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Cattail (Typha spp.) Harvesting in Manitoba: A legislative and market analysis for operationalization and carbon emission offsets

A publication under the Netley-Libau Nutrient-Bioenergy Project

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Written by Rosemary Dohan, Dimple Roy, Richard Grosshans, Philip Gass, Mathew McCandless, and Henry David Venema

Executive Summary

Research findings from the Netley-Libau Nutrient-Bioenergy project are encouraging replication of the cattail harvesting concept to areas in the Manitoba region of the Lake Winnipeg watershed, as well as Minnesota and North Dakota. It is also increasingly being seen as a component of an integrated nutrient and surface water management plan. As a result of this replication, there is a need to understand and synthesize the legislative and policy implications of the harvesting of cattails (*Typha* spp.) and other potential plants, or ecological biomass, with similar benefits (i.e. *Phragmites* reeds, reed canary grass, willows) in Manitoba. This analysis will ensure that the operationalization of these new value chains as part of a Manitoba bioeconomy includes sustainable processes for due diligence. It also ensures that these value chains are subject to appropriate oversight to ensure that social, economic and environmental needs and concerns are balanced in the best way possible.

This report presents a legislative review of cattail (*Typha* spp.) harvesting in Manitoba. Our review found that the harvest of cattails and other similar ecological biomass is not currently explicitly included in any federal or provincial legislation, policy or programming. This study provides some research and analysis to understand the current and potential position of cattail harvesting in Manitoba. Based on our review, we present two management scenarios in this report that include legislation, policies and programming;:

1. A private benefit harvesting scenario based on other resource extraction programs similar to for-profit activities like wild rice harvesting. This scenario is relevant for both Crown and private lands.
2. A publicly funded land management assistance scenario, where private corporations are contracted to harvest cattails in areas of concern. This scenario can be used on Crown lands in this way, or for private lands using incentives such as those used for agricultural beneficial management practices or other tax credits to land owners.

An adaptive management framework, which may be a combination of the two scenarios, is recommended in order to fully realize and understand the multiple economic and environmental co-benefits from the harvest of cattail biomass. In addition, it is recommended that some language around cattail harvesting be included into the Manitoba Bioproducts Strategy and the Manitoba Biomass Energy Support Program list of approved biomass feedstock sources.

A brief analysis of the market opportunities for the sale of carbon offsets from cattail harvesting identified gaps in formal markets and protocols at the provincial and federal levels in Canada. However, precedents for protocols and standards can be found in more mature systems developed in places such as Alberta and Quebec. In addition, the voluntary offsets system offers a means of gaining and crediting benefit while waiting for a regional compliance market to form (i.e., Western Climate Initiative) or for cost-recovery for greenhouse gas mitigation benefits. The Alberta protocol and Verified Carbon Standard offers the most viable model to include cattail harvesting based offsets into the voluntary carbon market.

Other recommendations are made regarding the selection and development of appropriate legislative frameworks for maximizing public benefits while minimizing potential negative impacts. Demand and markets for not only biofuel-based heating, but also a range of other bioproducts from cattail-based biomass would also assist in the decision of a management system for cattails and other ecological biomass in Manitoba.

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Introduction

Netley-Libau Marsh lies at the south end of Lake Winnipeg, and is one of the largest inland freshwater coastal wetlands in Canada. The marsh has been recognized as an important wildlife habitat and natural filter for the nutrients that cause algal blooms in Lake Winnipeg and is designated as an Important Bird Area (Lindgren & The Netley Libau Marsh Foundation Inc., 2001) by Bird Studies Canada. Netley-Libau Marsh has been substantially altered over the years, with dredging, drainage and ditches; and has undergone significant natural and human-induced changes over the past century. Many of the natural nutrient-filtration benefits the marsh could provide to Lake Winnipeg have been severely degraded, but can be restored and enhanced through proper management (IISD, 2011a).

Lake Winnipeg is the tenth largest lake in the world, and is an important part of Manitoba's culture, recreation and economics. It is also considered one of the most nutrient-loaded or eutrophic large lakes in the world as a result of excessive nutrient loading from the surrounding watershed (Lakes, 2013). There have been major nutrient-loading (i.e., phosphorus) issues that have caused algal blooms in many areas of the lake (IISD, 2011a). The Red River, which flows through Netley-Libau Marsh, is the largest contributor of nitrogen and phosphorus to the lake, with the highest amount of excessive nutrients usually found in the south basin of the lake (Environment Canada & Manitoba Water Stewardship, 2011).

Research by IISD and its partners has shown that the sustainable harvest of plants such as cattails throughout the Lake Winnipeg watershed can help reduce nutrient loading, especially in areas with significant runoff and stored sediment nutrients. IISD's research has also shown that cattail biomass is excellent feedstock for bioenergy, biofuels and biomaterials (IISD, 2011a). Unlike other biomass feedstocks, cattails have the added benefit of removing excessive nutrients in their harvested biomass.

1.1 Netley-Libau Nutrient-Bioenergy Project

The Netley-Libau Nutrient-Bioenergy research project has demonstrated how the harvesting of cattails can yield multiple private and public benefits. The initial proof of concept research conducted at Netley-Libau Marsh has since been applied in areas upstream within the Lake Winnipeg watershed, and has expanded to include a variety of stakeholders in sites across the province (IISD, 2011b). The benefits that can be realized from harvesting cattails include: water quality and nutrient management benefits; biomass and bioenergy supply benefits, with the ability to offset non-renewable energy use; habitat improvement; and phosphorus recovery for fertilizer use and water quality trading. Cattails can be utilized as a biomass feedstock similar to those that are already being used across the province for heating, biofuels and biomaterials. With the increasing worldwide demand for sustainable biomass feedstocks and the current move in Manitoba towards a ban on coal use for heating applications, cattail biomass is sustainable biomass feedstock with multiple additional co-benefits for use in the Manitoba bioeconomy.

TABLE 1: PRIVATE AND PUBLIC BENEFITS FROM HARVESTING

PUBLIC	BOTH	PRIVATE
New bioproducts	Greenhouse gas mitigation	Fisheries enhancement
Fishing improvement	Greenhouse gas reduction	Nutrient recapture
Wildlife habitat improvement	Water quality improvement	Rural economic diversification
	Ecotourism improvement	Biomass products production
	Habitat improvement	Fertilizer production
		Hunting and angling guiding opportunities improvement
		New biomass source
	Fertilizer production	

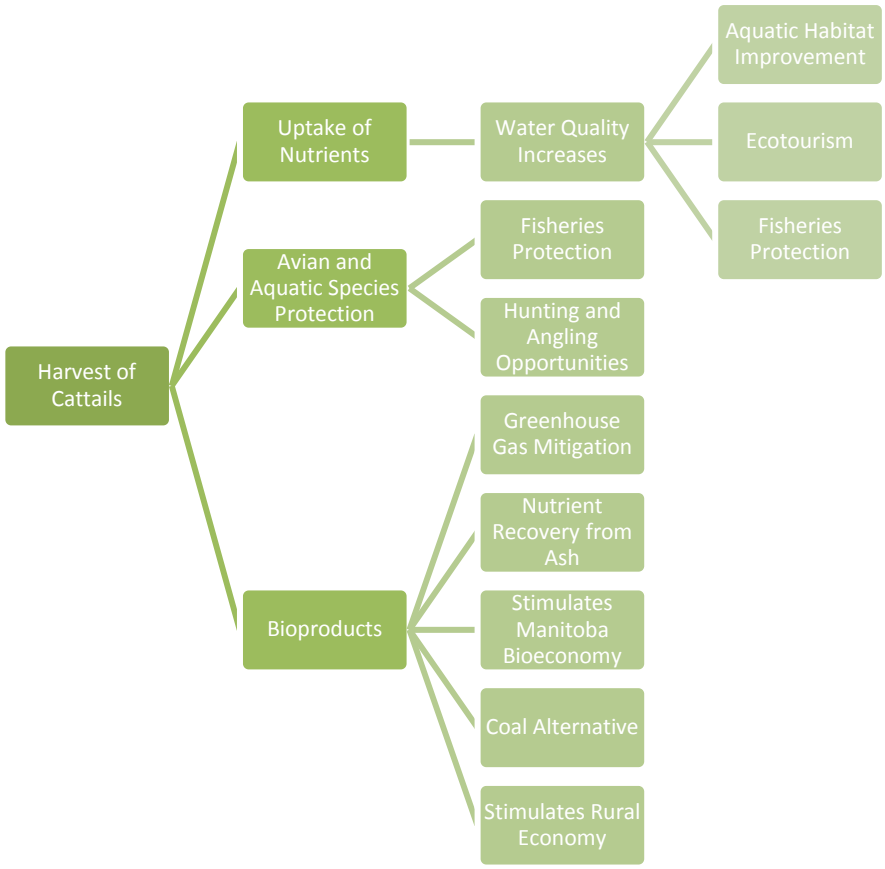

FIGURE 1. BENEFITS OF CATTAIL HARVESTING IN MANITOBA.

1.1.1 Nutrient Management

Water travels through numerous jurisdictions in Canada and the United States before reaching Lake Winnipeg, which is the mechanism for transporting nutrients from the watershed into Lake Winnipeg. This nutrient-rich runoff water represents opportunities to reduce nutrient loading through cattail harvesting, as well as surface water management to hold water on the land throughout the watershed through distributed water storage, incorporating cattail biomass production and harvesting. According to research by Grosshans, Venema, Cicek & Goldsborough (2011), the ability for cattails to capture and store nutrients was measured to be approximately 30 kg of phosphorus and 150 kg of nitrogen per hectare of cattail in this region. This represents an innovative solution to help reduce loading and aid in the recovery and maintenance of the health of Lake Winnipeg and other waterways within the province, while providing additional environmental and economic benefits from the harvested biomass material. The Netley-Libau Marsh and many other areas in the province contain cattails, which are currently taking up nutrients. When cattails are left unharvested, those nutrients taken up in the biomass are naturally returned to the system during decomposition into the litter layer and the water column. If harvested, these nutrients can be captured and removed from the system, reducing the overall amount of excessive nutrients in Manitoba's waterways that contribute to Lake Winnipeg eutrophication. Nutrients removed in the harvested biomass can be utilized for fertilizer products and represent potential credits for a water quality trading scenario. A nutrient reduction strategy across the province that includes the sustainable harvest of cattails and other ecological biomass will contribute to reduced nutrient loading to Lake Winnipeg.

1.1.2 Habitat Invigoration

The harvest of plant biomass from wetlands has the potential to increase plant diversity and create new wetland habitats by opening shaded areas and providing new areas for plants to colonize, which can result in a healthier and more diverse plant community (Kantrud, Millar & van Der Valk, 1989; Murkin, Kaminski & Titman, 1982). Disturbances such as flooding, drought, ice scouring and fire are necessary for the long-term ecological health of a wetland area (van Der Valk & Davis, 1978). Harvesting is also a type of disturbance that performs the critical tasks of removing dense standing litter that makes it possible for new plants to recolonize and form a healthy and diverse plant community. Cattail and *Phragmites* (*Phragmites australis*) are both extremely competitive and can form dense monocultures that, if left to flourish, can adversely affect both floral and faunal diversity; therefore, disturbance is critical for the proper maintenance of healthy wetland habitat diversity (van Der Valk & Davis, 1978). The impacts that cattail harvesting could have on wildlife are being examined through studies located in the Netley-Libau Marsh and other sites, the majority of which are on private land.

1.1.3 Greenhouse Gas Mitigation

The harvest of cattails has great potential in the mitigation of greenhouse gas (GHG) emissions in two distinct ways:

1. The sustainable harvest of cattails removes old cattail growth that would have otherwise decomposed as litter in the marsh, releasing carbon dioxide (CO_2) when the plants die back at the end of the season. If this decomposition occurs under flooded anaerobic conditions, this results in the release of methane (CH_4), a GHG with 21 times the greenhouse warming potential than CO_2.
2. The sustainable harvest of cattails as a renewable and sustainable biomass feedstock contributes to the portfolio of feedstocks currently being converted into a broad variety of biomass products, such as heat and biomaterials. Cattail biomass can contribute to displacing fossil fuels such as coal—a major emitter of CO_2—and other pollutants like sulfur dioxide, nitrogen oxides and mercury, a neurotoxin.

1.1.4 Bioproducts

The harvest, processing and use of biomass feedstocks within the Manitoba bioeconomy will encourage sustainable economic growth in rural areas. There is a range of products that can be processed from biomass that can be used directly in local areas,[1] or exported to other communities, such as compressed fuel products (i.e., pellets, cubes, logs). The local use that has the most co-benefits is as a direct coal-replacing energy source for heat production. Manitoba has newly imposed a coal tax (Government of Manitoba, 2012a), in anticipation of a coal ban for 2014 for smaller-scale consumers that have been using coal for a heat or energy source. Cattails have been shown to be an excellent biomass source (Grosshans et al, 2011; IISD, 2011a) and grow throughout most rural areas of Manitoba, with the possibility of local processing. In addition to the nutrient capture, biomass and carbon reduction benefits, the nutrients taken up in the cattail biomass are retained in the ash following combustion and can be recycled as a fertilizer. Although the fertilizer properties of the ash have not yet been fully explored, this is a value-added product that can be land-applied and has the potential for refinement.

1.2 Research Goals and Scope

Research findings from the Netley-Libau Nutrient-Bioenergy project are encouraging replication of the cattail harvesting concepts in areas of the Manitoba, Minnesota and North Dakota regions of the watershed, as a component of an integrated nutrient and surface water management plan. There is a need to further understand the legislative and policy implications in Manitoba of the harvesting of cattails (*Typha* spp.) and other plants with similar benefits as cattail ecological biomass (i.e. *Phragmites* reeds, reed canary grass, willows), in order to ensure that operationalizing these new value chains as part of a Manitoba bioeconomy includes processes for due diligence. It will also ensure that new value chains are subject to appropriate oversight to ensure that social, economic and environmental needs and concerns are balanced in the best way possible.

The scope of this study includes the first step of the value chain, or the harvesting of cattails. Legislative review related to this step and the development of potential scenarios for review can ensure minimum impact on natural ecosystems and ensure that harvesting is designed for maximizing overall ecosystem health and the delivery of ecosystem goods and services.

This legislative review examines the current institutional oversight mechanisms available for use in the context of cattail harvesting, which can also be applied to other potential ecological biomass. It also explores potential scenarios for recommending appropriate policy and legislative instruments in the absence of adequate oversight mechanisms.

The harvesting of cattails and other ecological biomass is not currently controlled by any legislative or regulatory process. This gap needs to be examined more closely in order to scale-up this activity to a commercial scale beyond research and piloting. Close analogues exist in the legislated or controlled harvests and use of common biomass sources, including forestry debris and the residue of various agricultural crops. These analogues are examined through the development of the two management scenarios envisioned for cattail harvesting in a later section of this report.

[1] Cattail biomass can potentially be processed into a large variety of bioproducts including low-end biopellets for local energy production all the way to high-end bioplastics and pharmaceuticals.

2.0 Policy and Legislative Context

The emerging Manitoba bioeconomy is evidenced by the release of provincial policies such as the Manitoba Bioproducts Strategy. This strategy is intended to aid in the diversification of rural and northern communities (Manitoba Agriculture, Food and Rural Initiatives, 2012a). The Emissions Tax on Coal Act provides an enabling environment to the development of renewable energy, including bioenergy (Government of Manitoba, 2012a). The effect that this legislation has on the price of coal is notable; in section 3(2) of the act, the tax rates for the different grades of coal are (Government of Manitoba, 2012a):

a. Bituminous coal: $22.57[2] per tonne
b. **Sub-bituminous coal: $17.37 per tonne**
c. Lignite: $14.27 per tonne
d. For any other grade of coal, including anthracite: $23.97 per tonne

One of the objectives of the act is to phase out coal through taxation policy. In addition to this act, Manitoba Finance has made recent changes to the Retail Sales Tax Act to expand the retail sales tax exemption for straw pellets used for heating or cooking to include other biomass materials (Government of Manitoba, 2012b). These two recent developments are positive steps towards an enabling policy environment in Manitoba for more widespread use of cattail biomass in the province.

In January 2012 Manitoba released the Manitoba Biomass Energy Support Program (MBESP) to provide financial support for: (i) consumers to purchase biomass/biomass-use infrastructure and (ii) producers, as start-up funding for biomass harvesting/processing (Manitoba Agriculture, Food and Rural Initiatives, 2012b). Manitoba aims to reduce GHGs from coal burning and Manitobans' reliance on fossil fuels. Some technologies used for the approved list of biomass sources have been tested for their efficiency in harvesting cattails as a biomass source in pilot trials (Grosshans, 2011).

That same month, the Manitoba government introduced a coal tax equivalent of $10 per tonne of CO_2 equivalent emissions (Manitoba Finance, 2012). This leads up to an anticipated 2014 Manitoba ban on all coal that is used for space and water heating. The transition will affect individuals and communities using coal for heat and, as such, is required to happen in a timely manner. Small communities that are reliant on coal will be affected the most; alternatives are required by law to be sought before the end of the transitional period.

The multiple benefits of cattail harvesting, revealed as a result of the nutrient bioenergy project, make it an attractive proposition for public and private investment. The Netley-Libau Nutrient-Bioenergy project and the restoration of the health of Manitoba's waterways and coastal marshes have been mentioned in several Manitoba throne speeches from 2008 to 2011. Specifically, IISD's Netley-Libau Nutrient-Bioenergy project, led by researcher Richard Grosshans, was mentioned in the 2010 Manitoba Speech from the Throne as a project that is aimed at reducing the amount of nutrients entering into Lake Winnipeg and mitigating GHG emissions (Government of Manitoba, 2010). Since cattails are not specifically included in a number of the recent policy developments, this study will include some exploration into the implications of cattails as a viable source of biomass.

Several pieces of legislation, policies and programming are important models to review when considering how cattail harvesting could fit into the emerging Manitoba bioproducts economy. Many of these are relevant to the two management scenarios (private benefits emphasis and public benefits emphasis) presented in the Section 3.

[2] All dollar amounts are in Canadian currency.

TABLE 2: SUMMARY OF FEDERAL, PROVINCIAL AND MUNICIPAL LEGISLATION RELEVANT TO HARVESTING CATTAILS

Federal Acts
The Canadian Environmental Protection Act, 1999 ensures that projects are reviewed prior to licensing and potentially causing significant environmental impacts. This act also ensures that the public is given a forum to express their concerns. A formal review would have to determine if an environmental assessment needs to be performed, and at which class (class 1, class 2, class 3) (Government of Canada, 2012a). However, at this time it is not immediately clear that one must be completed at any class level for the sustainable harvest of cattails.
The Fisheries Act concerns water that is considered to be fish habitat and bans deleterious substances that may be deposited into water that may be harmful to fish habitats (Government of Canada, 2012b). Deleterious substances are broad and varied and, in the case of cattail harvesting, may include harvest residue. A review from Fisheries and Oceans Canada may be recommended.
Provincial Acts
The Crown Lands Act outlines the types of activities that can occur on Manitoba Crown lands and has recently been amended to designate any area of Crown land as a provincially significant wetland (7.1.1(1)). From a regulatory perspective, the one requirement that could likely apply would be a work permit for activities being undertaken on Crown land (Government of Manitoba, 2012c). This would be analogous to getting a work permit to harvest firewood on Crown land. Work permits are obtained from local district offices of Manitoba Conservation and Water Stewardship, and can usually be obtained almost instantly. They will specify conditions for environmental protection, such as when the activity can be undertaken and what measures are necessary to protect against fuel spills.
The Emissions Tax on Coal Act would support either scenario, as GHG mitigation benefits and biomass phase-in goals would be supported if cattails were harvested and used as biomass. One of the goals of this act is to facilitate the phase-out of coal (Government of Manitoba, 2012a).
The Endangered Species Act would have to be considered regardless of the scenario to ensure that harvesting minimizes impacts on wildlife habitat and endangered species anywhere in the province (Government of Manitoba, 2012d).
Based on the current requirements within the Environment Act (Government of Manitoba, 2012e) and personal communications with the Environmental Licensing Office (B. Webb, personal communication, March 9, 2012) at Manitoba Conservation and Water Stewardship, we have concluded that harvesting cattails from public or private land would not be subject to environmental assessment and licensing at the provincial level. The Environmental Licensing Office indicated that the main environmental concerns would be habitat disturbance at critical times and harmful effects from machine operations. Both of these issues are easily addressed through simple mitigation measures involving the timing of harvesting operations and the servicing of machines, respectively.
The Noxious Weeds Act outlines a duty that any weeds named in its schedule be controlled. This applies to the common cattail and the narrow-leaved cattail (Government of Manitoba, 2012f). Cattails are now naturalized throughout the province and it is likely that cattail control applies to government-owned land (right of ways, ditches) or private land, in the case of a complaint. Based on the stipulations of this act, there are specific circumstances where these "noxious weeds" need to be completely and safely eliminated to prevent harm and proliferation on Manitoba landscapes. Two other sections are relevant for either scenario: (i) machines must be cleaned post-harvest to avoid the spread of noxious weeds and (ii) a copy of the act must be in the harvester when in use.
The Save Lake Winnipeg Act is a provincial commitment to aid in the restoration of the health of Lake Winnipeg. There are several amendments to already-established Manitoban acts within the *Save Lake Winnipeg Act* (Government of Manitoba, 2012g) that are relevant to the sustainable harvest of cattails. It allows for the minister to designate provincially significant wetlands on Crown lands and calls for stricter nutrient management standards across several other acts. A cattail harvesting regime could be a part of any nutrient management strategy that may come of this act.
Municipal Bylaws
All municipalities surveyed have very similar bylaws that seem to be related to the Noxious Weed Act. Persons with property are mandated to control noxious weeds, and cities and rural municipalities are mandated to control noxious weeds found on their land. There may be other bylaws that the harvesting of cattails may be subject to in each individual rural municipality.

There are several other elements to consider regardless of how cattail harvesting is to be legislated. Beneficial management practices (BMPs) to ensure the sustainable harvest of cattails should be researched in conjunction with initial large-scale harvesting, and before larger commercial-scale harvesting takes place, in order to inform licensing and the development of legislation. The timing of harvest, types of equipment and sensitivity of wetland areas should be researched through pilot trials and an adaptive management framework, prior to the official legislation of cattail harvesting.

Currently, cattails are not on the list of approved biomass sources[3] for the MBESP assistance (Manitoba Agriculture, Food and Rural Initiatives, 2012c). However, the fact that they are not on the list of products specifically *excluded* from the funding indicates that the benefits and potential of cattail biomass for the province have not been fully understood.

Cattails as a biomass do differ from other biomass products discussed in the Manitoba Bioproducts strategy. While forestry and agricultural biomass harvesting involves diverting materials from waste streams, cattails are not actively harvested on a large scale in Manitoba. They are, however, typically considered a waste and nuisance plant species that is managed at a cost to local government. Currently, cattail-filled storm water ditches along highways and waterways are mowed to maintain drainage. Additionally, within the City of Winnipeg, cattail-filled ditches are annually mowed or harvested at a cost to the city, and the material is either left to decompose or is transported to a landfill as a compost waste.

While there is no existing legislative oversight for cattail harvesting, we see it as a key biomass for bioenergy, biomaterials and nutrient reduction benefits, along with other public and private benefits. To inform the enabling policy environment for cattails harvest and use, we are building on legislative and policy precedents that currently exist for other regional biomass and present two possible legislative scenarios for the harvest and use of cattails in Manitoba, emphasizing the private and public benefits. These two potential scenarios are described briefly as part of this research report, and their implications are explored briefly to best inform the development of appropriate legislative mechanisms for sustainable management of wetland and ecological biomass.

[3] Approved biomass sources include: agricultural residue (wheat straw, corn stover, flax straw); agri-processing by-products (flax shives, sunflower hulls, oat-hulls); compacted biomass (wheat chaff/oat hull pellets); forestry residues (hog fuel, forestry operations residues, salvaged timber); and purpose-grown crops (switchgrass, willow crops, poplar crops).

3.0 Management Scenarios

This section presents two plausible scenarios for cattail harvest management based on the range of anticipated private and public benefits. The following section describes these two scenarios briefly and a more detailed section on each presents an analysis on the legislative and policy implications of each.

Scenario One: Private benefits approach

- **Premise**: Cattail harvesting on both private and public lands provides significant **private benefits** but must be managed to ensure minimum environmental and other impacts.
- **Management and legislative precedents**: Forestry, mining or wild rice harvesting. For example, through the Wild Rice Act for public lands and the Manitoba Woodlot Management model for private lands.
- **Intent**: Policy instruments would regulate the harvest but would not include incentives or financial support for the process.

Scenario Two: Maximized public benefits approach

- **Premise**: Cattail harvesting on both private and public lands provide significant public benefits—most prominently, nutrient management and offsetting coal use for space heating.
- **Management and legislative precedents**: This scenario would include some policy incentives to initiate the process and would follow existing models provided by programs such as Trees for Tomorrow and the MBESP.
- **Intent**: Cattail harvesting on both public and private land must be actively managed to ensure maximum public benefits and to make it economically attractive to implement.

The following section presents each of these scenarios in some detail, and uses the existing analogues to present a relevant legislative and policy process for implementation.

3.1 Scenario One: Private Benefits Emphasis

This scenario for cattail harvesting and management is built on precedents offered by the forestry or wild rice harvesting schemes. In this scenario, the assumption is that, since there are significant private benefits from harvesting cattails for a growing market for biomass, bioenergy and other bioproducts, this process is managed by the development of regulatory oversight mechanisms for harvesting and all proponents undergo this process to ensure negative environmental impacts are minimized.

In this scenario, the rural economic development benefits are emphasized and the environmental/public co-benefits (GHG mitigation, coal displacement, habitat improvement and nutrient management) can all be realized, provided that harvest methods are ensured to be sustainable (yield, equipment and habitat are all considered). There are several pieces of legislation and policies that would potentially affect a cattail harvesting scheme. For the purposes of this analysis, the most relevant piece of legislation for this scenario is the **Wild Rice Act**, the most relevant policy is the **Manitoba Bioproducts Strategy** and the most relevant programming is the **MBESP**. Other provincial policies and legislation will have to be considered for the implementation of this scenario.

Figure 2 illustrates the types of licensing and permits that are required for the harvest of wild rice in Manitoba for Crown and private lands. If one were developing on private land, for private use, no permits or licences are needed. If one is on private land and harvesting for commercial use, a load slip and an export certificate may be needed. Each

year the minister designates areas for wild rice harvesting where handpicking only and mechanical means are allowed on Crown land. Figure 2 may serve as a model for the licensing of cattail harvesting.

3.1.1 Crown Lands

The implementation of this scenario of managing the cattail harvesting process would likely begin with an application by the proponent for review by the Lands Program Branch, as that branch works with the Crown Lands Act, Wild Rice Act and the East Side Traditional Lands Planning and Special Protected Areas Act. Depending on the legislation it may affect, the application would be circulated to other departments for comment, which would likely include Wildlife and Ecosystem Protection Branch, Water Quality Branch and possibly the Forestry Branch of Manitoba Conservation and Water Stewardship.

Currently, the Crown Lands Act is in the first stages of a rewrite (J. Stevens, personal communication, February 10, 2012) in order to address old issues and to incorporate new sections. This may be an opportunity to incorporate cattail and other ecological biomass harvesting into the Crown Lands Act, or to create new legislation with harvesting cattails. The Wild Rice Act most closely follows what a cattail harvesting act may look like in this legislative scenario. Wild rice, like cattails, has been harvested for years by Aboriginal peoples in Manitoba and across North America and both regenerate with vigour. The Wild Rice Act already contains many of the elements that should be addressed in a Cattail Harvesting Act.

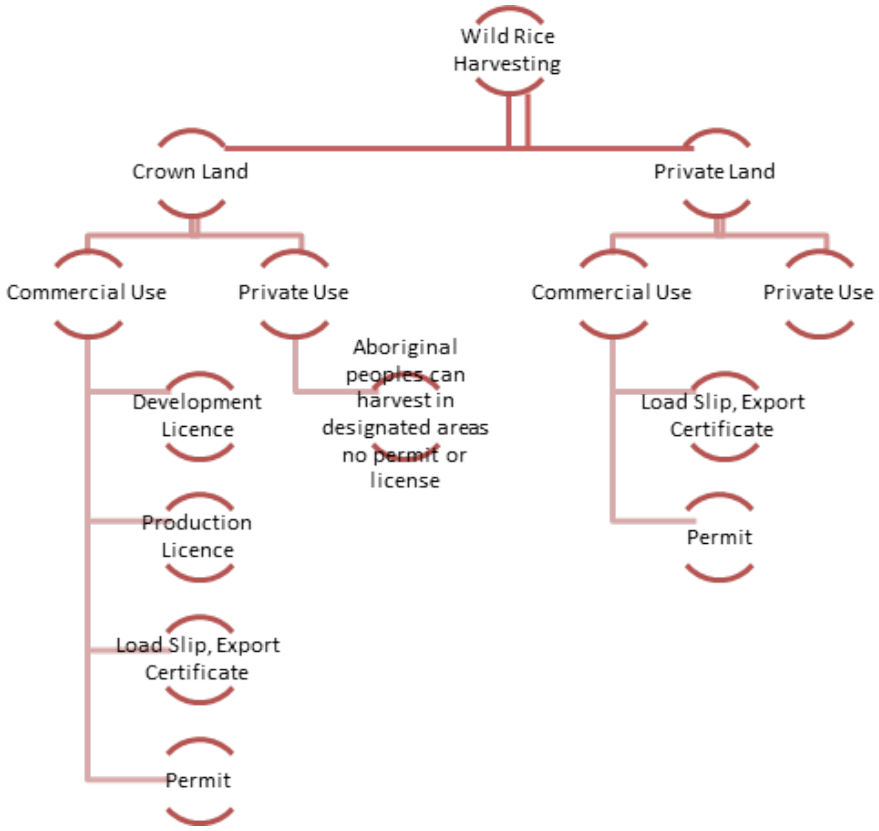

FIGURE 2: REGULATORY REQUIREMENTS FOR HARVESTING WILD RICE IN MANITOBA

The many considerations examined for the Wild Rice Act could act as a model cattail or other biomass harvesting act. This section outlines the parts of the Wild Rice Act (Government of Manitoba, 2012h) that could most likely inform the creation of a new cattail harvesting act.

- Application of Act 2(1): The act does not apply to wild rice that is growing on private land. For the purposes of this review, another management scheme, the Manitoba Woodlot Program,[4] could be offered as a model of cattail harvesting on private lands.
- Aboriginal and treaty rights 2(4): The act is to be administered in a manner that does not infringe upon the inherent rights of Aboriginal Peoples relating to wild rice. For generations, cattails have been harvested by Aboriginal Peoples and are put to a variety of uses. A cattail harvesting act should respect those rights.
- Development License 3: No person can develop a wild rice area on Crown land without a specific development licence. The control of development areas is essential for any operations happening in sensitive wetland areas—especially now, considering the Save Lake Winnipeg Act and its clause amended into the Crown Lands Act for (a) the designation of a provincially significant wetland and (b) governing, regulating or prohibiting any use, activity or thing in a designated wetland or in any part of a designated wetland.
- Production License 4(1): The seeding of wild rice cannot take place without a production licence. A similar licensing structure for cattail harvesting on Crown lands may be appropriate; however, the seeding of cattails is not typically necessary and may be prohibited under the Noxious Weeds Act on Crown lands.
- Mechanical harvesting 4(2): Similar to wild rice, cattails can be harvested by canoe/on foot in a fairly low-impact/high-energy manner, but they can also be harvested mechanically by specially adapted wetland harvesters at a faster and more efficient rate. Some areas for wild rice harvesting and some areas for cattail harvesting would naturally be more sensitive than others, depending on the ecological structure. Currently, there are mechanical harvesters for cattails, but none have been tested on a large-scale operation in Manitoba. Several pilot projects were conducted in 2012 for harvesting, processing and use of cattails. Like the Wild Rice Act, legislation for cattail harvesting should include areas for mechanical harvest and areas of concern (where nutrient loading may be high, thus maximizing nutrient mitigation benefits).
- Designation of areas 5(2): The minister may designate areas of Crown lands that have not previously been designated for the harvesting of wild rice. Since large-scale cattail harvesting is a new venture in Manitoba, the power to designate additional appropriate areas on Crown land will be useful, especially in areas where 1) nonpoint source pollution (nutrients) are unfavourably high and in danger of flowing into Lake Winnipeg and 2) habitat is in need of invigoration.
- Areas designated for hand-picking 6(1): Some areas of Crown land, through the Wild Rice Regulation are designated for hand-picking only by any person without a licence or permit. For some, cattails are used on a household or traditional scale and this would be a useful section to include on a cattail harvesting legislation.
- Areas designated for Indian Bands 6(2): Registered Indians or Indian Bands may engage in harvesting of wild rice for household purposes without a licence or permit in areas designated for such harvesting within the Wild Rice Regulation. Aboriginal Peoples' right to bypass official licensing is something that could be replicated in cattail harvesting legislation as deemed appropriate by the Crown. Further to this, Crown lands should be cleared with neighbouring bands or communities to gain understanding of possible cultural/recreational/spiritual meaning to the area of potential harvest (Stevens, 2012).

[4] More about the Manitoba Woodlot Program and possible synthesis with cattail harvesting on page 11.

- Wild rice zones 10(2): To facilitate the management of wild rice in the province, the minister may designate a wild rice zone by the Wild Rice Regulation. In these specific zones, a permit or license will not be offered to anyone that has not been a resident in that zone for at least one year. This practise can promote many things if applied to a future cattail harvesting legislation: (i) the removal of nutrients where an imbalance occurs and excessive amounts are entering into Lake Winnipeg or other bodies of water where excessive nutrients are a problem, (ii) establishing economic endeavours where there may be few and (iii) habitat invigoration where needed. Overall, establishing zones where only residents harvest has established a culture of land stewardship. Ideally, only Manitoba residents and Manitoba corporations should be allowed to harvest cattails considering the scale and stewardship of land management.
- Other sections of the Wild Rice Act describe the duration of licences and permits, ownership, transport, storage and other specifics that could serve as a model for a cattail harvesting act. Storage and transport of biomass goods is further discussed in the Manitoba Bioproducts Strategy, but not for biomass supplies that have no prior attached legislation (like cattails), which would need to be addressed.

A proposed act for cattail or ecological biomass harvesting on Crown lands should, when necessary, consider the cultural needs of local aboriginal communities and include discussions with local residents to ensure cultural uses of Crown land areas are respected. The Wild Rice Act may act as an appropriate legislation to model cattail legislation; however, lessons may be learned from additional legislation and policies, as mentioned in Table 2 and Section 3, as well as current Manitoba programs and other jurisdictions where wetland plants have been harvested. In many parts of Europe, for example, the mechanized and sustainable harvesting of wetland plants, such as reeds (*Phragmites*), has taken place for the past several decades under established legislations and policy.

3.1.2 Private Lands

For the harvest of cattails on private land, a module could be added onto **Manitoba's Agro Woodlot Program** through Manitoba Agriculture, Food and Rural Initiatives (MAFRI). In 1992 a survey completed by landowners indicated that there is a strong desire to keep forested areas on their lands for the benefit of wildlife, a place to relax or just for its pure, natural beauty (Manitoba Agriculture, Food and Rural Initiatives, 2012d). Like forested areas, wetlands and cattails provide excellent breeding and nesting habitat for a variety of fauna and exist in large tracts and small pockets all over private land in Manitoba. Conversely, there are also large areas of pastures and marginal agricultural lands that have become overgrown with cattails, where many landowners view them as a nuisance plant species that causes lost revenue on marginal lands. Many of these large areas of cattails provide useful wildlife habitat; can be harvested for nutrient recapture, habitat invigoration and reduction of greenhouse gas emissions; and can provide alternative economic revenue to the private landowner.

Currently, the goal of the Manitoba Woodlot Program is to assist landowners in the recognition and implementation of sustainable economic opportunities that already exist on their land (Manitoba Agriculture, Food and Rural Initiatives, 2012e). Several workshops have been presented in various areas around Manitoba; in 2008 a Woody Biomass Workshop in Portage la Prairie discussed bioenergy conversion projects, biomass heat for greenhouses and the use of willow in treating wastewater and other equipment developments (Manitoba Agriculture, Food and Rural Initiatives, 2012f). This program already has established rapport with many landowners across Manitoba that have interests

that could easily integrate into the management objectives of the program. Foresters from the Manitoba Forestry Association and Manitoba government (MAFRI) assist landowners in stewardship and diversification of their land. The implementation of workshops, information sessions and technical experts would be helpful in assisting landowners in the harvesting, processing and marketing of their cattails. Considering that cattail harvesting is a newly emerging sector, and a newly emerging biomass source, this may be an essential part of supporting the Manitoba bioproducts economy.

3.2 Scenario Two: Public Benefits Emphasis

This scenario for the management of cattail harvesting is built on the assumption that, since cattail harvesting offers significant public benefits through nutrient management, habitat enhancement, greenhouse gas mitigation and the use of biomass to replace coal, some of this process may be applied to funding harvesting contracts, and partially incented through tax breaks and other incentives for people on private lands. The benefits would need to be monitored and used to justify such public support for programming.

In this scenario, on Crown lands, the Manitoba government sets the harvesting regulations and contracts individuals or corporations to harvest cattails in areas that may be deemed effective for the removal of excessive nutrients. Examples may include areas of Netley-Libau Marsh that are high in nutrient levels, or areas in the watershed downstream from known nutrient sources. On private lands, the growth of cattails and the conservation of such areas could be incented with a property tax break. The harvest of cattails on private land may also be incented by other policy mechanisms. In this scenario, the private benefits of biomass harvesting, although realized, are de-emphasized in favour of the larger public benefit.

Several pieces of Manitoba legislation support a publicly funded effort like the Climate Change and Emissions Reduction Act, which sets targets for emissions reductions, sustainable economy and energy security (Government of Manitoba, 2012i). The harvesting of cattails could fit under this legislation. The Manitoba Trees for Tomorrow program, governed by the Forestry Branch of Manitoba Conservation and Water Stewardship, has similar outcomes as a large-scale cattail harvesting scheme would: carbon sequestration would take place through planting trees that take up carbon dioxide and harvesting trees to displace fossil fuels (Manitoba Conservation and Water Stewardship, 2012).

The cattail harvest would also support the province's coal ban efforts; Manitoba has aimed significant efforts at phasing out coal and discouraging its use. The Emissions Tax on Coal Act, the Manitoba Bioproducts Strategy and the MBESP are all policy tools aimed at the reduction and eventual elimination of coal use for heating and energy. Cattails, found in abundance in parts of the province, would add to the biomass supply available to replace the use of coal and could help encourage communities to switch from coal-based energy to local bioenergy production and use.

The Sustainable Development Act was formed with the intention of facilitating sustainable development in the private and public sectors (Government of Manitoba, 2012j). The engagement of landowners and industry in educating them regarding the harvest, processing and use of cattails would create awareness of sustainable development. Cattail harvesting as a part of Manitoba Crown land management would support the purposes of this legislation. Related to this act, the *Manitoba Principles and Guidelines of Sustainable Development* (Manitoba Conservation, 2012) would also be highly supported, as many of the principles would be reflected in a cattail harvesting scheme, particularly stewardship, rehabilitation and reclamation, conservation and enhancement.

By including cattail harvesting in legislation, Manitoba could add to progressive nutrient capture and bioeconomic initiatives, and help implement sustainable development and nutrient management in the province. Cattail and ecological biomass harvesting is an opportunity to help reduce nutrient loading to Lake Winnipeg and other waterways, while creating economic opportunities. The Save Lake Winnipeg Act supports the enhancement of the health of Lake Winnipeg through several pieces of legislation. Removing nutrients from Lake Winnipeg through the sustainable cattail harvest would be supported by this legislation. Amending the Crown Lands Act to designate a provincially significant wetland could include special harvest areas for the removal of cattails, and hence the removal of nutrients. Designations for removal of cattails could also be made under the Wildlife Act (Government of Manitoba, 2012k), under which areas of Crown land can be designated for the improvement of wildlife habitat; the removal of overgrown cattails and excessive litter would improve wildlife habitat.

3.3 Program Implementation Process

With either scenario, a pilot or a pre-legislative trial period would be beneficial to inform new legislation or amend existing legislation to include cattail harvesting. This is not unlike the Dunnottar sewage lagoon, a licensed pilot project under the 2005 Environment Act that uses an alternative method of sewage filtration that has the potential to capture nutrients before entering Lake Winnipeg. The innovative nature of the project was carefully followed with rigorous testing to ensure that it was removing the intended nutrients and bacteria. The adaptive management strategy and close links with government agencies were important parts of the licensing process for the Dunnottar sewage lagoon (R. Gamble, personal communication, March 9, 2012).

The following table summarizes potential processes for the implementation of the two scenarios.

TABLE 3: SUMMARY OF PROCESSES FOR POSSIBLE SCENARIOS FOR SCALING UP CATTAIL HARVESTING IN MANITOBA

<table>
<tr><th>SCENARIO 1 – PRIVATE BENEFITS EMPHASIS</th><th>SCENARIO 2 – PUBLIC BENEFIT EMPHASIS</th></tr>
<tr><td colspan="2">1. Establish science and TEK-based research on the best management practises for cattail harvesting. This protocol should consider:
Harvesting equipment that does not damage the ecosystem
Harvesting timing that does not interfere with spawning, nesting and other important human use, wildlife and ecosystem considerations
Harvest zones, similar to the Registered Trapline System,* that promote stewardship, habitat invigoration and/or the removal of nutrients</td></tr>
<tr><td colspan="2">2. After a protocol has been established, working closely with stakeholders and government officials (Manitoba Conservation and Water Stewardship, MAFRI), a primary research body should use several pilot testing sites to understand the impacts of larger-scale cattail harvesting.</td></tr>
<tr><td colspan="2">3. Provided that cattail harvesting can be done in a sustainable manner, legislation should be established to outline zones, harvest times, fees, equipment used, license types, license fees and any other legislative concerns. Legislation could be modelled after the Wild Rice Act or Agro Woodlot program.</td></tr>
<tr><td>4. Private land: All producers must follow related legislation. Those that wish to develop can participate in a model similar to the Manitoba Agro Woodlot program, with workshops supporting interested harvesters and a Manitoba Cattail Extension Officer to aid landowners in the harvest, processing and marketing of cattails.</td><td>4. Private land: Manitoba can provide assistance following the Trees for Tomorrow programming model; the assistance would be in the harvest of cattails, with the processing and use being left to the landowner. Further to this, a tax credit similar to the Riparian Tax Credit may be a useful tool; people with cattails being harvested by the province would receive a tax credit for the amount of land that they own with cattails growing on it and/or the amount of phosphorus they remove.</td></tr>
<tr><td>5. Crown land: All harvesters must follow related legislation. Those that wish to harvest on Crown land, must abide by a Cattail Harvesting Act, which would include zonation, licencing, type of machinery, yield and a written plan approved by a member of the supervising department. This act could potentially be modelled after the Wild Rice Act.</td><td>5. Crown land: Manitoba contracts private enterprise to harvest in specific zones; zones have been determined based on nutrient removal and habitat invigoration needs. These zones can change with the ecosystem health needs of the province. This zonation policy is complimentary to the scenario 1 emphasis.</td></tr>
<tr><td colspan="2">6. Cattail harvesting should be integrated into the Manitoba Bioproducts Strategy and supported by the MBESP.</td></tr>
</table>

** The Registered Trapline System is a commercial furbearer harvest management system whereby a person, the "lineholder," is granted the exclusive opportunity to harvest (trap) furbearing animals in a certain area, the "RTL." The system ensures sustainable furbearer populations by controlling the number of trappers in that area and recognizes the lineholder as the steward of the resource. See http://www.gov.mb.ca/conservation/wildlife/trapping/rtl_lines.html for further details.*

4.0 Market Opportunities for Cattail-Based Value Chain

As the harvesting of cattail and other ecological biomass moves toward commercial scale, there is a need to examine existing and projected markets to determine potential demand for the various benefits derived from this value chain. As demonstrated in Figure 3, the core benefits include: (i) nutrient management and reduction in lake eutrophication, (ii) habitat improvement and related benefits including recreation and tourism, (iii) biomass for bioenergy and bioproducts, (iv) carbon offsets for greenhouse gas mitigation and (v) phosphorus recovery for fertilizers and water quality trading.

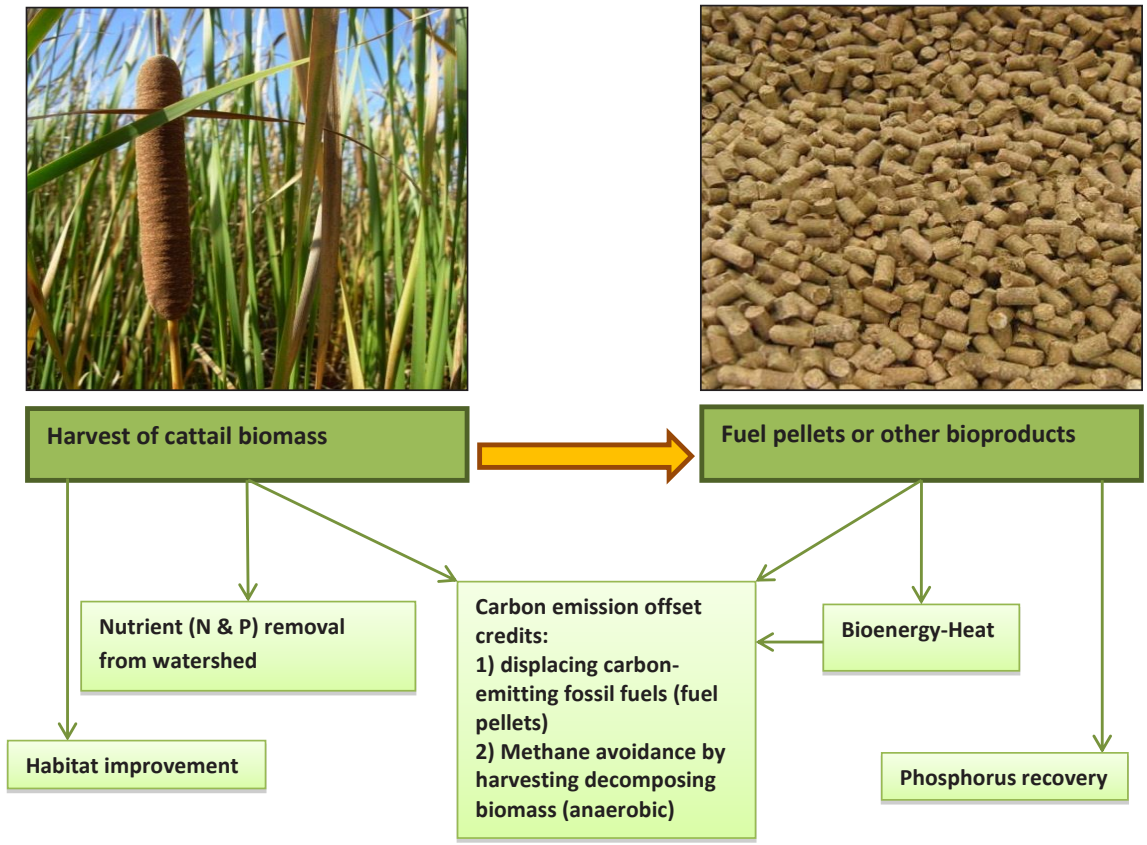

FIGURE 3: PROPOSED VALUE CHAIN AND NON-MARKET BENEFITS OF HARVESTING CATTAILS

A study of current and projected market demand will ensure this value chain can be realized to its optimum potential and market adjustments might be informed in the best possible manner.

An initial step in the study of markets and market demands for the products and by-products of this value chain is a preliminary scoping of the opportunities that exist for carbon offsets in the region and nationally, in Canada.

4.1 Offsets Opportunities in Canada

4.1.1 The Potential for Offsets to Help Canada Meet GHG Targets

IISD conducted a preliminary study of the potential for offsets to help Canada meet its 2020 emissions reduction target, showing that offsets can be a significant contributor to emissions reduction. A preliminary analysis by IISD in *Mind the Gap: The State-of-Play in Canadian Greenhouse Gas Mitigation* revealed that domestic offsets alone have the ability to contribute as much as 26 megatonnes of reductions annually in 2020 at a price of $25 per tonne in the sectors of agriculture, waste, buildings and transport (Sawyer, 2011). This represents as much as 12 per cent of the reductions needed to meet the Canadian government's 2020 target of 17 per cent below 2005 levels. While these numbers are only an initial modelling, and therefore must be taken with a degree of caution, they are illustrative of how offsets could contribute to emissions reductions targets in Canada.

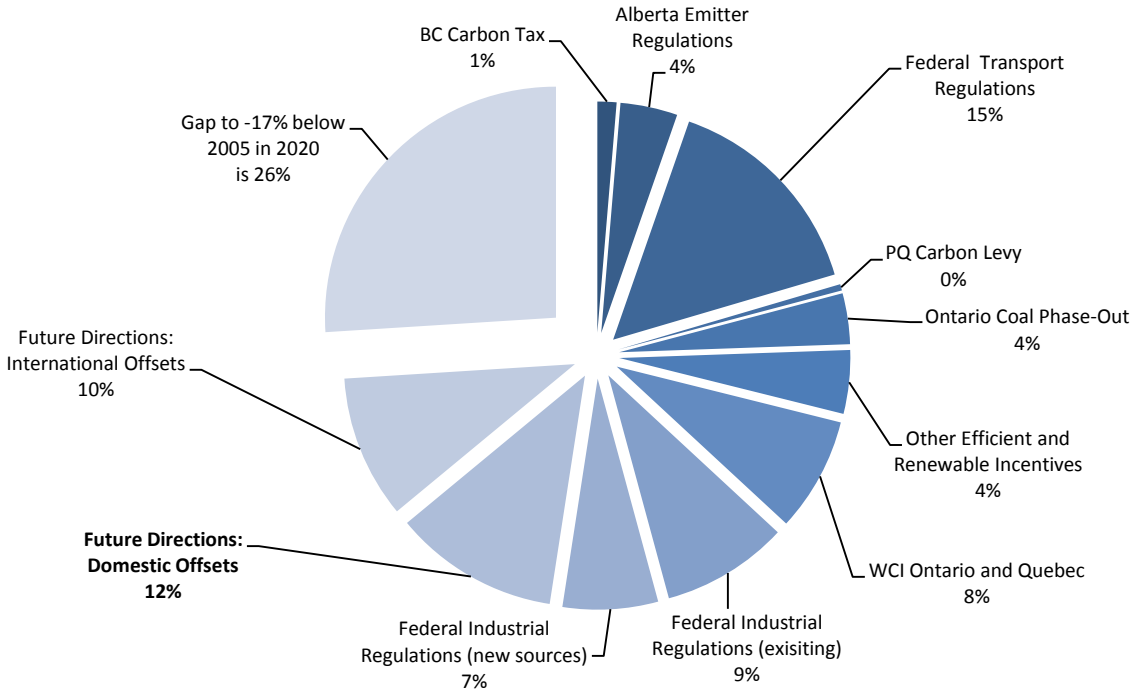

FIGURE 4: CURRENT, PLANNED AND POSSIBLE ACTIONS TO REDUCE GHG EMISSIONS IN CANADA: COMPOSITION OF CANADA'S TARGET OF 17 PER CENT BELOW 2005 IN 2020 (SAWYER, 2011)

Mind the Gap proposes that an offsets system could either be a form of flexibility for emitters to reduce compliance costs or a standalone government fund that purchases reductions itself for retirement against the national GHG reduction target. While such a system has yet to move forward, the potential for offsets to contribute to national targets in a significant way makes it an attractive option.

4.1.2 The Canadian Offsets Market

There is currently no national strategy or market for offsets for GHG mitigation at the federal level in Canada. The current role of offsets in Canadian GHG mitigation is based on a patchwork of approaches, without a clear guiding strategy at this level.

Efforts have been made to propose the development of an offset system for greenhouse gases in Canada. The last of these proposals, in 2009, included incentives for reductions in sectors uncovered in other approaches to GHG mitigation (i.e., cap and trade, sector performance regulations) (Environment Canada, 2009). Credits for offset action would then be purchased and utilized by entities in sectors that have offsets flexibility as part of their compliance regime. The initial goal was to include actions such as methane capture and destruction, afforestation, soil management and renewable energy. Steps included in an offset project approval would have included: (i) creation of a quantification protocol for the project type, (ii) registration of the project, (iii) implementation of the registered project and monitoring of data, (iv) reporting and verification of reductions from the registered project and (v) certification of reductions and issuance of offset credits by Environment Canada.

4.1.3 Provincial Offsets Systems

In the absence of a federal system, several provinces have taken to developing their own offset regimes with varying levels of coverage, standards and pricing. A summary of some of the prominent provincial approaches is included here.

4.1.3.1 Manitoba

A good starting point for a potential market for carbon credits for Manitoba-based cattail harvesting would be from Manitoba-based offset purchasers. Currently in Manitoba, domestic offsets have been piloted through the Manitoba Sustainable Agriculture Practices Program (MSAPP) (Manitoba Agriculture, Food and Rural Initiatives, 2010). The MSAPP operates as a single-purchaser offsets program to help the province achieve its climate change objectives and its transition to a low-carbon and green economy with a focus on reducing GHG emissions in the agriculture sector. The MSAPP has three components:

- BMPs
- Research and development
- Extension

The BMP program (currently fully subscribed and not accepting applications) enabled farmers to adopt practices that would achieve GHG reductions, such as improved manure storage, reduced tillage and pasture management planning.

The MSAPP has created a market for agricultural offsets in Manitoba at the price of CAD$24 per tonne, covering 180 projects for a total payout of CAD$2 million (Government of Manitoba, 2010). To date, this has resulted in 82,000 tonnes of emissions reductions that the province (as purchaser of the offsets) can claim towards its provincial emissions mitigation target. The program is currently scheduled to run until March 31, 2012, with its long-term future currently unclear.

There is potential that future iterations of an MSAPP program could be expanded to include projects such as IISD's cattail harvesting program given its GHG reduction (via energy fuel switching and methane mitigation) and nutrient

management benefits. Once the long-term lifespan of the MSAPP is determined, a review of acceptable projects would be a useful exercise to expand opportunities.

4.1.3.2 Alberta

Alberta has the most mature offsets regime within Canada, due in part to the strength of its GHG mitigation strategies. The structure of Alberta's climate change plan, including the Climate Change and Emissions Management Amendment Act and the Specified Gas Emitters Regulations, have developed three methods through which covered entities can meet their compliance requirements:

- Improve the efficiency of operations (meet intensity targets directly)
- Purchase offset credits through the in-province offset system
- Make payments into a provincially managed fund (Climate Change and Emissions Management Fund [CCEM]) designated for technology improvements at $15 per tonne of carbon dioxide equivalent (CO_2e)

The presence of the CCEM and the offset system serve as flexibility mechanisms to enable compliance at reasonable cost. The CCEM sets a carbon price within the system, setting a price point that the offsets regime can work with. As of late 2011, Alberta had collected more than $312 million through CCEM fund payments (Government of Alberta, 2013b), while the offset registry has 133 projects registered accounting for over 25 million tCO_2e in emissions reductions (Government of Alberta, 2013a).

Alberta developed its own in-province Offset Credit System Protocols (Government of Alberta, n.d.) covering the types of projects accepted[5] and third party verification. The system is operated and managed by a Crown corporation through the Carbon Offset Solutions[6] website.

4.1.3.3 British Columbia and Quebec

British Columbia and Quebec both have taken steps toward the development of an offset regime under the Western Climate Initiative (WCI). British Columbia developed an emissions offset regulation (Government of British Columbia, 2008) informing how measurement and removals of GHGs are to be expressed, as well as giving reporting and verification requirements. Initially intended to help the public sector become carbon neutral, the intention was eventually to have the offsets regime operate as part of the provincial cap-and-trade program under WCI, which was to start January 1, 2012 (Ministry of the Environment, Government of B.C., n.d.). Currently, launching cap and trade has been delayed in the province, but the offsets regime still has delivered significant reductions to both the B.C. government and private sector clients through voluntary purchases. Pacific Carbon Trust (PCT), a B.C. government Crown corporation established in 2008 to facilitate GHG reductions through B.C.-based offsets, offers credits for purchase at $25 per tonne (Pacific Carbon Trust, n.d., b). PCT also offers advice and market assistance to offset project developers and delivered nearly 750,000 tonnes of carbon offsets to clients in 2010 (Pacific Carbon Trust, n.d., a).

[5] There is a protocol for biomass combustion within the Alberta system, both related to the avoided GHGs from switching to biomass from fossil fuels and avoided GHGs by combusting biomass (versus undergoing anaerobic decomposition). This protocol, with some amendment, could be used as a basis on which to build an offset protocol for the cattail harvesting project. This biomass protocol is available via the Alberta Environment website at: http://environment.gov.ab.ca/info/library/7908.pdf

[6] Carbon Offset Solutions: http://carbonoffsetsolutions.climatechangecentral.com/

Through its involvement in WCI, Quebec has also considered offsets for compliance, and the launch of the WCI emissions trading system in Quebec on January 1, 2012 gives added weight to the commitment. WCI developed essential elements for an offsets system (Western Climate Initiative Offsets Committee, 2010) and reviewed existing offset protocols against their own criteria (Det Norske Veritas, 2010). Recommendations included areas such as ownership, use, geographic limits (offsets from non-WCI jurisdictions may be used), quantification, leakage, permanence, eligibility, verification and additionality. Importantly, only protocols approved through the WCI protocol review process may be used. Protocols that WCI reviewed include soil sequestration, manure management, rangeland management, forestry, landfill gas and waste treatment.

4.2 The Voluntary Market

With the offset market disjointed in Canada, many entities are relying on the voluntary market for offsets. Much of this market relies on targets imposed internally, not by government regulations, but by shareholding management or ownership groups imposing internal reduction targets.

For the Netley cattail harvesting project, like other projects in stages of development that have GHG mitigation opportunities, the presence of a voluntary market serves as an outlet to gain a crediting benefit while they wait for a regional compliance market to come into form (i.e., WCI) or just as a way to derive a funding or cost-recovery source for a project with a GHG mitigation benefit. A relevant example is in the case of fuel switching from coal to biomass for heat generation, where the biomass is more expensive, but becomes economically competitive with an offset credit.

4.3 Standards

There are a series of regionally and globally accepted standards that operate in place of jurisdictional standards (i.e., Alberta or WCI's system) in the voluntary market. Some, such as the Gold Standard, and Verified Emissions Reductions (VER+) standard, are based on the Clean Development Mechanism (part of the Kyoto Protocol) but designated for use on the voluntary markets. Others are developed by specific groups, such as the Verified Carbon Standard (VCS), which was developed by The Climate Group, the International Emissions Trading Association and the World Business Council for Sustainable Development.

There are also standards specifically for developing countries, such as the Gold Standard, which is only for projects developed in countries without Kyoto targets, and those for use anywhere in the world, such as the VCS.

Overall, the VCS is one of the most commonly used standards around the world, with the largest market share (Stanley, Hamilton, Marcello & Sjardin, 2011, p. 34). It is also a viable option, at least upon initial review, to bring the IISD cattail project's offset potential to the voluntary carbon market. For this reason, it is the model that we will focus on in terms of how a project gets accredited.

4.4 Developing a VCS-Approved Project and Selling Credits

Getting accredited and issuing credits in the form of Verified Carbon Units (VCUs) with the VCS is a multistep process for project developers. The VCS website[7] offers a step-by-step process for project development, but the basic steps are as follows:

[7] Verified Carbon Standard: http://www.v-c-s.org/

1. Choose a methodology: Project proponents must choose a methodology under VCS or another approved GHG program.
2. Validate project description: Proponents must develop a complete project description using the VCS template and have it validated by an approved validation body.
3. Verify emission reductions: Project proponents monitor and measure GHG emissions reductions and document these in a monitoring report in a prescribed template.
4. Register project and issue VCUs: Proponents must open an account and submit all required documentation to a VCS registry operator to be registered on the VCS database.

Given its worldwide applicability, highly respected and accepted standards, and competitive price points, it is likely that the VCS will continue to be a leading offset standard in Canada for the foreseeable future. Pending the development of a more structured and expansive offset system in Manitoba, with its own set of regulations, the VCS also serves as a suitable model for the IISD cattail project to study the potential of developing standard-approved offset credits for the project.

5.0 Conclusion

Well-managed cattail and ecological biomass harvesting offers a range of benefits complementary to provincial and regional priorities in Prairie Canada. IISD's research and development has demonstrated and analyzed the positive impacts of cattail harvesting on water quality and nutrient management, habitat, GHG mitigation and carbon offsets, bioenergy, and phosphorus recovery. However, in order to ensure these benefits are maximized as this concept moves toward commercial-scale applications in Manitoba, and to ensure potential negative impacts are minimized, due diligence through policy and legislative oversight is necessary. This research provides some insight into current legislation and markets in Manitoba and possible scenarios for commercialization. Additionally, it provides legislative and policy guidance for implementation of these scenarios with the necessary monitoring and accountability necessary for sustainable management of land and water management for public and private benefit.

In order to move the harvesting of cattail and other ecological biomass to provincial and commercial levels, it is necessary to assess the demand and market for the range of benefits from harvesting this novel biomass, that is to say, the demand and current market for biomass and bioenergy. This report provides an initial assessment of available and potential markets for carbon offsets provincially and across Canada. This provides a conceptual background for developing the carbon offset potential of scaled-up cattail harvesting. Conceivably, such an assessment should also be carried out to examine the demand for nutrient recycling, water quality improvement and potential water quality offset trading.

This report presents two possible scenarios for the harvest of cattails in Manitoba. These are not presented as mutually exclusive, and nor are they the only possible scenarios. They are presented as two possibilities based on a study of current legislative and policy limitation and oversight. These scenarios are based on the understanding that cattail harvests are providing significant public as well as private benefits. They can therefore be treated as a process for maximizing public benefits with private co-benefits—to offset the costs, or as a means for private gains, with public co-benefits that might facilitate some financial breaks or incentives.

Scenario one is a private-benefits approach based on the understanding that cattail harvesting on both private and public lands provides significant private benefits, but must be managed to ensure minimum environmental and other impacts. Management or legislative precedents are provided by existing processes such as forestry, mining or wild rice harvesting. Policy instruments, such as the Wild Rice Act for public lands and the Manitoba Woodlot Management model for private lands, would regulate the harvest but not include incentives or financial support for the process.

Scenario two is the maximized public-benefits approach based on the understanding that cattail harvesting on both private and public lands provides significant public benefits—most prominently, nutrient management and offsetting coal use for space heating. This process must be actively managed to ensure maximum public benefits and to make it economically attractive to implement. Examples of management and legislative precedents include the Trees for Tomorrow, the existing programs incenting agricultural beneficial management practices and the MBESP.

Support for both these scenarios is provided by several existing provincial laws, policy documents and articulated priorities. The ecosystem health goals articulated through the Save Lake Winnipeg Act, the Climate Change and Emissions Reductions Act, the Nutrient Management Regulation, the Sustainable Development Act and the Emissions Tax on Coal Act are all strongly supported by the sustainable harvest of cattails for the regional (especially rural) economic development, the health of Manitoba's waterways and achieving GHG mitigation targets. The rural economic

goals of the Manitoba Bioproducts Strategy and the MBESP are supported well with a new biomass supply that grows abundantly throughout the province.

Our initial assessment of opportunities for realizing carbon offset sales through implementing cattail harvesting revealed a gap in "ready-to-use" markets and protocols at both the federal and provincial levels. However, the provincial agricultural offsets currently implemented through the MSAPP program may offer some opportunity for realizing provincial carbon offsets through cattail harvesting through a similar incentive-based program. The details of the program design and implementation will have to be considered. Precedents set by more mature carbon markets such as those in Alberta, B.C. and Quebec offer guidance for the future development of Manitoba-based protocols that enable the efficient realization of carbon offsets from provincial cattail harvesting.

The Alberta protocol and voluntary market provides the greatest opportunity at present for the sale of carbon offsets from cattail harvesting in Manitoba. The presence of a voluntary market offers an opportunity to derive funding or cost-recovery against GHG mitigation benefits while waiting for a regional compliance market to be formalized.

6.0 Key Recommendations

Further development and implementation of cattail harvesting in Manitoba requires several policy/legislative and market-related changes. A few key recommendations are highlighted to ensure cattail and ecological biomass harvesting in Manitoba are implemented to maximize benefits and minimize negative impacts.

A key recommendation is to **develop an appropriate scenario or combination of scenarios based on provincial priorities.** This will inform the legislative and market systems most relevant for the particular scenario and will inform the process and research going forward.

A key piece of analysis to help guide this decision would be **an assessment of the cattail biomass resource, and the minimum and maximum potential for cattail harvesting in the province**. Furthermore, articulating and quantifying the potential for water quality improvements, habitat restoration and carbon offsets with greater accuracy would inform decisions on management scenarios, as well as help to inform any supporting policy or legislation that may be developed. It is recommended that other plant species with similar benefits as cattail, or ecological biomass, should be researched to assess the potential for nutrient capture, bioenergy/bioproducts and flood storage.

A specific recommendation based on this review is to **include cattails in the MBESP schedule** to promote the use of cattails as a coal-replacing biomass. Like many other biomass feedstocks, cattails are available across the province and could further help to reduce GHG emissions by potentially lowering the distance of transport. Cattails should also be included in the Manitoba Bioproducts Strategy moving forward, and in the Retail Sales Tax Act tax exemption on biomass. Further to this, cattail and other biomass removal should be explored and evaluated as a part of a larger nutrient reduction strategy with the possibility of a water quality trading or nutrient reduction credit that is similar to a carbon offset credit.

Another specific insight is to use the Crown Lands Act and its provision for the ministerial designation of a provincially significant wetland to include and **assign special harvest areas for the removal of cattails**. These areas can be identified as **areas of concern for excessive nutrient loading** and facilitate the removal of nutrients. These could be clearly managed under the proposed scenario two for high levels of public nutrient management benefits.

Some other recommendations are for further research in specific areas where information gaps exist or where more information will provide significant benefit. For example, in the absence of a provincial standard, and in light of the transferability and prevalence of the VCS, **standard-approved offset credits** should be developed for the use of biomass to displace fossil fuels.

Current and future research should feed into an **adaptive management framework** as a learning tool for Manitoba's government, harvesters and processors. A strong **monitoring system** will ensure that the implementation of cattail harvesting is monitored carefully and the outcomes, both positive and negative, are measured, to learn about:

1. The magnitude of GHG emissions that can be potentially mitigated through the harvesting of cattails and other ecological biomass.
2. *Actual* impacts on wildlife habitat and the means to mitigate any negative impacts.
3. Long-term nutrient capture from harvesting and nutrient balance in harvested areas.

Finally, there needs to be better understanding of the **existing and potential demand for biomass, bioproducts and bioenergy in Manitoba**. Without such an estimate, cattail harvesting might over-supply a good that is not yet understood from a demand focus. Further market analysis, exploration and research into alternative end uses of harvested cattail biomass is also necessary; for example, studies should assess its use for the production of other high-value bioproducts, not just as a solid fuel to replace coal.

These recommendations should inform a clear implementation process as well as management protocol, including legislative and policy direction, for the sustainable harvest of cattails on private and public land in Manitoba as a part of an overall provincial surface water management and nutrient management strategy.

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Appendix A

This table summarizes any legislation and regulation currently relevant to the harvest of cattails in Manitoba. It also highlights regulatory elements relevant to the two management scenarios presented in this research paper.

DEPARTMENT BRANCH/ SECTION	LEGISLATION/ REGULATION	RELEVANT SECTIONS AND OTHER COMMENTS
PROVINCIAL LEGISLATION		
Manitoba Conservation Lands Program Branch	Crown Lands Act Related Regulations: Agricultural Crown Land Leases Regulation, Crown Lands Fees Regulation, Land Administration Fees Regulation, Vehicle Use on Crown Lands Resource Roads Regulation	Dictates what types of activities can occur on Crown lands (Government of Manitoba, 2012c). Currently, the Crown Lands Act is being reviewed by the Province of Manitoba. The rewrite is being led by Michal Kubasiewicz, policy analyst for Corporate Crown Land Policy. This legislation would have to be consulted for any harvest on Crown lands. From a regulatory perspective, the one requirement that could likely apply would be a **work permit** for activities being undertaken on Crown land. This would be analogous to getting a work permit to harvest firewood on Crown land. Work permits are obtained from local district offices of Manitoba Conservation and Water Stewardship, and can usually be obtained almost instantly. They will specify conditions for environmental protection, such as when the activity can be undertaken, and what measures are necessary to protect against fuel spills.
	The Wild Rice Act, The Wild Rice Regulation	This is perhaps the closest act that can apply as a precedent/analogue to cattail harvesting on Crown lands, as both cattails and wild rice grow wild all over Crown lands. Wild rice is harvested mainly on Crown lands. This act defines who can harvest, where harvesting can take place and how a person can harvest. Persons can hold wild rice licenses for their areas of residency for no less than one year. This act defines ownership, transportation and wild rice camps (Government of Manitoba, 2012h).
Climate and Green Initiatives Branch	Climate Change and Emissions Reductions Act	The purpose of this act is to address climate change, to encourage and assist Manitobans in reducing emissions, to set targets for reducing emissions and to promote sustainable economic development and energy security (Government of Manitoba, 2012i). Netley-Libau and other similar cattail biomass development projects would certainly support the goals of this act, such as emission reductions, sustainable economic development and energy security.
Wildlife and Ecosystem Protection Branch	Endangered Species Act	Habitat is not to be disturbed for species outlined in Schedule 1 of this Act (Government of Manitoba, 2012d). This would only affect specific areas of harvest and only for specific plants and animals. Most species listed do not regularly use wetland habitat. This act would have to be consulted for any large-scale harvesting sites.
	The Wildlife Act	The Lieutenant Governor in Council may designate Crown lands as (a) wildlife management areas, (b) registered trapline districts, (c) special trapping areas or (d) any other type of area if it results in any area that could be "better managed, improved or enhanced" (Government of Manitoba, 2012k). The cattails harvest has the potential to enhance wildlife habitat areas in wetlands that have been degraded over time. Other stewardship initiatives, like registered trapline areas, wildlife management areas and special trapping areas have been designated under this act, and have active (faunal) harvesting within boundaries. The designation of an area does not necessarily limit the types of activities undertaken in an area, as long as the activity respects the use, control and management of an area.

Environmental Assessment and Licencing Branch	The Environment Act	The intent of this act is to develop and maintain an environmental protection and management system in Manitoba that will ensure that the environment is protected and maintained in such a manner as to sustain a high quality of life, including social and economic development, recreation and leisure for this and future generations, and in regards to the harvest of biological materials in Manitoba. This act provides the legislative mechanism for environmental assessment, supports future provincial planning and policy mechanisms and provides an avenue for public consultation. A public hearing is required where there is an objection to a (class 1) project 10(7). A public hearing can be not recommended by a director or a minister and written reasons for this decision must be given to the objector. If a proposed project has a "habitat modification development" aspect, like controlled burning, it may be a class 2 project. An "energy development" plant would likely be considered a class 2 development project (Government of Manitoba, 2012e). Cattail harvesting may not follow a class 1, and definitely does not follow a class 2 or 3 development; therefore, the EIA process or a public consult may not be triggered. It may count as a "development" project, as defined in the act. At the discretion of the minister, it may require some assessment and possibly a public hearing. Based on the following description within the Environment Act and personal communications with the Environmental Licensing Office at Manitoba Conservation, we've concluded that harvesting cattails from public or private lands would not be subject to environmental assessment and licensing at the provincial level. The Environmental Licensing Office indicated that the main environmental concerns would be habitat disturbance at critical times and harmful effects from machine operations. Both of these issues are easily addressed through simple mitigation measures involving the timing of harvesting operations and the servicing of machines, respectively.
Forestry Branch	The Forest Act	This act outlines harvesting procedures, licenses, areas and all to do with forestry management in Manitoba. The Forestry Branch and this act set important precedents for private operations on both Crown and private lands (Government of Manitoba, 2012l). Under Scenario 1, there are a variety of licenses and regulations that could be modelled to form regulations for cattail harvesting in Manitoba. Under Scenario 2, this act does not seem to have an immediate need to be consulted.
Sustainable Resources and Policy Management	The Sustainable Development Act	This act establishes the Manitoba Round Table for Sustainable Development, with goals for the promotion of sustainable development in both the private and public sectors (Government of Manitoba, 2008). It may be useful for Scenario 2 to operate under this act.
Manitoba Water Stewardship Division Water Quality Branch	The Water Protection Act, Nutrient Management Regulation	The Nutrient Management Regulation is a piece of planning legislation for the residents and business owners of Manitoba (Government of Manitoba, 2008). However, as a part of the agricultural/municipal nutrient management strategy that is mandated under this regulation, cattail or other biomass harvesting may be a viable option for nutrient removal for environmental protection and nutrient recapture. Under Scenario 1, this may be developed as a way that agricultural producers can mitigate their impact on aquatic systems, recapture use of wet areas and appease the requirements of the nutrient management plans that are mandatory under the regulation. Under Scenario 2, this act would support the Manitoba government in the mitigation of nutrients into waterways.

	The Save Lake Winnipeg Act	This act has amended several other acts (The Crown Lands Act, The Environment Act, The Mines and Minerals Act, The Planning Act, The Water Protection Act) with the ultimate goal of restoring the health of Lake Winnipeg (Government of Manitoba, 2012g)
Manitoba Agriculture, Farm and Rural Initiatives (MAFRI)	The Noxious Weeds Act	In the Schedule of Noxious Weeds in this act, "cattail, common" and "cattail, narrow-leaved" are listed as noxious weeds in Manitoba. Based on this designation, the act states that the owner of a land has duty to destroy weeds and seeds in order to prevent the spreading of these listed species. However, cattails are naturalized across the province, much like the common dandelion, and under this act would likely need to be controlled only under complaint or by law from municipally owned areas (ditches, green spaces). Perhaps the most relevant section to this act describes the cleaning of machines after harvest to prevent the spread of noxious weeds. By law, any harvester operating on land other than their own must have a copy of this act on hand when operating a harvesting machine (Government of Manitoba, 2012f).
Manitoba Finance Taxation Division	The Emissions Tax on Coal Act	This act, in concert with other financial incentives (MBESP), is being used to phase-out coal for smaller-scale users (heat, electricity) and to tax large industrial users with the end goal of a coal phase-out and biomass phase-in (Government of Manitoba, 2012a).
FEDERAL LEGISLATION		
Department of Fisheries and Oceans (DFO)	The Fisheries Act	S 34/ 35(1) [No person shall carry on work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.] outlines what a deleterious substance is, and that it is an offence if any were to enter into a waterway that is considered to be fish habitat. This may include harvest residue that could possibly make its way into fish habitats (Government of Canada, 2012b). However, during a pilot period, research to determine the effect that the harvesting process may have on fish and waterfowl habitat could be evaluated. This could inform a modification to reduce or eliminate the possibility of harmful effects to the surrounding ecosystem.
Environment Canada Minister of the Environment	Canadian Environmental Assessment Act	The Canadian Environmental Assessment Agency is responsible for this act. The act ensures that projects are carefully reviewed before possibly causing significant environmental impacts and ensures that the public participation process occurs. It also promotes sustainable development (Government of Canada, 2012a), as well as co-operation and coordination between federal and provincial governments. If an environmental impact assessment must be performed, this effort would be coordinated between governments, although it seems unlikely in this case.
MANITOBA GOVERNMENT POLICIES		
Manitoba Agriculture, Food and Rural Initiatives Energy Division (Agri-Energy	Manitoba Bioproducts Strategy	A strategy to encourage the growth of the Manitoba bioproducts economy, so far it only includes biomass materials that are sourced from agricultural and forestry operations. The strategy has five main focus areas: (i) to establish Innovation and industry champions, (ii) to invest in research, innovation and commercialization, (iii) to create a skilled workforce, (iv) to support market development and (v) to increase public awareness (Manitoba Agriculture, Food and Rural Initiatives, 2012a).
	Manitoba Biomass Energy Support Program	This program intends to provide support to Manitobans to transition from coal to biomass supply for heating and energy. The two facets to this program are: (i) to support consumer coal users to purchase approved biomass and (ii) to assist biomass users and processors in establishing or upgrading biomass infrastructure and facilities (Manitoba Agriculture, Food and Rural Initiatives, 2012c).

Manitoba Conservation and Water Stewardship Sustainable Resources and Policy Management Branch	Manitoba Principles and Guidelines of Sustainable Development	Seven principles, with the most relevant to this report being: 4. Prevention (cattails can effectively prevent some nutrients from flowing into Manitoba's waterways); 5. Conservation and Enhancement: (a) maintain the ecological processes, biological diversity and life-support systems; (b) harvest renewable resources on a sustainable yield basis; (c) make wise and efficient use of renewable and non-renewable resources; and (d) enhance the long-term productive capability, quality and capacity of natural ecosystems. 6. (a) Endeavour to repair damage to or degradation of the environment and (b) consider the need for rehabilitation and reclamation in future decisions and actions. According to this report, the responsibilities for No. 5 and No. 6 are the province of Manitoba's responsibilities. (Manitoba Conservation, 2012)
MUNICIPAL BYLAWS		
City of Winnipeg, RM Rosser, St. Andrews, Headingly	All surveyed have very similar bylaws that seem to be related to the Noxious Weed Act. Persons with property are mandated to control noxious weeds, and the city/rural municipalities are mandated to control noxious weeds found on their land.	

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