

Environmental Management Program for Land-Based Finfish Aquaculture in New Brunswick

Version 2.0

Environment and Local Government
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1.0 INTRODUCTION

The Environmental Management Program for Land-Based Finfish Aquaculture in NB (EMP), is a Department of Environment and Local Government (the Department) document that outlines the environmental management requirements for land-based finfish aquaculture facilities. The EMP will be enforced through Approvals to Operate and/or Construct issued by the Authorizations Branch, under the authority of the *Water Quality Regulation – Clean Environment Act*.

The main objective of the EMP is to manage nutrient over-enrichment to the receiving environments through monitoring the phosphorous and nitrogen from land-based finfish aquaculture facilities and measure compliance. The framework of the program is based on the trophic status or load capacity of the aquatic receiving environment.

The EMP will be updated based on evolving science and technology, new environmental management techniques, and stakeholder engagement as needed. The document will be reviewed periodically to incorporate changes in the management approach. This will ensure that it includes the most current information pertaining to science, policy and management practices.

2.0 ENVIRONMENTAL MANAGEMENT

This section describes the environmental management tools used to ensure the long-term environmental sustainability of land-based finfish aquaculture on New Brunswick's aquatic receiving environments.

This section also details and defines the Approval process, Water Quality Objectives (WQO's) and describes the monitoring program that will be utilized to determine compliance.

2.1 *Approvals to Operate and/or Construct*

The EMP will be enforced through the Approvals program administered by the Authorizations Branch of the Department, under the authority of the *Water Quality Regulation – Clean Environment Act* and applies to land-based finfish tank and pond culture operations exceeding 25,000 fish. A Class 5 Approval will be issued to facilities with 25,000 to 200,000 finfish and a Class 6 Approval will be issued to facilities with greater than 200,000 finfish. The Approval Class system is in accordance with the *Fees for Industrial Approvals Regulation – Clean Water Act*. The Approval to Operate contains terms and conditions related to discharge limits, testing and monitoring, water usage, chemical storage and handling, reporting, solid waste management and emergency reporting. An Approval to Construct may be required if the facility's construction project has potential impacts to the environment.

All Approval Holders are subject to a monthly water quality monitoring program from June 1st through November 15th. From the monitoring program, Approval Holders are required to immediately submit a non-conformance report (Appendix 3, Form 1) to the Department if a monthly Regulatory objective is exceeded. Approval Holders are required to submit an Annual Report (Appendix 3, Form 2) by January 15th for the previous calendar year. Upon review of the Annual Report, the Department may determine the Approval Holder to be out of compliance, at which time a Compliance Plan (Appendix 3, Form 3) will be required by March 31st.

Note that land-based finfish aquaculture facilities may also require Registration under the *Environmental Impact Assessment Regulation – Clean Environment Act* and/or a *Watercourse and Wetland Alteration Permit* for any proposed facility, including those under 25,000 finfish – see “Section 3 Other Regulatory Requirements” for more details.

2.2 Water Quality Objectives

Nutrient over-enrichment occurs with the overloading of seas, coastal waters, lakes and rivers with nutrients and can result in a series of adverse effects such as algal blooms, dissolved oxygen depletion and a loss of vegetation. Two nutrient elements, nitrogen and phosphorous, are responsible for nutrient over-enrichment in most instances. Phosphorous is usually the key factor, with nitrogen playing a secondary role. An overabundance of nitrogen and phosphorous in water starts a process called eutrophication. Algae feed on the nutrients, growing, spreading, and turning the water green. Algae blooms can smell bad, block sunlight, and even release toxins in some cases.

In order to manage nutrient over-enrichment in New Brunswick’s receiving environments from the land-based finfish aquaculture sector, Total Phosphorous (TP), is identified as the limiting parameter identified and Water Quality Objectives (WQO) are discussed for this parameter for both freshwater and saltwater receiving environments. The WQOs will determine the Regulatory objectives and be managed through the Department’s Approval process.

2.2.1 WQO’s for freshwater receiving environments

WQOs for freshwater receiving environments are intended to maintain the trophic status of the receiving environment below the eutrophic zone, as seen in Table 1. This is achieved by comparing the facility’s effluent at the edge of a mixing zone¹ to a control station (upstream and/or uninfluenced) on the receiving water. Table 1 also outlines various trophic zones and indicates the general point of eutrophication based on Total Phosphorous.

¹ A mixing zone is, under no circumstances, to be used as an alternative to reasonable and practical treatment. It must be designed to be as small as possible.

Table 1: Trophic status for rivers, streams and lakes

Trophic Zone*	Rivers / Streams		Lakes			
	Total Phosphorous (µg/l)	Total Nitrogen (µg/l)	Total Phosphorous¹ (µg/l)	Total Nitrogen (µg/l)	Chlorophyll A (µg/l)	Secchi Depth (metre)
<i>Oligotrophic</i>	≤10	≤ 300	≤10	≤ 300	≤ 2.0	>5.0
<i>Mesotrophic</i>	10-19	300-500	10-19	300-500	2-10	5.0-3.0
<i>Meso-Eutrophic</i>	20-34	500-650	20-24	500-600	10-20	3.0-1.5
Regulatory Objective	35	-	25	-	-	-
<i>Eutrophic</i>	35-100	650-1200	25-100	600-1200	20-50	2.0-0.5
<i>Hypertrophic</i>	>100	>1200	>100	>1200	>50	≤ 0.5

* Sources: CCME (2004), Environment Canada (2004) and CCME (2007).

2.2.2 WQO's for saltwater receiving environments

The trophic status for the marine environment varies significantly, therefore facilities that discharge into estuaries and coastal waters will be required to establish WQOs for TP and/or TN, by following the procedures in the 2003 Canadian Council of Ministers of Environment (CCME) document "[*Guidance on the Site Specific Application of Water Quality Guidelines in Canada: Procedures for Deriving Numerical Water Quality Objectives*](#)". The WQOs derived from the above procedures will be used to create site specific Effluent Discharge Objectives (EDO) and once approved by the Department will become the site specific Regulatory objectives and incorporated into the Approval to Operate.

2.3 Regulatory Objectives

Regulatory objectives are established from the WQOs and are dependent on the receiving environment. Table 2 outlines the Regulatory objectives that will be applied to land-based finfish aquaculture facilities that discharge to streams, brooks, rivers, ponds and lakes. The Regulatory objective locations will be dependent on the receiving environment. The location for streams, brooks and rivers will be 100 m downstream of the facilities outfall. The location for ponds and lakes will be at the edge of the regulated mixing zone, which shall have a maximum radius of 100 m or 25% of the width of the lake (whichever is smaller, not to exceed 10% of the available volume for mixing and not extend closer to shore than the mean low water mark). The Regulatory objectives for estuaries and coastal receiving water will be determined once the EDOs are derived from the method outlined in Section 2.2.2. The Regulatory objectives take into account the trophic status of the receiving environment and will be assessed accordingly.

Table 2: Regulatory Objectives

Receiving Environment	Location	Regulatory Objectives
		Total Phosphorous ($\mu\text{g/L}$)
Streams, brooks and rivers	100 m downstream of outfall	35
Ponds or lakes	Edge of Regulated Mixing Zone	25
Estuaries and Coastal	End of pipe	N/A, see section 2.2.2

2.4 Water Quality Monitoring Program

Water Quality Monitoring is undertaken to assess the level of compliance of land-based finfish aquaculture in relation to Regulatory objectives. The water quality monitoring program and Regulatory objectives are incorporated into the Approval to Operate.

Water quality monitoring varies between facility size and receiving environments which are outlined in Table 3. All facilities are required to conduct monitoring from June 1st to November 15th, during the typical period of peak growth and feeding.

It is recommended to avoid sampling during spring runoff or heavy storm events as this may have adverse effects on the control station sampling results. If these periods cannot be avoided, sampling conditions should be documented and submitted with the monitoring results.

Additional monitoring may be required, as determined by the Department. The Department may also conduct both random and targeted sampling in and around land-based finfish aquaculture facilities for auditing purposes.

The water quality monitoring should follow the Standard Sampling Procedures outlined in Appendix 2. All “Lab” sample analysis must be completed by laboratories with accreditation from the Standards Council of Canada (SCC) and/or the Canadian Association of Laboratory Accreditation (CALA) while “Self” sample analysis may be measured by facility staff. Approval Holders are required to have flow meters installed on each intake and are encouraged to conduct a complete water chemistry analysis for well water once per year as a means of monitoring possible changes in water chemistry.

Table 3: Water Quality Monitoring Schedule

Approval Class and Effluent Location	Sample Location	Parameters	Frequency
Class 6 Approvals effluent discharges into streams, brooks and rivers	Upstream of effluent discharge	Lab: TP and TN Self: Temp, DO and pH	Monthly (6 times) Between June 1- Nov. 15
	Effluent discharge	Lab: TP, TN and TSS Self: Temp, flow, DO and pH	
	100 m downstream of effluent discharge	Lab: TP and TN Self: Temp, DO and pH	
	Well	Self: Flow and Temp	Once per year
Class 5 Approvals effluent discharges into streams, brooks and rivers	Upstream of effluent discharge	Lab: TP Self: Temp, DO and pH	June, August, October
	Effluent discharge	Lab: TP and TSS Self: Temp, flow, DO and pH	
	100m downstream of effluent discharge	Lab: TP Self: Temp, DO and pH	
	Well	Self: Flow and Temp	Once per year
Class 5 and 6 Approvals effluent discharges into lakes and ponds	Control station ¹	Lab: TP and TN Self: Temp, DO, pH, secchi depth	Monthly (6 times) Between June 1- Nov. 15
	Intake surface water	Self: Flow	
	Effluent discharge	Lab: TP, TN, and TSS Self: Temp, flow, DO and pH	
	Edge of Regulated mixing zone²	Lab: TP and TN Self: Temp, DO, pH and Secchi depth	
	Well	Self: Flow and Temp	Once per year
Class 5 and 6 Approvals effluent discharges into estuaries or coastal waters.	Control station	Lab: TP and TN Self: Temp, DO, pH	Monthly (6 times) Between June 1- Nov. 15
	Intake surface water	Self: Flow	
	Effluent discharge	Lab: TP, TN and TSS Self: Temp, flow, DO and pH	
	Well	Self: Flow, Temp, conductivity	Once per year

¹ Control Station should be at the intake for the pond or lake.

² Edge of Regulated Mixing Zone should have a maximum radius of 100 m or 25% of the width of the lake (whichever is smaller), not exceed 10% of the available volume for mixing and not extend closer to shore than the mean low water mark or established by the Department.

2.5 Compliance Plan

Environmental management of land-based finfish aquaculture facilities requires action be taken in response to monitoring results exceeding Regulatory objective. Approval Holders that are consistently above the Regulatory objective(s) in the previous year, may be subjected to submit a compliance plan prior to **March 31 of the following year**. The Department will inform the Approval Holder if a compliance plan is required prior to February 15th.

2.6 Waste Management

Approval Holders must comply with the standard waste management plan outlined in Appendix 1. The aim of the plan is to ensure proper disposal of all waste materials generated at the site. Categories of waste covered include, but are not limited to operational waste, hazardous waste, biological waste (including fish and egg mortalities), and solid wastes from sludge tanks and settling ponds/pits.

3.0 OTHER REGULATORY REQUIREMENTS

The Department may have additional requirements for land-based finfish aquaculture such as Environmental Impact Assessment, Water Supply Source Assessment and Watercourse and Wetland Alteration Permitting.

3.1 *Environmental Impact Assessment*

Any new land-based finfish aquaculture facility is required to register for an Environmental Impact Assessment and undergo a Determination review because they have wastewater disposal systems to treat effluent and/or waterworks (i.e., *Environmental Impact Assessment Regulation - Clean Environment Act* Schedule A: Undertaking (m) all waste disposal facilities or systems and (s) all waterworks with a capacity greater than fifty cubic metres of water daily). The Determination Review is coordinated by a Project Manager assigned by the Environmental Impact Assessment Branch (EIA Branch) and is completed with the assistance of a specially constituted Technical Review Committee (TRC). The TRC is comprised of experts and specialists from federal, provincial, and local municipal government departments and agencies. The Determination Review is an interactive and iterative process and includes opportunities for clarification of specific technical issues. Proponents are generally asked to provide supplementary studies and information to address identified concerns and questions.

Further information can be found in A Guide to Environmental Impact Assessment in New Brunswick:

<https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/GuideEnvironmentalImpactAssessment.pdf>

3.2 *Water Supply Source Assessment*

The Department has regulatory requirements for groundwater sourcing, the Water Supply Source Assessment (WSSA), in accordance with the *Environmental Impact Assessment Regulation – Clean Environment Act*, for the development of waterworks with a cumulative capacity greater than 50 m³/day.

The WSSA process begins with the submission of an EIA Registration document and a completed WSSA Initial Application for a proposed project.

Further information can be found in the WSSA Guidelines:

<https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/WaterSupplyAssessmentGuidelines.pdf>

3.3 *Watercourse and Wetland Alteration*

The purpose of the *Watercourse and Wetland Alteration Regulation (90-80) - Clean Water Act* is to protect provincial streams, rivers, wetlands, and lakes from work or ground disturbance in their vicinity. Therefore, any person intending to do work (water withdrawal, construction, demolition, clearing land, landscaping, etc.) within 30 metres of a watercourse or wetland is required to apply for a Watercourse and Wetland Alteration (WAWA) Permit.

An online application program has been developed to help guide you to the proper permit application based on your answers to a series of site and activity specific questions. More information can be found on the Department's website.

https://www2.gnb.ca/content/gnb/en/departments/elg/services/services_renderer.2935.html

4.0 ANNUAL SCHEDULES

Dates and time frames are established to ensure that a Compliance Plan is prepared by the Approval Holder, reviewed and approved by the Department, and implemented such that an optimal result is obtained. All parties are responsible to ensure that the goals of this EMP are fulfilled. Below is a listing of key dates and time frames as they pertain to this EMP:

June 1st – November 15th (Monthly Monitoring): Required by all Approval Holders monthly monitoring as outlined in Table 3.

January 15: Annual Report submission deadline: Requirements as outlined within Appendix 3 Form 2.

February 15: The Department's response to Annual Report. The response may require the Approval Holder to develop a compliance plan.

March 31: Compliance Plan submission deadline if required.

Within 3 working days of receiving monitoring results above Regulatory objectives as listed in Table 2 or within the Approval, the Approval Holder must contact the Department, complete a Non-conformance Report (Form 1 in Appendix 3) and submit it to the Department.

Immediately report all non-fully functioning effluent treatment infrastructure to the Department as required in the Emergency Reporting Section of the Approval. Information provided should include specific effluent treatment equipment in question, estimated time to return to full functionality and alternative measures taken during down time. The Approval Holder shall report to the Department once the equipment has been repaired or replaced.

REFERENCES

Boyd, Claude E. 1990. *Water Quality in Ponds for Aquaculture*. Birmingham, Ala.: Auburn University Press.

CCME (Canadian Council of Ministers of the Environment), 2004. *Canadian water quality guidelines for the protection of aquatic life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems*. In: *Canadian environmental quality guidelines, 2004*, Canadian Council of Ministers of the Environment, Winnipeg.

CCME 2003. *Guidance on the Site Specific Application of Water Quality Guidelines in Canada: Procedures for Deriving Numerical Water Quality Objectives*

CCME 2007. *Canadian Water Quality Guidelines for the Protection of Aquatic Life*

Dodds, W.K., J.R. Jones and E.B. Welch, 1998. Suggested classification of stream trophic state: Distribution of temperate stream types by chlorophyll, total nitrogen and phosphorus. *Water Res.* 32: 1455–1462.

Environment Canada, 2004. *Canadian Guidance Framework for the Management of Phosphorus in Freshwater Systems*. Report No. 1-8. ISBN 0-662-36110-5. National Guidelines and Standards Office, Environment Canada. February 2004.

MVLWB/GNWT Guidelines for Effluent Mixing Zones, September 2017

APPENDIX 1: Waste Management

Operational Waste

- Operational waste includes but is not limited to feed bags, domestic garbage, etc.
- All operational waste shall be managed to maximize waste diversion.
- Recycling of operational waste shall be attempted if recycling option exists.

Chemical and Hazardous Waste

“Hazardous Waste” means any waste material intended for disposal or recycling, that is identified as a hazardous waste by the federal Cross-border Movement of Hazardous Waste and Hazardous Recyclable Material Regulation, and/or is included in Class 1 and/or Class 7 of the federal Transportation of Dangerous Goods Regulations. This definition excludes any waste(s) for which the Department has issued a written exemption.

- Hazardous materials include but are not limited to grease tubes, used paint cans, paint brushes, wasted fuels, copper based paints, waste disinfectants, etc.
- Hazardous materials shall be separated from regular garbage and collected in designated containers.
- Commercial and Industrial Hazardous Waste greater than 5 L shall be transported and disposed of by a **Carrier Approved by the Department**.
- Commercial and Industrial Hazardous Waste less than 5 L shall be disposed of at a **Facility Approved by the Department**.

Biological Waste

- Biological waste includes but is not limited to fish and egg mortalities, spawning wastes, etc.
- All biological waste shall be transported in secure, leakproof and covered containers and disposed of at a **Department Approved Facility** or a method approved by the Department.
- At no time shall dead or moribund fish be released into the water.
- All finfish blood water shall be disposed of at a **Department Approved Facility**.
- All finfish blood water shall be collected and contained in secure and leakproof containers.
- All transport tanks for harvest and/or major stock loss waste materials shall be in good condition so that no spillage occurs.
- The harvest and/or major stock loss waste shall be disposed of at a **Department Approved Facility**.

Solid Waste

- Solids (Feces and Excess Feed) that are filtered out of the final effluent water and retained in septic tanks or settling pond/pits, shall be emptied either a minimum of once per year, or as required to meet regulatory effluent discharge limits. Solids shall be removed by a **Department Approved Septage Hauler** and disposed of at a **Department Approved Septage Treatment Facility (these may differ)** or a method approved by the Department.

APPENDIX 2: Standard Sampling Procedures

Sampling and the type of analysis required for this EMP are broken down into “self” and “lab” samples. Self-monitoring and analysis are conducted onsite to minimize expense and/or the inability to be properly measured at the laboratory (i.e. temperature). All laboratory analysis must be completed by laboratories with accreditation from the Standards Council of Canada (SCC) and/or the Canadian Association of Laboratory Accreditation (CALA). Minimum detection limits required are 0.005 mg/litre (5 µg/l) for Total Phosphorous (TP_L) and 0.3 mg/litre (300 µg/l) for Total Nitrogen (TN).

Sample Location

Prior to sampling, the sample location must be marked by measuring the distance from the point of effluent outfall to the location upstream and downstream within the receiving water course. The GPS co-ordinates for the sampling location (i.e. 100 m downstream, 10 m upstream, etc.) shall be submitted to the Department. GPS coordinates shall also be submitted for sampling locations within lakes and coastal environment. Permanent markers (buoys) are not permitted for safety purposes.

Sampling Methodology

Sampling must be conducted with the direction of the flow of water through the facility to maintain biosecurity standards (i.e. inflow samples taken first with progressing to edge of mixing zone which are taken last).

Sampling Protocol

Collect samples only in the proper size and type of bottle as supplied by the laboratory employed and for the parameters measured.

APPENDIX 3: Regulatory Reporting Forms 1, 2, and 3

Form 1: Non-conformance Report

Form 2: Annual Report

Form 3: Compliance Plan

**New Brunswick Land-Based Finfish Aquaculture
Environmental Management Program
FORM 1
NON-CONFORMANCE REPORT**

The following information is to be sent to the Department after each non-conformance incident during the monitoring season (June 1st - November 15th). Monitoring results and this report are to be forwarded to the Department **within three working days of receiving results from laboratory.**

1. Date, time, biomass and amount fed (kg) on date of water quality monitoring.
2. Feed Types used: pellet size, % protein and % phosphorous.
3. Effluent Treatment system inspection (i.e. size and condition of RDF screen, flocculent dosing rate, settling pond organic load, constructed wetland etc.).
4. Date of last clean out of septic, settling pit or settling pond.
5. Date of next expected significant reduction in biomass.
6. Potential mitigation measures chosen to aid in bringing the facility back into conformance, such as cleaning of septic, settling pit or settling pond or change in feed type.

**New Brunswick Land-Based Finfish Aquaculture
Environmental Management Program
FORM 2
ANNUAL REPORT**

Below is the information required within the Annual Report for the preceding calendar year
(Due: January 15th).

1. Company and facility name.
2. Average weight, bi-weekly biomass, feed fed and % protein and phosphorous content of feeds.
3. Average weekly effluent flow (lpm or IGPM).
4. Reporting requirements as outlined in the Reporting section of the Approval.
5. Environmental Monitoring Program results received from laboratory* and self-monitoring.
6. Date of last clean out of septic, settling pit or settling pond.
7. Results of any effluent treatment system inspection reports.
8. Comments on planned production plan for upcoming year.

*Includes a copy of the laboratory report results

**New Brunswick Land-Based Finfish Aquaculture
Environmental Management Program
FORM 3
COMPLIANCE PLAN**

Below is a guide to the information that may be contained as a minimum within the compliance plan (**Due: March 31st**).

1. Review of annual production data (biomass, feed fed and % protein and phosphorous content of feeds) and environmental monitoring results;
2. Review of effluent treatment employed at facility;
3. Effluent treatment system inspection results;
4. Review of mitigation measures available to correct non-conformance issue(s);
5. Facility mitigation response(s) chosen and timeline to complete; and
6. Conclusions