The Environmental Management Program for the Marine Finfish Cage Aquaculture Industry in New Brunswick

Version 2.0

July 2006

New Nouveau Brunswick

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1.0 INTRODUCTION

This Environmental Management Program (EMP) applies to marine finfish cage aquaculture sites operating in New Brunswick. The provisions of this program will be enforced through the Aquaculture Approvals program administered by the Department of Environment (DENV), under the authority of the *Water Quality Regulation – Clean Environment Act* and by Fisheries and Oceans Canada (DFO) through the Fish habitat Protection Provisions of the *Fisheries Act*.

The overall goal of this EMP is to guide the long-term environmental sustainability of the marine finfish cage aquaculture industry in New Brunswick. It is intended to be continually evolving in response to the opportunities and challenges of the marine finfish cage aquaculture industry. It must continue to meet the overall goal of guiding long-term environmental sustainability. The EMP will continue to be responsive to evolving science, environmental management techniques, technology, and the public interest.

This Version 2.0 of the document will replace the previous edition (Version 1.0). Review of this EMP will be conducted regularly and amended as circumstances require. Major revisions will include a complete re-issuance of the entire document.

This EMP has several components designed to support the overall goal. These components are reflected in the following sections of the document:

- **2.0 ENVIRONMENTAL MANAGEMENT FRAMEWORK** – to provide a framework for the implementation of this EMP, provide marine environmental quality objectives and indicators
- **3.0 MITIGATION AND REMEDIATION** – to provide a guide for mitigation and remediation of marine finfish cage aquaculture sites should marine environmental quality objectives not be met
- **4.0 ANNUAL SCHEDULES** – to provide a guide for key dates and timeframes for required actions

1.1 Background

Since January 2005 both provincial and federal government regulators and industry have been involved in developing a process to apply a Performance Based Standards (PBS) approach to the management and regulation of the marine finfish cage aquaculture industry in southwest NB. Currently, DENV is responsible for issuing Approvals to Operate, which include conditions such as environmental monitoring requirements, waste management plans, chemical storage and handling, noise control, etc., and the New Brunswick Department of Agriculture, Fisheries, and Aquaculture (DAFA) is responsible for issuing aquaculture licenses, which includes conditions such as limitations on the area or size of a site and to date, the level of production.

It is recognized that the production levels at any given site are contingent on the environment's capacity to sustain aquaculture development at that particular location and influenced by the management practices that are implemented. Therefore, baseline assessments are undertaken to assess initial site conditions which vary from erosional to depositional. Factors such as speed and direction of current, bottom type, flushing capability and assimilative capacity of the sediments, water depth and quality, can influence the development potential of a site. The Estimated Site Potential (ESP) was used in the past as a mathematical formula for determining initial production levels on all new aquaculture sites. The ESP considered the physical engineering, stocking density and market weight of fish in order to determine the estimated number of fish a site could reasonably support. An Allowable Production Limit (APL) was determined as a percentage of the ESP using criteria primarily based on the depositional or erosional nature of the site, but also considered fisheries habitat concerns and other ecological factors.

A flaw identified in the governance system described above was regulators inability to truly identify the production numbers on a site and the unbalanced production at sites within bays. In addition, industry techniques and management practices have evolved considerably since 1993 and policy has not been keeping pace. There was acknowledgement by regulators that the process in place was not effective, equitable or easily enforceable, and that an updated system for sustainable development needed to be evaluated and implemented. Therefore, changes to the current regulatory framework including environmental management, reporting, feedback and compliance were made.

As a result, the aquaculture licenses issued by DAFA will no longer make reference to a specific APL, however, this has been replaced by a system of production plans that are submitted, reviewed, and approved as required by the DENV Approval to Operate. The DAFA license will still be issued but instead of making reference to a specific APL and holding unit capacity, the license will make reference to a site development plan which must demonstrate that all holding units, structures and equipment associated with the aquaculture operation must be contained entirely within the lease boundaries of the site.

2.0 ENVIRONMENTAL MANAGEMENT FRAMEWORK

This section describes the environmental management framework used to ensure the long-term environmental sustainability of marine finfish cage aquaculture in New Brunswick. It outlines a Performance Based Standards (PBS) approach to the regulation of marine environmental quality intended to provide a regulatory framework that is operationally flexible and provides the maximum level of protection to the environment. This PBS approach is based on the following guiding principles:

- Maintenance of environmental quality with operational flexibility;
- Application of a risk-based and science-supported environmental management and regulatory process;
- Intergovernmental cooperation; and
- Public accountability

This section also details and defines the marine environmental quality objectives (MEQO) that will be applied to the marine finfish cage aquaculture industry and describes the environmental indicators and monitoring program that will be utilized to determine site classifications. The MEQO will be defined for the indicators so that the results of the monitoring can be placed in context.

It is the intention of DENV and other government agencies to ensure smooth coordination between Provincial Regulation and Federal responsibilities. Thus, both the MEQO and the environmental indicator in this EMP have been established in accordance with current science and management advice.

2.1 Marine Environmental Quality Objective (MEQO)

Government regulators recognize the Oxic site classification as the MEQO for marine finfish cage aquaculture sites. However, should Oxic conditions not be met, sites must be in compliance with regulatory processes that identify efforts to be undertaken to improve or maintain site conditions.

Fish habitat concerns increase when sediments become hypoxic. Hypoxic conditions are of concern to government regulators and require appropriate site management responses and/or potentially a DFO *Fisheries Act* Authorization to prevent further progression to anoxia. Sites with anoxic conditions, and in some cases hypoxic conditions, operating without a *Fisheries Act* Authorization are likely in contravention of the *Fisheries Act*. These conditions can be defined along a gradient of decreasing presence and diversity of macrofauna and the change from aerobic to an anaerobic flora or by measurements of sulfide in excess of 3000μM.

2.2 Environmental Indicators

Sediment sulfide concentration is the indicator that has been chosen for this EMP and is related to the benthic environment in the immediate area of the cage structures and lease area. The criteria for this choice are listed as follows:

- Scientific confidence in the parameters and methods of sampling analysis to describe changes to the benthic community structure;
- Repeatability and consistency in sampling and analysis;
- Clear specification of spatial and temporal bounds; and,
- Cost effectiveness

Sediment sulfide concentration in the sediment is one of the key indicators of environmental quality recommended by Wildish et al. (1999). However, other indicators, such as oxidation-reduction potential, or those related to water quality may also satisfy one or more criteria in the above list, but none to the extent of the benthic environmental indicator chosen for this EMP.

2.3 Site Classification

All marine finfish cage aquaculture sites will be classified based on the mean sediment sulfide concentration measured during the annual monitoring program. Other parameters and information, such as the oxidation-reduction potential results and video/visual observations will continue to be included as part of the weight-of-evidence approach for the overall site assessment as well as aid in determining cause-effect relationships and appropriate management responses. These site classifications are listed in Table 1 below.

Table 1: Site Classifications and Sediment Sulfide Concentrations

Site Classification		Sediment Sulfide Concentrations
Oxic	Oxic A	Sulfide = <750μM
	Oxic B	Sulfide = 750 to 1500 μM
Hypoxic	Hypoxic A	Sulfide = 1500 to 3000 μM
	Hypoxic B	Sulfide = 3000 to 4500 μM
	Hypoxic C	Sulfide = 4500 to 6000 μM
Anoxic	Anoxic	Sulfide > 6000 μM

2.4 Environmental Monitoring Program

The primary purpose of the monitoring program is to accurately evaluate the condition of the marine sediments under the marine finfish cage aquaculture sites and provide a reliable indicator of compliance with the MEQO. The information obtained from the monitoring program is valuable to both government and industry in recognizing trends and cause and effect relationships associated with sustainable marine finfish cage aquaculture.

The monitoring program will be conducted annually from the beginning of August to the end of October during the peak of growth and feeding. This timeframe has been chosen to assess conditions when the maximum potential for degradation exists. The monitoring program will be conducted in the area immediately under and adjacent to marine finfish cage aquaculture sites.

The monitoring must be carried out in accordance with the most recent version of the "*Standard Operating Practices for the Environmental Monitoring of the Marine Finfish Cage Aquaculture Industry in New Brunswick*" (SOP). Additional monitoring may be required in some circumstances, as directed by the Minister of Environment or Fisheries and Oceans Canada.

The monitoring program will undergo review and adjustment as our knowledge and understanding of environmental conditions in the marine environment surrounding marine finfish cage aquaculture sites evolves. Review and adjustment will be triggered when it is demonstrated that there is a need, based on the progress of scientific research, or shifts in farm management strategies.

2.5 Auditing

Audits will be conducted by DENV on an annual basis on a minimum of 20% of the total marine finfish cage aquaculture sites monitored in the program. The purpose of the audit is to ensure accurate and reliable information is available for the government agencies and growers and to ensure that the SOP is being followed.

Audits will consist of one or all of the following three components:

- A review of the monitoring practices on each site as indicated by documentation of sampling, analytical and quality assurance and quality control procedures, test results and supporting data;
- Visual observations of the actual monitoring work in progress; and ,
- Repeat sampling by auditor if necessary.

2.6 Ongoing and Future Initiatives

A considerable amount of research has been conducted to document the effects of finfish culture, particularly of Atlantic salmon on the benthic environment. This research has greatly improved our understanding of the factors influencing the effects at the site-specific level.

Researchers have attempted to better understand the factors influencing the effect on the benthic characteristics with the intent on developing a model for predicting environmental effects of marine finfish cage aquaculture. As research continues and additional data becomes available, it is expected that models will eventually be developed to account for a broader spectrum of potential effects. As new knowledge is acquired, the EMP may be adjusted to reflect new capability to identify parameters appropriate for assessing additional near-field and far field effects of marine finfish cage aquaculture operations. In addition, as information becomes available, other indicators of environmental impact may be incorporated into the EMP.

In recognition of global efforts to manage marine finfish cage aquaculture in a more integrated fashion at the bay or ecosystem level, research is being pursued to better understand the cumulative effects of finfish farms and other human activities on the marine environment. This includes activities associated with the use of chemicals and metals, among others, at finfish farm operations that may affect the predefined MEQO. Work is continuing towards the development of environmental quality guidelines (water and sediment) that would be applicable to the aquaculture sector. Other aspects of environmental effects (e.g. input of chemicals, metals, etc.) are also being addressed as opportunities arise. Progress in these areas may help refine future monitoring requirements.

3.0 MITIGATION AND REMEDIATION

The environmental management of an industry requires that action be taken to react to deviations from the MEQO, as detected by the monitoring program. This section describes the response guide that will aid an operator in preparing and implementing a plan of action should the MEQO not be met directly below or in the vicinity of the cages. The primary focus of mitigation and remediation is to react by implementing changes in operational practices when the MEQO is not met. The Aquaculture Site Environmental Review Committee (ASERC) will review remediation plans farmers submit in order to fulfill requirements under a compliance schedule.

The current MEQO is based on the sediment quality conditions beneath marine finfish cage aquaculture sites and is intended to promote sustainable fish farming in SWNB. The sediment quality conditions and resulting site classifications are surrogate measures for negative changes to benthic fish habitat caused by organic loading. Based on this EMP, changes in the benthic MEQO will be attributed to operations at the cage site. It is recognized that through sustainable siting of fish farms and the implementation of Operational Best Management Practices, both organic and inorganic loading can be minimized and adverse effects to the benthic environment avoided.

3.1 Operational Best Management Practices

The following practices are designed to minimize the organic and inorganic loading from marine finfish cage aquaculture sites and are a requirement of all marine finfish cage aquaculture operators. All site staff and contractors must understand that harmful releases of waste materials could result in enforcement action under the New Brunswick *Clean Environment Act* against the corporation and/or individuals (up to $50,000 potential fine per individual and up to $1,000,000 potential fine per corporation). Enforcement action against the corporation or individuals could also be taken under federal legislation such as the *Fisheries Act* and *Canadian Environmental Protection Act*.

3.1.1 Waste Management

- Cage site operators are required to develop and comply with site-specific waste management plans developed by their facility as required by provincial and federal regulators. The aim of the plan is to ensure proper disposal of all waste materials generated at the facility. Categories of waste covered include, but are not limited to: operational debris, hazardous waste, human waste, bio-fouling, fish mortalities, fish feed, waste products from harvesting, etc.

3.1.2 Record Keeping and Reporting:

- Marine finfish cage aquaculture site operators are required to maintain records as per their Approval to Operate and report information as required by provincial and federal regulators.
- Environmental monitoring data will be reported to DENV within 10 calendar days of sampling activity.

3.1.3 Equipment Cleaning (nets, cages, mooring, other equipment)

- It is recommended that no net washing be conducted on-site, and that farmers monitor nets for biofouling organisms during routine mortality dives.
- In some circumstances, maintenance washing of lightly fouled nets still attached to cage structures is allowed on-site; however, once nets are removed they must be brought to shore for cleaning at an Approved land based facility.
- Washing of lightly fouled equipment or nets with washing systems at the site will be conducted only under conditions that maximize dispersal of the dislodged materials away from the site and neighboring sites (e.g. strongest currents).
- Nets will be replaced at least at the beginning of each production cycle, and more often as required.
- No nets or other equipment shall be dropped to the bottom for the purpose of storage or cleaning. In the event of emergency circumstances such as worker safety or fish survival, any nets or equipment dropped to the bottom must be within lease boundaries and must be reported to DENV and DFO immediately.
- Sites classified as HYPOXIC B, C, or ANOXIC will not conduct any on-site net cleaning.

3.1.4 Equipment Disinfection (nets, cages, mooring, other equipment)

- The “Cleaning and Disinfection Guidelines for the Control of Infectious Salmon Anemia” document that was issued to growers from DAFA, February 10, 2003, should be followed.
- Cage disinfection at a location other than on the aquaculture site will only take place within the intertidal zone, below the ordinary high water mark (OHWM), with appropriate tenure from DNR, permission from the upland property owner, and a review by DFO. It is recommended that cage disinfection only be undertaken at facilities Approved by DENV for this activity.
- Steam is the only disinfectant to be used on-site to clean cages and equipment.
- The cages will be cleaned on the aquaculture site prior to transport to the off-site location where the disinfection will take place.

- Only the following disinfecting agents will be used to clean cages at a location other than on the aquaculture site: steam, chlorine-based solutions, iodophor-based solutions, and hydrogen peroxide-based solutions.
- Environment Canada has suggested maximum discharge concentrations for each of the indicated disinfectants so that runoff from the disinfection process should not be deleterious to fish. The release of disinfectant solutions to waters frequented by fish could be considered a violation of Section 36(3) of the federal *Fisheries Act* at concentrations above the following maximum values:
    - Chlorine = 0.02 ppm
    - Iodine = 0.1 ppm
    - Hydrogen peroxide = 0.5 ppm
- During disinfection, the disinfectants will be stored such that any spill is contained and not released to the environment. All reasonable precaution will be taken to avoid releases due to spills.
- Cage disinfection at a location other than on the aquaculture site will only occur at low-tide, in areas free of tidal pools and other standing or free-flowing water. Additionally, disinfection will not take place within 30 m of a wetland or watercourse without a Watercourse Alteration Permit from DENV.
- When cage disinfection is to occur at a location other than the aquaculture site, the location, the name of the company that owns the cages, the name of the company conducting the disinfection, and the name of an on site responsible party for contact purposes will be reported to DENV 48 hours in advance of the event.
- Disinfection of cages will only take place during sunny days, especially with chlorine-based solutions. Bright sunshine will aid in decreasing the concentration of chlorine, and speed up the evaporation of other disinfectant solutions.
- Care will be taken to ensure that disinfectant is not applied in excess. Direct discharge of disinfectants other than steam to waters of the province or to marine waters will not occur.
- Disinfectant solutions will be directed only at cage structures, with care taken to avoid over-spraying onto the beach.
- Ample drying time will be allotted to ensure that all disinfectant has completely dried prior to inundation with the next high tide.
- The disinfection of the cages will be spread out over a number of days to reduce the potential for impacts from the disinfectant residues.
- Disinfectant storage will occur in an area not in danger of being inundated by tidal waters or any other water source.
- To whatever extent possible, disinfection events will be coordinated with other growers within the same Bay Management Area to spread it out over time and space.

3.1.5 Feed Handling and Storage:

- Site staff and feed delivery personnel will take all reasonable precautions to reduce spills during delivery of feed to the site.
- Should a spill of feed occur, cleanup will occur immediately to minimize the loss of feed into the ocean.
- Accurate records will be kept of the amount of feed delivered to the site, stored at the site, fed to the fish, spilled and/or returned unused to the manufacturer. These records will provide a mass balance of feed use at the site.
- The amount of feed on site at any one time will be limited to an amount that can be safely and properly stored at the site.
- Feed will be stored, as much as practically possible at the site in covered areas including hoppers, bins, or buildings so that spills and spoilage are minimized.
- Bags or open containers of feed will not be left exposed or uncovered at the site.
- Any feed that is unusable will be removed from the site as new feed is delivered and disposed of at an approved site.

3.1.6 Feeding Practices

- Amounts of feed given to stock will be based on biomass contained in the pen and environmental conditions present.
- Feeding will be reduced or stopped if conditions such as low temperature, low dissolved oxygen, high tide currents, or heavy weather suggest that utilization of feed by the stock will be affected.
- Site staff will monitor all feeding operations at the facility. Feeding equipment will always be monitored during operations. Staff will closely observe fish feeding behavior.
- The use of underwater video cameras to monitor the feeding activity is recommended for all sites and will be used when available or when required.
- Feeding rates should be reduced or stopped when staff observes changes in fish activity indicating a reduction in appetite and/or if uneaten feed is detected passing through the bottom of the cage nets.
- Feeding will be temporarily reduced or suspended at times of strong currents flowing through the net pens that impact the ability of the fish to eat the feed.
- Hand feeding will be conducted in a manner to ensure an even distribution and reduce the amount of waste feed. Feeding will be slowed or paused if staff observe a reduction in feeding activity.
- Feeding performed with feed blowers will be conducted in a manner to ensure minimum loss of uneaten fish feed. Feeding will be slowed or paused if staff observe a reduction in feeding activity.
- Feeding equipment must be properly maintained to minimize the crushing of the feed pellets that can result in fine feed dust that will not be eaten by the fish. The

operator must establish a schedule for the regular maintenance of mechanical feed blowers.

- Mechanical feed blower nozzles must be carefully aimed and controlled to ensure that the feed is being evenly distributed across the surface of the net pen and that no feed is missing the net pen entirely.
- Computer-controlled feeding systems require that a qualified operator be on duty at all times when feed is being administered.
- Detailed records will be kept for each cage of feed type and amount, fish numbers, total fish biomass, water temperature, and growth rates to ensure optimal feed conversion rates are being achieved at the site and that minimal feed losses are occurring.
- Feeding of moist feed will be conducted slowly to ensure that the fish have adequate time to consume the feed being distributed in the net pens.
- Feeding will be timed to coincide with the times of the day that the fish are eating well.
- Close attention will be given to the size of the pellets being used to feed the fish to ensure that the proper size pellets for the size of the fish in the net pens are being utilized.
- All staff must be trained in the above practices. Detailed records of training must be kept for each employee including training received and dates of training.

3.2 Site Classification Management Responses

The Environmental Effects Management Framework (EEM), in support of the PBS framework outlined in Table 2 is designed to promote compliance with the provincial and federal legislation and relies on a tiered approach to monitoring and site management. Table 2 describes a series of site classifications defined by mean sulfide measurements taken from site sediments, which confirms when a site management response is required. The EEM is based on a multi-tiered approach whereby monitoring efforts increase proportionately with the severity of the measured impact. Table 2 also illustrates the application of progressively more rigorous management requirements in response to degrading site classification. Monitoring and site management responses are used to delineate the temporal and spatial extent of the effect and promote benthic sediment conditions defined as Oxic or having sulfide levels <1500µM. Details of the Tiered EEM are outlined in the most recent version of the "*Standard Operating Practices for the Monitoring Program of the Environmental Monitoring Program for the Marine Finfish Cage Aquaculture Industry in New Brunswick.*"

3.2.1 OXIC A and OXIC B SITES (<1500µM)

These sites have low environmental effects on the marine sediments under the cages and will follow the Operational Best Management Practices and implement the Tier 1 EEM.

3.2.2 HYPOXIC A SITES (1500-3000µM)

These sites may be causing adverse environmental effects to the marine sediments under the net pens. They will continue to follow the Operational Best Management Practices and implement the Tier 1 EEM.

The Approval Holder must undertake one or more of the following **Adjustments to the Operational Best Management Practices** or other appropriate or acceptable measures as identified by the site operator that are applicable to the site's operations:

- Increase the frequency of record keeping from weekly records to daily records.
  - By keeping more detailed and frequent records, the site operator will have better and more complete data for analyzing site operations.

Table 2 Sediment condition, ratings and site management decision framework based on analysis of mean sulfide concentrations in surface sediments.

Site Classification	Sediment Condition	Responsive Management Decision Framework	
		TIERED EEM	**Site Management Response**
Oxic A	**Sulfide < 750 μM**	TIER 1 EEM (See SOP)	Refer to *Operational Best Management Practices* as defined in the Section 3.1
Oxic B	**Sulfide = 750 to 1500 μM**		
Hypoxic A	**Sulfide = 1500 to 3000 μM**	TIER 1 EEM (See SOP)	Refer to Section 3.2.2 including the Adjustments to the *Operational Best Management Practices*
Hypoxic B	**Sulfide = 3000 to 4500 μM**	TIER 1, 2 EEM (See SOP)	Refer to Section 3.2.3 including the Additional *Operational Best Management Practices*
Hypoxic C	**Sulfide = 4500 to 6000 μM**	TIER 1,2,3 EEM (See SOP)	Refer to Section 3.2.4 including the Further enhanced *Operational Best Management Practices*
Anoxic	**Sulfide > 6000 μM**	TIER 1,2,3 EEM (See SOP)	Further response measures will be decided upon in consultation with the Site Management Committee as defined in Section 3.2.5

- Conduct more detailed data analyses.
  - Instead of only looking at overall farm productivity, fish size and growth, feed consumption and feed conversion rates, the site operator will also examine the site data on the basis of cage, feeding technician, cage position within the farm site and environmental condition. Data analysis will be looked at from a site-specific historical perspective, as well as between site operations. Statistical methods should be applied (graphics, trend analysis)
- Evaluate the use of dry feed versus moist feed.
  - The site operator will conduct this evaluation by examining the feeding activities of the fish, feed conversion rates, and/or feed usage per net pen.
  - The site operator will conduct feeding trials with both moist and dry feed and examine the above factors to determine effectiveness.
- Review status of staff training and update as required.
  - The site operator will evaluate the site staff in terms of experience, qualifications, and awareness of site policies and procedures.
- Review equipment maintenance schedule and practices.
  - All equipment will be maintained in good repair and working order. There will be a regular program of inspection and maintenance. All inspection and maintenance activities will be recorded in a log book.
- Review and improve site cleaning practices: frequency, timing, methods, on-site vs. off-site.
  - More frequent on-site cleaning of lightly biofouled equipment will reduce the potential for organic loading impacts.
  - At some sites, on-site net cleaning will be avoided and the site operator should make more frequent net changes.

3.2.3 HYPOXIC B SITES (3000-4500μM)

These sites are likely causing adverse environmental effects on marine benthic sediments. They will follow the Operational Best Management Practices and implement the Tier 2 EEM (Confirmation Monitoring) in addition to the Tier 1 monitoring. This increased level of monitoring reflects the potential for causing adverse environmental effects, and the need for more detailed information on which to base responses should further adverse effects be observed. In addition, the site operator must initiate enhanced practices that include specific actions to reduce organic loading.

The site operator, upon receiving notification of this classification, will submit a report in writing to DENV within 30 calendar days of being notified describing the action to be taken as explained in this section, including identified solutions. This site classification will require that the operator review and revise production plans for future cycles and provide strong rationale for maintaining or increasing production levels.

An Approval Holder is advised that if there is a probability that the site will become further degraded before corrective actions can be taken (i.e. before the end of the production cycle), he or she should discuss the situation with DFO and discuss the necessity for applying for *a Fisheries Act* Authorization.

In addition to the requirement for an increase in monitoring and reporting to government, a site in HYPOXIC B must follow the requirements for the HYPOXIC A classification AND follow two or more of the following **Additional Best Management Practices** that are applicable to the site's operations:

- Conduct an internal audit of site operations in addition to any regularly scheduled auditing.
    - An internal auditor will be a site manager from another farm operated by the same owner or an experienced salmon grower from within the company.
    - An internal auditor will examine the operational practices followed on the site for such things as record keeping, feed handling and storage, feeding, equipment cleaning and maintenance, environmental monitoring and waste management and determine if the site's Operational Best Management Practices are being followed.
    - The internal auditor will file a written report noting any deficiencies observed and make recommendations for improvements in site operations. This report must be maintained for potential third party audit processes.
- Modify the harvesting schedule to reduce biomass as soon as possible over degraded parts of the site.
    - If a particular portion of the site is more degraded, the net pens in that area will be harvested first or have its harvesting schedule advanced to reduce the biomass potentially impacting that portion of the site.
    - Increase the fallow period to allow improved site recovery.
    - Earlier harvesting of fish from more degraded portions of the site will provide for a longer fallow period of that area before re-stocking.
- Review and adjust site set-up and net pen orientation.
    - Tidal currents are not necessarily uniform across a site. A HYPOXIC B site will examine the tidal current patterns on the overall lease and cages could be re-positioned to take best advantage of the dispersal provided by stronger currents.
    - If space allows, the net pens will be arranged for subsequent production cycles to avoid further impacts to areas showing adverse environmental conditions.
- The site operator will not conduct any on-site equipment or net cleaning and implement a program of more frequent net changes.

3.2.4 HYPOXIC C SITES (4500-6000μM)

These sites are causing adverse conditions in the marine sediments directly under the net pens as a result of releases of organic material and have been defined by DFO as unacceptable unless Authorized pursuant to the *Fisheries Act*. These sites must continue to follow the Operational Best Management Practices and implement the Tier 3 EEM (Spring Monitoring), in addition to Tier 1 and Tier 2 monitoring. The site operator must also initiate enhanced practices that include specific actions to reduce organic loading.

The site operator, upon receiving notification of this classification, will submit a Remediation Plan, for Approval, to DENV within 30 calendar days of being notified describing the action to be taken as explained in this section, including identified solutions. This must also include a plan for subsequent production cycles that must not propose any increases in the production level at the site and provide the rationale for maintaining levels, if applicable.

As a result of the degraded site conditions, a *Fisheries Act* Authorization will likely be required. Therefore the site operator should discuss the options for applying for a *Fisheries Act* Authorization with DFO.

In addition to the requirement to conduct increased monitoring and reporting to government, a site in HYPOXIC C must build on the practices noted for HYPOXIC B sites **AND** follow the **Enhanced Best Management Practices as described** below:

- The site operator must thoroughly review the site operations including conducting an external, third party audit of the operation to identify potential problems.
    - An external, third party auditor must not be someone associated in any way with a site owner and /or site operator for any New Brunswick salmon farm.
    - The auditor must be recognized by government regulators through ASERC as a properly qualified, independent auditor.
    - An external auditor will examine the operational practices followed on the site for such things as record keeping, feed handling and storage, feeding, equipment cleaning and maintenance, environmental monitoring and waste management and determine if the site's Operational Best Management Practices are being followed.
    - The external auditor will file a written report with DENV noting any deficiencies observed and making recommendations for improvements in site operations.
- The site operator must conduct studies to improve the understanding of the tidal currents on-site and how that could affect organic deposition (e.g. plume delineation, current modeling).
    - Tidal currents are not necessarily uniform across a site. A HYPOXIC C site will require the site operator to examine the tidal current patterns on

- the overall site lease. This could include conducting tidal current measurements and modeling studies to fully understand the tidal currents on the site and how the currents impact dispersion of organic material released from farm operations.
- If the studies indicate that it would be beneficial for waste dispersion, the site operator will rearrange or re-position the site to take the best advantage of the available currents.

- The site operator will not conduct any on-site equipment or net cleaning and implement a program of more frequent net changes.
- The site operator will consider reducing stocking density.
- If no further improvements in site operational practices can be identified and implemented to further reduce organic loading, DENV may instruct the site operator to reduce the size or loading density on the site through an expedited or focused harvest program.

3.2.5 ANOXIC SITES (>6000μM)

A site classified as ANOXIC is causing severe damage to the marine habitat as a result of releases of excessive organic material. ANOXIC sites are in non-compliance with DENV Approvals to Operate and site operators will be subject to the DENV Compliance and Enforcement Policy. In addition, anoxic sites are likely to require a *Fisheries Act* Authorization. Therefore the site operator should discuss the options for applying for a *Fisheries Act* Authorization with DFO.

The site operator will be required to work closely with government regulatory agencies and to follow any specific direction provided. Government-directed actions could include an expedited or focused harvest program, a longer-term fallow period before re-stocking, increased monitoring, and limitations to future operations (production levels, site layouts, equipment requirements, monitoring, etc.).

3.3 Aquaculture Site Environmental Review Committee (ASERC)

ASERC is chaired by DENV and is made up of representatives from DENV, DAFA, DFO and Environment Canada (EC). Other agencies may be involved as required. Site operators with sites in the HYPOXIC C or ANOXIC categories are required to develop Remediation Plans within 30 calendar days of being notified and within the following context:

- The site operator will develop a Remediation Plan with input from the ASERC.
- The site operator will implement the Remediation Plan approved by the Minister of Environment on the advice of the ASERC.

- Individual Remediation Plans will identify the area and timing of implementing actions, as well as observing results. These may vary from site to site depending on environmental and operational conditions.
- Remediation Plans will provide a justification for the area and timing of remedial activities.
- Remediation Plans must describe actions intended to achieve improved site condition results by the time the monitoring program is conducted in the following year.

The ASERC operates under a Terms of Reference which includes a protocol for the review of Production Plans and evaluation of Remediation Plans.

4.0 ANNUAL SCHEDULES

Dates and time frames are established to ensure that a Remediation Plan is prepared by the grower, reviewed by the ASERC, approved by the Minister, 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:

August 1 – October 31 (Tier 1 Monitoring): Required by all Approval Holders. The site operator submits Tier 1 Eh/sulfide readings to DENV within 10 calendar days of monitoring occurring.

March 1 – May 31 (Tier 3 Monitoring): Required if mean Tier 1 or Tier 2 sulfide levels ≥4500μM. The site operator submits Tier 3 Eh/sulfide readings to DENV within 10 calendar days of monitoring occurring.

Within 20 calendar days of Tier 1 or Tier 3 monitoring: If required (i.e. mean Tier 1 or Tier 3 sulfide levels ≥3000μM), the site operator must conduct Tier 2 (confirmation) monitoring. The operator must submit Tier 2 Eh/sulfide readings to DENV within 10 calendar days of monitoring occurring. Site plans and Tables 5 & 6 from the SOPs must also accompany the results.

Within 14 calendar days of submission of Tier 1, Tier 2, and/or Tier 3 results: DENV notifies the site operator of Site Classification and/or requirements to implement additional or enhanced Operational Best Management Practices, which may include the submission of a Remediation Plan.

Within 30 calendar days of being notified: Remediation Plans are to be submitted to DENV and distributed to the ASERC (If not provided electronically, 4 hard copies of the plan are to be submitted to DENV, 4 copies of the video are to be provided as well).

Within 30 days of being received: The ASERC will review and provide comments on the Remediation Plan, including the necessity for any revisions.

Within 7 calendar days of being notified: Revised Remediation Plans are to be submitted to DENV (If not provided electronically, 4 hard copies of the plan are to be submitted to DENV).

Within 10 calendar days of being received: If acceptable, the revised Remediation Plan will be approved by the Minister of Environment and a new Approval to Operate will be issued. The site operator is to begin implementing the approved Remediation Plan immediately.