

PROVINCIAL POLICY OBJECTIVES FOR MANAGING EFFECTS OF CAGE AQUACULTURE OPERATIONS ON THE QUALITY OF WATER AND SEDIMENT IN ONTARIO'S LAKES AND WATERWAYS

1. INTRODUCTION - PURPOSE AND APPLICATION

Cage aquaculture is the commercial culture of fish in net cages floating in open waters. It is a unique industry because it releases untreated waste (fish feces and uneaten feed) directly into open waters.

The purpose of this document, developed by the Ministry of the Environment, Parks and Conservation (MECP), is to help ensure the protection of Ontario's lakes and waterways by setting out water and sediment quality policy objectives for the long-term environmental sustainability of commercial-scale cage aquaculture operations in Ontario. It also supports environmental requirements in cage aquaculture licences issued by the Ministry of Natural Resources and Forestry (MNR) under the *Fish and Wildlife Conservation Act* (FWCA) and MNR's Application Guidelines for Cage Aquaculture Facilities (Application Guidelines).

The provincial environmental policy objectives for cage aquaculture set out in this document apply to existing operations, as well as proposed expansions and new operations where the proposed annual feed allocation does not exceed 2,500 tonnes (metric) of low phosphorus feed (i.e., not more than 1.3% phosphorus content), which is the maximum feed allocation of the largest existing cage aquaculture operation in Ontario. These policy objectives do not apply to operations larger than 2,500 tonnes of low phosphorus feed. As larger operations have the potential to pose higher environmental risks, the approach for larger new and expanded cage aquaculture operations will require further analysis by the Province, and may include the consideration of a new regulatory framework and/or new processes. In the interim, should a larger new or expanding operation begin the cage aquaculture licence application process before the Province completes its analysis of the approach and establishes any necessary new processes, the environmental policy objectives set out in this document will serve as the minimum objectives, with site and proposal-specific requirements and restrictions added as appropriate.

In summary, the key provincial environmental policy objectives for cage aquaculture operations are that they should be situated, sized and managed so as to ensure that the resulting release of nutrients and oxygen-consuming substances, and accumulation of waste at the lakebed, do not exceed the local assimilative capacity of the receiving water body and conform to the provincial waste assimilation and non-toxic sediment objectives. In addition, the water and sediment quality effects of the operations are to be contained within the permitted area (e.g., the Crown land use occupational authority set in a permit or lease under the *Public Lands Act* or the operational boundary specified in conditions of the cage aquaculture licence) to minimize any local or lake-wide cumulative effects.

To meet these policy objectives, cage aquaculture operators should minimize the water and sediment quality effects of the operations by reducing the potential for the operations to

contribute to or cause dissolved oxygen depletion, phosphorus enrichment or sediment toxicity, and monitor these effects on an on-going basis.

The provincial environmental policy objectives for cage aquaculture are intended to work with MNRF's Application Guidelines for cage aquaculture. As part of the cage aquaculture application process set out in the Application Guidelines, proponents of new operations and expansions of existing operations are required to undertake baseline monitoring of the proposed sites and model the anticipated impact of the proposed operation(s). This monitoring and modelling assists in determining whether or not the proposed operations, when properly managed, would conform to the water and sediment quality objectives, and any nutrient loading targets established or adopted by the Province.

In order to ensure that the water and sediment quality objectives are being met by established cage aquaculture operations on an on-going basis, through conditions of the MNRF issued licences, operators are required to undertake ongoing water and sediment monitoring and reporting.

This document does not set out any objectives regarding the application of drugs or pesticides into water at the cage aquaculture operations as such activities are separately regulated provincially and/or federally. (See Appendix A)

2. REGULATORY AND POLICY FRAMEWORK

Currently in Ontario, MNRF is the lead provincial agency with respect to the regulation of cage aquaculture operations through its authority to issue aquaculture licences under the *Fish and Wildlife Conservation Act* (FWCA), and the authority to manage the use of Crown lands under the *Public Lands Act* (PLA), including the issuance of Crown land use occupational authority permits or leases. The Application Guidelines outlines MNRF's licence application requirements and the process of application review for periodic renewal of licences for existing operations and issuance of licences for new and expanding operations. This review includes local and lake-wide water and sediment quality considerations, as well as Crown land use planning, appropriateness of proposed cultured species for the local water body, and navigability of local waters.

In addition, should any lake-wide or local nutrient loading targets be established or adopted by the Province (e.g., under the *Great Lakes Protection Act, 2015*), such targets will also be considered in the review of cage aquaculture applications for operations proposed in the affected areas.

In its current regulatory oversight of cage aquaculture, MNRF works with MECP to manage cage aquaculture impacts on water quality and sediments. This is because the management of Ontario's lakes and waterways, including the soils and sediments that are in contact with the water, is part of the MECP's environmental protection mandate.

As part of this co-operative approach to cage aquaculture operations, MECP provides general and site specific water and sediment quality management conditions for inclusion in cage aquaculture licences issued by MNR.

MECP's authority to manage Ontario's lakes and waterways comes primarily from the *Ontario Water Resources Act* (OWRA) and the *Environmental Protection Act* (EPA), which give MECP the authority to regulate the waters, including the regulation of water takings, the disposal of sewage, wastewater and waste, and the regulation of other sources of water pollution.

The EPA prohibits the discharge of contaminants to the natural environment, if the discharge causes or may cause an adverse effect, such as the impairment of the quality of the natural environment for any use that can be made of it or injury/damage to property or to plant or animal life. This prohibition under the EPA does not apply if the discharge is authorized by a regulation made under the EPA or OWRA or by a site specific sewage works approval, and the discharge does not cause and is not likely to cause an adverse effect.

Under the OWRA, it is an offence to discharge, or cause or permit a discharge of, material that may impair the quality of the water of any waters, including any soil or sediment that is in contact with the water. The OWRA deems the quality of water to be impaired by, among other things, the discharge of material if the material or its derivative that enters the water causes or may cause injury to or interference with any living organism that lives in or comes into contact with the water, or the soil or sediment that is in contact with the water.

The policy basis for general and site specific MECP decisions authorized under the EPA or OWRA, such as the issuance of Environmental Compliance Approvals (ECAs) and orders related to the discharge of contaminants into surface waters, is laid out in a number of MECP policy documents (see the links in the footnote¹). These documents include the *Water Management Policies, Guidelines and Provincial Water Quality Objectives* (PWQOs); *Procedure B-1-5 Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters*, which is a procedure for deriving wastewater effluent requirements in ECAs and Orders from the PWQOs; and *Guidelines for Identifying, Assessing and Managing Contaminated Sediments in Ontario: An Integrated Approach*, which includes the Provincial Sediment Quality Guidelines.

¹ Ministry of Environment and Energy 1994. *Water Management Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy*. PIBS 3303e
<https://www.ontario.ca/environment-and-energy/water-management-policies-guidelines-provincial-water-quality-objectives>

Ministry of Environment and Energy 1994. *Procedure B-1-5 Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters*. PIBS 3302e
<http://www.ontario.ca/environment-and-energy/b-1-5-deriving-receiving-water-based-point-source-effluent-requirements>

Ontario Ministry of the Environment 2008. *Guidelines for Identifying, Assessing and Managing Contaminated Sediments in Ontario: An Integrated Approach*. PIBS 6658e
<http://www.ontario.ca/environment-and-energy/guidelines-identifying-assessing-and-managing-contaminated-sediments-ontario>

The wastewater effluent objectives set out in these documents were developed by MECP to address discharges from point-sources (e.g., sewage treatment plants and industrial wastewater treatment facilities), and they do not directly apply to cage aquaculture operations as fish rearing cages lack any waste/wastewater discharge facilities or specific points of discharge where the effluent quantity or quality could be monitored. For this reason, MECP has developed a separate set of policy objectives specific to the management of environmental impacts of cage aquaculture operations to protect water and sediment quality that are consistent with the existing environmental policy objectives for point-source discharges.

The process for developing environmental objectives specific to cage aquaculture began through MECP led First Nations and stakeholders cage aquaculture water quality workshops in 1999 and 2000, and through MECP participation in the development of MNRF's Application Guidelines which began in 2005. In 2009, MNRF posted for public consultation on the Environmental Registry draft Application Guidelines and, concurrently, MECP posted the supporting *Water Quality Discussion Paper* and *Sediment Discussion Paper*.

The provincial environmental policy objectives for cage aquaculture operations set out in Section 6 of this document are based on the water and sediment policy objectives proposed in the 2009 discussion papers, the MNRF led 2010-2014 Collaborative Cage Aquaculture Sediment Policy Development Process, which involved First Nations, non-governmental organizations, cage aquaculture operators, and provincial and federal agencies, as well as comments received through the 2016 Environmental Registry posting of a draft of this document and the associated engagement sessions with First Nations and Métis communities, non-governmental organizations and aquaculture industry.

3. RATIONALE FOR CAGE AQUACULTURE ENVIRONMENTAL POLICY OBJECTIVES

The environmental policy objectives developed for cage aquaculture operations incorporate measureable factors such as water and sediment quality, and effects on benthic and aquatic life in the vicinity of the facilities, as well as define the acceptable level of effect on the local water body. This is done to address the fact that fish rearing cages lack any waste/wastewater discharge facilities or specific points of discharge where the effluent quantity or quality could be monitored.

The MECP water and sediment quality objectives for cage aquaculture operations set out in this document are supported by research information available in literature and MECP's own data from extensive monitoring of water quality and sediment conditions at both operational and decommissioned cage aquaculture operations in Ontario.

Extensive research literature exists on the potential environmental impacts of cage aquaculture operations on marine and freshwater systems in Europe and the U.S., and marine systems in Canadian coastal regions. Nutrient pollution (eutrophication), and the corresponding potential for algal blooms, oxygen depletion and degradation of benthic habitat, have been identified as the principal water quality issues in the vicinity of open cage

operations which have no waste collection system and limited flushing (see, for example, Black and Cromey. 2008²).

The specific policy objectives set out in this document only apply to cage aquaculture operations. These policy objectives do not apply to land-based aquaculture facilities with effluent discharge to a water body or floating-tank closed-containment systems with collect-and-treat technology, which are subject to the MECP approval requirements.

4. BACKGROUND FOR CAGE AQUACULTURE WATER QUALITY OBJECTIVES

In 1999 and 2000, MECP, MNRF, and the Ministry of Agriculture, Food and Rural Affairs organized First Nations and stakeholders workshops, which led to the development of water quality objectives for cage aquaculture operations, and established that the potential for water quality impacts from cage aquaculture operations depended significantly upon site characteristics. Three general types of sites were identified, and it was recommended that site considerations and operational monitoring requirements be tailored according to the type of site. As the risk of local water quality impacts is higher at the more sensitive Type 1 and 2 sites, it was further recommended that cage aquaculture operations be sited in exposed and well-flushed environments, such as Type 3 sites, to minimize potential for eutrophication.

Type 1: Enclosed (lake like) water bodies/embayments with limited flushing;

Type 2: Partially exposed sites having good surface water layer (epilimnion/ metalimnion) flushing but having limited or no deep water layer (hypolimnion) exchange; and

Type 3: Exposed locations where the deep water layer (hypolimnion) is also well flushed.

Building on the 1999 and 2000 First Nations and stakeholders workshops, in 2001, MECP provided the participants and other interested parties with *Recommendations for Operational Water Quality Monitoring at Cage Aquaculture Operations*, which identified total phosphorus and dissolved oxygen as the most critical water quality indicators (Boyd *et al.* 2001³).

The key objectives from the 2001 MECP recommendations were reiterated in MECP's 2009 *Water Quality Discussion Paper* posted on the Environmental Registry in support of MNRF's 2009 posting of a draft Application Guidelines. That discussion paper set out water

²Black K. and C. Cromey. 2008. *Fish farming effects on benthic community changes due to sedimentation*. In GESAMP (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP Joint Group of Experts on Scientific Aspects of Marine Environmental Protection [eds.], Assessment and communication of environmental risks in coastal aquaculture, Rome, FAO, Reports and Studies GESAMP No. 76: 198 pp

³ Boyd, D., Wilson, M., and Howell, T. 2001. *Recommendations for Operational Water Quality Monitoring at Cage Aquaculture Operations*. Environmental Monitoring and Reporting Branch, Ministry of the Environment.

quality objectives for cage aquaculture operations in Ontario's lakes and waterways which are consistent with the *Water Management Policies, Guidelines Provincial Water Quality Objectives*, and protective of the aquatic environment.

5. BACKGROUND FOR CAGE AQUACULTURE SEDIMENT QUALITY OBJECTIVES

The above-noted *Recommendations for Operational Water Quality Monitoring at Cage Aquaculture Operations* (2001) also included provisional sediment quality monitoring recommendations for the perimeter of the Crown land use occupational authority as a means of ensuring that the long term cage aquaculture operation "footprint" is not exceeding the area permitted for use.

Subsequently, sediment quality objectives for cage aquaculture were developed as part of the MNRF led 2005-2009 development of the 2009 draft Application Guidelines. The associated Environmental Registry posting of MECP's 2009 *Sediment Discussion Paper* set out an overarching objective of non-toxic sediment for cage aquaculture operations in Ontario to ensure long-term environmental sustainability of this industry, including the containment of any sediment effect of the operations within the permitted area.

Further discussion through the MNRF led 2010-2014 Collaborative Cage Aquaculture Sediment Policy Development Process identified waste assimilation as a desirable environmental management outcome. Evidence of on-going waste assimilation (i.e., consumption of waste material by benthic invertebrates and its conversion into invertebrate tissue) can be used to demonstrate conformance to the Province's non-toxic sediment policy objective and is consistent with the interpretation put forward in the 2009 *Sediment Discussion Paper*. It is now included as part of the provincial non-toxic sediment quality policy objective set out in this document.

6. PROVINCIAL ENVIRONMENTAL POLICY OBJECTIVES FOR CAGE AQUACULTURE

The intent of the provincial environmental policy objectives for cage aquaculture operations is to protect the quality of water and sediment of Ontario's lakes and waterways. They represent the receiving water-based environmental effects policies and criteria specific to cage aquaculture operations located in the waters. Conformance to these policy objectives will protect water and sediment quality and ensure environmentally sustainable use of this resource.

In summary, the key provincial environmental policy objectives for cage aquaculture operations are that they should be situated, sized and managed so as to ensure that:

- the resulting release of nutrients and oxygen-consuming substances, and accumulation of waste at the lakebed, do not exceed the local assimilative capacity of the receiving water body, and conform to the provincial waste assimilation and non-toxic sediment objectives; and

- the water and sediment quality effects of the operations are contained within the permitted area (e.g., Crown land use occupational authority set in a permit or lease under the *Public Lands Act* or the operational boundary specified in conditions of the cage aquaculture licence) to minimize any local or lake-wide cumulative effects.

Cage aquaculture operators should minimize the water and sediment quality effects of the operations by reducing the potential for the operations to contribute to or cause dissolved oxygen depletion, phosphorus enrichment and sediment toxicity, and should monitor these effects on an on-going basis to ensure conformance to the policy objectives.

The specific water and sediment quality objectives of these key provincial environmental policy objectives for cage aquaculture operations are as follows:

Policy Objective #1: Effects Contained within the Permitted Area

Cage aquaculture operators should ensure that the release of waste material associated with the operation does not result in measureable water or sediment quality effects beyond the permitted area (e.g., Crown land use occupational authority set in a permit or lease under the *Public Lands Act* or the area specified in conditions of the cage aquaculture licence) to minimize any local or lake-wide cumulative effects.

Policy Objective #2: Water Quality – Dissolved Oxygen

Cage aquaculture operators should ensure that the release of waste material associated with the operation does not result in the lowering of dissolved oxygen concentrations within the local receiving water body below levels that are essential for healthy functioning of all forms of local aquatic life throughout its aquatic life cycles.

The operators should ensure that water quality effects are minimized by reducing the potential for the operation to contribute to or cause dissolved oxygen depletion within the local receiving water body to the extent that the water quality at any depth at the deepest location in the vicinity of the operation could be in non-conformance to the following minimum dissolved oxygen concentration objectives set in MECP’s *Water Management Policies, Guidelines, Provincial Water Quality Objectives*.

Minimum Dissolved Oxygen Saturation and Concentration				
Temperature	Cold Water Biota (e.g., salmonid fish communities)		Warm Water Biota (e.g., centrarchid fish communities)	
	°C	% Saturation	mg/L	% Saturation
0	54	8	47	7
5	54	7	47	6
10	54	6	47	5
15	54	6	47	5
20	57	5	47	4
25	63	5	48	4

Policy Objective #3: Water Quality – Nutrients

Cage aquaculture operators should ensure that the release of waste material associated with the operation does not result in harmful or nuisance concentrations of algae and aesthetic deterioration of the local receiving water body.

The operators should ensure that water quality effects within the permitted area are minimized to reduce the potential for the operation to contribute to or cause nutrient enrichment of the local receiving water body to the extent that the water quality could be in non-conformance to total phosphorus concentration objectives set in MECP's *Water Management Policies, Guidelines, Provincial Water Quality Objectives* or any lake-wide or local nutrient loading targets established or adopted by the Province.

As an absolute minimum objective, the total phosphorus concentration at a distance of 30 metres from the edge of a cage or cage array should not exceed 10 ug/L (0.01 mg/L), and at the edge of the permitted area of the facility should not exceed the background concentrations measured at reference monitoring stations.

Policy Objective #4: Sediment Quality – Waste Assimilation and Non-toxic Sediment

Cage aquaculture operators should ensure that the release of waste material associated with the operation does not exceed the capacity of the local environment and benthic organisms to assimilate the waste material on an on-going basis and maintain non-toxic conditions of the sediment.

Non-toxic sediment is defined as sediment whose conditions do not severely inhibit the benthic invertebrate community, as demonstrated through sediment quality indicators representing at least 50% of the near-field waste depositional footprint of the operation. Waste assimilation is the consumption of waste material by benthic invertebrates and its conversion into invertebrate tissue, resulting in reduced net accumulation of the waste material at the lakebed sufficient to maintain non-toxic sediment conditions.

To help reduce net accumulation of waste material at the lakebed and the potential for toxic sediment conditions to develop, operators should minimize the discharge of waste material from the operation and ensure dispersion of the waste material within the waste depositional footprint of the operation, which will facilitate ongoing assimilation of the material by benthic invertebrates.

7. ESTABLISHING BASELINE INFORMATION FOR PROPOSED CAGE AQUACULTURE OPERATIONS

The provincial environmental policy objectives for cage aquaculture set out above apply to both existing operations, and proposed expansions and new operations where the proposed operation's annual feed allocation does not exceed the maximum feed allocation of the largest existing cage aquaculture operation in Ontario (i.e., 2,500 tonnes). Such cage aquaculture operations should be situated, sized and managed so as to ensure that the resulting release of nutrients and oxygen-consuming substances, and the deposition and accumulation of waste at the lakebed meet these provincial environmental policy objectives.

As outlined in MNRF's Application Guidelines, proponents of new and expanded operations are required to gather and assess pre-operational (baseline) environmental information on the proposed site, and model the impact of the proposed new or expanded operation to help ensure that the proposed operation is situated, sized and designed such that, if properly managed, would meet the provincial water and sediment quality policy objectives for cage aquaculture operations, including any lake-wide or local nutrient loading targets established or adopted by the Province.

The required pre-operational monitoring should include characterization of baseline water quality, sediment quality and hydrological conditions of the proposed site. This information is necessary for the consideration of site selection, operation sizing and design, and operational planning. A modelled waste depositional footprint, based on site-specific physical data and the proposed operational plan, should be used to determine whether or not the expected deposition and accumulation of waste at the lakebed would conform to the provincial environmental policy objectives for cage aquaculture set out in this document. As outlined in MNRF's Application Guidelines, this information would be part of the supporting information submitted to MNRF with applications for proposed expansions and new cage aquaculture operations in Ontario.

8. RELEASE OF DATA PROVIDED TO THE PROVINCE

Cage aquaculture licensees, through conditions of their aquaculture licences, are required to submit water and sediment monitoring data to MNRF in order to confirm compliance with water and sediment quality requirements set out in the licence conditions. Data submitted to MNRF will be shared with MECP for its interpretation and assessment of the operation's conformance to the policy objectives set out in this document. As the Province is committed to transparency, MECP will make this water and sediment quality monitoring data publicly available in a manner consistent with the Province's Open Data practices.

APPENDIX A

Application of Pesticides and Drugs at Cage Aquaculture Operations

Neither drugs nor pesticides are currently applied into water at any of Ontario's cage aquaculture operations except for occasional use of medicated feed, which is regulated under the federal *Food and Drugs Act*, *Health of Animals Act* and *Feeds Act*.

In Ontario, the application of a pesticide into water requires a site and pesticide specific permit from MECP under Ontario's *Pesticides Act* and its General Regulation (O. Reg. 36/09). Federally, if pesticides are to be used for aquaculture purposes, such products must also be applied in accordance with the requirements of the *Pest Control Products Act* (PCPA).

In addition, the deposition of drugs and pesticides into water by aquaculture operations is regulated by the new federal Aquaculture Activities Regulations (AAR) under the *Fisheries Act* that came into effect in July 2015. The AAR sets the foundation for explicit environmental management requirements, to reduce potential impacts to fish and fish habitat. These requirements include strict rules on the use of any products to treat fish diseases, environmental monitoring and reporting to government on measures taken to avoid irreversible harm to fish and fish habitat.

Under the federal AAR, aquaculture owners/operators are able to apply a drug and/or a pesticide into water at the operation if the application of the drug is completed in accordance with label requirements found on the product (including the use of medicated feed), or as prescribed by a veterinary practitioner licensed in the province of the operation and the owner/operator takes measures to minimize the risk of accidental deposit of the drug. Further, the pesticide intended for application must be registered or otherwise permitted under the federal *Pest Control Products Act* (PCPA), the pesticide must be applied in accordance with the PCPA, and the owner/operator should have considered alternatives to depositing the pesticide and made record of such consideration.

Also under the federal AAR, if unusual mortality of fish in the vicinity of an aquaculture operation is observed following application of a drug or pesticide at the operation, the owner/operator must notify a fisheries officer (designated under the federal *Fisheries Act*), follow any instructions given by the fisheries officer, and cease application of the drug or pesticide until it is determined that its application can continue.