

2020

**ENVIRONMENTAL AND WASTE  
MANAGEMENT PLAN:  
RAS HATCHERY OPERATIONS**



**GRIEG NL**

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**Grieg NL**

**Environmental and Waste Management Plan: RAS Hatchery Operations**

**Document Number:**

**Rev. 04**

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This Grieg NL *Environmental and Waste Management Plan: RAS Hatchery Operations* is a living document that will be reviewed and updated prior to Project commencement and throughout the duration of the Project. This document should be read in the context of other, related plans, including the Grieg NL:

- *RAS Hatchery Emergency Incident Response Plan;*
- *Fish Health and Biosecurity Management Plan: RAS Hatchery; and*
- *Environmental Protection Plan – RAS Hatchery Operations*
- *Environmental Protection Plan – RAS Hatchery Construction*

## 1.0 Purpose

As required by the Aquaculture Policy and Procedures Manual (AP 2; DFLR 2019), Grieg NL Nurseries (hereinafter referred to as Grieg NL) has developed this *Environmental and Waste Management Plan* to describe the principles, procedures and management of the waste generated at its land-based RAS Hatchery facility in Marystown, NL. Grieg NL has developed this plan to ensure waste (including mortalities) is handled properly, reduced and reused where possible. The document will outline measures to manage and mitigate waste generation as well as resource consumption during Grieg NL operations.

The Grieg NL *Environmental and Waste Management Plan* is intended for use by all Grieg NL employees. Grieg NL contractors and suppliers will be required to comply with this Plan. Contractors will be provided a copy of this Plan and/or Grieg NL's *Environmental Protection Plan: RAS Hatchery Construction* as needed, if it applies to their operation. Regulators can be expected to use this plan as a reference document in monitoring the company's performance and compliance.

## 2.0 Regulatory Context

Aquaculture activities at the RAS facility will generate a variety of wastes and will include predominantly organic and inorganic waste. Several federal, provincial and regional organizations are involved in aquaculture waste management as regulators and financial stakeholders. The *Fisheries Act* and the *Aquaculture Activities Regulations (AAR)* as well as the *Environmental Protection Act* are just some examples of regulations governing waste management for Grieg NL. Grieg NL has reviewed and intends to follow guidelines and recommendations as developed by the Department of Fisheries and Land Resources (DFLR) in their *Aquaculture Waste Management Action Plan* (DFLR 2016) and will take into consideration the Newfoundland Aquaculture Industry Association's (NAIA) *Salmonid Aquaculture Waste Management Contingency Plan* (NAIA 2017 [draft version]).

During a Reportable Disease Event, Grieg NL will follow the NL Aquatic Animal Health Division (AAHD) Contingency Plan (AP 33; DFLR 2019) as well as all federal requirements. If any of the RAS facilities has a confirmed case of a federally Reportable Disease that results in fish mortality (or an ordered depopulation of fish), the stock that has died will be disposed of under direction of the Canadian Food Inspection Agency (CFIA) and/or DFLR. Grieg NL will adhere to these regulations and guidelines for disposal.

Waste management will be consistent with industry best practices. Facilities will be built to meet codes and requirements of the Sanitation Regulations under the *Public Health Act*. The transportation, use, storage and disposal of fuel and other hazardous materials is regulated by The Storage and Handling of Gasoline and Associated Products (GAP) Regulations and Amendments, Used Oil Control Regulations (82/02), *Transportation of Dangerous Goods Act* (1992) and

*Dangerous Goods Transportation Act* (2006). Grieg NL will operate in conformance with the requirements of the Workplace Hazardous Materials Information System (WHMIS).

With action plans focused on priorities such as fish discards, mortalities and emergency preparedness, as well as adhering to the guiding principles such as an emphasis on biosecurity and market potential, Grieg NL is committed to aquaculture waste management. This Grieg NL *Environmental and Waste Management Plan* is a living document that will be reviewed and updated as the Project progresses and throughout the duration of the Project. This Grieg NL *Environmental and Waste Management Plan* should be read in the context of other related plans, including the Grieg NL:

- *RAS Hatchery Emergency Incident Response Plan*;
- *Environmental Protection Plan: RAS Hatchery Operations*; and
- *Fish Health and Biosecurity Management Plan: RAS Hatchery*

### **3.0 Waste Management Goals**

Grieg NL will prioritize waste management options that are sustainable and will divert aquaculture waste from rural landfills and instead place an emphasis on value and market potential of this material. Grieg NL strives to utilize fish by-products instead of sending these materials to landfills. Wherever possible, Grieg NL will reduce, reuse, recycle or recover materials. All waste management practices will adhere to strict biosecurity protocols to reduce the potential risk of transmitting infectious disease. Grieg NL will reduce greenhouse gases by prioritizing the use of local waste management facilities where feasible to decrease the travel time of waste.

### **4.0 Waste Prevention Plan**

Grieg NL will, to the extent possible, recycle or reuse the following material:

- newspaper
- corrugated cardboard
- white and coloured office paper
- plastic as well as glass bottles and jars
- metal cans

Grieg NL will operate in compliance with Burin Peninsula Waste Management Landfill Bans, (i.e., no landfill disposal of tires, appliances, yard waste, mandatory recyclables, hazardous waste, batteries, fluorescent tubes, and large metal items).



During Project operations, Grieg NL will ensure that all contractors and suppliers meet company requirements for waste management practices. The waste reduction requirements shall be implemented and executed as follows:

- Salvageable materials will be diverted from disposal where feasible.
- There will be a designated area labelled and reserved for reusable material and domestic waste to be received.

#### **4.1 Plan Amendments and Updates**

Revisions and updates to the Grieg NL *Environmental and Waste Management Plan* will be in accordance with an approved process. Amendments and Updates will be issued on an as-needed basis. Users of the Plan should ensure they have the most updated version of the document on hand.

### **5.0 Waste Types**

The operation of the RAS facility will generate a variety of wastes including organic waste (i.e. mortalities); inorganic waste (i.e. feed bags), which can also include obsolete or worn infrastructure (i.e. jump nets and dip nets); and contaminated or hazardous waste (i.e. chemicals, petroleum products, and diseased fish).

Any materials not currently listed in this document (Table 1) but identified during operations will be assessed for proper disposal procedures and the Grieg NL *Environmental and Waste Management Plan* will be updated as per section 4.1.

**Table 1. Waste types and management practices for Grieg NL’s Placentia Bay Atlantic Salmon Aquaculture Project during the Operation Phase per annum.**

| Waste Classification          | Waste Type  | Frequency/Duration | Approximate Amount (annually)                                      | Waste Form     | Waste Stream  | Waste Destination   |
|-------------------------------|---|--------------------|--|----------------|---|---|
| Organic                       | Feed/Feces  | Continuous         | Varies with Ramp-up Production, Estimated Max: 1700 m <sup>3</sup> | Liquid         | Composting  | BPWMC <sup>a</sup> or approved waste facility   |
|                               | Regular Mortalities   | Continuous         | Varies with Ramp-up Production, Estimated Max: 70 Tonne/year       | Liquid         | Ensilage and/or anaerobic digestion                 | AllerAqua, Hordafor or other company interested in ensilage and/or New World Dairy  |
|                               | Mass Mortality (without reportable disease)                           | Infrequent         | 600 Tonne (based on maximum production month)                      | Liquid         | Ensilage, anaerobic digestion, and/or rendering     | Aller Aqua, Hordafor or other company interested in ensilage; New World Dairy; Barry Group Inc. and/or another approved company |
|                               | Mass Mortality (with reportable disease)                              | Infrequent         | 600 Tonne (based on maximum production month)                      | Liquid         | Ensilage, anaerobic digestion, and/or rendering     | Aller Aqua, Hordafor or other company interested in ensilage; New World Dairy; Barry Group Inc. and/or another approved company |
|                               | Sewage  | Continuous         | n.d. <sup>b</sup>  | Liquid         | On-site Blivet                                      | Municipal   |
|                               | Clean dimensional wood and wood pallets (equipment and feed delivery) | Continuous         | Varies with Ramp-up Production, n.d.                               | Solid          | Reuse on site/recycle or BPWMC for composting       | Recycled or BPWMC   |
|                               | Employee food waste   | Continuous         | n.d.   | Solid          | Composting or landfill                              | BPWMC   |
|                               | Paper and cardboard products  | Continuous         | n.d.   | Solid          | Recycle if facilities exist, composting or landfill | BPWMC or approved facility  |
| Inorganic                     | Feed bags   | Continuous         | Varies with Ramp-up Production, Max: 6.5 Tonne/year                | Solid          | Landfill  | BPWMC or approved waste facility  |
|                               | Expired netting   | Infrequent         | <1   | Solid          | Landfill  | BPWMC or approved waste facility  |
|                               | Expired & excess piping   | Infrequent         | <1   | Solid          | Landfill  | BPWMC or approved waste facility  |
|                               | Plastic components  | Infrequent         | <1   | Solid          | Reuse or landfill                                   | Reuse on-site or BPWMC  |
|                               | Metals  | Infrequent         | <1   | Solid          | Recycle   | Recycle at approved metals recycling location   |
|                               | Bottles and cans  | Continuous         | n.d.   | Solid          | Recycle   | MMSB <sup>c</sup>   |
|                               | Fuels (petroleum)   | Infrequent         | <1   | Liquid         | Hazardous disposal                                  | Approved hazardous waste facility   |
|                               | Glycol (antifreeze)   | Infrequent         | <1   | Liquid         | Hazardous disposal                                  | Approved hazardous waste facility   |
| Chemicals/<br>Hazardous Waste | Oil, lubricants and oily waste  | Infrequent         | <1   | Liquid & Solid | Hazardous disposal                                  | Approved hazardous waste facility   |
|                               | Cleaning and disinfecting   | Continuous         | n.d.   | Liquid         | Landfill or hazardous disposal                      | BPWMC or approved hazardous waste facility  |
|                               | Anaesthetics  | Occasional         | Varies with Ramp-up Production, n.d.                               | Liquid & Solid | Hazardous disposal                                  | Approved Hazardous waste facility   |

<sup>a</sup> Burin Peninsula Waste Management Corporation

<sup>b</sup> Not determined, no method to approximate

<sup>c</sup> Multi-Materials Stewardship Board

## **5.1 Organics**

There are several sources of organic waste that will be generated by Grieg NL (Table 1) and organic wastes will constitute the largest volume of waste generated during operations.

During operations, the majority of organic waste will be from feces and uneaten feed. These by-products (sludge) must be removed continuously to maintain the health and welfare of the fish. This sludge contains important nutrients such as phosphorus and nitrogen, which are a valuable resource for agriculture. However, excessive amounts of these nutrients can harm the fish in the RAS if not removed, or ecosystems if released to the environment. The treatment of wastewater to remove excess nutrients is commonly used for municipalities to handle household sewage. A biological process called denitrification utilizes beneficial bacteria to remove the nitrogen from the water. Once the nutrients have been removed and the water treated, it can be returned to the fish tanks for use again. Once the water is removed, the resulting sludge is composed of concentrated solids that can be transported to a local waste management facility for use in their operations such as composting.

Another source of organic waste is mortalities of the stock due to general losses or from removal (culling) of stock for reasons such as poor growth performance. Mortalities can also be a result of a depopulation order (i.e., a reportable disease), or disease. Mortalities will be treated according to best practice techniques and under the guidance and recommendation of the federal, provincial as well as regional regulators. See section 6.3 for detailed fish disposal plan.

Employees will be encouraged to sort all waste generated while working in the RAS facility. Currently, the Multi-Materials Stewardship Board (MMSB) does not recycle paper or cardboard on the Burin Peninsula; however, the Burin Peninsula Waste Management Corporation (BPWMC) can use it in their composting facility if operational. Paper products will be separated and collected by BPWMC for composting. Food waste will be sorted into a separate waste bin in the kitchen until appropriate disposal.

## **5.2 Inorganic Wastes**

Most inorganic waste generated by Grieg NL will consist of plastics such as high-density polyethylene (HDPE), low-density polyethylene (LDPE), Polypropylene (PP) and nylon. These plastics are found in the feed bags, piping, and netting used in the RAS facility. Where possible, these waste materials will be reduced, reused or recycled before disposal.

## **5.3 Contaminated or Hazardous Waste**

Human waste (sewage) will be generated in the facility by employees. Sewage from the buildings will be connected to the Marystown municipal sewer. Facilities at each location will be built to meet codes and requirements of the Sanitation Regulations under the *Public Health Act*.

Only a select collection of chemicals will be used and disposed of by Grieg NL. These chemicals will include oils, fuels and formic acid. Oils and fuels will be used for back-up generators in the event of a power outage. Chemicals such as formic acid will be used for the ensilage process.

Should Grieg NL have a disease event that results in fish mortality or an ordered depopulation of fish, the stock that has died must be disposed of following Standard Operating Procedures (SOPs) approved by regulatory bodies including Department Fish and Land Resources (DFLR) and the Canadian Food Inspection Agency (CFIA). Grieg NL will adhere to these regulations and guidelines for disposal. See section 6.3 for detailed fish disposal plan.

## **6.0 Waste Management**

### **6.1 Measures to Minimize and Mitigate**

#### *Mortality Mitigation*

Grieg NL will routinely and frequently collect (daily) and dispose of fish mortalities. Appropriate biosecurity protocols will ensure the risk of potential transfer of disease through either the carcasses or equipment is minimized. Grieg NL is committed to reducing the number of fish mortalities. As part of best practice, control techniques including the following will be implemented:

- Stress during procedures such as transportation, sampling and inspections as well as mortality removal will be minimized.
- In addition to the Provincial Animal Health Plan, Grieg NL will implement, in consultation with Provincial and private veterinarians, a *Fish Health and Biosecurity Plan* to ensure any health or welfare problems with the fish will be addressed promptly.
- Records of inspections, mortalities, as well as likely causes of mortalities will be maintained and submitted to the regulatory agencies as required and maintained within Grieg NL records.
- Implementation of an approved Fish Disposal Plan and daily removal/disposal of any dead or moribund fish to prevent risk of disease spread.

#### *Inorganic Mitigation*

Any surplus material that can be utilized in future operations such as rope cut-offs or spare netting will be labelled and stored for reuse. To reduce plastic waste as a result of feed bags, Grieg NL intends to purchase fish feed in bulk to be delivered to a feed storage location near the RAS facility. This bulk transport will reduce the use of plastic bags and ultimately reduce the waste generated. Other waste plastic generated will be reused or repurposed if possible before disposal at an approved waste management facility.

## *Chemicals and Hazardous Mitigation*

Products such as chemicals, fuels, and maintenance hydrocarbons will be used on-site for the RAS facilities back-up generators. To reduce on-site storage of these hazardous materials and ultimately waste, Grieg NL has engaged in discussions with local companies for service arrangements to handle storage and deliveries of these materials. A local petroleum company will be engaged in order to utilize their storage facilities on the Burin Peninsula for its emergency supply of fuel as well as automatic and on-demand supplies. A local chemical company will supply formic acid on an as-needed basis with minimal storage on-site. Very little waste fuel and chemicals will be produced and stored on-site prior to disposal.

### **6.1.1 Training**

All Grieg NL staff, as well as third-party service contractors, will be provided with a copy of Grieg NL's *Environmental and Waste Management Plan: RAS Hatchery Operations* in conjunction with on-site training on waste management. This training will focus on Grieg NL goals and ensure they are understood and followed. Having staff educated on why waste management is important is a crucial step in being able to execute the Plan goals effectively.

## **6.2 Waste Collection and Disposal**

### **6.2.1 Fish Feces and Feed**

Fish feces and uneaten fish feed in the RAS Hatchery will be separated from the production system water in the settling filter. Specialized media in the settling filter improves this settling process. Settled sludge is sent into the denitrification facility for further "digestion". This process purifies the water for reuse in the fish production system.

Bioretur AS will provide Grieg NL with a state-of-the-art solution to the challenge of water treatment in a sustainable and environmentally sound manner. The Bioretur sludge treatment system separates the water and sludge to reduce the weight of the material to be transported for disposal. The water extracted from the sludge is returned to the denitrification system for final treatment before being returned to the fish culture tanks. The sludge produced from the culture of the fish in the RAS will be collected from the denitrification reactors, dewatered and stored in an approved holding facility. This sludge will be delivered on a routine schedule to the BPWMC for use in their composting facility. Grieg NL will be dewatering the sludge from the facility to 15-20% dry matter. Using a conservative dewatering value of 15%, Grieg NL anticipates a maximum volume at peak production of waste sludge to be 35 MT per week.

The BPWMC currently receives household and commercial waste at their facilities on the Burin Peninsula. BPWMC has received an amendment to their operating permit to utilize Geotubes at their facility to treat sludge from septic systems (household and commercial) and the Grieg NL RAS Hatchery.

Geotextile tubes are porous tubular containers made of a woven polyethylene material which can dewater wastes to achieve a final solid. As the sludge is pumped into the Geotube, it is mixed with a polymer that combines the solids into a flock which separates the clear processed effluent to pass through the porous tube and the solids remain inside the Geotube. Sludge from the RAS Hatchery will be transported to BPWMC via a vacuum truck and transferred to Geotubes for dewatering. The dewatered sludge from the Geotube will be used as a compost at BPWMC.

### **6.2.2 Other Organics**

Employees will be encouraged to sort all waste generated while working in the facility. Currently, the MMSB does not recycle paper or cardboard on the Burin Peninsula; however, BPWMC can use it in their composting facility. Such material will be reused or recycled before collected by BPWMC. Food waste will be placed in separate waste bins in the staff kitchens until appropriate disposal.

### **6.2.3 Inorganic Waste**

Feed bags will be secured by bailing (or other mechanism approved by the department) prior to transport to BPWMC in order to mitigate risk of loss prior to disposal as per AP 16 (DFLR 2019).

Recycling of employee domestic waste such as plastic packaging, beverage containers and the like will be encouraged where appropriate. Material that cannot be recycled will be disposed as with other inorganic waste through BPWMC.

### **6.2.4 Contaminated or Hazardous Waste**

#### *Sanitary Waste*

All sanitary waste from the RAS Hatchery (toilets, sinks, showers, etc.) will conform to the Environmental Control Water and Sewage Regulations 2003 (OLC/NL 2009) and will be collected by the existing 200 mm sanitary system on Kaetlyn Osmond Drive, Marystown and transported to the existing municipal Blivet sewer treatment plant. A Blivet system is an “all-in-one” packaged sewage treatment plant that is a stand-alone system. It is designed to accept raw sewage and produce a high-quality effluent without the need for auxiliary equipment or tankage. Aerobic treatment is via a rotating biological contactor. Lamella plates are used to provide primary and final settlement of sludges. Sludge storage is provided within the unit and removed by a qualified waste management firm such as BPWMC for disposal when full. BPWMC will either compost this material or dispose at local landfill facilities.

#### *Chemical and Petroleum Waste*

Grieg NL intends to utilize companies within Newfoundland and Labrador that specialize in, and are approved for, handling and disposing of hazardous waste.

Chemicals (i.e. formic acid) and hazardous compounds (i.e. oil and fuels) will be used during operations. Grieg NL recognizes the hazards these materials can impart on the environment. As such, Grieg NL will ensure that these waste materials are stored and disposed of according to the requirements of WHMIS as well as the Transportation of Dangerous Goods/Regulations (TDG).

Hazardous waste generated at the RAS Hatchery will be stored in containers clearly labelled according to WHMIS and TDG requirements. These containers will be appropriate for holding the material and will be in good condition as well as free of rust and cracks. A designated storage area as prescribed by Occupational Health and Safety Regulation, 2012 [OLC/NL 2012, s.59] will be used for waste storage at the RAS Hatchery with a sign clearly indicating “Hazardous Waste – Authorized Personnel Only”. Any vaccine or diluent requiring disposal, as well as biomedical waste such as needles, will be handled according to biomedical waste disposal guidelines and municipal regulations. Vaccines will be prescribed and administered by a qualified veterinarian.

All necessary precautions will be implemented to prevent the spillage, misplacement, and loss of fuels and other hazardous materials. Greasy or oily rags or other materials at risk of spontaneous combustion will be deposited and stored in appropriate secure receptacles. In the case of a leak or spill during petroleum storage and handling, the Environmental Emergencies 24-Hour Report Line will be notified at 1-800-563-9089. Grieg NL will also have an *Emergency Incident Response Plan* in place and a Response Organization contract. Spill Kits will be maintained at each facility for quick response purposes and staff will have necessary training to respond to spills.

### 6.3 Fish Disposal Plan

The Government of Newfoundland and Labrador’s (NL) Department of Fisheries and Land Resources (DLFR) has stipulated in their recent Aquaculture Policy and Procedures Manual that all aquaculture operators must have a Fish Disposal Plan in place (AP 23; DLFR 2019a).

As per AP 23 (DLFR 2019), the following plan outlines procedures to dispose of fish, fish by-products and mortalities during routine operations, mass mortality events, and reportable disease events. All required permits and approvals will be acquired by Grieg NL.

#### 6.3.1 Fish Disposal Options and Practices

Grieg NL will incorporate several different practices for secure disposal of mortalities. The current local infrastructure in Newfoundland can accommodate disposal of mortalities through the processes of landfilling, composting, ensilage, anaerobic digestion, and/or rendering. Given the logistics and location of the RAS Hatchery in Placentia Bay, Grieg NL will focus on ensilage, anaerobic digestion, and/or rendering for fish disposal (See Table 2). Should the infrastructure for other fish disposal options become available in the future, Grieg NL will explore and update the fish disposal plan accordingly.

**Table 2. Fish disposal options and capacities identified by Grieg NL.**

| Company         | Location     | Use Agreement  | Approximate Capacity   | Disposal Options   |
|-----------------|--------------|----------------|--|--------------------|
| New World Dairy | Newfoundland | In discussions | 200 MT/week*   | Anaerobic Digester |
| Aller Aqua      | Denmark      | In discussions | Unlimited  | Ensilage           |
| Hordafor        | Norway       | In discussions | Unlimited  | Ensilage           |
| Shell-EX        | Newfoundland | In discussions | Contingent upon necessary infrastructure and permit approval | Ensilage           |
| Barry Group Inc | Newfoundland | In discussions | Unknown  | Rendering          |

\*200 MT/week estimate provided by Pollution Prevention Division (PPD) communicated in an email to Grieg NL on 18 June 2020 and is considered total capacity for all aquaculture waste.

#### *Ensilage*

Fish ensilage is a liquid product made from whole fish or parts of fish that are liquefied by the action of enzymes in the fish in the presence of an added acid. The enzymes break down fish proteins into smaller units, and the acid helps to speed up the breakdown while preventing bacterial spoilage (FAO 2001). This process inactivates bacteria and viruses (Dixon et al. 2012). Ensilage can be used to make several products including, animal feed and fertilizer. As part of the ensilage process, acid is used. There is a designated storage tank for the acid (food grade formic acid (85%))



and containers can easily be unloaded and loaded into this storage tank. The acid will be delivered to the facility in bulk containers for refilling the storage tank.

The mortalities at the RAS hatchery will be monitored and collected daily from each fish tank. A mortality vacuum system (BUSCH) will be utilized within each building in the RAS hatchery. The vacuum system is equipped with several funnels to transfer the mortalities into a separate mort building. In the mort building, the fish enter directly from the transport vacuum line to a cyclone that chops the fish into smaller pieces while a dose pump adds a food grade formic acid to produce a slurry with a pH of 4.5 or lower. The milling pump will be used for transporting the ensilage from the chopper tank to a storage tank. The storage tank will be secured, safe and covered. There will be limited access to this building to maintain a high level of biosecurity.

Grieg NL will use, where possible, local companies that are interested in the ensilage. A candidate user is Newfoundland owned Marine Bio-refinery (Shell-Ex (<http://www.shell-ex.com/>)). Shell-Ex can utilize this product as a commercial fertilizer or animal feed additive. Grieg NL recognizes that infrastructure to accommodate estimated volumes are currently not in place in Newfoundland and may need to be developed by these local companies. Therefore, Grieg NL has engaged a feed supply company (Aller Aqua in Denmark) from the European Union (EU) that would be interested in purchasing any volumes of ensilage Grieg NL has to offer. Other international companies have also expressed an interest in this product including Hordafor. Hordafor has been utilizing fishing and aquaculture by-products since 1983 to produce fish oil and hydrolyzed marine protein for use in the Norwegian, Asian and European feed industries. This contingency plan will ensure that local companies such as Shell-Ex can still utilize the material Grieg NL has to offer while expanding and developing their operations to meet the demand of the local aquaculture industry while international markets eager for such product can ensure that any material produced can be utilized.

### *Anaerobic Digestion*

Anaerobic digestion is a process in which organic matter is broken down by bacteria without the presence of oxygen. This creates biogases which can be used to generate heat and electricity (FAO 1992). As a disposal option, Grieg NL may securely transport fish mortalities (whole and/or ensilage) to New World Dairy (NWD). NWD is one of the approved facilities for receiving fish mortalities (which have not been ensiled) with a reportable fish disease. NWD is a dairy farm that is generating power from cow manure by processing the manure and other organics in an anaerobic digester. The NWD anaerobic digester can accept up to 200 MT per week (see Table 2) of fish carcasses and/or fish silage (based on silage with reduced water content).

Grieg NL has been in discussions with NWD and WMB Holdings Ltd (WMB) for a disposal service for its silage. This service would provide clean empty tankers to Grieg NL on-site for direct filling from our ensilage system. Also provided would be transportation from our location to NWD's certified disposal system, where the silage will be received, and the tanker sanitized before returning to Grieg NL for future use.

## *Rendering*

Rendering is a process that simultaneously dries the inputted material and separates the fat from the bone and protein. This produces protein meal and oil which can be used as a raw ingredient for many industries (i.e. pet food). The Barry Group is a rendering plant in Newfoundland which expanded their operation to be able to accept salmon by-products and morts from the local growing aquaculture industry (BG 2016). The Barry Group is one of the approved facilities for receiving fish mortalities (which have not been ensiled) with a reportable fish disease. Grieg NL plans to ensile all mortalities during normal operations. The Barry Group's facility is unable to receive ensilage at this time. Therefore, rendering is not the preferred option for normal operations. Grieg NL has discussed with The Barry Group the potential to utilize their facilities in the event of a mortality event that is beyond our capabilities.

### **6.3.2 Fish Disposal Approach**

During operations, there will be regular mortality of salmon. There is also potential for mass mortality events and mortality from a reportable disease event. Procedures for the handling and transport of fish waste including biosecurity measures and Standard Operating Procedures (SOPs) are outlined for normal operations, reportable disease events, and mass mortality events. Several disposal options are available for Grieg NL fish mortalities including (but not limited to) New World Dairy (NWD), Barry Group Inc, Aller Aqua, and Hordafor. The maximum capacity of each of these fish waste destination sites varies from 200 tonnes/week (NWD) to unlimited (Aller Aqua). Ideally, local facilities will be used to keep the value-added products within the province as well as to reduce overall carbon footprint and travel time of waste.

A practice that is common and proven both nationally and internationally for finfish mortalities and culls is ensilaging. Grieg NL recognizes the benefits of ensilaging mortalities and culls as a best practice to reduce the risk of infectious disease transmission as well as for optimizing the use of this product in other industries (i.e., agriculture, renewable energy sector). As such, Grieg NL will ensilage all mortalities, capacity permitting. Should mortality exceed typical ensilage capacity, mortalities will not be ensilaged but instead may be collected and transported to a local rendering facility or NWD for their anaerobic digester.

Mortalities accumulate at the bottom of the tanks and at the surface. A specialized standpipe transports morts to a mort collector box on the side of each tank. From the mort collector box, staff can count and weigh the morts then dispose of them by placing them in the BUSCH vacuum system. This vacuum system is equipped with a funnel receptacle to biosecurely transport the fish into a grinder to start the ensilage process.

Should a site be under a Quarantine Order by the province, Grieg NL will provide notice of 72 hours to the Aquatic Animal Health Division (AAHD) to obtain a Licence To Move (LTM), if required. Prior to any fish, fish by-product, or mortalities being moved from a quarantined area, a

LTM will be in place (as issued by AAHD of DFLR and/or CFIA). SOPs are to be submitted to the AAHD for review and approval prior to a Licence To Move being issued. Grieg will also seek approval from any other regulatory agencies with relevant authority related to these SOPs. In addition, any facility receiving mortalities with a reportable disease must have CFIA-approved SOPs in place for the handling of such salmon, which include procedures for transport of waste, offloading, containment of the fish and cleaning and disinfections for equipment and the facility. Other SOPs may be needed as ordered by CFIA and/or FLR.

### *Normal Operations*

Daily mortality removal will be achieved using the BUSCH system. Mortalities will be transported to be ensiled as described above. Any visible moribund fish or surface mortalities will be retrieved, and moribund fish will be euthanized if required<sup>1</sup>. When handling mortalities, personnel will be required to follow all relevant mortality and disinfection related SOPs. Once retrieved, the mortalities are transferred to the BUSCH vacuum system for transportation to the central ensilaging system. Ensilage will be securely stored in an external container until sufficient quantities are acquired to justify transport to an approved waste facility.

The following SOPs will be in place to detail procedures related to disposal of fish, fish by-products, and mortalities during routine operations:

- Euthanasia
- Mortality Collection and Disposal
- Mortality Storage Security
- Supplier Procedures

### *Mass Mortality*

Mass mortality may occur due to reduced water quality (i.e. low oxygen) or a disease outbreak. Regardless of the cause of mortality, several options exist to collect and remove the mortalities from the facility. The BUSCH mortality removal system in combination with the tank mort collector box will be used to gather mortalities that settle at the bottom of the tanks so that they can be directed to the ensilaging system. If the mortality volume exceeds capacity for the ensilage system, the mortalities can be diverted from the chopper system and collected in a truck for transport to a rendering facility. Alternatively, the whole morts can be removed from the facilities using the harvest piping system and collected by a vessel anchored in Mortier Bay for transfer to a rendering facility.

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<sup>1</sup> If euthanasia of fish is required it will be done in a manner which minimizes pain and suffering of fish being used for sampling or culled due to health or production reasons. Euthanasia will be accomplished via an overdose of anesthetic, complete spinal severance, or a sharp blow on the top of the head ensuring a result of fish that are permanently unresponsive to stimuli. Records of all fish either culled or sampled are maintained.

If the mass mortality event is found to be caused by a reportable disease, the steps described below (*Reportable Disease Events*) will also be followed. All mortalities will be contained in a secured container and transported in a biosecure manner. Biosecure handling and transport will be undertaken to avoid any spillage. Governmental guidelines and regulations for the disposal of organic material and deadstock will be followed. Recovery and counting of the mortalities will be governed by acceptable industry standards.

Each Grieg NL facility manager shall be responsible for following SOPs pertaining to recovery and counting during mass mortality events:

- Mortality Collection and Disposal
- Mortality Storage Security
- Mass Mortality or Depopulation
- Increased Mortality and Feeding Reduction Procedures
- Supplier Procedures

#### *Reportable Disease Events*

During a Reportable Disease Event, Grieg NL will follow the NL Aquatic Animal Health Division (AAHD) Contingency Plan (AP 33; DFLR 2019) as well as all federal requirements. If any tank/building has a confirmed case of a federally Reportable Disease that results in fish mortality (or an ordered depopulation of fish), the stock that has died will be disposed of under direction of the Canadian Food Inspection Agency (CFIA) and/or DFLR. Grieg NL will adhere to these regulations and guidelines for disposal. For appropriate reporting procedures see section 7 below.

Prior to any fish, fish by-product, or mortalities being moved from a quarantined area a License to Move (LTM) will be in place (as issued by AAHD of DFLR and/or CFIA). In addition, any facility receiving mortalities with a reportable disease must have CFIA-approved SOPs in place for the handling of such salmon, which include procedures for transport of waste, offloading, containment of the fish and cleaning and disinfections for equipment and the facility. Other SOPs may be needed as ordered by CFIA and/or FLR.

Mortality as a result of a Reportable Disease Event can result in either normal to high mortality or mass mortality. The amount of mortality will determine which fish disposal procedure to follow. Should mortalities or depopulation be ordered due to a reportable disease, yet are within the normal to high mortality range, the mortalities will be ensiled using the same process as regular mortalities (see section 6.3.1 *Ensilage*). If mortalities exceed Grieg NL ensilage capacity, the mass mortality procedure will be followed as described above.

In the case of an event due to disease, disposal shall be conducted within the guidelines specified by the AAHD of DFLR and the CFIA. The following SOPs will be in place to detail procedures related to disposal of fish, fish by-products, and mortalities during a Reportable Disease Event:

- Mortality Collection and Disposal
- Mortality Storage Security
- Mass Mortality or Depopulation
- Increased Mortality and Feeding Reduction Procedures
- High Risk Material (Isolation and Quarantine)
- Personnel and Equipment Movement
- Cleaning and Disinfection
- Supplier Procedures

## **7.0 Reporting**

Grieg NL recognizes the importance of reporting which includes Federal, Provincial and even public reporting. Grieg NL has a responsibility to be open and transparent. Grieg NL will adhere to Provincial and Public reporting as per AP 7 and AP 17 (DFLR 2019). All fish health incidents will be reported to the DFLR as per AP 32 (DFLR 2019).

### **7.1 Mortalities**

Mortalities, both daily and mass mortality events will be recorded by Grieg NL. Grieg NL is committed to ensuring their fish stock is monitored at all stages. Counting cameras will be utilized each time the fish are transferred and/or graded. This inventory process ensures that accurate records of stock are maintained.

#### *Mortality Events: Abnormal/Mass*

If an abnormal mortality of farmed fish occurs, including a mass mortality event, due to a reason other than a reportable disease, details of the event will be reported as per AP 17, Public Reporting (DFLR 2019). Mass mortality events will be reported to the Chief Aquaculture Veterinarian (CAV) of the Aquatic Animal Health Division (a division of DFLR). If there is suspicion of a significant fish disease, CFIA will also be notified. Based on the recommendations of these regulatory agencies and stakeholders, Grieg NL will be required to conduct investigations and submit detailed documentation on the event in a timely manner.

#### *Mortality Events: Reportable Disease*

Farmed fish mortality events will be reported to the AAHD (DFLR) and CFIA if there is suspicion of a significant fish disease. Based on the recommendations of these regulatory agencies and stakeholders, Grieg NL will be required to conduct investigations and submit detailed

documentation on the event. Grieg NL will acquire a License To Move before any fish or fish by-products (including mortalities) from a quarantined area (i.e. area under a Quarantine Order) can be removed from the aquaculture facility or site. Grieg NL will follow the requirements outlined in AP 17, Public Reporting and AP 33, Aquatic Animal Disease Contingency Plan (DFLR 2019).

## **7.2 Fish Disposal Plan**

Grieg NL's Fish Disposal Plan (as a part of this document) will be submitted to and approved by DFLR on an annual basis. It will be accessible to DFLR at all times. In addition, the Plan will be submitted to all relevant agencies with a regulatory responsibility for waste management for review prior to implementation and when amendments are made (as per AP 23; DFLR 2019).

Grieg NL is committed to working with the federal, provincial and regional organizations that govern waste management in Newfoundland's aquaculture industry. Therefore, Grieg NL's waste collection and disposal plan will be based on these principles and regulations while meeting Grieg NL's goals and striving to meet Best Practice Management Practices.

## 8.0 References

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