

FINFISH AQUACULTURE SITE AQUACULTURE STEWARDSHIP COUNCIL REPORT STEAMER POINT, HECATE CHANNEL, BC

SITE LICENSE: AQ1079

SURVEY TYPE: ASC

SURVEY DATE: FEBRUARY 11, 2021

REPORT DATE: MARCH 19, 2021

PREPARED FOR:

*GRIEG SEAFOOD BC, LTD
#106 3001 IRONWOOD STREET
CAMPBELL RIVER, BC
V9W 5P7*



1310 Marwalk Cres
Campbell River, BC.
V9W 5X1
phone: (250) 287-2462
fax: (250) 287-2452
email: info@mainstreambio.ca
www.mainstreambio.ca



Summary

This document presents the qualitative and quantitative assessment of sediment obtained during the survey completed at the Steamer Point finfish aquaculture site operated by Grieg Seafood Ltd in Hecate Channel, BC, on February 11, 2021. Sediment was collected and the data analyzed according to the *Aquaculture Activities Regulations* (AAR) and adapted to address Criterion 2.1 and 5.2 of the Aquaculture Stewardship Council (ASC) Salmon Standard.

The measured and observed characteristics of the sediment collected during the sampling confirmed that the stations outside the Allowable Zone of Effect (AZE) on Transect C had mean sulphide levels less than the ASC Salmon Standard acceptable limit of 1500 µm. Redox potential measured in sediment obtained outside the AZE on Transect C was greater than the ASC Salmon Standard acceptable lower limit of 0 mV.

As required by Criterion 5.2 of the ASC monitoring for parasiticide residue was completed at the station outside the AZE on Transects C and at two reference stations. Emamectin benzoate and florfenicol was below detectable limits in all collected samples.

An assessment and identification of the benthic organisms present in the sediment was not completed to evaluate for potential impacts to habitat, as BC salmon farms have been granted a variance to Indicators 2.1.2 and 2.1.3 and instead rely on the scientifically proven and federally regulated sulfide surrogates (ASC VR224)¹.

Previous grab attempts at all other ASC stations completed in 2017 at the Steamer Point aquaculture site failed to successfully obtain any samples for analysis. These stations were therefore not attempted during this survey.

¹ <http://variance-requests.asc-aqua.org/questions/vr-224-benthic-biodiversity-and-benthic-effects-salmon-v1-0-2-1-2-2-1-3/>

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1.0 Introduction

This document presents the marine sediment data collected as part of a benthic study completed at the Steamer Point finfish aquaculture site operated by Greig Seafood BC Ltd (Campbell River, BC). The Steamer Point site is located in Hecate Channel, BC (Figure 1).

The study was completed by adapting the methodology required for operational monitoring of waste dispersion required under *Aquaculture Activities Regulations* (AAR) and comparing the results with the indicators listed in Criterion 2.1 of the Aquaculture Stewardship Council (ASC) Salmon Standard. Additional analysis of the collected sediment was also completed to address Criterion 5.2 of the ASC.

The purpose of the ASC Salmon Standard is to evaluate concerns of potential environmental impact related to salmon farming. The Standard is based on a combination of requirements and performance levels that must be reached in order to determine if potential impacts are being addressed. Principle 2 of the Standard addresses the “*potential impacts from salmon farms on natural habitat, local biodiversity and ecosystem function*” (ASC, 2012).

This survey was specifically designed to address Criterion 2.1 within Principle 2 of the ASC Salmon Standard which involved the collection of sediment within and outside of the Allowable Zone of Effect (AZE). Sediment was analyzed for redox potential and sulphide levels to evaluate benthic habitat conditions. In addition, testing for parasiticide residue in sediment collected at the two reference stations and at the stations outside the AZE was completed to address Criterion 5.2.1 of the ASC.

An assessment and identification of the benthic organisms present in the sediment was not completed to evaluate for potential impacts to habitat, biodiversity and ecosystem function, as BC salmon farms have been granted a variance to Indicators 2.1.2 and 2.1.3 and instead rely on the scientifically proven and federally regulated sulfide surrogates (ASC VR224).

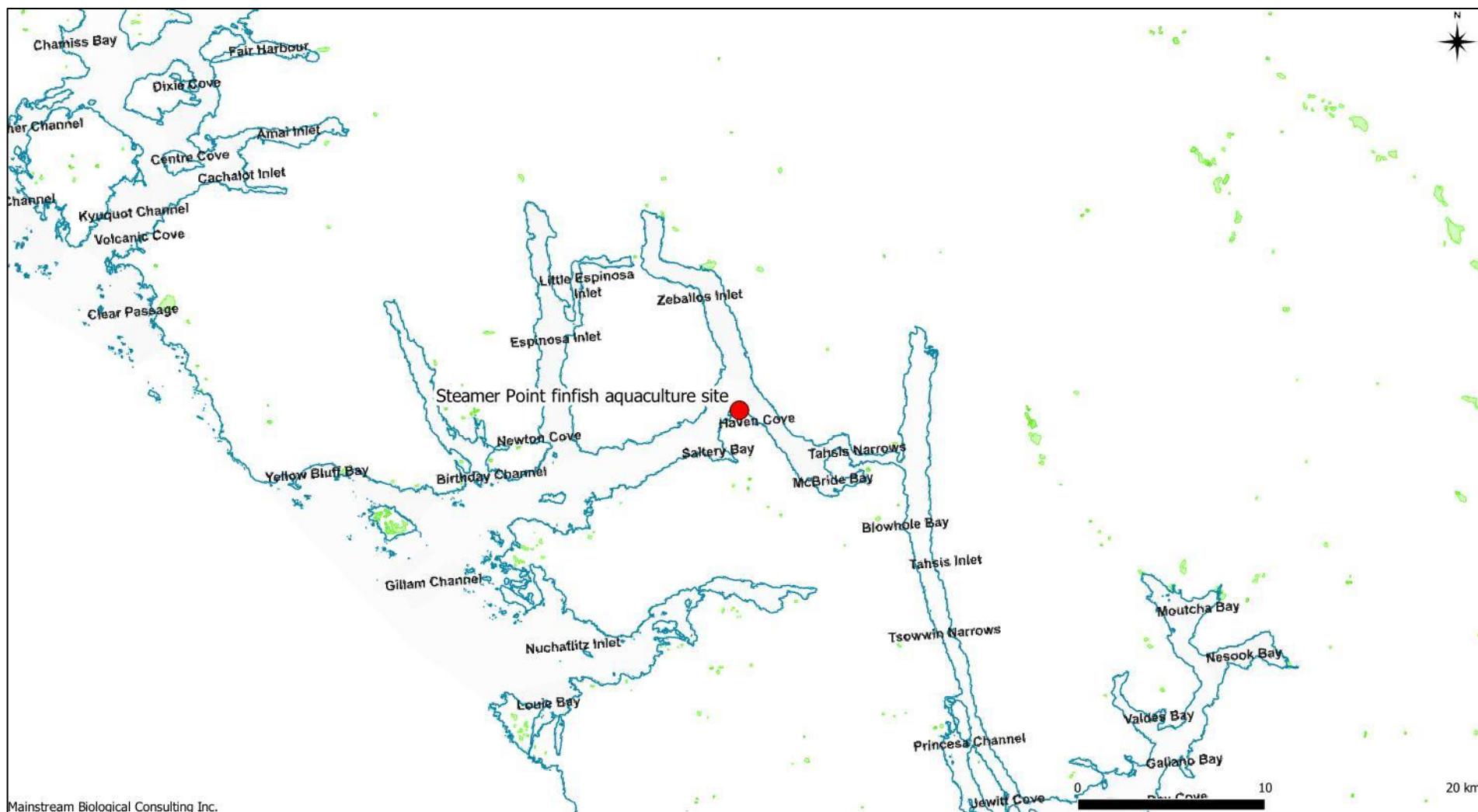


Figure 1: An overview map showing the approximate location of the Steamer Point finfish aquaculture farm site (red dot) in Hecate Channel, BC.

2.0 Methods

The substrate at the designated sampling locations at the Steamer Point finfish aquaculture site had been previously identified to consist of “soft” sediment on Transect C and at reference locations. Therefore, the field activities involved the collection of sediment samples for physical and chemical analysis.

2.1 Field Sampling

The locations of sediment sampling stations were provided by Greig Seafood BC Ltd.

Individual sediment sampling stations were located along one transect (Transect C). Stations within the AZE were located 5 m inside the 1 g DEPOMOD contour (Figure 2) for Transect C. Stations outside the AZE were located 25 m outside of the 1 g DEPOMOD contour. Additional stations were established at two reference sites within the range of 500 m to 1000 m from the aquaculture containment system as outlined in the ASC Salmon Standard (Figure 3).

A previous survey completed at all ASC sample locations at the Steamer Point finfish aquaculture site in 2017 failed to successfully obtain sediment at any other ASC sampling locations. Attempted sampling was not completed at the unsuccessful locations during this survey.

Sediment was collected using a Petite Ponar grab sampler. Two sediment samples were collected at each station.

The coordinates of the sample locations were recorded using a Trimble GeoExplorer GeoXT (Firmware v1.05) using TerraSync 3.30 software and equipped with an external Hurricane antenna.

Data filters were set to standards recommended by the Resource Inventory Standards Committee (RISC)², with at least 15 fixes taken per location, using satellites greater than 15 % above the horizon with signal to noise ratios (SNR) greater than 40 and a horizontal dilution of precision (HDOP) of five. The GPS data was corrected post-mission with Pathfinder Office v5.40 software using data from the Eliza base station (ELIZ).

The Trimble antenna was attached to the grab davit and positional fixes were obtained while the grab was completing the estimated bottom third of its descent. Positional fixes were completed when the grab was on the bottom and the drop line was as close vertical as possible.

² Integrated Land Management Bureau. 2008. Province of British Columbia Standards, Specifications and Guidelines for Resource Surveys Using Global Positioning System (GPS) Technology. Release 4.0d.

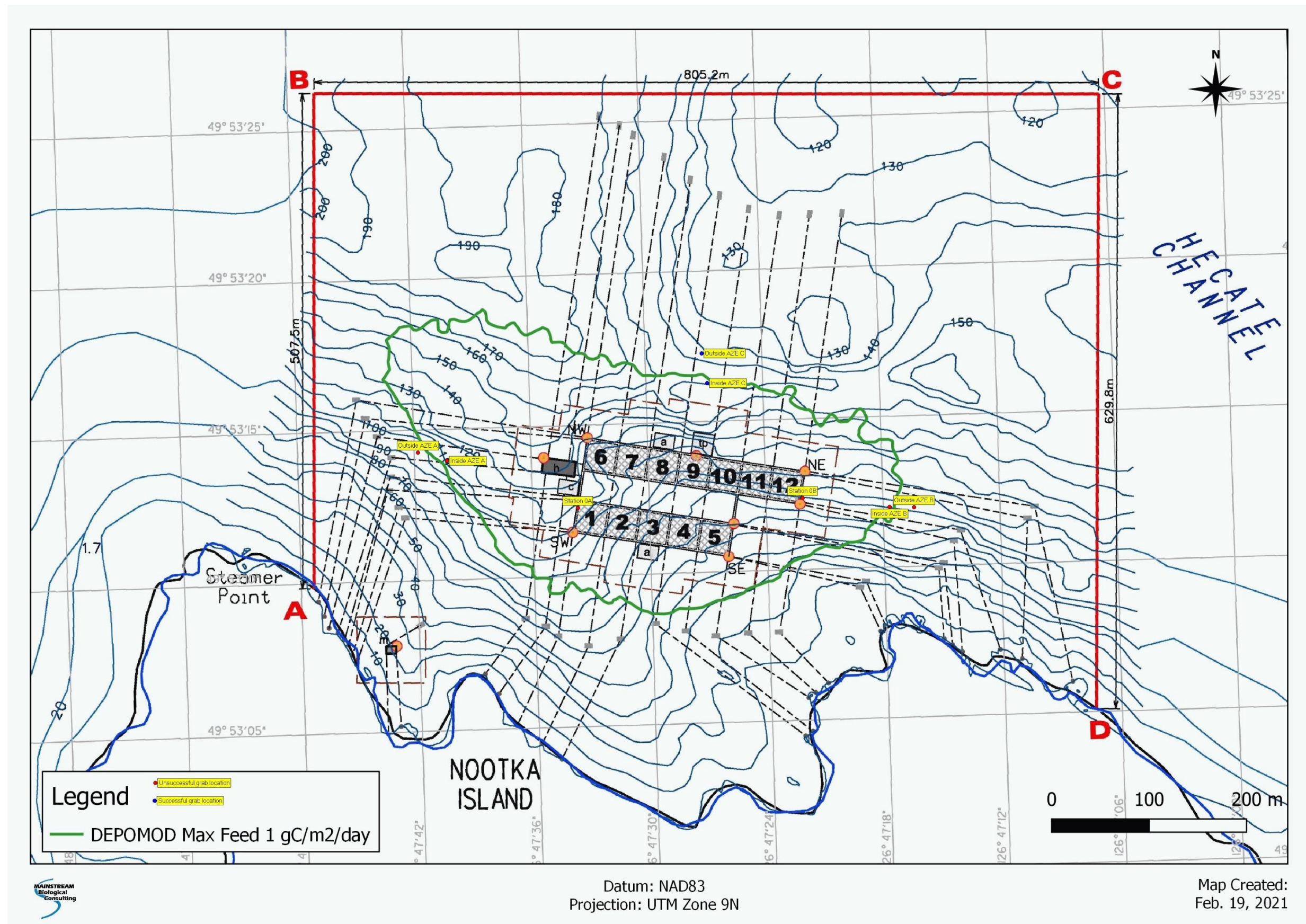


Figure 2: The locations of the sampling stations for the ASC survey at the Steamer Point finfish aquaculture site in relation to the pen system and surrounding area on February 11, 2021 and the location of the failed grab attempts during the 2017 sampling at the ASC stations.

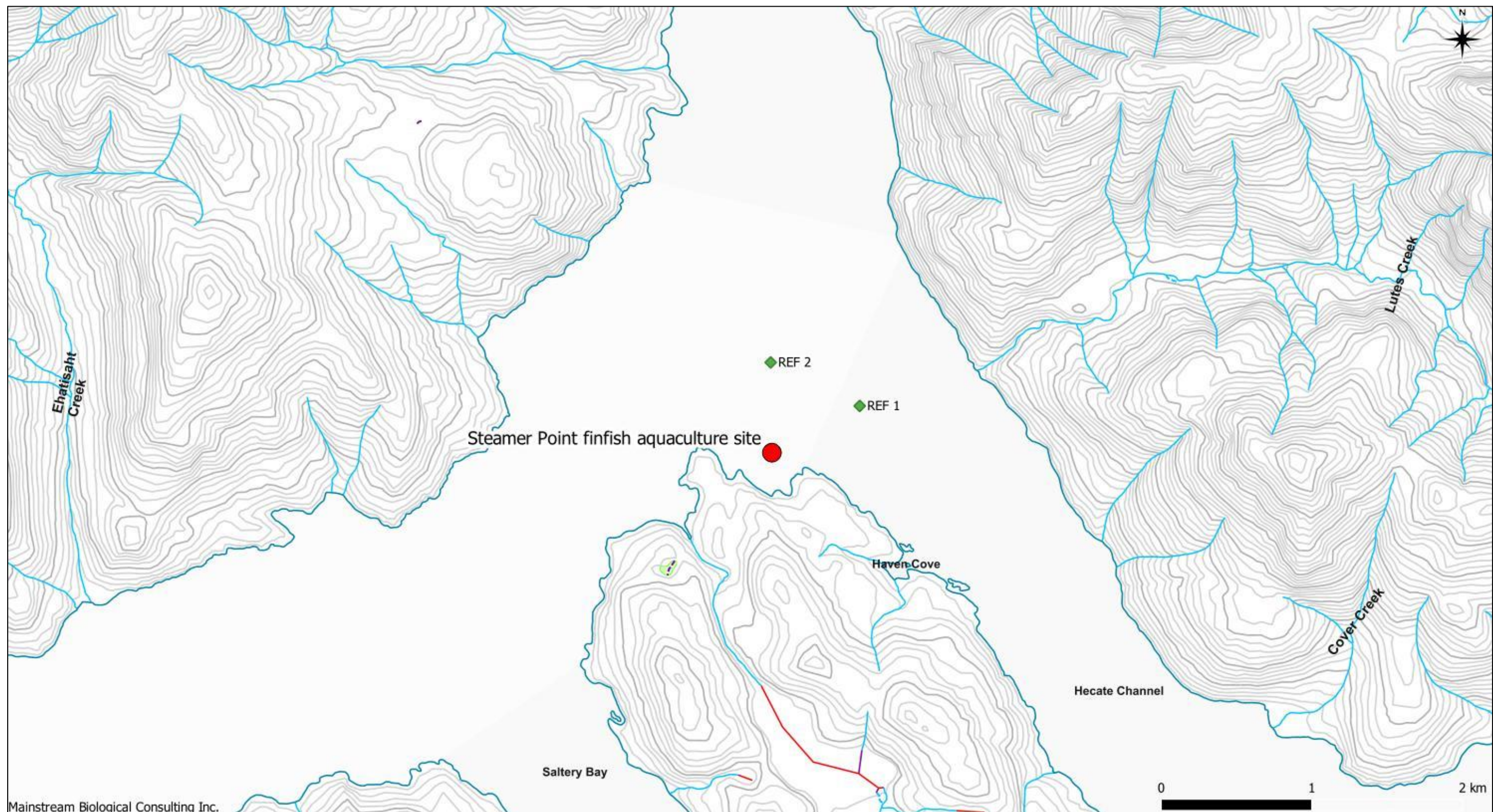


Figure 3: The locations of the reference stations for the ASC survey at the Steamer Point finfish aquaculture site in relation to the site and surrounding area on February 11, 2021.

The time at which each sample was successfully obtained, and physical characteristics of the collected sediment were recorded. A digital photograph of each sample was also taken. As per Indicator 2.1.1, levels of free sulphides and redox potential of each sediment sample were measured in the field using an Orion A324 meter and the appropriate ISE probes. A digital thermometer was used to measure the temperature of the sediment.

As per Indicator 5.2.1, portions of the grab samples collected at the station outside the AZE on Transect C as well as the reference stations were retained for analysis. Retained samples were stored at 4° Celsius and transported to SGS Canada Inc for analysis for emamectin benzoate and florfenicol.

2.2 Data Analysis

In order to evaluate if the benthic conditions at and near the Steamer Point site met the requirements of Criterion 2.1 of the ASC Salmon Standard, the data collected was compared to required levels for indicators of potential finfish farm impacts. These indicators represent a combination of chemical and biodiversity measurements to evaluate the status of benthic health, biodiversity and ecosystem function and to detect potential impacts related to the salmon farm operation. The indicators considered for this assessment are summarized below in Table 1.

Additional analysis of parasiticide residue was completed to fulfill the requirement for monitoring of these chemicals but there is no required level presented in the ASC to compare these results to.

Table 1: Summary of indicators of benthic health, biodiversity and ecosystem function that were considered during the evaluation of the Steamer Point finfish aquaculture site. The indicators have been adopted from Criterion 2.1 of the ASC Salmon Standard.

Criterion Number	Indicator	ASC Salmon Standard Requirement
2.1.1	Redox potential in sediment outside the AZE ¹ .	>0 millivolts (mV)
2.1.1	Sulphide levels in sediment outside the AZE.	≤1500 microMoles / L (µM)

1: AZE = Allowable Zone of Effect

3.0 Results and Discussion

Representative photographs of sediment obtained at each sampling station are presented in Appendix 1. Raw data obtained from sediment sampled in the field is presented in Appendix 2 and the summarized data is presented in Appendix 3.

The sediment successfully collected at the Steamer Point sampling stations typically consisted of green mud.

In the 2017 pre-survey at Steamer point, sediment could not be successfully collected at the stations located on the A and B transects. The results of each unsuccessful grab attempt from the 2017 pre-survey are presented in Table 2 and shown in Figure 2.

3.1 Redox Potential and Sulphide Levels

Following Criterion 2.1.1 of the ASC Salmon Standard, the results of redox potential and sulphide testing at the station outside the AZE were analyzed to help evaluate if the Site name facility was meeting the certification requirements (Appendix 3).

The mean sulphide level in sediment collected at the station outside AZE on Transect C (15.4 μM) on February 11, 2021 was less than the ASC Salmon Standard sulphide upper limit of 1500 μM .

Mean redox potential in sediment collected at the station outside the AZE on Transect C (158.8 mV) was greater than the 0 mV minimum requirement cited in Criterion 2.1.1 of the ASC Salmon Standard.

Table 2 The station and results of each unsuccessful grab attempt at the Steamer Point finfish aquaculture site pre-survey on February 21, 2017.

Station	Replicate Number	Sampling Device	Sample Depth	Comments
0B	1	Van Veen	0	Skim of black sand
0B	2	Van Veen	0	Flecks of sand
0B	3	Van Veen	0	Flecks of sand
0B	4	Van Veen	0	Flecks of sand, mussel shell
B-5m	1	Van Veen	0	
B-5m	2	Van Veen	0	Bluff, fleck sand
B-5m	3	Van Veen	0	Bluff, fleck sand
B-5m	4	Van Veen	0	Bluff, Fleck sand
B+25m	1	Van Veen	0	Grab rolled down bedrock bluff, skiff of sand
B+25m	2	Van Veen	0	Grab rolled down bedrock bluff, skiff of sand
B+25m	3	Van Veen	0	Grab rolled down bedrock bluff, skiff of sand
B+25m	4	Van Veen	0	Grab rolled down bedrock bluff, skiff of sand
0A	1	Van Veen	0	Skiff of sand, mussel shell
0A	2	Van Veen	0	
0A	3	Van Veen	0	
0A	4	Van Veen	0	
A-5m	1	Van Veen	0	Grab rolled down bluff, skiff sand, 65m from system
A-5m	2	Van Veen	0	
A-5m	3	Van Veen	0	
A-5m	4	Van Veen	0	Mussel shell
A+25m	1	Van Veen	0	Grab rolled down bluff, skiff of sand
A+25m	2	Van Veen	0	
A+25m	3	Van Veen	0	
A+25m	4	Van Veen	0	

3.2 Parasiticide Residue

Analysis of the sediment collected from the station outside the AZE on Transect C and the two reference stations for emamectin benzoate and florfenicol are shown in Table 3. The analysis was completed to fulfill the requirement of the ASC Salmon Standard Criterion number 5.2.1. All of the collected sediment samples analyzed had parasiticide residue concentrations less than the laboratory detectable limit.

Table 3: The parasiticide residue concentration of collected sediment at the station outside the AZE on Transect C and the two reference stations at the Steamer Point finfish aquaculture site on February 11, 2021.

Station Name	Sample Number	Emamectin Benzoate (ppm)	Florfenicol (ng/g)
Detection Limit		1.0	2.00
Outside AZE C	1	<1.0	<2.00
Outside AZE C	2	<1.0	<2.00
Reference 1	1	<1.0	<2.00
Reference 1	2	<1.0	<2.00
Reference 2	1	<1.0	<2.00
Reference 2	2	<1.0	<2.00

4.0 References

- Aquaculture Stewardship Council. 2012. ASC Salmon Standard Version 1.3. Available online: www.asc-aqua.org.
- Salas, F., Patrício, J. and Marques, J.C. 2006. Ecological Indicators in Coastal and Estuarine Environmental Quality Assessment - A user friendly guide for practitioners. Imprensa da Universidade de Coimbra.

Appendix 1 – Sample Photographs



Photo 1

Sediment sample collected at the station inside the AZE on Transect C at the Steamer Point site on February 11, 2021.



Photo 2

Sediment sample collected at the station outside the AZE on Transect C at the Steamer Point site on February 11, 2021.



Photo 3

Sediment sample collected at the Reference 1 at the Steamer Point site on February 11, 2021.



Photo 4

Sediment sample collected at the Reference 2 at the Steamer Point site on February 11, 2021.

Appendix 2 – Steamer Point Field Data

Reference Information:		Farm site: Steamer Point		Field Crew: E. Cicon, P. Jones	
Aquaculture Company:		Greig Seafood BC Ltd		Field Investigator: Mainstream Biological Consulting Inc.	
Site Reference #:		AQ1079		Laboratory: SGS Canada Inc	
Geographic Region:		Hecate Channel, BC			

<i>Transect A, B, C Name</i>	<i>Sampling Station Name</i>	<i>Replicate Number</i>	<i>Transect A, B, C Bearing (Magnetic)</i>	<i>Reference Station (Y/N)</i>	<i>Distance from Pens (m)</i>	<i>Sampling Device Type</i>	<i>Sampling Device Capacity (m2)</i>	<i>Quality Control Replicate (Y/N)</i>	<i>Replicate Analysis Type</i>	<i>Sample Date (YYYY-MM-DD)</i>	<i>Sample Time (24HH:MM)</i>	<i>Sample Latitude (Degrees)</i>	<i>Sample Latitude (Minutes)</i>	<i>Sample Longitude (Degrees)</i>	<i>Sample Longitude (Minutes)</i>	<i>GPS Correction Status</i>	<i>Ocean Depth (m)</i>	<i>Sample Depth (cm)</i>
C	5m	1				Petite Ponar	0.02			2021-02-11	12:29	49	53.2716	126	47.4528	Post Process Corrected	179	9
C	5m	1				Petite Ponar	0.02	Y	Duplicate	2021-02-11	12:29	49	53.2716	126	47.4528	Post Process Corrected	179	9
C	5m	1				Petite Ponar	0.02	Y	Triplicate	2021-02-11	12:29	49	53.2716	126	47.4528	Post Process Corrected	179	9
C	5m	2				Petite Ponar	0.02			2021-02-11	12:31	49	53.2711	126	47.4474	Post Process Corrected	179	9
C	25m	1				Petite Ponar	0.02			2021-02-11	12:53	49	53.2875	126	47.4514	Post Process Corrected	175	9
C	25m	2				Petite Ponar	0.02			2021-02-11	13:02	49	53.2866	126	47.4441	Post Process Corrected	175	10
Ref 1	Ref 1	1				Petite Ponar	0.02			2021-02-11	12:24	49	52.4260	126	45.8553	Post Process Corrected	162	9
Ref 1	Ref 1	2				Petite Ponar	0.02			2021-02-11	12:33	49	52.4065	126	45.8397	Post Process Corrected	162	5
Ref 2	Ref 2	1				Petite Ponar	0.02			2021-02-11	13:57	49	53.4909	126	47.5001	Post Process Corrected	164	8
Ref 2	Ref 2	2				Petite Ponar	0.02			2021-02-11	14:17	49	53.5040	126	47.5132	Post Process Corrected	164	8

<i>Transect A, B, C Name</i>	<i>Sampling Station Name</i>	<i>Replicate Number</i>	<i>Free Sulphide (micromolar)</i>	<i>Sediment Temperature (deg C)</i>	<i>Eh Uncorrected (mV)</i>	<i>Eh Corrected (mV)</i>	<i>Cu (micro-g/g)</i>	<i>Zn (micro-g/g)</i>	<i>Li (micro-g/g)</i>	<i>Gravel Percent</i>	<i>Sand Percent</i>	<i>Mud Percent</i>	<i>TVS Percent</i>	<i>Beggiatoa Observed (Y/N)</i>	<i>OPC Observed (Y/N)</i>	<i>Fish Feed Observed (Y/N)</i>	<i>Fish Feces Observed (Y/N)</i>	<i>Odour Rating</i>	<i>Black Sediment Observed (Y/N)</i>	<i>Gas Bubbles Observed (Y/N)</i>
C	5m	1	48.3	8.3	-53.6	162.4									N	N	N	N	0	N
C	5m	1	44.7	8.3	-72.3	143.7									N	N	N	N	0	N
C	5m	1		8.3	-76.3	139.7									N	N	N	N	0	N
C	5m	2	34.9	8.4	-93.1	122.9									N	N	N	N	0	N
C	25m	1	12.0	8.2	-43.7	172.3									N	N	N	N	0	N
C	25m	2	18.8	8.7	-69.8	145.2									N	N	N	N	0	N
Ref 1	Ref 1	1	12.5	8.3	-50.4	165.6									N	N	N	N	0	N
Ref 1	Ref 1	2	42.4	8.1	-61.7	154.3									N	N	N	N	0	N
Ref 2	Ref 2	1	21.6	8.4	-51.3	164.7									N	N	N	N	0	N
Ref 2	Ref 2	2	20.1	8.1	-105.4	110.6									N	N	N	N	0	N

Table note:

- Odour rating: ranked on a scale of 0 (no odour) to 4 (very strong sulphide odour)

<i>Transect A, B, C Name</i>	<i>Sampling Station Name</i>	<i>Replicate Number</i>	<i>Flocculent Organic Material Observed (Y/N)</i>	<i>Shell Hash Observed (Y/N)</i>	<i>Terrigenous Material Observed (Y/N)</i>	<i>Farm Litter Observed (Y/N)</i>	<i>Macrophytes Observed (Y/N)</i>	<i>Megafauna Observed (Y/N)</i>	<i>Sediment Colour Observations</i>	<i>Sediment Texture Observations</i>	<i>Other Sample Observations (Comments)</i>
C	5m	1	N	Y	N	N	N	N	green	mud	flecks of shell
C	5m	1	N	Y	N	N	N	N	green	mud	flecks of shell
C	5m	1	N	Y	N	N	N	N	green	mud	flecks of shell
C	5m	2	N	Y	N	N	N	N	green	mud	
C	25m	1	N	Y	N	N	N	N	green	mud	flecks of shell
C	25m	2	N	Y	N	N	N	N	green	mud	flecks of shell
Ref 1	Ref 1	1	N	Y	N	N	N	N	green	mud	couple flecks of shell
Ref 1	Ref 1	2	N	Y	N	N	N	N	green	mud	couple flecks of shell
Ref 2	Ref 2	1	N	Y	N	N	N	N	green	mud	flecks of shell
Ref 2	Ref 2	2	N	Y	N	N	N	Y	green	mud	worm

Appendix 3 – Steamer Point ASC Survey Summary

Company:	Greig Seafood BC Ltd	Sample date:	February 11, 2021
Farm Site:	Steamer Point	Field crew:	E. Cicon, P. Jones
Site License #:	AQ1079	Analytical:	SGS Canada Inc
Site Location	Hecate Channel, BC		

SULPHIDES Indicator 2.1.1 Requirement ≤ 1500 (μm)					
Station	Rep 1	Rep 2	n	Mean	ASC Criteria Met
Inside AZE C	48.3	34.9	2	41.6	
Outside AZE C	12.0	18.8	2	15.4	Yes
Reference 1	12.5	42.4	2	27.5	
Reference 2	21.6	20.1	2	20.9	

REDOX POTENTIAL Indicator 2.1.1 Requirement > 0 mV					
Station	Rep 1	Rep 2	N	Mean	ASC Criteria Met
Inside AZE C	162.4	122.9	2	142.7	
Outside AZE C	172.3	145.2	2	158.8	Yes
Reference 1	165.6	154.3	2	160.0	
Reference 2	164.7	110.6	2	137.7	