

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

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 but is not subject to the sewage works approval requirements under the *Ontario Water Resources Act* administered by the Ministry of the Environment and Climate Change (MOECC). For this reason, the Province has identified key water and sediment quality policy objectives to ensure environmental sustainability of cage aquaculture operations in Ontario's waters.

The purpose of this document is to help ensure the protection of Ontario's "waters" (which includes their sediments) 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 draft Application Guidelines for Cage Aquaculture Facilities (Application Guidelines). The provincial environmental policy objectives for cage aquaculture 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, 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 the existing operations. 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 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 organically enriched 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 that the effects of the operations are contained within the permitted area (e.g., the Crown land tenure 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.

To meet these policy objectives, cage aquaculture operators should seek to minimize the severity of water and sediment quality effects of the operation by reducing the potential for the operation to contribute to or cause dissolved oxygen depletion, phosphorus enrichment and sediment toxicity.

The provincial environmental policy objectives for cage aquaculture are intended to work with MNRF's draft Application Guidelines for cage aquaculture. As part of the cage aquaculture application process set out in the draft 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 by the Province. Once cage aquaculture licences are issued, operators are required to undertake ongoing water and sediment monitoring and reporting to ensure that the water and sediment quality objectives are being met.

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. Also, 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 *Health of Animals Act* and *Feeds Act*.

The application of a pesticide into water requires a site and pesticide specific permit from the MOECC under Ontario's *Pesticides Act* and its General Regulation (O. Reg. 36/09).

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.

Under the federal AAR, aquaculture owners/operators would be allowed to apply a drug and/or a pesticide into water at the operation if the application of the drug (including the use of medicated feed) is 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*), take and analyse samples of affected fish, water and sediment, and cease application of the drug or pesticide until it is determined that its application can continue.

2. REGULATORY AND POLICY FRAMEWORK

Currently in Ontario, the Ministry of Natural Resources and Forestry (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 tenure permits or leases. MNRF's current draft *Application Guidelines for Cage Aquaculture Facilities* (Application Guidelines) outlines proposed MNRF's licence application requirements and the process of application review by provincial and federal agencies for periodic re-issuance 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 its current regulatory oversight of cage aquaculture, the MNRF follows a collaborative approach with the MOECC to manage cage aquaculture impacts on water quality and sediments. The management of Ontario's waters, including the soils and sediments that are in contact with the water, is part of the MOECC's environmental protection mandate.

As part of this collaborative approach to cage aquaculture operations, the MOECC provides recommendations for general and site specific water and sediment quality management conditions intended for inclusion in cage aquaculture licences issued by MNRF for cage aquaculture operations.

The MOECC's authority to manage Ontario's waters comes primarily from the *Ontario Water Resources Act* (OWRA) and the *Environmental Protection Act* (EPA), which give the MOECC the authority to regulate Ontario's 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.

Also under the OWRA, an operation that discharges waste/wastewater into any waters is required to obtain an Environmental Compliance Approval (ECA) for its sewage works (wastewater facilities), if there are sewage works associated with the operation. Generally, in order to be approved, these sewage works must be capable of treating the effluent to a level that will have an acceptably low impact on the environment. When approving sewage works, the MOECC Director imposes site-specific terms and conditions in an ECA such as effluent discharge limits, and monitoring and reporting requirements.

The policy basis for general and site specific MOECC decisions authorized under the EPA or OWRA, such as the issuance of ECAs and orders related to the discharge of contaminants into surface waters, is laid out in a number of MOECC policy documents (see the links in the footnote¹). These documents include the *Water Management Policies, Guidelines, 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.

Since the OWRA sewage works approval requirements do not apply to cage aquaculture operations as fish rearing cages lack any waste/wastewater collection, transmission, treatment or discharge facilities (sewage works), a separate policy rationale is necessary for alternate means of proactive management of environmental impacts of cage aquaculture operations to protect water and sediment quality.

The waste generated by cage aquaculture facilities is expected to be assimilated locally by natural water bodies, and MOECC has the responsibility to ensure adequate management of environmental effects of the operations. MOECC's goal is to have in place effective receiving water-based environmental effects management criteria to enable cage aquaculture facilities to demonstrate they are operating sustainably and meeting environmental outcomes consistent with the environmental effects management criteria applicable to all other direct dischargers of waste/wastewater into Ontario's waters.

The process for developing environmental objectives specific to cage aquaculture began through MOECC-led First Nations and stakeholders cage aquaculture water quality workshops in 1999 and 2000, and through MOECC participation in the development of MNRF's Application Guidelines which began in 2005. In 2009, MNRF posted for public

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>

consultation on the Environmental Registry a draft Application Guidelines and, concurrently, MOECC posted the supporting *Water Quality Discussion Paper*² and *Sediment Discussion Paper*³. 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 and the MNRF led 2010-2014 Collaborative Cage Aquaculture Sediment Policy Development Process involving First Nations, non-governmental organizations, cage aquaculture operators, and provincial and federal agencies.

3. RATIONALE FOR CAGE AQUACULTURE ENVIRONMENTAL POLICY OBJECTIVES

Effluent contaminant concentration limits and/or effluent toxicity limits are generally imposed through a sewage works ECA. The requirement for a sewage works ECA does not apply to cage aquaculture facilities, which rely on the local assimilative capacity of the water body without any waste collection or treatment works (sewage works). As such, MOECC has developed receiving water-based environmental effects criteria incorporating such measurable factors as water quality, sediment quality and effects on benthic and aquatic life in the vicinity of the facilities.

As the earlier mentioned MOECC procedure B-1-5 for deriving wastewater effluent requirements from the PWQOs focuses on “end-of-pipe” compliance limits, it is necessary to establish additional criteria to define acceptable localized effects of cage aquaculture operations. These local effect criteria incorporate a concept analogous to the MOECC’s “Mixing Zone” policy (in the PWQOs document), which accommodates a degree of localized water quality degradation in the immediate vicinity of the point of discharge of treated wastewater effluent.

The receiving water-based MOECC water and sediment quality objectives for cage aquaculture operations set out in this document are supported by research information available in literature and the MOECC’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

² MOE 2009. Development of a Coordinated Application and Review Guide for Cage Aquaculture Sites in Ontario. *Water Quality Discussion Paper*. January 2009.
http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2009/010-5166%202.pdf

³ MOE 2009. Development of a Coordinated Application and Review Guide for Cage Aquaculture Sites in Ontario. *Sediment Discussion Paper*. January 2009.
http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2009/010-5166.pdf

habitat in the vicinity of open cage operations with no waste collection system and limited flushing are the principal water quality issues that have been identified (see, for example, Black and Cromey. 2008⁴).

The specific policy objectives for cage aquaculture set out in this document only apply to cage aquaculture operations. The policy objectives set out in this document 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 MOECC approval requirements.

4. BACKGROUND FOR CAGE AQUACULTURE WATER QUALITY OBJECTIVES

In 1999 and 2000, the MOECC, 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.

In 2001, following the 1999 and 2000 First Nations and stakeholders workshops, the MOECC 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.* 2001⁵).

⁴Black 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

⁵ 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.

The key policy objectives from the 2001 MOECC recommendations were reiterated in the MOECC's 2009 *Water Quality Discussion Paper* posted on the Environmental Registry in support of the MNRF's 2009 posting of a draft Application Guidelines. That discussion paper set out water quality objectives for cage aquaculture operations in Ontario's waters 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 land tenure 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 the MOECC'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. Waste assimilation 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 provincial environmental policy objectives for cage aquaculture operations are intended to be protective of the quality of water and sediment of Ontario's waters. They represent the receiving water-based environmental effects policies and criteria specific to cage aquaculture operations located in Ontario's waters. Conformance to these policy objectives will protect water and sediment quality and ensure the environmentally sustainable use of this resource.

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

- the resulting release of nutrients and oxygen-consuming substances, and accumulation of organically enriched 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 tenure 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.

Cage aquaculture operations should seek to minimize the severity of water and sediment quality effects by reducing the potential for the operation to contribute to or cause dissolved oxygen depletion, phosphorus enrichment and sediment toxicity, and 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 materials associated with the operation does not result in measureable water or sediment quality effects beyond the permitted area (e.g., Crown land tenure 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 materials 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 MOECC's *Water Management Policies, Guidelines, Provincial Water Quality Objectives* (as amended) are not met.

Policy Objective #3: Water Quality – Nutrients

Cage aquaculture operators should ensure that the release of waste materials 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 could be in non-conformance to the MOECC's *Water Management Policies, Guidelines, Provincial Water Quality Objectives* (as amended) or any lake-wide or local nutrient loading targets established by the Province.

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

Cage aquaculture operators should ensure that the release of waste materials associated with the operation does not result in the degradation of sediment quality conditions above levels that are toxic to benthic aquatic life, or exceed the capacity of the local environment to maintain non-toxic sediment through ongoing waste assimilation.

Non-toxic sediment is defined as sediment whose conditions do not severely inhibit benthic invertebrate life, 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 materials by benthic invertebrates and their conversion into invertebrate tissue, resulting in reduced net accumulation of the waste materials at the lakebed sufficient to maintain non-toxic sediment conditions.

Sediment quality effects should be minimized by ensuring dispersion of waste materials deposited within the waste depositional footprint of the operation, which will facilitate ongoing assimilation of waste materials by benthic invertebrates, thereby reducing net accumulations of waste materials at the lakebed and the potential for the operation to contribute to or cause toxic sediment conditions.

7. ESTABLISHING BASELINE INFORMATION FOR PROPOSED CAGE AQUACULTURE OPERATIONS

The water and sediment quality policy objectives for cage aquaculture operations in Ontario, 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., 2500 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 organically enriched waste at the lakebed do not exceed the assimilative capacity of the local receiving water body; and no effects are observable outside of the permitted area to minimize any local or lake-wide cumulative effects.

As outlined in MNR's draft 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, it would meet the provincial water and sediment quality policy objectives for cage aquaculture operations, including any lake-wide or local nutrient loading targets established by the Province.

Proponents of new and expanded cage aquaculture operations are required to undertake pre-operational monitoring to determine if the proposed operation is sized and situated in an area with sufficient assimilative capacity. Pre-operational monitoring should include the characterization of baseline water quality, sediment quality and hydrological conditions. This will help determine whether or not the expected release of nutrients and oxygen-consuming substances would exceed the assimilative capacity of the local receiving water body and the proposed operation, if properly managed, could conform to the water and sediment quality objectives, and any nutrient loading targets established by the Province. 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 organically enriched waste at the lakebed would exceed the assimilative capacity of the local receiving water body, and whether or not the effects of the operation would be observable outside of the proposed permitted area (e.g., the Crown land tenure requested to be set in a permit or lease under the *Public Lands Act* or the area requested to be specified in conditions of the cage aquaculture licence). As outlined in MNRF's draft Application Guidelines, this information would be part of the supporting information submitted to the 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, may be required to submit water and sediment monitoring data to the MNRF to confirm compliance with the licence conditions. Data submitted to the MNRF will be shared with the MOECC for interpretation of the data and assessment of conformance to the policy objectives set out in this document. The Province is committed to transparency, and MOECC will make this water and sediment quality monitoring data publicly available in a manner consistent with the Province's Open Data practices.