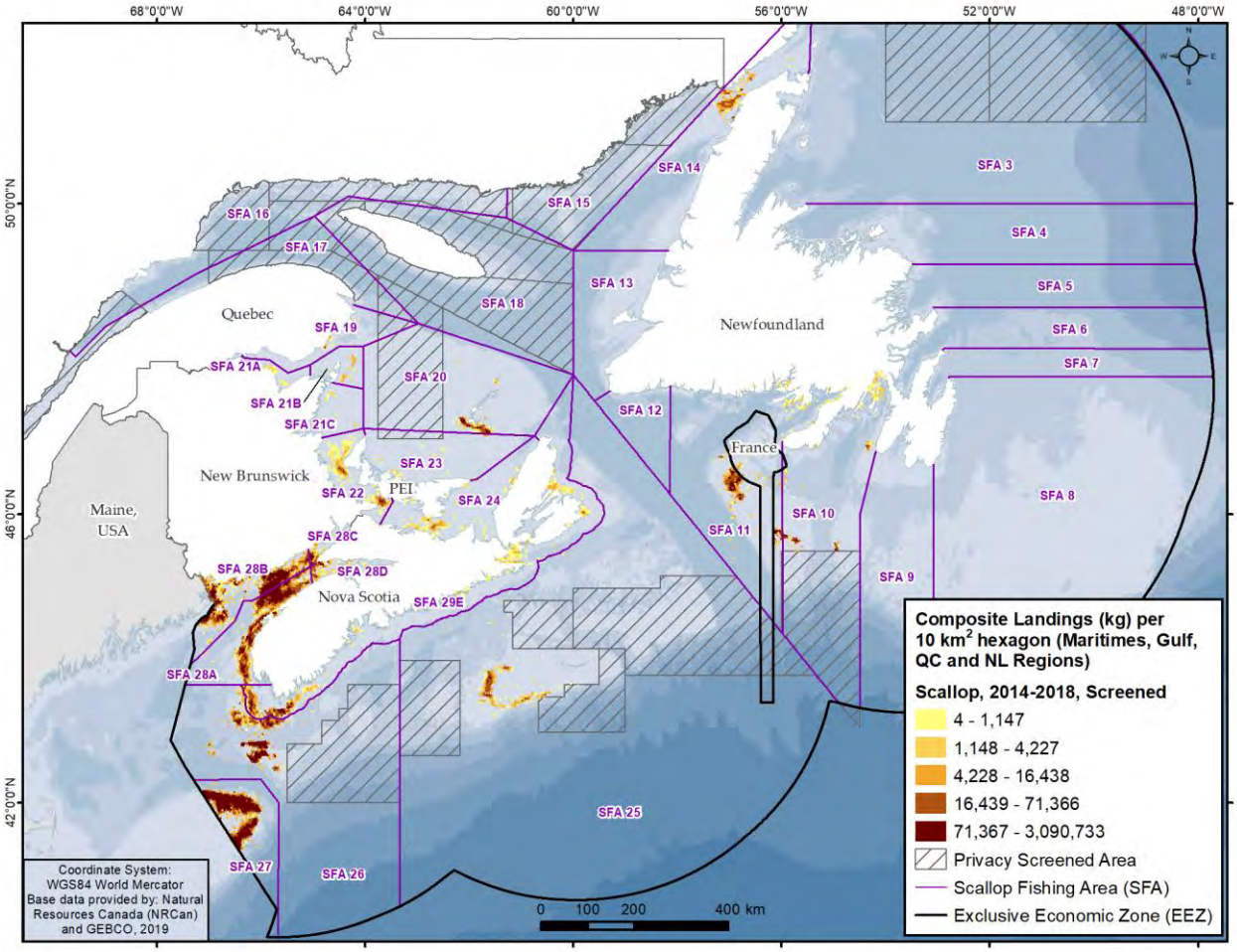
Scallop (Figure 35)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: The Bay of Fundy and Scallop Fishing Area 29 West of 65° 30' W longitude certified as sustainable in July 2013 (Full Bay Fleet only). The Offshore Scallop fishery was certified in March 2010.

All scallop fishing in the Bay of Fundy takes place in Scallop Fishing Areas (SFA) 28A, 28B, 28C, and 28D as described in the *Atlantic Fishery Regulations, 1985*.[16] The various fleet sectors are eligible by licence condition to fish one or more areas as follows: Full Bay: SFA 28A, 28B, 28C and 28D; Mid Bay: SFA 28B and 28C only; and Upper Bay: SFA 28C and 28D only. These areas can be further sub-divided into areas that are closed by either regulation or variation orders that restrict fishing during all or part of the year. In addition, specific management measures are applied to broader Scallop Production Areas (SPA) that are designed to incorporate one or more scallop biological production areas and may fall within the boundaries of one or more of the regulated SFAs. SPA boundaries are described in variation orders and/or licence conditions whereas SFA boundaries are described in the *Atlantic Fishery Regulations, 1985*. Inshore scallop fishing also takes place in SFA 29 as described in the *Atlantic Fishery Regulations, 1985*. SFA 29 is divided into SFA 29 West of 65°30' W longitude west to the 43°40' Line and SFA 29 East of 65°30' W longitude, east to Cape North and within the 12-nautical mile territorial sea. Two of the fleet sectors are eligible by licence condition to fish one or more areas as follows: Full Bay: SFA 29 West; Inshore: SFA 29 East, 64 licences eligible for SFA 29 West.[17]

The offshore scallop fishery in Maritimes Region operates primarily on Georges and Browns Banks, German Bank, Western and Sable Banks, and Banquereau (Figure 35) and includes sea scallop (*Placopecten magellanicus*) and Iceland scallop (*Chlamys islandica*) that are only landed on Banquereau. The quota for Iceland scallop and sea scallop on St. Pierre Bank in NL Region is set by Maritimes Region. The offshore scallop fishery occurs year-round in the Maritimes Region; however, not all areas are open year-round. German Bank is open from June 1 to November 15. The closure during the late fall and spring is to avoid conflicts with the Lobster fishery that takes place in the area from late November until May 31. In addition, there are two specific closures on Georges Bank: one to protect spawning Atlantic Cod (early February to March 31) and one to protect Yellowtail Flounder (June).[18]

[16] Atlantic Fishery Regulations, 1985 (SOR/86-21), <https://laws-lois.justice.gc.ca/PDF/SOR-86-21.pdf>.
[17] Inshore Scallop Integrated Fisheries Management Plan, 2015, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/scallop-petoncle/scallop-petoncle2015-toc-eng.html>.
[18] Offshore Scallop Integrated Fisheries Management Plan, 2018, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/scallop-petoncle/2018/index-eng.html>.

Figure 35.—Scallop Landings, 2014–2018



Scallop Q1–Q4 (Figures 36 to 39)

Quarterly scallop maps are shown in Figures 36–39. Much of Georges Bank shows high landings year-round, reflecting the area's importance to the offshore fishery. There is little activity on the eastern Scotian Shelf during the winter. There are high landings in the area off Digby in the Bay of Fundy for much of the year, reflecting the importance of this area to the inshore fishery. A winter scallop fishery exists around Grand Manan and in the Passamaquoddy Bay area off southwest New Brunswick.

Figure 36.—Seasonal Scallop Landings, January–March, 2014–2018

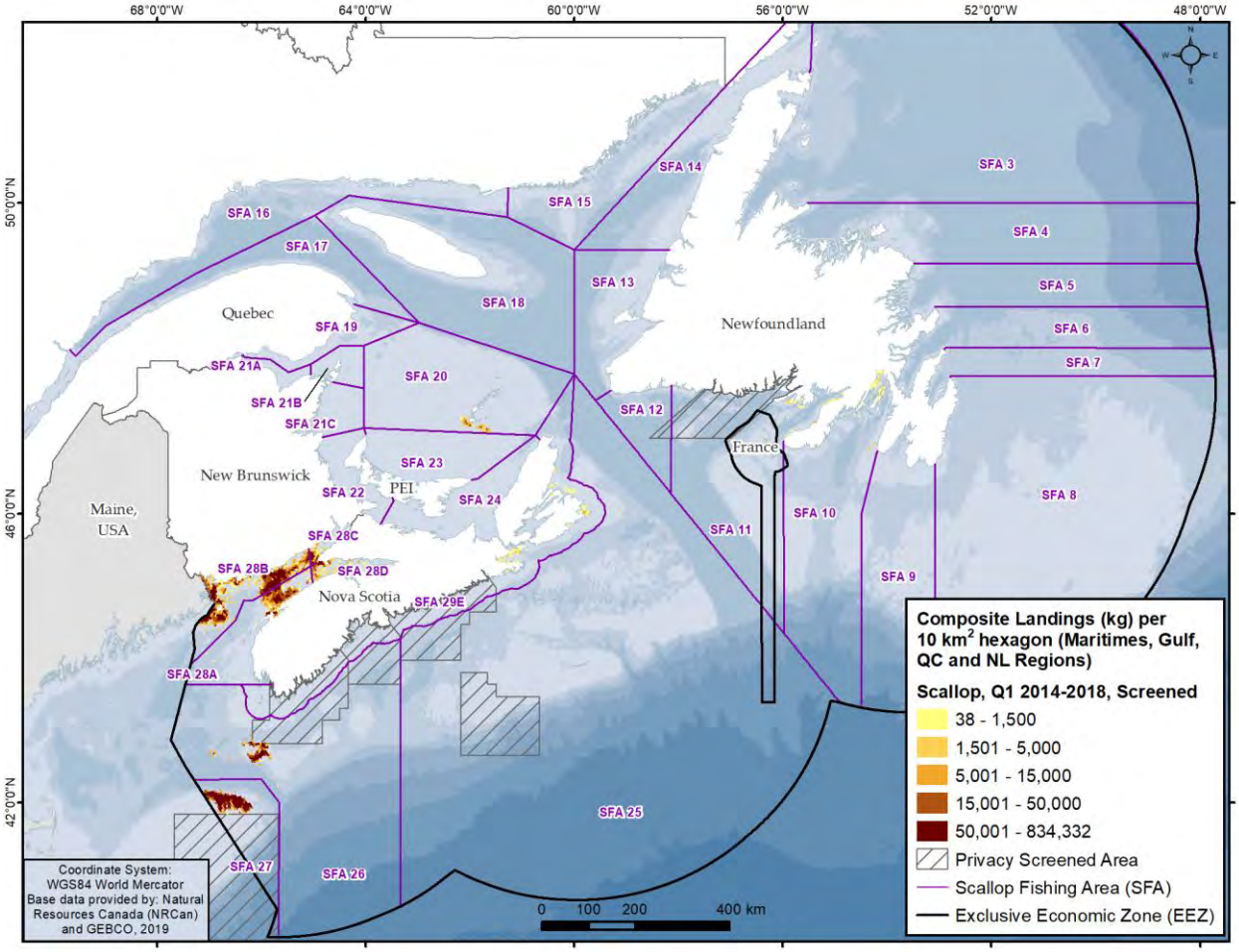


Figure 37.—Seasonal Scallop Landings, April–June, 2014–2018

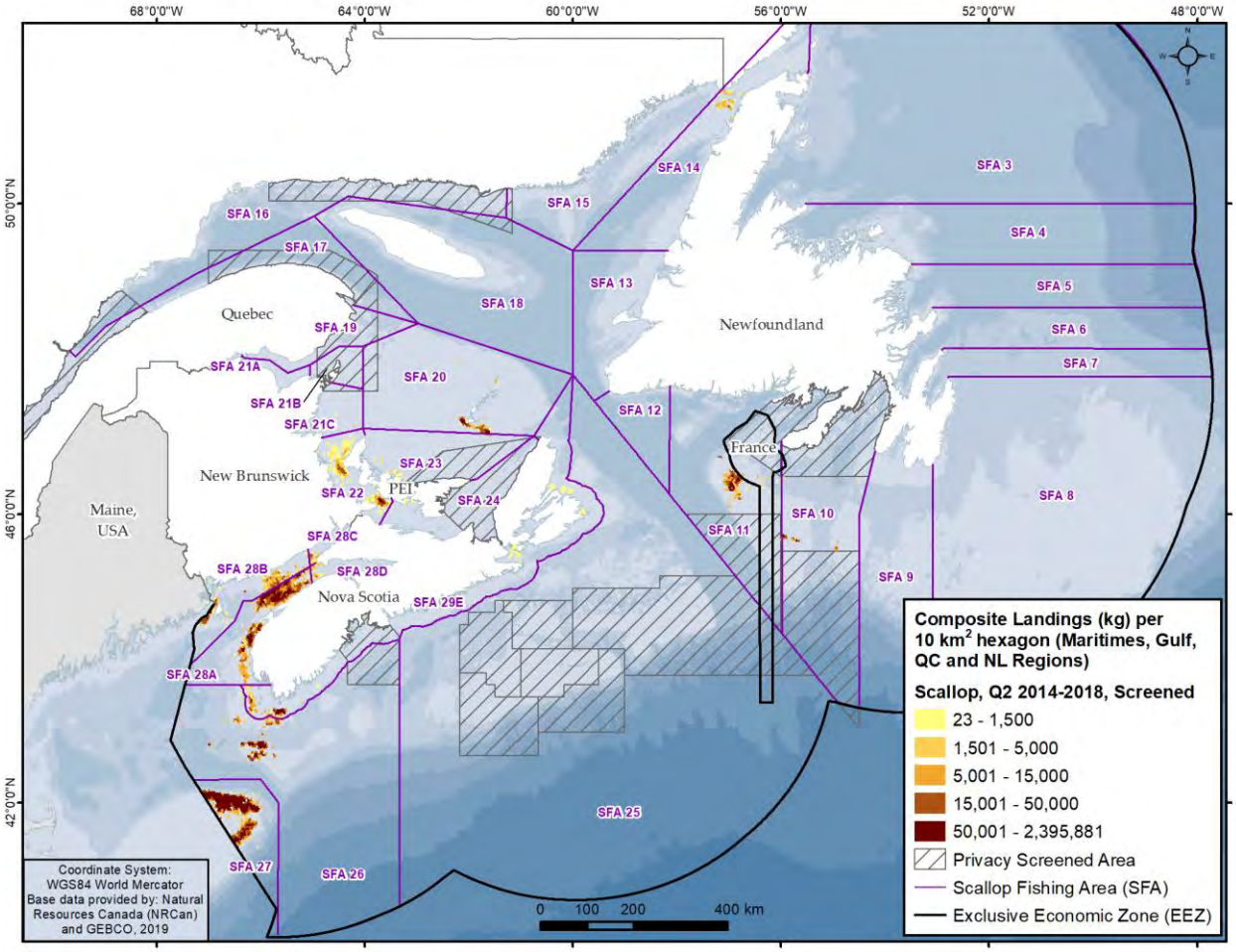


Figure 38.—Seasonal Scallop Landings, July–September, 2014–2018

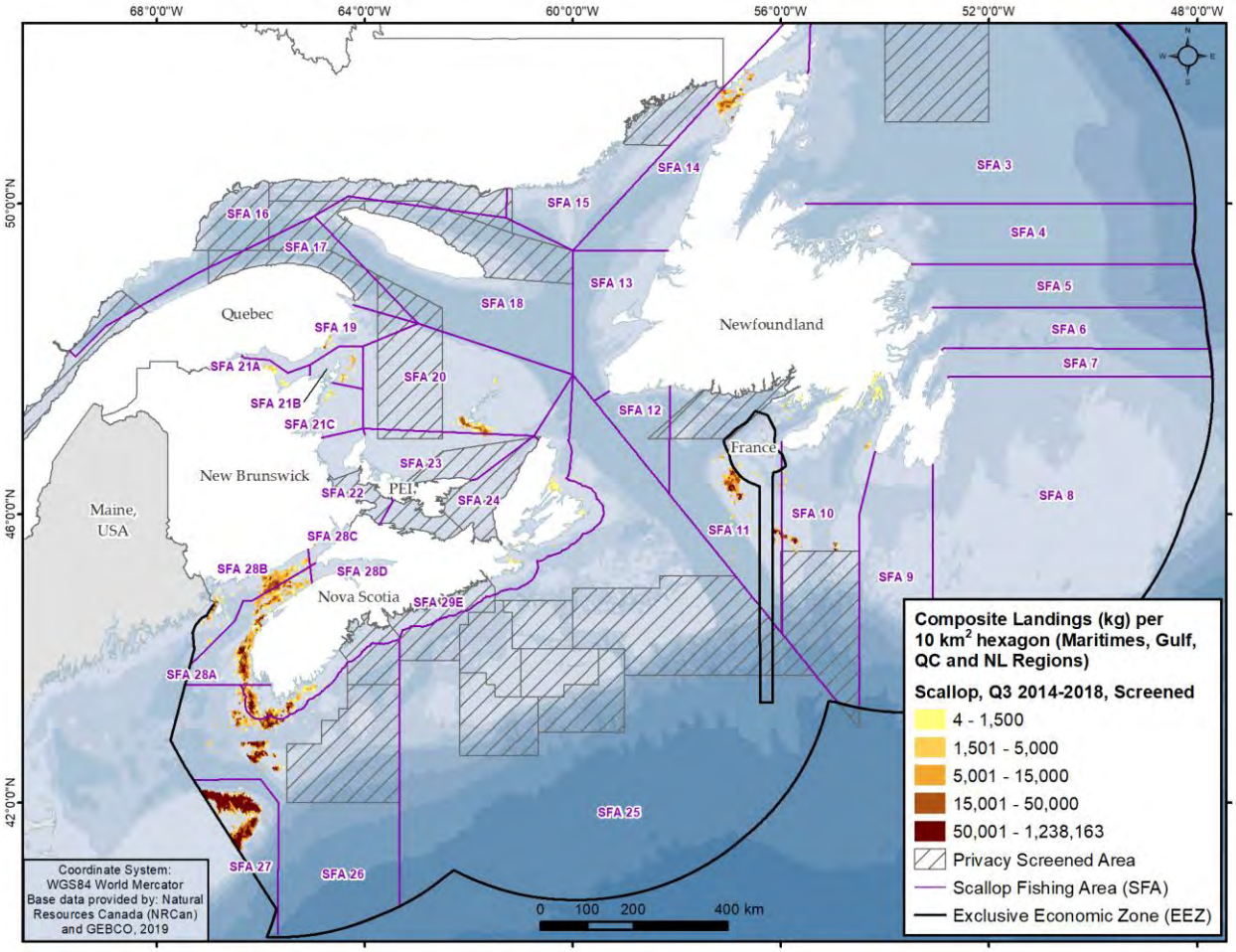
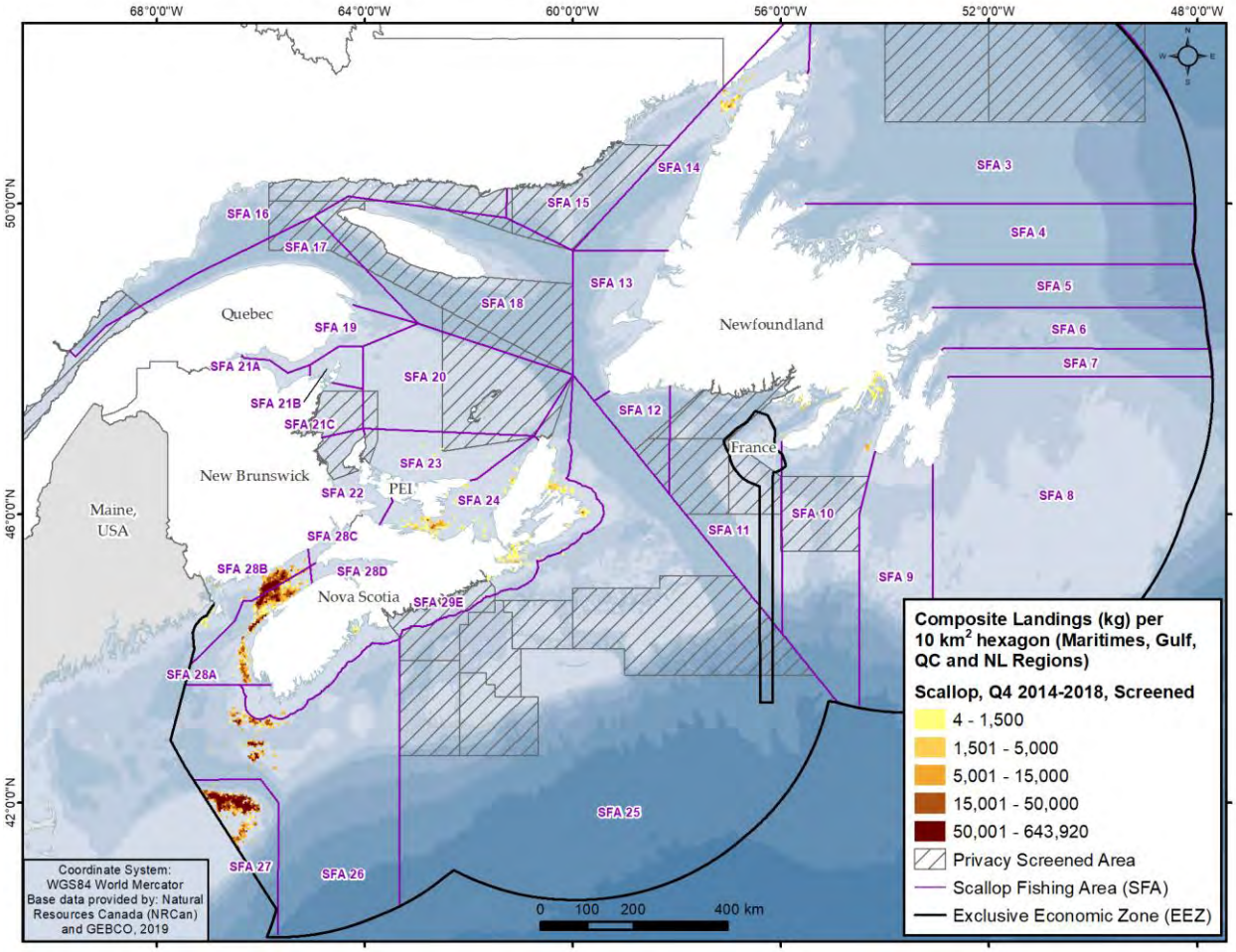


Figure 39.—Seasonal Scallop Landings, October–December, 2014–2018

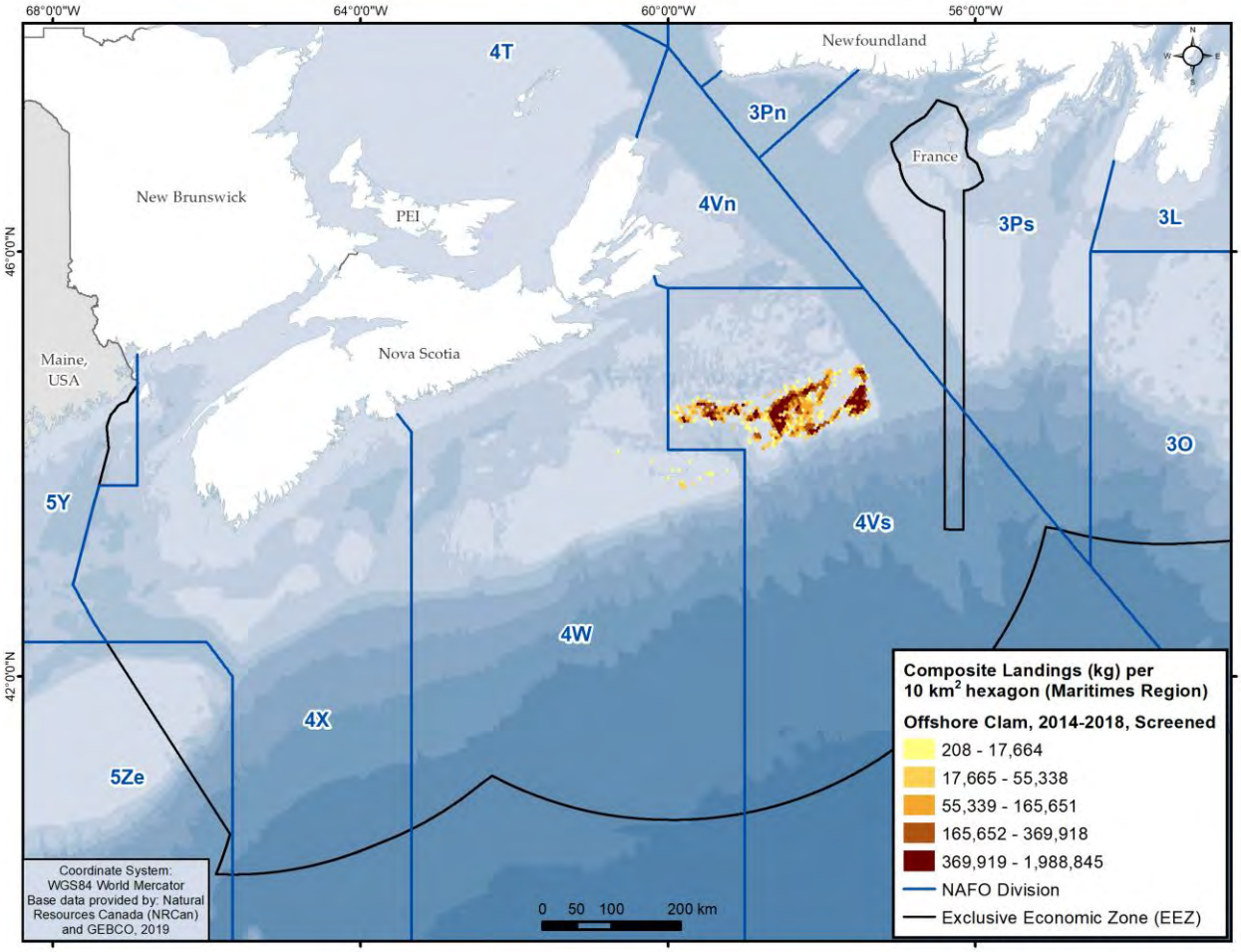


Offshore Clam (Figure 40)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Certified as sustainable in July 2012.

The Arctic Surfclam (*Mactromeris polynyma*) fishery is concentrated on offshore clam beds on the Grand Banks and Banquereau (Figure 40). The Ocean Quahog (*Arctica islandica*) resource is located on Sable Island Bank and the southern Grand Banks; however, licence holders are not permitted to direct for Ocean Quahog on Grand Banks and no quahog harvest has occurred on Sable Island Bank in recent years. The Surfclam fishery is conducted on a year-round basis commencing January 1. There are three licences: Arctic Surf Co. Inc. (NL); Clearwater Seafoods Limited Partnership (NS); and Clearwater Seafoods Limited Partnership (NL). Specialized factory-freezer clam vessels operate year-round and the licences have equal allocations for both commercial fishing areas, Banquereau and Grand Bank. The 2018 TAC was 20,943 tonnes on Banquereau and 14,756 tonnes on Grand Bank, for a total of 35,699 tonnes.[19] Data entry errors in the database were corrected using two polygons provided by the licence holder that approximated the 100-m bathy contour around Sable Island Bank and Banquereau. The offshore clam fishery also retains the following bycatch species: Atlantic Surfclam (Bar Clam), Quahaugs, Propeller Clams and cockles.

[19] Offshore Clam Integrated Fisheries Management Plan, 2014, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/clams-palourdes/clams-palourdes-2014-eng.html>.

Figure 40.—Offshore Clam Landings, 2014–2018



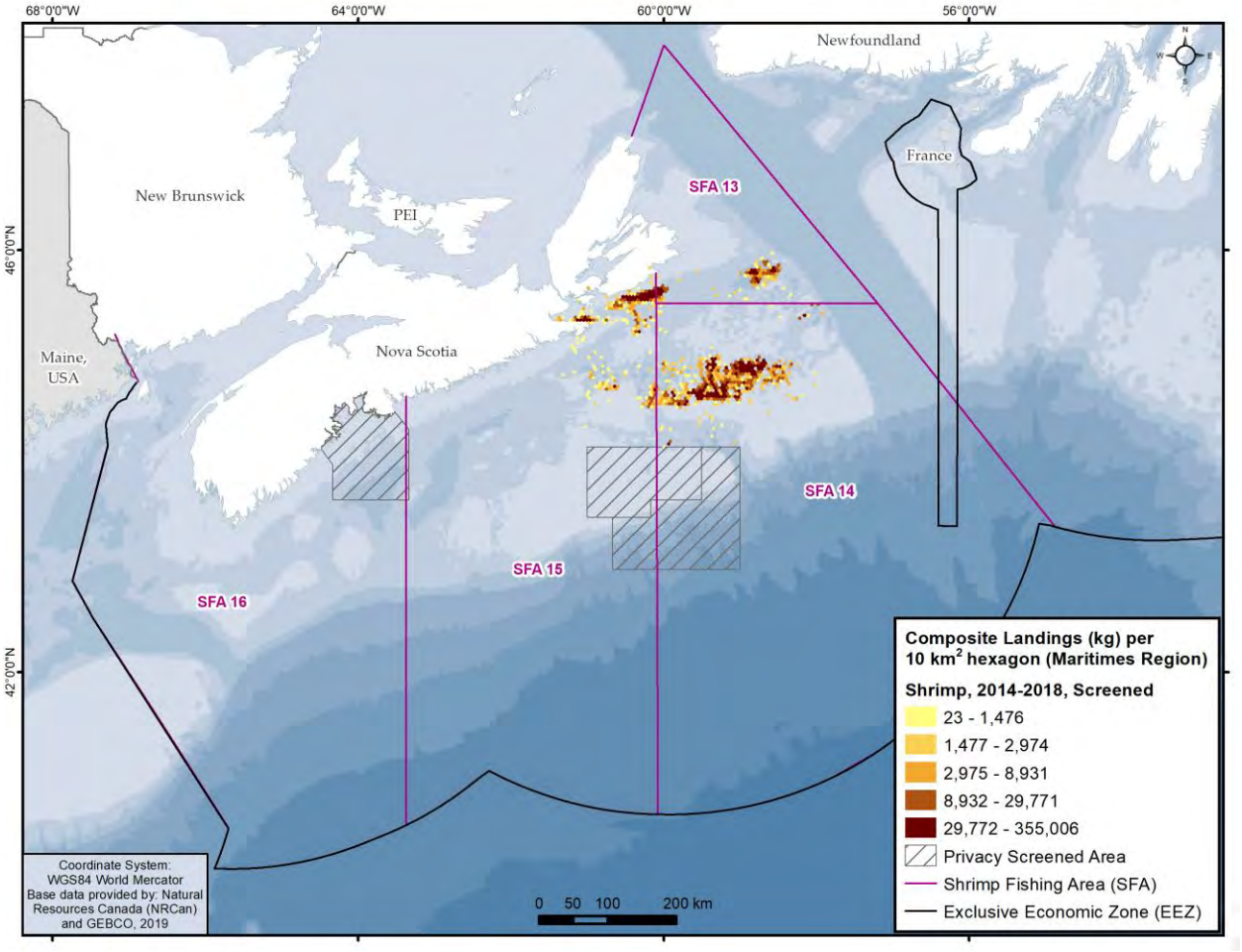
Shrimp (Figure 41)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Shrimp Fishing Areas 13, 14, and 15 certified as sustainable since June 2011.

Two species of shrimp are harvested in the Canadian Northwest Atlantic. Northern Shrimp (*Pandalus borealis*) is most abundant and widespread in commercial quantities in 'holes' on the Scotian Shelf (Figure 41), and the Striped Shrimp (*Pandalus montagui*) is widely distributed from Davis Strait to the Grand Banks and is more abundant in northerly areas at shallower depths. Northern Shrimp is the only shrimp species of commercial importance in the Maritimes Region. The mobile shrimp fishery uses bottom otter trawls with a minimum mesh size of 40 mm. Shrimp trawl nets are equipped with a mandatory Nordmore separator grate to allow other fish to escape through the upper panel of the trawl. Shrimp in Shrimp Fishing Areas (SFAs) 13-15 are managed as one stock, with a TAC of 2,600 tonnes in 2018. The trawl fishery is open year-round and operates from late winter to early summer. In SFA 13-15, the mobile fleet with 20 active shrimp trawl licences (2014-2018) holds 92 percent of the TAC. Of this, 25 percent is held by Gulf-based vessels and 75 percent by Maritimes-based vessels. The mobile fleet has been operating under a system of individual transferrable quotas since 1998. Shrimp in SFA 16 may be part of the Gulf of Maine stock, which is fished competitively as there is no TAC available in this area. Shrimp harvests in SFA 16 have been very low in recent years.

A small shrimp trap fishery operates in Chedabucto Bay (SFA 15). There are 14 trap licences in total with an allocation of 100 traps each. Five trap licences are located in the north of Chedabucto Bay, eight in the south, and one along the eastern shore just south of the bay. The trap fleet is active primarily from late fall through winter. The trap fleet holds 8 percent of the TAC and trappers fish their share competitively.[20]

[20] Scotian Shelf Shrimp Integrated Fisheries Management Plan, 2013, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/shrimp-crevette/shrimp-crevette-2013-eng.html>.

Figure 41.—Shrimp Landings, 2014–2018

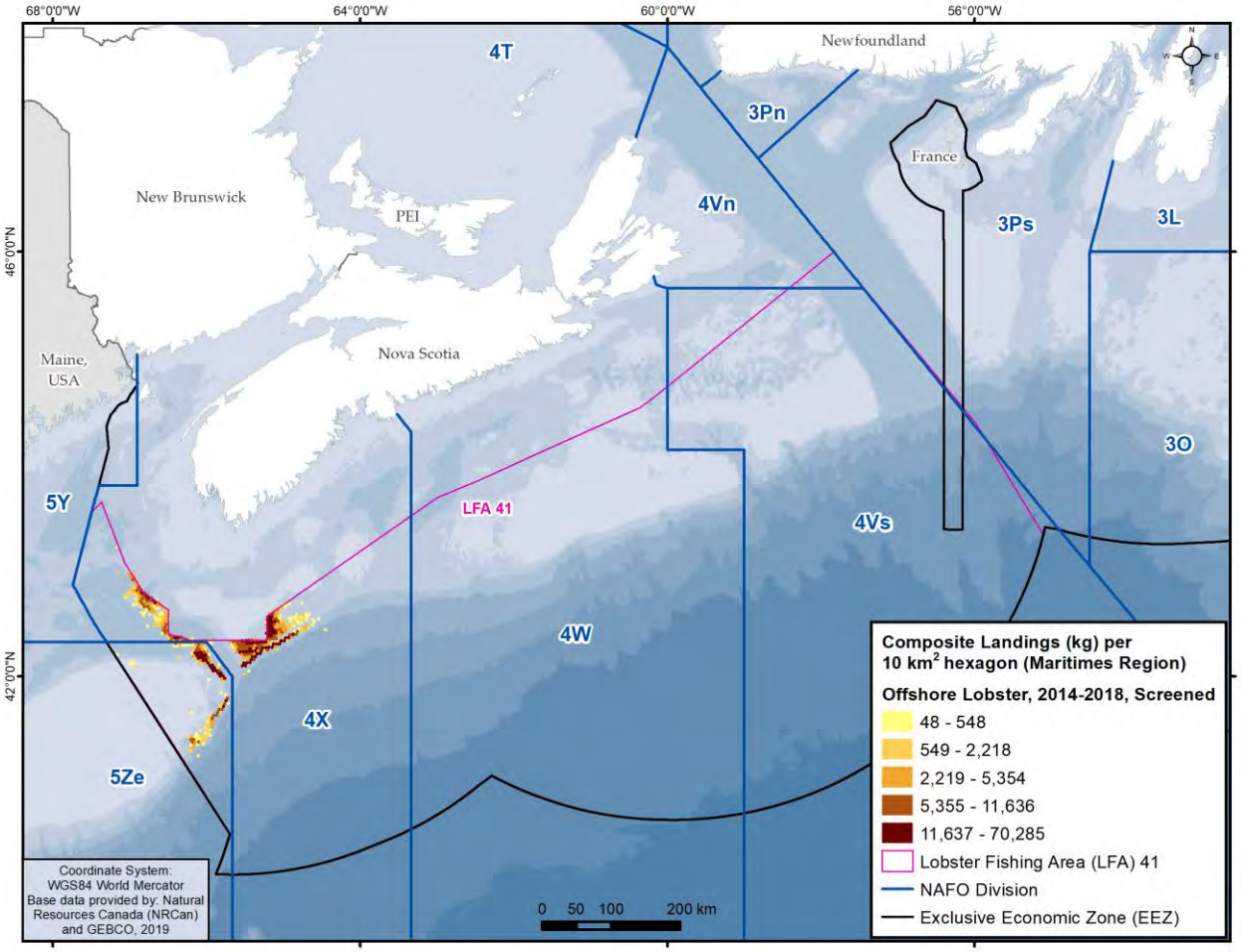


Offshore Lobster (Figure 42)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Eastern Canada offshore Lobster trap fishery was certified sustainable in June 2010.

Most Lobster fisheries in the region report landings by inshore Lobster Fishing Area and statistical grid fished, not by latitude and longitude coordinates. However, the offshore Lobster fishery is required to report coordinates. The fishery for offshore American Lobster (*Homarus americanus*) occurs within the boundaries of Lobster Fishing Area (LFA) 41, as described in the *Atlantic Fishery Regulations*.[21] LFA 41 extends from the Hague Line on Georges Bank to the Laurentian Channel off Cape Breton; however, all traditional offshore Lobster and Jonah crab commercial fishing occurs on five major grounds, namely Georges Bank (outer shelf and upper slope), Georges Basin, Crowell Basin, Southeast Browns Bank (outer shelf and upper slope east of Northeast Channel) and west Browns Bank, all within NAFO divisions 4X and 5Ze (Figure 42). The TAC for LFA 41 was established at 720 tonnes in 1985 based on landings history and has remained unchanged.[22] Outlier coordinates north of the LFA 41 line were considered data entry errors and were removed. Data from the statistical grid-based inshore Lobster fishery are not included in this report, but are analyzed and published in a separate atlas (Serdynska and Coffen-Smout, 2017).

[21] Atlantic Fishery Regulations, 1985 (SOR/86-21), <https://laws-lois.justice.gc.ca/PDF/SOR-86-21.pdf>.
[22] Offshore Lobster and Jonah Crab Integrated Fisheries Management Plan, 2019, <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/lobster-crab-homard/2019/index-eng.html>; <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/lobster-crab-homard/index-eng.html>.

Figure 42.—Offshore Lobster Landings, 2014–2018

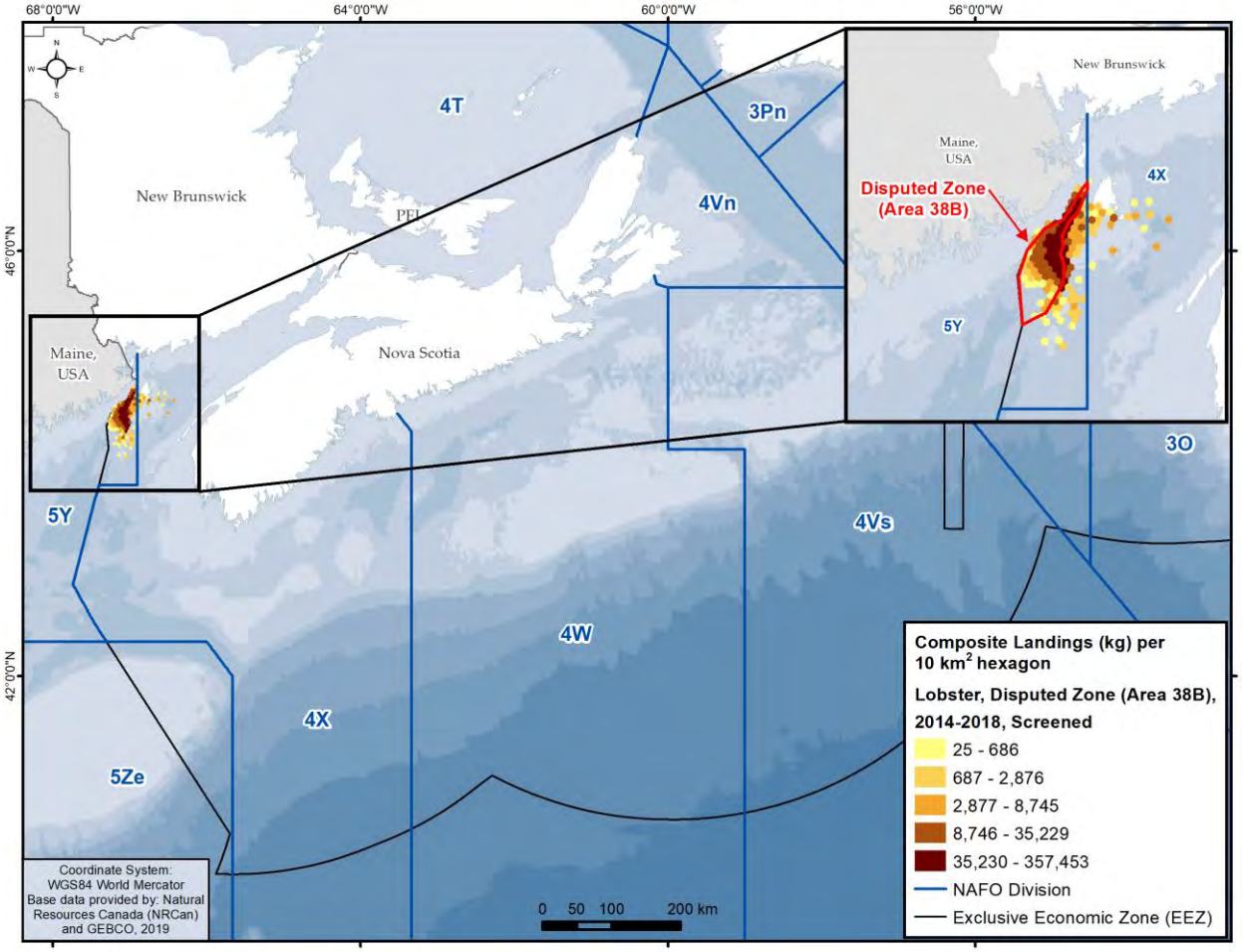


Disputed Zone Area 38B Lobster (Figure 43)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Bay of Fundy, Scotian Shelf and Southern Gulf of St. Lawrence Lobster trap fishery was certified sustainable in May 2015.

Most Lobster fisheries in the region report landings by inshore Lobster Fishing Area and statistical grid, not latitude and longitude coordinates; however, the Disputed Zone Lobster fishery is required to report coordinates. Figure 43 shows Disputed Zone Lobster landings. Landings reported outside the Disputed Zone are considered to have errors in their coordinates, but have not been removed from the map. The Disputed Zone Lobster (*Homarus americanus*) fishery occurs in a disputed zone known as Area 38B (see inset map in Figure 43), an area in Grand Manan Channel disputed between Canada and the U.S.A. The fishing season begins June 30 and ends on the Friday preceding the opening of the regular LFA 38 Lobster season on the second Tuesday in November. Only licence holders with a valid Lobster licence for LFA 38 are permitted to fish in Area 38B. Access to the disputed zone is limited by the number of Lobster licences in LFA 38. Single Lobster licences are limited to 375 traps, while partnership Lobster licences are limited to 563 traps. Licence holders and operators are required to have a DFO-approved Vessel Monitoring System (VMS) on vessels authorized to fish any Disputed Zone fishing licence. U.S.-based fishers from Maine also target Lobster in the Disputed Zone.[23] Data from the statistical grid-based inshore Lobster fishery are not included in this report, but are analyzed and published in a separate atlas (Serdynska and Coffen-Smout, 2017).

[23] See section 4.6.2, Inshore Lobster Integrated Fisheries Management Plan, 2011, <http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/maritimes/2019/inshore-lobster-eng.html>.

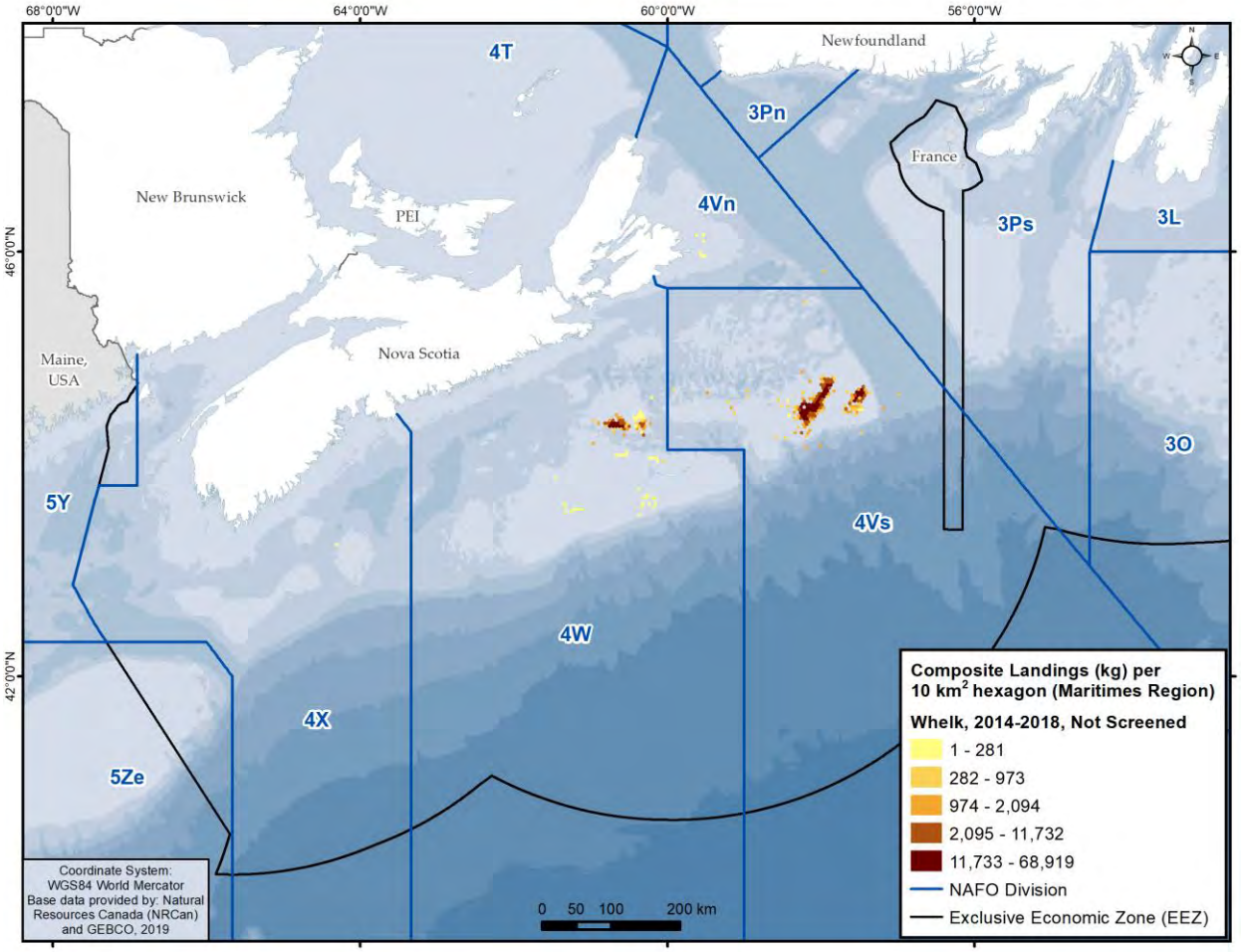
Figure 43.—Disputed Zone Area 38B Lobster Landings, 2014–2018 (Outlier points outside the red polygon are assumed to be data errors.)



Whelk (Figure 44)
SARA Status: No Status.
COSEWIC Status: No Status.
MSC Status: Not in MSC program.

Waved Whelk (*Buccinum undatum*) is a common marine snail native to the Northwest Atlantic and distributed from Newfoundland and Labrador to New Jersey, USA. A small exploratory fishery for Whelk using conical traps exists off Canada's east coast. Two Whelk licence holders operate inshore exploratory licences restricted to Lobster Fishing Areas 27, 29, 30 and 31A/B off Eastern Nova Scotia. Three offshore exploratory enterprise allocation licences are operated on the Scotian Shelf by two licence holders in NAFO areas 4Vs and 4W. Each offshore licence holder is restricted to a maximum annual catch of 700 tonnes in 4Vs and 250 tonnes in 4W. The licence conditions for Whelk state that "acceptance of these licence conditions acknowledges that the data collected about this fishery from the licence may be made public." Therefore, privacy screening was not required for this fishery. Maritimes Region Whelk landings are shown in Figure 44.

Figure 44.—Whelk Landings, 2014–2018



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APPENDIX E: AKVA Group Site and Equipment Plans

Page 313: Seawater Installation Plans

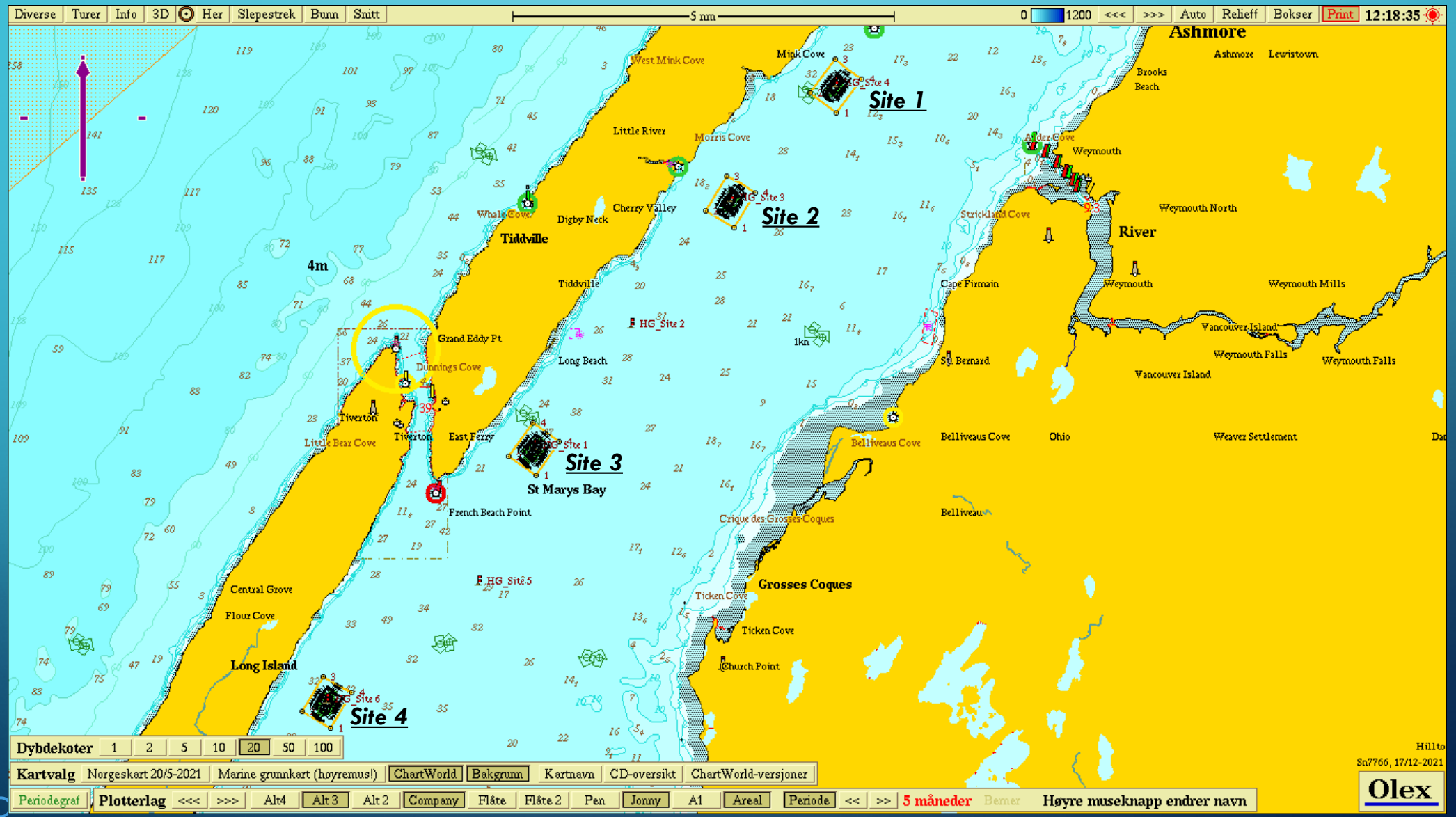
Page 332: Equipment Quotes

ST. MARY´S BAY

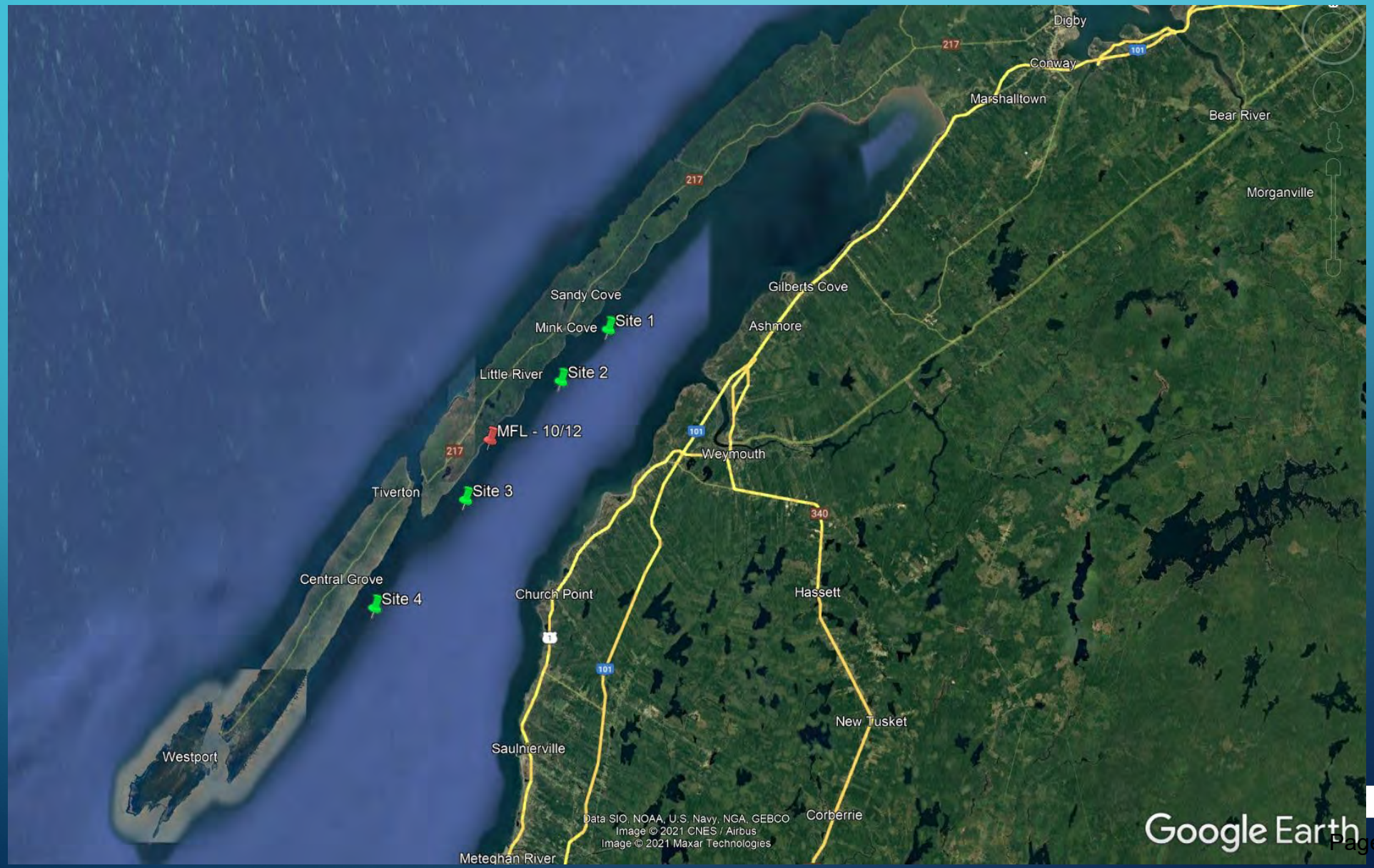
SEA-WATER INSTALLATION

ILLUSTRATIONS & SPECIFICATIONS 180122

Overview - Site 1, 2, 3 and 4



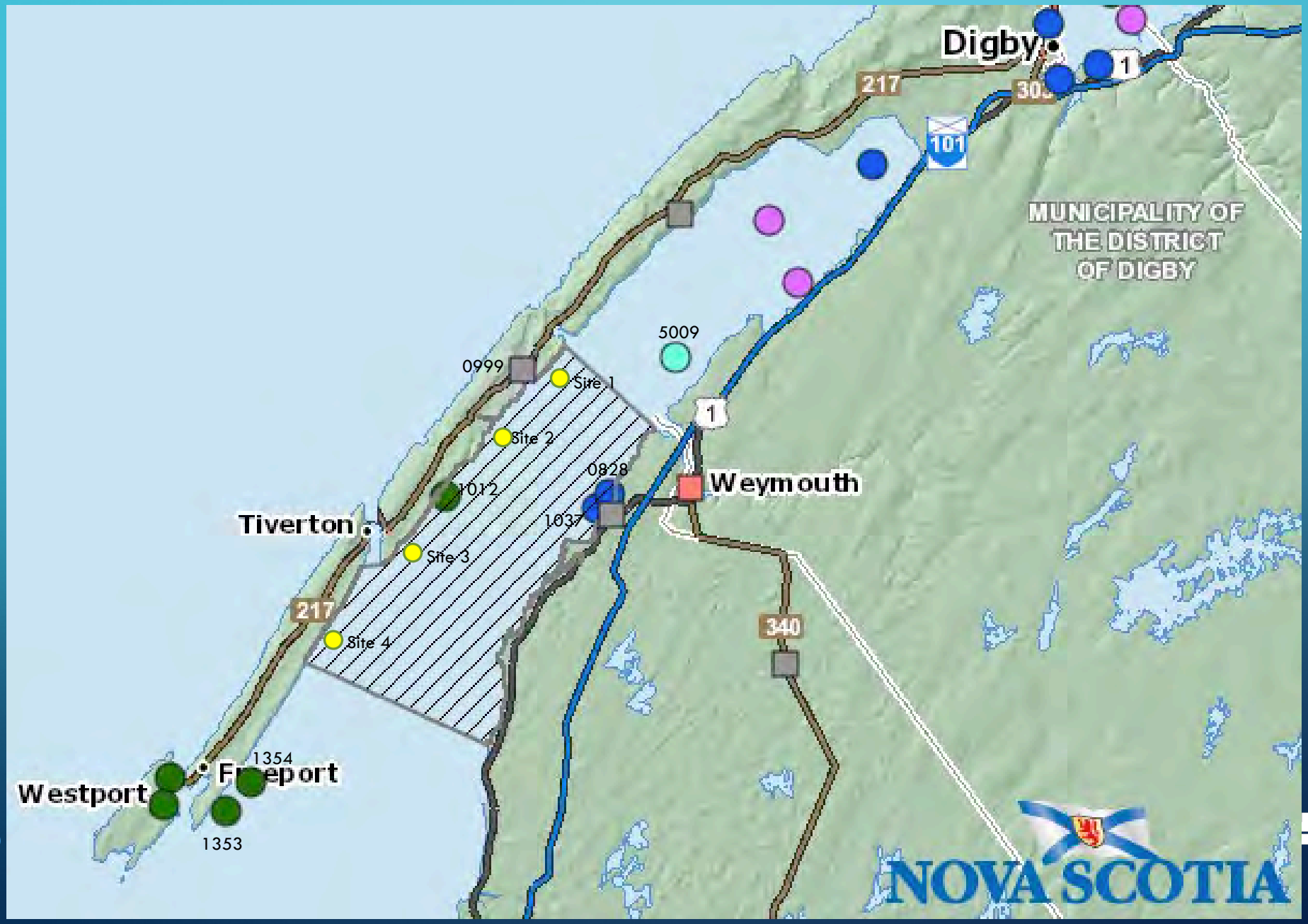
Overview - Site 1, 2, 3 and 4



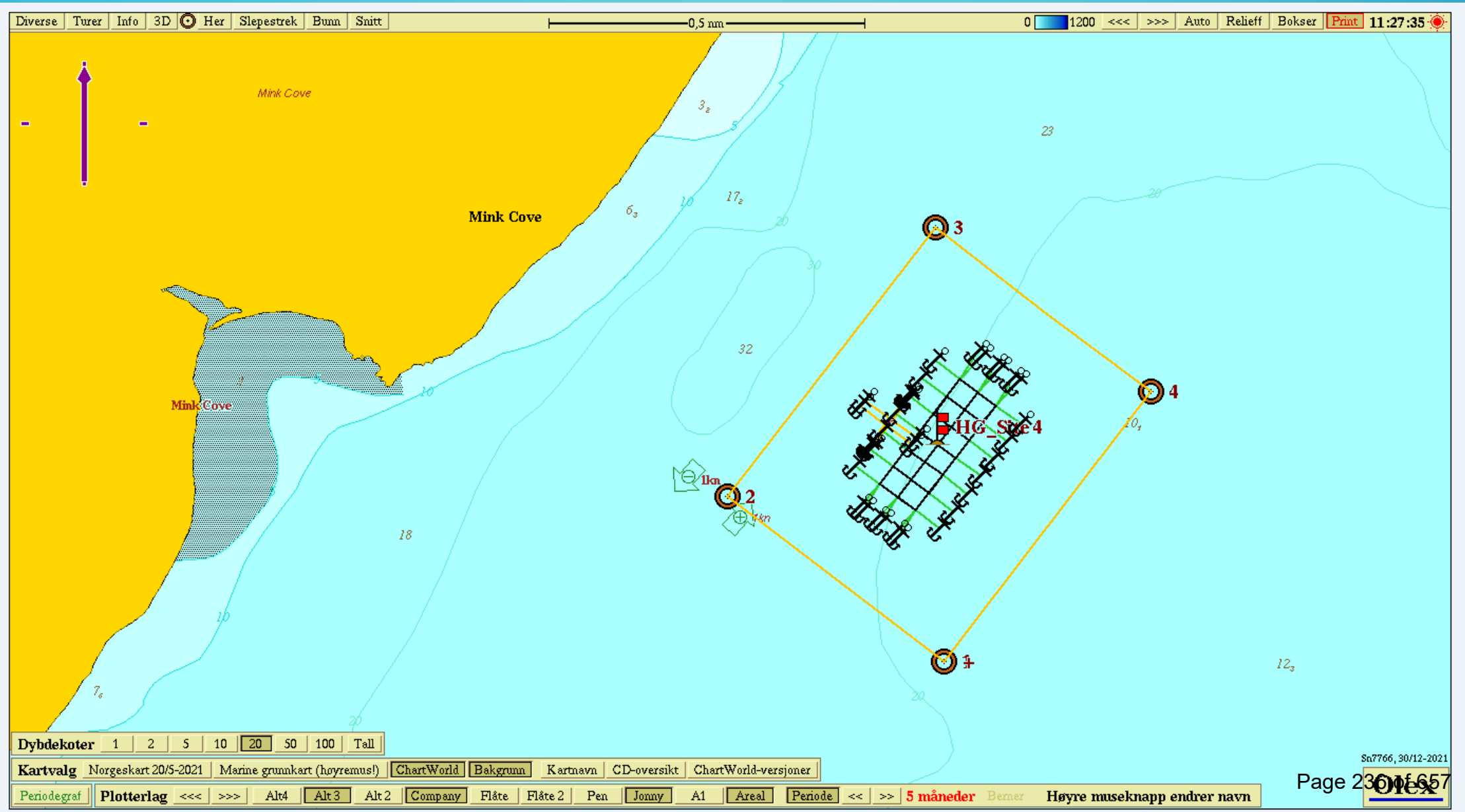
Overview - Site 1, 2, 3 and 4



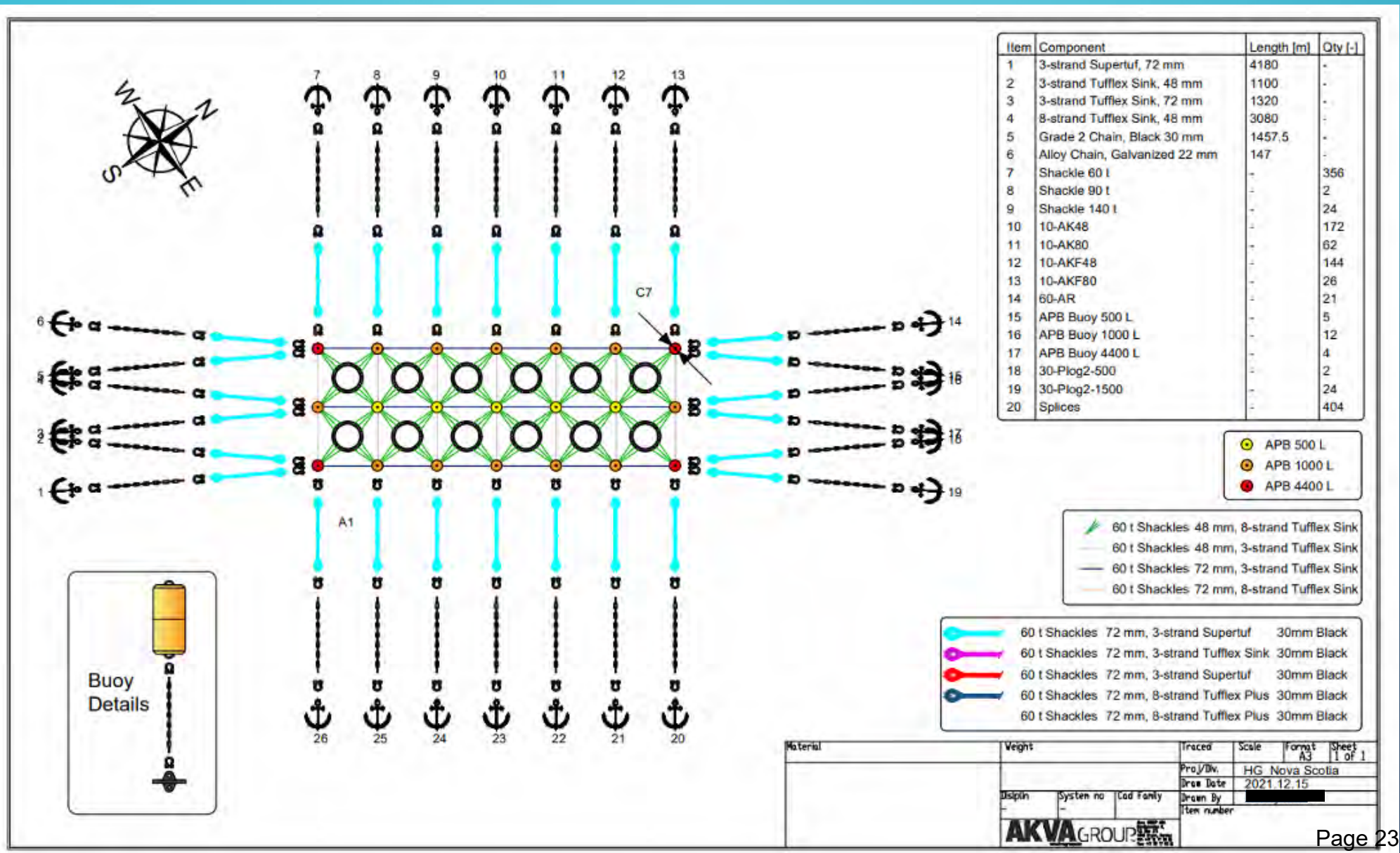
Overview - Site 1, 2, 3 and 4



Site 1: Overview



Site 1: Specifications



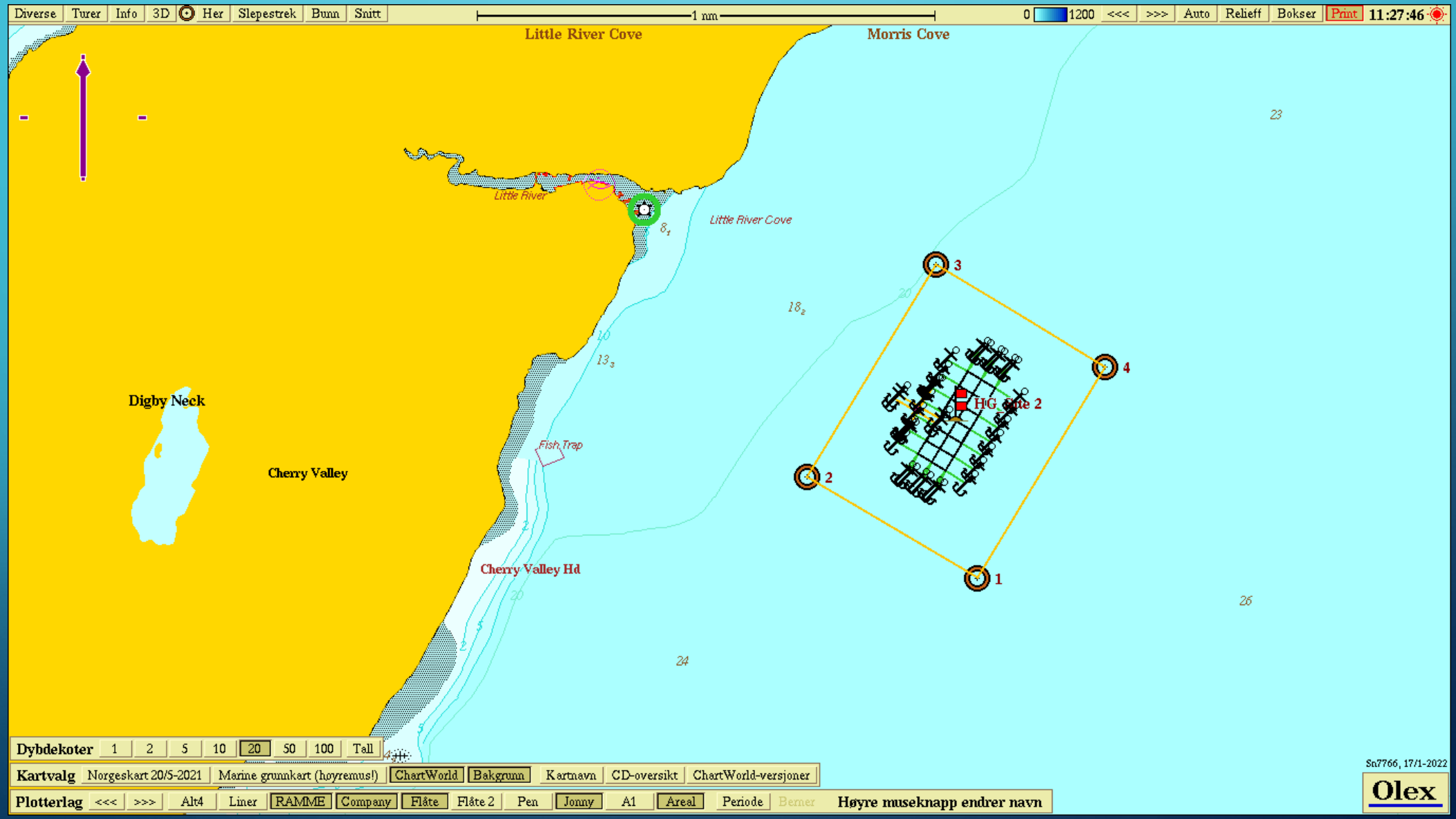
Item	Component	Length [m]	Qty [-]
1	3-strand Supertuf, 72 mm	4180	-
2	3-strand Tufflex Sink, 48 mm	1100	-
3	3-strand Tufflex Sink, 72 mm	1320	-
4	8-strand Tufflex Sink, 48 mm	3080	-
5	Grade 2 Chain, Black 30 mm	1457.5	-
6	Alloy Chain, Galvanized 22 mm	147	-
7	Shackle 60 t	-	356
8	Shackle 90 t	-	2
9	Shackle 140 t	-	24
10	10-AK48	-	172
11	10-AK80	-	62
12	10-AKF48	-	144
13	10-AKF80	-	26
14	60-AR	-	21
15	APB Buoy 500 L	-	5
16	APB Buoy 1000 L	-	12
17	APB Buoy 4400 L	-	4
18	30-Plog2-500	-	2
19	30-Plog2-1500	-	24
20	Splices	-	404

Site 1: Coordinates

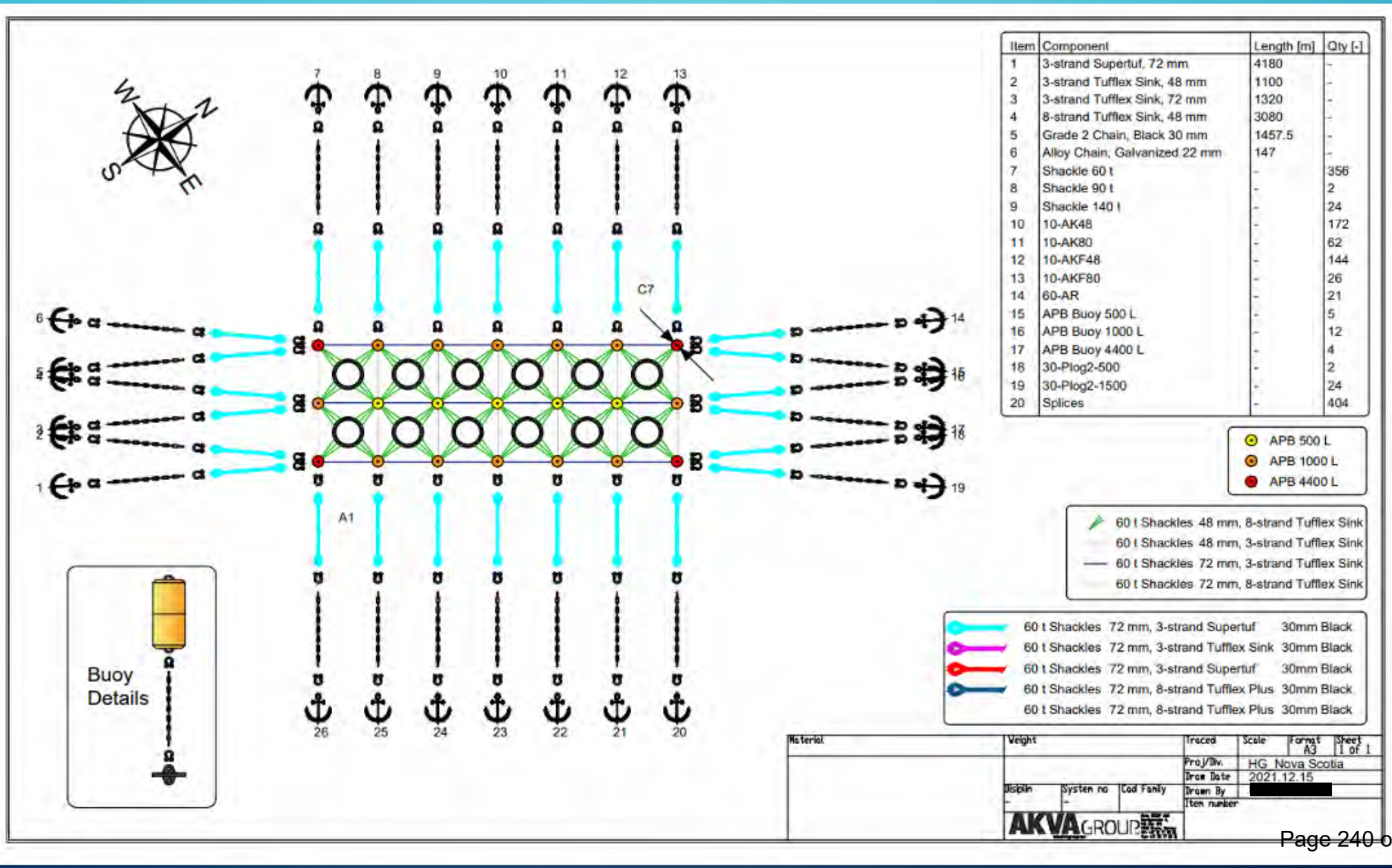
COORDINATES GRID								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint		44°27.677'	66°4.869'					
Corner	1	44°27.572'	66°4.918'	Farming Area	3	NW	44°28.026'	66°04.875'
	2	44°27.614'	66°4.997'		4	NE	44°27.762'	66°04.398'
	3	44°27.782'	66°4.820'		2	SW	44°27.595'	66°05.334'
	4	44°27.740'	66°4.741'		1	SE	44°27.328'	66°04.856'
1		44°27.572'	66°4.918'	44°27.530'	66°4.955'	16	212	22%
2		44°27.572'	66°4.918'	44°27.536'	66°4.964'	16	222	22%
3		44°27.593'	66°4.958'	44°27.552'	66°4.994'	16	212	22%
4		44°27.593'	66°4.958'	44°27.557'	66°5.004'	16	222	22%
5		44°27.614'	66°4.997'	44°27.573'	66°5.033'	16	212	22%
6		44°27.614'	66°4.997'	44°27.578'	66°5.043'	16	222	22%
7		44°27.614'	66°4.997'	44°27.643'	66°5.052'	16	307	22%
8		44°27.642'	66°4.967'	44°27.671'	66°5.022'	16	307	22%
9		44°27.670'	66°4.938'	44°27.699'	66°4.992'	16	307	22%
10		44°27.698'	66°4.908'	44°27.727'	66°4.963'	16	307	22%
11		44°27.726'	66°4.879'	44°27.756'	66°4.933'	16	307	22%
12		44°27.754'	66°4.849'	44°27.784'	66°4.904'	16	307	22%
13		44°27.782'	66°4.820'	44°27.812'	66°4.874'	16	307	22%
14		44°27.782'	66°4.820'	44°27.824'	66°4.783'	16	32	22%
15		44°27.782'	66°4.820'	44°27.818'	66°4.774'	16	42	22%
16		44°27.761'	66°4.780'	44°27.802'	66°4.744'	16	32	22%
17		44°27.761'	66°4.780'	44°27.797'	66°4.734'	16	42	22%
18		44°27.740'	66°4.741'	44°27.781'	66°4.705'	16	32	22%
19		44°27.740'	66°4.741'	44°27.776'	66°4.695'	16	42	22%
20		44°27.740'	66°4.741'	44°27.711'	66°4.686'	16	127	22%
21		44°27.712'	66°4.771'	44°27.683'	66°4.716'	16	127	22%
22		44°27.684'	66°4.800'	44°27.655'	66°4.746'	16	127	22%
23		44°27.656'	66°4.830'	44°27.627'	66°4.775'	16	127	22%
24		44°27.628'	66°4.859'	44°27.598'	66°4.805'	16	127	22%
25		44°27.600'	66°4.889'	44°27.570'	66°4.834'	16	127	22%
26		44°27.572'	66°4.918'	44°27.542'	66°4.864'	16	127	22%

COORDINATES BARGE								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint								
Corner	1	44°27.706'	66°4.979'	Farming Area	3	NW	44°28.026'	66°04.875'
	2	44°27.715'	66°4.969'		4	NE	44°27.762'	66°04.398'
	3	44°27.719'	66°4.975'		2	SW	44°27.595'	66°05.334'
	4	44°27.709'	66°4.986'		1	SE	44°27.328'	66°04.856'
1		44°27.706'	66°4.979'	44°27.673'	66°5.015'	16	212	22%
2		44°27.709'	66°4.986'	44°27.676'	66°5.021'	16	222	22%
3		44°27.709'	66°4.986'	44°27.738'	66°5.041'	16	212	22%
4		44°27.719'	66°4.975'	44°27.747'	66°5.030'	16	222	22%
5		44°27.719'	66°4.975'	44°27.755'	66°4.937'	16	212	22%
6		44°27.715'	66°4.969'	44°27.751'	66°4.933'	16	222	22%
7		44°27.715'	66°4.969'	44°27.687'	66°4.914'	16	307	22%
8		44°27.706'	66°4.979'	44°27.678'	66°4.925'	16	307	22%

Site 2: Overview



Site 2: Specifications



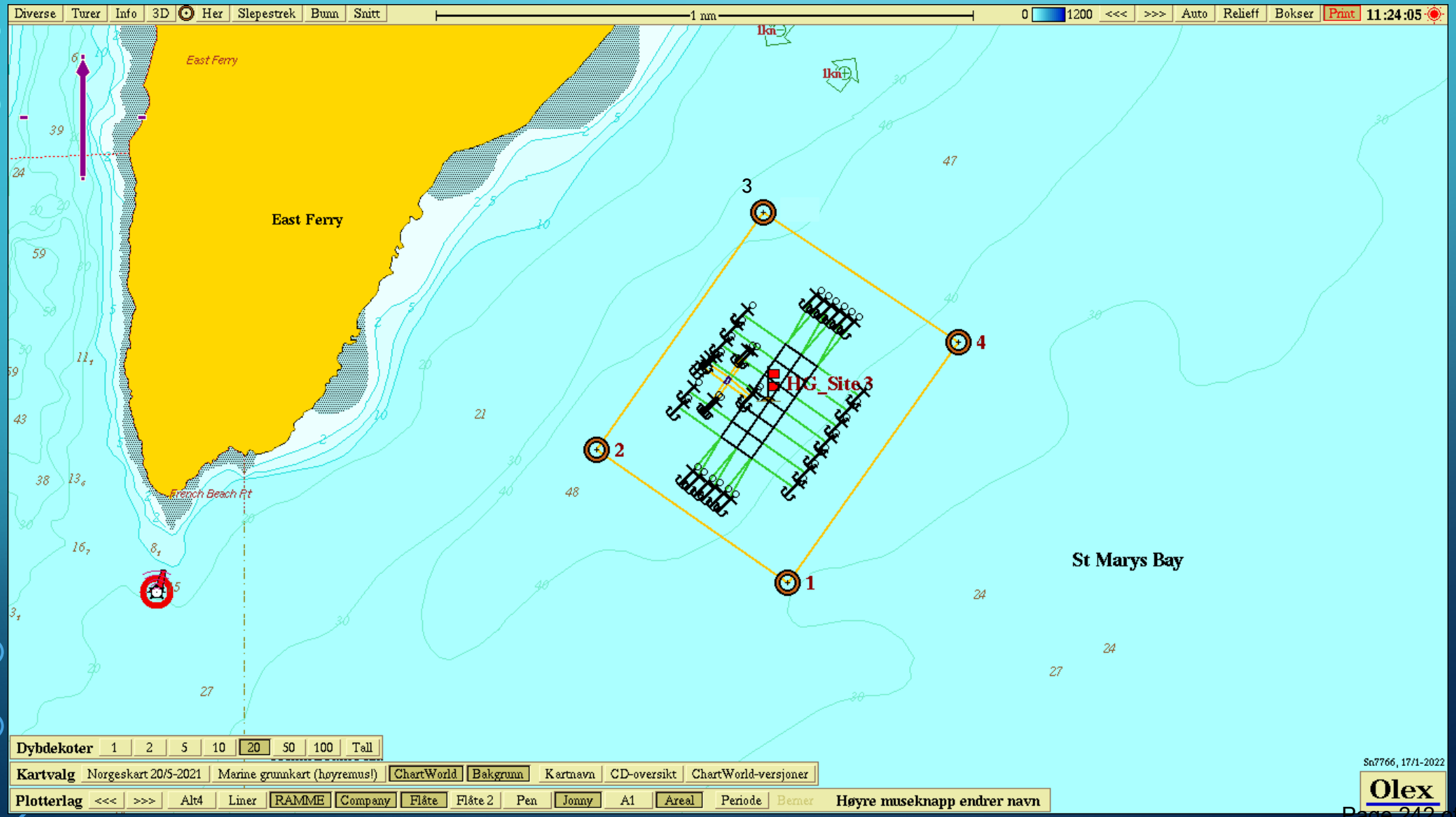
Item	Component	Length [m]	Qty [-]
1	3-strand Supertuf, 72 mm	4180	-
2	3-strand Tufflex Sink, 48 mm	1100	-
3	3-strand Tufflex Sink, 72 mm	1320	-
4	8-strand Tufflex Sink, 48 mm	3080	-
5	Grade 2 Chain, Black 30 mm	1457.5	-
6	Alloy Chain, Galvanized 22 mm	147	-
7	Shackle 60 t	-	356
8	Shackle 90 t	-	2
9	Shackle 140 t	-	24
10	10-AK48	-	172
11	10-AK80	-	62
12	10-AKF48	-	144
13	10-AKF80	-	26
14	60-AR	-	21
15	APB Buoy 500 L	-	5
16	APB Buoy 1000 L	-	12
17	APB Buoy 4400 L	-	4
18	30-Plog2-500	-	2
19	30-Plog2-1500	-	24
20	Splices	-	404

Site 2: Coordinates

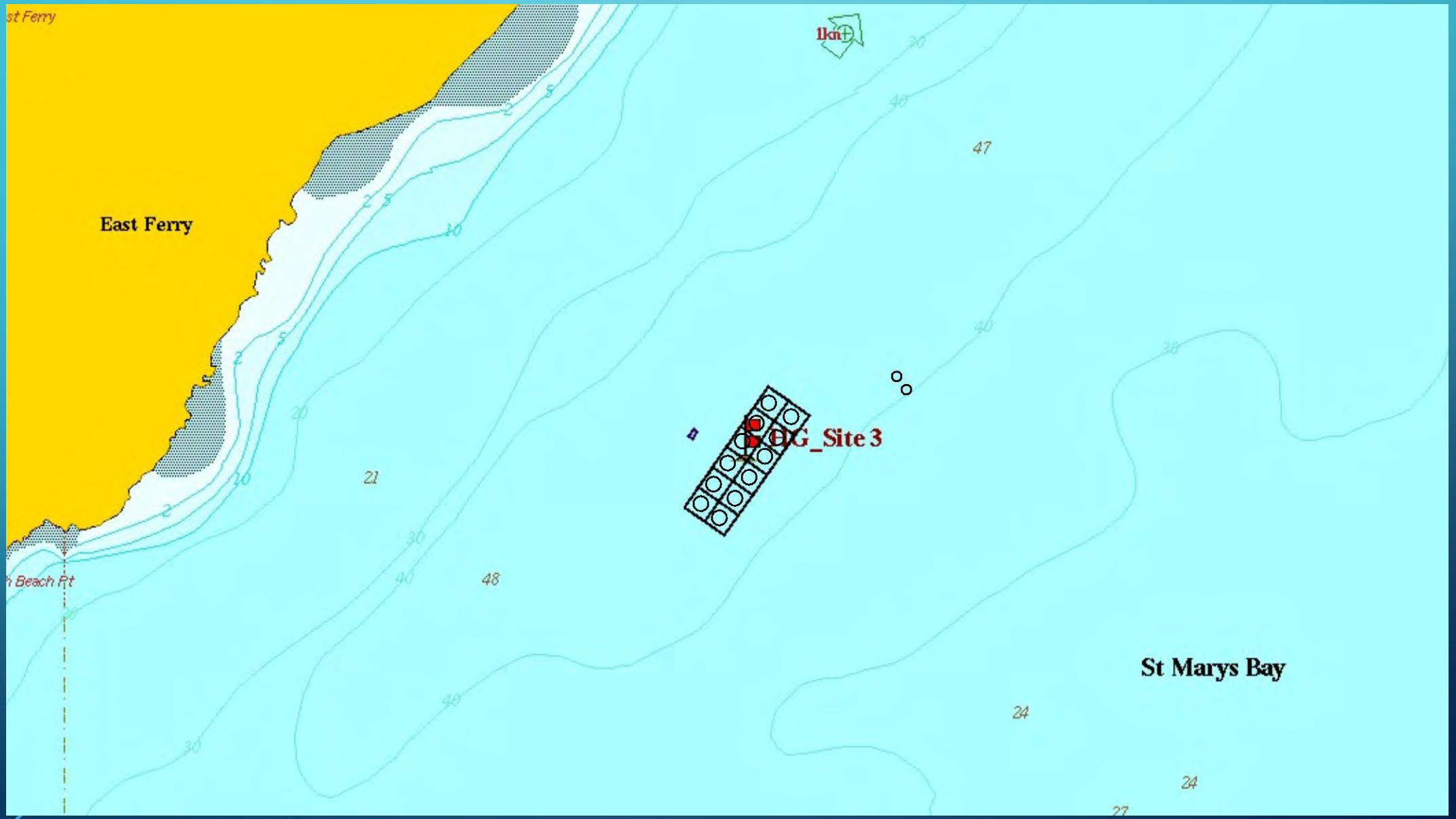
COORDINATES GRID								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line-ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint		44°26.164'	66°6.792'					
Corner	1	44°26.056'	66°6.826'	Farming Area	3	NW	44°26.505'	66°06.854'
	2	44°26.092'	66°6.910'		4	NE	44°26.281'	66°06.338'
	3	44°26.272'	66°6.758'		2	SW	44°26.043'	66°07.246'
	4	44°26.236'	66°6.674'		1	SE	44°25.821'	66°06.728'
1		44°26.056'	66°6.826'	44°26.009'	66°6.858'	18	206	23%
2		44°26.056'	66°6.826'	44°26.014'	66°6.869'	18	216	23%
3		44°26.074'	66°6.868'	44°26.027'	66°6.900'	18	206	23%
4		44°26.074'	66°6.868'	44°26.032'	66°6.911'	18	216	23%
5		44°26.092'	66°6.910'	44°26.045'	66°6.942'	18	206	23%
6		44°26.092'	66°6.910'	44°26.050'	66°6.953'	18	216	23%
7		44°26.092'	66°6.910'	44°26.119'	66°6.973'	18	301	23%
8		44°26.122'	66°6.885'	44°26.149'	66°6.947'	18	301	23%
9		44°26.152'	66°6.859'	44°26.179'	66°6.922'	18	301	23%
10		44°26.182'	66°6.834'	44°26.209'	66°6.897'	18	301	23%
11		44°26.212'	66°6.809'	44°26.239'	66°6.871'	18	301	23%
12		44°26.242'	66°6.784'	44°26.269'	66°6.846'	18	301	23%
13		44°26.272'	66°6.758'	44°26.299'	66°6.821'	18	301	23%
14		44°26.272'	66°6.758'	44°26.319'	66°6.726'	18	26	23%
15		44°26.272'	66°6.758'	44°26.314'	66°6.715'	18	36	23%
16		44°26.254'	66°6.716'	44°26.301'	66°6.684'	18	26	23%
17		44°26.254'	66°6.716'	44°26.296'	66°6.673'	18	36	23%
18		44°26.236'	66°6.674'	44°26.283'	66°6.642'	18	26	23%
19		44°26.236'	66°6.674'	44°26.278'	66°6.631'	18	36	23%
20		44°26.236'	66°6.674'	44°26.209'	66°6.611'	18	121	23%
21		44°26.206'	66°6.699'	44°26.179'	66°6.637'	18	121	23%
22		44°26.176'	66°6.725'	44°26.149'	66°6.662'	18	121	23%
23		44°26.146'	66°6.750'	44°26.119'	66°6.687'	18	121	23%
24		44°26.116'	66°6.775'	44°26.089'	66°6.713'	18	121	23%
25		44°26.086'	66°6.800'	44°26.059'	66°6.738'	18	121	23%
26		44°26.056'	66°6.826'	44°26.029'	66°6.763'	18	121	23%

COORDINATES BARGE								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line-ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint								
Corner	1	44°26.184'	66°6.910'	Farming Area	3	NW	44°26.505'	66°06.854'
	2	44°26.193'	66°6.902'		4	NE	44°26.281'	66°06.338'
	3	44°26.196'	66°6.909'		2	SW	44°26.043'	66°07.246'
	4	44°26.187'	66°6.917'		1	SE	44°25.821'	66°06.728'
1		44°26.184'	66°6.910'	44°26.142'	66°6.946'	18	206	23%
2		44°26.187'	66°6.917'	44°26.145'	66°6.954'	18	216	23%
3		44°26.187'	66°6.917'	44°26.213'	66°6.980'	18	206	23%
4		44°26.196'	66°6.909'	44°26.222'	66°6.972'	18	216	23%
5		44°26.196'	66°6.909'	44°26.045'	66°6.942'	18	206	23%
6		44°26.193'	66°6.902'	44°26.239'	66°6.864'	18	216	23%
7		44°26.193'	66°6.902'	44°26.168'	66°6.841'	18	301	23%
8		44°26.184'	66°6.910'	44°26.158'	66°6.849'	18	301	23%

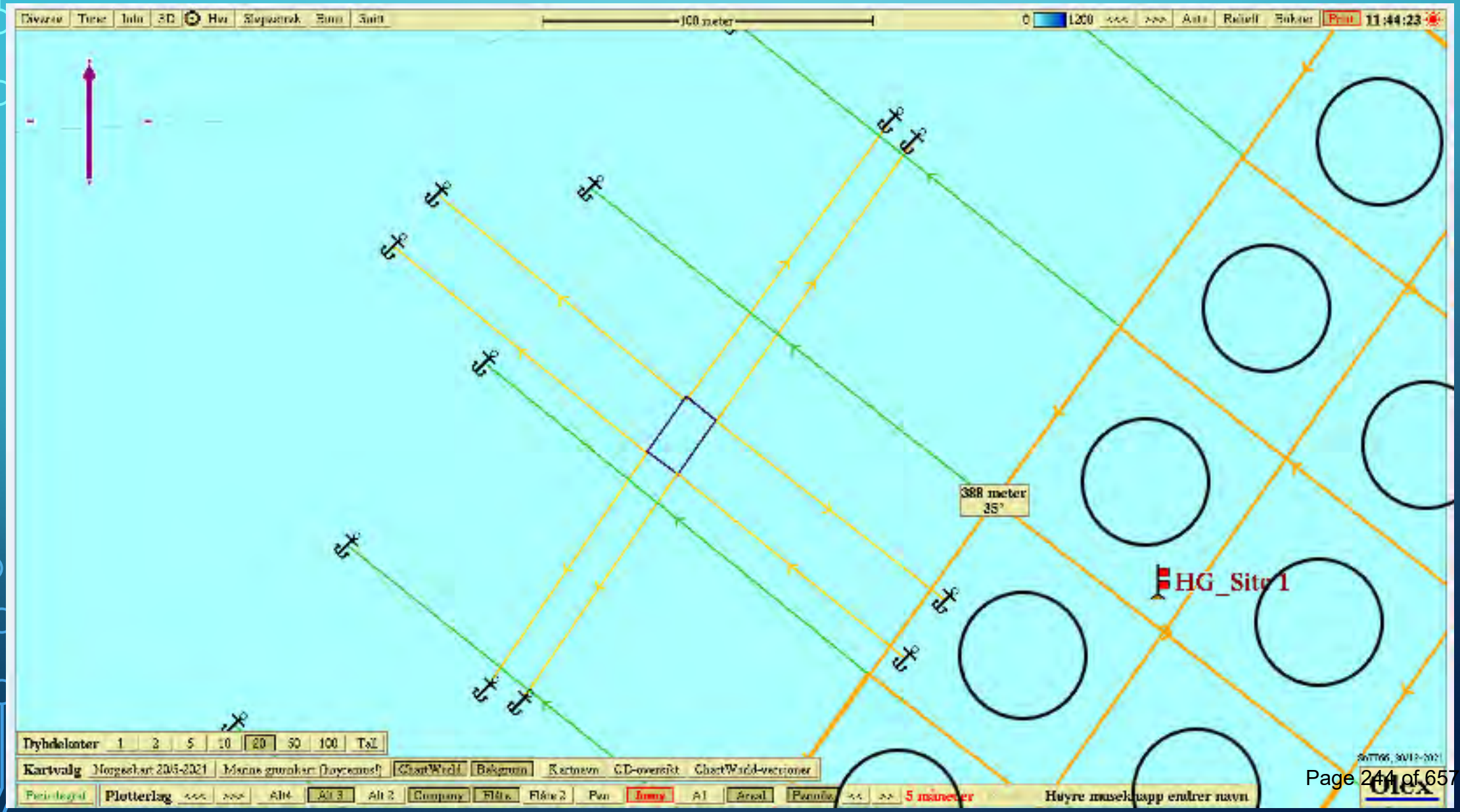
Site 3 - Overview



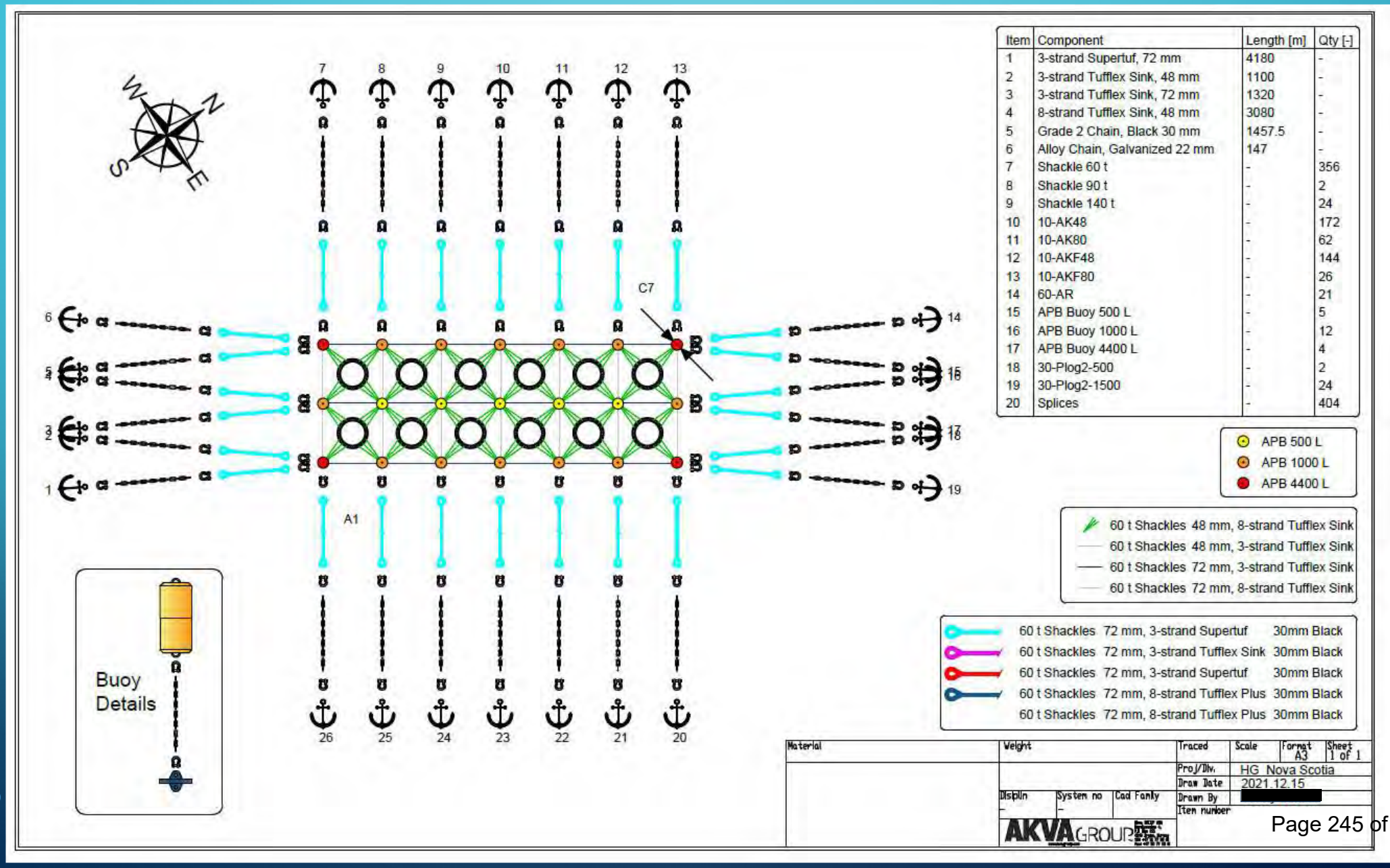
Site 3 - Overview



Site 3 – Details anchoring system



Site 3: Specfications



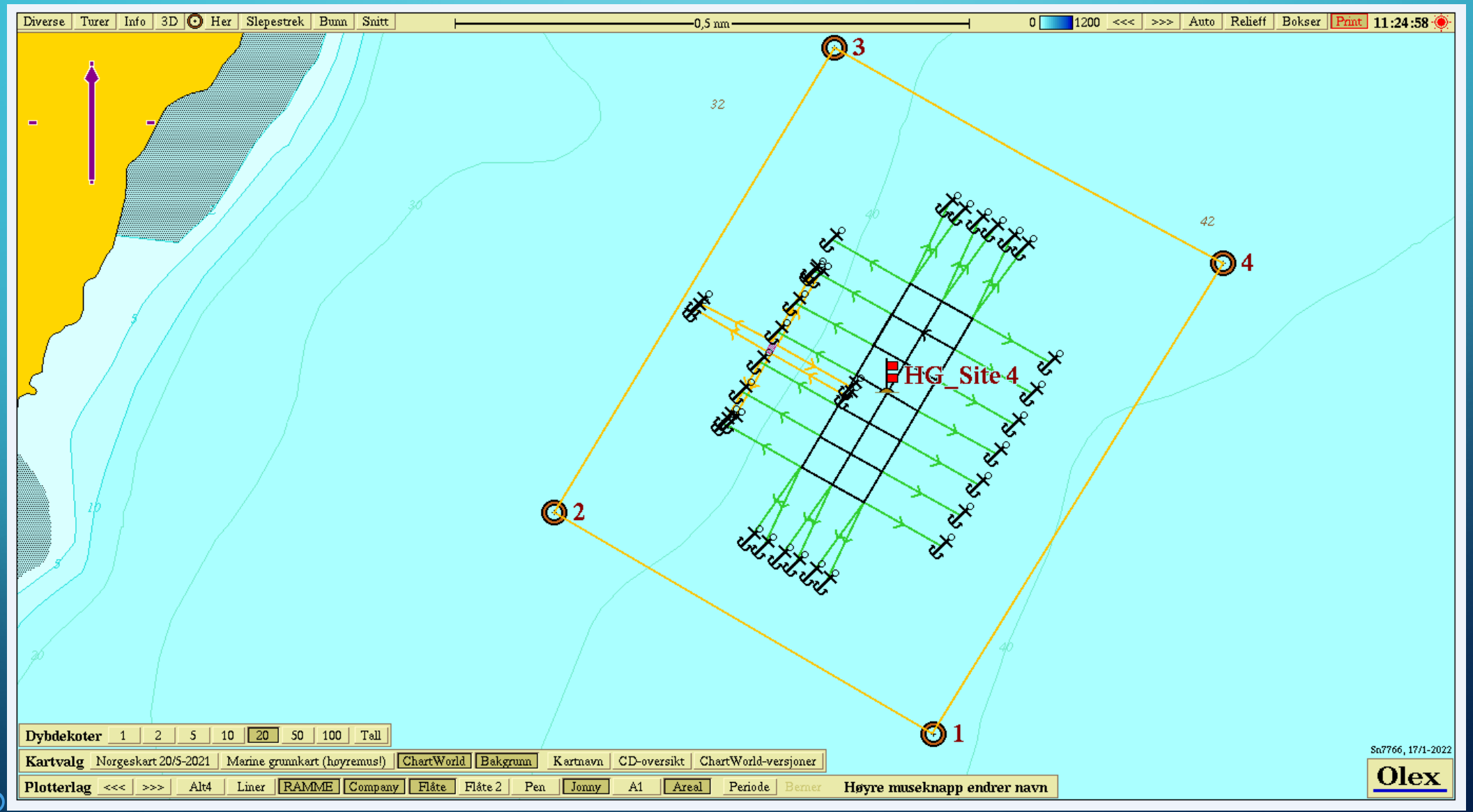
Item	Component	Length [m]	Qty [-]
1	3-strand Supertuf, 72 mm	4180	-
2	3-strand Tufflex Sink, 48 mm	1100	-
3	3-strand Tufflex Sink, 72 mm	1320	-
4	8-strand Tufflex Sink, 48 mm	3080	-
5	Grade 2 Chain, Black 30 mm	1457.5	-
6	Alloy Chain, Galvanized 22 mm	147	-
7	Shackle 60 t	-	356
8	Shackle 90 t	-	2
9	Shackle 140 t	-	24
10	10-AK48	-	172
11	10-AK80	-	62
12	10-AKF48	-	144
13	10-AKF80	-	26
14	60-AR	-	21
15	APB Buoy 500 L	-	5
16	APB Buoy 1000 L	-	12
17	APB Buoy 4400 L	-	4
18	30-Plog2-500	-	2
19	30-Plog2-1500	-	24
20	Splices	-	404

Site 3: Coordinates

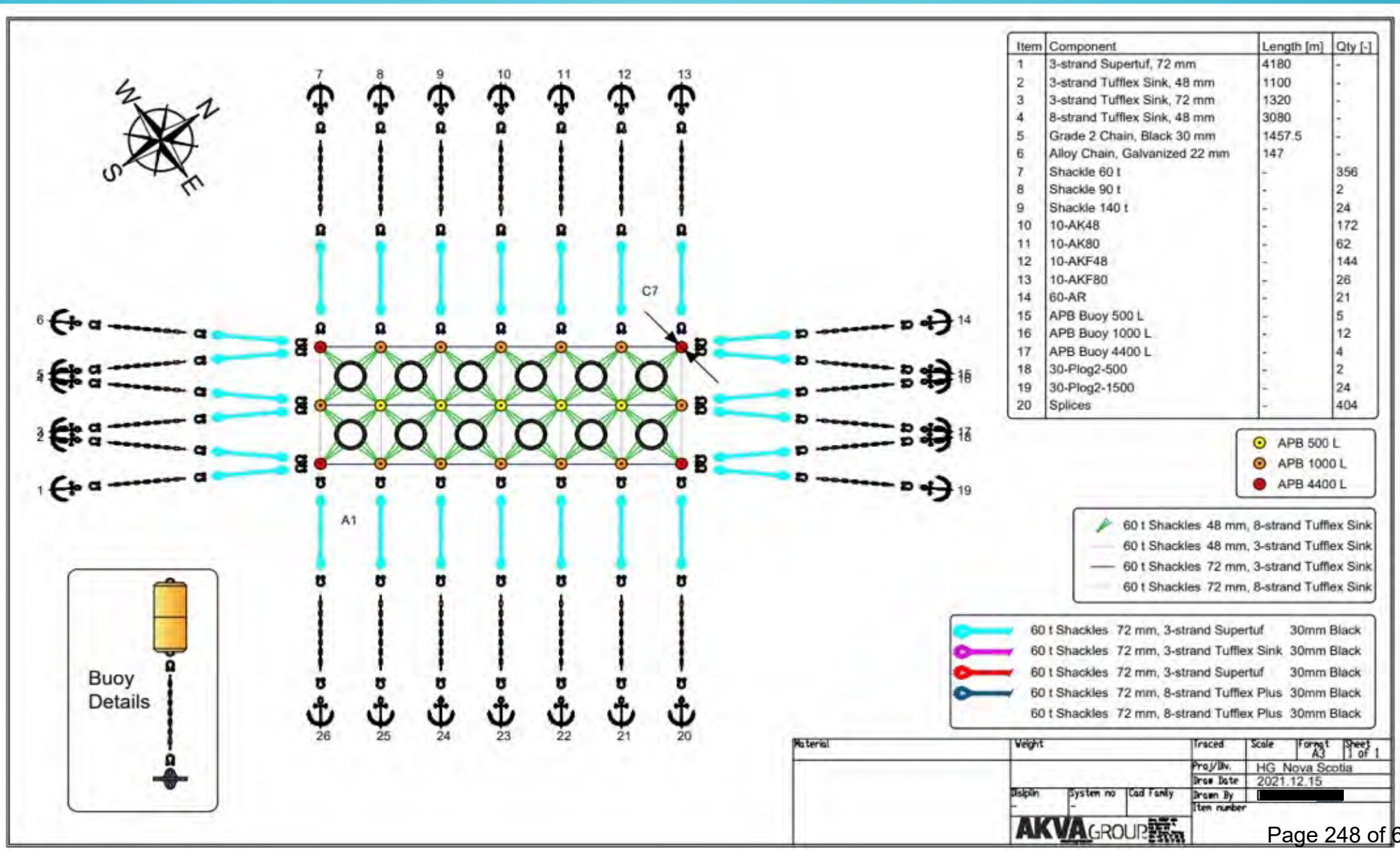
COORDINATES								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line- ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint		44°22.706'	66°10.605'					
Corner	1	44°22.600'	66°10.649'					
	2	44°22.640'	66°10.730'					
	3	44°22.812'	66°10.561'					
	4	44°22.772'	66°10.480'					
1		44°22.600'	66°10.649'	44°22.517'	66°10.716'	40	210	25 %
2		44°22.600'	66°10.649'	44°22.526'	66°10.735'	40	220	25 %
3		44°22.620'	66°10.689'	44°22.537'	66°10.756'	40	210	25 %
4		44°22.620'	66°10.689'	44°22.546'	66°10.776'	40	220	25 %
5		44°22.640'	66°10.730'	44°22.557'	66°10.797'	40	210	25 %
6		44°22.640'	66°10.730'	44°22.567'	66°10.816'	40	220	25 %
7		44°22.640'	66°10.730'	44°22.695'	66°10.839'	40	305	25 %
8		44°22.669'	66°10.701'	44°22.724'	66°10.811'	40	305	25 %
9		44°22.697'	66°10.673'	44°22.752'	66°10.783'	40	305	25 %
10		44°22.726'	66°10.645'	44°22.781'	66°10.755'	40	305	25 %
11		44°22.755'	66°10.617'	44°22.810'	66°10.727'	40	305	25 %
12		44°22.784'	66°10.589'	44°22.839'	66°10.699'	40	305	25 %
13		44°22.812'	66°10.561'	44°22.867'	66°10.671'	40	305	25 %
14		44°22.812'	66°10.561'	44°22.895'	66°10.494'	40	30	25 %
15		44°22.812'	66°10.561'	44°22.886'	66°10.475'	40	40	25 %
16		44°22.792'	66°10.521'	44°22.875'	66°10.454'	40	30	25 %
17		44°22.792'	66°10.521'	44°22.866'	66°10.434'	40	40	25 %
18		44°22.772'	66°10.480'	44°22.855'	66°10.413'	40	30	25 %
19		44°22.772'	66°10.480'	44°22.845'	66°10.394'	40	40	25 %
20		44°22.772'	66°10.480'	44°22.717'	66°10.371'	40	125	25 %
21		44°22.743'	66°10.509'	44°22.688'	66°10.399'	40	125	25 %
22		44°22.715'	66°10.537'	44°22.660'	66°10.427'	40	125	25 %
23		44°22.686'	66°10.565'	44°22.631'	66°10.455'	40	125	25 %
24		44°22.657'	66°10.593'	44°22.602'	66°10.483'	40	125	25 %
25		44°22.628'	66°10.621'	44°22.573'	66°10.511'	40	125	25 %
26		44°22.600'	66°10.649'	44°22.545'	66°10.539'	40	125	25 %

COORDINATES BARGE								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line- ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint								
Corner	1	44°22.738'	66°10.713'	Farming Area	3	NW	44°23.274'	66°10.412'
	2	44°22.742'	66°10.720'		4	NE	44°23.023'	66°09.924'
	3	44°23.750'	66°10.711'		2	SW	44°22.852'	66°10.852'
	4	44°22.747'	66°10.704'		1	SE	44°22.363'	66°10.363'
1		44°22.738'	66°10.713'	44°22.911'	66°10.537'	40	210	25 %
2		44°22.742'	66°10.720'	44°22.914'	66°10.545'	40	220	25 %
3		44°22.742'	66°10.720'	44°22.987'	66°10.566'	40	210	25 %
4		44°23.750'	66°10.711'	44°22.995'	66°10.556'	40	220	25 %
5		44°23.750'	66°10.711'	44°23.007'	66°10.453'	40	210	25 %
6		44°22.747'	66°10.704'	44°23.004'	66°10.448'	40	220	25 %
7		44°22.747'	66°10.704'	44°22.928'	66°10.440'	40	305	25 %
8		44°22.738'	66°10.713'	44°22.919'	66°10.449'	40	305	25 %

Site 4: Overview



Site 4: Spcifications

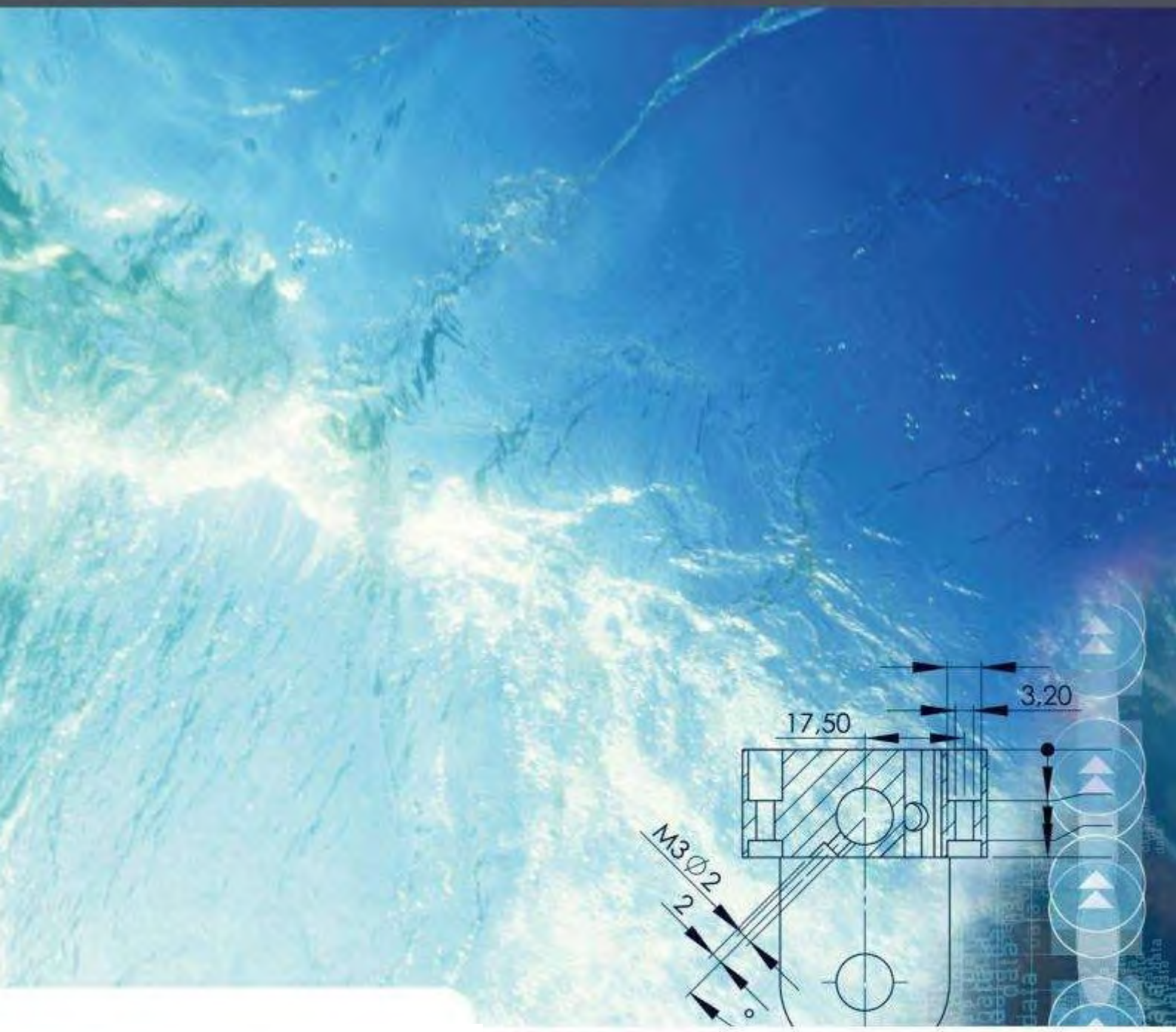


Item	Component	Length [m]	Qty [-]
1	3-strand Supertuf, 72 mm	4180	-
2	3-strand Tufflex Sink, 48 mm	1100	-
3	3-strand Tufflex Sink, 72 mm	1320	-
4	8-strand Tufflex Sink, 48 mm	3080	-
5	Grade 2 Chain, Black 30 mm	1457.5	-
6	Alloy Chain, Galvanized 22 mm	147	-
7	Shackle 60 t	-	356
8	Shackle 90 t	-	2
9	Shackle 140 t	-	24
10	10-AK48	-	172
11	10-AK80	-	62
12	10-AKF48	-	144
13	10-AKF80	-	26
14	60-AR	-	21
15	APB Buoy 500 L	-	5
16	APB Buoy 1000 L	-	12
17	APB Buoy 4400 L	-	4
18	30-Plog2-500	-	2
19	30-Plog2-1500	-	24
20	Splices	-	404

Site 4: Coordinates

COORDINATES								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint		44°19.606'	66°14.187'					
Corner	1	44°19.497'	66°14.218'	Farming Area	3	NW	44°19.950'	66°14.258'
	2	44°19.532'	66°14.303'		4	NE	44°19.735'	66°13.730'
	3	44°19.715'	66°14.156'		2	SW	44°19.486'	66°14.639'
	4	44°19.680'	66°14.071'		1	SE	44°19.266'	66°14.125'
1		44°19.497'	66°14.218'	44°19.418'	66°14.270'	40	205	27%
2		44°19.497'	66°14.218'	44°19.426'	66°14.288'	40	215	27%
3		44°19.515'	66°14.261'	44°19.435'	66°14.312'	40	205	27%
4		44°19.515'	66°14.261'	44°19.443'	66°14.331'	40	215	27%
5		44°19.532'	66°14.303'	44°19.453'	66°14.355'	40	205	27%
6		44°19.532'	66°14.303'	44°19.461'	66°14.373'	40	215	27%
7		44°19.532'	66°14.303'	44°19.576'	66°14.409'	40	300	27%
8		44°19.563'	66°14.278'	44°19.607'	66°14.385'	40	300	27%
9		44°19.593'	66°14.254'	44°19.637'	66°14.360'	40	300	27%
10		44°19.624'	66°14.229'	44°19.667'	66°14.336'	40	300	27%
11		44°19.654'	66°14.205'	44°19.698'	66°14.311'	40	300	27%
12		44°19.684'	66°14.180'	44°19.728'	66°14.287'	40	300	27%
13		44°19.715'	66°14.156'	44°19.759'	66°14.262'	40	300	27%
14		44°19.715'	66°14.156'	44°19.794'	66°14.104'	40	25	27%
15		44°19.715'	66°14.156'	44°19.786'	66°14.086'	40	35	27%
16		44°19.697'	66°14.113'	44°19.777'	66°14.062'	40	25	27%
17		44°19.697'	66°14.113'	44°19.769'	66°14.043'	40	35	27%
18		44°19.680'	66°14.071'	44°19.759'	66°14.019'	40	25	27%
19		44°19.680'	66°14.071'	44°19.751'	66°14.001'	40	35	27%
20		44°19.680'	66°14.071'	44°19.636'	66°13.965'	40	120	27%
21		44°19.649'	66°14.096'	44°19.605'	66°13.989'	40	120	27%
22		44°19.619'	66°14.120'	44°19.575'	66°14.014'	40	120	27%
23		44°19.588'	66°14.145'	44°19.545'	66°14.038'	40	120	27%
24		44°19.558'	66°14.169'	44°19.514'	66°14.063'	40	120	27%
25		44°19.528'	66°14.194'	44°19.484'	66°14.087'	40	120	27%
26		44°19.497'	66°14.218'	44°19.453'	66°14.112'	40	120	27%

COORDINATES								
Point/ Line		Coupling Plate		Mooring Point		Depth [m]:	Direction [°]:	Line ascent
		Latitude N	Latitude W	Latitude N	Latitude W			
Midpoint								
Corner	1	44°19.645'	66°14.343'	Farming Area	3	NW	44°19.950'	66°14.258'
	2	44°19.654'	66°14.336'		4	NE	44°19.735'	66°13.730'
	3	44°19.657'	66°14.343'		2	SW	44°19.486'	66°14.639'
	4	44°19.647'	66°14.350'		1	SE	44°19.266'	66°14.125'
1		44°19.645'	66°14.343'	44°19.578'	66°14.397'	40	205	27%
2		44°19.497'	66°14.218'	44°19.580'	66°14.404'	40	215	27%
3		44°19.515'	66°14.261'	44°19.689'	66°14.448'	40	205	27%
4		44°19.515'	66°14.261'	44°19.696'	66°14.441'	40	215	27%
5		44°19.532'	66°14.303'	44°19.724'	66°14.287'	40	205	27%
6		44°19.532'	66°14.303'	44°19.723'	66°14.279'	40	215	27%
7		44°19.532'	66°14.303'	44°19.611'	66°14.235'	40	300	27%
8		44°19.645'	66°14.343'	44°19.602'	66°14.241'	40	300	27%





Budget Quota Total farm

Haugland Group
Att: [redacted]

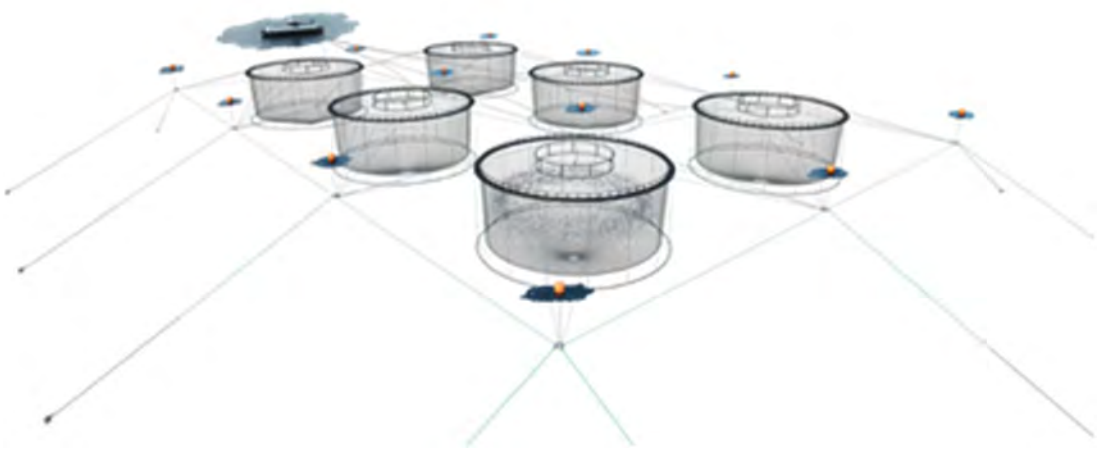
Site 1

Total Farm

From AKVAgroup
12. Desember, 2021

Scope of delivery:

1. AKVAGROUP.
2. Mooring grid 2x6 with Alfaring.
3. 120m Polarcirkel pen including net and bird net.
4. Budget quota Barge (appendix a)
5. Investment summary
6. Drawings and coordinates for the farm



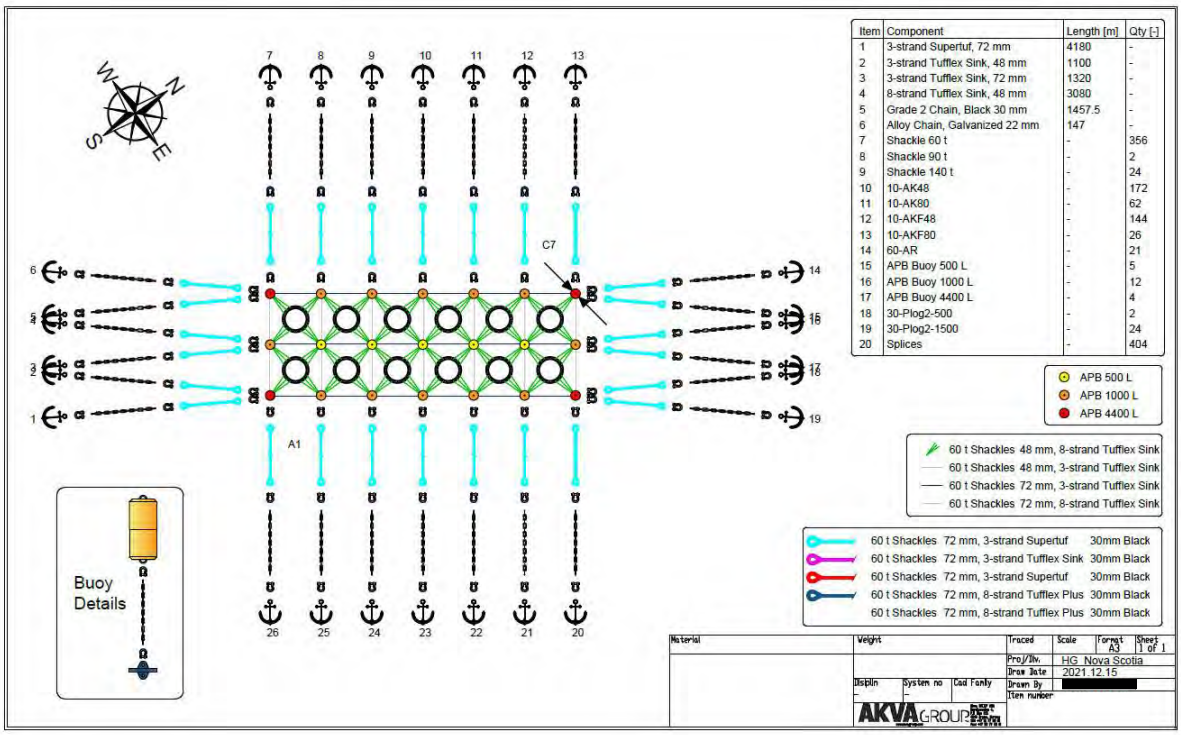
1. AKVA group ASA

AKVA group is present in all markets with offices in Norway, Chile, Denmark, Scotland, Spain, Greece, Iceland, Canada, Australia, and Turkey. AKVA group is a unique partner with the capability to offer both Sea based, and Land based aquaculture operations with complete technical solutions and service.

AKVA group is a global technology and service partner that deliver technology and services that helps solve biological challenges within the aquaculture industry. Good operational performance and fish welfare ensures sustainability and profitability for the customer. This is the premise for everything we deliver, from single components to services and complete installations. In-depth aquaculture knowledge, extensive experience and a high capacity for innovation characterizes and enables us to deliver the best solutions for both land based and sea based fish farming.

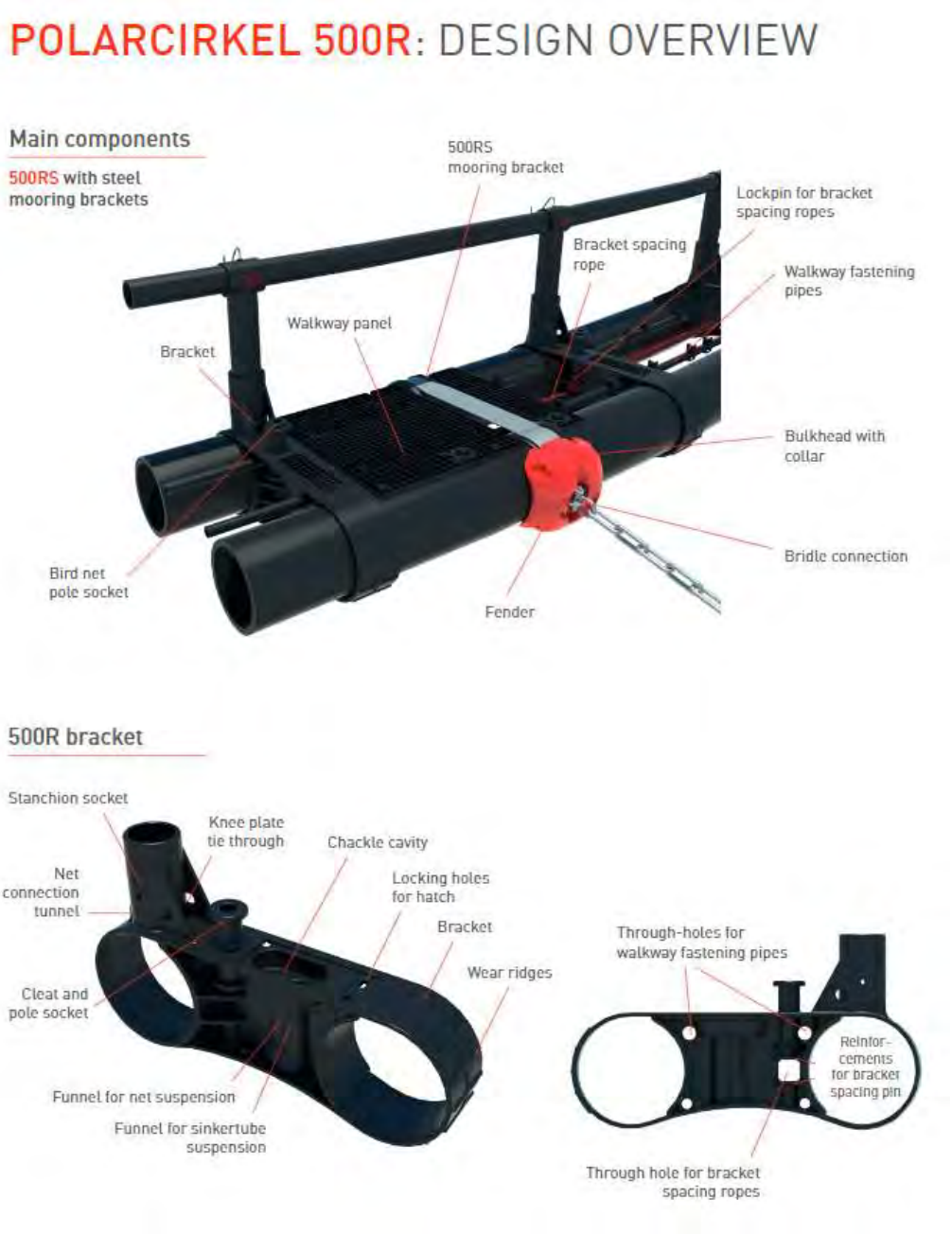
This quota is based on request from [redacted] per mail 22.11.2021.
Design and dimensions on the farm and equipment are based on information provided by costumer. Before making a final quota, analysis etc has to be performed.

2. Mooring grid 2x6 with Alfaring.

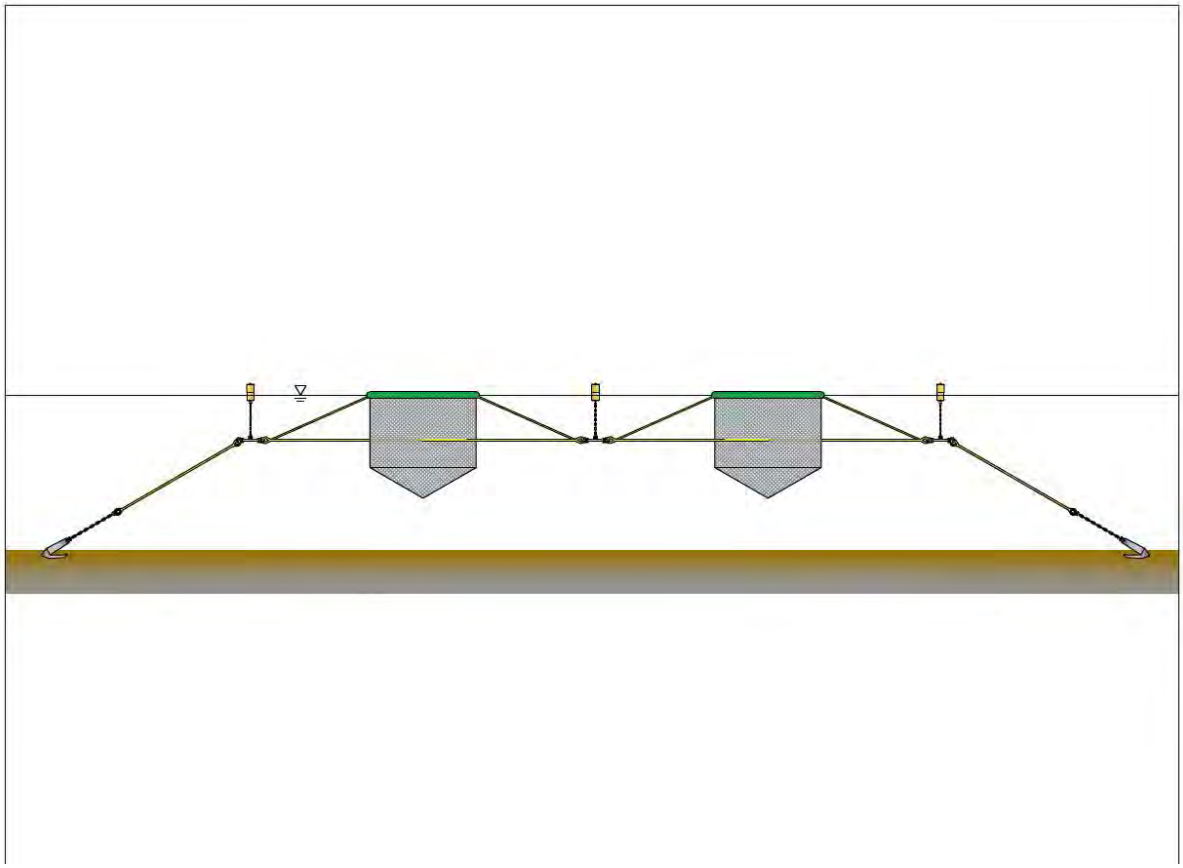


Product	Investment, NOK
Mooring grid 2x6 with Alfaring.	
Freight	
Installation	
Total investment, incl. transportation	

3. Polarcirkel pen including net and bird net.



Product	Investment, NOK
Polarcirkel 120m x 12	
Egersund ENC net 120m x 12	
Bird net with pole	
Freight	
Total investment, incl. transportation	



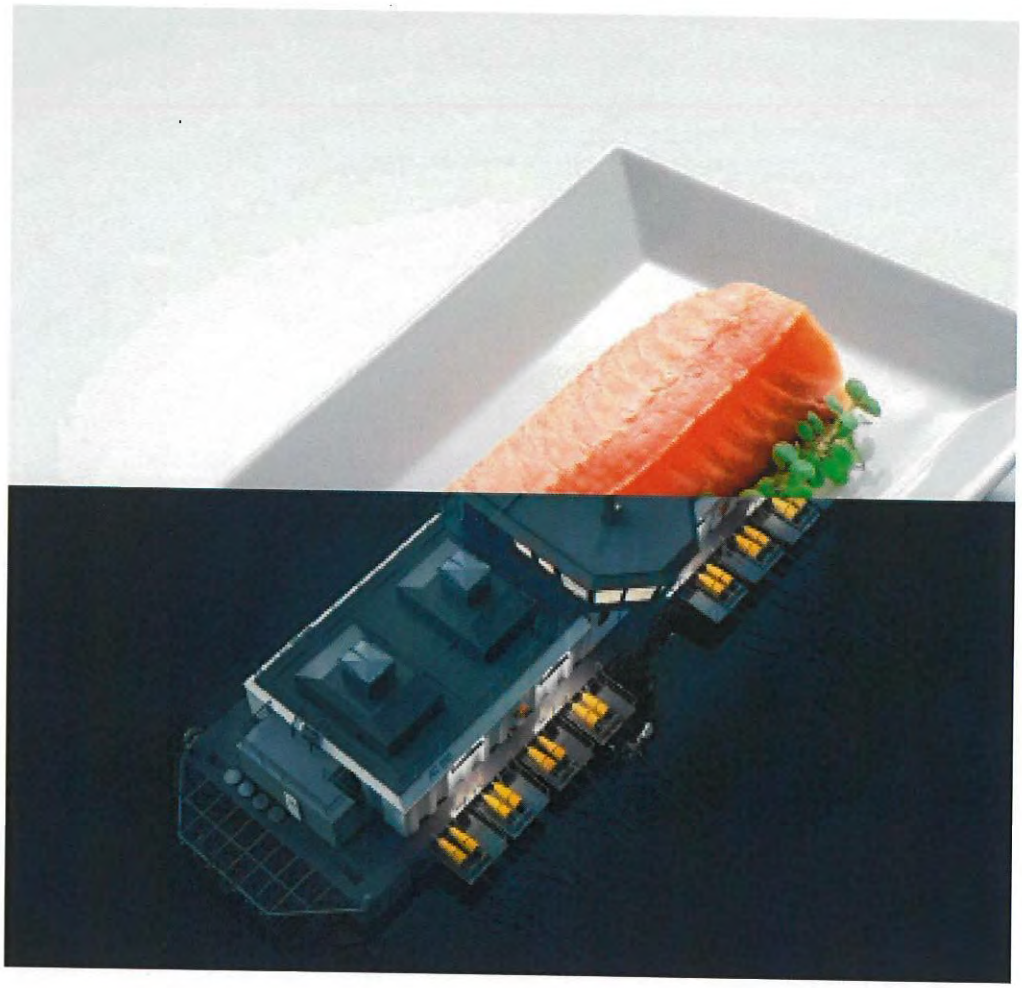
Best Regards
AKVA group ASA

[redacted]
Product sales manager Mooring

4.Budget quota Barge (appendix a)

See attached ***appendix a***

Haugland Group
AKVA Master AM 240 Classic Barge with Quattro Feeding System



Date:	December 15 th ,2021
Valid to:	December 31 th, 2021 (budget quote)
Written by:	[redacted]

17/12. 2[redacted]

Haugland Group

December 15, 2021

AKVA group - AKVAMaster 240 ton "Classic" Feed Barge.

AKVA Group is pleased to present the attached offer for the AKVA Master AM 240 feed barge. In addition to its inherent stability and dependability, we believe that this barge provides Haugland Group & Group & Aquaculture with an excellent foundation on which to build a state-of-the-art precision feed environment when coupled with our market-leading digital feeding solutions. AKVA barges are supported by our technical teams from around the world and locally by our experienced service team based in Saint George, New Brunswick.

First, let us highlight some of the features of the AKVA Master 240 barge that make our barge stand as a dependable system for all environmental conditions and improved efficacy:

- The AM 240 has an overall length of 21.50 m and a breadth of 10 m. This design creates a lower centre of gravity on the water which translates less motion on the sea leading to 2 significant benefits
    1. Lower motion makes the barge much safer and more comfortable for the employees to work on especially in events of high wave action
    2. The reduced motion will reduce the strain on feed pipes to the cages which will reduce the potential for pipes becoming kinked or even separated because of large wave action.
- Additional LOA provides an increased deck surface both at the front of the barge as well as at the stern of the barge. This allows for the storage of site items (seine nets, totes etc.). In addition, it can be used to store extra bags of feed in period of higher feed volumes.
- The barge comes with a pedestal for a crane included in the design, this will allow for the installation of a crane at a later stage without any requirement for mechanical modifications to the barge.
- All AKVA feed barges come with air intakes that have an installed "Wide ME Fog filter". It is our experience over many years of supply that one of the biggest culprits in the premature failure of electrical equipment in the barge is moisture in the way of sea spray and fog entering thru air intakes.

- Akva group has gained significant experience in the past two years on Transport Canada requirements related toGroup & Aquaculture barges in Canada. We have included a number of those learnings in the design for the barge quoted here.

<u>AKVA group Barges for Canadian market are built according to requirements of:</u>

Hull Design and Contraction according to requirements of *DNV GL rules: Ships (RU-SHIP) Pt.3, Pt.5 Ch.11 July 2019*;
Machinery and Piping Design and Construction and Outfitting according to *Part 4 Systems and components Chapter 6 Piping systems, DNVGL-RU-SHIP-Pt4Ch6.*
TIER I – POLICY ALTERNATIVE REQUIREMENTS FOR THE DESIGN.

Electrical Design and Construction and Outfitting according *to IEC60092 / 507 (small vessels, under 24m under 500GT).*

We welcome the opportunity to discuss any of these features in more detail as we truly believe that they set our barges as the standard of this workhorse class of barges.

<u>We have quoted the barges below from Vietnam Shipyard</u>

1. *AKVA – AM240 Feed Barge*



1.1 General Barge Specifications

Feed Capacity	:	240/270 Tons (6 silos).
Silo Capacity	:	40/45 Tons. (495 m^3)
LOA	:	21.50 m.
Breadth	:	10 m.
Hull Height	:	3.5 m.
Minimum Freeboard	:	1.065 m.

1.2 Hull Specifications

Bottom Plate Thickness	:	6mm
Deck Plate Thickness	:	6mm
Side Plate Thickness	:	6mm
Steel	:	RO (recogn. Org) Certified Steel Grade NV-A.
Welding	:	Certified welders. Non Destructive Test (NDT) will be performed.

1.3 Outfitting

Ensilage	:	Not included.
Crane	:	Not included, base installed.
Lunch Room	:	Area below control room as area for staff (appliances to be supplied by client)
Zinc Anodes	:	included.
Mooring Points	:	included
Antenna Mast	:	included.
Fenders	:	included (Port and starboard sides).
Doors	:	Marine quality watertight.
Windows	:	Marine quality watertight.
Railing Height	:	1000 mm

1.4 Support Systems

Freshwater System	:	included (2000 liters), 2 tanks in the bow.
Fuel System	:	included (23.5 m^3)
Bilge System	:	included- 2 pumps to achieve redundancy, manual manifold with suction pipes in each watertight compartment.

1.5 Paint Specifications

Color	:	According to Haugland Group & Aquaculture corporate color
Technical Specification	:	According with Paint Supplier Specifications (will be supplied on request)
Anti-skid silica sand	:	Applied to topcoats on all decks.
Metalization	:	Included, from waterline and upwards.
Additional	:	2 layers of antifouling paint over anticorrosive paint below waterline

1.6 Living Area

Control Room

Spec	:	Office desk and chair
Flooring	:	Laminated Flooring
Walls	:	Fibro
Roof	:	Insulated Plates 600mm x 600mm ceiling panels.

Toilet

Spec	:	Sink with H/C water, toilet
Flooring	:	Laminated Flooring.
Walls	:	Fibro
Roof	:	Insulated Plates 600mm x 600mm ceiling panels.

Heating	:	Panel heaters in all occupied spaces.
Insulation	:	Rockwool Marine Grade

1.7 Generator Set- configured to meet local requirements

Electrical standard	:	Approved to operate in North America.
Main Generator	:	2 x 99kW/124 kVA 416 Volt 3 Phase 60 Hz (MARINE GENERATOR).
Supplier	:	To be Determined
Silencer Cabinet	:	Not Included
Transformer	:	416v to 208/120v, 25.0 kVA included

1.8 Safety Equipment

Emergency Light	:	24V system
Life Rings	:	3 units
Fire extinguishers	:	5 units
Smoke detectors	:	included
Heat detectors	:	included
Firefighting system	:	included (1 pump/hose), Novec FIFI in engineroom.
Life-saving	:	included (1 pcs, Life raft 6 persons A pack), Included (3 pcs, liftBouy) Included (6 pcs, rocket parachute flare) Included (1 pcs, Rescue hook) Included (2 pcs, Buoyant smoke signal) Included (6 pcs, Lifejackets) Included (6 pcs, immersion suits) Included (1 pcs, Two-way vhf radiotlf)

1.9 Optional Equipment/Components for Barge (All pricing is in CAD)

- Manual plug injectors (4 lines)
- Bag splitter (per silo)
- Transformer* and cage light cabinet

[redacted]

*(75KVA 3-Phase 400V/230V 60HZ)

2. *AKVAmarina CCS 8 silo Quattro Feed System*

2.1 Feed System General Specifications



Number of Silos	:	6 units.
Number of Feeding Lines	:	4 units.
Size of Feed Lines	:	90mm.
Blowers	:	4 blowers KAESER **22KW** unsilenced
Feed Distribution	:	Doser
Selector Valves per line	:	4 x4L Selectors allowing connection of up to 4 feed lines per selector
Frequency Drives	:	Included in Control Cabinet.
Air Cooling Lines	:	Integrated into the hull of the barge.
PC	:	DELL or equivalent.
Monitor	:	Included
Printer	:	Included

Feeding Pipe 90mm : From selector valve to cage **(not included)**

2.2 Feed System General Features

- The system will be delivered with the latest version of AKVAConnect feeding software this platform allows continuous development of the system and improvements to be added.
- System is designed with capacity to give greater feeding flexibility and control allowing the system to feed on higher energy sites with time restrictions on feeding.
- Improved Feeding analysis output using Fishtalk Feeding which will be included in the supply.
- We have an extensive locally based service team with the additional ability to access technicians from Chile, Norway and Australasia as required.
- Integration to Cameras and Sensor systems

2.3 Optional Equipment/Components for Feed System

- **Air Monitoring Units (for 4 feed lines)** **CAD** [redacted]

2.4 Installation

Installation of HDPE piping to the cages is not included, however included in the quoted price is the startup and commissioning of the feeding system. This commissioning will include the training of operator(s) to run the equipment on a day-to-day basis. Initial Start-up must be performed by AKVA for the warranty to be valid.

NOTE: All start-up and other work to be performed at the farm site are quoted based on the planned work being performed on one trip without delays. This means that the customer must be well prepared and that all agreed to preparations are done prior to the arrival of the technician. Such preparations typically include: barge and cages being moored in their final position, fuel tank filled and feeding pipes installed. Farm staff must be on hand for training. Failure to comply with this could result in extra expenses and the postponement of startup.

3. *Price*

3.1 Barge Pricing- AM240 Classic barge with Quattro Line feed system

(unit prices are based on an agreed purchase/ delivery of three AM240 barges in Canada)

Vietnam: EXW from yard (Incoterms 2020) [redacted]

*All pricing is Ex (not included): VAT and all local taxes, also import taxes, all cost related to transports, cost related changes in regulation occuring after sign of contract.

3.2 Lead Time – Available from yard approximatly (EXW) 7-8 months from signing of contract (end of contract validity period -Dec 30th 2021). Actual lead time will be confirmed at confirmation of order.

3.3 Freight - AKVA group offers to Haugland Group an proposal in regard to the freight costs plus an administration fee to help ship the barges to destination from the shipyard in Vietnam. This will allow for the best possible freight costs to be determined at the time of the order/shippment. Costs will include applicable taxes / duties.

3.4 Exchange Rate Fluctuation

This price is based on a NOK/CAD exchange rate of 6.90, NOK/EUR 10.0 , NOK/USD 8.2 . Actual exchange rates will be applied at the time of an agreement.

Respectfully Submitted,

[redacted]
Regional Business Director
AKVA Group North America
[redacted]

This quote will be converted to a Sales Agreement when both parties initial each page and sign the agreement and each party receives an original copy of the document.

Agreement date:

per: **AKVA group NA**

[redacted]

Authorized representative (signature)
Printed name: [redacted]
Printed title: Regional Business Manager

Sign on behalf by [redacted] –
SVP – AKVA group ASA

[redacted]

Box 271 - N-4349 Bryne-Norway

per: **Haugland Group & Aquaculture**

Authorized representative (signature)
Printed name:
Printed title:

APPENDIX F: Outreach and Engagement Report

The following is a list of contacts Canadian Salmon Limited has engaged throughout the application process thus far:

- A.F. Theriault - [redacted]
- Comeau Seafood - [redacted]
- Cooke Aquaculture - [redacted]
- Benjamin Cleaveland - Mayor of Digby
- [redacted] -Yarmouth Seafood / O'Neil Fisheries
- Sea Crest Fisheries - [redacted]
- W.R. Murphy Fisheries - [redacted]
- P.F. Collins - [redacted]
- Bay Ferries - [redacted]
- David Tudor - Counselor Municipality of Digby
- Hon. Jill Balsar - MLA
- [redacted] - Sandy Cove
- Halifax Offshore Limited - [redacted]
- I. H. Mathers - [redacted]
- Aon - [redacted]
- Linda Gregory - Warden of Municipality of Digby
- Atlantic Towing - [redacted]
- Fisherman's Market - [redacted]
- Dartek Transport - [redacted]
- Tom Ossinger - CAO Town of Digby
- Mullen Smolt - [redacted]
- Long Beach Farms Limited - [redacted]
- North River Fish Farm - [redacted]
- Strickland farms - [redacted]
- AquaBounty - [redacted]
- Full Bay Scallop Association - [redacted]
- Scotia Seafood - [redacted]
- Chris d'Entremont MP
- Acadia First Nation - Chief Debra Robinson and Band Officials, [redacted]
- Bear River First Nation - Chief Carol Dee Potter
- Annapolis Valley First Nation - Chief Gerald Toney

The engagement and outreach portion of this application is ongoing. CSL intends to participate in further discussion with the above listed contacts and host meetings with additional individuals listed below:

- United Fisheries Conservation Alliance - [redacted]
- Trevor Cunningham - Deputy Warden Municipality of Yarmouth
- Cold Water Lobster Association - [redacted]
- Terry Thibodeau - Development Officer Digby Municipality
- Digby Harbour Port Association - [redacted]
- Innovative Fisheries - [redacted]
- Synergy Seafoods - [redacted]n
- Oyster Farm - [redacted]
- Pam Doucet - Development Officer of Municipality of Clair
- Stephane Cyr - CAO Municipality of Claire
- Yvon LeBlanc - Warden of Municipality of Claire
- Maritime Fishermen's Union - [redacted]
- DB Kenney Fisheries - [redacted]
- Hazelton Fisheries - [redacted]

APPENDIX G: DSA Reports

Page 348: *Environmental Conditions Report – 3327832 Nova Scotia Limited – St. Mary's Bay*, DSA Ocean, 2021-10-18

Page 438: Canadian Salmon Limited Site Drawings – *3327832 Nova Scotia Limited – St. Mary's Bay*, DSA Ocean, 2022-02-16

Document Title	**Environmental Conditions Report – 3327832 Nova Scotia Limited – St. Mary's Bay**
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DSA project no.	HAUG-21SSR
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Pages (incl. cover)	90

Confidential

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Revision history

Revision	Date last revised	Summary of changes / Comments	Revisions by	Checked by	Approved for release by	Issued to / Distribution	Engineering review status (IFI / IFR / IFC)
A	2021-10-21	Draft report release for review	[redacted]	[redacted]	[redacted]	3327832 Nova Scotia Limited	IFR
B	2021-10-28	Mean current speeds and time series plots added as per client request	[redacted]	[redacted]	[redacted]	3327832 Nova Scotia Limited	IFR

Engineering review status acronyms
IFI – Issued for Information
IFR – Issued for Review
IFC – Issued for Construction

List of authors / reviewers

Initials	Name
[redacted]	[redacted]
[redacted]	

Executive summary

In support of 3327832 Nova Scotia Limited, the following report presents data on the seabed, current, wind, and wave conditions as well as temperature and ice conditions at the six potential finfish farms in St. Mary's Bay, Nova Scotia, Canada. As per NS9415 and the Scottish Technical Standard, a site survey is required which determines seabed/bathymetry at the site, and wind, wave and current conditions. This data is required to assess feasibility of farming at potential sites; it is also required for the analysis the mooring and anchoring system requirements for the systems installed on the site. In this report, information is presented for six potential site locations:

- Potential site 1: 44° 22.929'N, 66° 10.392'W
- Potential site 2: 44° 24.506'N, 66° 8.627'W
- Potential site 3: 44° 26.164'N, 66° 6.797'W
- Potential site 4: 44° 27.677'N, 66° 4.869'W
- Potential site 5: 44° 21.147'N, 66° 11.424'W
- Potential site 6: 44° 19.606'N, 66° 14.187'W



Figure 1 Potential sites within St Mary's Bay option area. Plus deployment locations of 3 ADCPs: ADCP #1: 44° 26.329'N, 66° 6.470'W, ADCP #2: 44° 23.135'N, 66° 10.136'W, ADCP #3: 44° 19.690'N, 66° 14.342'W. Option boundaries shown by a yellow line at the south and north of the area

To determine the wave field evolution at the St. Mary's Bay potential marine fish farm sites, and to determine sufficiently accurate 10- and 50- year return period wave data, near shore wave modelling was used. The software STWave was used to model the nearshore wave conditions; the model's predicted wave heights account for depth induced energy dissipation (bottom friction, breaking). Wind and wave source data were taken from the MSC50 HindCast model. One source point was located at the entrance to St. Mary's Bay and one source point was located in the outer Bay of Fundy. The extreme wave conditions at the potential leases are determined in part by propagating waves from the offshore hindcast model locations into the location of interest.

To support estimation the currents at the potential sites, 3 ADCP deployments were completed by the DSA Ocean team in St. Mary's Bay. In addition to the ADCP measurements, the tide regime was predicted in the region based on spatial flow modeling results for 1 year (calendar year 2020) with 10 minutes time interval.

Water temperature and ice conditions also investigated for each potential fish farm site location in St. Mary's Bay using the historical ERA5 data, 4 short-term data measurements which are publicly available in Nova Scotia Open Data Portal [5], and a long-term temperature data at the northern boundary of the St. Mary's Bay is measured using satellite data.

A summary of each site condition has provided as follows:

- Potential Site 1: The proposed site is located at 44° 22.929'N, 66° 10.392'W with the approximate water depth of 43m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.3m. Based on ADCP 1 measurements near the site location, the estimated 10- and 50-year current speeds at 10m water depth are 1.86m/s, and 2.09m/s, respectively. The estimated 10- and 50- year wave conditions are 1.97m and 2.24m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 2: The proposed site is located at 44° 24.506'N, 66° 8.627'W with the approximate water depth of 32m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.4m. Based on ADCP measurements at ADCP 1 and 2 locations, the estimated 10- and 50- year current speeds at 5m water depth are 1.75m/s, and 1.96m/s, respectively. The estimated 10- and 50- year wave conditions are 1.7m and 1.97m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 3: The proposed site is located at 44° 26.164'N, 66° 6.797'W with the approximate water depth of 23m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.4m. Based on ADCP 2 measurements near the site location, the estimated 10- and 50-year current speeds at 5m water depth are 1.66m/s, and 1.86m/s, respectively. The estimated 10- and

50- year wave conditions are 1.4m and 1.73m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 4: The proposed site is located at 44° 27.677'N, 66° 4.869'W with the approximate water depth of 21m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.4m. Based on ADCP measurements at ADCP 2 locations, the estimated 10- and 50- year current speeds at 5m water depth are 1.5m/s, and 1.68m/s, respectively. The estimated 10- and 50- year wave conditions are 1.28m and 1.62m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 5: The proposed site is located at 44° 21.147'N, 66° 11.424'W with the approximate water depth of 31m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.8m. Based on ADCP measurements at ADCP 1 and 3 locations, the estimated 10- and 50- year current speeds at 5m water depth are 2.5m/s, and 2.8m/s, respectively. The estimated 10- and 50- year wave conditions are 2.02m and 3.2m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 6: The proposed site is located at 44° 19.606'N, 66° 14.187'W with the approximate water depth of 43m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.8m. Based on ADCP 3 measurements near the site location, the estimated 10- and 50- year current speeds at 5m water depth are 3.11m/s, and 3.49m/s, respectively. The estimated 10- and 50- year wave conditions are 1.92m and 2.25m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

Based on provided environmental data, DSA Ocean recommends developing of potential sites 1, 2, 3, and 4 first. Since sites 5 and 6 are in a turbulent area have much stronger currents, it is likely that these sites should be developed after experience in the area has been developed with sites 1-4.

Contents

Revision history 2

List of authors / reviewers 2

Executive summary 3

Contents 6

Figures 7

Tables 9

1 Introduction 11

1.1 Overview 11

1.2 Objectives 13

2 Abbreviations and acronyms 13

3 Reference documents and drawings 13

4 Seabed information and bathymetry 14

4.1 Bathymetry 14

4.2 Seabed composition 17

5 Tidal Range 17

6 Current conditions 18

6.1 FVCom current modeling predictions 18

6.2 ADCP data 22

6.2.1 ADCP #1 26

6.2.2 ADCP #2 31

6.2.3 ADCP #3 35

7 Wind and wave conditions 40

7.1 Wave model setup 40

7.2 Boundary conditions – offshore wind and wave conditions 42

7.3 Wave modeling results 57

7.3.1 Wave/wind conditions for potential site 1 59

7.3.2 Wave/wind conditions for potential site 2 62

7.3.3 Wave/wind conditions for potential site 3 64

7.3.4 Wave/wind conditions for potential site 4 67

7.3.5 Wave/wind conditions for potential site 5 69

7.3.6 Wave/wind conditions for potential site 6 72

8 Water temperature 74

9 Ice potential 78

10 Discussion 80

Figures

Figure 1 Potential sites within St Mary's Bay option area. Plus deployment locations of 3 ADCPs: ADCP #1: 44° 26.329'N, 66° 6.470'W, ADCP #2: 44° 23.135'N, 66° 10.136'W, ADCP #3: 44° 19.690'N, 66° 14.342'W. Option boundaries shown by a yellow line at the south and north of the area 3

Figure 2: Potential fish farm site and ADCP locations at the St. Mary's Bay option area, Nova Scotia, Canada. Option boundaries shown by a yellow line at the south and north of the area 11

Figure 3: The St. Mary's Bay, Nova Scotia, Canada 12

Figure 4: Potential site 1 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 43 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m. 14

Figure 5: Potential site 2 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 32 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m. 15

Figure 6 Potential site 3 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 23 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m. 15

Figure 7: Potential site 4 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 21 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m. 16

Figure 8: Potential site 5 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 31 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m. 16

Figure 9 Potential site 6 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 43 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m. 17

Figure 10 Surface flood speed at the St.Mary's Bay 19

Figure 11 Depth averaged flood speed at the St.Mary's Bay 20

Figure 12 Surface ebb speed at the St.Mary's Bay 21

Figure 13 Depth averaged ebb speed at the St.Mary's Bay 22

Figure 14: Deployment locations of 3 ADCPs in St. Mary's Bay option area, Nova Scotia, Canada 23

Figure 15 A picture of single float ADCP with subsurface moorings at the deployment location. The single float system used for ADCP 1 and 2 24

Figure 16 A picture of dual float ADCP with subsurface moorings at the deployment location. The dual float system used for ADCP 3 25
Figure 17 ADCP 3 during deployment 26
Figure 18 Scatter plot of current speed vs direction at ADCP 1 location - 10m water depth 27
Figure 19 Frequency plot of current direction at ADCP 1 location - 10m Water depth 28
Figure 20 A sample time series plot of current speeds at ADCP 1 location - 10m Water depth 28
Figure 21 Scatter plot of current speed vs direction at ADCP 1 location - 15m water depth 29
Figure 22 Frequency plot of current direction at ADCP 1 location - 15m Water depth 29
Figure 23 A sample time series plot of current speeds at ADCP 1 location - 15m Water depth 30
Figure 24 Scatter plot of current speed vs direction at ADCP 2 location - 5m water depth 32
Figure 25 Frequency plot of current direction at ADCP 2 location - 5m Water depth 32
Figure 26 A sample time series plot of current speeds at ADCP 2 location - 5m Water depth 33
Figure 27 Scatter plot of current speed vs direction at ADCP 2 location - 15m water depth 33
Figure 28 Frequency plot of current direction at ADCP 2 location - 15m Water depth 34
Figure 29 A sample time series plot of current speeds at ADCP 2 location - 15m Water depth 34
Figure 30 Scatter plot of current speed vs direction at ADCP 3 location - 5m water depth 36
Figure 31 Frequency plot of current direction at ADCP 3 location - 5m Water depth 36
Figure 32 A sample time series plot of current speeds at ADCP 3 location - 5m Water depth 37
Figure 33 Scatter plot of current speed vs direction at ADCP 3 location - 15m water depth 37
Figure 34 Frequency plot of current direction at ADCP 3 location - 15m Water depth 38
Figure 35 A sample time series plot of current speeds at ADCP 3 location - 15m Water depth 38
Figure 36 Bathymetry at site on hydrographic charts- Depth reported in meters 40
Figure 37 Bathymetry at site on STWave. Note the MSC50 HindCast model source point 1 indicated at 44° 6.000'N, 66° 18.001'W and source point 2 indicated at 44° 24.000'N, 66° 24.001'W 42
Figure 38 Wave height versus wave direction plot for the source point 1 43
Figure 39 Wave height versus wave direction plot for the source point 2 43
Figure 40 Wind speed versus wind direction plot for the source point 1 44
Figure 41 Wind speed versus wind direction plot for the source point 2 44
Figure 42: Extreme value analysis on wind data – for Source Point 1 offshore location [1] 47
Figure 43: Extreme value analysis on wind data – for Source Point 2 offshore location [1] 49
Figure 44: Extreme value analysis on wave data – for Source Point 1 offshore location [1] 51
Figure 45: Extreme value analysis on wave data – for Source Point 2 offshore location [1] 53
Figure 46 Maximum wind speed at 10 year return period and direction [from]- for Source Points offshore location [1] 54
Figure 47 Maximum wind speed at 50 year return period and direction [from]- for Source Points offshore location [1] 55
Figure 48 Maximum wave height at 10 year return period and direction [from]- for Source Points offshore location [1] 55
Figure 49 Maximum wave height at 50 year return period and direction [from]- for Source Points offshore location [1] 56
Figure 50 Wave modeling results at St. Mary's Bay for direction [From] 180 deg- S 58

Figure 51 Wave modeling results at St. Mary's Bay for direction [From] 203 deg- SW 59
Figure 52: Maximum wave height at 10- year return period and direction [from]- potential site 1 61
Figure 53: Maximum wave height at 50- year return period and direction [from]- potential site 1 61
Figure 54: Maximum wave height at 10- year return period and direction [from]- Potential site 2 63
Figure 55: Maximum wave height at 50- year return period and direction [from]- Potential site 2 64
Figure 56: Maximum wave height at 10- year return period and direction [from]- Potential site 3 66
Figure 57: Maximum wave height at 50- year return period and direction [from]- Potential site 3 66
Figure 58: Maximum wave height at 10- year return period and direction [from]- Potential site 4 68
Figure 59: Maximum wave height at 50- year return period and direction [from]- Potential site 4 69
Figure 60: Maximum wave height at 10- year return period and direction [from]- Potential site 5 71
Figure 61: Maximum wave height at 50- year return period and direction [from]- Potential site 5 71
Figure 62: Maximum wave height at 10- year return period and direction [from]- Potential site 6 73
Figure 63: Maximum wave height at 50- year return period and direction [from]- Potential site 6 74
Figure 64 Sampling temperature stations in St. Mary's Bay 75
Figure 65 Temperature data from 1979 to 2017 using ERA5 model [6]- Coordinates: 44° 15.000'N, 66° 18.601'W 75
Figure 66 Temperature data from 2009 to 2021 using Satellite data - Coordinates: 44° 32.716'N, 65° 57.370'W 76
Figure 67 Long Beach temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 24.104'N, 66° 9.576'W 76
Figure 68 Long Island temperature data from January 2019 to May 2019 [7]- Coordinates: 44° 21.007'N, 66° 13.458'W 77
Figure 69 Long Island temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 21.007'N, 66° 13.458'W 77
Figure 70 Long Island 2 temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 19.986'N, 66° 12.125'W 78
Figure 71 Sandy Cove temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 29.140'N, 66° 3.575'W 78
Figure 72 St. Mary's Bay (circled in black) was not well represented in the A) weekly ice chart (Eastern Coast), or B) daily ice [8] 79

Tables

Table 1 Tide information at St. Mary's Bay- all the values presented based on WebTide data 18
Table 2 Tide information at St. Mary's Bay- all the values presented based on ADCP measurements 18
Table 3 List of ADCP models with their deployment locations and dates 23
Table 4: 1 in 10 and 1 in 50 current conditions at ADCP 1 location using Scottish standard [2] 30
Table 5: 1 in 10 and 1 in 50 current conditions at ADCP 2 location using Scottish standard [2] 34
Table 6: 1 in 10 and 1 in 50 current conditions at ADCP 3 location using Scottish standard [2] 39
Table 7 Results extreme value analysis for wind and waves at the offshore source point locations in Figure 4 ... 54
Table 8 T_p values used in analysis. 56

Table 9: Estimated wave and wind design conditions for potential site 1 59
Table 10: Estimated wave and wind design conditions for potential site 2 62
Table 11: Estimated wave and wind design conditions for potential site 3 64
Table 12: Estimated wave and wind design conditions for potential site 4 67
Table 13: Estimated wave and wind design conditions for potential site 5 69
Table 14: Estimated wave and wind design conditions for potential site 6 72
Table 15 Freeze-up and break-up dates for St. Mary's Bay as per weekly historic ice charts [8] 80

1 Introduction

1.1 Overview

The following report has been prepared for 3327832 Nova Scotia Limited for their evaluation of an option area in St. Mary's Bay, Nova Scotia, that is being considered for several marine finfish leases. The report presents the environmental conditions at six identified potential finfish farms locations, as shown in Figure 2. First, this data can be used to ensure a suitable marine environment suitable for raising fish (i.e. assessment of water temperatures, current speeds). Second, the data can be used to determine ensure technical feasibility of anchoring and containment systems. The current, wind and wave conditions presented in this report can be used to determine engineering load cases. Extreme environmental conditions with maximum 10- and 50-year return periods are required for the design of marine fish farms, as per guidance in the Scottish technical standard [2], and NS9415 [3]. This report reviews bathymetric data, current, wind and wave conditions to be used in engineering analysis for the site. In addition, water temperature and ice conditions for each potential site location are investigated.



Figure 2: Potential fish farm site and ADCP locations at the St. Mary's Bay option area, Nova Scotia, Canada. Option boundaries shown by a yellow line at the south and north of the area

St. Mary's Bay is located between Digby Neck and mainland southwestern Nova Scotia, as can be seen in Figure 3. It is adjacent to the Gulf of Maine and the Bay of Fundy, a well developed fish farming and fishing region. St. Mary's Bay is a well known lobster fishing zone, but haddock, herring, mackerel, clams and scallops are also fished in the bay. It has high tidal ranges (6 to 7m), strong currents (excess of 2 m/s in areas), and remains essentially ice free throughout the year. St. Mary's Bay is protected from ocean swell waves by Digby Neck to the north, and southwestern Nova Scotia to the east. The option area under consideration is exposed to ocean swell from south and southwest which will travel directly into the bay. These waves are expected to lose energy by travelling into shallower waters. Based on the site location, detailed wave modeling will predict more appropriate wave conditions (based on application of less conservative assumptions) to use in engineering analysis. Feasibility of fish farming directly in the option region is very dependent on ensuring that current speeds are not excessive, and that water temperatures are suitable.

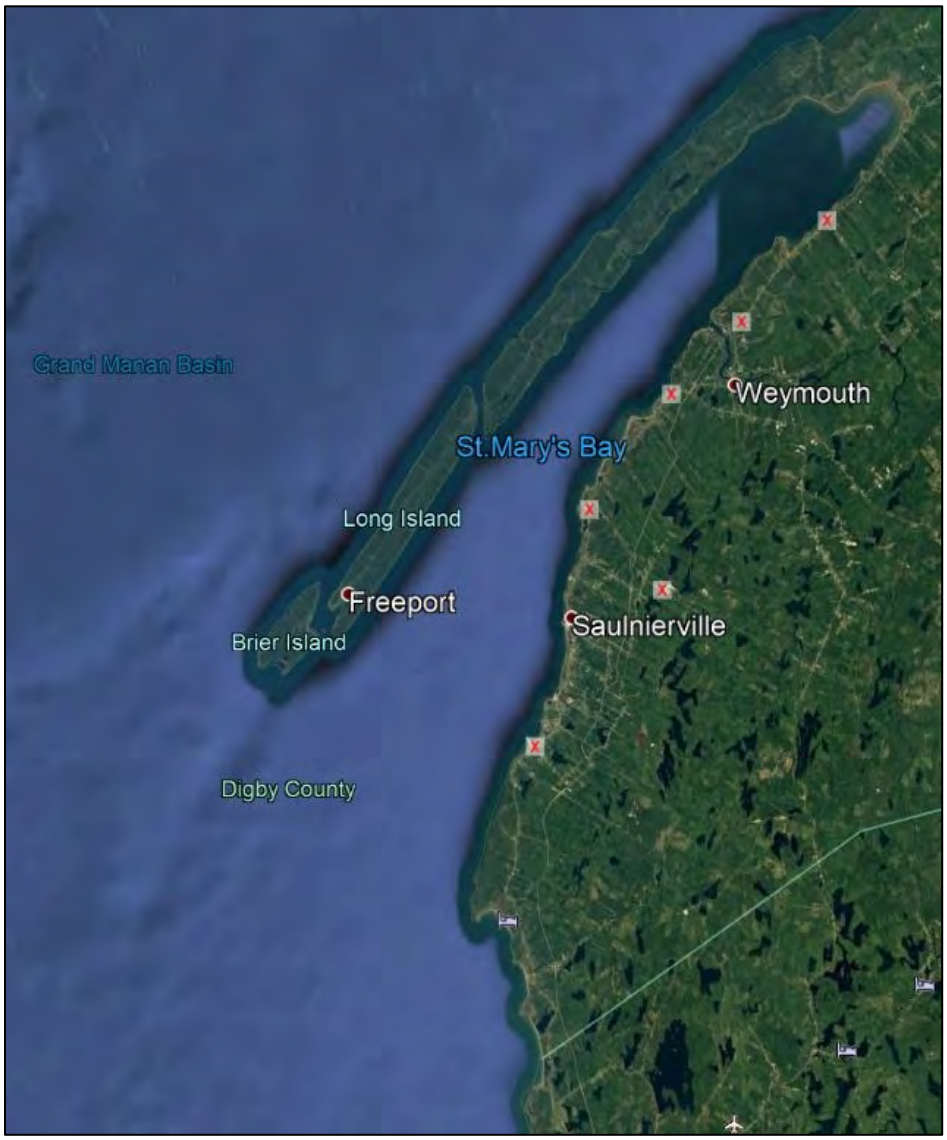


Figure 3: The St. Mary's Bay, Nova Scotia, Canada

1.2 Objectives

- Provide environmental data for option areas in St. Mary's Bay that will assist in evaluating feasibility of farming fish in the area
- Propose potential fish farm leases and anchoring plans in St. Mary's Bay option area
- Summarize current, wave and wind conditions at the St. Mary's Bay potential fish-farm locations, and find the extreme conditions associated with 10- and 50- year return periods.
- Summarize available seabed and bathymetry data
- Summarize water temperature and ice conditions for each site

2 Abbreviations and acronyms

DSA	Dynamic Systems Analysis Ltd.
SMS	Surface-water Modeling System
CHS	Canadian Hydrographic Services
Tp	Peak period
Hs	Significant wave height
ADCP	Acoustic Doppler Current Profiler

3 Reference documents and drawings

[1]	V. Swail, V. Cardone, M. Ferguson, D. Gummer, E. Harris, E. Orelup, and A. Cox, "The msc50 wind and wave reanalysis," in *9th International Workshop On Wave Hindcasting and Forecasting*, 2006.
[2]	Marine Scotland. (2015). A Technical Standard for Scottish Finfish Aquaculture. Ministerial Group for Sustainable Aquaculture's Scottish Technical Standard Steering Group
[3]	Norge, S. (2009). Norwegian Standard NS 9415. E: 2009. Marine Fish Farms—Requirements for Site Survey, Risk Analyses, Design, Dimensioning, Production, Installation and Operation. *Standard Norge, Lysaker*.
[4]	Chen, Changsheng, Geoffery Cowles, and R. C. Beardsley. An unstructured grid, finite-volume coastal ocean model: FVCOM User Manual. SMAST. UMASSD Technical Report-06-0602, 2006
[5]	https://data.novascotia.ca/
[6]	https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5
[7]	CMAR, (2021). Coastal Monitoring Program Report: Digby County
[8]	CMAR, (2021). NEARSHORE ICE MONITORING AND ANALYSIS
[9]	ISO 14688-1:2002, "Geotechnical investigation and testing — Identification and classification of soil".

4 Seabed information and bathymetry

4.1 Bathymetry

The bathymetry of the fish farm sites, from the hydrographic charts provided by CHS, and a 2x5 cage arrangement are shown in Figure 4 to Figure 9 for potential sites 1 to 6, respectively. The maximum depth beneath the farms at low tide are summarized as follows:

- Potential site 1: the maximum depth is approximately 43 meters
- Potential site 2: the maximum depth is approximately 32 meters
- Potential site 3: the maximum depth is approximately 23 meters
- Potential site 4: the maximum depth is approximately 21 meters
- Potential site 5: the maximum depth is approximately 31 meters
- Potential site 6: the maximum depth is approximately 43 meters

The resolution of the CHS hydrographic data is 10m. To develop the drawings of the site the CHS data was post-processed using GIS software and added as a layer in the drawings. The details regarding the cage arrangement, a summary of environmental conditions, lease corner coordinates and bathymetry contour lines for potential fish farm sites are available in Appendix A.

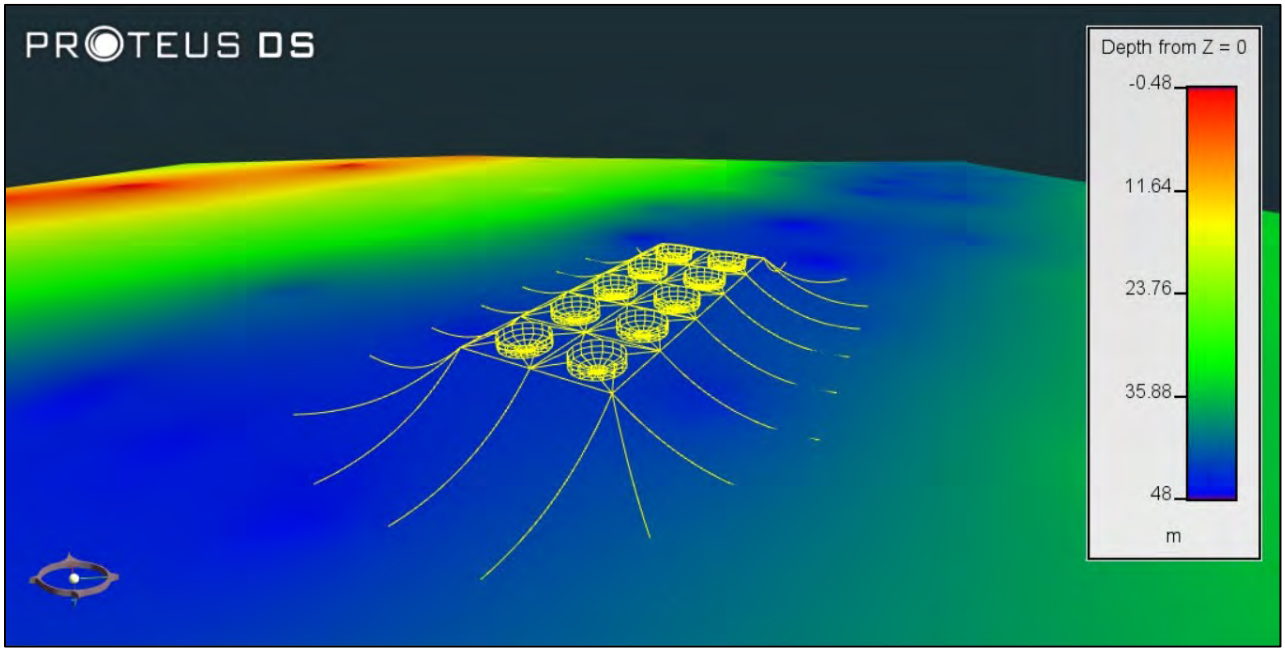


Figure 4: Potential site 1 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 43 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m.

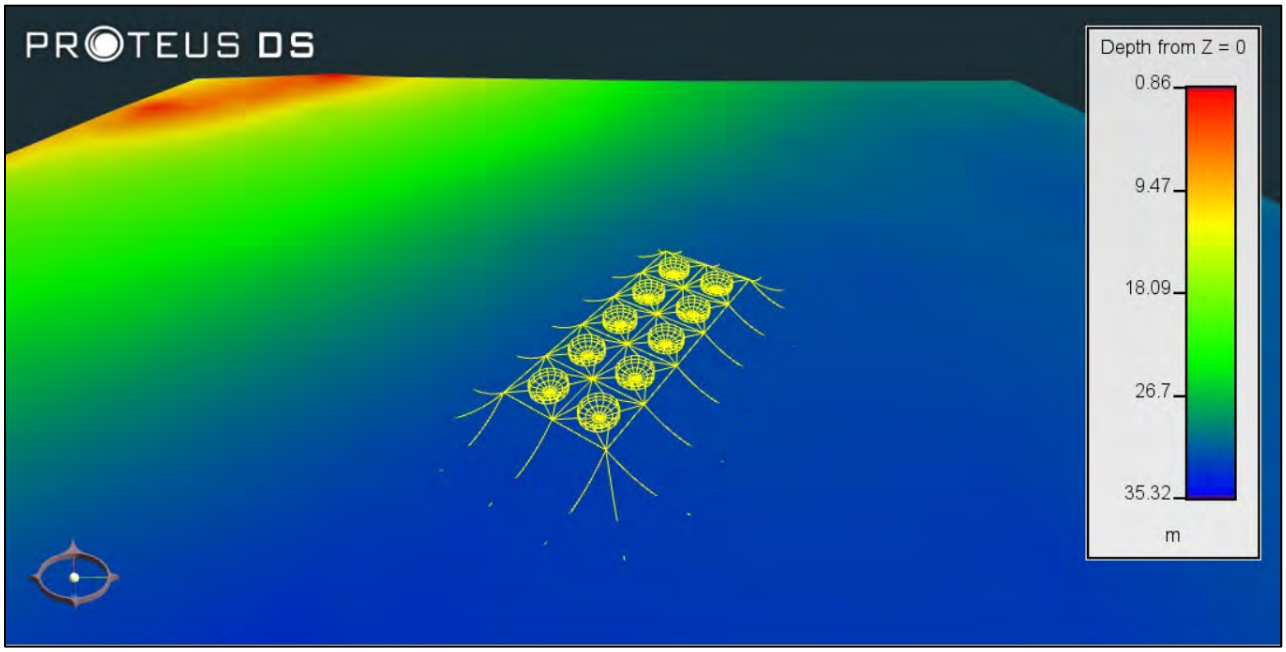


Figure 5: Potential site 2 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 32 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m.

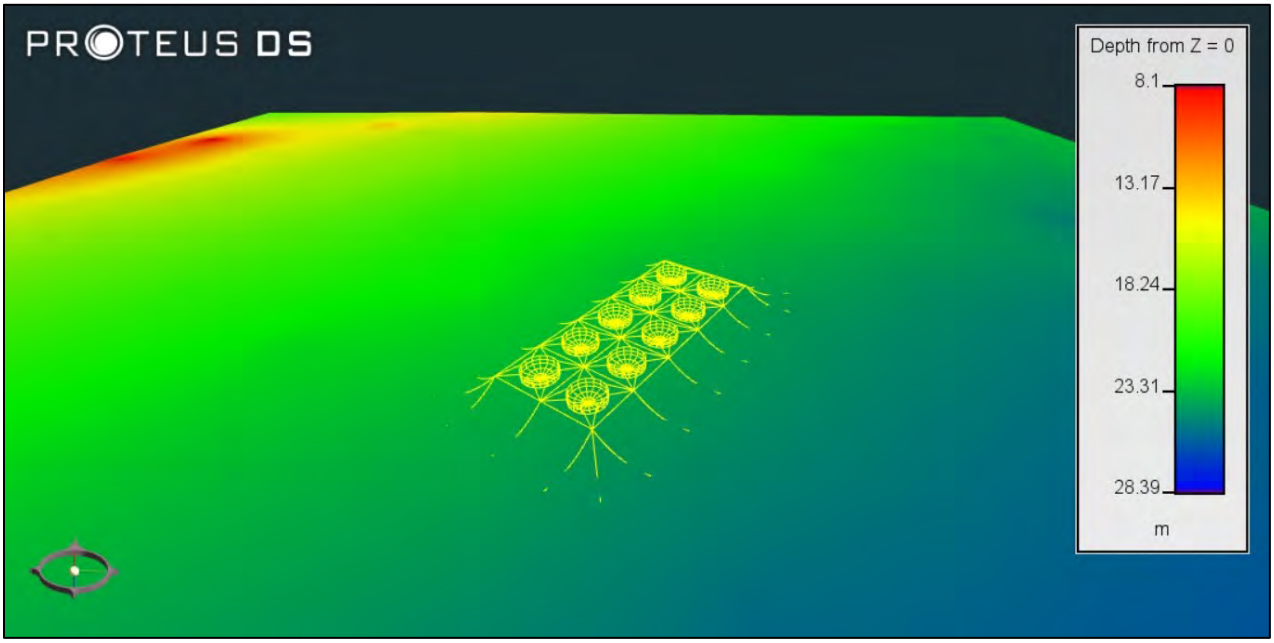


Figure 6 Potential site 3 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 23 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m.

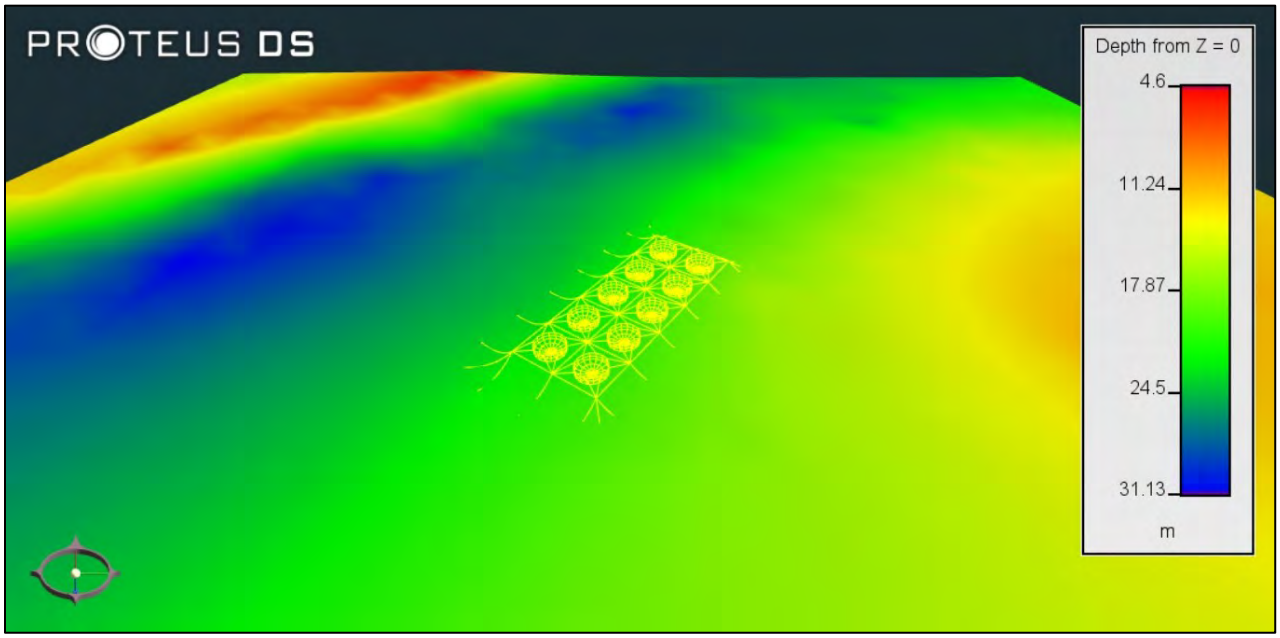


Figure 7: Potential site 4 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 21 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m.

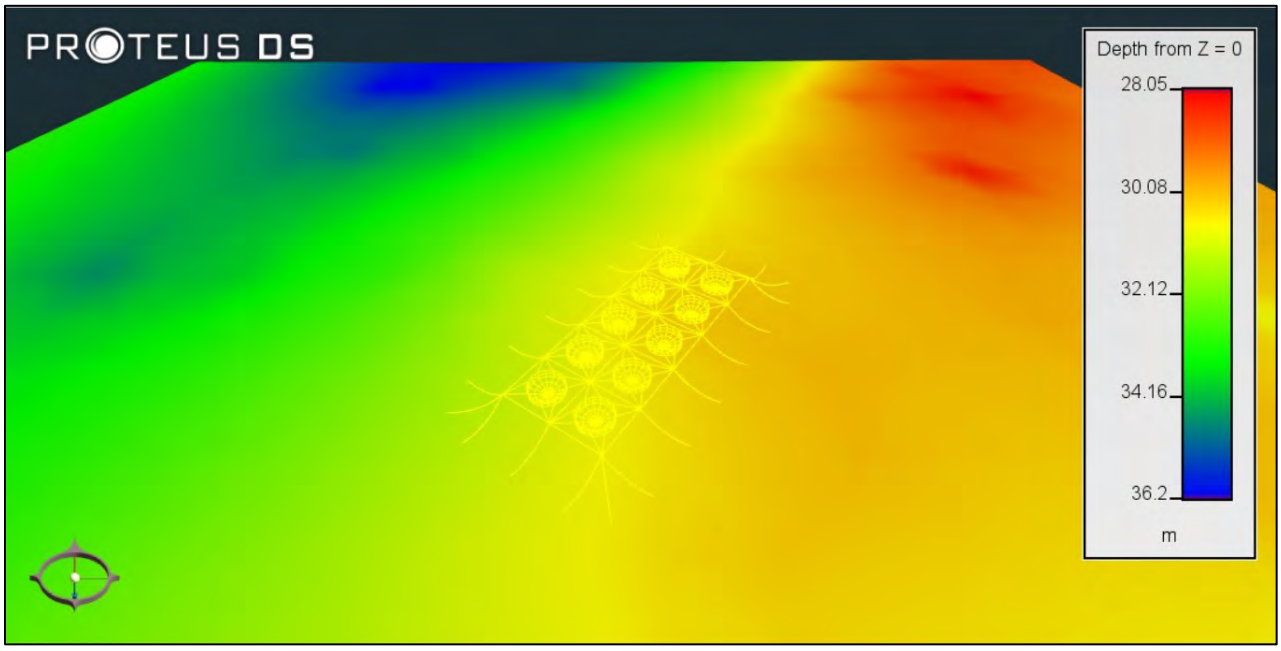


Figure 8: Potential site 5 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 31 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m.

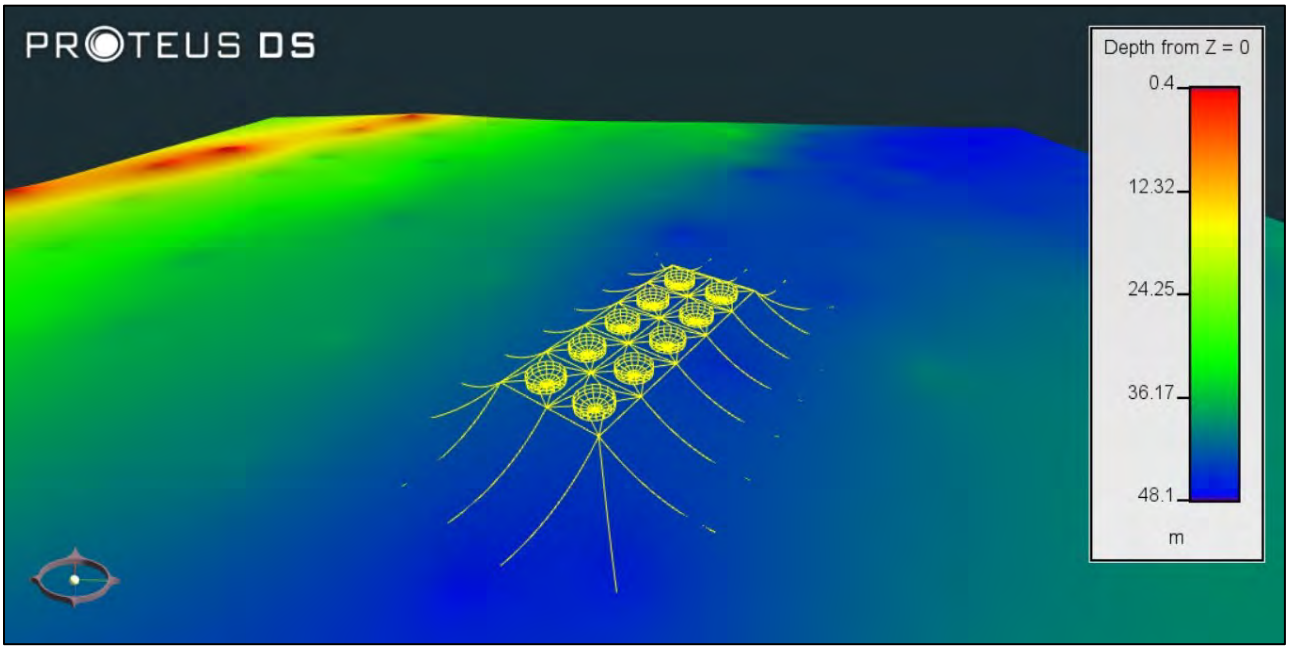


Figure 9 Potential site 6 bathymetry and cage arrangements in ProteusDS. The maximum depth beneath the farm at low tide is approximately 43 meters. Cages are 130m circumference, and mooring grid size is 65m X 65m.

4.2 Seabed composition

The seabed in much of St Mary's Bay consists of cobbles and rock over glacial till. There is some sediment cover, but the depth of the sediment is difficult to determine based on acoustic sub bottom profiling due to dispersion of the signal. Seabed information for the sites were assessed based in part on diver's videos at ADCP 3 location, and available information from other fish farm sites in the area. The sediment at the ADCP location is sandy silt[1], which is consistent with DSA's experience in the region. Anchoring in St. Mary's Bay in these conditions will require checking that anchors are keyed and/or sufficiently buried. Other fish farm sites in the area are known to use concrete blocks in combination with drag anchors to cope with the varied seabed conditions.

5 Tidal Range

The tidal range is approximated as 6m for all the Potential sites at St. Mary's Bay according to the WebTide data as shown in Table 1.

Table 2 provides detailed measurement of the tide variation for each site using ADCP data.

[1] The seabed identification and classification of soils are reported based on terminology found ISO 14688-1:2002 [9]

Table 1 Tide information at St. Mary's Bay- all the values presented based on WebTide data

Tide Components	St. Mary's Bay
Max Tide (m)	6.38
Min Tide (m)	0.32
Max Range of Tide (m)	6.06

Table 2 Tide information at St. Mary's Bay- all the values presented based on ADCP measurements

Tide Components	ADCP #		
	1	2	3
Max Tide (m)	6.6	6.9	7.3
Min Tide (m)	0.3	0.5	0.5
Max Range of Tide (m)	6.3	6.4	6.8

6 Current conditions

The current conditions in St. Mary's Bay within the option area were assessed using both modeling and direct ADCP measurements. While the FVCom modeling did not provide accurate maximum current speed predictions, it is believed the distribution of currents shown is indicative of those seen in the area.

6.1 FVCom current modeling predictions

The tidal currents were first assessed in the region based on spatial flow modeling results. The model used was developed at Acadia University using FVCom and has been used for a number of applications (shellfish farms, marine energy). The FVCom model has been validated in the Minas Passage using ADCP data collected for tidal energy projects throughout the region, but not specifically within the St. Mary's Bay option area. More details about the model is provided in [4]. Because of the lack of validation directly in the option area, the FVCom modeling results are only useful for understanding spatial distribution of currents; maximum current values are not likely to be reliable.

Data for 1 year (calendar year 2020) with 10 minutes time interval resolution was assessed to evaluate the peak ebb and flood conditions across the option area. Visualization of the FVCom modeling are shown in Figure 10, Figure 11, Figure 12, and Figure 13 for surface flood/ebb speeds and depth averaged flood/ebb speeds. Note that the following figures only provided to present the tide regime in vicinity of potential fish farm sites in St. Mary's Bay. More details about the maximum current speeds will be available in the next section (ADCP data).

The data shows that there is turbulent and higher current velocities developed through Petite Passage. Potential sites 5 and 6 are likely to see higher current speeds than sites 1-4.

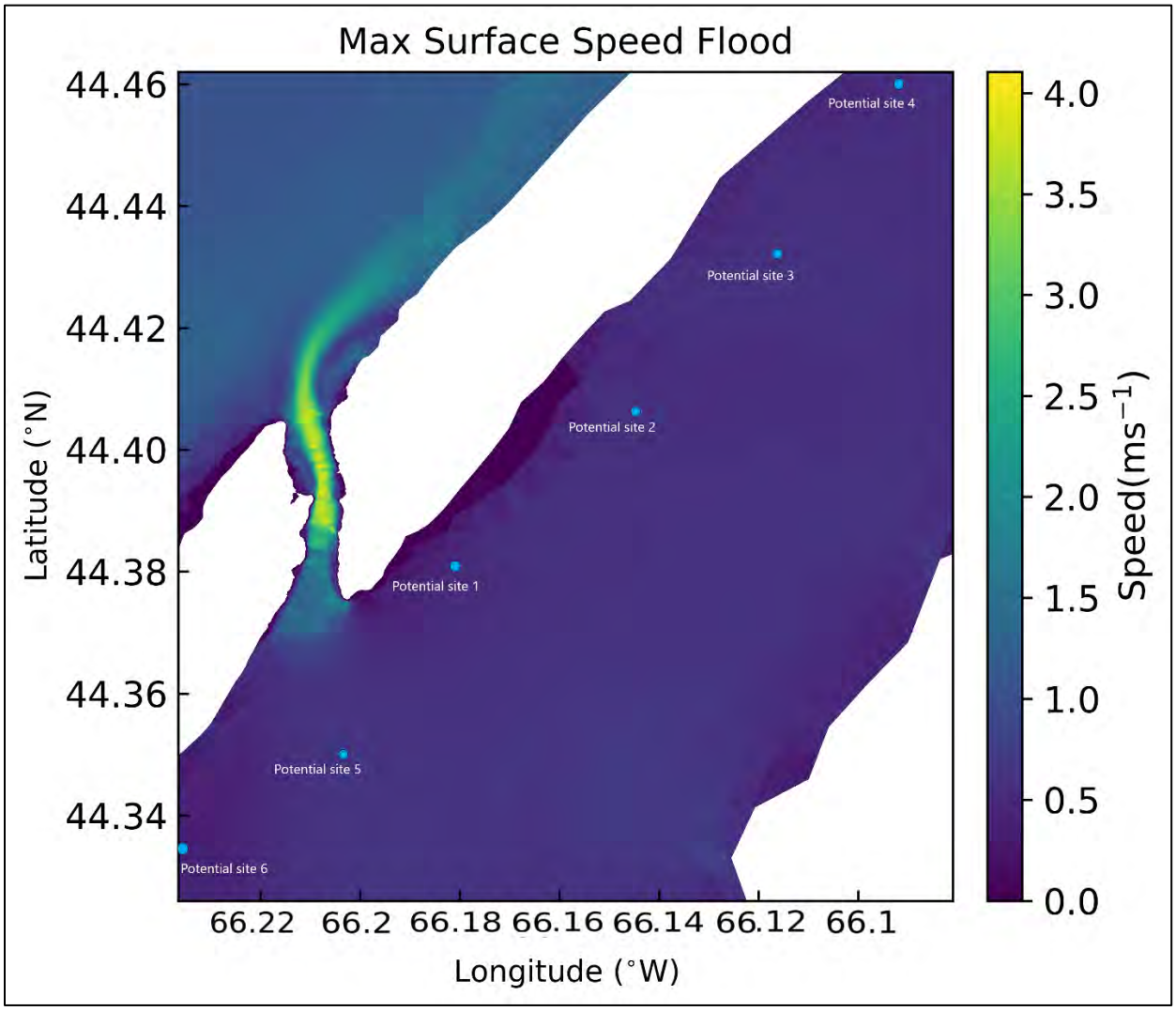


Figure 10 Surface flood speed at the St.Mary's Bay

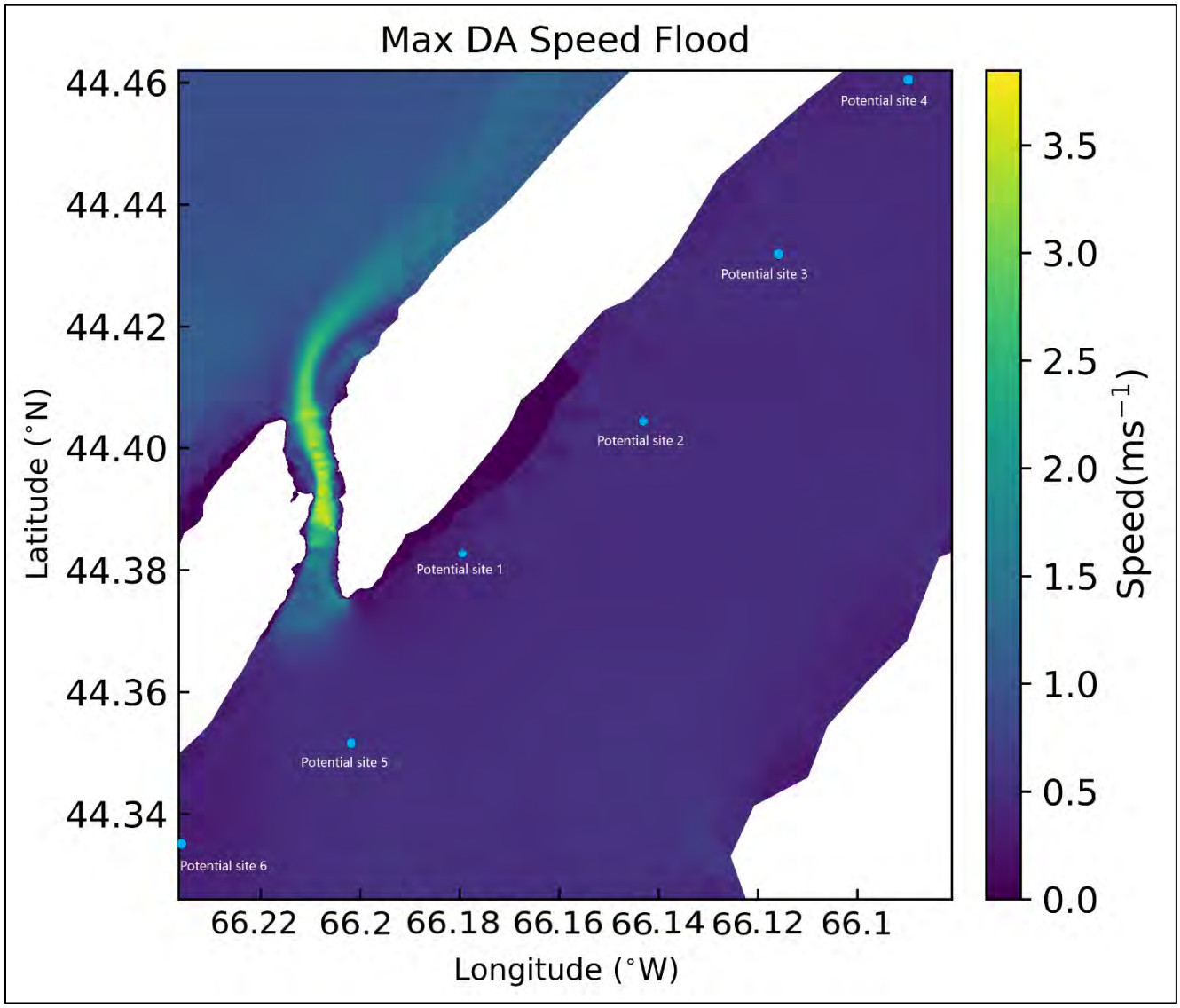


Figure 11 Depth averaged flood speed at the St.Mary's Bay

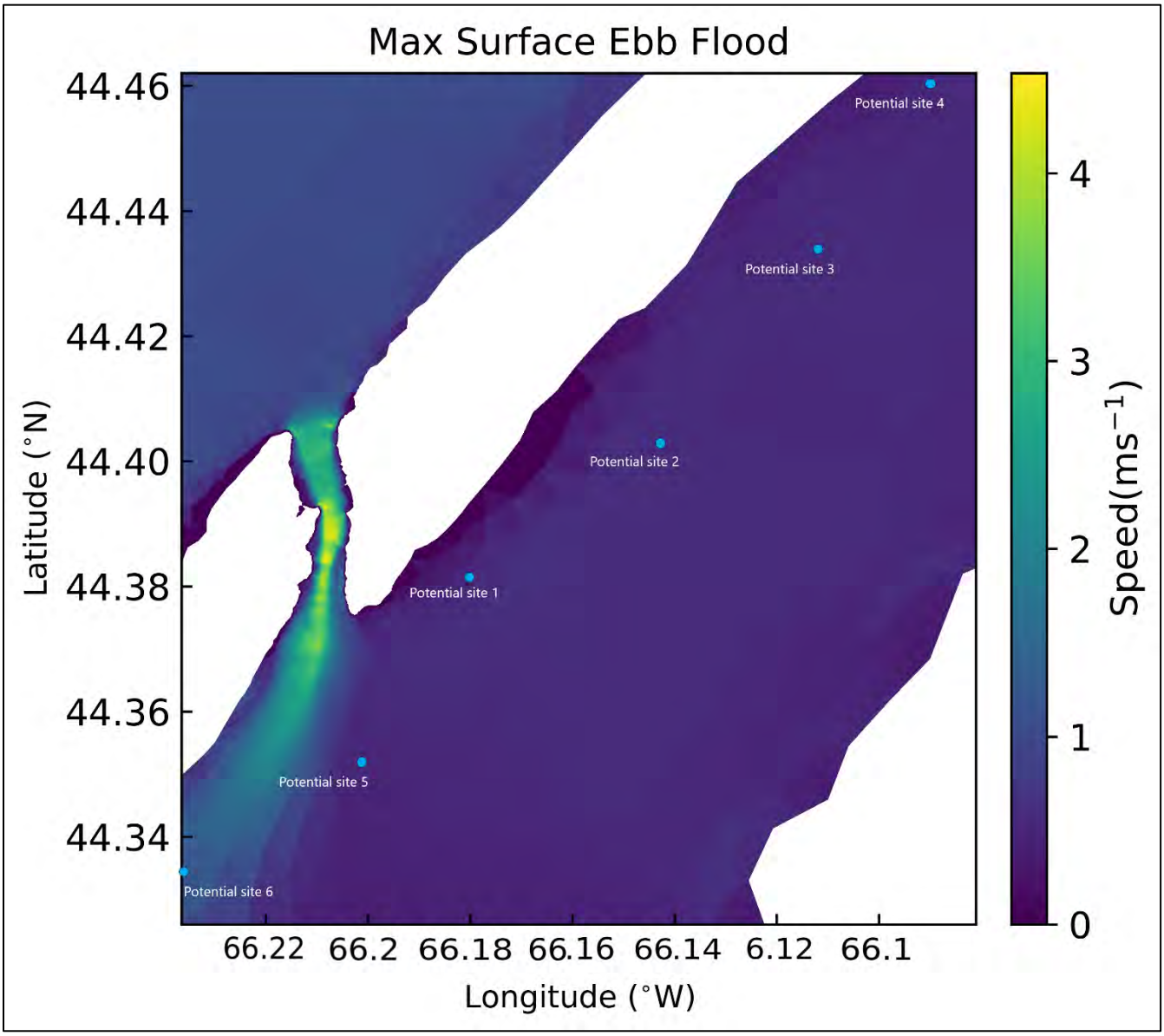


Figure 12 Surface ebb speed at the St.Mary's Bay

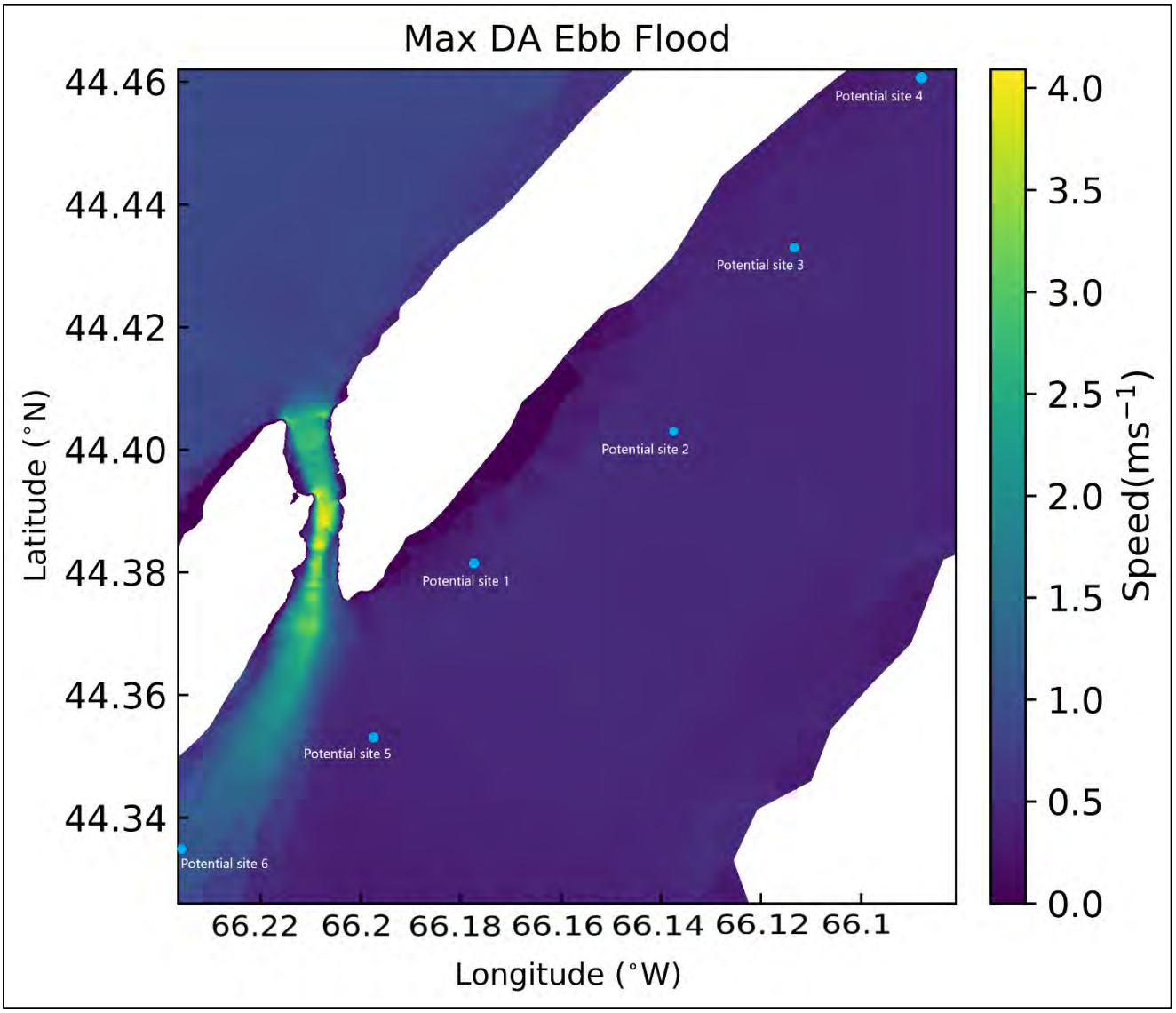


Figure 13 Depth averaged ebb speed at the St.Mary's Bay

6.2 ADCP data

Three ADCPs were deployed in the option area at the locations shown in Figure 14. The ADCPs were deployed using a subsurface mooring, as shown in Figure 15 and Figure 16. A schematic of the SUBS buoy mooring is provided in Appendix A – last sheet of drawing package. The deployments were carried out using Leeway Venture's boat (Rosborough 246). The length of the deployments was chosen to cover at least one tide cycle in the area.

Table 3 List of ADCP models with their deployment locations and dates

ADCP	ADCP model	Deployment location	Water depth (Low water)	Deployment dates
1	Teledyne RDI Workhorse Sentinel 300kHz	44° 23.134'N, 66° 10.118'W	44m	Deployed June 18, 2021 for 90 days
2	Teledyne RDI Workhorse Sentinel 600kHz	44° 26.325'N, 66° 6.475'W	22m	Deployed June 18, 2021 for 90 days
3	Teledyne RDI Workhorse Sentinel 300kHz	44° 19.621'N, 66° 14.346'W	40m	Deployed August 4, 2021 for 50 days



Figure 14: Deployment locations of 3 ADCPs in St. Mary's Bay option area, Nova Scotia, Canada

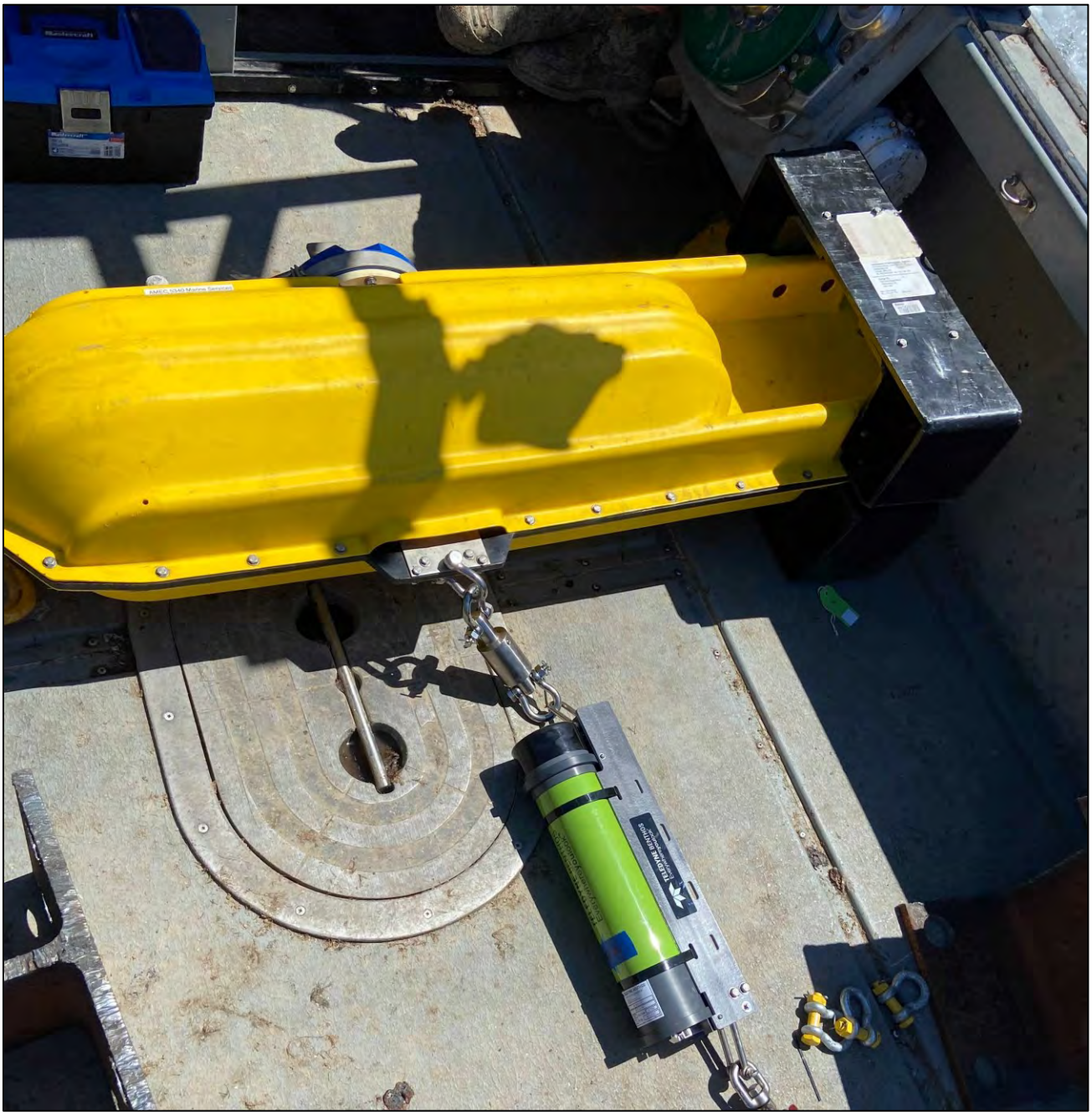


Figure 15 A picture of single float ADCP with subsurface moorings at the deployment location. The single float system used for ADCP 1 and 2



Figure 16 A picture of dual float ADCP with subsurface moorings at the deployment location. The dual float system used for ADCP 3



Figure 17 ADCP 3 during deployment

6.2.1 ADCP #1

An ADCP was deployed at St. Mary's Bay (44° 23.134'N, 66° 10.118'W) for 90 days from June 17, 2021, to September 17, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 10m and 15m are shown in Figure 18 to Figure 23. The total mean of current speeds at 10m, and 15m water depths are 0.36m/s, and 0.15m/s. The maximum recorded current speed at 10m, and 15m water depths are 1.49m/s, and 0.82m/s, respectively. As per Scottish standard [2], the 10- and 50-year

return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated current and there is at least 90 days of data available. The results are shown in Table 4. Note that in addition to the maximum values, mean directional current speeds are also available in Table 4.

Based on the ADCP 1 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 12 hours (see Figure 20).

The predominant current directions at the ADCP 1 location were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 230 deg (flood) and 60 deg (ebb).

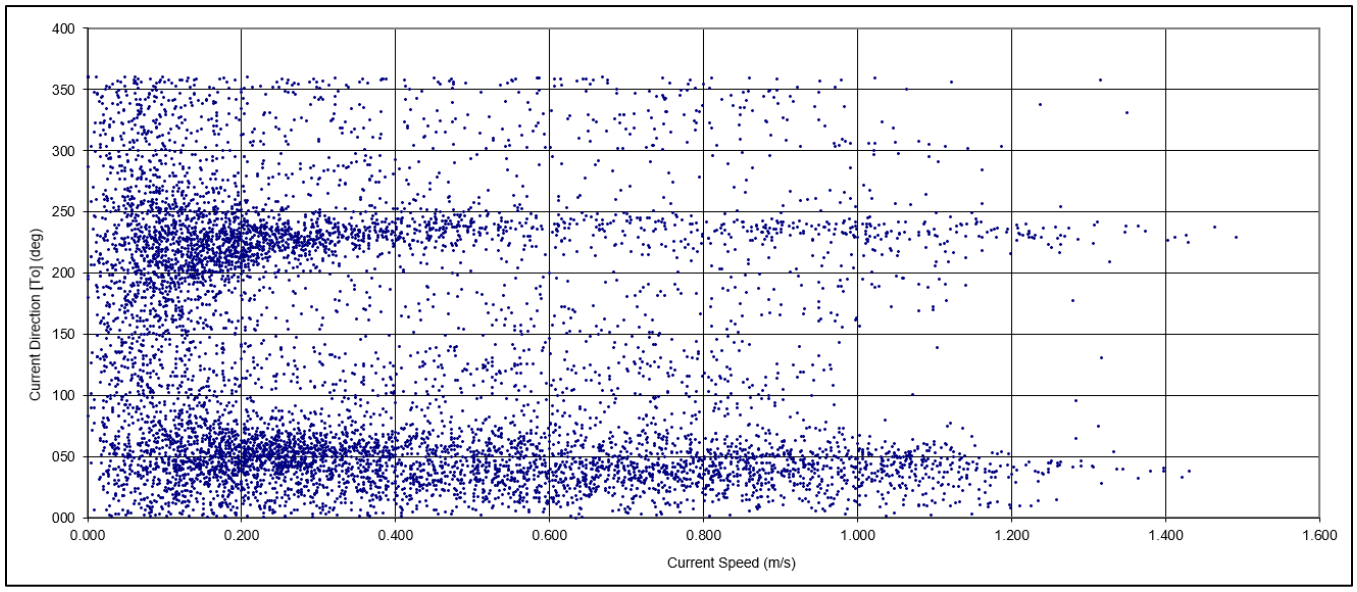


Figure 18 Scatter plot of current speed vs direction at ADCP 1 location - 10m water depth

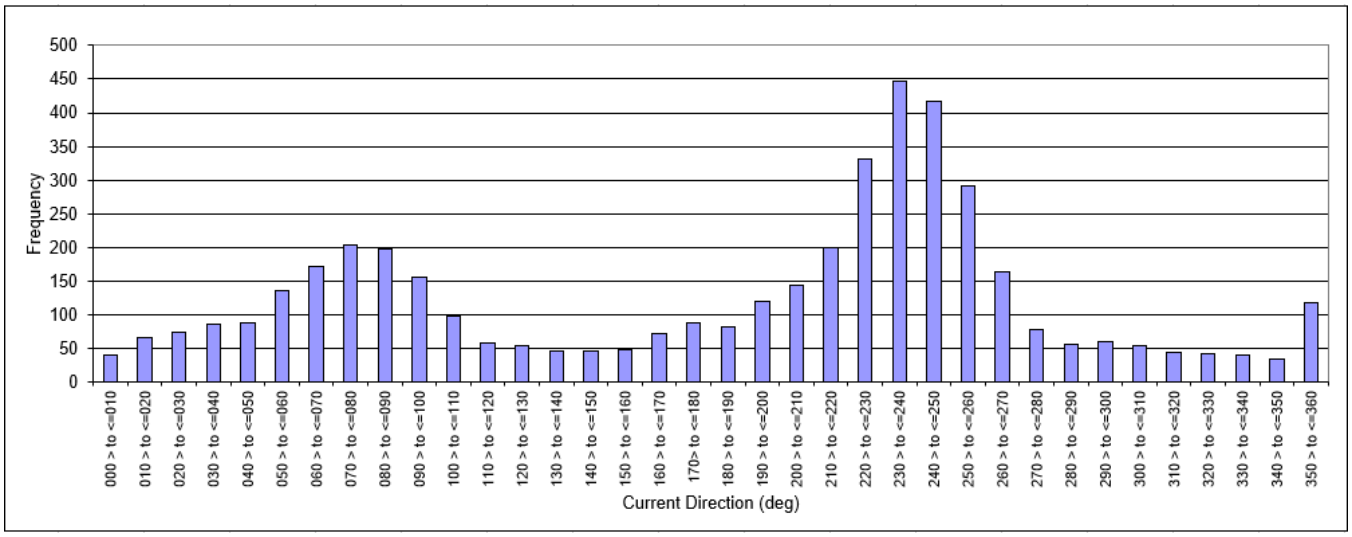


Figure 19 Frequency plot of current direction at ADCP 1 location - 10m Water depth

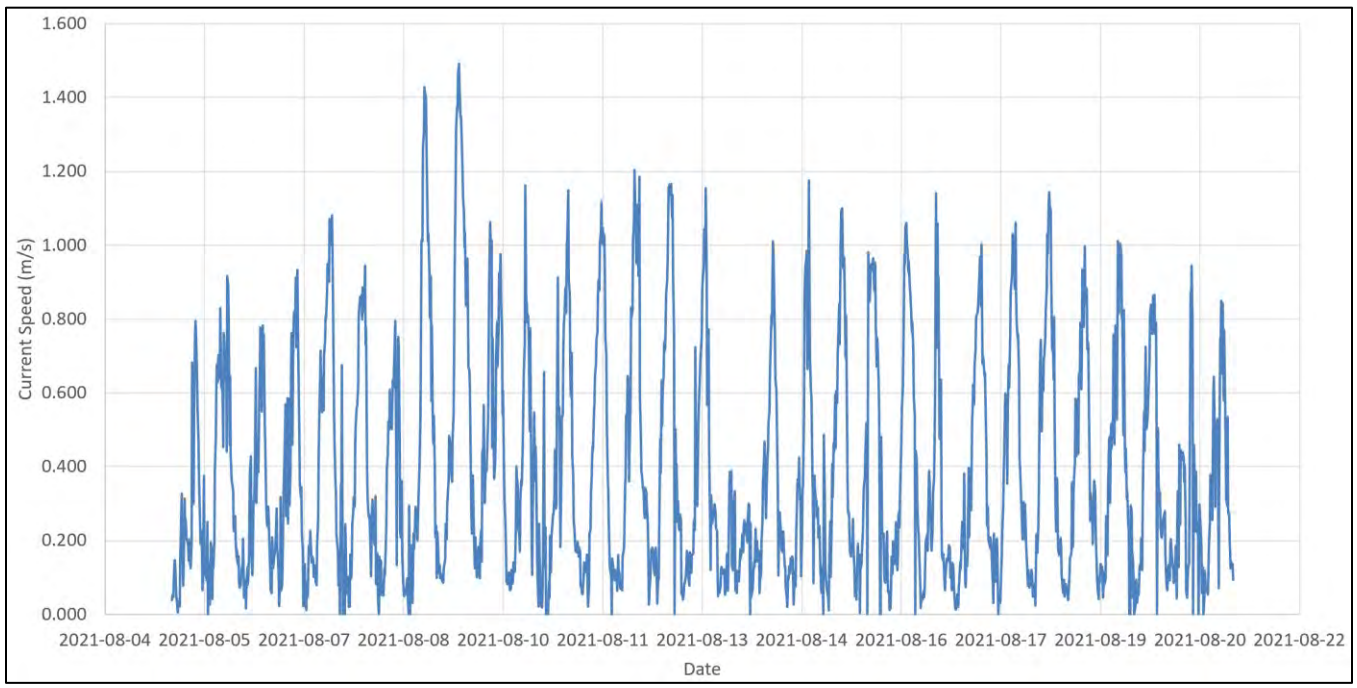


Figure 20 A sample time series plot of current speeds at ADCP 1 location - 10m Water depth

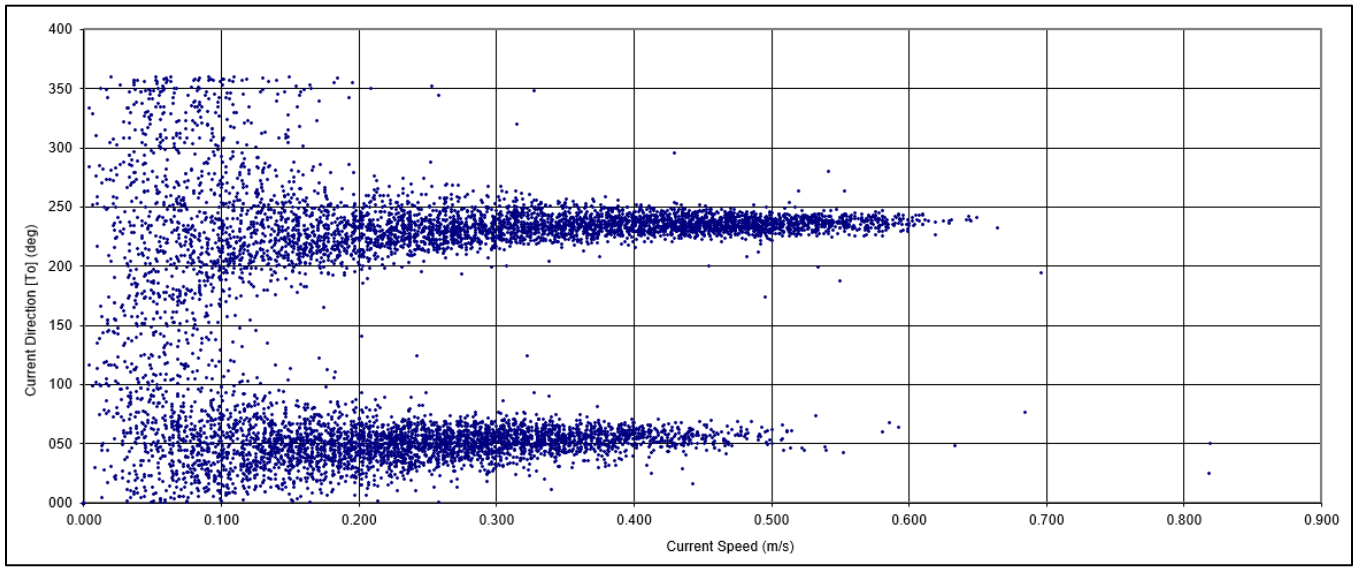


Figure 21 Scatter plot of current speed vs direction at ADCP 1 location - 15m water depth

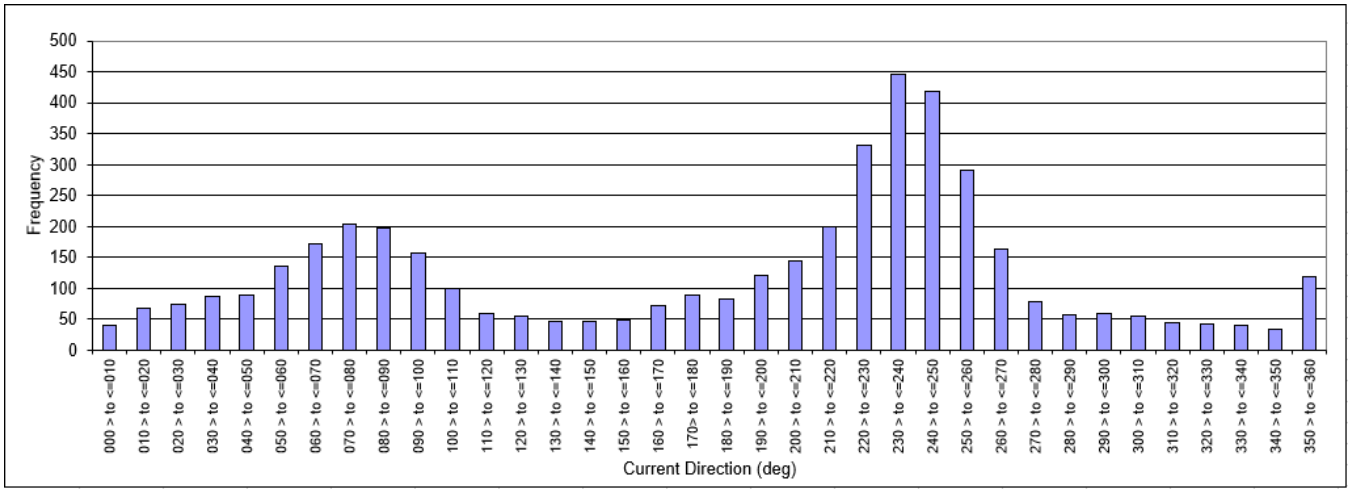


Figure 22 Frequency plot of current direction at ADCP 1 location - 15m Water depth

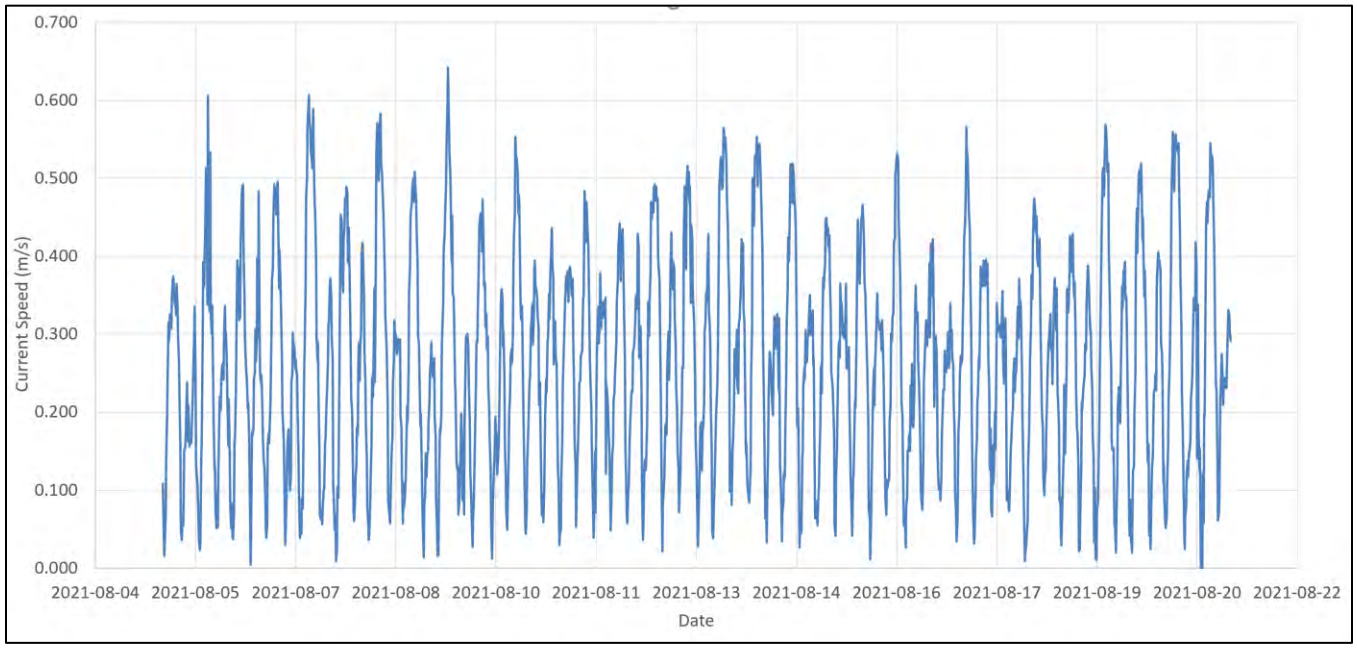


Figure 23 A sample time series plot of current speeds at ADCP 1 location - 15m Water depth

Table 4: 1 in 10 and 1 in 50 current conditions at ADCP 1 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
10 m	*0*	N	1.32	0.37	1.65	1.85
	22.5	NNE	1.26	0.47	1.58	1.76
	45	NE	1.43	0.54	1.79	2.00
	67.5	ENE	1.33	0.45	1.66	1.86
	90	E	1.31	0.36	1.64	1.83
	112.5	ESE	1.28	0.36	1.60	1.79
	135	SE	1.32	0.38	1.65	1.85
	157.5	SSE	1.10	0.32	1.38	1.54
	180	S	1.28	0.31	1.60	1.79
	202.5	SSW	1.14	0.27	1.43	1.60
	225	SW	1.33	0.27	1.66	1.86
	247.5	WSW	1.49	0.42	1.86	2.09
	270	W	1.26	0.28	1.58	1.76

	292.5	WNW	1.16	0.27	1.45	1.62
	315	NW	1.19	0.37	1.49	1.67
	337.5	NNW	1.35	0.36	1.69	1.89
15 m	*0*	N	0.33	0.09	0.41	0.46
	22.5	NNE	0.44	0.13	0.55	0.62
	45	NE	0.82	0.20	1.03	1.15
	67.5	ENE	0.82	0.27	1.03	1.15
	90	E	0.68	0.18	0.85	0.95
	112.5	ESE	0.34	0.08	0.43	0.48
	135	SE	0.32	0.07	0.40	0.45
	157.5	SSE	0.20	0.06	0.25	0.28
	180	S	0.50	0.07	0.63	0.70
	202.5	SSW	0.70	0.12	0.88	0.98
	225	SW	0.50	0.21	0.63	0.70
	247.5	WSW	0.66	0.37	0.83	0.92
	270	W	0.55	0.23	0.69	0.77
	292.5	WNW	0.54	0.10	0.68	0.76
	315	NW	0.43	0.08	0.54	0.60
	337.5	NNW	0.32	0.08	0.40	0.45

6.2.2 ADCP #2

An ADCP was deployed at St. Mary's Bay (44° 26.325'N, 66° 6.475'W) for 90 days from June 17, 2021, to September 17, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 5m and 15m are shown in Figure 24 to Figure 29. The total mean of current speeds at 5m, and 15m water depths are 0.4m/s, and 0.15m/s. The maximum recorded current speed at 5m, and 15m water depths are 1.33m/s, and 0.69m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated current and there is at least 90 days of data available. The results are shown in Table 5. Note that in addition to the maximum values, mean directional current speeds are also available in Table 5.

Based on the ADCP 2 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 12 hours (see Figure 26).

The predominant current directions at the ADCP 2 location were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 240 deg (flood) and 70 deg (ebb).

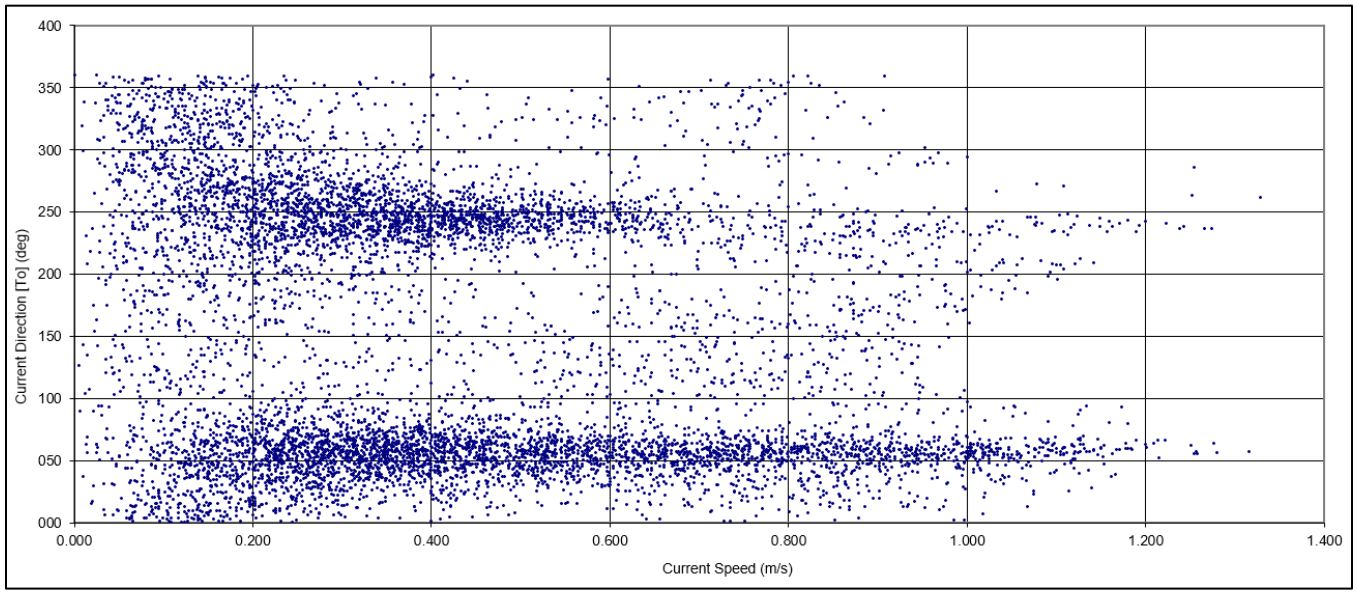


Figure 24 Scatter plot of current speed vs direction at ADCP 2 location - 5m water depth

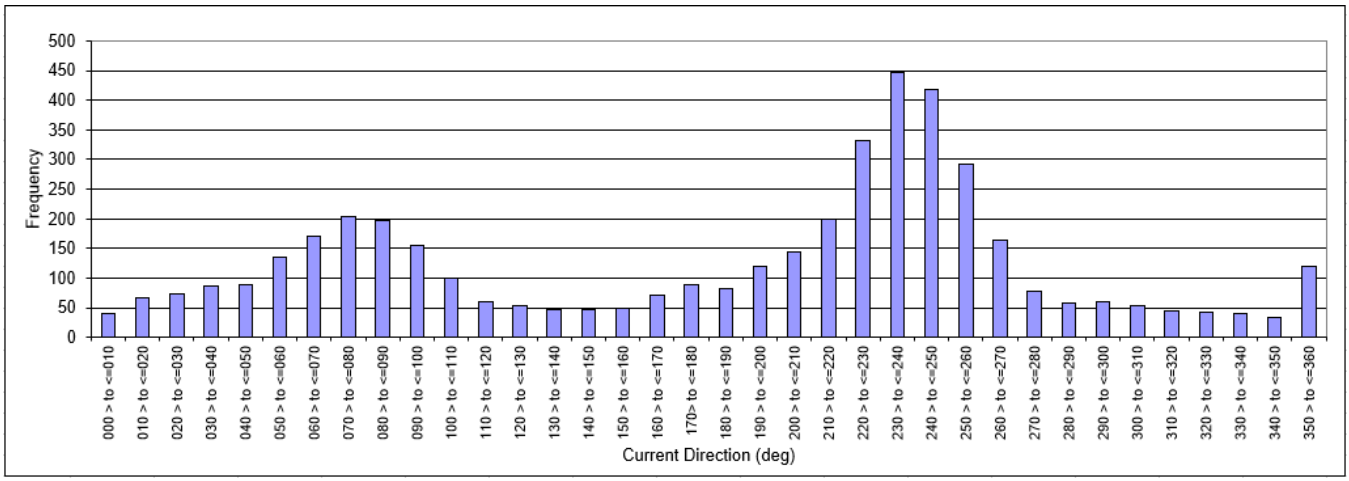


Figure 25 Frequency plot of current direction at ADCP 2 location - 5m Water depth

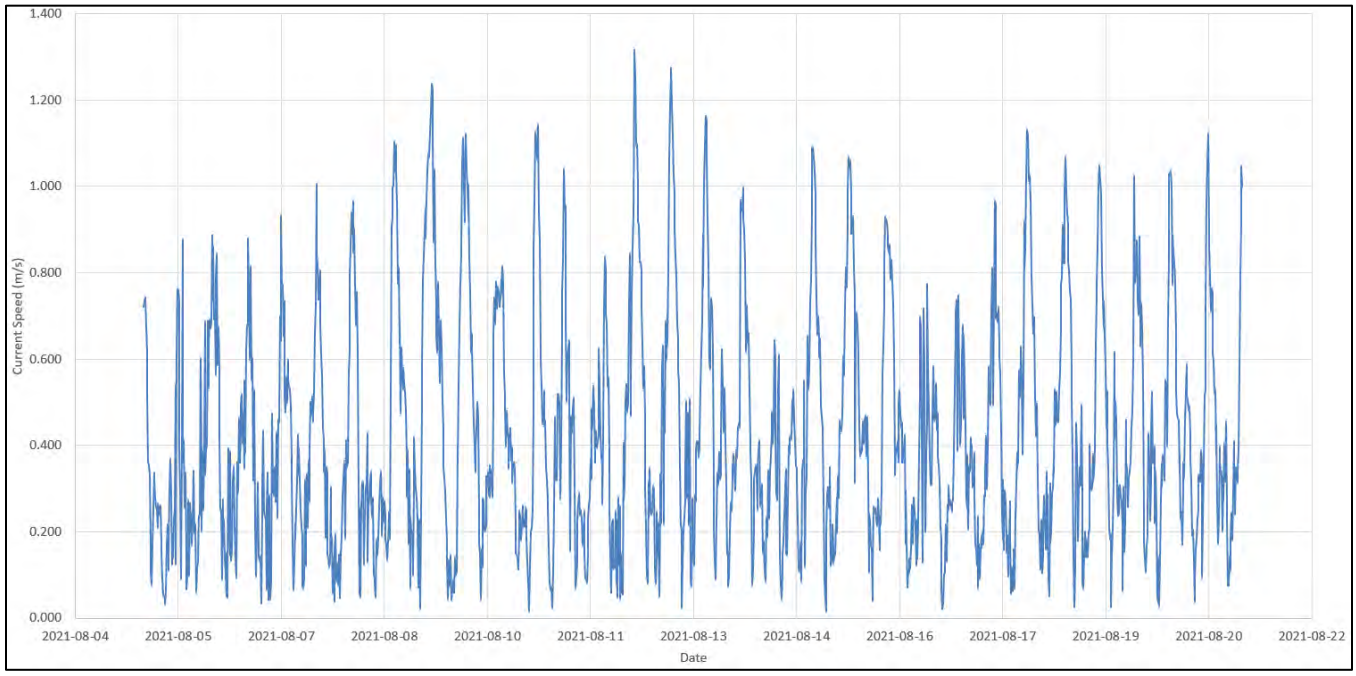


Figure 26 A sample time series plot of current speeds at ADCP 2 location - 5m Water depth

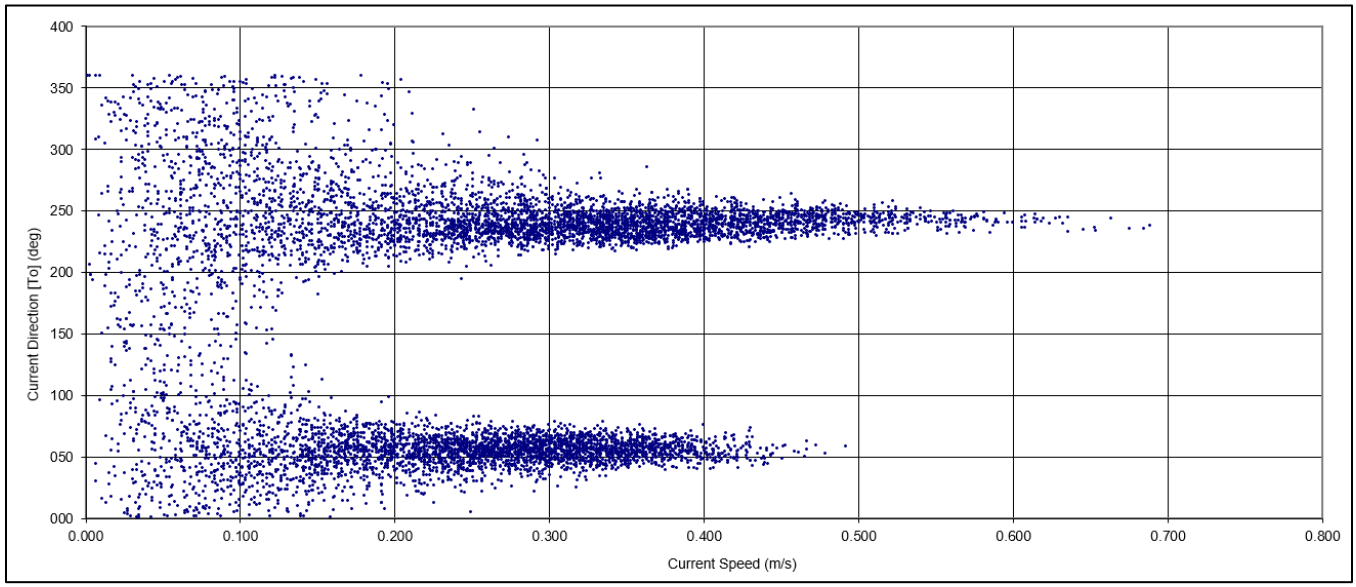


Figure 27 Scatter plot of current speed vs direction at ADCP 2 location - 15m water depth

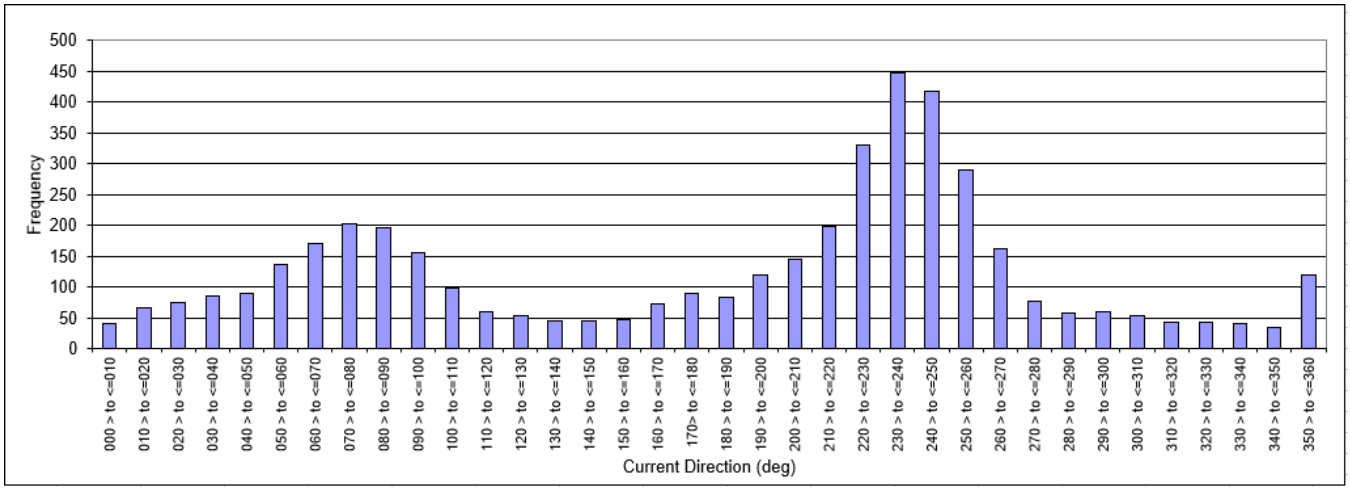


Figure 28 Frequency plot of current direction at ADCP 2 location - 15m Water depth

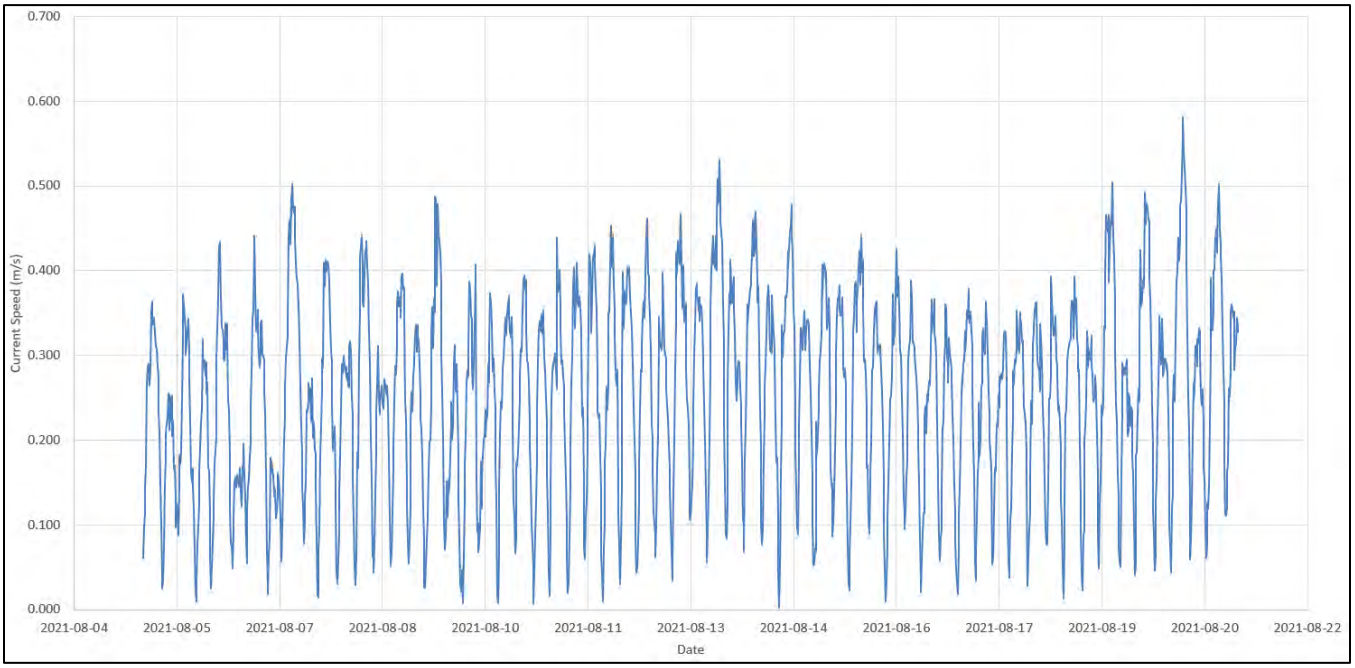


Figure 29 A sample time series plot of current speeds at ADCP 2 location - 15m Water depth

Table 5: 1 in 10 and 1 in 50 current conditions at ADCP 2 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
	0	N	0.91	0.27	1.14	1.27

5 m	*22.5*	NNE	1.07	0.35	1.34	1.50
	45	NE	1.17	0.45	1.46	1.64
	67.5	ENE	1.32	0.54	1.65	1.85
	90	E	1.18	0.43	1.48	1.65
	112.5	ESE	1.17	0.48	1.46	1.64
	135	SE	0.94	0.47	1.18	1.32
	157.5	SSE	0.98	0.50	1.23	1.37
	180	S	1.00	0.49	1.25	1.40
	202.5	SSW	1.10	0.42	1.38	1.54
	225	SW	1.14	0.40	1.43	1.60
	247.5	WSW	1.27	0.43	1.59	1.78
	270	W	1.33	0.36	1.66	1.86
	292.5	WNW	1.25	0.27	1.56	1.75
	315	NW	1.00	0.26	1.25	1.40
	337.5	NNW	0.91	0.26	1.14	1.27
15 m	*0*	N	0.21	0.09	0.26	0.29
	22.5	NNE	0.26	0.11	0.33	0.36
	45	NE	0.44	0.19	0.55	0.62
	67.5	ENE	0.49	0.27	0.61	0.69
	90	E	0.43	0.21	0.54	0.60
	112.5	ESE	0.20	0.08	0.25	0.28
	135	SE	0.15	0.07	0.19	0.21
	157.5	SSE	0.12	0.06	0.15	0.17
	180	S	0.12	0.06	0.15	0.17
	202.5	SSW	0.24	0.08	0.30	0.34
	225	SW	0.43	0.19	0.54	0.60
	247.5	WSW	0.69	0.33	0.86	0.97
	270	W	0.59	0.29	0.74	0.83
	292.5	WNW	0.36	0.15	0.45	0.50
	315	NW	0.29	0.11	0.36	0.41
	337.5	NNW	0.26	0.09	0.33	0.360

6.2.3 ADCP #3

An ADCP was deployed at St. Mary's Bay (44° 19.621'N, 66° 14.346'W) for 50 days from August 4, 2021, to September 24, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 5m and 15m are shown in Figure 30 to Figure 35. The total mean of current speeds at 5m, and 15m water depths are 0.35m/s, and 0.29m/s. The maximum recorded current speed at 5m, and 15m water depths are 2.49m/s, and 1.52m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a

tidally dominated currents. The results are shown in Table 6. Note that in addition to the maximum values, mean directional current speeds are also available in Table 6.

Based on the ADCP 3 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 8 hours (see Figure 32).

The predominant current directions at the ADCP 3 locations were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 230 deg (flood) and 70 deg (ebb).

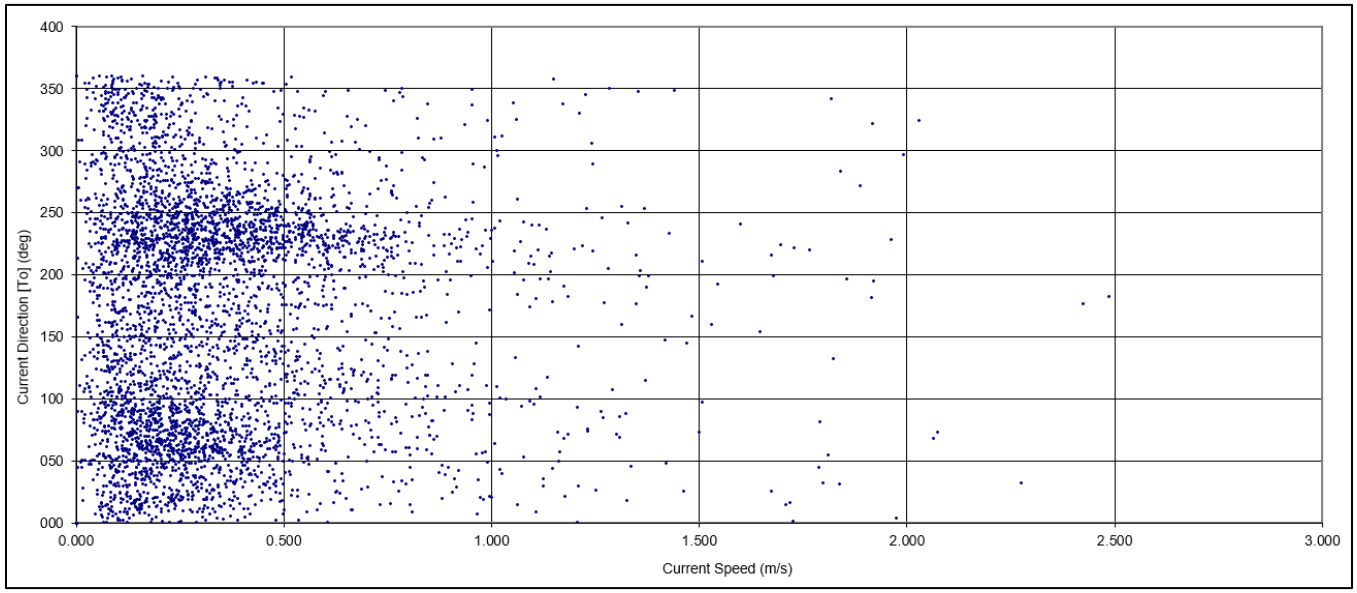


Figure 30 Scatter plot of current speed vs direction at ADCP 3 location - 5m water depth

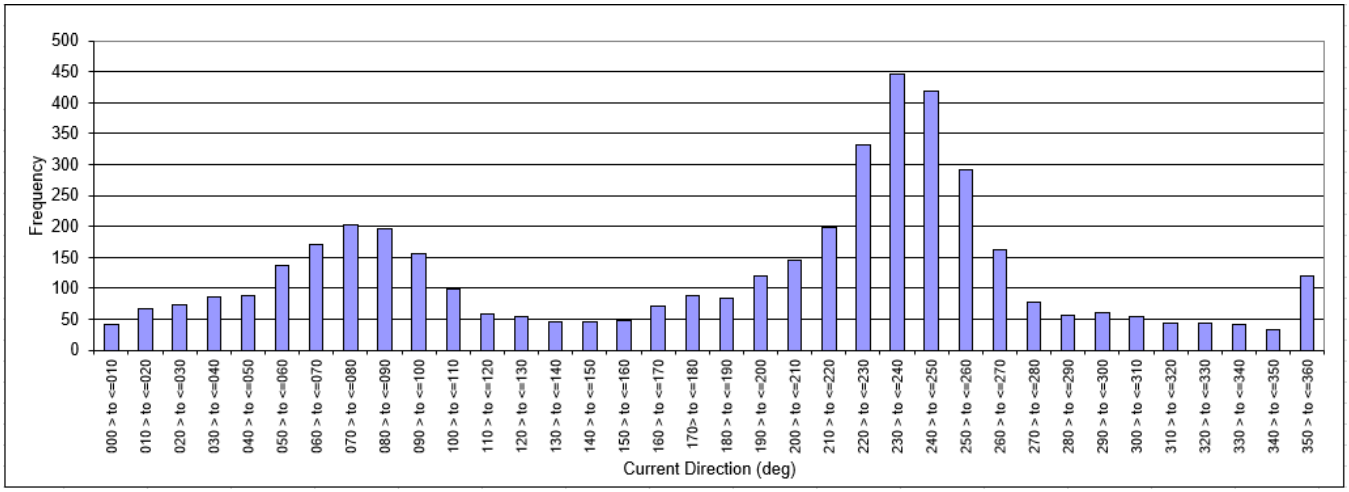


Figure 31 Frequency plot of current direction at ADCP 3 location - 5m Water depth

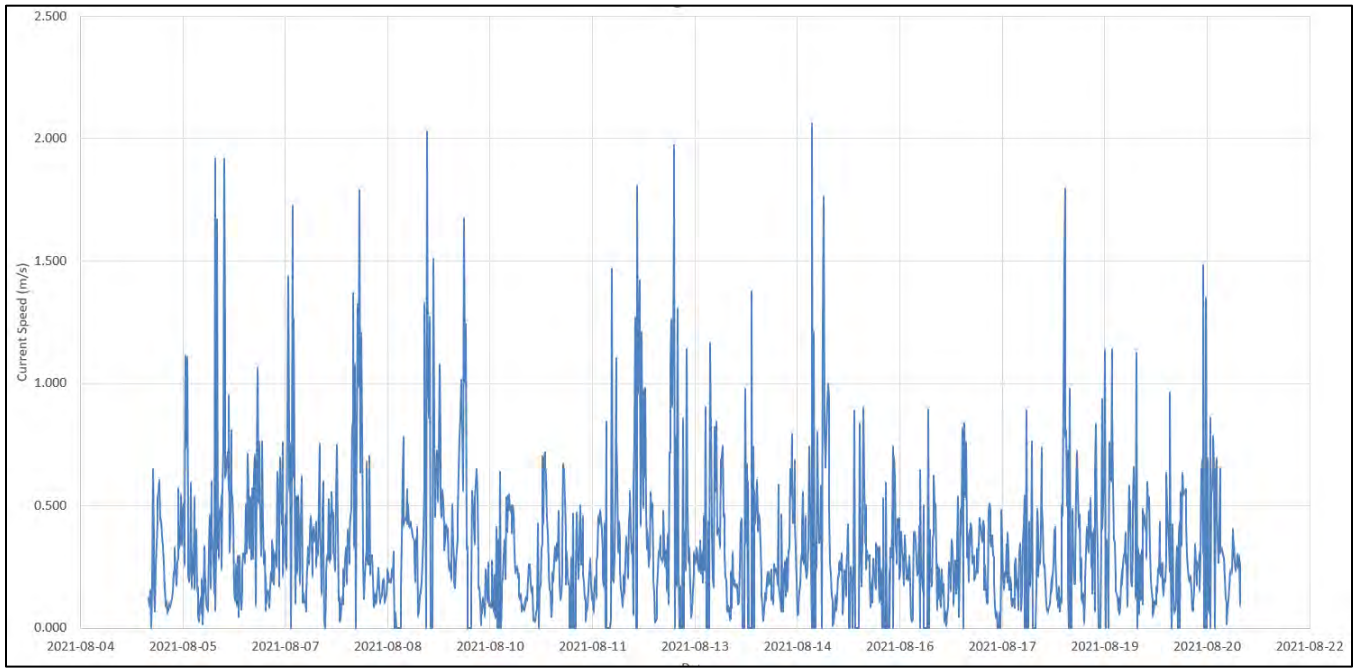


Figure 32 A sample time series plot of current speeds at ADCP 3 location - 5m Water depth

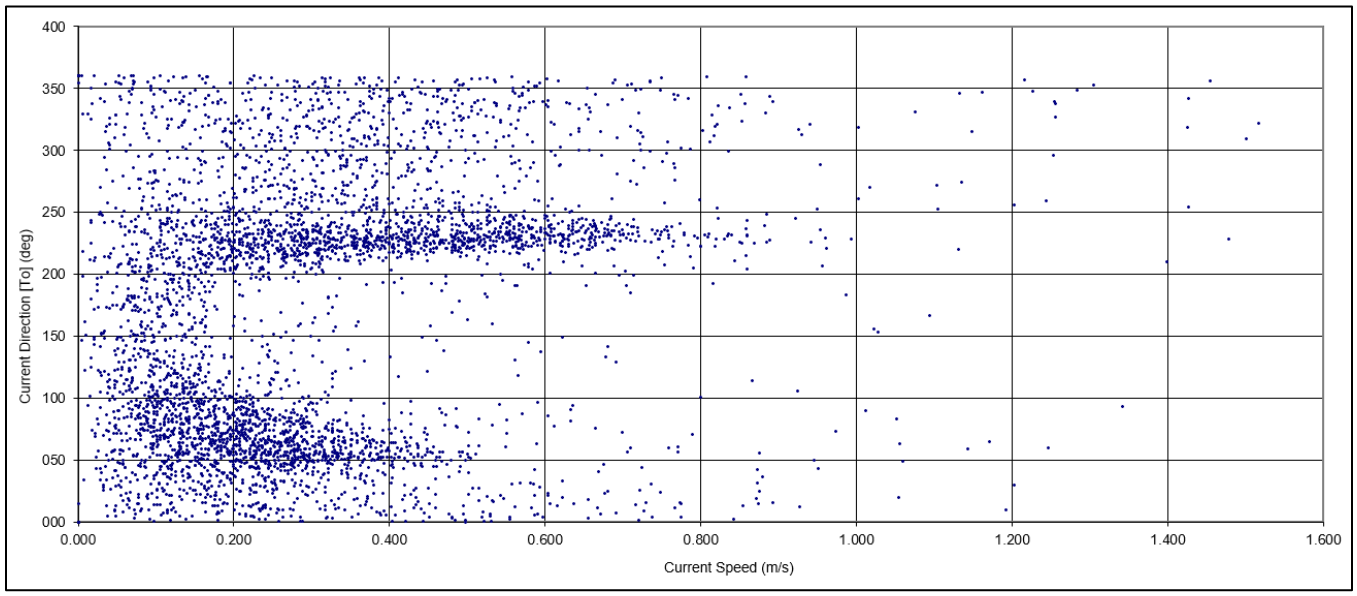


Figure 33 Scatter plot of current speed vs direction at ADCP 3 location - 15m water depth

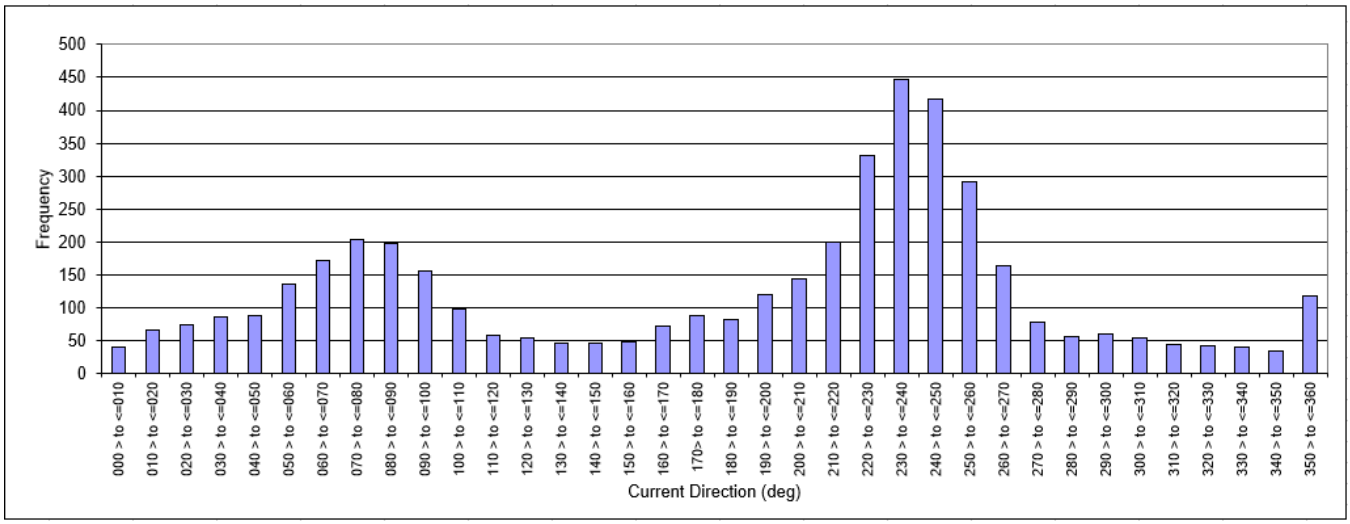


Figure 34 Frequency plot of current direction at ADCP 3 location - 15m Water depth

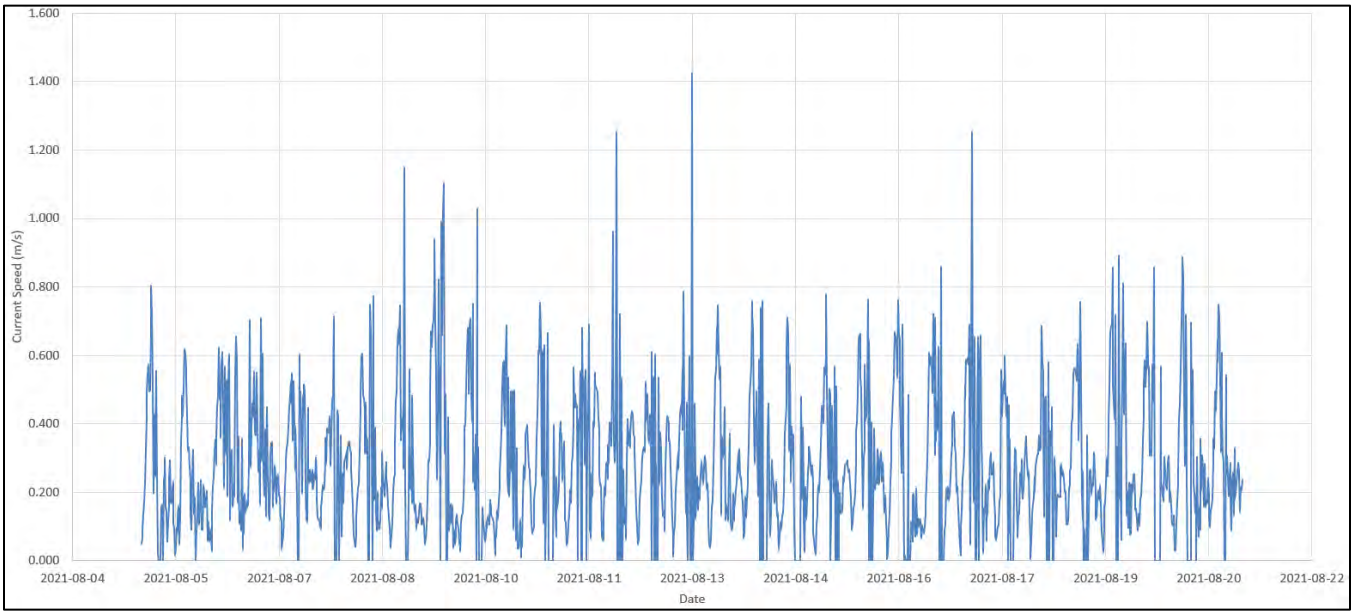


Figure 35 A sample time series plot of current speeds at ADCP 3 location - 15m Water depth

Table 6: 1 in 10 and 1 in 50 current conditions at ADCP 3 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
5 m	*0*	N	1.82	0.29	2.28	2.55
	22.5	NNE	1.97	0.33	2.46	2.76
	45	NE	2.28	0.37	2.85	3.19
	67.5	ENE	1.81	0.31	2.26	2.53
	90	E	2.07	0.33	2.59	2.90
	112.5	ESE	1.51	0.35	1.89	2.11
	135	SE	1.82	0.36	2.28	2.55
	157.5	SSE	1.65	0.33	2.06	2.31
	180	S	2.43	0.37	3.04	3.40
	202.5	SSW	2.49	0.40	3.11	3.49
	225	SW	1.77	0.41	2.21	2.48
	247.5	WSW	1.96	0.38	2.45	2.74
	270	W	1.37	0.34	1.71	1.92
	292.5	WNW	1.89	0.32	2.36	2.65
	315	NW	1.99	0.33	2.49	2.79
	337.5	NNW	2.03	0.29	2.54	2.84
15 m	*0*	N	1.46	0.39	1.83	2.04
	22.5	NNE	1.19	0.33	1.49	1.67
	45	NE	1.20	0.26	1.50	1.68
	67.5	ENE	1.25	0.27	1.56	1.75
	90	E	1.05	0.22	1.31	1.47
	112.5	ESE	1.34	0.18	1.68	1.88
	135	SE	0.87	0.16	1.09	1.22
	157.5	SSE	1.03	0.17	1.29	1.44
	180	S	1.09	0.17	1.36	1.53
	202.5	SSW	0.99	0.22	1.24	1.39
	225	SW	1.40	0.33	1.75	1.96
	247.5	WSW	1.48	0.42	1.85	2.07
	270	W	1.43	0.35	1.79	2.00
	292.5	WNW	1.14	0.35	1.43	1.60
	315	NW	1.50	0.38	1.88	2.10
	337.5	NNW	1.52	0.39	1.90	2.13

7 Wind and wave conditions

Wind conditions for the 6 potential sites were determined based on MSC50 hindcast model of the area [1]. The wave conditions were determined using CHS hydrographic data, MSC50 hindcast model, and STWave software.

7.1 Wave model setup

SMS version 12.2.13 was used to setup the bathymetric and computational grid. This section provides a description of the grid size, mesh size and offshore environmental conditions. Site bathymetry is provided in Figure 36. Note that a CHS hydrographic data is used to generate the bathymetric data for wave modeling.

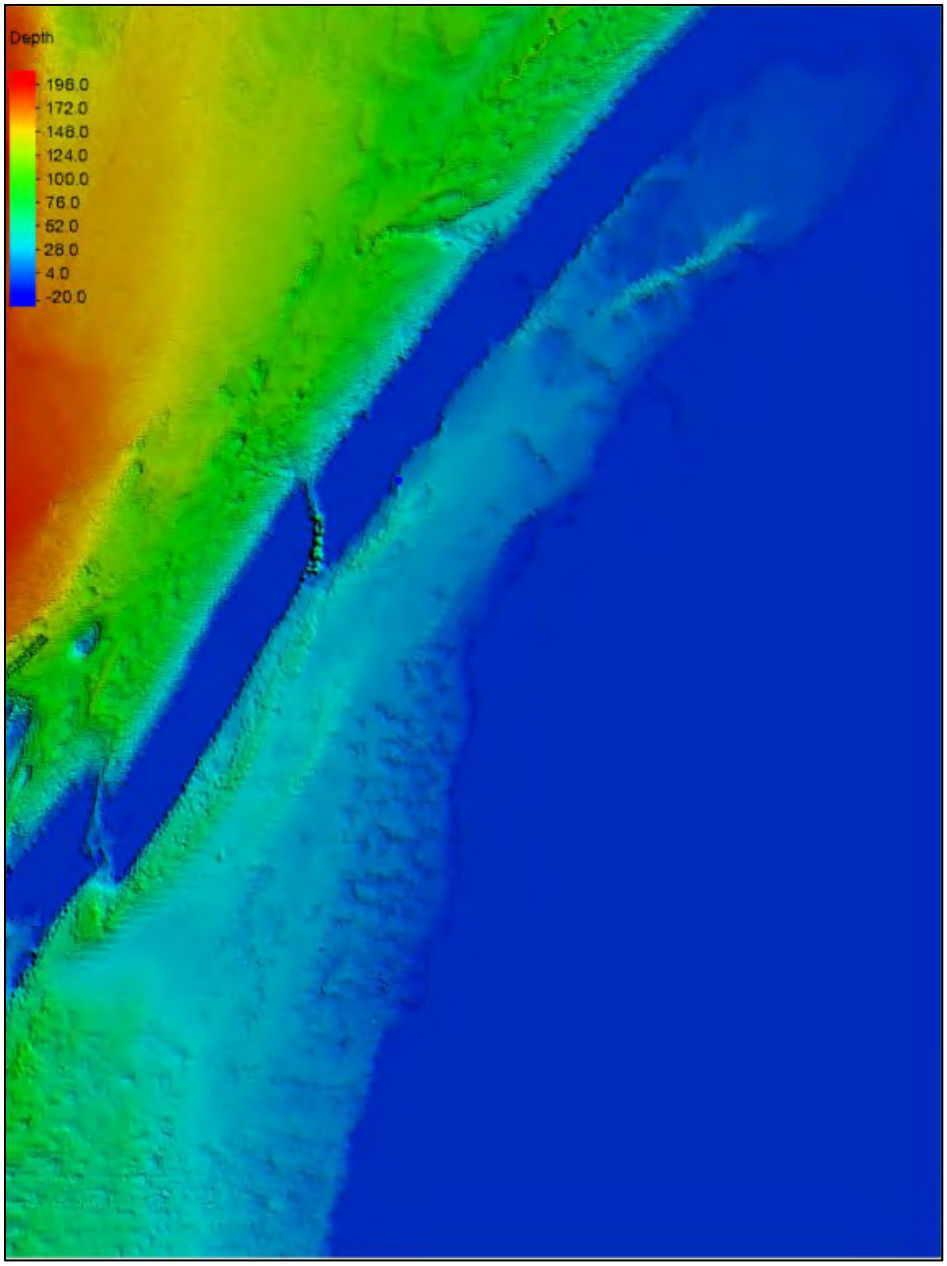


Figure 36 Bathymetry at site on hydrographic charts- Depth reported in meters

SMS, created by Aquaveo, is a modelling software that contains various water surface modelling tools for predicting wave and current flow. For this analysis SMS in combination with STWave is used. STWave is a nearshore spectral Hydraulics model, developed by U.S. Army Engineer Research and Development Center (ERDC) and Coastal and Hydraulics Laboratory (CHL). It is capable of modelling accurately wave transformation and propagation.

Two grids were setup, computational grid and spectral grid. The computational grid and its mesh sizes are mainly defined by the bathymetry. The bathymetry in SMS is presented in Figure 37. For this analysis the computational grid size was 56.2 km x 42.1 km. The mesh size was 25 m x 25 m, resulting in 2251 x 1686= 3,795,186 grid cells.

The spectral domain was divided into 72 directions and 50 frequencies, with a minimum frequency of 0.03Hz and a maximum frequency of 1.01 Hz.

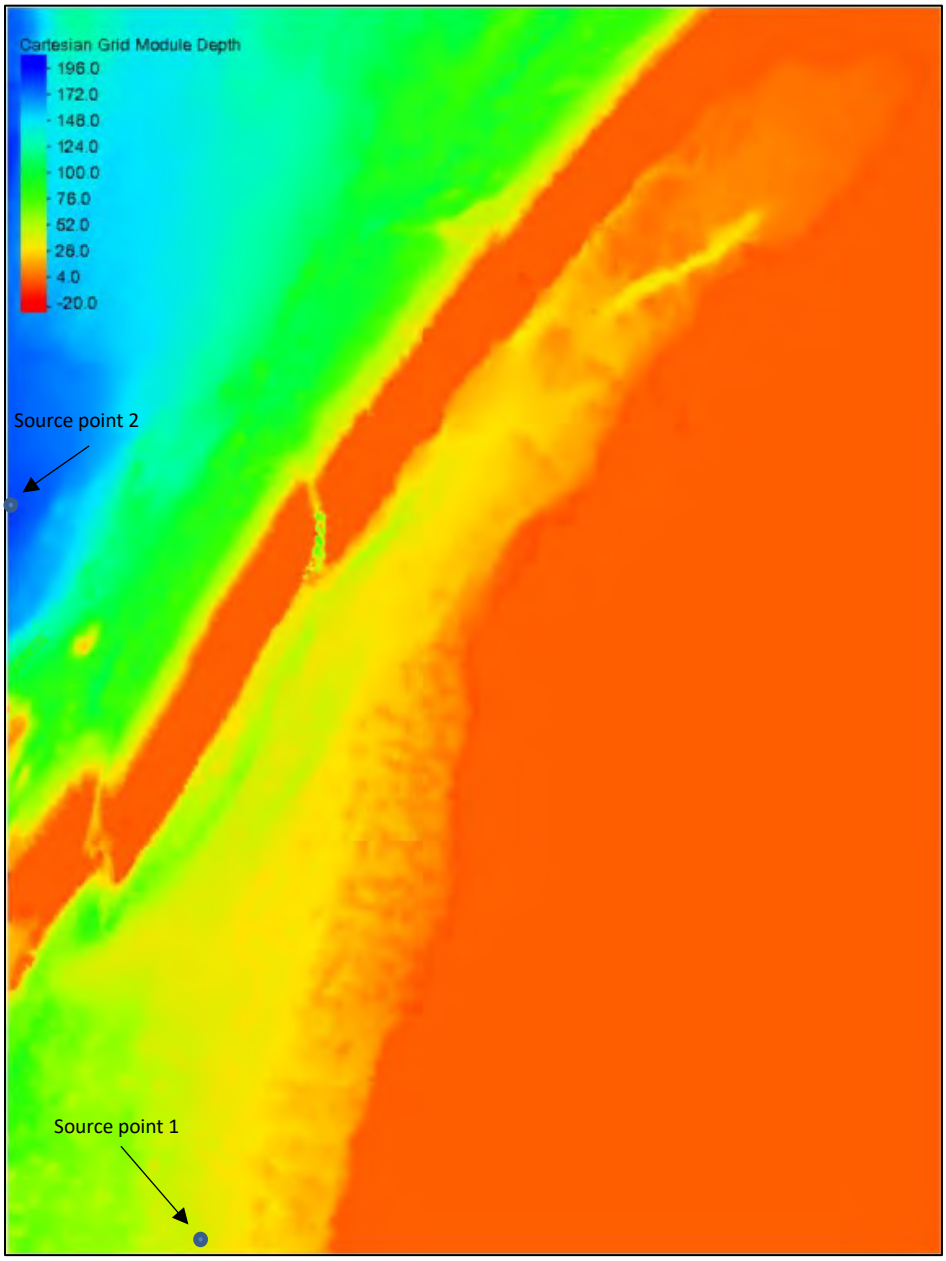


Figure 37 Bathymetry at site on STWave. Note the MSC50 HindCast model source point 1 indicated at 44° 6.000'N, 66° 18.001'W and source point 2 indicated at 44° 24.000'N, 66° 24.001'W

7.2 Boundary conditions – offshore wind and wave conditions

The MSC50 HindCast model [1] data from location 43° 36.000'N, 65° 12.000'W and location 44° 24.000'N, 66° 24.001'W were used to determine the 10 and 50 year return periods for wind and wave of the St. Mary's Bay fish farm sites; the locations are labelled as the "Source point" in Figure 37. The scatterplots of wave heights versus wave directions for the source points are shown in Figure 38 and Figure 39. The scatter plot of wind speeds versus wind directions for the source points are also shown in Figure 40 and Figure 41. Extreme waves and wind at the source points appear to originate more frequently from the south, and southwest.

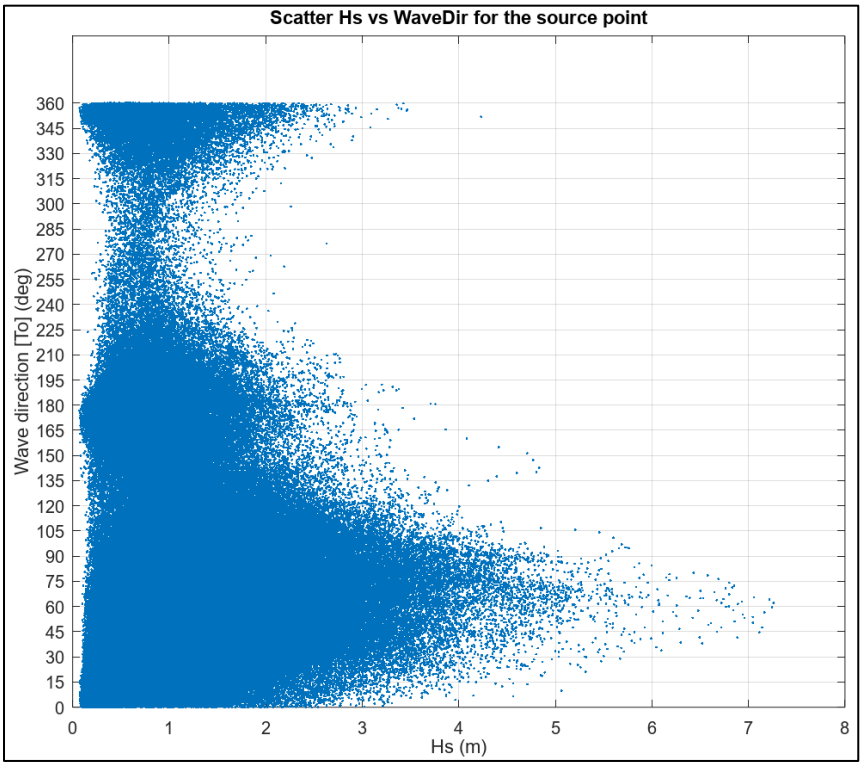


Figure 38 Wave height versus wave direction plot for the source point 1

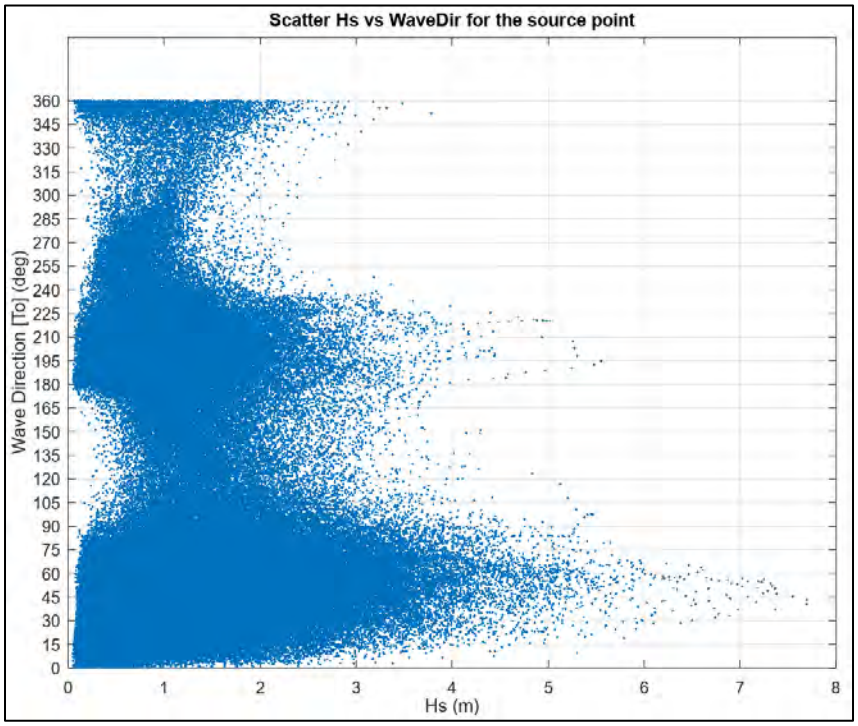


Figure 39 Wave height versus wave direction plot for the source point 2

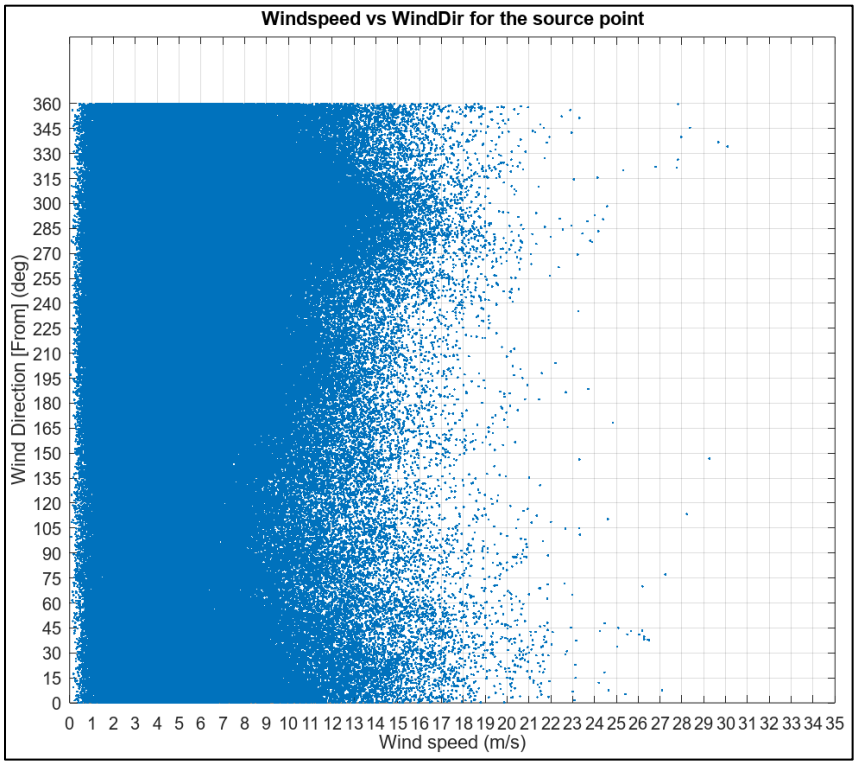


Figure 40 Wind speed versus wind direction plot for the source point 1

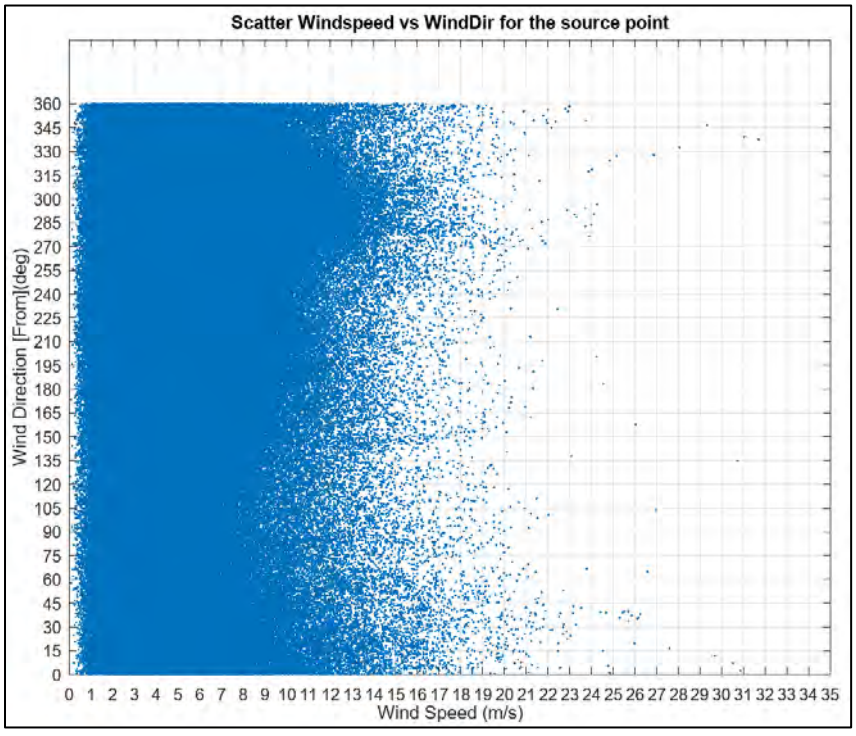
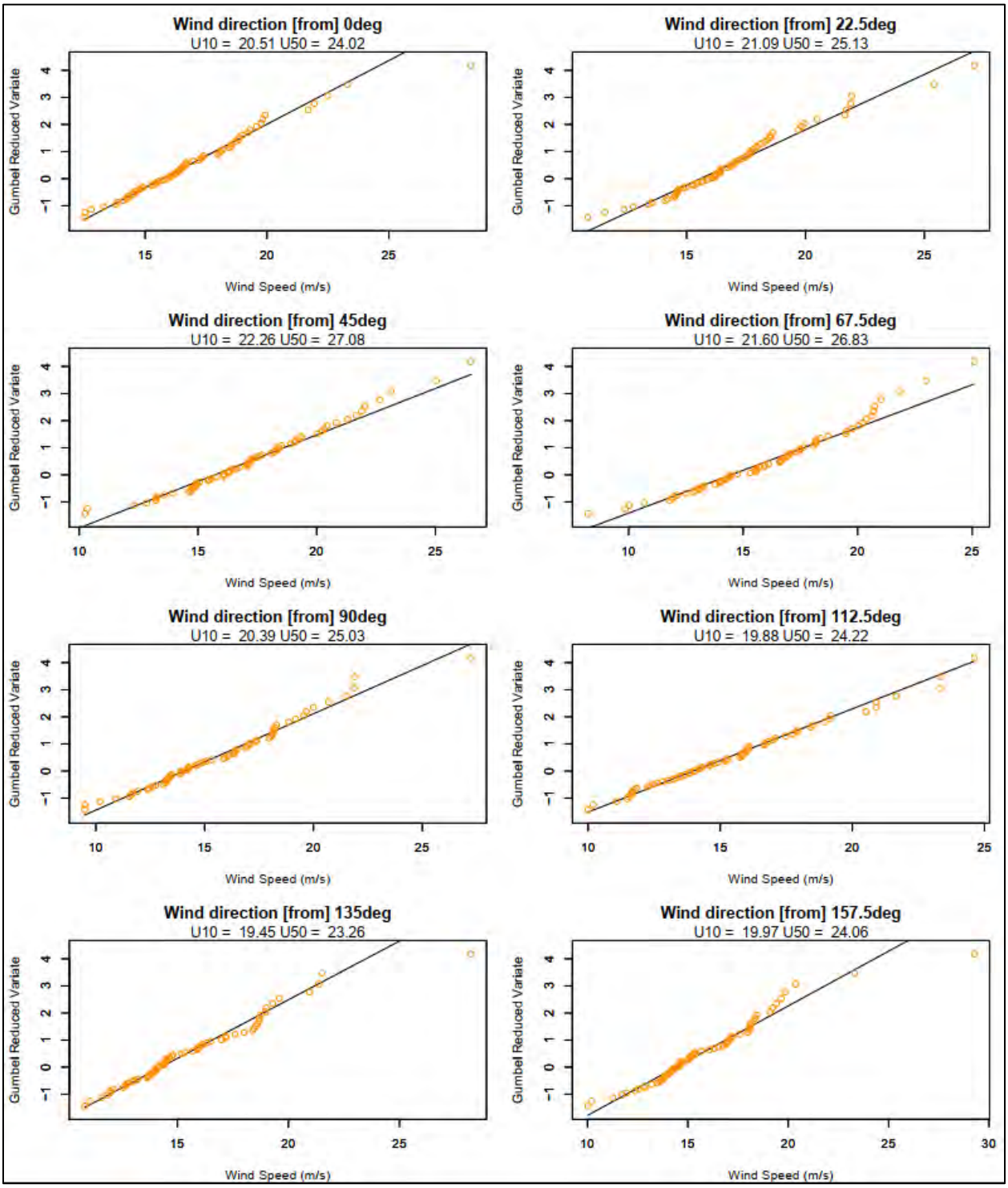


Figure 41 Wind speed versus wind direction plot for the source point 2

10 and 50 year return period conditions are in general achieved by:

- Obtaining measured or hindcast data for parameter in question
- For each parameter, bin data by direction
- Perform extreme value analysis.
    - Extract annual maxima
    - Fit Gumbel or Weibull distribution to this data
    - Use fitted distribution to calculate values corresponding to 10 and 50 year return period

The extreme value analysis of the wind velocities are presented in Figure 42 and Figure 43. U10 and U50 represent the 10 and 50 year return period wind velocities, respectively.


Wind direction [from] 0deg
U10 = 20.51 U50 = 24.02
Wind direction [from] 22.5deg
U10 = 21.09 U50 = 25.13
Wind direction [from] 45deg
U10 = 22.26 U50 = 27.08
Wind direction [from] 67.5deg
U10 = 21.60 U50 = 26.83
Wind direction [from] 90deg
U10 = 20.39 U50 = 25.03
Wind direction [from] 112.5deg
U10 = 19.88 U50 = 24.22
Wind direction [from] 135deg
U10 = 19.45 U50 = 23.26
Wind direction [from] 157.5deg
U10 = 19.97 U50 = 24.06
Gumbel Reduced Variate
Wind Speed (m/s)

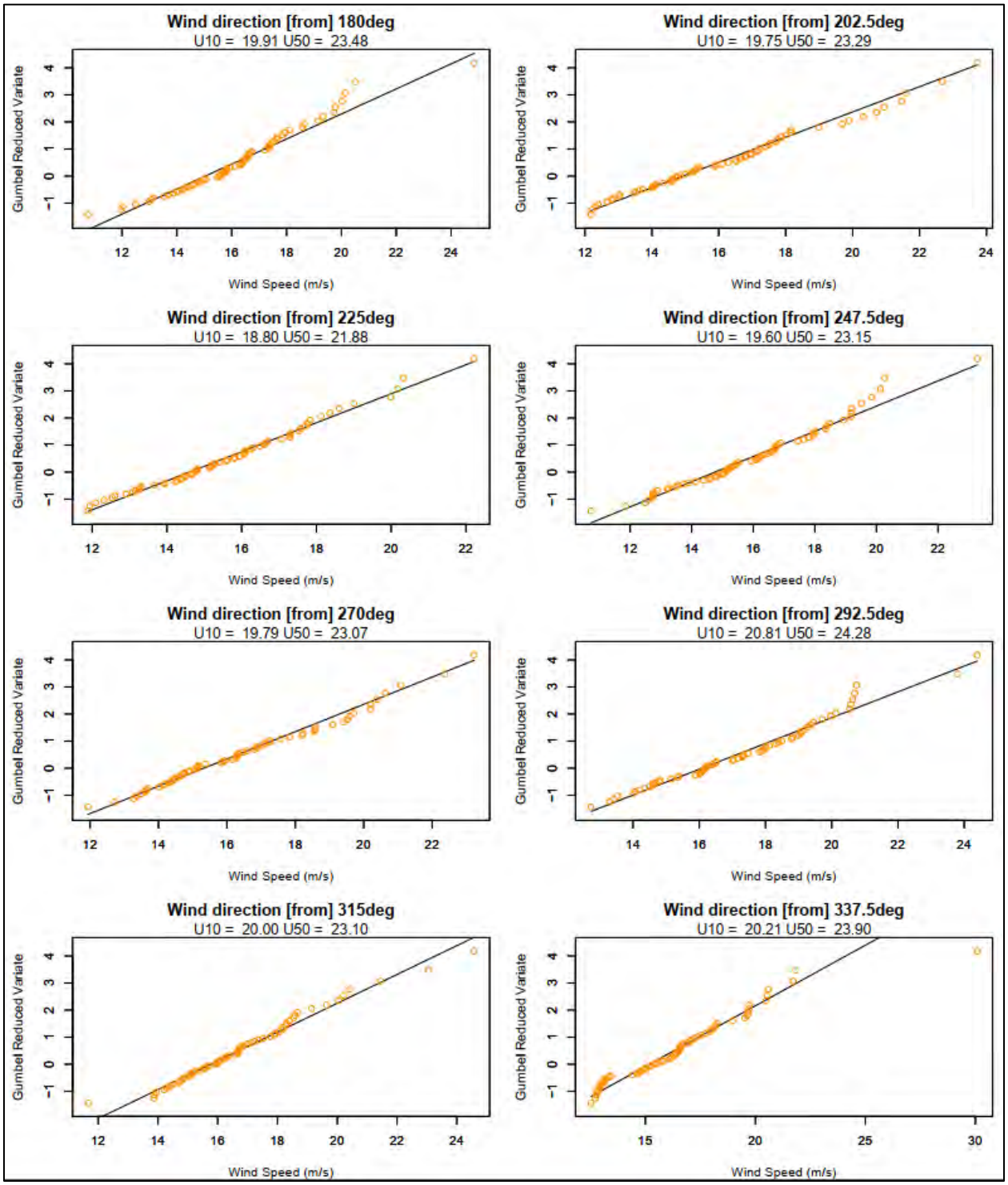
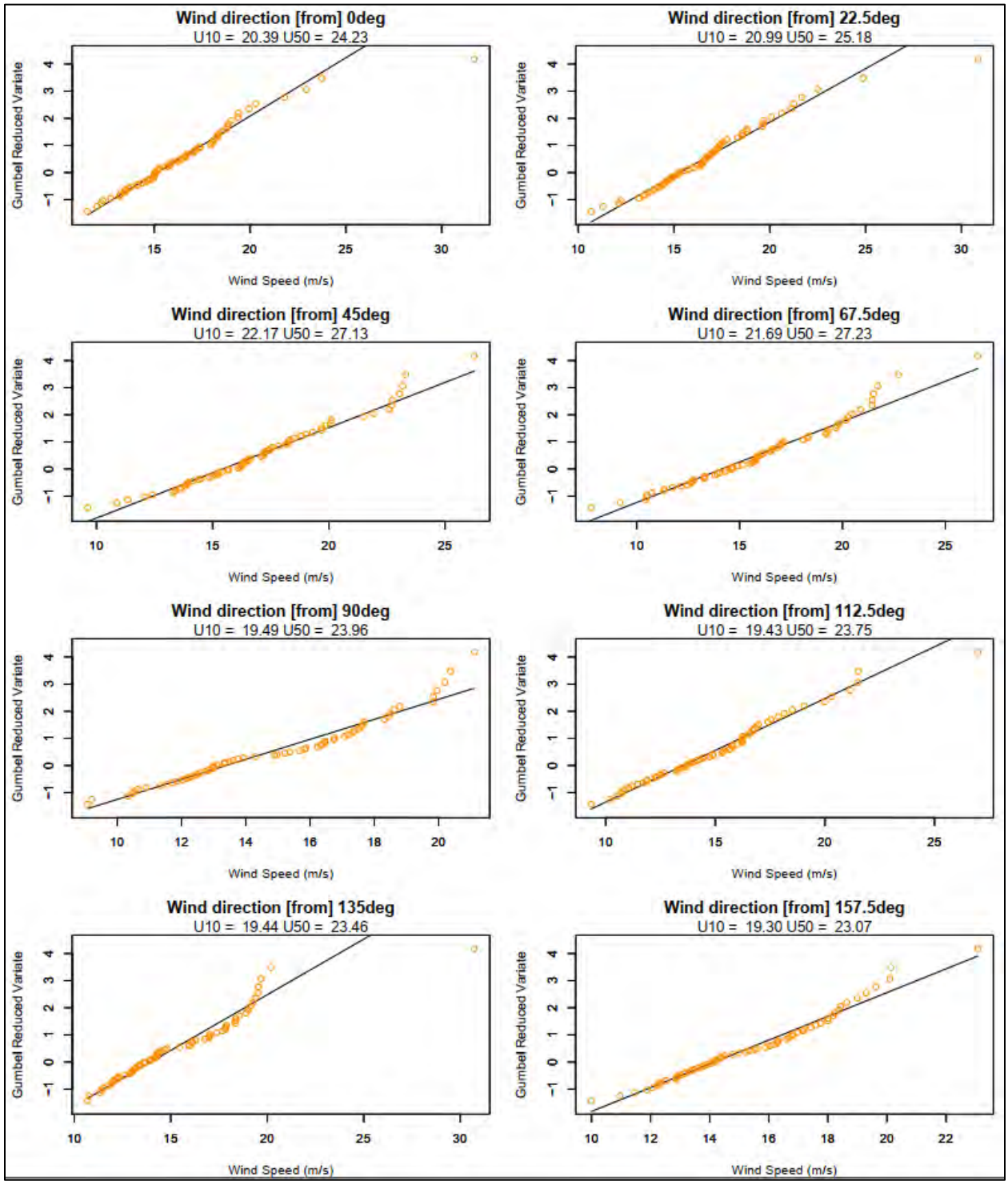


Figure 42: Extreme value analysis on wind data – for Source Point 1 offshore location [1]


Wind direction [from] 0deg
U10 = 20.39 U50 = 24.23
Wind direction [from] 22.5deg
U10 = 20.99 U50 = 25.18
Wind direction [from] 45deg
U10 = 22.17 U50 = 27.13
Wind direction [from] 67.5deg
U10 = 21.69 U50 = 27.23
Wind direction [from] 90deg
U10 = 19.49 U50 = 23.96
Wind direction [from] 112.5deg
U10 = 19.43 U50 = 23.75
Wind direction [from] 135deg
U10 = 19.44 U50 = 23.46
Wind direction [from] 157.5deg
U10 = 19.30 U50 = 23.07
Gumbel Reduced Variate
Wind Speed (m/s)

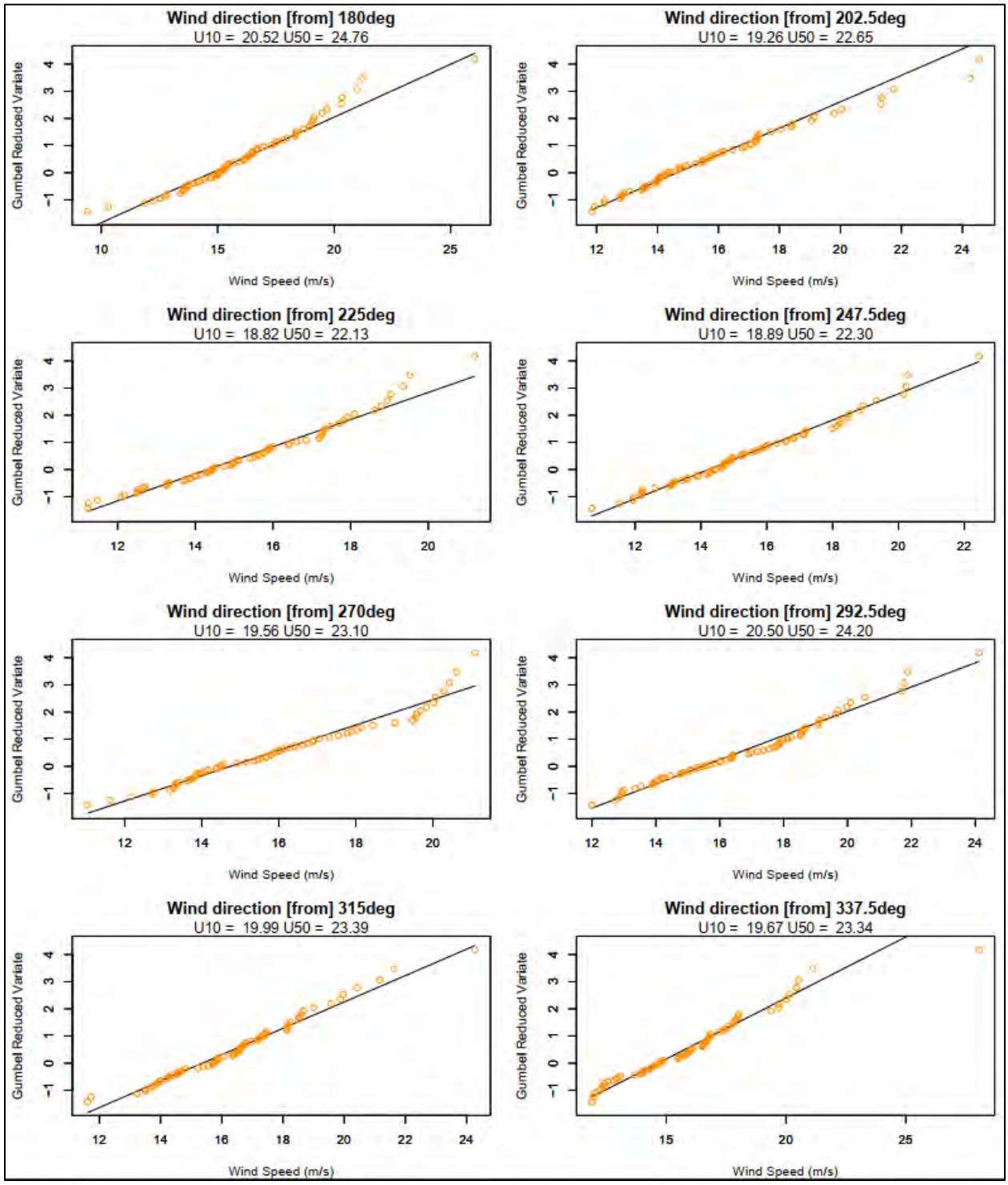
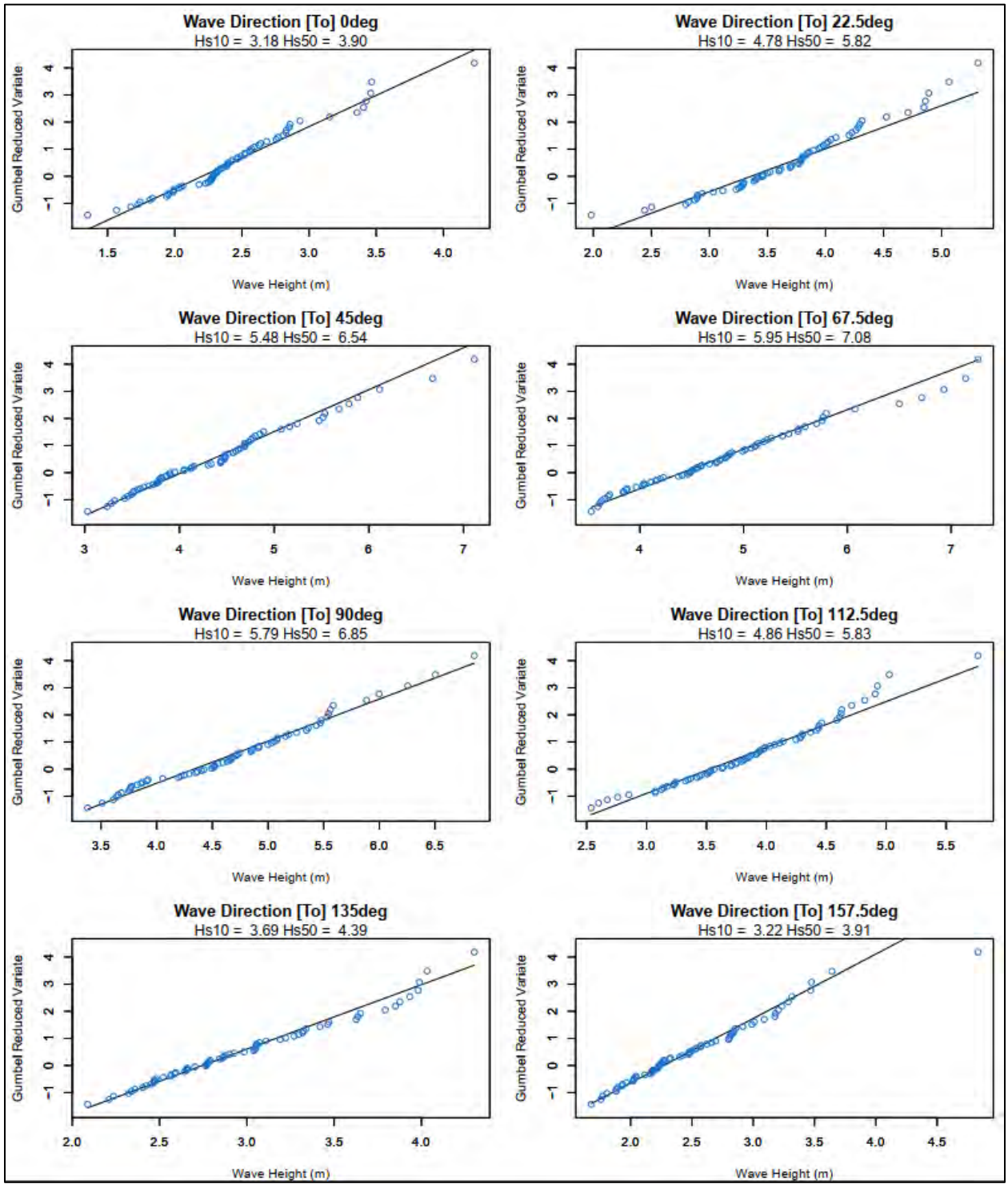


Figure 43: Extreme value analysis on wind data – for Source Point 2 offshore location [1]

The extreme value analysis of the wave heights are presented in Figure 44 Figure 45. Similar to the presentation of the wind data, Hs10 and Hs50 represent the 10 and 50 year return period wave heights, respectively.


Wave Direction [To] 0deg
Hs10 = 3.18 Hs50 = 3.90
Wave Direction [To] 22.5deg
Hs10 = 4.78 Hs50 = 5.82
Wave Direction [To] 45deg
Hs10 = 5.48 Hs50 = 6.54
Wave Direction [To] 67.5deg
Hs10 = 5.95 Hs50 = 7.08
Wave Direction [To] 90deg
Hs10 = 5.79 Hs50 = 6.85
Wave Direction [To] 112.5deg
Hs10 = 4.86 Hs50 = 5.83
Wave Direction [To] 135deg
Hs10 = 3.69 Hs50 = 4.39
Wave Direction [To] 157.5deg
Hs10 = 3.22 Hs50 = 3.91
Gumbel Reduced Variate
Wave Height (m)

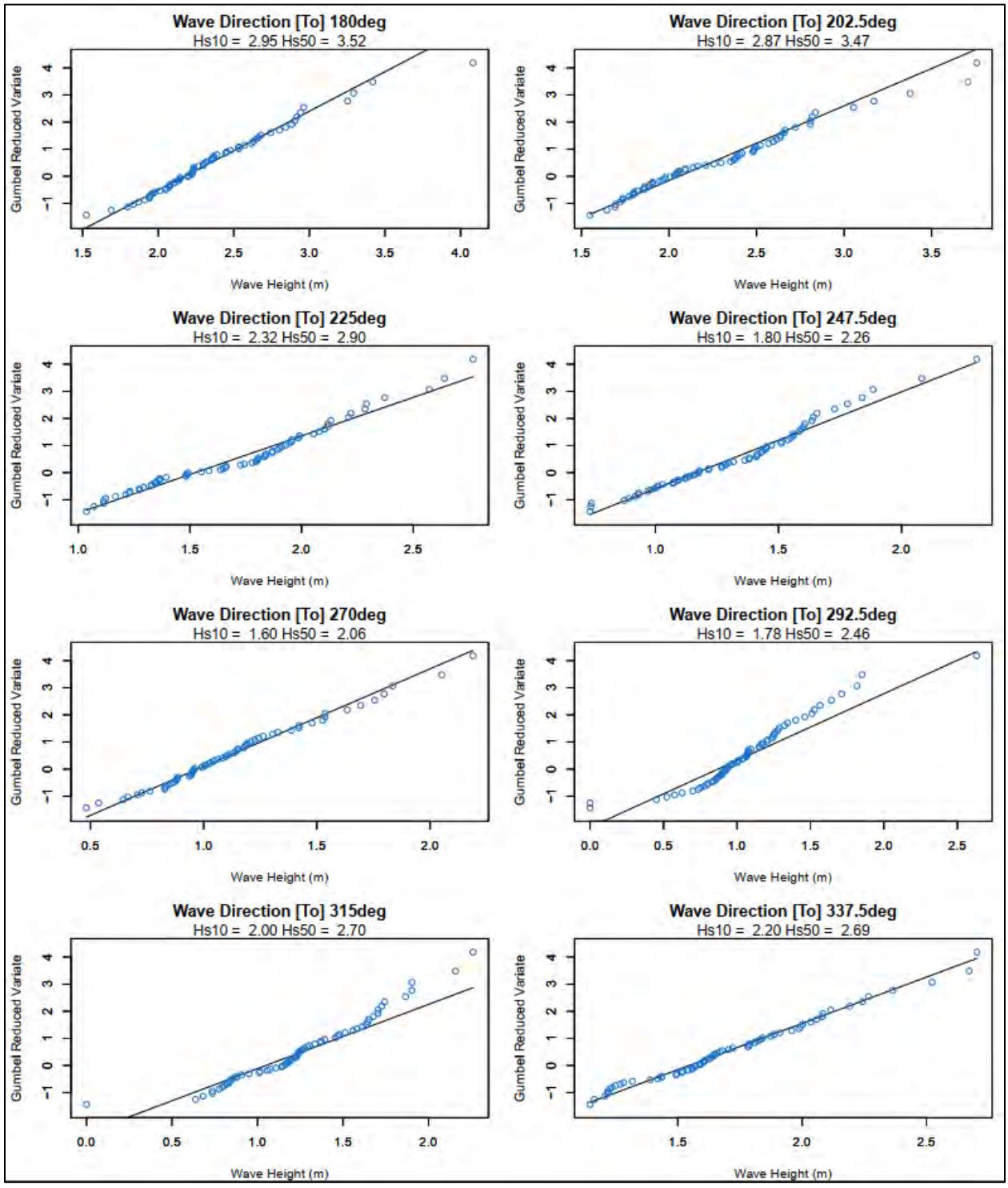
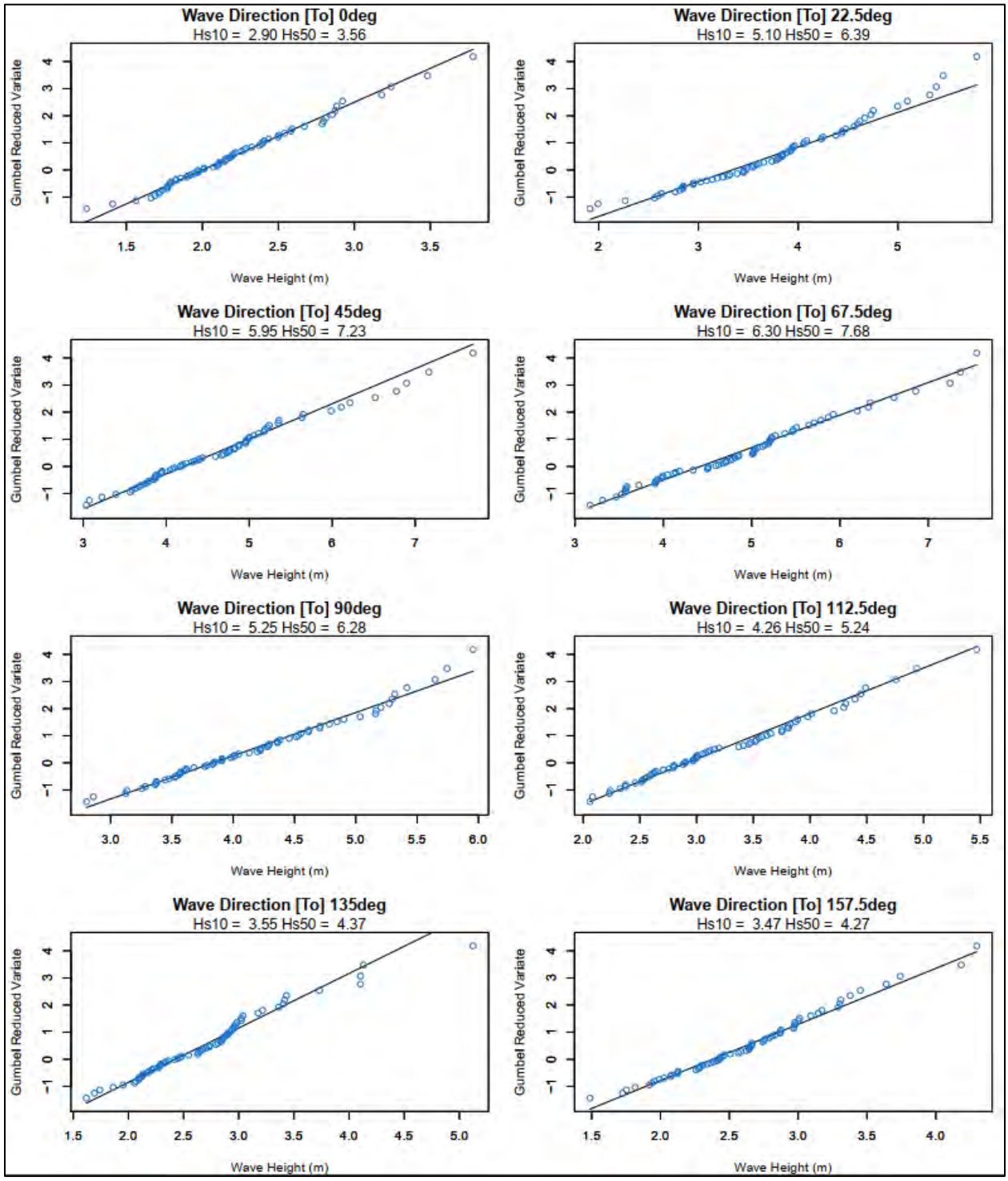


Figure 44: Extreme value analysis on wave data – for Source Point 1 offshore location [1]


Wave Direction [To] 0deg
Hs10 = 2.90 Hs50 = 3.56
Wave Direction [To] 22.5deg
Hs10 = 5.10 Hs50 = 6.39
Wave Direction [To] 45deg
Hs10 = 5.95 Hs50 = 7.23
Wave Direction [To] 67.5deg
Hs10 = 6.30 Hs50 = 7.68
Wave Direction [To] 90deg
Hs10 = 5.25 Hs50 = 6.28
Wave Direction [To] 112.5deg
Hs10 = 4.26 Hs50 = 5.24
Wave Direction [To] 135deg
Hs10 = 3.55 Hs50 = 4.37
Wave Direction [To] 157.5deg
Hs10 = 3.47 Hs50 = 4.27
Gumbel Reduced Variate
Wave Height (m)

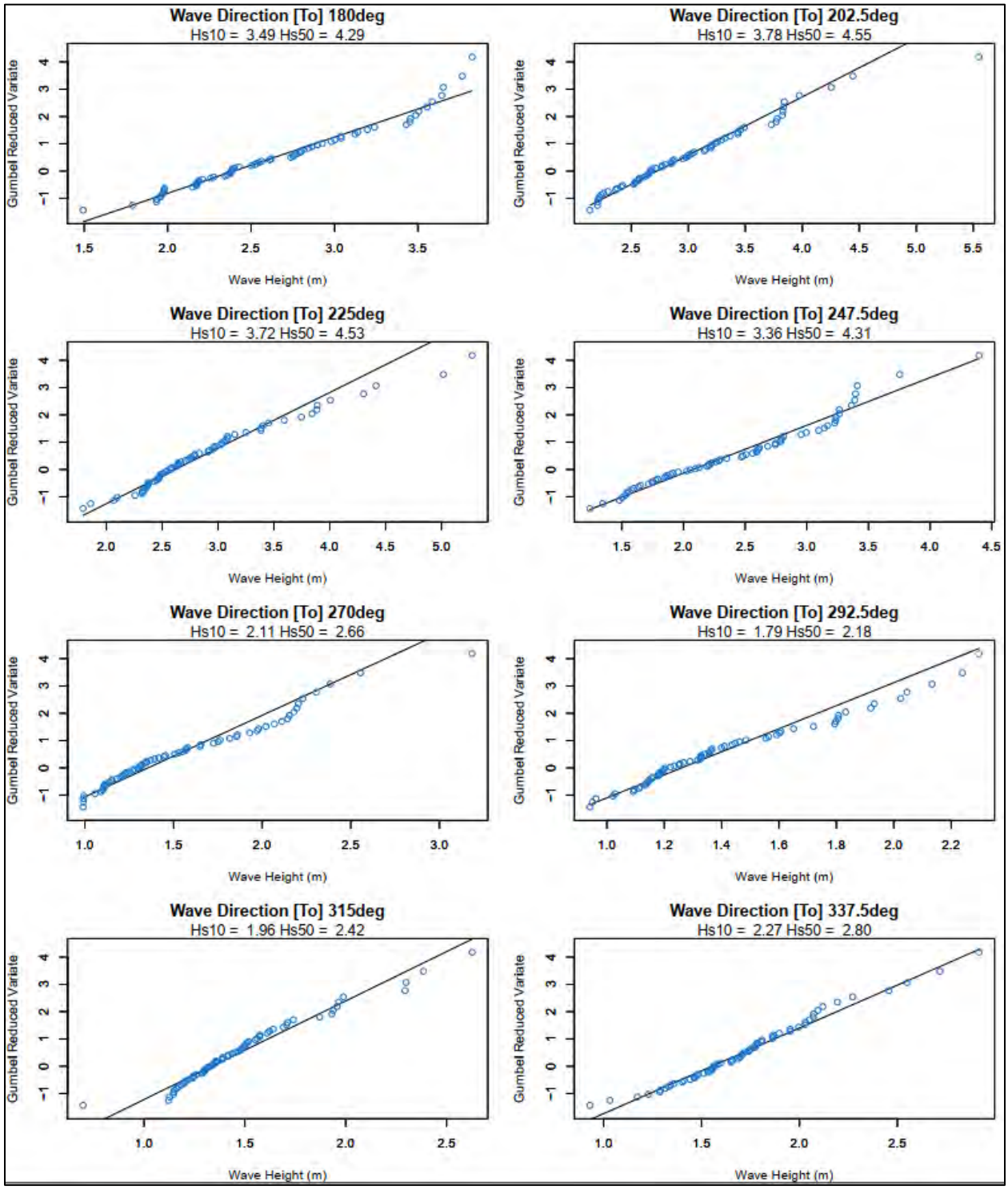


Figure 45: Extreme value analysis on wave data – for Source Point 2 offshore location [1]

In summary, the following data was obtained from the extreme value analysis:

Table 7 Results extreme value analysis for wind and waves at the offshore source point locations in Figure 4

Direction [from] [°]		$U_{wind,10year}$ [m/s]	$U_{wind,50year}$ [m/s]	$H_{s,10year}$ [m]	$H_{s,50year}$ [m]
0	N	20.39	24.33	3.49	4.29
23	NNE	20.99	25.18	3.78	4.55
45	NE	22.17	27.13	3.72	4.53
68	ENE	21.69	27.33	3.36	4.31
90	E	23.39	25.03	3.36	4.31
113	ESE	19.88	24.22	1.78	2.46
135	SE	19.45	23.26	2	2.7
158	SSE	19.97	24.06	2.2	2.69
180	S	19.91	23.48	3.18	3.9
203	SSW	19.75	23.29	4.78	5.82
225	SW	18.8	21.88	5.48	6.54
248	WSW	19.6	23.15	5.95	7.08
270	W	19.56	23.1	5.25	6.28
293	WNW	20.5	24.2	4.26	5.24
315	NW	19.99	23.39	3.55	4.37
338	NNW	19.67	23.34	3.47	4.27

Polar plots for maximum wind speeds and wave heights at 10 year and 50 year return periods are shown in Figure 46 to Figure 49, respectively.

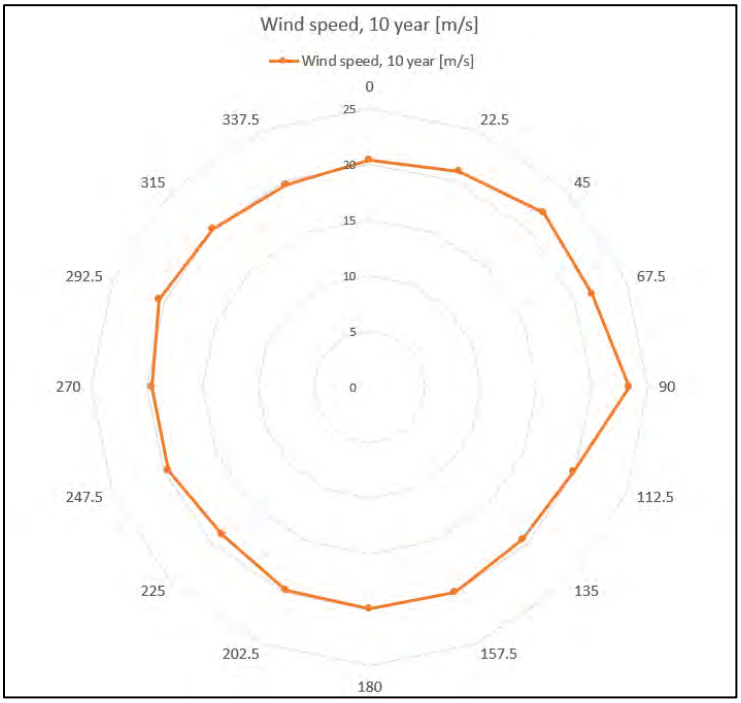


Figure 46 Maximum wind speed at 10 year return period and direction [from]- for Source Points offshore location [1]

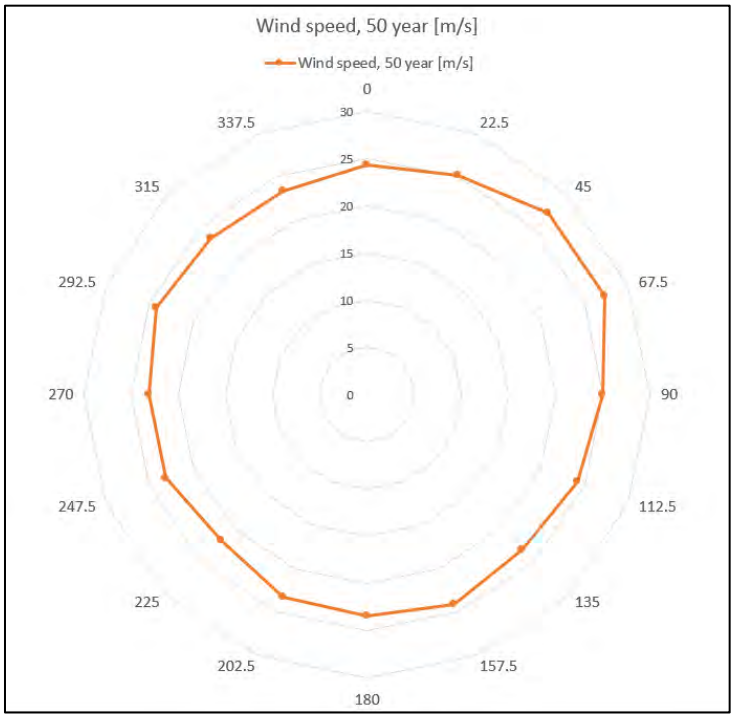


Figure 47 Maximum wind speed at 50 year return period and direction [from]- for Source Points offshore location [1]

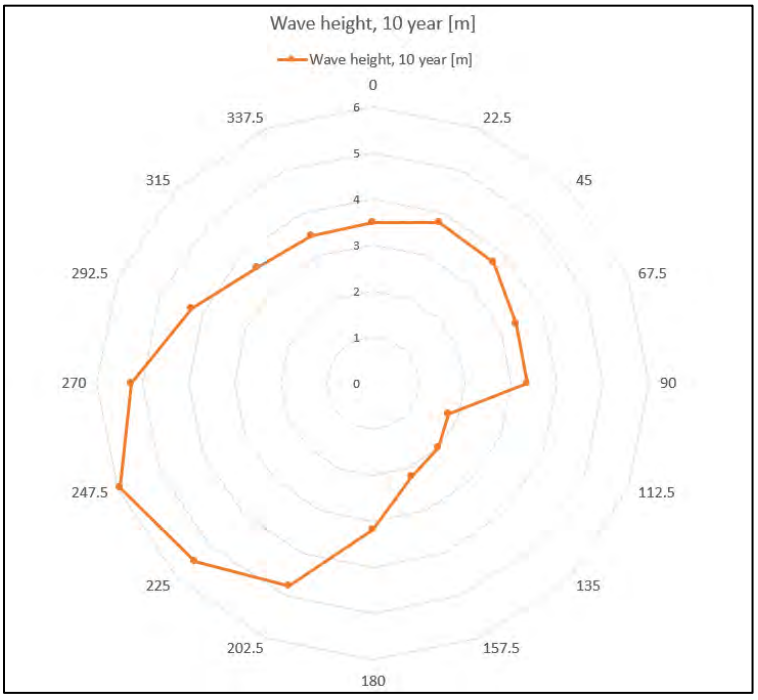


Figure 48 Maximum wave height at 10 year return period and direction [from]- for Source Points offshore location [1]

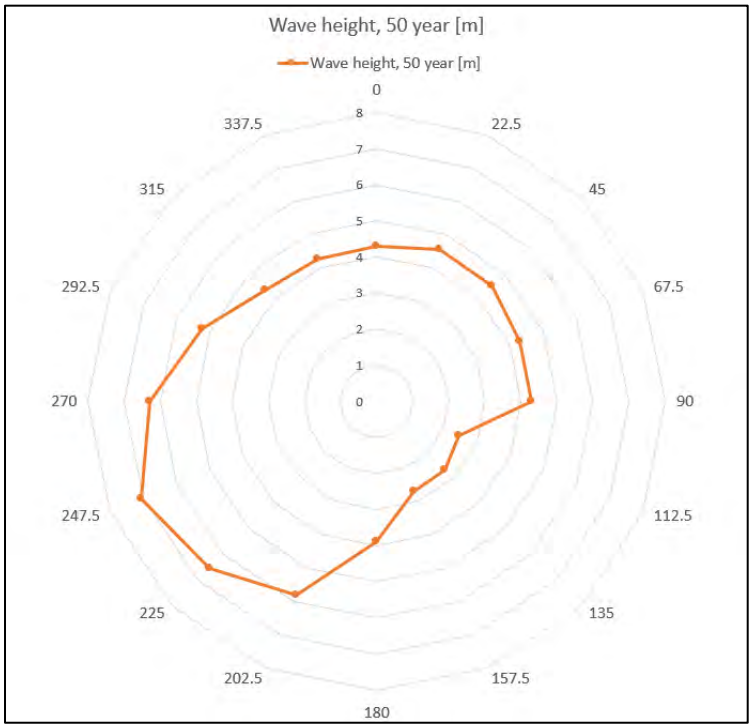


Figure 49 Maximum wave height at 50 year return period and direction [from]- for Source Points offshore location [1]

The wave data, presented in Table 7, was set as boundary condition and specified as a JONSWAP spectrum. The peak-enhancement factor was set to 3.3 and directional spreading was included as a $\cos^m(\theta)$ distribution.

Only wind-wave interaction was considered. Current-wave interaction was not included because local flow velocities are very small.

Eight headings were used, the wind direction was kept constant within its directional bin. T_p was varied in the presented range as shown in Table 8.

Table 8 T_p values used in analysis.

Direction [from] [°]		*T_p [s]*
0	N	5_7.47
23	NNE	4.9_14.2
45	NE	4.93_17
68	ENE	4.25_9
90	E	3.48_9.5
113	ESE	1_5.55
135	SE	1_5.53
158	SSE	4.5_7.66
180	S	5.83_12.77
203	SSW	6.3_14.12
225	SW	8.25_13.95

248	WSW	8.8_13.9
270	W	8.16_11.2
293	WNW	5.96_8.77
315	NW	5.27_8.36
338	NNW	4.7_7.45

In this method, wave design conditions for the project location are based on 10 and 50 year return period sea-state and winds for an offshore location, which have subsequently been transferred to the project location. This will provide reasonable design conditions; however, they cannot be linked directly to a return period at the site.

7.3 Wave modeling results

The results of the wave modeling at St. Mary's Bay are presented in Figure 50 and Figure 51 for directions from south and southwest, respectively for two key wave headings with the highest wave heights. The size of the arrows indicates the relative significant wave height. The orientation of the arrows indicates wave direction. In Figure 50 and Figure 51, the direction indicated for each figure is based on the direction at the source point. The wind and wave conditions used as boundary conditions for the indicated direction are those presented in Table 7. As stated in the previous section, the wind conditions are assumed to stay constant for the region. The results from STWave represent the maximum significant wave height value at the region including its spectral peak period and wave direction.

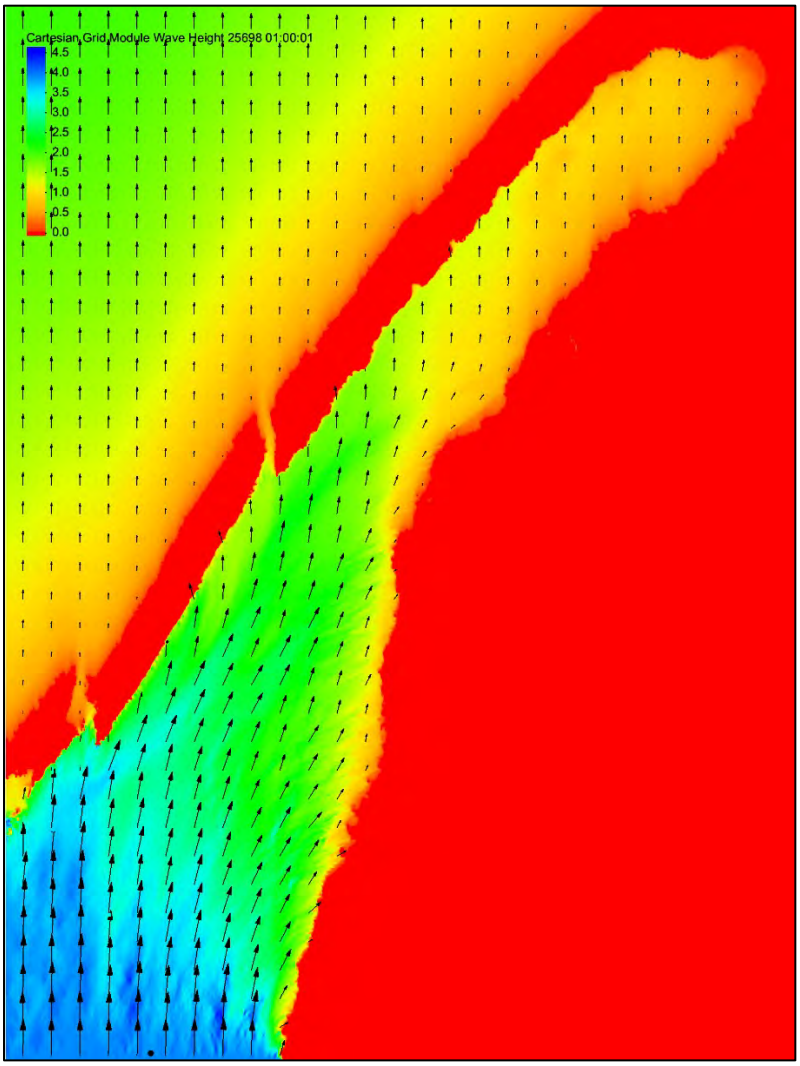


Figure 50 Wave modeling results at St. Mary's Bay for direction [From] 180 deg- S

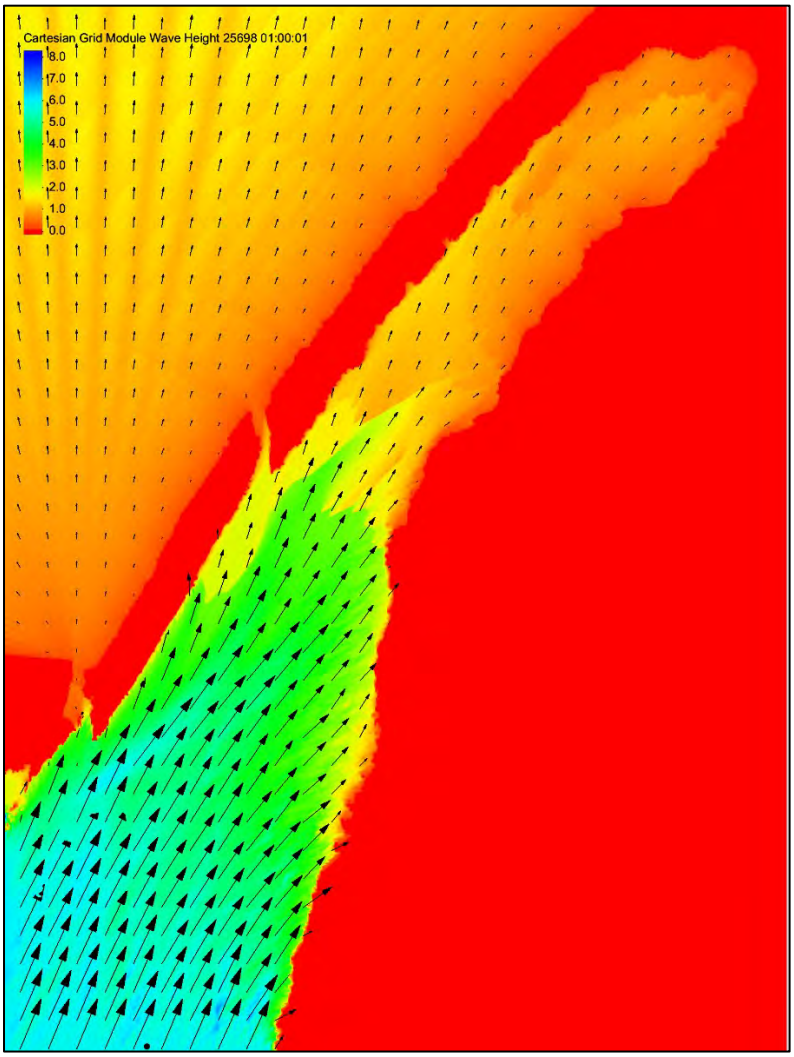


Figure 51 Wave modeling results at St. Mary's Bay for direction [From] 203 deg- SW

7.3.1 Wave/wind conditions for potential site 1

The wave and wind results from the STWave model, for the potential site 1 are summarized in Table 9. Note that the results in Table 9 indicate significant wave height (Hs) and peak period (T_P) for the selected site. These represent the extreme wave conditions at this coordinate: 44° 22.929'N, 66° 10.392'W.

Table 9: Estimated wave and wind design conditions for potential site 1

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.56	2.2
	23	NNE	20.99	0.75	3
	45	NE	22.17	1.53	3.72
	68	ENE	21.69	1.38	3.4

	90	E	23.39	1.16	3.18
	113	ESE	19.88	0.69	2.75
	135	SE	19.45	0.81	4.59
	158	SSE	19.97	1.28	4.42
	180	S	19.91	1.97	6.1
	203	SSW	19.75	1.71	4.95
	225	SW	18.8	1.61	5.79
	248	WSW	19.6	0.8	4.07
	270	W	19.56	0.48	2.02
	293	WNW	20.5	0.34	1.84
	315	NW	19.99	0.37	2.37
	338	NNW	19.67	0.43	2.19
50yr wave/wind	*0*	N	24.33	0.69	2.38
	23	NNE	25.18	0.93	3.26
	45	NE	27.13	1.88	4.04
	68	ENE	27.33	1.78	3.76
	90	E	25.03	1.26	3.28
	113	ESE	24.22	0.88	3
	135	SE	23.26	1	4.96
	158	SSE	24.06	1.53	4.6
	180	S	23.48	2.24	5.9
	203	SSW	23.29	1.91	4.5
	225	SW	21.88	1.65	5.35
	248	WSW	23.15	0.91	3.64
	270	W	23.1	0.58	2.17
	293	WNW	24.2	0.43	1.95
	315	NW	23.39	0.45	2.54
	338	NNW	23.34	0.52	2.36

It should be noted that the return periods indicated for each wave parameter in Table 9 are representative of the boundary condition used to derive that value, not the value itself. Polar plots for maximum wave heights are presented in Figure 52 and Figure 53.

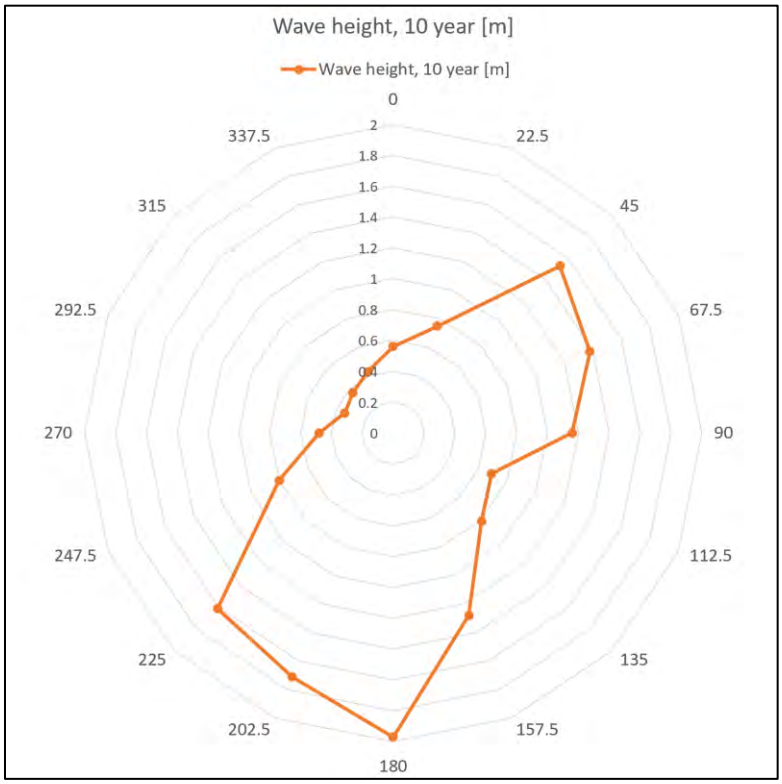


Figure 52: Maximum wave height at 10- year return period and direction [from]- potential site 1

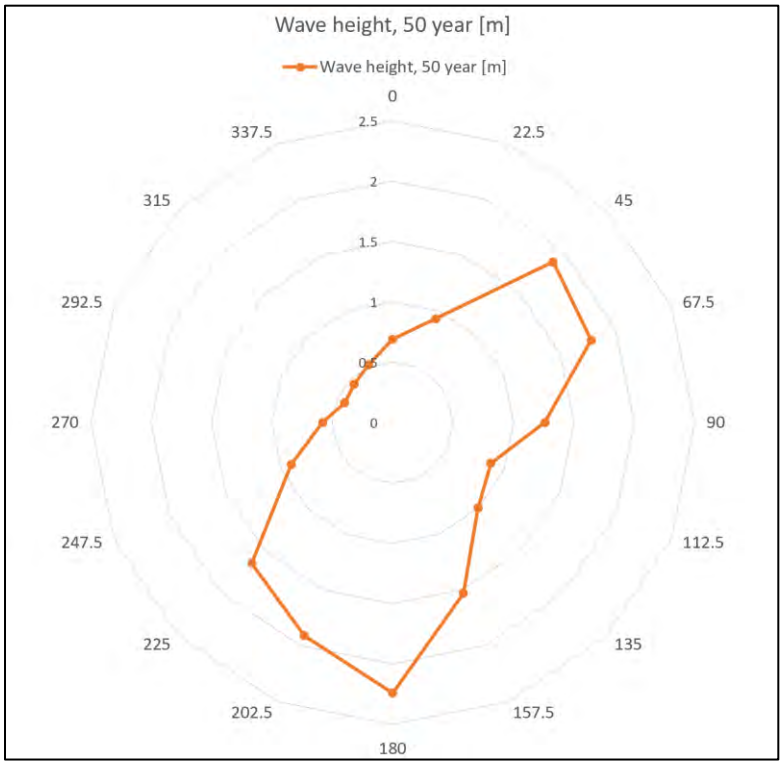


Figure 53: Maximum wave height at 50- year return period and direction [from]- potential site 1

7.3.2 Wave/wind conditions for potential site 2

The wave and wind results from the STWave model, for the potential site 2 are summarized in Table 10. Note that the results in Table 10 indicate significant wave height (Hs) and peak period (T_P) for the selected site. These represent the extreme wave conditions at this coordinate: 44° 24.506'N, 66° 8.627'W.

Table 10: Estimated wave and wind design conditions for potential site 2

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.54	2.14
	23	NNE	20.99	0.73	3.03
	45	NE	22.17	1.45	3.67
	68	ENE	21.69	1.34	3.43
	90	E	23.39	1.28	3.65
	113	ESE	19.88	0.66	2.63
	135	SE	19.45	0.75	4.03
	158	SSE	19.97	1.07	3.96
	180	S	19.91	1.7	4.62
	203	SSW	19.75	1.1	3.43
	225	SW	18.8	1.38	4.31
	248	WSW	19.6	0.65	2.74
	270	W	19.56	0.49	2.05
	293	WNW	20.5	0.36	1.91
	315	NW	19.99	0.43	2.33
	338	NNW	19.67	0.47	2.14
50yr wave/wind	*0*	N	24.33	0.67	2.3
	23	NNE	25.18	0.91	3.3
	45	NE	27.13	1.82	4
	68	ENE	27.33	1.77	3.81
	90	E	25.03	1.38	3.47
	113	ESE	24.22	0.84	2.88
	135	SE	23.26	0.92	4.35
	158	SSE	24.06	1.31	4.24
	180	S	23.48	1.97	4.72
	203	SSW	23.29	1.21	3.18
	225	SW	21.88	1.43	4.12
	248	WSW	23.15	0.76	2.66
	270	W	23.1	0.6	2.2
	293	WNW	24.2	0.46	2.04

	315	NW	23.39	0.52	2.5
	338	NNW	23.34	0.58	2.3

It should be noted that the return periods indicated for each wave parameter in Table 10 are representative of the boundary condition used to derive that value, not the value itself. Polar plots for maximum wave heights are presented in Figure 54 and Figure 55.

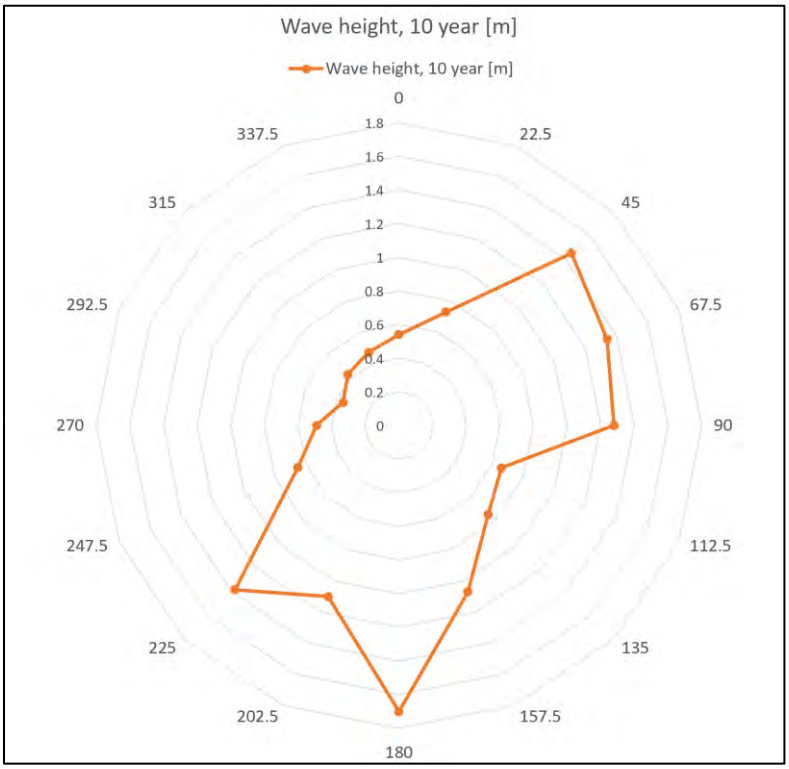


Figure 54: Maximum wave height at 10- year return period and direction [from]- Potential site 2

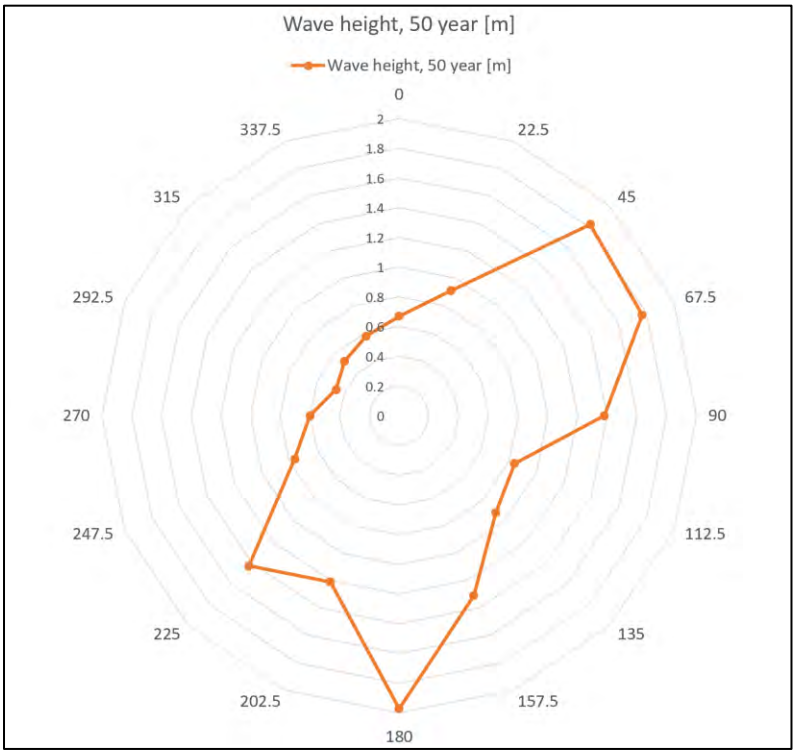


Figure 55: Maximum wave height at 50- year return period and direction [from]- Potential site 2

7.3.3 Wave/wind conditions for potential site 3

The wave and wind results from the STWave model, for the potential site 3 are summarized in Table 11. Note that the results in Table 11 indicate significant wave height (Hs) and peak period (T_P) for the selected site. These represent the extreme wave conditions at this coordinate: 44° 26.164'N, 66° 6.797'W.

Table 11: Estimated wave and wind design conditions for potential site 3

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.6	2.26
	23	NNE	20.99	0.66	2.79
	45	NE	22.17	1.32	3.54
	68	ENE	21.69	1.33	3.37
	90	E	23.39	1.2	3.24
	113	ESE	19.88	0.7	2.76
	135	SE	19.45	0.79	3.47
	158	SSE	19.97	0.94	3.37
	180	S	19.91	1.4	4.04

	203	SSW	19.75	1.13	3.24
	225	SW	18.8	1.27	4.1
	248	WSW	19.6	0.64	2.65
	270	W	19.56	0.5	2.08
	293	WNW	20.5	0.38	1.92
	315	NW	19.99	0.42	2.44
	338	NNW	19.67	0.48	2.23
50yr wave/wind	*0*	N	24.33	0.74	2.43
	23	NNE	25.18	0.82	3.03
	45	NE	27.13	1.62	3.85
	68	ENE	27.33	1.73	3.73
	90	E	25.03	1.3	3.34
	113	ESE	24.22	0.87	3.01
	135	SE	23.26	0.97	3.76
	158	SSE	24.06	1.16	3.63
	180	S	23.48	1.65	4.12
	203	SSW	23.29	1.28	3.19
	225	SW	21.88	1.4	3.93
	248	WSW	23.15	0.75	2.6
	270	W	23.1	0.61	2.23
	293	WNW	24.2	0.47	2.05
	315	NW	23.39	0.51	2.62
	338	NNW	23.34	0.58	2.4

It should be noted that the return periods indicated for each wave parameter in Table 11 are representative of the boundary condition used to derive that value, not the value itself. Polar plots for maximum wave heights are presented in Figure 56 and Figure 57.

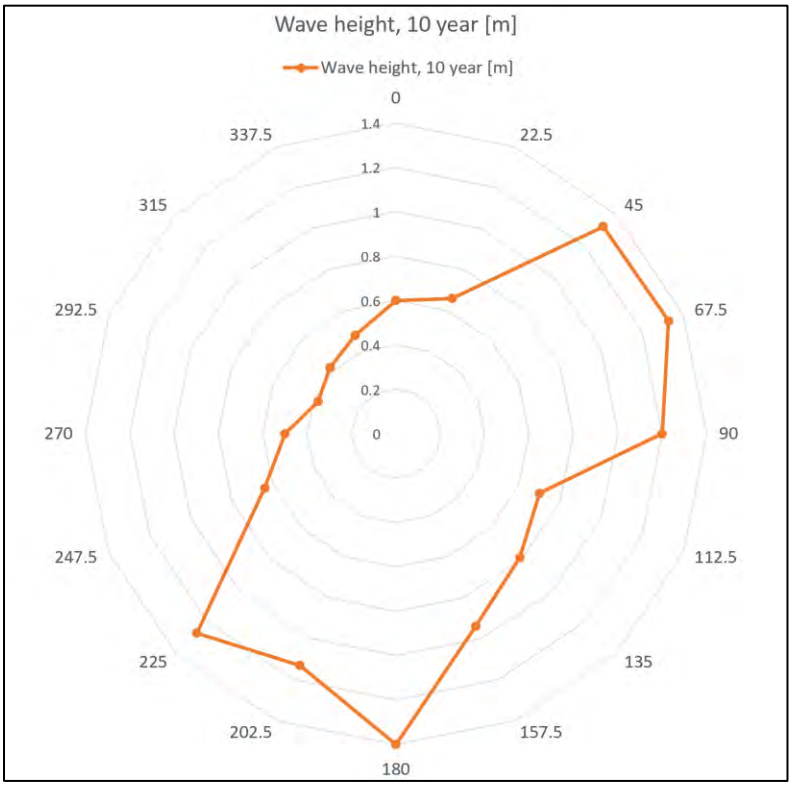


Figure 56: Maximum wave height at 10- year return period and direction [from]- Potential site 3

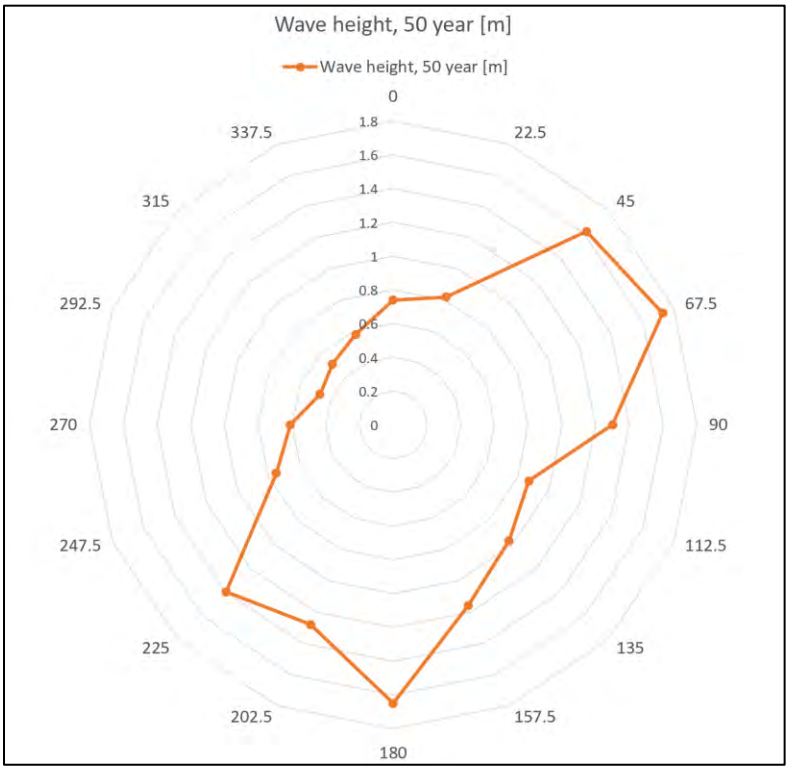


Figure 57: Maximum wave height at 50- year return period and direction [from]- Potential site 3

7.3.4 Wave/wind conditions for potential site 4

The wave and wind results from the STWave model, for the potential site 4 are summarized in Table 12. Note that the results in Table 12 indicate significant wave height (Hs) and peak period (T_P) for the selected site. These represent the extreme wave conditions at this coordinate: 44° 27.677'N, 66° 4.869'W.

Table 12: Estimated wave and wind design conditions for potential site 4

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.6	2.28
	23	NNE	20.99	0.71	2.87
	45	NE	22.17	1.19	3.48
	68	ENE	21.69	1.28	3.32
	90	E	23.39	1.19	3.23
	113	ESE	19.88	0.64	2.65
	135	SE	19.45	0.78	3.47
	158	SSE	19.97	0.97	3.24
	180	S	19.91	1.2	3.5
	203	SSW	19.75	1.23	2.93
	225	SW	18.8	1.27	3.64
	248	WSW	19.6	0.71	2.5
	270	W	19.56	0.54	2.2
	293	WNW	20.5	0.33	1.85
	315	NW	19.99	0.39	2.38
	338	NNW	19.67	0.45	2.22
50yr wave/wind	*0*	N	24.33	0.73	2.45
	23	NNE	25.18	0.88	3.12
	45	NE	27.13	1.45	3.8
	68	ENE	27.33	1.62	3.65
	90	E	25.03	1.29	3.32
	113	ESE	24.22	0.81	2.9
	135	SE	23.26	0.95	3.75
	158	SSE	24.06	1.2	3.5
	180	S	23.48	1.42	3.63
	203	SSW	23.29	1.36	3.04
	225	SW	21.88	1.42	3.6
	248	WSW	23.15	0.85	2.6
	270	W	23.1	0.66	2.35
	293	WNW	24.2	0.41	1.96

	315	NW	23.39	0.47	2.56
	338	NNW	23.34	0.54	2.38

It should be noted that the return periods indicated for each wave parameter in Table 12 are representative of the boundary condition used to derive that value, not the value itself. Polar plots for maximum wave heights are presented in Figure 58 and Figure 59.

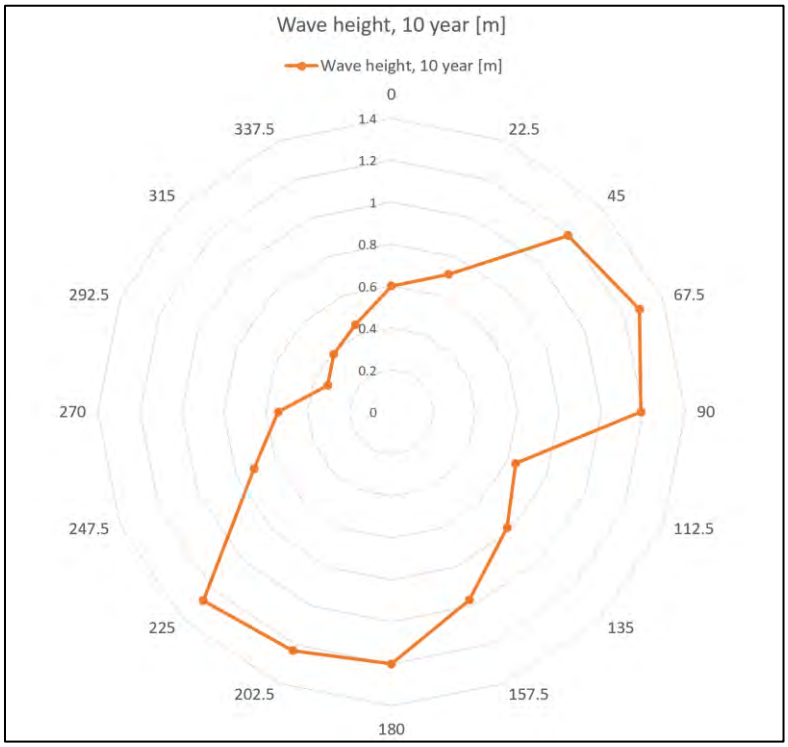


Figure 58: Maximum wave height at 10- year return period and direction [from]- Potential site 4

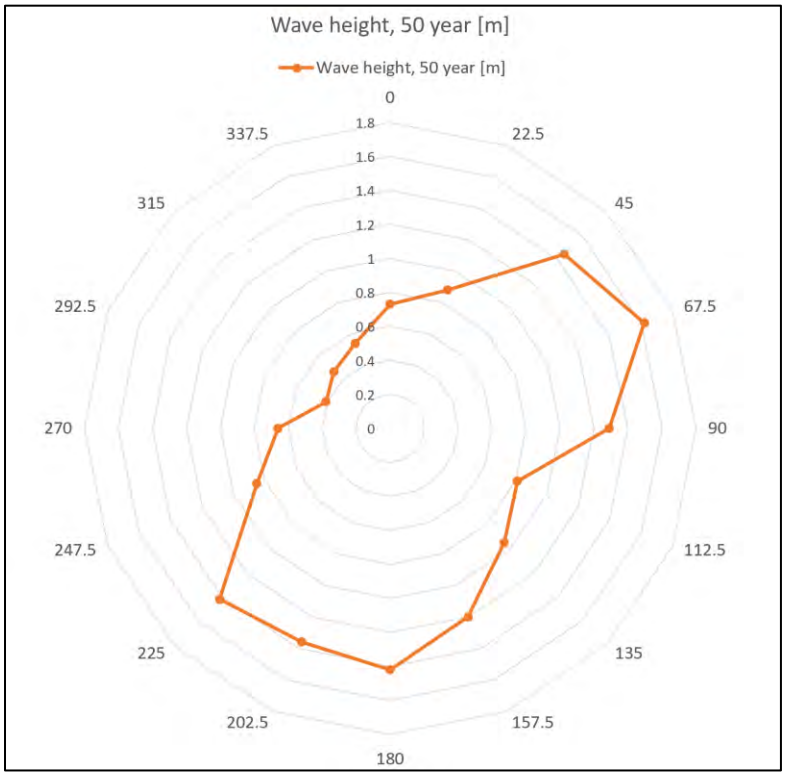


Figure 59: Maximum wave height at 50- year return period and direction [from]- Potential site 4

7.3.5 Wave/wind conditions for potential site 5

The wave and wind results from the STWave model, for the potential site 5 are summarized in Table 13. Note that the results in Table 13 indicate significant wave height (Hs) and peak period (T_P) for the selected site. These represent the extreme wave conditions at this coordinate: 44° 21.147'N, 66° 11.424'W.

Table 13: Estimated wave and wind design conditions for potential site 5

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.77	2.61
	23	NNE	20.99	1.03	3.6
	45	NE	22.17	1.59	3.69
	68	ENE	21.69	1.24	3.25
	90	E	23.39	1.16	3.19
	113	ESE	19.88	0.67	2.74
	135	SE	19.45	0.86	4.56
	158	SSE	19.97	1.37	4.52
	180	S	19.91	2.24	7.74

	203	SSW	19.75	2.02	7.05
	225	SW	18.8	2.19	7.18
	248	WSW	19.6	1.12	5.4
	270	W	19.56	0.7	2.48
	293	WNW	20.5	0.51	2.3
	315	NW	19.99	0.6	2.83
	338	NNW	19.67	0.65	2.6
50yr wave/wind	*0*	N	24.33	0.94	2.82
	23	NNE	25.18	1.27	3.93
	45	NE	27.13	1.96	4.02
	68	ENE	27.33	1.61	3.6
	90	E	25.03	1.25	3.28
	113	ESE	24.22	0.85	3
	135	SE	23.26	1.05	4.92
	158	SSE	24.06	1.63	4.66
	180	S	23.48	2.46	7.3
	203	SSW	23.29	3.2	6.1
	225	SW	21.88	2.3	6.82
	248	WSW	23.15	1.25	4.86
	270	W	23.1	0.85	2.66
	293	WNW	24.2	0.63	2.48
	315	NW	23.39	0.71	3.03
	338	NNW	23.34	0.79	2.8

It should be noted that the return periods indicated for each wave parameter in Table 13 are representative of the boundary condition used to derive that value, not the value itself. Polar plots for maximum wave heights are presented in Figure 60 and Figure 61.

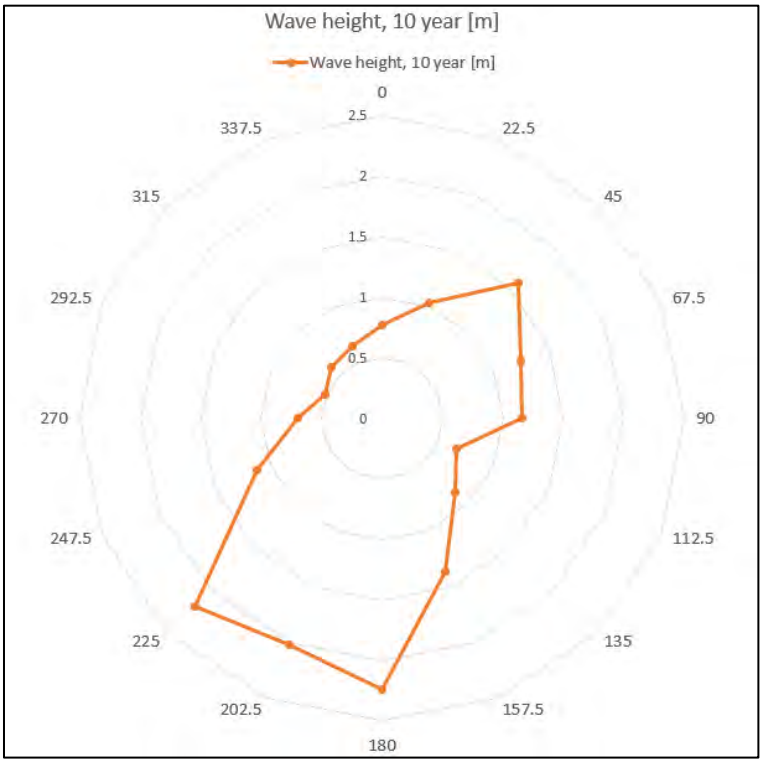


Figure 60: Maximum wave height at 10- year return period and direction [from]- Potential site 5

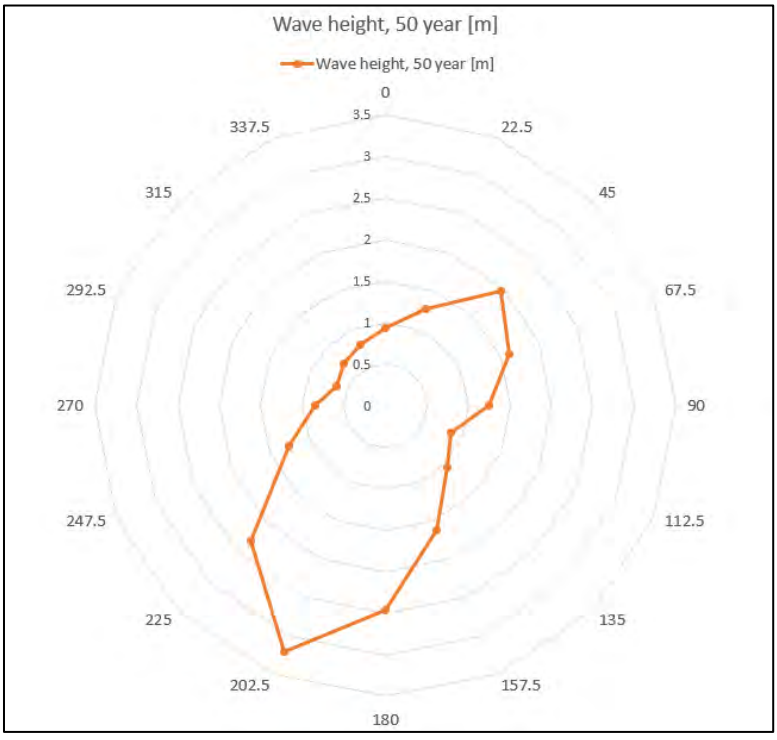


Figure 61: Maximum wave height at 50- year return period and direction [from]- Potential site 5

7.3.6 Wave/wind conditions for potential site 6

The wave and wind results from the STWave model, for the potential site 6 are summarized in Table 14. Note that the results in Table 14 indicate significant wave height (Hs) and peak period (T_P) for the selected site. These represent the extreme wave conditions at this coordinate: 44° 19.606'N, 66° 14.187'W.

Table 14: Estimated wave and wind design conditions for potential site 6

Wave/Wind conditions	Direction [from] [°]		Wind (m/s)	Hs (m)	Tp (s)
10yr wave/wind	*0*	N	20.39	0.64	2.37
	23	NNE	20.99	0.73	3
	45	NE	22.17	1.64	3.88
	68	ENE	21.69	1.39	3.53
	90	E	23.39	1.4	3.53
	113	ESE	19.88	0.84	3.14
	135	SE	19.45	1.1	4.57
	158	SSE	19.97	1.54	5.25
	180	S	19.91	1.62	7.1
	203	SSW	19.75	1.92	5.42
	225	SW	18.8	1.57	5.78
	248	WSW	19.6	0.74	3.97
	270	W	19.56	0.47	2
	293	WNW	20.5	0.34	1.87
	315	NW	19.99	0.41	2.62
	338	NNW	19.67	0.48	2.38
50yr wave/wind	*0*	N	24.33	0.79	2.56
	23	NNE	25.18	0.9	3.27
	45	NE	27.13	2.06	4.23
	68	ENE	27.33	1.83	3.92
	90	E	25.03	1.51	3.63
	113	ESE	24.22	1.07	3.44
	135	SE	23.26	1.36	4.95
	158	SSE	24.06	1.73	5.21
	180	S	23.48	1.73	6.84
	203	SSW	23.29	2.25	5.1
	225	SW	21.88	1.67	5.43
	248	WSW	23.15	0.82	2.53
	270	W	23.1	0.57	2.14

	293	WNW	24.2	0.42	1.98
	315	NW	23.39	0.49	2.81
	338	NNW	23.34	0.59	2.56

It should be noted that the return periods indicated for each wave parameter in Table 14 are representative of the boundary condition used to derive that value, not the value itself. Polar plots for maximum wave heights are presented in Figure 62 and Figure 63.

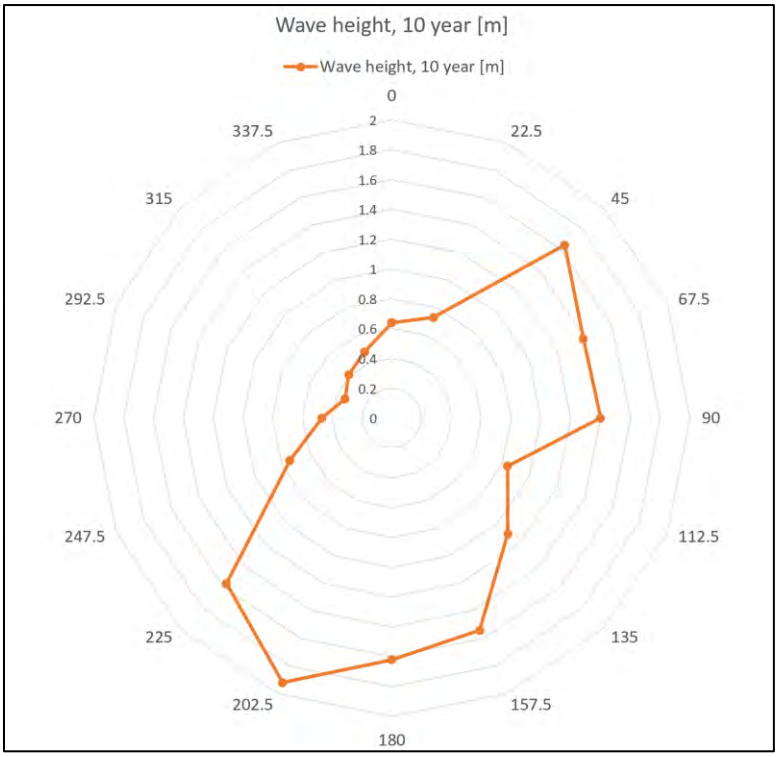


Figure 62: Maximum wave height at 10- year return period and direction [from]- Potential site 6

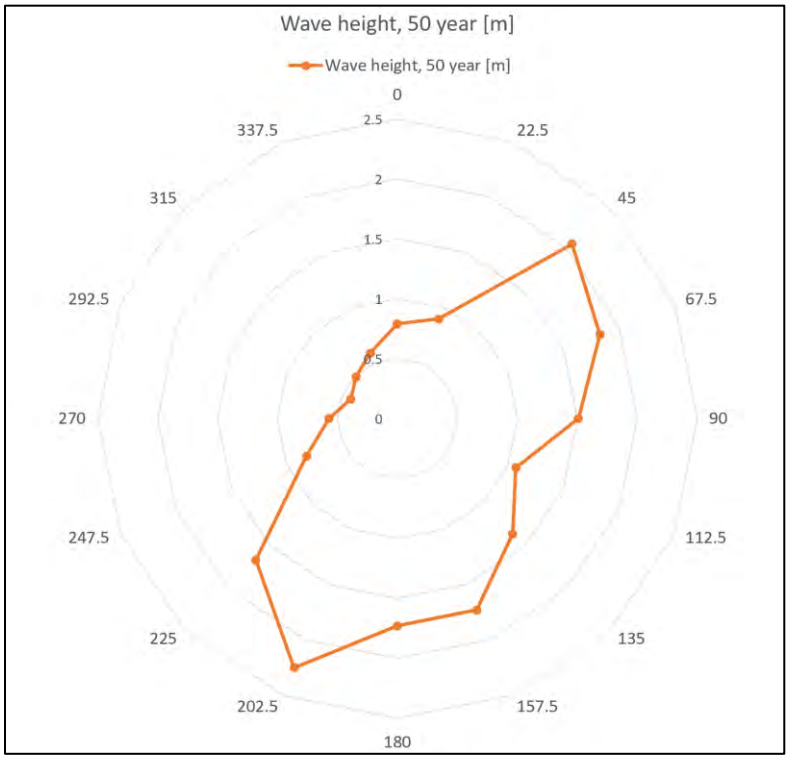


Figure 63: Maximum wave height at 50- year return period and direction [from]- Potential site 6

8 Water temperature

The location of 6 sampling stations for water temperature in St. Mary's Bay is shown in Figure 64. The presented data includes 4 short-term data measurements which are publicly available in Nova Scotia Open Data Portal [5] (see Figure 67 to Figure 71). A long-term historical temperature data also provided using ERA5 model [6] (see Figure 65). In addition, another long-term temperature data at the northern boundary of the St. Mary's Bay is measured using satellite data (see Figure 66).

In this report, water temperature information is presented for six sampling stations:

- ERA5 model data from 1979 to 2017: 44° 15.000'N, 66° 18.601'W
- Satellite data from 2009 to 2021: 44° 32.716'N, 65° 57.370'W
- Long Beach data from July 2020 to November 2020: 44° 24.104'N, 66° 9.576'W
- Long Island data from January 2019 to May 2019: 44° 21.007'N, 66° 13.458'W
- Long Island data from July 2020 to November 2020: 44° 21.007'N, 66° 13.458'W
- Long Island 2 data from July 2020 to November 2020: 44° 19.986'N, 66° 12.125'W
- Sandy Cove data from July 2020 to November 2020: 44° 29.140'N, 66° 3.575'W



Figure 64 Sampling temperature stations in St. Mary's Bay

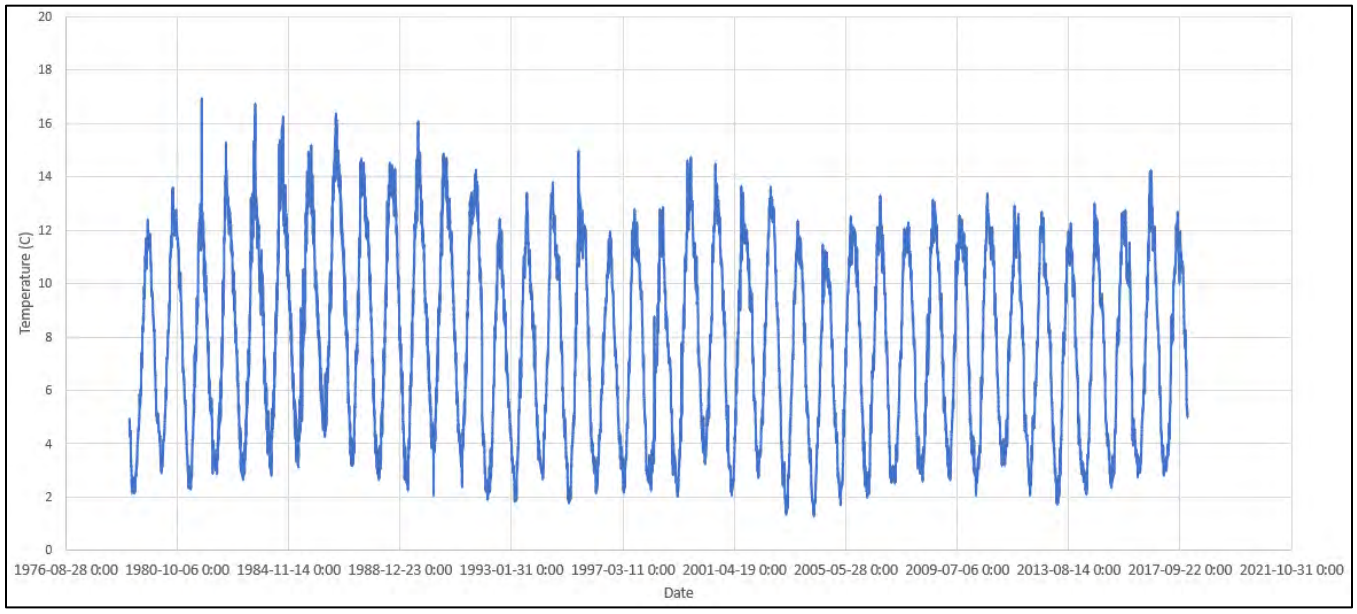


Figure 65 Temperature data from 1979 to 2017 using ERA5 model [6]- Coordinates: 44° 15.000'N, 66° 18.601'W

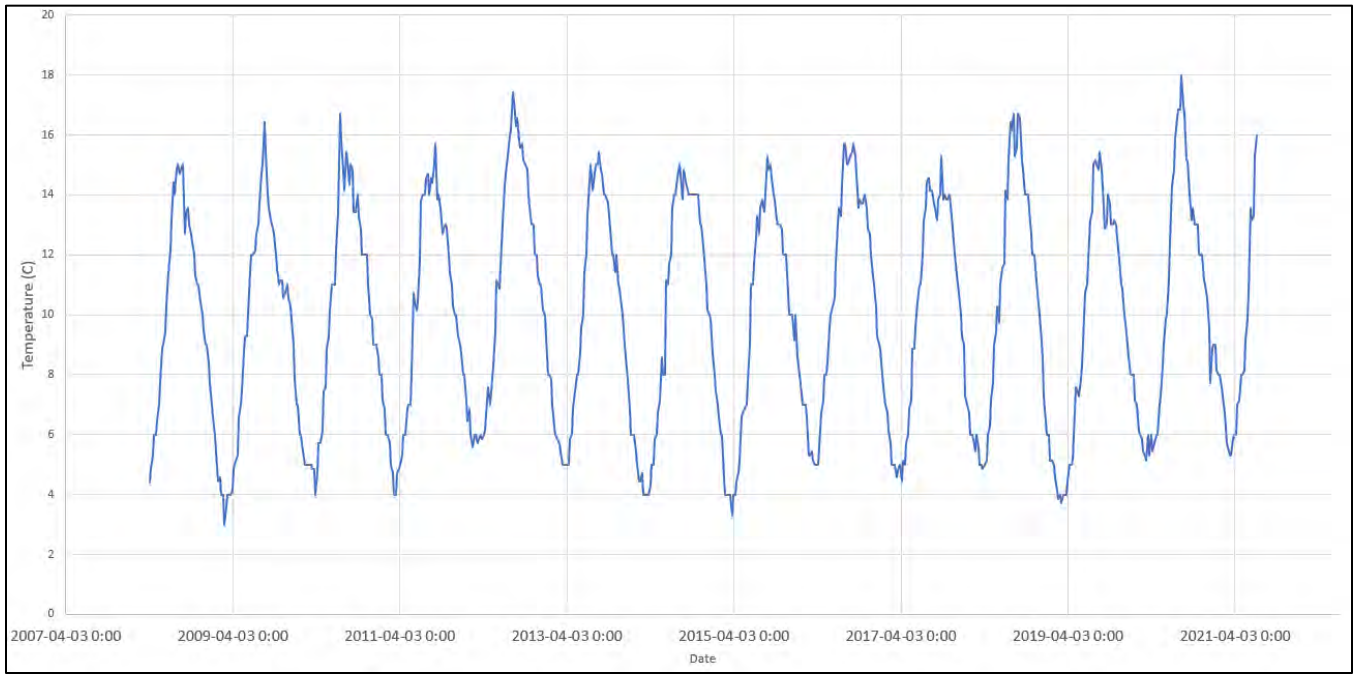


Figure 66 Temperature data from 2009 to 2021 using Satellite data - Coordinates: 44° 32.716'N, 65° 57.370'W

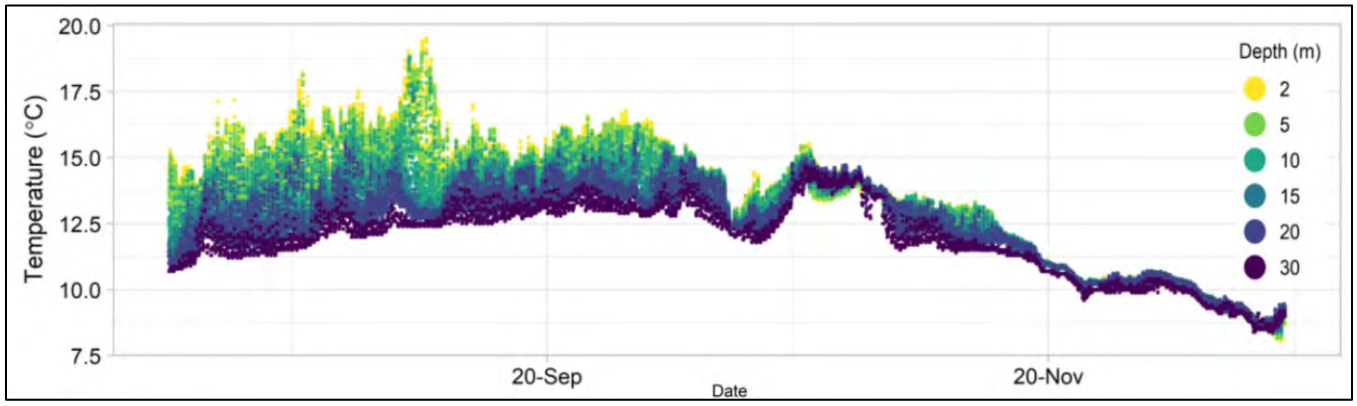


Figure 67 Long Beach temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 24.104'N, 66° 9.576'W

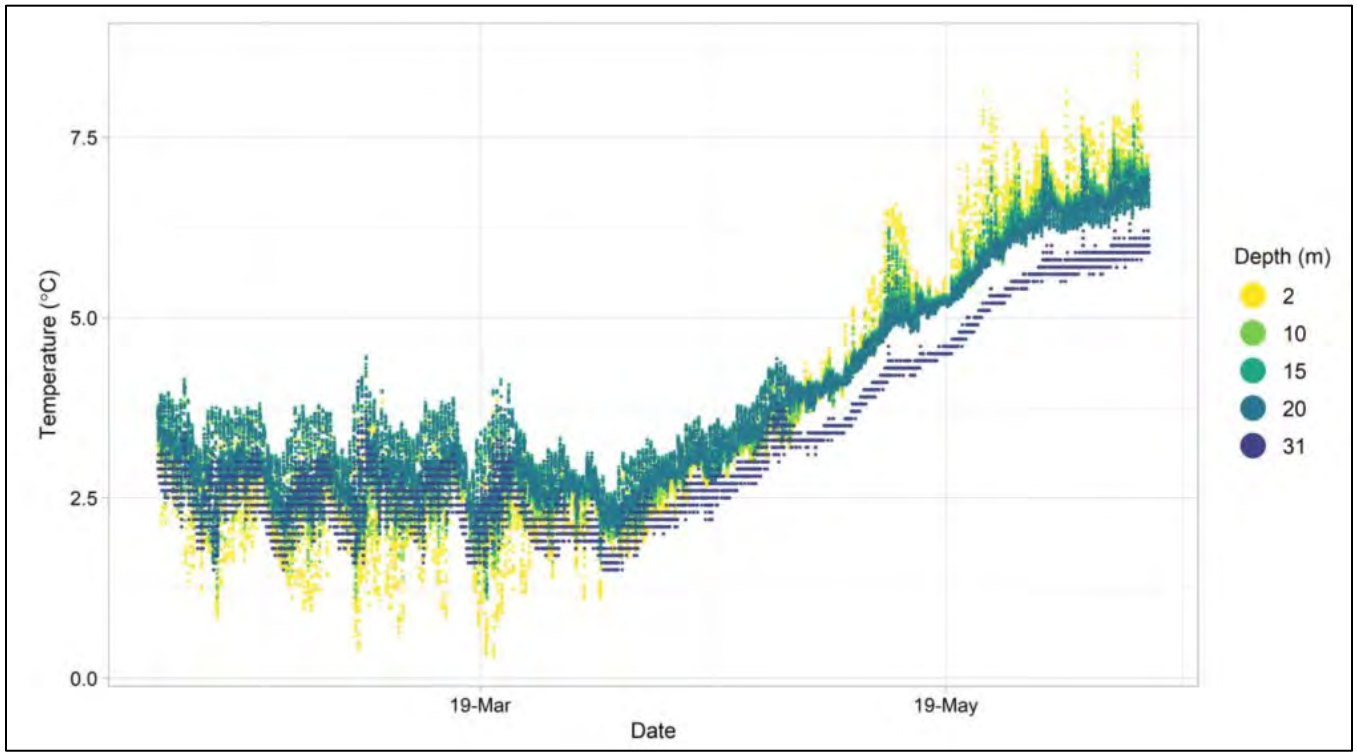


Figure 68 Long Island temperature data from January 2019 to May 2019 [7]- Coordinates: 44° 21.007'N, 66° 13.458'W

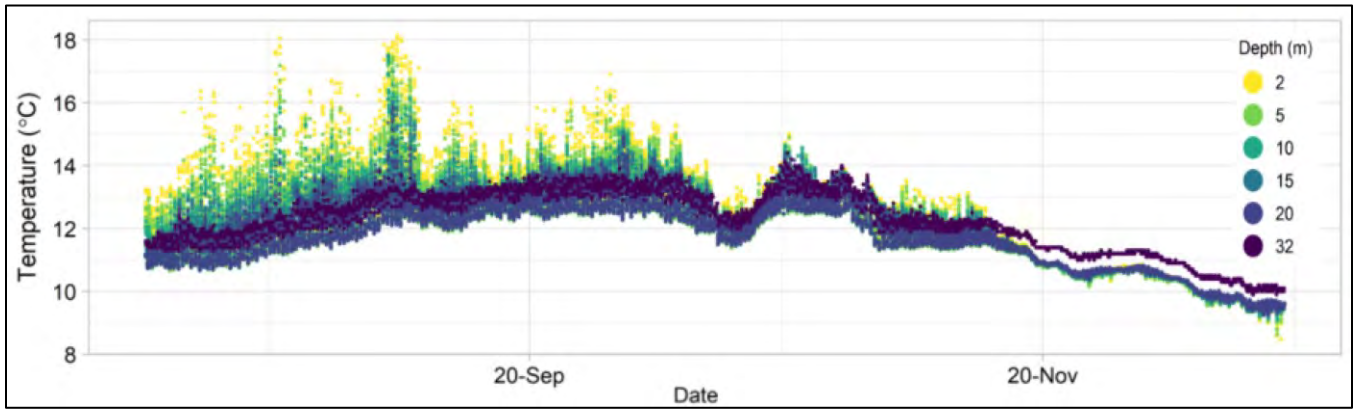


Figure 69 Long Island temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 21.007'N, 66° 13.458'W

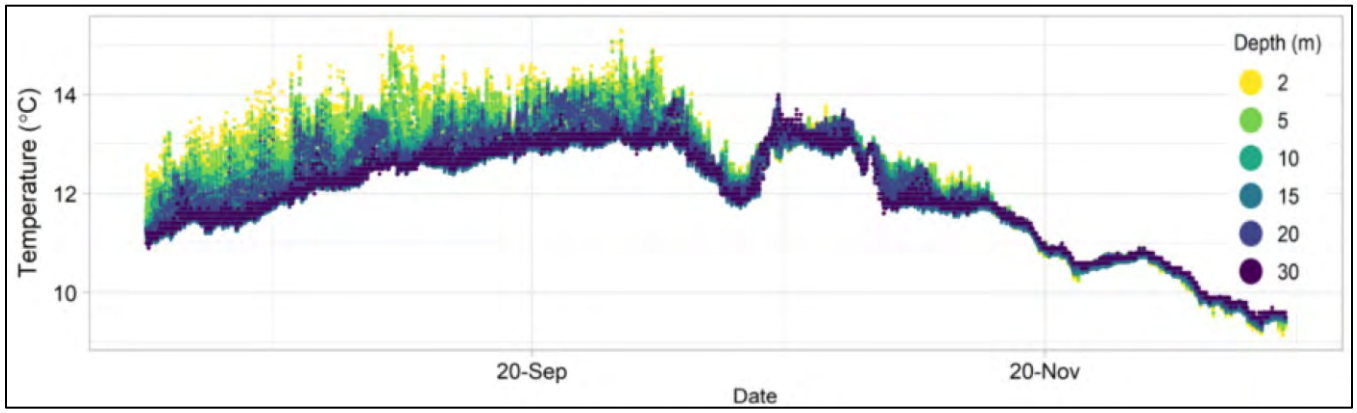


Figure 70 Long Island 2 temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 19.986'N, 66° 12.125'W

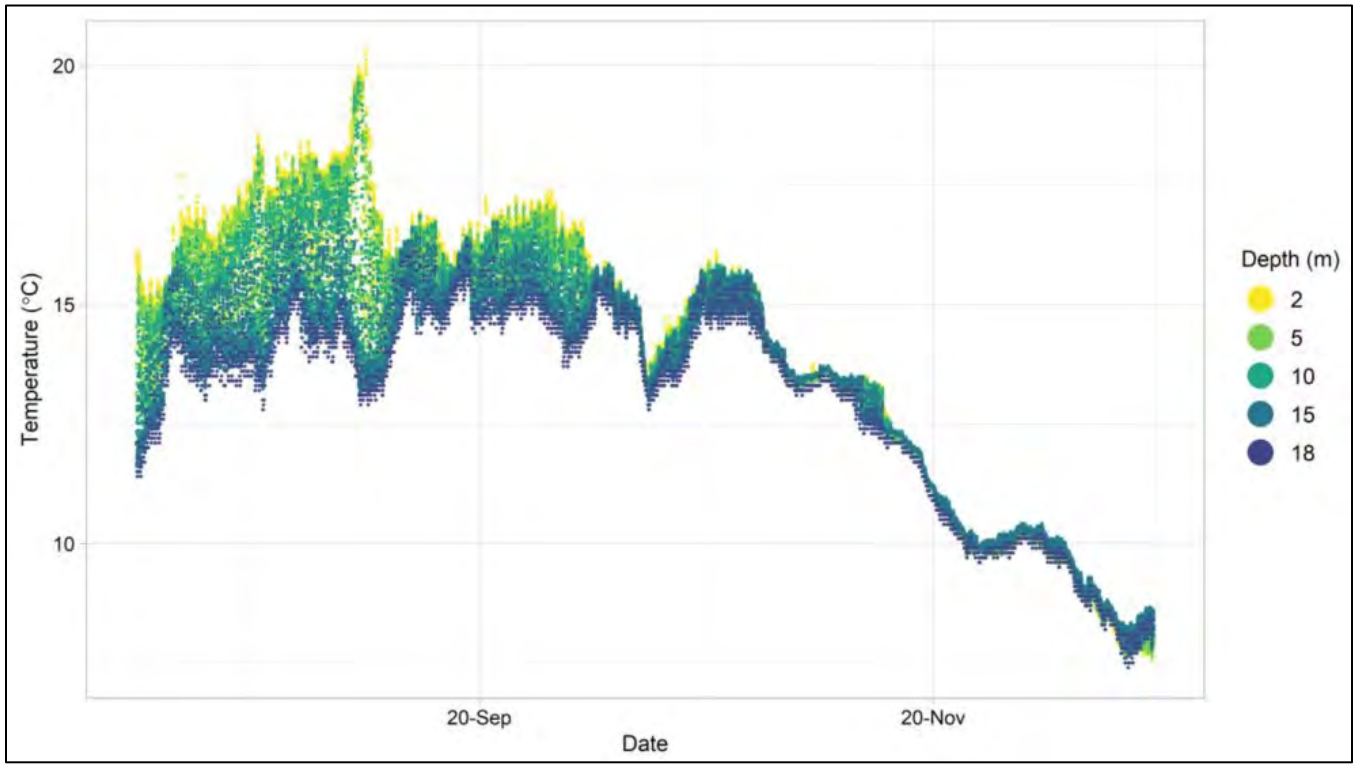


Figure 71 Sandy Cove temperature data from July 2020 to November 2020 [7]- Coordinates: 44° 29.140'N, 66° 3.575'W

9 Ice potential

Between 2004 and 2019, the CIS ice maps indicate ice presence of ice in St. Mary's Bay during four of these years: 2004-2005, 2008-2009, 2014-2015, and 2018-2019. In all of them, the ice conditions are classified as "open water", which is defined by WMO as ice covering less than 10% of the surface. In practice, the classification of "open water" indicates that there is potential for ice to be present but does not necessarily indicate the actual presence of ice. For example, although open water was indicated for 2009, all the historical

temperature data (Satellite data and ERA5 data) presented in the previous section, show the mean daily water surface (2m depth) temperature for 2009 from mid January until May remained above 1℃ throughout the entire winter, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter of 2009.

Additionally, St. Mary's Bay is not well represented in both weekly and daily ice charts (Figure 72). However, some efforts were made by CMAR to interpret the weekly charts which indicated that the bay did not freeze during 2003-2004, 2005-2006, 2006-2007, 2009-2010, 2011-2012, 2013-2014 and 2015-2018 [8]. Freeze-up and break-up dates for the Eastern Coast of St. Mary's Bay are presented in Table 15.

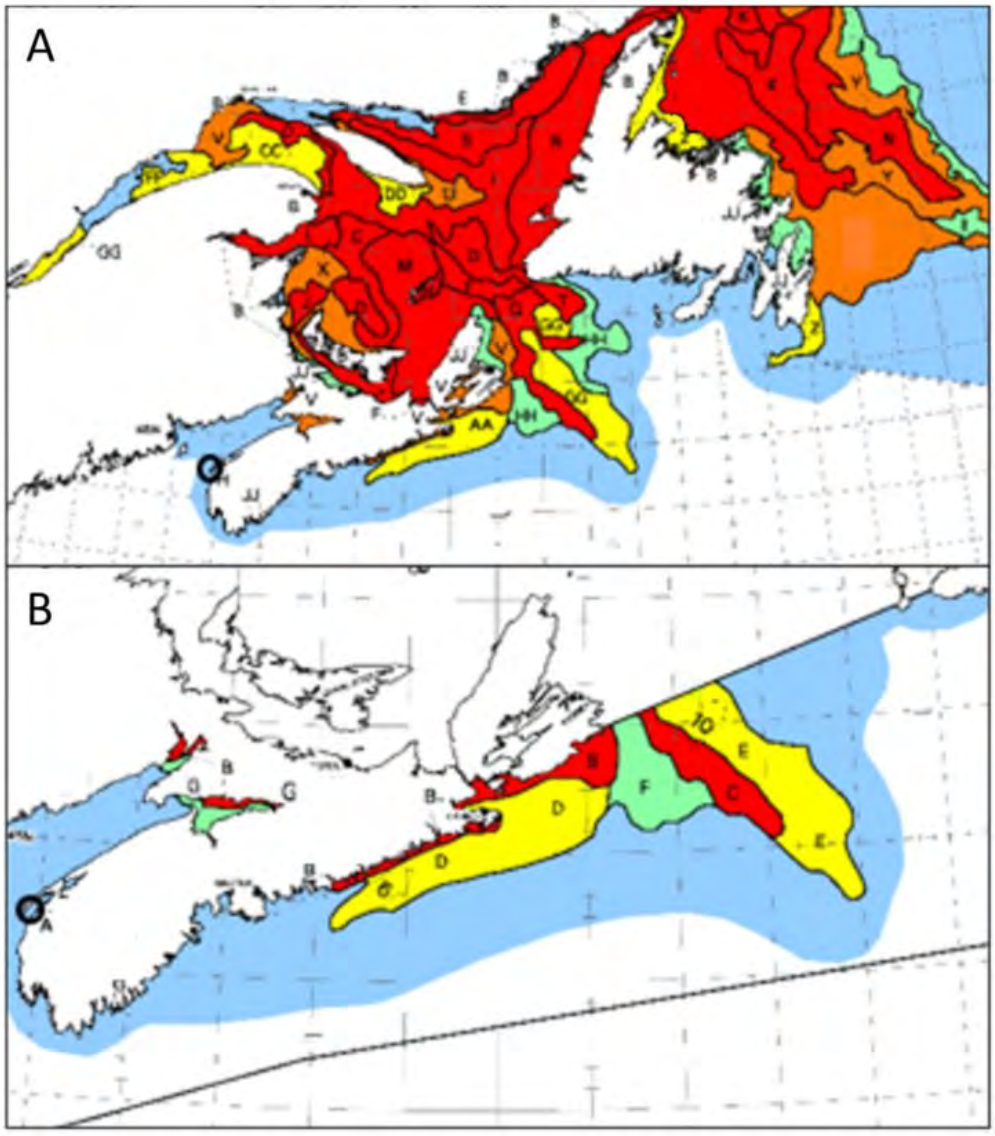


Figure 72 St. Mary's Bay (circled in black) was not well represented in the A) weekly ice chart (Eastern Coast), or B) daily ice [8]

Table 15 Freeze-up and break-up dates for St. Mary's Bay as per weekly historic ice charts [8]

Area of Interest	Extent	Season	Freeze-up	Legend Value	Break-up
St. Mary's Bay	Eastern Coast	2004-2005	07/02/2005	< 1/10	14/02/2005
St. Mary's Bay	Eastern Coast	2008-2009	26/01/2009	< 1/10	09/03/2009
St. Mary's Bay	Eastern Coast	2014-2015	23/02/2015	< 1/10	20/04/2015
St. Mary's Bay	Eastern Coast	2018-2019	14/01/2019	< 1/10	25/03/2019

According to the presented data and the location of potential marine fish farms (Western Coast), we can conclude that there will be a low chance of sea ice during the winter.

10 Discussion

In support of 3327832 Nova Scotia Limited, DSA Ocean has provided the environmental conditions at the St. Mary's Bay potential finfish farms located in the Nova Scotia, Canada. This report presented data on the seabed, current, wind, and wave conditions as well as temperature and ice conditions at the six potential finfish farms in St. Mary's Bay. Complementary to this, a set of site drawings has been developed which identifies the site layout. A summary of each site condition has provided as follows:

- Potential Site 1: The proposed site is located at 44° 22.929'N, 66° 10.392'W with the approximate water depth of 43m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.3m. Based on ADCP 1 measurements near the site location, the estimated 10- and 50-year current speeds at 10m water depth are 1.86m/s, and 2.09m/s, respectively. The estimated 10- and 50- year wave conditions are 1.97m and 2.24m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 2: The proposed site is located at 44° 24.506'N, 66° 8.627'W with the approximate water depth of 32m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.4m. Based on ADCP measurements at ADCP 1 and 2 locations, the estimated 10- and 50- year current speeds at 5m water depth are 1.75m/s, and 1.96m/s, respectively. The estimated 10- and 50- year wave conditions are 1.7m and 1.97m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 3: The proposed site is located at 44° 26.164'N, 66° 6.797'W with the approximate water depth of 23m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.4m. Based on ADCP 2 measurements near the site location, the estimated 10- and 50-

year current speeds at 5m water depth are 1.66m/s, and 1.86m/s, respectively. The estimated 10- and 50- year wave conditions are 1.4m and 1.73m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 4: The proposed site is located at 44° 27.677'N, 66° 4.869'W with the approximate water depth of 21m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.4m. Based on ADCP measurements at ADCP 2 locations, the estimated 10- and 50- year current speeds at 5m water depth are 1.5m/s, and 1.68m/s, respectively. The estimated 10- and 50- year wave conditions are 1.28m and 1.62m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 5: The proposed site is located at 44° 21.147'N, 66° 11.424'W with the approximate water depth of 31m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.8m. Based on ADCP measurements at ADCP 1 and 3 locations, the estimated 10- and 50- year current speeds at 5m water depth are 2.5m/s, and 2.8m/s, respectively. The estimated 10- and 50- year wave conditions are 2.02m and 3.2m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

- Potential Site 6: The proposed site is located at 44° 19.606'N, 66° 14.187'W with the approximate water depth of 43m. The seabed information stating this site seabed composition is sandy silt. Tidal range is approximately 6.8m. Based on ADCP 3 measurements near the site location, the estimated 10- and 50- year current speeds at 5m water depth are 3.11m/s, and 3.49m/s, respectively. The estimated 10- and 50- year wave conditions are 1.92m and 2.25m with corresponding wind speeds of 23.39m/s and 27.33m/s, respectively. The minimum water temperature remains above 1℃ throughout the entire winter at this site, which is well above the temperature required to grow sea ice. Therefore, it is unlikely that there was any actual sea ice during the winter at this location.

Based on provided environmental data, DSA Ocean recommends developing of potential sites 1, 2, 3, and 4 first. Since sites 5 and 6 are in a turbulent area have much stronger currents, it is likely that these sites should be developed after experience in the area has been developed with sites 1-4.

Appendix A: Drawing Package



3327832 NOVA SCOTIA LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

SITE LOCATIONS

ENVIRONMENT FEATURES

LEASE BOUNDARY

ADCP LOCATION

OPTION AREA BOUNDARY

ADCP COORDINATES

1	44.385567°	-66.168633°
2	44.438743°	-66.107910°
3	44.327017°	-66.239100°

APPROVED OPTION AREA

A	44.479282°	-66.081807°
B	44.439707°	-66.022103°
C	44.328967°	-66.254017°
D	44.289557°	-66.132587°

SITE COORDINATES

POTENTIAL SITE #1	44.382148°	-66.173200°
POTENTIAL SITE #2	44.408443°	-66.143770°
POTENTIAL SITE #3	44.436076°	-66.113277°
POTENTIAL SITE #4	44.461297°	-66.081138°
POTENTIAL SITE #5	44.352461°	-66.190392°
POTENTIAL SITE #6	44.326771°	-66.236456°

NOTES:

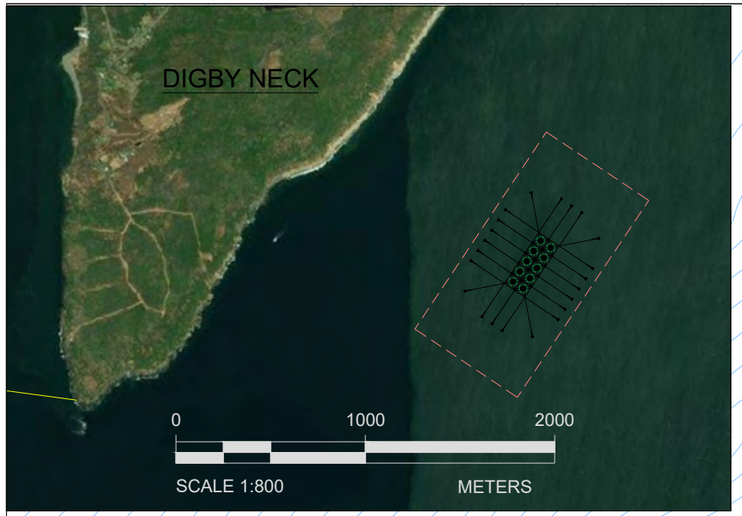
1) SITE COORDINATES ARE LOCATED IN THE CENTER OF LEASE BOUNDARY

DSAocean

DRAWING NUMBER: DSA-HAUG-21SSR-D01

SHEET 1 OF 8

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2021-10-18
APPROVED BY: [redacted] REVISION: IFR



A

B

C

D

1250m

650m

65m

65m

200m

130m CIRCUMFERENCE

20

30

40

43

44

45

N

225°

45°

PREDOMINANT CURRENT DIRECTION

0 200 400

SCALE 1:150 METERS

3327832 NOVA SCOTIA LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE #1

FARM FEATURES	ENVIRONMENT FEATURES
MOORING LINE 2" POLYSTEEL	BATHYMETRY (METERS) 5
1" GROUND CHAIN	LEASE BOUNDARY
2 TON DUAL SHANK ANCHOR	DOMINANT CURRENT DIR
FISH NET	
NET PEN	

SITE COORDINATES

POTENTIAL SITE #1

CORNER A	44.3885°	-66.1723°
CORNER B	44.3852°	-66.1655°
CORNER C	44.3759°	-66.3759°
CORNER D	44.3791°	-66.1810°

NOTES:

1) 1 TON EQUAL 1000KG
2) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 2.24M
3) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.43M/S
4) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.49M/S
5) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.3M/S
6) TIDAL RANGE: 6.3M
7) APPROXIMATE DEPTH AT CENTER OF SITE 43 METERS WITH ORIENTATION OF 34° EAST OF NORTH
8) APPROXIMATE DEPTH OF FISH NET IS 15M
9) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

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DRAWING NUMBER: DSA-HAUG-21SSR-D01

SHEET 2 OF 8

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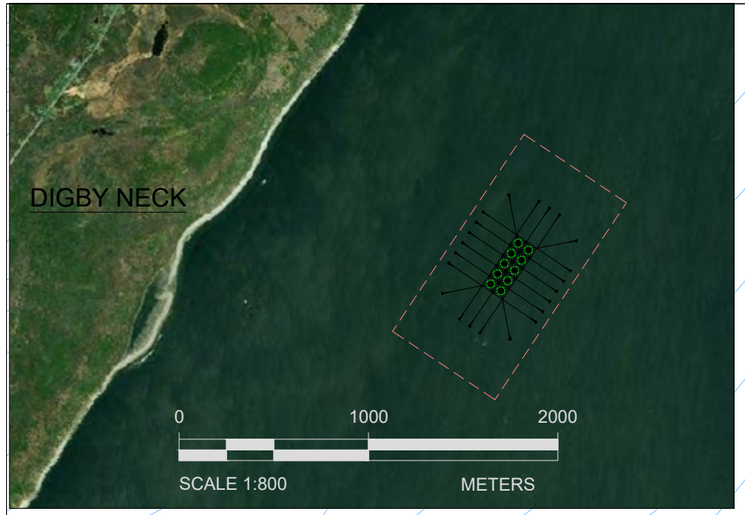

A

B

C

D

28

31

32

33

30

30

1250m

650m

65m

65m

200m

130m CIRCUMFERENCE

N

45°

225°

PREDOMINANT CURRENT DIRECTION

0
200
400
SCALE 1:150
METERS

3327832 NOVA SCOTIA LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE #2

FARM FEATURES	ENVIRONMENT FEATURES
MOORING LINE 2" POLYSTEEL	BATHYMETRY (METERS) 5
1" GROUND CHAIN	LEASE BOUNDARY
2 TON DUAL SHANK ANCHOR	DOMINANT CURRENT DIR
FISH NET	
NET PEN	

SITE COORDINATES

POTENTIAL SITE #2

CORNER A	44.4148°	-66.1428°
CORNER B	44.4115°	-66.1360°
CORNER C	44.4022°	-66.1447°
CORNER D	44.4054°	-66.1515°

NOTES:

1) 1 TON EQUAL 1000KG
2) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 1.97M
3) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.4M/S
4) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.4M/S
5) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
6) TIDAL RANGE: 6.4M
7) APPROXIMATE DEPTH AT CENTER OF SITE 32 METERS WITH ORIENTATION OF 34° EAST OF NORTH
8) APPROXIMATE DEPTH OF FISH NET IS 15M
9) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

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SHEET 3 OF 8

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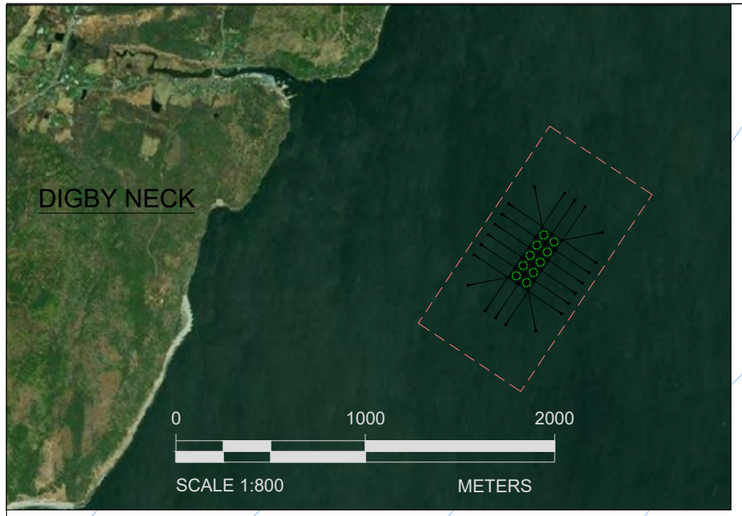

A

B

C

D

1250m

650m

65m

65m

200m

130m CIRCUMFERENCE

20

23

27

45°

225°

PREDOMINANT CURRENT DIRECTION

N

0
200
400
SCALE 1:150
METERS

3327832 NOVA SCOTIA LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE #3

FARM FEATURES	ENVIRONMENT FEATURES
MOORING LINE 2" POLYSTEEL	BATHYMETRY (METERS) 5
1" GROUND CHAIN	LEASE BOUNDARY
2 TON DUAL SHANK ANCHOR	DOMINANT CURRENT DIR
FISH NET	
NET PEN	

SITE COORDINATES

POTENTIAL SITE #3

CORNER A	44.4424°	-66.1123°
CORNER B	44.4391°	-66.1360°
CORNER C	44.4298°	-66.1143°
CORNER D	44.4330°	-66.1210°

NOTES:

1) 1 TON EQUAL 1000KG
2) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 1.73M
3) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.32M/S
4) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.33M/S
5) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
6) TIDAL RANGE: 6.4M
7) APPROXIMATE DEPTH AT CENTER OF SITE 23 METERS WITH ORIENTATION OF 34° EAST OF NORTH
8) APPROXIMATE DEPTH OF FISH NET IS 15M
9) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

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SHEET 4 OF 8

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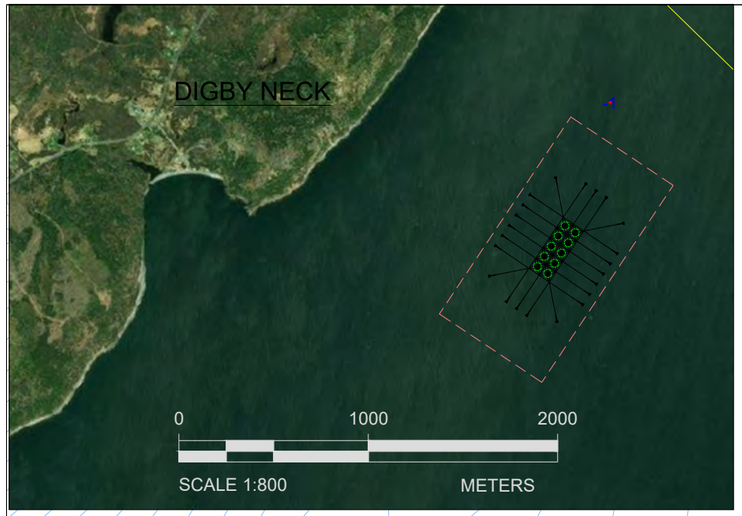

A

B

C

D

1250m

650m

65m

65m

200m

130m CIRCUMFERENCE

25

22

20

17

13

N

45°

225°

PREDOMINANT CURRENT DIRECTION

0
200
400
SCALE 1:150
METERS

3327832 NOVA SCOTIA LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE #4

FARM FEATURES	ENVIRONMENT FEATURES
MOORING LINE 2" POLYSTEEL	BATHYMETRY (METERS) 5
1" GROUND CHAIN	LEASE BOUNDARY
2 TON DUAL SHANK ANCHOR	DOMINANT CURRENT DIR
FISH NET	
NET PEN	

SITE COORDINATES

POTENTIAL SITE #4

CORNER A	44.4676°	-66.0802°
CORNER B	44.4644°	-66.0734°
CORNER C	44.4550°	-66.0821°
CORNER D	44.7583°	-66.0889°

NOTES:

1) 1 TON EQUAL 1000KG
2) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 1.62M
3) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.2M/S
4) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.2M/S
5) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
6) TIDAL RANGE: 6.4M
7) APPROXIMATE DEPTH AT CENTER OF SITE 21 METERS WITH ORIENTATION OF 34° EAST OF NORTH
8) APPROXIMATE DEPTH OF FISH NET IS 15M
9) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

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DRAWING NUMBER: DSA-HAUG-21SSR-D01

SHEET 5 OF 8

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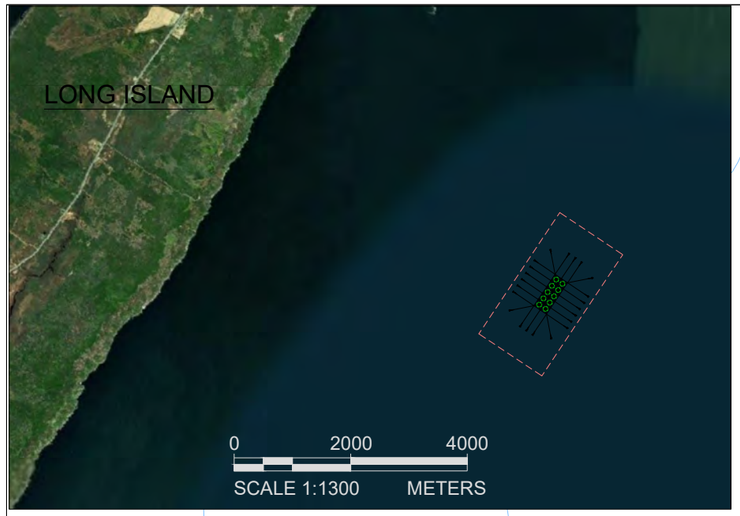
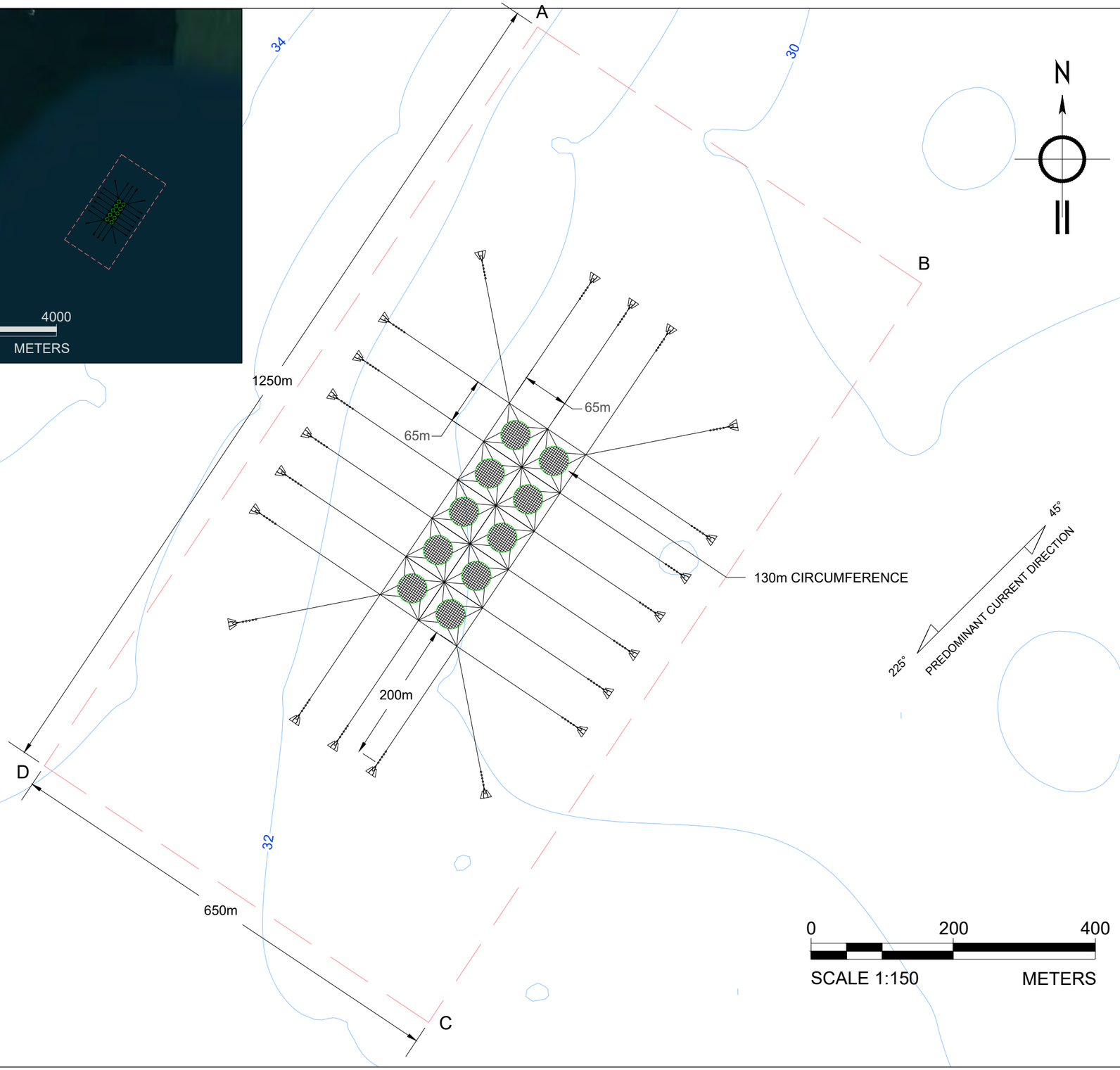
CHECKED BY: LAST REVISED: 2021-10-18
APPROVED BY: REVISION: IFR





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ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE #5

FARM FEATURES	ENVIRONMENT FEATURES
MOORING LINE 2" POLYSTEEL	BATHYMETRY (METERS) 5
1" GROUND CHAIN	LEASE BOUNDARY
2 TON DUAL SHANK ANCHOR	DOMINANT CURRENT DIR
FISH NET	
NET PEN	

SITE COORDINATES

POTENTIAL SITE #5

CORNER A	44.3588°	-66.1894°
CORNER B	44.3556°	-66.1826°
CORNER C	44.3462°	-66.1913°
CORNER D	44.3495°	-66.1981°

NOTES:

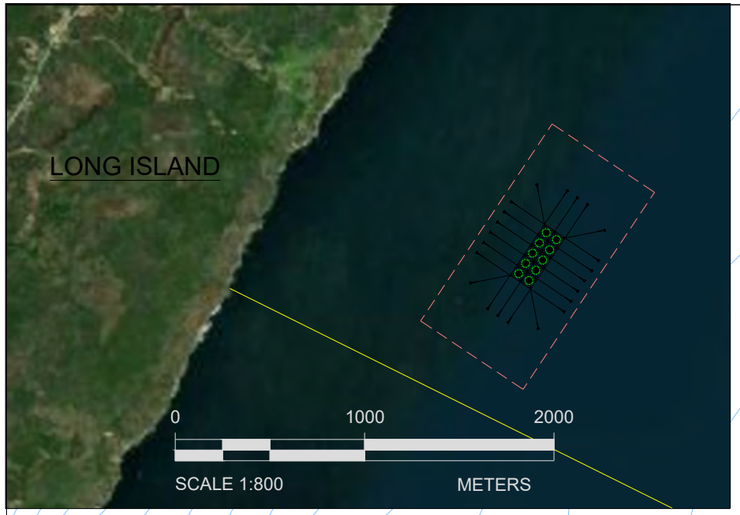
1) 1 TON EQUAL 1000KG
2) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 3.2M
3) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.6M/S
4) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 2M/S
5) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
6) TIDAL RANGE: 6.8M
7) APPROXIMATE DEPTH AT CENTER OF SITE 31 METERS WITH ORIENTATION OF 34° EAST OF NORTH
8) APPROXIMATE DEPTH OF FISH NET IS 15M
9) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

DSAocean

DRAWING NUMBER: DSA-HAUG-21SSR-D01

SHEET 6 OF 8

DRAWN BY:
CHECKED BY: LAST REVISED: 2021-10-18
APPROVED BY: REVISION: IFR



A

B

C

D

1250m

650m

65m

65m

200m

130m CIRCUMFERENCE

30

38

40

42

44

42

39

45°

203°

PREDOMINANT CURRENT DIRECTION

N

0 200 400

SCALE 1:150 METERS

3327832 NOVA SCOTIA LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE #6

FARM FEATURES	ENVIRONMENT FEATURES
MOORING LINE 2" POLYSTEEL	BATHYMETRY (METERS) 5
1" GROUND CHAIN	LEASE BOUNDARY
2 TON DUAL SHANK ANCHOR	DOMINANT CURRENT DIR
FISH NET	
NET PEN	

SITE COORDINATES

POTENTIAL SITE #6

CORNER A	44.3331°	-66.2355°
CORNER B	44.3298°	-66.2287°
CORNER C	44.3205°	-66.2374°
CORNER D	44.3237°	-66.2442°

NOTES:

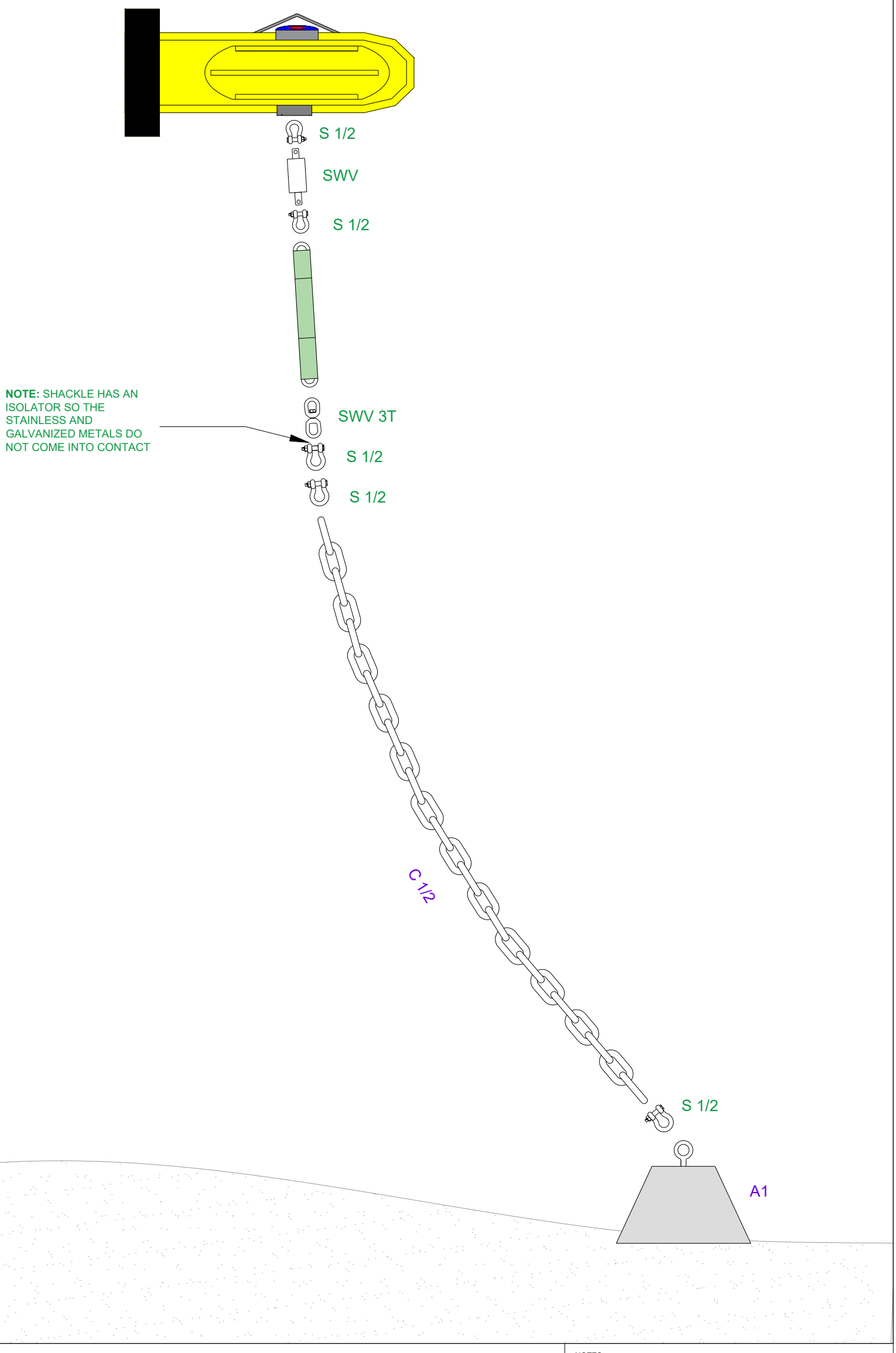
1) 1 TON EQUAL 1000KG
2) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 2.25M
3) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 2M/S
4) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 2.49M/S
5) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
6) TIDAL RANGE: 6.8M
7) APPROXIMATE DEPTH AT CENTER OF SITE 43 METERS WITH ORIENTATION OF 34° EAST OF NORTH
8) APPROXIMATE DEPTH OF FISH NET IS 15M
9) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

DSAocean

DRAWING NUMBER: DSA-HAUG-21SSR-D01

SHEET 7 OF 8

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2021-10-18
APPROVED BY: [redacted] REVISION: IFR



ADCP MOORING LAYOUT

3327832 NOVA SCOTIA LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

FEATURES

SUBS & TELEDYNE RDI WORKHORSE SENTINEL ADCP

TELEDYNE BENTHOS R500 ACOUSTIC RELEASE

A1 — 350LB DEADWEIGHT ANCHOR

C 1/2 — MOORING CHAIN 1/2" MBL = 12T

S 1/2 — 1/2" SHACKLE WLL = 2T

SWV — OCEANOGRAPHIC SWIVEL WLL 1.8T

SWV 3T — 3T SWIVEL WLL 3T

ENVIRONMENT FEATURES

SEABED

NOTES:

1)
2)

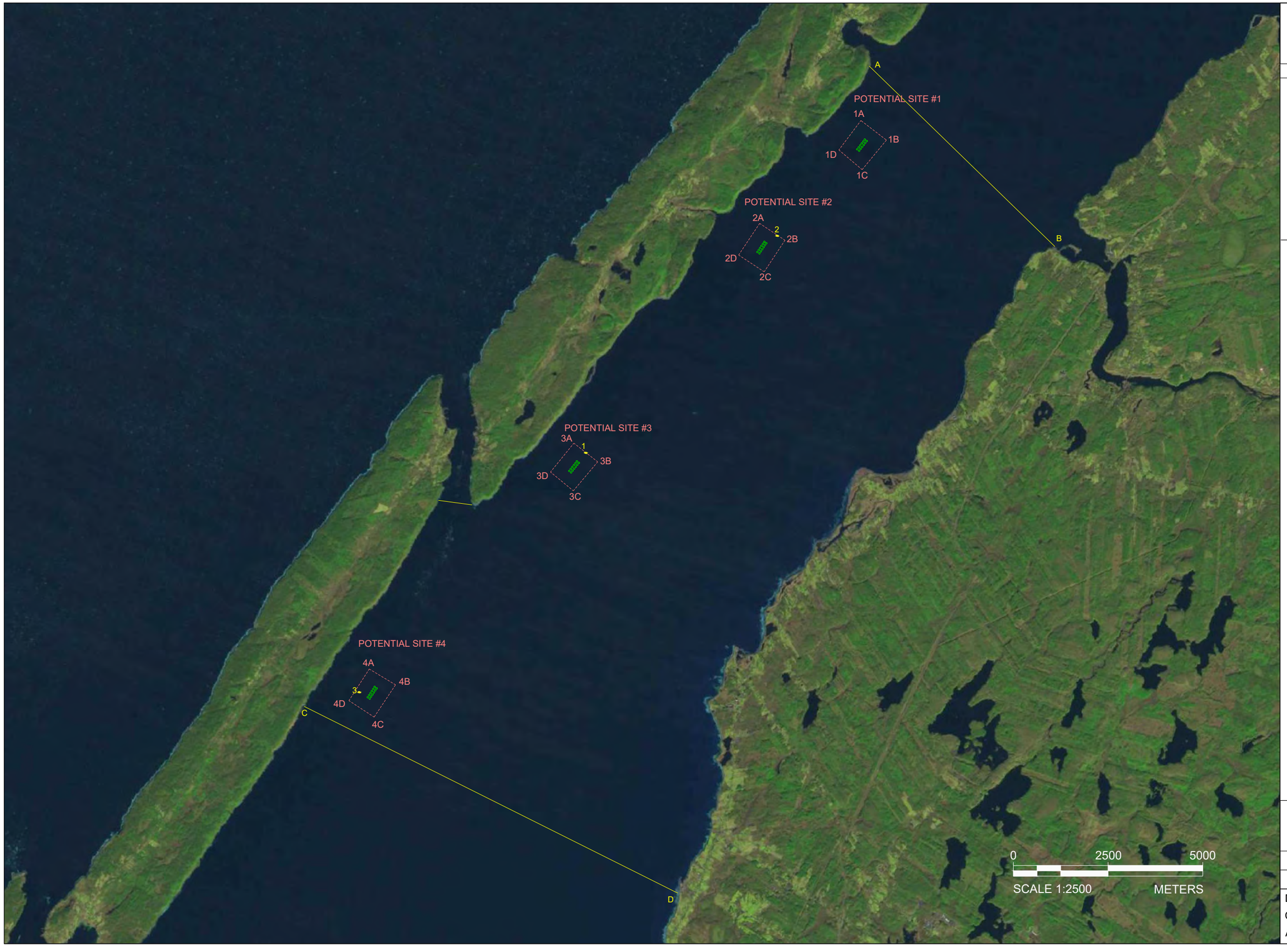
DSAocean

DRAWING NUMBER: DSA-HAUG-21SSR-D01

SHEET 8 OF 8

DRAWN BY: [redacted]
CHECKED BY: [redacted]
APPROVED BY: [redacted]

LAST REVISED: 2021-10-18
REVISION: IFR



CANADIAN SALMON LIMITED

NOVA SCOTIA, CANADA

SITE LOCATIONS

ENVIRONMENT FEATURES

LEASE BOUNDARY

ADCP LOCATION

OPTION AREA BOUNDARY

ADCP COORDINATES

1	44.385567°	-66.168633°
2	44.438743°	-66.107910°
3	44.327017°	-66.239100°

APPROVED OPTION AREA

A	44.479282°	-66.081807°
B	44.439707°	-66.022103°
C	44.328967°	-66.254017°
D	44.289557°	-66.132587°

SITE CENTER COORDINATES

POTENTIAL SITE #1	44.461250°	-66.081390°
POTENTIAL SITE #2	44.436068°	-66.113149°
POTENTIAL SITE #3	44.382293°	-66.173163°
POTENTIAL SITE #4	44.326828°	-66.236474°

DSAocean

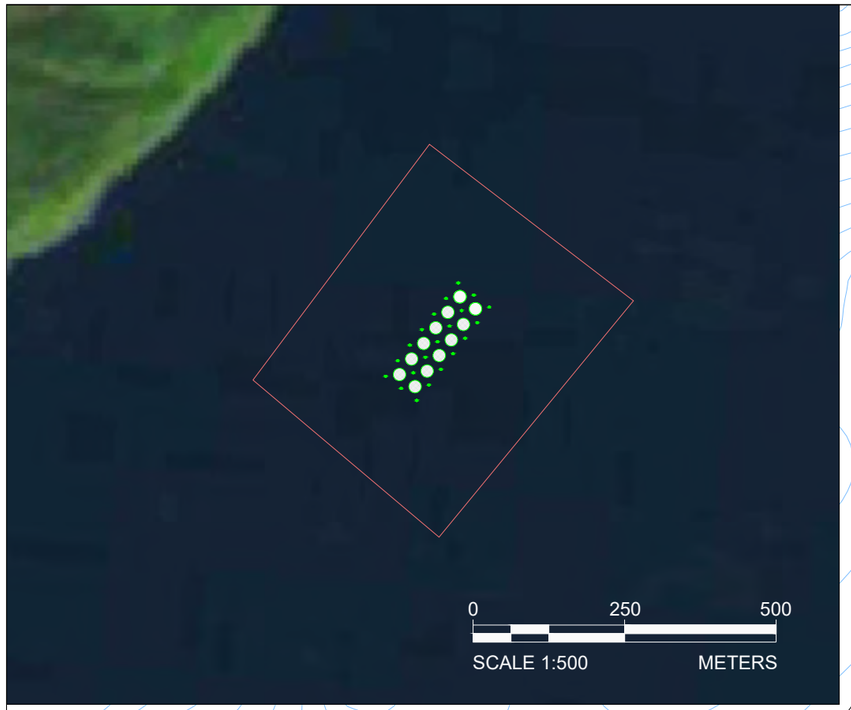
DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 1 OF 5

DRAWN BY: [redacted]

CHECKED BY: [redacted] LAST REVISED: 2022-02-16

APPROVED BY: [redacted] REVISION: C - IFR



CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 1

FARM FEATURES

- FISH NET
- NET PEN
- SITE CENTER
- COMPENSATOR BUOY

ENVIRONMENT FEATURES

- BATHYMETRY (METERS) 5
- LEASE BOUNDARY
- DOMINANT CURRENT DIR

SITE COORDINATES

POTENTIAL SITE #1

CORNER A	44.4671°	-66.0818°
CORNER B	44.4627°	-66.0733°
CORNER C	44.4554°	-66.0809°
CORNER D	44.4599°	-66.0889°

NOTES:

1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 1.62M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.2M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.2M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
5) TIDAL RANGE: 6.4M
6) APPROXIMATE DEPTH AT CENTER OF SITE 21 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

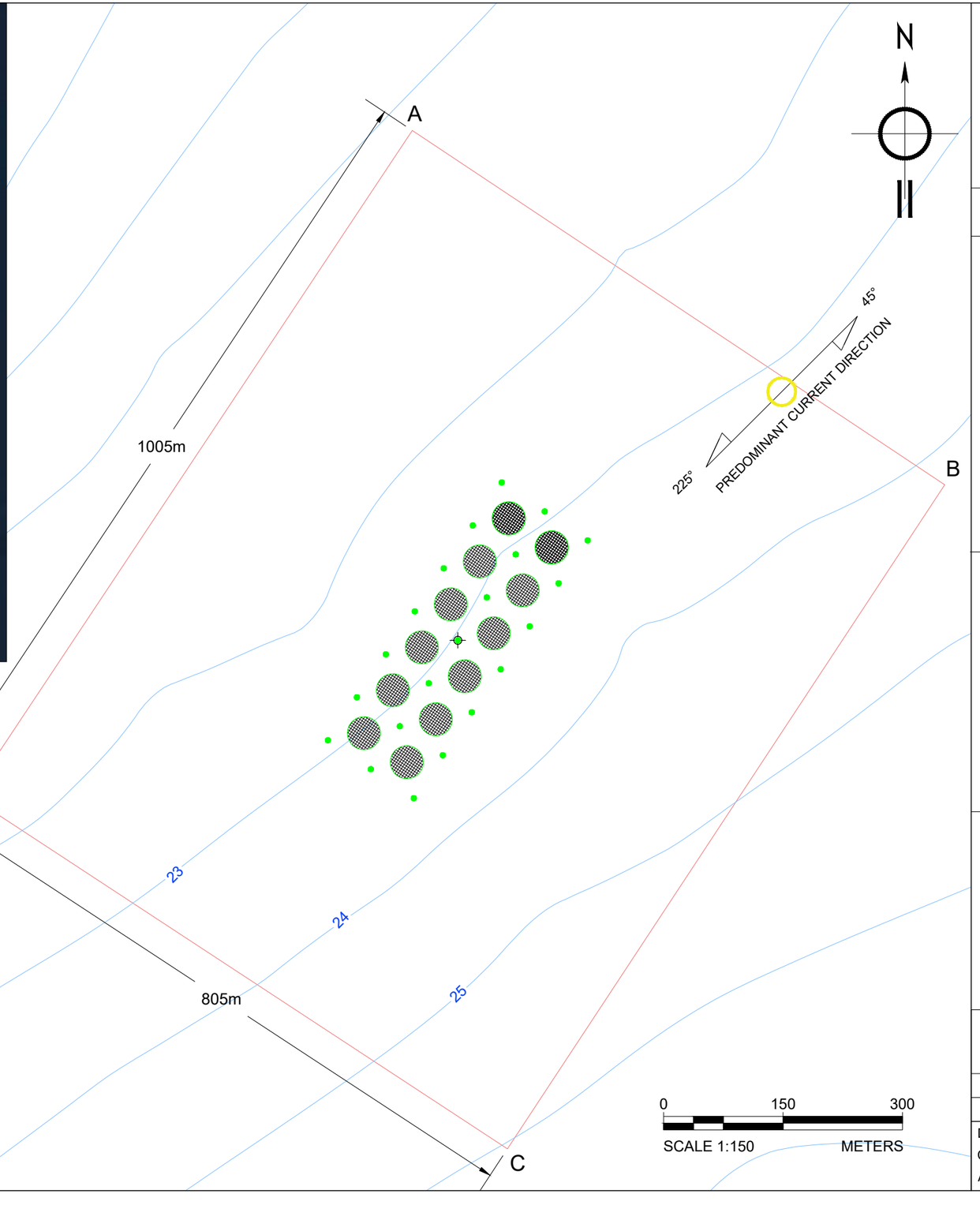
DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 2 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR





CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 2

FARM FEATURES

- FISH NET
- NET PEN
- ADCP LOCATION
- SITE CENTER
- COMPENSATOR BUOY

ENVIRONMENT FEATURES

- BATHYMETRY (METERS) 5
- LEASE BOUNDARY
- DOMINANT CURRENT DIR

SITE COORDINATES

POTENTIAL SITE #2

CORNER A	44.4417°	-66.1142°
CORNER B	44.4380°	-66.1056°
CORNER C	44.4305°	-66.1121°
CORNER D	44.4340°	-66.1207°

NOTES:

1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 1.73M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.32M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.33M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
5) TIDAL RANGE: 6.4M
6) APPROXIMATE DEPTH AT CENTER OF SITE 23 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

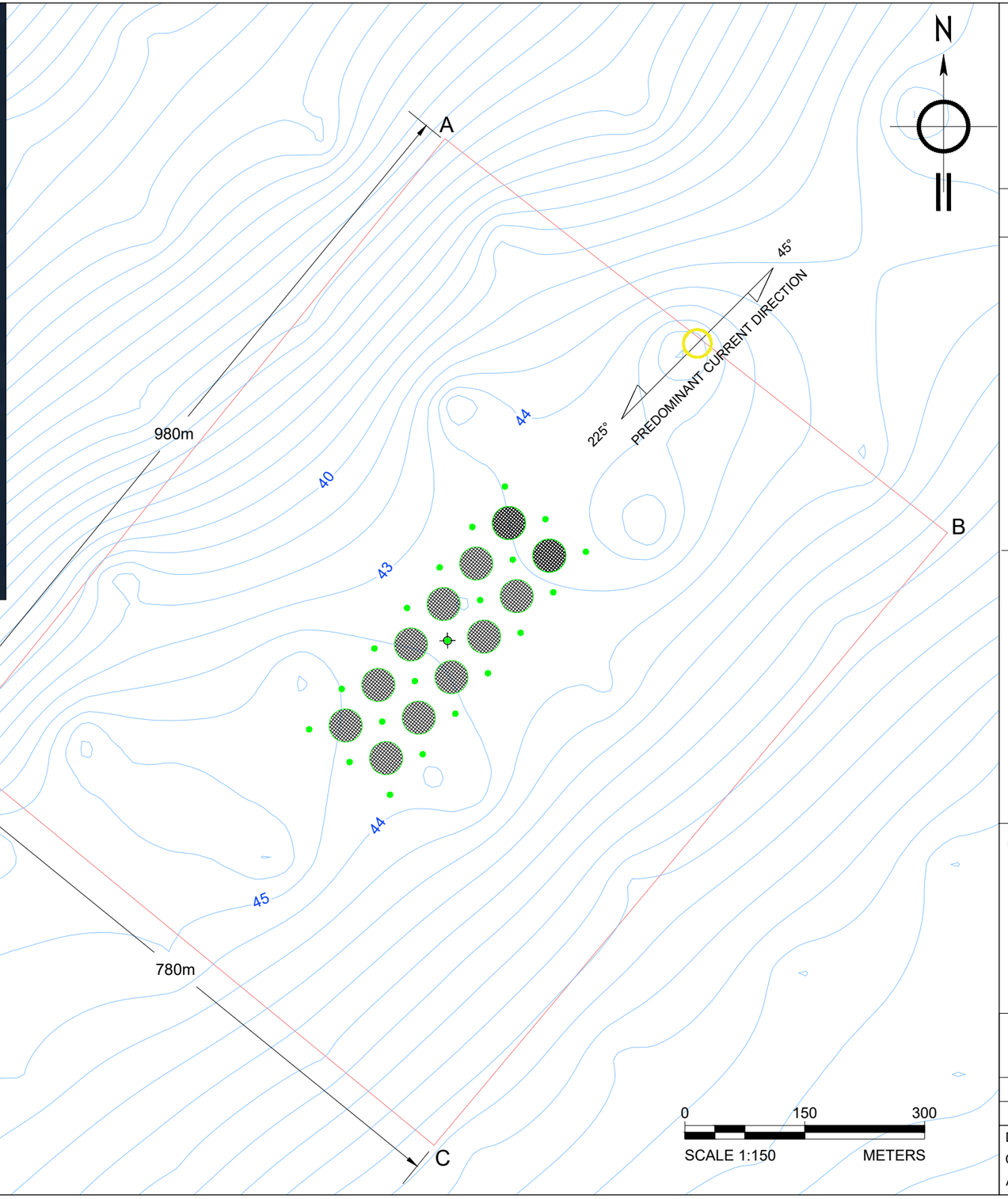
DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 3 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR





CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 3

FARM FEATURES

- FISH NET
- NET PEN
- ADCP LOCATION
- SITE CENTER
- COMPENSATOR BUOY

ENVIRONMENT FEATURES

- BATHYMETRY (METERS) 5
- LEASE BOUNDARY
- DOMINANT CURRENT DIR

SITE COORDINATES

POTENTIAL SITE #3

CORNER A	44.3879°	-66.1735°
CORNER B	44.3837°	-66.1654°
CORNER C	44.3766°	-66.1730°
CORNER D	44.3806°	-66.1808°

NOTES:

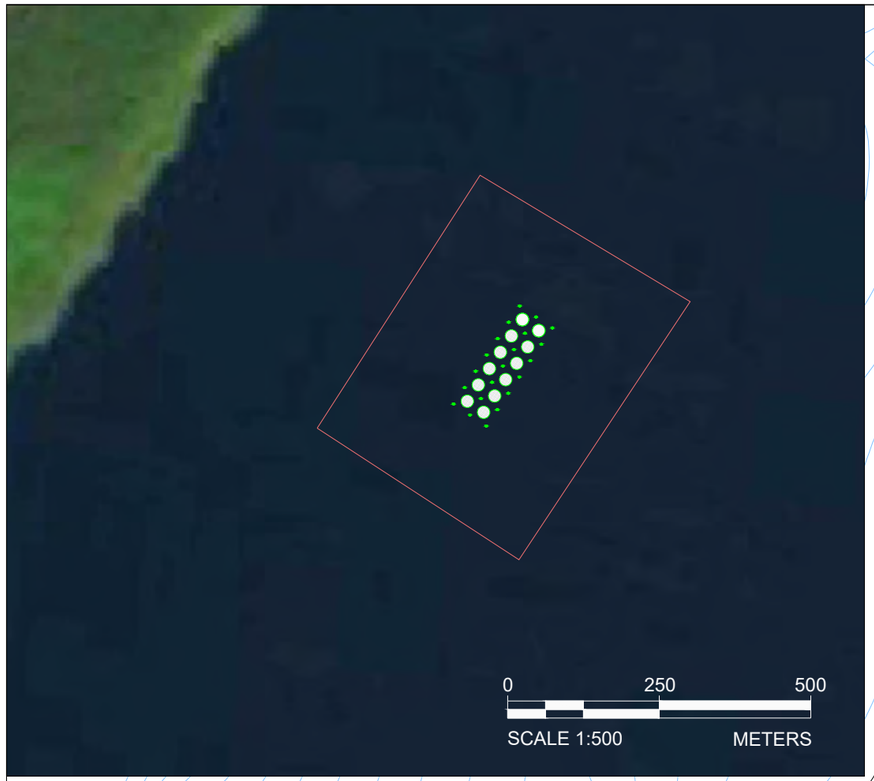
1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 2.24M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.43M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.49M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.3M/S
5) TIDAL RANGE: 6.3M
6) APPROXIMATE DEPTH AT CENTER OF SITE 43 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 4 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR



CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 4

FARM FEATURES	ENVIRONMENT FEATURES
FISH NET	BATHYMETRY (METERS)
NET PEN	LEASE BOUNDARY
ADCP LOCATION	DOMINANT CURRENT DIR
SITE CENTER	
COMPENSATOR BUOY	

SITE COORDINATES

POTENTIAL SITE #4

CORNER A	44.3325°	-66.2376°
CORNER B	44.3289°	-66.2288°
CORNER C	44.3211°	-66.2354°
CORNER D	44.3247°	-66.2439°

NOTES:

1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 2.25M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 2M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 2.49M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
5) TIDAL RANGE: 6.8M
6) APPROXIMATE DEPTH AT CENTER OF SITE 43 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 5 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR

Appendix H: Design Point Report

Page 444: Site 1

Page 445: Site 2

Page 446: Site 3

Page 447: Site 4



DESIGNPOINT
engineering • surveying • solutions

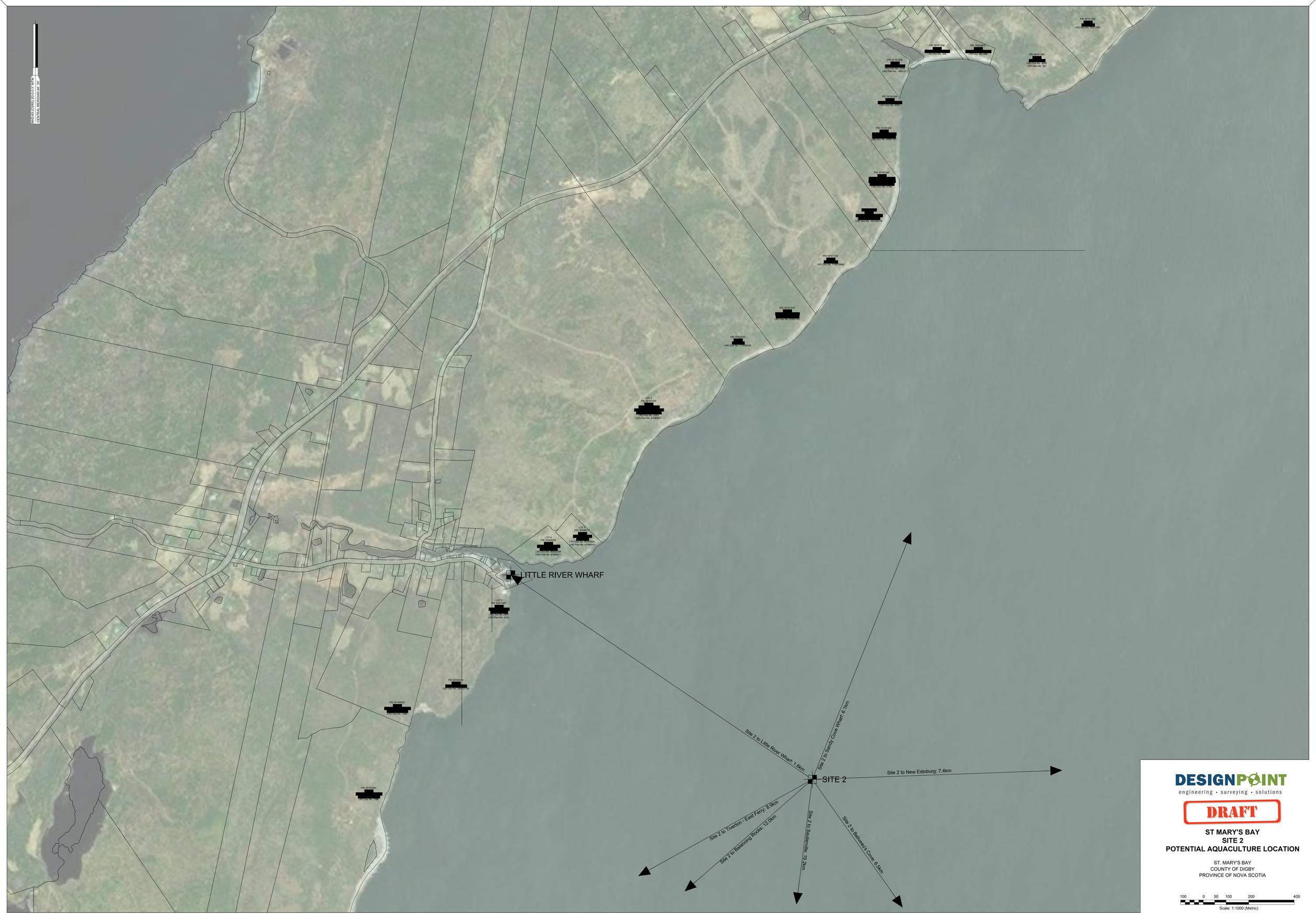
DRAFT

ST MARY'S BAY
SITE 1
POTENTIAL AQUACULTURE LOCATION

ST. MARY'S BAY
COUNTY OF DIGBY
PROVINCE OF NOVA SCOTIA

100 0 50 100 200 400
Scale: 1:1000 (Metric)

DATE: JANUARY 20, 2022



DESIGNPOINT
engineering • surveying • solutions

DRAFT

ST MARY'S BAY
SITE 2
POTENTIAL AQUACULTURE LOCATION

ST. MARY'S BAY
COUNTY OF DIGBY
PROVINCE OF NOVA SCOTIA

100 0 50 100 200 400
Scale: 1:1000 (Metric)

DATE: JANUARY 20, 2022

NAD 83 (CSRS) 2010.0 3 MTM
CENTRAL MERIDIAN 64° 30'

TIVERTON-EAST FERRY

SITE 3

Site 3 to Tiverton - East Ferry - 3.3km

Site 3 to Little River Wharf- 8.2km

Site 3 to Sandy Cove Wharf- 14.1km

Site 3 to New Edinburg - 14.2km

Site 3 to Beliveau's Cove: 9.0km

Site 3 to Balancing Rocks- 4.2km

Site 3 to Swallerville - 13.0km

DESIGNPOINT
engineering • surveying • solutions

DRAFT

ST MARY'S BAY
SITE 3
POTENTIAL AQUACULTURE LOCATION

ST. MARY'S BAY
COUNTY OF DIGBY
PROVINCE OF NOVA SCOTIA

100 0 50 100 200 400
Scale: 1:1000 (Metric)

DATE: JANUARY 20, 2022

NAD 83 CSRS 2010.0 3 MTM
CENTRAL MERIDIAN 64° 30'

SITE 4

Site 4 to Balancing Rocks- 4.2km

Site 4 to Tiverton - East Ferry- 8.0km

Site 4 to Little River Wharf- 15.5km

Site 4 to Sandy Cove Wharf- 21.3km

Site 4 to New Edinburg- 21.3km

Site 4 to Belliveau's Cove- 15.3km

Site 4 to Saulnierville- 10.4km

DESIGNPOINT
engineering • surveying • solutions

DRAFT

ST MARY'S BAY
SITE 4
POTENTIAL AQUACULTURE LOCATION

ST. MARY'S BAY
COUNTY OF DIGBY
PROVINCE OF NOVA SCOTIA

100 0 50 100 200 400
Scale: 1:1000 (Metric)

DATE: JANUARY 20, 2022

APPENDIX I: Definitions

The three types of economic impacts discussed in this report are defined as follows:

- **Direct Impacts/Effects** – These consider production, income, employment, taxes and spending on goods and services associated with the direct operation of the **CLS Project** or the direct spending on construction. They include employees, contractors, service providers and others directly involved in, for example, providing equipment related to the farming operations, modifications, building the hatchery, among the direct purchases. This includes, for example, individuals employed by the **project**.
- **Indirect Impacts/Effects** – These are the production, income, employment, tax, resource or environmental changes in backward linked industries (i.e., those that supply the operators who have service contracts for aquaculture equipment). One example is the impacts associated with suppliers to the operation and, in turn, the suppliers of these suppliers (i.e., the fuel suppliers, mechanics, contract engineers).
- **Induced Impacts/Effects** – These are the changes in household spending brought about by the shifts in household incomes of workers either directly employed by the aquaculture operation or indirectly employed by suppliers. Specifically, these are the impacts stemming from employees spending their wages and salaries on goods and services in support of their own households, in short, these capture household spending.

The propriety I-O model employed by GATN identifies the following economic impacts:

- **Employment** – The impact on employment is measured in person years (where a person year is equal to 2,000 hours and defined as a full-time equivalent position - FTE). FTEs are calculated based on annual wages and salaries and on an industry-by-industry basis, for each area being assessed;
- **Household Income** – The impact on wages and salaries associated with person years of employment (FTEs);
- **Gross Domestic Product (GDP)** – One of the more important outputs from the I-O model, changes in GDP at market prices are an important consideration. Being the monetary value of all goods and services generated within the aquaculture operations and the associated spending, GDP is the most direct and readily evident economic impact; and
- **Tax Effects/Impacts** – These are the estimated changes in federal and provincial taxation stemming from economic activity relating to the spending.


GROUP
A-TEN
CONSULTING INC

CONTENTS

1 INTRODUCTION 1

2 EXPANDED REPORT ON THE SCOPING PROCESS 1

2.1 Overview 1

2.2 Public Meetings / Virtual Sessions 2

2.3 Engagement Materials and Notices of Public Meeting 4

2.4 Community Engagement 4

3 ENVIRONMENTAL MONITORING PROGRAM BASELINE SAMPLING 5

4 CSL'S INTENT TO PURSUE RAINBOW TROUT 5

APPENDIX A: LETTER FROM THE DEPARTMENT OF FISHERIES AND AQUACULTURE 6

APPENDIX B: ENGAGEMENT DOCUMENTS AND ADVERTISEMENTS 9

Canadian Salmon Limited FAQ Sheet 10

Public Meeting Notices 19

Saltwire Digital Ads 19

Chronicle Herald Ad 20

Excerpt from the Chronicle Herald, January 24, 2022 21

One-Pager – Descriptive Advertisement 23

Chronicle Herald Receipt / Proof of Payment 25

Virtual Session Attendee List 27

APPENDIX C: PARTIES CONSULTED THROUGH OUTREACH AND ENGAGEMENT 29

Parties Engaged in the Scoping Process 30

APPENDIX D: ENVIRONMENTAL MONITORING PROGRAM BASELINE SAMPLING REPORT 31

1 Introduction

Canadian Salmon Limited (CSL) received a letter from the Department of Fisheries and Aquaculture on March 25, 2022. This letter is included in **Appendix A** of this report.

The letter notes that DFA had completed a preliminary review of CSL's aquaculture applications (AQ#1449, 1450, 1451, 1452) and determined that additional information is required. This additional information request addressed three specific items:

- A report outlining what was done for the scoping and engagement process. Specifically, DFA noted that further details are required on the scoping performed by Canadian Salmon Limited, including but not limited to:
    - How the public meetings/sessions were advertised including evidence of this, i.e., electronic scanned copy of the advertisement; and
    - Evidence of the attendees who attended virtual sessions.
- A report on the Environmental Monitoring Program Baseline Sampling for each proposed area including the following:
    - Geospatial data of sampling locations.
    - Video survey recordings;
    - Sediment collection and analytical data;
    - Bathymetric data; and
    - Current speed and direction data from a consecutive 30-day deployment.
- Clarification as to whether CSL wishes to include Rainbow trout in the above applications.

The DFA letter noted that the foregoing information is required before CSL's application can proceed to the review stage of the application process. CSL was requested to provide the additional required information on or before June 23, 2022.

This supplemental report addresses these three items below.

2 Expanded Report on the Scoping Process

2.1 Overview

In advance of tabling its application for an aquaculture license for development in the area of its *Option Agreement* within St. Mary's Bay, CSL undertook an extensive outreach and engagement process. The focus of this process was fourfold:

- To address the requirements noted in Section 11 (2) of the *Aquaculture Licence and Lease Regulations* related to the public engagement process.
- To brief a broad range of stakeholders on CSL's proposed plans for this site.
- To identify any issues and concerns that fishers and citizens may have; and

- To identify potential supply chain partners and collaborators, including among Indigenous communities within the area.

This outreach and engagement process took a variety of approaches including group briefing sessions, as well as bi-lateral meetings with potential supply chain partners, political leaders, community members, public officials, outreach to Chiefs and Indigenous fishers and industry proponents.

2.2 Public Meetings / Virtual Sessions

Two public meetings were held on February 8 and 9, 2022. These were essentially briefing sessions to explain CSL's proposed plans and its approach to aquaculture development in St. Mary's Bay. Because these briefing sessions were required to be conducted virtually as a result of health restrictions related to COVID-19, CSL took extra steps to ensure that community issues/concerns/input were canvassed so they could be addressed both in the license application document and in response to any concerns raised.

The agenda for the public meetings included the following:

- An introduction to the presenters;
- Canadian Salmon Limited's commitment to the region;
- The benefits and sector direction of aquaculture in Nova Scotia;
- Highlighting the competitive advantage for Nova Scotia in fostering a healthy aquaculture industry;
- A focus on the future of aquaculture; and
- Instructions for submitting feedback.

A website was established through which individuals could register for the virtual sessions. Registrants were invited to identify any questions or issues they wished to see addressed through these briefings.

The virtual meetings were held on February 8th and 9th. Videos of the virtual sessions were recorded and posted on the website following the virtual meetings. Both the February 8, 2022 and February 9, 2022 sessions can be found online.

In an effort to enhance input, registrants were invited to complete an online survey following the briefing sessions enabling them to offer further comment (provisions were made to include those who preferred a print format for completing the survey). Further input was received through an '*info@*' modality available on the project website or through direct outreach to the CSL lead whose name and contact information was included on the site and who invited meeting participants to contact him.

The survey opened for registrants at commencement of the presentations on February 8, 2022 and remains open to provide an ongoing channel for feedback. A link is available on the contact page for interested parties to complete the survey online or they may still receive a hardcopy of the survey. The '*info@*' email address also remains available for continued communication between CSL and stakeholders.

Broadly, the questions/issues raised through the public surveys included:

- The potential impact on the wild fishery in St. Mary's Bay and, particularly, the lobster fishery.
- Potential tourism impacts.
- Questions respecting the use of antibiotics and parasite management.
- Various observations on land-based aquaculture.
- Comments in respect to plastic detritus associated with sea facilities following storms.
- Comments in respect to the wild salmon population; and
- Issues related to environmental practices and potential environmental impacts.

Nine respondents completed the survey immediately following the sessions. Of those respondents, 56% found the briefings helpful in understanding the project. 44% of respondents who attended the information session identified as stakeholders who live near the site, and 22% indicated their attendance at the information session was due to general interest and curiosity about the project. Of the remaining respondents who used the 'Other' category to respond with their reason for attendance, one indicated that they were from the Aquaculture Association of Nova Scotia and another identified as a local Councillor. The most commonly identified elements of interest for attendees were the proposed locations, the science behind the project and economic benefits for the local community, as can be seen in the figure below:

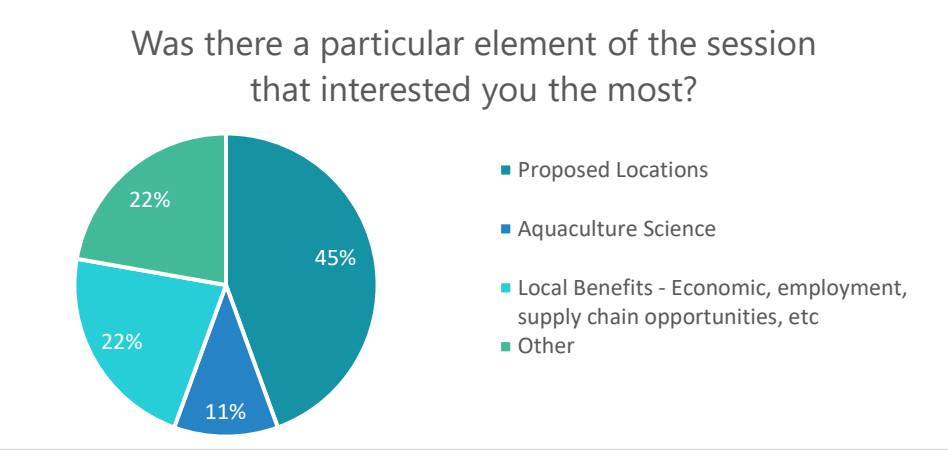


Figure 1. Exit Survey Result Example

To address the questions that arose through the virtual sessions and opportunities for feedback, CSL created a FAQ sheet and video to fill any identified gaps in public knowledge. The responses are aligned with the details provided throughout the application document. The FAQ sheet is included in **Appendix B**.

2.3 Engagement Materials and Notices of Public Meeting

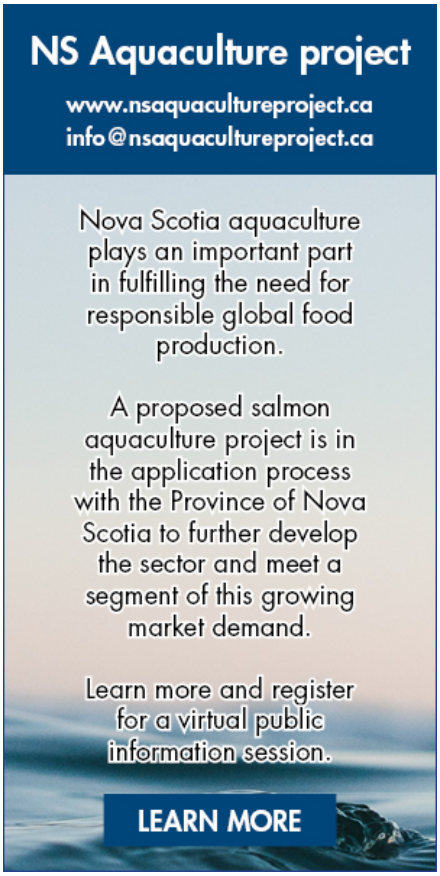


Figure 2. Digital Advertisement for Virtual Session Registration

CSL issued a variety of marketing approaches/materials and advertisements in advance of the virtual sessions including two cover displays in the Chronicle Herald and two digital campaigns. The Chronicle Herald receipt for the ad campaign can be seen in **Appendix B**.

Phase 1 included ad insertions in the SaltWire Network and a full Chronicle Herald distribution on January 24 and 30, 2022.

Phase 2 included a SaltWire Digital Ad campaign, geotargeted in the Digby County area with up to 35,000 impressions.

The digital ads in Phase 2 contained links to the project website which would then provide more extensive details on the project and as noted, an opportunity to register for the virtual sessions.

This campaign ran the week prior to the sessions and continued through until the week following the sessions to drive more traffic to the website and obtain more feedback.

An example of the advertisements used in this campaign are included on the previous page, with the remainder in **Appendix B**. Additionally included in **Appendix B** is a sample page from the January 24, 2022 Chronicle Herald displaying a printed notice of the sessions.

CSL developed a one-page descriptive document outlining the virtual sessions, their dates, and how to register. This document was shared with the MLA's office, Aquaculture Association of Nova Scotia (AANS), Atlantic Canada Fish Farmers Association (ACFFA), and Canadian Aquaculture Industry Alliance (CAIA) and other stakeholders who promoted the session for distribution among their social channels. This one-pager can be viewed in **Appendix B**.

2.4 Community Engagement

CSL recognizes the importance of Indigenous engagement and potential collaborations with First Nations fisheries. Outreach to First Nations (Acadia, Bear River and Annapolis Valley First Nation) was undertaken to inform them of the proposed development and to discuss potential opportunities for collaboration. CSL was deliberate in framing these discussions as 'information sharing' and not as 'consultation' as the *duty to consult* is under the purview of the Province as enshrined in the inter-governmental Tri-Partite Process.

Briefings of government officials, elected officials, fishing organizations, smolt producers (in Nova Scotia and Prince Edward Island) and potential supply chain partners were similarly focussed on information sharing and considering opportunities for potential collaborations.

Response from potential supply chain partners was enthusiastic, with many reaching out to declare an interest in potential partnership development.

CSL also received much encouragement from many who took the time to reach out and offer their observations on the importance of aquaculture development to future food security and to express their support for an ethical and sustainable approach to this development.

A list of those consulted during the outreach process is included in **Appendix C**. CSL's outreach and engagement is ongoing and will continue throughout assessment of the license application.

3 Environmental Monitoring Program Baseline Sampling

Contained in **Appendix D** is the full Environmental Monitoring Program Baseline Sampling report from DSA Ocean, completed April 5, 2022.

4 CSL's Intent to Pursue Rainbow Trout

It is CSL's intention that the site application also includes rainbow trout (*Oncorhynchus mykiss*), in addition to Atlantic salmon, for production at the proposed St. Mary's Bay sites. Including rainbow trout in the site plan will allow versatility in our production and assurance that we will have consistent production as outlined in our site plan.

This does not impact the total production numbers for stocking and harvest, but rather, rainbow trout may be used to stock certain sites.

Biologically, Atlantic salmon and rainbow trout are very similar. Therefore, most of our operations in production between Atlantic salmon and rainbow trout will be the same. Sites, infrastructure (e.g., cage design, feed barge, vessels, etc.), service and suppliers (except for seed and smolt supply), and harvest and processing will be the same for both species. The proposed revenue and economic contributions to the region will not be different with the addition of rainbow trout.

Caring and managing rainbow trout and Atlantic salmon are essentially identical because the species are so closely related. The Farm Management Plan will be the same for salmon and trout. In terms of fish health and welfare, CSL will strictly follow the Code of Practice for the Care and Handling of Farmed Salmonids (National Farm Animal Care Council 2021) for both salmon and trout.

Impacts on commercial fisheries and aquaculture activities in the region, other users of the region, marine life and wildlife, wild salmon, etc. will not be different than what has been outlined in the site application. This is because the production numbers of fish will be the same (regardless of species) and that salmon and trout are biologically similar.

APPLICATION INCOMPLETE
AQ#1449, 1450, 1451, 1452
BN# 790418933NS0001

March 25, 2022

Canadian Salmon Limited
c/o Martin Karlsen
44 Bedford Highway
Halifax, NS
B3M 2J2

Dear Martin,

RE: Aquaculture Applications -AQ#1449, 1450, 1451, 1452 - Incomplete
St. Mary's Bay, Digby County, N.S.

The Department has completed a preliminary review of the above applications and has determined that additional information is required. Please see below for a summary of the information required.

Scoping Requirements:

Section 11 (2) of the *Aquaculture Licence and Lease Regulations* requires an option to lease holder to include a report on the scoping process carried out under Section 10. Please submit a report outlining what was done for the scoping and engagement process. Refer to the following link for the requirements on scoping:

https://novascotia.ca/fish/aquaculture/licensing-leasing/Scoping_Guide.pdf

Your application noted that briefing sessions and virtual meetings were held on February 8th and 9th. Further details are required on the scoping performed by Canadian Salmon Limited, including but not limited to:

- How the public meetings/sessions were advertised including evidence of this, i.e., electronic scanned copy of the advertisement; and
- Evidence of the attendees who attended virtual sessions.

Please include the above details in your scoping report.

Environmental Monitoring Program Baseline Sampling:

There is outstanding baseline information that is required to be submitted to the Department for each proposed lease area. This information includes:

- Geospatial data of sampling locations;
- Video survey recordings;
- Sediment collection and analytical data;

- Bathymetric data; and
- Current speed and direction data from a consecutive 30-day deployment.

Rainbow trout

The submitted documents make reference only to Atlantic salmon, however in your Request for an Option to Lease you indicated an interest in Rainbow trout. Please confirm if you still desire to include Rainbow trout in the above applications.

The above identified information is required before your application can proceed to the review stage of the application process. Please provide the additional required information on or before June 23, 2022. If you do not submit the required additional information in compliance with the above deadline, your applications will be deemed withdrawn per Section 11A(2) of the *Aquaculture Licence and Lease Regulations*. Should you have any questions, please feel free to contact Amanda Spencer, Licensing Coordinator by email at Amanda.Spencer@novascotia.ca or by phone at 902-875-7442.

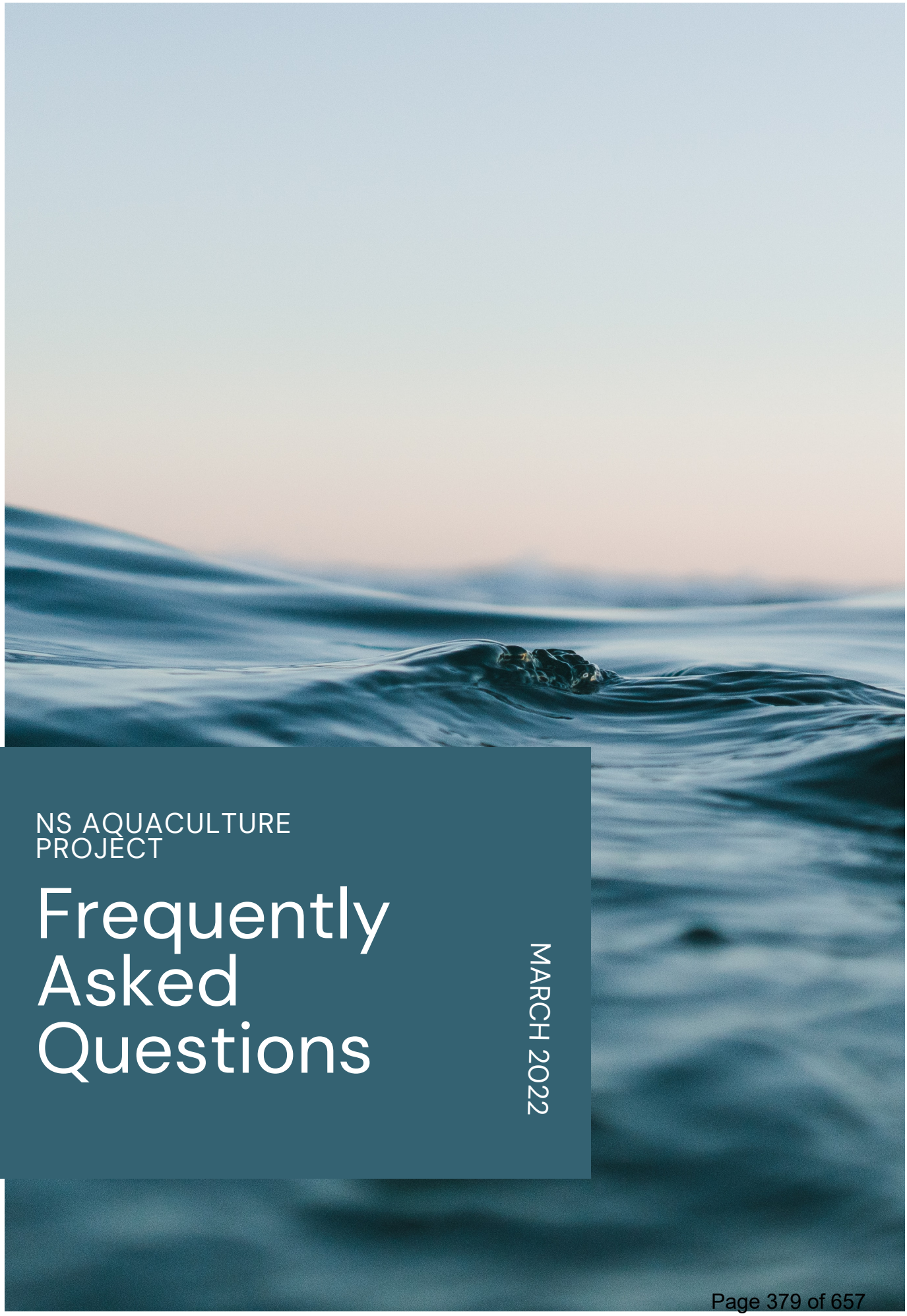
Sincerely,

[redacted]

Robert Ceschiutti
Manager of Licencing and Leasing

c. Amanda Spencer, Licensing Coordinator
Nathaniel Feindel, Manager of Aquaculture Development
Jennifer Feehan, Aquaculture Advisor
Gretchen Wagner, EMP Supervisor
Dan Mombourquette Coastal Resource Coordinator

Canadian Salmon Limited FAQ Sheet



NS AQUACULTURE PROJECT

Frequently Asked Questions

MARCH 2022

What you've asked.

Do salmon in the wild depend on cleaner fish to remove sea lice from them? The presentation made it seem like this was a natural way of controlling sea lice but is that true for salmon in the wild?

- Wild salmon do not typically have a symbiotic relationship with cleaner fish to take care of their sea lice.
- The natural relationship that the industry is harnessing is well-known in various marine and freshwater species.
- It is a form of biological control, similar to how ladybugs control aphids/ants on commercially-grown crops. E.g., ladybugs do not typically encounter canola in the wild, but it has proven to be an effective strategy for controlling aphids on canola farms.
- In the context of aquaculture, cleaner fish (like lumpfish or wrasse) may not typically help clean sea lice off salmon in the wild, but it is a strategy the industry can safely and effectively use.

The waste of open pen farms must be incredible, especially for four sites? How does that affect the ocean floor and other natural species?

- In recent years, waste in aquaculture has been minimized thanks to innovative technologies adopted to reduce waste generation and mitigate existing waste.
- Candian Salmon Limited (C.S.L.) has a strategy and standard operating procedures for waste collection (dead fish, feces, and overfeeding) where the waste will be brought to the water's surface by pumps at the bottom of the nets. The waste is disinfected and stored in closed tanks for transport to a regulated disposal vendor or compost/fertilizer producer.
- C.S.L. is regulated to participate in annual environmental monitoring, conducted as part of the Department of Fisheries and Aquaculture's standard operating procedures for Environmental Monitoring of marine aquaculture sites in Nova Scotia. These monitoring standards are among the highest standards in the world. C.S.L. will begin operations with one site and will consider environmental monitoring data before deploying any new sites.
- Decades of peer-reviewed research show that salmon farms have a very little long-term environmental impact on the marine environment.

Are open pen farmed salmon treated with antibiotics at any point in their development?

- Antibiotics are not frequently or commonly used; however, their use is sometimes necessary for fish health and welfare. When there is a concern for fish health, an aquaculture-specialized veterinarian will visit the site and determine if antibiotics are needed.
- In Canada, antibiotics can only be administered to fish with a prescription by an aquaculture-specialized veterinarian. If antibiotics are used, it is under the direction of the veterinarian and is typically administered via the feed.
- Antibiotic use in Canadian salmon operations is declining, despite an increase in the number of farms. This downward trend data is based on public data from Fisheries and Oceans Canada.

Does Canadian Salmon Limited/ Haugland Gruppen plan on using antibiotics?

- Canadian Salmon Limited (C.S.L.) will follow the regulations mandated by the NS Department of Fisheries and Aquaculture.
- C.S.L. has strict standard operating procedures for biosecurity and fish health and welfare that will help them avoid the need for antibiotics as much as possible.
- C.S.L. follows the principle that good practices with a focus on fish health and welfare not only mitigate risk for any health issues on-farm but also support healthy animals on other aquaculture operations within the vicinity. C.S.L. will strictly follow the Code of Practice for the Care and Handling of Farmed Salmonids.
- If antibiotics must be used, they must be prescribed by an aquaculture-specialized veterinarian after a site visit.

Will this operation damage the marine environment and sea life, or adversely affect certain species' health?

- Decades of peer-reviewed research show that salmon farms have a little long-term environmental impact on the marine environment.
- Canadian Salmon Limited (C.S.L.) will employ industry best practices and the highest standard of risk mitigation to ensure minimal impact on the surrounding marine environment and sea life.
- C.S.L. will use state-of-the-art risk mitigation strategies to avoid contamination of surrounding water and species. Risk mitigation will be conducted through regular monitoring and strict adherence to compliance requirements. Initial low stocking density will also help to prevent potential incidence.
- C.S.L. has chosen the site in St. Mary's Bay because it is not a known habitat for feeding or breeding any protected aquatic species. C.S.L. are stewards of the environment and respect any species that may encounter the site.

Why can't you consider land-based operations?

- Land-based operations are a completely different method of farming salmon. Their operations use recirculating aquaculture systems (R.A.S.), which is a relatively new technology. While the technology evolves and shows signs of progress, many technical issues still pose real challenges. Those issues need to be solved to have a commercially successful operation.
- Growing salmon to market size on land and while trying to meet the global demand would require massive amounts of land, water, and energy.
- While things are improving, the land farming sector has suffered from mass mortalities due to recirculating water within the system. The fish meat can have an earthy flavour due to biological conditions of land-based facilities that are challenging to control.
- There is a lot of research and development in this area, so it is promising that salmon farming may be more land-based in the future. However, growing salmon in natural waters is the best method for sustainable, high-quality salmon with a minimal carbon footprint.

Some say open pen salmon farms will affect the lobster fishery. Can you assure me there will be no impact on the Lobster fishery?

- Research studies show that salmon farming does not impact lobster populations or the health of lobsters within the Bay of Fundy region and beyond.
- A study conducted in Grand Manan, New Brunswick over an eight-year period found that aquaculture operations had no impact on lobster abundance, size, or growth in the lobster fishing area (L.F.A.) 38. The study demonstrated that there was no significant difference between the number of lobsters inside the salmon farming area versus a nearby reference site and no significant difference in the number of berried females (lobster with fertilized eggs held on the underside of her abdomen) inside or out of the farm lease area.
- When looking at Atlantic Canada lobster landings between 1990 and 2017, the number of landings grew more than 50%, yet there is no indication that this growth negatively impacted lobster farming.
- It is important to note that lobster populations are prone to natural fluctuations. Population dynamics can be the result of many different factors like sampling time, L.F.As, bottom temperature, water depth and lobster size.
- With increases in benthic marine temperature, lobster populations will fluctuate as these temperatures can be above a lobsters' normal thermal optimal range.

How many is too many fish farms in St. Mary's Bay?

- The amount of fish farms in the bay depends on the ecological carrying capacity of St. Mary's Bay.
- The ecological carrying capacity is the maximum use that the biota (plants and animals) or the number of physical processes an area can withstand before becoming unacceptably or irreversibly damaged.
- Research is in progress now to define the carrying capacity of St. Mary's Bay. Because the ecological carrying capacity is yet to be determined, Canadian Salmon Ltd. is taking the approach of starting one site at a time, while taking measurements over time to help define the carrying capacity before establishing new sites.
- Decisions can be sill made if the precautionary principle is enacted; starting with low stocking and developing a robust monitoring plan is crucial.
- The monitoring plan will give information over time leading to science-based decisions related to adaptive management, ensuring the precautionary principle and providing an empirical approach to carrying capacity.

Is the rate of growth in the sector sustainable with the quantity of feed needed?

- Yes. While there is increased growth in salmon production, the feed industry is also increasing production to meet demand.
- From an economic development perspective, with the increase in aquaculture in eastern Canada, we expect to see an increase in feed production as well. This increase in demand will lead to greater economic development, prosperity and better use of local resources.
- A sustainable benefit of using feed is that fish are incredibly efficient in converting feed into high-quality protein. On average, farmed fish require 1.1 kg of feed to gain 1 kg of body mass, compared with 1.7 kg for poultry and 6.6 kg for cattle.

What portion of your product (salmon) will be sold in countries that need food? The aquaculture industry often speaks about how sustainable food production is necessary to feed the growing population. How much of your product will be sold in countries that need food?

- Sales of our salmon depend on market demand. With local and national food security top of mind, we intend to sell primarily in Canada, the U.S. and in additional markets worldwide, such as Asia.
- Food supply and demand on a global scale is highly complicated with many players. By selling our products within the Canadian, U.S., and Asian markets, we will reduce domestic reliance on imported salmon. By reducing our imports, the global supply chain will redistribute to other countries in need of sustainable food.

Is the rate of growth of the sector also sustainable with the amount of waste produced?

- In terms of waste, there is currently very minimal feed waste. This reduction has much improved in the past decade, thanks to innovative technologies used for feeding. These innovations include the use of integrated systems with cameras and sensors, to significantly improve feed efficiency and prevent overfeeding. This technology also allows us to monitor the waste nutrient load in the surrounding waters.
- Feed designs for salmon continue to improve, with approximately 90% of their feed being digestible. This improvement helps to significantly reduce fecal waste.

Are wild caught fish used for Salmon feed?

- There will be some wild-caught fish in the feed as a source of essential fatty acids and amino acids. These nutrients are unique in fish meal and oil and cannot be sourced from plant-based ingredients already included in the feed.
- Fish meal and fish oil come from both forage fish and by-products. By-products result from fish processing that would otherwise be discarded and, therefore, part of an integrated industry-wide approach to utilize wild harvest fully.
- For the last ten years, the production of fish meal and fish oil has been relatively stable.
- Over the last ten years, fish meal and oil in salmon feed have decreased from 40% and 20% down to 10% and 5%. This trend is poised to further reduce in the future with new ingredients such as nutritious algae that can replace all fish meal and oil.
- It is important to note that for everyone 1 kg of wild fish used in feed, the end result is 5 kg of farmed fish across the global production system.

What else is in standard salmon feed and what is the break down?

- A healthy salmon requires a diet comprised of 45% protein and 25% fat, in addition to essential fatty acids like omega-3 and other amino acids, vitamins and minerals. Some ingredients like wheat are included in the feed to help form the pellets.
- When developing salmon feed, the key priority is to make a formulation that offers all required nutrients, helping the salmon achieve the correct amounts of protein and fat.
- Sources for protein in salmon feed include soybean meal, cornmeal, insect meal, and pulse meals (like pea protein).
- Sources of fat for salmon feed include canola oil, soybean oil and poultry fat.
- A vitamin and mineral premix is also used in the feed (similar to a daily multi-vitamin). In some cases, purified essential amino acids are also added to the feed.
- A key focus of feed development for the future will be to use novel raw materials that do not compete with human consumption. These may include insect protein, microbial protein, and algae products.

Does the feed Canadian Salmon Limited/Haugland Gruppen propose to use contain any animal protein?

- Canadian Salmon LimitedC will be purchasing commercial feed that will consist of the most nutritious and sustainable feed designs.
- Feed formulations may contain some animal protein.
- The safety of animal by-products has been proven by numerous scientific studies. Utilizing these raw materials that would otherwise go to waste also helps to dramatically reduce the amount of fish meal and fish oil used by the industry. Using by-products contributes to the sustainability of the food industry and the circular bioeconomy.
- As for animal proteins, there will be some wild-caught fish in the feed as a source of essential fatty acids and amino acids. The nutrients gained from wild-caught fish are unique in fish meal and oil and cannot be sourced in plant-based ingredients.
- There may also be animal proteins such as poultry by-products included in the feed. Poultry by-products contain highly digestible protein for fish, as well as essential amino acids. Formed into a pellet with other nutritive ingredients, the poultry meal complements other ingredients to make a complete and balanced meal/pellet.
- Feed companies invest in continuous research and development into raw materials and technologies to ensure sustainable, and nutritious feed ingredients.

What security is in place to ensure that the cages do not break, the fish do not escape, and that the existing biodiversity is not damaged by the presence of these proposed farms?

- Most escape incidents were directly caused by technological factors such as holes in nets.
- Canadian Salmon Ltd. (C.S.L.) will use the latest net-pen designs (e.g., high-density polyethylene mesh and stainless steel wire) developed specifically to prevent escapes.
- C.S.L. will also have a rigorous standard operating procedure for inspection, cleaning, testing, maintaining, and disinfecting our net pens and below-water infrastructure. These procedures will ensure that our infrastructure is in excellent condition, and therefore will reduce and eliminate the chance of escapes.
- In terms of salmon farming's impact on its surrounding environment, annual environmental monitoring will be conducted as part of the Departments of Fisheries and Aquaculture's standard operating procedures for Environmental Monitoring of Marine Aquaculture Sites in Nova Scotia.
- C.S.L. will begin operations with one site and will consider environmental monitoring data before deploying any new sites.
- C.S.L. is proposing a smaller operation than most salmon farms. They will start with a lower density (number of fish per pen) compared to other operations. This lower density will help gather initial monitoring data for the St. Mary’s Bay site before increasing fish numbers and sites in the area.
- C.S.L. is working with technology partners to stay up to date on innovative methods and materials for the salmon farming industry. With a commitment to using state-of-the-art technology, C.S.L. will be first in line to roll-out new technologies as they become available.

When is the project going to be evaluated by the province?

- The Department of Fisheries and Aquaculture (D.F.A.) is currently evaluating the project. After the evaluation is complete, the D.F.A. will send our application to the Aquaculture Review Board, who will decide if the sites are approved to go ahead. Find more information about the process on the province's Licensing & Leasing website.

Does the company consider its regulatory duty to consult with / inform the public about the project proposal satisfied?

- Yes. The virtual sessions held on February 3 & 4, 2022, were suggested under the guidance of the Department of Fisheries and Aquaculture. We continue to work with the Department to consult with and inform the public as our application is reviewed.

How can people provide their feedback on this development?

- Yes, a survey is available on the NS Aquaculture Project website.
- Alternatively, you can email info@nsaquacultureproject.com to send any questions or comments.

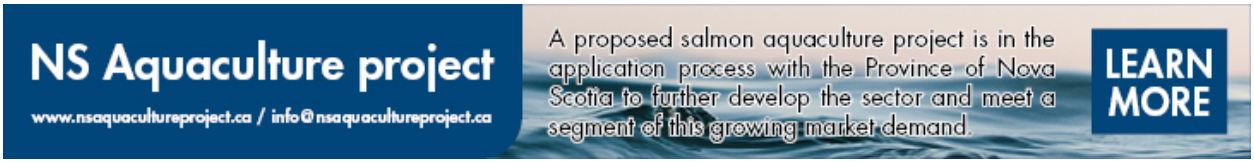
Where can we find more information on Canadian Salmon Limited and Haugland Gruppen and their plans?

- You can visit www.nsaquacultureproject.ca for more information.

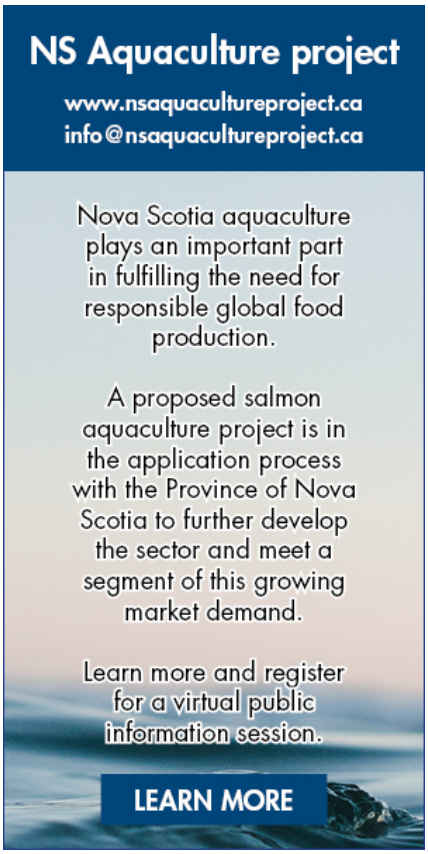
Public Meeting Notices

Saltwire Digital Ads:











Chronicle Herald Ad:



Excerpt from the Chronicle Herald, January 24, 2022

HEALTH

C.B. woman raising money for new prosthetic leg

AARON BESWICK
THE CHRONICLE HERALD
abeswick@herald.ca
@chronicleherald



Arielle Vienneau is raising money to replace her existing prosthetic leg with a waterproof micro processor enabled leg. CONTRIBUTED

Arielle Vienneau wants a life as near as possible to anyone with two legs.

But that's going to be expensive.

The 31 year-old Port Hawkesbury health-care worker and part-time parental figure to a child is trying to raise $48,000 for a new waterproof artificial leg that will allow her to run or walk.

"I would like to go outside without worrying about wrapping my leg with a garbage bag," said Vienneau.

"If my child runs into the water at the beach, I would like to be able to run after her. I just want to live like everyone else with two legs."

Vienneau's heath insurance through work will cover $92,000 of the cost of a replacement prosthesis leg as her current one nears the end of its working life. A waterproof micro-processor prosthesis for an above the knee amputee runs about $140,000.

Vienneau resorted to setting up a GoFundMe site last week in an attempt to raise the additional funds.

As of Sunday she'd raised $3,800 toward her goal.

Vienneau was walking home at 14 years old on what had been to that point two good legs when she suffered an injury that saw her knee pop backwards.

Five surgeries at the IWK and a gangrene infection later and she had a new journey to face – learning to walk with a prosthetic.

Her first was a mechanical leg – without the computers that help you develop a natural gait.

The added strain saw damage done to her good knee, strain on her hips.

Vienneau looked around at her life and started making changes.

She lost weight, became a para-sport athlete – competing in volleyball and sprinting with Team Canada.

She began a career in administration in long-term care with the Nova Scotia Health Authority.

And she moved back home to Cape Breton.

Now that her existing prosthesis is over six years old, the warranty is gone but repairs need to be done so she is looking forward.

"According to my clinicians, for the longevity of my bones and my body this is the most suitable prosthesis for me," said Vienneau.

"It's about the longevity of my life and living it to the fullest."

Halifax man gets 4 years for box cutter attack

CHRIS LAMBIE
THE CHRONICLE HERALD
clambie@herald.ca
@tophlambie

A judge has sentenced a Halifax man to four years in prison for slicing his dad's face with a box cutter on Christmas Day 2017, creating a wound that required 26 sutures to fix.

The same man was already behind bars for stabbing his former employer in the head and neck during a gunpoint robbery in Toronto.

Lorne Eric Corey Horton, now 28, got into a shoving match with his father, Adam Corey Cain, and his uncle, Michael Cain, a little over four years ago, the Nova Scotia Supreme Court heard.

"The family had gathered at Mr. Horton's grandmother's home to celebrate the holiday. People stayed up late on Christmas Eve and some were still up, socializing in the early hours of Christmas morning," Justice Jamie Campbell said in a written decision released Friday.

Horton had a "troubled relationship" with his uncle, which came up that morning, said the judge.

The pair discussed their past, then Horton confronted his father about grievances he had with him as well.

'MORE HEATED'

"The interaction got more and more heated," Campbell said.

His father decided to leave, but then bumped into Horton.

"Mr. Horton thought that was intentional and pushed back at his father. It turned into a shoving match. Then Michael Cain got involved. He confronted Mr. Horton about his behaviour and Mr. Horton shoved his uncle. That caused Michael Cain to fall backwards into a cart in the kitchen."

Horton and his father "were grappling with each other, and Mr. Cain brought his son to the floor. He had Mr. Horton pinned to the ground, with his arms restrained," said the judge.

"As Mr. Cain lightened his grip, Mr. Horton slid his neck out from under his father's grip and bit him on the chest. After biting Mr. Cain and while still pinned down Mr. Horton got a box cutter knife from his pocket and sliced his father's face once lengthways from his left eyebrow and down to his cheek."

FATHER HAD NO WEAPON

Horton told the court he thought his dad was going to hit him after he bit him. "But Mr. Cain did not hit his son while he had him pinned down and Mr. Cain did not have a weapon at any time," said the judge.

His uncle tried to grab the box cutter from Horton, cutting his hand in the process. "After Mr. Cain was cut, the struggle stopped."

When police arrived, Horton went outside, but he didn't go easy.

"He struggled to get away from them as they tried to arrest him. Mr. Horton and the two officers slipped on the deck outside the home. When that happened, Mr. Horton made a run for it toward the woods. A Taser was deployed and Mr. Horton then complied with the directions given to him by the police. The police who came to the scene did not observe any signs of intoxication."

Horton pleaded guilty to aggravated assault on his father, common assault on his uncle, resisting police, and possession of a weapon for a dangerous purpose.

GUNPOINT ROBBERIES

Horton has been in prison since January 14, 2019, serving a five-and-a-half-year sentence for two robberies he committed in Toronto in January 2019.

"Both involved robberies at gunpoint while wearing a mask. In one, Mr. Horton confronted his former employer with a knife and stabbed him several times in the head and neck. Those offences took place after the events of Christmas 2017," Campbell said.

"In one, Mr. Horton confronted his former employer with a knife and stabbed him several times in the head and neck," Campbell said.

According to his parole officer, Horton arrived at Atlantic Institution in Renous, N.B., in June 2021 and was "alleged to have been involved in two inmate assaults, one of which will likely result in criminal charges, a fight with another inmate, possession of a homemade sharp weapon, and he had a random urinalysis test come back positive for THC, methadone, and fentanyl," said the judge.

FIREARMS HISTORY

Horton was also sentenced to three years in prison in June 2014 for four firearms offences, Campbell said.

The court heard Horton had been "subjected to physical and emotional abuse by both his father and stepfather," the judge said in his decision.

"He said that he was a problematic child and was placed with his grandmother for a while on a few occasions. He was taken for psychiatric evaluations during his teenage years after altercations with his father. Mr. Horton says that he now suffers from several psychological or psychiatric conditions but there is no medical evidence to confirm any diagnosis of that kind. He has Crohn's Disease."

Horton moved out of the family home in Halifax as a teen and lived downtown with friends, said the judge.

While he "was back and forth to the family home over the years," Horton moved to Toronto in October 2017.

"In summary, it might be said that Mr. Horton had a troubled upbringing and has led a troubled life so far, as a young adult," said the judge.

"There are issues with substance use and impulse control."

The slice with the box cutter left Adam Cain permanently scarred, said the judge. "He was unable to work for 21 working days and lost more than $8,000 in income."

Horton "was not dragged into a fight," said the judge, noting he could have just let his father leave his grandmother's home that night.

Horton "clearly has issues that need to be resolved and they relate to public safety," Campbell said.

The judge said a four-year sentence "reflects his level of moral culpability in committing a serious act of violence with a weapon. That sentence will be served consecutive to the sentence that he is now serving."



municipality of cumberland

NOTICE OF ADOPTION

By-Law to Amend the Solid Waste By-Law 21-08

Second Reading of the By-Law to Amend the Solid Waste By-Law 21-08 was held at a Special Council meeting on Wednesday, January 12th, 2022. At that meeting, Council passed a motion to adopt the By-Law.

This By-Law will allow the Municipality to adhere to the requirements for closing the agreements to give effect to the sale of the assets of the Cumberland Central Landfill and Septage Facility.

For a copy of the by-law or for further information, please call 902-297-3989, 888-756-6262 (toll free), or email clerk@cumberlandcounty.ns.ca.

Shelley Hoeg-Eaton
Municipal Clerk

municipality of cumberland

NOTICE OF ADOPTION

By-Law to Amend the Septage Hauling Licensing By-Law 21-09

Second Reading of the By-Law to Amend the Septage Hauling Licensing By-Law 21-09 was held at a Special Council meeting on Wednesday, January 12th, 2022. At that meeting, Council passed a motion to adopt the By-Law.

This By-Law will allow the Municipality to adhere to the requirements for closing the agreements to give effect to the sale of the assets of the Cumberland Central Landfill and Septage Facility.

For a copy of the by-law or for further information, please call 902-297-3989, 888-756-6262 (toll free), or email clerk@cumberlandcounty.ns.ca.

Shelley Hoeg-Eaton
Municipal Clerk

One-Pager – Descriptive Advertisement

Future Focused.
Sustainable Aquaculture.

Nova Scotia aquaculture plays an important part in fulfilling the need for responsible global food production. As the demand for aquaculture products, specifically sea-farmed salmon continues to grow, Nova Scotia is in an enviable position for proximity to global markets and access to exceptional conditions for sustainable sea-farming.

Salmon is increasingly viewed as a healthier and more sustainable protein option. A proposed aquaculture project is in the application process with the Province of Nova Scotia to further develop the sector and meet a segment of this growing market demand.

Stakeholders can participate in virtual public information sessions regarding the proposed project near Digby Neck and Islands:

- February 8 (1:30-3 pm)
- February 9 (1:30-3 pm)

To register for a virtual public information session and to learn more about the project visit:
www.NSAquacultureProject.ca

For all inquiries or for assistance registering for a virtual public information session please email:
info@nsaquacultureproject.ca

Chronicle Herald Receipt / Proof of Payment

The ChronicleHerald

PAYMENT RECEIPT

Payee Information

Account No.: [redacted]

Customer Name: [redacted]

Customer Address: [redacted]
CANADA

Payment Detail

Payment/Receipt No. [redacted]

Payment Date:

Payment Method: [redacted])

Payment Entered By: [redacted]

Payment Amount: [redacted]

Invoices Paid

Invoice No.	Date	Description	Invoice Amount	Paid Amount	Balance
[redacted]	2/7/2022			[redacted]	
	1/29/2022				
	1/29/2022				
	1/29/2022				

Virtual Session Attendee List

Event Date	Name	Email	Phone Number
Feburary 8	[redacted]		
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Executive Summary

The following document has been prepared for Canadian Salmon Ltd. to summarize the baseline environmental data collected for its proposed sites in St. Mary's Bay, Nova Scotia. The data has been collected to meet the requirements of the July 2021 NS DFA *"Standard Operation Procedures for the Environmental Monitoring of Marine Aquaculture In Nova Scotia"* [1] and DFO's "*AAR Monitoring Standard 2018*" [2]. Baseline environmental data has been collected at four proposed sites within the option area.

This report first presents data on the site bathymetry. Next it reviews the sediment samples collected, and the analysis results. ADCP data of the currents at the site are presented. Next, depositional modeling results are provided. Last, the fish habitat video survey data is summarized.

The proposed farm sites in St. Mary's Bay may be characterized as high energy based on wave exposure, high current speeds, and coarse sediments. From the perspective of organic loading, these are considered ideal fish farm sites, since they are dispersive. In terms of local or far field bathymetry, there are no obvious depocentres or sheltered areas (i.e. behind islands) to act as particle sinks.

In depositional environments, sulfide may be substantial even in the absence of aquaculture. However, these sites have virtually zero sulfides and low organic content indicative of well flushed sediments that do not incorporate organic matter. Some sites have substantial mud content mixed with sand and gravel. However, Fundy sediments have an extensive glacial history, and gravel/cobble within a sand-mud matrix are common [16]. The presence of fine consolidated sediments is thus not indicative of a net depositional environment.

Beyond sediment texture and geochemistry, depositional modelling shows footprints tight to the cage sites in all cases. We emphasize that these models do not include resuspension and are thus conservative. With free-stream current speeds often exceeding 1-2 knots, the local deposition of fine particles such as fish feces is unlikely.

Contents

Revision history 2

List of authors / reviewers 2

Executive Summary 3

Contents 4

Figures 6

Tables 8

1 Document Scope 9

2 Abbreviations and acronyms 9

3 Reference documents and drawings 9

4 Videos, Grab Samples, and ADCP Data 10

5 Site Layout and Bathymetry 10

6 Sediment Sample Collection and Analysis 17

6.1 Collection dates and personnel 17

6.2 Field Methods 18

6.3 Lab Methods 18

6.3.1 Porosity & Organic Matter 19

6.3.2 Redox Potential 19

6.3.3 Dissolved Sulfides 19

6.3.4 Grain Size 19

6.4 Sediment Analysis Results 20

6.4.1 Overview 20

6.4.2 Geochemistry 21

6.4.3 Grain size 24

6.4.4 Sulfide & Redox Potential Calibrations 29

7 Current Speed and Direction 32

7.1 ADCP #1 35

7.2 ADCP #2 40

7.3 ADCP #3 44

8 Depositional Modeling 49

8.1 Model 49

8.2 Model Parameters 49

8.2.1 Organic Matter 49

8.2.2 Array Design & Stocking 49

8.2.3 Hydrodynamics 49

8.3 Depositional Model Results 50

9 Video Survey / Fish and Fish Habitat 54

10 Conclusions 55

Figures

Figure 1 Site distribution within St. Mary's Bay. (The yellow numbers 1, 2, and 3 – at sites 3, 2 and 4 respectively, are the deployment locations of the ADCPs in the area) 12
Figure 2 Bathymetry at site on hydrographic charts- Depth reported in meters 13
Figure 3 - Site 1 bathymetry and cage placement [3] 14
Figure 4 - Site 2 bathymetry and cage placement 15
Figure 5 - Site 3 bathymetry and cage placement 16
Figure 6 - Site 4 bathymetry and cage placement 17
Figure 7 Sampling location for sediment 20
Figure 8 - Examples of dense arrays of polychaete castings at sediment surface from Site 2 (AQ#1450). 24
Figure 9 - Sediment grab attempts from Site 4 (AQ#1452) 24
Figure 10 - Grain size distribution Site 1 (AQ#1449) 25
Figure 11 - Grain size distribution Site 2 (AQ#1450) 26
Figure 12 - Grain size distribution Site 3 (AQ#1451) 27
Figure 13 - Sulfide calibration curves 32
Figure 14 A picture of single float ADCP with subsurface moorings at the deployment location. The single float system used for ADCP 1 and 2 33
Figure 15 A picture of dual float ADCP with subsurface moorings at the deployment location. The dual float system used for ADCP 3 34
Figure 16 ADCP 3 during deployment 35
Figure 17 Scatter plot of current speed vs direction at ADCP 1 location - 10m water depth 36
Figure 18 Frequency plot of current direction at ADCP 1 location - 10m Water depth 36
Figure 19 A sample time series plot of current speeds at ADCP 1 location - 10m Water depth 37
Figure 20 Scatter plot of current speed vs direction at ADCP 1 location - 15m water depth 37
Figure 21 Frequency plot of current direction at ADCP 1 location - 15m Water depth 38
Figure 22 A sample time series plot of current speeds at ADCP 1 location - 15m Water depth 38
Figure 23 Scatter plot of current speed vs direction at ADCP 2 location - 5m water depth 40
Figure 24 Frequency plot of current direction at ADCP 2 location - 5m Water depth 41
Figure 25 A sample time series plot of current speeds at ADCP 2 location - 5m Water depth 41
Figure 26 Scatter plot of current speed vs direction at ADCP 2 location - 15m water depth 42
Figure 27 Frequency plot of current direction at ADCP 2 location - 15m Water depth 42
Figure 28 A sample time series plot of current speeds at ADCP 2 location - 15m Water depth 43
Figure 29 Scatter plot of current speed vs direction at ADCP 3 location - 5m water depth 45
Figure 30 Frequency plot of current direction at ADCP 3 location - 5m Water depth 45
Figure 31 A sample time series plot of current speeds at ADCP 3 location - 5m Water depth 46
Figure 32 Scatter plot of current speed vs direction at ADCP 3 location - 15m water depth 46
Figure 33 Frequency plot of current direction at ADCP 3 location - 15m Water depth 47
Figure 34 A sample time series plot of current speeds at ADCP 3 location - 15m Water depth 47
Figure 35 - Site 1 (AQ#1449) Deposition Model Results 51
Figure 36 - Site 2 (AQ#1450) Depositional model results 52

Figure 37 - Site 3 (AQ#1451) deposition model results 53
Figure 38 - Site 4 (AQ#1452) deposition model results 54

Tables

Table 1 Site Center Coordinates 11
Table 2. Water depths at Sites – based on CHS 10m resolution non-navigational data – Low water 14
Table 3 - Tide table for sampling dates 17
Table 4 - Geochemistry results (A) 22
Table 5 - Geochemistry results (B) 23
Table 6 Grain size results 28
Table 7 - March 10th sulfide and redox calibrations 29
Table 8 - March 12th sulfide and redox calibrations 30
Table 9 - March 17th sulfide and redox calibrations 31
Table 10 List of ADCP models with their deployment locations and dates 32
Table 11: 1 in 10 and 1 in 50 current conditions at ADCP 1 location using Scottish standard [2] 39
Table 12: 1 in 10 and 1 in 50 current conditions at ADCP 2 location using Scottish standard [2] 43
Table 13: 1 in 10 and 1 in 50 current conditions at ADCP 3 location using Scottish standard [2] 48
Table 14 Residual current velocities 50
Table 15 Depositional Model Parameters 50

1 Document Scope

The following document has been prepared for Canadian Salmon Ltd. to summarize the baseline environmental data collected for its proposed sites in St. Mary's Bay, Nova Scotia. The data has been collected to meet the requirements of the July 2021 NS DFA *"Standard Operation Procedures for the Environmental Monitoring of Marine Aquaculture In Nova Scotia"* [1] and DFO's "*AAR Monitoring Standard 2018*" [2]. Baseline environmental data has been collected at four proposed sites within the option area.

This report first presents data on the site bathymetry. Next it reviews the sediment samples collected, and the analysis results. ADCP data of the currents at the site are presented. Next, depositional modeling results are provided. Last, the fish habitat video survey data is summarized.

2 Abbreviations and acronyms

DSA	Dynamic Systems Analysis Ltd.
NS DFA	Nova Scotia Department of Fisheries and Aquaculture
ADCP	Acoustic Doppler Current Profiler

3 Reference documents and drawings

[1]	Standard Operation Procedures for the Environmental Monitoring of Marine Aquaculture In Nova Scotia, https://novascotia.ca/fish/documents/ns-emp-sops.pdf
[2]	AAR Monitoring Standard 2018, http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/aar-raa-eng.htm
[3]	DSA-CSL-22DSV-D02-RevC – Canadian Salmon Ltd. Site Drawings
[4]	Wildish, D., Akagi, H., Hamilton, N., Hargrave, B.T., "A recommended method for monitoring sediments to detect organic enrichment from mariculture in the Bay of Fundy", Canadian Technical Report of Fisheries and Aquatic Sciences, Fisheries and Oceans Canada Biological Station, St. Andrews, New Brunswick, Canada, September 1999.
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[12]	Cromey, C.J., Thetmeyer, H., Lampadariou, N., Black, K.D., Kogeler, J., Karakassis, I., "MERAMOD: predicting the deposition and benthic impact of aquaculture in the eastern Mediterranean Sea", *Aquaculture Environment Interactions,* Volume 2, Pages 157-176, March 2012, doi: 10.3354/aei00034.
[13]	Chang, B.D., Page, F.H., Losier, R.J., McCurdy, E.P., "Organic enrichment at salmon farms in the Bay of Fundy, Canada: DEPOMOD predictions versus observed sediment sulfide concentrations", *Aquaculture Environment Interactions,* Volume 5, Pages 185–208, 2014, doi: 10.3354/aei00104.
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4 Videos, Grab Samples, and ADCP Data

Provided with this report are digital videos and photos of the grab samples and video transects. The associated digital files can be found here: Data Download Link

The log sheets and ADCP data are also provided in this folder.

5 Site Layout and Bathymetry

The four intended sites are shown below in Figure 1. The centers of the four leases are given in Table 1.

Non-navigational 10m resolution Canadian Hydrographic Survey (CHS) data were extracted for the region to develop site plans which allowed for sufficient clearance of the nets. Figure 2 shows the water

depths throughout the bay, which is generally 30-50m deep. The water depths at each of the 4 corners of the sites are provided in Table 2. Site 1 is the shallowest, with depths approaching 11m at some areas of the lease. Site 2 depths at low water range from 20-26m. Site 3 and 4 are generally deeper with depths typically between 30 and 40m. Figure 3 to Figure 6 provide contour lines of the site bathymetry [3]. Attached to this report are drawings of the site, with corner coordinates listed.

Table 1 Site Center Coordinates

POTENTIAL SITE #1	44.461250°	-66.081390°
POTENTIAL SITE #2	44.436068°	-66.113149°
POTENTIAL SITE #3	44.382293°	-66.173163°
POTENTIAL SITE #4	44.326828°	-66.236474°

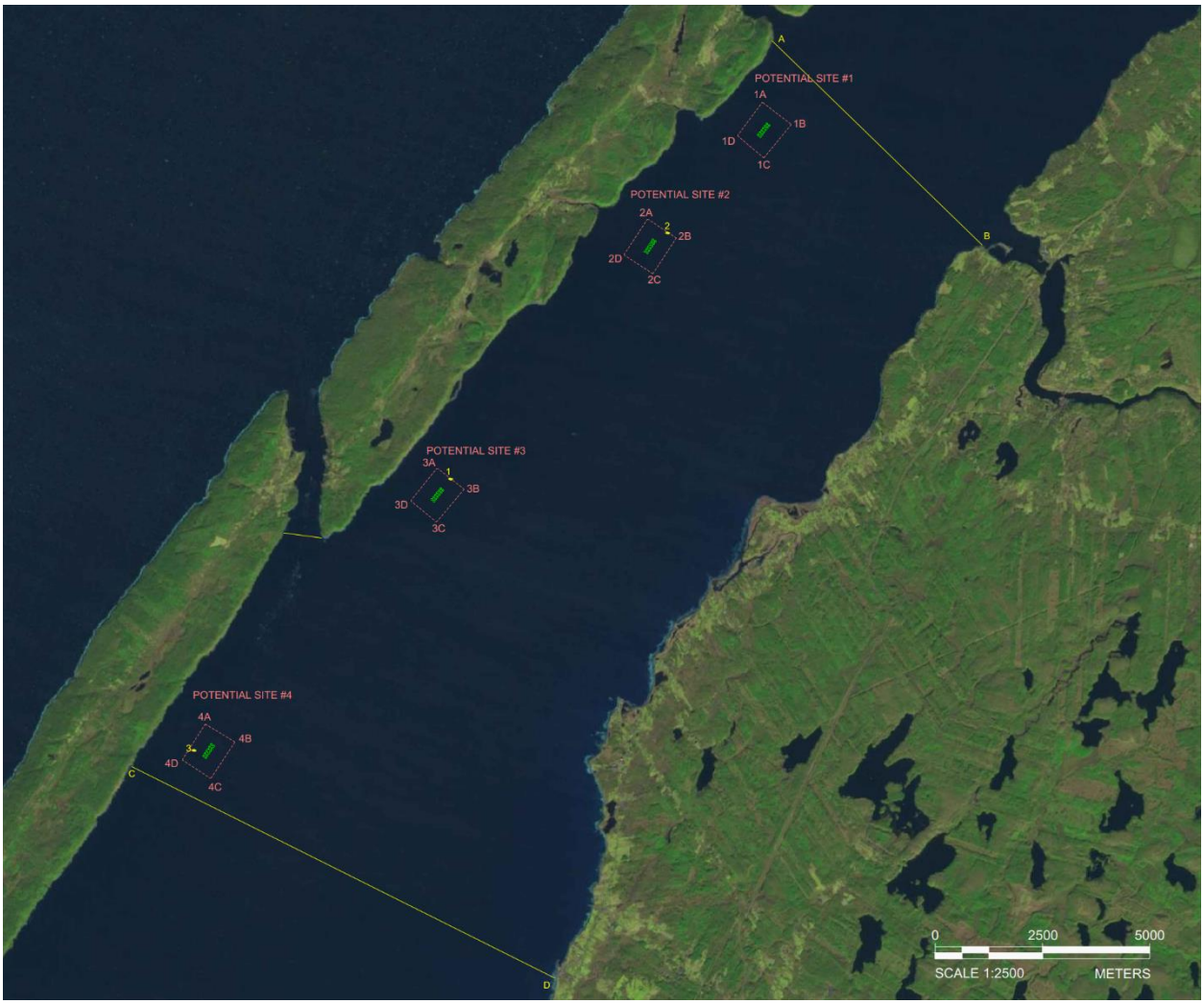


Figure 1 Site distribution within St. Mary's Bay. (The yellow numbers 1, 2, and 3 – at sites 3, 2 and 4 respectively, are the deployment locations of the ADCPs in the area)

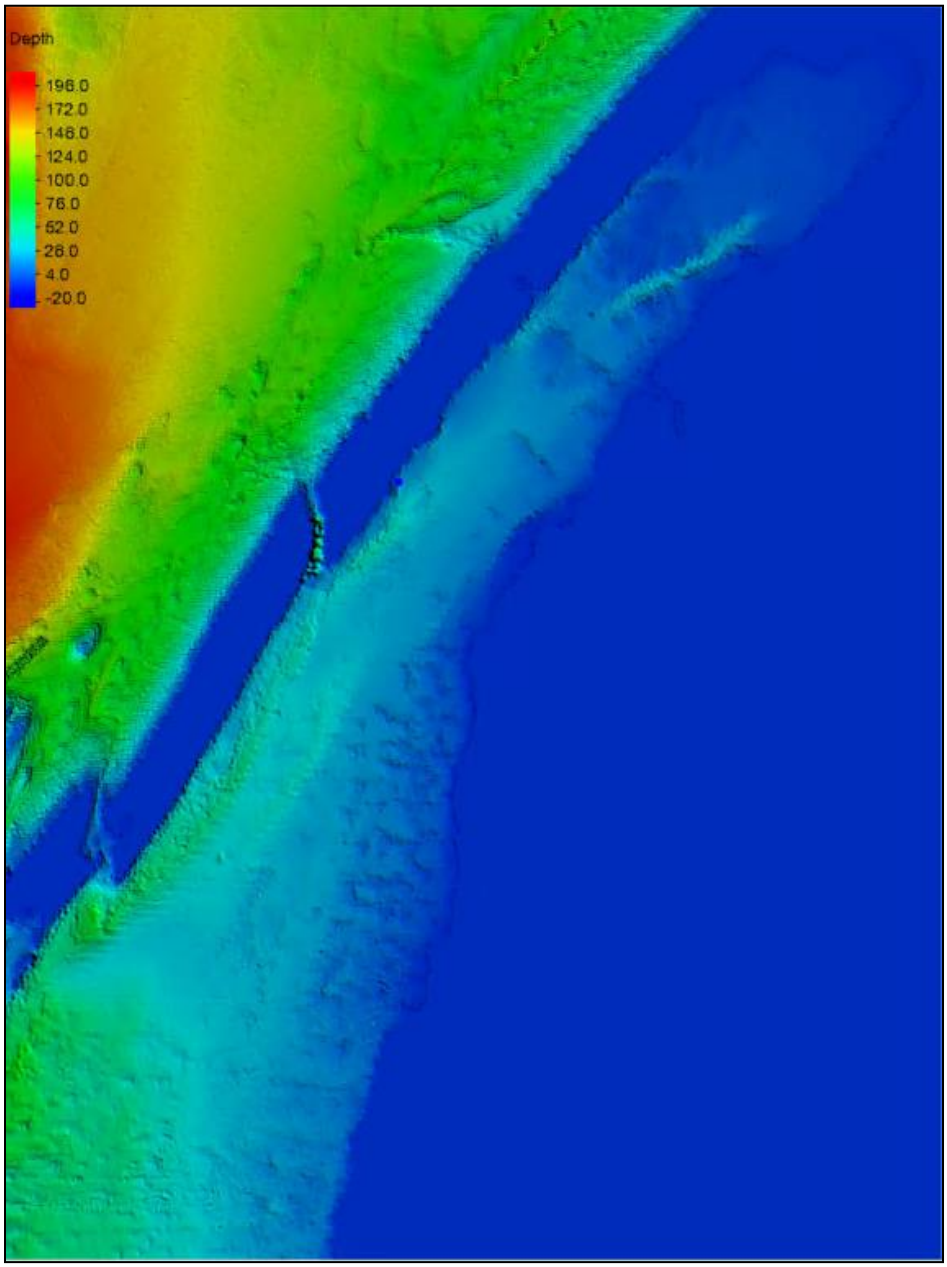


Figure 2 Bathymetry at site on hydrographic charts- Depth reported in meters

Table 2. Water depths at Sites – based on CHS 10m resolution non-navigational data – Low water

	Site 1	Site 2	Site 3	Site 4
Site Corner	**Depth (m) – at LLW**			
NW	**28**	**20**	**31**	**37**
NE	**11**	**24**	**38**	**41**
SE	**19**	**26**	**35**	**43**
SW	**26**	**21**	**39**	**37**

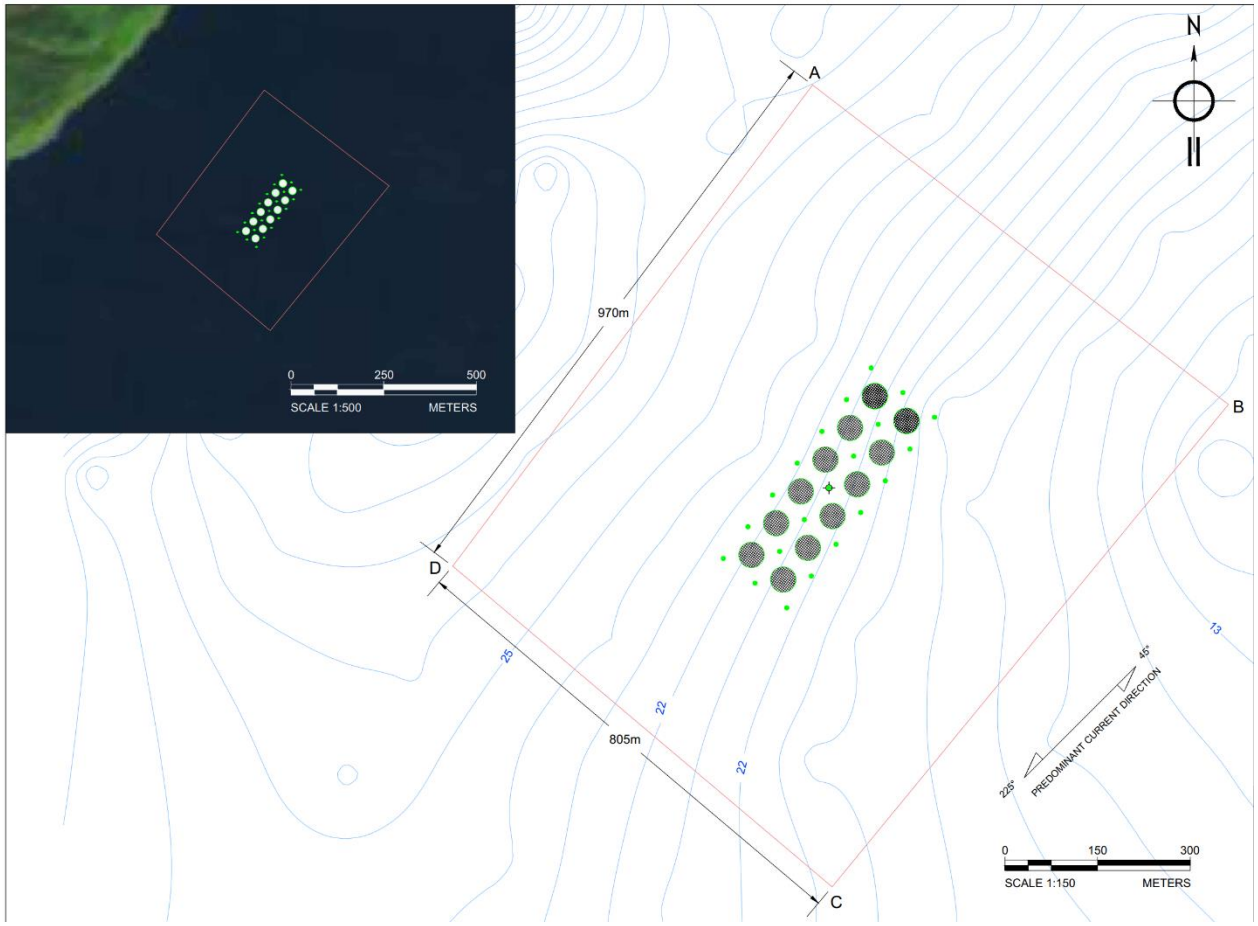


Figure 3 - Site 1 bathymetry and cage placement [3]

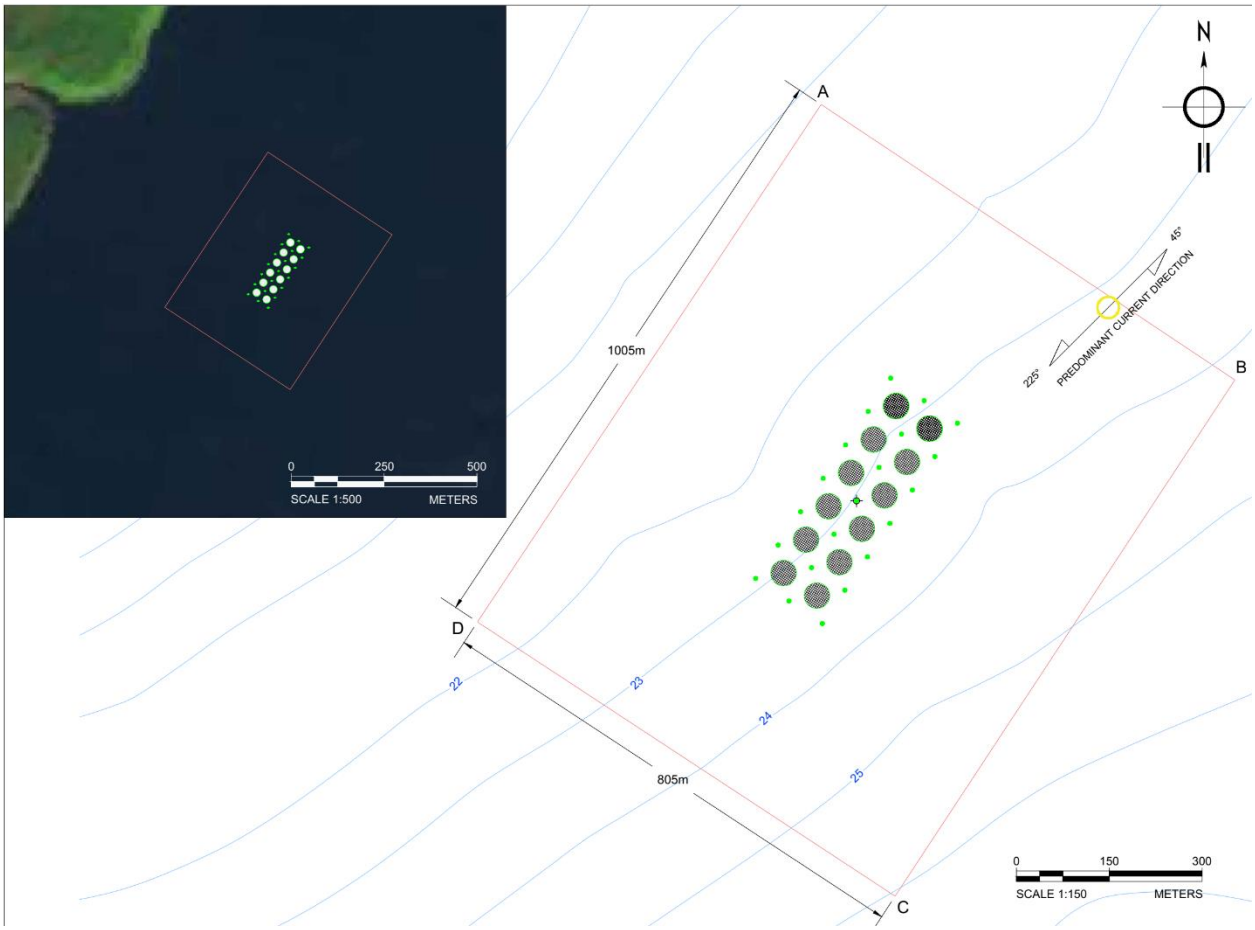


Figure 4 - Site 2 bathymetry and cage placement

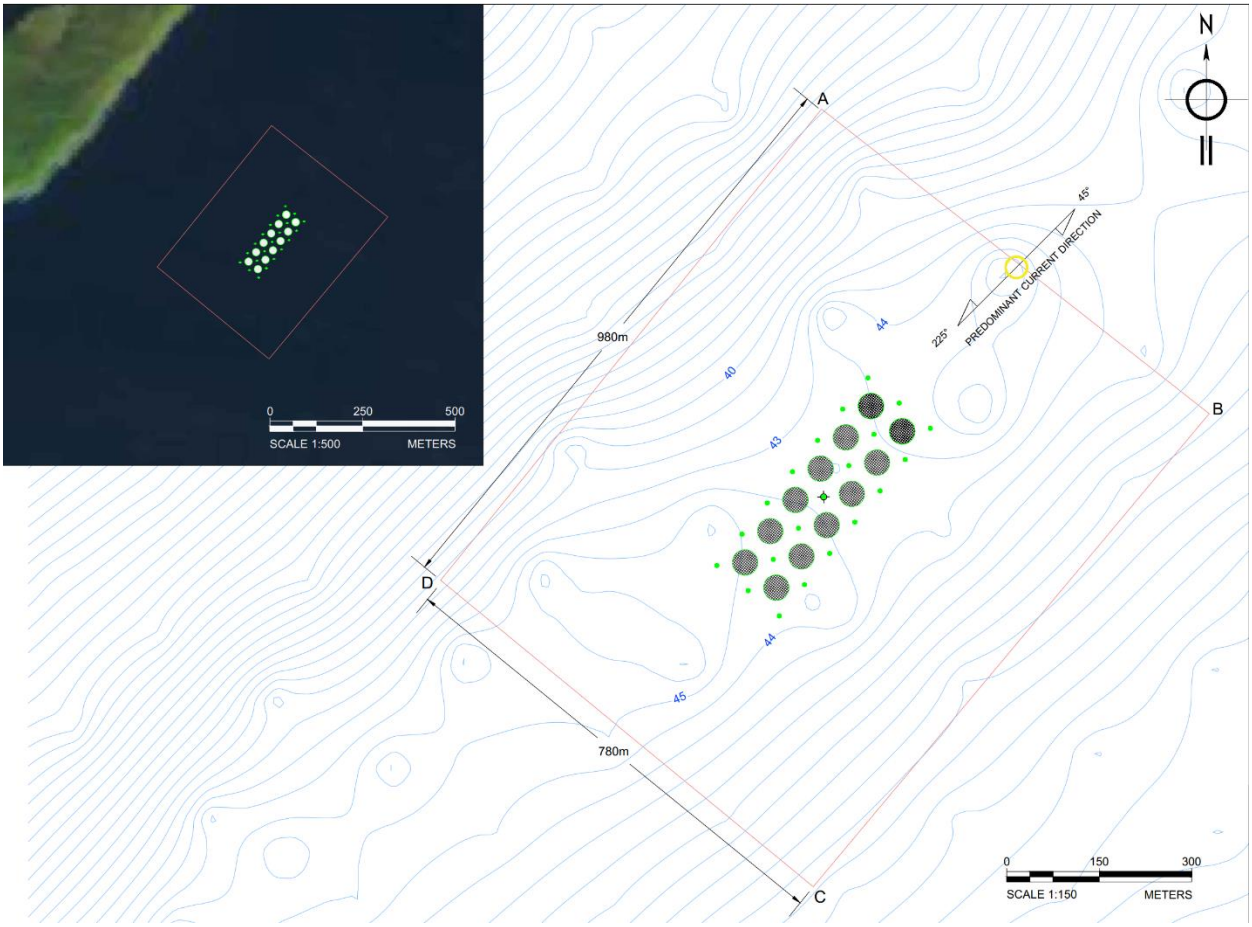


Figure 5 - Site 3 bathymetry and cage placement

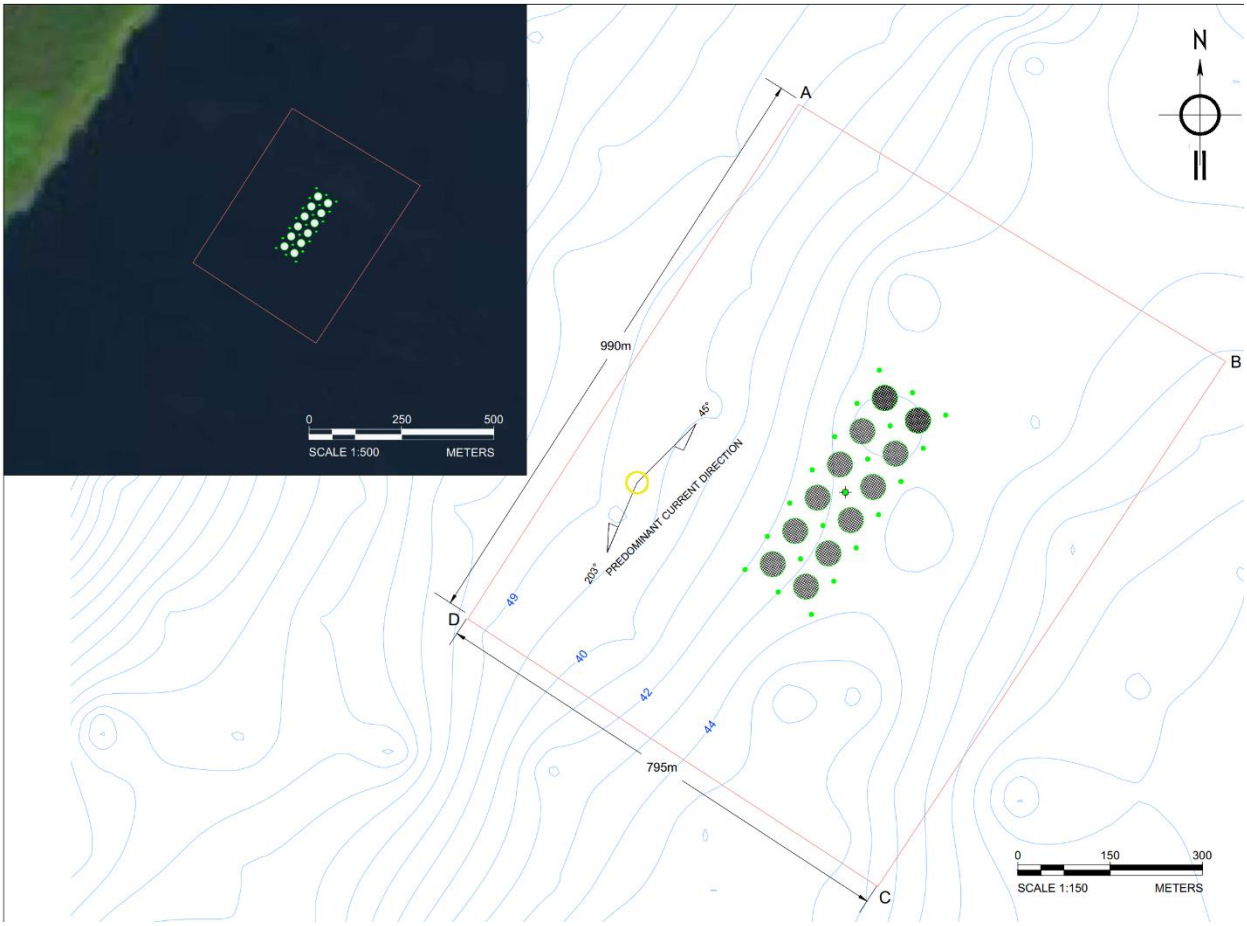


Figure 6 - Site 4 bathymetry and cage placement

6 Sediment Sample Collection and Analysis

6.1 Collection dates and personnel

Benthic field data contained within this report were collected on March 9-11 & 16-17. Both sets of field days involved a combination of benthic sediment sampling and bottom video, conducted by Field Supervisor and Oceanographer [redacted], MSc., and Marine Technician [redacted].

Table 3 - Tide table for sampling dates

Date	High Tide (hh:mm)	Low Tide (hh:mm)
March. 9	03:30, 1600	10:00, 22:15
March. 10	04:30, 17:15	11:00, 23:15
March. 11	05:30, 18:15	12:00
March. 16	10:45, 23:15	04:30, 17:00
March. 17	11:30, 23:45	5:15, 17:30

6.2 Field Methods

Methods for baseline monitoring and analyses were informed by NSDFA, the Standard Operating Procedures for the Environmental Monitoring of Marine Aquaculture in Nova Scotia [1], and the Aquaculture Activities Regulations [2].

From March 9-11, benthic sediment samples were collected using a Petit Ponar grab, while bottom video was collected using a Seaviewer 950 Sea-Drop Camera (S/N 04712). From March 16-17, benthic sediment samples were collected using a large Van Veen grab, while bottom video was collected using a DeepSea Power & Light (S/N 12-029-00251) and Multi-SeaCam 2060 (S/N 3026-7).

The sediment samplers were deployed over the side of the vessel and were retrieved using the capstan at a velocity of 0.89m/s. Photos were taken of the sample both before and after the overlying water was siphoned. Observations of sediment characteristics were recorded while subsampling of the upper 2cm of sediment was performed. The syringe was inserted into the upper 2cm of the sediment in three different locations, followed by capping the syringe and storage in a cooler kept between 2-5˚C. Two syringes were filled: one for redox potential and sulfide analyses, and the other for porosity and organic matter analyses. The remaining upper 2cm of sediment was scooped into a sealed bag for grain size analysis. Samples remained in the cooler for transport until they could be transferred to the lab fridge.

Video cameras were mounted to a 0.25m^2 quadrat frame for stability and size reference. Weights were added to the corners of the frame to mitigate horizontal current influence. Video output was fed through a Seaviewer Sea-Trak GPS overlay which provided real-time position (NAD83 CSRS; degrees minutes), date, and time during recording. Once recording commenced, a placard with lease number and station ID were presented to the camera, followed by a 360° panorama of the surrounding coastline. Recording continued during deployment, descent to the sediment, a minimum of 2 minutes panning bottom footage, ascent, and retrieval onto the deck of the boat. At each station, attempts were made to capture a minimum of 5 m^2 of seafloor, maintain a 90° angle between the camera and seafloor, and limit the amount of resuspension caused by impact of the mount frame with the seafloor.

A technical error with GPS overlay occurred on March 10 during the recording of the central transects at Sites 1-3, making the video difficult to review due to excess noise. These three transect videos were re-recorded on March 11 and 17. However, weather, and hydrodynamic conditions during this period were optimal, and the content of these videos is still discernable. If further footage of the central transects at Sites 1-3 is requested, then recordings from March 10 will be provided.

6.3 Lab Methods

Once the samples were collected, all sediment samples were processed within 36 hours of collection time[1]. Samples were kept sealed in syringes in the lab fridge at 2-5°C until moments before processing. Temperature was taken both immediately after redox had been measured to determine adjustment for

[1] Processing samples for determination of grain size isn't necessary to complete during the 36h window; grain size processing was completed within 7 days.

mV_{NHE}, and after the SAOB was added for sulfide analysis to allow temperature adjustment to better reflect conditions during calibration.

6.3.1 Porosity & Organic Matter

Sediment samples were weighed wet, dried at 60°C for 24-48h, and dry weight determined. Aliquots of the dry samples were then transferred into pre-weighed tins, weighed, and combusted in a muffle furnace at 490°C for a minimum of 8 hours. After removal, tins were re-weighed to determine washed weights, and POM content was calculated as the difference between mass of the dry sample before treatment in the muffle oven and after.

6.3.2 Redox Potential

Redox potential was measured using a SPER Scientific Meter (S/N L927382) and an Orion (96-78BNWP) oxidation-reduction potential (ORP) platinum electrode (S/N TU1-12636), placed directly into the sediment sample, and recorded in millivolts. Temperature was also recorded to correct the redox potential relative to the normal hydrogen electrode (mVNHE). Twenty-four hours prior to analysis, the electrode was prepared and filled with 4M KCl filling solution. An electrode accuracy check was completed using an ORP standard (ORI967901) before and after all samples were analyzed, where the electrode was deemed accurate if the redox potential reading was +220mv ± 3mV at 25°C.

6.3.3 Dissolved Sulfides

Immediately following the measurement of redox potential, the sediment sample was measured for dissolved sulfide concentration by first adding sulfide antioxidant buffer (SAOB) to create a slurry of equal parts sediment and SAOB. Increased pH converts H_2S and HS^- to S^{-2}, which is measurable by the electrode. The dissolved sulfide concentration was then measured using a Thermo Scientific Orion Star A211 Meter (S/N X49024) and an Orion (96-16BNWP) Silver/Sulfide combination electrode (S/N TU1-11670) placed directly into the sediment slurry. The dissolved sulfide concentration was later converted from mV to µM using a five-point standard curve created prior to analysis. The sulfide curve was created in accordance to [4], with known points in the curve adjusted to reflect the actual weight of Na2S*9H2O present in the stock solution. To combat drift and determine error for the ISE probe, a new curve was measured after analysis, created through dilution of the original sulfide standard.

6.3.4 Grain Size

Grain size analyses were performed using the wet sieving method. Size bins were defined as <63µm, 63-125 µm, 125-250 µm, 250-500 µm, 500-1000 µm, 1000-2000 µm, and >2000 µm. All water that passed though the 63 µm sieve was collected and a subsample filtered through a pre-weighed Whatman GF/F grade glass microfiber filter, which was dried and weighed. Descriptive categorization for further comparisons were determined using the Wentworth grain size scale. Care was taken to ensure all structures, inorganic or organic, remained in a format similar to that during time of sampling (e.g. polychaete castings). This approach allows determination of 'natural' grain size compared to geological grain size in which all aggregate structures are macerated.

6.4 Sediment Analysis Results

6.4.1 Overview

Figure 7 shows the targeted sampling locations and numbering for each of the four sites. A map displaying the targeted coordinates, and showing targeted video transect lines are attached to this report. Samples were taken at the four corners of the site (Station IDs labeled A, B, C, D), at the center of the site (Station IDs labeled CP), and at a reference point in the direction of the predominant current (Station IDs labeled RP).

Of the four sites being considered (AQ#1449-1452), sediment samples were only successfully collected at Sites 1-3. Through both bottom video review and five or more unsuccessful attempts to collect sediment samples at each station, Site 4 (AQ#1452) was determined to be hard bottom at all sampling locations, restricting observations to only video and photo.

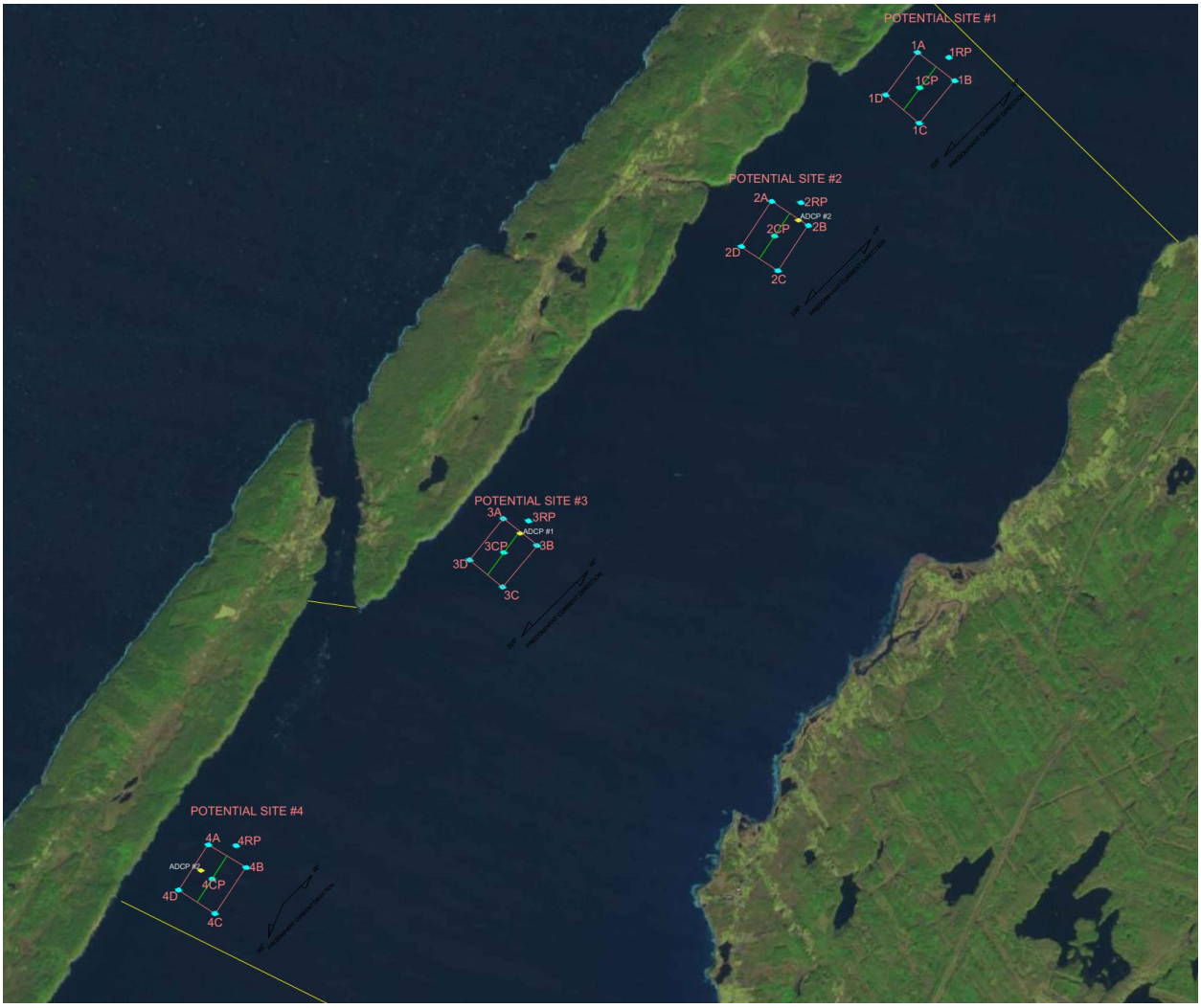


Figure 7 Sampling location for sediment

6.4.2 Geochemistry

While hard bottom characteristics of Site 4 (AQ#1452) prevented acquisition of sediment samples and further geochemical analyses, Sites 1, 2, & 3(AQ#1449, 1450, & 1451) were all classified as soft bottom. Geochemical analyses of the soft bottom sediments of the latter sites produced results expected in a benthic environment subject to high tidal ranges and strong bottom currents. All results supported an 'Oxic' classification under the Environmental Quality Standards used by the NSDFA [1]. The results are presented in Table 4 and Table 5. Sulfide was virtually absent from these sites such that sulfide values were Oxic A at all sites, and though some redox potential values at Site 1 were classified as Oxic B (18%), all other values at Sites 1-3 were Oxic A. Mean values were similar at Sites 1 and 3 for porosity (63.2 + 5.5%, 63.5 + 3.4%) and organic matter (2.2 + 0.4%, 2.2 + 0.5%), whereas Site 2 had lower mean porosity (55.9 + 3.0%) and higher organic matter (2.8 + 0.6%) than the other sites. Porosity was typical of sediments with sand and gravel, and the relatively low organic content was consistent with a largely coarse sediment with some mud content.

Grain size results indicated a majority sandy composition at Site 1, with smaller but notable percentages of mud and gravel sizes. Sites 2 and 3 skewed towards greater percentages of gravel and mud compared sandy sizes, and while the distributions of these two size classifications at each station were often similar, stations at Site 2 displayed a greater tendency towards mud and stations at Site 3 towards gravel. Sample locations where the sediment surface was composed of dense surface bioturbation (see Figure 8) generally skewed towards greater values in both gravel (>2mm) and mud (<0.063mm) classifications. While some of the weight in the gravel classification for the samples with high casting presence was attributed to inorganic matter, the vast majority of weight was always due to apparent polychaete tubes, burrow structures (see videos). This type of distribution was present at most stations at Sites 2 and 3, and station D at Site 1.

Table 4 - Geochemistry results (A)

Monitoring Date	Sample ID		Longitude	Latitude	Location	Lease #	Sample temp. (°C)	Redox (mV)	Redox (mV NHE)	Sulfide (mV)	Sulfide (µM)	Porosity (%)	Organic Matter (%)
	Station ID	Replicate											
2022-03-16	1A	1	44.467095	-66.081946	St. Mary's Bay	1449	14.7	90	299.3	-784.6	1	65.7	2.2
2022-03-16	1A	2	44.467095	-66.081946	St. Mary's Bay	1449	12.1	-47	164.9	-774.5	0	63.4	2.3
2022-03-16	1A	3	44.467095	-66.081946	St. Mary's Bay	1449	9.8	88	302.2	-777.5	1	60.0	1.8
2022-03-16	1B	1	44.462660	-66.07326	St. Mary's Bay	1449	9.9	55	269.1	-769.9	0	63.3	2.3
2022-03-16	1B	2	44.462660	-66.07326	St. Mary's Bay	1449	10.6	97	310.4	-809.4	6	63.6	2.1
2022-03-09	1C	1	44.462660	-66.07326	St. Mary's Bay	1449	12.7	130	341.3	-802.9	6	65.2	2.0
2022-03-09	1C	2	44.455522	-66.081022	St. Mary's Bay	1449	12.5	54	265.5	-804.1	6	60.7	2.4
2022-03-09	1C	3	44.455522	-66.081022	St. Mary's Bay	1449	14.7	-112	97.3	-799.3	4	61.7	2.1
2022-03-09	1CP	1	44.461251	-66.081364	St. Mary's Bay	1449	12.8	-118	93.2	-811.2	11	63.0	2.3
2022-03-09	1CP	2	44.461251	-66.081364	St. Mary's Bay	1449	11.7	5	217.3	-707.0	0	63.7	2.2
2022-03-09	1CP	3	44.461251	-66.081364	St. Mary's Bay	1449	9.3	5	219.7	-748.9	0	68.9	1.7
2022-03-11	1D	1	44.459919	-66.088883	St. Mary's Bay	1449	12.1	53	264.9	-790.2	1	55.5	2.8
2022-03-11	1D	2	44.459919	-66.088883	St. Mary's Bay	1449	15.9	42	250.1	-802.6	3	53.8	3.1
2022-03-16	1D	3	44.459919	-66.088883	St. Mary's Bay	1449	15.2	58	266.8	-783.6	1	53.3	3.1
2022-03-09	1RP	1	44.466677	-66.075120	St. Mary's Bay	1449	11.1	17	229.9	-813.6	13	71.3	1.6
2022-03-09	1RP	2	44.466677	-66.075120	St. Mary's Bay	1449	12.8	-99	112.2	-798.1	4	73.8	1.6
2022-03-09	1RP	3	44.466677	-66.075120	St. Mary's Bay	1449	14.9	-140	69.1	-803.1	6	67.9	1.7
2022-03-16	2A	1	44.441755	-66.114241	St. Mary's Bay	1450	11.5	87	299.5	-787.1	1	56.1	3.0
2022-03-16	2A	2	44.441755	-66.114241	St. Mary's Bay	1450	10.9	-20	193.1	-795.8	2	51.7	3.1
2022-03-16	2A	3	44.441755	-66.114241	St. Mary's Bay	1450	9.0	97	312.0	-807.0	5	53.8	3.0
2022-03-16	2B	1	44.437964	-66.105673	St. Mary's Bay	1450	13.7	-39	171.3	-824.9	20	60.7	2.2
2022-03-16	2B	2	44.437964	-66.105673	St. Mary's Bay	1450	14.2	-33	176.8	-771.3	0	54.2	2.3
2022-03-16	2B	3	44.437964	-66.105673	St. Mary's Bay	1450	11.6	-83	129.4	-830.3	30	59.8	2.4
2022-03-16	2C	1	44.430295	-66.112164	St. Mary's Bay	1450	9.4	2	216.6	-803.3	4	60.7	2.1
2022-03-16	2C	2	44.430295	-66.112164	St. Mary's Bay	1450	9.9	77	291.1	-793.4	2	51.6	2.3
2022-03-16	2C	3	44.430295	-66.112164	St. Mary's Bay	1450	10.7	85	298.3	-771.2	0	60.2	2.5

Table 5 - Geochemistry results (B)

Monitoring Date	Sample ID		Longitude	Latitude	Location	Lease #	Sample temp. (°C)	Redox (mV)	Redox (mV NHE)	Sulfide (mV)	Sulfide (µM)	Porosity (%)	Organic Matter (%)
	Station ID	Replicate											
2022-03-16	2CP	1	44.436079	-66.113085	St. Mary's Bay	1450	13.9	109	319.1	-789.3	1	56.8	2.4
2022-03-16	2CP	2	44.436079	-66.113085	St. Mary's Bay	1450	13.8	65	275.2	-785.4	1	57.7	3.0
2022-03-16	2CP	3	44.436079	-66.113085	St. Mary's Bay	1450	9.8	84	298.2	-718.5	0	55.3	2.8
2022-03-16	2D	1	44.434108	-66.120817	St. Mary's Bay	1450	10.7	44	257.3	-801.6	3	57.0	3.0
2022-03-16	2D	2	44.434108	-66.120817	St. Mary's Bay	1450	10.8	64	277.2	-776.6	0	53.7	2.5
2022-03-16	2D	3	44.434108	-66.120817	St. Mary's Bay	1450	15.8	-9	199.2	-796.0	2	55.2	5.1
2022-03-16	2RP	1	44.441777	-66.10747	St. Mary's Bay	1450	9.4	25	239.6	-780.1	1	53.3	3.1
2022-03-16	2RP	2	44.441777	-66.10747	St. Mary's Bay	1450	11.4	35	247.6	-775.7	0	50.8	2.7
2022-03-16	2RP	3	44.441777	-66.10747	St. Mary's Bay	1450	12.3	-60	151.7	-803.6	4	56.8	2.9
2022-03-16	3A	1	44.387901	-66.173560	St. Mary's Bay	1451	13.4	6	216.6	-765.5	0	66.1	1.7
2022-03-16	3A	2	44.387901	-66.173560	St. Mary's Bay	1451	11.6	8	220.4	-791.8	2	71.5	1.6
2022-03-16	3A	3	44.387901	-66.173560	St. Mary's Bay	1451	13.0	101	312.0	-758.9	0	68.3	1.8
2022-03-16	3B	1	44.383734	-66.165405	St. Mary's Bay	1451	12.4	52	263.6	-768.3	0	56.5	3.9
2022-03-16	3B	2	44.383734	-66.165405	St. Mary's Bay	1451	14.8	47	256.2	-762.6	0	63.0	2.1
2022-03-16	3B	3	44.383734	-66.165405	St. Mary's Bay	1451	15.3	50	258.7	-777.7	1	61.5	2.1
2022-03-16	3C	1	44.376621	-66.173076	St. Mary's Bay	1451	9.1	24	238.9	-774.8	0	62.6	2.5
2022-03-16	3C	2	44.376621	-66.173076	St. Mary's Bay	1451	10.9	107	320.1	-792.8	2	63.2	2.4
2022-03-16	3C	3	44.376621	-66.173076	St. Mary's Bay	1451	11.3	99	311.7	-780.1	1	61.8	2.1
2022-03-16	3CP	1	44.382314	-66.173137	St. Mary's Bay	1451	15.1	69	277.9	-787.6	1	62.7	2.2
2022-03-16	3CP	2	44.382314	-66.173137	St. Mary's Bay	1451	9.9	49	263.1	-785.6	1	65.1	2.1
2022-03-16	3CP	3	44.382314	-66.173137	St. Mary's Bay	1451	9.9	75	289.1	-775.9	0	68.8	1.8
2022-03-16	3D	1	44.380910	-66.180853	St. Mary's Bay	1451	9.9	64	278.1	-776.7	0	63.3	2.3
2022-03-16	3D	2	44.380910	-66.180853	St. Mary's Bay	1451	11.8	84	296.2	-780.9	1	61.3	1.8
2022-03-16	3D	3	44.380910	-66.180853	St. Mary's Bay	1451	14.1	36	245.9	-763.6	0	61.3	1.7
2022-03-16	3RP	1	44.387690	-66.167036	St. Mary's Bay	1451	11.8	27	239.2	-784.3	1	65.2	2.0
2022-03-16	3RP	2	44.387690	-66.167036	St. Mary's Bay	1451	14.2	35	244.8	-770.5	0	59.4	2.9
2022-03-16	3RP	3	44.387690	-66.167036	St. Mary's Bay	1451	12.7	34	245.3	-778.6	1	61.8	2.5



Figure 8 - Examples of dense arrays of polychaete castings at sediment surface from Site 2 (AQ#1450)

6.4.3 Grain size

Figure 10, Figure 11 and Figure 12 provide the grain size distribution at Sites 1-3. Table 6 provides the grain size results. Due to the hard bottom characteristics of Site 4, acceptable samples were unobtainable, though five or more attempts were made at each station (Figure 9).

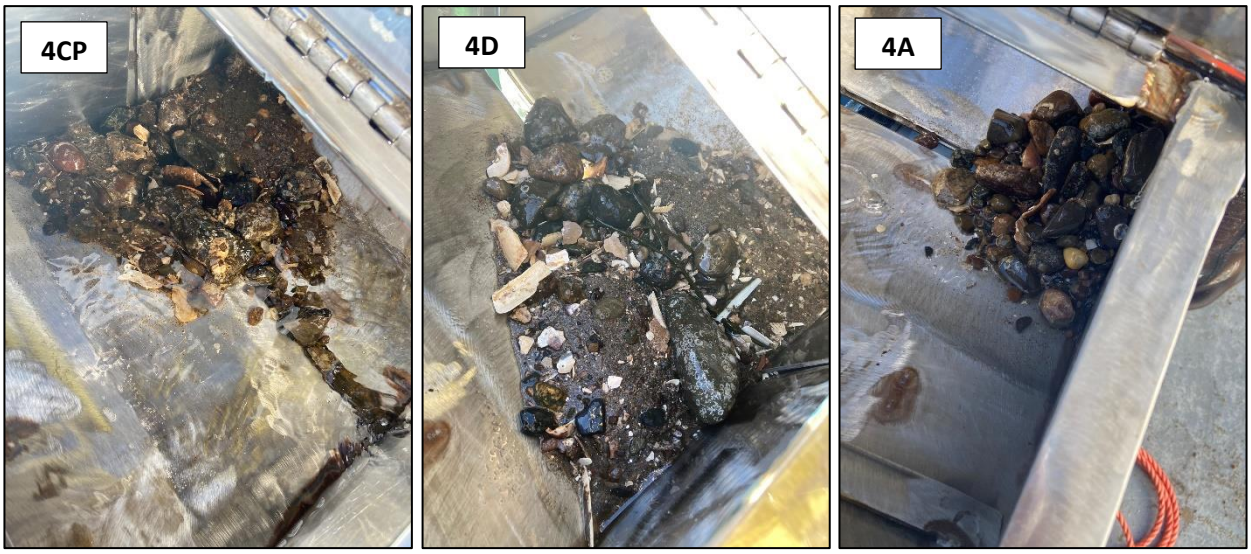


Figure 9 - Sediment grab attempts from Site 4 (AQ#1452)

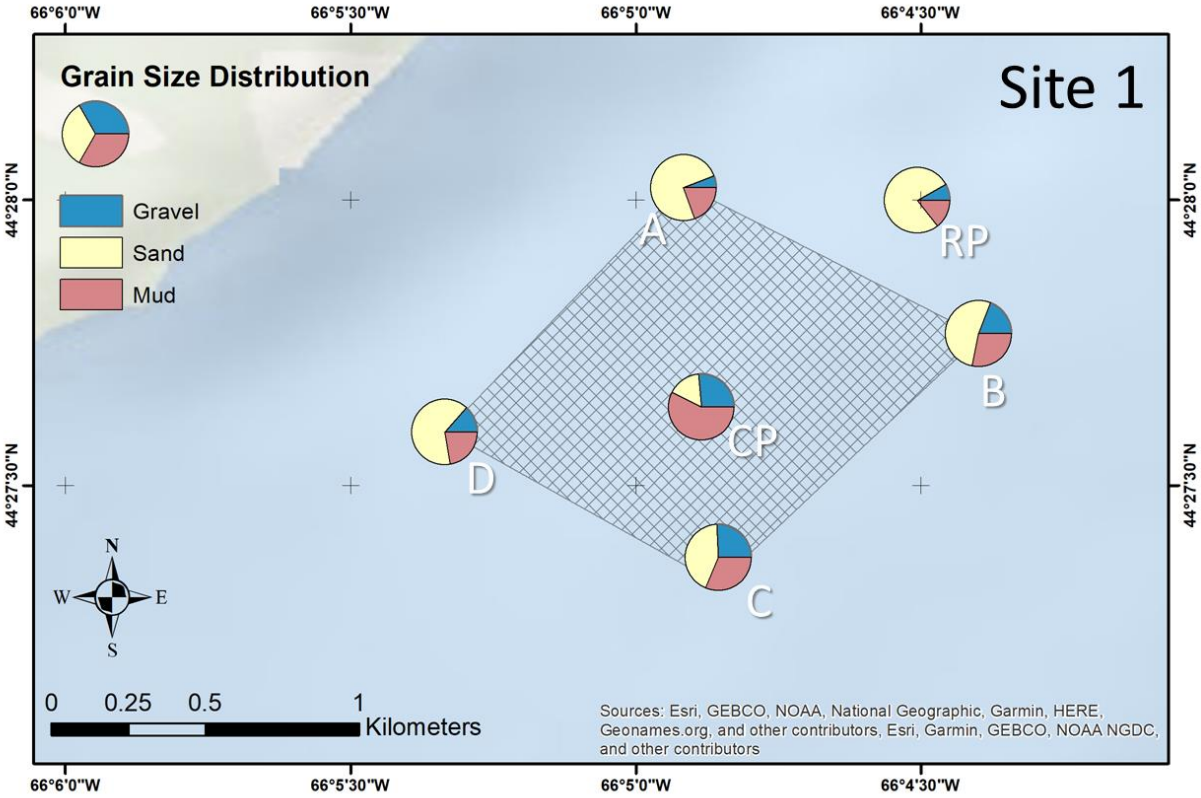


Figure 10 - Grain size distribution Site 1 (AQ#1449)

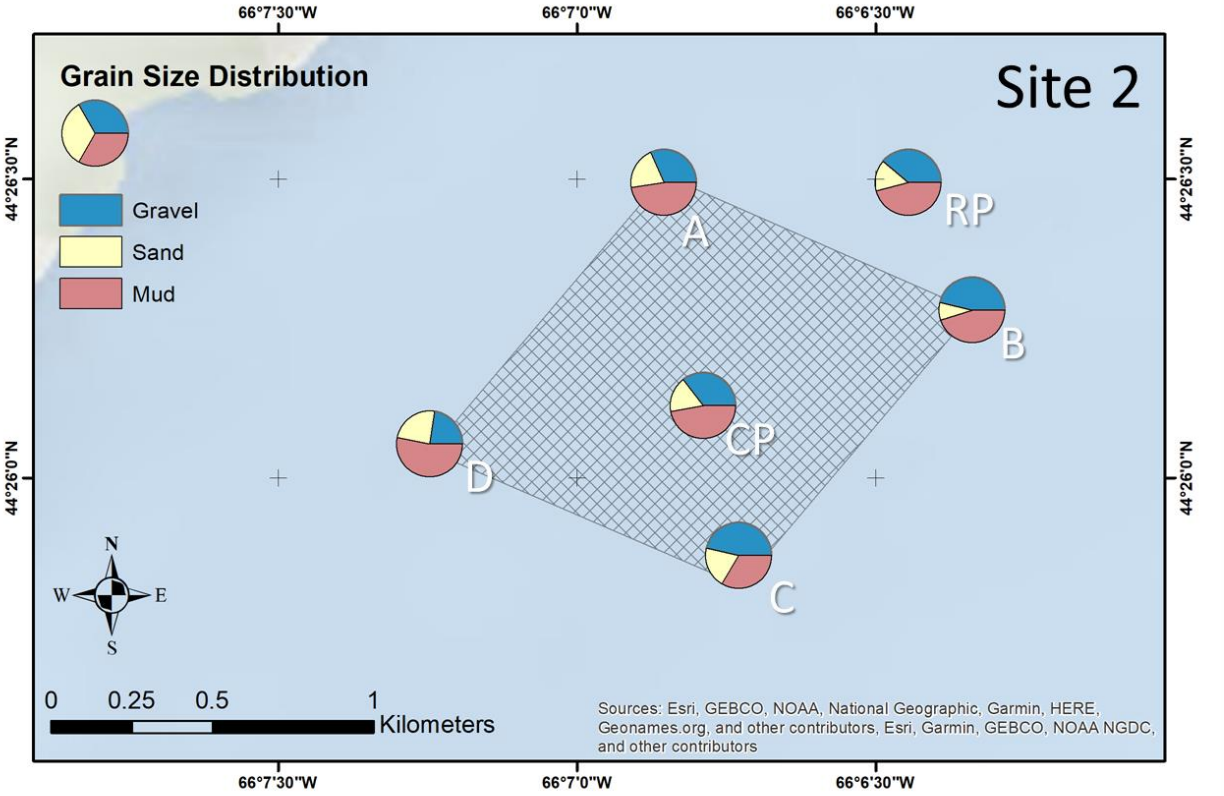


Figure 11 - Grain size distribution Site 2 (AQ#1450)

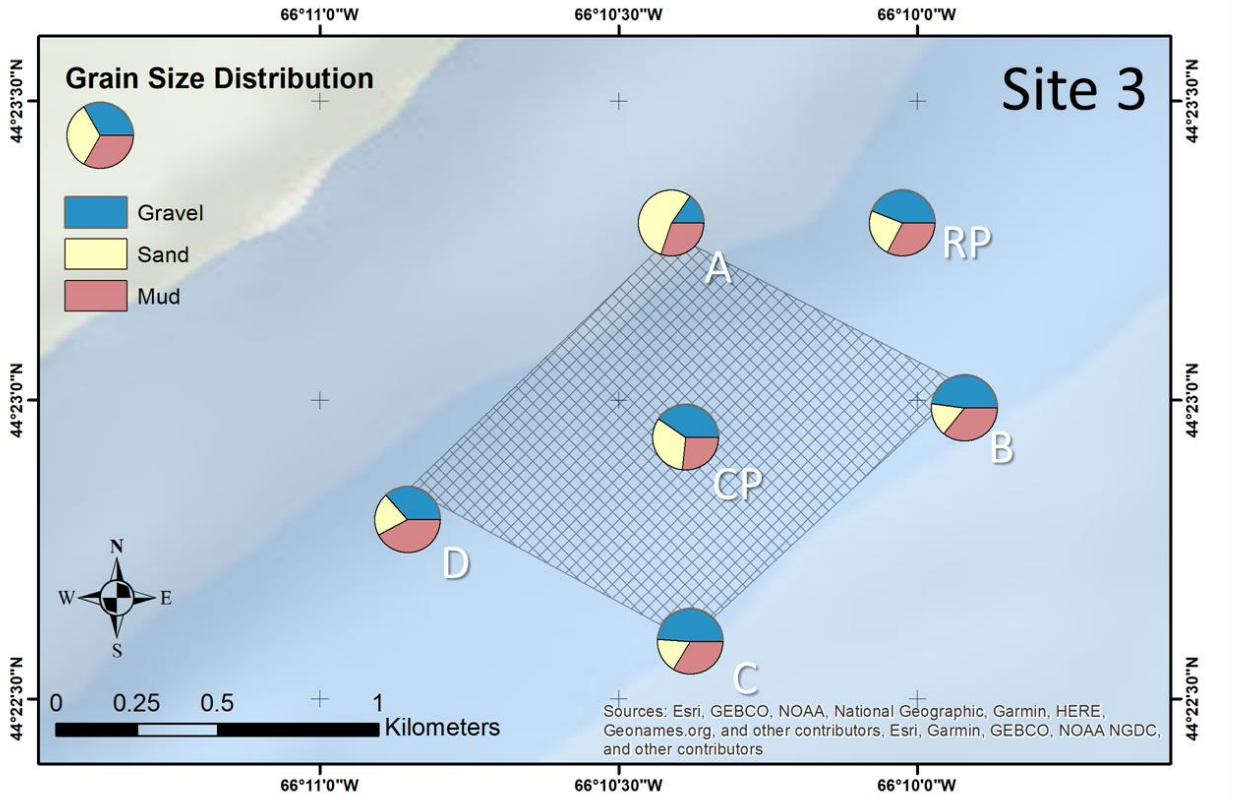


Figure 12 - Grain size distribution Site 3 (AQ#1451)

Table 6 Grain size results

		% Fraction					
	mm	1A	1B	1C	1D	1CP	1RP
Gravel	>2	5.94701	19.1103	25.7237	26.46	13.3078	8.08729
Very Coarse	1-2	9.71695	13.1604	14.7351	2.1839	20.122	31.2395
Coarse	0.5-1	14.1117	11.6267	14.207	1.9315	1.21918	3.94761
Medium	0.25-0.5	8.10893	3.28646	3.78623	0.58848	2.13244	7.78532
Fine	0.125-0.25	4.83666	2.71153	2.20362	0.9495	3.10321	7.89514
Very Fine	0.063-0.125	37.7037	22.0381	8.12452	10.5359	37.8483	26.7352
Mud	<0.063	19.5751	28.0666	31.2198	57.3508	22.2671	14.3099
% Gravel		5.94701	19.1103	25.7237	26.46	13.3078	8.08729
% Sand		74.4779	52.8231	43.0565	16.1893	64.4251	77.6028
% Mud		19.5751	28.0666	31.2198	57.3508	22.2671	14.3099

	mm	2A	2B	2C	2D	2CP	2RP
Gravel	>2	31.5874	46.1937	46.4493	35.3916	22.518	38.7584
Very Coarse	1-2	0.7086	1.04206	4.41325	1.07586	2.28026	1.22827
Coarse	0.5-1	0.64932	0.31293	0.81311	0.5263	0.69311	0.319
Medium	0.25-0.5	0.89016	0.53767	0.57285	0.38611	1.1161	0.71149
Fine	0.125-0.25	0.93414	0.78831	1.13745	1.16292	2.58571	1.54896
Very Fine	0.063-0.125	17.704	5.99013	13.0707	14.4709	17.6861	11.4507
Mud	<0.063	47.5264	45.1352	33.5434	46.9863	53.1207	45.9832
% Gravel		31.5874	46.1937	46.4493	35.3916	22.518	38.7584
% Sand		20.8862	8.67111	20.0074	17.6221	24.3613	15.2584
% Mud		47.5264	45.1352	33.5434	46.9863	53.1207	45.9832

	mm	3A	3B	3C	3D	3CP	3RP
Gravel	>2	15.2413	47.9092	48.9647	40.3137	36.5549	43.8497
Very Coarse	1-2	18.6263	0.53859	7.56225	12.6516	5.01233	9.30217
Coarse	0.5-1	18.4775	3.39566	0.33451	1.3835	3.40429	4.87853
Medium	0.25-0.5	0.99166	0.45397	0.55597	1.10121	1.79855	1.23974
Fine	0.125-0.25	0.78663	0.93587	1.07917	1.62685	1.50266	1.78252
Very Fine	0.063-0.125	15.7857	10.8823	7.72498	16.2729	9.44093	6.2654
Mud	<0.063	30.091	35.8844	33.7784	26.6503	42.2863	32.682
% Gravel		15.2413	47.9092	48.9647	40.3137	36.5549	43.8497
% Sand		54.6677	16.2064	17.2569	33.0361	21.1588	23.4684
% Mud		30.091	35.8844	33.7784	26.6503	42.2863	32.682

6.4.4 Sulfide & Redox Potential Calibrations

The tables in the following section outline the sulfide and redox calibrations undertaken for all lab work on March 10th, 12th and 17th; sulfide calibration curves are also reported.

Table 7 - March 10th sulfide and redox calibrations

Analytical Data Record Sheet

Lease #/ name: AQ#1449

Date samples collected: March 9,2022 Time samples collected (x – x): 10:34 – 12:15

Date of analysis: March 10,2022 Analysis start time: 13:44 Analysis end time: 14:15

Analysis performed by: [redacted]

Redox Probe Accuracy Check (25˚C)

ORP standard (start): 220 ORP standard (finish): 220

Sulfide Calibration Temperature target (20-25˚C)

Na_2S standard concentration (µM)	mV	Meter calculated slope (mV) Acceptable range: -27 to -33mV after 500	Calculated 10-fold change (mV)	Verification Check	
				µM	mV
100.4	-840.5		1. 5,000 mV – 500 mV 2. 10,000 mV – 1,000 mV Acceptable range: -25 to -30 mV	100.4	-842.3
501.9	-863.6	-29.162		501.9	-863.9
1,003.7	-872.4			1,003.7	-873.1
5,018.6	-892.3		1. -28.7	5,018.6	-892.8
10,037.2	-901.8		2. -29.4	10,037.2	-902.1

Time calibration completed: 13:40 Time L-ascorbic acid added to SAOB: 13:31

Time calibration expires: 16:40 Time SAOB + L-ascorbic acid expires: 16:31

Table 8 - March 12th sulfide and redox calibrations

Analytical Data Record Sheet

Lease #/ name: AQ#1449

Date samples collected: March 11,2022 Time samples collected (x – x): 10:24 – 11:42

Date of analysis: March 12,2022 Analysis start time: 10:02 Analysis end time: 10:06

Analysis performed by: [redacted]

Redox Probe Accuracy Check (25˚C)

ORP standard (start): 220 ORP standard (finish): 220

Sulfide Calibration Temperature target (20-25˚C)

Na_2S standard concentration (µM)	mV	Meter calculated slope (mV) Acceptable range: -27 to -33mV after 500	Calculated 10-fold change (mV)	Verification Check	
				µM	mV
100.0	-843.6		1. 5,000 mV – 500 mV 2. 10,000 mV – 1,000 mV Acceptable range: -25 to -30 mV	100.0	-843.3
499.9	-860.1	-28.51		499.9	-859.4
999.8	-869.0			999.8	-868.2
4999.1	-889.1		1. -29.0	4999.1	-887.9
9998.2	-897.1		2. -28.1	9998.2	-898.1

Time calibration completed: 9:40 Time L-ascorbic acid added to SAOB: 9:32
Time calibration expires: 12:40 Time SAOB + L-ascorbic acid expires: 12:32

Table 9 - March 17th sulfide and redox calibrations

Analytical Data Record Sheet

Lease #/ name: AQ#1449, 1450, 1451

Date samples collected: March 16,2022 Time samples collected (x – x): 09:37 – 15:21

Date of analysis: March 17,2022 Analysis start time: 14:20 Analysis end time: 16:23

Analysis performed by: [redacted]

Redox Probe Accuracy Check (25°C)

ORP standard (start): 220 ORP standard (finish): 220

Na_2S standard concentration (µM)	mV	Meter calculated slope (mV) Acceptable range: -27 to -33mV after 500	Calculated 10-fold change (mV)	Verification Check	
				µM	mV
99.9	-842.1		1. 5,000 mV – 500 mV 2. 10,000 mV – 1,000 mV Acceptable range: -25 to -30 mV	99.9	-842
499.7	-856.9	-30.024		499.7	-854.9
999.4	-866.7			999.4	-866.5
4996.9	-886.5		1. -29.6	4996.9	-884.7
9993.9	-896.6		2. -29.9	9993.9	-896.2

Time calibration completed: 14:05 Time L-ascorbic acid added to SAOB: 14:03

Time calibration expires: 17:05 Time SAOB + L-ascorbic acid expires: 17:03

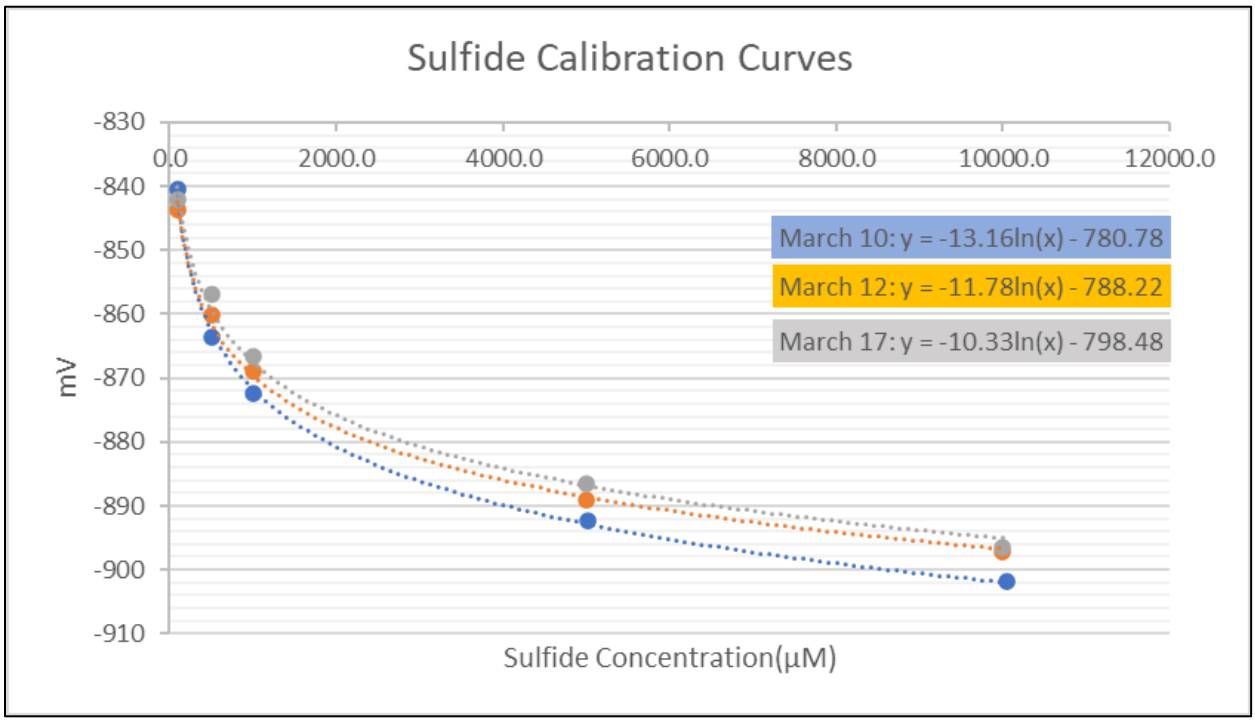


Figure 13 - Sulfide calibration curves

7 Current Speed and Direction

Three ADCPs were deployed in the option area at the locations shown in Figure 1 on page 12. The ADCPs were deployed using a subsurface mooring, as shown in Figure 14 and Figure 15. The deployments were carried out using [redacted] boat (Rosborough 246). The length of the deployments was chosen to cover at least one tide cycle in the area, with >90 days selected for locations 1 and 2. The greater deployment lengths allow for better characterization of the peak speeds within the lease areas.

Table 10 List of ADCP models with their deployment locations and dates

ADCP	ADCP model	Deployment location	Water depth (Low water)	Deployment dates
1	Teledyne RDI Workhorse Sentinel 300kHz	44° 23.134'N, 66° 10.118'W	44m	Deployed June 18, 2021 for 90 days
2	Teledyne RDI Workhorse Sentinel 600kHz	44° 26.325'N, 66° 6.475'W	22m	Deployed June 18, 2021 for 90 days
3	Teledyne RDI Workhorse Sentinel 300kHz	44° 19.621'N, 66° 14.346'W	40m	Deployed August 4, 2021 for 50 days

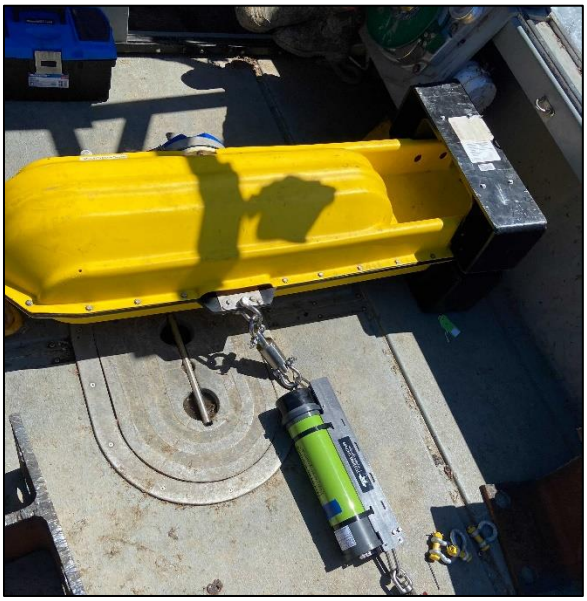


Figure 14 A picture of single float ADCP with subsurface moorings at the deployment location. The single float system used for ADCP 1 and 2



Figure 15 A picture of dual float ADCP with subsurface moorings at the deployment location. The dual float system used for ADCP 3

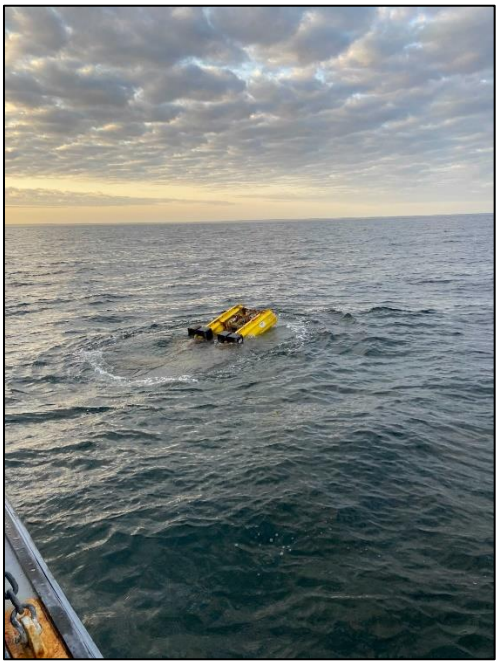


Figure 16 ADCP 3 during deployment

7.1 ADCP #1

An ADCP was deployed at St. Mary's Bay (44° 23.134'N, 66° 10.118'W) for 90 days from June 17, 2021, to September 17, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 10m and 15m are shown in Figure 17 to Figure 22. The total mean of current speeds at 10m, and 15m water depths are 0.36m/s, and 0.15m/s. The maximum recorded current speed at 10m, and 15m water depths are 1.49m/s, and 0.82m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated current and there is at least 90 days of data available. The results are shown in Table 11. Note that in addition to the maximum values, mean directional current speeds are also available in Table 11.

Based on the ADCP 1 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 12 hours (see Figure 19).

The predominant current directions at the ADCP 1 location were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 230 deg (flood) and 60 deg (ebb).

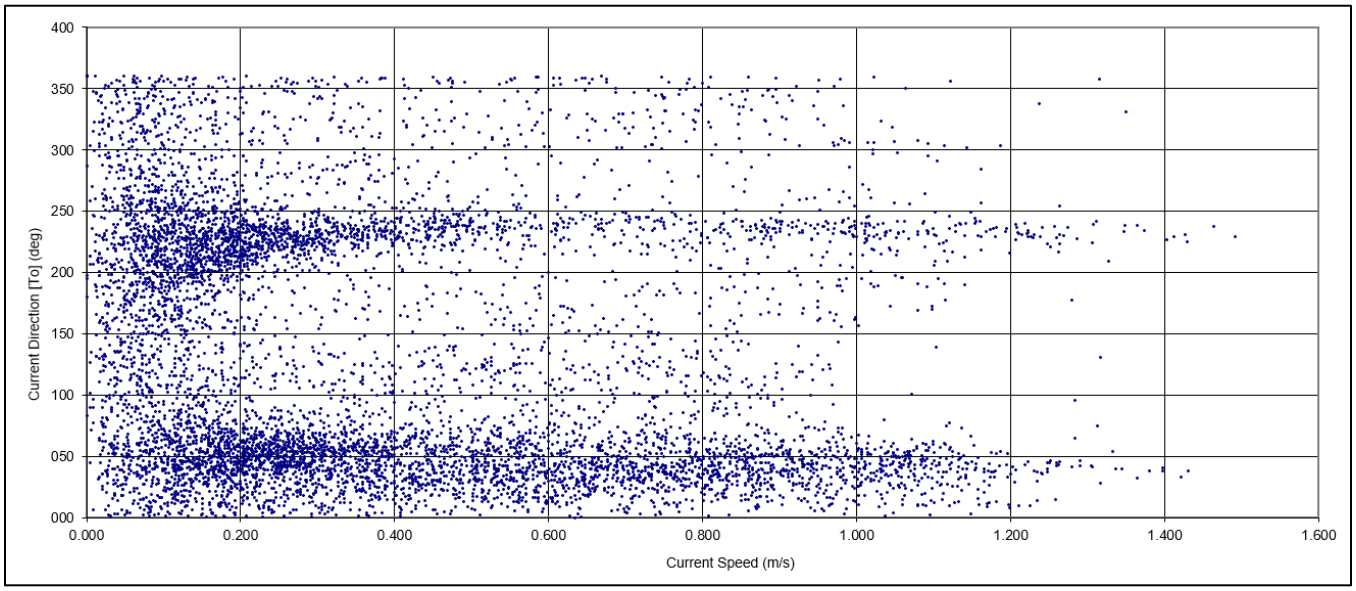


Figure 17 Scatter plot of current speed vs direction at ADCP 1 location - 10m water depth

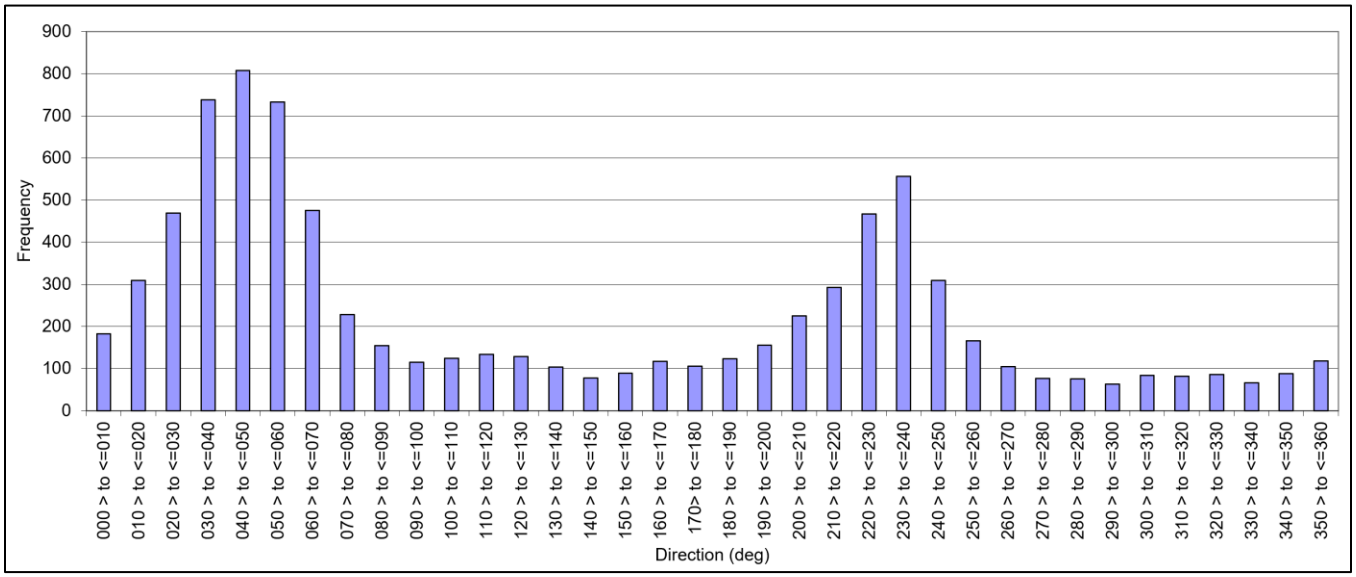


Figure 18 Frequency plot of current direction at ADCP 1 location - 10m Water depth

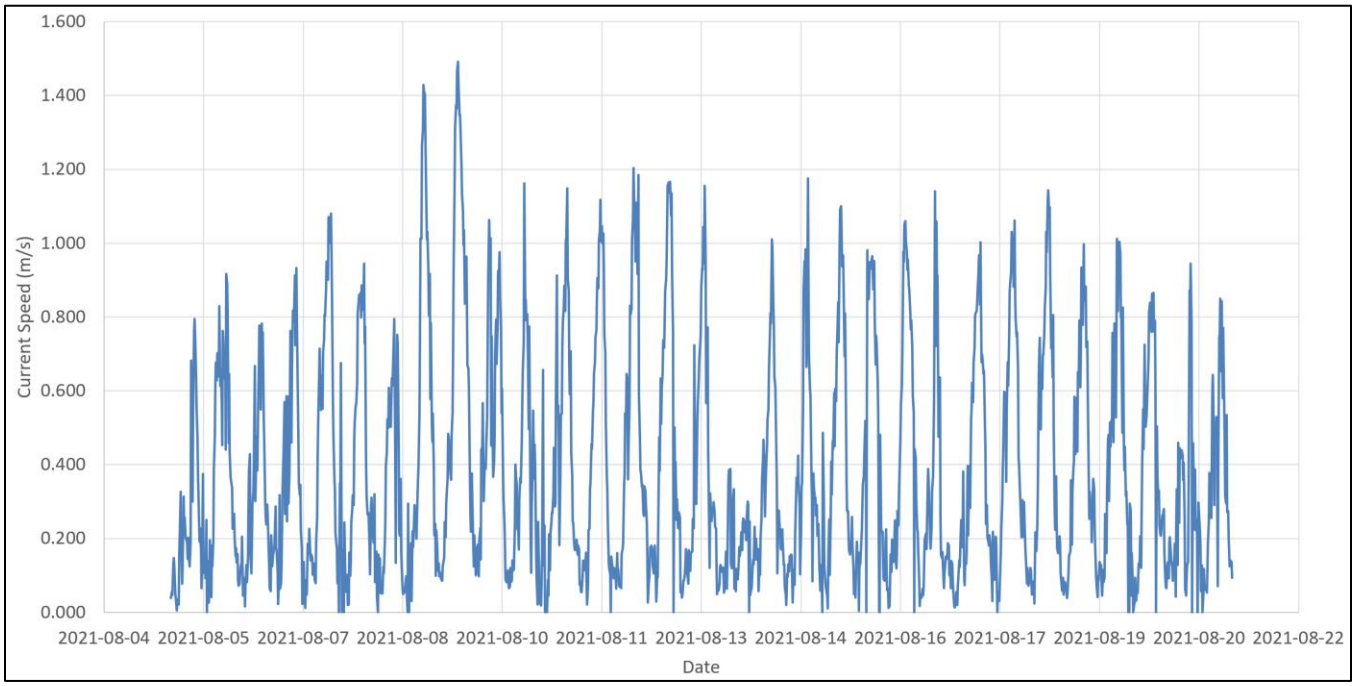


Figure 19 A sample time series plot of current speeds at ADCP 1 location - 10m Water depth

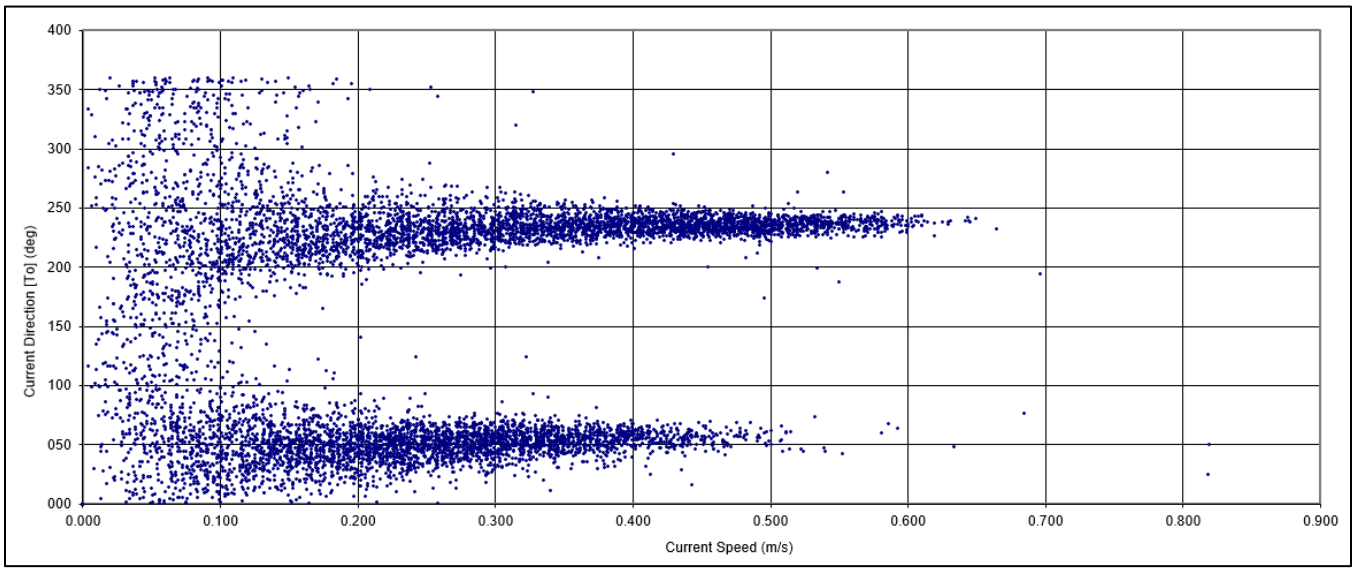


Figure 20 Scatter plot of current speed vs direction at ADCP 1 location - 15m water depth

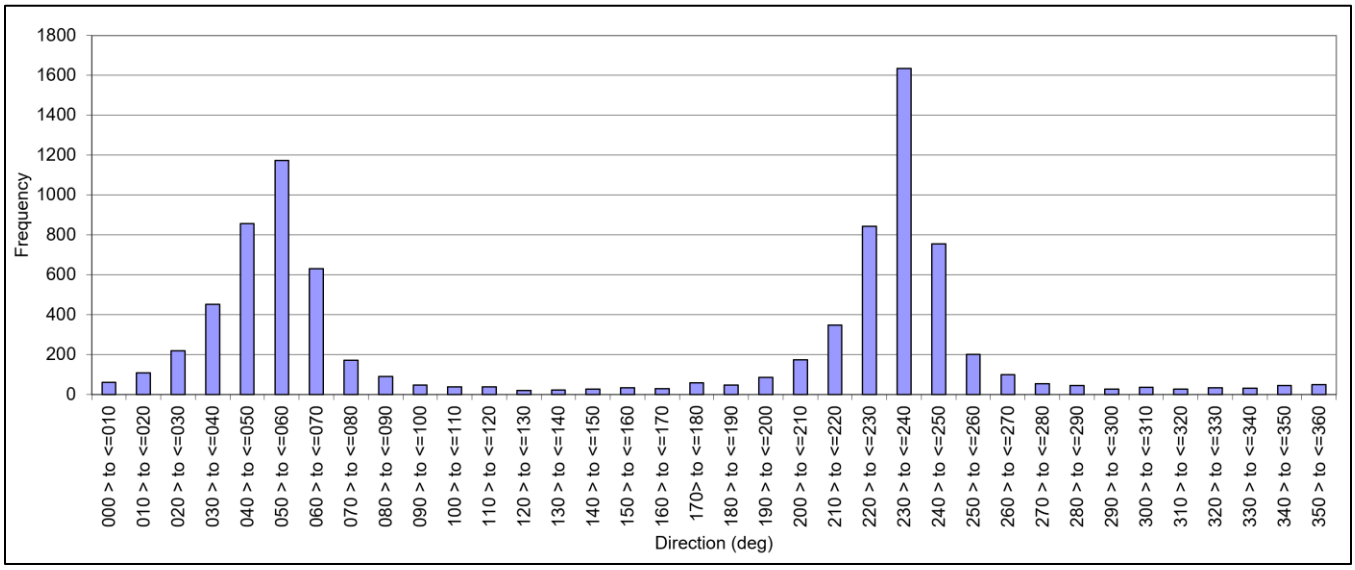


Figure 21 Frequency plot of current direction at ADCP 1 location - 15m Water depth

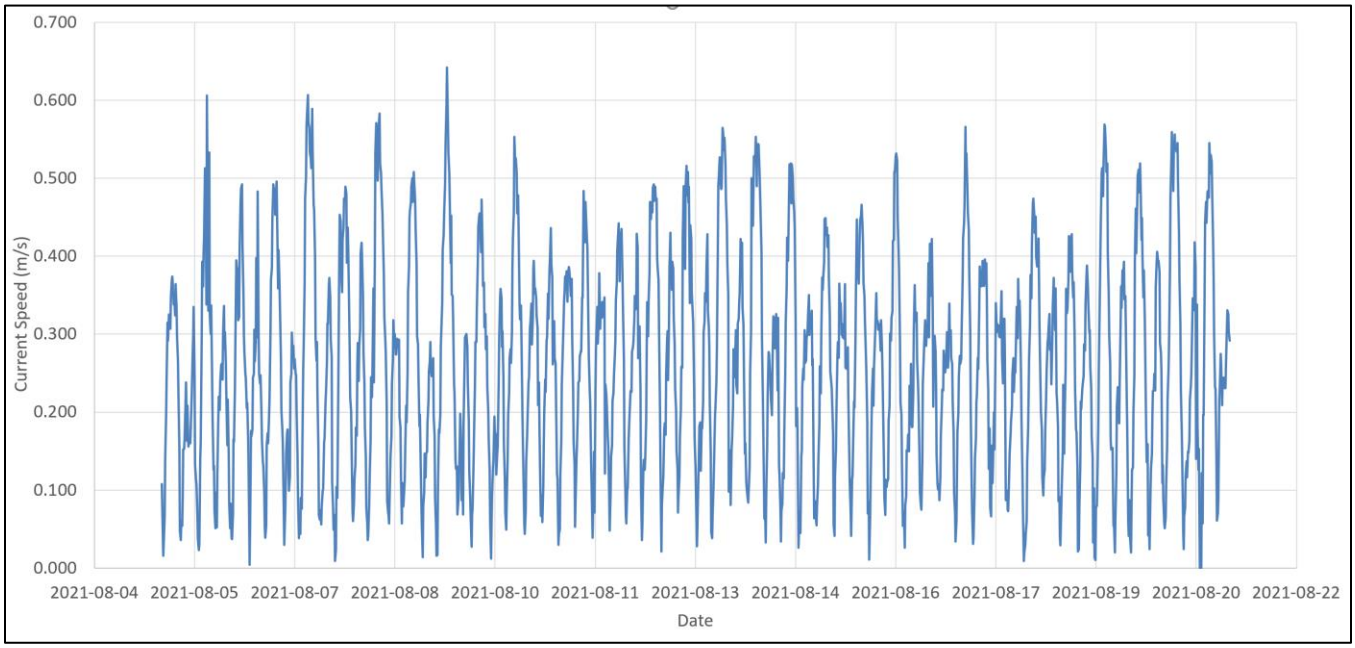


Figure 22 A sample time series plot of current speeds at ADCP 1 location - 15m Water depth

Table 11: 1 in 10 and 1 in 50 current conditions at ADCP 1 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
10 m	*0*	N	1.32	0.37	1.65	1.85
	22.5	NNE	1.26	0.47	1.58	1.76
	45	NE	1.43	0.54	1.79	2.00
	67.5	ENE	1.33	0.45	1.66	1.86
	90	E	1.31	0.36	1.64	1.83
	112.5	ESE	1.28	0.36	1.60	1.79
	135	SE	1.32	0.38	1.65	1.85
	157.5	SSE	1.10	0.32	1.38	1.54
	180	S	1.28	0.31	1.60	1.79
	202.5	SSW	1.14	0.27	1.43	1.60
	225	SW	1.33	0.27	1.66	1.86
	247.5	WSW	1.49	0.42	1.86	2.09
	270	W	1.26	0.28	1.58	1.76
	292.5	WNW	1.16	0.27	1.45	1.62
	315	NW	1.19	0.37	1.49	1.67
	337.5	NNW	1.35	0.36	1.69	1.89
15 m	*0*	N	0.33	0.09	0.41	0.46
	22.5	NNE	0.44	0.13	0.55	0.62
	45	NE	0.82	0.20	1.03	1.15
	67.5	ENE	0.82	0.27	1.03	1.15
	90	E	0.68	0.18	0.85	0.95
	112.5	ESE	0.34	0.08	0.43	0.48
	135	SE	0.32	0.07	0.40	0.45
	157.5	SSE	0.20	0.06	0.25	0.28
	180	S	0.50	0.07	0.63	0.70
	202.5	SSW	0.70	0.12	0.88	0.98
	225	SW	0.50	0.21	0.63	0.70
	247.5	WSW	0.66	0.37	0.83	0.92
	270	W	0.55	0.23	0.69	0.77
	292.5	WNW	0.54	0.10	0.68	0.76
	315	NW	0.43	0.08	0.54	0.60
	337.5	NNW	0.32	0.08	0.40	0.45

7.2 ADCP #2

An ADCP was deployed at St. Mary's Bay (44° 26.325'N, 66° 6.475'W) for 90 days from June 17, 2021, to September 17, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 5m and 15m are shown in Figure 23 to Figure 28. The total mean of current speeds at 5m, and 15m water depths are 0.4m/s, and 0.15m/s. The maximum recorded current speed at 5m, and 15m water depths are 1.33m/s, and 0.69m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated current and there is at least 90 days of data available. The results are shown in Table 12. Note that in addition to the maximum values, mean directional current speeds are also available in Table 12.

Based on the ADCP 2 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 12 hours (see Figure 25).

The predominant current directions at the ADCP 2 location were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 240 deg (flood) and 70 deg (ebb).

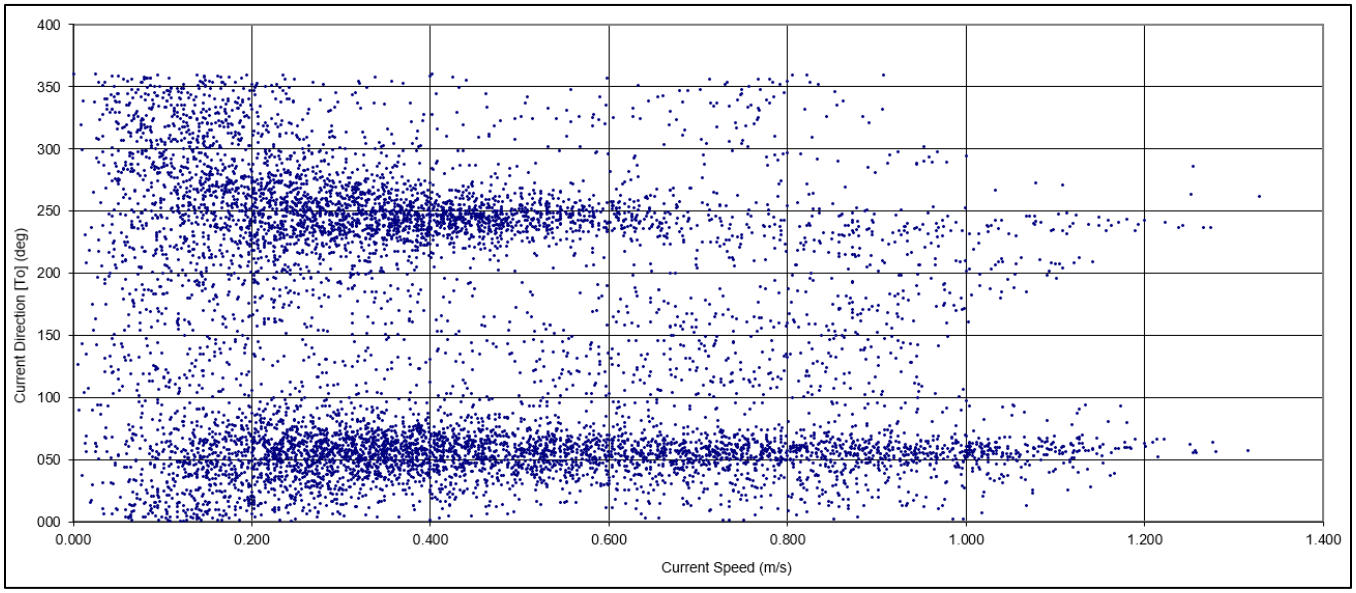


Figure 23 Scatter plot of current speed vs direction at ADCP 2 location - 5m water depth

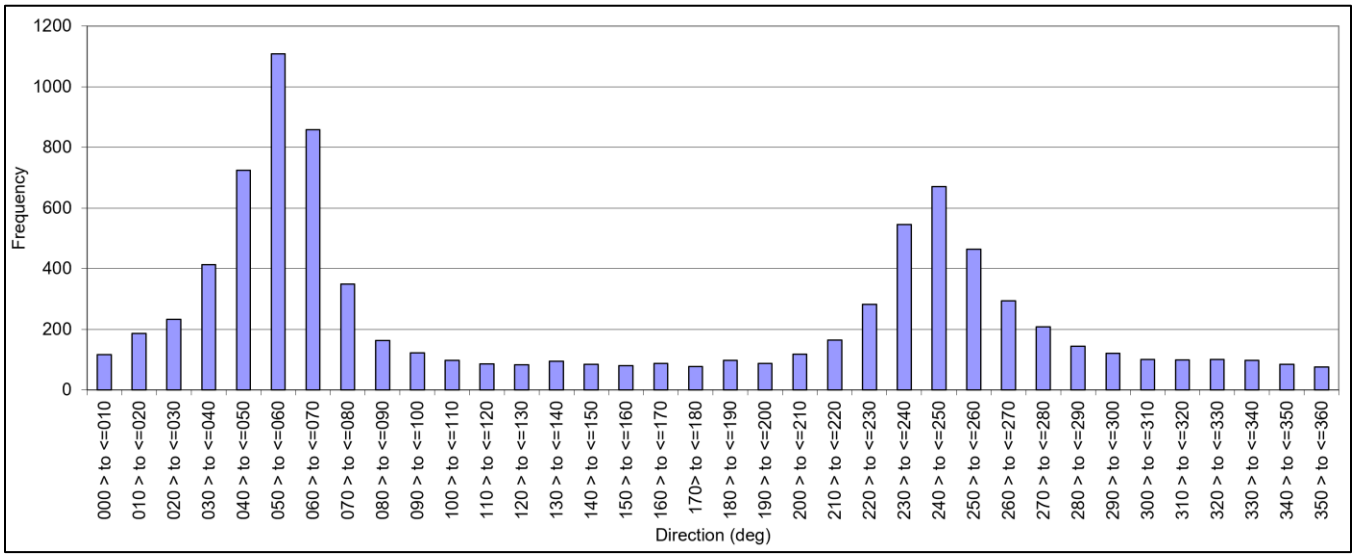


Figure 24 Frequency plot of current direction at ADCP 2 location - 5m Water depth

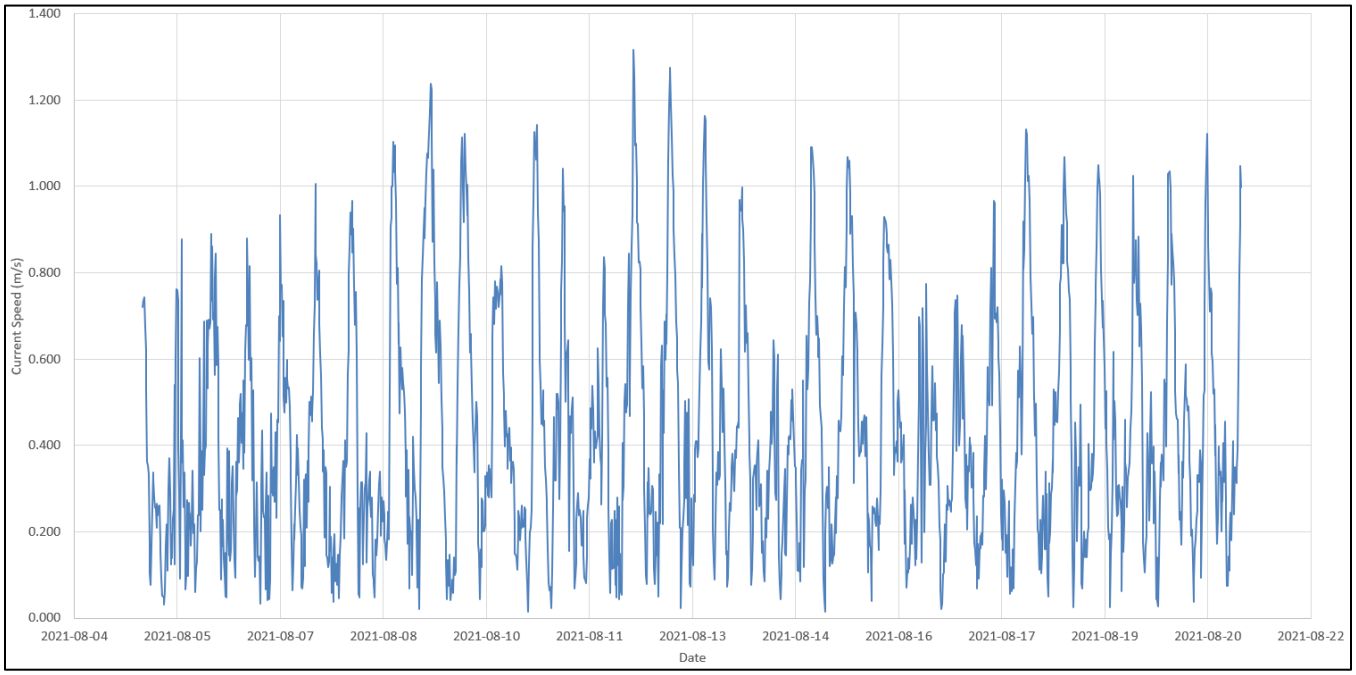


Figure 25 A sample time series plot of current speeds at ADCP 2 location - 5m Water depth

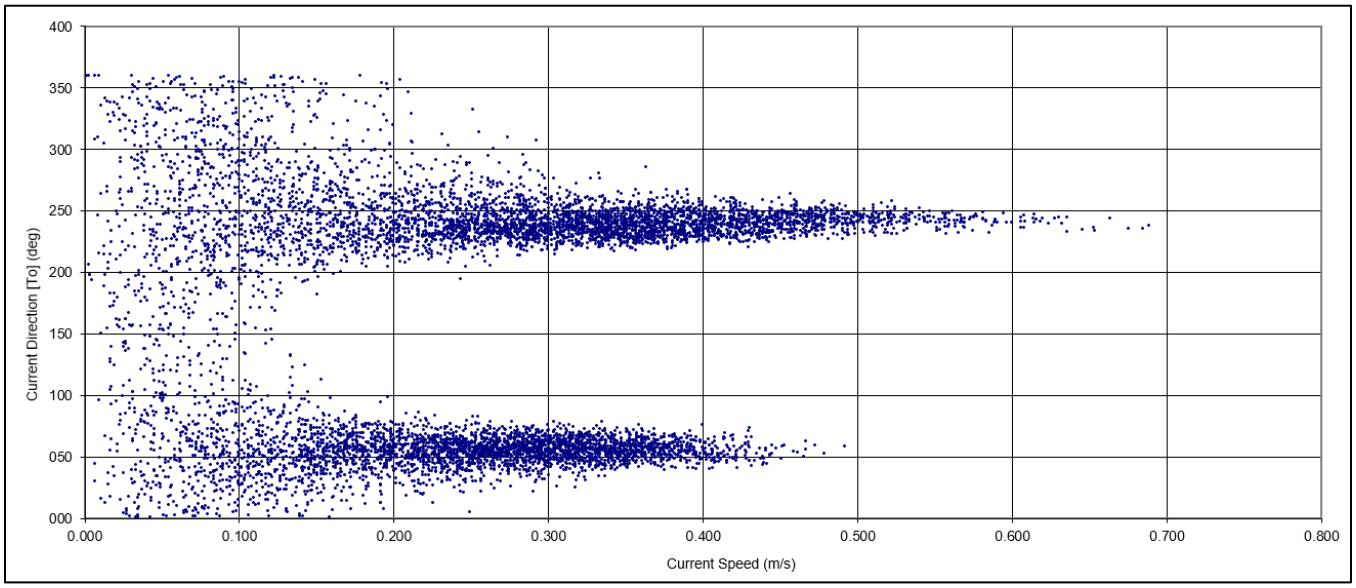


Figure 26 Scatter plot of current speed vs direction at ADCP 2 location - 15m water depth

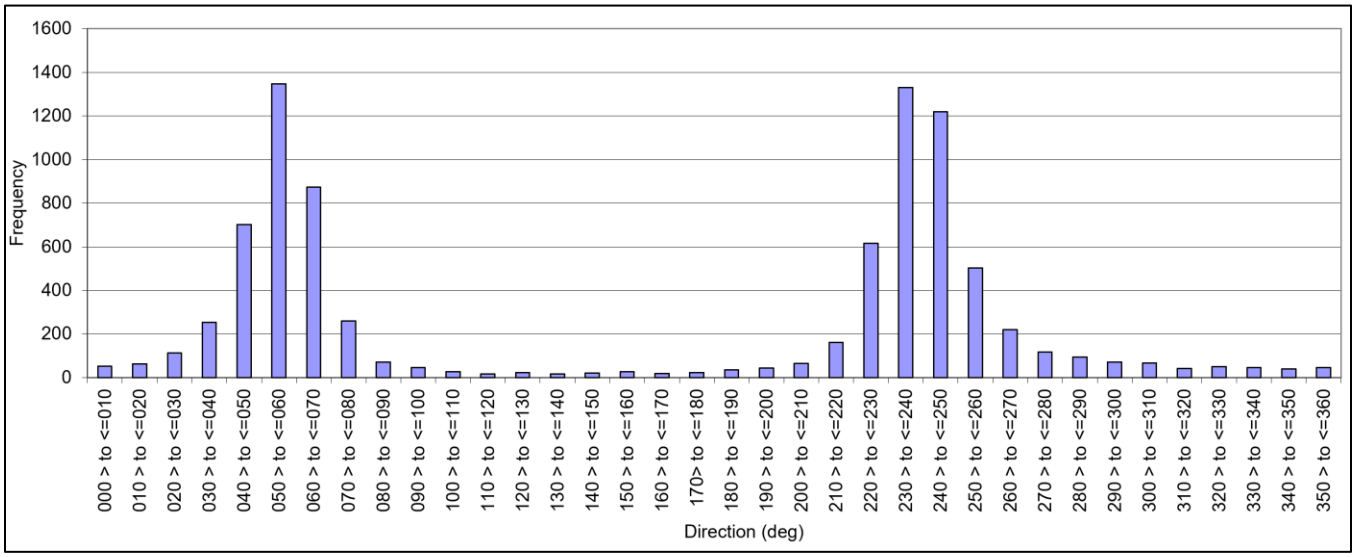


Figure 27 Frequency plot of current direction at ADCP 2 location - 15m Water depth

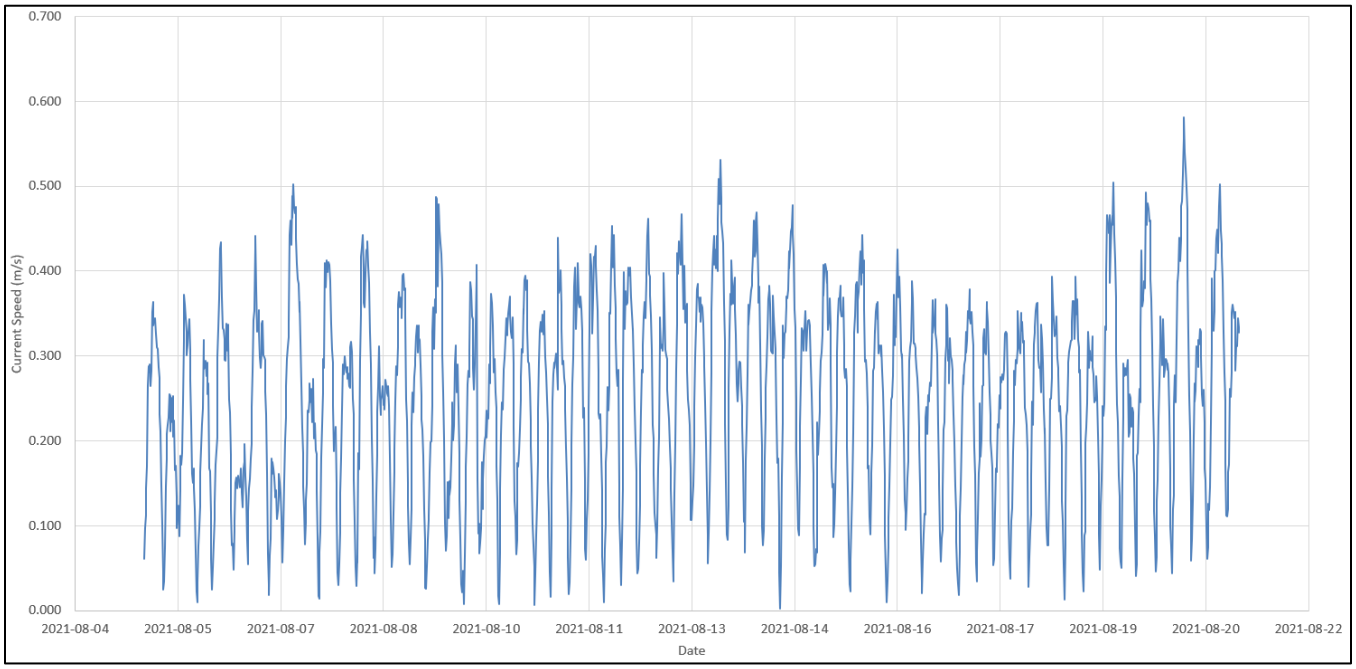


Figure 28 A sample time series plot of current speeds at ADCP 2 location - 15m Water depth

Table 12: 1 in 10 and 1 in 50 current conditions at ADCP 2 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
5 m	*0*	N	0.91	0.27	1.14	1.27
	22.5	NNE	1.07	0.35	1.34	1.50
	45	NE	1.17	0.45	1.46	1.64
	67.5	ENE	1.32	0.54	1.65	1.85
	90	E	1.18	0.43	1.48	1.65
	112.5	ESE	1.17	0.48	1.46	1.64
	135	SE	0.94	0.47	1.18	1.32
	157.5	SSE	0.98	0.50	1.23	1.37
	180	S	1.00	0.49	1.25	1.40
	202.5	SSW	1.10	0.42	1.38	1.54
	225	SW	1.14	0.40	1.43	1.60
	247.5	WSW	1.27	0.43	1.59	1.78
	270	W	1.33	0.36	1.66	1.86
	292.5	WNW	1.25	0.27	1.56	1.75
	315	NW	1.00	0.26	1.25	1.40

	337.5	NNW	0.91	0.26	1.14	1.27
15 m	*0*	N	0.21	0.09	0.26	0.29
	22.5	NNE	0.26	0.11	0.33	0.36
	45	NE	0.44	0.19	0.55	0.62
	67.5	ENE	0.49	0.27	0.61	0.69
	90	E	0.43	0.21	0.54	0.60
	112.5	ESE	0.20	0.08	0.25	0.28
	135	SE	0.15	0.07	0.19	0.21
	157.5	SSE	0.12	0.06	0.15	0.17
	180	S	0.12	0.06	0.15	0.17
	202.5	SSW	0.24	0.08	0.30	0.34
	225	SW	0.43	0.19	0.54	0.60
	247.5	WSW	0.69	0.33	0.86	0.97
	270	W	0.59	0.29	0.74	0.83
	292.5	WNW	0.36	0.15	0.45	0.50
	315	NW	0.29	0.11	0.36	0.41
	337.5	NNW	0.26	0.09	0.33	0.360

7.3 ADCP #3

An ADCP was deployed at St. Mary's Bay (44° 19.621'N, 66° 14.346'W) for 50 days from August 4, 2021, to September 24, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 5m and 15m are shown in Figure 29 to Figure 34. The total mean of current speeds at 5m, and 15m water depths are 0.35m/s, and 0.29m/s. The maximum recorded current speed at 5m, and 15m water depths are 2.49m/s, and 1.52m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated currents. The results are shown in Table 13. Note that in addition to the maximum values, mean directional current speeds are also available in Table 13.

Based on the ADCP 3 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 8 hours (see Figure 31).

The predominant current directions at the ADCP 3 locations were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 230 deg (flood) and 70 deg (ebb).

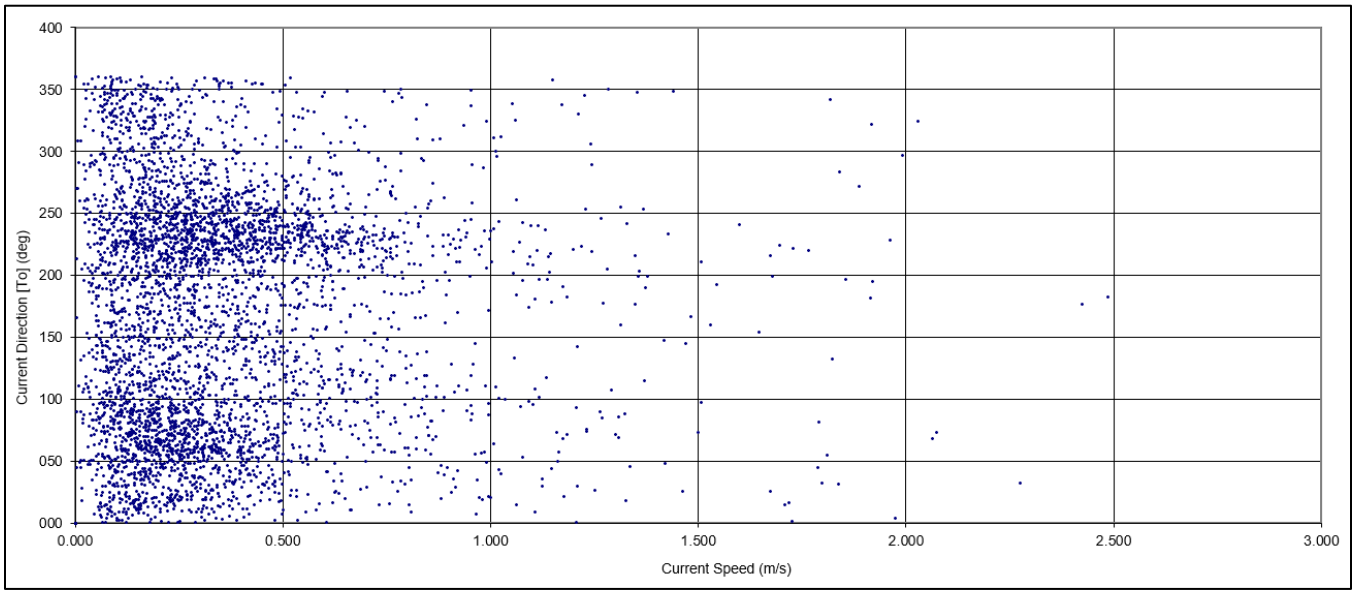


Figure 29 Scatter plot of current speed vs direction at ADCP 3 location - 5m water depth

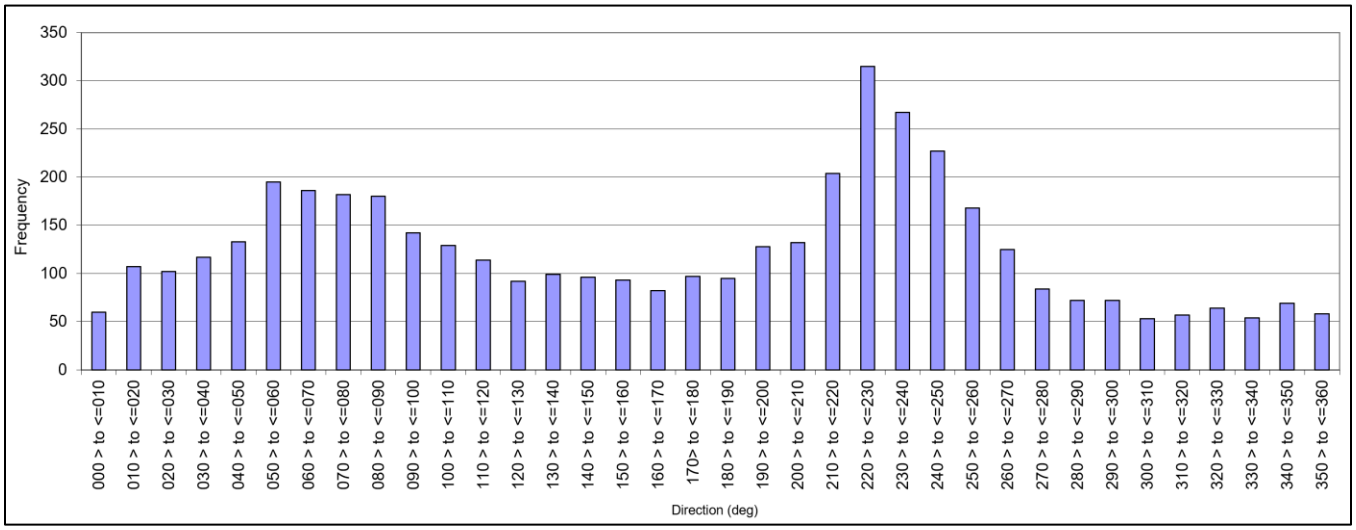


Figure 30 Frequency plot of current direction at ADCP 3 location - 5m Water depth

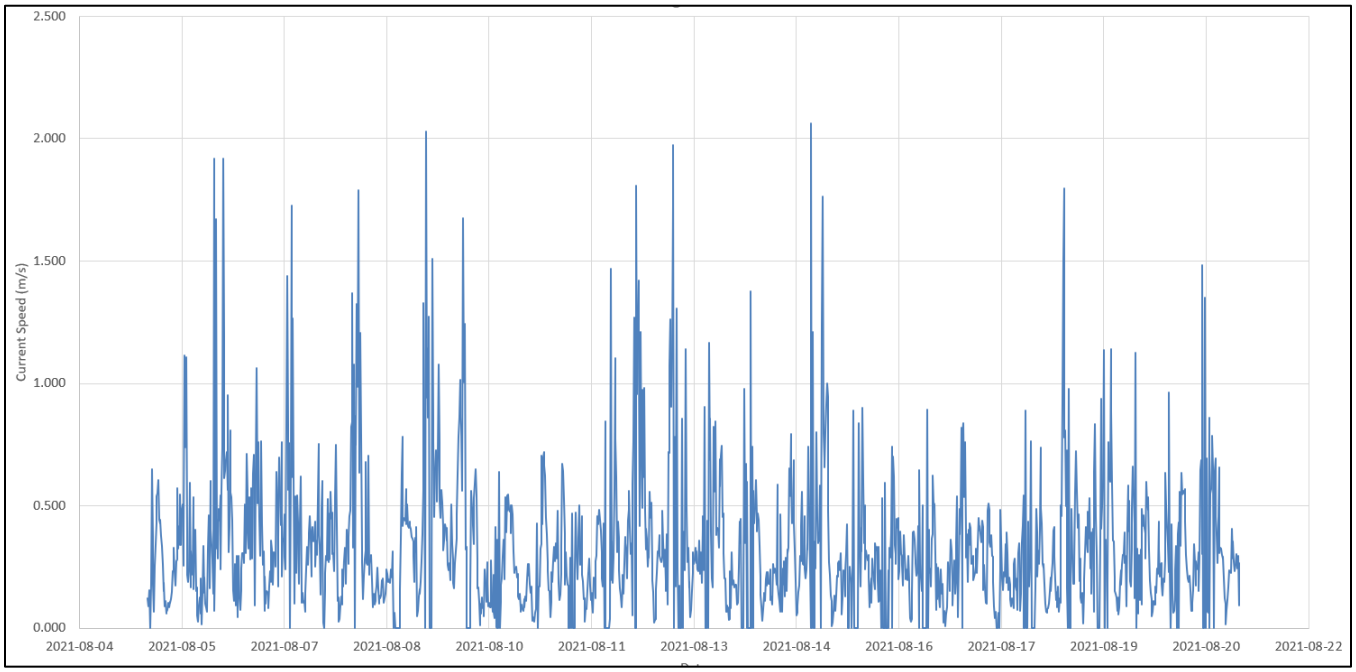


Figure 31 A sample time series plot of current speeds at ADCP 3 location - 5m Water depth

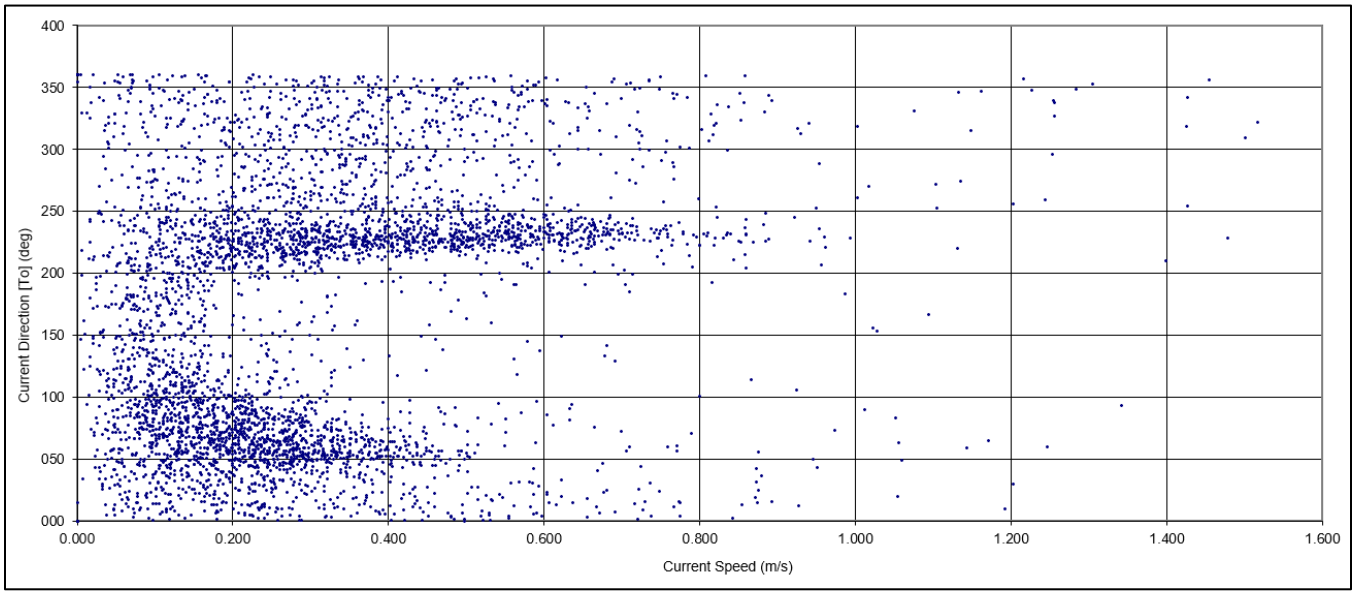


Figure 32 Scatter plot of current speed vs direction at ADCP 3 location - 15m water depth

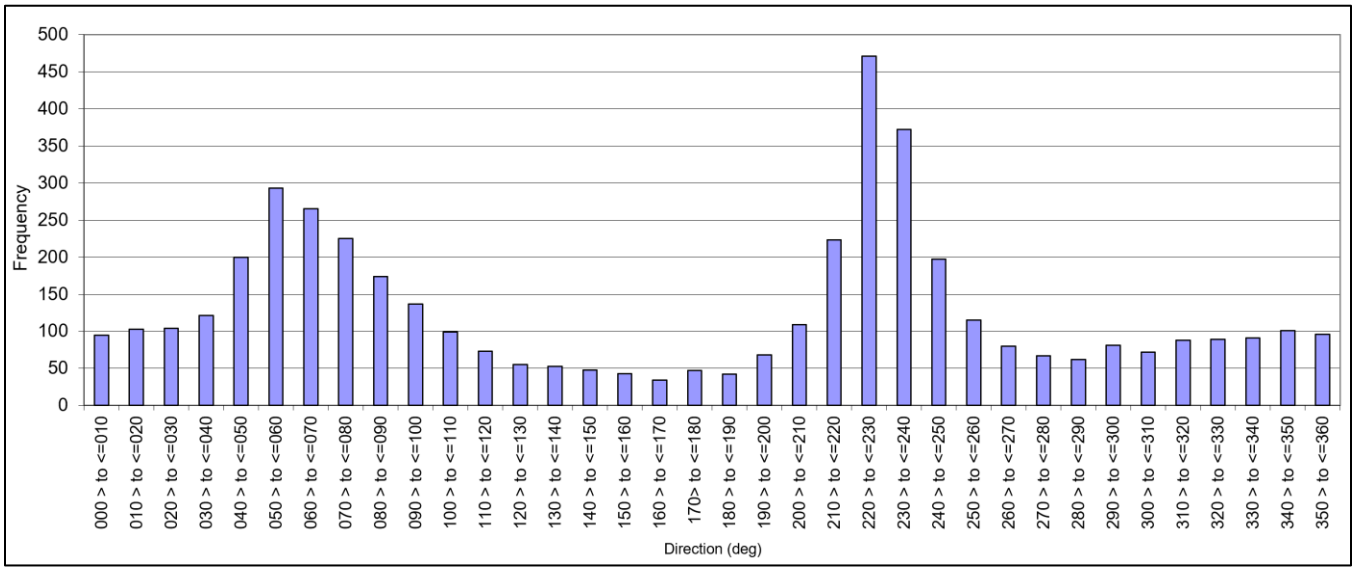


Figure 33 Frequency plot of current direction at ADCP 3 location - 15m Water depth

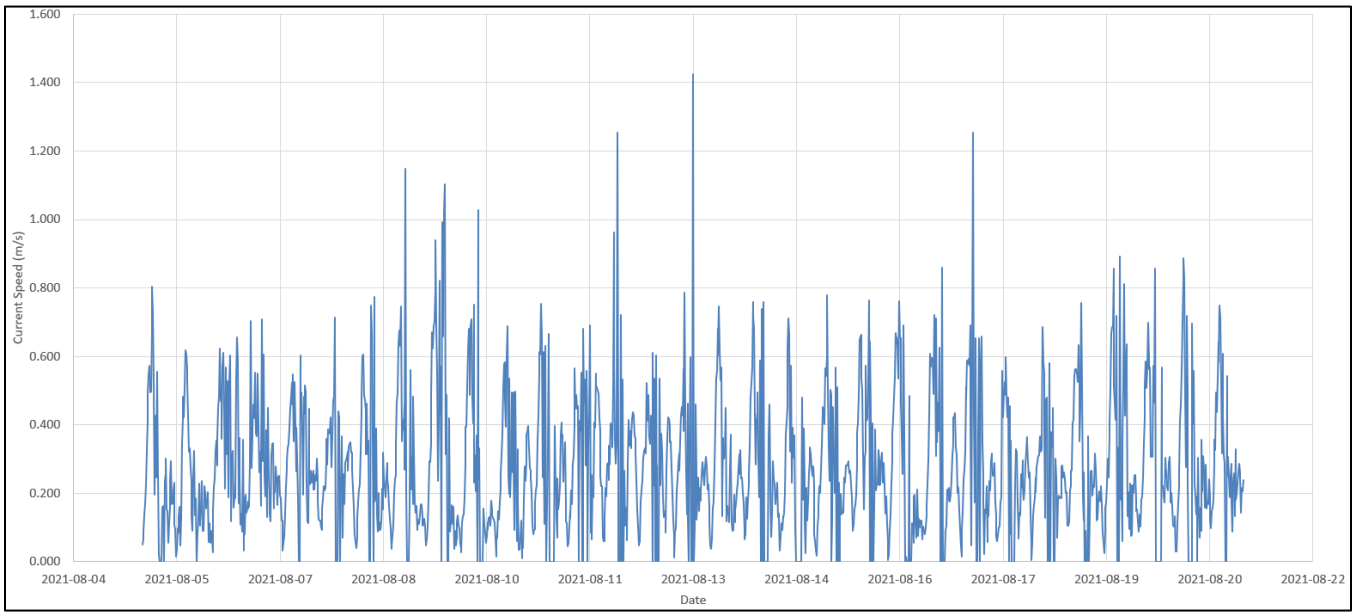


Figure 34 A sample time series plot of current speeds at ADCP 3 location - 15m Water depth

Table 13: 1 in 10 and 1 in 50 current conditions at ADCP 3 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
5 m	*0*	N	1.82	0.29	2.28	2.55
	22.5	NNE	1.97	0.33	2.46	2.76
	45	NE	2.28	0.37	2.85	3.19
	67.5	ENE	1.81	0.31	2.26	2.53
	90	E	2.07	0.33	2.59	2.90
	112.5	ESE	1.51	0.35	1.89	2.11
	135	SE	1.82	0.36	2.28	2.55
	157.5	SSE	1.65	0.33	2.06	2.31
	180	S	2.43	0.37	3.04	3.40
	202.5	SSW	2.49	0.40	3.11	3.49
	225	SW	1.77	0.41	2.21	2.48
	247.5	WSW	1.96	0.38	2.45	2.74
	270	W	1.37	0.34	1.71	1.92
	292.5	WNW	1.89	0.32	2.36	2.65
	315	NW	1.99	0.33	2.49	2.79
	337.5	NNW	2.03	0.29	2.54	2.84
15 m	*0*	N	1.46	0.39	1.83	2.04
	22.5	NNE	1.19	0.33	1.49	1.67
	45	NE	1.20	0.26	1.50	1.68
	67.5	ENE	1.25	0.27	1.56	1.75
	90	E	1.05	0.22	1.31	1.47
	112.5	ESE	1.34	0.18	1.68	1.88
	135	SE	0.87	0.16	1.09	1.22
	157.5	SSE	1.03	0.17	1.29	1.44
	180	S	1.09	0.17	1.36	1.53
	202.5	SSW	0.99	0.22	1.24	1.39
	225	SW	1.40	0.33	1.75	1.96
	247.5	WSW	1.48	0.42	1.85	2.07
	270	W	1.43	0.35	1.79	2.00
	292.5	WNW	1.14	0.35	1.43	1.60
	315	NW	1.50	0.38	1.88	2.10
	337.5	NNW	1.52	0.39	1.90	2.13

8 Depositional Modeling

8.1 Model

Depositional simulations of farm-origin feed and faeces was conducted using the equilibrated ORGANIX model [5]. ORGANIX bases settling velocity of organic matter on faecal and feed pellet dimensions, while the horizontal advection is resolved through a Gaussian random walk approach that utilizes residual currents. Resuspension is assumed to be zero within this model. Because we expect resuspension to be significant at these energetic sites, the model predictions can be considered a worst-case scenario, with net deposition likely lower than model outputs.

8.2 Model Parameters

8.2.1 Organic Matter

Studies of Atlantic salmon have produced settling velocities of 3.2-9.2 cm s^{-1} for faeces [6][7][8] and 8.5-12.8 cm s^{-1} for uneaten feed [9][10]. For each site, an input of 3.5mm for faeces and 5.5mm for feed pellets was used, producing settling velocities of 4.02cm s^{-1} for faeces and 9.94cm s^{-1} for feed.

8.2.2 Array Design & Stocking

Cages were arranged in a 2x6 array at each site, and were oriented lengthwise along the x-axis (E-W) as follows:

1. 25˚
2. 20˚
3. 27˚
4. 23˚

In the model, at all sites, cages were polar, had a radius of 20.7m, a distance between the centers of adjacent cages of 65m, and a depth extending 15m from the surface. Each cage was stocked with 50,000 fish and was assigned a grow-out period of 18 months.

8.2.3 Hydrodynamics

The ADCP data was used to compute the residual currents for each site. Sites 1 & 2 (AQ#1449 & 1450) used ADCP2, Site 3 (AQ#1451) used ADCP1, and Site 4 (AQ#1452) used ADCP3. ORGANIX utilizes both an x and y component for residual currents and dispersion coefficients. Previous models have utilized dispersion coefficients in the range of 0.003 – 1m^2 s^{-1} for both k_x and k_y [6][11][12][13][14]. Both k_x and k_y were set to 0.1m^2 s^{-1} for the present simulations.

Initially, current velocity vectors were converted to their individual components on the x and y planes. Then, assuming a uniform bin size (beyond Bin 1), a rolling $A_{24}A_{24}A_{25}$ [15] detiding filter was applied to the individual bins for each ADCP dataset. Resulting matrices were integrated over time and depth, resulting in residual currents for each ADCP is presented in Table 14. Model parameters for the depositional model are summarized in Table 15.

Table 14 Residual current velocities

	Residual current velocities x (m/s)	Residual current velocities y (m/s)
ADCP 1	0.04	0.00
ADCP 2	0.01	0.00
ADCP 3	-0.07	-0.07

Table 15 Depositional Model Parameters

Site	Orientation (deg)	ADCP#	Mean Depth (m)	Cage Depth (m)	Cage Diameter (m)	Growth cycle length (d)	Fish Per Cage	Faecal Diameter (mm)	Feed pellet (mm)	x-velocity (m/s)	y-velocity (m/s)	K_x (m^2/s)	K_y (m^2/s)
1 (AQ#1449)	25	2	21	15	41.4	540	50,000	3.5	5.5	0.01	0.00	0.1	0.1
2 (AQ#1450)	20	2	23							0.01	0.00		
3 (AQ#1451)	27	1	44							0.01	0.04		
4 (AQ#1452)	23	3	43							-0.07	-0.07		

8.3 Depositional Model Results

Low residual currents at Site 1 kept the highest POM deposition values very close the cage centers and produces negative gradients from the center towards the cage edges. Minimal overlap of cage footprints >1gC $m^{-2}d^{-1}$ occurred between adjacent cages, and POM contours >1gC $m^{-2}d^{-1}$ extended <25m beyond the cage edges.

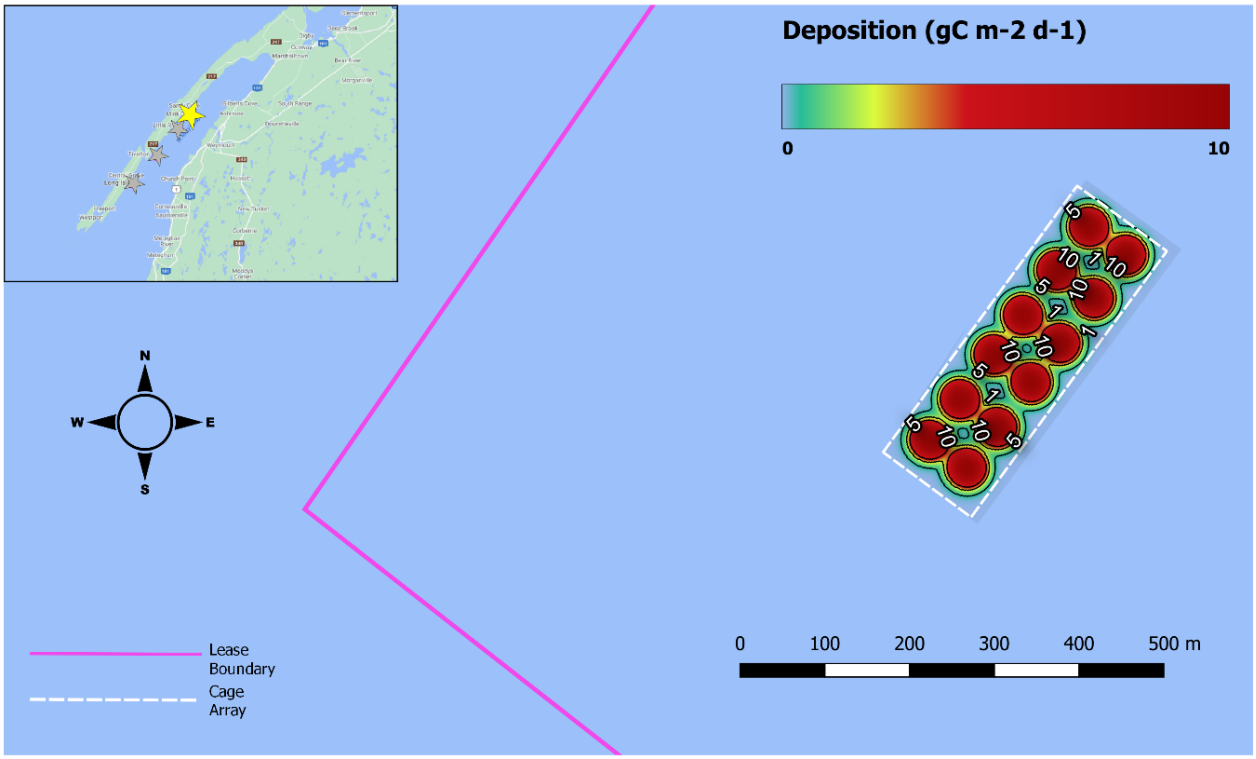


Figure 35 - Site 1 (AQ#1449) Deposition Model Results

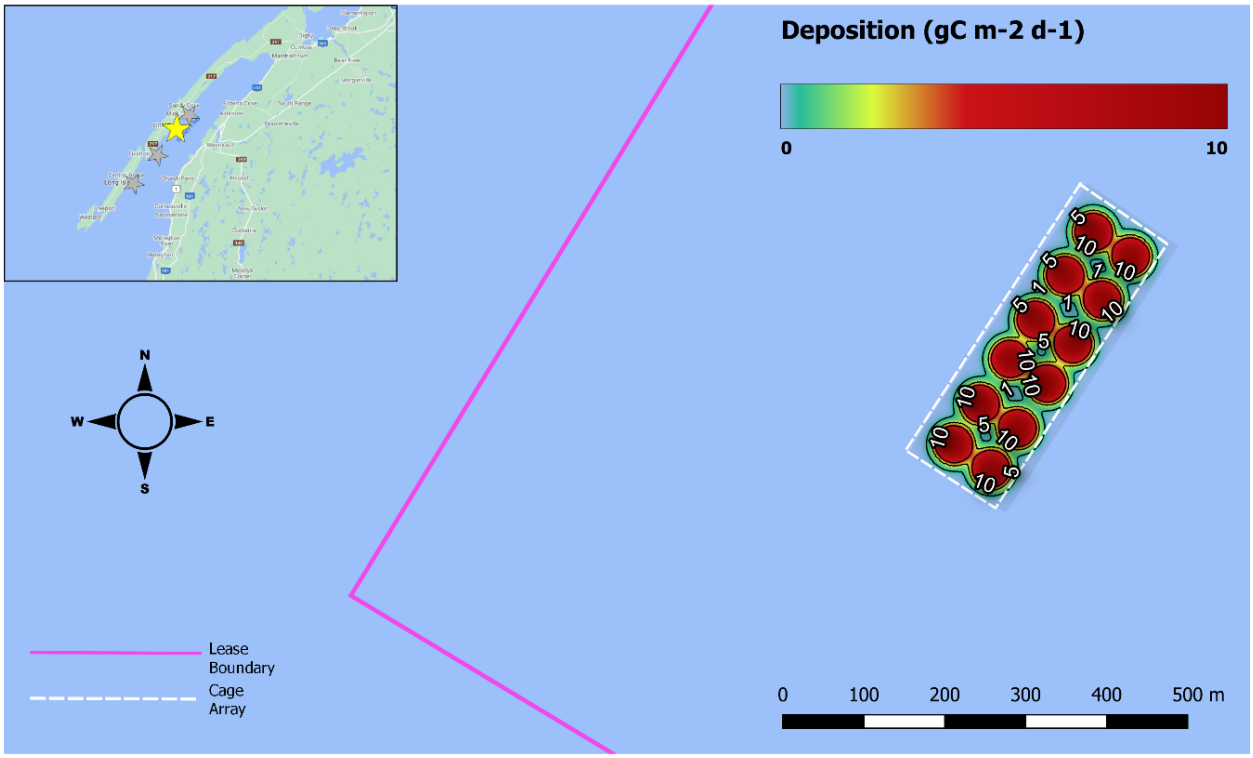


Figure 36 - Site 2 (AQ#1450) Depositional model results

Low residual currents at Site 2 kept the highest POM deposition values very close the cage centers and produced negative gradients from the center towards the cage edges. Minimal overlap of cage footprints >1gC $m^{-2}d^{-1}$ occurred between adjacent cages, and POM contours >1gC $m^{-2}d^{-1}$ extended <25m beyond the cage edges.

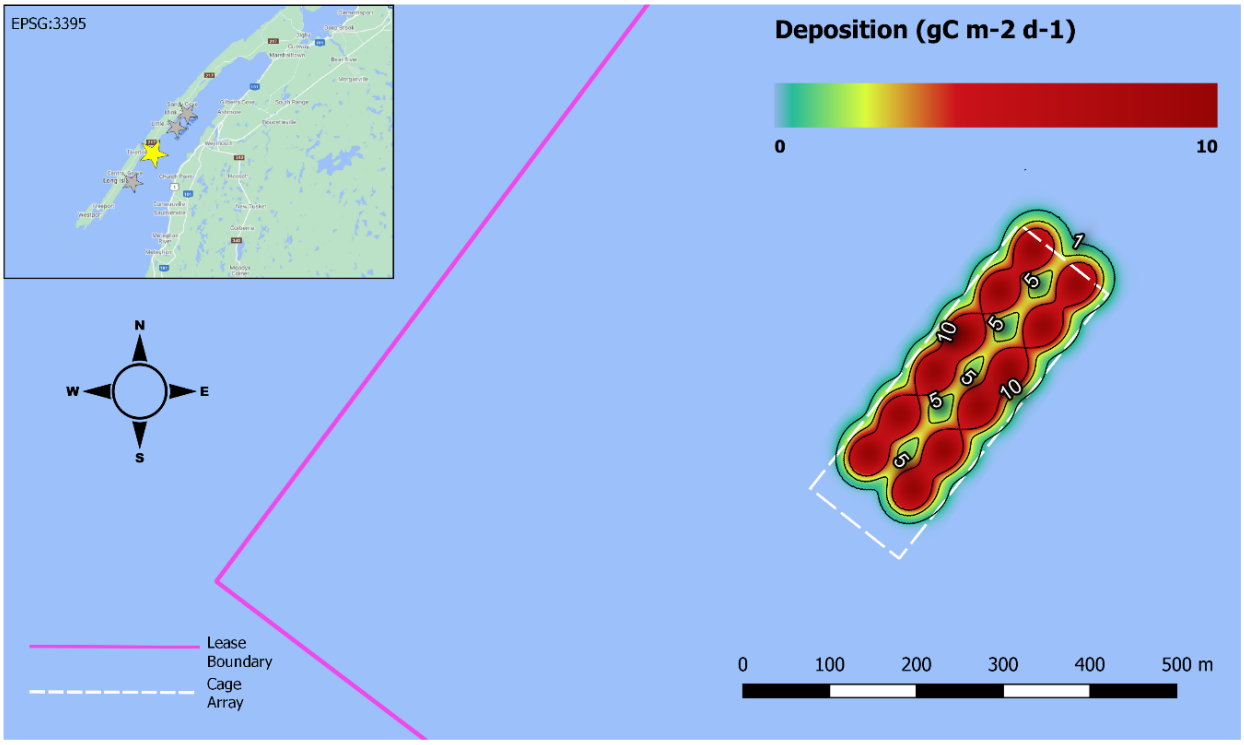


Figure 37 - Site 3 (AQ#1451) deposition model results

Residual currents to the NE were dominant at Site 3, pushing the highest deposition values to the NE edges of each cage. Moderate footprint overlap occurred between adjacent cages, and contours $\geq$1gC $m^{-2}d^{-1}$ extended beyond both lengthwise cage edges ~10m and the NE array edge ~40m.

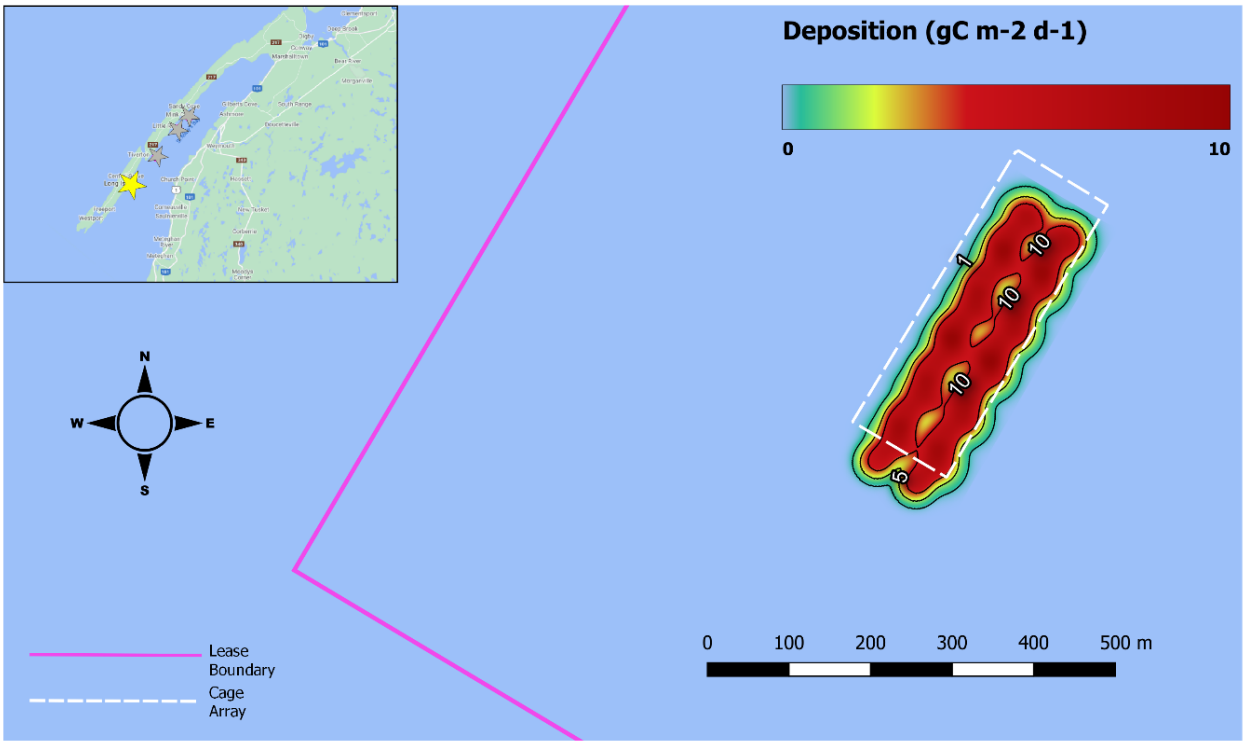


Figure 38 - Site 4 (AQ#1452) deposition model results

Residual currents to the SW were dominant at Site 4, pushing the deposition footprint beyond the SW and SE edges of the array. Footprint overlap was the greatest of all four sites, with highest values occurring under the southern edge of odd-numbered cages. Contours $\geq$ 1gC $m^{-2}d^{-1}$ extended beyond the cage array edge ~ 75m to the SW and ~25m to the SE.

Higher residual currents at Site 3 & Site 4 were likely due to their proximity to Petit Passage and the open ocean.

9 Video Survey / Fish and Fish Habitat

Across all sites, there was no discernable presence of fish feed, finfish faeces, organic detritus, gas bubbles, bacterial mats, OPCs, or anthropogenic debris. Other than a limited number of stations that were host to small seaweed beds ~1-2m^2, sites were >95% barren. While moderate amounts of suspended particulate matter were present at all stations, visibility was not significantly reduced between the camera and benthos unless impact from the camera frame to the sediment caused resuspension.

The soft bottom sediments at Sites 1, 2, & 3 (AQ#1449, 1450, & 1451) displayed similar characteristics between sites. Sediment was easily disturbed when impacted by the camera frame during descent, with the majority of the resuspended sediment remaining in the water column while the camera was in the area. These sites also appeared mostly barren at the surface, with infrequent observations of benthic macrofauna (scallops, barnacles, sea cucumbers, groundfish) and unattached macroflora. However, three

small seaweed beds were found growing around groups of boulders at Site 2. Though actual observations of polychaetes at the sediment water interface did not occur during video, and rarely during grab sampling, burrows were frequently observed in soft sediments, at most ~10 per 0.252m.

A substantial bioturbation feature occurred at Sites 1, 2, and 3, but more so at the latter two sites. Observed burrows in the video, and a high density of polychaete tubes, burrow structures or fecal castings in the majority of grab samples suggest high subsurface macrofaunal activity. Site 1 also contained greater concentrations of shell hash than Sites 2 and 3. We have requested identification of the faunal traces from Huntsman Marine Lab[2].

Alternatively, Site 4 (AQ#1452) was hard bottom throughout the entire area, with patchy presence of sand, pebble, and cobble. The sediment was not easily disturbed when impacted by the camera frame, and any sand that was resuspended would settle rapidly. Site 4 did not appear to have greater diversity or population of macrofauna (epifauna) than Sites 1-3, however, heterogeneity of the sediment made it difficult to confidently ascertain presence and numbers of smaller organisms. Seaweeds that were present at Site 4 were more frequently attached to the substrate, and a larger seaweed bed was observed growing around a group of boulders at Station 6 of the central transect.

10 Conclusions

The proposed farm sites in St. Mary's Bay may be characterized as high energy based on wave exposure, high current speeds, and coarse sediments. From the perspective of organic loading, these are considered ideal fish farm sites, since they are dispersive. In terms of local or far field bathymetry, there are no obvious depocentres or sheltered areas (i.e. behind islands) to act as particle sinks.

In depositional environments, sulfide may be substantial even in the absence of aquaculture. However, these sites have virtually zero sulfides and low organic content indicative of well flushed sediments that do not incorporate organic matter. Some sites have substantial mud content mixed with sand and gravel. However, Fundy sediments have an extensive glacial history, and gravel/cobble within a sand-mud matrix are common [16]. The presence of fine consolidated sediments is thus not indicative of a net depositional environment.

Beyond sediment texture and geochemistry, depositional modelling shows footprints tight to the cage sites in all cases. We emphasize that these models do not include resuspension and are thus conservative. With free-stream current speeds often exceeding 1-2 knots, the local deposition of fine particles such as fish feces is unlikely.

[2] DSA will inform CSL once this has been identified

Appendix A – Sediment Grab / Video Records

Appendix contents:

1) ***Sediment grabs and video records***.
2) ***Video Transect Log Sheet***

Please refer to Figure 7 on page 20 for sample location nomenclature.

All videos have been provided via a Google Drive download link here:

https://drive.google.com/drive/folders/1ALSh_SgDfVZPYerWxgCh648Wb9TjbUMO?usp=sharing

Table A 1 - 1C: Sediment Grabs & Videos

Date:	March 09, 2022	**Wind direction and speed:**	335˚, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	1C	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.455464	**Video Notes:** Tan, Soft, Clay, silt, sand, sparse shells (S) Sea cucumber	
Longitude (decimal degrees):	-66.080921		
Dist. and dir. from WP	Video end 63.4m from WP		
Time:	10:13	**Comments:**	
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar	**Benthic Descriptor Key:**	
Station depth (m):	21	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 11:41	Y	5S22	89	Tan, Soft, Clay, silt, sand, shells (S)	6	N	
Benthic Replicate B 11:54	Y	5S15	89	Tan, Soft, Clay, silt, sand, shells (S)	5	N	Arthropods
Benthic Replicate C 12:03	Y	8S15	89	Tan, Soft, Clay, silt, sand, shells (S)	5.5	N	Many arthropods

Table A 2 - 1CP: Sediment Grabs & Video

Date:	March 9, 2022	**Wind direction and speed:**	335˚, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.2m/s
Monitoring Station ID:	1CP	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.461271	**Video Notes:** Tan, Soft, Clay, silt, sand, sparse shells (S)	
Longitude (decimal degrees):	-66.081415		
Dist. and dir. from WP	Video end 60.1m from WP	**Comments:**	
Time:	12:15		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar	**Benthic Descriptor Key:**	
Station depth (m):	23.2	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:18	Y	9S1	89	Tan, Soft, Clay, silt, sand, shells (S-L)	6.5	N	Shells
Benthic Replicate B 12:28	Y	8S6	89	Tan, Soft, Clay, silt, sand, shells (S-L)	6.5	N	Worms, bivalves
Benthic Replicate C 12:51	Y	8S23	89	Tan, Soft, Clay, silt, sand, shells (S-L)	5	N	Arthropods

Table A 3 - 1RP: Sediment Grabs & Video

Date:	March 9, 2022	**Wind direction and speed:**	345˚, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	1RP	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.466665	**Video Notes:** Tan, Soft, Clay, silt, sand, sparse shells (S)	
Longitude (decimal degrees):	-66.075102		
Dist. and dir. from WP	Video end 131.6 m from WP	**Comments:**	
Time:	12:57		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar	**Benthic Descriptor Key:**	
Station depth (m):	23.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 13:09	Y	8S17	89	Tan, Soft, Clay, silt, sand, shells (S)	5	N	Shells
Benthic Replicate B 13:20	Y	8S13	89	Tan, Soft, Clay, silt, sand, shells (S)	5.5	N	Scallop
Benthic Replicate C 13:33	Y	5S21	89	Tan, Soft, Clay, silt, sand, shells (S)	6	N	Lots of shells

Table A 4 - 1B: Video Only

Date:	March 9, 2022	**Wind direction and speed:**	285˚, 5km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	1B	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.462683	**Video Notes:** Clay, silt, sand, pebble, cobble, abundant shells (S-L)	
Longitude (decimal degrees):	-66.073312		
Dist. and dir. from WP	Video end 87.0 m from WP	**Comments:** 3 Sediment grabs attempted with Ponar	
Time:	13:48		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	16.5

Table A 5 - Video Transect Log Sheet Central Transect: Site 1

Date	March 10, 2022		**Station Depth:**		29.6		**Colour:**	Tan	
Water Body	St. Mary's Bay		**Wind direction and speed:**		245˚, 22km/h		**Consistency:**	Soft	
Lease name and #	AQ#1449		**Wave action:**		Low		**Notes:**		
Time:	Start: 09:58	End: 11:41	**Current direction:**		SW				
Recorder:	[redacted]		**Tide schedule**		High-0430,1715 Low-1100,2315				

Station ID	Start		End		Dist. (m)	Relative Bottom Velocity (m)	Composition	Macrofauna	Macroflora
	Latitude	Longitude	Latitude	Longitude					
1	44.457490	-66.084543	44.457800	-66.084357	37.6	0.7	Clay, silt, sand, shells (S)		Brown, green seaweed
2	44.458125	-66.084252	44.458082	-66.084295	5.9	1.0	Clay, silt, sand, shells (S-L)	Pelagic worms	
3	44.458772	-66.083400	44.459018	-66.083303	28.5	0.8	Clay, silt, sand, shells (S)	Barnacles, pelagic worms, jellyfish	Green seaweed
4	44.459530	-66.082707	44.459700	-66.082732	19.0	1.5	Clay, silt, sand, shells (S-L)	Pelagic worms, Scallops	Brown, green seaweed
5	44.460302	-66.082063	44.460618	-66.082197	36.8	1.8	Clay, silt, sand, shells (S-L)	Scallops, flatfish, barnacles	Brown, green seaweed
6	44.461038	-66.081287	44.461350	-66.081260	34.8	1.1	Clay, silt, sand, shells (S-L)	Scallops, pelagic worms, barnacles	Brown, green seaweed
7	44.461883	-66.080517	44.462167	-66.080643	33.1	1.0	Clay, silt, sand, abundant shells (S-L)	Scallops, barnacles	Brown, green seaweed
8	44.462640	-66.079660	44.462637	-66.079380	22.2	1.2	Clay, silt, sand, shells (S)	Scallops, barnacles	Brown, green seaweed
9	44.463228	-66.078850	44.463355	-66.078942	15.9	0.7	Clay, silt, sand, pebbles, cobbles, shells (S)	Jellyfish, barnacles	Brown, green seaweed
10	44.464113	-66.078188	44.464102	-66.078333	11.6	1.1	Clay, silt, sand, shells (S)	Scallops	Brown, green seaweed
11	44.464792	-66.077492	44.464873	-66.077318	16.5	1.2	Clay, silt, sand, shells (S)	Scallops, barnacles	Brown, green seaweed

Table A 6 - 3D: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	70˚, 12km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW, relative bottom current 0.8m/s
Monitoring Station ID:	3D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.380887	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows, finfish (S) Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.180892		
Dist. and dir. from WP	Video end 63.5m from WP		
Time:	08:01		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	49.4

Table A 7 - 3C: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	75˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW, relative bottom current 0.9m/s
Monitoring Station ID:	3C	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.376602	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows, scallops Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.173001		
Dist. and dir. from WP	Video end 35.5m from WP		
Time:	09:05		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	39.0

Table A 8 - 1D: Sediment Grabs & Video

Date:	March 11, 2022	**Wind direction and speed:**	110˚, 7km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	SW, relative bottom current 0.9m/s
Monitoring Station ID:	1D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.459894	**Video Notes:** Tan, soft, clay, silt, sand, shells (S) Burrows, jellyfish Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.088921		
Dist. and dir. from WP	Video end 50.3m from WP		
Time:	10:26		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar/Petit Ponar/Ekman	**Benthic Descriptor Key:**	
Station depth (m):	29.6	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	13		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:34	Y	5S13	89	Tan, soft, clay, silt, sand, shells (S)	5.5	N	Shells, rockweed
Benthic Replicate B 11:27	Y	7S9	89	Tan, soft, clay, silt, sand, shells (S)	5	N	
Benthic Replicate C 10:39,10:42, 10:47,11:01,11:05,11:09, 11:16, 11:20,11:39,11:42	N		89	Tan, soft, clay, silt, sand, shells (S)		N	

Table A 9 - 1A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	240˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	1A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.466688	**Video Notes:** Tan, clay, silt, sand, moderate number of shells (S) Burrows, jellyfish, barnacles, scallops, mussels Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.075153		
Dist. and dir. from WP	Video end 34.3m from WP		
Time:	12:01		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	29.9

Table A 10 - 2RP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	230˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	2RP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.441708	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows **Comments:**	
Longitude (decimal degrees):	-66.107423		
Dist. and dir. from WP	Video end 43.7m from WP		
Time:	12:25		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	29.9

Table A 11 - 2A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235˚, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	2A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.441742	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.114242		
Dist. and dir. from WP	Video end 50.3m from WP		
Time:	12:35		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	26.2

Table A 12 - 2B: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235˚, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	2B	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.438019	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.105641		
Dist. and dir. from WP	Video end 49.2m from WP		
Time:	12:45		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	30.5

Table A 13 - 2CP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235˚, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	2CP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.436054	**Video Notes:** Tan, clay, silt, sand, boulders, shells (S) Burrows, jellyfish, crab Brown, green, yellow seaweed, seaweed bed around boulders **Comments:**	
Longitude (decimal degrees):	-66.113145		
Dist. and dir. from WP	Video end 56.5m from WP		
Time:	12:54		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	28.8

Table A 14 - 2D: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235˚, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	2D, relative bottom current 0.7m/s
Monitoring Station ID:	2D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.434044	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.120775		
Dist. and dir. from WP	Video end 64.3m from WP		
Time:	13:02		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	26.8

Table A 15 - 2C: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235˚, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.8m/s
Monitoring Station ID:	2C	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.430321	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows, jellyfish Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.112152		
Dist. and dir. from WP	Video end 45.5m from WP		
Time:	13:10		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	31.1

Table A 16 - Video Transect Log Sheet Central Transect: Site 2

Date	March 11, 2022	**Station Depth:**	32.9	**Colour:**	Tan	
Water Body	St. Mary's Bay	**Wind direction and speed:**	225˚, 19km/h	**Consistency:**	Soft	
Lease name and #	AQ#1450	**Wave action:**	Low	**Notes:**		
Time:	Start: 13:21 End: 14:03	**Current direction:**	SW			
Recorder:	[redacted]	**Tide schedule**	High-0430,1715 Low-1100,2315			

Station ID	Start		End		Dist. (m)	Relative Bottom Velocity (m)	Composition	Macrofauna	Macroflora
	Latitude	Longitude	Latitude	Longitude					
1	44.432815	-66.115657	44.432837	-66.115335	25.7	0.3	Clay, silt, sand, boulders, shells (S)	Burrows, jellyfish, crab	Brown, green, yellow seaweed, seaweed bed around boulders
2	44.433520	-66.115177	44.433460	-66.115388	18.1	1.2	Clay, silt, sand, shells (S)	Burrows	Brown, green, yellow seaweed
3	44.434313	-66.114738	44.434290	-66.114605	10.9	0.5	Clay, silt, sand, boulders, shells (S)	Burrows, crab	Brown, green, yellow seaweed, two seaweed beds around boulders
4	44.435218	-66.113950	44.435357	-66.113940	15.4	1.2	Clay, silt, sand, shells (S)	Burrows, jellyfish	
5	44.436007	-66.113345	44.436662	-66.112905	80.9	0.4	Clay, silt, sand, shells (S)	Burrows	Brown, green, yellow seaweed
6	44.436733	-66.112543	44.436678	-66.112340	17.3	0.5	Clay, silt, sand, shells (S)	Burrows	
7	44.437542	-66.111920	44.437508	-66.112100	14.8	0.9	Clay, silt, sand	Burrows	
8	44.438240	-66.111335	44.438332	-66.111330	10.2	0.7	Clay, silt, sand	Burrows	Brown, green seaweed
9	44.439163	-66.110665	44.439428	-66.110898	34.8	0.5	Clay, silt, sand	Burrows, jellyfish	
10	44.439752	-66.110033	44.440267	-66.109913	58.1	0.3	Clay, silt, sand	Burrows	

Table A 17 - 3A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215˚, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	3A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.38784	**Video Notes:** Tan, clay, silt, sand, pebbles, abundant shells (S-M) Burrows, jellyfish, scallops Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.173534		
Dist. and dir. from WP	Video end 31.3m from WP		
Time:	14:46		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	34.4

Table A 18 - 3RP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215˚, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	3RP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.380887	**Video Notes:** Tan, clay, silt, sand, shells (S-L) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.180892		
Dist. and dir. from WP	Video end 26.9m from WP		
Time:	14:53		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	57.9

Table A 19 - 3B: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215˚, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	3B	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.383684	**Video Notes:** Tan, clay, silt, sand, shells (S-L) Burrows, jellyfish, groundfish Brown, green, yellow seaweed **Comments:**	
Longitude (decimal degrees):	-66.165352		
Dist. and dir. from WP	Video end 10.8m from WP		
Time:	15:03		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	43.0

Table A 20 - 3CP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215˚, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	3CP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.382294	**Video Notes:** Tan, clay, silt, sand, shells (S-L) Burrows, crab, scallop, groundfish Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.17313		
Dist. and dir. from WP	Video end 35.4m from WP		
Time:	15:14		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	50.9

Table A 21 - 4RP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.3m/s
Monitoring Station ID:	4RP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.332456	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Pelagic worm, scallops, crabs Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.231043		
Dist. and dir. from WP	Video end 14.3m from WP		
Time:	15:57		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	50.0

Table A 22 - 4A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.4m/s
Monitoring Station ID:	4A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.332456	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops **Comments:**	
Longitude (decimal degrees):	-66.237671		
Dist. and dir. from WP	Video end 22.8m from WP		
Time:	16:05		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	40.5

Table A 23 - 4B: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.4m/s
Monitoring Station ID:	4B	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.328956	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, boulders, abundant shells (S-L) Burrows, scallops, starfish Brown, green, yellow seaweed **Comments:**	
Longitude (decimal degrees):	-66.228879		
Dist. and dir. from WP	Video end 22.8m from WP		
Time:	16:14		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	48.8

Table A 24 - 4CP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	4CP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.326792	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops Brown, green, yellow seaweed **Comments:**	
Longitude (decimal degrees):	-66.236454		
Dist. and dir. from WP	Video end 29.7m from WP		
Time:	16:23		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	47.5

Table A 25 - 4D: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	4D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.32478	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops Brown, green, seaweed **Comments:**	
Longitude (decimal degrees):	-66.244028		
Dist. and dir. from WP	Video end 61.5m from WP		
Time:	16:33		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	45.1

Table A 26 - 4C: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.5m/s
Monitoring Station ID:	4C	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.321111	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops, crabs Brown, green, seaweed **Comments:**	
Longitude (decimal degrees):	-66.235372		
Dist. and dir. from WP	Video end 19.3m from WP		
Time:	16:42		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	44.5

Table A 27 - 1A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	325˚, 23km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE
Monitoring Station ID:	1A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.466688	**Video Notes:**	
Longitude (decimal degrees):	-66.075153		
Dist. and dir. from WP		**Comments:**	
Time:	0843		
Recorder name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	29.9	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 09:13	Y	8S8	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Shells (S)
Benthic Replicate B 09:22	Y	8S4	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7.5	N	Shells (S-M)
Benthic Replicate C 09:30	Y	5S4	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	5.5	N	Shells (S)

Table A 28 - 1B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE
Monitoring Station ID:	1B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.462683	**Video Notes:**	
Longitude (decimal degrees):	-66.073312		
Dist. and dir. from WP		**Comments:**	
Time:	09:37		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	25.0	**4. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**5. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**6. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 9:37	Y	7S2	89	Pebbles & cobble present, brown, grainy, coarse	5	N	Shells(S), bivalves
Benthic Replicate B 9:45	Y	5S34	89	Pebbles & cobble present, brown, grainy, coarse	6	N	Shells(S), bivalves, vegetation
Benthic Replicate C 9:54	N		89	Pebbles & cobble present, brown, grainy, coarse			

Table A 29 - 1D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE
Monitoring Station ID:	1D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.459894	**Video Notes:**	
Longitude (decimal degrees):	-66.088921		
Dist. and dir. from WP		**Comments:**	
Time:	10:01		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	29.6	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	1		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:01	Y	8S19	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	
Benthic Replicate B							
Benthic Replicate C							

Table A 30 - 2RP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE
Monitoring Station ID:	2RP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.441708	**Video Notes:**	
Longitude (decimal degrees):	-66.107423		
Dist. and dir. from WP		**Comments:**	
Time:	10:15		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	29.9	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	6		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:23	Y	3S8	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	6	N	
Benthic Replicate B 10:28, 10:30, 10:35, 11:21	Y	8S3	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	15	N	Sea Cucumber(?)
Benthic Replicate C 11:27	Y	8S18	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	

Table A 31 - 2A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE
Monitoring Station ID:	2A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.441742	**Video Notes:**	
Longitude (decimal degrees):	-66.114242		
Dist. and dir. from WP		**Comments:**	
Time:	10:44		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	26.2	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	7		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:44, 10:48, 10:53, 10:58	Y	5S18	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	
Benthic Replicate B 11:04, 11:08	Y	5S29	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	13	N	
Benthic Replicate C 11:15	Y	5S12	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	14	N	

Table A 32 - 2B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	110˚, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.438019	**Video Notes:**	
Longitude (decimal degrees):	-66.105641		
Dist. and dir. from WP		**Comments:**	
Time:	11:34		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	30.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 11:34, 11:38	Y	8S11	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	Polychaetes, shells (S)
Benthic Replicate B 11:43	Y	5S36	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	13	N	shells (S)
Benthic Replicate C 11:48	Y	5S24	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	

Table A 33 - 2CP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	110˚, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2CP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.436054	**Video Notes:**	
Longitude (decimal degrees):	-66.113145		
Dist. and dir. from WP		**Comments:**	
Time:	12:07		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	28.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:07	Y	5S2	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	9	N	Polychaetes
Benthic Replicate B 12:13	Y	8S1	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	Polychaetes
Benthic Replicate C 12:19	Y	5S10	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	

Table A 34 - 2C: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	110˚, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2C	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.430321	**Video Notes:**	
Longitude (decimal degrees):	-66.112152		
Dist. and dir. from WP		**Comments:**	
Time:	12:25		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	31.1	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:25	Y	8S7	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	7	N	
Benthic Replicate B 12:32	Y	8S12	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Polychaetes, brown seaweed, shells(S)
Benthic Replicate C 12:37	Y	5S14	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	10	N	Polychaetes

Table A 35 - 2D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	100˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.434044	**Video Notes:**	
Longitude (decimal degrees):	-66.120775		
Dist. and dir. from WP		**Comments:**	
Time:	12:43		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	26.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:44	Y	8S5	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	9	N	
Benthic Replicate B 12:49	Y	3S25	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	14	N	
Benthic Replicate C 12:54	Y	7S3	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	10	N	Arthropods, shells (S)

Table A 36 - 3RP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	95˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3RP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.387711	**Video Notes:**	
Longitude (decimal degrees):	-66.167082		
Dist. and dir. from WP		**Comments:**	
Time:	13:25		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	57.9	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 13:25	Y	7S5	89	Brown, soft, oxic layer >1cm, polychaete castings >50% of surface	7	N	
Benthic Replicate B 13:32	Y	8S22	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	Lots of shells (S & M)
Benthic Replicate C 13:38	Y	5S27	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	5	N	Vegetation

Table A 37 - 3A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	90˚, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.38784	**Video Notes:**	
Longitude (decimal degrees):	-66.173534		
Dist. and dir. from WP		**Comments:**	
Time:	13:45		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	34.4	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 13:45	Y	5S11	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	5	N	Shells(L), bivalves
Benthic Replicate B 13:51, 13:54	Y	8S20	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Shells
Benthic Replicate C 13:59	Y	5S28	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	6	N	Shells(S-L)

Table A 38 - 3B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	90˚, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.383684	**Video Notes:**	
Longitude (decimal degrees):	-66.165352		
Dist. and dir. from WP		**Comments:**	
Time:	14:07		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	43.0	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 14:07	Y	8S16	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	Shells(S)
Benthic Replicate B 14:12	Y	5S31	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	7	N	
Benthic Replicate C 14:17, 14:20	Y	5S3	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Seaweed, arthropods, shells(S)

Table A 39 - 3CP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	90˚, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3CP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.382294	**Video Notes:**	
Longitude (decimal degrees):	-66.17313		
Dist. and dir. from WP		**Comments:**	
Time:	14:26		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	50.9	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 14:26	Y	5S1	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	6	N	Shells
Benthic Replicate B 14:32	Y	5S26	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	10	N	Big shells, hermit crab
Benthic Replicate C 14:37	Y	5S16	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	8	N	Shells

Table A 40 - 3C: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	35˚, 3km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3C	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.376602	**Video Notes:**	
Longitude (decimal degrees):	-66.173001		
Dist. and dir. from WP		**Comments:**	
Time:	14:45		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	39.0	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 14:45	Y	8S14	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	8	N	
Benthic Replicate B 14:50	Y	7S6	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	9	N	
Benthic Replicate C 14:53, 14:56	Y	7S7	89	Brown, soft, oxic layer >1cm	7	N	Shells(S)

Table A 41 - 3D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	35˚, 3km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.380887	**Video Notes:**	
Longitude (decimal degrees):	-66.180892		
Dist. and dir. from WP		**Comments:**	
Time:	15:04		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	49.4	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 15:04	Y	5S25	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	
Benthic Replicate B 15:09, 15:12, 15:16	Y	7S1	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	9	N	Shells(S)
Benthic Replicate C 15:21	Y	5S7	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	

Table A 42 - 4RP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	320˚, 5km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4RP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.332456	**Video Notes:**	
Longitude (decimal degrees):	-66.231043		
Dist. and dir. from WP		**Comments:**	
Time:	15:54		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	50.0	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	6		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 15:54, 15:57, 16:01, 16:04, 16:07, 16:12	N		89	Sand, pebble, cobble, shells		N	
Benthic Replicate B							
Benthic Replicate C							

Table A 43 - 4A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	320˚, 5km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.332456	**Video Notes:**	
Longitude (decimal degrees):	-66.237671		
Dist. and dir. from WP		**Comments:**	
Time:	16:18		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	40.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 16:18, 16:21, 16:24, 16:27, 16:30	N		89	Sand, pebble, cobble, shells		N	
Benthic Replicate B							
Benthic Replicate C							

Table A 44 - 4B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	300˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.328956	**Video Notes:**	
Longitude (decimal degrees):	-66.228879		
Dist. and dir. from WP		**Comments:**	
Time:	16:36		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	48.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 16:36, 16:39, 16:41, 16:45, 16:49	N		89	Sand, pebble, cobble, shells		N	
Benthic Replicate B							
Benthic Replicate C							

Table A 45 - 4CP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	300˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4CP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.326792	**Video Notes:**	
Longitude (decimal degrees):	-66.236454		
Dist. and dir. from WP		**Comments:**	
Time:	16:56		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	47.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 16:56, 17:00, 17:03, 17:06, 17:09	N		89	Sand, pebble, cobble, shells		N	Bivalves, barnacles, seaweed, crab
Benthic Replicate B							
Benthic Replicate C							

Table A 46 - 4C: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	300˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4C	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.321111	**Video Notes:**	
Longitude (decimal degrees):	-66.235372		
Dist. and dir. from WP		**Comments:**	
Time:	17:15		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	44.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 17:15, 17:18, 17:21, 17:25, 17:28	N		89	Sand, pebble, cobble, shells		N	Bivalves, barnacles, seaweed
Benthic Replicate B							
Benthic Replicate C							

Table A 47 - 4D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	275˚, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.32478	**Video Notes:**	
Longitude (decimal degrees):	-66.244028		
Dist. and dir. from WP		**Comments:**	
Time:	17:36		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	45.1	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 17:36, 17:39, 17:43, 17:45, 17:50	N		89	Sand, pebble, cobble, shells		N	Bivalves, barnacles, seaweed
Benthic Replicate B							
Benthic Replicate C							

Table A 48 - Video Transect Log Sheet Central Transect: Site 4

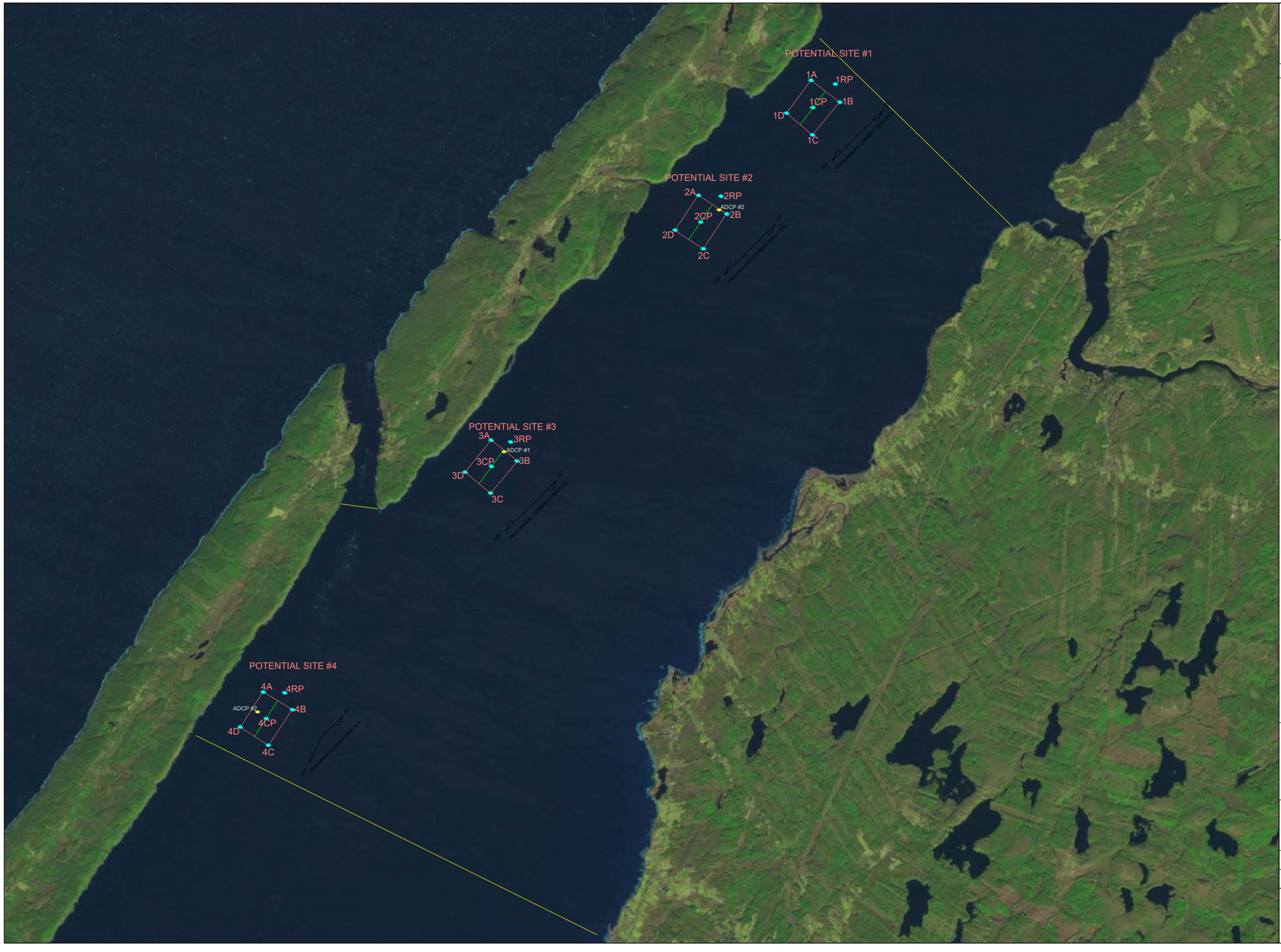
Date:	March 17, 2022		**Station Depth:**			44.7		**Colour:**	Red, brown, black, grey, white	
Water Body	St. Mary's Bay		**Wind direction and speed:**			175˚, 28km/h		**Consistency:**	Hard	
Lease name and #	AQ#1452		**Wave action:**			Low-Moderate		**Notes:**		
Time:	Start: 08:42	End: 09:35	**Current direction:**			NE				
Recorder:	[redacted]		**Tide schedule**			High-1130,2345 Low-0515,1730				
Station ID	**Start**		**End**		**Dist. (m)**	**Relative Bottom Velocity (m)**	**Composition**	**Macrofauna**	**Macroflora**	
	Latitude	**Longitude**	**Latitude**	**Longitude**						
1	44.330933	-66.233847	44.330962	-66.233318	42.2	0.9	Sand, pebble, cobble, boulders, abundant shells (S-L)	Starfish, scallops	Brown, green, yellow seaweed	
2	44.329948	-66.233660	44.329885	-66.233552	11.1	0.8	Sand, pebble, cobble, abundant shells (S-L)	Scallops, pelagic worms	Brown, green seaweed	
3	44.329092	-66.234435	44.329152	-66.234835	32.5	0.9	Sand, pebble, cobble, abundant shells (S-L)	Scallops	Brown, green seaweed	
4	44.328563	-66.235242	44.328552	-66.234943	23.8	1.2	Sand, pebble, cobble, abundant shells (S-L)		Brown, green seaweed	
5	44.327467	-66.235745	44.327458	-66.235752	1.1	0.3	Sand, pebble, cobble, abundant shells (S-L)	Scallops, lobster	Brown, green, yellow seaweed	
6	44.326822	-66.236423	44.326935	-66.236660	22.7	0.7	Sand, pebble, cobble, boulders, abundant shells (S-L)	Scallops	Brown, green, yellow seaweed, two seaweed beds around boulders	
7	44.325927	-66.237070	44.326008	-66.237258	17.5	0.4	Sand, pebble, cobble, abundant shells (S-L)	Scallops, crabs	Brown, green, yellow seaweed	
8	44.325290	-66.237790	44.325263	-66.237910	10.0	1.1	Sand, pebble, cobble, boulders, abundant shells (S-L)	Scallops	Brown, green, yellow seaweed	
9	44.324373	-66.238315	44.324705	-66.238548	41.3	1.0	Sand, pebble, cobble, abundant shells (S-L)	Starfish, scallops	Brown, green, yellow seaweed	
10	44.323142	-66.239587	44.323640	-66.239968	63.3	0.7	Sand, pebble, cobble, abundant shells (S-L)	Hard	Scallops	

Table A 49 - Video Transect Log Sheet Central Transect: Site 3

Date	March 17, 2022		**Station Depth:**			44.1		**Colour:**	Tan	
Water Body	St. Mary's Bay		**Wind direction and speed:**			175˚, 99km/h		**Consistency:**	Soft	
Lease name and #	AQ#1451		**Wave action:**			Moderate		**Notes:** Moderate swell made maintaining appropriate camera positioning about the sediment difficult, leading to numerous impacts with the sediment		
Time:	Start: 10:14	End: 10:57	**Current direction:**			NE				
Recorder:	[redacted]		**Tide schedule**			High-1130,2345 Low-0515,1730				
Station ID	**Start**		**End**		**Dist. (m)**	**Relative Bottom Velocity (m)**	**Composition**	**Macrofauna**	**Macroflora**	
	Latitude	**Longitude**	**Latitude**	**Longitude**						
1	44.386068	-66.169277	44.386118	-66.169553	22.7	0.8	Clay, silt, sand, shells (S-L)	Burrows	Brown, green, yellow seaweed	
2	44.385398	-66.170918	44.385172	-66.170557	38.3	0.3	Clay, silt, sand, shells (S)	Burrows	Brown, green seaweed	
3	44.384385	-66.171085	44.384270	-66.170988	14.9	1.2	Clay, silt, sand, shells (S)	Burrows, groundfish	Brown, green, yellow seaweed	
4	44.383618	-66.171888	44.383882	-66.171570	38.7	1.2	Clay, silt, sand, shells (S)	Burrows		
5	44.382948	-66.172540	44.383010	-66.172273	22.3	1.5	Clay, silt, sand, shells (S-L)	Burrows, lobster	Brown, green seaweed	
6	44.382252	-66.172950	44.382190	-66.172838	11.2	0.9	Clay, silt, sand, shells (S-L)	Burrows, finfish (S), crab	Brown, green seaweed	
7	44.381152	-66.173795	44.381408	-66.174323	50.8	1.3	Clay, silt, sand, shells (S-L)	Burrows, finfish (S), mussels	Brown, green seaweed	

8	44.380695	-66.174668	44.380622	-66.174352	26.5	1.2	Clay, silt, sand, shells (S)	Burrows	Brown, green seaweed
9	44.379685	-66.175322	44.379823	-66.175762	38.2	1.8	Clay, silt, sand, shells (S-L)	Burrows	Brown, green seaweed
10	44.378702	-66.176582	44.379120	-66.177325	75.3	1.0	Brown	Clay, silt, sand, shells (S)	Soft

Appendix B - Site Maps and Sampling Locations



CANADIAN SALMON LIMITED

ST MARY'S BAY, NOVA SCOTIA

SITE LOCATIONS

ENVIRONMENT FEATURES

LEASE BOUNDARY

SAMPLE LOCATIONS

ADCP LOCATION

OPTION AREA BOUNDARY

VIDEO SURVEY LINE (VSL)

SAMPLE COORDINATES

POTENTIAL SITE #1

1A	44.4671° -66.0819°
1B	44.4627° -66.0733°
1C	44.4554° -66.0809°
1D	44.4599° -66.0889°
1CP	44.4612° -66.0813°
1VSL	44.4648,-660776 to 44.4575, -66.0846
1RP	44.4666° -66.0751°

POTENTIAL SITE #2

2A	44.4417° -66.1142°
2B	44.4380° -66.1056°
2C	44.4303° -66.1121°
2D	44.4340° -66.1207°
2CP	44.4360° -66.1131°
2VSL	44.4398,-661098 to 44.4322,-66.1164
2RP	44.4417° -66.1074°

POTENTIAL SITE #3

3A	44.3879° -66.1735°
3B	44.3837° -66.1654°
3C	44.3766° -66.1730°
3D	44.3806° -66.1806°
3CP	44.3822° -66.1731°
3VSL	44.3858,-66.1690 to 44.3785,-66.1765
3RP	44.3877° -66.1670°

POTENTIAL SITE #4

4A	44.3325° -66.2376°
4B	44.3289° -66.2288°
4C	44.3211° -66.2354°
4D	44.3247° -66.2439°
4CP	44.3268° -66.2364°
4VSL	44.3306,-66.2333 to 44.3229, -66.2396
4RP	44.3324° -66.2310°

NOTES:

1)
2)

DSAocean

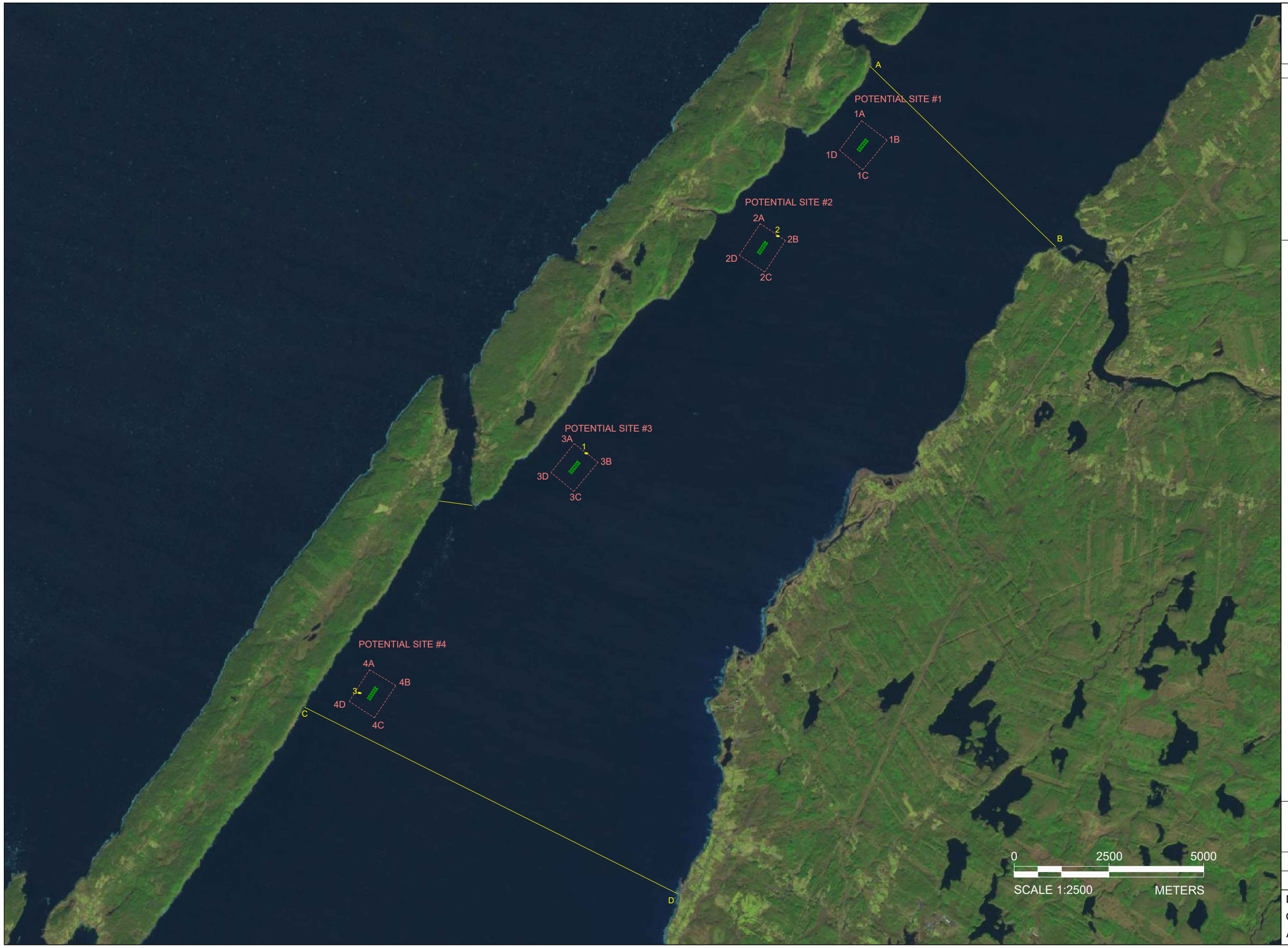
DRAWING NUMBER: DSA-CSL-22DSV-D01

SHEET 1 OF 1

DRAWN BY: [redacted]

CHECKED BY: XXX LAST REVISED: 2022-01-18

APPROVED BY: XXX REVISION: X - XXX



CANADIAN SALMON LIMITED

NOVA SCOTIA, CANADA

SITE LOCATIONS

ENVIRONMENT FEATURES

LEASE BOUNDARY

ADCP LOCATION

OPTION AREA BOUNDARY

ADCP COORDINATES

1	44.385567°	-66.168633°
2	44.438743°	-66.107910°
3	44.327017°	-66.239100°

APPROVED OPTION AREA

A	44.479282°	-66.081807°
B	44.439707°	-66.022103°
C	44.328967°	-66.254017°
D	44.289557°	-66.132587°

SITE CENTER COORDINATES

POTENTIAL SITE #1	44.461250°	-66.081390°
POTENTIAL SITE #2	44.436068°	-66.113149°
POTENTIAL SITE #3	44.382293°	-66.173163°
POTENTIAL SITE #4	44.326828°	-66.236474°

DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 1 OF 5

DRAWN BY: [redacted]

CHECKED BY: [redacted] LAST REVISED: 2022-02-16

APPROVED BY: [redacted] REVISION: C - IFR



CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 1

FARM FEATURES

- FISH NET
- NET PEN
- SITE CENTER
- COMPENSATOR BUOY

ENVIRONMENT FEATURES

- BATHYMETRY (METERS) 5
- LEASE BOUNDARY
- DOMINANT CURRENT DIR

SITE COORDINATES

POTENTIAL SITE #1

CORNER A	44.4671°	-66.0818°
CORNER B	44.4627°	-66.0733°
CORNER C	44.4554°	-66.0809°
CORNER D	44.4599°	-66.0889°

NOTES:

1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 1.62M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.2M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.2M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
5) TIDAL RANGE: 6.4M
6) APPROXIMATE DEPTH AT CENTER OF SITE 21 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

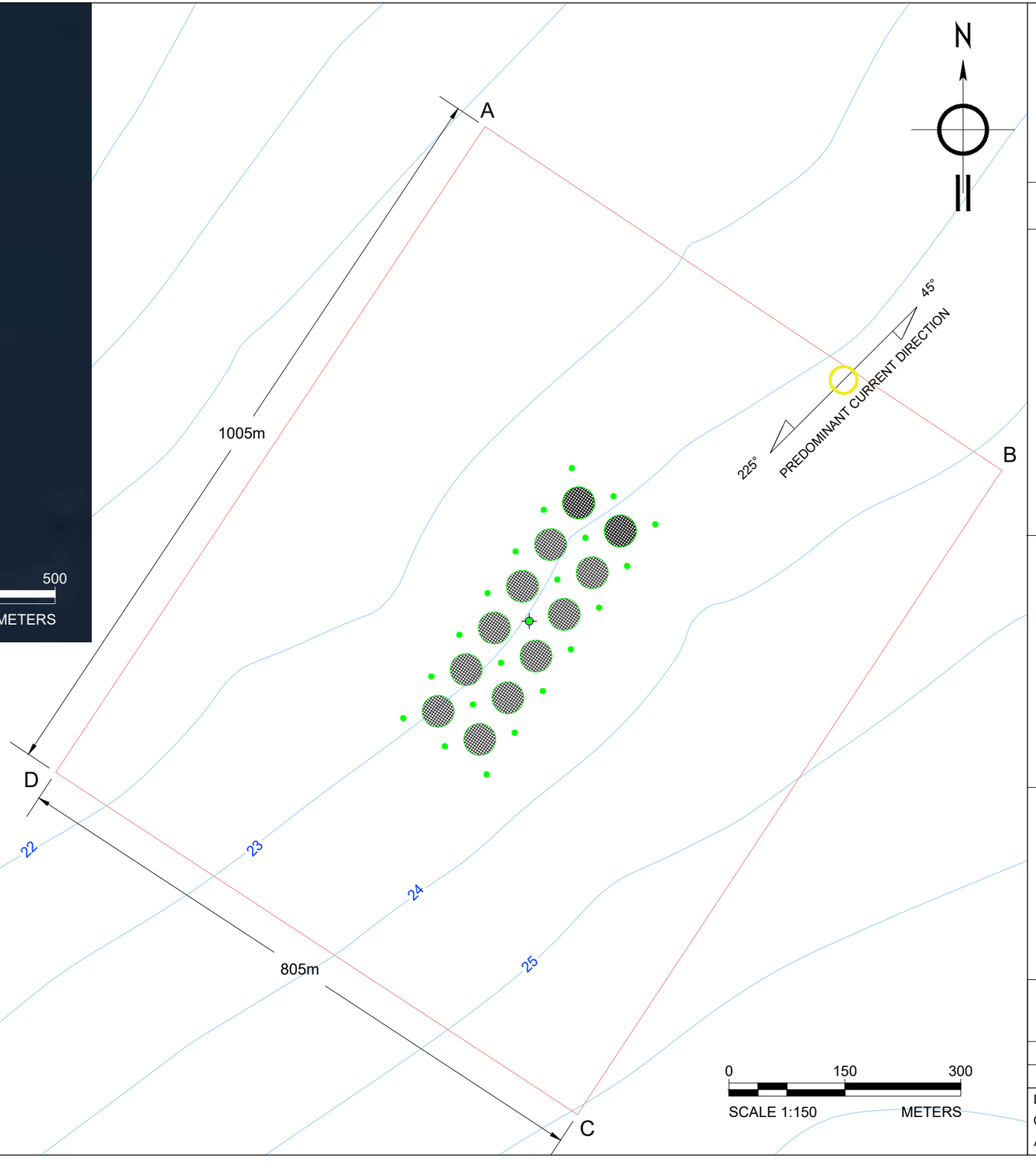
DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 2 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR





CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 2

FARM FEATURES

- FISH NET
- NET PEN
- ADCP LOCATION
- SITE CENTER
- COMPENSATOR BUOY

ENVIRONMENT FEATURES

- BATHYMETRY (METERS) 5
- LEASE BOUNDARY
- DOMINANT CURRENT DIR

SITE COORDINATES

POTENTIAL SITE #2

CORNER A	44.4417°	-66.1142°
CORNER B	44.4380°	-66.1056°
CORNER C	44.4305°	-66.1121°
CORNER D	44.4340°	-66.1207°

NOTES:

1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 1.73M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.32M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.33M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
5) TIDAL RANGE: 6.4M
6) APPROXIMATE DEPTH AT CENTER OF SITE 23 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

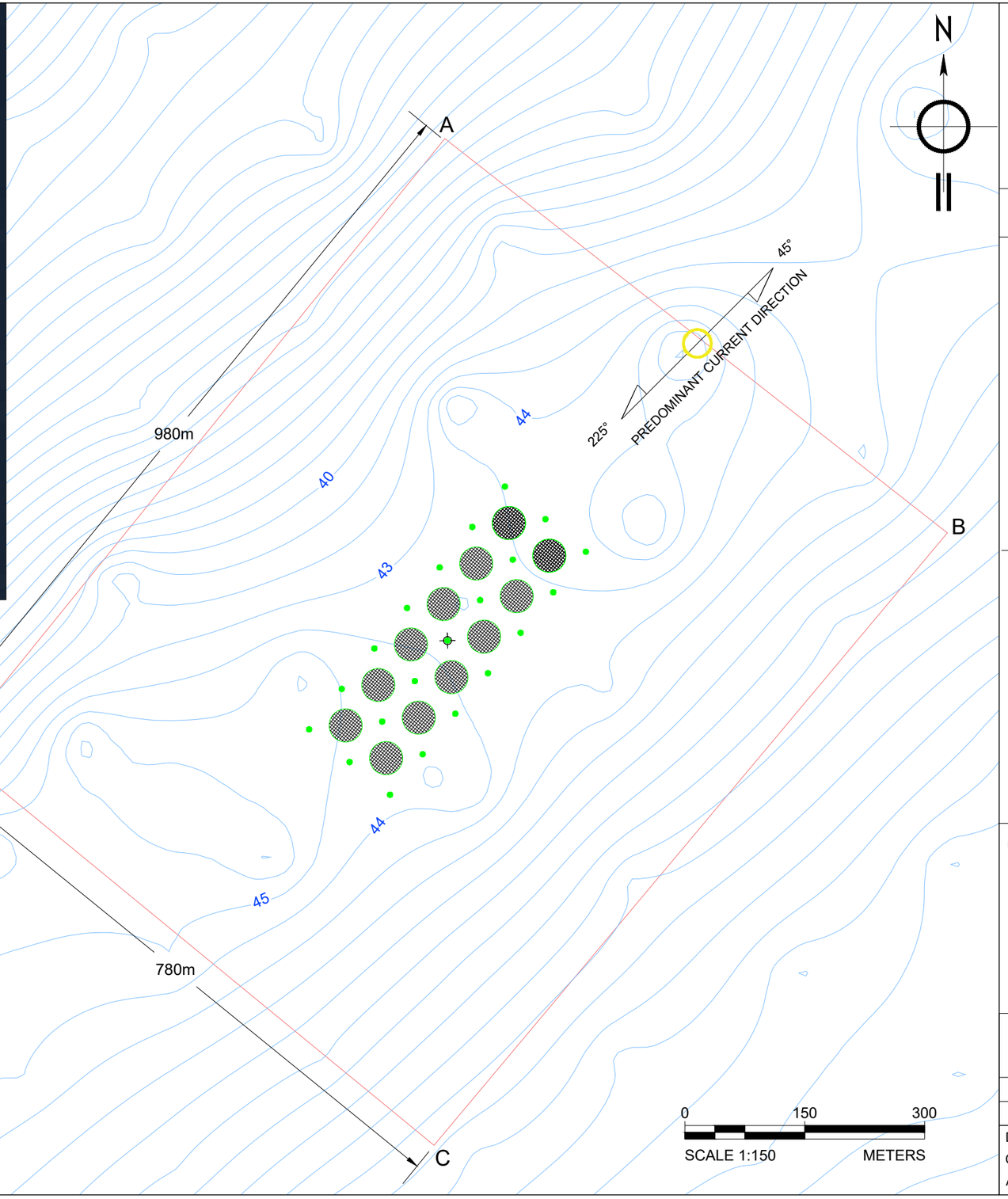
DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 3 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR





CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 3

FARM FEATURES	ENVIRONMENT FEATURES
FISH NET	BATHYMETRY (METERS) 5
NET PEN	LEASE BOUNDARY
ADCP LOCATION	DOMINANT CURRENT DIR
SITE CENTER	
COMPENSATOR BUOY	

SITE COORDINATES

POTENTIAL SITE #3

CORNER A	44.3879°	-66.1735°
CORNER B	44.3837°	-66.1654°
CORNER C	44.3766°	-66.1730°
CORNER D	44.3806°	-66.1808°

NOTES:

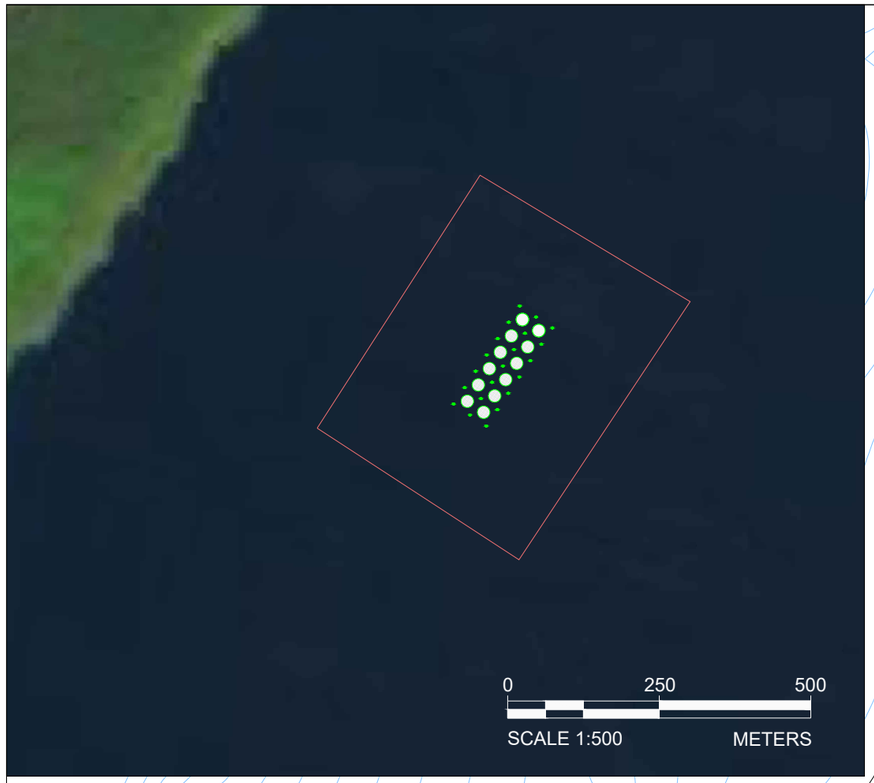
1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 2.24M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 1.43M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 1.49M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.3M/S
5) TIDAL RANGE: 6.3M
6) APPROXIMATE DEPTH AT CENTER OF SITE 43 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 4 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR



CANADIAN SALMON LIMITED

ST. MARY'S BAY
NOVA SCOTIA, CANADA

POTENTIAL SITE 4

FARM FEATURES	ENVIRONMENT FEATURES
FISH NET	BATHYMETRY (METERS)
NET PEN	LEASE BOUNDARY
ADCP LOCATION	DOMINANT CURRENT DIR
SITE CENTER	
COMPENSATOR BUOY	

SITE COORDINATES

POTENTIAL SITE #4

CORNER A	44.3325°	-66.2376°
CORNER B	44.3289°	-66.2288°
CORNER C	44.3211°	-66.2354°
CORNER D	44.3247°	-66.2439°

NOTES:

1) ESTIMATED 1 IN 50 YEAR WAVE CONDITION: Hs= 2.25M
2) ESTIMATED MAXIMUM ANNUAL EBB CURRENT: 2M/S
3) ESTIMATED MAXIMUM ANNUAL FLOOD TIDE CURRENT: 2.49M/S
4) ESTIMATED 1 IN 50 YEAR RETURN PERIOD WIND SPEED: 27.33M/S
5) TIDAL RANGE: 6.8M
6) APPROXIMATE DEPTH AT CENTER OF SITE 43 METERS WITH ORIENTATION OF 34° EAST OF NORTH
7) APPROXIMATE DEPTH OF FISH NET IS 15M
8) GREEN INDICATES OBJECT IS ABOVE THE WATER SURFACE

DSAocean

DRAWING NUMBER: DSA-CSL-22DSV-D02

SHEET 5 OF 5

DRAWN BY: [redacted]
CHECKED BY: [redacted] LAST REVISED: 2022-02-16
APPROVED BY: [redacted] REVISION: C - IFR

STANDARD OPERATING PROCEDURES – FISH HEALTH MANAGEMENT

August 2022

CANADIAN SALMON LIMITED

CONTENTS

Introduction 1

Scope of the Health Plan 1

Main objective: 1

Sub-objectives: 1

Veterinary Supervision and Health Control 1

Potential Diseases, Including Preventive Measures and Disease Relief in Salmon Fish 2

Infectious Pancreas Necrosis ("IPN") 2

Infectious Salmon Anemia ("ISA") 2

ILAV-HPR0 3

Pancreas Disease ("PD") 3

Heart and Skeletal Muscle Inflammation ("HSMB") 3

Cardio-Myopathy Syndrome ("CMS") 3

Classic Vibriosis 4

Cold Water Vibriosis 4

Furunculosis 4

Bacterial Kidney Disease (BKD) 5

Winter Wound ("WW") 5

Wounds Caused by Bacteria Other Than *Moritella viscosa* 5

Yersinia Ruckeri (Red-Mouth Disease) 5

Pasteurellosis 6

Other Bacterial Diseases 6

Amoebic Gill Disease ("AGD") 6

Epitheliocystis – Ca. Branchiomonas cysticola and/or Ca. Piscichlamydia salmonis 6

Desmozoon lepeophtherii (Paranucleospora theridion) - Autumn sickness 7

Salmon Pox 7

Gill damage without finding of amoebas 7

Sea lice 8

Handling injuries 8

1. General Guidelines for Ensuring Biosecurity and Avoiding Disease 10

2. Guidelines for Ensuring Good Fish Welfare* 11

Relevant Drugs* 12
Risk of drug residues in relation to food safety and impact on wild fish in the surrounding area 15
Risk of vaccine tests in relation to food safety (retention period) 15
Contingency plan for slaughter-ready fish when the MRL value has been exceeded 15
Risk of drug residues on the environment: 15
Detergents and Disinfectants 15

Introduction

This document has been prepared to meet the requirements of the Veterinary Health Plan (VHP) related to of the Global G.A.P. At the same time, the purpose is to produce a document that ensures that operations at Canadian Salmon Ltd with regard to fish health and fish welfare are in accordance with relevant Canadian regulations, including the Aquaculture Operations Regulations and internationally applicable standards. However, the main purpose is to establish an active health plan that intervenes in production and changes in line with new priorities and challenges related to the production of salmon in the sea.

Scope of the Health Plan

The health plan applies to Canadian Salmon Ltd's location in Nova Scotia.

The health plan is based on the current regulations that apply within monitoring the health development of aquatic animals. To a large extent, this applies to the national network of laws and regulations related to animal welfare, food production and aquaculture (e.g., DFO and DFA regulations, Code of Practice for the Care and Handling of Farmed Salmonids, etc.), but also to some international standards. This primarily applies to Office International des Epizooties ("OIE")'s Aquatic Animal Health Code (Aquatic Code), which sets standards for improving fish health and fish welfare in farmed fish worldwide through several standards for safe international trade in aquatic animals and their products.

The World Organization for Animal Health (OIE) was created in 1924 and is recognized as a reference organization by the World Trade Organization (WTO).

Main objective:

Mortality shall not exceed 10% of initial smolt release measured from release of smolt into the site until the fish group is delivered for slaughter. All mortality above this level shall be reviewed and explained.

Sub-objectives:

The fish shall at all stages of production in every respect be handled in such way that unnecessary suffering is avoided. The fish shall be farmed in an as optimal environment as possible and be given the highest quality feed that allows it to cope with the situation without an unnecessary risk of illness, malformations or injuries occurring.

Veterinary Supervision and Health Control

The fish health service conducts a minimum of 6 routine visits per year for sites with ordinary operations and 12 routine visits per year for locations with more than 1 million fish or localities in observation zone for ISA. In addition, the DFA veterinarian shall be called upon by an increase in mortality, decreased appetite, or abnormal behavior. This shall be documented by veterinary reports and incidents on the site shall be recorded by the health service.

Health controls include inspection of operating units, autopsy of dead fish and gasping fishes, as well as review of the site's registrations of importance for fish health. Control is risk-based and may include uptake of fish for adverse reaction control, lice counting, gill scores or sampling. The health service has a duty to notify DFA if there is suspicion of mandatory reportable diseases and in case of neglected farming procedures, see also risk assessment of fish diseases and related reporting routines.

Good and adequate communication with the fish health service shall ensure quick access to relevant treatment agents.

Potential Diseases, Including Preventive Measures and Disease Relief in Salmon Fish

Infectious Pancreas Necrosis ("IPN")

IPN is a viral disease that can occur both in freshwater and seawater. The IPN virus is widespread while disease on salmon is rare in Canada after 2010. The company aims not to get clinical IPN on fishes on site.

Symptoms and autopsy findings: Spiral swimming, gasping fish, dizziness, increased mortality, fluid-filled abdomen, small bleeding on blind spots and yellow liver.

Diagnosis: Made based on histological changes and coloring of viruses in tissue sections by use of immunohistochemistry.

Treatment: There is no possibility of drug treatment of the disease. Frequent withdrawal of gasping and dead fish can reduce infection pressure.

Prevention:

- Use of smolt that is genetically resistant to IPN (QTL-IPN)
- Use of smolt vaccinated against IPN
- Avoid triggering causes such as stress and poor smolt quality

Infectious Salmon Anemia ("ISA")

ISA is a viral disease.

Goal: No ISA at the site. The risk of ISA disease outbreak is considered low.

Treatment: No drug treatment.

Symptoms and clinical findings: Dizzy / gasping fish, increased mortality. Classic symptoms are bleeding, dark/black liver and pale anemic gills and heart.

Diagnosis: To be based on histological changes, autopsy findings and detection of viruses by e.g., PCR analysis.

Prevention: High husbandry standards, good infection hygiene, avoid triggering causes such as stress and poor smolt quality.

ILAV-HPR0

ILAV-HPR0 is a non-disease-causing viral disease that in rare cases can develop into the disease-causing and reporting disease (ISA).

Objective: Avoid repeated detections of ILAV-HPR0 in the site. The risk of detection of ILAV- HPR0 is considered medium as the disease is generally common at fish farms.

Treatment: None.

Symptoms and clinical findings: Short-term and transient infection without clear symptoms Diagnosis: detection of viruses by e.g., PCR analysis.

Prevention: Avoid intake of fish with detected HPR0.

Pancreas Disease ("PD")

A viral disease linked to seawater. The risk of the disease is considered medium.

Symptoms: Circulatory disorders, decreased appetite and burning.

Diagnosis: Based on histological changes, autopsy findings and detection of viruses by pcr-analysis.

Treatment: No drugs available for treatment.

Prevention: Intake of smolt that is smolt vaccinated against PD, intake of smolt that is genetically resistant to SAV virus (QTL-PD) and hygienic routines.

Heart and Skeletal Muscle Inflammation ("HSMB")

A disease associated with the PRV virus that is widely found in both healthy and sick fish in the sea.

The risk of detecting the virus is very high, while the risk of outbreaks and mortality of more than 5% is considered small.

Symptoms: moderately increased mortality with autopsy findings such as pale heart and liver.

Diagnosis: Autopsy findings and histopathological changes.

Treatment: None known.

Prevention: None known.

Cardio-Myopathy Syndrome ("CMS")

A viral disease caused by PMC-Virus. The disease can cause large losses over time on slaughter-ready salmon. The risk of outbreaks and mortality of more than 5 % is considered medium.

Symptoms: Moderately increased mortality with autopsy findings such as heart fracture and circulatory failure.

Diagnose: Autopsy findings and histopathological changes.

Treatment: None known.

Prevention: None known, accelerate slaughtering.

Classic Vibriosis

Disease caused by the bacterium *Listonella anguillarum* which is widely distributed in seawater. The bacterium is linked to seawater and the risk of outbreaks is thought to be low. CSL aims not to detect the bacterium.

Symptoms: Increased mortality at water temperature > 10°C, boils, and ulcers, emitting spleen.

Diagnosis: Autopsy findings, histopathology, cultivation of the bacterium.

Treatment: Antibiotic.

Prevention: Intake of smolt that is sting vaccinated against *Listonella anguillarum*.

Cold Water Vibriosis

Disease caused by the bacterium *Vibrio salmonicida* which is widespread in the sea.

The risk of outbreaks is considered low. CSL aims not to detect the bacterium.

Symptoms: Bleeding on internal organs and pale liver. Increased mortality at sea temperature <10° C

Diagnose: Autopsy findings, histopathology, cultivation of the bacterium.

Treatment: Antibiotic.

Prevention: Intake of smolt that is smolt vaccinated against *Vibrio salmonicida*.

Furunculosis

The disease caused by *Aeromonas salmonicida*. In Canada, the disease is linked to seawater and outbreaks are seen at sea temperature above 8 degrees. The risk of detection of Furunculosis is considered low. CSL aims not to get the bacterium detected at the plant.

Symptoms**:** Bloody boils, bleeding, and wounds.

Diagnosis: Autopsy findings, histopathology, cultivation of the bacterium from the kidney.

Treatment: Antibiotic.

Prevention**:** Intake of smolt that is prickly vaccinated with oil-based vaccine against *Aeromonas salmonicida*.

Bacterial Kidney Disease (BKD)

Disease caused by the bacterium *Renibacterium salmoninarum*.

Symptoms: Granulomas in the kidney. Increased mortality.

Diagnosis: Autopsy findings, histopathology, detection of the bacterium by PCR, cultivation or indirect diagnostics.

Treatment: No effective drugs available for treatment.

Prevention: Monitoring of broodstock and hatcheries.

Winter Wound ("WW")

The disease caused by *the bacterium Moritella viscosa*. In Canada, the disease is associated with seawater above 8 degrees. The risk of detection of winter sores is considered medium.

Objective: Mortality not to exceed 0.05% / day due to winter wounds Symptoms**:** Bloody boils, bleeding, and wounds.

Diagnosis: Autopsy findings, histopathology, cultivation of the bacterium from the kidney.

Treatment: Antibiotic.

Prevention**:** Intake of smolt that is sting vaccinated against Moritella viscosa, the use of health foods such as Protec in connection with treatments and treatments.

Wounds Caused by Bacteria Other Than *Moritella viscosa*

Symptoms: Wounds on the muzzle, side, tail, or fins with findings of microorganisms other than the winter ulcer

Diagnosis: Autopsy findings, histopathology, cultivation of the bacterium from the kidney. Relevant bacterial diseases may be *Tenacibaculum sp, Allovibrio sp, Vibrio sp* and more.

Treatment: Antibiotics, health foods.

Prevention: Gentle handling, use of health foods such as Protec in connection with treatments and treatments. Risk of wounds with findings of agents other than the winter sore bacteria are considered medium.

Yersinia Ruckeri (Red-Mouth Disease)

The disease caused by *the bacterium Yersinia ruckeri*. In Canada, the disease is associated with seawater above 8 degrees. The risk of detection of yersiniosis is considered low.

Symptoms**:** Increased mortality at sea temperatures above 8 degrees C. General inflammation with bleeding in the internal organ, eyes, element of heart sac inflammation.

Diagnosis: Autopsy findings, histopathology, detection of the bacterium by cultivation or PCR.

Treatment: Antibiotics in severe cases.

Prevention**:** Vaccinate smolt, reduced stress during any handling.

Pasteurellosis

The disease caused by *the bacterium Pasteurella sp.* In Norway, the disease has appeared at several locations in the sea in recent years. The risk of detection of pasteurellosis is considered medium.

Symptoms**:** General brushy inflammation of the internal organ, eyes and heart sac.

Diagnosis: Autopsy findings, histopathology, detection of the bacterium during cultivation or PCR.

Treatment: Antibiotics in severe cases.

Prevention**:** reduced stress during any handling, infection hygiene.

Other Bacterial Diseases

Diseases caused by other bacteria known from fresh water or marine species.

Symptoms: General sepsis symptoms such as bleeding etc.

Diagnosis: Autopsy findings, histopathology, cultivation of the bacterium, possibly PCR if developed.

Treatment: Will depend on which bacterium is detected.

Prevention: Intake of smolt with systematic health control, internal hygiene rules.

Amoebic Gill Disease ("AGD")

Gill inflammation in the sea caused by a single-celled parasite: *Paramoeba perurans*.

The risk of AGD is greatest in autumn on fish from 100 grams to 1.5 kg and at sea temperature above 8 degrees and salinity above 27 promille. This often occurs simultaneously with other gill diseases.

Symptoms: Gill injuries with white, mucous areas and with the discovery of amoebas. Dull fish when the damage is large.

Diagnosis: Active gill score over 1 on average, detection of amoeba on histology, direct discharge, and PCR.

Treatment: Bath treatment with peroxide or fresh water.

Prevention: Systematic scoring and sampling of gills during risk periods to be able to insert measures early in the course. Risk of AGD is considered high due to high salinity during the risk periods in the autumn.

Epitheliocystis – Ca. Branchiomonas cysticola and/or Ca. Piscichlamydia salmonis

Bacteria encapsulating themselves in gill tissue. The bacteria are widespread in both farmed and wild fish, especially Ca. *Branchiomonas cysticola*. Often occurs simultaneously with other gill diseases.

Symptoms: Lethargic fish when the damage is great.

Diagnosis: Histopathological detection of epitheliocysts and detection of agents by PCR

Treatment: Bath treatment with peroxide or fresh water may help, but there is no evidence of this.

Prevention: Systematic scoring and sampling of gills during risk periods to implement measures early in the course. Risk of outbreaks of epitheliocystis is considered moderate to high because historically there have been recurrent gill disease at the plant.

Desmozoon lepeophtherii (Paranucleospora theridion) - Autumn sickness

Microsporidie found in both sea lice and salmon. Gives rise to infection of gills in salmon and may be spread to other tissues in the salmon subsequently. This often occurs simultaneously with other gill diseases.

Symptoms: Impaired growth, lethargic fish, mucous and uneven gill filaments.

Diagnosis: Histopathological detection of the microsporidi and detection of agents by PCR.

Treatment: Bath treatment with peroxide or fresh water may help, but there is no evidence of this.

Prevention: Systematic scoring and sampling of gills during risk periods to implement any measures early in the course of the course. The risk of outbreaks of epitheliocystis is considered moderate to high because historically there has been recurrent gill disease at the plant.

Salmon Pox

The disease is caused by a smallpox virus (Salmon Gill Pox virus). The disease can cause great mortality, but, as a rule, only in the hatching fish phase. This often occurs simultaneously with other gill diseases.

Symptoms: Difficulty breathing, lethargic fish, decreased appetite.

Diagnosis: Few autopsy findings, detection takes place first and promoted with the detection of agents with PCR, histopathological changes, and immunohistochemistry.

Treatment: None, but stop feeding and oxygenating water can help, avoid stressing the fish.

Prevention: Avoid releasing salmon that are in the break-out of salmon pox. Still lack of basic knowledge to do good enough infection prevention. The risk of outbreaks of salmon pox with associated mortality is considered low because it rarely causes disease in the sea phase, but the detection of viruses can occur, especially in combination with other gill diseases.

Gill damage without finding of amoebas

Symptoms: Gill damage; - acute or chronic.

Treatment: Depending on symptoms and cause, fresh water and peroxide may be relevant.

Prevention: No safe prevention. Risk of gill damage without findings of amoebas is considered high based on experiences in outer coastal areas.

Sea lice

Parasitic crustacean with 6 stages of development on the salmon. The salmon may withstand up to 0.1 lice per gram of fish before the sea lice have welfare effects. The public limit value for sea lice is much lower than this and is justified by the risk of infection pressure.

Symptoms: Sexually mature female lice of *Lepeoptheirus salmonis* above the public boundary level.

Treatment: Bath treatment with peroxide or oral treatment with chitin inhibitors (releeze, ektobann) or Slice (emamectin). The company prioritize the use of non-medicinal methods such as freshwater treatment, thermal treatment, and flushing.

Prevention: The use of cleaner fish including good care of cleaner fish with feeding and hiding, pure nets. Use of skirts. Risk of sea lice is considered medium to large.

Handling injuries

The company expects to have to treat both wellboats and cages. The company will try to avoid any handling at sea temperatures below 4 degrees C. All handling will take place with continuous monitoring.

Objective for farmed salmon:	Sub-objectives	Prevention	Treatment
No outbreaks of bacterial or viral diseases	Furuncolosis: No outbreaks	Vaccinated smolt	According to DFA guidelines
	Cold water vibriosis: No outbreaks	Vaccinated smolt	Antibiotic at strong attacks
	Vibriose: No outbreaks	Vaccinated smolt	Antibiotic at strong attacks
	Winter wounds (WW): No losses due to WW	Vaccinated smolt	Antibiotic at strong attacks
	Pasterurellosis: No outbreaks	Bio security	None
	Epitheliocystis: No outbreaks	Monitoring gill conditions /use functional feed	Eventual freshwater treatment
	Infectious Pancreas Necrosis (IPN): No outbreaks	Vaccinated smolt, broodstock check	None
	Pancreas Disease (PD): No outbreaks	Vaccinated smolt, Screening dead fish, func. feed	None
	Infectious Salmon Anemia (ISA): No outbreaks	High husbandry level, destressing	According to DFA guidelines
	Heart and skeletal muscle inflammation HSMB): Loss not to exceed 0.05% per day	None known	None
	Cardio- myopathy syndrome ("CMS") Loss not to exceed 0.05% per day	None known	Eventual accelerated harvesting
Avoidance of loss due to parasites	Sea lice: No mortality due to sea lice	Use of cleaner fish, frequent net cleaning, close monitoring	Delicing through bathing or oral treatment
	Amoebic gill disease (AGD): No mortality due to AGD	Frequent monitoring & PCR screening	Bathing in freshwater or H2O2 treatment
	Paranucleospora theridion: No loss	Frequent monitoring	Bathing in freshwater or H2O2 treatment
	Eubothrium sp: No loss	Control at 0.5 – 1.0 kgs fish	Consider praziquantel

1. General Guidelines for Ensuring Biosecurity and Avoiding Disease

Sub-objectives	Actions	Reference / procedures	Control
Release of smolt with a low risk of disease.	Close relationship with smolt supplier, secure transport route, vaccinated smolt.	Transport route smolt. Documentation vaccination.	According to standard procedures.
Hygienic routines.	Daily recording and destruction of dead fish. Control of arriving equipment, personnel etc.	SOP for dead fish management.	Dead fish records and control of silage.
Ensure quick action in the event of outbreaks / diseases.	Routine checks of fish health service as well as more frequent visits in case of suspected diseases. Proper use of drugs.	Agreement for Health Control Services. SOP for use and storage of chemicals and pharmaceuticals. Contingency Plan.	Fish health control reports. Dead fish records. Purchase lists and checklists when treating for Diseases.

Other biosecurity: See the company's risk assessment regarding hygiene.

Measures and notification in case of increased mortality and disease outbreaks: Contained in contingency plan.

Routines for the removal of sick and dead fish: Outlined in SOP for dead fish handling.

Parasite control: Counting of lice according to requirements and SOP.

Screening program:

- 20 risk-based sampling for PCR regarding SAV (Pancreas disease) per site and month according to the Regulations on Pancreas Disease.
- If suspected pancreas disease: Sampling of 10 risk-based fish, histology, and PCR. If these are negative, 60 risk-based fish, PCR, per month for 4 months.
- If confirmed diagnosis of Pancreas Disease: no routine screening, except in cases where the law dictates otherwise.

Other sampling will take place risk-based and in accordance with governmental requirements. In the combat & observation zone for ISA: screening according to governmental requirements.

2. Guidelines for Ensuring Good Fish Welfare*

Sub-goals	Action	Reference	Control
Secure sufficient water and oxygen.	Clean nets, oxygenation by bath treatment, starving of fish prior to handling.	SOP for starving fish.	Oxygen measurement during risk periods and during treatment. Production management system.
Prevent damage when handling.	Gentle sedation and handling when lice counting, gill scoring or other observations.	SOP for lice counting, Quality Control System, average weight.	Records, average weights, lice count, gill scoring, etc.
Optimal light regime.	Plan for the use of light in accordance with new knowledge.	SOP for Light Management.	Production management system.
Optimal feed and feeding.	The feed should be adapted to the size and production stage of the fish. Correct feed allocation. Health feed during risk periods cleaner fish to be fed daily.	Feed supplier's recommendation.	Daily inspection of the feeding in each cage. Production management system.
Harvesting.	Fish that are euthanized have enough anesthesia or blows to the head with subsequent bleeding.	SOP for Euthanizing. Contingency plan.	Checklists.
Employee training.	Company internal training program, external courses.	Plan for employee´s increased competence.	Active focus and records of competence building.

*Also in accordance with The Code of Practice for the Care and Handling of Farmed Salmonids.

Relevant Drugs*

Product Name	Active substance	Indication / Administration metod	Dosage	Supplier	Withholding time (dgr = 24/7)	MRL
Benzoak	Benzocaine 200 mg/ml	Anesthesia / bath	Temperature dependent and depending on the desired depth of anesthesia. 15-20 ml / 100 liters of water	ACD Pharmaceuti cals AS	7 dgr	0*1
Benzorion	Benzocaine 200 mg/ml	Anesthesia / bath	Temperature dependent and depending on the desired depth of anesthesia. 15-20 ml / 100 liters of water	Orion Corporation	7 dgr	0*1
Optomease	Benzocaine 200 mg/ml	Anesthesia / bath	Temperature dependent and depending on the desired depth of anesthesia. 15-20 ml / 100 liters of water	Virbac	7 dgr	0*1
Finquel	1000 mg/g trikainmeilat	Anesthesia / bath	Temperature dependent and depending on the desired depth of anesthesia. 15-135 mg/litre	MSD Animal Health	25 dgr	0*1
Tricain	1000 mg/g trikainmeilat	Anesthesia / bath	Temperature dependent and depending on the desired depth of anesthesia. 15-135 mg/litre	Pharmaq	70 dgr	0*1
Nytox	1000 mg/g trikainmeilat	Anesthesia / bath	Temperature dependent and depending on the desired depth of anesthesia. 15-135 mg/litre	NAqua Limited	70 dgr	0*1
Floraqpharm a vet.*3	Florfenicol 2g/kg (Antibiotic)	Bacterial infections / oral (medicine pellet)	10 mg per kg of fish daily for 10 days	Squeezing	150 dgr*2	1mg/kg
Slice	Emamectin-benzoate2g/kg (0.2%) (Avermectins)	Sea lice (Lepeophtheirus salmonis) and scotch lice (Caligus spp.) / oral (medicine pellet)	50 µg/kg fish daily for 7 days	MSD Animal Health	175 dgr 500 dgr wood increased	0.1 mg/kg

					dose *2	
ALPHA MAX	Deltamethrin 10 mg/ml	Sea Lice bath	0,2 ml per m3 sea water, 30 min.	Pharmaq	5 dgr > 10 dgr (double dose)	0*1
Azasure	Azamethos 500 mg/g (Organophospha te	Sea Lice bath	0.2 g powder perm3 (1000 liters) of water (0.1 ppm azametifos) for 30 to 60 min.	Ground Animal Health Ltd.	10 dgr >20 dgr at double dose	0*1
Salmon-san	Azamethos 500 mg/g (Organopho-sphate)	Sea lice (Lepeophtheirus salmonis) / bath	0.2 g powder perm3 (1000 liters) of water (0.1 ppm azametifos) for 30 to 60 min.	FVG Limited	10 dgr >20 dgr at double dose, checked with residual concentrate	0*1
Ectosan	Imidacloprid 1000mg/g (neonicotinoid)	Sea lice (Lepeophtheirus salmonis) / bath	20 mg per liter of seawater. Duration of treatment 60 minutes.	Benchmark Animal Health	98 degrees. checked for residual concentrate	0.6mg/kg
Releeze	Diflubenzuron 0.6g/kg (Kitin inhibitor)	Sea lice (Lepeophtheirus salmonis) / oral (medicine pellet)	3-6 mg per kg of fish daily for 14 days	EWOS AS	**Fillet samples for residual concentration in muscle.**	0.01mg/kg
Ektobann	Teflubenzuron 2g/kg (Chitin inhibitor)	Sea lice (Lepeophtheirus salmonis) / oral (medicine pellet)	10 mg per kg of fish for 7 days	Squeezing	96 dgr*2,500 dgr using a consensus other than 2 g/kg	0.5mg/kg

Paramove	H_2O_2 (hydrogen peroxide) 495 mg/g	Sea lice (Lepeophtheirus salmonis) and scotch lice (Caligus spp.) (and AGD - Paramoeba perurans) / bathroom	Varies with temperature, approx. 1500 mg/l hydrogen peroxide	Solvay Chemical International. S. A.	0	0*1
Nemona	H_2O_2 (hydrogen peroxide) 495 mg/g	Sea lice (Lepeophtheirus salmonis) and scotch lice (Caligus spp.) (and AGD - Paramoeba perurans) / bathroom	Varies with temperature, approx. 1500 mg/l hydrogen peroxide	Nouryon Pulp and Performance Chemicals AB	0	0*1
Hydrogen peroxide	H_2O_2 (hydrogen peroxide) 495 mg/g	Sea lice (Lepeophtheirus salmonis) and scotch lice (Caligus spp.) (and AGD - Paramoeba perurans) / bathroom	Varies with temperature, approx. 1500 mg/l hydrogen peroxide	Chemco	0	0*1
Hydrogen peroxide Helm	H_2O_2 (hydrogen peroxide) 495 mg/g	Sea lice (Lepeophtheirus salmonis) and scotch lice (Caligus spp.) (and AGD - Paramoeba perurans) / bathroom	Varies with temperature, approx. 1500 mg/l hydrogen peroxide	Helm Scandinavian AS	0	0*1

*List of drugs and use to be discussed with DFA veterinarian.

*[1] = Not necessary in accordance with regulation.

*[2] = Storage time before slaughter begins only when remnants of medicated feed have been removed from the feeding plant and ordinary feed has been used to clean out the remnants of medicinal feed from the feeding system.

*[3] = When using antibiotics, the prescription director fish health personnel shall provide a written justification in each case.

Risk of drug residues in relation to food safety and impact on wild fish in the surrounding area

Very low risk due to the following factors:

- Fishing is prohibited closer than 100 meters from the site
- The plant is marked with "medication in progress" as long as the retention period runs
- Wild fish will always receive lower doses of the drug than farmed fish
- Treatment with feed always involves restrictive feeding

Risk of vaccine tests in relation to food safety (retention period)

Not applicable as there is no retention period on vaccines.

Contingency plan for slaughter-ready fish when the MRL value has been exceeded

- Always check the detention time before slaughter.
- If the withholding period has not been met, the DFA and Canadian Food Inspection Agency shall be contacted and decide on measures.

Plan to avoid resistance: Control of sensitivity before use, low consumption of drugs.

Antibiotic use: Should be avoided as far as possible and always considered against human health, i.e., avoid using antibiotics that are important for the treatment of humans.

Risk of drug residues on the environment:

Low risk due to low consumption. Investigated indirectly by B and C surveys at the site

Detergents and Disinfectants

Detergent / disinfectant	Area of use	Proportions	Working time
Detergent			
Foam 22	Washing equipment	2-5%	15-20 mins
Foam 30	Washing equipment	1-5%	15-20 mins
Power wash	Washing equipment	1:20	3-5 mins
Disinfectants			
Sodium hypochlorite	Disinfection of equipment	0.3-0.5 dl per 10 l of water	5-15 mins
Perfectoxid	Disinfection of equipment	1%	30 mins

STANDARD OPERATING PROCEDURES – DELICING

August 2022

CANADIAN SALMON LIMITED

CONTENTS

Introduction 1
- Purpose 1
- Responsibility & Empowerment 1
  - Operation Manager 1
  - Site Manager 1
  - Employees 1
  - Quality coordinator 1
- Requirements 1
- Definition 1

Implementation 1
  - Equipment & Updates to be Made Available in Advance 1
- General Guidelines 2
  - Before Delicing 2
  - During Delicing 2
  - After Delicing 2
  - Increased Mortality 3
- Use of Closed Tarpaulin 3
- Delicing by Use of Wellboat Including Fresh and Hot Water Treatment 3
- Delicing by Use of Hot Water 4
  - Delicing at Cage 4
  - Delicing at Small Steel Cages (25m x 25m, 20m x 32m, etc.) 5
  - Delicing at Large Steel Cages (+40m x +40m) 5
- Logging of Canceled or Not Started Treatment 5
- Cancelation and/or Not Completed Treatment Criteria 6

Deviation 6

Introduction

Purpose

Remove all sea lice from the fish, avoid injuries and death, minimize stress and avoid escape. Record reasons why delicing has not started in accordance with internal procedures. Secure correct notification of increased fish mortality. Delicing procedures will follow NS regulations and that which is stated in Canadian Salmon Ltd Farm Management Plan.

Responsibility & Empowerment

Operation Manager

- Has the overall responsibility.

Site Manager

- Responsible for ensuring that the site is operated according to the procedure and that established operational guidelines are followed by site employees.

Employees

- Responsible for following the established procedures.
- Participate in efforts to ensure that correct reporting in accordance with the procedure.

Quality coordinator

- Responsible for ensuring the procedure follows Canadian Salmon Limited guidelines and is documented.

Requirements

- Treat the fish in a responsible and required manner according to SOPs, to avoid damages of fish, environment, personal and equipment.

Definition

- Day-degrees: Number of Celsius-degrees times number of days.
- Delicer: Vessel / barge especially equipped for delicing.
- Doughnut: Plastic ring for net handling in connection with delicing.
- Floater: Floating equipment for delicing purse seine net / collection net.
- Cuttingrope: Rope to position the pearl-ribbons for concentration of salmon for delicing / harvest.

Implementation

Equipment & Updates to be Made Available in Advance

- Ropes
- Pearl-ribbons
- Lice counting equipment
- Oxygen
- Oxygen meter
- Purse seine (if used)

- Power block
- Anesthetic agent
- Doughnut (if used)
- Personnel
- Weather review
- Current characteristics
- Update on general biomass condition
- Updated veterinarian risk assessment

General Guidelines

Before Delicing

- Consider a risk assessment from fish veterinarian on treatment to be performed.
- Starvation for fish for treatment, 20 – 25 day-degrees recommended for intestine to be free of feed with reduced level of enzymes and bacteria.
- All equipment related to the cage such as deadfish equipment, feeding components, cameras, bird nets, etc., that may conflict with the operation shall be moved away.
- The net to be made ready for reducing net-volume, sinking weights removed.
- Slack net to be tightened to avoid fish traps in the net.
- Tighten all ropes to the net bottom.
- Pearl-ribbon to be made operational.
- Final check for verification of current to be within acceptable level. If not delay the complete operation, all equipment to be returned to normal operational positions/status.

During Delicing

- Counting of sea lice on fish according to SOP for **Counting and Reporting Sea Lice** during pumping fish back into cages, to evaluate the effectiveness of the delicing treatment and assess whether adjustments are needed.
- Register general fish welfare conditions during and after the treatment, ref. following guidelines from our Norwegian partners:
    - *NOFIMA_VELFERDSINDIKATOR_V1.1*
    - *Lice counting and gill score form*
- If increased mortality or extraordinary damages on fish are detected, notification to the DFA will be carried out in accordance with the guidelines for reporting obligations if fish injury or mortality occurs during treatment.
    - Limit-value for notifying increased mortality during delicing is 0.5% per cage.
    - Notification to DFA shall include name of the site, a specific case-number to be included when achieved.
    - Mortality until 5 days after the delicing process to be classified as mortality during delicing.

After Delicing

Waste and used / unused materials

All waste and other delicing equipment / materials used or unused (e.g., cutting ropes, small boats, hooks, pearl ribbons, etc.) to be collected and stored adequately.

Increased Mortality

- Timely reporting to according to SOP.
- The delicing action also to be registered as a nonconformity, in accordance with the DFA guidelines.
- The completed nonconformance form (part 1 and part 2) to be sent to DFA.
- Any measures, test results, visitor reports from fish health / veterinarian services and evaluation forms etc. also to be sent to DFA.

In case of drug treatment

The treatment shall be evaluated using specific evaluation form to be sent to fish health services for comment before sending to DFA.

In case of treatment without use of drugs

The treatment to be evaluated using specific evaluation form if required by DFA. The treatment shall in case be evaluated using specific evaluation form to be sent to fish health services for comment before sending to DFA.

Use of Closed Tarpaulin

- Equipment for adding oxygen to be made ready for use.
- Install tarpaulin by crane from workboat.
- Oxygen to be added.
- Attach ropes to the tarpaulin and tighten ropes to the opposite side. It is important that the tarpaulin is allowed to sink well under the net. Then winch the tarpaulin under the net and on to opposite side of net. All ropes to be identical knotted/fastened.
- Check current to be within acceptable level. If current turns out to be too strong, operation to be canceled and all equipment/handling returned to normal status for awaiting acceptable current conditions.
- When the tarpaulin is adequately tightened, treatment drugs to be added, timer to be started when adequate drug concentration is achieved.
- Continuous measuring and reading of oxygen level.
- After the completion of the delicing process, ref. Section 12 of the Regulations "Treatment procedure for the actual delicing agent", release the tarpaulin and pull it back into the workboat. Important to release rope by rope to avoid overload on a single rope.

Delicing by Use of Wellboat Including Fresh and Hot Water Treatment

- For possible sedation, an appropriate anesthetic may be used under guidance of a DFA veterinarian.
- Check the arriving route of the wellboat to ensure it is not arriving from areas containing infected fish.
- Arrival of wellboat to the site to follow SOP for boat arrivals.
- Check the freight- and disinfection log on the wellboat.
- Make sure that the anchor lines for the actual cage are stretched and that the net is adequately prepared and positioned on the loading side.
- Loading by fishpump or natural elevation method, check equipment for functionality

- Fish to be counted at loading.
- Treated fish to be off-loaded into the cage.

Delicing by Use of Hot Water

- Recommended temperature for delicing using hot water is the actual seawater temperature plus 20-22° Celsius, up to 34° Celsius.
- Check that delicing equipment is properly cleaned/disinfected from previous treatments.
- Delicing to be canceled if sick / infected fish have recently been treated.
- Arrival of delicer boat/barge to the site to follow SOP for boat arrivals.
- Make sure that the anchor lines for the actual cage are stretched and that the net is adequately prepared and positioned on the loading side.
- Position the delicer for loading and unloading (any return hose must reach behind the pearl-ribbon, or to a new cage). Secure satisfactory deep around the outlet on the return hose.
- Check current to be within acceptable level. If current turns out to be too strong, operation to be canceled and all equipment/handling returned to normal status for awaiting acceptable current conditions.
- Fish treated with hot water treatment are pumped through the delicing system and back into cages.

Delicing at Cage

- Position delicer adequately and make small boats available.
- If needed arrange weights at the pump intake to control deep of the net.
- When using some particular nets, a doughnut can be used for easier net control.
    - Arrange the doughnut into the net and prepare the net to be hauled through it.
    - Pull the bottom ropes through the doughnut and fasten the ropes in the railings on the opposite side of where the delicer is located.
    - Fasten the doughnut to the lower part of the railing and make sure that the rope is fastened in such a way that the rope does not slip upwards on the railing.
    - Apply 2 strong ropes to fasten the doughnut, where each rope shall be fastened in the railing on each side of the delicer, so that the doughnut stayed roughly in the middle of the cage when started pulling the bottom ropes.
    - All ropes to be fastened identically and made easy to release.
    - Jump-net to be partly released.
- Pull the pearl-ribbon gently against delicer. When using doughnuts, stop pulling before the doughnut to get nets and doughnuts over pearl-ribbons before continuing to pull.
- Oxygen level to be measured continuously and oxygen added if necessary.
- Arrange return hose on the back side of the pearl-ribbon.
- Arrange a workboat alongside the delicer, stretch up a rope between the boats which is attached to the purse seine net and winch the purse seine from one boat to the

other.
    - Attach a rope to the top and a rope in the middle of the purse seine and through a block or similar in the crane.
    - The purse line shall preferably be handled by a separate winch.
- Perform fish collection by use of the purse seine until it is recommendable to use the pearl- ribbon for remaining fish.
- When the treatment has been completed, release the net, insert the Lift-Up and arrange weights.

Delicing at Small Steel Cages (25m x 25m, 20m x 32m, etc.)

- Accept delicer.
- If needed arrange weights at the pump intake to control deep of the net.
- Pull the pearl-ribbon gently against delicer.
- Oxygen level to be measured continuously and oxygen added if necessary.
- Arrange return hose on the back side of the pearl-ribbon.
- Pump the fish through delicer.
- Count sea lices at loading.
- Make adjustments as needed.
- When the treatment has been completed, release the net, insert the Lift-Up and arrange weights.

Delicing at Large Steel Cages (+40m x +40m)

- Purse seine net to be made ready and position opposite the delicer in reasonable time before arrival of delicer.
- Hang up the floating devices of the purse seine.
- Pull the pursing line towards the delicer location without tightening.
- Advise delicer for mooring on location
- Pull the pearl-ribbon towards the delicer.
- Arrange return hose on the back side of the pearl-ribbon.
- If needed arrange weights at the pump intake to control deep of the net.
- Oxygen level to be measured continuously and oxygen added if necessary.
- Perform fish collection by use of the purse seine.
- If several collections are needed, move the net back to starting position and start the collection routines over again.
- Count sea lice at loading.
- Make adjustments as needed.
- When the treatment has been completed, release the net, insert the Lift-Up and arrange weights.

Logging of Canceled or Not Started Treatment

- If it turns out that no delicing has been implemented before it reaches statutory limit values (e.g., see below), started delicing process has been canceled implicating that statutory limit values will be exceeded, a cancelation form must be completed and the reasons for no start / cancelation of delicing to be logged. Procedures also described in SOP for counting and reporting of sea lice.

- The cancelation form must be completed each day that the limit values are exceeded and delicing process has not been possible to complete.
- The form shall include actual date, site name, reasons for aborting or not starting delicing and a detailed description of the incident.

Cancelation and/or Not Completed Treatment Criteria

Description of criteria that may result in cancelation and/or not completed delicing process:

- Weather conditions, too strong wind, too strong current or too large waves related to the site.
- Too low oxygen levels:
    - In the sea (< 65%)
    - In wellboat, to be continuously measured
- Abnormal fish behavior before, during or after treatment related to the general fish health condition:
    - Too many inactive, floating fishes
    - Too many gasping fishes
    - Abnormal changes in behavior during treatment
    - Too many inactive, floating fishes after returning to cage
    - Unexpected stop or failures on delicing equipment
    - Too long concentration time
        - Global GAP requires max. 2 hours concentration time.

Deviation

Increased abnormal mortality shall be reported to DFA and nonconformity treatment to be handled as major deviation.

STANDARD OPERATING PROCEDURES – COUNTING AND REPORTING OF SEA LICE

August 2022

CANADIAN SALMON LIMITED

CONTENTS

Introduction 1
- Purpose 1
- Scope 1
- Responsibility & Empowerment 1
  - Managing Director 1
  - Operations Manager 1
  - Site Manager 1
  - Employees 2
  - Quality coordinator 2
- Requirements 2

Implementation 2
- Counting of Sea Lice 2
- Life Stages of Salmon Lice 2
- Development Interval for Sea Lice 3
- Time Schedule for Counting of Sea Lice 4
- Reporting of Sea Lice 4
- Assessment and Implementation of Measures to Remove Sea Lice 4
- When Exceeding Locality Limit Values 5

Deviation 5

Introduction

Purpose

Knowing the status of the farm in terms of the occurrence of sea lice distributed in the stages of fixed lice, movable lice, and adult female lice.

Knowing the status of lice in the farm is crucial to be able to assess which measures should be implemented, when they should be inserted, and to be able to coordinate measures in a zone or in an area.

This knowledge is the starting point, not only to be able to control and limit lice levels, and to ensure good fish welfare and good slaughter quality in own facilities, but also to reduce infection to wild salmon fish, to own facilities and to nearby facilities with salmon fish.

Proper counting of sea lice before and after treatment is a prerequisite for assessing the effect of implemented measures.

This guideline ensures that the provisions and intentions of lice regulations can be safeguarded in a good way.

This SOP follows section 9 on 'Fish Health' in the Nova Scotia Aquaculture Management Regulations.

Scope

This SOP is concerning all counting and reporting of sea lice in Nova Scotia for Canadian Salmon Limited.

Responsibility & Empowerment

Managing Director

- Has the overall responsibility.

Operations Manager

- Is responsible for ensuring that reporting is completed every week to the director and that counts are then reported to the NS Department of Fisheries and Aquaculture (DFA) as required by regulation.

Site Manager

- Is responsible for ensuring that counting, registration, and reporting are carried out every week.
- In case of their absence from the site, Site Manager is responsible for ensuring that this point is carried out by a superior officer according to description during implementation.
- Responsible for overall compliance with this SOP and that the procedure works appropriately.

Employees

- Responsible for carrying out tasks and reporting according to what is described.

Quality coordinator

- Responsible for keeping the procedure updated in EQS Quality system.

Requirements

- Reporting of number of sea lice on fish shall be reported to DFA as required. Reporting is due to take place no later than Tuesday in the following week.
- Routine reporting of sea lice will be followed according to DFA guidelines and recommendations.
- Measures to eliminate / reduce number of sea lice attached to salmon, must be implemented before the number reaches the limit values.

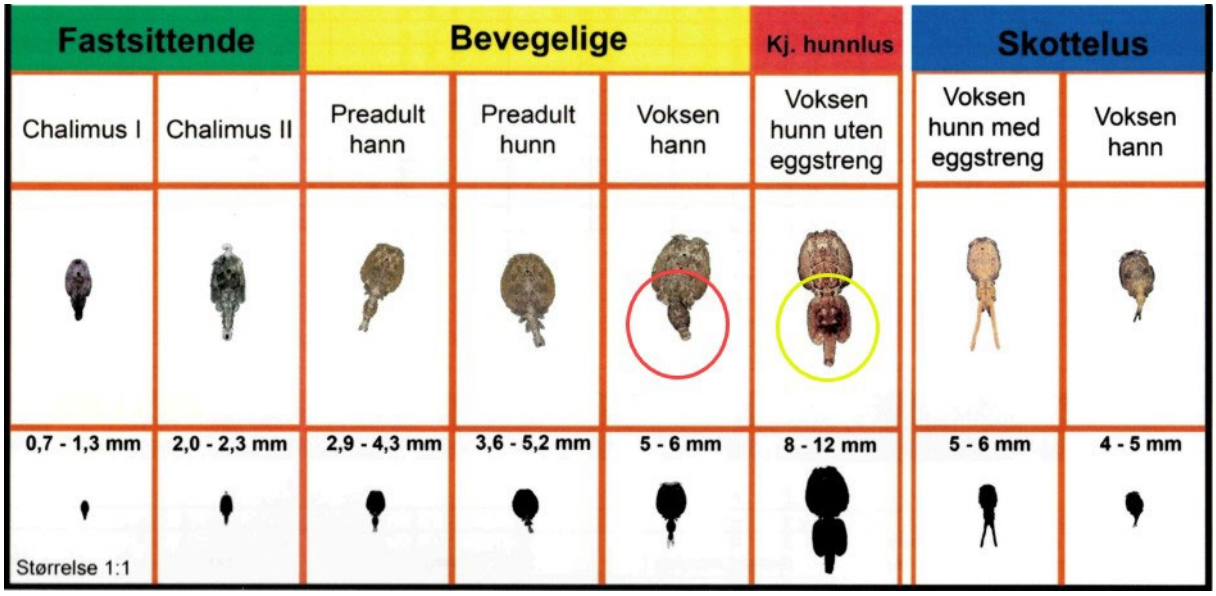
Implementation

Counting of Sea Lice

Counting of sea lice shall follow the industry guidelines for the counting of sea lice, for example, the Norwegian guidelines which can be found here: (http://lusedata.no). Counting, reporting counts, and compliance with regulation on management will be done in consultation with the DFA to follow public reporting requirements.

Life Stages of Salmon Lice

Most important source to visually distinguish male sea lice (red ring) from female sea lice (yellow ring) is the shape of the back of the lice, as well as the size difference. The following diagram has been adapted from our Norwegian partner's sea lice counting SOP.



Source: Marine Health

Development Interval for Sea Lice

The table below shows the number of days from infestation to 85% or more lice have evolved to the relevant stage. Implication of this is that already before the number of days described below, occurrence of sea lice at a given stage, will materialize (up to 85%). The following table has been adapted from our Norwegian partner's sea lice counting SOP:

	Temperatur (°C)																	
Hanner	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Chalimus 1	23	17	14	11	9	8	7	6	5	4	4	4	3	3	3	2	2	2	2
Skallskifte	40	30	24	19	16	13	12	10	9	8	7	6	6	5	5	4	4	4	3
Chalimus 2	46	34	27	22	18	15	13	11	10	9	8	7	6	6	5	5	5	4	4
Skallskifte	63	47	37	30	25	21	18	16	14	12	11	10	9	8	7	7	6	6	5
Preadult 1	69	52	40	33	27	23	20	17	15	13	12	11	10	9	8	7	7	6	6
Skallskifte	82	62	48	39	33	28	24	21	18	16	14	13	12	11	10	9	8	8	7
Preadult 2	92	69	54	44	36	31	26	23	20	18	16	14	13	12	11	10	9	8	8
Skallskifte	102	77	60	49	40	34	29	25	22	20	18	16	14	13	12	11	10	9	9
Voksen	115	86	67	55	45	38	33	29	25	22	20	18	16	15	13	12	11	10	10

Hunner	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Chalimus 1	24	18	14	11	9	8	7	6	5	5	4	4	3	3	3	3	2	2	2
Skallskifte	43	32	25	20	17	14	12	11	9	8	7	7	6	6	5	5	4	4	4
Chalimus 2	54	39	31	25	21	17	15	13	12	10	9	8	8	7	6	6	5	5	5
Skallskifte	72	53	41	33	27	23	20	17	15	14	12	11	10	9	8	8	7	7	6
Preadult 1	84	61	48	38	32	27	23	20	18	16	14	13	12	11	10	9	8	8	7
Skallskifte	99	72	56	45	38	32	27	24	21	19	17	15	14	13	12	11	10	9	8
Preadult 2	114	83	65	52	43	37	32	28	24	22	19	17	16	14	13	12	11	10	10
Skallskifte	133	98	76	61	51	43	37	32	28	25	23	20	19	17	15	14	13	12	11
Voksen	150	110	85	69	57	48	41	36	32	28	25	23	21	19	17	16	15	14	13
Første egg	195	142	111	89	74	63	54	47	41	37	33	30	27	25	23	21	19	18	17
Dager mellom egg	37	27	21	17	14	12	10	9	8	7	6	6	5	5	4	4	4	3	3

Source: Institute of Marine Research

Time Schedule for Counting of Sea Lice

- Counting of sea lice shall primarily take place on Monday for reporting the coming week.
    - Example: Counting of sea lice Monday week 1 -> reporting Monday / Tuesday week 2, etc.
- Exceptions: If working conditions prevent counting on the scheduled day, the counting has to be performed the first possible day thereafter.

Reporting of Sea Lice

1. Counting of sea lice shall always follow the reviewed and approved procedure which is a part of the plan for sea lice control. Canadian Salmon Ltd will work with DFA on reporting requirements and the SOP will be updated accordingly.
2. Number of sea lice shall be reported internally and as required by the DFA. This reporting schedule continues until the sites are emptied of fish. There shall also be a performed counting and reporting of sea lice during slaughter periods, except if the site is completely slaughtered out within 14 days after the counting should have been carried out.

Site Manager is responsible for the counting of sea lice and reporting the counts internally and externally. If Site Manager is prevented from reporting of sea lice counts, this reporting shall be completed by the Operations Manager or Managing director. The reporting responsibility to be agreed between Site Manager, Operations Manager and Managing Director in advance and approved by CEO to avoid any failure in required reporting.

Assessment and Implementation of Measures to Remove Sea Lice

Measures to remove sea lice on the salmon shall be assessed before the number of sea lice reach the limit values defined below:

- From **Monday in week 16 to Sunday in week 21**:
    - Measures to be considered if number of adult female sea lice exceeds 0.05 on average per fish in the site.
    - Measures to be Implemented if number of adult female sea lice exceeds 0.15 on average per fish in the plant.
- From **Monday in week 22 to Sunday in week 15**:
    - Measures to be considered if number of adult female sea lice exceeds 0.25 on average per fish in the site.
    - Measures to be Implemented if number of adult female sea lice exceeds 0.40 on average per fish in the plant.

In addition, and as a more practical guideline, measures shall be taken to treat individual cages approximately at the time of estimation/or via counting finds sea lice to develop sexually maturity or if a larger increase of attached / movable sea lice to keep in-site infection risk as low as possible at any time. If the number of movable sea lice exceeds approximately 2.5 pc per fish, even if sexually maturity is not detected when counting, measures shall be taken as soon as possible. This means measures shall be planned approximately 1-2 weeks ahead of the actual need for delicing

according to SOP, also to be prepared for challenges due to bad weather etc. The limit values stated above are still in full force.

When Exceeding Locality Limit Values

Managing Director to report and log the incident and its underlying reasons to the DFA.

Deviation

Any deviation from this SOP to be in consultation with the DFA.

CANADIAN SALMON LIMITED

September 16, 2022

Shelley VanBuskirk-Spears
Licensing Coordinator
Nova Scotia Fisheries and Aquaculture
1575 Lake Road
Shelburne, Nova Scotia
B0T 1W0

RE: New Marine Finfish Aquaculture application - AQ#1449, 1450, 1451, 1452, - St. Mary's Bay, Digby County, N.S. - Additional Information Required

Dear Shelley,

I refer to your August 17th, 2022, request for additional information related to our license application for marine finfish development in St. Mary's Bay – AQ# 1449, 1450, 1451, 1452.

By way of background, as part of the initial and ongoing outreach and engagement process related to our license application, beyond public engagement, CSL officials have conducted extensive targeted outreach to the following:

- Fish processers in the area including virtually all the processors on both sides of St. Mary's Bay and some beyond, including DB Kenney, O'Neil/Scotia Harvest, Comeau's Seafoods, Synergy Seafoods.
- Potential supply chain partners related to everything from vessel construction/leasing, equipment suppliers, transportation services, workforce supply and innovation partners, among others.
- Potential smolt/post smolt partnership arrangements and/or interested parties for facility investment.

Through this ongoing outreach, it is noteworthy to report that CSL's plans have uniformly been enthusiastically endorsed by suppliers generally. There is both interest and excitement as these potential partners and collaborators fully understand the significant economic development potential of these investments and the associated local economic benefits as outlined in the CSL business plan included in the application document (Appendix B). However, without the license applications approved, CSL is, understandably, not in a position to consummate final agreements with various suppliers and potential partners. These discussions are contingent on

acquisition of the license and, further, are necessarily commercially confidential. Though some of these potential partnerships are underpinned by informal agreements/letters of intent, we are not a in a position to release more specific information on these arrangements at this time as it would potentially erode our competitive position and impact our ultimate negotiations and necessary contingencies that must be applied to discussions of this nature and complexity.

This engagement with potential suppliers, partners and collaborators is ongoing in anticipation of our license operations being approved.

The information noted below mirrors the sequence of information requests as outlined in your letter of August 17.

1. **Identification of wharf or wharves we intend to use for this development –** Our application fully documents Private and Public Wharves & Anchorages (Section 5.1.8, Pg. 107), as well as Harbour Authorities (Table 22, Pg. 107-108) around St. Mary's Bay. We have visited all these sites. Beyond these, we have also visited and inventoried assets in other locales, e.g., Yarmouth area for docking larger vessels such as well-boats. Ultimately, where we locate and which wharves or access points we may use will depend entirely on finalizing interim and/or longer term cost-competitive arrangements with a processor(s), proximity with efficient transportation networks and the extent and size of vessels we're using. Ordinary utility vessels being used at the farm site could easily use several of the existing wharves; larger vessels may need to transit to a different port with appropriate infrastructure. As our operations grow and scale, these arrangements will inevitably evolve. We are prepared to build new wharf facilities as well, should we not be successful in finding existing usable wharfs and facilities.

2. **Fisheries and Oceans supplementary information**
    a. **Specific dates for Construction Phase, Operations Phase and Decommissioning Phase** –
        - **Construction phase** – This will entail the construction, assembly and installation of the seawater farming equipment at the first site. It will be procured through a turn-key purchase agreement with AKVA group ASA ("AKVA"), the global leading supplier of fish farming equipment. The executed purchase order for delivery of the first site will be agreed upon as soon as the license has been granted.
        - The installation of the first site (estimated start time of May 2023) will follow the following overall plan / time schedule as follows:
            - Construction of PEH-cages will be assembled, towed to the site and anchored by AKVA in cooperation with a local supplier. The estimated time of construction, including final anchoring, is expected to be 4 – 5 months from final order.

- Deliveries and installation of other necessary farming equipment will be undertaken during the first 5 months.
- The first site will be completed through the installation of a feed- and service barge constructed by AKVA, towed to site and anchored by AKVA´s specialized team within 9 months from the first purchase order.
- Construction of remaining sites will follow similar schedules as above, starting approximately one year later to some degree depending on agreed time schedule for deliveries of 2024-generation smolts.

- **Operations phase -** Operations to start in the Spring of 2023 after installation of the first site has been finalized. Stocking will be 2023-generation smolts. Operations on remaining sites will start in 2024 after installation of sites has been finalized and by stocking of 2024-generation smolts.
- **Decommissioning phase** – If/when the need for decommissioning arises, it will be organized in accordance with the following plan:
  - Smaller equipment would be loaded on a cargo ship for transportation to new site if relevant / or for temporary stocking in Norway.
  - PEH-cages to be disassembled at site for onloading to a cargo ship for transportation to an agreed location for reassembling for use on new site.
  - Feed-/service barge to be towed to any new site in Canada or abroad.
  - Working boats to be moved to a new site in Canada or abroad.

All equipment will be cleaned and disinfected before shipment in accordance with global best practices.

b. **Details related to various service requirements during each of these three time frames** – this section of the request for additional information in the August 17th letter relates to a broad range of questions on everything from slip usage through to hoist usage and asks of information on how CSL will address parking, lay down areas, waste disposal, water supply, berthage and fuel requirements related to each of these time frames.

As noted above, the CSL Team has extensively researched all these areas as qualifiers for site selection options post license acquisition. There are other matters which we've included in this qualification process which go beyond these

and include transportation considerations, optimal proximity to required supply chain partners, potential synergies with similar operations, demonstrated community interest in hosting such developments and smolt/post smolt supply, among other factors.

Prominent among site selection criteria from CSL's perspective and considering our parent company's deep commitment to ESG (environmental, social and governance) reporting and GHG reductions, we are also very interested in understanding the potential innovation quotient in these site options; for example, the interest/opportunity for developments such as fleet electrification and use of renewable energy to support operations.

Also, as noted above, these discussions are ongoing with a number of potential partners and communities in a competitive context. We continue to undertake options analysis on the most efficient, cost effective and synergistic opportunities. At this stage, as noted, these discussions are proprietary and commercially confidential. That said, as an important proxy indicator, the site(s) for which CSL is seeking a license is in an area of the province which has one of the most extensive fisheries support ecosystems from both a vertical and horizontal integration perspective. In this context, we are robustly confident in being able to bring these discussions to a mutually satisfactory conclusion with all partners upon acquisition of the license.

3. **Section 2.1: Production Plan –** We appreciate your guidance respecting adjustments to the fallowing schedule within the production plan, aligned with the Farm Management plan. We have adjusted the production plan (attached) with fallowing between generations on each site. This has not resulted in production volumes being significantly changed. We will naturally collaborate with other producers on the bay to develop a joint production plan in the bay. Upon issuance of licenses, and as our operation grows and scales, we will work with other providers to prepare and implement a joint production plan. If it is not possible to agree on such a plan among the parties, as an alternative, we will revise the production plan in accordance with fallowing requirements in collaboration with Departmental officials again with these activities reflected in and managed through the Farm Management Plan and Environmental Monitoring Program.

4. **Section 8: The Number and Productivity of Other Aquaculture Sites in Public Waters Surrounding the Proposed Aquaculture Location –** Addressing the measurements in Section 8 of the licensing document, we provide an updated table containing measurements between each of the four proposed sites, AQ#1449, AQ#1450, AQ#1451, and AQ#1452 and other nearby aquaculture activity.

Distances included in the initial licensing application were measured using the centre point of proposed site AQ#1451. Updated measurements for all four sites to surrounding aquaculture activity have now been recorded and may be viewed in Table 2 of the PDF attachment *DSA-CSL-22NOVA-M01-RevA.0 -- Additional Information for St. Mary's Bay*. Additional data on distance between sites is available subject to further discussion with DSA Ocean.

Canadian Salmon Limited is committed to ensuring that operations have minimal impact on surrounding activity – recreational, commercial, and aquaculture related. For this reason, CSL will maintain a healthy distance between its aquaculture sites and nearby activity, which will continue to exceed minimum distances maintained in other similar jurisdictions. Though Nova Scotia does not regulate the distance between boundaries, CSL is confident it can maintain ~2 km separation between site boundaries (see proposed medication to our original application document below).

As noted in your letter dated August 17th, nearby land-based site AQ#0999 is approximately 1.8 km from our proposed site AQ#1449. Though this is below our target minimum distance of ~2 km, considering the nature of the operation and based on the available data and current legislation, we do not anticipate any issues between the two sites.

Thus, this response memo formally modifies Section 8 of the licensing application stating that a minimum distance of 2.5 km will be maintained between sites. As of September 16, 2022, the following modification to the February 17, 2022 licensing application is in effect:

- *CSL will make best efforts to maintain a reasonable minimum distance of ~2 km between the four proposed aquaculture sites and nearby aquaculture operations. In a case where 2 km is not able to be maintained and in the absence of legislation to the contrary, CSL will work with the Department and adjacent license holders to conduct necessary due diligence to ensure that the distance does not provide interference to the nearby site or overall production plan for the Bay.*

Sites AQ#5007 and AQ#5009 have been removed from the included data due to withdrawal of the applications.

I trust that the foregoing will answer these questions. If there are further inquiries, please do not hesitate to contact me.

Yours truly,

Martin Karlsen
President, Canadian Salmon Limited

cc.

Robert Ceschuitti, Manager, License and Leasing
Nathaniel Feindel, Manager, Aquaculture Development
Jennifer Feehan, Aquaculture Advisor
Gretchen Wagner, Aquaculture Biologist
Dan Mombourquette, Coastal Resource Coordinator

Attachments:

Production Plan 140922 – CSL's production plan, revised to reflect a fallow period of 2.5 months to be established jointly with other St. Mary's Bay operators.

DSA-CSL-22NOVA-M01-RevA.0 -- Additional information for St. Mary's Bay – A memo containing updated distance measurements from DSA Ocean and subcontractors pertaining to Section 8 of the licensing application.

Production Plan

for

Salmon Farming Operations

St. Mary's Bay, Nova Scotia

Canadian Salmon Limited

14.sep.22

St. Mary´s Bay Site 1							
Year	**Month**	**No. fishes EoM (pc)**	**Av. Weight EoM (g/pc)**	**Total biomas EoM (kgs)**	**Mortality counts**	**Growth month (kgs)**	**Feed (kgs)**
2024	Jan.	Preparation, site installation					
	Feb.						
	Mar.						
	Apr.	End of April: Stocking 1/3 of 24 - G, 720.000 of total 2.160.000 pcs / 200 g					
	May	718 800	328	235 479	1 200	-196 521	-245 651
	June	717 040	493	353 357	1 760	117 878	147 348
	July	715 200	735	525 672	1 840	172 315	215 393
	Aug.	713 210	1 156	824 756	1 990	299 084	373 854
	Sep.	711 259	1 594	1 133 996	1 950	309 241	386 551
	Oct.	709 387	2 129	1 510 250	1 872	376 254	470 317
	Nov.	707 627	2 520	1 783 221	1 760	272 971	341 213
	Dec.	705 837	2 845	2 007 965	1 790	224 744	280 930
2025	Jan.	704 237	3 150	2 218 346	1 600	210 381	262 977
	Feb.	702 621	3 424	2 406 055	1 616	187 709	234 636
	Mar.	700 989	3 640	2 551 599	1 632	145 545	181 931
	Apr.	699 358	3 825	2 674 906	1 630	123 307	154 133
	May	697 550	4 060	2 832 055	1 808	157 149	196 436
	June	695 760	4 304	2 994 273	1 790	162 218	202 773
	July	693 990	4 707	3 266 474	1 770	272 201	340 252
	Aug.	First & second week of August: Harvest					
	Sep.	From third week of August until end of October: Fallowing					
	Oct.						
	Nov.						
	Nov.	First week of November: Stocking 1/4 of 25-G from Site 3, 530.721 of total 2.128.162 pcs / 2.874 g					
	Nov.	530 721	3 402	1 805 511	1 320	276 383	345 479
	Dec.	529 378	3 840	2 033 065	1 343	227 554	284 442
2026	Jan.	528 089	4 253	2 245 697	1 289	212 633	265 791
	Feb.	526 853	4 623	2 435 612	1 235	189 914	237 393
	Mar.	First & second week of March: Harvest 1/4 of 25 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 26-G, 750.000 pcs / 400 g					
	June	749 100	560	419 496	900	119 496	149 370
	July	748 680	841	629 640	1 320	210 144	262 680
	Aug.	748 620	1 177	881 126	1 380	251 486	314 357
	Sep.	748 507	1 648	1 233 540	1 493	352 414	440 518
	Oct.	748 537	2 143	1 604 115	1 463	370 575	463 219
	Nov.	748 578	2 786	2 085 537	1 422	481 422	601 778
	Dec.	748 653	3 482	2 606 809	1 347	521 271	651 589
2027	Jan.	748 727	4 353	3 259 211	1 273	652 402	815 503
	Feb.	748 802	5 006	3 748 504	1 198	489 293	611 617
	Mar.	First & second week of March: Harvest 1/4 of 26 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 27-G, 750.000 pcs / 450 g					
	June	749 100	585	438 224	900	100 724	125 904
	July	748 680	819	613 169	1 320	174 945	218 682
	Aug.	748 620	1 147	858 368	1 380	245 199	306 498
	Sep.	748 507	1 605	1 201 534	1 493	343 166	428 958
	Oct.	748 537	2 167	1 622 136	1 463	420 602	525 752
	Nov.	748 578	2 926	2 190 001	1 422	567 866	709 832
	Dec.	748 653	3 803	2 847 287	1 347	657 286	821 607
2028	Jan.	748 727	4 640	3 474 037	1 273	626 750	783 438
	Feb.	748 802	5 336	3 995 542	1 198	521 505	651 881
	Mar.	First & second week of March: Harvest 1/4 of 27 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 28-G, 750.000 pcs / 500 g					
	June	749 100	625	468 188	900	130 688	163 359
	July	748 680	844	631 699	1 320	163 511	204 389
	Aug.	748 620	1 139	852 725	1 380	221 026	276 283
	Sep.	748 507	1 595	1 193 635	1 493	340 910	426 138
	Oct.	748 537	2 233	1 671 156	1 463	477 521	596 901
	Nov.	748 578	2 902	2 172 620	1 422	501 464	626 830
	Dec.	748 653	3 628	2 716 048	1 347	543 427	679 284

St. Mary´s Bay Site 2							
Year	**Month**	**No. fishes EoM (pc)**	**Av. Weight EoM (g/pc)**	**Total biomas EoM (kgs)**	**Mortality counts**	**Growth month (kgs)**	**Feed (kgs)**
2024	Jan.	Preparation, site installation					
	Feb.						
	Mar.						
	Apr.	End of April: Stocking 1/3 of 24 - G, 720.000 of total 2.160.000 pcs / 200 g					
	May	718 800	328	235 479	1 200	-196 521	-245 651
	June	717 040	493	353 357	1 760	117 878	147 348
	July	715 200	735	525 672	1 840	172 315	215 393
	Aug.	713 210	1 156	824 756	1 990	299 084	373 854
	Sep.	711 259	1 594	1 133 996	1 950	309 241	386 551
	Oct.	709 387	2 129	1 510 250	1 872	376 254	470 317
	Nov.	707 627	2 520	1 783 221	1 760	272 971	341 213
	Dec.	705 837	2 845	2 007 965	1 790	224 744	280 930
2025	Jan.	704 237	3 150	2 218 346	1 600	210 381	262 977
	Feb.	702 621	3 424	2 406 055	1 616	187 709	234 636
	Mar.	700 989	3 640	2 551 599	1 632	145 545	181 931
	Apr.	699 358	3 825	2 674 906	1 630	123 307	154 133
	May	697 550	4 060	2 832 055	1 808	157 149	196 436
	June	695 760	4 304	2 994 273	1 790	162 218	202 773
	July	693 990	4 707	3 266 474	1 770	272 201	340 252
	Aug.	First & second week of August: Harvest					
	Sep.	From third week of August until end of October: Fallowing					
	Oct.						
	Nov.						
	Nov.	First week of November: Stocking 1/4 of 25-G from Site 3, 530.721 of total 2.128.162 pcs / 2.874 g					
	Nov.	530 721	3 402	1 805 511	1 320	276 383	345 479
	Dec.	529 378	3 840	2 033 065	1 343	227 554	284 442
2026	Jan.	528 089	4 253	2 245 697	1 289	212 633	265 791
	Feb.	526 853	4 623	2 435 612	1 235	189 914	237 393
	Mar.	First & second week of March: Harvest 1/4 of 25 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 26-G, 750.000 pcs / 400 g					
	June	749 100	560	419 496	900	119 496	149 370
	July	748 680	841	629 640	1 320	210 144	262 680
	Aug.	748 620	1 177	881 126	1 380	251 486	314 357
	Sep.	748 507	1 648	1 233 540	1 493	352 414	440 518
	Oct.	748 537	2 143	1 604 115	1 463	370 575	463 219
	Nov.	748 578	2 786	2 085 537	1 422	481 422	601 778
	Dec.	748 653	3 482	2 606 809	1 347	521 271	651 589
2027	Jan.	748 727	4 353	3 259 211	1 273	652 402	815 503
	Feb.	748 802	5 006	3 748 504	1 198	489 293	611 617
	Mar.	First & second week of March: Harvest 1/4 of 26 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 27-G, 750.000 pcs / 450 g					
	June	749 100	585	438 224	900	100 724	125 904
	July	748 680	819	613 169	1 320	174 945	218 682
	Aug.	748 620	1 147	858 368	1 380	245 199	306 498
	Sep.	748 507	1 605	1 201 534	1 493	343 166	428 958
	Oct.	748 537	2 167	1 622 136	1 463	420 602	525 752
	Nov.	748 578	2 926	2 190 001	1 422	567 866	709 832
	Dec.	748 653	3 803	2 847 287	1 347	657 286	821 607
2028	Jan.	748 727	4 640	3 474 037	1 273	626 750	783 438
	Feb.	748 802	5 336	3 995 542	1 198	521 505	651 881
	Mar.	First & second week of March: Harvest 1/4 of 27 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 28-G, 750.000 pcs / 500 g					
	June	749 100	625	468 188	900	130 688	163 359
	July	748 680	844	631 699	1 320	163 511	204 389
	Aug.	748 620	1 139	852 725	1 380	221 026	276 283
	Sep.	748 507	1 595	1 193 635	1 493	340 910	426 138
	Oct.	748 537	2 233	1 671 156	1 463	477 521	596 901
	Nov.	748 578	2 902	2 172 620	1 422	501 464	626 830
	Dec.	748 653	3 628	2 716 048	1 347	543 427	679 284

St. Mary´s Bay Site 3							
Year	**Month**	**No. fishes EoM (pcs)**	**Av. Weight EoM (g/pcs)**	**Total biomas EoM (kgs)**	**Mortality counts**	**Growth month (kgs)**	**Feed (kgs)**
2023	Jan.	Preparation, site installation					
	Feb.						
	Mar.						
	Apr.	Stocking 23-6: 500.000 pcs / 120 g					
	May	499 250	234	116 825	750	116 825	146 031
	June	498 150	352	175 349	1 100	58 524	73 155
	July	497 000	525	260 925	1 150	85 576	106 970
	Aug.	495 756	826	409 494	1 244	148 569	185 712
	Sep.	494 537	1 181	584 048	1 219	174 554	218 192
	Oct.	493 367	1 577	778 040	1 170	193 992	242 489
	Nov.	492 267	1 800	886 081	1 100	108 041	135 051
	Dec.	491 148	2 032	998 013	1 119	111 932	139 915
2024	Jan.	490 148	2 250	1 102 833	1 000	104 820	131 025
	Feb.	489 138	2 446	1 196 432	1 010	93 599	116 998
	Mar.	488 118	2 600	1 269 107	1 020	72 675	90 844
	Apr.	487 099	2 732	1 330 754	1 019	61 648	77 060
	May	485 969	2 900	1 409 310	1 130	78 556	98 195
	June	484 850	3 074	1 490 429	1 119	81 119	101 399
	July	483 744	3 362	1 626 347	1 106	135 918	169 898
	Aug.	482 556	3 719	1 794 626	1 188	168 278	210 348
	Sep.	481 356	4 264	2 052 502	1 200	257 876	322 345
	Oct.	480 236	4 716	2 264 793	1 120	212 291	265 364
	Nov.	479 046	5 218	2 499 662	1 190	234 869	293 586
	Dec.	Harvest 23-G					
2025	Jan.	Fallowing					
	Feb.						
	Mar.						
	Apr.	Stocking 25-G: 2.160.000 pcs / 300 g					
	May	2 156 400	459	989 011	3 600	341 011	426 264
	June	2 151 120	665	1 431 097	5 280	442 086	552 607
	July	2 145 600	992	2 128 972	5 520	697 874	872 343
	Aug.	2 139 629	1 561	3 340 260	5 971	1 211 289	1 514 111
	Sep.	2 133 778	2 152	4 592 684	5 851	1 252 424	1 565 530
	Oct.	2 128 162	2 874	6 116 512	5 616	1 523 828	1 904 785
	Nov.	530 721	3 402	1 805 511	1 320	276 383	345 479
	Dec.	529 378	3 840	2 033 065	1 343	227 554	284 442
2026	Jan.	528 089	4 253	2 245 697	1 289	212 633	265 791
	Feb.	526 853	4 623	2 435 612	1 235	189 914	237 393
	Mar.	First & second week of March: Harvest 1/4 of 25 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr.						
	May						
	June	First week of June: Stocking 26-G: 750.000 pcs / 400 g					
	June	749 100	560	419 496	900	119 496	149 370
	July	748 680	841	629 640	1 320	210 144	262 680
	Aug.	748 620	1 177	881 126	1 380	251 486	314 357
	Sep.	748 507	1 648	1 233 540	1 493	352 414	440 518
	Oct.	748 537	2 143	1 604 115	1 463	370 575	463 219
	Nov.	748 578	2 786	2 085 537	1 422	481 422	601 778
	Dec.	748 653	3 482	2 606 809	1 347	521 271	651 589
2027	Jan.	748 727	4 353	3 259 211	1 273	652 402	815 503
	Feb.	748 802	5 006	3 748 504	1 198	489 293	611 617
	Mar.	First & second week of March: Harvest 1/4 of 26 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr.						
	May						
	June	First week of June: Stocking 27-G: 750.000 pcs / 450 g					
	June	749 100	585	438 224	900	100 724	125 904
	July	748 680	819	613 169	1 320	174 945	218 682
	Aug.	748 620	1 147	858 368	1 380	245 199	306 498
	Sep.	748 507	1 605	1 201 534	1 493	343 166	428 958
	Oct.	748 537	2 167	1 622 136	1 463	420 602	525 752
	Nov.	748 578	2 926	2 190 001	1 422	567 866	709 832
	Dec.	748 653	3 803	2 847 287	1 347	657 286	821 607
2028	Jan.	748 727	4 640	3 474 037	1 273	626 750	783 438
	Feb.	748 802	5 336	3 995 542	1 198	521 505	651 881
	Mar.	First & second week of March: Harvest 1/4 of 27 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr.						
	May						
	June	Stocking 28-G: 750.000 pcs / 500 g					
	June	749 100	625	468 188	900	130 688	163 359
	July	748 680	844	631 699	1 320	163 511	204 389
	Aug.	748 620	1 139	852 725	1 380	221 026	276 283
	Sep.	748 507	1 595	1 193 635	1 493	340 910	426 138
	Oct.	748 537	2 233	1 671 156	1 463	477 521	596 901
	Nov.	748 578	3 014	2 256 183	1 422	585 026	731 283
	Dec.	748 653	3 918	2 933 331	1 347	677 149	846 436

St. Mary´s Bay Site 4							
Year	**Month**	**No. fishes EoM (pc)**	**Av. Weight EoM (g/pc)**	**Total biomas EoM (kgs)**	**Mortality counts**	**Growth month (kgs)**	**Feed (kgs)**
2024	Jan.	Preparation, site installation					
	Feb.						
	Mar.						
	Apr.	End of April: Stocking 1/3 of 24 - G, 720.000 of total 2.160.000 pcs / 200 g					
	May	718 800	328	235 479	1 200	-196 521	-245 651
	June	717 040	493	353 357	1 760	117 878	147 348
	July	715 200	735	525 672	1 840	172 315	215 393
	Aug.	713 210	1 156	824 756	1 990	299 084	373 854
	Sep.	711 259	1 594	1 133 996	1 950	309 241	386 551
	Oct.	709 387	2 129	1 510 250	1 872	376 254	470 317
	Nov.	707 627	2 520	1 783 221	1 760	272 971	341 213
	Dec.	705 837	2 845	2 007 965	1 790	224 744	280 930
2025	Jan.	704 237	3 150	2 218 346	1 600	210 381	262 977
	Feb.	702 621	3 424	2 406 055	1 616	187 709	234 636
	Mar.	700 989	3 640	2 551 599	1 632	145 545	181 931
	Apr.	699 358	3 825	2 674 906	1 630	123 307	154 133
	May	697 550	4 060	2 832 055	1 808	157 149	196 436
	June	695 760	4 304	2 994 273	1 790	162 218	202 773
	July	693 990	4 707	3 266 474	1 770	272 201	340 252
	Aug.	First & second week of August: Harvest					
	Sep.	From third week of August until end of October: Fallowing					
	Oct.						
	Nov.						
	Nov.	First week of November: Stocking 1/4 of 25-G from Site 3, 530.721 of total 2.128.162 pcs / 2.874 g					
	Nov.	530 721	3 402	1 805 511	1 320	276 383	345 479
	Dec.	529 378	3 840	2 033 065	1 343	227 554	284 442
2026	Jan.	528 089	4 253	2 245 697	1 289	212 633	265 791
	Feb.	526 853	4 623	2 435 612	1 235	189 914	237 393
	Mar.	First & second week of March: Harvest 1/4 of 25 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 26-G, 750.000 pcs / 400 g					
	June	749 100	560	419 496	900	119 496	149 370
	July	748 680	841	629 640	1 320	210 144	262 680
	Aug.	748 620	1 177	881 126	1 380	251 486	314 357
	Sep.	748 507	1 648	1 233 540	1 493	352 414	440 518
	Oct.	748 537	2 143	1 604 115	1 463	370 575	463 219
	Nov.	748 578	2 786	2 085 537	1 422	481 422	601 778
	Dec.	748 653	3 482	2 606 809	1 347	521 271	651 589
2027	Jan.	748 727	4 353	3 259 211	1 273	652 402	815 503
	Feb.	748 802	5 006	3 748 504	1 198	489 293	611 617
	Mar.	First & second week of March: Harvest 1/4 of 26 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 27-G, 750.000 pcs / 450 g					
	June	749 100	585	438 224	900	100 724	125 904
	July	748 680	819	613 169	1 320	174 945	218 682
	Aug.	748 620	1 147	858 368	1 380	245 199	306 498
	Sep.	748 507	1 605	1 201 534	1 493	343 166	428 958
	Oct.	748 537	2 167	1 622 136	1 463	420 602	525 752
	Nov.	748 578	2 926	2 190 001	1 422	567 866	709 832
	Dec.	748 653	3 803	2 847 287	1 347	657 286	821 607
2028	Jan.	748 727	4 640	3 474 037	1 273	626 750	783 438
	Feb.	748 802	5 336	3 995 542	1 198	521 505	651 881
	Mar.	First & second week of March: Harvest 1/4 of 27 - G					
	Mar.	Fallowing: From third week of March until end of May					
	Apr						
	May						
	June	First week of June: Stocking 28-G, 750.000 pcs / 500 g					
	June	749 100	625	468 188	900	130 688	163 359
	July	748 680	844	631 699	1 320	163 511	204 389
	Aug.	748 620	1 139	852 725	1 380	221 026	276 283
	Sep.	748 507	1 595	1 193 635	1 493	340 910	426 138
	Oct.	748 537	2 233	1 671 156	1 463	477 521	596 901
	Nov.	748 578	2 902	2 172 620	1 422	501 464	626 830
	Dec.	748 653	3 628	2 716 048	1 347	543 427	679 284

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To	Martin Karlsen, Canadian Salmon Ltd
From	DSA Ocean Team
Date	August 25th 2022
DSA Document Reference	DSA-CSL-22NOVA-M01
Project	CSL-22NOVA
Subject	**Additional Information for St. Mary's Bay**

This memo presents center to center distances between the proposed marine finfish leases in St. Mary's Bay with all the available aquaculture facilities in the area. A list of all aquaculture facilities provided in Table 1 and shown in Figure 1.

Table 1 List of all aquaculture facilities in St. Mary's Bay with their central coordinates

Aquaculture facilities in St. Mary's Bay	Latitude	Longitude
Proposed Marine Finfish Lease: 1449	44°27'39.92"N	66° 4'52.52"W
Proposed Marine Finfish Lease: 1450	44°26'9.41"N	66° 6'47.79"W
Proposed Marine Finfish Lease: 1451	44°22'55.98"N	66°10'23.35"W
Proposed Marine Finfish Lease: 1452	44°19'36.50"N	66°14'11.05"W
Shellfish Centre Point: 1228	44°33'51.95"N	65°52'40.37"W
Land-based Facility: 1436	44°32'27.25"N	66° 0'18.93"W
Experimental-Shellfish Centre Point: 5008	44°30'43.43"N	65°55'39.86"W
Land-based Facility: 0999	44°28'4.35"N	66° 6'32.99"W
Proposed-Land-based Facility: 1437	44°24'40.42"N	65°59'54.46"W
Shellfish Centre Point: 0828	44°24'32.14"N	66° 3'6.50"W
Land-based Facility: 1185	44°23'56.66"N	66° 3'1.25"W
Shellfish Centre Point: 1037	44°24'6.19"N	66° 3'36.63"W
Marine Finfish Lease: 1012	44°24'26.58"N	66° 9'38.55"W
Marine Finfish Lease: 1354	44°16'19.91"N	66°17'23.53"W
Marine Finfish Lease: 1353	44°15'29.16"N	66°18'20.57"W
Marine Finfish Lease: 0742	44°15'41.35"N	66°20'48.97"W
Marine Finfish Lease: 0829	44°16'26.83"N	66°20'37.65"W

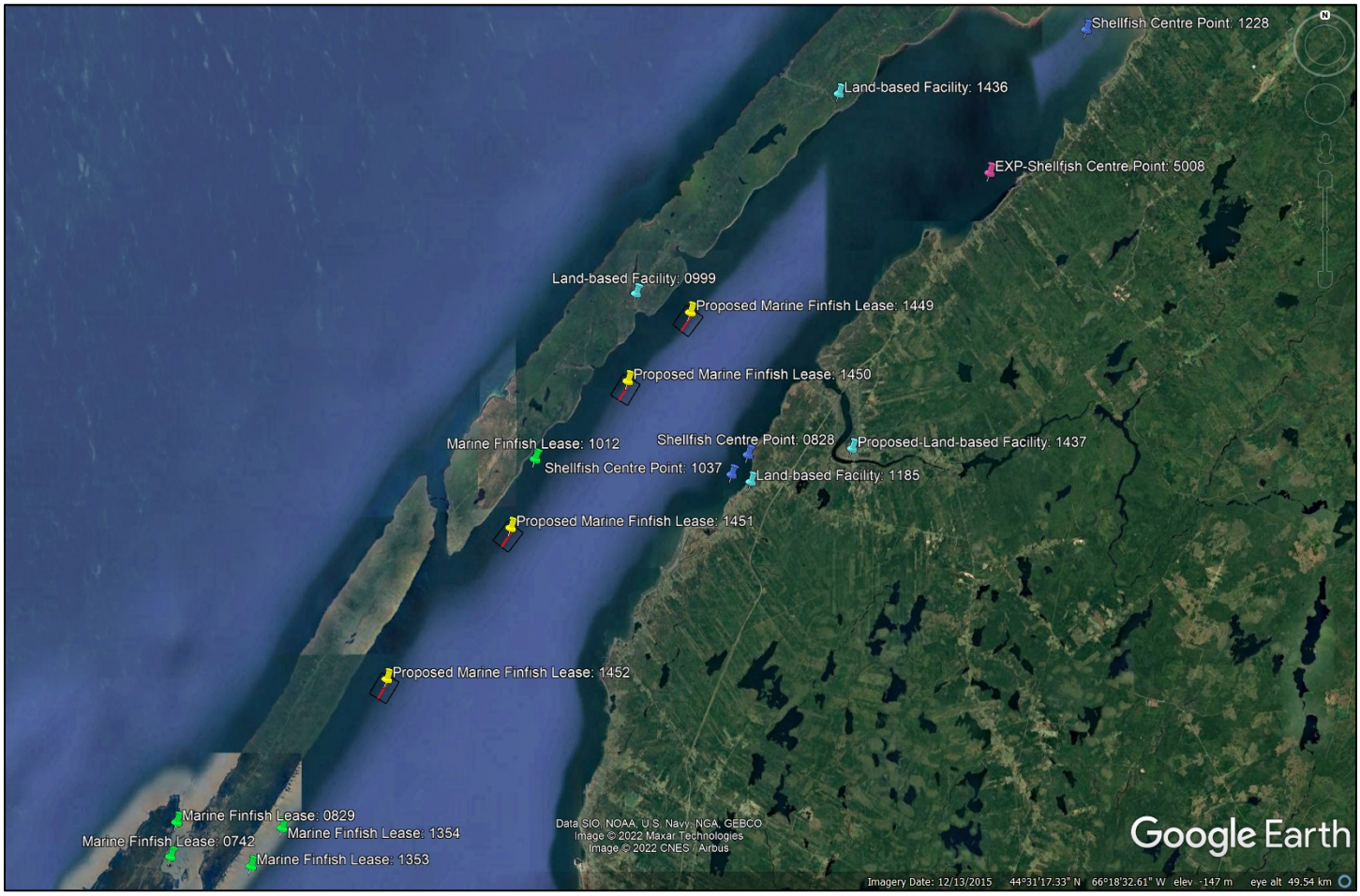

Figure 1 All aquaculture facilities marked on the map. Source: Nova Scotia Fisheries and Aquaculture mapping tool

Direct distance from the proposed lease centers to lease centers for all the aquaculture facilities in St. Mary's Bay has been provide in Table 2.

Table 2 Direct distance from the proposed lease centers to lease centers for all the aquaculture facilities in St. Mary's Bay

All aquaculture Facilities	Proposed Marine Finfish Leases			
	Marine Finfish Lease: 1449	**Marine Finfish Lease: 1450**	**Marine Finfish Lease: 1451**	**Marine Finfish Lease: 1452**
Shellfish Centre Point: 1228	19.83 km	23.54 km	31.01 km	38.88 km
Land-based Facility: 1436	10.73 km	14.19 km	22.13 km	30.08 km
Experimental-Shellfish Centre Point: 5008	13.46 km	17.01 km	24.29 km	32.06 km
Land-based Facility: 0999	2.35 km	3.56 km	10.8 km	18.67 km
Proposed-Land-based Facility: 1437	8.61 km	9.55 km	14.29 km	21.16 km
Shellfish Centre Point: 0828	6.25 km	5.74 km	10.11 km	17.31 km
Land-based Facility: 1185	7.32 km	6.47 km	9.96 km	16.86 km
Shellfish Centre Point: 1037	6.81 km	5.69 km	9.26 km	16.33 km
Marine Finfish Lease: 1012	8.7 km	4.93 km	2.97 km	10.8 km
Marine Finfish Lease: 1354	26.78 km	23.01 km	15.37 km	7.42 km
Marine Finfish Lease: 1353	28.79 km	25.02 km	17.38 km	9.43 km
Marine Finfish Lease: 0742	30.67 km	26.89 km	19.29 km	11.42 km

Marine Finfish Lease: 0829	29.49 km	25.71 km	18.15 km	10.38 km
Proposed Marine Finfish Lease: 1449	N/A	3.79 km	11.42 km	19.38 km
Proposed Marine Finfish Lease: 1450	3.78 km	N/A	7.64 km	15.6 km
Proposed Marine Finfish Lease: 1451	11.42 km	7.64 km	N/A	7.96 km
Proposed Marine Finfish Lease: 1452	19.38 km	15.6 km	7.96 km	N/A

The available distance between the southern and northern boundary of marine finfish lease # 1012 with the boundary of two proposed leases presented in Figure 2.

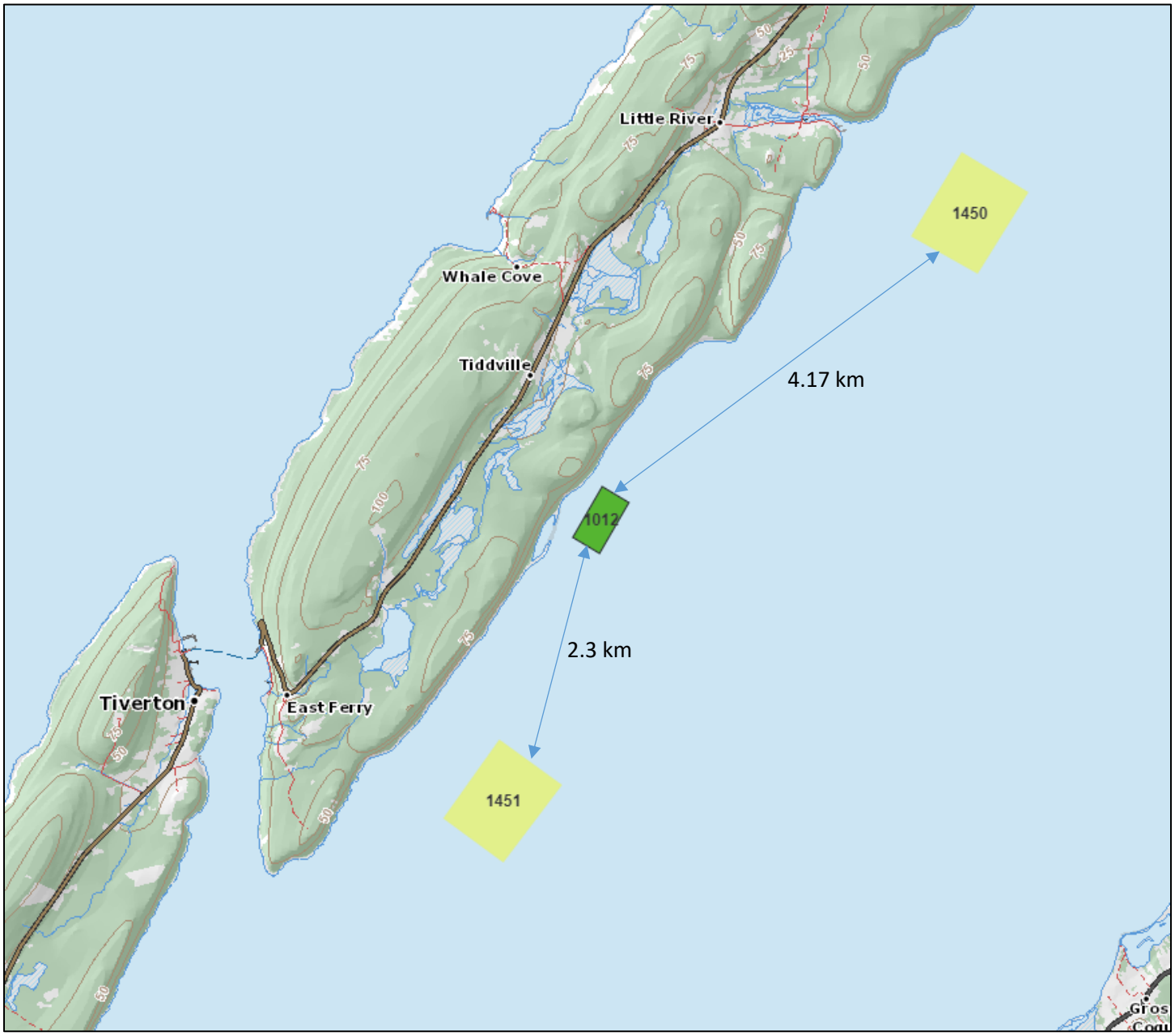

Figure 2 Lease boundary to lease boundary distance between an available site and two proposed sites

The available distance between the northern boundary of marine finfish lease # 1354 with the boundary of one of the proposed leases presented in Figure 3.



Figure 3 Lease boundary to lease boundary distance between an available site and one of the proposed sites

CANADIAN SALMON LIMITED

September 16, 2022

Gretchen Wagner, M.Sc.
Aquaculture Biologist
Fisheries and Aquaculture
1575A Lake Road
Sandy Point, Nova Scotia
B0T 1W0

RE: Baseline Review of AQ#1449, AQ#1450, AQ#1451, and AQ#1452 as submitted by Canadian Salmon Limited

Dear Gretchen,

We refer to your August 18th request for additional information for our licensing application's baseline review.

In response, please find attached a memo and updated report from DSA Ocean addressing:

AQ#1449, AQ#1450, AQ#1451:

- Calibration temperatures for three sulfide electrode calibrations provided in section 6.4.4 (Tables 7, 8, 9)
- Clarification on stabilization of redox measurements in section 6.4.2 (Table 4 & 5); and
- Instruction on how sulfide electrodes were calibrated in section 6.3.3.

AQ#1449:

- Clarification on third replicate for 1B in attached memo from DSA Ocean
- Indication that the coordinates in Table 4 for station 1C were intended to be for the 1st replicate of 1C; and
- Corrected coordinates for Video and Sediment Sampler Log Sheet 1A.

AQ#1450:

- Photographic records included (attached) for outstanding sample collection results.

AQ#1451:

- Photographic records included (attached) and mislabelled photos for 3CP corrected; and
- Coordinates for Video and Sediment Sampler Log Sheet 3RP corrected.

We also appreciate your guidance and direction on the requirement for future monitoring events to be undertaken in compliance with the most recent version of the NS Environmental Monitoring Program Framework and Standard Operating procedures (SOP). We have shared this information with our subcontractors who complete this work for us.

We appreciate your outreach to us on these matters and the ongoing coordination from your office. Should there be further questions please do not hesitate to contact me.

Yours truly,

Martin Karlsen
President, Canadian Salmon Limited

cc.
Shelley VanBuskirk-Spears, Licensing Coordinator, NSDFA
Jessica Feindel, NSDFA
Carla Buchan, NSDFA

Attachments:

DSA-CSL-22DSV-M03 NSDFA response to baseline monitoring – A memo from DSA Ocean containing a summary of updates and additions to the baseline monitoring report.

DSA-CSL-22DSV-R01-RevC – Canadian Salmon Ltd – St. Mary's Bay Baseline Environmental Monitoring – Sites 1-4 – A revised version of CSL's Baseline Monitoring Report with requested modifications.

Grab_pictures revC additions – A zipped folder containing requested photographic records.

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To	Gretchen Wagner, Aquaculture Biologist NS DFA
From	[redacted], DSA Ocean
Date	2022-08-30
DSA Document Reference	M01
Project	n/a
Subject	**Response to feedback from NS DFA**

A revised report and photographs have been provided alongside this memo for submission to NS DFA based on their feedback to the baseline environmental monitoring report for the proposed leases in St. Mary's Bay. The responses to NS DFA requests are summarized below.

AQ#1449, AQ#1450, and AQ#1451:

1. Please provide calibration temperatures for the three sulfide electrode calibrations.

This has been updated in section 6.4.4 for each calibration on March 10 (Table 7), 12 (Table 8), and 17 (Table 9).

2. Please provide clarification on which redox measurements did or did not stabilize within 2 minutes.

These have been updated in section 6.4.2 in Table 4 & 5.

3. Please provide additional clarification on how sulfide electrodes were calibrated, and why the standard solutions weren't 100, 500, 1000, 5000, and 10,000 μM sodium sulfide.

Addition to section 6.3.3:

Once removed from the glass bottle, the mass of Na_2S*9H_2O begins to change due to its sensitivity to light and air. Therefore, it is best to rapidly weigh out the reagent to reduce exposure and adjust the concentrations of the values on the curve, than to spend excessive time getting the exact mass for 10,000µM

AQ#1449:

1. Please provide clarification on the lack of a third replicate for 1B. If there wasn't a third successful sediment grab sample this station should have been treated as hard bottom and a 0-50m transect extending perpendicular from cage edge should have been conducted.

After three unsuccessful attempts on March 9th and two more unsuccessful attempts on March 16th before three successful samples were made, the site was determined to be hard bottom. A time stamp from the fourth unsuccessful grab was added to Table A 28

2. Please clarify the coordinates in Table 4 of your baseline submission for station 1C, replicate 1. Was this coordinate for the 3rd replicate of 1B or is it the 1st replicate of 1C?

This coordinate was meant to be for the 1st replicate of 1C and it has been corrected.

3. Please correct the coordinates provided for Video and Sediment Sampler Log Sheet 1A: Video Only as well as Sediment Only.

Both of these coordinates have been corrected.

AQ#1450:

1. Please provide the photographic record of the results of each sample collection attempt for 2C_3B, 2A_3B, 2RP_2B, 2D_1A.

Photographic records were found for 2C_3B and 2A_3B, but not for 2RP_2B and 2D_1A

AQ#1451:

1. Please provide the photographic record of the results of each sample collection attempt for 3A_2B, 3CP_1B, 3CP_2A.

Photographic records were found for all. Some photos for 3CP were mislabelled; this has been fixed and new photos with proper labelling have been attached.

2. Please correct the coordinates provided for Video and Sediment Sampler Log Sheet 3RP: Video Only.

These coordinates have been changed.

Document Title	**Canadian Salmon Ltd. – St. Mary's Bay Baseline Environmental Monitoring – Sites 1-4**
File	DSA-CSL-22DSV-R01-RevB.0 -- Canadian Salmon Ltd - St. Mary's Bay Baseline Environmental Monitoring - Sites 1-4.docx
Revision	C
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Pages (incl. cover)	96

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Revision history

Revision	Date last revised	Summary of changes / Comments	Revisions by	Checked by	Approved for release by	Issued to / Distribution	Engineering review status (IFI / IFR / IFC)
A	2022-04-05	Report release	[redacted]	[redacted]	[redacted]	Martin Karlsen, Canadian Salmon Ltd.	IFR
B	2022-04-06	Added executive summary and conclusions; minor corrections.	[redacted]	[redacted]	[redacted]	Martin Karlsen, Canadian Salmon Ltd.	IFR
C	2022-08-26	Revisions as per NS DFA feedback	[redacted]	[redacted]	[redacted]	Martin Karlsen, Canadian Salmon Ltd.	IFR

Engineering review status acronyms
IFI – Issued for Information
IFR – Issued for Review
IFC – Issued for Construction

List of authors / reviewers

Initials	Name	Organization / Affiliation
[redacted]	[redacted]	DSA Ocean
[redacted]	[redacted]	DSA Ocean
[redacted]	[redacted]	[redacted], Dalhousie University
[redacted]	[redacted]	[redacted] Dalhousie University

Executive Summary

The following document has been prepared for Canadian Salmon Ltd. to summarize the baseline environmental data collected for its proposed sites in St. Mary's Bay, Nova Scotia. The data has been collected to meet the requirements of the July 2021 NS DFA *"Standard Operation Procedures for the Environmental Monitoring of Marine Aquaculture In Nova Scotia"* [1] and DFO's "*AAR Monitoring Standard 2018*" [2]. Baseline environmental data has been collected at four proposed sites within the option area.

This report first presents data on the site bathymetry. Next it reviews the sediment samples collected, and the analysis results. ADCP data of the currents at the site are presented. Next, depositional modeling results are provided. Last, the fish habitat video survey data is summarized.

The proposed farm sites in St. Mary's Bay may be characterized as high energy based on wave exposure, high current speeds, and coarse sediments. From the perspective of organic loading, these are considered ideal fish farm sites, since they are dispersive. In terms of local or far field bathymetry, there are no obvious depocentres or sheltered areas (i.e. behind islands) to act as particle sinks.

In depositional environments, sulfide may be substantial even in the absence of aquaculture. However, these sites have virtually zero sulfides and low organic content indicative of well flushed sediments that do not incorporate organic matter. Some sites have substantial mud content mixed with sand and gravel. However, Fundy sediments have an extensive glacial history, and gravel/cobble within a sand-mud matrix are common [16]. The presence of fine consolidated sediments is thus not indicative of a net depositional environment.

Beyond sediment texture and geochemistry, depositional modelling shows footprints tight to the cage sites in all cases. We emphasize that these models do not include resuspension and are thus conservative. With free-stream current speeds often exceeding 1-2 knots, the local deposition of fine particles such as fish feces is unlikely.

Contents

Revision history 2

List of authors / reviewers 2

Executive Summary 3

Contents 4

Figures 6

Tables 8

1 Document Scope 9

2 Abbreviations and acronyms 9

3 Reference documents and drawings 9

4 Videos, Grab Samples, and ADCP Data 10

5 Site Layout and Bathymetry 10

6 Sediment Sample Collection and Analysis 17

6.1 Collection dates and personnel 17

6.2 Field Methods 18

6.3 Lab Methods 18

6.3.1 Porosity & Organic Matter 19

6.3.2 Redox Potential 19

6.3.3 Dissolved Sulfides 19

6.3.4 Grain Size 19

6.4 Sediment Analysis Results 20

6.4.1 Overview 20

6.4.2 Geochemistry 21

6.4.3 Grain size 25

6.4.4 Sulfide & Redox Potential brations 30

7 Current Speed and Direction 33

7.1 ADCP #1 36

7.2 ADCP #2 41

7.3 ADCP #3 45

8 Depositional Modeling 50

8.1 Model 50

8.2 Model Parameters 50

8.2.1 Organic Matter 50

8.2.2 Array Design & Stocking 50

8.2.3 Hydrodynamics 50

8.3 Depositional Model Results 51

9 Video Survey / Fish and Fish Habitat 55

10 Conclusions 56

Figures

Figure 1 Site distribution within St. Mary's Bay. (The yellow numbers 1, 2, and 3 – at sites 3, 2 and 4 respectively, are the deployment locations of the ADCPs in the area) 12
Figure 2 Bathymetry at site on hydrographic charts- Depth reported in meters 13
Figure 3 - Site 1 bathymetry and cage placement [3] 14
Figure 4 - Site 2 bathymetry and cage placement 15
Figure 5 - Site 3 bathymetry and cage placement 16
Figure 6 - Site 4 bathymetry and cage placement 17
Figure 7 Sampling location for sediment 21
Figure 8 - Examples of dense arrays of polychaete castings at sediment surface from Site 2 (AQ#1450). 25
Figure 9 - Sediment grab attempts from Site 4 (AQ#1452) 25
Figure 10 - Grain size distribution Site 1 (AQ#1449) 26
Figure 11 - Grain size distribution Site 2 (AQ#1450) 27
Figure 12 - Grain size distribution Site 3 (AQ#1451) 28
Figure 13 - Sulfide calibration curves 33
Figure 14 A picture of single float ADCP with subsurface moorings at the deployment location. The single float system used for ADCP 1 and 2 34
Figure 15 A picture of dual float ADCP with subsurface moorings at the deployment location. The dual float system used for ADCP 3 35
Figure 16 ADCP 3 during deployment 36
Figure 17 Scatter plot of current speed vs direction at ADCP 1 location - 10m water depth 37
Figure 18 Frequency plot of current direction at ADCP 1 location - 10m Water depth 37
Figure 19 A sample time series plot of current speeds at ADCP 1 location - 10m Water depth 38
Figure 20 Scatter plot of current speed vs direction at ADCP 1 location - 15m water depth 38
Figure 21 Frequency plot of current direction at ADCP 1 location - 15m Water depth 39
Figure 22 A sample time series plot of current speeds at ADCP 1 location - 15m Water depth 39
Figure 23 Scatter plot of current speed vs direction at ADCP 2 location - 5m water depth 41
Figure 24 Frequency plot of current direction at ADCP 2 location - 5m Water depth 42
Figure 25 A sample time series plot of current speeds at ADCP 2 location - 5m Water depth 42
Figure 26 Scatter plot of current speed vs direction at ADCP 2 location - 15m water depth 43
Figure 27 Frequency plot of current direction at ADCP 2 location - 15m Water depth 43
Figure 28 A sample time series plot of current speeds at ADCP 2 location - 15m Water depth 44
Figure 29 Scatter plot of current speed vs direction at ADCP 3 location - 5m water depth 46
Figure 30 Frequency plot of current direction at ADCP 3 location - 5m Water depth 46
Figure 31 A sample time series plot of current speeds at ADCP 3 location - 5m Water depth 47
Figure 32 Scatter plot of current speed vs direction at ADCP 3 location - 15m water depth 47
Figure 33 Frequency plot of current direction at ADCP 3 location - 15m Water depth 48
Figure 34 A sample time series plot of current speeds at ADCP 3 location - 15m Water depth 48
Figure 35 - Site 1 (AQ#1449) Deposition Model Results 52
Figure 36 - Site 2 (AQ#1450) Depositional model results 53

Figure 37 - Site 3 (AQ#1451) deposition model results 54
Figure 38 - Site 4 (AQ#1452) deposition model results 55

Tables

Table 1 Site Center Coordinates 11
Table 2. Water depths at Sites – based on CHS 10m resolution non-navigational data – Low water 14
Table 3 - Tide table for sampling dates 17
Table 4 - Geochemistry results (A) 23
Table 5 - Geochemistry results (B) 24
Table 6 Grain size results 29
Table 7 - March 10th sulfide and redox calibrations 30
Table 8 - March 12th sulfide and redox calibrations 31
Table 9 - March 17th sulfide and redox calibrations 32
Table 10 List of ADCP models with their deployment locations and dates 33
Table 11: 1 in 10 and 1 in 50 current conditions at ADCP 1 location using Scottish standard [2] 40
Table 12: 1 in 10 and 1 in 50 current conditions at ADCP 2 location using Scottish standard [2] 44
Table 13: 1 in 10 and 1 in 50 current conditions at ADCP 3 location using Scottish standard [2] 49
Table 14 Residual current velocities 51
Table 15 Depositional Model Parameters 51

1 Document Scope

The following document has been prepared for Canadian Salmon Ltd. to summarize the baseline environmental data collected for its proposed sites in St. Mary's Bay, Nova Scotia. The data has been collected to meet the requirements of the July 2021 NS DFA *"Standard Operation Procedures for the Environmental Monitoring of Marine Aquaculture In Nova Scotia"* [1] and DFO's "*AAR Monitoring Standard 2018*" [2]. Baseline environmental data has been collected at four proposed sites within the option area.

This report first presents data on the site bathymetry. Next it reviews the sediment samples collected, and the analysis results. ADCP data of the currents at the site are presented. Next, depositional modeling results are provided. Last, the fish habitat video survey data is summarized.

2 Abbreviations and acronyms

DSA	Dynamic Systems Analysis Ltd.
NS DFA	Nova Scotia Department of Fisheries and Aquaculture
ADCP	Acoustic Doppler Current Profiler

3 Reference documents and drawings

[1]	Standard Operation Procedures for the Environmental Monitoring of Marine Aquaculture In Nova Scotia, https://novascotia.ca/fish/documents/ns-emp-sops.pdf
[2]	AAR Monitoring Standard 2018, http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/aar-raa-eng.htm
[3]	DSA-CSL-22DSV-D02-RevC – Canadian Salmon Ltd. Site Drawings
[4]	Wildish, D., Akagi, H., Hamilton, N., Hargrave, B.T., "A recommended method for monitoring sediments to detect organic enrichment from mariculture in the Bay of Fundy", Canadian Technical Report of Fisheries and Aquatic Sciences, Fisheries and Oceans Canada Biological Station, St. Andrews, New Brunswick, Canada, September 1999.
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[12]	Cromey, C.J., Thetmeyer, H., Lampadariou, N., Black, K.D., Kogeler, J., Karakassis, I., "MERAMOD: predicting the deposition and benthic impact of aquaculture in the eastern Mediterranean Sea", *Aquaculture Environment Interactions,* Volume 2, Pages 157-176, March 2012, doi: 10.3354/aei00034.
[13]	Chang, B.D., Page, F.H., Losier, R.J., McCurdy, E.P., "Organic enrichment at salmon farms in the Bay of Fundy, Canada: DEPOMOD predictions versus observed sediment sulfide concentrations", *Aquaculture Environment Interactions,* Volume 5, Pages 185–208, 2014, doi: 10.3354/aei00104.
[14]	Carvajalino-Fernandez, M.A., Saevik, P.N., Johnsen, I.A., Albretsen, J., Keeley, N.B., "Simulating particle organic matter dispersal beneath Atlantic salmon fish farms using different resuspension approaches" *Marine Pollution Bulletin,* Volume 161, Part B, 111685, December 2020, https://doi.org/10.1016/j.marpolbul.2020.111685.
[15]	Godin, G., "Daily mean sea level and short-period seiches", *International Hydrographic Review,* Volume 43, No. 2, Pages 75-89, 1966.
[16]	Shaw, John & Todd, Brian & Li, Michael. (2012). Seascapes, Bay of Fundy, offshore Nova Scotia/New Brunswick; Geological Survey of Canada Open File 7028, scale 1:350 000. 10.4095/292047.

4 Videos, Grab Samples, and ADCP Data

Provided with this report are digital videos and photos of the grab samples and video transects. The associated digital files can be found here: Data Download Link

The log sheets and ADCP data are also provided in this folder.

5 Site Layout and Bathymetry

The four intended sites are shown below in Figure 1. The centers of the four leases are given in Table 1.

Non-navigational 10m resolution Canadian Hydrographic Survey (CHS) data were extracted for the region to develop site plans which allowed for sufficient clearance of the nets. Figure 2 shows the water

depths throughout the bay, which is generally 30-50m deep. The water depths at each of the 4 corners of the sites are provided in Table 2. Site 1 is the shallowest, with depths approaching 11m at some areas of the lease. Site 2 depths at low water range from 20-26m. Site 3 and 4 are generally deeper with depths typically between 30 and 40m. Figure 3 to Figure 6 provide contour lines of the site bathymetry [3]. Attached to this report are drawings of the site, with corner coordinates listed.

Table 1 Site Center Coordinates

POTENTIAL SITE #1	44.461250°	-66.081390°
POTENTIAL SITE #2	44.436068°	-66.113149°
POTENTIAL SITE #3	44.382293°	-66.173163°
POTENTIAL SITE #4	44.326828°	-66.236474°

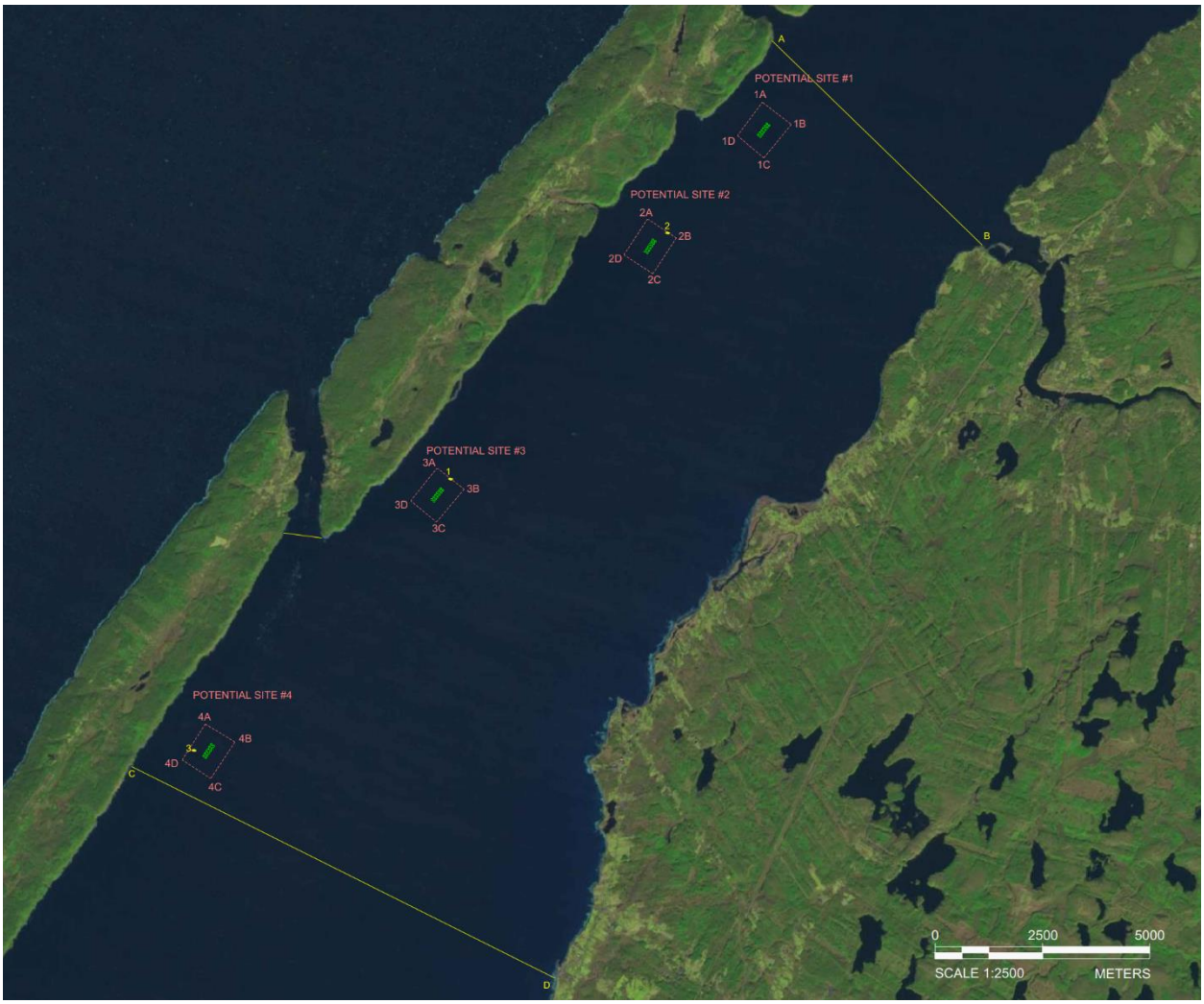


Figure 1 Site distribution within St. Mary's Bay. (The yellow numbers 1, 2, and 3 – at sites 3, 2 and 4 respectively, are the deployment locations of the ADCPs in the area)

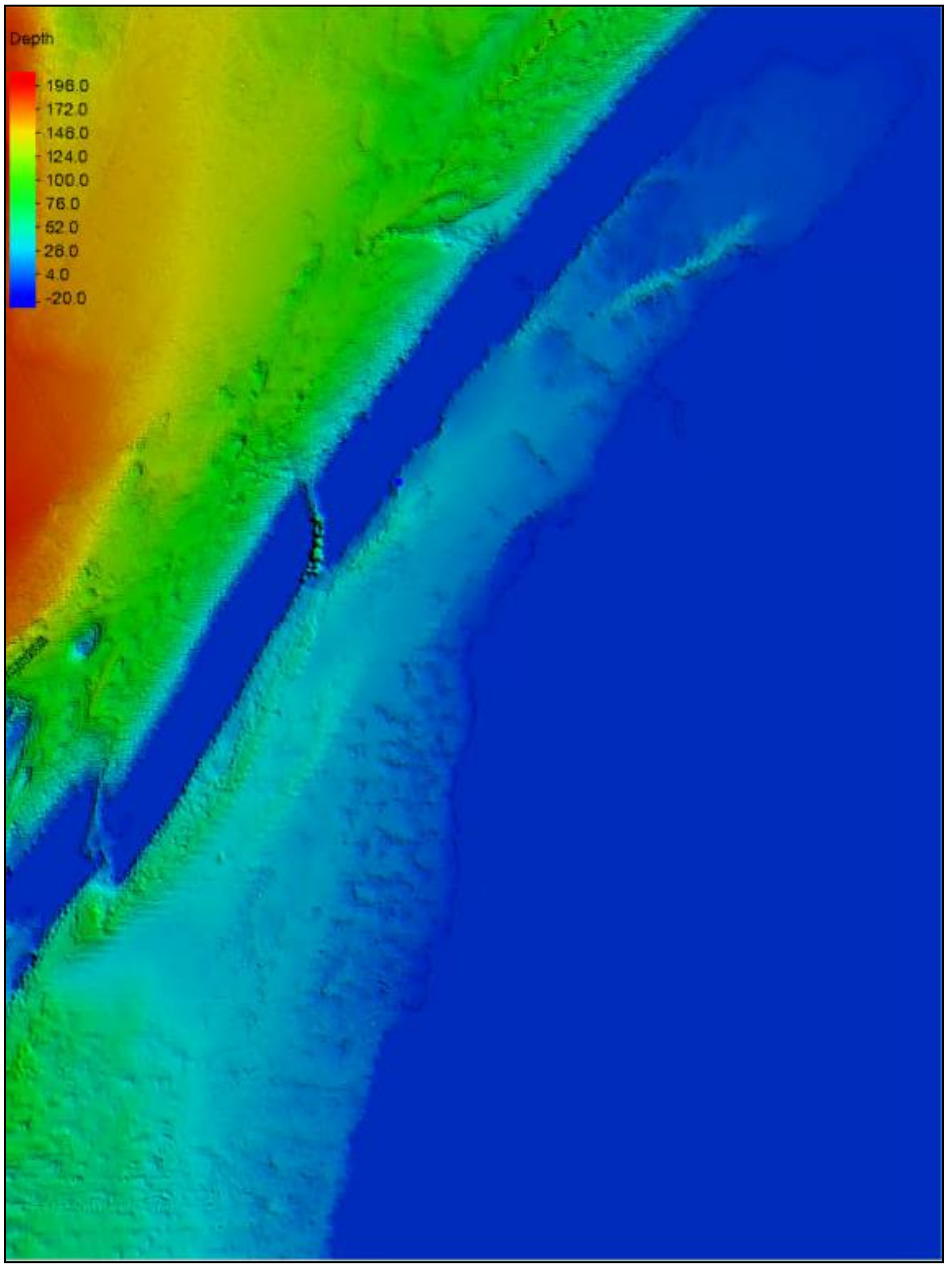


Figure 2 Bathymetry at site on hydrographic charts- Depth reported in meters

Table 2. Water depths at Sites – based on CHS 10m resolution non-navigational data – Low water

	Site 1	Site 2	Site 3	Site 4
Site Corner	Depth (m) – at LLW			
NW	28	20	31	37
NE	11	24	38	41
SE	19	26	35	43
SW	26	21	39	37

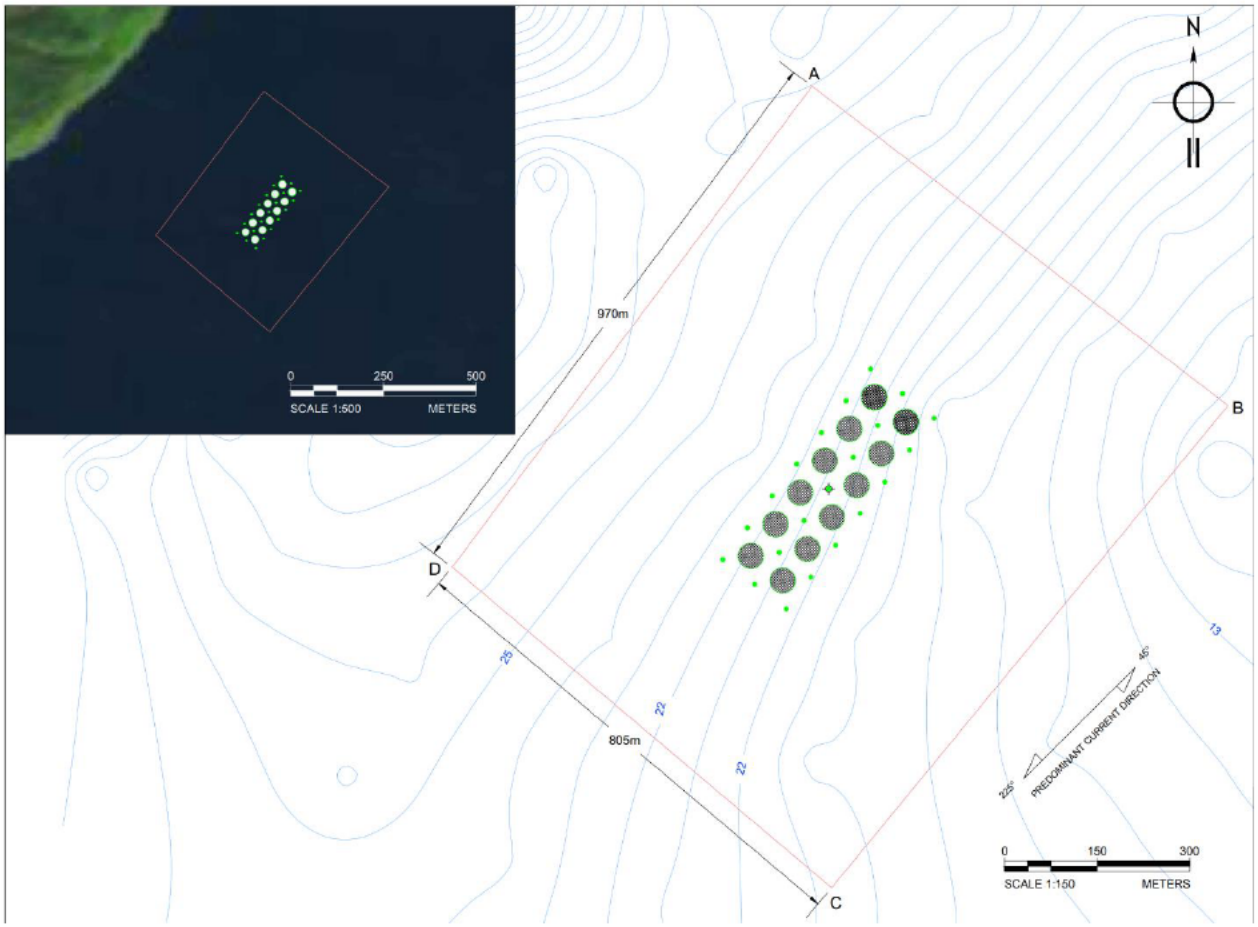


Figure 3 - Site 1 bathymetry and cage placement [3]

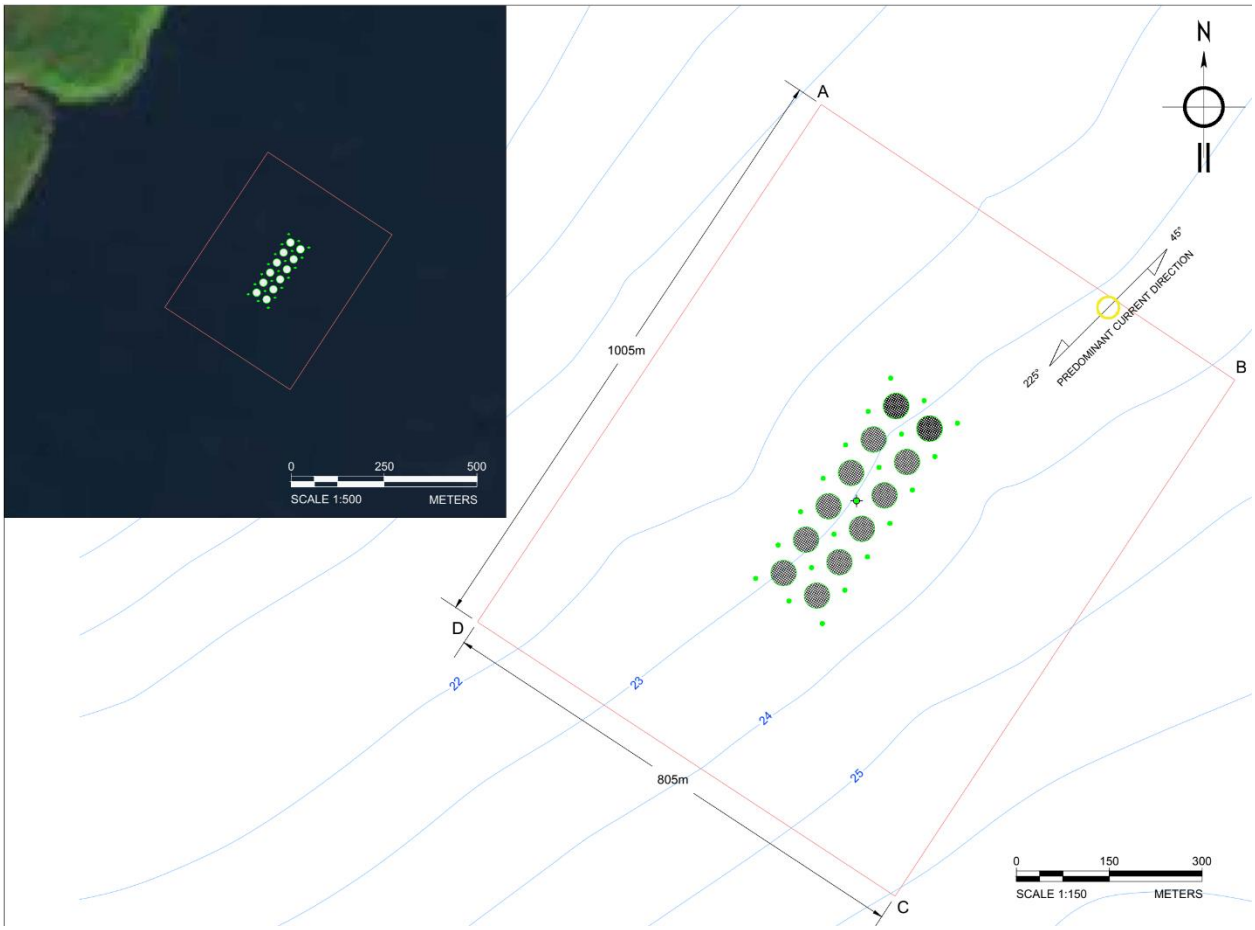


Figure 4 - Site 2 bathymetry and cage placement

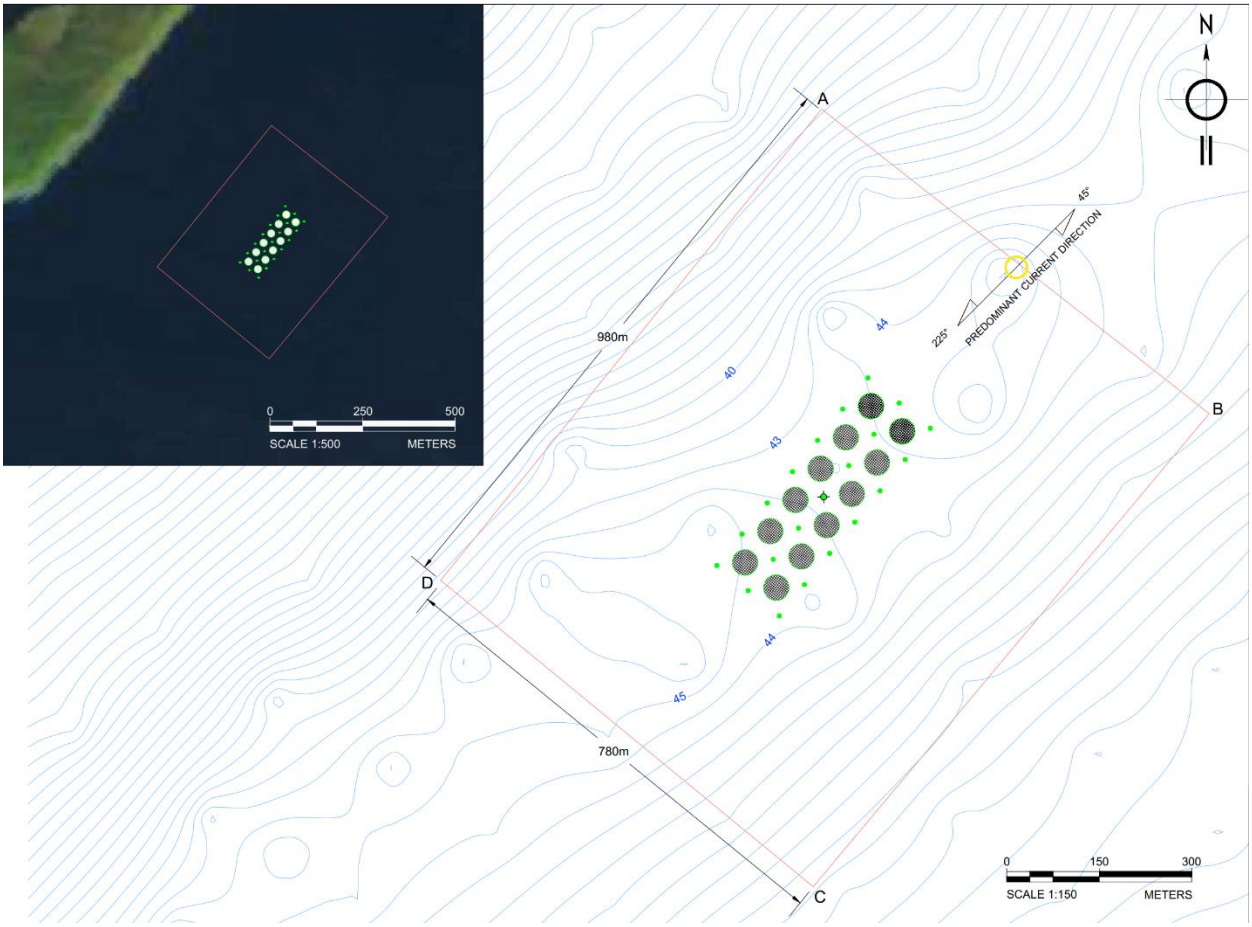


Figure 5 - Site 3 bathymetry and cage placement

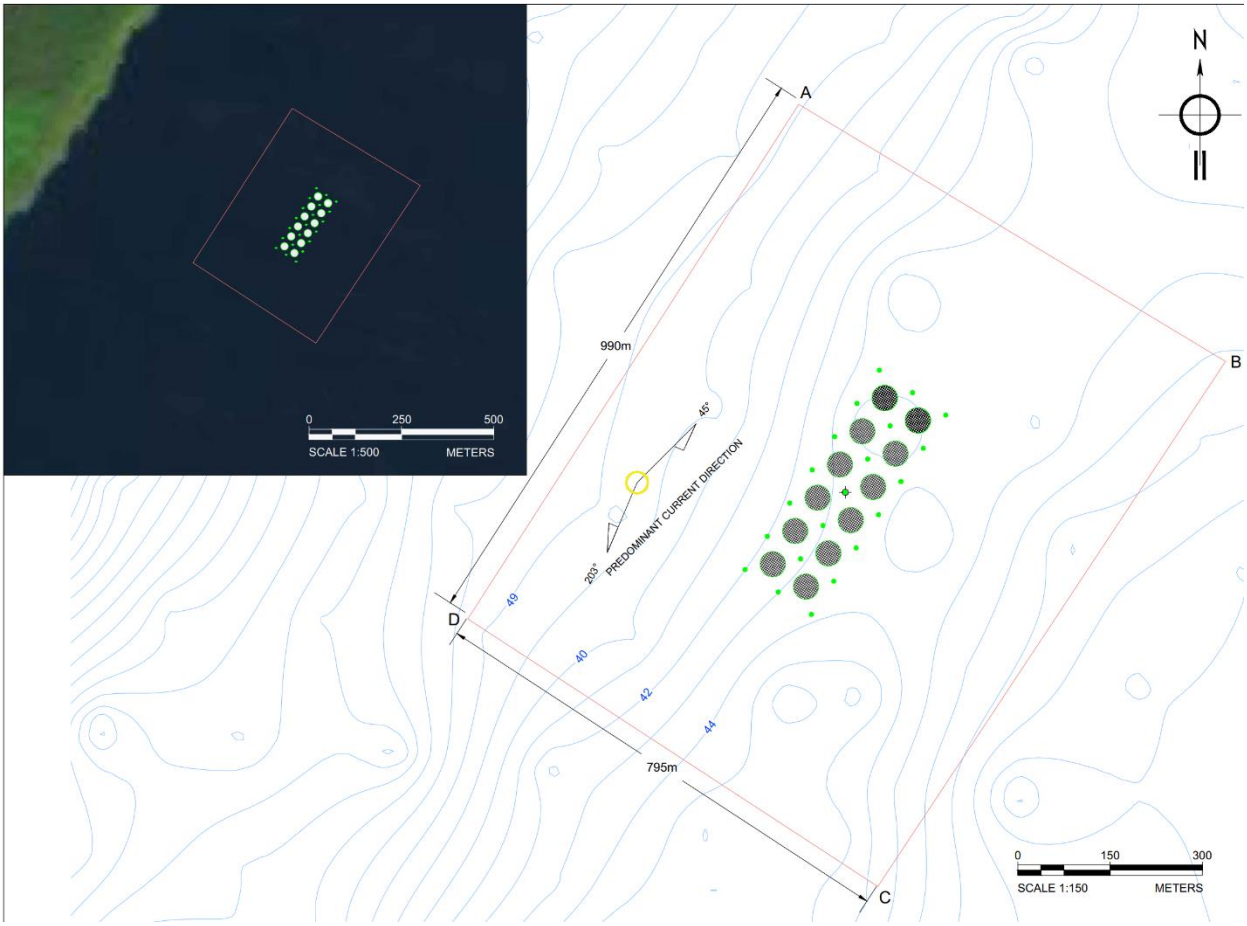


Figure 6 - Site 4 bathymetry and cage placement

6 Sediment Sample Collection and Analysis

6.1 Collection dates and personnel

Benthic field data contained within this report were collected on March 9-11 & 16-17. Both sets of field days involved a combination of benthic sediment sampling and bottom video, conducted by Field Supervisor and Oceanographer [redacted], MSc., and Marine Technician [redacted]

Table 3 - Tide table for sampling dates

Date	High Tide (hh:mm)	Low Tide (hh:mm)
March. 9	03:30, 1600	10:00, 22:15
March. 10	04:30, 17:15	11:00, 23:15
March. 11	05:30, 18:15	12:00
March. 16	10:45, 23:15	04:30, 17:00
March. 17	11:30, 23:45	5:15, 17:30

6.2 Field Methods

Methods for baseline monitoring and analyses were informed by NSDFA, the Standard Operating Procedures for the Environmental Monitoring of Marine Aquaculture in Nova Scotia [1], and the Aquaculture Activities Regulations [2].

From March 9-11, benthic sediment samples were collected using a Petit Ponar grab, while bottom video was collected using a Seaviewer 950 Sea-Drop Camera (S/N 04712). From March 16-17, benthic sediment samples were collected using a large Van Veen grab, while bottom video was collected using a DeepSea Power & Light (S/N 12-029-00251) and Multi-SeaCam 2060 (S/N 3026-7).

The sediment samplers were deployed over the side of the vessel and were retrieved using the capstan at a velocity of 0.89m/s. Photos were taken of the sample both before and after the overlying water was siphoned. Observations of sediment characteristics were recorded while subsampling of the upper 2cm of sediment was performed. The syringe was inserted into the upper 2cm of the sediment in three different locations, followed by capping the syringe and storage in a cooler kept between 2-5˚C. Two syringes were filled: one for redox potential and sulfide analyses, and the other for porosity and organic matter analyses. The remaining upper 2cm of sediment was scooped into a sealed bag for grain size analysis. Samples remained in the cooler for transport until they could be transferred to the lab fridge.

Video cameras were mounted to a 0.25m^2 quadrat frame for stability and size reference. Weights were added to the corners of the frame to mitigate horizontal current influence. Video output was fed through a Seaviewer Sea-Trak GPS overlay which provided real-time position (NAD83 CSRS; degrees minutes), date, and time during recording. Once recording commenced, a placard with lease number and station ID were presented to the camera, followed by a 360° panorama of the surrounding coastline. Recording continued during deployment, descent to the sediment, a minimum of 2 minutes panning bottom footage, ascent, and retrieval onto the deck of the boat. At each station, attempts were made to capture a minimum of 5 m^2 of seafloor, maintain a 90° angle between the camera and seafloor, and limit the amount of resuspension caused by impact of the mount frame with the seafloor.

A technical error with GPS overlay occurred on March 10 during the recording of the central transects at Sites 1-3, making the video difficult to review due to excess noise. These three transect videos were re-recorded on March 11 and 17. However, weather, and hydrodynamic conditions during this period were optimal, and the content of these videos is still discernable. If further footage of the central transects at Sites 1-3 is requested, then recordings from March 10 will be provided.

6.3 Lab Methods

Once the samples were collected, all sediment samples were processed within 36 hours of collection time[1]. Samples were kept sealed in syringes in the lab fridge at 2-5°C until moments before processing. Temperature was taken both immediately after redox had been measured to determine adjustment for

[1] Processing samples for determination of grain size isn't necessary to complete during the 36h window; grain size processing was completed within 7 days.

mV_{NHE}, and after the SAOB was added for sulfide analysis to allow temperature adjustment to better reflect conditions during calibration.

6.3.1 Porosity & Organic Matter

Sediment samples were weighed wet, dried at 60°C for 24-48h, and dry weight determined. Aliquots of the dry samples were then transferred into pre-weighed tins, weighed, and combusted in a muffle furnace at 490°C for a minimum of 8 hours. After removal, tins were re-weighed to determine washed weights, and POM content was calculated as the difference between mass of the dry sample before treatment in the muffle oven and after.

6.3.2 Redox Potential

Redox potential was measured using a SPER Scientific Meter (S/N L927382) and an Orion (96-78BNWP) oxidation-reduction potential (ORP) platinum electrode (S/N TU1-12636), placed directly into the sediment sample, and recorded in millivolts. Temperature was also recorded to correct the redox potential relative to the normal hydrogen electrode (mVNHE). Twenty-four hours prior to analysis, the electrode was prepared and filled with 4M KCl filling solution. An electrode accuracy check was completed using an ORP standard (ORI967901) before and after all samples were analyzed, where the electrode was deemed accurate if the redox potential reading was +220mv ± 3mV at 25°C.

6.3.3 Dissolved Sulfides

Immediately following the measurement of redox potential, the sediment sample was measured for dissolved sulfide concentration by first adding sulfide antioxidant buffer (SAOB) to create a slurry of equal parts sediment and SAOB. Increased pH converts H_2S and HS^- to S^{-2}, which is measurable by the electrode. The dissolved sulfide concentration was then measured using a Thermo Scientific Orion Star A211 Meter (S/N X49024) and an Orion (96-16BNWP) Silver/Sulfide combination electrode (S/N TU1-11670) placed directly into the sediment slurry. The dissolved sulfide concentration was later converted from mV to µM using a five-point standard curve created prior to analysis. The sulfide curve was created in accordance to [4], with known points in the curve adjusted to reflect the actual weight of Na_2S*9H_2O. Once removed from the glass bottle, the mass of Na_2S*9H_2O begins to change due to its sensitivity to light and air. Therefore, it is best to rapidly weigh out the reagent to reduce exposure and adjust the concentrations of the values on the curve, than to spend excessive time getting the exact mass for 10,000µM. To combat drift and determine error for the ISE probe, a new curve was measured after analysis, created through dilution of the original sulfide standard.

6.3.4 Grain Size

Grain size analyses were performed using the wet sieving method. Size bins were defined as <63µm, 63-125 µm, 125-250 µm, 250-500 µm, 500-1000 µm, 1000-2000 µm, and >2000 µm. All water that passed though the 63 µm sieve was collected and a subsample filtered through a pre-weighed Whatman GF/F grade glass microfiber filter, which was dried and weighed. Descriptive categorization for further comparisons were determined using the Wentworth grain size scale. Care was taken to ensure all structures, inorganic or organic, remained in a format similar to that during time of sampling (e.g.

polychaete castings). This approach allows determination of 'natural' grain size compared to geological grain size in which all aggregate structures are macerated.

6.4 Sediment Analysis Results

6.4.1 Overview

Figure 7 shows the targeted sampling locations and numbering for each of the four sites. A map displaying the targeted coordinates, and showing targeted video transect lines are attached to this report. Samples were taken at the four corners of the site (Station IDs labeled A, B, C, D), at the center of the site (Station IDs labeled CP), and at a reference point in the direction of the predominant current (Station IDs labeled RP).

Of the four sites being considered (AQ#1449-1452), sediment samples were only successfully collected at Sites 1-3. Through both bottom video review and five or more unsuccessful attempts to collect sediment samples at each station, Site 4 (AQ#1452) was determined to be hard bottom at all sampling locations, restricting observations to only video and photo.

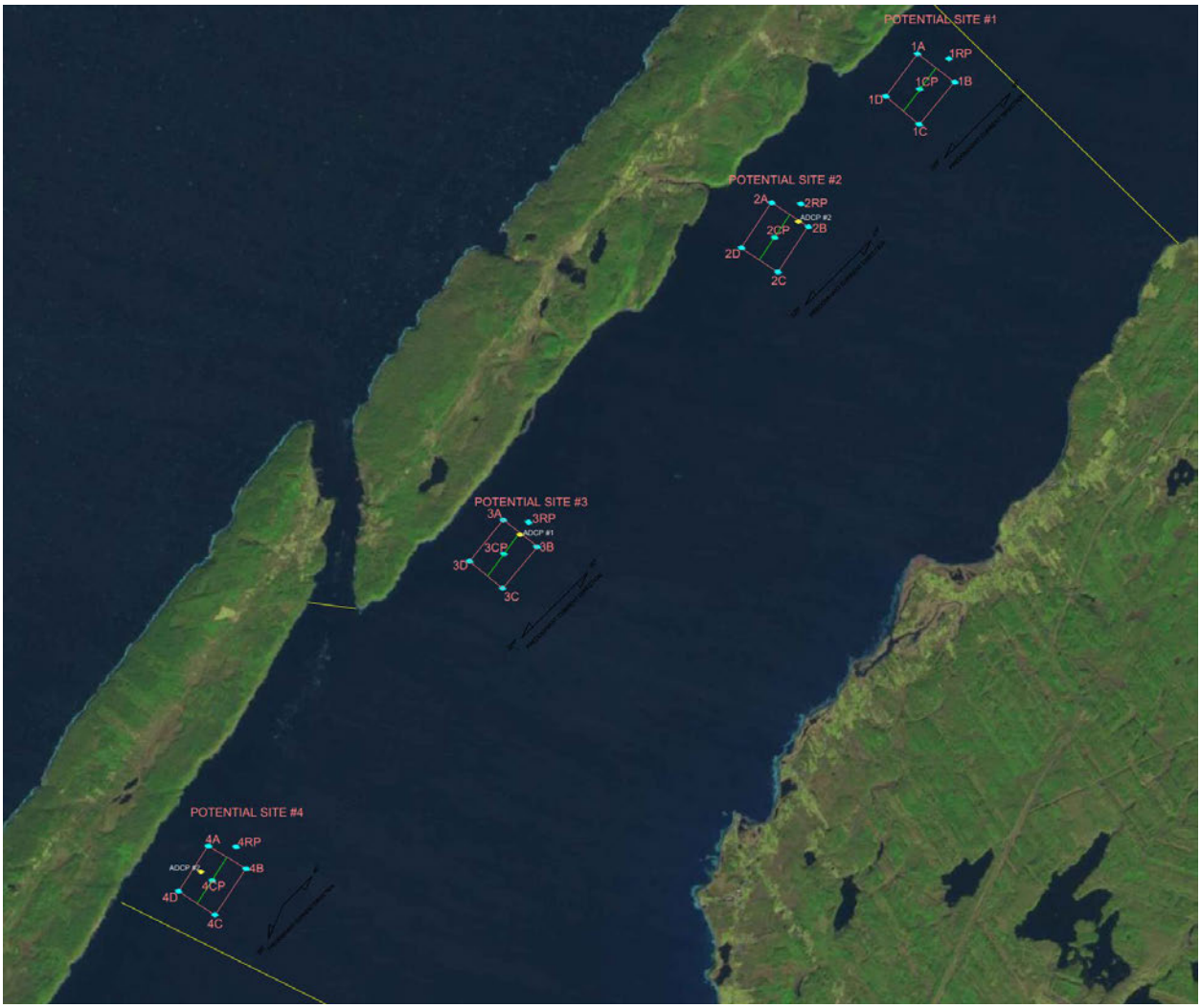


Figure 7 Sampling location for sediment

6.4.2 Geochemistry

While hard bottom characteristics of Site 4 (AQ#1452) prevented acquisition of sediment samples and further geochemical analyses, Sites 1, 2, & 3(AQ#1449, 1450, & 1451) were all classified as soft bottom. Geochemical analyses of the soft bottom sediments of the latter sites produced results expected in a benthic environment subject to high tidal ranges and strong bottom currents. All results supported an 'Oxic' classification under the Environmental Quality Standards used by the NSDFA [1]. The results are presented in Table 4 and Table 5. Sulfide was virtually absent from these sites such that sulfide values were Oxic A at all sites, and though some redox potential values at Site 1 were classified as Oxic B (18%), all other values at Sites 1-3 were Oxic A. Mean values were similar at Sites 1 and 3 for porosity (63.2 + 5.5%, 63.5 + 3.4%) and organic matter (2.2 + 0.4%, 2.2 + 0.5%), whereas Site 2 had lower mean porosity (55.9 + 3.0%) and higher organic matter (2.8 + 0.6%) than the other sites. Porosity was typical of sediments with sand and gravel, and the relatively low organic content was consistent with a largely coarse sediment with some mud content.

Grain size results indicated a majority sandy composition at Site 1, with smaller but notable percentages of mud and gravel sizes. Sites 2 and 3 skewed towards greater percentages of gravel and mud compared sandy sizes, and while the distributions of these two size classifications at each station were often similar, stations at Site 2 displayed a greater tendency towards mud and stations at Site 3 towards gravel. Sample locations where the sediment surface was composed of dense surface bioturbation (see Figure 8) generally skewed towards greater values in both gravel (>2mm) and mud (<0.063mm) classifications. While some of the weight in the gravel classification for the samples with high casting presence was attributed to inorganic matter, the vast majority of weight was always due to apparent polychaete tubes, burrow structures (see videos). This type of distribution was present at most stations at Sites 2 and 3, and station D at Site 1.

Table 4 - Geochemistry results (A)

Monitoring Date	Sample ID		Longitude	Latitude	Location	Lease #	Sample temp. (°C)	Redox (mV)	Stabilized ≤ 2 minutes?	Redox (mV_{NHE})	Sulfide (mV)	Sulfide (µM)	Porosity (%)	Organic Matter (%)
	Station ID	Replicate												
2022-03-16	1A	1	44.467095	-66.081946	St. Mary's Bay	1449	14.7	90	Y	299.3	-784.6	1	65.7	2.2
2022-03-16	1A	2	44.467095	-66.081946	St. Mary's Bay	1449	12.1	-47	Y	164.9	-774.5	0	63.4	2.3
2022-03-16	1A	3	44.467095	-66.081946	St. Mary's Bay	1449	9.8	88	Y	302.2	-777.5	1	60.0	1.8
2022-03-16	1B	1	44.462660	-66.073255	St. Mary's Bay	1449	9.9	55	Y	269.1	-769.9	0	63.3	2.3
2022-03-16	1B	2	44.462660	-66.073255	St. Mary's Bay	1449	10.6	97	Y	310.4	-809.4	6	63.6	2.1
2022-03-09	1C	1	44.455522	-66.081022	St. Mary's Bay	1449	12.7	130	N	341.3	-802.9	6	65.2	2.0
2022-03-09	1C	2	44.455522	-66.081022	St. Mary's Bay	1449	12.5	54	Y	265.5	-804.1	6	60.7	2.4
2022-03-09	1C	3	44.455522	-66.081022	St. Mary's Bay	1449	14.7	-112	N	97.3	-799.3	4	61.7	2.1
2022-03-09	1CP	1	44.461251	-66.081364	St. Mary's Bay	1449	12.8	-118	N	93.2	-811.2	11	63.0	2.3
2022-03-09	1CP	2	44.461251	-66.081364	St. Mary's Bay	1449	11.7	5	Y	217.3	-707.0	0	63.7	2.2
2022-03-09	1CP	3	44.461251	-66.081364	St. Mary's Bay	1449	9.3	5	Y	219.7	-748.9	0	68.9	1.7
2022-03-11	1D	1	44.459919	-66.088883	St. Mary's Bay	1449	12.1	53	Y	264.9	-790.2	1	55.5	2.8
2022-03-11	1D	2	44.459919	-66.088883	St. Mary's Bay	1449	15.9	42	Y	250.1	-802.6	3	53.8	3.1
2022-03-16	1D	3	44.459919	-66.088883	St. Mary's Bay	1449	15.2	58	Y	266.8	-783.6	1	53.3	3.1
2022-03-09	1RP	1	44.466677	-66.075120	St. Mary's Bay	1449	11.1	17	Y	229.9	-813.6	13	71.3	1.6
2022-03-09	1RP	2	44.466677	-66.075120	St. Mary's Bay	1449	12.8	-99	Y	112.2	-798.1	4	73.8	1.6
2022-03-09	1RP	3	44.466677	-66.075120	St. Mary's Bay	1449	14.9	-140	N	69.1	-803.1	6	67.9	1.7
2022-03-16	2A	1	44.441755	-66.114241	St. Mary's Bay	1450	11.5	87	Y	299.5	-787.1	1	56.1	3.0
2022-03-16	2A	2	44.441755	-66.114241	St. Mary's Bay	1450	10.9	-20	Y	193.1	-795.8	2	51.7	3.1
2022-03-16	2A	3	44.441755	-66.114241	St. Mary's Bay	1450	9.0	97	Y	312.0	-807.0	5	53.8	3.0
2022-03-16	2B	1	44.437964	-66.105673	St. Mary's Bay	1450	13.7	-39	Y	171.3	-824.9	20	60.7	2.2
2022-03-16	2B	2	44.437964	-66.105673	St. Mary's Bay	1450	14.2	-33	Y	176.8	-771.3	0	54.2	2.3
2022-03-16	2B	3	44.437964	-66.105673	St. Mary's Bay	1450	11.6	-83	Y	129.4	-830.3	30	59.8	2.4
2022-03-16	2C	1	44.430295	-66.112164	St. Mary's Bay	1450	9.4	2	Y	216.6	-803.3	4	60.7	2.1
2022-03-16	2C	2	44.430295	-66.112164	St. Mary's Bay	1450	9.9	77	Y	291.1	-793.4	2	51.6	2.3
2022-03-16	2C	3	44.430295	-66.112164	St. Mary's Bay	1450	10.7	85	Y	298.3	-771.2	0	60.2	2.5

Table 5 - Geochemistry results (B)

Monitoring Date	Sample ID		Longitude	Latitude	Location	Lease #	Sample temp. (°C)	Redox (mV)	Stabilized ≤ 2 minutes?	Redox (mV_{NHE})	Sulfide (mV)	Sulfide (µM)	Porosity (%)	Organic Matter (%)
	Station ID	Replicate												
2022-03-16	2CP	1	44.436079	-66.113085	St. Mary's Bay	1450	13.9	109	N	319.1	-789.3	1	56.8	2.4
2022-03-16	2CP	2	44.436079	-66.113085	St. Mary's Bay	1450	13.8	65	Y	275.2	-785.4	1	57.7	3.0
2022-03-16	2CP	3	44.436079	-66.113085	St. Mary's Bay	1450	9.8	84	Y	298.2	-718.5	0	55.3	2.8
2022-03-16	2D	1	44.434108	-66.120817	St. Mary's Bay	1450	10.7	44	Y	257.3	-801.6	3	57.0	3.0
2022-03-16	2D	2	44.434108	-66.120817	St. Mary's Bay	1450	10.8	64	Y	277.2	-776.6	0	53.7	2.5
2022-03-16	2D	3	44.434108	-66.120817	St. Mary's Bay	1450	15.8	-9	Y	199.2	-796.0	2	55.2	5.1
2022-03-16	2RP	1	44.441777	-66.107473	St. Mary's Bay	1450	9.4	25	Y	239.6	-780.1	1	53.3	3.1
2022-03-16	2RP	2	44.441777	-66.107473	St. Mary's Bay	1450	11.4	35	Y	247.6	-775.7	0	50.8	2.7
2022-03-16	2RP	3	44.441777	-66.107473	St. Mary's Bay	1450	12.3	-60	Y	151.7	-803.6	4	56.8	2.9
2022-03-16	3A	1	44.387901	-66.173560	St. Mary's Bay	1451	13.4	6	Y	216.6	-765.5	0	66.1	1.7
2022-03-16	3A	2	44.387901	-66.173560	St. Mary's Bay	1451	11.6	8	Y	220.4	-791.8	2	71.5	1.6
2022-03-16	3A	3	44.387901	-66.173560	St. Mary's Bay	1451	13.0	101	Y	312.0	-758.9	0	68.3	1.8
2022-03-16	3B	1	44.383734	-66.165405	St. Mary's Bay	1451	12.4	52	Y	263.6	-768.3	0	56.5	3.9
2022-03-16	3B	2	44.383734	-66.165405	St. Mary's Bay	1451	14.8	47	Y	256.2	-762.6	0	63.0	2.1
2022-03-16	3B	3	44.383734	-66.165405	St. Mary's Bay	1451	15.3	50	Y	258.7	-777.7	1	61.5	2.1
2022-03-16	3C	1	44.376621	-66.173076	St. Mary's Bay	1451	9.1	24	Y	238.9	-774.8	0	62.6	2.5
2022-03-16	3C	2	44.376621	-66.173076	St. Mary's Bay	1451	10.9	107	N	320.1	-792.8	2	63.2	2.4
2022-03-16	3C	3	44.376621	-66.173076	St. Mary's Bay	1451	11.3	99	Y	311.7	-780.1	1	61.8	2.1
2022-03-16	3CP	1	44.382314	-66.173137	St. Mary's Bay	1451	15.1	69	Y	277.9	-787.6	1	62.7	2.2
2022-03-16	3CP	2	44.382314	-66.173137	St. Mary's Bay	1451	9.9	49	Y	263.1	-785.6	1	65.1	2.1
2022-03-16	3CP	3	44.382314	-66.173137	St. Mary's Bay	1451	9.9	75	Y	289.1	-775.9	0	68.8	1.8
2022-03-16	3D	1	44.380910	-66.180853	St. Mary's Bay	1451	9.9	64	Y	278.1	-776.7	0	63.3	2.3
2022-03-16	3D	2	44.380910	-66.180853	St. Mary's Bay	1451	11.8	84	Y	296.2	-780.9	1	61.3	1.8
2022-03-16	3D	3	44.380910	-66.180853	St. Mary's Bay	1451	14.1	36	Y	245.9	-763.6	0	61.3	1.7
2022-03-16	3RP	1	44.387690	-66.167036	St. Mary's Bay	1451	11.8	27	Y	239.2	-784.3	1	65.2	2.0
2022-03-16	3RP	2	44.387690	-66.167036	St. Mary's Bay	1451	14.2	35	Y	244.8	-770.5	0	59.4	2.9
2022-03-16	3RP	3	44.387690	-66.167036	St. Mary's Bay	1451	12.7	34	Y	245.3	-778.6	1	61.8	2.5

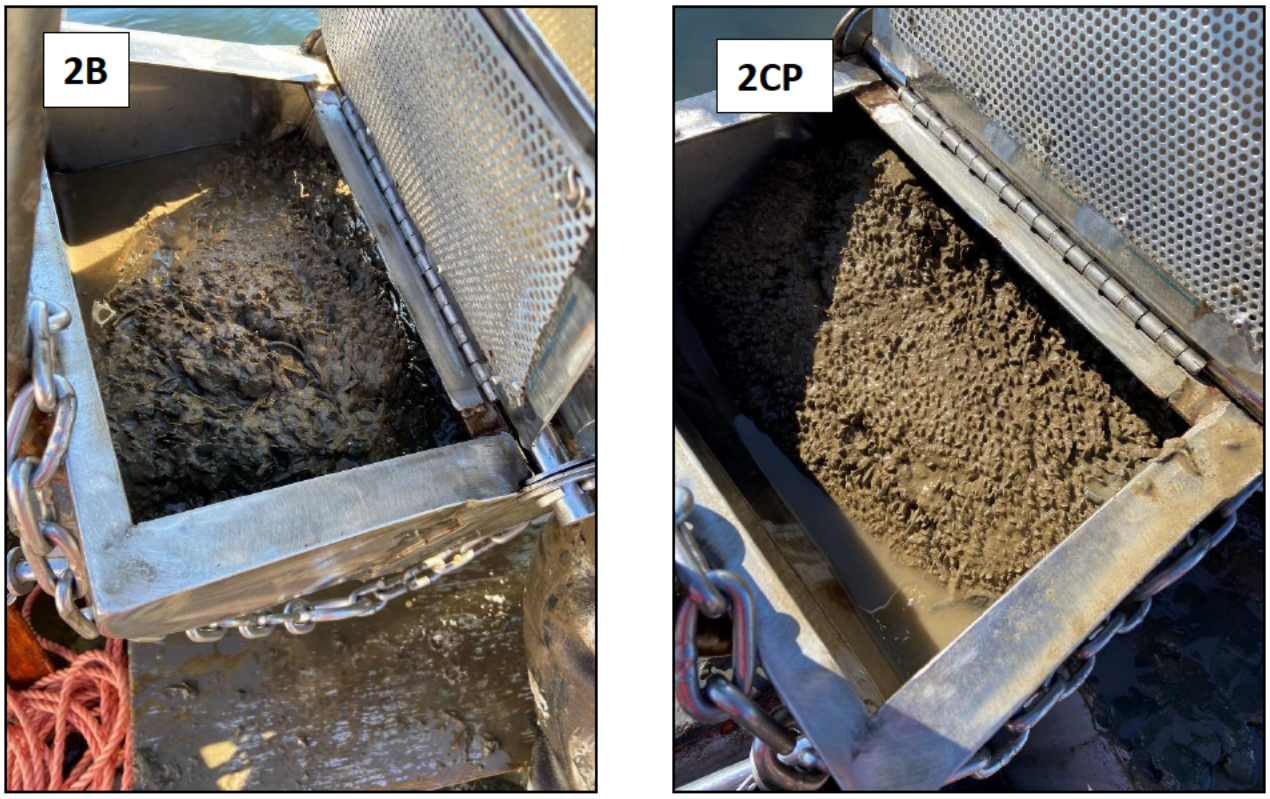
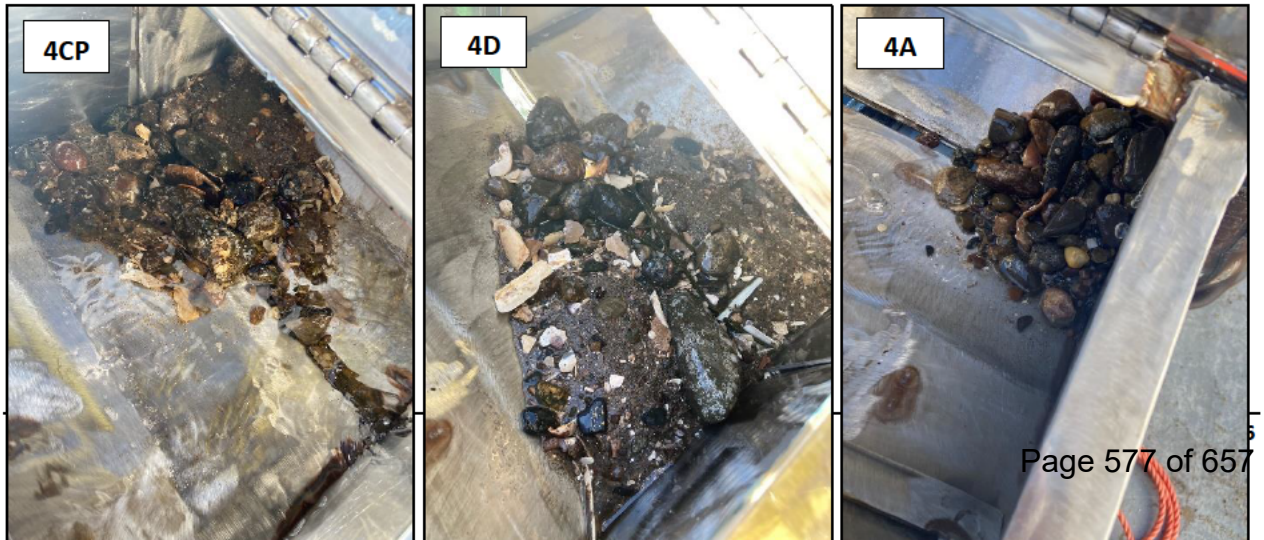


Figure 8 - Examples of dense arrays of polychaete castings at sediment surface from Site 2 (AQ#1450)

6.4.3 Grain size

Figure 10, Figure 11 and Figure 12 provide the grain size distribution at Sites 1-3. Table 6 provides the grain size results. Due to the hard bottom characteristics of Site 4, acceptable samples were unobtainable, though five or more attempts were made at each station (Figure 9).



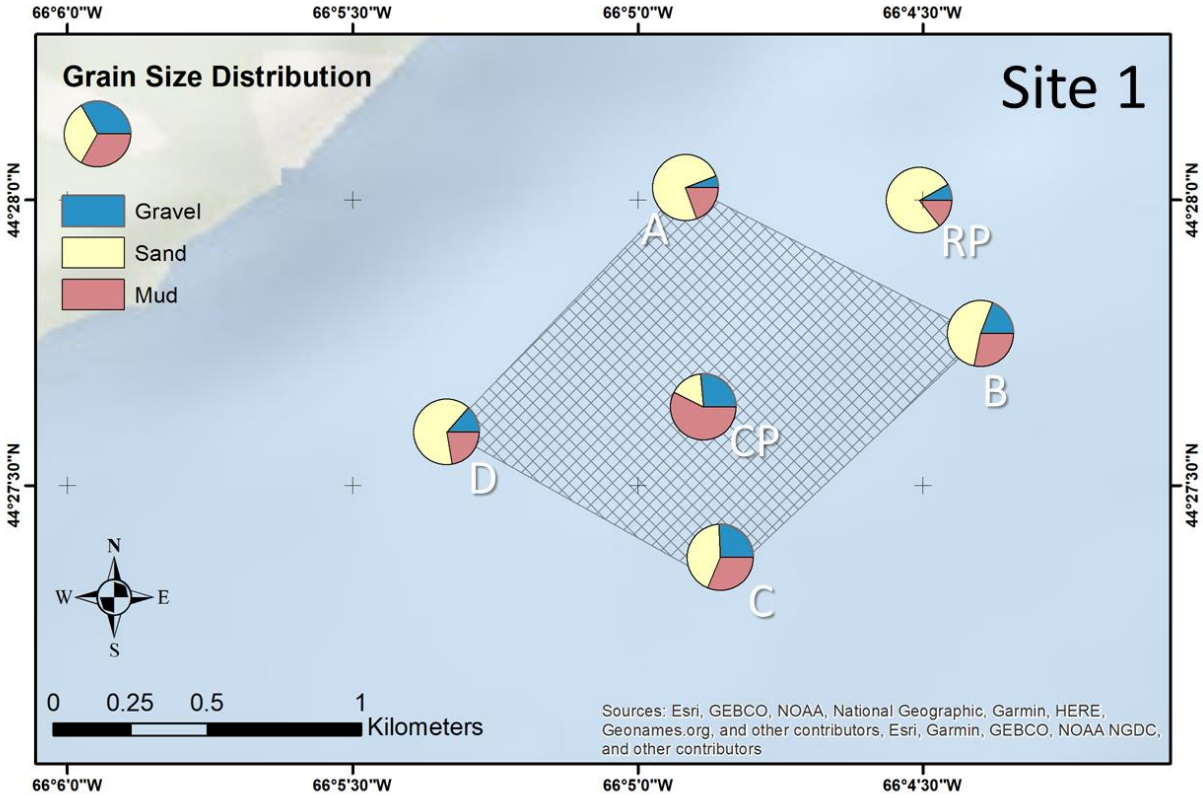


Figure 10 - Grain size distribution Site 1 (AQ#1449)

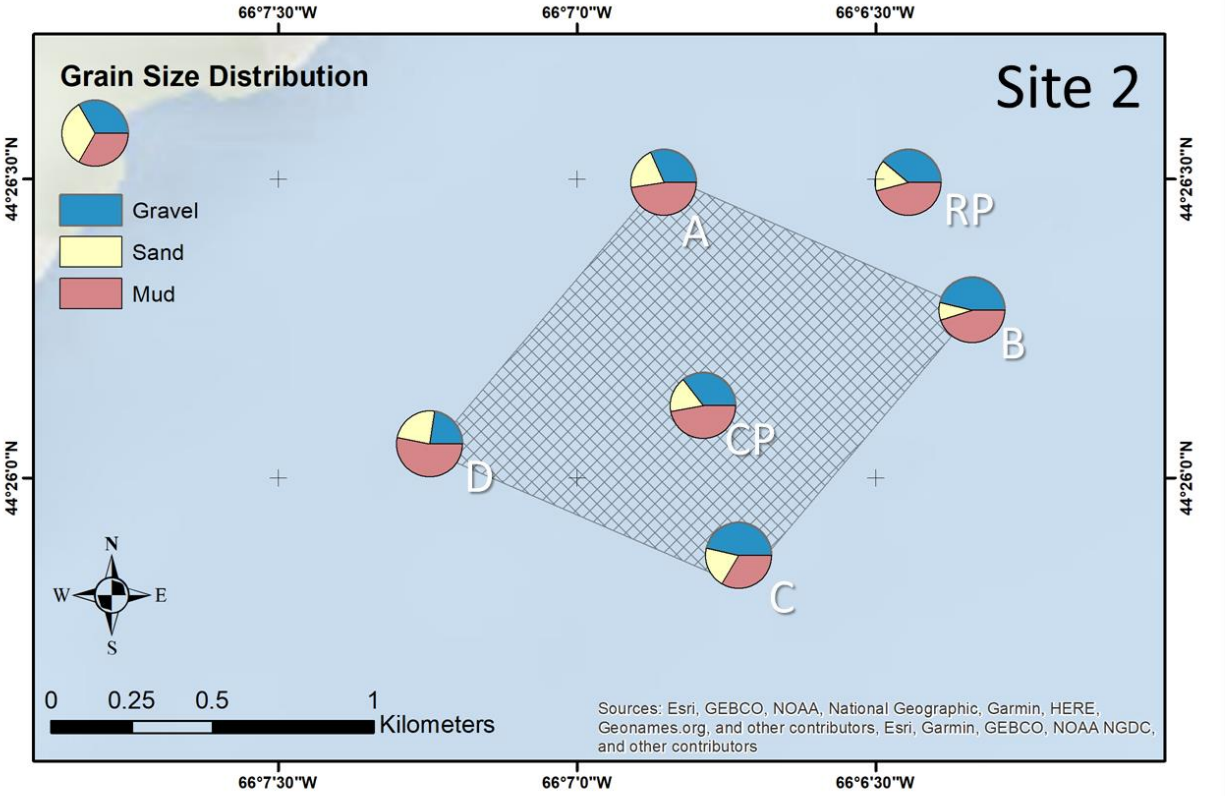


Figure 11 - Grain size distribution Site 2 (AQ#1450)

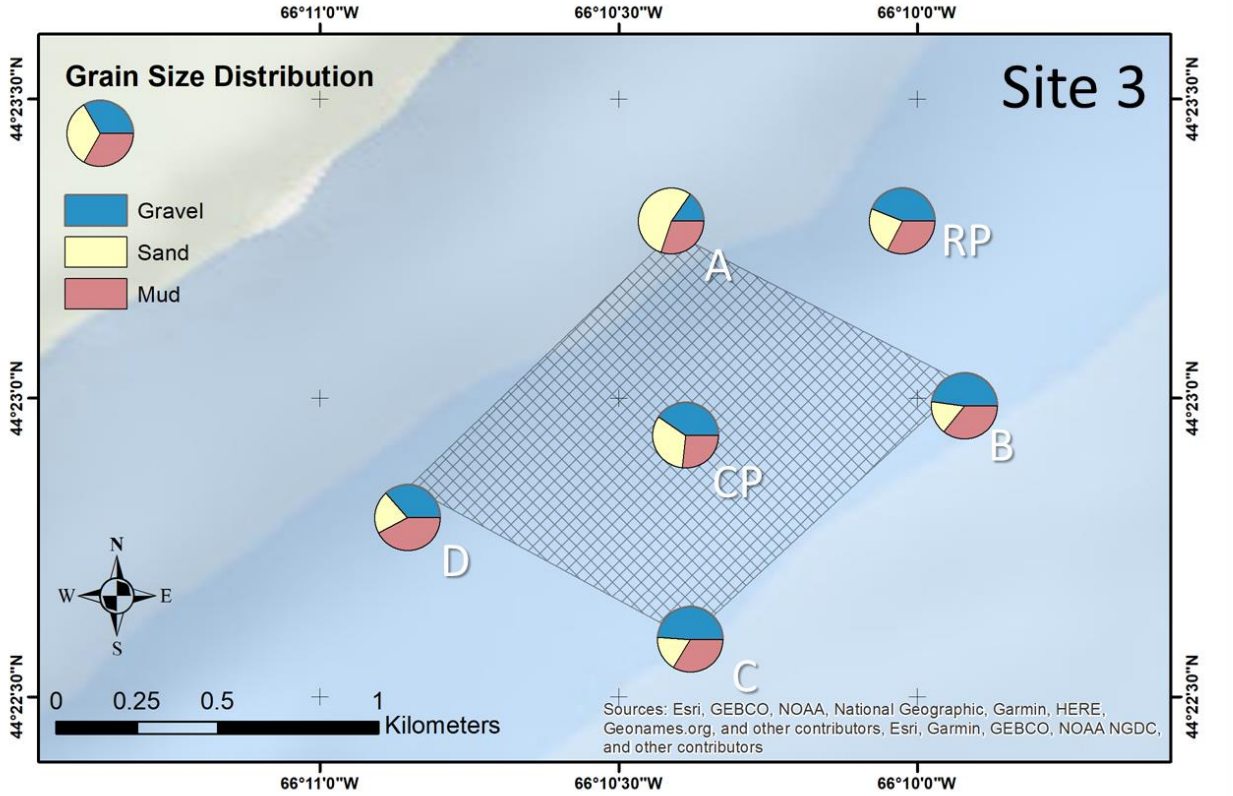


Figure 12 - Grain size distribution Site 3 (AQ#1451)

Table 6 Grain size results

		% Fraction					
	mm	1A	1B	1C	1D	1CP	1RP
Gravel	>2	5.94701	19.1103	25.7237	26.46	13.3078	8.08729
Very Coarse	1-2	9.71695	13.1604	14.7351	2.1839	20.122	31.2395
Coarse	0.5-1	14.1117	11.6267	14.207	1.9315	1.21918	3.94761
Medium	0.25-0.5	8.10893	3.28646	3.78623	0.58848	2.13244	7.78532
Fine	0.125-0.25	4.83666	2.71153	2.20362	0.9495	3.10321	7.89514
Very Fine	0.063-0.125	37.7037	22.0381	8.12452	10.5359	37.8483	26.7352
Mud	<0.063	19.5751	28.0666	31.2198	57.3508	22.2671	14.3099
% Gravel		5.94701	19.1103	25.7237	26.46	13.3078	8.08729
% Sand		74.4779	52.8231	43.0565	16.1893	64.4251	77.6028
% Mud		19.5751	28.0666	31.2198	57.3508	22.2671	14.3099

	mm	2A	2B	2C	2D	2CP	2RP
Gravel	>2	31.5874	46.1937	46.4493	35.3916	22.518	38.7584
Very Coarse	1-2	0.7086	1.04206	4.41325	1.07586	2.28026	1.22827
Coarse	0.5-1	0.64932	0.31293	0.81311	0.5263	0.69311	0.319
Medium	0.25-0.5	0.89016	0.53767	0.57285	0.38611	1.1161	0.71149
Fine	0.125-0.25	0.93414	0.78831	1.13745	1.16292	2.58571	1.54896
Very Fine	0.063-0.125	17.704	5.99013	13.0707	14.4709	17.6861	11.4507
Mud	<0.063	47.5264	45.1352	33.5434	46.9863	53.1207	45.9832
% Gravel		31.5874	46.1937	46.4493	35.3916	22.518	38.7584
% Sand		20.8862	8.67111	20.0074	17.6221	24.3613	15.2584
% Mud		47.5264	45.1352	33.5434	46.9863	53.1207	45.9832

	mm	3A	3B	3C	3D	3CP	3RP
Gravel	>2	15.2413	47.9092	48.9647	40.3137	36.5549	43.8497
Very Coarse	1-2	18.6263	0.53859	7.56225	12.6516	5.01233	9.30217
Coarse	0.5-1	18.4775	3.39566	0.33451	1.3835	3.40429	4.87853
Medium	0.25-0.5	0.99166	0.45397	0.55597	1.10121	1.79855	1.23974
Fine	0.125-0.25	0.78663	0.93587	1.07917	1.62685	1.50266	1.78252
Very Fine	0.063-0.125	15.7857	10.8823	7.72498	16.2729	9.44093	6.2654
Mud	<0.063	30.091	35.8844	33.7784	26.6503	42.2863	32.682
% Gravel		15.2413	47.9092	48.9647	40.3137	36.5549	43.8497
% Sand		54.6677	16.2064	17.2569	33.0361	21.1588	23.4684
% Mud		30.091	35.8844	33.7784	26.6503	42.2863	32.682

6.4.4 Sulfide & Redox Potential Calibrations

The tables in the following section outline the sulfide and redox calibrations undertaken for all lab work on March 10th, 12th and 17th; sulfide calibration curves are also reported.

Table 7 - March 10th sulfide and redox calibrations

Analytical Data Record Sheet

Lease #/ name: AQ#1449

Date samples collected: March 9,2022 Time samples collected (x – x): 10:34 – 12:15

Date of analysis: March 10,2022 Analysis start time: 13:44 Analysis end time: 14:15

Analysis performed by: [redacted]

Redox Probe Accuracy Check (25˚C)

ORP standard (start): 220 ORP standard (finish): 220

Sulfide Calibration Temperature target (20-25˚C) : 21.7˚

Na_2S standard concentration (µM)	mV	Meter calculated slope (mV) Acceptable range: -27 to -33mV after 500	Calculated 10-fold change (mV)	Verification Check	
				µM	mV
100.4	-840.5		1. 5,000 mV – 500 mV 2. 10,000 mV – 1,000 mV Acceptable range: -25 to -30 mV	100.4	-842.3
501.9	-863.6	-29.162		501.9	-863.9
1,003.7	-872.4			1,003.7	-873.1
5,018.6	-892.3		1. -28.7	5,018.6	-892.8
10,037.2	-901.8		2. -29.4	10,037.2	-902.1

Time calibration completed: 13:40 Time L-ascorbic acid added to SAOB: 13:31
Time calibration expires: 16:40 Time SAOB + L-ascorbic acid expires: 16:31

Table 8 - March 12th sulfide and redox calibrations

Analytical Data Record Sheet

Lease #/ name: AQ#1449

Date samples collected: March 11,2022 Time samples collected (x – x): 10:24 – 11:42

Date of analysis: March 12,2022 Analysis start time: 10:02 Analysis end time: 10:06

Analysis performed by: [redacted]

Redox Probe Accuracy Check (25˚C)

ORP standard (start): 220 ORP standard (finish): 220

Sulfide Calibration Temperature target (20-25˚C) : 22.0˚

Na_2S standard concentration (µM)	mV	Meter calculated slope (mV) Acceptable range: -27 to -33mV after 500	Calculated 10-fold change (mV)	Verification Check	
				µM	mV
100.0	-843.6		1. 5,000 mV – 500 mV 2. 10,000 mV – 1,000 mV Acceptable range: -25 to -30 mV	100.0	-843.3
499.9	-860.1	-28.51		499.9	-859.4
999.8	-869.0			999.8	-868.2
4999.1	-889.1		1. -29.0	4999.1	-887.9
9998.2	-897.1		2. -28.1	9998.2	-898.1

Time calibration completed: 9:40 Time L-ascorbic acid added to SAOB: 9:32
Time calibration expires: 12:40 Time SAOB + L-ascorbic acid expires: 12:32

Table 9 - March 17th sulfide and redox calibrations

Analytical Data Record Sheet

Lease #/ name: AQ#1449, 1450, 1451

Date samples collected: March 16,2022 Time samples collected (x – x): 09:37 – 15:21

Date of analysis: March 17,2022 Analysis start time: 14:20 Analysis end time: 16:23

Analysis performed by: [redacted]

Redox Probe Accuracy Check (25˚C)

ORP standard (start): 220 ORP standard (finish): 220

Sulfide Calibration Temperature target (20-25˚C): 21.1˚

Na_2S standard concentration (µM)	mV	Meter calculated slope (mV) Acceptable range: -27 to -33mV after 500	Calculated 10-fold change (mV)	Verification Check	
				µM	mV
99.9	-842.1		1. 5,000 mV – 500 mV 2. 10,000 mV – 1,000 mV Acceptable range: -25 to -30 mV	99.9	-842
499.7	-856.9	-30.024		499.7	-854.9
999.4	-866.7			999.4	-866.5
4996.9	-886.5		1. -29.6	4996.9	-884.7
9993.9	-896.6		2. -29.9	9993.9	-896.2

Time calibration completed: 14:05 Time L-ascorbic acid added to SAOB: 14:03
Time calibration expires: 17:05 Time SAOB + L-ascorbic acid expires: 17:03

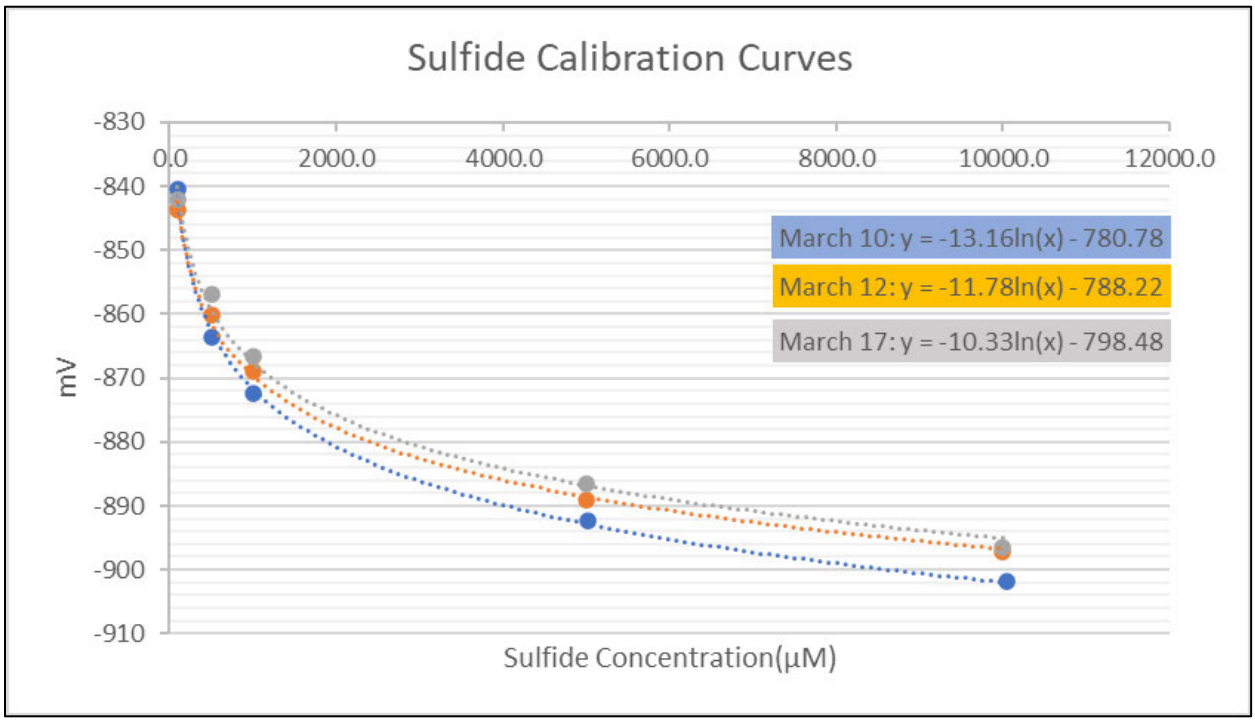


Figure 13 - Sulfide calibration curves

7 Current Speed and Direction

Three ADCPs were deployed in the option area at the locations shown in Figure 1 on page 12. The ADCPs were deployed using a subsurface mooring, as shown in Figure 14 and Figure 15. The deployments were carried out using Leeway Venture's boat (Rosborough 246). The length of the deployments was chosen to cover at least one tide cycle in the area, with >90 days selected for locations 1 and 2. The greater deployment lengths allow for better characterization of the peak speeds within the lease areas.

Table 10 List of ADCP models with their deployment locations and dates

ADCP	ADCP model	Deployment location	Water depth (Low water)	Deployment dates
1	Teledyne RDI Workhorse Sentinel 300kHz	44° 23.134'N, 66° 10.118'W	44m	Deployed June 18, 2021 for 90 days
2	Teledyne RDI Workhorse Sentinel 600kHz	44° 26.325'N, 66° 6.475'W	22m	Deployed June 18, 2021 for 90 days
3	Teledyne RDI Workhorse Sentinel 300kHz	44° 19.621'N, 66° 14.346'W	40m	Deployed August 4, 2021 for 50 days

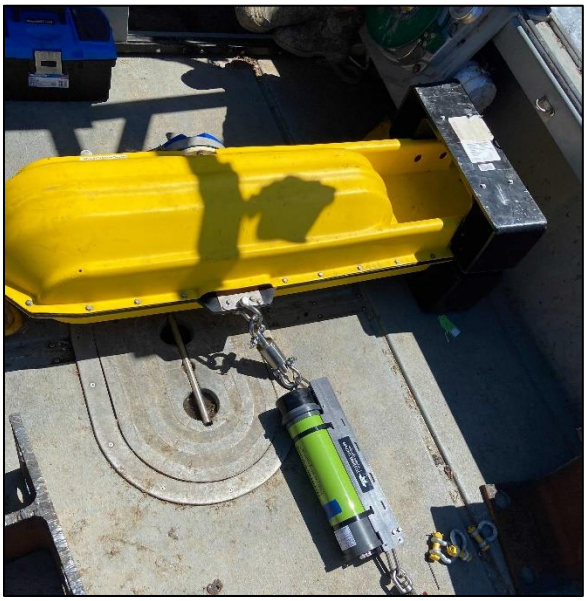


Figure 14 A picture of single float ADCP with subsurface moorings at the deployment location. The single float system used for ADCP 1 and 2



Figure 15 A picture of dual float ADCP with subsurface moorings at the deployment location. The dual float system used for ADCP 3

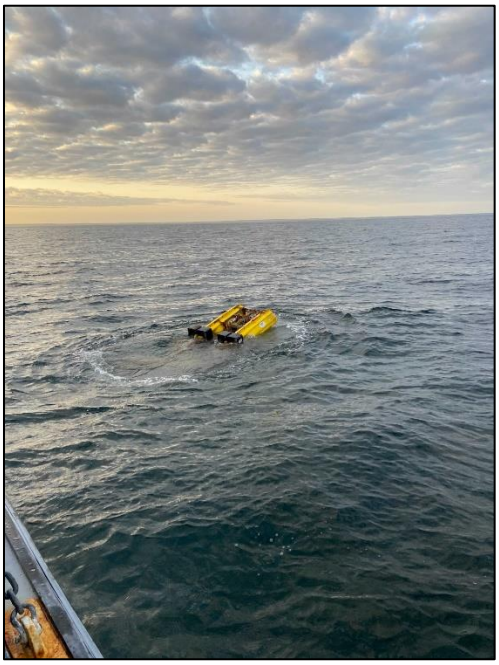


Figure 16 ADCP 3 during deployment

7.1 ADCP #1

An ADCP was deployed at St. Mary's Bay (44° 23.134'N, 66° 10.118'W) for 90 days from June 17, 2021, to September 17, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 10m and 15m are shown in Figure 17 to Figure 22. The total mean of current speeds at 10m, and 15m water depths are 0.36m/s, and 0.15m/s. The maximum recorded current speed at 10m, and 15m water depths are 1.49m/s, and 0.82m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated current and there is at least 90 days of data available. The results are shown in Table 11. Note that in addition to the maximum values, mean directional current speeds are also available in Table 11.

Based on the ADCP 1 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 12 hours (see Figure 19).

The predominant current directions at the ADCP 1 location were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 230 deg (flood) and 60 deg (ebb).

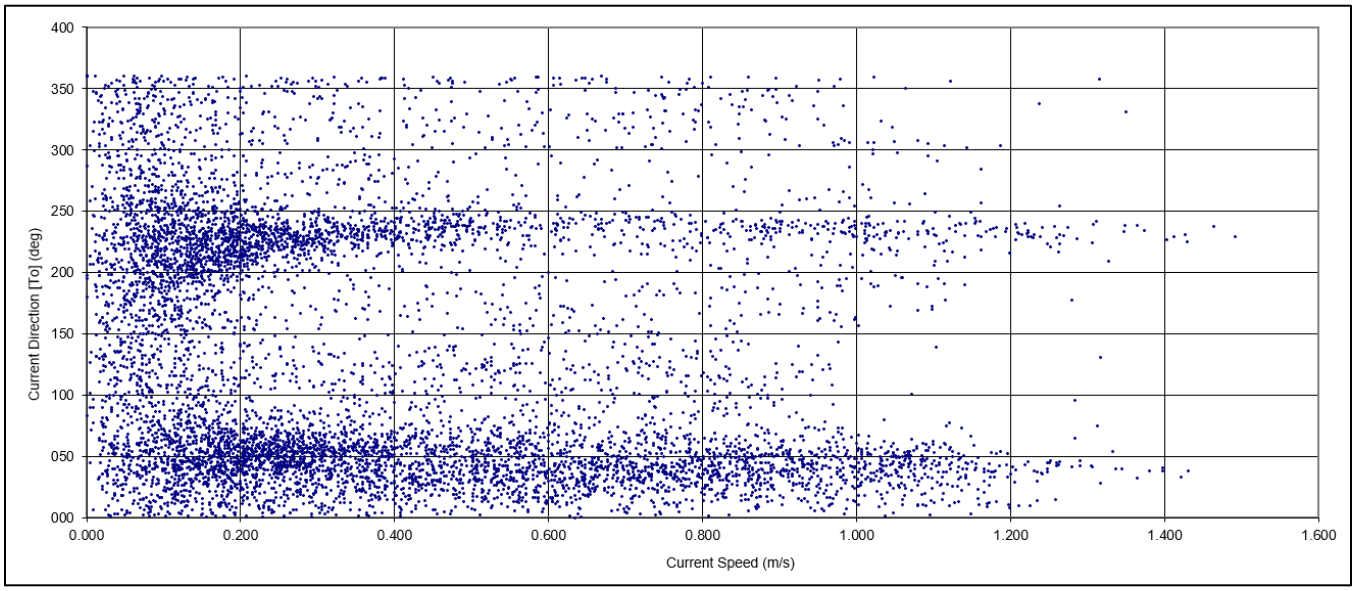


Figure 17 Scatter plot of current speed vs direction at ADCP 1 location - 10m water depth

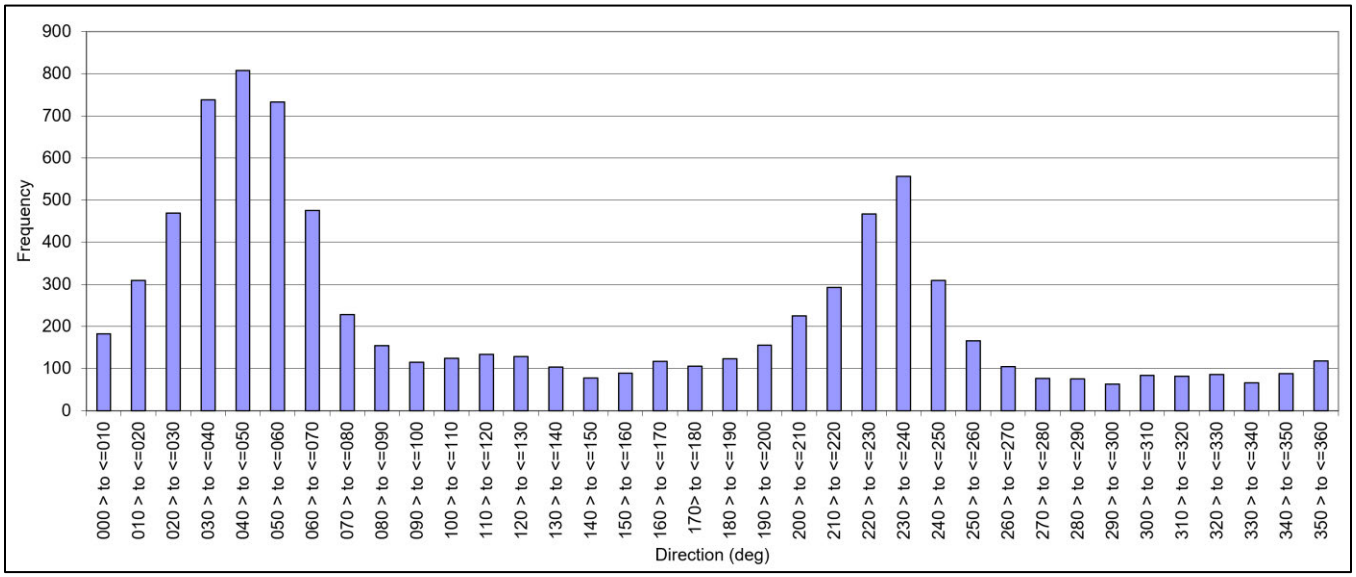


Figure 18 Frequency plot of current direction at ADCP 1 location - 10m Water depth

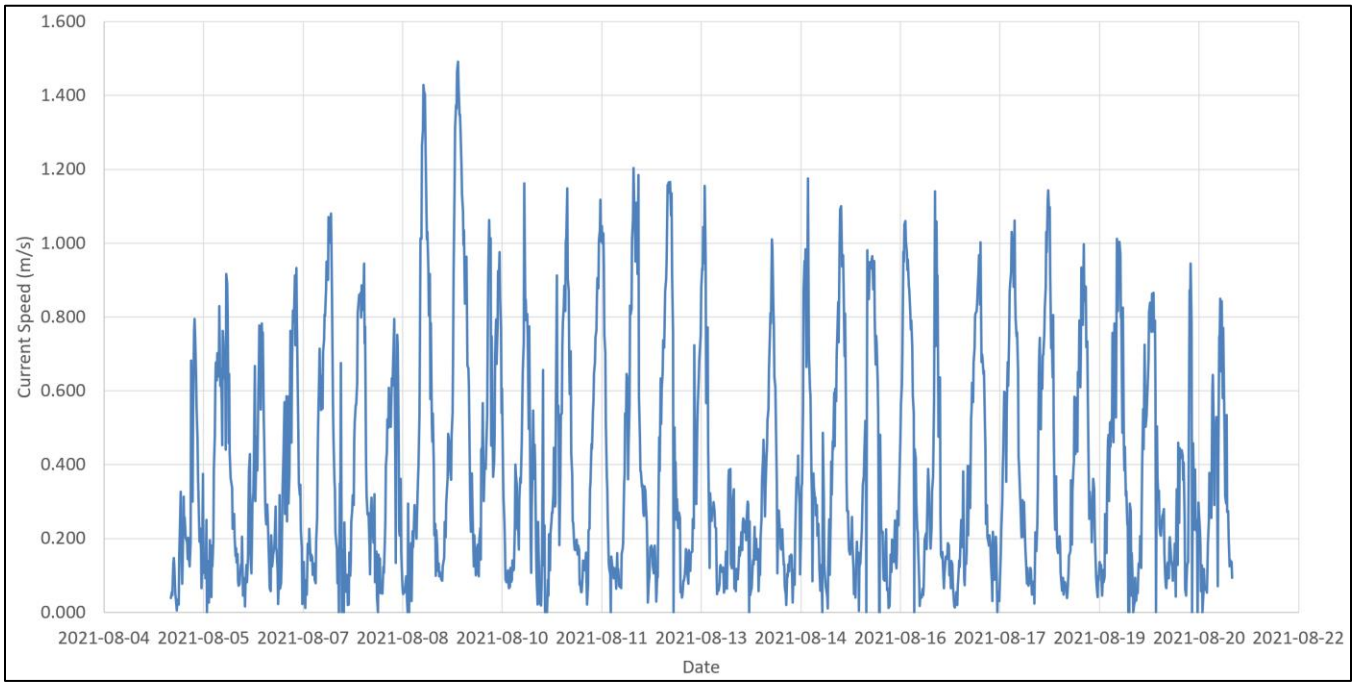


Figure 19 A sample time series plot of current speeds at ADCP 1 location - 10m Water depth

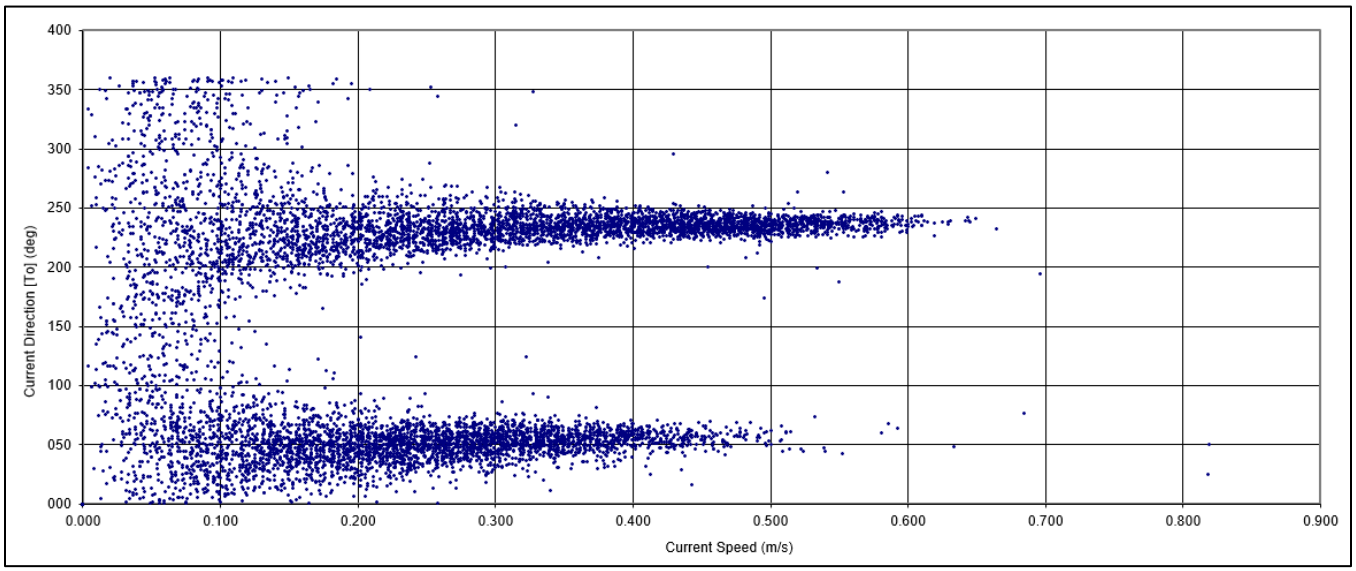


Figure 20 Scatter plot of current speed vs direction at ADCP 1 location - 15m water depth

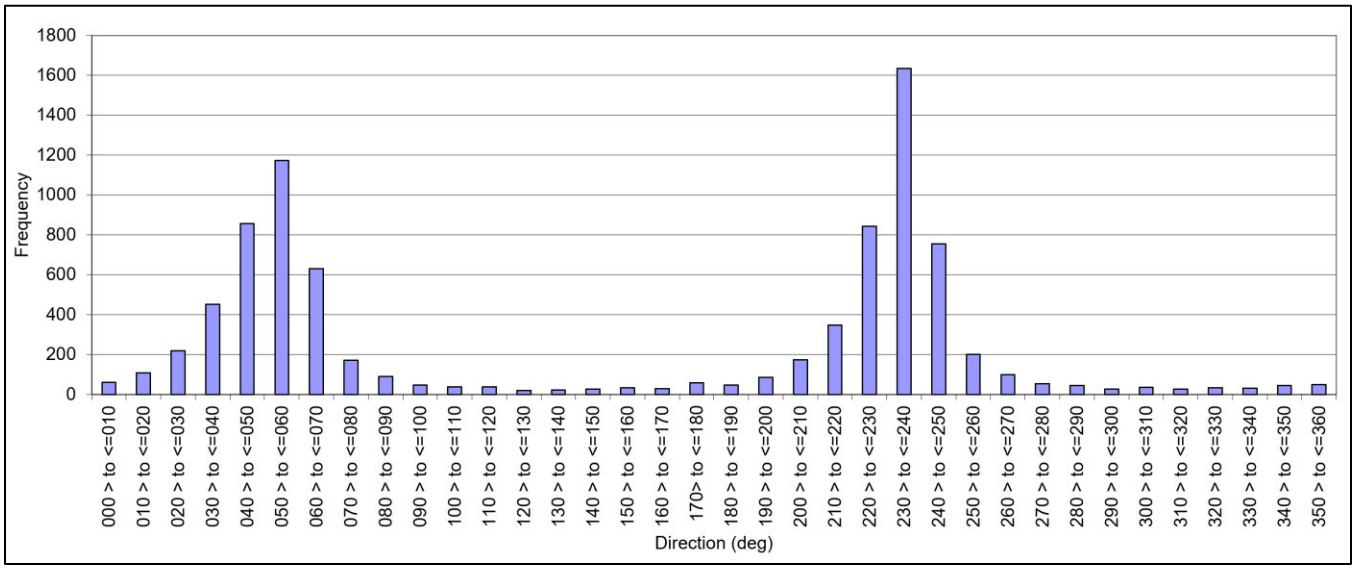


Figure 21 Frequency plot of current direction at ADCP 1 location - 15m Water depth

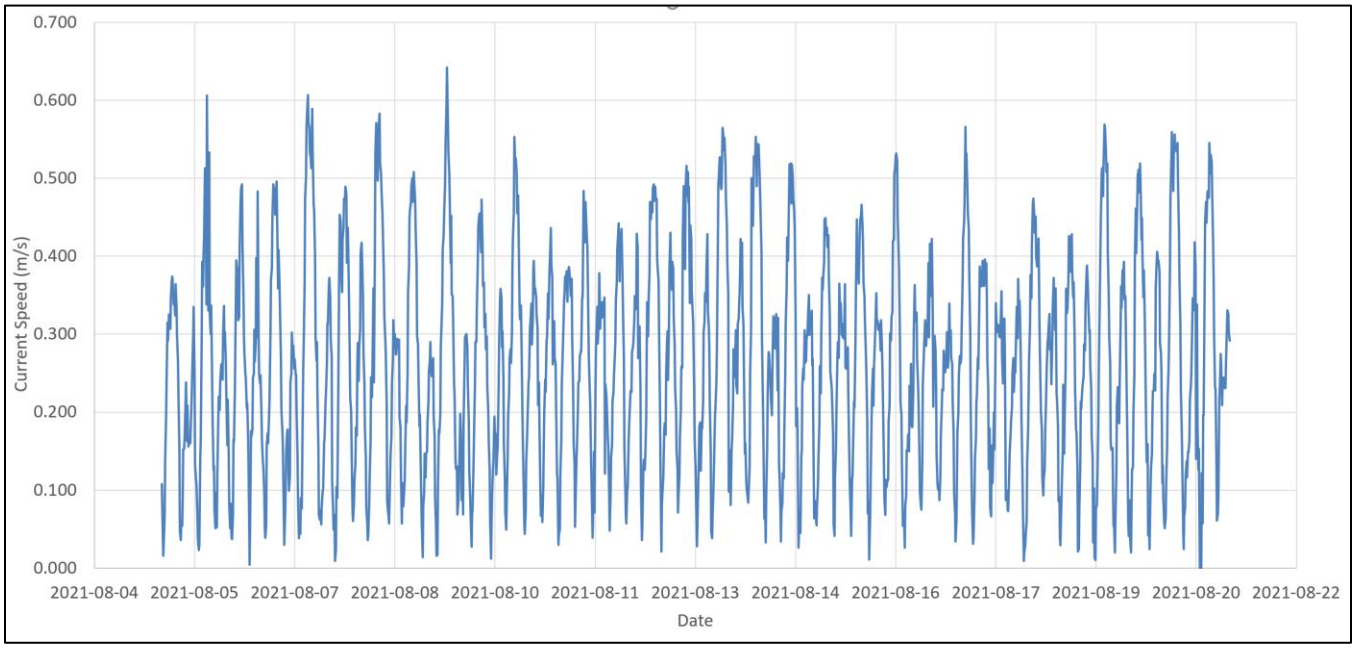


Figure 22 A sample time series plot of current speeds at ADCP 1 location - 15m Water depth

Table 11: 1 in 10 and 1 in 50 current conditions at ADCP 1 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
10 m	*0*	N	1.32	0.37	1.65	1.85
	22.5	NNE	1.26	0.47	1.58	1.76
	45	NE	1.43	0.54	1.79	2.00
	67.5	ENE	1.33	0.45	1.66	1.86
	90	E	1.31	0.36	1.64	1.83
	112.5	ESE	1.28	0.36	1.60	1.79
	135	SE	1.32	0.38	1.65	1.85
	157.5	SSE	1.10	0.32	1.38	1.54
	180	S	1.28	0.31	1.60	1.79
	202.5	SSW	1.14	0.27	1.43	1.60
	225	SW	1.33	0.27	1.66	1.86
	247.5	WSW	1.49	0.42	1.86	2.09
	270	W	1.26	0.28	1.58	1.76
	292.5	WNW	1.16	0.27	1.45	1.62
	315	NW	1.19	0.37	1.49	1.67
	337.5	NNW	1.35	0.36	1.69	1.89
15 m	*0*	N	0.33	0.09	0.41	0.46
	22.5	NNE	0.44	0.13	0.55	0.62
	45	NE	0.82	0.20	1.03	1.15
	67.5	ENE	0.82	0.27	1.03	1.15
	90	E	0.68	0.18	0.85	0.95
	112.5	ESE	0.34	0.08	0.43	0.48
	135	SE	0.32	0.07	0.40	0.45
	157.5	SSE	0.20	0.06	0.25	0.28
	180	S	0.50	0.07	0.63	0.70
	202.5	SSW	0.70	0.12	0.88	0.98
	225	SW	0.50	0.21	0.63	0.70
	247.5	WSW	0.66	0.37	0.83	0.92
	270	W	0.55	0.23	0.69	0.77
	292.5	WNW	0.54	0.10	0.68	0.76
	315	NW	0.43	0.08	0.54	0.60
	337.5	NNW	0.32	0.08	0.40	0.45

7.2 ADCP #2

An ADCP was deployed at St. Mary's Bay (44° 26.325'N, 66° 6.475'W) for 90 days from June 17, 2021, to September 17, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 5m and 15m are shown in Figure 23 to Figure 28. The total mean of current speeds at 5m, and 15m water depths are 0.4m/s, and 0.15m/s. The maximum recorded current speed at 5m, and 15m water depths are 1.33m/s, and 0.69m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated current and there is at least 90 days of data available. The results are shown in Table 12. Note that in addition to the maximum values, mean directional current speeds are also available in Table 12.

Based on the ADCP 2 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 12 hours (see Figure 25).

The predominant current directions at the ADCP 2 location were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 240 deg (flood) and 70 deg (ebb).

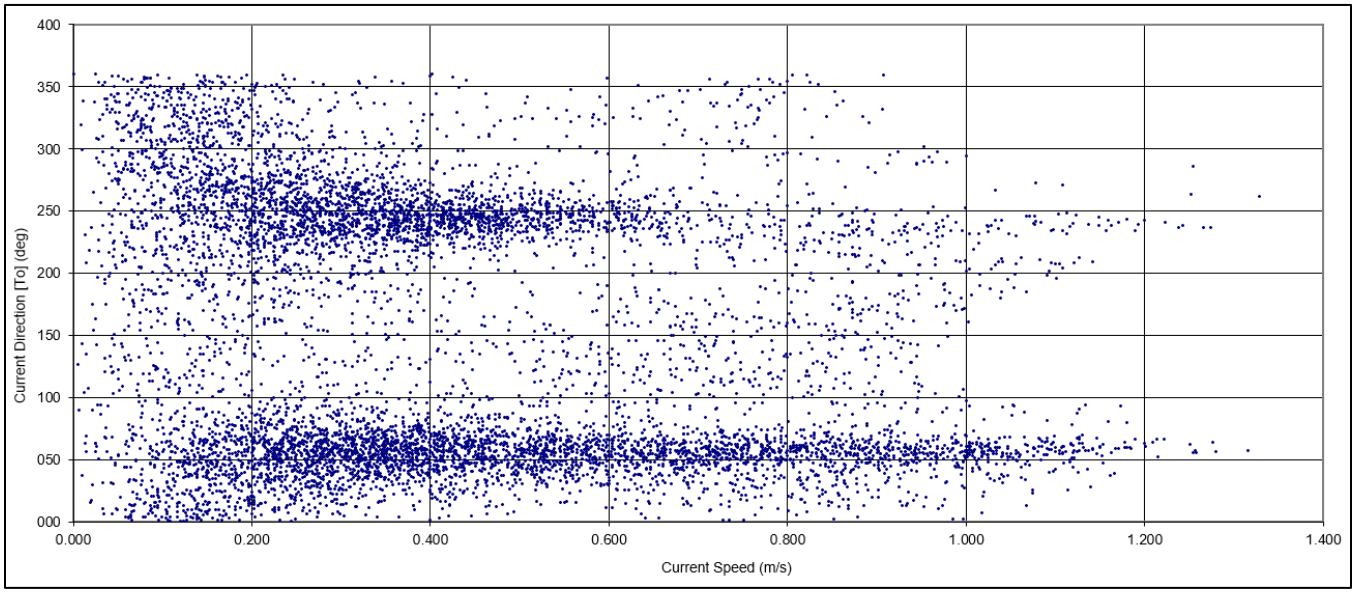


Figure 23 Scatter plot of current speed vs direction at ADCP 2 location - 5m water depth

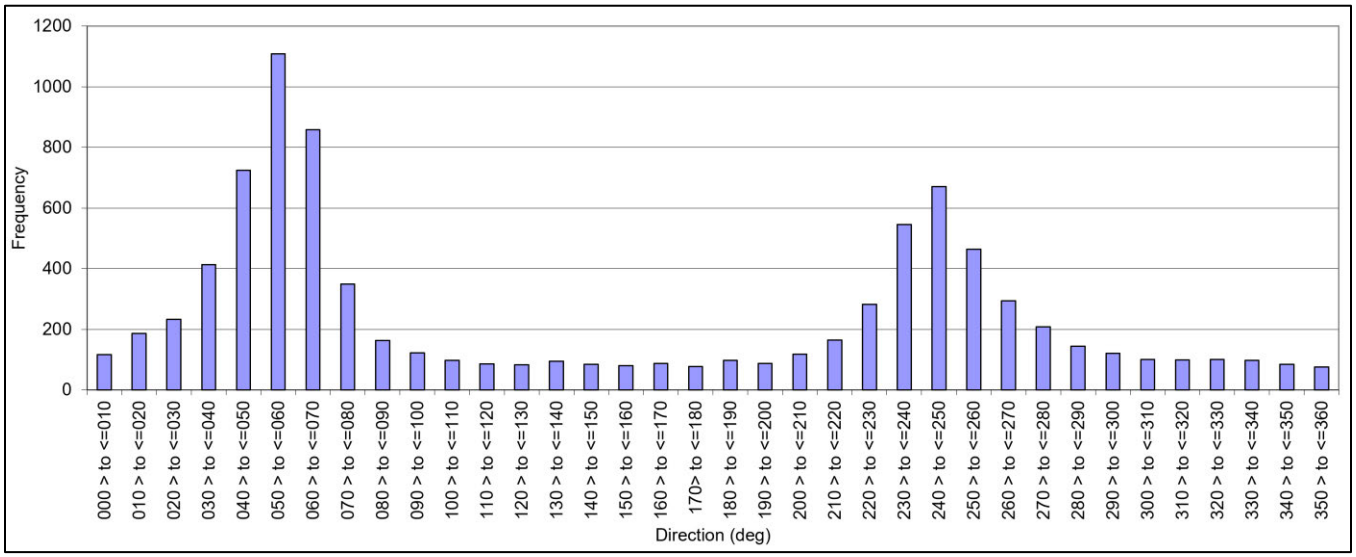


Figure 24 Frequency plot of current direction at ADCP 2 location - 5m Water depth

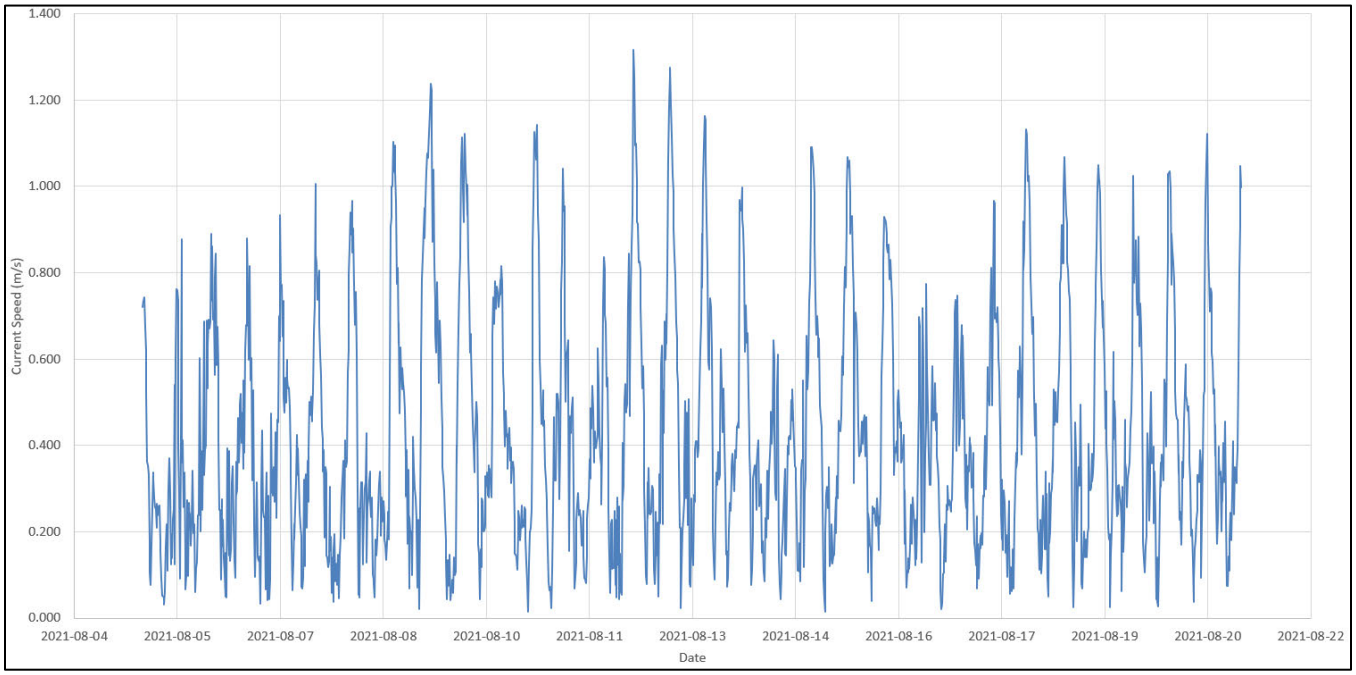


Figure 25 A sample time series plot of current speeds at ADCP 2 location - 5m Water depth

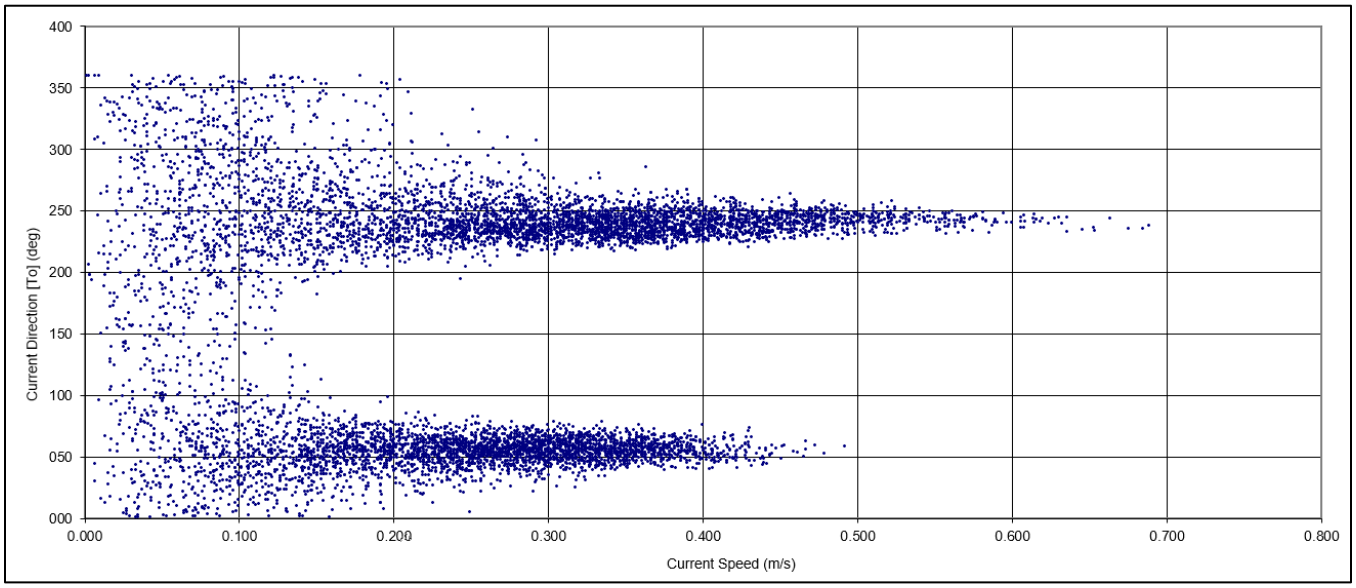


Figure 26 Scatter plot of current speed vs direction at ADCP 2 location - 15m water depth

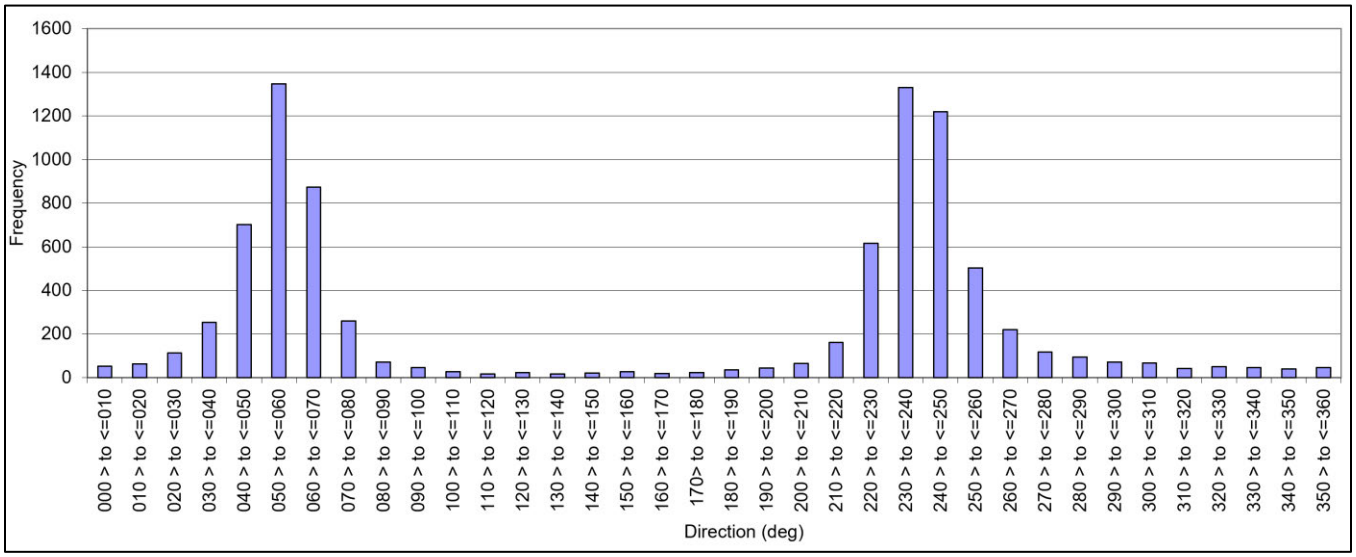


Figure 27 Frequency plot of current direction at ADCP 2 location - 15m Water depth

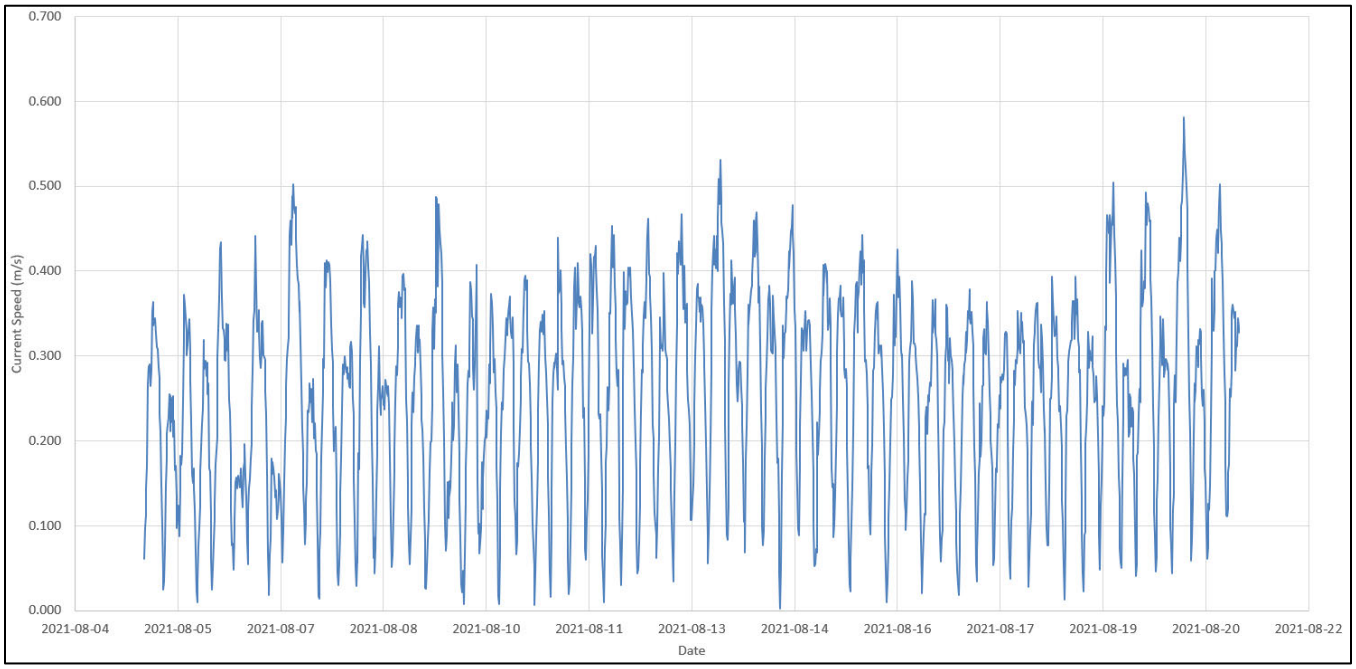


Figure 28 A sample time series plot of current speeds at ADCP 2 location - 15m Water depth

Table 12: 1 in 10 and 1 in 50 current conditions at ADCP 2 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
5 m	*0*	N	0.91	0.27	1.14	1.27
	22.5	NNE	1.07	0.35	1.34	1.50
	45	NE	1.17	0.45	1.46	1.64
	67.5	ENE	1.32	0.54	1.65	1.85
	90	E	1.18	0.43	1.48	1.65
	112.5	ESE	1.17	0.48	1.46	1.64
	135	SE	0.94	0.47	1.18	1.32
	157.5	SSE	0.98	0.50	1.23	1.37
	180	S	1.00	0.49	1.25	1.40
	202.5	SSW	1.10	0.42	1.38	1.54
	225	SW	1.14	0.40	1.43	1.60
	247.5	WSW	1.27	0.43	1.59	1.78
	270	W	1.33	0.36	1.66	1.86
	292.5	WNW	1.25	0.27	1.56	1.75
	315	NW	1.00	0.26	1.25	1.40

	337.5	NNW	0.91	0.26	1.14	1.27
15 m	*0*	N	0.21	0.09	0.26	0.29
	22.5	NNE	0.26	0.11	0.33	0.36
	45	NE	0.44	0.19	0.55	0.62
	67.5	ENE	0.49	0.27	0.61	0.69
	90	E	0.43	0.21	0.54	0.60
	112.5	ESE	0.20	0.08	0.25	0.28
	135	SE	0.15	0.07	0.19	0.21
	157.5	SSE	0.12	0.06	0.15	0.17
	180	S	0.12	0.06	0.15	0.17
	202.5	SSW	0.24	0.08	0.30	0.34
	225	SW	0.43	0.19	0.54	0.60
	247.5	WSW	0.69	0.33	0.86	0.97
	270	W	0.59	0.29	0.74	0.83
	292.5	WNW	0.36	0.15	0.45	0.50
	315	NW	0.29	0.11	0.36	0.41
	337.5	NNW	0.26	0.09	0.33	0.360

7.3 ADCP #3

An ADCP was deployed at St. Mary's Bay (44° 19.621'N, 66° 14.346'W) for 50 days from August 4, 2021, to September 24, 2021. The scatter plots of current speed vs direction as well as a current direction frequency and time series plots for water depth of 5m and 15m are shown in Figure 29 to Figure 34. The total mean of current speeds at 5m, and 15m water depths are 0.35m/s, and 0.29m/s. The maximum recorded current speed at 5m, and 15m water depths are 2.49m/s, and 1.52m/s, respectively. As per Scottish standard [2], the 10- and 50-year return period current speeds are estimated based on factors of 1.25 and 1.4, given that this is an area with a tidally dominated currents. The results are shown in Table 13. Note that in addition to the maximum values, mean directional current speeds are also available in Table 13.

Based on the ADCP 3 data, the time interval between each current speed measurement is 15 minutes. The time period for the typical daily maximums is approximately 8 hours (see Figure 31).

The predominant current directions at the ADCP 3 locations were determined by plotting the cumulative frequency for each current direction. Based on the results, the predominant current directions are 230 deg (flood) and 70 deg (ebb).

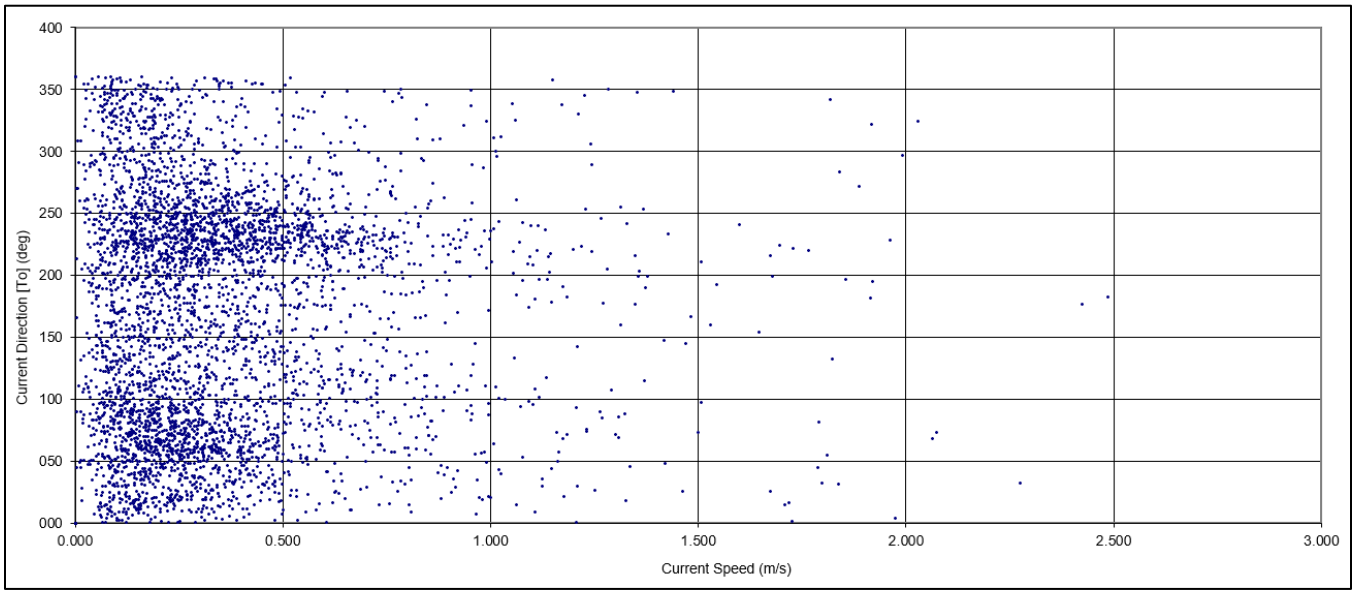


Figure 29 Scatter plot of current speed vs direction at ADCP 3 location - 5m water depth

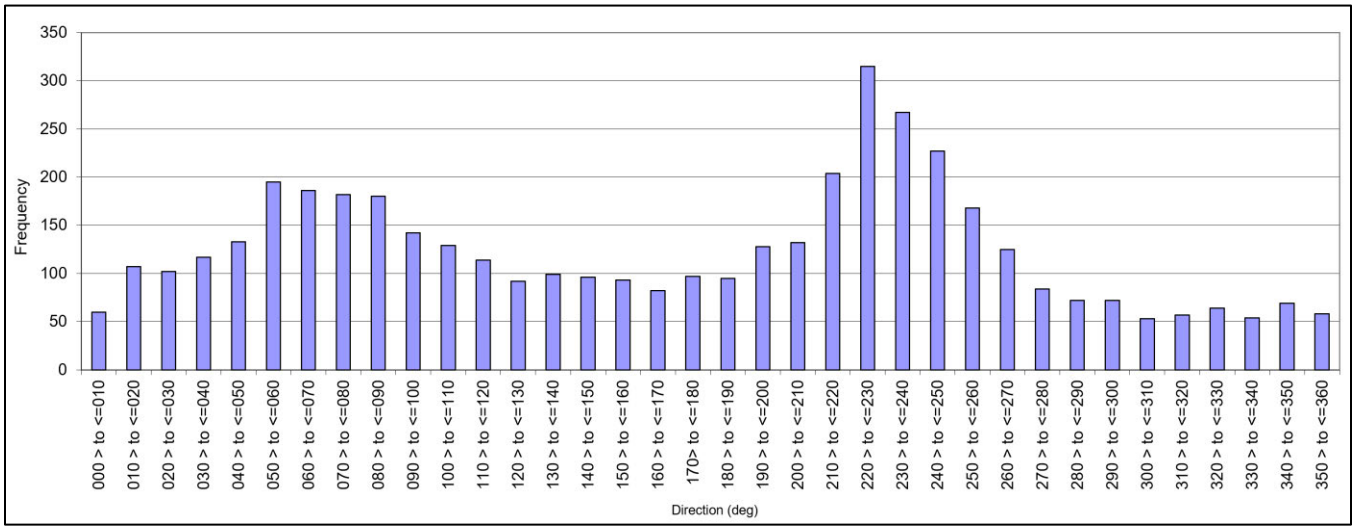


Figure 30 Frequency plot of current direction at ADCP 3 location - 5m Water depth

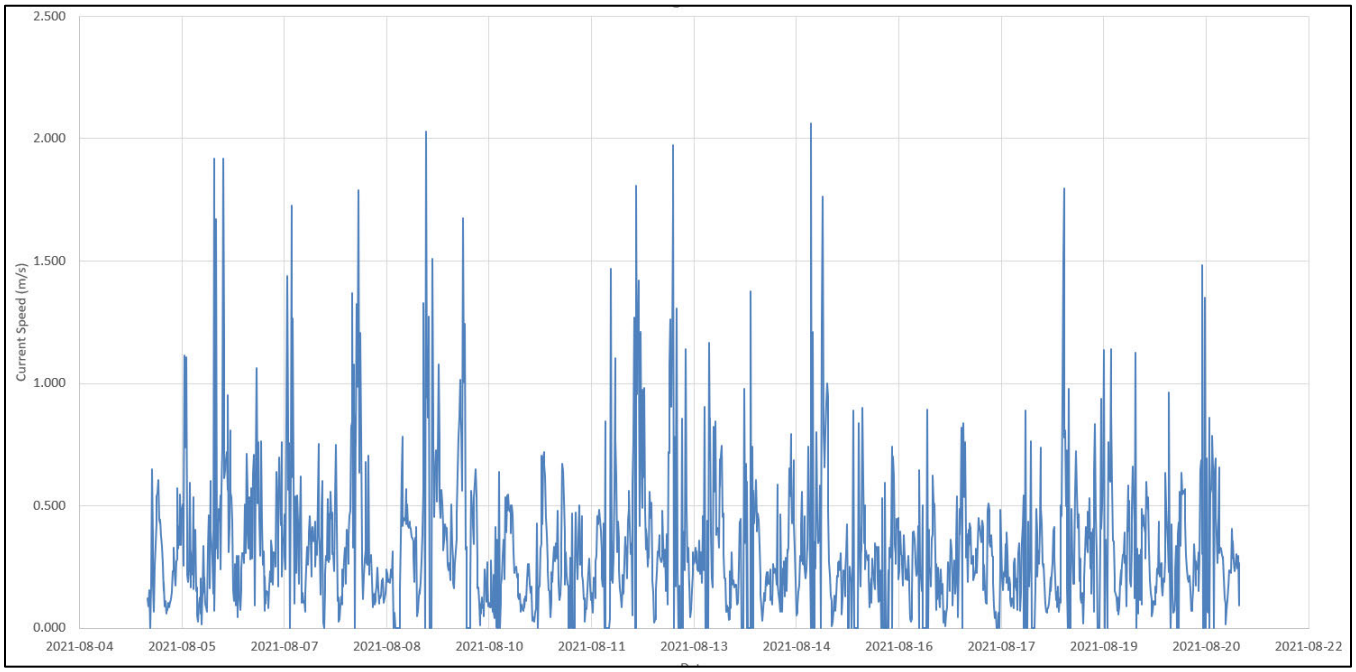


Figure 31 A sample time series plot of current speeds at ADCP 3 location - 5m Water depth

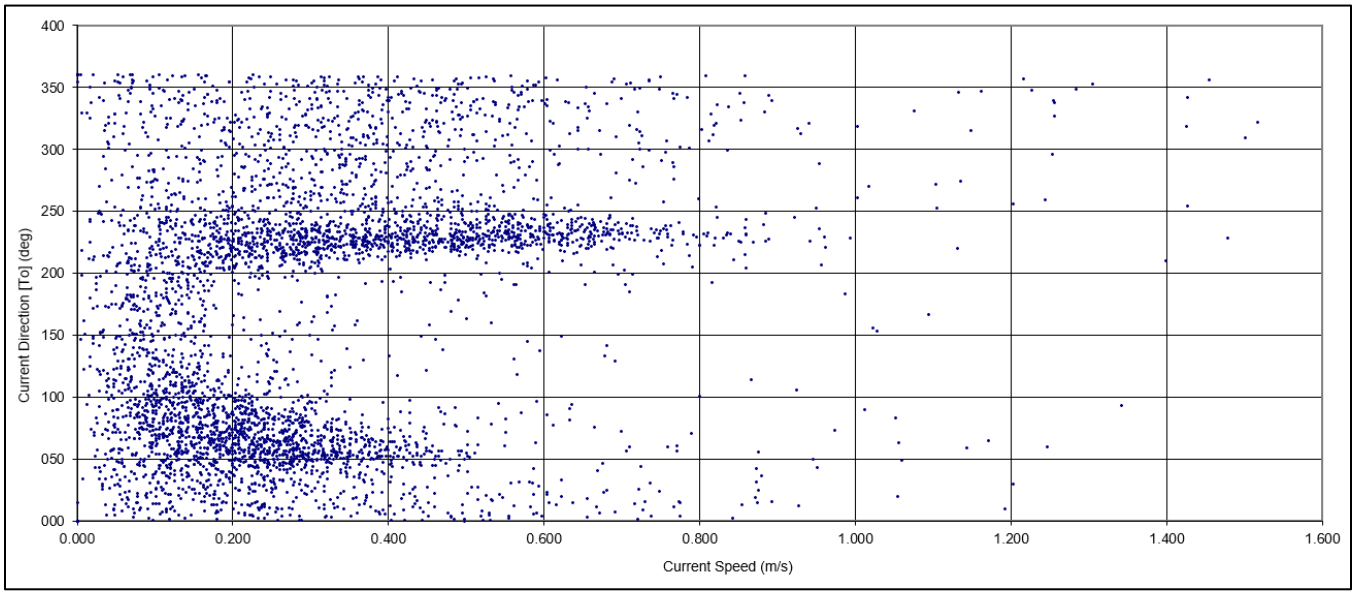


Figure 32 Scatter plot of current speed vs direction at ADCP 3 location - 15m water depth

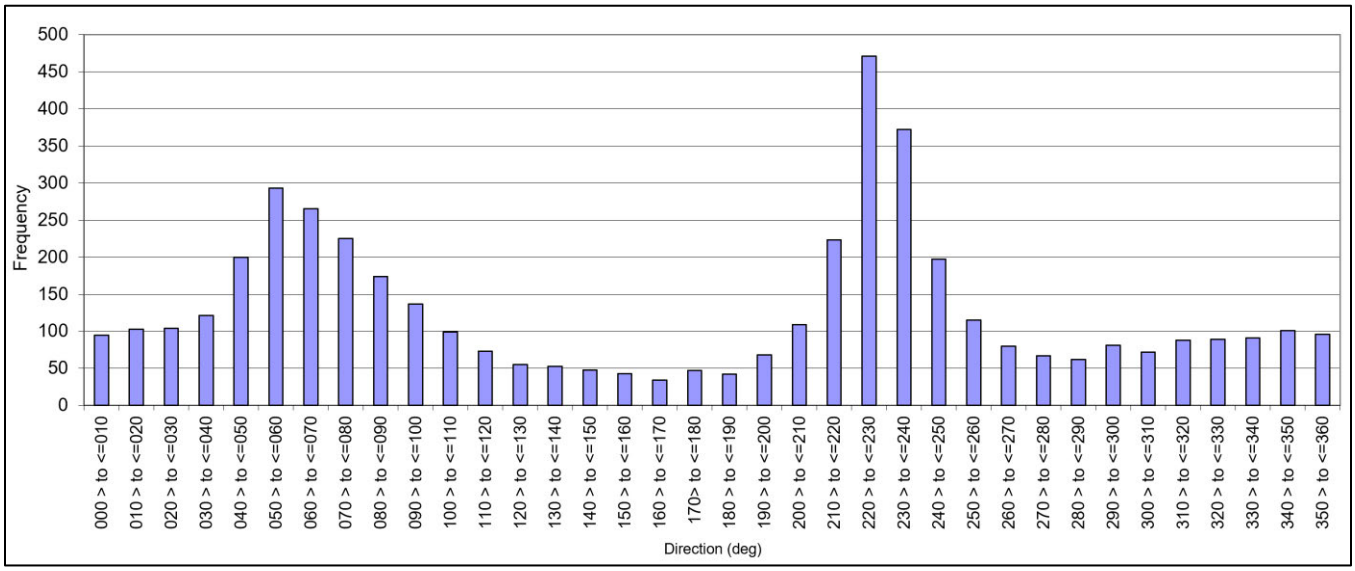


Figure 33 Frequency plot of current direction at ADCP 3 location - 15m Water depth

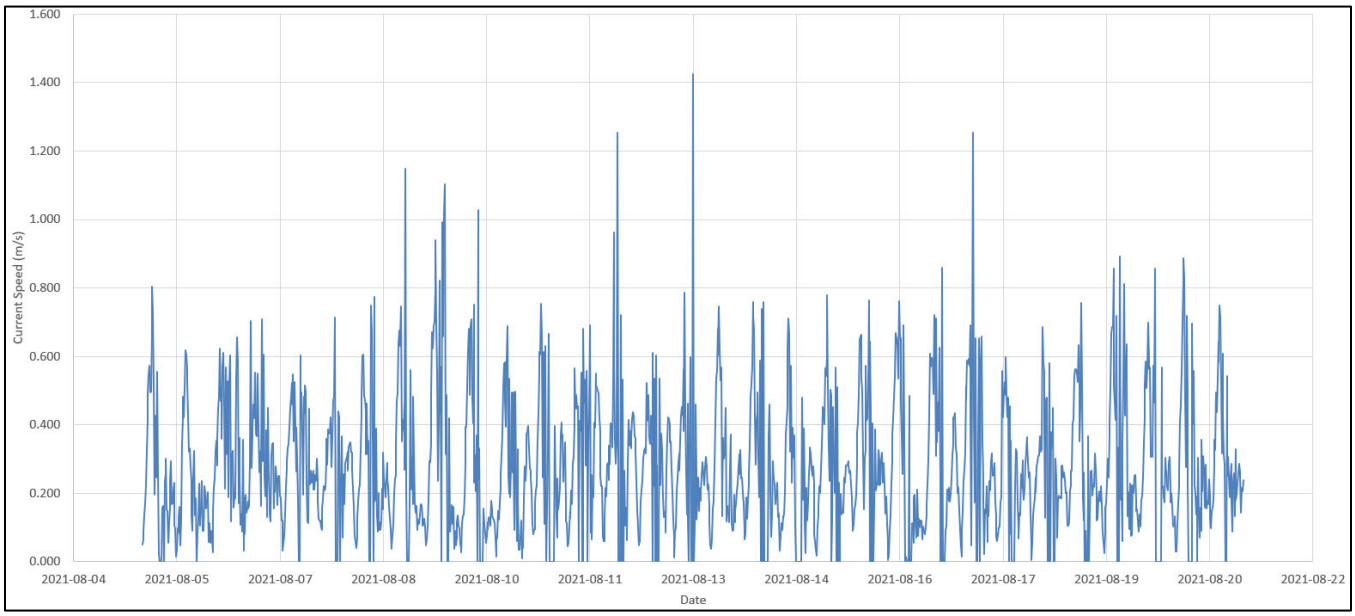


Figure 34 A sample time series plot of current speeds at ADCP 3 location - 15m Water depth

Table 13: 1 in 10 and 1 in 50 current conditions at ADCP 3 location using Scottish standard [2]

Water depth	Direction [To] [°]		Maximum current speed recorded (m/s)	Mean current speed (m/s)	1 in 10 current speed (m/s)	1 in 50 current speed (m/s)
5 m	*0*	N	1.82	0.29	2.28	2.55
	22.5	NNE	1.97	0.33	2.46	2.76
	45	NE	2.28	0.37	2.85	3.19
	67.5	ENE	1.81	0.31	2.26	2.53
	90	E	2.07	0.33	2.59	2.90
	112.5	ESE	1.51	0.35	1.89	2.11
	135	SE	1.82	0.36	2.28	2.55
	157.5	SSE	1.65	0.33	2.06	2.31
	180	S	2.43	0.37	3.04	3.40
	202.5	SSW	2.49	0.40	3.11	3.49
	225	SW	1.77	0.41	2.21	2.48
	247.5	WSW	1.96	0.38	2.45	2.74
	270	W	1.37	0.34	1.71	1.92
	292.5	WNW	1.89	0.32	2.36	2.65
	315	NW	1.99	0.33	2.49	2.79
	337.5	NNW	2.03	0.29	2.54	2.84
15 m	*0*	N	1.46	0.39	1.83	2.04
	22.5	NNE	1.19	0.33	1.49	1.67
	45	NE	1.20	0.26	1.50	1.68
	67.5	ENE	1.25	0.27	1.56	1.75
	90	E	1.05	0.22	1.31	1.47
	112.5	ESE	1.34	0.18	1.68	1.88
	135	SE	0.87	0.16	1.09	1.22
	157.5	SSE	1.03	0.17	1.29	1.44
	180	S	1.09	0.17	1.36	1.53
	202.5	SSW	0.99	0.22	1.24	1.39
	225	SW	1.40	0.33	1.75	1.96
	247.5	WSW	1.48	0.42	1.85	2.07
	270	W	1.43	0.35	1.79	2.00
	292.5	WNW	1.14	0.35	1.43	1.60
	315	NW	1.50	0.38	1.88	2.10
	337.5	NNW	1.52	0.39	1.90	2.13

8 Depositional Modeling

8.1 Model

Depositional simulations of farm-origin feed and faeces was conducted using the equilibrated ORGANIX model [5]. ORGANIX bases settling velocity of organic matter on faecal and feed pellet dimensions, while the horizontal advection is resolved through a Gaussian random walk approach that utilizes residual currents. Resuspension is assumed to be zero within this model. Because we expect resuspension to be significant at these energetic sites, the model predictions can be considered a worst-case scenario, with net deposition likely lower than model outputs.

8.2 Model Parameters

8.2.1 Organic Matter

Studies of Atlantic salmon have produced settling velocities of 3.2-9.2 cm s^{-1} for faeces [6][7][8] and 8.5-12.8 cm s^{-1} for uneaten feed [9][10]. For each site, an input of 3.5mm for faeces and 5.5mm for feed pellets was used, producing settling velocities of 4.02cm s^{-1} for faeces and 9.94cm s^{-1} for feed.

8.2.2 Array Design & Stocking

Cages were arranged in a 2x6 array at each site, and were oriented lengthwise along the x-axis (E-W) as follows:

1. 25˚
2. 20˚
3. 27˚
4. 23˚

In the model, at all sites, cages were polar, had a radius of 20.7m, a distance between the centers of adjacent cages of 65m, and a depth extending 15m from the surface. Each cage was stocked with 50,000 fish and was assigned a grow-out period of 18 months.

8.2.3 Hydrodynamics

The ADCP data was used to compute the residual currents for each site. Sites 1 & 2 (AQ#1449 & 1450) used ADCP2, Site 3 (AQ#1451) used ADCP1, and Site 4 (AQ#1452) used ADCP3. ORGANIX utilizes both an x and y component for residual currents and dispersion coefficients. Previous models have utilized dispersion coefficients in the range of 0.003 – 1m^2 s^{-1} for both k_x and k_y [6][11][12][13][14]. Both k_x and k_y were set to 0.1m^2 s^{-1} for the present simulations.

Initially, current velocity vectors were converted to their individual components on the x and y planes. Then, assuming a uniform bin size (beyond Bin 1), a rolling $A_{24}A_{24}A_{25}$ [15] detiding filter was applied to the individual bins for each ADCP dataset. Resulting matrices were integrated over time and depth, resulting in residual currents for each ADCP is presented in Table 14. Model parameters for the depositional model are summarized in Table 15.

Table 14 Residual current velocities

	Residual current velocities x (m/s)	Residual current velocities y (m/s)
ADCP 1	0.04	0.00
ADCP 2	0.01	0.00
ADCP 3	-0.07	-0.07

Table 15 Depositional Model Parameters

Site	Orientation (deg)	ADCP#	Mean Depth (m)	Cage Depth (m)	Cage Diameter (m)	Growth cycle length (d)	Fish Per Cage	Faecal Diameter (mm)	Feed pellet (mm)	x-velocity (m/s)	y-velocity (m/s)	K_x (m^2/s)	K_y (m^2/s)
1 (AQ#1449)	25	2	21	15	41.4	540	50,000	3.5	5.5	0.01	0.00	0.1	0.1
2 (AQ#1450)	20	2	23							0.01	0.00		
3 (AQ#1451)	27	1	44							0.01	0.04		
4 (AQ#1452)	23	3	43							-0.07	-0.07		

8.3 Depositional Model Results

Low residual currents at Site 1 kept the highest POM deposition values very close the cage centers and produces negative gradients from the center towards the cage edges. Minimal overlap of cage footprints >1gC $m^{-2}d^{-1}$ occurred between adjacent cages, and POM contours >1gC $m^{-2}d^{-1}$ extended <25m beyond the cage edges.

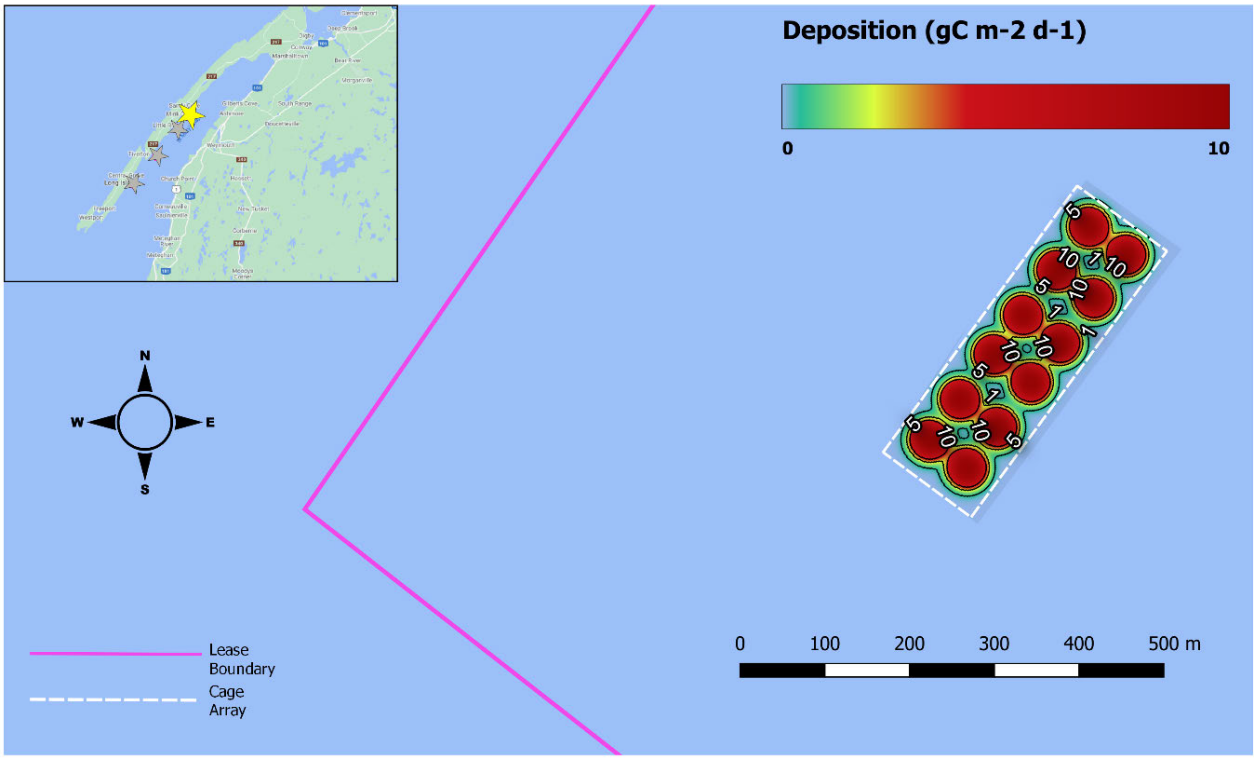


Figure 35 - Site 1 (AQ#1449) Deposition Model Results

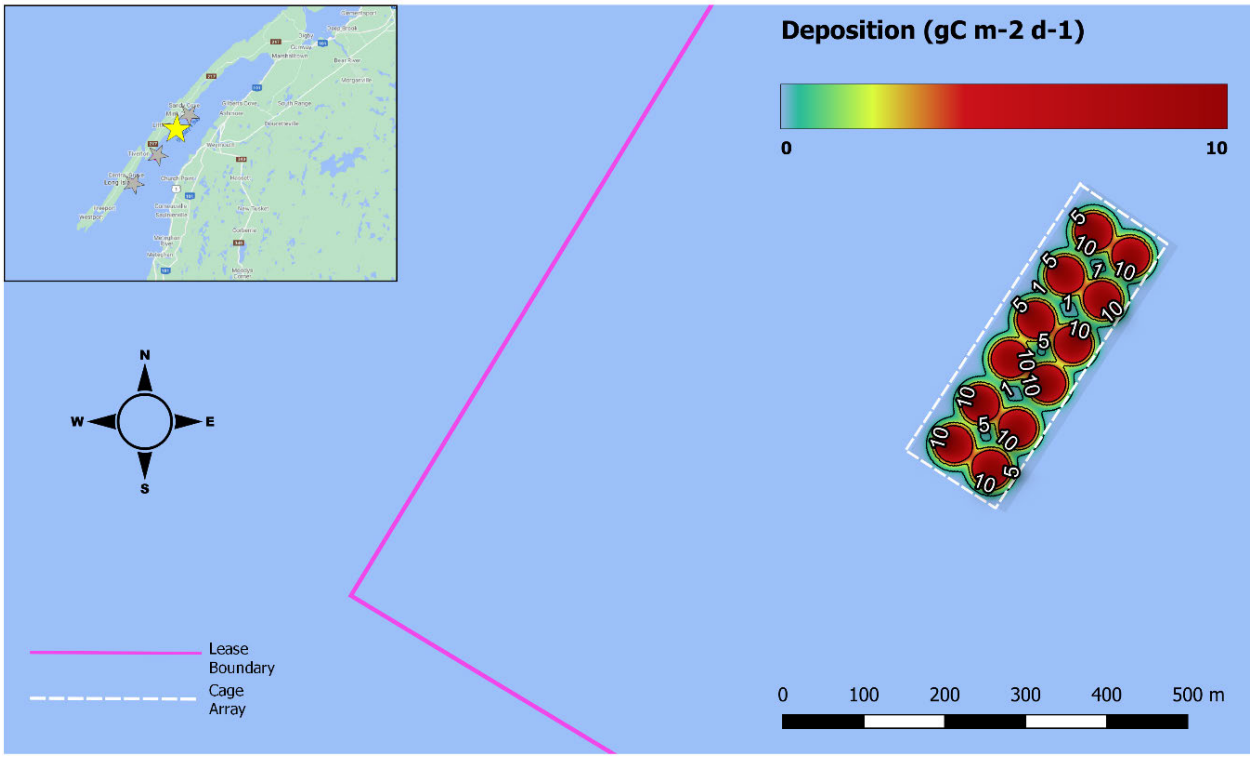


Figure 36 - Site 2 (AQ#1450) Depositional model results

Low residual currents at Site 2 kept the highest POM deposition values very close the cage centers and produced negative gradients from the center towards the cage edges. Minimal overlap of cage footprints >1gC $m^{-2}d^{-1}$ occurred between adjacent cages, and POM contours >1gC $m^{-2}d^{-1}$ extended <25m beyond the cage edges.

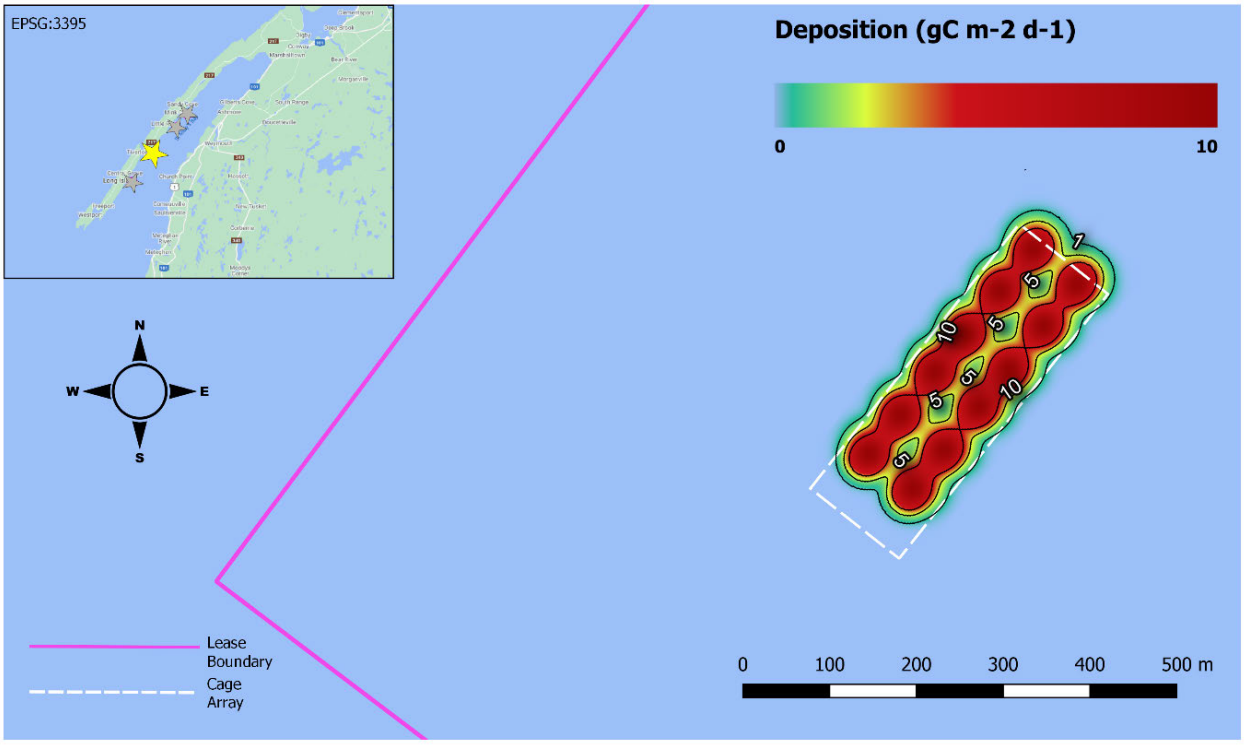


Figure 37 - Site 3 (AQ#1451) deposition model results

Residual currents to the NE were dominant at Site 3, pushing the highest deposition values to the NE edges of each cage. Moderate footprint overlap occurred between adjacent cages, and contours $\geq$1gC $m^{-2}d^{-1}$ extended beyond both lengthwise cage edges ~10m and the NE array edge ~40m.

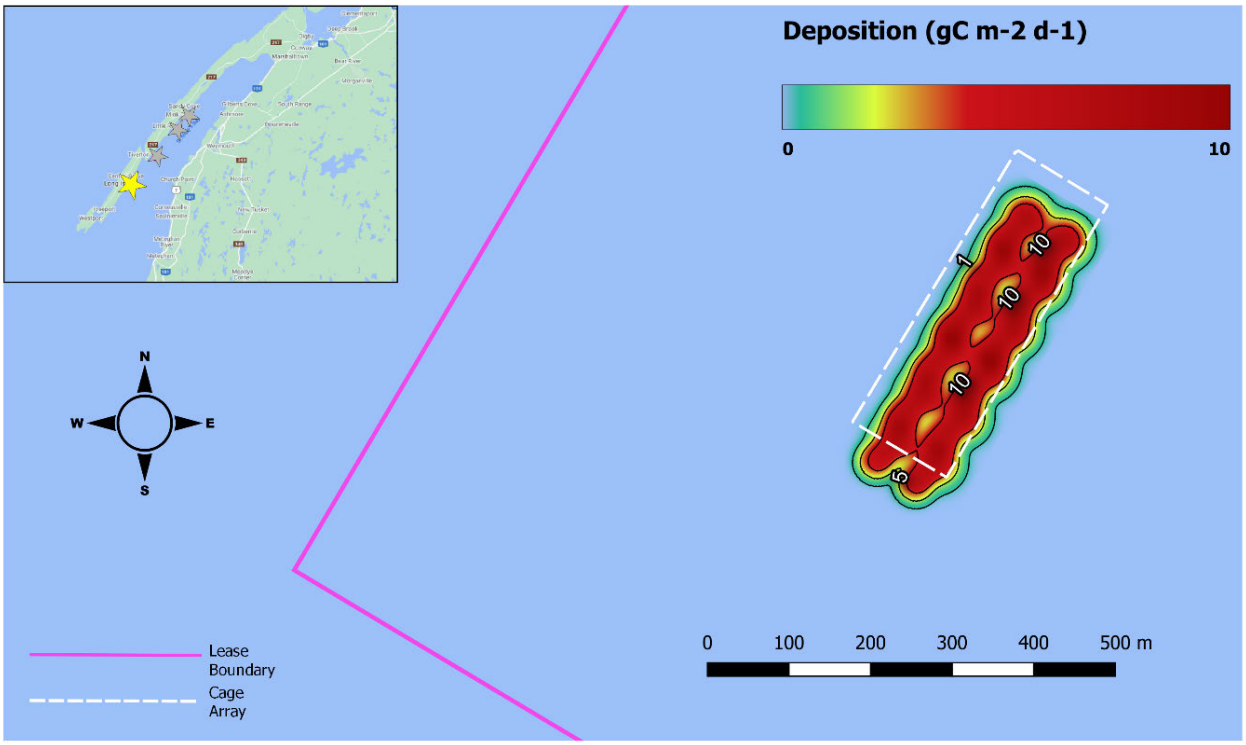


Figure 38 - Site 4 (AQ#1452) deposition model results

Residual currents to the SW were dominant at Site 4, pushing the deposition footprint beyond the SW and SE edges of the array. Footprint overlap was the greatest of all four sites, with highest values occurring under the southern edge of odd-numbered cages. Contours $\geq$ 1gC $m^{-2}d^{-1}$ extended beyond the cage array edge ~ 75m to the SW and ~25m to the SE.

Higher residual currents at Site 3 & Site 4 were likely due to their proximity to Petit Passage and the open ocean.

9 Video Survey / Fish and Fish Habitat

Across all sites, there was no discernable presence of fish feed, finfish faeces, organic detritus, gas bubbles, bacterial mats, OPCs, or anthropogenic debris. Other than a limited number of stations that were host to small seaweed beds ~1-2m^2, sites were >95% barren. While moderate amounts of suspended particulate matter were present at all stations, visibility was not significantly reduced between the camera and benthos unless impact from the camera frame to the sediment caused resuspension.

The soft bottom sediments at Sites 1, 2, & 3 (AQ#1449, 1450, & 1451) displayed similar characteristics between sites. Sediment was easily disturbed when impacted by the camera frame during descent, with the majority of the resuspended sediment remaining in the water column while the camera was in the area. These sites also appeared mostly barren at the surface, with infrequent observations of benthic macrofauna (scallops, barnacles, sea cucumbers, groundfish) and unattached macroflora. However, three

small seaweed beds were found growing around groups of boulders at Site 2. Though actual observations of polychaetes at the sediment water interface did not occur during video, and rarely during grab sampling, burrows were frequently observed in soft sediments, at most ~10 per 0.252m.

A substantial bioturbation feature occurred at Sites 1, 2, and 3, but more so at the latter two sites. Observed burrows in the video, and a high density of polychaete tubes, burrow structures or fecal castings in the majority of grab samples suggest high subsurface macrofaunal activity. Site 1 also contained greater concentrations of shell hash than Sites 2 and 3. We have requested identification of the faunal traces from Huntsman Marine Lab[2].

Alternatively, Site 4 (AQ#1452) was hard bottom throughout the entire area, with patchy presence of sand, pebble, and cobble. The sediment was not easily disturbed when impacted by the camera frame, and any sand that was resuspended would settle rapidly. Site 4 did not appear to have greater diversity or population of macrofauna (epifauna) than Sites 1-3, however, heterogeneity of the sediment made it difficult to confidently ascertain presence and numbers of smaller organisms. Seaweeds that were present at Site 4 were more frequently attached to the substrate, and a larger seaweed bed was observed growing around a group of boulders at Station 6 of the central transect.

10 Conclusions

The proposed farm sites in St. Mary's Bay may be characterized as high energy based on wave exposure, high current speeds, and coarse sediments. From the perspective of organic loading, these are considered ideal fish farm sites, since they are dispersive. In terms of local or far field bathymetry, there are no obvious depocentres or sheltered areas (i.e. behind islands) to act as particle sinks.

In depositional environments, sulfide may be substantial even in the absence of aquaculture. However, these sites have virtually zero sulfides and low organic content indicative of well flushed sediments that do not incorporate organic matter. Some sites have substantial mud content mixed with sand and gravel. However, Fundy sediments have an extensive glacial history, and gravel/cobble within a sand-mud matrix are common [16]. The presence of fine consolidated sediments is thus not indicative of a net depositional environment.

Beyond sediment texture and geochemistry, depositional modelling shows footprints tight to the cage sites in all cases. We emphasize that these models do not include resuspension and are thus conservative. With free-stream current speeds often exceeding 1-2 knots, the local deposition of fine particles such as fish feces is unlikely.

[2] DSA will inform CSL once this has been identified

Appendix A – Sediment Grab / Video Records

Appendix contents:

1) ***Sediment grabs and video records***.
2) ***Video Transect Log Sheet***

Please refer to Figure 7 on page 21 for sample location nomenclature.

All videos have been provided via a Google Drive download link here:

https://drive.google.com/drive/folders/1ALSh_SgDfVZPYerWxgCh648Wb9TjbUMO?usp=sharing

Table A 1 - 1C: Sediment Grabs & Videos

Date:	March 09, 2022	**Wind direction and speed:**	335°, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	1C	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.455464	**Video Notes:** Tan, Soft, Clay, silt, sand, sparse shells (S) Sea cucumber	
Longitude (decimal degrees):	-66.080921		
Dist. and dir. from WP	Video end 63.4m from WP		
Time:	10:13	**Comments:**	
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar	**Benthic Descriptor Key:**	
Station depth (m):	21	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 11:41	Y	5S22	89	Tan, Soft, Clay, silt, sand, shells (S)	6	N	
Benthic Replicate B 11:54	Y	5S15	89	Tan, Soft, Clay, silt, sand, shells (S)	5	N	Arthropods
Benthic Replicate C 12:03	Y	8S15	89	Tan, Soft, Clay, silt, sand, shells (S)	5.5	N	Many arthropods

Table A 2 - 1CP: Sediment Grabs & Video

Date:	March 9, 2022	**Wind direction and speed:**	335°, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.2m/s
Monitoring Station ID:	1CP	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.461271	**Video Notes:** Tan, Soft, Clay, silt, sand, sparse shells (S)	
Longitude (decimal degrees):	-66.081415		
Dist. and dir. from WP	Video end 60.1m from WP	**Comments:**	
Time:	12:15		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar	**Benthic Descriptor Key:**	
Station depth (m):	23.2	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:18	Y	9S1	89	Tan, Soft, Clay, silt, sand, shells (S-L)	6.5	N	Shells
Benthic Replicate B 12:28	Y	8S6	89	Tan, Soft, Clay, silt, sand, shells (S-L)	6.5	N	Worms, bivalves
Benthic Replicate C 12:51	Y	8S23	89	Tan, Soft, Clay, silt, sand, shells (S-L)	5	N	Arthropods

Table A 3 - 1RP: Sediment Grabs & Video

Date:	March 9, 2022	**Wind direction and speed:**	345°, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	1RP	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.466665	**Video Notes:** Tan, Soft, Clay, silt, sand, sparse shells (S)	
Longitude (decimal degrees):	-66.075102		
Dist. and dir. from WP	Video end 131.6 m from WP	**Comments:**	
Time:	12:57		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar	**Benthic Descriptor Key:**	
Station depth (m):	23.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 13:09	Y	8S17	89	Tan, Soft, Clay, silt, sand, shells (S)	5	N	Shells
Benthic Replicate B 13:20	Y	8S13	89	Tan, Soft, Clay, silt, sand, shells (S)	5.5	N	Scallop
Benthic Replicate C 13:33	Y	5S21	89	Tan, Soft, Clay, silt, sand, shells (S)	6	N	Lots of shells

Table A 4 - 1B: Video Only

Date:	March 9, 2022	**Wind direction and speed:**	285˚, 5km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	1B	**Tide schedule:**	High – 03:30, 16:00 Low – 10:00, 22:15
Latitude (decimal degrees):	44.462683	**Video Notes:** Clay, silt, sand, pebble, cobble, abundant shells (S-L)	
Longitude (decimal degrees):	-66.073312		
Dist. and dir. from WP	Video end 87.0 m from WP	**Comments:** 3 Sediment grabs attempted with Ponar	
Time:	13:48		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	16.5

Table A 5 - Video Transect Log Sheet Central Transect: Site 1

Date	March 10, 2022	**Station Depth:**	29.6	**Colour:**	Tan	
Water Body	St. Mary's Bay	**Wind direction and speed:**	245˚, 22km/h	**Consistency:**	Soft	
Lease name and #	AQ#1449	**Wave action:**	Low	**Notes:**		
Time:	Start: 09:58 End: 11:41	**Current direction:**	SW			
Recorder:	[redacted]	**Tide schedule**	High-0430,1715 Low-1100,2315			

Station ID	Start		End		Dist. (m)	Relative Bottom Velocity (m)	Composition	Macrofauna	Macroflora
	Latitude	Longitude	Latitude	Longitude					
1	44.457490	-66.084543	44.457800	-66.084357	37.6	0.7	Clay, silt, sand, shells (S)		Brown, green seaweed
2	44.458125	-66.084252	44.458082	-66.084295	5 9	1 0	Clay, silt, sand, shells (S-L)	Pelagic worms	
3	44.458772	-66.083400	44.459018	-66.083303	28.5	0 8	Clay, silt, sand, shells (S)	Barnacles, pelagic worms, jellyfish	Green seaweed
4	44.459530	-66.082707	44.459700	-66.082732	19.0	1 5	Clay, silt, sand, shells (S-L)	Pelagic worms, Scallops	Brown, green seaweed
5	44.460302	-66.082063	44.460618	-66.082197	36.8	1 8	Clay, silt, sand, shells (S-L)	Scallops, flatfish, barnacles	Brown, green seaweed
6	44.461038	-66.081287	44.461350	-66.081260	34.8	1.1	Clay, silt, sand, shells (S-L)	Scallops, pelagic worms, barnacles	Brown, green seaweed
7	44.461883	-66.080517	44.462167	-66.080643	33.1	1 0	Clay, silt, sand, abundant shells (S-L)	Scallops, barnacles	Brown, green seaweed
8	44.462640	-66.079660	44.462637	-66.079380	22.2	1 2	Clay, silt, sand, shells (S)	Scallops, barnacles	Brown, green seaweed
9	44.463228	-66.078850	44.463355	-66.078942	15.9	0.7	Clay, silt, sand, pebbles, cobbles, shells (S)	Jellyfish, barnacles	Brown, green seaweed
10	44.464113	-66.078188	44.464102	-66.078333	11.6	1.1	Clay, silt, sand, shells (S)	Scallops	Brown, green seaweed
11	44.464792	-66.077492	44.464873	-66.077318	16.5	1 2	Clay, silt, sand, shells (S)	Scallops, barnacles	Brown, green seaweed

Table A 6 - 3D: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	70°, 12km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW, relative bottom current 0.8m/s
Monitoring Station ID:	3D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.380887	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows, finfish (S) Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.180892		
Dist. and dir. from WP	Video end 63.5m from WP		
Time:	08:01		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	49.4

Table A 7 - 3C: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	75°, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW, relative bottom current 0.9m/s
Monitoring Station ID:	3C	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.376602	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows, scallops Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.173001		
Dist. and dir. from WP	Video end 35.5m from WP		
Time:	09:05		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	39.0

Table A 8 - 1D: Sediment Grabs & Video

Date:	March 11, 2022	**Wind direction and speed:**	110°, 7km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	SW, relative bottom current 0.9m/s
Monitoring Station ID:	1D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.459894	**Video Notes:** Tan, soft, clay, silt, sand, shells (S) Burrows, jellyfish Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.088921		
Dist. and dir. from WP	Video end 50.3m from WP		
Time:	10:26		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Ponar/Petit Ponar/Ekman	**Benthic Descriptor Key:**	
Station depth (m):	29.6	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	Y	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	13		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:34	Y	5S13	89	Tan, soft, clay, silt, sand, shells (S)	5.5	N	Shells, rockweed
Benthic Replicate B 11:27	Y	7S9	89	Tan, soft, clay, silt, sand, shells (S)	5	N	
Benthic Replicate C 10:39,10:42, 10:47,11:01,11:05,11:09, 11:16, 11:20,11:39,11:42	N		89	Tan, soft, clay, silt, sand, shells (S)		N	

Table A 9 - 1A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	240˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	None
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	1A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.467273	**Video Notes:** Tan, clay, silt, sand, moderate number of shells (S) Burrows, jellyfish, barnacles, scallops, mussels Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.081650		
Dist. and dir. from WP	Video end 34.3m from WP		
Time:	12:01		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	29.9

Table A 10 - 2RP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	230˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	2RP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.441708	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows **Comments:**	
Longitude (decimal degrees):	-66.107423		
Dist. and dir. from WP	Video end 43.7m from WP		
Time:	12:25		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	29.9

Table A 11 - 2A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235°, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	2A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.441742	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.114242		
Dist. and dir. from WP	Video end 50.3m from WP		
Time:	12:35		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	26.2

Table A 12 - 2B: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235°, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	2B	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.438019	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.105641		
Dist. and dir. from WP	Video end 49.2m from WP		
Time:	12:45		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	30.5

Table A 13 - 2CP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235°, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	2CP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.436054	**Video Notes:** Tan, clay, silt, sand, boulders, shells (S) Burrows, jellyfish, crab Brown, green, yellow seaweed, seaweed bed around boulders **Comments:**	
Longitude (decimal degrees):	-66.113145		
Dist. and dir. from WP	Video end 56.5m from WP		
Time:	12:54		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	28.8

Table A 14 - 2D: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235°, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	2D, relative bottom current 0.7m/s
Monitoring Station ID:	2D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.434044	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.120775		
Dist. and dir. from WP	Video end 64.3m from WP		
Time:	13:02		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	26.8

Table A 15 - 2C: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	235°, 15km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE, relative bottom current 0.8m/s
Monitoring Station ID:	2C	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.430321	**Video Notes:** Tan, clay, silt, sand, shells (S) Burrows, jellyfish Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.112152		
Dist. and dir. from WP	Video end 45.5m from WP		
Time:	13:10		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	31.1

Table A 16 - Video Transect Log Sheet Central Transect: Site 2

Date	March 11, 2022	**Station Depth:**	32.9	**Colour:**	Tan	
Water Body	St. Mary's Bay	**Wind direction and speed:**	225°, 19km/h	**Consistency:**	Soft	
Lease name and #	AQ#1450	**Wave action:**	Low	**Notes:**		
Time:	Start: 13:21 End: 14:03	**Current direction:**	SW			
Recorder:	[redacted]	**Tide schedule**	High-0430,1715 Low-1100,2315			

Station ID	Start		End		Dist. (m)	Relative Bottom Velocity (m)	Composition	Macrofauna	Macroflora
	Latitude	Longitude	Latitude	Longitude					
1	44.432815	-66.115657	44.432837	-66.115335	25.7	0.3	Clay, silt, sand, boulders, shells (S)	Burrows, jellyfish, crab	Brown, green, yellow seaweed, seaweed bed around boulders
2	44.433520	-66.115177	44.433460	-66.115388	18.1	1.2	Clay, silt, sand, shells (S)	Burrows	Brown, green, yellow seaweed
3	44.434313	-66.114738	44.434290	-66.114605	10.9	0.5	Clay, silt, sand, boulders, shells (S)	Burrows, crab	Brown, green, yellow seaweed, two seaweed beds around boulders
4	44.435218	-66.113950	44.435357	-66.113940	15.4	1.2	Clay, silt, sand, shells (S)	Burrows, jellyfish	
5	44.436007	-66.113345	44.436662	-66.112905	80.9	0.4	Clay, silt, sand, shells (S)	Burrows	Brown, green, yellow seaweed
6	44.436733	-66.112543	44.436678	-66.112340	17.3	0.5	Clay, silt, sand, shells (S)	Burrows	
7	44.437542	-66.111920	44.437508	-66.112100	14.8	0.9	Clay, silt, sand	Burrows	
8	44.438240	-66.111335	44.438332	-66.111330	10.2	0.7	Clay, silt, sand	Burrows	Brown, green seaweed
9	44.439163	-66.110665	44.439428	-66.110898	34.8	0.5	Clay, silt, sand	Burrows, jellyfish	
10	44.439752	-66.110033	44.440267	-66.109913	58.1	0.3	Clay, silt, sand	Burrows	

Table A 17 - 3A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215°, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	3A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.38784	**Video Notes:** Tan, clay, silt, sand, pebbles, abundant shells (S-M) Burrows, jellyfish, scallops Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.173534		
Dist. and dir. from WP	Video end 31.3m from WP		
Time:	14:46		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	34.4

Table A 18 - 3RP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215°, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	3RP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.387710	**Video Notes:** Tan, clay, silt, sand, shells (S-L) Burrows Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.166692		
Dist. and dir. from WP	Video end 26.9m from WP		
Time:	14:53		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	57.9

Table A 19 - 3B: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215°, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	3B	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.383684	**Video Notes:** Tan, clay, silt, sand, shells (S-L) Burrows, jellyfish, groundfish Brown, green, yellow seaweed **Comments:**	
Longitude (decimal degrees):	-66.165352		
Dist. and dir. from WP	Video end 10.8m from WP		
Time:	15:03		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	43.0

Table A 20 - 3CP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	215°, 19km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 1.0m/s
Monitoring Station ID:	3CP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.382294	**Video Notes:** Tan, clay, silt, sand, shells (S-L) Burrows, crab, scallop, groundfish Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.17313		
Dist. and dir. from WP	Video end 35.4m from WP		
Time:	15:14		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	50.9

Table A 21 - 4RP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200°, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.3m/s
Monitoring Station ID:	4RP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.332456	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Pelagic worm, scallops, crabs Brown, green seaweed **Comments:**	
Longitude (decimal degrees):	-66.231043		
Dist. and dir. from WP	Video end 14.3m from WP		
Time:	15:57		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	50.0

Table A 22 - 4A: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200°, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.4m/s
Monitoring Station ID:	4A	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.332456	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops **Comments:**	
Longitude (decimal degrees):	-66.237671		
Dist. and dir. from WP	Video end 22.8m from WP		
Time:	16:05		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	40.5

Table A 23 - 4B: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200°, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.4m/s
Monitoring Station ID:	4B	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.328956	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, boulders, abundant shells (S-L) Burrows, scallops, starfish Brown, green, yellow seaweed **Comments:**	
Longitude (decimal degrees):	-66.228879		
Dist. and dir. from WP	Video end 22.8m from WP		
Time:	16:14		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	48.8

Table A 24 - 4CP: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200°, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.6m/s
Monitoring Station ID:	4CP	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.326792	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops Brown, green, yellow seaweed **Comments:**	
Longitude (decimal degrees):	-66.236454		
Dist. and dir. from WP	Video end 29.7m from WP		
Time:	16:23		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	47.5

Table A 25 - 4D: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	NE, relative bottom current 0.7m/s
Monitoring Station ID:	4D	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.32478	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops Brown, green, seaweed **Comments:**	
Longitude (decimal degrees):	-66.244028		
Dist. and dir. from WP	Video end 61.5m from WP		
Time:	16:33		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	45.1

Table A 26 - 4C: Video Only

Date:	March 11, 2022	**Wind direction and speed:**	200˚, 20km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	NE, relative bottom current 0.5m/s
Monitoring Station ID:	4C	**Tide schedule:**	High-0530,1815 Low-1200
Latitude (decimal degrees):	44.321111	**Video Notes:** Red, brown, black, grey, white Sand, pebble, cobble, abundant shells (S-L) Scallops, crabs Brown, green, seaweed **Comments:**	
Longitude (decimal degrees):	-66.235372		
Dist. and dir. from WP	Video end 19.3m from WP		
Time:	16:42		
Record name:	[redacted]		
Sample collector:	[redacted]	**Station depth (m):**	44.5

Table A 27 - 1A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	325°, 23km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE
Monitoring Station ID:	1A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.467095	**Video Notes:**	
Longitude (decimal degrees):	-66.081946		
Dist. and dir. from WP		**Comments:**	
Time:	0843		
Recorder name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	29.9	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 09:13	Y	8S8	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Shells (S)
Benthic Replicate B 09:22	Y	8S4	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7.5	N	Shells (S-M)
Benthic Replicate C 09:30	Y	5S4	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	5.5	N	Shells (S)

Table A 28 - 1B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE
Monitoring Station ID:	1B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.462683	**Video Notes:**	
Longitude (decimal degrees):	-66.073312		
Dist. and dir. from WP		**Comments:** 3 Sediment Ponar grabs were unsuccessful on March 9th before video was captured. Site to be classified as hard bottom.	
Time:	09:37		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	25.0	**4. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**5. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**6. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 9:37	Y	7S2	89	Pebbles & cobble present, brown, grainy, coarse	5	N	Shells(S), bivalves
Benthic Replicate B 9:45	Y	5S34	89	Pebbles & cobble present, brown, grainy, coarse	6	N	Shells(S), bivalves, vegetation
Benthic Replicate C 9:51, 9:54	N		89	Pebbles & cobble present, brown, grainy, coarse			

Table A 29 - 1D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1449	**Direction and speed of current:**	NE
Monitoring Station ID:	1D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.459894	**Video Notes:**	
Longitude (decimal degrees):	-66.088921		
Dist. and dir. from WP		**Comments:**	
Time:	10:01		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	29.6	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	1		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:01	Y	8S19	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	
Benthic Replicate B							
Benthic Replicate C							

Table A 30 - 2RP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE
Monitoring Station ID:	2RP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.441708	**Video Notes:**	
Longitude (decimal degrees):	-66.107423		
Dist. and dir. from WP		**Comments:**	
Time:	10:15		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	29.9	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	6		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:23	Y	3S8	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	6	N	
Benthic Replicate B 10:28, 10:30, 10:35, 11:21	Y	8S3	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	15	N	Sea Cucumber(?)
Benthic Replicate C 11:27	Y	8S18	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	

Table A 31 - 2A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	120˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	NE
Monitoring Station ID:	2A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.441742	**Video Notes:**	
Longitude (decimal degrees):	-66.114242		
Dist. and dir. from WP		**Comments:**	
Time:	10:44		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	26.2	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	7		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 10:44, 10:48, 10:53, 10:58	Y	5S18	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	
Benthic Replicate B 11:04, 11:08	Y	5S29	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	13	N	
Benthic Replicate C 11:15	Y	5S12	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	14	N	

Table A 32 - 2B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	110°, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.438019	**Video Notes:**	
Longitude (decimal degrees):	-66.105641		
Dist. and dir. from WP		**Comments:**	
Time:	11:34		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	30.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 11:34, 11:38	Y	8S11	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	Polychaetes, shells (S)
Benthic Replicate B 11:43	Y	5S36	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	13	N	shells (S)
Benthic Replicate C 11:48	Y	5S24	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	

Table A 33 - 2CP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	110°, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2CP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.436054	**Video Notes:**	
Longitude (decimal degrees):	-66.113145		
Dist. and dir. from WP		**Comments:**	
Time:	12:07		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	28.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:07	Y	5S2	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	9	N	Polychaetes
Benthic Replicate B 12:13	Y	8S1	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	12	N	Polychaetes
Benthic Replicate C 12:19	Y	5S10	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	

Table A 34 - 2C: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	110°, 13km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2C	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.430321	**Video Notes:**	
Longitude (decimal degrees):	-66.112152		
Dist. and dir. from WP		**Comments:**	
Time:	12:25		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	31.1	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:25	Y	8S7	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	7	N	
Benthic Replicate B 12:32	Y	8S12	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Polychaetes, brown seaweed, shells(S)
Benthic Replicate C 12:37	Y	5S14	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	10	N	Polychaetes

Table A 35 - 2D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	100˚, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1450	**Direction and speed of current:**	SW
Monitoring Station ID:	2D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.434044	**Video Notes:**	
Longitude (decimal degrees):	-66.120775		
Dist. and dir. from WP		**Comments:**	
Time:	12:43		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	26.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 12:44	Y	8S5	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	9	N	
Benthic Replicate B 12:49	Y	3S25	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	14	N	
Benthic Replicate C 12:54	Y	7S3	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	10	N	Arthropods, shells (S)

Table A 36 - 3RP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	95°, 10km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3RP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.387690	**Video Notes:**	
Longitude (decimal degrees):	-66.167036		
Dist. and dir. from WP		**Comments:**	
Time:	13:25		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	57.9	1. **Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	2. **Degree of odour (strong, slight, none)**	
Video (Y/N):	N	3. **Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 13:25	Y	7S5	89	Brown, soft, oxic layer >1cm, polychaete castings >50% of surface	7	N	
Benthic Replicate B 13:32	Y	8S22	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	Lots of shells (S & M)
Benthic Replicate C 13:38	Y	5S27	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	5	N	Vegetation

Table A 37 - 3A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	90°, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.38784	**Video Notes:**	
Longitude (decimal degrees):	-66.173534		
Dist. and dir. from WP		**Comments:**	
Time:	13:45		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	34.4	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 13:45	Y	5S11	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	5	N	Shells(L), bivalves
Benthic Replicate B 13:51, 13:54	Y	8S20	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Shells
Benthic Replicate C 13:59	Y	5S28	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	6	N	Shells(S-L)

Table A 38 - 3B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	90°, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.383684	**Video Notes:**	
Longitude (decimal degrees):	-66.165352		
Dist. and dir. from WP		**Comments:**	
Time:	14:07		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	43.0	1. **Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	2. **Degree of odour (strong, slight, none)**	
Video (Y/N):	N	3. **Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 14:07	Y	8S16	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	Shells(S)
Benthic Replicate B 14:12	Y	5S31	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	7	N	
Benthic Replicate C 14:17, 14:20	Y	5S3	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	Seaweed, arthropods, shells(S)

Table A 39 - 3CP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	90°, 8km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3CP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.382294	**Video Notes:**	
Longitude (decimal degrees):	-66.17313		
Dist. and dir. from WP		**Comments:**	
Time:	14:26		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	50.9	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	3		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 14:26	Y	5S1	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	6	N	Shells
Benthic Replicate B 14:32	Y	5S26	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	10	N	Big shells, hermit crab
Benthic Replicate C 14:37	Y	5S16	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	8	N	Shells

Table A 40 - 3C: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	35°, 3km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3C	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.376602	**Video Notes:**	
Longitude (decimal degrees):	-66.173001		
Dist. and dir. from WP		**Comments:**	
Time:	14:45		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	39.0	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	4		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 14:45	Y	8S14	89	Brown, soft, oxic layer >1cm, polychaete castings >70% of surface	8	N	
Benthic Replicate B 14:50	Y	7S6	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	9	N	
Benthic Replicate C 14:53, 14:56	Y	7S7	89	Brown, soft, oxic layer >1cm	7	N	Shells(S)

Table A 41 - 3D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	35°, 3km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1451	**Direction and speed of current:**	SW
Monitoring Station ID:	3D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.380887	**Video Notes:**	
Longitude (decimal degrees):	-66.180892		
Dist. and dir. from WP		**Comments:**	
Time:	15:04		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	49.4	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 15:04	Y	5S25	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	8	N	
Benthic Replicate B 15:09, 15:12, 15:16	Y	7S1	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	9	N	Shells(S)
Benthic Replicate C 15:21	Y	5S7	89	Brown, soft, oxic layer >1cm, polychaete castings >90% of surface	7	N	

Table A 42 - 4RP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	320˚, 5km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4RP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.332456	**Video Notes:**	
Longitude (decimal degrees):	-66.231043		
Dist. and dir. from WP		**Comments:**	
Time:	15:54		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	50.0	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	6		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 15:54, 15:57, 16:01, 16:04, 16:07, 16:12	N		89	Sand, pebble, cobble, shells		N	
Benthic Replicate B							
Benthic Replicate C							

Table A 43 - 4A: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	320˚, 5km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4A	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.332456	**Video Notes:**	
Longitude (decimal degrees):	-66.237671		
Dist. and dir. from WP		**Comments:**	
Time:	16:18		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	40.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 16:18, 16:21, 16:24, 16:27, 16:30	N		89	Sand, pebble, cobble, shells		N	
Benthic Replicate B							
Benthic Replicate C							

Table A 44 - 4B: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	300˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4B	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.328956	**Video Notes:**	
Longitude (decimal degrees):	-66.228879		
Dist. and dir. from WP		**Comments:**	
Time:	16:36		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	48.8	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 16:36, 16:39, 16:41, 16:45, 16:49	N		89	Sand, pebble, cobble, shells		N	
Benthic Replicate B							
Benthic Replicate C							

Table A 45 - 4CP: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	300˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4CP	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.326792	**Video Notes:**	
Longitude (decimal degrees):	-66.236454		
Dist. and dir. from WP		**Comments:**	
Time:	16:56		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	47.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 16:56, 17:00, 17:03, 17:06, 17:09	N		89	Sand, pebble, cobble, shells		N	Bivalves, barnacles, seaweed, crab
Benthic Replicate B							
Benthic Replicate C							

Table A 46 - 4C: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	300˚, 9km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4C	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.321111	**Video Notes:**	
Longitude (decimal degrees):	-66.235372		
Dist. and dir. from WP		**Comments:**	
Time:	17:15		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	44.5	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 17:15, 17:18, 17:21, 17:25, 17:28	N		89	Sand, pebble, cobble, shells		N	Bivalves, barnacles, seaweed
Benthic Replicate B							
Benthic Replicate C							

Table A 47 - 4D: Sediment Only

Date:	March 16, 2022	**Wind direction and speed:**	275°, 11km/h
Water body:	St. Mary's Bay	**Wave action:**	Low
Lease name and #:	AQ#1452	**Direction and speed of current:**	SW
Monitoring Station ID:	4D	**Tide schedule:**	High-1045,2315 Low-0430,1700
Latitude (decimal degrees):	44.32478	**Video Notes:**	
Longitude (decimal degrees):	-66.244028		
Dist. and dir. from WP		**Comments:**	
Time:	17:36		
Record name:	[redacted]		
Sample collector:	[redacted]		
Type of sediment sampler:	Van Veen	**Benthic Descriptor Key:**	
Station depth (m):	45.1	**1. Oxic layer thickness, gas bubbles, feed, faeces, sediment: colour, type, and consistency**	
Gear present on bottom (description)	N	**2. Degree of odour (strong, slight, none)**	
Video (Y/N):	N	**3. Flora/Fauna (e.g. eel grass, kelp lobster, crab, starfish, *Beggiatoa*-like, polychaetes etc.)**	
# of sediment collection attempts	5		

Sediment Samples	Sample (y/n)	Sample ID	Sediment Sampler Retrieval Speed (cm/s)	Sediment Description	Sediment Sample Depth (cm)	Odour	Flora/Fauna
Benthic Replicate A 17:36, 17:39, 17:43, 17:45, 17:50	N		89	Sand, pebble, cobble, shells		N	Bivalves, barnacles, seaweed
Benthic Replicate B							
Benthic Replicate C							

Table A 48 - Video Transect Log Sheet Central Transect: Site 4

Date:	March 17, 2022		Station Depth:		44.7		Colour:	Red, brown, black, grey, white
Water Body	St. Mary's Bay		Wind direction and speed:		175°, 28km/h		Consistency:	Hard
Lease name and #	AQ#1452		Wave action:		Low-Moderate		Notes:	
Time:	Start: 08:42	End: 09:35	Current direction:		NE			
Recorder:	[redacted]		Tide schedule		High-1130,2345 Low-0515,1730			

Station ID	Start		End		Dist. (m)	Relative Bottom Velocity (m)	Composition	Macrofauna	Macroflora
	Latitude	Longitude	Latitude	Longitude					
1	44.330933	-66 233847	44.330962	-66 233318	42.2	0.9	Sand, pebble, cobble, boulders, abundant shells (S-L)	Starfish, scallops	Brown, green, yellow seaweed
2	44.329948	-66 233660	44.329885	-66 233552	11.1	0.8	Sand, pebble, cobble, abundant shells (S-L)	Scallops, pelagic worms	Brown, green seaweed
3	44.329092	-66 234435	44.329152	-66 234835	32.5	0.9	Sand, pebble, cobble, abundant shells (S-L)	Scallops	Brown, green seaweed
4	44.328563	-66 235242	44.328552	-66 234943	23.8	1.2	Sand, pebble, cobble, abundant shells (S-L)		Brown, green seaweed
5	44.327467	-66 235745	44.327458	-66 235752	1.1	0.3	Sand, pebble, cobble, abundant shells (S-L)	Scallops, lobster	Brown, green, yellow seaweed
6	44.326822	-66 236423	44.326935	-66 236660	22.7	0.7	Sand, pebble, cobble, boulders, abundant shells (S-L)	Scallops	Brown, green, yellow seaweed, two seaweed beds around boulders
7	44.325927	-66 237070	44.326008	-66 237258	17.5	0.4	Sand, pebble, cobble, abundant shells (S-L)	Scallops, crabs	Brown, green, yellow seaweed
8	44.325290	-66 237790	44.325263	-66 237910	10.0	1.1	Sand, pebble, cobble, boulders, abundant shells (S-L)	Scallops	Brown, green, yellow seaweed
9	44.324373	-66 238315	44.324705	-66 238548	41.3	1.0	Sand, pebble, cobble, abundant shells (S-L)	Starfish, scallops	Brown, green, yellow seaweed
10	44.323142	-66 239587	44.323640	-66 239968	63.3	0.7	Sand, pebble, cobble, abundant shells (S-L)	Hard	Scallops

Table A 49 - Video Transect Log Sheet Central Transect: Site 3

Date	March 17, 2022		Station Depth:		44.1		Colour:	Tan
Water Body	St. Mary's Bay		Wind direction and speed:		175°, 99km/h		Consistency:	Soft
Lease name and #	AQ#1451		Wave action:		Moderate		Notes: Moderate swell made maintaining appropriate camera positioning about the sediment difficult, leading to numerous impacts with the sediment	
Time:	Start: 10:14	End: 10:57	Current direction:		NE			
Recorder:	[redacted]		Tide schedule		High-1130,2345 Low-0515,1730			

Station ID	Start		End		Dist. (m)	Relative Bottom Velocity (m)	Composition	Macrofauna	Macroflora
	Latitude	Longitude	Latitude	Longitude					
1	44.386068	-66.169277	44.386118	-66.169553	22.7	0.8	Clay, silt, sand, shells (S-L)	Burrows	Brown, green, yellow seaweed
2	44.385398	-66.170918	44.385172	-66.170557	38.3	0.3	Clay, silt, sand, shells (S)	Burrows	Brown, green seaweed
3	44.384385	-66.171085	44.384270	-66.170988	14.9	1.2	Clay, silt, sand, shells (S)	Burrows, groundfish	Brown, green, yellow seaweed
4	44.383618	-66.171888	44.383882	-66.171570	38.7	1.2	Clay, silt, sand, shells (S)	Burrows	
5	44.382948	-66.172540	44.383010	-66.172273	22.3	1.5	Clay, silt, sand, shells (S-L)	Burrows, lobster	Brown, green seaweed
6	44.382252	-66.172950	44.382190	-66.172838	11.2	0.9	Clay, silt, sand, shells (S-L)	Burrows, finfish (S), crab	Brown, green seaweed
7	44.381152	-66.173795	44.381408	-66.174323	50.8	1.3	Clay, silt, sand, shells (S-L)	Burrows, finfish (S), mussels	Brown, green seaweed

8	44.380695	-66.174668	44.380622	-66.174352	26.5	1.2	Clay, silt, sand, shells (S)	Burrows	Brown, green seaweed
9	44.379685	-66.175322	44.379823	-66.175762	38.2	1.8	Clay, silt, sand, shells (S-L)	Burrows	Brown, green seaweed
10	44.378702	-66.176582	44.379120	-66.177325	75.3	1.0	Brown	Clay, silt, sand, shells (S)	Soft

Appendix B - Site Maps and Sampling Locations







