REGISTRATION OF AN UNDERTAKING

UNDER THE ENVIRONMENTAL ASSESSMENT REGULATIONS, 2003, SECTION 29

"MARYSTOWN ATLANTIC SALMON HATCHERY"

Prepared for:
Government of Newfoundland and Labrador
Department of Environment and Conservation
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September 28, 2015

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1 NAME OF UNDERTAKING

"Marystown Atlantic Salmon Hatchery"

2 PROPONENT

2.1 Name of Corporate Body:

Grieg Nurseries NL Ltd.

2.2 Address:

205 McGettigan Blvd.
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2.3 Chief Executive Officer:

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2.4 Principal Contact Person:

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3 THE UNDERTAKING

3.1 Nature of the Undertaking:

This undertaking is a construction and operation of a Recirculation Aquaculture System (RAS) Hatchery for Atlantic salmon (*Salmo salar*) in the Marystown Marine Industrial Park on Lots 7, 9, 11, 13, and 15. The facility, once constructed, will produce 6,000,000 300 gram smolt and 1,000,000 1,500 gram smolt on a yearly basis. This will be a biosecure facility and all access and supplies will be of a controlled nature. The smolt from the RAS Hatchery will be sold to Newfoundland salmonid aquaculture farms.

3.2 Purpose/Rationale/Need for the Undertaking:

The purpose of the project is to produce the disease free seed stock for the Newfoundland salmonid aquaculture industry. The Marystown site is ideal in that it provides suitable groundwater and land adjacent to the Mortier Bay for ease of loading unto a wellboat with minimal handling and without having to truck the fish. Production of the salmon smolt locally in the Province provides for ease of permitting Introduction and Transfer Licenses. The facility will provide for a critical asset in the farming production of Atlantic salmon in Newfoundland and Labrador and adding greatly to the prosperity of the Province. The use of water and land for the project are a part of the renewable and sustainable resources of the Province making this a pastoral project. The project is a very important piece of a network of assets that will provide much needed sustainable employment to rural Newfoundland and Labrador. The project will provide profit to its shareholders, business opportunity to suppliers, wholesome food to customers, and finally tax revenue to the Municipality, the Province and the Country.

3.3 Alternatives to the Undertaking:

There are no alternatives to the undertaking as it is proposed in Marystown for Newfoundland and Labrador without compromising:

1. Management Efficiency -- by creating distance between various operations of hatchery, marine farms, and processing;

2. Economics -- by creating greater distances for transportation; and,

3. Fish Health -- by inducing more handling and for longer periods. The proposed location of the facility in Marystown is adjacent to marine farms on the south coast.

At the start of the assessment of the project, including hatching and smoltification, consideration was given to the southwest and west coasts of Newfoundland. The Hydrogeology of the west coast including the Codroy Valley and Bay St. Georges was studied for possible hatching and smoltification facilities. There appeared to be adequate supplies of suitable groundwater resources on the west coast. The consideration of building hatching and smoltification facilities on the west coast was rejected because it was more distant from the intended customers than the Marystown aquifer. Hatchery and smoltification development was given full consideration to the most economical and animal welfare sensitive solution in Marystown rather than 700 kilometers away on the west coast.

4 DESCRIPTION OF THE UNDERTAKING

4.1 Geographic Location:

The project will be undertaken at serviced Lots 7, 9, 11, 13, and 15 adjacent to the Marine Industrial Park Access Road from the Buin Peninsula Highway Route 210 in Marystown. For the purpose of the Aquaculture License Application the estimated central location was stated as N47^{o} 10.741' W55^{o} 08.271'. The area combined for all lots is 10.2455 hectares. The exact location is provided in the figures below:

Figure 1 – Location Provincial Perspective

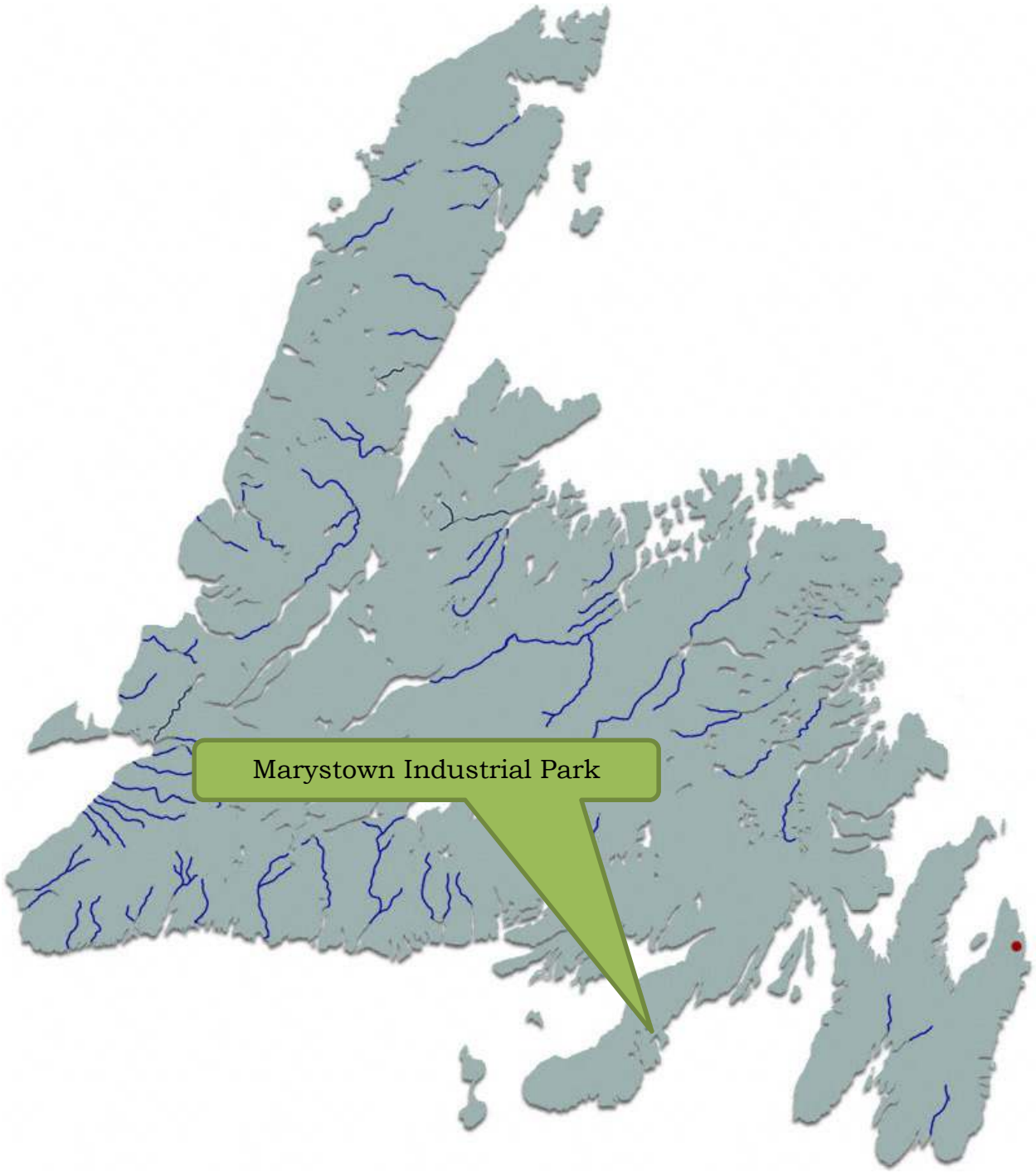


Figure 2 – Location Regional Perspective

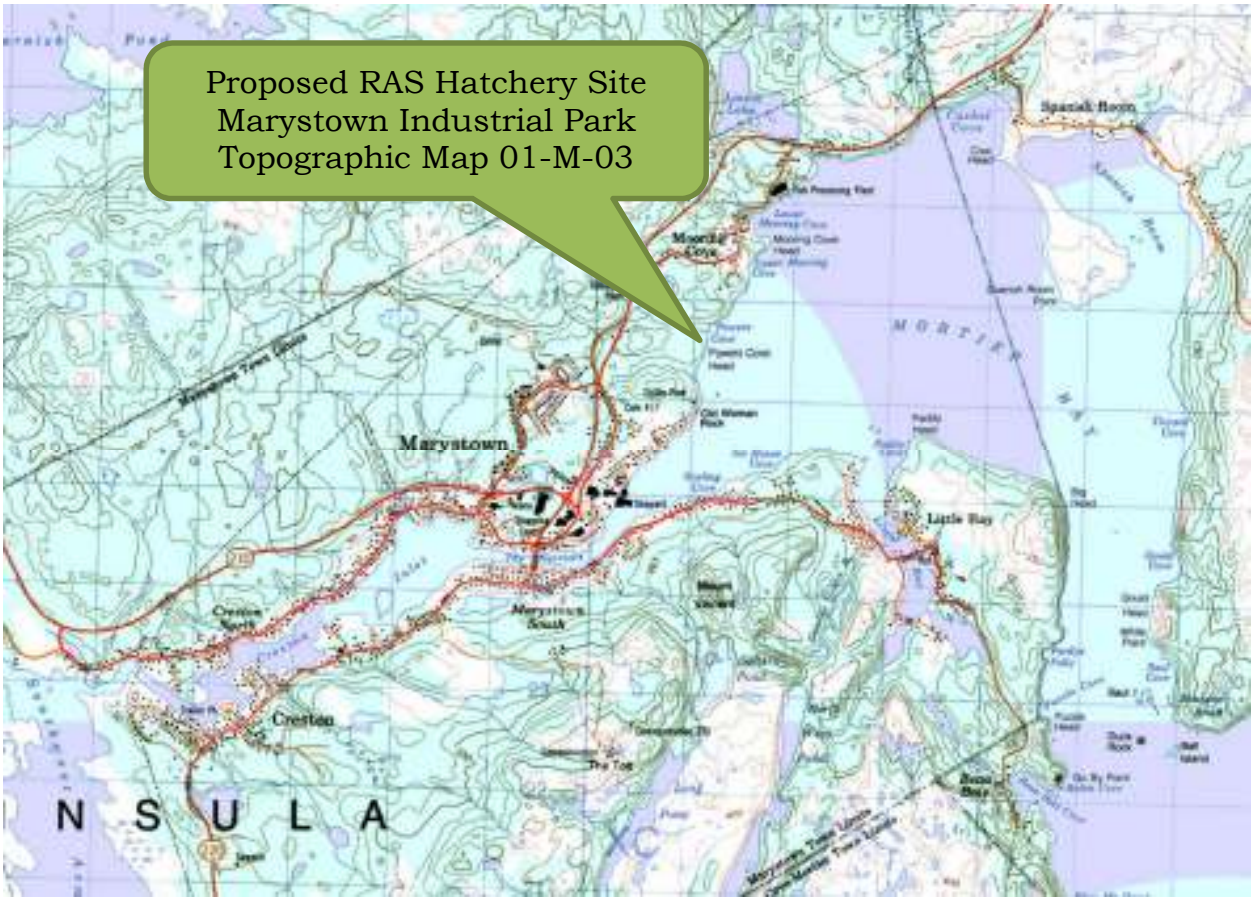


Figure 3 – Location Aerial Perspective

4.2 Physical Features:

4.2.1 Major Features of the Undertaking:

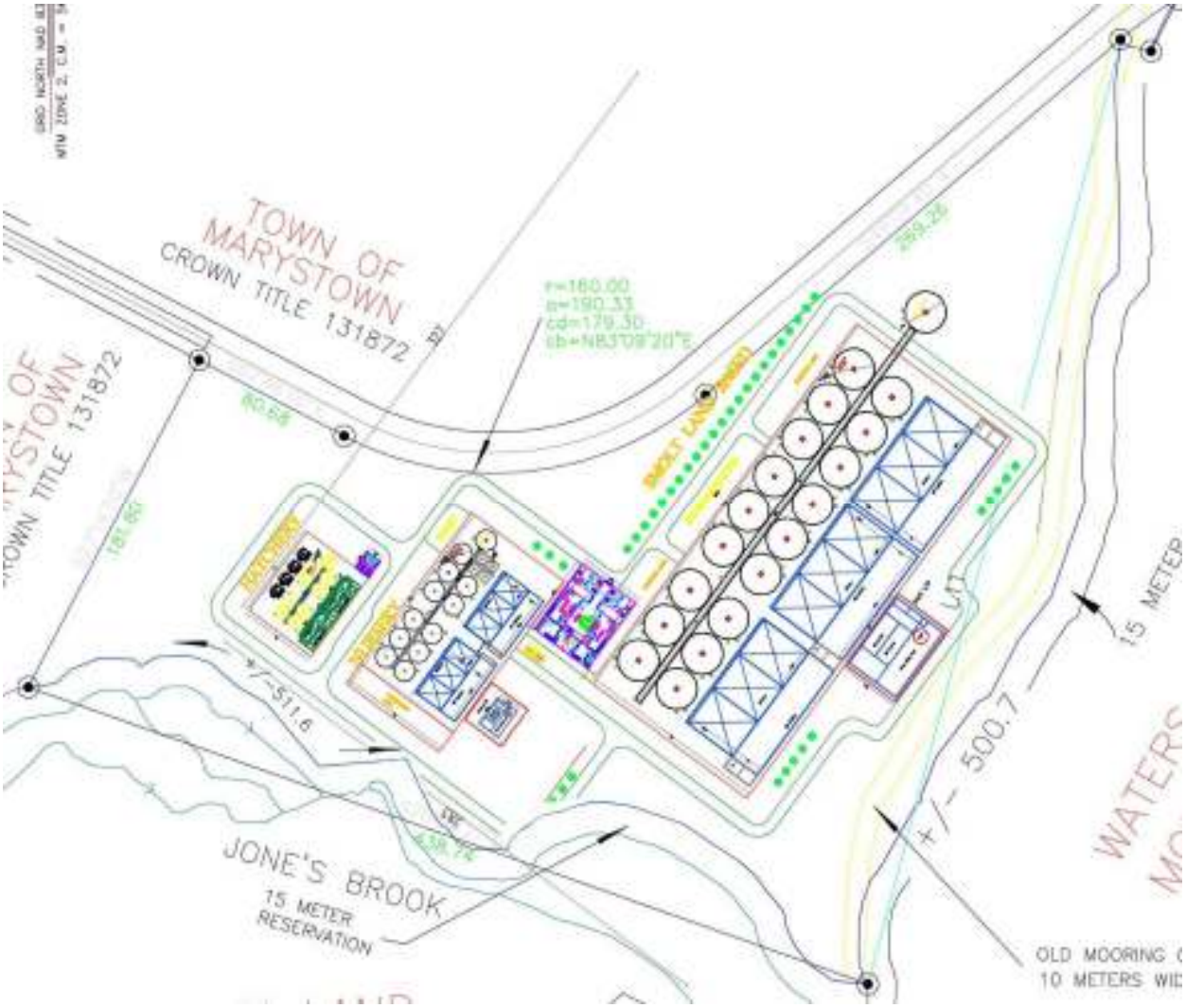
The main features of the undertaking will be a parking lot and the buildings -- Hatchery, Smolt Nursery, and Smolt Landbase. The lots are already serviced with 3 phase power, municipal water and sewer, and a paved access road.

Figure 4 – Picture of Service to the Lots

4.2.2 Area to be Affected by the Undertaking:

The area affected by the undertaking is 10.2455 hectares. A digital rendition of the site is presented in the figure below.

Figure 5 – Area Affected by the Undertaking



4.2.3 Existing Biophysical Environment:

4.2.3.1 Topography

The project site is located within the Maritime Barrens Eco-region (6) and Sub region Southeastern Barrens. This is identified as 6B in the Figure below. It encompasses much of the Burin and Avalon peninsulas. The Department of Natural Resources describes the Eco-region as follows:

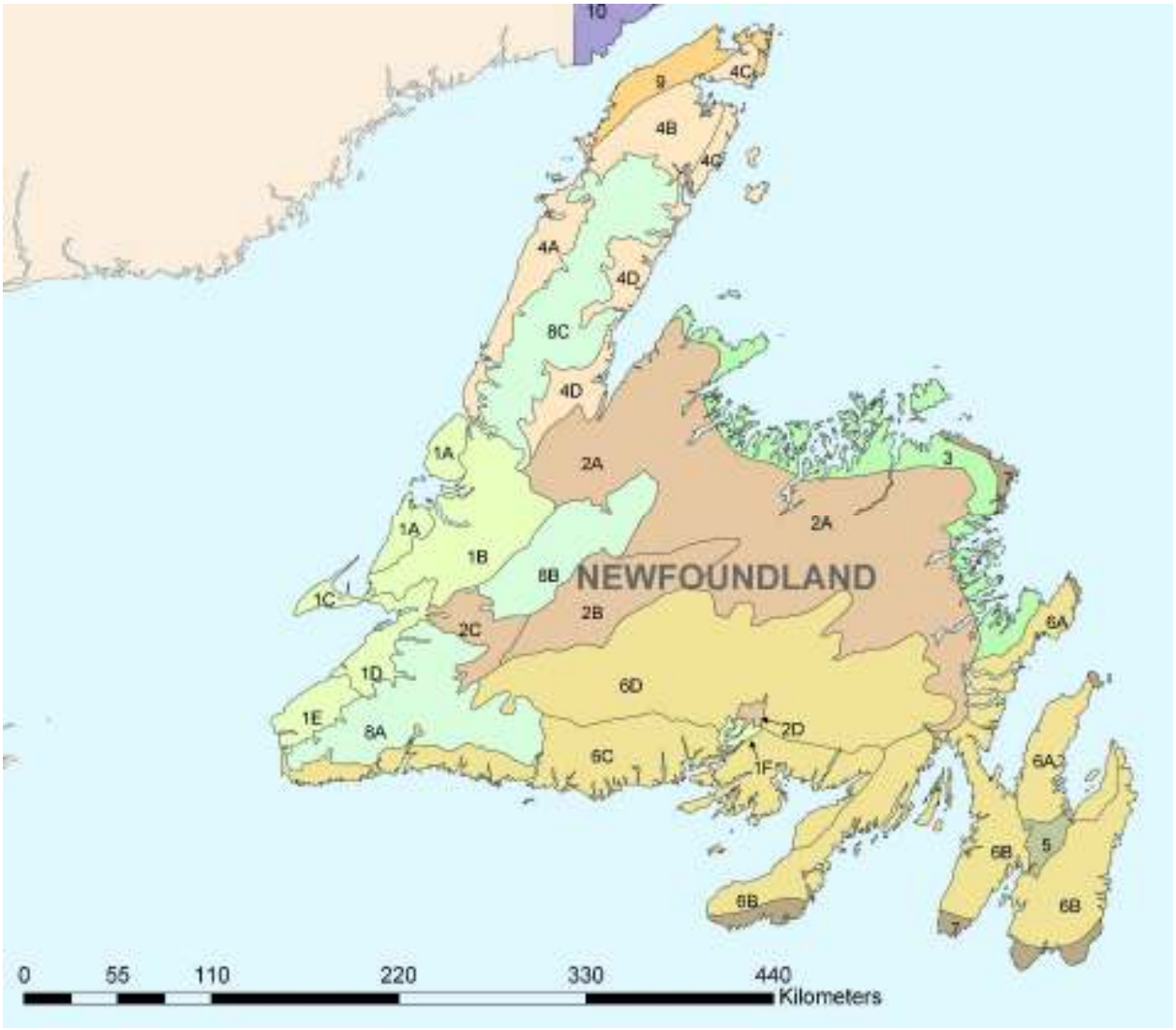
> "*The Maritime Barrens Ecoregion extends from the east coast of Newfoundland to the west coast through the south central portion of the island. This ecoregion has the coldest summers with frequent fog and strong winds. Winters are relatively mild with intermittent snow cover particularly near the coastline. Annual precipitation exceeds 1250 mm.*
>
> *The landscape pattern consists of usually stunted, almost pure stands of Balsam Fir, broken by extensive open heathland. Good forest growth is localized on long slopes of a few protected valleys. The development of the extensive heath landscape was precipitated by indiscriminate burning by European settlers. Railways in the nineteenth century also had a significant impact on fire frequency in the eastern part of the region. The heaths are dominated by* ***Kalmia angustifolia*** *on protected slopes where snow accumulates and by cushions of* ***Empetrum nigrum*** *or* ***Empetrum easmesii*** *on windswept ridges and headlands.*
>
> *Attempts to afforest these heaths with* ***Picea sitchensis*** *have been unsuccessful, but Eastern larch and Scots Pine may have potential for fuelwood stands (Hall 1986). However, site selection is critical because the historical removal of forest has deflected the natural tree line to low elevations. Wind, lack of protective snow cover and soil frost disturbance are important factors limiting plantation establishment in this ecoregion."*

The Department of Natural Resources describes the Southeastern Barrens Sub-region as follows:

> "*In this sub-region the landscape is dominated by heathlands and the forest only occurs in small acreages which escaped fire. The dominant heath shrub on uplands is* ***Empetrum nigrum*** *with* ***Kalmia angustifolia*** *forming a dense cover only in protected valleys.*

The topography is generally undulating with shallow heavily compacted till and numerous large erratics. The Clintonia-Balsam Fir type is most common where the forest is still present. Good forest growth only occurs in a few large protected valleys where the Dryopteris-Balsam Fir type dominates the slopes. Good specimens of Yellow Birch are also found in these stands."

Figure 6 – Newfoundland Eco-regions



The elevation of the project site ranges from 58 M above sea level near the west side of the Marine Industrial Park, to sea level at Powers Cove, with some moderate-to-steep-sloping hillsides towards the east and north.

The industrial park area is dominated by a moderate to dense vegetation cover with the exception of the road consisting primarily of balsam fir, with some spruce and juniper.

AMEC Foster Wheeler (AMEC) in their Aquifer Testing Report in support of this application (see Appendix A) described the superficial geology of the Site "consists of vegetation concealed thin veneer (<1.5M) of glacial till and angular frost heaved bedrock (Batterson and Taylor, 2007)." AMEC described the bedrock geology "Marystown lies within the Avalon tectonostratigraphic zone and is underlain by mafic to acidic volcanic rocks and minor sedimentary rocks of the Mortier Group. Rocks in the area have undergone region-scale folding related to Devonian Acadian orogenesis and form the core of a broad regional northeast – southwest trending anticline, referred to as the Burin Anticline. A series of joint sets and fracture zones occur within rocks underlying Marystown and are related to deformation (JWEL, 2008)." AMEC further describes the bedrock geology as "The Creston Formation of the Mortier Group underlies the Site and is dominated by 500 M of basaltic flows with subordinate acidic pyroclastic and sedimentary rocks with an estimated thickness of 550M. The basalts are highly amygdaloidal and green to purple. The pyroclastic and sedimentary rocks of the Mortier Group are acidic; although locally they have high concentrations of mafic debris giving the rocks a greenish colour and intermediate composition (Strong et al., 1977)."

The area east of the proposed development is characterized by the very deep water of Powers Cove in Mortier Bay. The shoreline is a mix rock and gravel.

Jone's Brook is separated from the property by a 15 meter buffer. This is a very small brook in Zone 10 and is not a Scheduled Salmon River. There are no impacts to this brook from this development.

The property has an old overgrown road that is not being used even for recreational purposes called "Old Mooring Cove Road". The Town of Marystown have applied to the Department of Transportation and Works for decommissioning.

Prior to the commencement of this undertaking under this application the Town of Marystown will complete the clearing and grubbing of the lots as per their undertaking that was released in August 2008 with Registration number 1387.

4.2.3.2 Climate

The following table provides the most recent month by month data for the nearby Environment Canada weather station in Winterland 15 kilometers from the project site. This is from the most recent year that complete data was available, 2007:

Table 1 – Monthly Climate Data Winterland Station 2007

Month	Mean Max Temp	Mean Min Temp	Average Temp	Extreme Max Temp	Extreme Min Temp	Total Precip
January	0.6	-5.6	-2.5	10.3	-14.9	166.0
February	-2.8	-8.6	-5.7	4.9	-15.2	128.5
March	1.8	-6.1	-2.2	7.8	-14.1	78.5
April	5.7	-2.3	1.7	11.6	-9.2	54.5
May	11.2	1.2	6.2	18.9	-2.4	74.0
June	16.1	7.0	11.6	25.5	-1.8	64.0
July	20.9	12.2	16.6	30.2	6.5	227.0
August	20.5	11.9	16.3	24.9	6.8	59.0
September	17.0	7.7	12.4	20.9	2.6	72.5
October	11.9	4.5	8.2	19.0	-1.9	93.5
November	8.1	0.5	4.3	14.2	-6.8	225.5
December	-0.3	-6.2	-3.3	7.5	-15.1	159.0
Total						**1402.0**
Average	**9.2**	**1.4**	**5.3**			
Extreme				**30.2**	**-15.2**	

4.2.3.3 Historical Resources

The Town of Marystown did a Historic Resources Assessment in 2005 for the project site; this assessment did not reveal any significant cultural or historic resources within the area. Appendix C is attached for full detail.

4.2.3.4 Groundwater Resources

AMEC Foster Wheeler Environment & Infrastructure prepared an “Aquifer Testing Report” to describe the groundwater resources available for use with this undertaking. The report is available in Appendix A. The drilled well is 200 mm in diameter and 128 meters deep and is capable of a sustainable flow of

1,208 liters per minute of withdrawal. The undertaking has a calculated water use of 25 liters per minute in the Nursery and 175 liters per minute in the Smolt Landbase for a total of 200 liters per minute. The proposal for the facilities by AquaMaof (Appendix D) have a conservative 50% buffer on the estimated water use taking it to 300 liters per minute or about 25% of the water available from the well. The water in the system is managed with a 99.5% recirculation rate and 0.5% is removed with the sludge and is then further processed to dry the sludge and return the water after ozone treatment back into the facility systems. Thus, there is no water effluent from the facility.

4.2.3.5 Species at Risk

All activities in Newfoundland and Labrador must comply with Canada's Species at Risk Act (SARA) and then further provincially with Newfoundland and Labrador's Endangered Species Act. The "Species at Risk" are collectively a part of SARA's Public Registry, the list of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the list of Newfoundland and Labradors Species Status Advisory Committee (SSAC). There is a general overlap of prohibitions under both jurisdictions for Species at Risk; however, there are some differences in terminology or definitions. Federally species are referred to as Extirpated or Extinct, Endangered, Threatened or Special Concern. The Provincial definitions are the same with the exception of Special Concern and are referred to as Vulnerable.

The proponent has consulted with the Atlantic Canada Conservation Data Centre (ACCDC) for an expert opinion. The ACCDC offer the following opinion:

> "Within your study area, there were 2 rare animal records found. These records were 2 Harlequin Duck observations, a species which is *Vulnerable* under our provincial Endangered Species Act (ESA) and *Special Concern* under COSEWIC. A new addition to our standard data requests is the use of Expert Opinion Maps. These maps are the result of our work with species-specific experts to gather suggestions about locations where species at risk - either provincially or COSEWIC listed - may be found. While we don't have observations in our database for these species within your study area, our Expert Opinion Maps suggest that Banded Killifish, Short-eared Owls and Boreal Felt Lichen are possible. Your area is also said to be within the Barrow's Goldeneye's range."

Table 2 – Atlantic Canada Conservation Data Centre – Rare Fauna in the 5 Kilometer Range of the Undertaking

OBSERVATION	GNAME	GCOMNAME	FAMILY	Observer	Total Number
1	Histrionicus histrionicus	Harlequin Duck	Anatidae	0	1
2	Histrionicus histrionicus	Harlequin Duck	Anatidae	0	1
	Month	Day	Year	SRANK	NRANK
1	11	27	1984	S3B,S2N	N3N4
2	2	10	1995	S3B,S2N	N3N4
	GRANK	General Status	COSEWIC_ST	PROVINCIAL	SARA
1	G4T4	Secure	Special Concern	Vulnerable	Special Concern
2	G4T4	Secure	Special Concern	Vulnerable	Special Concern
	SITE NAME	Accuracy	SYNAME	CITATION	IDNUM
1	Mooring Cove	0		Montevecchi list	mstr1006348
2	Mooring Cove	0		Montevecchi list	mstr1006349

Figure 7 – Atlantic Canada Conservation Data Centre – GIS Scan Rare Fauna within 5 Kilometers of the Undertaking

According to the advice of ACCDC and from Table 2 above there is one bird on COSEWIC's Schedule 1 list for the Atlantic Ocean that have the ability to frequent the nearshore of the project area. This is the Harlequin Duck (Special Concern) *Histrionicus histrionicus*. In the list of plants and animals prepared by the Department of Fisheries and Oceans (DFO) for its "Integrated Management Planning Placentia Bay" the Harlequin Duck is listed as an exceptional visitor. This project is adjacent to but not directly on or in Placentia Bay. No effluent from this project will enter Placentia Bay. Under the both SARA and ESA the prohibitions do not apply to species of Special Concern or Vulnerable. Further impacts to this species from this project are unlikely.

According to expert opinion provided by ACCDC the Banded Killfish *Fundulus diaphanous* may occur near the project site. The species occurs on the Burin Peninsula at Garnish Pond at 5.25 kilometers distance and Freshwater Pond at 10 kilometers distance from the project site. This species is considered Vulnerable or of Special Concern. These waterways are not connected to the project area. Under the both SARA and ESA the prohibitions do not apply to species of Special Concern or Vulnerable. Further impacts to this species from this project are unlikely.

According to expert opinion provided by ACCDC the Boreal Felt Lichen *Eroderma pedicellatum* may occur in vicinity of the project site. This species is considered Vulnerable or of Special Concern. It has been found mainly in two population hotspots on the Avalon Peninsula and in Bay d'Espoir; 96% of all occurrences. Research at Memorial University of Newfoundland (MUN) on predictive modelling of the species indicate that coastal regimes as near the project site are the least likely occurrence habitats. Under the both SARA and ESA the prohibitions do not apply to species of Special Concern or Vulnerable. Further impacts to this species from this project are unlikely.

According to expert opinion provided by ACCDC the Short-eared Owl *Asio flammeus* may occur in vicinity of the project site. This species is considered Vulnerable or of Special Concern. Any and all of Newfoundland and Labrador has suitable habitat for this owl. The species decline has been noted in other provinces but the population is stable in Newfoundland and Labrador. According to publications by the province's Department of Environment and Conservation's Wildlife Division the population is in Newfoundland limited by prey availability. Under the both SARA and ESA the prohibitions do not apply to species of Special Concern or Vulnerable. Further impacts to this species from this project are unlikely.

According to expert opinion provided by ACCDC the Barrows Goldeneye *Bucephala islandica* may occur in vicinity of the project site. This species is considered Vulnerable or of Special Concern. The species' population in Eastern North America mostly overwinter in the St. Lawrence estuary. They summer along boreal forest lakes near the St. Lawrence waterway. Under the both SARA and ESA the prohibitions do not apply to species of Special Concern or Vulnerable. Further impacts to this species from this project are unlikely.

There is one other rare species of flora known on the Burin Peninsula that is listed as Species at Risk and that is the Water Pygmyweed *Tillaea aquatica*. The Water Pygmyweed is located on the Burin peninsula at Point May, Pieduck Point, Taylor's Bay and Garnish. This species is considered to be of Special Concern or Vulnerable. This species do not occur in or near the project area: Garnish is the closest approach at 17.75 kilometers distance away. Under the both SARA and ESA the prohibitions do not apply to species of Special Concern or Vulnerable. Further impacts to this species from this project are unlikely.

There is a species of bird that is considered a general habitant of insular Newfoundland and Labrador and thus could potentially enter the project area and that is the Red Crossbill of the percna subspecies *Loxia curvirostra percna*. They are considered a nomadic species and their preferred habitats are mature forests of black spruce and balsam fir. This particular Species at Risk is considered Endangered. The COSEWIC status report of 2004 indicated an estimate of 500 to 1,500 individuals remain. The Department of Environment and Conservation indicate that the sighting of the last nest was in 1977 but that some juveniles were spotted in 2005. The cause for the decline of this species has been attributed to the loss of habitat through forestry operations and the introduction of the Red Squirrel *Sciurus vulgarus* to the island of Newfoundland. The presumption is that the Red Squirrel is out-competing the Red Crossbill for the food resource; namely, seeds of balsam fir and black spruce. The Red Crossbill has not been seen in vicinity of the project area and the preferred habitat does not present itself at the project area. Further impacts to this species from this project are unlikely.

There are three species of marine fish, and they are all wolfish, on COSEWIC's Schedule 1 list for the Atlantic Ocean that have the ability to frequent the nearshore of the project area. They are the Atlantic Wolfish (Special Concern) *Anarhichas lupus*, Northern Wolfish (Threatened) *Anarhichas denticulatus*, and Spotted Wolfish (threatened) *Anarhichas minor*. In the list of plants and animals prepared by the Department of Fisheries and Oceans (DFO) for its "Integrated Management Planning Placentia Bay" these marine fish are not listed. This project is adjacent to but not directly on or in Placentia Bay. No effluent from this project will enter Placentia Bay. Further impacts to these species from this project are unlikely.

There is one reptile on COSEWIC's Schedule 1 list for the Atlantic Ocean that have the ability to frequent the nearshore of the project area. This is the

Leatherback Sea Turtle (Endangered) *Dermochelys coriacea*. In the list of plants and animals prepared by the Department of Fisheries and Oceans (DFO) for its "Integrated Management Planning Placentia Bay" the Leatherback Sea Turtle is listed as an exceptional visitor. This project is adjacent to but not directly on or in Placentia Bay. No effluent from this project will enter Placentia Bay. Further impacts to this species from this project are unlikely.

There are two marine mammals from COSEWIC's Schedule 1 list for the Atlantic Ocean that have the ability to frequent the nearshore of the project area. They are the Fin Whale (Special Concern) *Balaenoptera physalus* and the Blue Whale (Endangered) *Balaenoptera musculus*. In the list of plants and animals prepared by the Department of Fisheries and Oceans (DFO) for its "Integrated Management Planning Placentia Bay" these whales are listed. This project is adjacent to but not directly on or in Placentia Bay. No effluent from this project will enter Placentia Bay. Further impacts to this species from this project are unlikely.

In summary, the project site will be a developed industrial lot prior to initiation of this project. The project, a RAS hatchery with 100% efficiency in water management and thus there are no water effluents released during operation. The project is entirely enclosed with only the building exposed to the elements. Windows are minimal in the building for control of day length for the fish; thus opportunities for fauna to fly into windows is absolutely minimal. The water used in the facility will be drawn from a deep well in the Marystown aquifer and thus streams and lakes are not impacted. Escape or accidental release of stock from this land based facility is not possible, therefore the undertaking poses no risk to local stocks. Considering all these factors it is very unlikely that the project will pose further impacts to Species at Risk or other flora and fauna from the area not at risk. The project is designed to be maximally sustainable to the environment in which it finds itself.

4.2.3.6 Potential Sources of Resource Conflict:

It is fully anticipated that there will be no resource conflicts as a result of this project. The facilities of the project are fully enclosed with 100 % recirculation and water reuse without effluent and thus not impacting Placentia Bay. Other typical resource users are aquaculture and fishing activities. There are no aquaculture sites or commercial fishing activities within the Mortier Bay area.

4.2.4 Artist's Conceptual Drawings:

The conceptual drawings are as follows:

Figure 8 - Hatchery

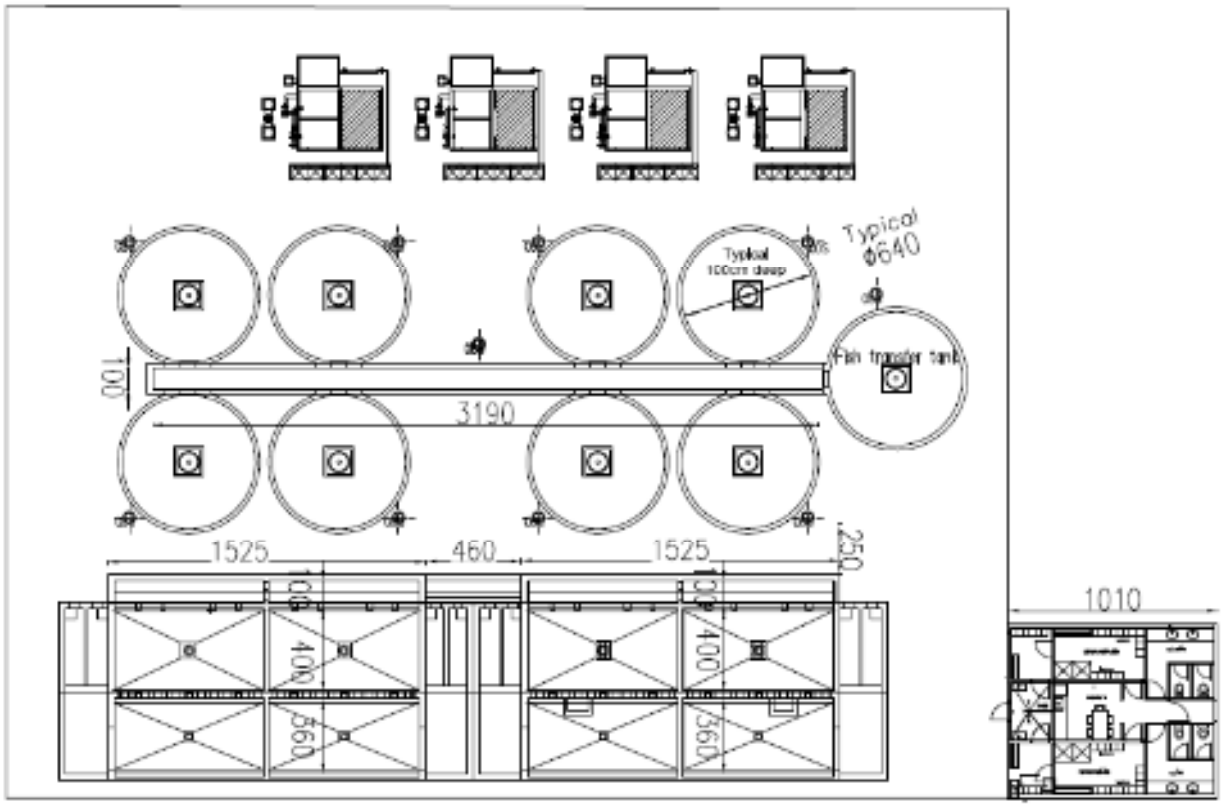


Figure 9 --Smolt Nursery

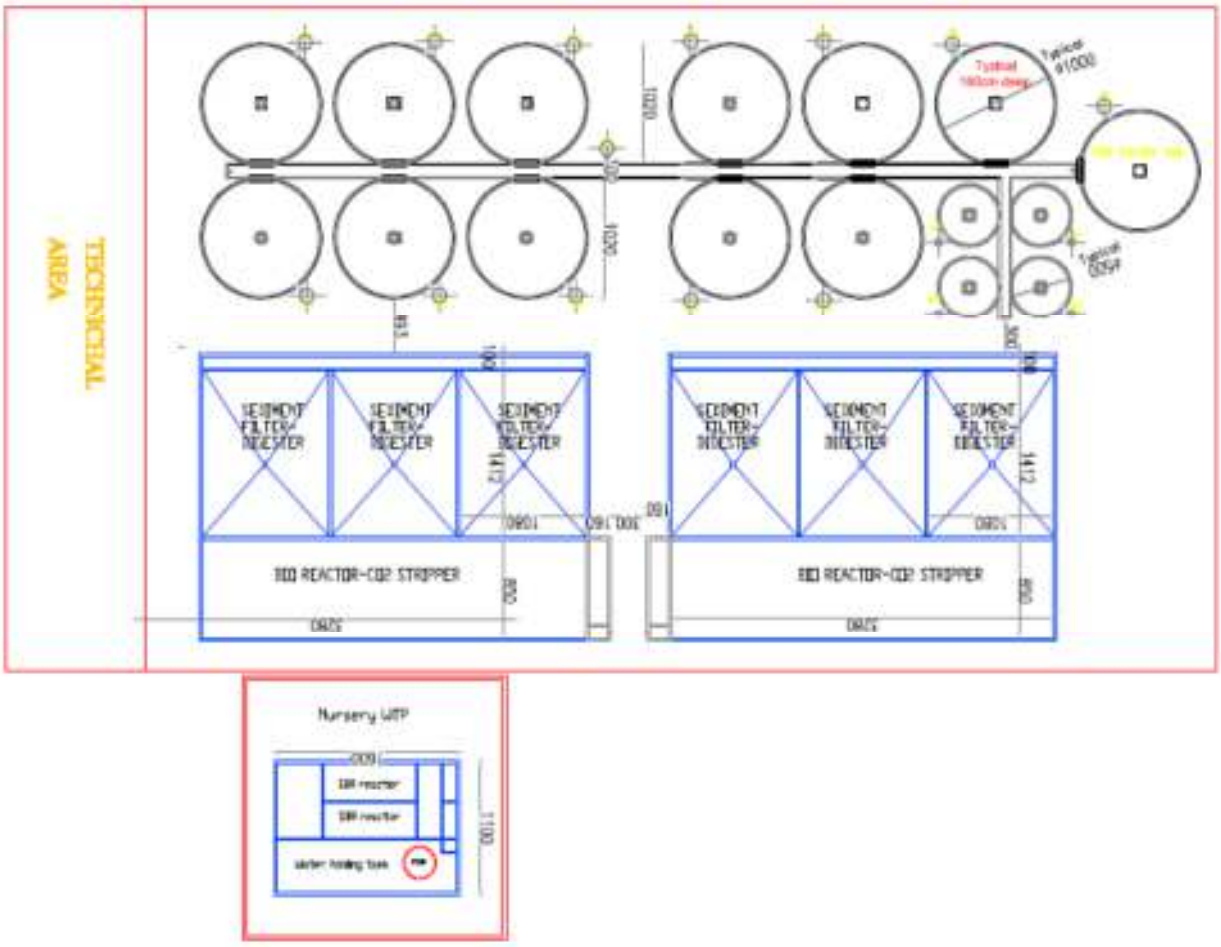


Figure 10 - Smolt Landbase

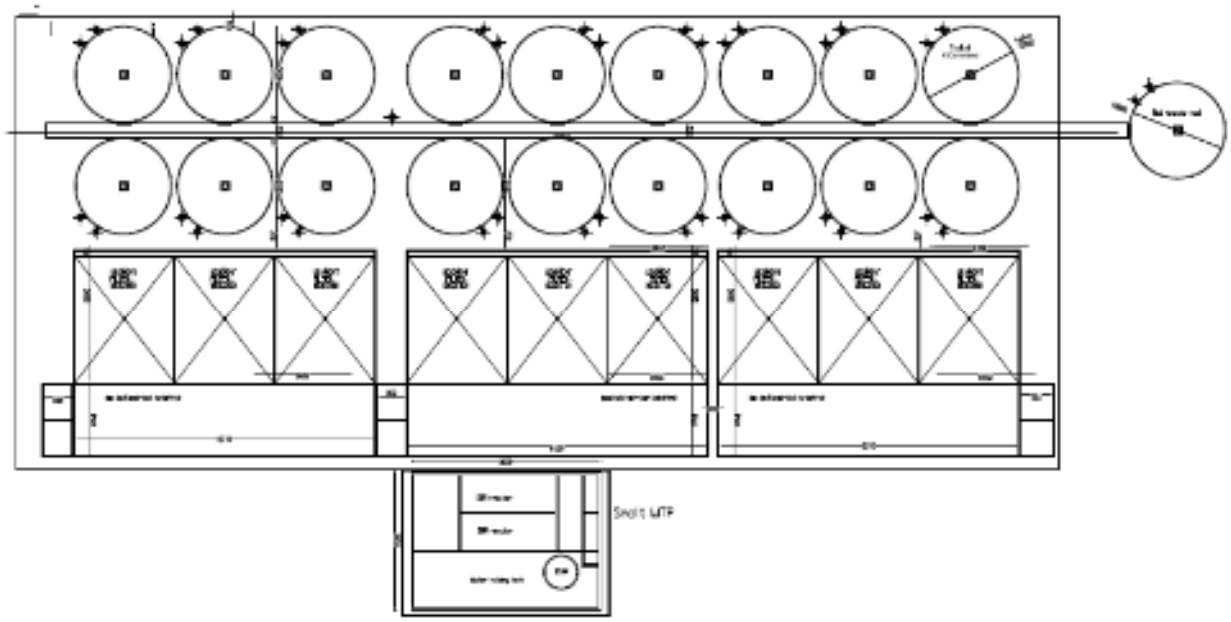
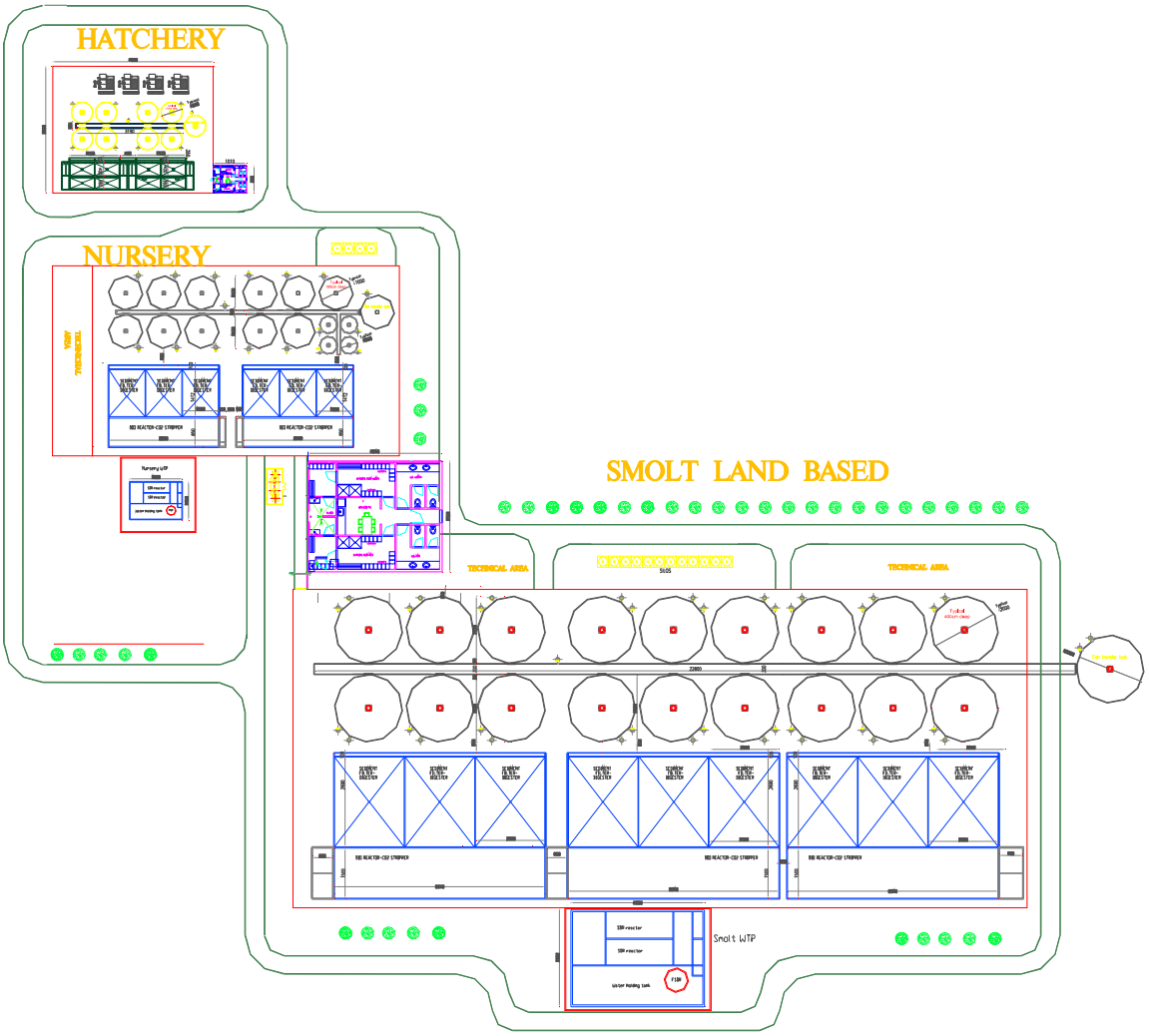


Figure 11 – Complete RAS Facility

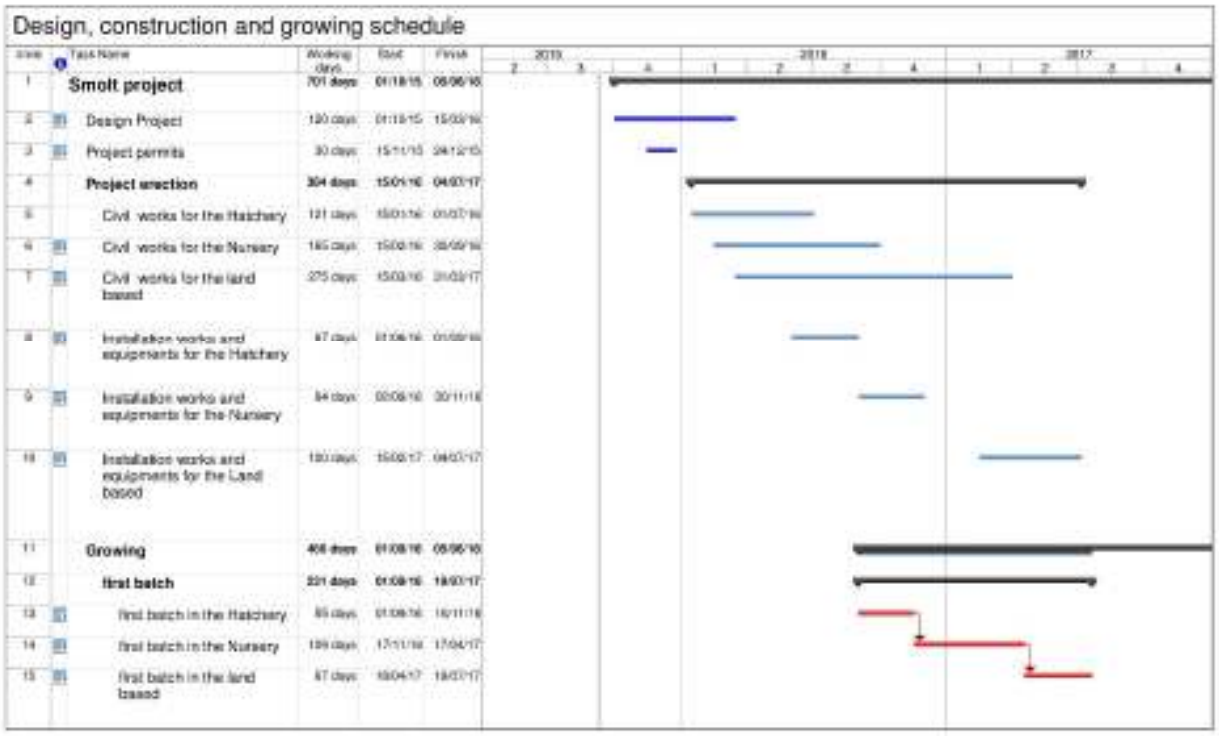


4.3 Construction:

4.3.1 The Approximate Construction Period:

The Project construction period is approximately 16 months starting in October of 2015 and finishing at the end of January 2017.

Figure 12 – The Approximate Construction Period



4.3.2 The Proposed Date of First Physical Construction:

The proposed date of first physical construction is immediately after this process. This is provided that all other licenses, permits, authorizations and titles are in place. Other licenses would include the Aquaculture License, the Water Use Authorization, the Municipal Building Permit, and the transfer of Land Title from the Town of Marystown with ancillary Municipal Tax Agreements. The proposed date is expected to be January 15th, 2016, with construction completing July 4th, 2017. Farming operations will commence part way through the construction project and in September 2016 with first smolt available for sale in May 2017.

4.3.3 Potential Sources of Pollutants during the Construction Period:

There is some potential that the construction equipment could encounter fuel and or gear oil spillage. Federal guidelines for fuel storage and handling will be followed. Equipment used during construction will be visually inspected daily before starting work to monitor for minor leaks. All minor leaks will be attended to immediately and the offended area cleaned. A spill kit will be on hand to absorb minor spillages. The overburden will have been already removed by the Town of Marystown under their previously released undertaking 1387 and thus erosion due to rain runoff is not a factor. There will be human waste that will be managed with a portable outhouse and a chemical toilet. These human wastes will be disposed of at the Burin Peninsula Waste Management facility near Jean de Baie. The construction wastes will be disposed of with the Regional Waste Management facility as well. It is anticipated that the sources of pollutants during the construction period will be finite and short lived.

Consideration is given to the following sources of pollution during the construction period:

Noise: Load noises will be generated by the construction equipment. Workers adjacent to load generated noises will wear suitable ear protection. The construction activity is not taking place adjacent any residential or active commercial properties and it is not anticipated that noise will be a concern. It is not anticipated that noise generated by the project will impact the surrounding environment or human, animal, avian or aquatic life.

Dust: Dust and particulate matter will be generated by the project construction. The project area is of basalt rock and with very little soil to create dust and particulate matter. For those areas where soil capable of producing dust is exposed the area will be covered with gravel. Aggregate on site will be covered to minimize dust. Materials carried unto the site for construction will be covered to minimize dust. It is not anticipated that dust generated by the project will impact the surrounding environment or human, animal, avian or aquatic life.

Vehicle and Construction Equipment Emissions: The Company anticipates that land construction will require an excavator, a tractor, and a dump truck (heavy construction equipment). The heavy construction equipment and transport vehicles will use diesel and gasoline and will release carbon dioxide into the atmosphere. The

vehicles and heavy equipment used on the project will be cleaned in in good repair at all times. Vehicles will not be fueled or serviced on the project site. Heavy equipment will have a designated refueling area. All vehicles and heavy equipment will follow regular maintenance requirements for optimization of fuel efficiency to minimize emissions. Idling of vehicles and heavy equipment will be kept to a minimum. It is not anticipated that increased vehicular traffic or heavy equipment use by the project will impact the surrounding environment or human, animal, avian or aquatic life.

4.3.4 Potential Causes of Resource Conflicts during Construction:

There are no resource conflicts related to the construction of the project. The project is well of the main highway and will not conflict with vehicular traffic. The project does not take place in or on Mortier Bay and thus there are no impacts to recreational fishers or boaters.

4.4 Operation:

4.4.1 Description of the Operation:

The operation will be a Recirculation Aquaculture System (RAS) with 100% recirculation with make-up water to overcome losses to evaporation. The facility will be operated to manage vapour pressure to minimize evaporation losses. The facility will not have any effluent. Water chemistry will be managed with the use of heterotrophic and autotrophic biofilters. The facility will have the capacity to produce 6,000,000 smolt at 300 grams and 1,000,000 smolt at 1,500 grams. All stocks entering the facility will meet the approval of the Canadian Food Inspection Agency (CFIA) and the provincially and federally guided committee for Introductions and Transfers. Fish leaving the facility will only do so with permission from the Introductions and Transfers committee. The facility will be able to manage salinity at different life stages to suit the fish to eliminate the confines of smoltification windows. This means that fish can be transferred to the marine environment at any time with appropriate temperatures rather than confined to narrow natural smoltification windows in May and June of the year. Escape from the facility is not possible in as all

drains go to the heterotrophic biofilter and all water flows are under anaerobic conditions for 45 minutes.

The management of this RAS facility intend to monitor and control the operation's employee safety protocols, environmental sustainability, and production traceability under a recognized international certification referred to as Best Aquaculture Practices (BAP) http://bap.gaalliance.org/ .

4.4.1.1 Hatchery Design Processes:

The proposed system design and floor plans as attached in Appendix E are AquaMaof's standard design and adapted for salmon smolt production which includes the recirculation pump, ODS, fish production tank, solids settler, controlled intermittent flow trickling (CIFT) biofilter (which includes CO_2 gas stripping), and harvest channel. The system operations are described in detail in the AquaMaof Facility Proposal as attached in Appendix D. Smolt growth will require 4 months from 2.5 grams to 50 grams. After 2 months of growth the fish will be redistributed in the tanks to maintain less than 81 kg/M^3 fish biomass for this first 2 months of smolt growth.

The water circulation system is designed for a single pumping step to complete the recirculation. These pumps are submerged vertical turbine type pumps. These pumps provide high efficiency pumping (80% or greater) at 9.4 meters of head. The recirculated water flows from the pump into the ODS (oxygen dissolving system).

The ODS is designed to provide high dissolved oxygen concentration with a small amount of pumped head pressure (about 0.3 M head pressure). Improved dissolving of oxygen can be attained with the following methods: 1) increase of water pressure where oxygen bubbles are dispersed; 2) increase of residence time of oxygen bubbles in the water; 3) oxygen gas bubble size, smaller bubbles result in more gas to water surface area; and 4) water temperature, colder water results in higher oxygen concentrations at 100% saturation and warmer water results in faster dissolving rate. The ODS obtains the increased pressure with the column of water and injection of the oxygen gas near the bottom of the column, thereby attaining higher water pressure without costly pumping. The residence time for allowing the oxygen bubbles to dissolve is attained in the ODS by creating a flow of water counter to the flow of oxygen bubbles. The AquaMaof ODS allows for low head

requirement for dissolving oxygen and attaining oxygen concentrations sufficient to eliminate oxygen concentration as a limiting factor in design of water flow volume. This ODS design has capability to attain oxygen concentrations up to 40 mg/liter, which is an over design safety factor to assure oxygen will never be a limiting factor for the fish and capability to maintain above 90% saturation at all times.

Oxygenated water flows from the ODS directly into the fish production tank with the water added tangentially at the outer edge of the tank at a slight downward angle which creates circular water flow in the tank and distributes water from near the surface to the tank floor. Circulated water flow leaves the tank from the drain stand-pipe at the center of the tank. The stand-pipe is perforated starting 30 cm from the tank bottom to the normal operating water level. This reduces the potential for any full blockage or plugging of the exit screen.

The fish tank is the first step in solids removal. The tank acts as a clarifier and has a drain trap around and below the central drain pipe. This sediment trap collects settled solids that are moved towards the center of the tank bottom by the circular water flow in the tank. This sediment trap is not a continuous flow but is drained 1-2 times per day significantly reducing the amount of water sent out with the settled solids. The settled solids and water in the trap are sent directly to the water re-use treatment and is not part of the recirculation water flow. The main recirculation water flows into the tank main drain pipe and directly into the solid waste settler distribution channel via gravity with minimal turbulence or bends in the pipe.

The second step in the solids removal process is the solids settler with a design concept adapted from the potable water industry used for removal of fine particulates. The settling basin is rectangular with the floor sloped to a center drain. Water is evenly distributed across the basin approximately 0.5 M above the floor from the distribution channel with pipes. A large portion of the solids settle on the floor of the basin and water flows upward through the tube settler media (Brentwood ACCU-PAC IFR 6036) and into water collection launderers and by gravity is distributed through the spray nozzles of the CIFT biofilter. Solid waste accumulated in the settler basin and on the settler media is periodically drained and washed from the media and basin into the discharge waste treatment. The exact schedule depends upon solid waste loading and can range from once every 4 days to once every 10 days.

There are several advantages of this solids removal process compared to other methods. First, there are no continuously moving parts that need maintenance or replacement. Second, this method has capability to remove very fine particles compared to mechanical screen methods which tend to increase the amount of fine particles. Third, this process will result in denitrification when managed on a proper draining schedule. The schedule for cleaning is adjusted after several months of operation to allow for stabilizing the denitrification process. The schedule will have longer intervals between cleaning in the early phase of operation then a regular schedule will be established which is in the range of 1 time per week.

The CIFT biofilter is the next step in the water recycle process. This is a trickling filter adapted for stripping carbon dioxide from the water and using a controlled and intermittent water flow over the media. The depth of media (Brentwood ACCU-PAC CF 1200) is 6 meters to provide maximum nitrification (removal of ammonia) with a single pass of water flow. This depth also allows for movement of carbon dioxide bound in the alkalinity buffer to free CO_2 as the carbon dioxide concentration is reduced in the water with counter flowing air. With this method the system can strip more mg/liter CO_2 from the water than exists as free CO_2 in the fish tanks. The hydraulic loading across the entire biofilter for CO_2 stripping is 7.8 M^3/hour/M^2, an order of magnitude less than hydraulic loadings typically used in CO_2 stripping by other companies.

The hydraulic loading on the trickling filter is designed for the optimum wetting of all surfaces of the biofilter media (14.6 M^3/hour/M^2). This loading is intermittent to obtain additional treatment advantages. The use of air circulation through the biofilter from bottom to top of the media provides all required oxygen for the bacterial processes and leaves the biofilter at near 100% oxygen saturation. This EBM-PAPST axial flow fan provides air flow of 10 times more air volume than water flow volume. The air flow is counter current to the water with air entering the base of the CIFT biofilter and water entering through the spray nozzles at the top. The CIFT biofilter can also be used for water temperature control when outside air temperature and humidity are appropriate during many months of the year. If the culture water needs to be increased and outside air temperature is higher than the water temperature, then outside air is used to supply the air fan. Also when outside humidity is low the trickling filter acts as a cooling tower. Because the facility has low water exchange rate the normal requirement for temperature control in the system water is cooling. This use for the CIFT biofilter reduces the electrical energy required for cooling fish water. Advantages for the CIFT biofilter are:

1. Water temperature increase or decrease depending upon a controlled source of air flow, inside building air or outside air. The CIFT biofilter can effectively be used as a cooling tower;
2. Can be scaled to match any nitrification quantity required by changing depth, width, and length dimensions with no change in the type of equipment used;
3. Use of solid cone spray pattern provides uniform optimal wetting of the media surfaces, much better than drip pans or the use of perforated pipes;
4. Intermittent flow provides for more effective nitrification by allowing water to more fully drain from the media surface before another water surge. This biological growth phenomenon can be observed in natural water settings of wave action (intermittent wetting or high energy areas) promoting increased biological growth;
5. Intermittent flow allows for more residence time on the media and time with thinner water film improving CO_2 stripping. Average daily hydraulic loading rate is an order of magnitude less than normal CO_2 strippers used in aquaculture applications; and,
6. Controlled intermittent water flow (control both the amount of time a nozzle is flowing and the interval between flow cycles) enables development of a biofilter of any required nitrification rate, maintain a specified media depth, and most importantly maintain optimum hydraulic loading. Many traditional trickling filter designs cannot attain optimum hydraulic loading with continuous flow regimes; the recirculation system water flow rate is not sufficient to enable proper hydraulic loading because the square meter footprint area is too large resulting in much less than optimum hydraulic loading. The water flow volume rate is not sufficient to properly wet the bacterial surface area of the media.

Requirements of the CIFT biofilter include:

1. Requires a larger footprint for construction, however this biofilter also provides for CO_2 stripping, temperature control capabilities, and water storage pumping basin; and,
2. Requires water pumping energy to allow water to gravity flow through the media with the counter current flow of air. Submerged biofilter design concepts require less energy for pumping but increased energy for oxygenation, gas stripping, and mixing. The total energy required for the complete recirculation cycle must be considered, and this is where the combination of AquaMaof system components results in lower total energy required for operation.

The water basin below the CIFT biofilter is used as a surge tank for holding a supply of water for the total system, one third of the fish production tank volume. This allows for capacity to drain a fish tank for harvest and retain all water in the operating system.

Waste water is drained from each tank secondary drain (from the sediment trap in the tank center) and from the solid waste settlers directly to the waste treatment / denitrification system. This water treatment system returns the water back to original quality standards. The process includes sequencing batch reactors, decanting and solids settler, trickling biofilter for aeration and gas stripping, followed by fluidized bed reactor, ozone, and UV. One day supply of new water is held in storage for use as continuous addition or in larger quantities in a short time for refilling the system. This one day supply of water will also ensure the facility will remain within the 300 liter per minute water use for the facility in case of any increase in water need.

The sequencing batch reactors are chosen because of the capability to process varying flow rates and allow for control flexibility. The fluidized bed reactor and ozone are selected for final polishing and breakdown of complex organic compounds that can build in aquaculture systems with very low to no water exchange. UV treatment is the final step in the waste treatment and this assures no residual ozone will reach fish production water. Waste water treatment is the only area where ozone is required or used in the salmon production facility.

It is anticipated that for every kilogram of feed entered into the system that 2% of sludge matter will produced. The production of the facility is anticipated at 3300 MT and with a Feed Conversion Rate of 0.70:1.0 some 2310 MT of feed will be consumed. At 2% 46.2 MT of sludge will be produced annually. This material will be collected and disposed of at a licensed disposal facility. The remaining matter will be consumed by the biofilters. The biofilters will not need to be replaced or disposed of.

It is not considered that there will be a necessity for facility waste water to be disposed of even during maintenance periods. The facility has regular cleaning of biofilters by module with individual modules with the capacity to manage the system needs while others are offline. If facility waters were ever to be released it would first be thoroughly processed by the biofilters to remove environmental pollutants such as nitrites, nitrates, phosphates or material with Biochemical

Oxygen Demand. In the unlikely event that facility water should be released it will be fully capable of sustaining flora and fauna as it does with the facility itself.

The maintenance of denitrification systems do not require addition of any chemicals. All autotrophic and heterotrophic bacteria in the system will accumulate naturally.

The maintenance of salinity will require the storage of dry marine salts. These will be stored in dry plastic sacks. The only clean up required for the marine salts is a shop vacuum for spilled granules. Alkalinity will be managed naturally with input water carry sufficient cations. System processes will return alkalinity to baseline after CO_2 stripping at the trickle filters. The CO2 stripping also returns the pH to the incoming baseline.

4.4.2 Estimated Period of Operation:

The facility will remain in continuous operation once operations have commenced.

4.4.3 Potential Sources of Pollutants during the Operation Period:

There is some potential that the transfer trucks and the employee work vehicles could encounter a fuel and or gear oil spillage. A spill kit will be on hand to absorb minor spillages. The trucks will use gasoline and diesel and will release carbon dioxide into the atmosphere. There will be human waste with this operation that will enter Marystown's sewage treatment system. There will be administrative paper waste and some industrial packaging wastes to be handled by the Burin Peninsula Waste Management facility in Jeanne de Baie.

4.4.4 Potential Sources of Resource Conflicts with the Operation:

There are no potential resource conflicts identified with this particular operation. The facility operations may temporarily interfere with recreational boaters and fishermen when the well boat is at the facility to receive smolt for transport to the sea cages. These periods are expected to be minimal.

There is an overgrown old road in the process of being decommissioned by the Town of Marystown and the Department of Works and Services. The project will not interfere with walking, snowmobile or ATV trails.

Control of lighting systems and photoperiods within the facility will be entirely indoors and contained. Facility photoperiods will not have any impact on the natural environment.

4.5 Occupations:

4.5.1 Estimated Number of Employees:

4.5.1.1 Construction Phase

During construction the proponent estimates workers during this phase will include supervisors and laborers for concrete footings and erectors of the pre-engineered steel buildings. There will be further concrete work in operational structures inside the buildings. There will also be electricians, plumbers, carpenters and finish trades for installing equipment, tanks, and various building systems and finishes. There is a potential need for up to 200 full-time and part-time workers during the construction period.

4.5.1.2 Operational Phase

The operational phase is projected to generate 23 full time positions from facility management to technicians.

4.5.2 Enumeration and Breakdown of Occupations:

4.5.2.1 Construction Phase

This particular undertaking will require workers from various trades and management. These workers will be the management responsibility of the General Contractor that submits the most competitive bid for the construction of the RAS facility. The occupations and their numbers below are an estimation by the proponent. The proponent of the undertaking will bear the responsibility of ensuring that all building and construction rules, policies, and laws of the jurisdiction are followed. The occupations are described according to the National Occupational Classification 2011:

Engineering Manager (0211) 3
Civil Engineers (2131) 2
Civil Engineering Technologists (2231) 2
Drafting Technologists and Technicians (2253) 1
Land Survey Technologists and Technicians (2254) 1
Construction Inspector (2264) 4
Electrical Power Line and Cable Workers (7244) 5
Telecommunication Line and Cable Workers (7245) 5
Steamfitters, Pipefitters and Sprinkler System Installers (7252) 20
Welder Operators (7237) 10
Carpenters (7271) 20
Concrete Finisher (7282) 20
Heavy Equipment Mechanics (7312) 4
Crane Operators (7371) 2
Truck Drivers (7511) 5
Heavy Equipment Operators (7521) 4
Construction Labourers (7611) 92

4.5.2.2 Operational Phase

The operational phase of the undertaking is projected to have 23 full time positions. The occupations are described below according to the National Occupational Classification 2011:

Senior Manager (0016) 1
Maintenance Manager (0714) 1
Production Manager (0911) 1

Aquaculture Managers (0823) 4
Aquaculture Technicians (2221) 12
Welder (7237) 1
Heavy Equipment Operator (7521) 1
Air Conditioning Mechanic (7313) 1
Power Systems Electrician (7202) 1

4.5.3 Delineation of Work Carried Out:

The construction of the RAS facility will be carried out by a General Contractor and hired by AquaMaof as a part of the "turnkey" purchase agreement. The proponent intends to maintain responsibility to ensure that all building and construction rules and codes, policies, and laws of the jurisdiction are followed.

The operational work will be completed directly by the proponent.

4.5.4 Employment Equity:

The Company has an equal opportunity hiring policy and does not hire relative to age, gender, race or sexual orientation. These employment conditions will be maintained internally and with suppliers and contractors to the project.

4.6 Project Related Documents:

The Company has a Business Plan in support of the undertaking. There a proposal by AquaMaof for the facility design Appendix D and floor plans Appendix E. There is an Aquifer Testing Report as prepared by AMEC Foster Wheeler Environmental and included as Appendix A.

5 APPROVAL OF THE UNDERTAKING

The Aquaculture License and Water Use Authorization are all pending for the undertaking that this application is related to. A permit from the Town of Marystown will be required for the development of the undertaking. A Transfer and Transport Permit will be required to stock the facility with fish.

The approval list is as follows:

Aquaculture License

Water Use Authorization

Transfer and Transport License

Land Title (transferred from the Town of Marystown)

Tax Agreement (Town of Marystown)

Construction Permit (Town of Marystown)

6 SCHEDULE

This project will commence only after it is "Released" from the Environmental Registration of an Undertaking. These commencements are scheduled for October 19th, 2015. Operations are scheduled to begin in August 2016. The construction will be staged in such a manner that operations startup can proceed before the end of all construction process which are anticipated at January 31st, 2017. These operations will only proceed with relevant approvals, licenses and authorizations for Water Use, Aquaculture, and Transportation and Transfer of eggs.

7 FUNDING

The capital costs of this project are $75,000,000. The Province of Newfoundland and Labrador are anticipated partners in the project with preferred shareholdings. The government of Canada is anticipated assisting this project through the Atlantic Canada Opportunities Agency.

Date: September 28th, 2015

Signature of Chief Executive Officer: _____