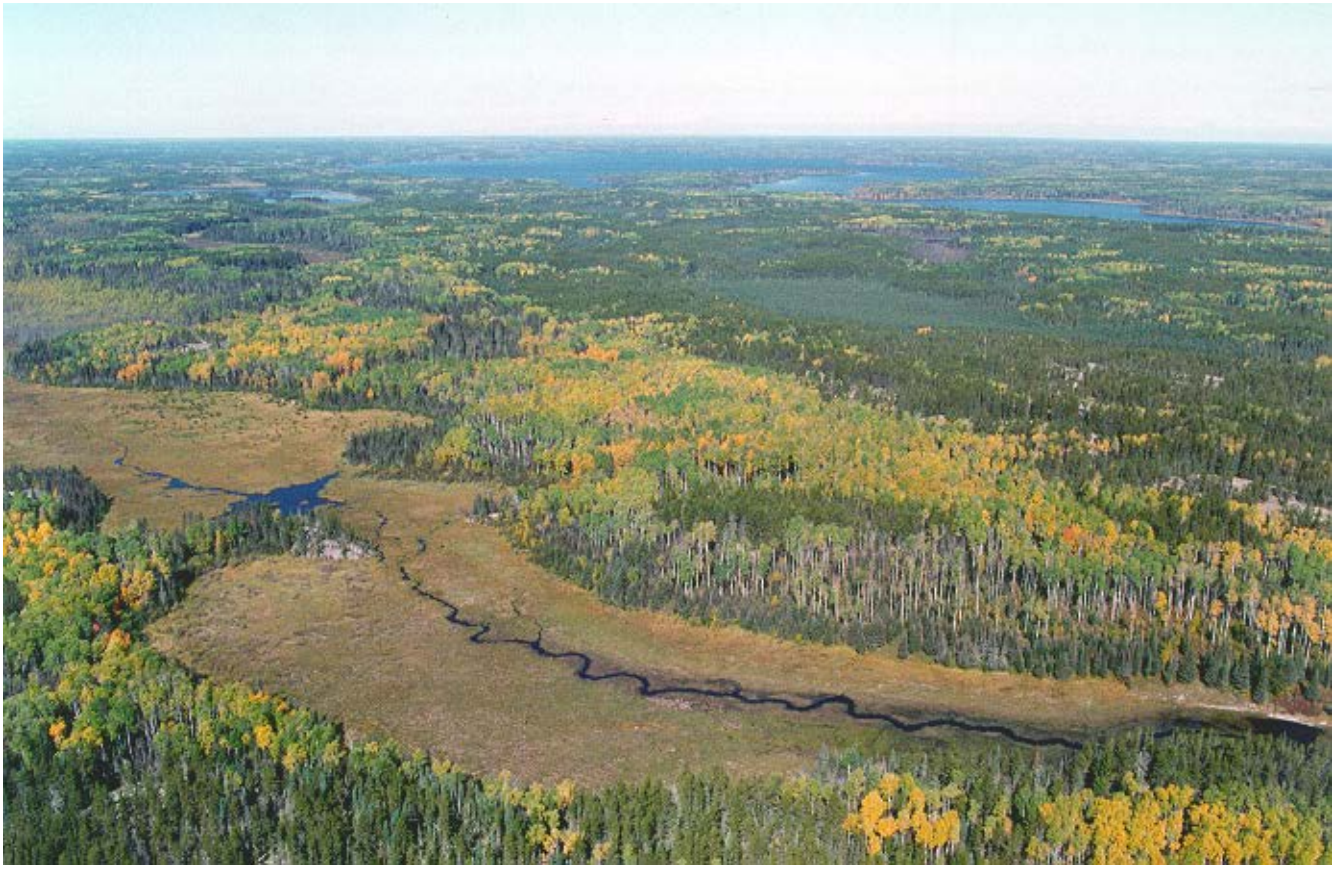
Lake Winnipeg East System Improvement (LWESI) Transmission Project

Forestry Technical Report

Maskwa Ecological Consulting



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EXECUTIVE SUMMARY

The Forestry Technical Report has been developed to assess the environmental effects of the Lake Winnipeg East System Improvement Transmission Project on the commercial aspect of the forest resource as well as private land forest values.

Forestry Valued Environmental Components were defined as productive forestlands and high value forest sites. Productive forestlands are assessed through their environmental indicators of sustainable Annual Allowable Cut levels, Forest Management Licence area and the volume of standing timber. High value forest sites are assessed through their environmental indicators of high value reforestation sites, research and monitoring sites and private land forest values.

Georeferenced data sets were obtained from Manitoba Conservation and Water Stewardship, the forest industry and Natural Resources Canada and compiled for the Project Study Area. The Forest Resource Inventory was updated to account for forest fire history and reforestation activities on Provincial Crown Land. Young forest stands were assigned a species composition, based on a forecasted subtype code, in order to use stratum based yield curves to quantify Project effects. Private land forest values were estimated from ocular assessments, aerial photo interpretation and forest resource inventory analysis. A separate Aboriginal Traditional Knowledge process provided forest values that were incorporated into the assessment process.

Alternative transmission routes were evaluated for their potential effect on high value forest site environmental indicators, the loss of productive forestland and Aboriginal Traditional Knowledge forest values. The forestry evaluation along with input from the Public Engagement Program was incorporated into a separate Alternative Route evaluation process that included socio-economic, biophysical, cost and technical assessments, which resulted in the selection of a Preferred Route.

The Project footprint, comprised of the Final Preferred Route 60 m right-of-way and the proposed Manigotagan Corner Station, formed the basis of an effects assessment on the forestry environment, Aboriginal Traditional Knowledge forest values and specifically by quantifying the effects on the forestry Valued Environmental Components.

Residual effects were determined and mitigation measures were proposed to mitigate potential effects on the forest environment resulting from the right-of-way clearing project. Manitoba Conservation and Water Stewardships' Forest Damage Appraisal and Valuation guide was used to estimate compensation values for the crown dues on standing timber and effects on high value reforestation sites. Environmentally Sensitive Sites that may be affected during the construction phase of the Project were produced as a spatial dataset for incorporation into an Environmental Protection Plan along with prescribed mitigation measures.

Interactions with other forestry related projects were identified and monitoring and follow-up requirements prescribed for the clearing project, both on crown and private lands, and future

Right-of-way maintenance projects. A requirement to confirm the Forest Damage Appraisal and Valuation assessment was also identified.

The effects of the Project on commercial forest resources are primarily limited to the loss of productive forestland. The effects on productive forestland environmental indicators are very minor and they can be incorporated into the development of a Request for Proposal for Forest Management Licence 01, which is currently being proposed by Manitoba Conservation and Water Stewardship.

The effect on private land forest values is limited to a small amount of natural forest area. This was achieved by maximizing the use of Manitoba Hydro property in locating the transmission line through the Powerview-Pine Falls community area.

Making firewood available to local and First Nation communities and local organizations, resulting from the Project footprint clearing project, can achieve positive effects. The demand for firewood was identified through the Aboriginal Traditional Knowledge and Public Engagement Program processes.

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LIST OF ACRONYMS

%	percent
AAC	Annual Allowable Cut
ATK	Aboriginal Traditional Knowledge
EA	Environmental Assessment
EnvPP	Environmental Protection Plan
ESS	environmentally sensitive sites
FDAV	Forest Damage Appraisal and Valuation
FLI	Forest Lands Inventory
FML	Forest Management Licence
FMU	Forest Management Unit
FRI	Forest Resource Inventory
GIS	Geographic Information System
ha	hectare
km	kilometre
km^2	square kilometres
kV	kiloVolt
Line PQ95	Pine Falls – Manigotagan 115 kV Transmission Line
LWESI	Lake Winnipeg East System Improvement
m	metre
m^3	cubic metre
m^3/ha/yr	cubic metres per hectare per year
m^3/yr	cubic metres per year
MAI	Mean Annual Increment
MCWS	Manitoba Conservation and Water Stewardship
PR	Provincial Road
ROW	right-of-way
the Project	The Lake Winnipeg East System Improvement Transmission Line Project
VEC	Valued Environmental Component

LIST OF FOREST LANDS INVENTORY ACRONYMS

AS	ash
BA	balsam poplar
BF	balsam fir
BS	black spruce
F	fir species
HWD	hardwood species
OHW	other hardwood
OSW	other softwood
JP	jack pine
P	pine species
RP	red pine
S	spruce species
SP	scots pine
TA	trembling aspen
TL	tamarack
WB	white birch
WS	white spruce

1 INTRODUCTION

1.1 Project Overview

The purpose of the Forestry Technical Report, **Environmental Assessment** (EA) is to describe and quantify all commercial forestry related land use activities, forest management and private forest land values within the Lake Winnipeg East System Improvement (LWESI) Transmission Project (the Project) Study Area. It determines the environmental effects of the Project on the forested environment and quantifies the effects specifically on productive forestlands, the **Annual Allowable Cut** (AAC), Forest Management Licence (FML) forested land base, standing timber volume and high value reforestation/research/monitoring sites. It also assesses Project effects on forest/tree values on private and/or municipal lands and Aboriginal Traditional Knowledge (ATK) forestry values.

The Project is required to provide system upgrades in the region east of Lake Winnipeg. The Project will serve existing and new load growth, and provide firm transformation and adequate voltage support for the communities located in and around the region. It is expected that this new development will meet the electrical requirements for at least the next 20 years.

The Project includes the construction of a new 115 kiloVolt (kV) transmission line from Powerview-Pine Falls, Manitoba to Manigotagan [Pine Falls–Manigotagan 115 kV Transmission Line (Line PQ95)], approximately 75 kilometers (km) north of Powerview-Pine Falls. The Project will require the development of a new 115-66 kV transmission station (Manigotagan Corner Station) west of the intersection of Provincial Road (PR) 304 and the Rice River Road, near the community of Manigotagan. This station will serve as the terminal for the new 115 kV transmission line as well as the existing 66 kV sub-transmission lines in the Manigotagan area.

This technical report supports the EA Report to meet the licensing requirements of the *Manitoba Environment Act* for a Class II Licence for this project.

As part of the effects assessment discussions, various study areas are considered. These are:

- Project Study Area – The Project Study Area includes an area of approximately 2,112 square kilometres (km^2) and extends from south of the community of Powerview-Pine Falls, north to the community of Manigotagan, and from the eastern boundary of Lake Winnipeg, to approximately 10 km east of PR #304. The Project Study Area was chosen to be of sufficient size to assess any potential project effects on biophysical and socioeconomic components;
- Right-of-way (ROW) – describes the Project footprint for the proposed transmission line;
- Footprint – describes the areas directly affected by all project components, including the transmission ROW, Manigotagan Corner Station Site and access routes/trails, etc. required for Project construction and maintenance purposes.

Map 1 describes the land base and shows the Manitoba Hydro existing and proposed Project infrastructure, including the three alternative transmission line routes that were evaluated.

The results of the forestry assessment are summarized and included in the *Manitoba Hydro Lake Winnipeg East System Improvement Transmission Project, Environmental Assessment Report* (Golder Associates Ltd. & R. Rawluk and Associates 2012) which Manitoba Hydro will submit to provincial regulators for review and licensing.

1.2 Report Outline

Section 1 of this report provides an overview of the Project and defines the geographic extent of the Project used for the forestry assessment.

Section 2 provides a general description of the forest resources for the Project Study Area that encompasses the Project area. The forest resources are described in terms of Manitoba's ecoregions and ecodistricts (Smith et al. 1998) and the Manitoba Conservation and Water Stewardship (MCWS) forest management administrative classifications. The MCWS forest inventory systems are also described.

Section 3 describes the methodology of the forestry assessment. It discusses the data upgrades, analysis and evaluations used to conduct the evaluations for the alternative and Final Preferred Routes. The process used to identify and select Valued Environmental Components (VEC) for the Project is described and the forestry VECs are defined.

Section 4 provides an evaluation of the Alternative Routes for each forestry VEC, and identified ATK values and quantifies the results.

Section 5 contains the environmental effects assessment for the forestry VECs and the ATK forestry values. Mitigation measures are proposed to reduce Project effects and protect values near the Project footprint that may be affected during the construction and maintenance phases. Residual effects are described and interactions with other projects in the Project Study Area are discussed and monitoring and follow up requirements proposed.

Section 6 summarizes the conclusions drawn from the forestry assessment, discusses mitigation measures and resultant residual effects as they relate to the VECs.

Section 7 contains the references cited, personal communications and websites used for relevant information.

Section 8 provides a glossary for terms used in the Report. Glossary terms appear in bold print in the report at their first occurrence.

2 STUDY AREA EXISTING ENVIRONMENT

The Project Study Area includes an area of approximately 2,112 km^2 and extends from south of the community of Powerview-Pine Falls, north to the community of Manigotagan, and from the eastern boundary of Lake Winnipeg, to approximately 10 km east of PR #304. The Project Study Area was chosen to be of sufficient size to assess any potential project effects on biophysical and socioeconomic components.

2.1 Ecoregion and Ecodistrict Description

The proposed Project is contained within the Boreal Shield Ecozone. In Manitoba, the ecozone extends northward, from the south-east corner of the Province, between the east shore of Lake Winnipeg and the Manitoba-Ontario border and proceeds across the top of Lake Winnipeg as a broad band from the Manitoba-Ontario to the Manitoba-Saskatchewan borders (Smith et al. 1998).

The extreme southern portion of the Project Study Area encompasses the northern extent of the Stead (375) Ecodistrict, which is contained in the Lake of the Woods (91) Ecoregion (Map 2). Fen peat lands support sedge-dominated vegetation with minor components of tamarack (*Larix laricina*) and shrubs, while bog peat lands have black spruce (*Picea mariana*), shrub and moss vegetation. Jack pine (*Pinus banksiana*), trembling aspen (*Populus tremuloides*) and white birch (*Betula papyrifera*) are the dominant tree cover on coarse textured soils. Balsam fir (*Abies balsamea*) and white spruce (*Picea glauca*) are found throughout on favourable sites. Balsam poplar (*Populus balsamifera*) is common on wetter sites, and deciduous trees such as white elm (*Ulmus americana*), ash (*Fraxinus* spp.) and bur oak (*Quercus macrocarpa*) are found along streams (Smith et al. 1998).

The Lac Seul Upland (90) Ecoregion extends from the eastern shore of Lake Winnipeg to the Manitoba-Ontario Border (Map 2). The Wrong Lake (371) Ecodistrict encompasses the majority of the Project Study Area and extends north of the Stead Ecodistrict. Jack pine and, to a lesser extent, trembling aspen are common on upland sites, due to extensive, repeated fires; however, black spruce is the dominant tree species and is especially widespread on imperfectly drained uplands and bog peat lands. In river valleys, around lakes and on south facing slopes, where drainage is good, white spruce, balsam fir, trembling aspen and balsam poplar form mixed stands. Deciduous and mixed stands have a diverse understory of shrubs and herbs, while coniferous stands tend to have feather moss ground cover. Bedrock outcroppings have patchy tree growth, dominated by jack pine, with an understory of low shrubs and groundcover of low **ericaceous** shrubs, mosses and lichens.

2.2 Forest Administration and Resource Description

For forest administrative purposes, Manitoba Conservation and Water Stewardship, Forestry Branch has divided the Province into administrative units of Forest Sections and Forest

Management Units (FMU) (Manitoba, Government of (A) website, 2012) (Map 3). The Project footprint is wholly contained within FMU 31 of the Pineland Forest Section.

MCWS establishes FMLs to provide a continuous timber supply to wood using industries (Manitoba, Government of (B) website, 2012). The Project footprint is wholly contained within FML 01, which is allocated to Tembec Industries Inc. (Tembec) (Map 3). The Tembec newsprint mill closed in 2009 and MCWS is in negotiations with Tembec to return FML 01 to the Province. Once FML 01 is returned to the Crown, MCWS is proposing to issue a Request for Proposal for the commercial utilization of the timber resources in the Project Study Area (Dojack pers. comm., 2012).

MCWS, Forestry Branch maintains a Forest Resource Inventory (FRI) (Manitoba Conservation 2007A;) or the newer Forest Lands Inventory (FLI) (Manitoba Conservation 2001) for the commercial forest areas of Manitoba (Manitoba, Government of (A) website, 2012). The FRI and the FLI are spatial and tabular database products of aerial photograph interpretation, maintained and managed within a **Geographic Information System** (GIS) environment. The 1997 FRI for the Project Study Area is displayed in Map 4.

3 METHODS

3.1 Data Collection and Analysis

3.1.1 Forest Inventory Data

MCWS, Forestry Branch, developed the 1997 enhanced FRI for the area of FML 01 (Map 4) (Manitoba, Government of (A) website, 2012). The enhancement of the FRI removed **Cutting Class** and added Year of Origin, Height, Landform, Moisture and Vegetation classifications. This allowed for the replacement of the original **Stand Stock Volume Tables** with age-based **yield curves**, by forest **strata**. The yield curves formed the basis of AAC determination for the FML 01 area (Manitoba Conservation 2006A; Manitoba Conservation 2006B; Manitoba Conservation 2010).

Major forest fires occurred within the Project Study Area in 1989 and again in 1999, shortly after the aerial photography was obtained for the inventory project. MCWS updated the forest fire effects on the 1997 enhanced FRI that was provided for the Project forestry effects analysis. The affected stands were updated, for the Year of Origin field, based on the regeneration lag period identified in the Wood Supply Report (Manitoba Conservation 2006B).

Prior to undertaking any effects analysis or conducting the Forest Damage Appraisal and Valuation (FDAV) calculations, the following updates and preparatory steps were performed.

- There were 36 of the 311 (12 percent [%]) productive area **polygons**, contained within the Project Footprint, that did not have an associated species composition assigned. These polygons did have a forecasted **subtype** code assigned, which provides a species content range. Species compositions were assigned to the 36 missing polygons based on the upper ranges and predominate species assigned to each subtype code (i.e., subtype 13 – black spruce 70% to 100% was assigned a species composition of BS10, while subtype 14 – black spruce 40% to 70%, second major species jack pine was assigned a species composition of BS7JP3).
- Stratum Codes and density classes were assigned based on species composition and **Crown Closure**, respectively, using the Yield Curve Strata Definitions provided by MCWS (Appendix A).
- Stand age was calculated based on the Year of Origin and 5-year age classes assigned as defined by MCWS (Klos pers. comm. 2012).

The updated FRI was used in the Alternative Route evaluation process to assess the potential effect on productive forestland (Section 4.2.1) and for the Project footprint effects assessment on annual allowable cut levels (Section 5.2.1.1), FML 01 area (Section 5.2.1.2), standing timber (Section 5.2.1.3), private land forest values (Section 5.2.2.3) and the Forest Damage Appraisal and Valuation calculations (Section 5.4.2).

The *Draft FML #1 Wood Supply Addendum* (Manitoba Conservation 2010) provides an area summary for the portion of FML 01 available for commercial forest management activities, as presented in Table 3-1.

Table 3-1 FML 01 Forest Management Area Classification

Classification	Area (hectares)	Percent of Total (percent)
Non-forested	88,479	11.9
Non-productive Forest	165,402	22.2
Productive Forest	492,364	65.9
Total	746,245	100

Source: Manitoba Conservation 2010; Appendix B.

3.1.2 Annual Allowable Cut

Annual allowable cut levels are determined by MCWS on an FMU basis (Manitoba, Government of (A) website, 2012). MCWS has developed an AAC for FML 01, which contains FMU 31 and a portion of FMU 35, and has not calculated a separate AAC for FMU 31 at this time (pers. comm. Epp, 2012). The Project effect on AAC will therefore be assessed against the FML 01 AAC.

A precise assessment of the Project effect on AAC levels would require the development of a detailed wood supply analysis, as was recently completed by Manitoba Conservation for

FML 01 (Manitoba Conservation, 2006A; Manitoba Conservation, 2006B; Manitoba Conservation, 2010). As this process is very detailed and time consuming, **Mean Annual Increment** (MAI) is proposed as the standardized unit for the purpose of assessing the effect of the Project on AAC levels. MCWS endorsed this approach as the assessment reflects a reasonable estimate of the effect of the Project on the AAC (Klos pers. comm. 2012).

In the FML 01 wood supply analysis, MCWS calculated MAI values for each strata yield curve, based on combined softwood and hardwood species (Manitoba Conservation 2006B). MAI is expressed as cubic metres per hectare per year (m^3/ha/yr) and when multiplied by the total area of productive forest removed by the Project footprint, will provide an indication of potential effects to AAC (cubic metres per year [m^3/yr]) without the consideration of other operational or forest practice limitations (i.e., operability, **forest succession**). MCWS recommended the use of the conventional standard, tree length MAI values for use in the AAC effects analysis (Klos pers. comm. 2012). The conventional standard, tree length MAI values are listed in Appendix C.

The MCWS wood supply analysis incorporated a land base net down process that identified no-harvest or restricted harvest areas which were removed from the AAC determination process (Manitoba Conservation 2006B). A land base net down procedure, based on the MCWS wood supply analysis net down specifications, was conducted on the area of the Project footprint, adjacent to the specified features, prior to determining the effect on AAC, as follows:

- Manigotagan River – 250 metres (m)
- Winnipeg River – 200 m
- **Single line** river – 50 m
- **Double line** river – 100 m
- PR #304 – 100 m

The AAC levels for FML 01, following the removal of Nopiming Park, are 302,242 cubic metres (m^3) softwood and 114,446 m^3 hardwood based on a **total harvest scenario** (Manitoba Conservation 2010). The softwood and hardwood conventional standard, tree length MAI values, by yield strata and density class, were multiplied by the area of each strata within the Project footprint. The resulting totals (m^3/yr), for each strata type, were then summed to arrive at an estimated Project effect on the existing AAC for FML 01. The results are shown in Table 5-1, Section 5.2.1.1.

3.1.3 Standing Timber Determination

The enhanced FRI for the Project area allows for the determination of standing timber using strata yield curves and stand age. Stratum codes and stand age classes were assigned to productive forestland polygons contained within the Project footprint (Section 3.1.1; Appendix D). Softwood and hardwood volumes, using the conventional standard tree length

yield curves (Klos pers. comm. 2012), were assigned to each polygon and multiplied by the polygon area. Softwood and hardwood volumes were calculated for all age classes and Crown Land classifications (Appendix D). The results are shown in Table 5-3, Section 5.2.1.3.

3.1.4 Forest Damage Appraisal and Valuation

Manitoba Conservation and Water Stewardship applies the Forest Damage Appraisal and Valuation Guideline (Manitoba Conservation, 2002) whenever productive forestland is removed from the land base. It is a compensatory form of mitigation that the Province levies on the project proponent. It accounts for the volume of timber affected at the time of clearing, determined by multiplying the affected yield strata area, by density and age class, by the applicable volume per hectare (ha). It also accounts for the investments in forest management such as forest renewal, forest protection, and research and monitoring sites, if applicable.

The FDAV has been conducted on the Crown Land portion of the proposed Project footprint. Additional productive forestland may be cleared for access development, borrow/deposition areas or bypass routes necessitated by terrain features encountered during ROW clearing. These areas, if required, will be very localized, small in extent and minimally incremental to the Project footprint.

The Forest Damage Appraisal and Valuation (Appendix E) has been completed for productive crown forestlands that are proposed to be cleared within the Project footprint. MCWS has developed strata yield tables for various utilization standards and indicated that the commercial standard, tree length yields (Appendix F) should be used for the FDAV assessment (Klos pers. comm. 2012). The crown dues to be used in the FDAV assessment, applicable to FML 01, were provided by MCWS (McGimpsey pers. comm. 2012; Swanson pers. comm. 2012). High value sites such as plantations, research/monitoring sites and tree improvement program sites have been avoided, where possible, in siting the Project. However, any high value reforestation sites that could not be avoided have also been accounted for in the damage appraisal. The calculations for the FDAV determination and strata yield table are contained in Appendix E and F respectively. The results of the FDAV are summarized in Section 5.4.2. It should be noted that this assessment is an estimate only and that recalculations may be required by MCWS after ROW clearing to ensure timber dues and the Project footprint are accurately reflected in the results.

3.1.5 High Value Reforestation Sites

Reforestation of harvest areas is performed through natural or assisted regeneration. Because of the financial investments, MCWS, Forestry Branch has identified harvest areas that are regenerated through tree planting, as high value reforestation sites. The locations of these silviculture sites are recorded and tracked by the Forestry Branch and FML holders within a GIS environment.

The reforestation data for the Project Study Area was acquired from MCWS; however, the GIS reforestation cover was compiled from annual reforestation projects and did not account for losses due to forest fires. There were two major fires in the project area in 1989 and 1999. In order to account for any forest fire effects, the GIS reforestation cover was updated by Golder Associates Ltd. as follows:

- Use Tembec plantation for PLANTYR <1989
- Intersect with MCWS 1989 forest fires
- Maintain Tembec plantations not intersected with the 1989 forest fires
- Add Tembec Plantations for PLANTYR ≥ 1989 and ≤1999
- Intersect with MCWS 1999 forest fires
- Maintain Tembec plantations not intersected with the 1999 forest fires
- Add Tembec Plantations for PLANTYR ≥ 2000

The updated high value reforestation site data was used in the Project footprint effects assessment (Section 5.2.2.1), the Forest Damage Appraisal and Valuation calculations (Section 5.4.2; Appendix E) and the identification of environmentally sensitive sites (ESS) (Section 5.4.3).

3.1.6 Research and Monitoring Programs

MCWS, the Manitoba Model Forest and the Canadian Forest Service have established forest research and monitoring programs within the Project Study Area. Site-specific information has been obtained from the various agencies and entered into Manitoba Hydro's Project database.

The following research and monitoring programs, along with their establishing agencies, have been compiled for the forestry assessment:

- Ecosystem Monitoring – MCWS
- Forest Management Research Sites – Manitoba Model Forest
- Forest Resource Inventory Permanent Sample Plots – MCWS
- National Forest Inventory Plots – Natural Resources Canada, Canadian Forest Service
- Trees for Tomorrow Program – MCWS
- Tree Improvement Program – MCWS

The research and monitoring site data was used in the Alternative Route evaluation process (Section 4.2.3), the Project footprint effects assessment (Section 5.2.2.2) and the identification of ESS (Section 5.4.3).

3.1.7 Private Land Forest Values

Numerous projects have been established in Manitoba to promote reforestation/afforestation and forest management on private and municipal lands. The Woodlot Management Program, delivered by the Manitoba Forestry Administration in this area, is the principal private land program that may potentially be affected by the Project. Woodlot location information for the Project area was sought from the Manitoba Forestry Administration.

The Agri-Environment Services Branch, formerly the Prairie Farm Rehabilitation Administration, provides planting stock and technical support to landowners for the establishment, maintenance and improvement of farmstead and field shelterbelts. The Agri-Environment Services Branch does not document the location of such planting projects; therefore, the assessment for potential afforestation projects, as well as tree planting for aesthetic values on residential properties, was noted through photo interpretation and field assessments within the Study Area.

The private land forest values in the Powerview-Pine Falls community area, for the Alternative Routes evaluation, have been estimated from ocular assessments taken from provincial or municipal roads and/or estimated from aerial photographs, as presented in Appendix G and summarized in Section 4.2.4, Table 4-3.

The Project effects assessment (Section 5.2.2.3) used FRI data, intersected with the Manitoba Hydro, Parcel Fabric Feature Class GIS cover to determine private property ownership and assess the Project effects on private land forest values.

3.1.8 Aboriginal Traditional Knowledge and Use of the Forest Resource

An ATK study was undertaken to provide relevant information on local knowledge and land use that were absent from the Project Study Area data record. Data on ATK was gathered during five workshops that were held in the communities of Hollow Water, Manigotagan, Black River, and Seymourville. Workshops were guided by a series of questions provided by discipline leads. Information was summarized in a series of map biographies on traditional and current land use practices, and interview summaries, and land use maps. Relevant information was integrated into this report.

Environmental values, identified as point, line or area features, were identified on a series of 1:50,000 National Topographic System maps. There were three area features found to contain forestry related values. The effects of the Project on ATK forestry values are further evaluated and assessed in Sections 4.3 and 5.3.3 respectively.

3.2 Valued Environmental Component (VEC) Selection

The environmental assessment was focused on Valued Environmental Components, which are aspects of the natural and socio-economic environment that are particularly notable or valued because of their ecological, scientific, resource, socio-economic, cultural, health, aesthetic, or spiritual importance. To be considered as a VEC, a component must have the potential to be adversely affected by project development or have the potential to have an effect on the Project.

A workshop was held with discipline experts to select VECs for the Project which met one or more of the following criteria:

- identified regulatory requirements;
- consultation with regulatory authorities;
- information derived from published and unpublished date sources;
- information and comment received during the engagement of local communities;
- feedback through the Public Engagement Program; and
- biophysical and heritage assessment field surveys.

A preliminary list of VECs was proposed, and revised throughout the EA process which balanced biophysical and socioeconomic components, and represented both potential positive and negative effects of the Project.

The Forestry VECs include:

- productive forestlands; and
- high value forest sites.

The above VECs were selected based on the following potential issues and linkages to the Project:

- Productive forestlands form the basis for all forest management planning for both MCWS, Forestry Branch and commercial forest users. AAC are calculated based solely on productive forestlands. Where the land use on productive forestlands changes from forest management to an alternative use, such as a transmission project, these lands are withdrawn from the productive forestland base. The withdrawal consequently affects all future AAC calculations. Forestry Branch passes on such reductions in the wood supply to the commercial forest users resulting in reduced annual timber volumes available for harvest.
- Forest Management Licences are awarded by the Province of Manitoba with specific quantities of productive forestlands needed to support the fibre requirements of the licence holder. When such lands are converted to uses other than forest management, they are withdrawn from the FML.

- As part of sustainable forest management, Forestry Branch or the forest industry reforest all harvested areas. This requires substantial capital investment; hence such sites are considered high value forest sites and are assigned greater emphasis from a protection perspective (e.g., fires, development). The invested value is reflected in the Forest Damage Appraisal and Valuation policy (Manitoba Conservation 2002).
- There are numerous, active federal, provincial and forest management research and monitoring initiatives underway within the forested zone of Manitoba. Many of these initiatives have been established for long-term monitoring purposes. The investment of time and resources, and the data already collected makes it important not to disturb/disrupt these initiatives, if feasible.
- Private land represents a very small portion of the Project Study Area; however, owners have potentially established managed woodlots, agricultural shelterbelts and/or aesthetic plantings. These serve both as sources of wood fibre, carbon storage and provide multiple environmental benefits.

Table 3-2 identifies the forestry VECs and includes environmental indicators and measurable parameters for each.

Table 3-2 Forestry Valued Environmental Components

Valued Environmental Component	Environmental Indicator	Measurable Parameter/ Variable
Productive forestland	Contribution to the sustainable AAC	Mean Annual Increment (MAI)/ha
	Forest Management Licence Area	Area withdrawn from commercial forest allocation (ha)
	Standing timber	Wood fibre volume (m^3)
High value forest sites	High value reforestation sites	Plantations affected (ha)
	Research/monitoring sites	Number of sites affected
	Private land forest values	Area under management (ha) and area/trees affected (ha/# trees)

AAC = allowable annual cut; ha = hectare; m^3 = cubic metre.

4 EVALUATION OF ALTERNATIVE ROUTES AND INFRASTRUCTURE

4.1 Overview

The overall route selection process, for the Line PQ95 component, is described in Chapter 3.0 of the main EA Report. Evaluation of the Alternative Routes focuses on a predetermined set of evaluation criteria. The evaluation criteria reflect the importance of known factors that are identified from various perspectives including socio-economic, biophysical, cost and technical. These criteria, as well as valuable feedback obtained from the Public Engagement Program, became the basis from which to compare and evaluate the Alternative Routes. The Sections below describe the inputs from a forest resource perspective.

The Manigotagan Corner Station site was selected on the basis of engineering and technical criteria. The preferred station site has been integrated into the Public Engagement Program and has received favourable feedback from local community representatives.

The Sections below describe the inputs for the Line PQ95 Alternative Routes and the Manigotagan Corner Station site from a forest resource perspective

An evaluation of the three Alternative Routes was conducted using the following criteria. The results of the evaluation are described in Sections 4.2 and 4.3.

- Productive forestland (ha);
- High value reforestation sites (ha);
- Research and monitoring sites;
- Private land forest values (ha/# trees); and
- Aboriginal Traditional Knowledge forestry values

4.2 Route Evaluation Criteria

4.2.1 Productive Forestland

The determination of productive forestland is described in Section 3.1.1. The area of productive crown forestland, intersected by the Project Alternative Route ROWs, is summarized in Table 4.1. The potential effect on productive crown forestland, by the three Alternative Routes, is very similar for softwood and hardwood areas as presented in Table 4-1.

Table 4-1 Productive Crown Forestland Area by Alternative Route

Alternative Route	Productive Crown Forestland (hectares)		
	Softwood[1]	Hardwood[2]	Total
A	230.7	124.1	354.8
B	242.8	110.4	353.2
C	232.7	109.7	342.3

[1] – Includes Softwood (S) and Softwood/Harwood (M) **covertypes**

[2] – Includes Hardwood (H) and Harwood/Softwood (N) covertypes

Source: Manitoba Conservation and Water Stewardship, Forest Resource Inventory

4.2.2 High Value Reforestation Sites

High value reforestation sites are described in Section 3.1.5. The area of high value reforestation sites, intersected by the Project Alternative Route ROWs, is presented in Map 5 and summarized in Table 4.2. The effects on reforestation areas are similar for each Alternative Route and only minimally influence the selection of a Preferred Route.

Table 4-2 Reforestation Area by Alternative Route

Alternative Route	Plantation[1] (hectares)
A	17.3
B	23.5
C	16.3

[1] - Tembec Industries Inc.

4.2.3 Research and Monitoring Sites

Research and monitoring sites are described in Section 3.1.6. The distribution of research and monitoring sites, in relation to the Project Alternative Route ROWs, is presented in Map 6. There are no research and monitoring sites affected by any of the Alternative Routes; however, some research and monitoring sites have been identified as ESS, as discussed in Section 5.4.3.

4.2.4 Private Land Forest Values

Private land forest values are described in Section 3.1.7. There are no identified woodlot management areas in the Project Study Area. There are no shelterbelts established for agricultural purposes in the Project Study Area; however, there are row plantings established for visual barriers and/or wind protection on residential properties. The private land forest values, intersected by the Project Alternative Route ROWs, are provided in Appendix G and summarized in Table 4.3.

All private land occurs in the Powerview-Pine Falls community area of the Project Study Area, within the Rural Municipality of Alexander. Alternative Route A and B have similar amounts of private land forest values, while Alternative Route C avoids all residential properties and only affects natural forest areas on private lands. Alternative Route C therefore has the least effect on private land forest values.

Table 4-3 Private Land Forest Area by Alternative Route

Alternative Route	Woodlot (ha)	Shelterbelt (m)	Aesthetic Trees (#)	Natural Forest (ha)
A	0.0	427	90	3.1
B	0.0	352	94	3.0
C	0.0	0	0	1.7

Source: Field/Aerial Photo Assessment (Appendix G)
ha = hectare; m = metre; # = number.

4.3 Aboriginal Traditional Knowledge Forest Values

The collection of ATK is described in Section 3.1.8. ATK workshops identified 22 forestry/vegetation related values (Appendix H). In reviewing these 22 forestry/vegetation values, 3 were found to be forestry related while the remainder were vegetation related and are assessed in the *Lake Winnipeg East System Improvement Transmission Project, Vegetation Technical Report* (Calyx Consulting 2012). The three ATK forestry value areas are presented in Table 4.4.

Table 4-4 Aboriginal Traditional Knowledge Forest Values by Alternative Route

ATK No.	ATK Forest Value
ATK_5	Firewood collected, for personal use, by Black River First Nation peoples
ATK_51	Firewood collected in old burn areas, for personal use, by Manigotagan and Seymourville residents.
ATK_87	Firewood harvesting area

Source: Northern Lights Heritage Services Inc. 2012

All three Alternative Routes intersect the three ATK forestry value areas. The clearing of the transmission line may result in a positive effect through the generation of firewood.

4.4 Results of Alternative Route Evaluation

The potential effects of the Alternative Routes have been quantified, where possible, in Section 4.2 and 4.3. Table 4-5 summarizes the potential effects on forestry values, of the Alternative Route ROWs, to assist in the selection of the Preferred Route for the Project.

Table 4-5 Alternative Routes Evaluation Summary

Alternative Route	Productive Forestland (ha)	Plantations (ha)	Research and Monitoring Sites (#)	Private Land			Aboriginal Traditional Knowledge Sites (#)
				Shelterbelt (m)	Aesthetic Trees (#)	Natural Forest (ha)	
A	354.8	17.3	0	427	90	3.1	3
B	353.2	23.5	0	352	94	3.0	3
C	342.3	16.3	0	0	0	1.7	3

ha = hectare; # = number; m = metre.

Table 4-5 shows that the effect on productive forestland is very similar for all three proposed Alternative Routes and should not influence route selection. The effect on plantations is very similar for Alternative Routes A and C and is only slightly higher for Alternative Route B; however, the effect of any of the Alternative Routes on plantations is quite small and should not substantially influence route selection. There are no research and monitoring sites potentially affected by any of the three proposed Alternative Routes. Section 4.3 shows the potential for a positive effect on ATK forest values, resulting from any of the Alternative Routes, in terms of a potential firewood source for the local communities.

The only significant variance between the Alternative Routes is for private land forest values. Alternative Routes A and B have similar effects on private land shelterbelts, aesthetic trees and natural forest areas, while Alternative Route C has no effect on any residential property forest values and affects approximately one half of the estimated private land natural forest area.

Based on the private land forest values effect, Alternative Route C or the southern private land segment of route C would be the Preferred Route option from a forestry perspective. The effect on Crown Land forest values is lowest for Alternative Route C but the effects are very similar for all Alternative Routes. Overall Alternative Route C is the preferred option from a forest value perspective; however, other technical or environmental effects or concerns raised through the Public Engagement Process may provide clearer direction to the Alternative Routes analysis and the Preferred Route selection processes.

5 EFFECTS ASSESSMENT AND MITIGATION

5.1 Overview

The effects assessment followed the methods described in Chapter 3.0 of the EA Report.

The Alternative Route evaluation process considered Manitoba Hydro technical considerations, environmental assessments from the Project disciplines and input from the Public Engagement Process in the selection of a Preferred Route. The Final Preferred Route, the Manigotagan Corner Station and any access development, if required, forms the Project footprint and the basis for the following effects assessment.

This section of the Forestry Technical Report presents the results of the effects assessment on the Project footprint. Project effects are quantified for the defined forestry Valued Environmental Components and assessed for Aboriginal Traditional Knowledge forest values. Mitigation measures are proposed to minimize the identified potential and residual effects. Interactions with other projects are discussed and monitoring requirements are defined.

5.2 Valued Environmental Components Effects Assessment

5.2.1 Productive Forestlands

The measurable parameters defined for the effects assessment of this VEC include annual allowable cut levels, Forest Management Licence area and volume of standing timber, as discussed in Sections 5.2.1.1 to 5.2.1.3.

5.2.1.1 Annual Allowable Cut

The effect of the Project on AAC is summarized in Table 5-1. The AAC effect is based on the mean annual increment for productive Crown Land, as calculated in Appendix I. The effect of the Project on the FML 01 AAC is very small and amounts to 0.12%. As the commercial timber harvesting rights for FML 01 are about to be returned to the Province of Manitoba (Section 2.2), the Project effect on AAC can be accounted for, by MCWS, when seeking new proposals for FML 01.

Table 5-1 Effect on Annual Allowable Cut Levels

Species Covertype	Total Harvest Scenario AAC[1] (m^3/yr)	Project Effect[2] (m^3/yr)	Project Effect (%)
Softwood	302,242	294	0.10
Hardwood	114,446	196	0.17
Total	**416,688**	**490**	**0.12**

1. Source: Manitoba Conservation 2010.

2. Appendix I.

m^3/yr = cubic metres per year;'% = percent

5.2.1.2 Forest Management Licence Area

The effect of the Project on FML 01, regarding the withdrawal of productive forestland, is provided in Appendix D and summarized in Table 5-2. As the commercial timber harvesting rights for FML 01 are about to be returned to the Province of Manitoba (Section 2.2), MCWS will not be liable for any land withdrawal limits contained within the current FML 01 Agreement with Tembec Industries Inc. The effects on the productive forestlands for FML 01 are minimal and amount to 0.08% of the total.

Table 5-2 Effect on FML 01 Area

Classification	Pre-Project Productive Forestland[1] (ha)	Productive Forestland Withdrawal[2] (ha)	Productive Forestland Withdrawal (%)
Productive Forest	492,364	345.5	0.07

1. Source: Manitoba Conservation 2010
2. Appendix D.

ha = hectare;'% = percent.

5.2.1.3 Standing Timber

The effect of the Project on Crown Land standing timber is provided in Appendix D and summarized in Table 5-3. There were large forest fires in 1989 and 1999 that occurred between the Black River and the Manigotagan Corner Station, resulting in currently young, low volume areas. Merchantable timber only accounts for 45% of the total volume within the Project footprint, when minimum harvest ages are considered (Manitoba Conservation 2006B). The project effects on standing timber are minimal and account for 0.04% of the total growing stock on FML 01.

Table 5-3 Effect on Crown Land Standing Timber

Pre-Project Standing Timber Total Growing Stock[1] (m^3)			Project Effect on Standing Timber Total Volume[2] (m^3)			Project Effect (%)		
Softwood	**Hardwood**	**Total**	**Softwood**	**Hardwood**	**Total**	**Softwood**	**Hardwood**	**Total**
23,000,000	8,000,000	31,000,000	6,488	4,851	11,339	0.03	0.06	0.04

1. Manitoba Conservation, 2006A
2. Appendix D

m^3 = cubic metre;'% = percent.

The effects on standing timber are limited to the construction phase of the Project and will be limited to the extent of the Project footprint. The projected losses and the permanency of the effects are also accounted for in the Forest Damage Appraisal and Valuation process (Section 5.4.2: Appendix E).

5.2.2 High Value Forest Sites

The measurable parameters defined for the effects assessment of this VEC include high value reforestation sites, research and monitoring sites and private land enhancements, as discussed in Sections 5.2.2.1 to 5.2.2.3.

5.2.2.1 High Value Reforestation Sites

The effect of the Project on high value reforestation sites is provided in Appendix J and summarized in Table 5-4 (Map Series 100). Of the 3,434 ha of reforestation sites found within the Project Study Area, 23 ha will be permanently lost. In the last 25 years, there were a total of 2,013 ha (37%) of reforestation sites destroyed by forest fires within the Project Study Area. In comparison, the project effects on high value reforestation sites are minimal and accounted for 0.43% of the total reforestation area and 0.70% of the reforestation sites remaining after forest fires.

Table 5-4 Effect on High Value Reforestation Sites

Project Study Area (ha)		Project Effect[3] (ha)	% Affected by Project[4]
Total Area[1]	Remaining after Fire[2]		
5,447	3,434	23.39	0.70

1. Manitoba Conservation, 2011.
2. Golder Associates Ltd., 2012.
3. Appendix J
4. Based on area remaining after fire.

ha = hectare;'% = percent.

The effects on high value reforestation sites are limited to the construction phase of the Project and will be limited to the extent of the Project footprint. The projected losses and the permanency of the effects are also accounted for in the Forest Damage Appraisal and Valuation process (Section 5.4.2: Appendix E).

In addition to the direct effects of the Project on high value reforestation sites discussed above, the potential exists for damage to adjacent sites from errant equipment. These sites have been identified as ESS, as displayed on Map Series 300 and discussed in Section 5.4.3.

5.2.2.2 Research and Monitoring Sites

There were no research and monitoring sites affected by the Project footprint; however, three research and monitoring sites have been identified as ESS, as displayed on Map Series 300 and discussed in Section 5.4.3.

5.2.2.3 Private Land Forest Values

The effect of the Project on private land forest values is summarized in Table 5-5 (Map Series 200). The Project does not affect any woodlot management areas, agricultural shelterbelts or residential tree planting projects. There are natural forest areas affected on two private properties within the Project footprint, as displayed on Map Series 200.

The effects on private land forest values are minimal as the Project avoids all residential properties and their related forest values (Section 4.2.4) and no private land forest management projects have been affected. The use of Manitoba Hydro property has been maximized which further reduces the effect on private lands forest values. A minimal amount of private land natural forest area was affected by the project as summarized in Table 5-5.

Table 5-5 Effect on Private Land Natural Forest Areas

R.M. Roll No.	Species Composition	Stratum	Age Class	Density Class	Softwood Volume (m^3/ha)	Hardwood Volume (m^3/ha)	Area (ha)	Total Softwood Volume (m^3)	Total Hardwood Volume (m^3)
146400	TA7WB2JP1	HWD	45	1	24.89	29.65	0.03	0.7	0.8
Total Roll No. 146400							**0.03**	**0.7**	**0.8**
130920	TA7BO3	OTHHW	45	100	24.89	29.65	0.12	3.0	3.6
	TA7AS1BA1 BO1	HWD	40	1	24.27	23.91	0.11	2.7	2.6
Total Roll No. 130920							**0.23**	**5.7**	**6.2**
Total All Private Land							**0.26**	**6.4**	**7.0**

ha = hectare;' m^3 = cubic metre.

Timber volumes determined from FRIs are designed for forest management planning at a landscape level and may not be representative at a stand level. Actual Project effects on private land natural forest areas will need to be determined during the construction phase. The two private land natural forest areas have been identified as ESS, as displayed on Map Series 300 and discussed in Section 5.4.3.

5.3 Literature Review and Project Effects Assessment

5.3.1 Project Footprint

Carvell and Johnston (1978) noted that damage and decline of trees adjacent to transmission line ROWs is often the result of scorching from slash burning during clearing or mechanical damage to tree roots and trunks from heavy equipment. Such damage usually does not kill the tree(s) directly, but the wounds can act as access points for insects and disease (Clatterbuck 2006). The implementation of best operating practices including, limiting clearing operations to frozen ground conditions, and limiting the need to remove stumps to tower locations and other infrastructure sites will minimize soil disturbance and root damage to trees thereby substantially

mitigating operational concerns. These protection and mitigation measures will be incorporated into the Project Environmental Protection Plan (EnvPP).

Although the White Spotted Sawyer Beetle (*Monopchamus scutellatus*) prefers dead and dying conifers, it will attack live trees as well (Ives 1982). As adults emerge from the larval stage, they feed on the tender bark and twigs of healthy trees (Ontario Ministry of Natural Resources 2007). Sawyer beetle populations are known to spike in areas of prolonged drought, snow damage, blow-down, fire and in timber harvest areas where slash levels are high. Incidents of damage or mortality to healthy trees in adjacent areas, as a result of adult feeding, are not uncommon (Evans et al. 2007). ROW clearing and slash disposal practices will minimize residual woody debris accumulations that may otherwise attract high sawyer beetle populations. This will minimize the risk of damage to trees adjacent to the Project footprint.

White elm trees may be encountered in **riparian zones** and hardwood stands on wet sites during the ROW clearing process. Storing dead elm wood is prohibited by law in Manitoba, as it contributes to the spread of Dutch Elm Disease by providing feeding areas and overwintering sites for the elm beetle (Manitoba, Government of (C) website, 2012). The beetle is responsible for transferring fungal spores from infected trees to healthy trees, thereby spreading the disease. All elm wood must be immediately burnt, chipped or disposed of at designated disposal sites.

Risk of wild fire exists where cleared vegetative debris is burnt following ROW clearing. Care must be taken to limit burning activities to winter months and on mineral soils. Monitoring activities must ensure all fires are extinguished prior to spring breakup. Debris piles must be placed well away from the ROW edge to minimize the risk of scorching adjacent trees and vegetation. Alternative methods of vegetative debris disposal may include chipping, mulching, mounding and burying.

Thin-barked tree species (some species of poplars) are subject to damage and mortality when exposed to full sunlight and the increase in temperature fluctuations brought about by ROW clearing. Sunscald to the bark and **cambium** layers of newly exposed trees may result in severe damage or mortality (Canada, Government of website, 2012).

The creation and existence of ROWs may facilitate additional local access. Associated with access are increased fire occurrence risk (human caused) and the introduction and proliferation of vegetation species that do not currently exist within specific ecosites (Szwaluk et al. 2011). Manitoba Conservation and Water Stewardship, Eastern Region and the Manitoba Model Forest, Committee for Cooperative Moose Management (Maskwa Ecological Consulting Inc. et al. 2012) have identified the opening of decommissioned access roads and the development of new roads for the construction phase of the Project as an area of concern, as it relates to the current management initiatives being undertaken to increase the moose population in the Project Study Area. Manitoba Hydro, in consultation with MCWS, Eastern Region, will identify areas of concern from an access perspective and develop an access management plan prior to

clearing and construction, thereby reducing the risks and effects of unwanted access. The access management plan will form part of the EnvPP.

Access activities associated with line construction could impede surface drainage (through soil compaction, rutting or **berming**), resulting in mortality in surrounding vegetation, altered vegetation community structure and potential changes in greenhouse gas exchange rates (Plus4 Consulting and Agriculture Canada 2003). The potential is highest in low-lying areas where water tables are usually nearer the surface. Blockage of overland drainage patterns on upland sites could have the same effect. Risk of soil erosion and sediment deposition in nearby water bodies are additional concerns, particularly on mineral soils and undulating topography. These risks must be recognized and considered at all levels of planning and development. Limiting project construction to winter, when the ground is frozen, minimizes the need for soil disturbance and road construction, which minimizes the risk of affecting existing drainage patterns.

Forest fragmentation occurs where plant communities become divided or isolated as a result of man's or nature's interventions (MacCrimmon et al. 2000; United States, Government of website, 2012). It is also recognized that forest fragmentation often takes place in a series of stages where multiple developments over time contribute to the problem. Forest fragmentation issues are largely ecology and wildlife related and is further discussed in the *Lake Winnipeg East System Improvement Transmission Project, Wildlife Technical Report* (Wildlife Resource Consulting Services Inc. 2012).

5.3.2 Commercial and Domestic Forest Resource Utilization

The primary effect of the Project, on commercial forest resource utilization, is the conversion of productive forestland to non-productive land. The extent of this effect has been discussed in Section 5.2.1 under the Productive Forestland VEC effects assessment. Effects extend to annual allowable cut levels, productive forestland withdrawal from FML 01 and volumes of standing timber.

Domestic forest resource utilization in the Project area is primarily limited to the personal use of fuelwood and, to a limited extent, commercial firewood production. The effect of the Project on domestic forest resource utilization is limited to the ability of people, residing adjacent to the Project footprint, to access the forest for fuelwood gathering purposes. The potential effect is limited to the duration of the construction phase of the Project. Where demand exists, Manitoba Hydro may make salvage timber available as fuelwood to nearby communities as part of clearing activities. The effect on domestic forest resource utilization is minimal and potentially positive.

5.3.3 Aboriginal Traditional Knowledge Forest Values

The effect of the Project on ATK forest values is provided in Table 5-6 (Map 7). The 3 ATK forestry value areas are presented on Map 7 and summarized in Table 5-6.

Table 5-6 Effect on Aboriginal Traditional Knowledge Forest Values

Map No.	ATK Forest Value
ATK_1	Firewood collected, for personal use, by Black River First Nation peoples
ATK_2	Firewood collected in old burn areas, for personal use, by Manigotagan and Seymourville residents.
ATK_3	Firewood harvesting area

Source: Northern Lights Heritage Services Inc. 2012

The clearing of the transmission line may result in positive effects through the generation of firewood; however, forest fires in 1989 and 1999 burnt most of the timber on the Project footprint from Black River to the Manigotagan Corner Station. Where demand exists, Manitoba Hydro may make salvage timber available as firewood to nearby communities but it will need to be transported from the southern extent of the Project footprint. The effect on ATK forest values is therefore minimal and possibly positive.

5.4 Proposed Mitigation Measures

Adherence to all applicable provincial and federal regulations and guidelines and to the Environment Act Licence to be issued for the Project, potential forestry environmental effects on and off the Project footprint can be partly mitigated. Detailed advance planning prior to construction and the preparation of a Project-specific EnvPP will serve to identify issues and areas of concern in advance of construction. On-site supervision of all activities during the construction phase further reduces potential problems and effects.

5.4.1 LWESI Project Clearing

The entire Project footprint needs to be cleared where forest resources exist. As much as possible clearing should be limited to the removal of the above ground organic matter, leaving the root systems in place. This will minimize the risk of root damage to ROW edge trees. Merchantable timber should be salvaged, if an economically feasible market can be found. Where timber is salvaged and utilized, carbon in the form of wood fibre is tied up in construction materials and paper products. This reduces the carbon footprint of the Project by limiting the volume of cleared biomass that is disposed of by other means. Local communities and the Waabanong Anishinaabe Interpretive Learning Centre have identified a desire to secure firewood (Maskwa Ecological Consulting Inc. et al. 2012), which would assist in maximizing utilization of the resource.

Timber that cannot be salvaged and other woody debris created through the clearing operation may be disposed of by piling and burning (under frozen conditions), chipping, mulching, mounding or as directed by MCWS. The disposal of this dead woody material will minimize the attraction of White Spotted Sawyer Beetles and thereby minimize the risk of their damage to adjacent forest stands through adult feeding on the bark and twigs of healthy trees (Evans et al. 2007). In riparian zones and hardwood stands on wet sites, white elm trees may be encountered. All elm wood must be burnt or chipped immediately or disposed of at approved municipal disposal sites to prevent the potential spread of Dutch Elm Disease (Manitoba, Government of (D) website, 2011).

Where fire is employed as a method of debris disposal, burning should occur on mineral soil, where possible. Piles must be kept well removed from the ROW edge to minimize the risk of heat scorching adjacent trees and other vegetation. All burning should be conducted during the winter months. Weather conditions, including **inversions** and wind direction, need to be considered to reduce the potential of smoke affecting local communities. All burn sites must be thoroughly examined prior to spring breakup to ensure all fires have been fully extinguished.

5.4.2 Forest Damage Appraisal and Valuation

The MCWS, FDAV policy stipulates financial compensation for timber values and investments on Crown productive forestlands (Manitoba Conservation 2002; Appendix G). Manitoba Hydro will compensate MCWS for the effects of the Project as specified in the policy. The compensation payable for the loss of standing timber (Section 5.2.1.3) and high value reforestation sites (Section 5.2.2.1) will provide mitigation, in part, for the effects of the Project on these VECs.

The FDAV was applied to the Final Preferred Route Project footprint area in order to quantify the effect on crown forest resources. The damage appraisal calculations and estimates of compensation payable to MCWS are provided in Appendix E and summarized in Table 5-7.

Table 5-7 Crown Land Forest Damage Appraisal and Valuation Summary

Crown Charges	Softwood ($)	Hardwood ($)	Plantations ($)	Total ($)
Crown Dues	$11,353.14	$8,489.83		$19,842.97
Forest Renewal Charge	$37,303.17	$2,425.67		$39,728.84
Forest Protection Charge	$1,102.88	$824.73		$1,927.60
Plantation Charge			$20,638.17	$20,638.17
Total All				**$82,137.58**

Crown Dues - $1.75 m^3; Forest Renewal Charge - softwood $5.75 m^3, hardwood $0.50 m^3; Forest Protection Charge - $0.17/$m^3$ and Plantation charge – $882.35/ha. Considers volume from all age classes using the MCWS conventional standard, tree length volume tables.

Clearing, in addition to the productive forestland evaluated in the Project footprint, may be required for access development, borrow/deposition areas or bypass routes necessitated by terrain features encountered during ROW clearing. The locations of these areas are currently unknown; however, they will be very localized, small in extent and minimally incremental. It should be noted that this evaluation is an estimate only and that recalculations may be required by MCWS after ROW clearing to ensure timber dues and the Project footprint are accurately reflected in the results.

5.4.3 Environmentally Sensitive Sites

The environmental indicators for the High Value Forest Sites VEC, identified in Sections 3.2, are considered ESS where these are either directly intersected by the Project, are located between the Project footprint and PR #304 or are located within 100 meters of the side of the footprint opposite of PR #304. They include high value reforestation sites, research and monitoring sites and private land natural forest areas (Table 5-8 and Appendix K). In order to provide them protection during the construction phase of the Project, these sites will be included in the EnvPP. The sites between the Project footprint and PR #304 and those adjacent to the Project footprint have been identified as ESS in order to ensure long-term protection from potential damage during operations and maintenance activities associated with the Project. Environmentally sensitive site types, the number identified, a brief description, the projected environmental effect and prescribed mitigation measures are provided in Table 5-8. All ESS are shown on Map Series 300 and listed in Appendix K.

Table 5-8 Forestry Environmentally Sensitive Sites

ESS Name	No. of Sites	ESS Description	Environmental Effect	Mitigation Measures
Manitoba Model Forest Research Site	1	Long term data collection site	Potential for damage outside of ROW	• Limit all equipment to ROW only, unless approved in writing by the Construction Supervisor/Site Manager • Maintain a minimum undisturbed buffer of 100 metres • Where debris disposal is by burning, pile at least 15 m from forest stands • Burn during frozen conditions only • Ensure fires are extinguished prior to spring breakup
Permanent Sample Plot	2	Growth and yield monitoring site	Potential for damage outside of ROW	• Limit all equipment to ROW only, unless approved in writing by the Construction Supervisor/Site Manager • Maintain a minimum undisturbed buffer of 100 metres • Where debris disposal is by burning, pile at least 15 m from forest stands • Burn during frozen conditions only • Ensure fires are extinguished prior to spring breakup

Table 5-8 Forestry Environmentally Sensitive Sites (continued)

ESS Name	No. of Sites	ESS Description	Environmental Effect	Mitigation Measures
Private Land Natural Forest Area	3	Private land forest area	Removal in area of ROW intersect	• Clearing limited to frozen conditions only • Develop mitigation plan with landowner • Consider off-set mitigation options • Compensate landowner based on timber values.
			Potential for damage outside of ROW	• Limit all equipment to ROW only, unless approved in writing by the Construction Supervisor/Site Manager • Where debris disposal is by burning, pile at least 15 m from forest stands • Burn during frozen conditions only • Ensure fires are extinguished prior to spring breakup
High Value Reforestation Site	34	Forest plantation representing considerable financial investment	Removal in area of ROW intersect;	• Clearing limited to frozen conditions only • Complete FDAV and compensate MCWS
			Potential for damage outside of ROW	• Limit all equipment to ROW only, unless approved in writing by the Construction Supervisor/Site Manager • Where debris disposal is by burning, pile at least 15 m from forest stands • Burn during frozen conditions only • Ensure fires are extinguished prior to spring breakup
High Value Reforestation Site (adjacent)	58	Forest plantation between PR #304 and Project Footprint or within 100 metres of opposite side	Potential for damage outside of ROW	• Limit all equipment to ROW only, unless approved in writing by the Construction Supervisor/Site Manager • Where debris disposal is by burning, pile at least 15 m from forest stands • Burn during frozen conditions only • Ensure fires are extinguished prior to spring breakup

The ATK process (Northern Lights Heritage Services Inc. 2012) clearly indicates local communities gathering fuelwood in proximity to their communities and the Project footprint. These specific fuelwood gathering sites (Map 7), identified through the ATK process, have not been identified as ESS because forest fires have drastically reduced the potential to secure firewood from the Project footprint in those areas. It is recommended that during clearing and construction of the Project, a process be developed to notify local communities, as well as the Waabanong Anishinaabe Interpretive Learning Centre, of the clearing schedule and provide the opportunity to make fuelwood available to them from the southern portion of the Project footprint.

Environmentally sensitive site location information, for future incorporation into the EnvPP, has been provided to Manitoba Hydro as GIS shape files to ensure correct geo-referencing (Appendix K).

5.5 Residual Effects

Project-specific residual effects that remain, or are predicted to remain, even after mitigation measures have been applied, include:

- Loss of productive forestland resulting in a reduction in sustainable AAC levels, reduction in FML 01 area and loss of standing timber,
- Loss of area in high value reforestation sites,
- Loss of private land natural forest area, and
- Potential opportunity to provide fuelwood to interested communities in proximity to the Project footprint.

Table 5-9 summarizes the residual effects of the Project on the forest environment.

Table 5-9 Summary of Residual Effects

Potential Effect	Project Phase	Key Mitigation Measures	Residual Effect	Significance Criteria[1]
Loss of productive forestland	Construction	• Limit Project footprint size, where possible • Locate Project footprint (e.g. access routes, borrow pits, storage sites, etc.) on non-productive forestlands, where possible • Rehabilitate productive forestlands after construction project and at decommissioning phase	Reduction in AAC levels	Magnitude – Moderate Geographic Extent – Regional Duration – Medium-term Frequency – Infrequent Reversibility – Permanent (for the life of the Project)
Withdrawal of productive forestland from FML 01	Operation	• Limit Project footprint size, where possible • Locate Project footprint on non-productive forestlands, where possible • Rehabilitate productive forestlands after construction project and at decommissioning phase • MCWS to incorporate withdrawal from FML area in proposed Request for Proposal for FML 01 • Return to FML area at time of decommissioning	Reduction in size of FML 01	Magnitude – Moderate Geographic Extent - Regional Duration – Medium-term Frequency – Infrequent Reversibility – Permanent (for the life of the Project)

Table 5-9 Summary of Residual Effects (continued)

Potential Effect	Project Phase	Key Mitigation Measures	Residual Effect	Significance Criteria[1]
Loss of standing timber	Construction	• Limit clearing to defined Project footprint, where possible • Avoid damage to standing timber along edge of ROW • Use existing cleared areas or non-productive areas for equipment staging and material storage • Use existing roads, trails and non-productive areas for access development • Complete Forest Damage Appraisal and Valuation and compensate MCWS	Reduction in standing timber	Magnitude – Small Geographic Extent – Project Footprint Duration - Medium-term Frequency – Infrequent Reversibility – Permanent (for the life of the Project)
Loss of high value reforestation sites	Construction	• Limit clearing to defined Project footprint when intersecting high value reforestation sites • Avoid high value reforestation areas for access development, equipment staging and material storage • Complete Forest Damage Appraisal and Valuation and compensate MCWS	Loss in area of high value reforestation sites	Magnitude – Small Geographic Extent - Project Footprint Duration - Medium-term Frequency – Infrequent Reversibility – Permanent
Loss of private land natural forest	Construction	• Limit clearing and construction activities to the Project footprint • Develop mitigation plan with landowner • Consider off-set mitigation options • Compensate landowner based on timber values.	Loss in private land natural forest area	Magnitude – Small Geographic Extent - Project Footprint Duration - Medium-term Frequency – Infrequent Reversibility – Permanent

1. Definition and criteria provided in Section 3.0, Environmental Assessment Report (Golder Associates Ltd. & R. Rawluk and Associates 2012)

5.6 Interactions with Other Projects

The spatial boundary for the interactions with other projects is the Project Study Area. Potential interactions were determined for adverse residual effects to VECs (Sections 3.2 and 5.2) that have the potential to interact with the effects of other past, current, or future projects and human activities. VECs with no residual effect or a positive residual effect are not included in the assessment. Finally, the assessment only includes adverse residual effects on VECs that overlap both spatially and temporally with the effects of other projects and human activities.

Project and human activities were selected for inclusion in the assessment based on the following criteria:

- Past Projects: Projects within the Study Area whose ongoing effects can be reasonably expected to change in the future and, as a result of those changes, interact with this Project's adverse residual effects.
- Current Projects: Projects in construction, development or operation within the Study Area.

- Future Projects: Projects approved for construction/development or in the permitting pipeline within the Study Area.
- Prospective Projects: Projects announced in the Study Area (e.g., wind farms, transmission expansion, government vision statements) but not yet moving along a development or permitting pathway, and any projected changes in land use patterns (e.g., changes in agricultural activity).

Table 5-10 provides the list of known projects in the area, considered for assessment of interactions with the Project.

Table 5-10 Interactions With Other Projects

Sector	Project	Description
Mining	San Gold Expansion	Planned expansion of San Gold's Gold Mine in Bissett
	Mineral Exploration	Ongoing and planned mineral exploration and development in Study Area
	Gravel Pits	Establishment or expansion of existing borrow pits in the Study Area
Forestry	Timber Resource Harvesting	Manitoba Conservation and Water Stewardship (MCWS) planned Request for Proposal for timber resource harvesting in FML 01
	Winnipeg River Integrated Wood and Biomass Project	Proposed forestry development that has initiated discussions with MCWS, Forestry Branch regarding commercial utilization of the forest resource on FML 01
Wildlife	Licensed and Rights Based Moose Hunting Closure	MCWS has implemented a moose hunting closure and is decommission roads in areas of the Eastern Region.
Transportation & Communication Infrastructure	East Side Road Authority	On-going development of Provincial highway up the east side of Lake Winnipeg
	Fibre Optic Cable	The San Gold Mine in Bissett and local First Nations have expressed an interest in fibre optic cable which could provide high speed internet
Cottage Development	Black River First Nation Cottage Development Initiative	Expansion of cottage development within the Black River FN territory in conjunction with MCWS is planned for the near future.
	Hollow Water First Nation Cottage Development Plans	Considering cottage development projects with MCWS
	Sagkeeng First Nation Cottage Development Plans	Considering cottage development projects with MCWS

Of the projects listed in Table 5-10, the following projects will have potential adverse effects on productive forestland and may have potential adverse effects to high value forest sites that overlap both spatially and temporally with the Project.

- Mining sector operations including mine expansions, exploration activities and gravel pit establishment.

- Transportation & Communication Infrastructure sector operations for the planned development of the East Side Road.
- Cottage Development sector for any or all of the identified potential development plans.

5.7 Monitoring and Follow-Up

This Forestry Technical Report has identified Project effects to forestry VECs and values (Section 5.2 and 5.3). It defines ESS and prescribes mitigation measures to minimize effects (Section 5.4.3). It is Manitoba Hydro's responsibility to implement recommended mitigation measures. This can best be achieved through the development of an EnvPP for the Project, which will direct Manitoba Hydro construction staff, contractors and their employees. Golder Associates Ltd. has developed a spatial dataset of the forestry ESS for field use during the construction phase of the Project.

It is Manitoba Hydro's responsibility to develop and implement a monitoring program to assess and evaluate the effectiveness of the implementation of the proposed mitigation measures and the accuracy of the forestry effects assessment.

In addition to monitoring the implementation of the mitigation measures, the following components may be assessed in order to verify the forestry assessment.

5.7.1 Project Footprint

Monitoring should include quantifying the amount of timber salvaged and utilized from the Project footprint. This may be done by tracking the amount of timber delivered to processing facilities or local communities for conversion to forest products and also tracking firewood delivered to local communities or organizations in the Project Study Area. The tracking of deliveries and their related end products should be performed using MCWS Load Slip forms required for the transportation of timber from Crown Land.

Forest fire records should be obtained from MCWS for those years in which the Project is constructed. Fires that occurred in the vicinity of the Project should be examined to determine if they are the result of Project activities. Where they are the result of the Project, quantification of such lateral effects to the forest environment should be calculated using the provincial forest inventory, including area burnt (ha) and timber volume affected (m^3).

5.7.2 Forest Damage Appraisal and Valuation

The forest damage appraisal and valuation determination, developed for the Project (Section 5.4.2; Appendix E), was developed as directed by MCWS, Forestry Branch (Klos pers. comm. 2012; McGimpsey pers. comm. 2012; Swanson pers. comm. 2012). Adjustments in the Project footprint location may be required by Manitoba Hydro during the final design stage of the

Project and/or additional clearing may be required for access development, borrow/deposition areas or bypass routes necessitated by terrain features encountered during ROW clearing. These variances will likely to be minor, small in extent and minimal in increment. A revision to the FDAV determination may be required if MCWS has revised the applicable crown dues at the time of the clearing project or if they deem that the variance from the appraisal conducted in Section 5.4.2 is significant.

5.7.3 Right-of-Way Maintenance

Forestry ESS have been identified for the construction phase of the Project (Section 5.4.3). It is recommended that Manitoba Hydro maintain the spatial GIS forestry ESS database for use during future ROW maintenance projects.

5.7.4 Annual Allowable Cut Levels and Withdrawals from FML 01

Manitoba Conservation and Water Stewardship, Forestry Branch will retain responsibility with regard to AAC calculations and administration as well as matters relating to withdrawals from FML 01. All follow up as a result of the Project will reside with the Forestry Branch.

5.7.5 Natural Forest Areas on Private Land

Specific mitigation and compensation measures should be agreed to and documented, between Manitoba Hydro and each private landowner, prior to any work being initiated. Manitoba Hydro should conduct inspections during the construction phase to ensure compliance with agreed measures. Documentation should include final sign off from the landowner indicating that Manitoba Hydro has fulfilled all of its obligations.

6 CONCLUSIONS

Forestry VECs, related environmental indicators, and measurable parameters for the Project effects assessment are provided in Table 6-1.

Table 6-1 Forestry VECs, Environmental Indicators and Measurable Parameters

Valued Environmental Component	Environmental Indicator	Measurable Parameter/ Variable
Productive forestland	Contribution to the sustainable AAC	Mean Annual Increment (MAI) / ha
	Forest Management Licence Area	Area withdrawn from commercial forest allocation (ha)
	Standing timber	Wood fibre volume (m^3)
High value forest sites	High value reforestation sites	Plantations affected (ha)
	Research/monitoring sites	Number of sites affected
	Private land forest values	Area under management (ha) and Area/trees affected (ha/# trees)

The proposed project requires the clearing of the Project footprint. This will result in a loss of productive forestland, which affects the related environmental indicators. Table 6.2 summarizes the Project effects on the forestry VECs and ATK values for FML 01 or the Project Study Area, as applicable.

Table 6-2 Forestry Assessment Results Summary

Parameter	Total	Project Effect	% of Total
FML 01 Softwood AAC	302,242 m^3/yr	294 m^3/yr	0.10
FML 01 Hardwood AAC	114,446 m^3/yr	196 m^3/yr	0.17
FML 01 Productive Forestland	492,364 ha	345.5	0.07
FML 01 Softwood Standing Timber	23,000,000 m^3	6,488 m^3	0.03
FML 01 Hardwood Standing Timber	8,000,000 m^3	4,851 m^3	0.06
PSA High Value Reforestation Sites	3,434 ha	23.39 ha	0.68
PSA Research and Monitoring Sites	3 adjacent	0	0
PSA Private Land Natural Forest	Not Determined	0.3 ha	N/A
Aboriginal Traditional Knowledge Forest/Vegetation Values	22	3	Positive Effect

PSA = Project Study Area; m^3/yr = cubic metres per year; ha = hectare; m^3 = cubic metres;% = percent;

Mitigation measures have been prescribed for the Project footprint clearing to minimize potential effects to forestry VECs. Additional mitigation includes financial compensation to Manitoba based on the MCWS Forest Damage Appraisal and Valuation guideline. ESS have been documented and spatially determined for research and monitoring sites, high value reforestation

sites and private land natural forest area that are adjacent to the Project footprint or may be affected by access development during the construction or maintenance phases. Specific environmental protection measures will be provided for ESS

A minor negative interaction has been determined related to potential, future commercial forest management proposals; however, proposals are only in the discussion stage at his time and any effect can be incorporated into the project development by MCWS.

Monitoring and follow up requirements have been proposed to verify the accuracy of the effects assessment and ensure the prescribed mitigation measures are implemented.

The effects of the Project on the forestry VECs will be evident for the life of the project; however, the residual effects on productive forestland and its related VECs are limited to the current extent of the Project footprint. The effects are minor and mitigable and possibly positive for ATK forestry values.

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8 GLOSSARY

Glossary terms appear in bold print in the report at their first occurrence.

Annual Allowable Cut – The volume of wood that can be harvested in one year from any area of forest under a sustained yield management regime. The term allowable cut is generic and represents a class of models applied when substantial inventories of mature timber exist and the management focus is on harvest volumes (Dunster & Dunster 1996).

berm – A raised bank of soil or rock constructed in the path of flowing water to divert its direction (Dunster & Dunster 1996) or a raised bank of soil or rock constructed for access control on a trail or road bed.

borrow area – A small quarry or excavation beyond the limits of road or dam construction, which provide material for use in the construction project (Dunster & Dunster 1996).

cambium – A layer of actively dividing cells situated between the xylem and phloem. As the cells develop, they add a new layer of woody material on the inner side of the root or stem and a new layer of bark on the outer side (Dunster & Dunster 1996).

covertype - Four broad cover types are recognized – Softwood 'S', Softwood-Hardwood 'M', Hardwood-Softwood 'N', Hardwood 'H'. The first number of the sup-type code indicates the type aggregate (0 to 3 - Softwood; 4 to 7 – Softwood/Hardwood Mixed ; 8 – Hardwood/Softwood Mixed; 9 – Hardwood) (Manitoba Conservation 2007A).

crown closure - Crown closure will be estimated from the photographs by the photo-interpreter. Ten classes will be recognized and entered onto the stand description sheet for each tile. Changes of this estimate can be made only under exceptional circumstances. Code 0 – 0-10%; 1 – 11-20%; 2 – 21-30%; 3 – 31-40%; 4 – 41-50%; 5 – 51-60%; 6 – 61-70%; 7 – 71-80%; 8 – 81-90% and 9 – 91-100% (Manitoba Conservation 2007A).

cutting class – Cutting class is based on size, vigour, state of development and maturity of a stand for harvesting purposes (Manitoba Conservation 2007B).

double line – A GIS feature that forms a polygon for which an area can be calculated.

environmental assessment – The actual technical assessment work that leads to the production of an environmental impact statement. The technical methodologies used must be scientifically sound, and explainable and defendable in a court of law. The scope of the assessment is typically outlined at the start of the project so that the project has some well-defined boundaries (Dunster & Dunster 1996).

ericaceous shrubs – Plants in or related to the heather family (Ericaceae), typically found on acid soils. (Dunster & Dunster 1996).

forest succession – A series of dynamic changes in ecosystem structure, function, and species composition over time as a result of which one group of tree species succeeds another through stages leading to a potential natural community or climax stage (Dunster & Dunster 1996).

inversion – The atmospheric condition in which temperature within a vertical layerof air increases with altitude, resulting in a very stable atmosphere. This is contrary to the usual situation in which temperature decreases with height. In fire management, its usage is generally restricted to a temperature inversion based at the earth's surface (Dunster & Dunster 1996).

Mean Annual Increment – The total increment to a given age in years, divided by that of age (Dunster & Dunster 1996).

polygon – In GIS work, a stream of digitized points approximating the delineation (perimeter) of an area (e.g., forest type) on a map (Dunster & Dunster 1996).

riparian zone - Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables and soils that exhibit some wetness characteristics (Dunster & Dunster 1996).

single line – A GIS feature represented by a line, for which area cannot be calculated.

Stand Stock Volume Table – Compiled from provincial volume sampling data, the table is comprised of forest stand volume estimates by type aggregate, diameter at breast height class and species for specific areas throughout the Province. Volumes are provided at various utilization levels for cutting classes 3, 4 and 5 stands.

strata – A subdivision of the forest area or population to be inventoried. Sample populations are usually stratified (divided into strata) to obtain separate estimates (volume yield curves) for each stratum (Dunster & Dunster 1996).

subtype - This term indicates the species composition in broad groups within the cover type. Subtype is determined by the proportion of basal area of two or three main species in the stand as found on sample plots to the total basal area of all species. To determine the subtype, the basal area of individual species must be computed and rounded off to the nearest ten percent.

The percentage range marked after the species symbol indicates the proportion of the basal area of this particular species in comparison to the total basal area of all species in the type. The second number of the type aggregate code identifies the subtype. Subtype will include non-productive forested land and non-forested land codes. Subtype will also include the Non-Productive Forested Land and Non Forested Land codes (Manitoba Conservation 2007A).

total harvest scenario – A total harvest scenario requires the full utilization of both hardwood and softwood species.

yield curves – In its simplest form, a plot of expected fibre yield in terms of volume per unit area, against the stand age (Dunster & Dunster 1996).