

2018

**PLACENTIA BAY ATLANTIC SALMON AQUACULTURE PROJECT
ENVIRONMENTAL PROTECTION PLAN (EPP):
RAS HATCHERY CONSTRUCTION**



GRIEG NL

9/27/2018

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Preface

Grieg NL's Environmental Protection Plan (EPP) for the Placentia Bay Atlantic Salmon Aquaculture Project is a directive document that provides detailed steps to avoid or minimize negative effects on the environment. The EPP covers construction of the Recirculating Aquaculture System (RAS) Hatchery located in Marystown, Newfoundland and Labrador (NL). The responsibilities and procedures presented in this document are designed to ensure the efficacy of the plan and to allow for ongoing updates to the plan to accommodate improvements. This Preface includes overviews of the following:

- Distribution List
- EPP Responsibilities
- EPP Revision Procedures

Distribution List

The EPP will be provided to relevant Grieg NL personnel, contractors, subcontractors, and government agencies designated as having a surveillance responsibility.

Grieg NL Personnel

- General Manager
- Production Manager
- Environment, Health and Safety Advisor
- Owner Representative
- Grieg NL Site Manager(s) (Land and Sea) where appropriate

Contractors

- General Manager
- Environment, Health and Safety Manager

Subcontractors

- General Manager
- Environment, Health and Safety Manager

Government Agencies

- Department of Municipal Affairs and Environment (DMAE)
- Department of Fisheries and Land Resources (DFLR)
- Fisheries and Oceans Canada (DFO)
- Environment and Climate Change Canada (ECCC)
- Transport Canada

EPP Responsibilities

The responsibilities of Grieg NL and its employees as well as those of contractors and subcontractors are summarized below.

As the proponent, Grieg NL shall:

- Provide approval for the final issued version of the EPP and subsequent revisions.
- Inspect and monitor project activities during construction of the RAS Hatchery.
- Conduct EPP reviews on a regular and as-needed basis.
- Communicate with relevant government agencies and local stakeholders as required.

The Grieg NL Environment, Health and Safety (EHS) Advisor or their designated representative(s) shall:

- Be responsible for implementation of the EPP.
- Review and approve revision requests.
- Conduct EPP reviews on a regular and as-needed basis.
- Maintain document control.
- Ensure the EPP holders and their personnel are familiar with the EPP and its procedures.
- Strive for compliance with all permits, authorizations, and approval conditions; and ensure that appropriate supervisory personnel are on site during project activities as appropriate.

The Grieg NL Site Managers or their designated representative(s) shall:

- Distribute revisions to EPP holders.
- Be familiar with all aspects of the EPP.
- Confirm that all activities are conducted in accordance with the EPP.
- Hold an environmental awareness session for each Contractor and its personnel, and other personnel to be involved in the Project.
- Report on the efficacy of the EPP.
- Attend weekly contractor meetings.
- Identify any deficiencies in the plan and propose appropriate changes.
- Direct appropriate contingency actions and enact external notifications procedures in the event of an incident.
- In his or her absence, designate a qualified replacement.
- Manage the environmental inspection and monitoring needed to meet EPP requirements and reporting requirements of Grieg NL.

EPP holders shall:

- Keep EPP copy current and enter all revisions on the revision control record.
- Familiarize themselves and their personnel with the EPP and any revisions.
- Initiate changes to improve the EPP.

Contractors, Subcontractors and Site Personnel shall:

- Become familiar with the EPP.
- Become knowledgeable of reporting procedures.
- Comply with the EPP, contract requirements, and applicable laws/regulations.
- Obtain applicable permits, approvals and authorizations in coordination with Grieg NL personnel.
- Attend all required EHS training and orientation programs.
- Report all incidents of non-compliance with the EPP.

EPP Revision Procedures

The EPP is a controlled document and revisions may only be made with the approval of Grieg NL. EPP users are encouraged to submit suggestions for changes and improvements to the EPP, using the *EPP Revision Request Initiation Form* (see below). Upon receipt of suggestions, and where appropriate, designated Grieg NL personnel will prepare a proposed revision to be submitted for approval by Grieg NL's EHS Advisor or another designated representative. Approved revisions will be issued to all members of the EPP Distribution List (see above), accompanied by a Revision Control Record (see below), which will provide the EPP section(s) being superseded and revision instructions. Each revision will also be accompanied by an updated EPP Table of Contents.

Within two working days of receiving an approved EPP revision, EPP users are to:

- Confirm all listed pages have been received in accordance with the Revision Control Record;
- Read the revised text;
- Insert the revised pages into the appropriate position within the EPP, and remove and destroy the superseded pages;
- Confirm the EPP document is in accordance with the updated Table of Contents;
- Enter the revision number and date on the Revision Control Record, and sign; and
- Incorporate the revision into Project activities, and ensure all personnel are familiar with the revision.

**Grieg NL Placentia Bay Atlantic Salmon Aquaculture Project
Environmental Protection Plan (EPP)**

Revision Request Initiation Form

Name:

Affiliation (Position and Company / Government Department):

Date (D-M-Y):

EPP Section to be Revised:

Nature of Revision (e.g., sewage disposal, noise control, etc.):

Rationale for Revision (e.g., environmental or worker safety, etc.):

Suggested Revision:

Please submit to TBD, Production Manager, Grieg NL at the following address:
205 McGettigan Blvd., Marystown, NL A0E 2M0

List of Acronyms

AAR	Aquaculture Activities Regulations
ATV	All-terrain Vehicle
BMA	Bay Management Area
BPWMC	Burin Peninsula Waste Management Corporation
<i>CEPA</i>	<i>Canadian Environmental Protection Act</i>
CWS	Canadian Wildlife Service
DFLR	Department of Fisheries and Land Resources
DFO	Fisheries and Oceans Canada
DMAE	Department of Municipal Affairs and Environment
ECCC	Environment and Climate Change Canada
EHS	Environment, Health and Safety
EIS	Environmental Impact Statement
EPP	Environmental Protection Plan
FCR	Feed Conversion Ratio
GAP	Gasoline and Associated Products
<i>MBCA</i>	<i>Migratory Birds Convention Act</i>
MBR	Migratory Birds Regulations
MSDS	Material Safety Data Sheets
NL	Newfoundland and Labrador
NLDGS	Newfoundland and Labrador Department of Government Services
NLDNR	Newfoundland and Labrador Department of Natural Resources
OCI	Ocean Choice International
PPE	Personal Protection Equipment
RAS	Recirculating Aquaculture System
<i>SARA</i>	<i>Species at Risk Act</i>
SOP	Standard Operating Procedures
WHMIS	Workplace Hazardous Materials Information System

1.0 Introduction

This Environmental Protection Plan (EPP) has been developed by Grieg NL to describe environmental protection procedures for activities associated with the construction of the land-based hatchery, which is a key component of the Placentia Bay Atlantic Salmon Aquaculture Project. The hatchery facility, referred to as the Recirculating Aquaculture System (RAS) Hatchery, is located in the Marystown Marine Industrial Park adjacent to Mortier Bay. The EPP has been developed in compliance with a condition of the Project release issued by the provincial Department of Municipal Affairs and Environment (DMAE) at the conclusion of an environmental assessment process. The EPP will serve as a set of instructions for Project-related activities and will list the various environmental permits and authorizations to be issued by different agencies. Separate EPP documents will be prepared for operation of the RAS Hatchery and construction and operation of the sea cage sites in Placentia Bay.

This Grieg NL EPP is considered a living document and will be reviewed and updated on a regular and as-needed basis throughout the various stages of the Project life. Consequently, this is a controlled-distribution document, intended to be maintained in an updated condition by each listed/approved recipient (see Preface for details).

1.1 Purpose of the EPP

The EPP is an important component of overall Project planning and implementation of Project activities. It is considered part of Grieg NL's overall Environment, Health and Safety management system (see Section 3).

The EPP is a stand-alone document describing the responsible Project staff and environmental protection procedures for activities associated with the construction of the RAS Hatchery. Environmental protection procedures for the operation phase and decommissioning and rehabilitation phase of the Project will be developed at a later date. In addition, the EPP clearly outlines responsible company personnel include front-line workers, occupational health and safety and environmental staff.

This EPP will be used to ascertain that Grieg NL's environmental-related commitments are implemented, adhered to, and monitored. The EPP will serve to:

- Provide a record of mitigation measure implementation.
- Provide a functional management framework to ensure regulatory compliance and to identify opportunities for continuous improvement in environmental performance.
- Identify and document compliance with applicable legislation, permits and authorizations associated with each Project phase and ensure adequate communication with government environmental surveillance staff.

1.2 Organization of the EPP

The EPP is organized as outlined below and is designed to address DMAE requirements and to facilitate ease of use. The organization of the EPP follows the outline provided in the Grieg NL Environmental Impact Statement (see Section 8.2 of the EIS; LGL Limited 2018) to the extent possible.

Preface – Identifies the distribution list for the EPP and provides document revision and control procedures.

Section 1: Introduction – Lays out the organization of the EPP and overviews the purpose of the document.

Section 2: Overview of the Project – Highlights the key components, location, activities, and timeline for the Project to provide context for the EPP user.

Section 3: Environment, Health and Safety System – Overviews Grieg NL's Environment, Health and Safety (EHS) system, the relationship of the EPP to the Grieg NL Policy on sustainability; the organization, development and implementation of the EPP; and employee environmental orientation.

Section 4: Environmental Protection Procedures – Details environmental protection procedures to be employed during routine construction activities. This section also includes a summary of key environmental concerns associated with Project activities.

Section 5: Contingency Plans – Provides contingency plans for potential unplanned and accidental events such as spills of fuel or other hazardous material, wildlife encounters, and the discovery of historic resources.

Section 6: Legislation, Permits and Authorizations – Outlines the legislation, required permits, approvals and authorizations for the construction of the RAS Hatchery.

Section 7: Contact List – Provides emergency, advisory and other contact numbers for corporate personnel, contractors, external resources and regulators.

Section 8: Resource Material – Identifies guidelines and resource material relevant to environmental protection measures, mitigation and monitoring.

2.0 Project Description

The Placentia Bay Atlantic Salmon Aquaculture Project has two primary components: (1) a land-based Recirculating Aquaculture System (RAS) Hatchery located in the Marystown Marine Industrial Park and (2) sea cage sites located in the northern portion of Placentia Bay that will be used to grow the salmon to market size (Figure 2.1). The development of the Project, including construction and operation of the RAS Hatchery and sea farms, will undergo a phased approach before reaching peak production of seven million salmon per year. It is anticipated that the RAS Hatchery will be operational in Year 2 and reach full production capacity in Year 6. The first harvest at peak production at the sea farms is anticipated to occur in Year 8.

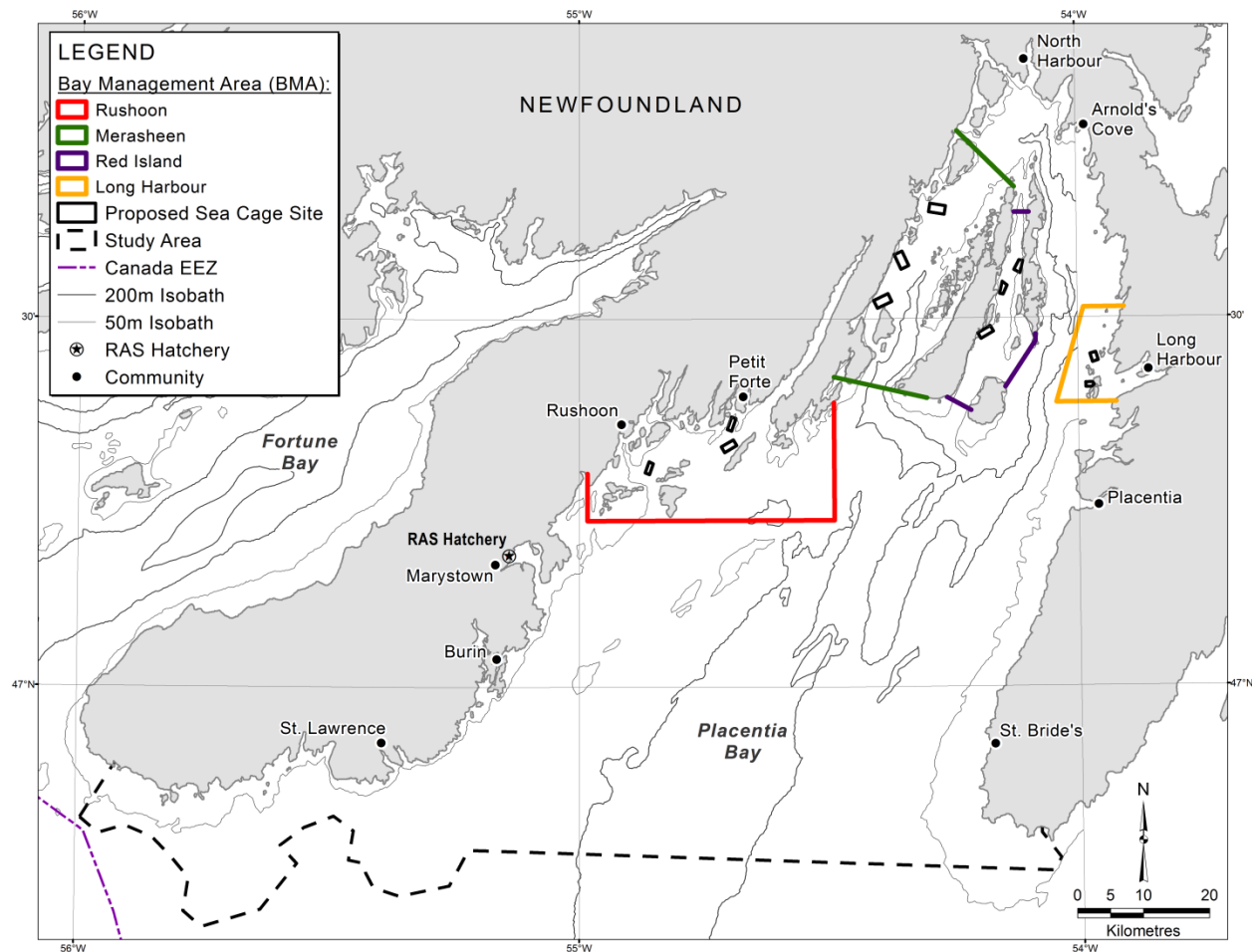


Figure 2.1. The locations of the RAS Hatchery, sea cage sites, and Bay Management Areas for Grieg NL's Placentia Bay Atlantic Salmon Aquaculture Project. [Also shown is the Study Area used in the Environmental Impact Statement].

At the RAS Hatchery, smolt will be grown to sizes ranging from 350–1,400 g and then will be transferred to a well boat and delivered directly to sea cage sites. Eleven sea cage sites will be located within four Bay Management Areas (BMAs), which have been established for biosecurity purposes. Three of the

BMA's are planned for semi-annual production and one BMA is planned for seasonal production. The semi-annual and seasonal sea cage sites will each have a maximum of 12 and 6 sea cages, respectively. Each of these sea cages can hold 160,000 salmon. At peak production, there will be seven active sea cage sites with 78 sea cages in operation per year. Each year, the sea cage sites in one BMA will be fallowed before the sea cages will be restocked with salmon.

Each sea cage site will be attended by several vessels including a feed/accommodation barge, satellite feed barge, service vessel, crew vessel, and a work boat. Once salmon have reached market size (~5 kg) they will be transferred to a dead hold vessel and then onto a third-party for processing.

Personnel working at the sea cage sites will be transported via dedicated crew vessels. Grieg NL anticipates one-week shifts at sea where personnel will live aboard the feed/accommodation barge. The crew change sites will have specific areas for embarkation to and disembarkation from the proposed sea cage sites, which is designed to avoid cross-contamination. Crew changes for the proposed sea cage sites in the Rushoon, Merasheen and Red Island BMA's will be conducted in Petit Forte and in Long Harbour for the Long Harbour BMA.

Services and supplies for all BMA's will be provided using wharf facilities at two former Ocean Choice International (OCI) premises, one each in Marystown and Burin. One of the resupply sites will be designated "inflow" and the other "outflow" to prevent cross-contamination of clean/new equipment going to the sea cage sites and used equipment returning for cleaning and servicing. Additionally, the resupply site designated as outflow will receive waste from the sea cage sites.

2.1 RAS Hatchery

The RAS Hatchery consists of three primary biosecure facilities (i.e., First-Feeding, Smoltification, and Post-Smolt) that have a total area of 30,000 m² (Figure 2.2). The site for the RAS Hatchery in the Marystown Marine Industrial Park was cleared in 2016 and 2017. However, blasting and some grubbing remains to be done before construction on the buildings can commence. The lots in the Marystown Marine Industrial Park are already serviced with three-phase power, municipal water and sewer, and a paved access road. The RAS that will be used at the hatchery is considered state-of-the-art and operates by filtering water from the fish tanks so it can be reused. The system uses 300 L of water per minute versus the 500,000 L of water per minute, which is typical in a flow-through system that is not reusing any water to accomplish an equivalent production of smolt.

2.2 Sea Cage Sites

The proposed sea cage sites (see Figure 2.1) have areas ranging from 0.8 km² to 3.2 km² and occur in water depths ranging from ~10 m to 308 m. Sites have been selected based on suitable water currents and depths, bottom type, shelter from wind and waves, and input from local users and regulatory agencies. Semi-annual and seasonal sea cage sites will have 12 or 6 sea cages, respectively; sea cages will be arranged in a line with a feed barge located between the cages. The sea cages and associated mooring system used to house fish will be state-of-the-art, heavy duty Aqualine Midgard Systems. Each sea cage is 50 m in diameter, extends 45 m below the surface, and will consist of a cage net, floating collar, gangway, sinker ring (tube), winches, and fish mortality removal system.

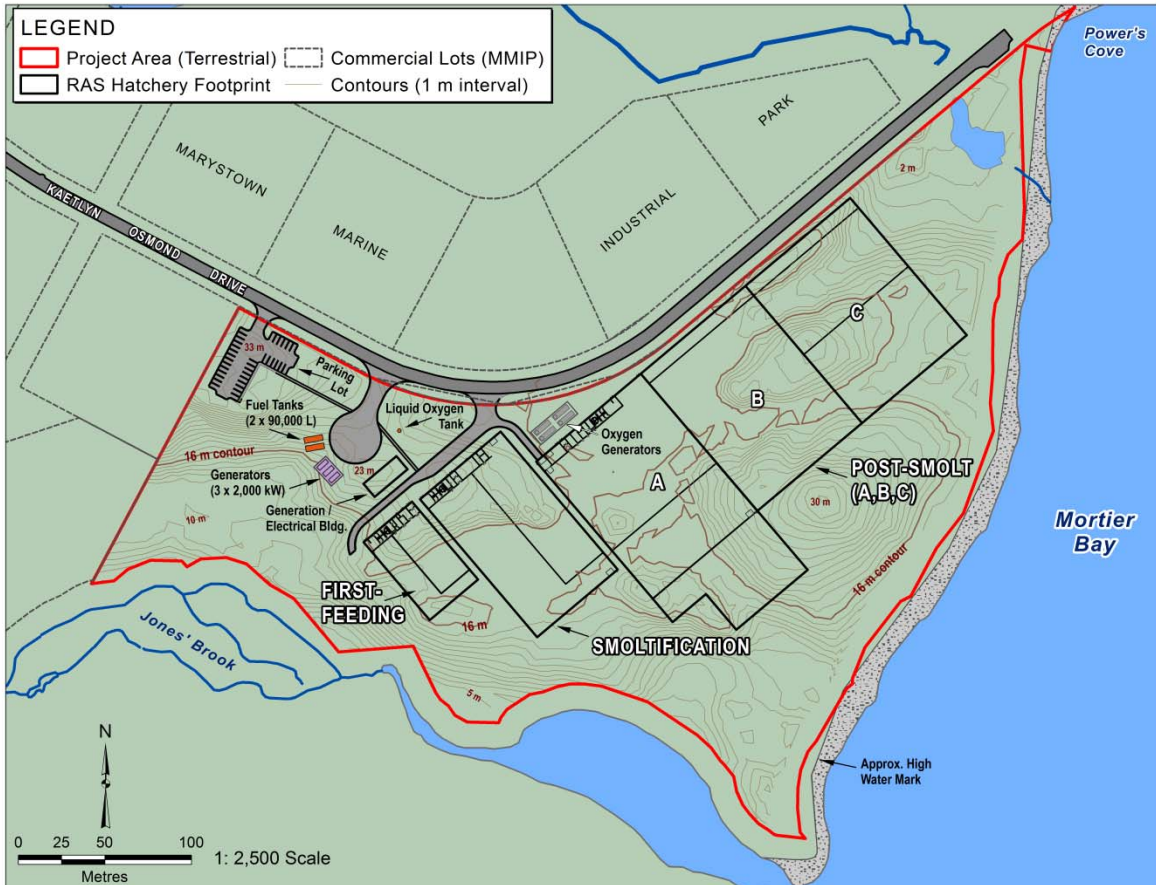


Figure 2.2. Schematic of RAS Hatchery in the Marystown Marine Industrial Park.

2.3 Best Available Technology

Grieg NL will use the best available technology at the RAS Hatchery and sea cage sites, along with a number of mitigation measures that go beyond the common aquaculture industry standard. These measures include such approaches as the utilization of sterile triploid all-female Atlantic salmon to minimize potential effects on wild salmon, the use of lumpfish (*Cyclopterus lumpus*) to control sea lice, and following protocols that exceed government requirements.

3.0 Environment, Health and Safety Management System

Grieg NL recognizes environmental protection as one of their guiding principles and a key component of sound business performance. Grieg NL is committed to providing a quality service in a manner that ensures a safe and healthy workplace for its employees and minimizes potential negative effects on the surrounding environment. Grieg NL will operate in compliance with all federal, provincial and municipal environmental legislation, and strive to use pollution prevention and environmental best practices whenever possible.

Grieg NL's EHS system will:

- Integrate the consideration of environmental concerns and interactions into all decision making and activities.
- Promote environmental awareness among its employees and require them to work in an environmentally responsible manner.
- Train, educate and inform its employees about environmental issues that may affect their work.
- Promote sustainability through the practice of reuse, recycle, refurbish and reduce waste.
- Avoid or reduce use of hazardous materials and products, seek substitutions when feasible, and take all reasonable steps to protect human health and the environment when such materials must be used, stored and disposed of.
- Operate by the highest standards possible to ensure protection of the environment while avoiding unplanned events (spills).
- Develop and maintain appropriate emergency and spill response capabilities.
- Train all employees in best practices for health and safety.
- Provide necessary Personal Protective Equipment (PPE) and instruction for its use and care.
- Develop and enforce safety and health rules, requiring that employees comply with these rules as a condition of employment.
- Investigate every incident, promptly and thoroughly, to determine its cause, and whenever possible, put measures in place to ensure against recurrence.
- Strive to continually improve environmental performance by periodically reviewing and updating EHS policy.

3.1 Roles and Responsibilities

The following section outlines the management structure, roles and responsibilities of personnel, for the implementation of Grieg NL's EHS policy for the construction phase of the RAS Hatchery.

Grieg NL General Manager: Primary person responsible for overall development of the RAS Hatchery, including environmental issues. Specific environmental responsibilities include:

- Ensuring environmental considerations are a part of the Project decision making process.
- Ensuring adequate plans and resources are in place to achieve environmental commitments to minimize environmental effects.
- Reviewing incident reports as they are submitted and ensuring the proper course of action is taken to manage unexpected environmental conditions or events.

EHS Project Consultant: Safety person responsible for Project construction. Will work with the team, report to the Grieg NL General Manager and be responsible for:

- Reviewing contractor documents.
- Overview of work being performed by contractors.
- Liaising with regulatory agencies on matters of EHS.
- Identifying any additional permitting requirements and submitting applications on behalf of the Contractor in a timely manner.

Owner Representative: Responsible for overseeing Project construction based on site. Reports to the Grieg NL General Manager and is responsible for:

- Ensuring compliance with relevant regulations, authorizations, permits and protocols.
- Ensuring documentation is submitted for compliance with Grieg NL policies.
- Coordinating with contractors and owners.
- Reviewing contractor documents.
- Conducting an overview of work being performed by contractors.

Grieg NL EHS Advisor: Primary Grieg NL employee responsible for overall environment, health and safety. Reports to the Grieg NL Production Manager and is responsible for:

- Performing orientations for new people on site (both visitors and workers).
- Providing environmental orientation to new employees.
- Providing awareness training on an as-needed basis.
- Ensuring that equipment is installed correctly/safely.
- Identifying potential environmental hazards.
- Determining ways of reducing EHS risks.
- Liaising with relevant authorities and contractors.
- Keeping up to date and ensuring compliance with current EHS legislation.

Contractor Project Managers: Responsible for specific scopes of work and ensuring the compliance of this specific scope. Report to the Owner Representative and are responsible for:

- Ensuring adequate resources are in place to achieve environmental commitments outlined in the contract, EPP, and any applicable permits and authorizations.
- Reviewing incident reports related to their specific work scope and employees as they are submitted and ensuring the proper management/resolution course of action is taken.
- Ensuring their scope does not impede or alter the scope or responsibilities of another contractor.

Contractor EHS Coordinator(s): Responsible for:

- Monitoring Project work to ensure that all provisions of the EPP, government approvals/authorizations and client/owner expectations are adhered to.
- Identifying any scope-specific permits not already obtained and working with the Owner Representative to ensure applications and approvals are timely.

3.2 Sustainability Policy

A key component of the Grieg NL EHS system is its sustainability policy, which is overviewed here and promoted throughout the EPP. Ultimately, Grieg NL's vision is to provide Placentia Bay Atlantic salmon for the world. Achieving this vision in a sustainable manner will be met through the company's commitment to the following principles: leadership, transparency, integrity, continuous improvement, inclusivity, and stewardship.

3.2.1 Priorities

Grieg NL's goal is the sustainable production of Atlantic salmon in the waters of Placentia Bay. Based on the expectations of Grieg NL and its stakeholders, the following priorities have been identified as key elements that are important for Grieg NL's achievements, profitability and survival with a focus on local and global sustainability:

- Fish health and welfare;
- Sea lice control;
- Fish escape control;
- Minimal emissions;
- Minimal interactions with wildlife; and
- Climate change.

3.2.2 Commitment and Scope

The sustainability policy will apply to all operations under Grieg NL. Grieg NL will utilize third-party service companies for many aspects of its operations and acknowledge that although Grieg NL cannot control the decisions of these parties, it commits to educate them of its policy. These third-party service providers will be encouraged to align their operating procedures with Grieg NL policy objectives. Grieg NL's priorities and any relevant decisions will be compliant with local, provincial and federal laws and regulations. Grieg NL will strive to exceed legal requirements with regard to sustainability, in order to be innovative and to demonstrate sustainability leadership.

3.2.3 Objectives

Grieg NL commits to:

- Focus on a safe and environmentally friendly food chain that produces quality products for consumers.
 - Strive to improve the feed conversion ratio (FCR) to a 1:1 ratio combined with optimization of fish products using the processing discards for human and other pharmaceutical or nutraceutical products.
- Balance profitable growth and innovation with environmental sustainability by using innovative technology and enhanced data collection to improve ecosystem understanding and sustainability decision-making.
 - Utilizing a RAS that requires minimal water consumption during smolt production.
 - Target to utilize fish feed that is produced using protein not designated for human consumption.
- Balance sustainable aquaculture and productive seas to maintain fish health and welfare, while also protecting the shared natural resources of the sea.
 - Utilizing sterile triploid all-female Atlantic salmon for all production in Placentia Bay.
- Providing a work environment that will attract and retain employees with a focus on health and safety, diversity, equity and integrity in the workplace.
 - Direct employment approaching 150 people in the Province upon reaching steady-state production.
- Local value creation, not only by hiring local residents, supporting local industries and utilizing third-party service contractors, but also contributing to the local communities by volunteering and donating resources.
- Publishing an annual Sustainability Report reviewing progress on achieving its goals that will be available to stakeholders and the public.

3.3 Development and Implementation of the EPP

The EPP is an essential component of Grieg NL's EHS system and is intended to ensure that all Project personnel abide by appropriate environmental protection actions, encompassing all Project phases for the RAS Hatchery. As noted earlier, this is a living document that will be revised as necessary based on review and approval of received suggestions, and to meet the requirements of reviewers and environmental approvals. EPP documents are typically revised as needed to reflect site- and/or task-specific activities as they relate to environmental protection measures and are structured to allow for revisions as Project activities progress. Separate EPP documents will be prepared for operation and decommissioning of the RAS Hatchery.

3.3.1 General Practices and Training

Grieg NL recognizes that communication and training are key to ensuring that Project activities with the potential to create a negative environmental effect are identified, and that preventative and/or mitigation measures are implemented. All Grieg NL employees, contractors, and subcontractors will undergo

employee orientation, which includes a review of environmental concerns and procedures. Additionally, multiple mechanisms are in place to ensure that the EPP contents are communicated to employees throughout the Project. A summary of these general practices is provided below.

3.3.1.1 Employee Orientation

Grieg NL recognizes the importance of EHS and is committed to ensuring a safe work environment for its employees, contractors and subcontractors, while also recognizing the importance of procedures and practices that will protect the environment. Grieg NL considers good husbandry and a strong focus on environmental protection essential during all Project phases and will emphasize this message to all new employees as part of their training and environmental orientation, and within Grieg NL's ongoing EHS management system. Grieg NL will ensure that all Project personnel, including contractors and subcontractors, are prepared and capable of completing their jobs competently and responsibly.

Grieg NL will maintain records of all environmental training and orientation sessions, including a description of the presented material, session dates and attendance. All Grieg NL personnel will receive orientation by a supervisor with awareness training. As well, on-going training will be provided on an as-needed basis.

All Project personnel working on site are required to participate in a site-specific Project and environmental orientation upon commencement of their employment and periodically thereafter as needed. This orientation will increase awareness of the Grieg NL EPP including the environmental protections relative to site-specific work activities, regulatory requirements, emergency preparedness and spill response capabilities, as well as client/contractor expectations for individual personnel roles and responsibilities.

Environmental orientation will include the following:

- Details on Grieg NL's EHS management system, EHS policy and obligations under the EPP.
- A presentation on environmental protection procedures to be applied to all work activities.
- Procedures for spill response and environmental emergencies.
- Personnel roles and responsibilities, including emergency preparedness.
- Description of tasks and activities, including any relevant activities that could involve environmental concerns.
- Instruction on specific procedures for environmental protection, including prevention, mitigation measures and documentation.
- The importance of enforcement and compliance with the EPP.

3.3.1.2 Construction Phase

During construction of the RAS Hatchery, Grieg NL has identified the following general mechanisms for dissemination of and conformance to the EPP:

- Contract documents will include a copy of the EPP for all bidders with a control copy of the EPP being issued to the successful bidder.
- Contractors will be requested to provide written confirmation that they will meet to requirements of the EPP.
- Contractors will be requested to review the specific scope for any known and potential issues that may be associated with their execution and methodology for the Project tasks.
- Where appropriate, contractors may be required to provide activity-specific EPPs at least seven days in advance of the initiation of the subject activity. This approach allows the EPP to be subdivided into smaller and more manageable and relevant documents. Submitting an EPP specific to a task, such as clearing and grubbing, closer to the point of execution optimizes complete understanding of task-specific EPP details and ensures the construction team remains focused on specific phase tasks and the EPP.
- Orientation sessions, including *New Employee, Project* and *Site Orientation*, will each include an “Environmental Orientation” component (see above) designed to inform employees of Project expectations with respect to individual performance on environmental issues.
 - Orientation sessions shall be provided to all employees by the EHS Advisor prior to work commencement. Hard copy records of these sessions shall be maintained on site in employee folders, along with electronic copies at the site office.
 - Site-specific issues will be covered, possibly including Species at Risk, Birds and Nests and Soils Management, among others.
- Environmental Awareness Training is Project-specific and is intended to highlight Project environmental sensitivities in appropriate detail relative to the various levels of Project involvement. A stand-alone session may be offered if required during the Project by the contractor EHS coordinator; however, environmental topics should also be embedded into daily toolbox talks, EHS meetings, progress meetings, work planning sessions, and the like. Such sessions will need to include such topics as spill prevention, incident reporting, fuelling, tank monitoring, wildlife encounters and waste management.
- *Mass EHS Meeting*: The Contractor Project Manager shall conduct a Mass EHS Meeting on a regular basis (interval to be Project Activity-specific) with staff and contractor/subcontractor representatives. The minutes will be recorded in a format suitable to the meeting or as prescribed by Project document control.
- *Weekly EHS Meetings*: These meetings shall be conducted by the immediate supervisor and periodically attended by a member of management. The minutes shall be recorded, and the attendees will sign to verify their attendance.
- *Daily Task/Toolbox Safety Meetings*: At the start of each day and the start of each new job, the supervisor shall conduct meetings relevant to the task(s) to be undertaken. The information conveyed to the crew shall include the task plan and precautions that should be taken. Meeting topics shall include: hazards (including environmental), permit reviews, site conditions, and special hazards/precautions.

3.3.1.3 Overall Operations

- *Annual Environmental Performance Review:* In order to continually improve on its performance, Grieg NL will hold annual environmental performance review meetings. Site managers, along with the Production Manager and/or General Manager, will review environmental performance and compliance at the RAS Hatchery construction site. These meetings will provide an opportunity to ensure EPP procedures as well as permitting and governmental policies are consistent.
- *Monthly/As-needed Toolbox Meetings:* The Production Manager will meet monthly or as required with site managers from the RAS Hatchery. These informal meetings will address, among other topics, Health, Safety, Environment and Security issues. These monthly meetings will provide an avenue to discuss any concerns or recent incidents.

4.0 Environmental Protection Procedures

Environmental protection procedures are provided here for each of the primary construction activities associated with the RAS Hatchery. As the work proceeds, these procedures may be modified or new procedures implemented, to account for new Project activities, site conditions, changes in engineering design or construction methods, and as a result of lessons learned during activities.

For Project activities at the RAS Hatchery, Grieg NL's civil contractor, Pennecon, as well as subcontractors will have Standard Operating Procedures (SOPs) in place, which provide step-by-step instructions for conducting various construction activities. These SOPs will also contain steps to protect the environment and which are in line with the procedures provided below. Employees, contractors and suppliers are required to follow and adhere to all environmental protection procedures. Also, as per the terms and conditions of the EIS release issued by the DMAE, Grieg NL shall adhere to all mitigation, monitoring, and commitments stated in the EIS.

As noted previously, the site for the RAS Hatchery has already been mostly cleared and grubbed. Some grubbing and leveling of the site is still required, including the removal of unsuitable material, common excavation, drilling and blasting.

4.1 Clearing, Grubbing and Removal of Related Debris

Environmental Concern

Environmental concerns include loss of habitat and potential effects of erosion and sedimentation on watercourses and the marine environment.

Environmental Protection Procedures

Though the majority of clearing and grubbing has been completed for the project, the following measures shall be implemented, as required:

1. Contractors shall adhere to current Industry Best Practices for managing erosion and sedimentation in accordance with municipal, provincial and federal regulations.
2. Clearing shall comply with the requirements of all applicable permits, including a Commercial Cutting Permit and an Operating Permit.
3. Where possible, timber shall be felled inward toward the work area to avoid damaging any standing trees within the immediate work area.
4. Clearing activities occurring during bird nesting season shall require a nest survey. No activities shall be permitted to disturb or scare away birds or wildlife.
5. Grubbing shall be contained to areas necessary for project development.
6. Grubbed material shall not be pushed into areas that are to be left undisturbed.
7. Grubbed material shall be stockpiled in a designated area.
8. A minimum 15 m buffer zone shall be maintained between grubbed areas and any adjacent watercourse, including Jones Brook and Placentia Bay.
9. Rock berms, silt fencing, and hay bales shall be used to control run-off and potential sedimentation of waterways, particularly in susceptible areas (i.e., steep slopes).

10. Sediment control structures shall be monitored, maintained, and repaired on a scheduled basis (minimum weekly) and before predicted/after actual rainfall events >25 mm.
11. Additional silt fencing and hay bales shall be stored on site and available if needed.
12. Additional measures to rehabilitate and stabilize construction sites include covering sloped areas with rip rap (clean blasted rock) or hydro seed as appropriate shall be undertaken.
13. Exposed soil and/or material stockpiles shall be placed such that the stockpiles are aligned relative to prevailing winds and dust control/suppression is implemented as required.
14. Any areas to be restored after construction is complete shall be covered with topsoil and sodded or hydro seeded.
15. There shall be no disruption of shoreline areas or requirement to construct access roads.

4.2 Storage, Transportation, Transfer, Handling and Disposal of Fuel and Other Hazardous Substances

Environmental Concern

During construction, some substances will be used which are or may be classified as hazardous including petroleum, oil and lubricants; chlorinated and non-chlorinated solvents (e.g., cleaner-degreasers); waste petroleum products (e.g., used engine/motor oil); glycol (e.g., antifreeze), paints, epoxies, concrete additives, and explosives. The primary concern regarding the use and storage of fuel or other hazardous materials is an uncontrolled or accidental release into the environment and subsequent negative effects on terrestrial and aquatic habitat and species, soil, surface and groundwater quality and human health and safety.

Environmental Protection Procedures

The following procedures will be implemented to reduce the likelihood of accidental release of hazardous substances that may result in negative environmental effects:

1. Procedures for the handling of fuels and other hazardous materials as well as contingency plans for spills will be present in hard copy at receiving, storage, transfer and disposal areas.
2. Contractors will be required to submit a detailed EPP prior to the start of construction including Material Safety Data Sheets (MSDS) of all hazardous products.
3. Any soil contaminated by small leaks of fuel, oil or grease from equipment shall be cleaned up and disposed of in accordance with the applicable regulations, under the provincial *Environmental Protection Act* (2006) and Used Oil Control Regulation (82/02). The Used Oil Control Regulation (82/02) will be used as a guideline to the DMAE requirements for such disposal.
4. Smoking shall be permitted in designated areas only. Designated smoking areas shall not be within 10 m of fuel or hazardous material storage areas.
5. A complete inventory of the hazardous materials on the job site shall be maintained according to the Workplace Hazardous Materials Information System (WHMIS) Regulations and will be made available to regulatory agencies upon request or in case of any emergency.
6. All subcontractors and Grieg NL employees shall be required to observe strict compliance with the requirements of WHMIS regarding employee training, use, handling, storage, and

disposal of hazardous materials and regarding labeling and provision of MSDS, as required by WHMIS legislation.

7. Tanks shall be located in areas where spills, should they occur, shall not flow to watercourses, water bodies, ditches or the marine environment.
8. If fuel tanks are required to be stored on site during construction, these shall be located on concrete pads surrounded by a containment barrier to prevent spills to the environment as described in section 27 – Construction and Installation Standards of *Storage and Handling of Gasoline and Associated Products Regulations, 2003*. Tanks for fuels and other hazardous materials shall be self-dyked or be positioned over an impervious mat, surrounded by an impervious dyke of sufficient height, more specifically:
 - a. Where a dyked area contains only one storage tank, the dyked area will retain not less than 110% of the capacity of the tank; and
 - b. Where a dyked area contains more than one storage tank, the dyked area will retain not less than 110% of the capacity of the largest tank or 100% of the capacity of the largest tank plus 10% of the aggregate capacity of all the other tanks, whichever is greater.
9. All storage facilities shall be located away from construction activities, provided with secondary containment, and inspected on a regular basis in compliance with all government laws and regulations.
10. As per the required operations permit and relevant legislation for drilling and blasting during the construction phase, explosives shall not be stored or remain on site overnight.
11. Oils, grease, gasoline, diesel or other fuels or any material deemed to be hazardous shall be stored at least 100 m from any watercourse or the ocean.
12. Fuel and other hazardous materials storage areas and non-portable transfer lines shall be clearly marked or barricaded to protect against damage by moving vehicles. The markers will be visible under all weather conditions. Barriers shall be constructed in compliance with the provincial Storage and Handling of Gasoline and Associated Product Regulations (58/03).
13. Hazardous materials shall be properly labelled and stored in an appropriate storage cabinet, cupboard or designated area.
14. Containers containing hazardous materials shall be appropriate for the material being stored and shall always be kept sealed when not in use.
15. The transportation, use and storage of fuel and other hazardous materials is regulated by The Storage and Handling of Gasoline and Associated Products (GAP) Regulations and Amendments, *Transportation of Dangerous Goods Act (1992)* and *Dangerous Goods Transportation Act (2006)*. Employees and contractors shall follow all required regulatory policies and procedures.
16. Diesel fuel tanks for the hatchery backup generator system will be installed with guidance from Service NL to register these tanks and receive instructions from an Environmental Protection Officer as to which contingency plan documents are required.
17. Hazardous Storage Areas shall be equipped with appropriate firefighting equipment.
18. All Occupation Health and Safety regulations regarding the use, storage and training on all classes of fire extinguishers that may be required shall be followed.
19. Waste oils, lubricants and other used oil shall be retained in a tank or closed container and shall be disposed of regularly under contract with a licensed used oil collector in accordance with the Used Oil Control Regulations (82/02).

20. Greasy or oily rags or other materials at risk of spontaneous combustion shall be deposited and stored in appropriate receptacles. This material shall be removed from the work site on a regular basis and shall be disposed of in an approved existing waste disposal facility. Removal of these materials from the job site is regulated under the *Transportation of Dangerous Goods Act*.
21. All hazardous materials shall be handled according to the provincial *Environmental Protection Act* (2006) and disposed of in accordance with government laws and regulations at an approved off-site hazardous waste disposal facility.
22. Regular inspections of hydraulic and fuel systems on machinery shall be performed, and all leaks shall be repaired immediately upon detection. Worn or damaged hoses, seals and fittings shall be promptly repaired or replaced.
23. Fuelling, routine maintenance activities, and lubrication of vehicles and mobile equipment shall be performed in designated and approved locations. Fuelling and lubrication of equipment shall occur in such a manner as to minimize the possibility of contamination to soil or water. All activities shall be performed with appropriate spill protection measures.
24. Fuelling or servicing of mobile equipment shall not be allowed within 30 m of water bodies, drainage systems or ecologically sensitive areas. For equipment of limited mobility where the 30 m buffer zone cannot be practically achieved, adequate spill containment shall be provided during the fueling and servicing operations. Fuelling and servicing of equipment shall occur on level terrain.
25. All deliveries of fuel shall be in conventional fuel delivery trucks that are operated by licensed distributors.
26. When fuelling equipment, operators shall:
 - a. Be in attendance for the duration of the operation;
 - b. Use leak-free containers and reinforced rip and puncture-proof hoses and nozzles;
 - c. Use hoses that have a design pressure rating of at least 150% of the maximum head of the system;
 - d. Lock out all tank nozzle valves except the valve currently in use;
 - e. Seal all storage container outlets except the outlet currently in use; and
 - f. Ensure drip pans, and other precautionary measures as required, are in place prior to the start of refueling activities.
27. Fuel unloading facilities shall be equipped with drip pans to collect hose drainage and drips. Hoses or pipes used for fuel transfer shall be equipped with properly functioning and approved check valves, spaced to prevent backflow of fuel in the case of failures.
28. All necessary precautions shall be implemented to prevent the spillage, misplacement, and loss of fuels and other hazardous materials used during the construction phase.
29. A fuel and other hazardous materials spill contingency plan, and appropriate emergency spill equipment, shall be in place on site.
30. All spills of fuel and hazardous materials shall be reported immediately to the EHS Advisor. Any spill of any volume to the marine environment or spills of 70 L or more on land shall be reported immediately in accordance with provincial regulation.
31. Any spill on land regardless of size that may enter a waterbody frequented by fish shall be reported immediately to Canadian Coast Guard Environmental Emergencies: (709) 772-2083 or 1-800-563-9089, as required by the *Fisheries Act* and Section 201 of *Canadian*

Environmental Protection Act (CEPA). All such spills shall also be reported immediately to the EHS Advisor and Production Manager.

32. Spill kits shall be maintained at the construction site for quick response purposes.
33. All selected response equipment shall be selected for its suitability/acceptability for deployment.
34. All employees and contractors shall be made aware of the Spill Management Plan and their role.
35. All petroleum-based products used in the facility during construction and operation including oils, fuels, and greases shall be reused when possible (e.g., waste oil can be collected and burned).
36. When possible, environmentally friendly options shall be used (e.g., food grade grease/oil).
37. Reduce the use of products such as paints and only paint areas as needed. Unused paint shall be recycled when possible or disposed of at an approved waste disposal area.

4.3 Blasting

Environmental Concern

Drilling and blasting are required to bring the site for the RAS Hatchery to specific grades/levels. Potential impacts include destruction of vegetation, noise disturbances to wildlife, and the potential effects on fish, aquatic animals, and residents in adjacent areas.

Environmental Protection Procedures

1. All blasting work shall be conducted in compliance with the appropriate permits and/or approvals and authorizations.
2. The handling, transportation, storage and use of explosives shall be conducted in compliance with all applicable laws, regulations, orders of the Newfoundland and Labrador Department of Government Services (NLDGS) and Newfoundland and Labrador Department of Natural Resources (NLDNR), and the *Dangerous Goods Transportation Act* (2006).
3. All personnel shall comply with site-approved safe blasting procedures.
4. Blasting activities shall be coordinated and scheduled to minimize the number of blasts required. In order to minimize the seismic effect, blasting patterns and procedures shall be used to reduce the shock wave and noise.
5. Blasting shall not occur in the vicinity of fuel storage facilities.
6. Use of explosives shall be restricted to authorized personnel who have been trained in their use. Licensed blasters shall undertake blasting.
7. Explosives and auxiliary materials shall be stored as stipulated in relevant legislation, in compliance with all permits.
8. Explosives shall be used in a manner that will minimize damage or defacement of landscape features, trees and other surrounding objects by controlling, through the best methods possible (including time-delay blast cycles), the scatter of blasted material beyond the limits of activity.
9. Pre-blast surveys shall be conducted for wildlife and, if wildlife is encountered in the area, the blast will be delayed until the wildlife is no longer present.

10. A blast site safety manual shall be required from the licensed contractor, a key aspect of which will include a blasting warning protocol (i.e., horns and/or sirens).
11. Blasting in close proximity to adjacent watercourses, including Jones Brook and Placentia Bay, shall follow the *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998; Appendix A).

4.4 Concrete Handling and Placing

Environmental Concern

Typical of industrial construction, large quantities of concrete shall be utilized during the construction phase of the RAS Hatchery. The production of concrete involves the use of cement, concrete additives, reaction agents and aggregates. Cement is highly alkaline and wash water (e.g., from spoiled concrete or cleaning mixers and mixer trucks) will have a high pH and will contain additives and agents, some of which are toxic to terrestrial and aquatic species. Of concern is the potential of fresh concrete or concrete products to affect the environment, such as released wash water increasing pH or chemical levels in local water sources to potentially toxic levels.

Environmental Protection Procedures

Grieg NL shall implement the following environmental protection procedures for the use of fresh concrete near bodies of water:

1. The batch plant providing concrete (i.e., a third-party provider) shall comply with the NL Environmental Code of Practice for Concrete Batch Plant (Ready Mix Plant) Operations and Rock Washing Operations, 1992, as well as all applicable authorizations and guidelines.
2. A third-party inspection will be utilized to ensure the contracted batch plant is performing to all required codes and standards.
3. Concrete delivery trucks or chutes shall not be washed within 100 m of any watercourse or waterbody.
4. When concrete is to be placed within 15 m of a waterbody, provisions of all required permits shall be followed. Under no circumstances shall fresh concrete come into contact with a waterbody before the concrete has cured.
5. Washwater from the cleaning of mixers, mixer trucks and concrete delivery systems shall be handled using the procedures outlined in Section 3.0 of the NL Environmental Code of Practice for Concrete Batch Plant and Rock Washing Operations. The following outlines important steps to take, however the code of practice shall be reviewed thoroughly:
 - a. All rinsing activities shall be carried out at the site of the concrete batch plant, except rinsing of the chute and concrete delivery systems;
 - b. The rinsing of the chute may be carried out at the delivery site, but care and caution shall be taken. It is permissible to rinse onto the ground or soil but under no circumstances into a pond or stream or onto a surface that leads directly to a water body, such as a storm sewer. A washout area shall be provided.
 - c. A qualified third-party responsible for reporting non-conformances to DMAE will be hired.

6. All necessary precautions shall be taken when handling related substances such as form coatings and concrete admixtures to prevent any spill or leakage of these substances.
7. All spills are to be captured and shall be handled as described in Section 4.1.2.
8. All spills over the minimum reporting volumes shall be reported to DMAE within the prescribed time frame.

4.5 Storage, Handling, and Disposal of Solid Waste

Environmental Concern

The release of solid waste is a concern to human health, drinking water quality, aquatic and terrestrial ecosystems.

Solid waste (e.g., domestic waste, paper, cardboard, wood, metals, etc.) will be generated during construction activities. These wastes, if not properly controlled and handled, will be unsightly and may cause human safety and health concerns. Uncontrolled waste may also attract wildlife leading to potential human-wildlife encounters.

Environmental Protection Procedures

1. The amount of waste generated and requiring disposal shall be minimized as much as possible.
2. All wastes shall be handled according to procedures in Grieg NL's Waste Management Plan and in compliance with all relevant regulations.
3. By using pre-fab buildings, only the necessary amount of materials required for building construction will be sent to the construction site, and there will be minimal waste associated with cutting materials or workmanship errors.
4. Fiber rebar (i.e., basalt fiber reinforced polymer) will be considered for use in concrete reinforcement to reduce steel waste with excess fiber rebar being chipped for compaction and disposal.
5. A refuse wood site shall be identified for local use for disposal of wood pallets and other excess wood materials.
6. Wood products shall be chipped for disposal whenever possible.
7. Scrap steel and plastic products such as piping will be retained by Grieg NL for use in facility repairs.
8. Where this is not practical due to materials being damaged or too small, steel products will be recycled through local companies.
9. Plastic products shall be recycled where possible with disposal only when no other option remains.
10. On site waste shall be disposed in accordance with the Burin Peninsula Waste Management Corporation (BPWMC).

4.6 Sewage Disposal

Environmental Concern

The release of untreated sewage may pose risks and/or concerns to human health, drinking water quality and marine and freshwater ecosystems.

Before the RAS Hatchery is constructed and the facility is tied into the existing BMS Blivet waste water treatment system in the Marystown Marine Industrial Park, temporary portable toilets may be on site, or temporary office facilities may be constructed that tie into the Blivet system. This will be decided by contractors after contracts are awarded.

Environmental Protection Procedures

1. Until such time as the contractor can tie into the Blivet system, sewage shall be handled by temporary portable toilets or washcars located around the construction site and will comply with all health and safety regulations, the Department of Health guidelines, the *Environmental Protection Act* (2006), and Environmental Control Water and Sewage Regulations, 2003 (65/03).
2. Sewage waste shall be trucked off-site by a licensed waste management firm for treatment and disposal.

4.7 Vehicular Traffic

Environmental Concern

Lots within the Marystown Marine Industrial Park are currently serviced with a paved access road. There will be no construction of access roads. Vehicular traffic will be typical of industrial construction projects in the province during the construction phase of the RAS Hatchery. Proposed construction activities will be supported by vehicles ranging in size from light trucks to heavy equipment, all of which can result in direct physical disturbances that can impact air quality and terrestrial and aquatic environments.

Environmental Protection Procedures

1. No anticipated requirement for all-terrain vehicle (ATV); if requirement arises, the use of ATVs shall be restricted to designated roadways and/or areas to minimize ground disturbance.
2. Heavy equipment shall be minimized near waterbodies. Heavy equipment use shall be restricted from performing work in the nearby brook.
3. Reasonable speed limits shall be posted to reduce potential environmental impacts and vehicular accidents.
4. Inspection and maintenance of all project vehicles shall be performed on a daily/weekly schedule to ensure they are in good working order. Inspections and maintenance shall include but not limited to exhaust systems, mufflers and any other pollution control devices in order to ensure emissions remain within acceptable standards.

5. Construction vehicular traffic shall not travel outside designated work areas.
6. Public roads shall be inspected on a regular basis with the local road authority. Repairs and/or clean-up shall be discussed and agreed to with the local road authority.

4.8 Dust Control

Environmental Concern

Excessive dust may be generated during dry conditions, which may pose environmental concerns related to human health, terrestrial vegetation, and marine and freshwater environments.

Environmental Protection Procedures

In order to maintain appropriate air quality and prevent smothering or other undue environmental effects, the following procedures will be implemented, as appropriate:

1. Freshwater shall be used as the primary measure to control dust. Application will be via water truck with sprinkler.
2. If necessary, using other agents, such as calcium chloride shall be used to control dust in accordance with applicable guidelines. No petroleum-based products shall be used for dust control.
3. All dust control agents shall be stored away from water bodies.
4. Dust emissions shall be reduced to the greatest extent possible.
5. No dust control shall be applied if weather conditions indicate a potential for freezing and creating traffic hazards.
6. Local road authorities shall be consulted prior to applying dust control measures on public roads.
7. A vehicle/tire wash/wet area shall be provided to control dirt and dust on public roadways.
8. Weather forecasts/conditions shall be monitored to ensure adequate dust control measures are implemented.

4.9 Equipment Use and Maintenance

Environmental Concern

Environmental concerns associated with the operation and use of construction equipment include atmospheric emissions, noise, accidental spills and chronic leaks. Emissions, spills and direct physical disturbances as a result of equipment can adversely affect surrounding resources.

Environmental Protection Procedures

1. All Project-related equipment must be clean and in good working order when delivered for construction activities.
2. All efforts must be made to avoid the discharge of oils, fuels or other such compounds from equipment to the surrounding environment.

3. Equipment including generators and vehicles shall be inspected and serviced routinely for mechanical condition and to ensure there are no leaks that could result in spills of hazardous materials.
4. Equipment inspections and maintenance shall be conducted by qualified personnel.
5. Pipes, hoses and connections for equipment shall be inspected routinely for breaches or defects.
6. Leaks, breaks, or compromised hoses, pipes and connectors shall be repaired and reported immediately.
7. Spill kits shall be maintained on site. Each piece of equipment shall have a portable spill kit on board. In addition, drum spill kits shall be strategically located near working areas. All deliveries of fuel shall be in conventional fuel delivery trucks that are operated by licensed distributors.
8. Records shall be maintained on file for all inspections and maintenance servicing.

4.10 Protection of Migratory Birds

Environmental Concern

Migratory birds, their eggs, nests, and young are protected under the *Migratory Birds Convention Act (MBCA)*. Migratory birds protected by the *MBCA* generally include all seabirds except cormorants and pelicans, all waterfowl, all shorebirds, and most landbirds (birds with principally terrestrial life cycles).

Under Section 6 of the *Migratory Birds Regulations (MBR)*, it is forbidden to disturb, destroy or take a nest or egg of a migratory bird or to be in possession of a live migratory bird, or its carcass, skin, nest or egg, except under authority of a permit. It is important to note that under the current *MBR*, no permits can be issued for the incidental take of migratory birds caused by development projects or other economic activities.

Furthermore, Section 5.1 of the *MBCA* describes prohibitions related to deposit of substances harmful to migratory birds:

5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.

(2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds.”

Environmental Protection Procedures

The following procedures shall be put into place to ensure that the Project does not pose a threat to migratory birds:

1. No one shall approach concentrations of seabirds, sea ducks or shorebirds that may occur at the construction site or adjacent to the site.
2. Care shall be taken to ensure that food scraps and other garbage are properly disposed of to avoid attraction of potential predators to migratory birds.
3. During the breeding bird season, visual monitoring for nesting activity within the construction area will be conducted.
4. No one shall disturb, move, or destroy migratory bird nests. If a nest or young birds are encountered, work will cease in the immediate area of the nest. Work shall not continue in the area until the nest is no longer occupied, otherwise the work plan shall be modified to avoid nest sites.
5. Personal pets shall not be brought to the construction site.
6. Buffers shall be established around known nests (species-specific); however, staff and crew shall be made aware of the possibility of undiscovered nests. When one or more of the indicators below are noted, notifications shall be made as appropriate. An active nest can be identified by:
 - a. the presence of birds or eggs in a nest;
 - b. adult birds carrying food or nesting materials to a specific location; or
 - c. adult birds defending territory, through singing, screeching or diving.
7. All precautions shall be taken to prevent fuel leaks from equipment. Staff and crew are aware that under the MBR, “no person shall deposit or permit to be deposited oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds”.
8. While there is no expectation of nighttime activities, should that requirement change the following measures shall be implemented:
 - a. The use of solid-burning or slow pulsing warning lights at night shall be avoided;
 - b. Lighting for the safety of the employees shall be shielded to shine down and only to where it is needed, without compromising safety; and
 - c. The minimum number of lights possible shall be used, while still ensuring the safety of crews working at night.

5.0 Contingency Plans

Contingency plans to address incidents and unplanned situations that may occur during the construction of the RAS Hatchery have been developed and will be modified as required. Grieg NL has developed a separate Emergency Response Plan that details procedures for personnel health and safety and response to accidents, malfunctions, and emergencies. Grieg NL has also developed a Spill Management Plan. These documents are the first point of reference for emergency responders in case of an emergency on site. Information provided in this section is meant to support the Emergency Response and Spill Management Plans and be available as an additional reference.

The following contingency plans have been developed to address accidental and unplanned situations that may occur during the construction phase at the RAS Hatchery:

- Fuel and Hazardous Materials Spills
- Forest Fires
- Wildlife Encounters
- Extreme Weather Events
- Discovery of Historic Resources
- Discovery of a Species At Risk

Notwithstanding these contingency plans, Grieg NL supports preventative measures as the first line of defence against the possibility of incidents.

5.1 Fuel or Hazardous Material Spills

The civil contractor, Pennecon in consultation with Grieg NL will lead and coordinate any field response to environmental incidents related to their activities. During construction of the RAS Hatchery, it is anticipated that spilled material will be primarily fuel, lube, and hydraulic fluid originating from equipment wear and tear and/or malfunction. Therefore, in the event of a spill, procedures for responding to hydrocarbon spills outlined herein, shall apply:

1. Assess the situation (Safety First). Personnel shall not approach the spill area without appropriate PPE.
2. Identify priorities while considering the threat to people, property, and the environment.
3. Initiate the appropriate response actions:
 - The individual who discovers the leak or spill shall make a reasonable attempt to immediately stop the leakage and contain the flow, where safe to do so.
 - Contact emergency personnel and request additional support if necessary.
 - Reporting: spill location, type of product, estimated volume and terrain condition at the spill site will be determined and reported immediately to Grieg NL's EHS Advisor for further reporting to authorities, as appropriate.
 - Initiate the containment and recovery of any free product and/or contaminated material.

4. Dispose of all waste material in the appropriate manner.
5. Restore the site to the satisfaction of the Project representative or governing regulatory body.
6. Document and investigate as required.

Reportable spills include:

- A spill or leak greater than 70 L on land;
- A spill or leak on land, regardless of quantity, that has the potential to contaminate nearby property or enter a water body or sewer;
- Spills or leaks from storage tanks; or
- A spill or leak in the water, regardless of quantity.

Spills meeting the above criteria shall be reported immediately to regulatory authorities via the **Environmental Emergency Report Line at (709) 772-2083 or 1-800-563-9089**.

In reaching decisions on containment and clean-up procedures, the following criteria will be applied:

- Minimize danger to persons;
- Minimize pollution of water courses;
- Minimize area affected by spill; and
- Minimize the degree of disturbance to the area and watercourses during cleanup.

Grieg NL and its subcontractors will take all necessary precautions to prevent a reoccurrence of the incident and the EHS Advisor shall prepare a written report as required.

All fuel-powered equipment shall contain appropriately-sized spill kits (23 L). In addition, 45 gallon drum spill kits shall be strategically placed throughout the site and moved as required. In addition, a sea-can clearly marked as “Spill Response Equipment” shall be located in the lay down area. The contents of spill kits shall be routinely inspected and supplies replenished as necessary.

In the event of fuel or hazardous material spills, Project personnel are also to refer to Grieg NL’s Spill Management Plan: Land and Water, and emergency contact phone numbers (first page [i]) and section 4.0, *Emergency Response*, of Grieg NL’s Emergency Response Plan.

5.2 Forest Fires

A fire at the construction site has the potential to spread to the surrounding area. Conversely, a forest fire or fire at another facility within the Marystown Marine Industrial Park could spread to the RAS Hatchery site. Terrestrial fires could result in habitat alteration or loss and/or mortality of wildlife. Fire fighting chemicals or spilled materials associated with fires could enter freshwater or marine environments, potentially negatively affecting habitat and biota, particularly if permitted to disperse and persist. Fires may also adversely affect air quality and pose risks to human health and safety.

Grieg NL shall take all necessary precautions to prevent fire hazards when working at the site, including, but not limited to, the following:

- Adhering to appropriate permits, including operating permits.
- Storing, handling and disposing of flammable materials and waste appropriately and in accordance with appropriate regulations.
- Smoking in designated areas only.
- Ensuring all fire extinguishers are marked and easily accessible to anyone who may need to use them.

If a fire is encountered, the following protocol shall be followed:

- The individual who discovers the fire shall raise the alarm to alert all on-site personnel.
- Immediately stopping work and controlling all sources of further ignition.
- Personnel trained in fire-fighting and the use of appropriate equipment shall take immediate steps to contain or extinguish the fire.
- Fires shall be reported immediately to the EHS Advisor, Marystown Fire Department, and the nearest Forest Management Unit office for further reporting to the local authorities. The following information shall be provided:
 - name and telephone number
 - time of detection
 - size of fire
 - location of fire
 - weather conditions (rain, sun, wind direction and speed, etc.)
- Follow the appropriate route to the construction site muster station.

Personnel are also referred to Section 7.1, *Fire Emergency Plan (Land-based RAS Hatchery)* of Grieg NL's Emergency Response Plan for fire prevention and response actions.

5.3 Wildlife Encounters

Wildlife encounters pose a potential risk for stress or injury to both the wildlife and site personnel. To reduce the risk to both wildlife and site personnel, the following measures will be implemented:

- Hunting, trapping or fishing by Project personnel is not permitted on site.
- Site and working areas shall be kept clean of food scraps and garbage.
- Wildlife protected disposal containers will be used and will be regularly emptied and transferred to the local landfill.
- No personal pets, domestic or wild, will be allowed on the site.

In addition to the above protection measures, the following protocol will be followed in the event of a wildlife encounter:

- Workers shall not attempt to chase, catch, divert, follow or otherwise harass wildlife by vehicle or on foot.
- Equipment and vehicles shall yield the right-of-way to wildlife.
- Wildlife sightings or encounters shall be reported to the EHS Advisor. All actions in response to nuisance animals shall be the responsibility of Grieg NL.

- If the nest of any bird is encountered during construction activities, work around the nest will be immediately stopped and the EHS Advisor notified.
- Any incidents that result in the displacement or killing of wildlife shall be reported to EHS Advisor, complete with details on the incident and the names (and contact information) of the persons involved, for reporting as required.

5.4 Extreme Weather Events

Extreme weather events, such as severe winter storms, hurricanes or post-tropical storms, can bring strong winds, heavy snow, rain or freezing rain, flooding, high waves or ice. Such events can disrupt unsecured construction materials or equipment, or damage buildings. In anticipation of an extreme weather event, precautionary measures to prevent negative impacts to the environment include:

- Securing loose materials, coverings and containers, including waste containers.
- If applicable, appropriately collecting and disposing/storing product from equipment drip pans or tank dyke pads and ensuring drainage equipment is in good condition and clear of debris, snow or ice.
- Checking that sedimentation control structures are secure and in good working order, and capable of handling anticipated flow.

Immediately following an extreme weather event, all on-site environmental protective measures will be checked. Any required repairs will be completed as soon as conditions allow, before any work occurs utilizing the equipment to be repaired/replaced.

5.5 Discovery of Historic Resources

Historic resource material that is disturbed, destroyed, or improperly removed from the construction site represents a cultural loss of information and history that could otherwise be handled and interpreted in an appropriate manner.

In the unlikely event evidence of an archaeological item/site is discovered during construction activities, the following measures will be taken:

- All work in the immediate area of the discovery shall be stopped until authorized personnel (EHS Advisor) consult with the Provincial Archaeologist and permission has been received to resume work.
- Report the find immediately to the EHS Advisor.
- Mark the site's visible boundaries. Personnel will not move or remove any artifacts or associated material unless advised to do so by the Provincial Archaeology Office.
- Grieg NL will report the find with the following information to the Provincial Archaeology Office, Culture and Heritage Division, Department of Tourism, Culture, and Recreation, St. John's, and comply with the instruction provided:
 - nature of the find;
 - precise descriptive and map location and the time of the find;
 - nature of the activity resulting in the find;

- identity of the person(s) making the find;
- present location of the material and any protective measures initiated for the material and the site; and,
- any extenuating circumstances.

5.6 Discovery of a Species at Risk

The following species at risk (as listed on Schedule 1 of the *Species at Risk Act [SARA]*) may occur within the RAS Hatchery site: Red Crossbill (Endangered), Olive-sided Flycatcher (Threatened), Peregrine Falcon (Special Concern), and Rusty Blackbird (Special Concern). Though unlikely to be found within the RAS Hatchery site, which has already been mostly cleared, these species may occur within the general area.

The construction of the Project may affect Species at Risk and their habitat. Since these species are extremely sensitive to habitat degradation the following measures will be put into place to ensure that the Project does not pose a threat to their population's survival:

- All personnel working on site will adhere to all stipulations set out in the *SARA*, and will be informed that it is illegal to kill, harass, capture or harm any species listed under it; and
- If a Species at Risk, as listed above or otherwise, is discovered, all work in proximity to the location will cease and it will be reported to the EHS Advisor who will then contact ECCC-CWS for further action.

6.0 Legislation, Permits and Authorizations

Grieg NL has identified the various legislation, permits and authorizations to which the company subscribes related to the Project's environmental aspects—see below.

6.1 Legislation

Relevant legislation for the construction of the RAS Hatchery component of the Project includes the following:

- *Transportation of Dangerous Goods Act*
- *Migratory Birds Convention Act*
- *Aquaculture Act*
- *Lands Act*
- *Environmental Protection Act*
- *Urban and Rural Planning Act*
- *Water Resources Act*
- *Occupational Health and Safety Act*
- *Buildings Accessibility Act*
- *Public Safety Act*
- *Fire Prevention Act*
- *Species at Risk Act*
- *Fisheries Act*
- Aquaculture Activities Regulations (AAR)
- Town of Marystown Development Regulations

6.2 Permits and Authorizations

In Canada, the aquaculture industry is regulated and managed by both the federal and provincial governments. Grieg NL is required to adhere to these regulations. The Project must also comply with provincial and municipal regulations related to the construction of the RAS Hatchery. A list of required key permits and approvals is provided in Table 6.1. Grieg NL's civil contractor, Pennecon in a joint-effort with Grieg NL, will house and manage permits and authorizations in dedicated software (i.e., *Intelex*, business intelligence software).

Table 6.1. Anticipated federal, provincial and municipal approvals and permits for the construction phase of the RAS Hatchery.

Permit, License or Regulatory Approval	Activity Requiring Approval	Legislation	Regulatory Agency Responsible	Status
Government of Canada				
As per Transport Canada Regulations ^a	Transportation of explosives	<i>Transportation of Dangerous Goods Act</i>	Transport Canada	In progress
Migratory Bird Permit	Any activities that could cause mortality, disturbance or require relocation of migratory birds	<i>Migratory Birds Convention Act</i>	ECCC-CWS	To be determined
Government of Newfoundland and Labrador				
Aquaculture Licence	Any aquaculture activities	<i>Aquaculture Act</i>	DFLR	In progress
Application for Crown Land Title	Leasing of land for the land-based facility	<i>Lands Act</i>	DFLR	Completed
Certificate of Approval for Construction of Commercial Plant	Construction of the land-based facility	<i>Environmental Protection Act</i>	DMAE	In progress
Development Certificate	Construction and operation of the land-based facility	<i>Urban and Rural Planning Act</i>	DMAE	In progress
Application for Permit Water and Sewage Works	Obtaining/discharging water for use in construction and operation of the land-based facility	<i>Water Resources Act</i>	DMAE	In progress
Permit for Flammable and Combustible Liquid Storage	Storage of flammable and combustible liquids	<i>Environmental Protection Act</i>	DMAE	In progress
As per Occupational Health and Safety Regulations ^a	Blasting at hatchery site	<i>Occupational Health and Safety Act</i>	Service NL	In progress
Notification to Minister of OH&S of start of construction for any project over 30 days duration	Construction of the land-based facility, including blasting	<i>Occupational Health and Safety Act</i>	Service NL	Obtained
Building Accessibility Exemption Registration	Construction of the land-based facility	<i>Buildings Accessibility Act</i>	Service NL	In progress
Fire Commissioners Approval under the National Building / Fire / Life Safety Code	Construction of any buildings		Service NL	In progress
Used Oil Storage Tank System	Storage and Handling of Petroleum Products	<i>Environmental Protection Act and Fire Prevention Act</i>	Service NL	In progress
Electrical Permit	All electrical wiring and infrastructure installation	<i>Public Safety Act</i>	Service NL	To be determined
Certificate of Plant Registration for Power, Heat, Refrigeration, Compressed Gas or Combined Plant	Various project related activities		Service NL	To be determined
Municipal Government				
Construction Permit	Permits must be in place for any development of the land-based facility	Town of Marystown Development Regulations	Marystown Municipal Government	In progress
Compliance with Marystown Municipal Plan	Permits must be in place for any development of the land-based facility	Town of Marystown Development Regulations	Marystown Municipal Government	In progress

Note: ^a The contractor conducting the blasting will be responsible for ensuring these regulations are followed.

7.0 Contact List

Contact lists will be posted in central, visible locations at the RAS Hatchery construction site. The lists will be kept up to date, and all contacts on the lists will be made aware of their expected role(s) during routine and/or emergency situations.

7.1 Emergency Numbers

Contact information that may be utilized during an emergency is provided in Table 7.1.

Table 7.1. Emergency contact phone numbers for the Project.

Title	Number
Emergency Personnel	911
Marystown Ambulance	709-279-2121
Marystown Fire Department	709-279-1333
Burin Peninsula Health Care	709-891-1040
Marystown Police	709-279-3001
Poison Control	1-866-727-1110
Search and Rescue	1-800-563-2444
Canadian Coast Guard	709-772-4423
Marine Pollution	1-800-563-9089
Emergency Response Organization	TBD
Marine Communication and Transport Center, Placentia	709-227-2181
Marine Mammal in Distress	1-888-895-3003
Poaching and Fisheries Violations	1-800-222-8477
Department Fisheries and Land	709-292-4111
Department Fisheries and Oceans	709-772-5202
Invasive Aquatic Species	1-888-435-4040

7.2 Advisory and Other Contact Numbers

Contact information for appropriate Grieg NL and other advisory personnel are provided in Table 7.2. These designated personnel can be reached at any time, in accordance with established communications protocols.

Table 7.2. Advisory and other contact numbers for the Construction of the RAS Hatchery.

Title	Name	Number
Grieg NL General Manager	Knut Skeidsvoll	TBD
Grieg NL Production Manager	Candice Way	TBD
Grieg NL EHS Advisor	Nicholas Rose	TBD
EHS Project Consultant	Gerry Sullivan	TBD
Owner Representative	Craig Moore	TBD
Site Security and Emergency Services	Cyril Drowns	TBD
Contractor Project Manager	TBD	TBD
Contractor EHS Coordinator	TBD	TBD

8.0 Resource Material

Information documents relevant to the Project were included as appendices to the EIS. Copies of the EIS and associated documents can be found at Grieg NL's office in Marystown and at public libraries in Marystown (as well as Corner Brook and St. John's).

8.1 Key Reference Material

Environmental documents previously completed for the Project and relevant to the RAS Hatchery are listed in Table 8.1. Personnel are also referred to further documentation included as appendices to and referenced throughout this EPP.

Table 8.1. Key Project reference material relevant to environmental protection measures, for construction of the RAS Hatchery. Material was provided as appendices to the Project EIS (LGL Limited 2018).

Document Name and Author	Summary	Release Date
Emergency Response Plan Grieg NL	Details the emergency procedures to be implemented in response to any situation that may endanger the safety and/or health of people; the environment; property and/or equipment.	May 2018
Spill Management Plan: Land and Water Grieg NL	Details the emergency procedures to be implemented in response to a spill that may endanger the safety and/or health of people; the environment; property and/or equipment.	May 2018
Waste Management Plan Grieg NL	Details the procedures to be implemented to manage waste associated with the Project including waste generated during construction of the RAS Hatchery.	May 2018
The Cultural, Recreational and Commercial Importance of the Waters of Placentia Bay Component Study Grattan et al. 2018	Provides a detailed description of the cultural, recreational and commercial usage of Placentia Bay. It focuses on fisheries, tourism, recreational activities, marine navigation, and culturally and ecologically important areas. The study also includes mitigation measures that will be undertaken to protect these uses and areas from the potential effects of the Project, as well as follow-up monitoring.	May 2018
Wild Atlantic Salmon Component Study LGL Limited 2018	Provides a review of wild Atlantic salmon with a focus on the salmon that occur in Placentia Bay. It also reviews the potential genetic and ecological interactions between wild and farmed salmon and the mitigation measures and follow-up monitoring intended to minimize the potential effects of Grieg NL's Project.	May 2018
Fish and Fish Habitat Component Study LGL Limited 2018	Provides a review of the existing fish and fish habitat in Placentia Bay with focus on the sea cage sites, the mitigation measures intended to minimize the potential effects of the proposed Project on fish and fish habitat, and the follow-up monitoring intended to validate the effects conclusions in the EIS.	May 2018
Sustainability Report 2017 Grieg Seafood	Defines Grieg's five essential principles for sustainable food production in the ocean and introduces a greenhouse gas account which maps emissions from Grieg Seafood as an organization.	April 2018
Bird Survey – Bird Nest Search of the Marystown RAS Hatchery Site LGL Ltd.	Reports on a search conducted for active bird nests at an area designated for clearing as part of the development of the RAS Hatchery.	July 2017

9.0 Literature Cited

LGL Limited. 2018. Environmental Impact Statement of the Placentia Bay Atlantic Salmon Aquaculture Project. LGL Rep. FA0144. Rep. by LGL Limited, St. John's, NL for Grieg NL, Marystown, NL. 528 p. + appendices.

Appendix A

Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters

Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters

D.G. Wright and G.E. Hopky

Science Directorate
Central and Arctic Region
Department of Fisheries and Oceans
Winnipeg, Manitoba R3T 2N6

and

Habitat Management & Environmental Science Directorate
Department of Fisheries and Oceans
Ottawa, Ontario K1A 0E6

1998

**Canadian Technical Report of
Fisheries and Aquatic Sciences 2107**

Canadian Technical Report of
Fisheries and Aquatic Sciences 2107

1998

**GUIDELINES FOR THE USE OF EXPLOSIVES IN OR NEAR
CANADIAN FISHERIES WATERS**

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ABSTRACT

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

The federal *Fisheries Act* includes provisions for the protection of fish, shellfish, crustaceans, marine mammals and their habitats. The detonation of explosives in or adjacent to fish habitat has been demonstrated to cause disturbance, injury and/or death to fish and marine mammals, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation.

Within the context of the guidelines and procedures outlined in this report, an explosive is defined as a chemical compound which, when detonated, creates a compressional wave having an almost instantaneous rise time to a very high peak pressure followed by a decay to below ambient pressure by either rapid oxidation or the breaking of high-energy chemical bonds.

The purpose of this report is to provide information to proponents who are proposing works or undertakings that involve the use of confined or unconfined explosives in or near Canadian fisheries waters, and to which the *Fisheries Act*, Sections 32 and 35 in particular, may apply. Guidelines are provided on methods and practices for the conservation and protection of fish, marine mammals, and fish habitat from impacts arising from the destructive forces of explosives. The report describes the suggested application and review procedures and processes for proponents whose use of explosives may result in the destruction of fish, or the harmful alteration, disruption or destruction of fish habitat.

RÉSUMÉ ANALYTIQUE

Wright, D.G. et G.E. Hopky. *Lignes directrices concernant l'utilisation d'explosifs à l'intérieur ou à proximité des eaux de pêche canadiennes*, rapport technique canadien des sciences halieutiques et aquatiques 2107, 1998, iv + 34 p.

La *Loi sur les pêches* fédérale renferme des dispositions relatives à la protection du poisson, des mollusques, des crustacés, des mammifères marins et de leur habitat. Il a été prouvé que la détonation d'explosifs dans l'habitat du poisson ou à proximité perturbe, blesse ou tue des poissons et des mammifères marins ou encore entraîne la détérioration, la destruction ou la perturbation de leur habitat. Il arrive parfois que les dommages se fassent sentir à une distance considérable du point de détonation.

Aux fins des lignes directrices et des procédures énoncées dans le présent rapport, on entend par explosif un composé chimique qui, lorsqu'il explose, crée une vague de compression entraînant presque instantanément un pic de pression extrêmement élevé suivi d'une décroissance sous la pression ambiante soit par oxydation rapide ou par la rupture des liaisons chimiques à haute énergie.

Le présent rapport a pour but de fournir de l'information aux promoteurs qui proposent des ouvrages ou des entreprises nécessitant l'utilisation d'explosifs confinés ou non confinés à l'intérieur ou à proximité des eaux de pêche canadiennes et auxquels la *Loi sur les pêches*, plus précisément les articles 32 et 35, pourraient s'appliquer. Il renferme des lignes directrices concernant les méthodes et pratiques de conservation et de protection du poisson, des mammifères marins et de leur habitat contre les effets découlant de la force destructrice des explosifs. On y décrit les procédures de présentation des demandes et d'examen pour les promoteurs qui prévoient l'utilisation d'explosifs de nature à entraîner la destruction du poisson ou la détérioration, la perturbation ou la destruction de son habitat.

SCOPE AND RATIONALE

The federal *Fisheries Act* includes provisions for the protection of fish, shellfish, crustaceans, marine mammals and their habitats. The detonation of explosives in or adjacent to fish habitat has been demonstrated to cause disturbance, injury and/or death to fish and marine mammals, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation. Therefore, the Department of Fisheries and Oceans (DFO) has prepared this document to provide information to proponents on the conservation and protection of fish, marine mammals, and their habitat from impacts arising from the use of confined or unconfined explosives in or near Canadian fisheries waters. The guidelines, and application and review procedures and processes outlined in this document apply in the context of the legislative and policy framework summarized below.

APPLICABLE LEGISLATION AND POLICY

Fisheries Act

A number of sections of the *Fisheries Act* and its attendant regulations are applicable to the conservation and protection of fish and fish habitat from the destructive forces of explosives.

- Section 2 defines “Canadian fisheries waters” as meaning all waters in the fishing zones of Canada, all waters in the territorial sea of Canada and all internal waters of Canada.
- Section 2 defines “fish” as including shellfish, crustaceans, marine animals and the eggs, sperm, spawn, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.
- Section 32 prohibits the destruction of fish by any means other than fishing, except as authorized by the Minister of Fisheries and Oceans or under regulations made by the Governor in Council under the *Fisheries Act*.
- Subsection 34(1) defines “fish habitat” as meaning spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.
- Subsection 35(1) prohibits any person from carrying on any work or undertaking that results in the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat.
- Subsection 35(2) provides for the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister of Fisheries and Oceans or under regulations made by the Governor in Council under the *Fisheries Act*.

- Subsection 36(3) prohibits the deposit of a deleterious substance into waters frequented by fish, unless otherwise permitted by regulation.
- Subsection 58(1) of the *Fishery (General) Regulations* provides for anyone proposing to carry on any work or undertaking likely to result in the HADD of fish habitat, to apply to have the means or conditions of that work or undertaking authorized by the Minister under Subsection 35(2) of the *Fisheries Act*, using the form set out in Schedule VI. Schedule VI includes a section for the applicant to provide details on the proposed use of explosives.
- Subsection 58(2) of the *Fishery (General) Regulations* provides the means for the Department of Fisheries and Oceans to issue Authorizations under Subsection 35(2) of the *Fisheries Act*, using the form set out in Schedule VII.
- Section 7 of the *Marine Mammal Regulations* prohibits disturbance of marine mammals except when fishing for them.

In addition, the Department of Fisheries and Oceans has developed a policy framework to assist in the interpretation and application of the applicable legislation. The most relevant documents are as follows:

- The **Policy for the Management of Fish Habitat** (1986) provides policy direction for interpreting the broad powers mandated in the *Fisheries Act* in a way that is consistent with the concept of sustainable development. To achieve the Policy's goal of fish habitat conservation when reviewing project proposals with the potential to affect fish habitat, DFO's habitat managers apply the No Net Loss (NNL) guiding principle. Under this principle, the Department strives to maintain the existing productive capacity of fish habitats, such that the fish habitat is able to sustain the production of fish suitable for fisheries purposes.

In summary, in order to meet the NNL guiding principle, the habitat manager's first preference is to avoid or reduce the project's potential for a HADD of fish habitat through the application of appropriate mitigation measures. Avoidance measures, such as project relocation or redesign, can be effectively applied at the project design stage. Failing that, impacts may be further reduced by application of specific mitigation measures, such as use of timing windows during the construction phase. If a HADD is still expected to occur, unavoidable - i.e. residual - losses in habitat productive capacity may be compensated on a case-by-case basis if the manager concludes that compensation is acceptable and feasible.

- The **Directive on the Issuance of Subsection 35(2) Authorizations** (1995) clarifies the circumstances when an Authorization under Subsection 35(2) may be issued, and on providing proponents with letters of advice suggesting means of avoiding HADD of fish habitat.

- The **Habitat Conservation and Protection Guidelines** (1998) is a document for use by DFO's staff in administering the habitat provisions of the *Fisheries Act*. It outlines a standard approach to habitat conservation and protection through the application of the NNL guiding principle.

Canadian Environmental Assessment Act

A decision to issue an Authorization under Section 32 or Subsection 35(2) of the *Fisheries Act* triggers an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA).

IMPACTS

The use of explosives may result in a number of adverse impacts on fish and marine mammals, and their habitats.

Effects on Fish

The detonation of explosives in or near water produces post-detonation compressive shock waves characterized by a rapid rise to a high peak pressure followed by a rapid decay to below ambient hydrostatic pressure. The latter pressure deficit causes most impacts on fish.

The primary site of damage in finfish is the swimbladder, the gas-filled organ that permits most pelagic fish to maintain neutral buoyancy. The kidney, liver, spleen, and sinus venous also may rupture and haemorrhage. Fish eggs and larvae also may be killed or damaged (Wright 1982).

Studies (Wright 1982) show that an overpressure in excess of 100 kPa will result in these effects. The degree of damage is related to type of explosive, size and pattern of the charge(s), method of detonation, distance from the point of detonation, water depth, and species, size and life stage of fish.

Vibrations from the detonation of explosives may cause damage to incubating eggs (Wright 1982, Wright in prep.). Sublethal effects, such as changes in behaviour of fish, have been observed on several occasions as a result of noise produced by explosives. The effects may be intensified in the presence of ice and in areas of hard substrate (Wright 1982, Wright in prep.).

The detonation of explosives may be lethal to marine mammals and may cause auditory damage under certain conditions. The detonation of explosives in the proximity of marine mammals also has been demonstrated to induce changes in behaviour (Wright in prep.).

The number of shellfish and crustaceans killed by the detonation of explosives is believed to be negligible, however, few data are available. Sublethal effects of explosives on

shellfish and crustaceans including behavioural modifications are little known or understood (Wright 1982, Wright in prep.).

Effects on Fish Habitat

The use of explosives in and near fish habitat may also result in the physical and/or chemical alteration of that habitat. For example, sedimentation resulting from the use of explosives may cover spawning areas or may reduce or eliminate bottom-dwelling life forms that fish use for food. By-products from the detonation of explosives may include ammonia or similar compounds and may be toxic to fish and other aquatic biota (Wright in prep.).

GUIDELINES, AND APPLICATION AND REVIEW PROCESSES

The following sections have been prepared to guide proponents proposing works or undertakings that involve the use of confined or unconfined explosives in or near Canadian fisheries waters, and to which the *Fisheries Act*, Sections 32 and 35 in particular, may apply. Confined explosives are those that would be used within a substrate, including ice, while unconfined explosives are those that would be used in open water, or not within a substrate.

Note that the information and guidance provided in these sections pertains to the conservation and protection of fish and fish habitat in the context of the *Fisheries Act*, and to the CEAA requirements that may result. There is no intent to relieve the proponent of responsibilities under any other federal, provincial or municipal legislation. Proponents are encouraged to contact other appropriate regulatory agencies to ensure that the proposed work or undertaking is carried out according to their requirements.

GUIDELINES

This section provides guidelines on methods and practices which, if incorporated into a project proposal, are intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives. Implementation of these measures, for this purpose, is at the discretion of the proponent. Use of these guidelines should not be taken to imply approval of the proposed project in accordance with the *Fisheries Act*. Note that should the proponent proceed with the project and the use of explosives results in the destruction of fish and/or the HADD of fish habitat as a result of a change in plans, or failure to implement the measures, contravention of Section 32 and/or Subsection 35(1) of the *Fisheries Act* could occur.

1. Proponents considering the use of explosives are encouraged to consult the appropriate DFO Regional/Area authorities (Appendix I) as early as possible in their planning process to identify possible alternatives to the use of explosives, the biological resources and their habitats at risk, and/or effective mitigation measures.

2. Where provincial or territorial resource management agencies, or aboriginal resource management boards undertake the administration of fisheries, the proponent is encouraged to consult with the relevant authorities.
3. The use of confined or, in particular, unconfined explosives in or near Canadian fisheries waters is discouraged, and proponents are encouraged to utilize other potentially less destructive methods wherever possible.
4. No use of ammonium nitrate-fuel oil mixtures occurs in or near water due to the production of toxic by-products (ammonia).

Note:

- The deposit of deleterious substances into waters frequented by fish is prohibited under Section 36(3) of the *Fisheries Act*, unless otherwise permitted by regulation. There is no regulation pursuant to the *Fisheries Act* that permits the deposit of by-products resulting from the use of ammonium nitrate-fuel oil mixtures.
5. After loading a charge in a hole, the hole is to be back-filled (stemmed) with angular gravel to the level of the substrate/water interface or the hole collapsed to confine the force of the explosion to the formation being fractured. The angular gravel is to have a particle size of approximately 1/12th the diameter of the borehole.
 6. All "shock-tubes" and detonation wires are to be recovered and removed after each blast.
 7. No explosive is to be knowingly detonated within 500 m of any marine mammal (or no visual contact from an observer using 7x35-power binocular).

Note:

- Upon review of a proposal, the DFO Regional/Area authority may impose a greater avoidance distance, depending on the size of the charge or other project specific or fishery resource conditions.
8. No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa (14.5 psi) in the swimbladder of a fish.

Notes:

- For confined explosives, setback distances from the land-water interface (e.g., the shoreline), or burial depths from fish habitat (e.g., from under the riverbed) that will ensure that explosive charges meet the 100 kPa overpressure

guideline are shown in Table 1. Equations to derive these relationships have been adapted from Nicholls et al. (1971) and Anon (1980). The equations are described in Appendix II, and should be used for weights of explosives not covered in Table 1. Sample calculations and examples are illustrated in Appendix III.

- If a confined explosive is to be detonated close to the substrate-water interface (such as in trenching or demolition), the set-back distance closely approximates the theoretical lethal range within which 50% of the fish may be killed or injured. Consequently, the 100 kPa guideline is not likely to be met in those situations where, because of the design constraint's of the project, it is also likely not possible or practical to 'adjust' the setback distance as a means to meet the 100 kPa guideline. For example, preparation of a trench for a pipeline crossing typically requires no more than a below grade burial depth of about 2m. Therefore, the weight of explosive charge per delay will have to be adjusted in an effort to meet the 100 kPa guideline. A sample calculation to illustrate a trenching example is given in Appendix III.
 - For unconfined explosives, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) for further guidance.
9. No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than $13 \text{ mm}\cdot\text{s}^{-1}$ in a spawning bed during the period of egg incubation.

Note:

- For confined explosives, setback distances or burial depths from spawning beds that will ensure that explosive charges meet the $13 \text{ mm}\cdot\text{s}^{-1}$ guideline criteria are shown in Table 2. Equations to derive these relationships have been adapted from Nicholls et al. (1971) and Anon (1980) and are described in Appendix II. Sample calculations and examples are illustrated in Appendix III.
- For unconfined explosives, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) for further guidance.

APPLICATION AND REVIEW PROCESSES

Proponents planning to use an explosive that is likely to destroy fish and/or cause a HADD of fish habitat are subject to certain legal obligations under the *Fisheries Act*, as identified in the preceding 'Applicable Legislation and Policy' section. This section discusses these obligations with respect to the proposed use of explosives, and suggests to proponents how to fulfil them.

Proponents should contact the DFO Regional/Area authorities (Appendix I) as early as possible in their planning process. The purpose is to find out whether the proposed use of

explosives is likely to affect a Canadian fisheries water and whether its use is likely to destroy fish and/or cause a HADD of fish habitat. Depending on the outcome, DFO may also discuss potential issues, specific information requirements, or the next steps and possible outcomes in a further review of the proposal. For example, as summarized in the subsequent 'Review and Decision-making Process' section, possible next steps could include a request for further information, or a recommendation that the proponent seek an authorization pursuant to Section 32 and/or Subsection 35(2). Possible outcomes may include the provision of written advice, the issuance of (an) authorization(s) subject to completion of a CEEA review, or, refusal to issue (an) authorization(s).

Proponents should contact DFO before irrevocable commitments (such as contracts for equipment/services) are made, in order to avoid any unnecessary delays in the application and review process. Note that DFO may become aware of your proposed project through its participation in co-operative arrangements with other governments, agencies, boards, etc.

The following 'Application Procedures' section provides information to assist the proponent in deciding if it should seek Authorization to destroy fish by means other than fishing, and/or Authorization to harmfully alter, disrupt or destroy fish habitat, through the use of explosives and, if so, provides information on procedures for filing, etc.

Note that application for Authorization under Section 32 and/or Subsection 35(2) is voluntary. Proponents are not prohibited from going ahead with their use of explosives without Authorization. But, if as a result of the use of explosives, fish are destroyed and/or there is a HADD of fish habitat, contravention of Section 32 and/or Subsection 35(1) of the *Fisheries Act* could occur and the proponent is liable to prosecution.

Application Procedures

1. Proponents unable to meet the overpressure or peak particle velocity guideline values identified, respectively, in measures 8 or 9 of the preceding 'Guidelines' section, should complete and submit an application for Authorization under Section 32 of the *Fisheries Act*, to destroy fish by means other than fishing. The recommended application form is shown in Appendix IV. However, the proponent should contact the appropriate DFO Regional/Area authority (Appendix I) to verify that this is the appropriate application form to use and/or to identify information requirements.
2. Proponents who wish to file for Authorization under Subsection 35(2) of the *Fisheries Act* should complete and submit a separate application in accordance with the form prescribed pursuant to Subsection 58(1) of the *Fishery (General) Regulations* (Appendix V). Assistance on filing the application form, and related procedures, may be obtained by contacting the appropriate DFO Regional/Area authorities (Appendix I).

3. Proponents seeking Authorization under both Section 32 and Subsection 35(2) should complete and submit both Section 32 (Appendix IV) and Subsection 35(2) (Appendix V) applications. However, to minimize duplication, the proponent may choose to cross-reference those sections that are the same in each application form, and is expected to only submit one set of the documents requested in the forms, unless otherwise requested by the DFO Regional/Area authority. Contact the appropriate DFO Regional/Area authorities (Appendix I) for further information and assistance.
4. In seeking Authorization, the proponent will be expected to provide the information requested in the application forms. Doing so will expedite the review process.

In general, the proponent is expected to provide all plans, specifications, studies, procedures, samples or other information required to permit an assessment of the potential impact of the proposed use of explosives on fish and fish habitat, and the mitigation and/or compensation measures proposed to alleviate impacts and/or to compensate for any loss of productive capacity of habitat to produce fish. Typically, the fish and/or fish habitat information requirements include, but may not necessarily be limited to the items summarized below:

- a) A description of the project and the expected effects resulting from the use of explosives on the fisheries resources (including marine mammals) and/or fish habitat, including:
 - i) A description of fish and marine mammal species and their habitats likely to be affected by the detonation;
 - ii) A description of whether the fish, marine mammals and their habitats contribute, or have the potential to contribute, directly or indirectly, to a fishery - subsistence, commercial or recreational;
 - iii) The timing of any seasonal migration of fish and marine mammals;
 - iv) The theoretical lethal range (i.e., the range, or distance, over which the overpressure exceeds 100 kPa) of the explosives to be used (from equations provided in Appendix II);
 - v) An assessment of potential impacts arising from the proposed use of explosives and a description of proposed mitigation and/or compensation measures; and
 - vi) Other matters, such as the proposed contingency plan and monitoring and follow-up program.
- b) The proponent's mitigation plan should include discussion of the following measures that are particularly relevant to alleviating the potential impacts of explosives:
 - i) The work or undertaking should be undertaken at the time of least biological activity or biological sensitivity. Proponents should consult with DFO Regional/Area authorities to determine the appropriate timing;

- ii) If multiple charges are required, time-delay detonation initiators (blasting caps) should be used to reduce the overall detonation to a series of discrete explosions. Time delays for discrete explosions should be greater than 25 ms; and,
- iii) If possible, large charges should be subdivided into a series of smaller discrete detonations or explosions using time-delay detonation initiators (a procedure known as decking) to reduce the overall detonation to a series of smaller discrete detonations or explosions.

In addition to these measures, the proponent should also consider additional mitigation measures including, but not limited to the following:

- iv) Deployment of bubble curtains/air curtains to disrupt the shock wave;
 - v) Deployment of noise generating devices, such as an air compressor discharge line, to scare fish away from the site; or,
 - vi) Removal or exclusion of fish from the work area before the blast occurs.
5. Proponents should be aware that subsequent to filing the application, DFO may request additional information concerning fish and fish habitat, the mitigation and/or compensation plans, the contingency and monitoring and follow-up programs, and other matters as required to complete the *Fisheries Act* review. If the appropriate information is not already available, it is the proponent's responsibility to provide it and, also, to assure DFO that the proposed mitigation and/or compensation measures will be effective. Should it be necessary to conduct an environmental assessment of the project pursuant to the CEEA, then additional information will be required in order to meet the requirements of the CEEA.
 6. The Department of Fisheries and Oceans will undertake to: respond to requests for review, or to referrals, of project proposals or activities; issue Authorizations or provide advice; and/or complete environmental assessments in a manner consistent with Departmental service standards. Generally, DFO will respond to requests for review or to referrals within 30 working days of notification. Timeframes required for the issuance of Authorizations or advice will be discussed with proponents. Proponents should be aware that the length of time required to complete a review can vary greatly, often depending on the type and complexity of project proposed, the fish and fish habitat issues involved, and whether or not an environmental assessment under the CEEA is required. Once again, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) to discuss these issues.
 7. If an unforeseen need to use explosives arises, Departmental service standards may be waived and a review completed as expeditiously as possible so as not to unduly delay a project. Further, Departmental service standards are waived in the event of an emergency where lives and/or property are threatened. In such cases, the amount of information required may be reduced due to the urgency of the

situation. Any verbal request for an emergency Authorization will be accepted only on the condition that it is followed by a written confirmation of the project details.

8. If applicable, proponents may be required by the Department of Fisheries and Oceans, Canadian Coast Guard, to issue a "Notice to Mariners" and/or a "Notice to Fishers". The appropriate DFO Area/Regional authorities (Appendix I) are prepared to assist the proponent with contacting the Canadian Coast Guard.
9. Resource management agencies of other governments, departments, or boards that have been established under some aboriginal land claim settlements, may have aquatic resource review requirements and service standards that are different than those described in this document. Proponents should contact those agencies to ensure compliance with any requirements they may have.

Review and Decision-making Process

This section summarizes the approach taken by the Department of Fisheries and Oceans in the review of referrals and of applications for Authorization. Included is a description of the key decisions possible from a review, and the criteria used in making decisions. There is also a brief summary of the linkage between Section 32 and/or Subsection 35(2) Authorizations and the responsibilities of the Department of Fisheries and Oceans to undertake environmental assessments pursuant to the *Canadian Environmental Assessment Act* (CEAA).

Fisheries Act

DFO will review the proponent's application in accordance with the *Fisheries Act* and its supporting policy framework, including this document. Upon receipt of information, notice, a referral, or application for Authorization concerning works or undertakings where the use of explosives is proposed, DFO will normally take the following steps in its review of the proposal:

1. Determine the adequacy of the information provided by the proponent.
2. Using the information provided, assess the extent of risk or potential damage to fish and marine mammals and/or fish habitat and the acceptability of this level of damage in context with the level of protection required.
3. Determine the probable success of proposed mitigation and/or compensation measures and, as appropriate the acceptability of any residual impacts.
4. Where relevant, consult with the appropriate provincial or territorial resource management agencies, and/or aboriginal resource management boards.
5. Note that prior to finalizing its review of the proposal DFO may, among other matters, advise the proponent of the need for more information, re-assess a revised project proposal, suggest that the proponent seek authorization, etc. The

review of a proposal is often an iterative process depending on a number of factors, such as the type of referral received by DFO, its completeness, its potential impacts on fish and/or fish habitat and the potential to mitigate and/or compensate for such impacts. Proponents should discuss this and related aspects of the review process with the relevant DFO/Regional area authority (Appendix I).

6. After examination of the proposal, DFO will make a decision regarding the proponent's application.

- **With respect to Section 32, DFO will either,**

⇒ upon determining that implementation of mitigation measures by the proponent is expected to prevent or avoid the destruction of fish, advise the proponent by letter that if such measures are incorporated into the project, Section 32 is not expected to be contravened. A letter of advice should not be taken to imply approval of the project pursuant to the habitat provisions of the *Fisheries Act*, or any other legislation. Note, if the destruction of fish occurs as a result of a change in the plans for the proposed project, or failure to implement the measures identified in the letter of advice, contravention of Section 32 of the *Fisheries Act* could occur.

OR

⇒ upon determining that even with the implementation of mitigation measures the destruction of fish is still expected to occur **and**, because this mortality is acceptable within the context of the fisheries resource, issue a Section 32 Authorization using a letter format.

OR

⇒ upon determining that even with the implementation of mitigation measures the destruction of fish is still expected to occur **but**, because this mortality is not acceptable within the context of the fisheries resource, reject the proposal, and notify the proponent that DFO will not issue a Section 32 Authorization and that a contravention of the *Fisheries Act* could occur should the proponent still choose to proceed as proposed.

- **With respect to Section 35, DFO will either,**

⇒ upon determining that implementation of mitigation measures by the proponent is expected to prevent or avoid a HADD of fish habitat, advise the proponent by letter that if such measures are incorporated into the project, Subsection 35(1) is not expected to be contravened. A letter of advice should not be taken to imply approval of the project pursuant to the habitat provisions of the *Fisheries Act*, or any other legislation. Note, if a

HADD of fish habitat occurs as a result of a change in the plans for the proposed project, or failure to implement the measures identified in the letter of advice, contravention of Subsection 35(1) of the *Fisheries Act* could occur.

OR

⇒ upon determining that even with the implementation of mitigation measures a HADD of fish habitat is still expected to occur **and**, because the proposed compensation for the unavoidable net loss of productive capacity of fish habitat is acceptable to DFO, issue a Subsection 35(2) authorization using the form provided in Schedule VII of Subsection 58(2) of the *Fishery (General) Regulations*.

OR

⇒ upon determining that even with the implementation of mitigation measures a HADD of fish habitat is still expected to occur **but**, because the proposed compensation for the unavoidable net loss of fish habitat productive capacity is not acceptable, reject the proposal, and notify the proponent that DFO will not issue a Subsection 35(2) Authorization and that a violation of the *Fisheries Act* could occur should the proponent still choose to proceed as proposed.

Notes:

- The Department of Fisheries and Oceans, in arriving at one of the above noted determinations, will also consider the following criteria:
 - Whether the use of explosives is the only technically feasible means by which to attain the desired objective; and
 - Whether the use of explosives is required to alleviate an emergency situation threatening human safety and/or property.
- Section 32 and/or Subsection 35(2) authorizations come with conditions attached, which among others may include:
 - The proponent may be required to develop, undertake and report on a monitoring program at its expense, typically, to monitor compliance and evaluate effectiveness of the mitigation and/or compensation measures.
 - If, during the course of the works or undertakings, the adverse effects of the explosives were significantly greater than anticipated, the proponent may be required to immediately cease all further use of explosives,

pending review of the situation with Department of Fisheries and Oceans personnel.

- Additional, site-specific terms and conditions as may be required in order to satisfy fishery resource and/or fish habitat protection requirements. For example, the conditions may be more stringent than the measures identified in the preceding 'Guidelines' section.

Canadian Environmental Assessment Act

Section 32 and Subsection 35(2) are included in the *Law List Regulation* of the *Canadian Environmental Assessment Act* (CEAA). Consequently, the Department of Fisheries and Oceans as the Responsible Authority must conduct an environmental assessment of the relevant proposed works or undertakings before an Authorization can be issued. If the result of the environmental assessment is that the work or undertaking will, after taking into account the appropriate measures, not likely result in significant impact that cannot be justified, then authorization(s) will normally be issued pursuant to Section 32 and/or Subsection 35(2) of the *Fisheries Act*. Procedures for coordinating the CEAA review with provincial and aboriginal government review processes vary. Proponents are strongly advised to contact the DFO Regional/Area authorities (Appendix I) to obtain additional information on environmental assessment procedures and requirements.

UPDATING

These guidelines will be reviewed and updated as necessary.

ACKNOWLEDGEMENTS

Many individuals and governmental and non-governmental organizations were consulted in the development of these guidelines. We gratefully acknowledge their interest and contributions. In particular, input from D. Haché, K. Fisher, K. Broughton and R. Drolet, from DFO, and L. Macanuf (Golder-VME) and R. Morin (Explotec Engineering Ltd) is appreciated.

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Table 1. Setback distance (m) from centre of detonation of a confined explosive to fish habitat to achieve 100 kPa guideline criteria for various substrates.

The data in this table is incorrect and should not be used.

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	1	2	5	10	25	50	100
Rock	3.6	5.0	7.1	11.0	15.9	25.0	35.6	50.3
Frozen Soil	2.3	3.2	4.5	7.2	14.3	16	22.6	32
Ice	1.5	2.1	3.0	4.7	6.6	10.5	14.8	21
Saturated Soil	1.5	2.1	3.0	4.8	6.7	10.0	15.1	21.3
Unsaturated Soil	0.7	1.0	1.4	2.2	3.1	4.9	6.9	9.8

Erratum:

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

Page 15: Table 1 should be replaced by the following Table:

Table 1. Setback distance (m) from centre of detonation of a confined explosive to fish habitat to achieve 100 kPa guideline criteria for various substrates.

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	1	2	5	10	25	50	100
Rock	3.6	5.0	7.1	11.0	15.9	25.0	35.6	50.3
Frozen Soil	3.3	4.7	6.5	10.4	14.7	23.2	32.9	46.5
Ice	3.0	4.2	5.9	9.3	3.2	20.9	29.5	41.8
Saturated Soil	3.0	4.2	5.9	9.3	13.2	20.9	29.5	41.8
Unsaturated Soil	2.0	2.9	4.1	6.5	9.2	14.5	20.5	29.0

Table 2. Setback distance (m) from centre of detonation of a confined explosive to spawning habitat to achieve $13 \text{ mm} \cdot \text{sec}^{-1}$ guideline criteria for all types of substrate.

	Weight of Explosive Charge (kg)						
	0.5	1	5	10	25	50	100
Setback distance (m)	10.7	15.1	33.7	47.8	75.5	106.7	150.9

Appendix I DFO Regional/Area Authorities

Newfoundland Region

Habitat Evaluation Engineer,
Habitat Management Division
Fisheries and Habitat Management Branch
PO Box 5667
St. John's, NF A1C 5X1
Voice: (709) 772-6157
Fax: (709) 772-4525

Maritime Region

New Brunswick and Prince Edward Island

Denis Haché, P. Eng.
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Nova Scotia

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Laurentian Region

Manager, Fish Habitat
Fish Habitat and Environmental Science
Maurice-Lamontagne Institute
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Central and Arctic Region

Ontario

Area Manager, Ontario Area
Fisheries Management Branch
PO Box 5050, 867 Lakeshore Road
Burlington, ON L7R 4A6
Voice: (905) 336-4567
Fax: (905) 336-6437

Manitoba, Saskatchewan and Alberta

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Fisheries Science Branch
501 University Crescent
Winnipeg, MB R3T 2N6
Voice: (204) 983-5164
Fax: (204) 984-2402

Appendix I (concluded)
DFO Regional/Area Authorities

Central and Arctic Region (continued)

Nunavut

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 Fisheries Management Branch
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 Iqaluit, NWT X0A 0H0
 Voice: (867) 979-8002
 Fax: (867) 979-8039

Western Arctic

Area Manager, NWT West Area
 Fisheries Management Branch
 PO Box 2310
 Yellowknife, NWT X1A 2P7
 Voice: (867) 920-6636
 Fax: (867) 873-8871

Pacific Region

North Coast

Chief,
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South Coast

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Fraser River

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 Fax: (604) 666-6627

Yukon

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Northeastern and Southeastern B.C.

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Appendix II
General Equations to Determine Setback Distance for Confined
Explosives to Meet Guideline Criteria of 100 kPa

Equation (A)

Equation (A) describes the transfer of shock pressure from the substrate to the water.

$$P_W = \frac{2(Z_W / Z_R)P_R}{1 + (Z_W / Z_R)}$$

where:

P_W	=	pressure (kPa) in water
P_R	=	pressure (kPa) in substrate
Z_W	=	acoustic impedance of water
Z_R	=	acoustic impedance of substrate

Equation (B)

Equation (B) describes the relationship between acoustic impedance and the density and velocity of the medium through which the compressional wave travels.

$$Z_W/Z_R = \frac{D_W C_W}{D_R C_R}$$

where:

D_W	=	density of water = 1 g•cm ⁻³
D_R	=	density of the substrate in g•cm ⁻³
C_W	=	compressional wave velocity in water
	=	146,300 cm•s ⁻¹
C_R	=	compressional wave velocity in substrate
	=	in cm•s ⁻¹

Appendix II (concluded)
General Equations to Determine Setback Distance for Confined
Explosives to Meet Guideline Criteria of 100 kPa

Equation (B) (continued):

The following values are used for D_R and C_R for various substrates:

Substrate	D_R ($\text{g}\cdot\text{cm}^{-3}$)	C_R ($\text{cm}\cdot\text{s}^{-1}$)
Rock	2.64	457,200
Frozen Soil	1.92	304,800
Ice	0.98	304,800
Saturated soil	2.08	146,300
Unsaturated soil	1.92	45,700

Equation (C)

Equation (C) describes the relationship between the peak particle velocity (V_R) and the pressure, density and compressional wave velocity in the substrate.

$$V_R = \frac{2P_R}{D_R C_R}$$

Equation (D)

Equation (D) represents the scaled distance relationship and is used to equate the peak particle velocity to charge weight and distance.

$$V_R = 100 (R/W^{.5})^{-1.6}$$

where:

V_R	=	peak particle velocity in $\text{cm}\cdot\text{s}^{-1}$
R	=	distance to the detonation point in m
W	=	charge weight per delay in kg

Appendix III
Sample Calculations and Examples for Confined Explosives

SAMPLE CALCULATIONS

Sample Calculation 1: Calculation of Setback Distance Required for a 100 kg Charge Set in Rock to Meet the 100 kPa Guideline.

1. From Equation (B):

$$\begin{aligned} Z_W/Z_R &= \frac{D_W C_W}{D_R C_R} \\ &= \frac{(1\text{g}\cdot\text{cm}^{-3})(146,300\text{cm}\cdot\text{s}^{-1})}{(2.64\text{g}\cdot\text{cm}^{-3})(457,200\text{cm}\cdot\text{s}^{-1})} \\ &= 0.1212 \end{aligned}$$

2. From Equation (A):

$$P_W = \frac{2(Z_W / Z_R)P_R}{1+(Z_W / Z_R)}$$

$$P_W = \frac{2(0.1212)P_R}{1+(0.1212)}$$

$$P_W = 0.22 P_R$$

3. To limit P_W to 100 kPa ($\text{kg}\cdot\text{m}\cdot\text{s}^{-2}\cdot\text{m}^{-2}$):

$$P_R = \frac{P_W}{0.22}$$

$$P_R = \frac{100 \text{ kPa}}{0.22}$$

$$P_R = 455 \text{ kPa}$$

$$P_R = 4.55 \times 10^2 \text{ kPa}$$

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

4. Convert kPa to dynes ($\text{g}\cdot\text{cm}\cdot\text{s}^{-2}$):

$$\text{dynes} = \text{kPa} \times 10^4$$

$$P_R = 4.55 \times 10^2 \times 10^4$$

$$P_R = 4.55 \times 10^6 \text{ dynes } (\text{g}\cdot\text{cm}\cdot\text{s}^{-2})$$

5. From Equation (C):

$$V_R = \frac{2P_R}{D_R C_R}$$

$$V_R = \frac{(2) (4.55 \cdot 10^6 \text{ g}\cdot\text{cm}\cdot\text{s}^{-2})}{(2.64 \text{ g}\cdot\text{cm}^{-3})(457,200 \text{ cm}\cdot\text{s}^{-1})}$$

$$V_R = 7.54 \text{ cm}\cdot\text{s}^{-1}$$

6. From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$

$$R = (W^{.5})(V_R/100)^{-0.625}$$

$$R = (100\text{kg})^{.5}(7.54\text{cm}\cdot\text{s}^{-1}/100\text{kg}\cdot\text{cm}\cdot\text{s}^{-1}\cdot\text{m})^{-0.625}$$

$$R = 50.3 \text{ m}$$

Therefore, a 100 kg charge of explosives detonated in rock requires a setback of 50.3 m from fish habitat in order to reduce the overpressure produced by the detonation to less than 100 kPa.

Now, the calculation of the set-back distance required for a 100 kg charge set in rock to meet the peak particle velocity guideline of $13 \text{ mm}\cdot\text{sec}^{-1}$ is as follows:

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

From Equation (D):

$$R = (W^{.5})(V_R/100)^{-0.625}$$

When

$$V_R = 13 \text{ mm}\cdot\text{sec}^{-1} = 1.3 \text{ cm}\cdot\text{sec}^{-1}$$

and $W = 100 \text{ kg}$

$$R = (100^{.5})(1.3/100)^{-0.625}$$

$$R = 150.9 \text{ m}$$

Therefore, a 100 kg charge of explosives detonated in rock requires a setback of 150.9 m from a spawning area in order to reduce the peak particle velocity produced by the detonation to less than $13 \text{ mm}\cdot\text{sec}^{-1}$.

Sample Calculation 2: Simplified Calculation of Setback Distance from Fish Habitat.

The calculations to determine the required setback distance to meet the 100 kPa guideline may be simplified. Since the weight of the charge and the distance from the charge to fish habitat are the only variables in the equations, a factor can be developed for substitution in Equation (D).

From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$

$$R = (W^{.5})(V_R/100)^{-0.625}$$

Therefore:

$$R = W^{.5}(K)$$

By working through the equations of Appendix II and solving for V_R for each substrate

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

type, the following results are obtained:

SUBSTRATE TYPE	K
Rock	5.03
Frozen Soil	3.2
Ice	2.1
Saturated Soil	2.13
Unsaturated Soil	0.98

Therefore, to determine the setback distance required to meet the peak pressure guideline of 100 kPa, multiply the square root of the charge weight by the appropriate “K” factor.

Sample Calculation 3: Simplified Calculation of Setback Distance from Fish Spawning Habitat.

Similarly, to determine the set-back distance required to meet the peak particle velocity (V_R) guideline of $13 \text{ mm}\cdot\text{sec}^{-1}$, a constant can be developed for substitution in Equation (D):

From Equation (D):

$$V_R = 100(R/W^5)^{-1.6}$$

$$R = (W^5)(V_R/100)^{-0.625}$$

where:

$$V_R = 13 \text{ mm}\cdot\text{sec}^{-1} = 1.3 \text{ cm}\cdot\text{sec}^{-1}$$

$$R = (W^5)(1.3/100)^{-0.625}$$

$$R = (W^5)(15.09)$$

Therefore, to determine the setback distance required to meet the peak particle velocity (V_R) guideline of $13 \text{ mm}\cdot\text{sec}^{-1}$, multiply the square root of the charge weight by a factor of 15.09.

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

EXAMPLES

Example 1: On-shore Setback Distance from Fish Habitat.

A proponent wishes to use explosives to break rock in a quarry near a stream. What is the minimum setback distance from the stream required in order to limit the overpressure in the stream to less than 100 kPa?

Calculate the required set back distance for a 35 kg charges set in rock.

$$\begin{aligned}
 W &= 35 \text{ kg} \\
 K_{(\text{rock})} &= 6.75 \\
 R &= (W^{-5})(K) \\
 R &= (35^{-5})(5.03) \\
 R &= 29.8 \text{ m}
 \end{aligned}$$

Note: It is assumed that the rock formation being quarried extends under the stream. Therefore the K factor for rock is used.

Therefore, the proponent would be required to maintain a set back distance of at least 29.8 m in order to meet the DFO guideline criteria of 100 kPa.

Example 2: Buried Charges for Geophysical Exploration.

A proponent wishes to conduct a geophysical survey beneath a shallow lake. Because of the shallow depth of the lake, it is not possible to use an air gun or other similar non-explosive energy source. To what depth must explosive charges (5 kg) be buried in order to limit the overpressure to less than 100 kPa?

$$\begin{aligned}
 W &= 5 \text{ kg} \\
 K_{(\text{sat. soil})} &= 2.13 \\
 R &= (W^{-5})(K) \\
 R &= (5^{-5})(2.13) \\
 R &= 4.8 \text{ m}
 \end{aligned}$$

Note: It is assumed that the charges are buried in un-consolidated sediments. Therefore the K factor for saturated soil is used.

Therefore the proponent would be required to bury the charges to a depth of at least 4.8 m below the substrate-water interface in order to limit the overpressure at the interface to less than 100 kPa.

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

Example 3: In-stream Trench Excavation.

A proponent wishes to use explosives to assist in the excavation of a trench for a pipeline across a trout stream. The right-of-way is located in a cobble bottom riffle area that is used as a feeding area. There is a potential spawning bed located 75 m upstream of the right-of-way. The explosives' parameters are as follows:

Weight of individual charges:	15 kg
# of holes detonated/delay:	5
Weight of charge/delay:	75 kg

Does the proposal meet the DFO guideline criteria for overpressure and peak particle velocity?

a) For the Overpressure Criteria:

$$\begin{aligned}
 W &= 75 \text{ kg} \\
 K_{(\text{rock})} &= 5.03 \\
 R &= (W^{\cdot 5})(K) \\
 R &= (75^{\cdot 5})(5.03) \\
 R &= 43.6 \text{ m}
 \end{aligned}$$

Note: Since explosives must be used to excavate the trench, it is assumed that the substrate consists of rock or strongly consolidated sediments. Therefore the K factor for rock is used.

Therefore the detonation of 75 kg of explosives could kill or injure fish within a radius of 43.6 m of the right-of-way.

b) For the Peak Particle Velocity Criteria:

To determine the setback distance required to meet the peak particle velocity (V_R) guideline of $13 \text{ mm} \cdot \text{sec}^{-1}$ in a spawning area, multiply the square root of the charge weight by a factor of 15.09.

$$\begin{aligned}
 R &= (W^{\cdot 5})(15.09) \\
 R &= (75^{\cdot 5})(15.09) \\
 R &= 130.7 \text{ m}
 \end{aligned}$$

Therefore, the detonation of 75 kg of explosives would exceed the DFO Guideline for peak particle velocity of $13 \text{ mm} \cdot \text{sec}^{-1}$ in a spawning bed.

Appendix III (concluded)
Sample Calculations and Examples for Confined Explosives

Therefore, the application for an authorization to use explosives would be denied and major changes in the explosives program would be required in order for the project to be acceptable to DFO.

For example:

If the weight of explosive/delay were reduced to 5 kg by increasing the number of holes in the pattern and detonating each hole separately with 25 msec delays between each hole, the zone of overpressure exceeding 100 kPa would be:

$$\begin{aligned}
 W &= 5 \text{ kg} \\
 K_{(\text{rock})} &= 5.03 \\
 R &= (W^{-5})(K) \\
 R &= (5^{-5})(5.03) \\
 R &= 11.2 \text{ m}
 \end{aligned}$$

Similarly, the distance at which the peak particle velocity in the substrate would not exceed $13 \text{ mm} \cdot \text{sec}^{-1}$ would be:

$$\begin{aligned}
 R &= (W^{-5})(15.09) \\
 R &= (5^{-5})(15.09) \\
 R &= 33.7 \text{ m}
 \end{aligned}$$

Therefore, if the weight of explosives per delay were reduced to 5 kg, the spawning area would be protected, as it is further than 33.7m from the detonation area. However, the detonation would still produce over-pressures exceeding 100 kPa to a distance of 11.2 m. Additional mitigation such as undertaking the project at a time of least fish activity or by removing/excluding fish from the area by either physical exclusion or scare tactics may be required.

APPENDIX V

Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat

SCHEDULE VI / ANNEXE VI
(Subsection 58(1)/paragraphe 58(1))

Fisheries and Oceans



Pêches et Océans

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Application No./N° de la demande

**APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON**

I, the undersigned, hereby request authorization to carry out the works or undertakings described on this application form. I understand that the approval of this application, if granted, is from the Minister of Fisheries and Oceans standpoint only and does not release me from my obligation to obtain permission from other concerned regulatory agencies.

Je soussigné, demande par les présentes l'autorisation d'exploiter les ouvrages ou entreprises décrits dans la formule. Je comprends que l'approbation de cette demande, le cas échéant, porte sur ce qui relève du ministre des Pêches et des Océans et ne me dispense pas d'obtenir la permission d'autres organismes réglementaires concernés.

If an authorization is granted as a result of this application, I hereby agree to carry out all activities relating to the project within the designated time frames and conditions specified in the authorization.

Si la demande est approuvée, je consens par les présentes à exécuter tous les travaux relatifs à ce projet selon les modalités et dans le laps de temps prescrits dans l'autorisation.

Applicant's Name (Please Print) _____ Nom du requérant (lettres moulées)

Applicant's Business Address _____ Adresse d'affaires du requérant

Applicant's Telephone No./ N° de téléphone du requérant _____ Date _____

I solemnly declare that the information provided and facts set out in this application are true, complete and correct, and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath. This declaration applies to all material submitted as part of this application.

Je déclare solennellement que les renseignements fournis et les faits énoncés dans cette demande sont véridiques, complets et exacts, et je fais cette déclaration solennelle, la croyant consciencieusement vraie et sachant qu'elle a la même force et le même effet que si elle était faite sous serment. Cette déclaration s'applique à tout document qui est présenté dans le cadre de cette demande.

Applicant's Signature (and corporate seal)

Signature du requérant (et sceau de la société)

Name of watercourse or waterbody (give coordinates)
Cours d'eau ou plan d'eau (donner les coordonnées) _____

This watercourse is a tributary of (where applicable)
Cours d'eau tributaire de (le cas échéant)

Nearest community
Localité la plus proche

County
Comté

Province
Province

APPENDIX V

Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (continued)

SCHEDULE VI-Continued/ANNEXE VI (suite)

Fisheries and Oceans



Pêches et Océans

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Application No./N° de la demande

**APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON**

Type of Activity/Genre d'activité

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> Bridge
Pont | <input type="checkbox"/> Stream Realignment
Alignement de cours
d'eau | <input type="checkbox"/> Gravel Removal
Enlèvement du gravier | <input type="checkbox"/> Stream Traverse
Traversée de cours d'eau |
| <input type="checkbox"/> Culvert
Ponceau | <input type="checkbox"/> Channelization
Canalisation | <input type="checkbox"/> Obstruction Removal - Bypass
Enlèvement ou contournement
d'obstacle | <input type="checkbox"/> Seismic Survey
Levé sismique |
| <input type="checkbox"/> Dam
Barrage | <input type="checkbox"/> Wharf - Break water
Quai - Brise-lames | <input type="checkbox"/> Stream Utilization - Recreation
Utilisation récréative du cours d'eau | <input type="checkbox"/> Agriculture |
| <input type="checkbox"/> Stream Diversion
Dérivation de cours d'eau | <input type="checkbox"/> Dewatering
Assèchement | <input type="checkbox"/> Erosion Control
Lutte contre l'érosion | <input type="checkbox"/> Other (specify)
Autres (préciser) |
| <input type="checkbox"/> Mining
Activité minière | <input type="checkbox"/> Aquaculture | <input type="checkbox"/> Flood Protection
Protection contre les inondations | |

List of Agencies (Federal, Provincial or Municipal) contacted or notified, or who have initiated contact with the applicant.

Liste des organismes (fédéraux, provinciaux ou municipaux) contactés ou qui ont pris contact avec le requérant.

**PROVIDE DETAILS OF PROPOSED ACTIVITY INCLUDING REASONS FOR THE PROJECT AND TYPES OF EQUIPMENT TO BE USED
DONNER DES PRÉCISIONS SUR LES TRAVAUX PROJETÉS Y COMPRIS LA JUSTIFICATION DU PROJET ET
LE TYPE D'ÉQUIPEMENT À UTILISER**

Blank lines for providing details of proposed activity and equipment.

APPENDIX V

Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (continued)

SCHEDULE VI-Continued/ANNEXE VI (suite)

Fisheries and Oceans



Pêches et Océans

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Application No./N° de la demande

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

SCHEDULE/CALENDRIER

	D/J	MM	Y/A		D/J	MM	Y/A
Proposed Starting Date Date prévue du début des travaux	_____	_____	_____		_____	_____	_____
Proposed Completion Date Date prévue de l'achèvement des travaux	_____	_____	_____		_____	_____	_____
Approximate Timing of Work in shoreline, foreshore, tidal zone, or underwater areas. Période approximative des travaux sur le rivage et les estrans ainsi que dans les zones à marées et les zones sous-marines.							
	D/J	MM	Y/A	To/A	D/J	MM	Y/A
From/De	_____	_____	_____		_____	_____	_____

The following documents will assist in assessing your application and help expedite its approval. Please check which documents you have attached.

Les documents suivants faciliteront l'évaluation de votre demande et permettront d'accélérer son approbation. Veuillez cocher les documents vous avez joints à votre demande.

Map indicating location of project	<input type="checkbox"/>	Carte indiquant l'emplacement du projet
Engineering Specifications	<input type="checkbox"/>	Spécifications techniques
Scale Drawings	<input type="checkbox"/>	Dessins à l'échelle
Dimensional Drawings	<input type="checkbox"/>	Plans cotés
Assessment of Existing Fish Habitat Characteristics	<input type="checkbox"/>	Évaluation des caractéristiques existantes de l'habitat du poisson
Assessment of Potential Effects of Project on Fish Habitat	<input type="checkbox"/>	Évaluation des répercussions possibles sur l'habitat du poisson
Measures Proposed to Offset Potential Damage to Fish Habitat	<input type="checkbox"/>	Mesures proposées pour compenser les ventuels dommages à l'habitat du poisson
Other	<input type="checkbox"/>	Autres

ENVIRONMENTAL ASSESSMENT AND REVIEW PROCESS
CONSIDERATIONSCONSIDÉRATIONS CONCERNANT LE PROCESSUS
D'ÉVALUATION ET D'EXAMEN EN MATIÈRE
D'ENVIRONNEMENT

NOTE: All applications pursuant to section 35 of the Fisheries Act will be assessed in accordance with applicable federal environmental assessment requirements.

REMARQUE : Toute demande en vertu l'article 35 de la Loi sur les pêches sera soumise aux exigences fédérales applicables à l'évaluation environnementale.

APPENDIX V

Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (concluded)

SCHEDULE VI-Concluded/ANNEXE VI (fin)



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Application No./N° de la demande

**APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON**

COMPLETE ONLY IF USE OF EXPLOSIVES IS INTENDED
A REMPLIR SEULEMENT EN CAS D'UTILISATION D'EXPLOSIFS

EXPLOSIVES CONTRACTOR (IF DIFFERENT FROM APPLICANT)/RESPONSABLE DES EXPLOSIFS (SI AUTRE QUE LE REQUIRANT)

Name/Nom : _____

Address/Adresse : _____

Telephone No./N° de téléphone : _____

	D/J	M/M	Y/A		D/J	M/M	Y/Y
Anticipated Starting Date				Completion Date			
Date prévue du début des travaux	_____	_____	_____	Date d'achèvement	_____	_____	_____

DETAILS OF EXPLOSIVES/PRÉCISIONS SUR LES EXPLOSIFS

Type (including trade name) _____

Genre (y compris la marque) _____

Weight and configuration (where applicable) _____

Poids et forme (le cas échéant) _____

Weight of individual shots and shot pattern where multiple charges are used

Poids des coups individuels et déploiement des coups, en cas de charges multiples

Detonation depth (in the rock; note also the depth of water, if applicable)

Profondeur de détonation (dans le roc; indiquer aussi, la profondeur de l'eau, s'il y a lieu)

Method of detonation _____

Méthode de détonation _____

