Prince Edward Island
Environment, Energy and Forestry

A WETLAND CONSERVATION POLICY FOR PRINCE EDWARD ISLAND

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Introduction

The *Wetland Policy for Prince Edward Island* is intended to complement existing legislation, regulations and operational policies protecting wetlands. All wetlands in P.E.I. received some protection under Section 10 of the *Environmental Protection Act.* This policy is intended to accentuate the importance of maintaining wetland functions and values and recommends appropriate mitigation mechanisms to insure **no net loss** of wetlands and wetland function.

Legislation, Regulations and Guidelines

Previous to the policy, when a development proposal was submitted to the Department of Environment, Energy & Forestry (EEF) for permit approval, it was screened to determine if it was an ***undertaking***, which would trigger an *Environmental Impact Assessment*, or simply a **project**. If wetlands were potentially affected, the undertaking or project proponent required a Watercourse Alteration Permit (Section 10, EPA). The policy within the EEF was "avoidance" of wetlands, unless it was "in the greater public interest" such as the Confederation Bridge or concerns for public safety as in the case of highway or bridge construction. This policy of **wetland avoidance** has served to provide protection to watercourses and wetlands.

Impacts of the *Wetland Policy for Prince Edward Island*

Despite protection given wetlands under existing legislation, permits were issued (in the public interest) that resulted in wetland loss and degradation. While consideration was given to **minimizing** damage, there was no policy in place requiring the proponent to **compensate** for the loss of wetland or wetland function and value. Under a policy of **No Net Loss (NNL) of wetlands and wetland function**, the proponent is now required to provide funding or conduct the work to replace wetland lost "in the public interest". Wetland replacement considers wetland function, area, type of wetland, geographic context and time frame.

The policy endorses the **mitigation** process, a hierarchical approach to wetland protection from development, starting with **avoidance** of wetlands as the top priority. In the rare case where the effects of development on wetlands cannot be avoided entirely *(for the greater public good)*, such effects are reduced to the greatest extent possible through the second step in the sequence, **minimization**. Following the **minimization** process, the proponent is required to redress the wetland lost through the **compensation** process, the third step in the procedure.

[*Of twenty Watercourse Alteration Applications requesting the infilling of wetlands, primarily salt marsh, during the period 1996-2000, a total of eleven were approved "in the public interest". There is only one example of voluntary compensation for wetland loss (Confederation Bridge Project) in which a small marsh adjacent to the wetland lost was enhanced in 1994. The result was still a net loss of wetland, since the wetland fill in was not replaced.*]

Background

Wetland Functions and Values

Wetlands perform a variety of important functions including but not limited to the following:

- Maintain ecosystem health and biodiversity by providing habitats to a wide variety of economically important fish and wildlife species;
- Form a vital link in the hydrologic (water) cycle by acting as groundwater recharge, discharge and storage reservoirs;
- Act as water purification systems by treating potentially harmful products in runoff from terrestrial sources by removing bacteria, assimilating nutrients (nitrates, phosphates, ammonia) and accumulating and retaining suspended sediments (silt).
- Contribute to productivity of rivers and estuaries by producing and exporting organic material and nutrients vital to nursery, growth and survival of valuable fish and wildlife species;
- Contribute to the global recycling of carbon, nitrogen and sulfur through anaerobic reduction which occurs in the wetland bottoms; and
- Accumulate organic matter and contribute to carbon sequestration thus acting as "carbon sinks" which aid in reducing the "greenhouse effect".

Additional Benefits:

- Stabilize shorelines of rivers and coast; and
- Provide areas for recreation (hunting, fishing, trapping, bird watching and canoeing), food production and other commercial opportunities.

Consequences of Wetland Loss

When wetlands are lost or their functions diminished, the natural capacity to filter and purify agricultural and domestic runoff is decreased. The impacts of high nutrient loads, over-enrichment (eutrophication), and oxygen depletion on rivers and estuaries are increased. Loss of in-stream wetlands increases the potential for coliform bacterial contamination of shellfish beds.

Wetland loss results in a loss of wildlife habitat and reduced productivity. Loss of wetland also decreases the ecosystem's capacity to contribute to the recycling of carbon, nitrogen and sulfur as well as carbon sequestration.

History of Wetlands on Prince Edward Island

Clearing of land during and following settlement, has resulted in an unknown loss of wetlands on Prince Edward Island over the past 350 years. Draining of salt marshes was initiated by the Acadians over 300 years ago. Undoubtedly, there was and continues to be a pattern of wetland drainage and infilling for agriculture, urbanization and shoreline cottage development. This has been offset to a degree by the development of wetlands associated with mill dams constructed by our ancestors in streams and rivers. This helped to compensate for the general lack of surface water on the Island.

More recently, numerous small wetlands have resulted from the construction of stock watering ponds and borrow pits in areas with high water tables. During the early and mid 20th Century, dams were constructed in Island streams by fish and wildlife interests. As well, farm pond programs sponsored by the federal government (ARDA) contributed to the creation of wetlands during the 1960's. Over the past 30 years, Ducks Unlimited (Canada), in cooperation with the Province and private interests, has constructed, repaired and enhanced over 100 wetlands.

The importance of the Province's wetlands has been acknowledged internationally. Malpeque Bay was recognized as a *Wetland of International Importance* in 1988 under the RAMSAR agreement, while wetlands in PEI have been secured, enhanced and managed through the North American Waterfowl Management Plan, Eastern Habitat Joint Venture since 1989.

Status of PEI Wetlands

Only 32,150 hectares (5.6%) of Prince Edward Island's land base (575,400 hectares) are currently classified as wetland. Of these, 25,303 hectares (79%) are freshwater wetlands and 6,847 hectares (21%) are salt marsh. There are 1,550 bogs on the Island comprising 7,527 hectares or 30% of freshwater wetlands. These figures are derived from the 2000 wetland inventory of PEI which delineated, classified and rated 16,270 wetlands greater than 0.25 hectares. The Wetland Inventory was derived from the *2000 Resource Inventory of Land Use and Land Cover on Prince Edward Island.*

Status of Coastal Wetlands

Salt marshes are some of the most productive ecosystems on earth. They provide essential habitat and nutrients for commercially important fish species and contribute globally to carbon sequestration. However, many of PEI's salt marshes and coastal wetlands have been lost through drainage, flooding and infilling for urban, industrial or agricultural purposes. PEI has little salt marsh considering the province has 2,852 kilometres of coastline. Salt marshes continue to be threatened by coastal developments, particularly cottage subdivisions and municipal development projects. Degradation of coastal wetlands continues to occur as a result of terrestrial runoff and sedimentation.

Status of Freshwater Wetlands

About 30% of 15,084 freshwater wetlands consist of bogs. Three of the Island's largest bogs at Black Banks, Bideford and Miscouche are being mined commercially for peat moss. Additional pressures have been exerted recently through interest in developing bogs for cranberry (*Vaccinium* spp.) production. An unknown quantity of freshwater wetlands has been lost through drainage and infilling during the past 350 years. Current pressures from large scale farming operations and commercial developments continue to degrade both the quantity and quality of freshwater wetlands. Degradation of wetland function from accelerated terrestrial erosion and resulting sedimentation reduces the capacity of wetlands to filter, assimilate and purify "natural" runoff from these operations with potentially harmful results downstream.

Wetland Management

Responsibility for managing and protecting wetlands in Prince Edward Island rests with the Department of Environment, Energy & Forestry (EEF). EEF is also responsible for wetland habitat, bio-diversity functions and for groundwater and surface water quality and quantity.

Legislative and Regulatory Management of Wetlands

EEF is responsible for provincial statutes and regulations that provide protection for wetlands. Permits issued under sections 9 and 10 of the *Environmental Protection Act* (EPA) dealing with "Environmental Impact Assessment" and "Watercourse/Watercourse Alterations" provide protection for wetlands. In some instances, wetlands receive additional protection under the "Watercourse Buffer Zones" section. EEF is also responsible for the *Wildlife Conservation Act* and the *Natural Areas Protection Act*, which have provisions to protect wetlands through designation, covenants and easements.

The *Planning Act* administered by the Department of Community and Cultural Affairs requires wetland buffers for all buildings, subdivisions and sewage disposal systems.

Policy Section

Policy Objective

The objective of the Provincial Government with respect to wetlands is:

To promote the conservation and protection of Prince Edward Island's wetlands to sustain their ecological and socio-economic functions, now and in the future.

Policy Statements

The Provincial Government through the Department of Environment, Energy & Forestry (EEF) will*:*

- Utilize existing wetlands management and protection mechanisms to control development in and adjacent to wetlands, and develop new management tools as appropriate, to ensure no net loss of wetlands and wetland function;
- Promote and develop wetlands education and awareness programs;
- Promote stewardship and securement of wetlands through enhanced cooperation among local, municipal, provincial and federal governments and the private sector.

All wetlands are considered under this policy.

Policy Goals

The goals of this policy are:

1. To manage human activity on or near wetlands in a manner which will achieve no net loss of wetlands and wetland function;
2. To promote and facilitate the development of wetland stewardship awareness and education through government initiatives and cooperative relationships among local citizens, stakeholder groups, the private sector, and municipal, provincial, and federal governments.

Guiding Principles

- Wetlands serve numerous valuable social, economic and environmental functions.
- In recognition of the historical and on-going wetland loss, concerted efforts are required to conserve and protect remaining wetlands.
- Because wetlands and their function are inseparably linked to their surroundings, wetland conservation must be pursued through an integrated systems approach to environmental conservation and sustainable development.
- Public support is essential and can be facilitated through public education and awareness regarding the functions and values of wetlands.

Scope and Application

This policy refers to all wetlands as defined by this policy and in the Prince Edward Island Wetland Inventory, regardless of ownership.

Procedure

Goal 1: Development Control

Where developments are proposed on or adjacent to a wetland the following process of **wetland mitigation** will be observed:

1. **Avoidance:** Development proposals will **avoid** wetlands. In cases where wetlands would be infringed upon, wetlands will be avoided or alternate sites chosen.

2. **Minimization:** In the rare case where, after all avoidance options are exhausted and impacts on the wetland are unavoidable, potential negative impacts on the wetland will be **minimized** to the extent possible.

3. **Compensation:** The developer (proponent) will **compensate** for any and all loss of wetland area, function and value resulting from development.

Assessments of wetland function and value, class, area, geographic location, time frame, monitoring requirements, estimates of wetland loss and recommendations for wetland compensation and associated costs will be made by a committee of wetland experts comprised of representatives of the Federal (Canadian Wildlife Service) and Provincial governments (Fish & Wildlife Division), and the major non-governmental organization involved in wetland conservation in the province (Ducks Unlimited Canada).

The committee will be charged with determining costs and recommending appropriate compensation based on accepted formulae in place in other jurisdictions in North America. The committee will be guided by the wetland mitigation sequence, mitigation principles and guidelines as outlined in the publication, *Wetland Mitigation in Canada: A Framework for Application,* published by the North American Wetlands Conservation Council Canada (Appendix I).

Goal 2: Securement, Stewardship, Education and Awareness

The following will be endorsed in promoting *Securement, Stewardship, Education and Awareness*:

Securement and Stewardship

EEF will:

- Examine the potential of restrictive covenants, easements and tax incentives as means of protecting wetlands;
- Participate in cooperative stewardship programs to protect and enhance wetlands;
- Secure wetlands through acquisition wherever possible;
- Retain ownership of all wetlands or portions thereof, presently owned by the Province; and
- Participate in cooperative projects to manage wetlands through agreements.

Other Government Departments

Government will:

- Ensure that policies and programs of other provincial government departments are consistent with and supportive of the objective of this policy.

Education and Awareness

EEF will:

- Promote and assist in the development of wetland education programs which target the general public, public schools, landowners and other stakeholders;
- Support and encourage the development of cooperative educational programs with the private sector; and
- Encourage the exchange of information and expertise among government departments and other jurisdictions regarding wetland issues.

Definitions

Avoidance
The prevention of impacts on wetlands, either by choosing an alternate project, alternate design or alternate site for development.

Compensation
Action taken as the last resort in the sequence of wetland mitigation, and consists of measures taken to offset losses of wetland, and wetland functions and values which remain after all possible minimization measures have been applied. It consists of wetland

creation, reconstruction, restoration or replacement and is an essential component in a **no net loss** policy.

Infringe Upon
For the purposes of this policy, ***infringe upon*** refers to activities that occur within the limits currently stated as setback distances or buffers on wetlands under current regulations and legislation in the *Environmental Protection Act* and *the Planning Act*, respectively.

Minimization
The reduction of adverse effects of development on the functions and values of wetlands, at all project stages including planning, design, implementation and monitoring to the smallest practicable degree.

Mitigation
A process for achieving wetland conservation through the application of a hierarchical progression of alternatives to the adverse effects of development, which include:

(a) **Avoidance** of impacts;
(b) **Minimization** of unavoidable impacts; and
(c) **Compensation** for impacts that cannot be avoided.

No Net Loss
No Net Loss (NNL) means no net loss of wetland area and function.

Restoration
Returned from a disturbed or totally altered condition to a previously existing natural or altered condition by some human action. Restoration refers to a return to preexisting conditions. However, in many situation restoration efforts do not result in the original condition, but to a more realistically achievable "natural" condition.

Wetland
"Wetland" means lands commonly referred to as marshes, salt marshes, swamps, bogs, flats and shallow water areas that are saturated with water long enough to promote wetland or aquatic biological processes which are indicated by poorly drained soil, water-tolerant vegetation, and biological activities adapted to a wet environment.

Wetland Classes

1. **Open Water**: Refers to wetland with water depths of one to three metres (3 to 10 feet), associated with any of the other wetland classes, but usually with deep or shallow marshes. Submergent and surface vegetation are dominant.

2. **Deep Marsh**: This class applies to wetlands with and average water depth between 6 in. and 3 ft. (10 cm. and 1 m.) during the growing season. Emergent

marsh vegetation is usually dominant, with surface and submergent plants present in open areas.

3. **Shallow Marsh**: This class applies to wetlands dominated usually by robust or marsh emergents, with an average water depth less than 6 in. (15 cm.) during the growing season. Surface water may be absent during the late summer and abnormally dry periods. Floating-leaved plants and submergents are often present in open areas.

4. **Seasonally Flooded Flats:** This class applies to extensive river floodplains where flooding to a depth of 12 or more inches (30 cm.) occurs annually during late fall, winter and spring. During the summer, the soil is saturated, with a few inches of surface water occurring locally. Dominant vegetation usually is emergent, but shrubs and scattered trees may be present.

5. **Meadow:** This class applies to wetland dominated by meadow emergents with up to 6 in. (15cm.) of surface water during the late fall, winter and early spring. During the growing season the soil is saturated and the surface exposed except in shallow depressions and drainage ditches. Meadows occur most commonly on agricultural land where periodic grazing or mowing keeps shrubs from becoming established.

6. **Shrub Swamp:** This class applies to wetlands dominated by shrubs where the soil surface is seasonally or permanently flooded with as much as 12 in. (30 cm.) of water. Sedges are often the ground cover under shrubs with meadow emergents occupying wetter areas.

7. **Wooded Swamp:** This class refers to wetlands dominated by trees growing in a muck soil. The soil surface may be seasonally flooded with up to 1 ft. (30 cm.) of water. Several levels of vegetation are usually present including trees, shrubs, and herbaceous plants. In mature wooded swamps, differences in elevation may result in pronounced micro-habitats (micro topography), where trees and shrubs occupy the drier areas whereas marsh emergents and ferns may occupy the ephemeral pools of standing water.

8. **Bog:** This class applies to wetlands where the accumulation of *Sphagnum* moss, as peat, determines the nature of the plant community. Young bogs commonly have floating peat mats that creep outward from shore over the surface of open water. *Picea mariana* and *Larix laricina* are typical tree species. *Chamaedaphne calyculata, Kalmia angustifolia, Sarracenia purpurea,* and *Eriophorum* spp. are characteristic plants found in bogs throughout the Northeast.

Wetland Function

The natural properties and processes (physical, chemical or biological) associated with wetland ecosystems. Wetland functions include the natural processes and derivation of

benefits and values associated with wetland ecosystems including economic production (e.g. peat, agricultural crops, wild rice, peatland forest products), fish and wildlife habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), soil and water conservation, as well as tourism, heritage, recreational, educational, scientific and esthetic opportunities.

Wetland Values

Benefits that accrue to humans as a result of natural wetland functions. These include the natural processes and derivation of benefits and values associated with wetland ecosystems including economic production (e.g. peat, agricultural crops, wild rice, peatland forest products), fish and wildlife habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), soil and water conservation, as well as tourism, heritage, recreational, educational, scientific and esthetic opportunities.

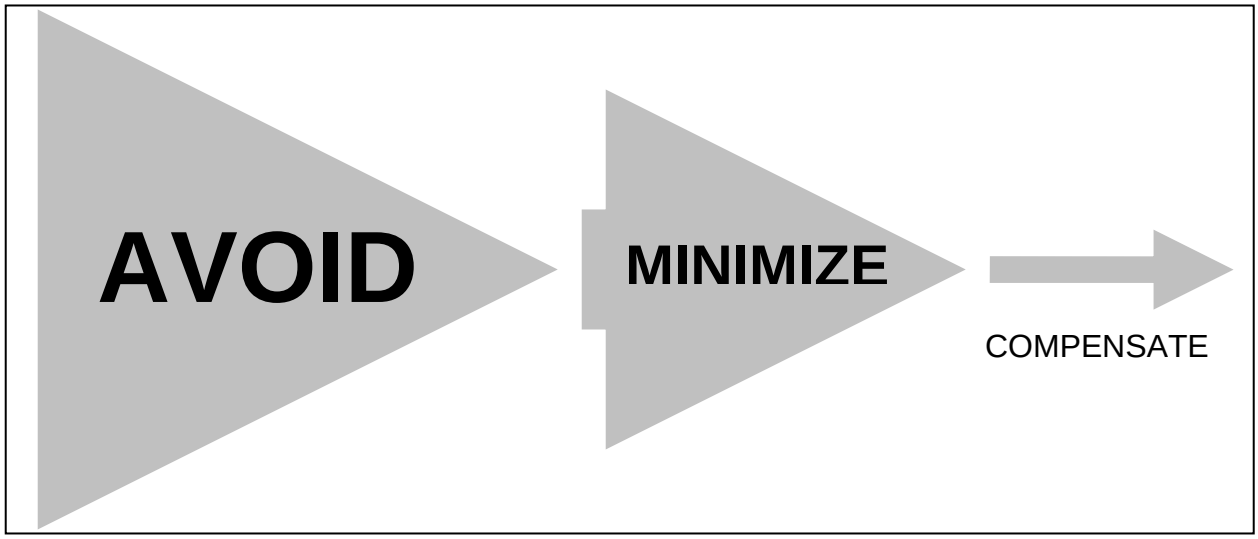
APPENDIX I

Adapted from: "Wetland Mitigation in Canada – A Framework for Application," Issues Paper, No. 2000-1. North American Wetlands Conservation Council (Canada), Ken Cox & Allison Grose Eds. 93pp.

The Wetland Mitigation Sequence

The sequence described below should be followed if the mitigation process is to be successful as a tool for wetland conservation (See Figure 1). In particular, the first two steps of the sequence should not be skipped for the sake of expediency. The steps between each stage should be perceived as huge barriers that are only to be breached in rare circumstances.

Figure 1. Diagram of the mitigation sequence.



The first step, **avoidance**, involves the prevention of impacts, either by choosing an alternate project, alternate design or alternate site for development. It is the first, best choice of mitigation alternatives. Because it involves prevention, the decision to avoid a wetland or to redesign a project so that it does not affect a wetland must be taken early in the planning process. It may be the most efficient, cost-effective way of conserving wetlands because it does not involve minimization, compensation or monitoring costs. It also avoids the uncertainty inherent in minimization or compensation activities that may not be successful because of the relatively undeveloped state of the science. It should be the choice in situations where cumulative impacts in a specific area exceed a certain threshold, and where impacts of even a small magnitude will result in significant negative effects.

The next step, **minimization**, should only be taken once the decision has been made that a project must proceed, that there are no reasonable alternatives to the project, and that there are no reasonable alternatives to locating the project on a wetland. Minimization involves the reduction of adverse effects of development on the functions and values of wetlands, at all project stages (including planning, design, implementation and monitoring), to the smallest practicable degree.

Compensation is the last resort in the mitigation process, and indication of failure in the two earlier steps. It should only be considered for residual effects that were impossible to minimize. Compensation refers to a variety of alternatives that attempt to "make up for" the unavoidable lass of or damage to wetland functions and values, usually by improving wetlands off-site from the development. Preferred methods include restoration and enhancement of wetlands, although the creation of a new wetland would also be a potential compensation method. Securement of a wetland alone would not normally be considered adequate compensation because it would not result in the replacement of lost or damaged wetland functions, but only in the protection of an existing wetland. However, there may be situations in which a combination of securement and other compensatory measures may be appropriate. Compensation may also include, but should not be limited to, the financing of wetland-related activities such as research and education.

There may be a tendency on the part of both government and industry to take the expedient route and go straight to compensation rather than deal with potential impacts in the design stage or through avoidance. Large developers may prefer to pay for functional losses with a cash settlement or technological "quick fix." For example, it may be easier to pay for a fish hatchery rather than prevent or minimize damage to a spawning habitat. It is often in the company's best interest to find a quick solution, write off costs, and proceed with the project. However, environmental impacts are seldom resolved by this approach.

Mitigation banking is a compensation alternative in the U.S., although not, so far, in Canada. However, inevitably any discussion about mitigation raises the question of whether mitigation banking has a role to play. Historically, the U.S. experience has not been positive, for a number of reasons. Mitigation banking does allow for some flexibility, and it also allows for compensation dollars to go to priority sites. However, it can also encourage a "commodity' approach to conservation wherein wetlands are traded for cash. Perhaps more importantly, it places emphasis on compensation rather than avoidance or minimization, and allows the mitigation process to be circumvented. For these reason, it is recommended that mitigation banking as it is conventionally defined, does not become part of mitigation in PEI. As an alternative, advance planning that identifies priority wetland areas and directs compensatory funding to these areas, is recommended.

It should also be noted that the science supporting some aspects of wetland mitigation is not well developed, and contains a degree of uncertainty and inherent risk, particularly as it relates to wetland replacement and creation. Because of this, monitoring is an integral

part of mitigation. While not strictly a stage of the mitigation process, monitoring must occur to determine success or failure of minimization and compensation efforts so we can learn from our mistakes. In any mitigation package that is negotiated, monitoring must be included within both minimization and compensation activities. Monitoring costs should also be factored in to project costs.

Mitigation Principles

A clear set of broadly applicable principles is required for wetland mitigation in Prince Edward Island. Principles, which embody "fundamental truths," give an underpinning philosophy or perspective. They should be broadly applicable in all situations and should not only be provincial but national in scope. Sixteen such principles are listed below.

1. Wetlands are one of the most productive ecosystems on earth, and are an integral component of PEI's landscapes, providing significant environmental, social, cultural and economic benefits. These benefits make wetlands a priority for conservation efforts.

2. Mitigation is a component of a broader approach to wetland conservation that should include policy, advance planning, protection, environmental assessment, stewardship, wetland inventory and monitoring, and research.

3. Mitigation is a process, which should begin with avoidance, proceed through minimization only if avoidance is not possible, and consider compensation only as a last resort.

4. The mitigation process and appropriate mitigation measures should be applied to all stages of a project: from planning, siting, and designing, through implementation and monitoring.

5. Wetland mitigation policies and actions should be consistent with the goals of both Canada's and PEI's national and international conservation agreements including the World Conservation Strategy, the Convention on Biological Diversity, the Convention on Wetlands of International Importance (Ramsar 1999) the North American Waterfowl Management Plan and the North American Bird Conservation Initiative.

6. Mitigation should be consistent with local policies, legislation and standards, and flexible enough to address social, economic and environmental variability across PEI. This is most likely to be achieved with the participation of all stakeholders.

7. Mitigation must be sustainable from an environmental, social and economic perspective.

8. Policies, guidelines and procedures should be applied in a consistent and equitable manner with respect to all sectors, levels of government and interests.

9. Wetland conservation through the mitigation process should be planned on an ecosystem basis and in a landscape context to minimize risks to the diversity and integrity of wetland-supported ecosystems, and to enable consideration of cumulative and downstream effects.

10. Sustaining the full range of wetland functions and values is the primary focus of mitigation processes.

11. Measures undertaken to restore or replace wetland functions and values should be ecologically sound and supported by the best available scientific information.

12. Monitoring should be considered an essential component of wetland mitigation efforts. It is required to ensure that:

    a. mitigation measures are implemented in accordance with approved designs;
    b. the effectiveness of the measures is assessed; and
    c. contingency measures are in place, should the measures not achieve the design objective.

13. The mitigation process must be transparent, accessible, timely and efficient. Mitigation solutions should be reasonable – cost effectiveness should be a consideration in negotiating mitigation packages.

14. There is a need for change in Islanders' perception of wetlands. Public awareness of wetland functions and values and the benefits they provide to society will be key to encouraging community support for mitigation measures.

15. No one group should be expected to bear the entire burden of policy decisions regarding mitigation. There must be some consideration of what constitutes an equitable sharing of costs among, for example, proponents of the development, beneficiaries of the development, and the beneficiaries of wetland conservation in general, i.e. "society."

Mitigation Guidelines

A set of guidelines is the foundation of a conceptual model for wetland mitigation on Prince Edward Island. Guidelines help by giving advice, directing the process, and providing a conceptual framework.

Avoidance Guidelines

Avoiding the impacts of developments on wetlands is the most efficient and effective mitigation strategy. It is also the simplest and most straightforward to understand. For this reason, even though avoidance is the most favoured choice among the alternatives, it has the least space in this document. Accordingly, four guidelines to direct when avoidance is the appropriate choice follow:

1. Avoidance should always be considered as the first alternative for any development that could potentially affect a wetland.

2. Avoidance should be the only choice where the wetland concerned is of local, provincial, regional, national or international significance.

3. Avoidance should be the choice in areas where wetland losses of a large magnitude have already occurred, or where cumulative losses have already reached the point where losses of a small magnitude will have a significant effect.

4. In cases where effects on a wetland are such that losses of values and benefits are significant, and where minimization cannot ameliorate these effects, development should be avoided.

Minimization Guidelines

There will be some cases in which developments on wetlands cannot be avoided entirely, and in such cases effects should be minimized to the greatest extent possible. The following 10 guidelines are proposed to determine minimization procedures and measures:

1. National mitigation guidelines should be adapted to suit specific requirements in PEI. Detailed mitigation standards and procedures for some activities have been developed nationally by industry and government, and are being applied in progressive industries to guide operations. More work is needed to refine guidelines for sectoral activities and to develop innovative mitigation technology.

2. Procedures and techniques should be based on sound ecological principles and the science available.

3. Proven measures are preferred over new or experimental techniques. New and experimental approaches should only be considered where proven techniques cannot be applied satisfactorily. They should, however, be carried out on a pilot basis and monitored to assess effectiveness.

4. Monitoring is required to evaluate the outcome of mitigation applications. The cost of monitoring should be factored in to any mitigation process.

5. An iterative or adaptive approach should be taken to improve knowledge and effectiveness of mitigation measures over time.

6. Procedures, technologies and applications should have some flexibility to address local concerns and conditions.

7. Minimization techniques should take natural succession into account, and should provide for environmental variability over time.

8. Minimization measures should remain functional as long as the project has reasonable potential to impact the environment.

9. Small-scale measures that can help control cumulative wetland losses should be implemented.

10. Incentives should be used to encourage the adoption and use of mitigation technologies in industry, governments and among private landowners.

Compensation Guidelines

Although compensation is the last resort in the mitigation process, inevitably there will be cases in which developments will go ahead on wetlands, and minimization efforts will be insufficient. In these cases, the following 12 guidelines are proposed to determine appropriate compensation:

1. Compensation requirements should be determined on a case-by-case basis, and should be prioritized, based on function/functional area, type of wetland geographic context and time frame, etc.

2. The preferred method of compensation for wetland functions is restoration or enhancement of other degraded wetland habitats, and then creation of replacement wetlands.

3. Functional losses should be restored in the following order of priority:

    a. on-site,
    b. as close to the site as possible,
    c. in the same ecosystem.

4. Functional losses should be restored first in the same wetland type, or second, with another wetland type.

5. Compensation ratios are justified based on the inherent uncertainty of replacing the loss of wetland functions. Ratios may be greater than 1:1 (wetland

restored/recreated to wetland lost), depending on the degree of uncertainty with respect to replacement of the lost functions. Compensation ratios should be negotiated both for wetlands directly impacted by the development, i.e. within the development "footprint," and for those areas indirectly affected.

6. Compensation for impacts on the social and cultural values of wetlands may include, but should not be restricted to, financial compensation to be used for activities appropriate to the site. These may include building public access facilities and interpretive centres, developing public education materials, or conducting research. Financial compensation should only be considered as an option if the restoration/enhancement/creation of a wetland will not replace the lost social and cultural values. Financial compensation does not have to involve an exchange of dollars.

7. The cost of physical replacement and societal value can provide a basis for estimating financial compensation where such compensation is appropriate.

8. Compensation measures should have at least as much resilience to environmental change as the habitat they replace. They should remain effective throughout the lifetime of the project and beyond.

9. Compensation requires monitoring the outcome of measures undertaken to replace or restore wetland functions. The monitoring process should be transparent and accessible to the public.

10. Proponents should demonstrate the efficiency and effectiveness of compensation measures in terms of replacing wetland functions.

11. An iterative approach, based on scientific evaluation, is needed to improve the reliability and performance of compensation measures. Adaptive approaches should be designed to reduce uncertainty with respect to mitigation options.

12. The science supporting wetland compensation is not well developed and contains a degree of uncertainty and inherent risk. However, the fact that this science is still developing should not prevent decisions being made, based on the best science available.