Millar Western Forest Products Ltd.
2017-2027 Detailed Forest Management Plan

Prepared by FORCORP
March 2017

2017-2027 Detailed Forest Management Plan

Millar Western Forest Products Ltd.

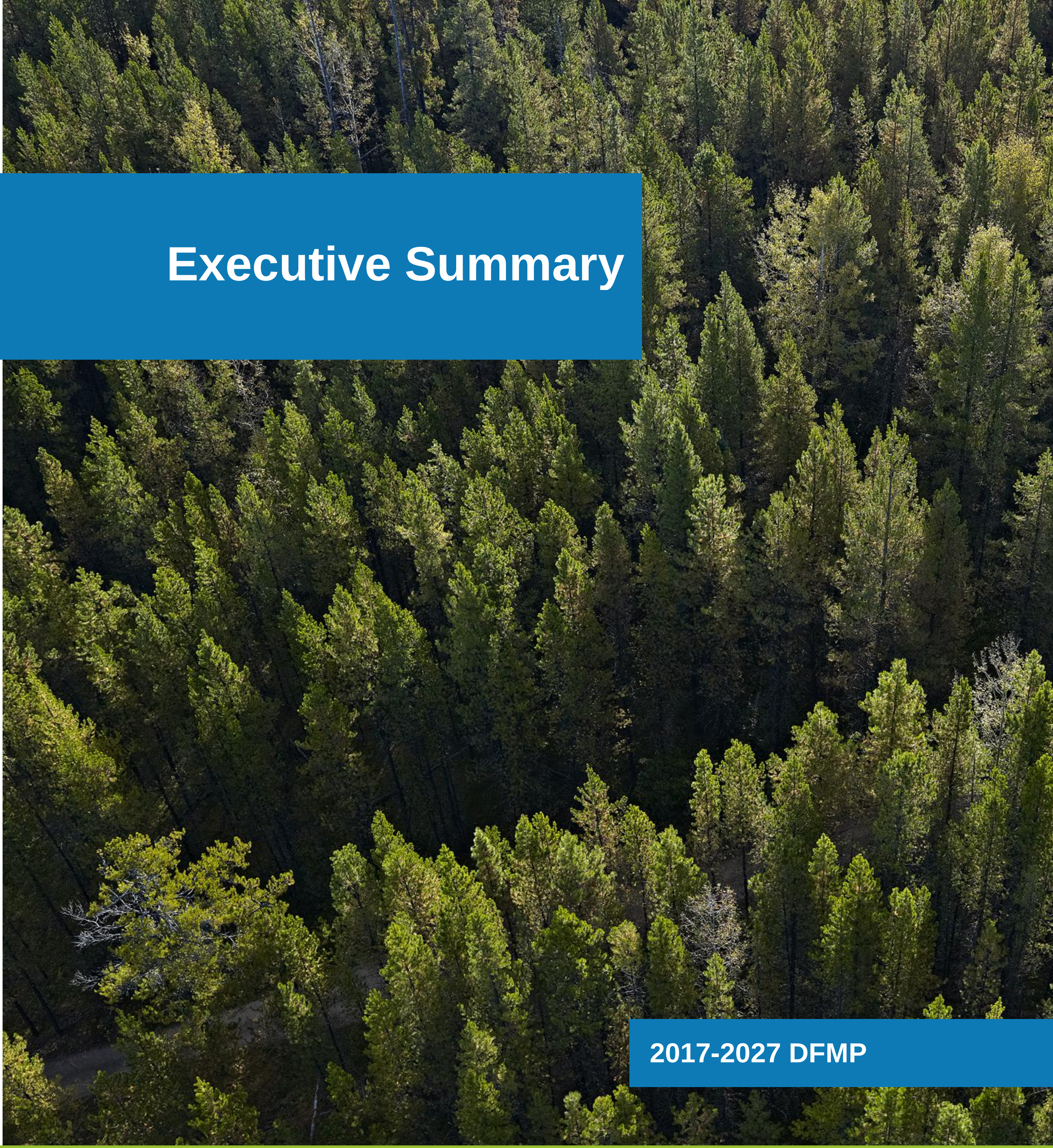
COLLEGE OF ALBERTA PROFESSIONAL FORESTERS
ROBERT MASON
RPF 483

Bob Mason

Bob Mason, RPF

Chief Forester

Table of Contents



Executive Summary

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

1. Executive Summary

Millar Western is an Alberta-based forest products company that has been in business for more than a century. Headquartered in Edmonton, the company produces softwood dimension lumber and specialty products, as well as bleached chemi-thermo-mechanical pulp (BCTMP), at manufacturing facilities at Whitecourt and Fox Creek, Alberta. Its mills are known for their advanced production and environmental control technologies, while the Whitecourt-based woodlands operations are recognized for their leadership in progressive, sustainable forest management. The company employs 550 people on a full-time basis, and hundreds more in seasonal contract work.

Each year, the company's forestry professionals are responsible for the harvest and delivery of about 2.4 million m^3 of timber, the majority of which is sourced from its area and volume based tenures, and through fibre-exchange agreements with other companies; the balance is purchased on the open market. The company's largest timber asset is its Forest Management Agreement (FMA) 9700034. Originally signed on May 14, 1997 (O.C. No. 194/97), the FMA area initially comprised most of Forest Management Unit (FMU) W13; the FMA was amended on June 25, 2002, (O.C. 280/2002) to incorporate most of FMU W11. The FMA area, along with the remaining portions of FMUs W11 and W13 not included in the FMA area, form the DFMP area (see Figure 1), upon which this DFMP is based. The DFMP area totals 472,696 hectares, including 296,851 hectares from W13 and 175,844 from W11. 59% of the DFMP area is available for harvesting, leaving 41% untouched by forest harvesting activity.

Two other companies also have timber rights in Millar Western's FMA: Weyerhaeuser (Pembina Timberlands) holds a Deciduous Timber Allocation (DTA) of 45,000 m^3 in FMU W13 and a deciduous volume agreement for 30,000 m^3 in W13 that expires April 30, 2018, to supply its oriented strand board (OSB) facility in Edson; Spruceland Millworks Ltd. has a Coniferous Timber Quota (CTQ) for 100% of the conifer AAC in FMU W11, to supply its sawmill in Timeu. Up to 30,000 m^3 of conifer logs from FMU W13 are also made available annually to the Community Timber Permit Program.

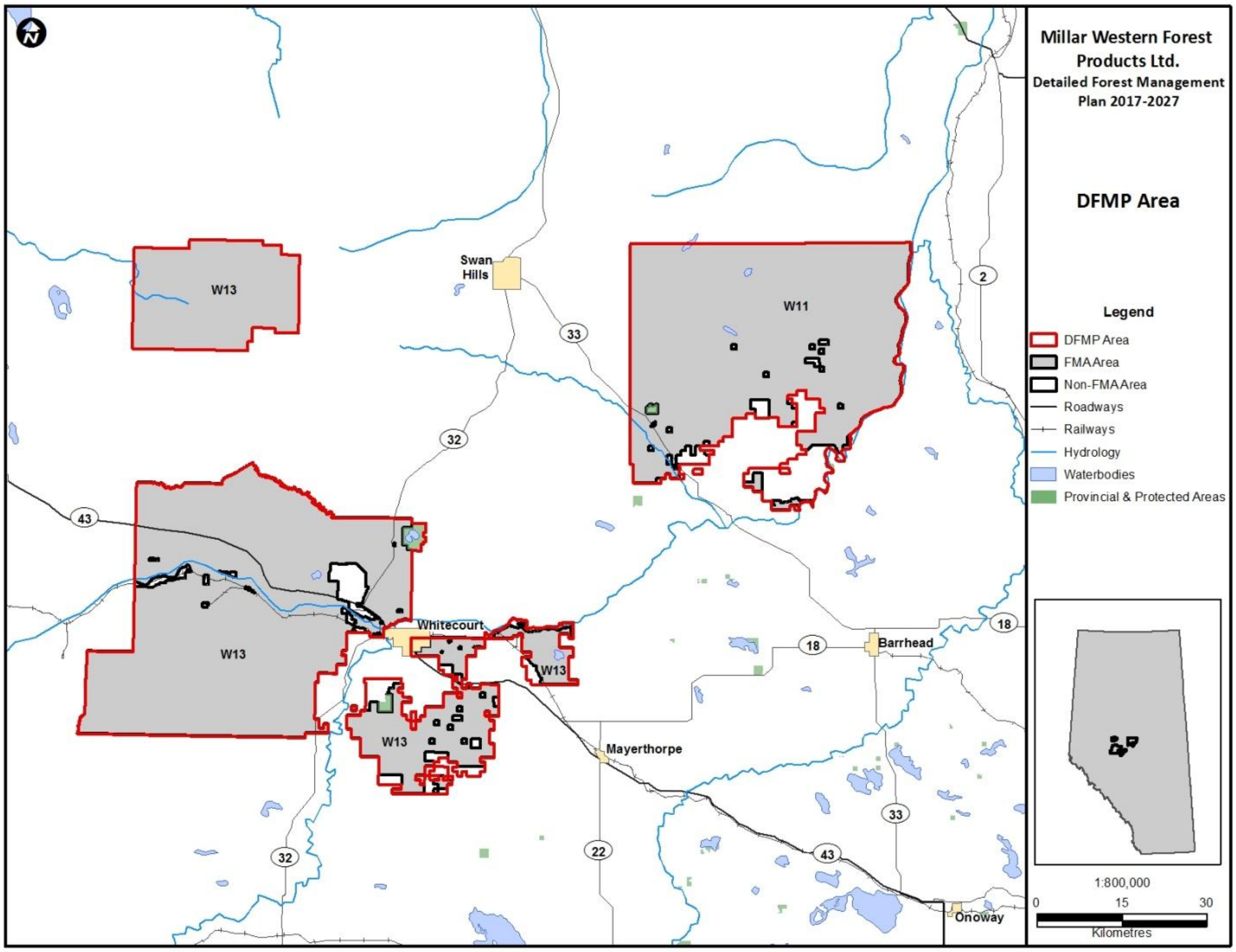


Figure 1. DFMP Area

As an FMA holder, Millar Western is required to develop long-term strategic forest management plans, called Detailed Forest Management Plans (DFMPs), at ten-year intervals. DFMPs allow for regular assessments of the state of the DFMP area's resources and provide an opportunity, through stakeholder and First Nations involvement, to confirm regional values and promote an understanding of planned operations in the coming years. This work forms the basis for determining sustainable harvesting volumes and harvesting locations, and for defining forest renewal strategies that will ensure the re-establishment of healthy, vigorous forests, into perpetuity.

In developing its 2017-2027 DFMP, the company's third, Millar Western built on previous plans while also incorporating the latest advances in forest management research and developments in government policy. The DFMP describes the sustainable forest management strategies and activities that, when deployed, will provide a flow of renewable timber products to Millar Western and local mills, to preserve jobs and stimulate economic activity within the region, while maintaining biodiversity and ecological integrity across the DFMP area. Upon approval by the Government of Alberta (GoA), all forest products companies operating on the FMA must adhere to the DFMP for its term, or until it is replaced by a new DFMP.

Millar Western's approach to forest management, as expressed through the DFMP, is to effectively utilize and enhance the productive forest land base while maintaining biodiversity and ecological integrity based on criteria set out by the GoA, the Canadian Council of Forest Ministers (CCFM) and the Canadian Standards Association (CSA). Millar Western seeks to continuously improve its performance and the health and sustainability of the forest through adaptive management, by considering and incorporating knowledge gained through experience, research and consultation, and by continuing to work with the Alberta government, to identify and address the varied land-use pressures and societal trends affecting the province's forest resources. Millar Western also engages with other organizations, such as Ducks Unlimited Canada, drawing upon their expertise to enhance resource management strategies and practices.

Millar Western's 2017-2027 Detailed Forest Management Plan (DFMP) was developed over a three-year period, beginning in 2014 and ending with the submission of the plan to the GoA in March 2017. In 2012, prior to the formal launch of the project, Millar Western commissioned a new Alberta Vegetation Inventory (AVI) dataset for the DFMP area, replacing the last AVI that was derived from aerial photography gathered from 1994 to 1997. The AVI validates the composition, condition and productivity of the forest, to ensure it can support proposed harvesting levels on a sustainable basis.

Millar Western formally began the DFMP development process by establishing a Terms of Reference (ToR), to define roles and responsibilities and guide project management. The company also sought to involve, to the greatest extent possible, the many stakeholders and interest groups that are potentially affected by forest management activities in the DFMP area. This was partially achieved by forming a diverse PDT that included representation from Millar Western, the GoA and quota holders; extensive public and First Nations consultation programs were developed to include other interests. Additionally, a Technical Team (TT) was created, to provide expert advice on technical issues. The Edmonton-based, independent consultancy firm FORCORP was engaged to facilitate the process, provide technical support and analysis, and assist in the development of plan components.

In Alberta, DFMPs are driven by government defined Values, Objectives, Indicators and Targets (VOITs), which are based on the CCFM's criteria for sustainable forest management and articulate the ecological, social and economic goals for Crown forests. Companies can, with government approval, modify or add to these VOITs, to reflect local priorities. Millar Western consulted extensively on the GoA-defined VOITs – with its Public Advisory Committee (PAC), First Nations and other stakeholders – and, on the basis of the outreach, added two new VOITs, to strengthen First Nations commitments. This brought the final total to 35.

An early phase of plan development was to define the net landbase, or the area that will be eligible for timber harvesting (i.e. the active or managed landbase). This exercise involved identifying and excluding areas within the DFMP area that were unavailable to commercial harvesting, including riparian areas, parks, roads, steep terrain and other industrial dispositions (e.g. oil and gas reserves, grazing leases). This process determined that 59% of the DFMP area was eligible for forest management and would form the basis for determining future annual allowable cuts (AACs).

Once the landbase was determined, yield curves were generated, which identified the merchantable timber volumes available for harvest as the stand ages. The process took into account current stand age, stratification (e.g. pure pine, spruce-aspen mix), and utilization standards (e.g. stump height and top diameter).

The next step was to arrive at a preferred forest management scenario (PFMS), or the scenario that best satisfies the environmental, economic and social objectives in the DFMP area. The PFMS describes the strategic direction and outcome of forest management activities over 200 years, with a focus on the first twenty years. A spatial modeling (forecasting) process with feedback loops was used to provide information to Millar Western, the quota holders, and the GoA, to assess the implications of management activities over the long-term. In late 2016, a draft PFMS was shared with stakeholders, to seek further input; however, no issues were identified.

In producing the PFMS, Millar Western was the first company to incorporate the GoA's updated modelling method to assess non-timber values, developed with the intent of minimizing impacts on forest-dependent species. The new habitat modelling approach was applied to five songbird species (black-throated green warbler, bay-breasted warbler, brown creeper, ovenbird and Canada warbler), along with barred owl, American marten, and grizzly bear.

The PFMS development process generates two primary products that are required for DFMP implementation: the recommended harvest levels over the planning horizon, as shown in the following table, and the spatial harvest sequence (SHS), which identify harvesting locations over the next 20 years.

Table 1. Millar Western 2017-2027 DFMP Recommended AAC

Company Name	Disposition ID	Type	Recommended Allocation m^3/yr	Period 1 [1] Carryover Volume (m^3/yr)	Period 1 [1] Harvest Level (m^3/yr)	Period 2 [2] Carryover Volume (m^3/yr)	Period 2 [2] Harvest Level (m^3/yr)
FMU W13							
Conifer Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	311,121	42,000	353,121	0	311,121
Millar Western Forest Products Ltd.	CTQW130001	Grazing [4]	5,879	0	5,879	0	5,879
CTP	[8(2)(d)(i)]	FMA	30,000	0	30,000	0	30,000
Total Coniferous			347,000	42,000	389,000	0	347,000
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	151,472	31,720	183,192	0	151,472
Millar Western Forest Products Ltd.	DTAW130002	Grazing [4]	6,528	0	6,528	0	6,528
Weyerhaeuser Company Ltd.	DTAW130001	FMU	45,000	20,280	65,280	0	45,000
Total Deciduous			203,000	52,000	255,000	0	203,000
FMU W11							
Conifer Allocations							
Spruceland Millworks Inc.	CTQW110008	FMU	103,000	22,674	125,674	22,674	125,674
Total Coniferous			103,000	22,674	125,674	22,674	125,674
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	113,894	26,000	139,894	0	113,894
Millar Western Forest Products Ltd.	DTAW110002	Grazing [4]	1,106	0	1,106	0	1,106
Total Deciduous			115,000	26,000	141,000	0	115,000
FMA							
Area Residents [3]	[8(2)(a)(i)]		1,000				

[1] Period 1: May 1, 2017 - April 30, 2022.
[2] Period 2: May 1, 2022 - April 30, 2027.
[3] Total volume of coniferous/deciduous (including birch); included in Millar Western FMA Volume
[4] Grazing volumes based on 20 year average harvest volume in PFMS
Conifer and Deciduous Utilization is 15/10/15
Volumes are reduced for Cull
Volumes have not been reduced for structure retention

The SHS identifies geographic areas planned for harvest from 2017 to 2037. All operators in the DFMP area will use the SHS polygons to create annual forest harvest plans. Before finalization, the SHS was shared with First Nations. During these consultations, four areas within W13 were identified as having cultural significance. These have been identified and will be taken into account in the development of annual operation plans (see Chapter 7 – *DFMP Implementation)*. The SHS was also posted for review and comment on Millar Western's corporate website; no further input was received as a result of this outreach.

As well as determining sustainable harvest levels, the DFMP also defines forest renewal strategies for the DFMP period, including a growth and yield program that describes short- and long-term monitoring to achieve forest regeneration objectives and targets in the DFMP area. The objectives of Millar Western's silviculture program are to ensure that harvested areas are established and grow according to the assumptions used to generate the PFMS and that the company is in compliance with legislated forest renewal requirements, as expressed in the Forests Act, the Timber Management Regulations and the Forest Management Agreement.

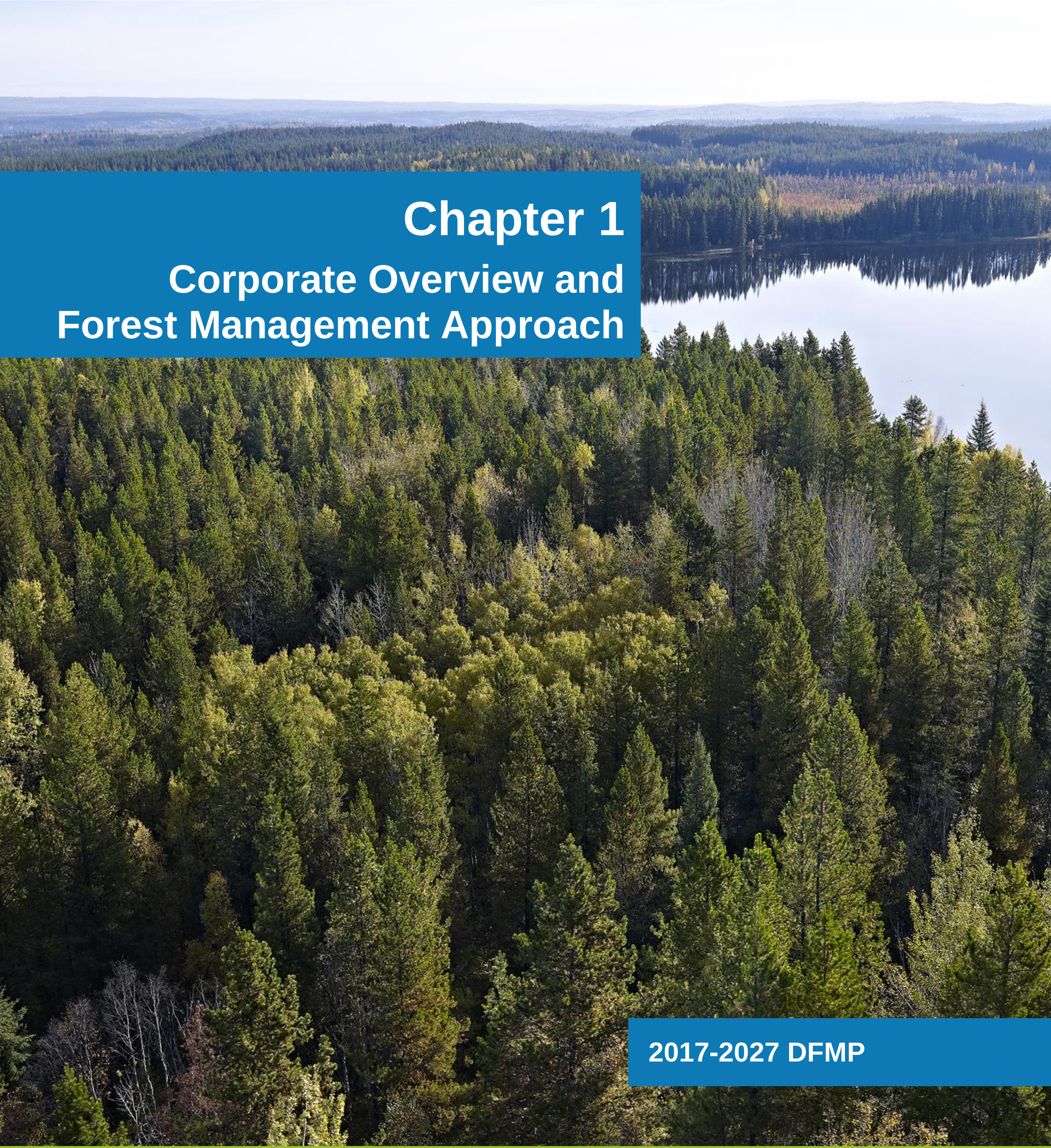
While establishment of robust forests is a goal, so is protection of these resources against risks such as wildfire and pathogen outbreaks. The DMFP therefore incorporates numerous strategies for enhancing the health and vitality of forest resources, to reduce their susceptibility to threats. These include maintaining a Helitak crew, to respond quickly to wildfire ignitions, and to work with the GoA to monitor forest risks, such as the mountain beetle, and develop and implement effective mitigation approaches.

Also included in this DFMP is a company commitment to continued investments in research and technical studies. As a result of its participation in a variety of initiatives, Millar Western benefits from new information, ideas and approaches to sustainable forest management, for application in the DFMP area. Ongoing involvement in research consortiums and partnerships with respected agencies such as Ducks Unlimited Canada, as well as continued certification to internationally recognized standards such as the Sustainable Forestry Initiative, ensures that Millar Western will continue to remain at the forefront of progressive, sustainable forest management.

The outcome of these efforts is a scientifically sound, long-term strategic plan that upholds the principles of sustainable forest management and reflects the views and expertise of a wide range of professionals. The plan was further enriched by seeking the input of external stakeholders and First Nations, to ensure that regional perspectives were heard and incorporated. This approach broadened the DFMP's values and objectives, as well as plan ownership.

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

\\silver\clients\MWFP\Projects\P755_DFMP\bz_ExecutiveSummary\ExecutiveSummary_20170901_Submit.docx



Chapter 1

Corporate Overview and Forest Management Approach

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

List of Tables

1. Introduction

Millar Western Forest Products Ltd. (Millar Western) is an Alberta-based, privately held forest products company that has been in operation for more than a century. Headquartered in Edmonton, Alberta, it produces pulp, lumber, and bioenergy at facilities in Whitecourt and Fox Creek. It obtains the majority of its fibre requirements on Crown land, including from its Forest Management Agreement (FMA 9700034) area, which was assigned to the company by the Government of Alberta (GoA) on May 28, 1997.

As an FMA holder, Millar Western is required to develop, at 10-year intervals, long-term, strategic plans, called Detailed Forest Management Plans (DFMPs). Based on 200-year planning horizons, DFMPs set the direction for forest management activities for the next decade and determine harvesting schedules, locations and allocations, as well as performance expectations for the next decade.

The 2017-2027 DFMP is Millar Western's third long-range plan for its FMA area. Pertaining to an area 472,696 ha in size in northwestern Alberta, it was developed over three years, with the involvement of the GoA, other tenure holders, forest experts, First Nations and a broad range of stakeholders. In keeping with corporate commitments to continuous improvement and adaptive management, this DFMP builds on the work of the previous plans while also incorporating the latest developments in science and government policy. It describes the sustainable forest management strategies and activities that, when deployed, will provide a flow of renewable timber products to Millar Western and local mills, to preserve jobs and stimulate economic activity within the region, while maintaining biodiversity and ecological integrity across the DFMP area. Upon approval by the GoA, all forest products companies operating on the FMA will be obliged to adhere to the DFMP.

This introductory chapter outlines the structure of the DFMP, describes the company's history and present-day operations, and ends with a discussion of the company's adaptive approach to managing the forests in its stewardship.

1.1 Structure of 2017-2027 DFMP

Millar Western's 2017-2027 DFMP is structured to meet the requirements of the Alberta Forest Management Planning Standard (Version 4.1 – April 2006). The plan, comprising eight chapters and eight annexes that are summarized below, describes development processes and methodologies, as well as the inputs used to arrive at the preferred forest management scenario (PFMS). It also includes information that will guide the plan's implementation. Supporting digital media with appropriate datasets and files also form part of the final submission to government.

1.1.1 Chapter Descriptions

1.1.1.1 DFMP Executive Summary

The executive summary provides a plain-language overview of the DFMP, focusing primarily on development process, and results and commitments. As well as an introduction to the DFMP, the executive summary serves as a stand-alone document, encapsulating the contents of the 2017-2027 DFMP for non-government stakeholders.

1.1.1.2 Chapter 1: Corporate Overview and Forest Management Approach

Chapter 1 presents history and background on Millar Western, as well as a description of its manufacturing and forestry operations. It also discusses the company's forest management goals and approach. Linkages between the company's forest management approach and the 2017-2027 DFMP can be found in Chapters 5 and 6.

1.1.1.3 Chapter 2: DFMP Development

DFMP development history and procedures are summarized in Chapter 2. This section provides an overview of plan inputs and the decision-making processes, including the composition and role of the Plan Development Team (PDT); consultation and communication plans for stakeholders and First Nations; responses to issues identified by stakeholders; and timelines and milestones.

1.1.1.4 Chapter 3: Forest Landscape Assessment

Chapter 3 provides a detailed description of the current condition of the DFMP area. It outlines the status of administrative, physical, environmental, anthropogenic and climatic conditions, in many cases using the same metrics developed for describing the Alberta land-use regions.

1.1.1.5 Chapter 4: Summary of Previous DFMP

Chapter 4 reflects Millar Western's commitment to adaptive management, summarizing its success in fulfilling the commitments outlined in the 2007-2016 DFMP and the lessons drawn from the implementation. It furthermore provides direction on how to apply those lessons to the implementation of the 2017-2027 DFMP. Significant changes and major events affecting the FMA are also discussed.

1.1.1.6 Chapter 5: Values, Objectives, Indicators and Targets (VOITs)

The Values, Objectives, Indicators and Targets (VOITs) that guided the development of the 2017-2027 DFMP are documented in Chapter 5. VOITs, which are developed with stakeholder and First Nations input, are an essential component of the DFMP, linking values to forest management objectives and identifying related indicators and targets for use in performance measurement.

1.1.1.7 Chapter 6: Preferred Forest Management Scenario (PFMS)

One of the primary products of the DFMP development process is the Preferred Forest Management Scenario (PFMS). The PFMS is the outcome of all planning decisions and the sum of all proposed forest management actions. It describes when and where forest management activities can be carried out across the FMA and predicts the impacts of those activities on the values identified for the DFMP area.

1.1.1.8 Chapter 7: DFMP Implementation

Chapter 7 consolidates in one location the information necessary to execute the 2017-2027 DFMP and serves as an important reference chapter for those charged with its implementation. It includes both specific direction as well as strategies meant to guide lower-level planning processes, to achieve DMFP objectives. Chapter 7 also includes the monitoring and reporting commitments for the DFMP.

1.1.1.9 Chapter 8: Research

While research commitments for the 2017-2027 DFMP implementation period are described in Chapter 7, Chapter 8 summarizes Millar Western's current research initiatives and their influence on forest management in the DFMP area.

1.1.1.1 Glossary

A list of terms and acronyms used throughout the DFMP are included here.

1.1.1.2 Annex I: Forest Management Agreement

A copy of Forest Management Agreement #9700034 for the Millar Western FMA is included in this annex. The agreement was renewed on April 2, 2014.

1.1.1.3 Annex II: Consultation Plans

Plans approved by GoA to guide Consultation with First Nations and the broader public are included in Annex II.

1.1.1.4 Annex III: Stewardship Report

Ongoing reporting is a requirement of the FMA. Millar Western's stewardship report summarizing activity on the FMA for the period 2007 to 2011 is included here.

1.1.1.5 Annex IV: Growth and Yield Program

The growth and yield program describes the monitoring and measurements that will be undertaken to verify current growth assumptions and to refine future timber growth assumptions.

1.1.1.6 Annex V: Growth and Yield Document

Growth and yield development of the timber resources across the FMA area is summarized in this annex. Timber resource sampling programs and the processes used to develop projections of timber volumes are described.

1.1.1.7 Annex VI: Timber Supply Analysis

Analysis undertaken to support the development of the DMFP is summarized in this annex. This includes any sensitivity analysis completed to support the determination of the assumptions used in the PFMS.

1.1.1.8 Annex VII: Spatial Harvest Sequence Maps

Large scale maps of the spatial harvest sequence (SHS) are included in this annex.

1.1.1.9 Annex VIII: Landbase Development Document

The net landbase is a detailed spatial digital representation of the DFMP area, as of May 1, 2015. This product is a key component of the modeling undertaken to develop the PFMS and the related annual allowable cut (AAC), spatial harvest sequence (SHS) and non-timber assessments.

1.2 Detailed Forest Management Plan (DFMP) Area

The DFMP area is the physical extent to which the 2017-2027 DFMP applies. Forests are complex and variable, composed of a mixture of terrestrial and wetland ecosystems. Only a portion of the DFMP area comprises lands ecologically capable of supporting timber production, and only a portion of those are eligible for harvesting: 59% of the DFMP area is available for harvesting, leaving 41% untouched by forest harvesting activity. Of the area eligible for harvest, 11% has been sequenced for harvesting over the next ten years. Following are examples of areas not eligible for harvesting:

- Administrative restrictions:
  - E.g. First Nation reserves, municipal boundaries, parks and protected areas (PPA), private land, colonial bird and swan-sensitive site buffers, and water buffers;
- Landscape restrictions:
  - E.g. Roadways, anthropogenic vegetated and non-vegetated lands, dispositions (DIDs), aquatic and flooded areas, lakes and rivers, naturally non-forested or non-vegetated land, and burned areas;
- Operational restrictions:
  - E.g. High moisture areas, low timber productivity rating (TPR) stands, low density stands, inoperable slopes, birch and larch stands, unidentified cutblocks, 2007-2016 DFMP SHS deletions, river islands, black spruce in W11, isolated stands, and subjective deletions, including horizontal stands with no strata, lower density stands with no understory, lower density black spruce stands, etc.

Table 1-1 summarizes the areas within the passive landbase that are not eligible for forest harvesting activities, broken down into the categories mentioned above, as well as the total DFMP area that is available for harvest.

Table 1-1. DFMP area summary

Landbase Category		W11	W13	Total
Passive Landbase	Administrative Restrictions	16,189	21,480	37,669
	Landscape Restrictions	12,444	24,948	37,391
	Operations Restrictions	59,584	60,378	119,961
Passive Landbase Subtotal		*88,216*	*106,806*	*195,022*
Active Landbase		87,628	190,046	277,674
Landbase Total		**175,844**	**296,851**	**472,696**

2. Corporate Overview

Alberta-based Millar Western operates manufacturing facilities in Whitecourt and Fox Creek that are known for their advanced production and environmental control technologies. These facilities are supported by Whitecourt-based woodlands operations, recognized for their leadership in progressive, sustainable forest management. The company's products, which include softwood dimension lumber and specialty wood products, and hardwood and softwood bleached chemi-thermo-mechanical pulp (BCTMP), are marketed around the world. In 2017, Millar Western commenced operation of a bioenergy plant that converts organics in pulp-mill effluent into green energy for use in mill processes.

2.1 Company History

Millar Western was founded by James William (J.W.) Millar, a Western Canadian business pioneer. In 1906, J.W. opened a blacksmith shop in North Battleford, Saskatchewan, and was soon involved in logging in the area. By 1919, J.W. and partners had incorporated one of the first construction companies in Western Canada. In the 1920s, he expanded into logging and sawmilling in Whitecourt, Alberta, and in the 1930s, established a sodium sulphate mining and processing operation in Palo, Saskatchewan.

In the 1930s and 1940s, J.W.'s sons Hugh, Allan and Keith joined the company and, in the decades that followed, oversaw the continued growth and diversification of the family enterprise, with a strong focus on the expansion of its various interests in the construction sector. Grandsons James, MacKenzie and Kenneth came on board in the 1960s and 1970s, preparing to lead the company's next phase of growth.

The 1980s was a period of rapid expansion for the business. In 1981, the lumber, construction and chemical companies were combined to form Millar Western Industries Ltd. Five years later, Millar Western Pulp Ltd. was established and, in 1988, it opened a bleached chemi-thermo-mechanical pulp (BCTMP) mill adjacent to the company's Whitecourt sawmill. The same year, a magnesium sulphate facility was added to the group's Whitecourt operations.

In 1992, Millar Western partnered with the Saskatchewan government to build the world's first successful zero-effluent market pulp mill. The facility was sold in 2007, after years of operation as one of the world's most technologically advanced, environmentally responsible BCTMP mills.

In 1993, Millar Western purchased and upgraded a sawmill in Boyle, Alberta. In 1998, this operation was amalgamated with the Whitecourt sawmill and BCTMP mill to form Millar Western Forest Products Ltd. Millar Western sold its Boyle operations to Northland Forest Products Ltd. in December 2015.

In 2001, Millar Western launched a new sawmill at the Whitecourt site on which it had operated a series of sawmills since 1926. The high-speed, high-efficiency facility has undergone significant additional investments since it opened.

Millar Western elected to focus on its core lumber and pulp businesses. In 2004, the group wound down its construction interests and, in 2007, sold its sodium sulphate plant in Palo.

In 2007, the company purchased a lumber operation located at Fox Creek, Alberta. The 60 million board feet sawmill was lost to a fire in August 2008. A new state-of-the-art replacement sawmill, with double the capacity of the original facility, was built and began production in late 2011.

Millar Western's newest project is a bioenergy installation. The plant, which began operation in early 2017, converts organics in pulp mill effluent to a biogas, which will be used to generate renewable energy for use in mill processes. The project will further improve the mill's competitiveness and environmental performance.

2.2 Manufacturing Operations

With its history of operations dating back to the early 1920s, Alberta-based Millar Western Forest Products Ltd. is one of the oldest forest products businesses in Western Canada. The company is headquartered in Edmonton, Alberta, with manufacturing operations in Whitecourt and Fox Creek:

- **Whitecourt sawmill:** Constructed in 2001, on the site where Millar Western has operated a succession of sawmills since the 1920s, this high-speed, high-efficiency sawmill features advanced technology, including scanning and optimizing equipment for improved lumber recovery and product quality. Designed to produce 190 million board feet of SPF lumber per year, the mill today generates approximately 330 million board feet annually. Committed to operating in an environmentally responsible manner, the sawmill has found uses for all byproducts of the lumber manufacturing process: wood chips are converted to bleached chemi-thermo-mechanical pulp (BCTMP) at the company's pulp mill and into newsprint at a neighbouring facility; trim ends and wood shavings are sold for the production of finger-jointed lumber and medium density fibreboard (MDF). Remaining wood waste is transported to a local power plant, to fuel electricity generation. Since 2005, the Whitecourt sawmill has been recognized under the Alberta government's EnviroVista program for its comprehensive, publicly-accessible, audited environmental management system and for achieving a long-term record of excellent performance under provincial legislation.

- **Fox Creek Sawmill:** In August 2007, Millar Western acquired a 60 million board feet/year sawmill operation at Fox Creek, Alberta. In 2008, the facility was lost to a fire. In November 2011, the company started up a state-of-the-art replacement facility that, at 120 million board feet per year, doubles the capacity of the original mill. The Fox Creek mill decommissioned its wood-waste incinerator in 2016 and based on current capacities for each facility, now conveys all wood residuals to Whitecourt Power, a local power plant, to fuel green energy generation.
- **Whitecourt Pulp Mill:** The Whitecourt pulp mill began production in 1988. Originally designed to produce 210,000 air-dried metric tonnes (ADMT) of BCTMP per year, the mill's output has risen to more than 320,000 ADMT per year. The facility converts residual softwood chips from its adjacent sawmill into softwood pulp; locally sourced aspen timber is chipped to produce hardwood pulp. The mill employs an advanced biological effluent treatment system to clean processed water before discharging it into the Athabasca River. In its many years of operation, the system has consistently exceeded all government requirements for effluent quality. In early 2017, Millar Western began operation of a new bioenergy facility that uses an advanced anaerobic hybrid technology to recover organic material from pulp mill effluent and convert it to a biogas. After conditioning, the biogas is used to fuel reciprocating engines, to generate 5.2 megawatts of renewable electricity for use in pulp operations. Waste heat from the combined-heat-and-power (CHP) plant is captured, to replace natural gas use in the mill's flash dryers.

2.3 Forest Management Operations

2.3.1 Millar Western Forest Products Ltd.

Millar Western's woodlands operations are based in Whitecourt, Alberta, and satisfy the fibre needs of the company's Whitecourt and Fox Creek sawmills and Whitecourt pulp mill. Each year, the company's forestry professionals are responsible for the harvest and delivery of about 2.4 million m^3 of timber, the majority of which is sourced from its FMA area and quotas, and through fibre-exchange agreements with other companies. The remainder is obtained on the open market. Harvesting and forest renewal activities are supervised by Millar Western and carried out by local contractors who share the company's commitment to operating in a safe and ecologically sensitive manner.

2.3.2 Other Forestry Operators

In addition to Millar Western, the following companies also have been granted rights to harvest timber in the Millar Western DFMP area under GoA-allocated timber dispositions.

2.3.2.1 Weyerhaeuser (Pembina Timberlands)

To supply its oriented strand board (OSB) facility in Edson, Weyerhaeuser Company Ltd. (Weyerhaeuser) holds a Deciduous Timber Allocation (DTA) of 45,000 m^3 in FMU W13. It also has a 30,000 m^3 deciduous timber supply agreement with Millar Western that expires April 30, 2018. Weyerhaeuser is responsible for its own harvest and forest renewal activities within the DFMP area.

2.3.2.2 Spruceland Millworks Ltd.

Spruceland Millworks Ltd. (Spruceland) has a Coniferous Timber Quota (CTQ) for 100% of the conifer AAC in FMU W11. The conifer sawlogs from this area supply Spruceland's sawmill in Timeu. Spruceland is responsible for its own harvest and forest renewal activities within the DFMP area.

2.3.2.3 Community Timber Permit Program

Up to 30,000 m^3 of conifer logs is available annually from FMU W13, to maintain the Community Timber Permit Program. If some or all of the annual volume provided under this program is not used after two forest management operating years, then the unused volume will accrue to Millar Western. Permit holders are responsible for their harvesting activities, while forest renewal activities are the responsibility of the GoA.

2.4 Certification

Already subject to some of the most rigorous forest management standards in the world, Millar Western has sought third-party certification under internationally recognized standards, to provide stakeholders with independent verification of the sustainability of its practices and legality of its timber procurement activities.

- Millar Western was the first company certified under FORESTCARE, an Alberta industry program that sets high standards for protection of the forest, environment and communities.
- Its Whitecourt pulp and woodlands operations are certified to the ISO 14001 environmental management system (EMS) standard.
- The Whitecourt woodlands operations are certified to the Sustainable Forestry Initiative (SFI) standards for sustainable forest management and fibre sourcing, which are recognized by the international umbrella organization Programme for the Endorsement of Forest Certification (PEFC).
- Whitecourt woodlands, pulp and lumber and Fox Creek lumber operations are further certified under two chain of custody programs — PEFC and Forest Stewardship Council (FSC). Companies certified to these standards are able to track timber from forest to mill and demonstrate they have implemented mechanisms to prevent illegally-procured or controversial wood from entering the supply chain.

3. Forest Management Approach

3.1 Sustainable Forest Management Statement

Over the next decade, Millar Western will strive to satisfy the fibre needs of its manufacturing operations through effective utilization and enhanced management of the productive forest landbase, while employing a sustainable forest management approach that maintains biodiversity and ecological integrity based on criteria set out by the GoA, the Canadian Council of Forest Ministers (CCFM) and the Canadian Standards Association (CSA). This approach follows the CSA framework based upon the establishment of Values, Objectives, Indicators and Targets (VOITs), which establishes management targets for the following criteria:

1. Conservation of biological diversity
2. Maintenance and enhancement of forest ecosystem condition and productivity
3. Conservation of soil and water resources
4. Forest ecosystem contribution to global ecological cycles
5. Multiple benefits to society
6. Accepting society's responsibility for sustainable development

Millar Western will also seek to continuously improve its performance and the health and sustainability of the forested land base through adaptive management, by considering and incorporating knowledge gained through experience, research and consultation, and by continuing to work with the Alberta government to identify and address the varied land-use pressures and societal trends affecting the long-term sustainability of the province's forest resources.

Millar Western's adherence to the principles of sustainable forest management is outlined in the Company's SFI commitment statement:

1. *Sustainable Forestry* – With roots reaching back to the early 1900s, Millar Western understands the importance of maintaining forests for the future and, therefore, will continue to manage the lands in its stewardship according to the principles of sustainability. Understanding that a forest is more

than a timber source, the company will work with stakeholders to manage for a broad range of forest values, including conservation of soil, air and water quality; biological diversity; wildlife and aquatic habitat; recreation and aesthetics.

2. *Forest Productivity and Health* – Millar Western remains committed to managing the forest in a way that maximizes its long-term health, adopting strategies that help to reduce the forest's vulnerability to wildfire, pests, disease and other destructive agents, and that contribute to improved yield. It will also continue to work with government and industry to ensure that governing policies remain conducive to fostering healthy, multiple-value forests for the future.
3. *Protection of Water Resources* – Understanding that water resources are critical to sustaining the diversity of life in the forest, Millar Western will continue to employ sound management practices that avoid adverse impacts on water bodies and riparian areas. It will also continue to work with government and industry to support broad-based initiatives aimed at maintaining the quality and quantity of the forest's water supply.
4. *Protection of Biological Diversity* – Millar Western supports an integrated land-use management (ILM) approach to the promotion of biological diversity and maintenance of ecosystems, working with other forest users, including oil and gas companies, trappers, aboriginal communities and recreational users, to identify and protect sensitive habitat.
5. *Aesthetics and Recreation* – Millar Western will continue to work closely with stakeholders through consultation mechanisms such as its Public Advisory Committee to identify areas prized for their beauty or recreational opportunities. Once identified, these important forest features will be given special consideration during the planning process, to ensure their value is preserved for public access and enjoyment.
6. *Protection of Special Sites* – Millar Western will continue to work with stakeholders, including aboriginal communities, to build its inventory of sites identified as having special historical, cultural or other significance and to ensure, though careful planning, that they remain protected.
7. *Responsible Fiber Sourcing Practices in North America* – Millar Western sources all of its fibre from Alberta, Canada, the vast majority from government-owned lands that are subject to strict laws and regulations. Although the risk of controversial fibre entering the supply chain is virtually non-existent, Millar Western maintains chain-of-custody certifications, enabling it to trace all timber back to the source, to further safeguard its timber supply chain against unwanted intrusions.
8. *Legal Compliance* – Millar Western is committed to maintaining its excellent record of compliance with applicable federal, provincial and local forestry and related environmental laws and regulations and to working with all levels of government to advance progressive forest policy development that reinforces Canada's reputation as a trusted source of products made from wood that has been legally acquired from sustainably managed forests.
9. *Research* - Through its participation in industry, professional and research associations, Millar Western will continue to take a leadership role in supporting the development of progressive forest management practices. It also commits to staying current with the latest information related to sustainable forest management and, where appropriate, to incorporate new scientifically-validated ideas into its forest management activities.
10. *Training and Education* – Millar Western considers training and education of its employees and contractors as vital to ensuring our forest management activities are carried out safely, legally, with minimal impact on the environment and in a way that is consistent with our core values of integrity,

honesty, trust and respect. With that in mind, we will continue to provide the necessary training and education to ensure our employees, or anyone acting on behalf of our company, are equipped to carry out their responsibilities in accordance with the highest standards.

11. *Community Involvement and Social Responsibility* – Because Millar Western's operations take place largely on publicly owned lands, it considers public consultation essential to developing forest management plans that reflect not only corporate but, also, societal values. To that end, the company will continue to maintain a Public Advisory Committee, to offer other consultation opportunities to stakeholders (e.g. annual open houses) and to recognize and respect the rights and traditional forest-related knowledge of indigenous peoples.
12. *Transparency* – Though a privately owned and operated company, Millar Western has built solid relationships with stakeholders, including the communities where it operates, by being transparent about its operations. It will continue to share information through mechanisms such as its corporate website and open houses and to respond to public inquiries openly and honestly.
13. *Continual Improvement* – Continual improvement is a cornerstone of Millar Western's operational approach. The company's woodlands operations regularly measure their performance, reporting results to stakeholders and using the outcomes as a basis for improvement.
14. *Avoidance of Controversial Sources, including Illegal Logging, in Offshore Fibre Sourcing* – Millar Western does not engage in off-shore fibre sourcing, instead obtaining all of its fibre from the highly-regulated jurisdiction of Alberta, Canada.

3.2 Forest Management Strategies

To support Millar Western's SFM principles and approach based on the CCFM criterion and indicators, the following strategies will be followed in the course of DFMP development and implementation.

3.2.1 Enhanced Reforestation

Millar Western applies silviculture prescriptions that enhance the growth and yield of regenerating stands, with the aim of providing a steady fibre stream to the company's mills. By controlling the density of regenerating stems and competing vegetation, new stands will be managed to produce fast growing, high-volume forests.

3.2.2 Wetlands Conservation

Wetlands are prevalent across the western boreal forest and an important habitat on Millar Western's FMA area; however, their extent and purpose are poorly understood. Working from the premise that sustaining forests and preserving wetlands habitats are intertwined, Millar Western has partnered with Ducks Unlimited Canada (DUC), to better integrate wetland and waterfowl conservation into its forest management planning and operations. See APPENDIX I – Wetland Conservation for more detail.

3.2.3 Approach to NRV

Integrating the historical or natural range of variation (NRV) of ecosystem patterns and processes into forest management is predicated on the idea that managing within natural ranges represents a low risk of loss of biological function, productivity, and individual ecological elements. Millar Western, through its involvement in the Canadian Boreal Forest Agreement (CBFA), is participating in the completion of a detailed NRV analysis through the fRI Research LandWeB (Landscape Modeling in the Western Boreal) Project, being led by Dr. David Andison of Bandaloop Landscape Ecosystem Services. This project will provide baseline NRV conditions that will improve the understanding of natural process, leading to improved forest management. The LandWeB project results are expected to be available in the second half of 2017. Once available, this information will be reviewed for potential implementation in subsequent DFMPs. For the 2017-2027 DFMP, Millar Western utilized interim NRV targets. Specifically, they were considered in the value-tradeoff process during development of the Preferred Forest Management Scenario (PFMS).

4. Forest Management Issues

As well as being guided by government standards and other legislative requirements, sustainable forest management plans respond to recent developments and current issues. These can range from physical events that threaten forest health, to changing societal expectations with respect to resource development. This section discusses the major issues that have informed the development and successful implementation of Millar Western's 2017-2027 DFMP.

4.1 Social License

Social license is defined as "ongoing approval or broad social acceptance" for a project or organization (http://socialicense.com/definition.html). As a company that relies on publicly owned natural resources to continue operations, sustaining a social license to operate is vital to the company's future. To date, Millar Western has enjoyed largely positive relationships with stakeholders, owing to its long history of transparency, excellent employee relations, robust safety program, outreach to interest groups, dedication to responsible resource management, regulatory compliance, community investments, and commitment to its core values of integrity, honesty, trust and respect. It also holds certification under several third-party certification programs that provide independent verification of its compliance with internationally recognized forest management and chain of custody standards. When issues arise, the company attempts to resolve them through consultation and impact mitigation.

Millar Western recognizes that broad social acceptance for its operation on Crown land is not to be taken for granted and allocates considerable resources to maintaining high operating standards and ongoing engagement with stakeholders. Beyond its own work to maintain its reputation, Millar Western holds membership in the Forest Products Association of Canada (FPAC) and the Alberta Forest Products Association (AFPA), which promote the forest sector and greater understanding of its economic and environmental contributions, as well as its potential. Despite these efforts, Millar Western is aware that not all are supportive of its plans and practices and that opposition could grow in the future. This DFMP was developed to meet or exceed the highest standards in sustainable forest management, to maintain public trust in Millar Western and its practices.

4.2 First Nations Consultation

Millar Western interacts with eight different First Nations communities in the DFMP area, though engagement levels vary among them: some communities take an active role in plan review while others choose not to provide any input. Millar Western regularly reaches out to First Nations in its operating area, to understand traditional land uses and ensure its operations do not conflict with treaty rights. Toward that end, Millar Western makes available information about its forest management activities and, where necessary, works to mitigate the impacts of its forest management activities through ongoing consultation. In addition to complying with *The Government of Alberta's Proponent Guide to First Nations and Metis Settlements Consultation Procedures*, it seeks to build stronger relationships and, where possible, to explore economic development opportunities through capacity building, by way of scholarships, support of community initiatives and employment, direct and contractual. Though many challenges remain, Millar Western is committed to fostering mutual understanding by approaching First Nations consultation on the basis of its core values of honesty, integrity, trust and respect.

4.3 Structure Retention

In Alberta, forest companies are required to leave a prescribed percentage of standing timber in harvested areas, a practice called structure retention, to serve as habitat for birds and other species. During DFMP development, the GoA issued a draft directive that sought to significantly increase the amount of standing timber left behind within harvested blocks. At the time of DFMP submission, the directive was still under development; however, Millar Western worked with the GoA to develop a structure retention strategy for the 2017-2027 DFMP that is consistent with the directive's direction.

4.4 Mountain Pine Beetle

Mountain Pine Beetle (MPB) continues to pose a threat to western Canada's pine forests. Strategies to mitigate the spread of the MPB include the GoA-sanctioned pine "surge cuts", which allow tenure holders to focus conifer harvests on mature and over mature pine stands, areas that are most vulnerable to the MPB, as part of their conifer AAC component. The intent is to diminish MPB habitat and minimize the extent of the infestation. Through the application of a pine focused surge cut during the last DFMP, the strategy has successfully reduced MPB risk in the FMA area; however, diligence is still required, especially considering the large area of pine in the Windfall area that will soon be old enough to support MPB infestations. Should a MPB outbreak occur, infested stands could be made a harvesting priority.

4.5 Land-use Pressures

The federal and provincial governments have launched programs to address the increasing land-use pressures, brought about by a number of factors, including industrial and urban expansion, growing recreational use and conservation initiatives. In Alberta, these include caribou range planning, resulting from the federal Species at Risk Act (SARA), and the province's Land-use Framework (LUF), which seeks to develop natural resource management plans for each of Alberta's seven regions.

4.5.1 Caribou Range Planning

The woodland caribou population throughout Canada is listed as threatened under SARA. In response, the federal government prepared and released the Recovery Strategy for the Woodland Caribou, Boreal Population in Canada, in 2012, which requires the GoA to develop caribou range plans for all provincial caribou ranges by October 2017. Depending on the status of the herds, range plans could call for significant harvesting curtailments, which could restrict fibre availability in parts of the province.

A small portion of the Slave Lake caribou range is located in the eastern portion of FMU W11. Since the GoA has not yet released a range plan for that area, Millar Western has included an interim strategy in *Chapter 7 - Implementation – Appendix III* of the 2017-2027 DFMP.

4.5.2 Land-use Framework

Introduced in 2008, the Land-use Framework (LUF) initiative sets out a new approach to managing the province's land and natural resources, to achieve Alberta's long-term economic, environmental and social goals. Developed with input from public, stakeholders, and First Nations, the LUF establishes seven new land-use regions and calls for the development of a regional plan for each. LUF consists of seven basic strategies to improve land-use decision-making in Alberta:

- *Strategy 1: Develop seven regional land-use plans based on seven new land-use regions ;*
- *Strategy 2: Create a Land-use Secretariat and establish a Regional Advisory Council for each region;*
- *Strategy 3: Cumulative effects management will be used at the regional level to manage the impacts of development on land, water and air;*
- *Strategy 4: Develop a strategy for conservation and stewardship on private and public lands;*
- *Strategy 5: Promote efficient use of land to reduce the footprint of human activities on Alberta's landscape;*
- *Strategy 6: Establish an information, monitoring and knowledge system to contribute to continuous improvement of land-use planning and decision-making; and*
- *Strategy 7: Inclusion of aboriginal peoples in land-use planning.*

Millar Western's DFMP area sits within the Upper Athabasca and Upper Peace LUF regions. At the time of the submission of the DFMP, the GoA had not yet developed plans for these regions; however, as indicated in the Forest Management Plan Issues and Management Direction Summary provided by the GoA on April 20, 2015, Millar Western will be required to align the DFMP with the regional plans once they are released.

4.6 Long-Term Growth Projections

Productive, healthy growing forests are critical to the long-term success of Millar Western's operations. While Millar Western continues to rely entirely on timber from forests that have never before been commercially harvested, it will, over time, begin to sequence second rotation stands for harvest, or stands that were established by Millar Western in areas it harvested.

According to growth-model projections, Millar Western's reforestation efforts have produced faster growing, higher volume forests, when compared to forests that regenerated naturally. These findings are supported by surveys required by the Reforestation Standard of Alberta (RSA), a provincial regulation. In addition, Millar Western has sampled a population of older regenerated stands, 20 to 40 years of age (juvenile stands), which also validated the growth projections. It will be important to continue to monitor the growth of stands beyond the RSA survey, to ensure volume and piece-size targets are being met and the AAC remains sustainable.

4.7 Wetlands

In Alberta, wetland conservation is becoming part of the legal, certification, and social license obligations that forest companies must meet. The Alberta Wetland Policy (Government of Alberta, 2013), which applies to all wetlands in Alberta, came into effect in the "White Area" of the province on June 1, 2015, and in the "Green Area" on July 4, 2016. Under this policy, impacts on wetlands must be avoided where possible; where avoidance is not possible, impacts must be minimized by demonstrating improved practices to support the intent of the policy (e.g. implementing best management practices).

In addition to greater government requirements for wetlands management, the Sustainable Forestry Initiative (SFI), to which Millar Western is certified, revised its forest management standard in 2015 to address wetlands. This new standard (SFI 2015-2019) now includes wetlands within Principle 3 (Protection of Water Resources) and Objective 3 (Protection and Maintenance of Water Resources). To conform to this standard, forest companies must develop a program that addresses the management and protection of wetlands during all stages of management, to maintain water reach, flow, and quality. This program must include wetland mapping.

By incorporating an assessment of wetlands within the DFMP and engaging with Ducks Unlimited Canada (DUC) to identify and implement best management practices for wetlands, Millar Western will be well positioned to address requirements of both the Alberta Wetland Policy and SFI's forest management standard. More descriptive information about wetlands and waterfowl within the DFMP area can be found in Chapter 3; more information about the Millar Western's collaborative work with DUC can be found in Chapter 7.

4.8 Climate Change

Assessing the influence of global climate change on forest landscapes involves complex questions surrounding the dynamics of forest productivity. Many biotic and abiotic factors, as well as ecological and geographical considerations, need to be taken into account, making it difficult to predict outcomes with any degree of certainty and to therefore develop effective adaptation strategies.

Without clear evidence as to how climate change will affect the DFMP area, Millar Western will commit to following emerging research and responding as necessary. In the meantime, Millar Western will continue to work to reduce greenhouse gas emissions that are the cause of a warming planet. It has, in recent years, undertaken several projects at its Whitecourt pulp mill that, between 2005 and 2016, have cut emissions by a total of 592,948 tonnes of CO2e (Alberta Carbon Registries). As a member of the Forest Products Association of Canada (FPAC), Millar Westerns subscribes to the "30 by 30" Climate Change Challenge, which seeks to lower forest sector carbon emissions in Canada by 30 MT, by 2030 (FPAC News release, May 2, 2016). To achieve this target, the industry will employ a number of measures, including maximizing the carbon storage potential of forests through intensive management practices, encouraging greater use of carbon-storing wood products, and developing wood-based alternatives for materials made from fossil fuels.

4.9 Migratory Birds

Most bird species in Canada are protected under the Migratory Birds Convention Act (MBCA). The MBCA was passed in 1917, to implement the Migratory Birds Convention, a treaty signed with the United States in 1916. The MBCA, which was updated in 1994 and 2005, gives the federal government authority to pass and enforce regulations to protect those species of birds that are included in the convention

The MBCA and its regulations prohibit the disturbance or destruction of migratory birds, nests and eggs in Canada, including damage inadvertently caused by industrial activity, including harvesting. Known as incidental take, these unintentional actions can not only affect individual birds, nests or eggs, but can have long-term negative consequences on migratory bird populations in Canada, especially when cumulative incidents are considered.

To minimize the possibility or frequency of incidental take, Millar Western will be working with other forest companies in Alberta to develop a migratory bird risk ranking matrix for all forest stands in Alberta, as well as a guidance document that will include beneficial management practices for forest-dwelling migratory birds. More information on this initiative can be found in Chapter 7.

5. References

Environment Canada. 2012. Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

Government of Alberta. 2013. Alberta Wetland Policy. Alberta Environment and Sustainable Resource Development. Edmonton, Alberta. 26pp.

Sustainable Forestry Initiative. 2015. SFI 2015 – 2019 Forest Management Standard. Washington, DC. 13pp.

APPENDIX I – Wetland Conservation

Although their extent and purpose are poorly understood, wetlands, which are prevalent across the western boreal forest, are an important habitat on Millar Western's FMA. Wetlands, including shallow open water, marshes, swamps, fens and bogs, are an integral component of forest ecosystems and thus play a role in sustainable forest management. Wetlands are important landscape features and provide ecological, social, and economic benefits: they provide habitat for many plants and animals, some of which are rare and/or at risk species; they sequester and store atmospheric carbon; and they contribute to annual water budgets helping regulate surface and subsurface water supplies and flow.

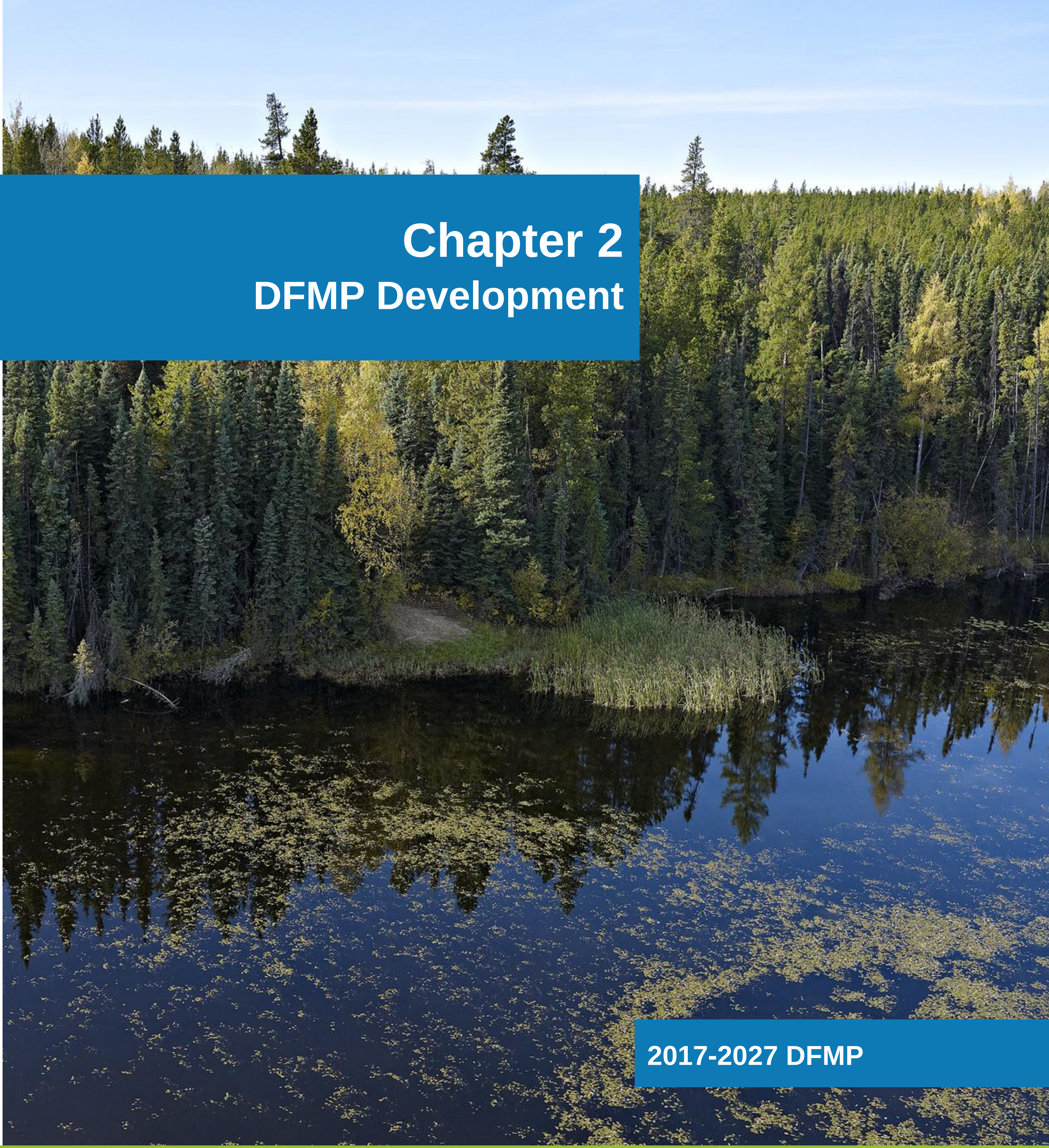
Research shows that wetland and forest functions can be interdependent, and thus healthy wetlands and healthy forests work together to create functioning forest ecosystems. Sustainable forest management is therefore key to having sustainable wetland habitats, and diverse, abundant and functioning wetlands are key to achieving diverse, abundant and healthy forests. Wetlands and forest management activities intersect in a number of ways. For example, from a forest management perspective, wetlands can impact infrastructure construction (e.g., roads) and maintenance costs, and worker and public safety. Increasingly wetland conservation is or is becoming part of legal, certification, and social license obligations. From a wetland conservation perspective, forest management activities have the potential to affect wetland quality, wetland quantity, and wetland/watershed hydrology throughout the landscape.

Sustainable forest management and sustaining wetland habitats are intertwined and achievable. Millar Western is working with Ducks Unlimited Canada (DUC) to integrate wetland and waterfowl conservation into its forest management planning and operations. In 2016, Millar Western began working with DUC and a coalition of forest industry partners to conserve wetlands and waterfowl habitat through a Forest Management and Wetland Stewardship Initiative (FMWSI). The FMWSI will provide guiding principles for strategic planning considerations in wetland environments, best management practices for planning and operating practices when working in or near wetlands, as well as best management practices that assess and reduce the risk of incidental take of waterfowl as a result of forest operations. Millar Western will continue working with DUC on this and other projects through the life of this DFMP.

More information about wetlands and waterfowl within the DFMP can be found in Chapter 3 and more information about the Millar Western and DUCs current and upcoming collaborative work to conserve wetlands and waterfowl can be found in Chapter 7.

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

\\silver\clients\MWFP\Projects\P755_DFMP\Ch1_Overview\Ch1_Overview_20170901_Submit.docx



Chapter 2
DFMP Development

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

List of Tables

List of Figures

1. Overview

Millar Western's 2017-2027 Detailed Forest Management Plan (DFMP) was developed over a three-year period, beginning in 2014 and ending with the submission of the plan to the Government of Alberta (GoA) in March 2017. Building on previous DFMP development processes, Millar Western involved a wide range of stakeholders and specialists, to build a plan that meets the requirements of the Alberta Forest Management Planning Standard (Version 4.1 – April 2006) and the Sustainable Forest Initiative (SFI) standard for sustainable forest management, to which the company is certified. The outcome is a comprehensive plan that will direct the company's long-term strategic forest management activities for the next 10 years, or until replaced by a new DFMP.

This chapter outlines the process for developing the 2017-2027 DFMP, focusing on the approach, the plan development team (PDT), key milestones, and public and First Nations communications and consultations. It is not intended to provide a detailed account of all the tasks involved in the plan's development but, rather, a general description, with more detailed information provided in subsequent chapters, annexes and appendices.

2. Plan Development Process

The development of the DFMP was guided by processes outlined in the 2017-2027 DFMP Terms of Reference (ToR). Millar Western assembled a Plan Development Team (PDT), consisting of GoA and Millar Western representatives, quota holders and technical consultants, to lead and manage the project. Regular PDT meetings served as the main venue for discussing status, resolving issues and providing direction. Additional details are available in Section 5 and Appendix I - PDT Meeting Summary.

A Technical Team (TT) consisting of Millar Western staff and technical experts was formed to support the PDT by addressing more complex and often highly detailed issues that required specialized professional input. TT outcomes were shared with the PDT for discussion and decision, and, as well, to ensure that the plan was advancing from a common knowledge base.

In addition to the PDT and TT processes, public and First Nations communications and consultation processes were implemented, to seek stakeholder input. Findings from this outreach were also provided to the PDT, to make certain that all stakeholder views were understood and considered in plan development. More details can be found in Sections 6 and 7.

2.1 Project Management

A key element of the GoA's process for managing timber resources is to require FMA holders to develop DFMPs, usually at 10-year intervals. Though forest companies are obligated to develop multi-level, comprehensive plans that define sustainable forest management activities on the land base, the GoA is ultimately responsible for setting management parameters and deciding what is acceptable in terms of the nature and extent of resource development within Crown forests.

Within this framework, Millar Western formally began the DFMP development process by establishing a Terms of Reference (ToR), to define roles and responsibilities and guide project management. Anticipating that decision-making would not always be unanimous or straight forward, a clear and effective process was established for achieving agreement, to ensure that the DFMP progressed in a timely, efficient manner. The company also sought to involve, to the greatest extent possible, the many stakeholders and interest groups that are affected by forest management activities in the DFMP area.

This was partially achieved by forming a diverse PDT that included representation from Millar Western, the GoA and quota holders; extensive public and First Nations consultation programs were developed to include other interests. A Technical Team (TT) was also created, to provide expert advice on technical issues. The Edmonton-based, independent consultancy firm FORCORP was engaged to facilitate the process, provide technical support and analysis, and assist in the development of plan components.

As outlined in the ToR, the PDT adopted an open and transparent decision-making process that involved progressive review of plan components, culminating with consensus agreement. As issues were identified, the PDT and TT discussed resolution approaches, undertook the necessary analysis, and reviewed options before unanimously accepting the preferred path forward. As they were finalized, critical plan components were submitted to the GoA, for Agreement in Principle (A-I-P). Though it did not constitute final approval, A-I-P provided assurance that the GoA was supportive of basic concepts and direction.

The outcome of these efforts is a scientifically sound, long-term strategic plan that upholds the principles of sustainable forest management and reflects the views and expertise of a wide range of professionals. The plan was further enriched by seeking the input of external stakeholders and First Nations, to ensure that regional perspectives were heard and incorporated. This approach broadened the DFMP's values and objectives, as well as plan ownership.

2.2 Information Management

DFMP development is a long and complex process, involving numerous parties. To ensure the project progresses in a timely manner, it is essential that mechanisms be established for the efficient management of issues and decisions.

As its information management tool, Millar Western utilized eTracker, an online web-based project management system hosted by FORCORP. eTracker was used to effectively manage each step of the DFMP process-related activities, including the following:

- Assign project tasks to team members and monitor their progress;
- Post issues and decisions for review and tracking throughout the project process;
- Tag items such as tasks and issues, to allow for filtering and reporting capabilities;
- Enable team members to comment on tasks and issues, and allow for discussions, including progress reports, to be captured; and
- Enable Millar Western to monitor the overall progress of the project.

New requirements and products were also incorporated into the development of the DFMP, for example, ARIS reconciliation and the GoA's wildlife models. As with most products being utilized for the first time, several iterations were required before achieving an acceptable result. The early establishment of a transparent and cooperative plan development process assisted with reaching consensus resolutions.

Also utilized in this DFMP were GoA models and tools to incorporate non-timber assessments (NTA). These models and tools predicted habitat impacts for selected species, including birds (neo-tropical migrants and year-round residents) and marten. This information, together with the GoA's processes for assessing impacts and providing recommendations, enabled the PDT to develop thresholds and better address NTAs in the Preferred Forest Management Strategy (PFMS). These new models, tools and processes, which were integrated and managed through the PDT, not only strengthened the plan but expanded the number of values that were considered.

3. DFMP Components

As described in this section, the process of building a DFMP in Alberta involves a number of steps, including development of guidance documents, such as the 2017-2027 DFMP ToR; identification of forest values; collection and analysis of data, such as a new Alberta Vegetation Inventory (AVI); and forecasting future timber availability, to determine annual timber allocations to forest companies. Following is a description of the measures taken to ensure the DFMP is accurate and thorough, and complies with prevailing legislation and standards.

3.1 Terms of Reference (ToR)

The purpose of the ToR for Millar Western's 2017-2027 DFMP was to guide the DFMP development project. The ToR adheres to the requirements of the *Alberta Forest Management Planning Standard Version 4.1, April 2006*, to ensure compliance with government expectations, and also takes into account Millar Western's own policies and procedures. As well as establishing a structure for the DFMP development process and identifying deliverables, it sets forth the schedule for plan development, review, and approval, and specifies the range of considerations and issues to be addressed during the process.

The ToR was developed over a two-and-a-half-year period, beginning in the summer of 2012; it was submitted to the GoA on December 15, 2014, and received approval on December 18, 2014.

The ToR was followed and largely executed as envisioned. Planned timelines were somewhat delayed due to unanticipated complexity of Alberta Regeneration Information System (ARIS) reconciliation and Non-Timber Assessment (NTA) analysis.

3.2 Completion and Approval of new AVI

Millar Western completed a new AVI dataset for the 2017-2027 DFMP, replacing the former AVI that was derived from aerial photography gathered between 1994 and 1997. The GoA finalized a dataset audit and approved the AVI for use in forest management and operational planning in January 2015. The

AVI dataset exceeded the current requirements of the AVI standard 2.1.1 by including the following additional fields: density, crown closure, moisture regime, nutrient regime, mapcode/ecosite, and canopy pattern.

This dataset was based on colour imagery collected in 2010, 2011 and 2012. Light Detection and Ranging (LiDAR) data, which was collected by GoA over 2005, 2006 and 2007, were also used as part of the interpretation of the AVI dataset.

Creation of the AVI dataset included photo interpretation, as well as a program for field calibration and validation. Audits were conducted by Millar Western and the GoA, to ascertain quality.

3.3 Volume Sampling Plan

The Millar Western volume sampling plan was developed in cooperation with the GoA and included the following objectives:

- establish new temporary sampling plots (TSP) as required, to characterize yield projection strata as classified by the new AVI;
- ensure appropriate data are collected to support GYPSY modeling anticipated for yield curve development;
- provide data to inform any future decision to potentially aggregate the conifer leading mixedwoods (CD) and deciduous leading mixedwoods (DC) strata for yield projection; and
- focus on the regenerating landbase because of its importance in supporting future allowable cut levels.

The volume sampling programs for W11 and W13, natural and managed stands, were submitted on the following dates: July 4, 2014; January 8, 2015; and July 2, 2015; they received A-I-P effective on August 13, 2014, April 24, 2015 and August 27, 2015, respectively.

3.4 DFMP Development Communication Plans

Millar Western drafted two plans (*Annex II – DFMP Communication & Consultation Plans*), to guide communication and consultation during the DFMP development process; one was aimed at the PDT and public, while the other outlined the engagement process for First Nations.

3.4.1 PDT and Public Communications

The Communication and Public Participation Plan (January 2015) addressed both internal communications (*i.e.* within the PDT) and external communications (*i.e.* outside the PDT). It outlined the strategies and tools to be used to manage the flow of information within the PDT and to engage with external stakeholders (*e.g.* local community residents, recreational and traditional users of the forest, non-government and special interest group representatives and the general public) in the DFMP development process. Among the tactics used to encourage input were open houses, Public Advisory Committee (PAC) presentations and discussions, website postings, DFMP newsletters, mail outs, radio and newspaper advertisements, and news releases. Communications and public participation process efforts and results are summarized in *Appendix II – DFMP Communications and Public Participation Summary.*

3.4.2 First Nations Communications

The First Nations Consultation Plan (February 2015) outlined the initiatives that would be undertaken to seek input from the eight First Nations identified by the GoA as having a stake in the development of the 2017-2027 DFMP. The goal was to reach out to the First Nations at two junctures in plan development: before finalization of the VOITs (see 3.6) and the spatial harvest sequence (SHS). The plan was designed to comply with the GoA's Policy on Consultation with First Nations on Land and Natural Resources Management and accompanying guidelines, to ensure First Nations consultation met regulatory requirements. As well as identifying tools and tactics, it outlined schedules, roles and responsibilities and identified available resources.

3.5 Forest Landscape Assessment

The Forest Landscape Assessment is a description of the existing administrative boundaries, physical conditions (*e.g.* landscape pattern, structure, disturbance and succession), and land use within the Millar Western DFMP area. The information, which was derived from data used to create the Regional Forest Landscape Assessment Report for the GoA (current to December 2012) and Millar Western's new AVI data, was assembled to promote a better understanding of the landscape's attributes and implications for resource development. On January 20, 2016, the assessment was submitted to the GoA for A-I-P, which was granted on March 16, 2016. Subsequent to the A-I-P, Millar Western integrated additional information about wetlands and waterfowl, provided by Ducks Unlimited Canada, into the assessment; A-I-P was not sought for this supplemental information.

3.6 Values, Objectives, Indicators and Targets (VOITs)

The GoA has developed a set of goals, known as Values, Objectives, Indicators and Targets (VOITs), to guide companies in achieving sustainable forest management on the landscape. In addition to government established VOITs, forest companies can, with government approval, create new VOITs based on internal objectives or in response to stakeholder input. Millar Western's approach to VOIT development was to consult with stakeholders and First Nations on the initial set of GoA VOITs, to identify any gaps. The PDT then undertook further review and modified the list as necessary. The PDT accepted the VOITs at PDT meeting #9 on November 27, 2015, with the GoA granting A-I-P on March 2, 2016. Two additional First Nation VOITs were added after the A-I-P and accepted by the PDT in June 2016. The final complete set of VOITs, with all of the targets populated, is included in the DFMP submission (*Chapter 5 - VOITs*) and will be further reviewed by the GoA as part of the approval process.

3.7 Net Landbase

The net landbase (landbase or NLB) classifies the Millar Western DFMP area into lands that are either eligible (*i.e.* the active or managed landbase) or ineligible for timber harvesting (*i.e.* the passive or non-managed landbase). Stands in the landbase are classified according to the strata categories that will be used to track growth-and-yield forecasts for the duration of the DFMP period.

Development of the landbase commenced in early spring of 2015. The first phases of landbase development included reconciliation of the cutblock and Alberta Regeneration Information System (ARIS) data with the new AVI. A new requirement for this DFMP, the reconciliation posed unique challenges for both the GoA and Millar Western, as datasets required to complete the matching and reconciliation process, especially for the older cutblocks, were not always readily available. Considerable effort was expended in attempting to identify challenges and potential solutions, which led to development of an issue summary document, the Regenerated Landbase Issue Summary. It was initially submitted for A-I-P in January 2016, and resubmitted on March 11, 2016, after some minor revision. The document received A-I-P from the GoA on April 15, 2016.

On May 12, 2016, representatives from Millar Western and FORCORP presented the classified landbase and the associated documentation to the GoA – a requirement of the landbase submission process. The landbase was submitted to the GoA on May 18, 2016, and A-I-P was granted by the GoA on July 15, 2016. *Annex VIII – Landbase Development Document* provides detailed documentation of the datasets used to generate the landbase and describes how the datasets were processed to prepare them for the netdown process. It also describes the business rules applied to the amalgamated landbase, to classify and stratify it for the purposes of DFMP development.

3.8 Yield Curves

Timber-volume yield curves predict the merchantable timber volumes available for harvest as the stand ages. Millar Western developed new timber-volume yield curves for its DFMP area, which were applied to the Timber Supply Analysis (TSA) component of the 2017-2027 DFMP. Stratification was based on Millar Western's nine base-yield strata (the Millar Western yield strata are a modification of the Alberta base 10 yield strata, excluding the Douglas fir pure or leading stratum, which is not present in the DFMP area). These strata were assigned through the net landbase development process using either AVI attributes for natural stands or a combination of silviculture declaration, treatment information, and Reforestation Standard of Alberta (RSA) performance survey data for managed stands. The yield curves were derived from information collected in temporary sample plots (TSP), permanent sample plots (PSP), and RSA performance survey programs across the DFMP area.

Gross merchantable tree-length volumes were compiled to the following utilization standard: a 10-cm top diameter, inside bark, and 15-cm stump diameter, outside bark (stump height at 15 cm, using a 4.88-m minimum merchantable tree length for both coniferous and deciduous species groups). Cull was accounted for in the TSA process.

Millar Western identified three categories for yield curves:

- **Natural stands (NAT)**: includes all fire-origin stands. Yield curves were based on TSP and PSP data projected using the GoA's Growth and Yield Projection System (GYPSY) growth model. Strata assignment was based on AVI attributes.
- **Pre-1991 managed stands (M91)**: represents the population of managed stands harvested before March 1, 1991. Yield curves were derived from TSP and PSP data projected using GYPSY. Strata assignment was based on the AVI attributes.
- **Post-1991 managed stands (MGD)**: represents the population of managed stands that were harvested on or after March 1, 1991. Yield curves were derived from RSA performance survey data and PSP data projected using GYPSY. Strata were assigned using RSA sampling units and AVI reconciled with ARIS.

The growth and yield analysis was submitted for A-I-P on June 10, 2016; A-I-P for the yield curves was granted by the GoA on August 19, 2016.

Annex V – Growth and Yield provides detailed documentation on the development of the yield curves, including the input datasets and models used, the yield curve categories, and the actual yield curves themselves.

3.9 Road Corridor Plan

In order to develop a road corridor plan for the DFMP area, a review of current access was undertaken, to identify areas that will require new permanent access. This evaluation identified that the majority of the SHS was within 5 km of permanent road dispositions (DLOs or LOCs) and therefore could be accessed by temporary roads. As a result, there were only two road corridors that were identified for future development. These roads have been incorporated into the Access Plan, which can be found in *Chapter 7 - Implementation*.

3.10 Preferred Forest Management Scenario (PFMS)

The PFMS describes the strategic direction and outcome of forest management activities over 200 years, with a focus on the first twenty years. A spatial modeling (forecasting) process with feedback loops was used to provide information to Millar Western, the quota holders, and the GoA, to assess the implications of management activities over the long-term. This process included a timber supply analysis (TSA) that determined harvest levels and a spatial allocation of harvestable stands for each operator. Once approved by the GoA, these harvest levels will become the annual allowable cuts (AACs) for the 10-year DFMP period, *i.e.* the timber years 2017-18 to 2026-27.

The PFMS was developed over a 6-month period, beginning in July 2016, and included the trade-offs between timber and non-timber values, as well as input received from the consultation process. It was presented to Millar Western's Public Advisory Committee (PAC) on October 4, 2016, where it was approved unanimously. A public open house was held in Whitecourt on October 5, 2016, to share the PFMS with interested stakeholders. The PFMS was also posted on the virtual open house on the company's website. It was accepted by the PDT on December 1, 2016, and submitted as part of the DFMP.

3.11 Spatial Harvest Sequence (SHS)

The spatial harvest sequence (SHS) was developed as part of the PFMS and identifies the forest stands planned for harvest during the first two, 10-year periods of the 2017 DFMP (2017-2018 to 2026-2027 and 2027-28 to 2036-37 timber years). All operators in the DFMP area must use the SHS polygons to create their forest harvest plans (FHPs), which are maps and associated reports describing the harvest plan layouts. These FHPs are then included as part of a series of components that make up the annual operating plan (AOP), which authorizes harvest activities for each operator upon GoA approval.

Millar Western developed an initial SHS in July 2016, which Millar Western and the quota holders refined over the following months. The review process included both field verification and modifications to the modeling assumptions to better align with management objectives. Once complete, the SHS was posted on the virtual open house and its availability promoted through advertisements in surrounding communities. It was also shared with First Nations communities.

3.12 Silviculture

Millar Western employs generic establishment regimes (GERs) to guide its silvicultural practices. GERs are silviculture prescriptions designed to ensure that the growth and yield targets in the Regeneration Standards of Alberta (RSA) and the applicable DFMP are realized in the field.

Generic establishment regimes are drawn from operational practice – in effect, they capture the current silviculture practices of Millar Western. Since they were derived from practice, it is reasonable to assume they will attain the desired growth and yield outcomes and that the timelines associated with the GERs are operationally sound.

A detailed summary of the GER's and their associated prescriptions is included in Chapter 7.

3.13 Growth and Yield Program

The Growth and Yield Program identifies data collection commitments for the following:

1) **Growth Model Development:** Data are required for improvements to growth models, which are used primarily for development of yield estimates in support of forest management planning and for evaluating performance survey results under the Reforestation Standard of Alberta (RSA).
2) **Yield Estimation:** Development of yield estimates for FMPs includes use of data for growth model initiation, calibration or localization of yield estimates, and validation of estimated yields. New data must be collected during each planning cycle to support new inventories and to ensure yield estimates remain current.
3) **Growth and Yield Monitoring:** Monitoring is required to evaluate whether yield assumptions underlying the AAC are being achieved. In cases where growth trajectories are not well supported by long-term data (e.g. managed stands), monitoring of growth is required to confirm accuracy of projections.

3.14 Non-Timber Assessments (NTA)

Assessments of non-timber values, including values related to wildlife habitat, were conducted in the development of the PFMS, using fine- and coarse-filter approaches. This analysis was undertaken using models that were developed by the GoA, to support the DFMP process. As the first company to incorporate the models into its DFMP process, Millar Western worked closely with the GoA, to further refine them before applying to the TSA process. The models included targets and thresholds for the following wildlife species:

- grizzly bear;
- American marten;
- barred owl; and

- songbirds (*i.e.* black throated green warbler, Canadian warbler, brown creeper, bay-breasted warbler, and ovenbird).

In addition, peak stream flow was modeled using the GoA Equivalent Clearcut Area (ECA) tool. Fish species (*i.e.* rainbow trout, arctic grayling, and bull trout) were also addressed through the ECA model and operational guidelines.

Supporting the GoA's NTA tools, coarse filter approaches consisting of seral-stage and patch-size targets were applied in the TSA and operational adjustments to the SHS.

Fine- and coarse- filter approaches and strategies for implementation are discussed in detail in *Chapter 6 – PFMS* and *Chapter 7 - Implementation.*

3.15 Review and Submission of the DFMP

The DFMP underwent several stages of review, including internal reviews by Millar Western and the PDT. In March 2017, Millar Western submitted the completed DFMP to the GoA, for approval.

4. Milestones

At the start of the DFMP development process, the PDT identified a number of key milestones and set target completion dates for each, as a way of monitoring progress and ensuring the project remained on schedule. Table 2-1 compares the target dates against the actual date of task completion.

Table 2-1. Summary of project milestones and associated dates

DFMP Component	Anticipated Completion (ToR)	Actual Completion
Terms of Reference approval	December 2014	December 2014
AVI approval	December 2014	January 2015
Public Participation Plan approval	February 2015	January 2015
Aboriginal Consultation Plan approval	February 2015	February 2015
Natural Stands Volume Sampling Plan A-I-P	-	April 2015
Volume Sampling Plan approval	February 2015	October 2015
Hydrology Layer A-I-P	-	November 2015
Natural Range of Variation A-I-P	-	February 2015
VOIT A-I-P	June 2015	March 2016
Landscape Assessment Chapter A-I-P	-	March 2016
Height Genetic Gains Approval	-	March 2016
Regenerated Landbase Issue Summary A-I-P	-	April 2016
Transition Matrix A-I-P	-	June 2016
Classified Landbase A-I-P	May 2016	July 2016
Yield Curve A-I-P	May 2016	June 2016
Completion of SHS reviews	October 2016	January 2017
Completion of non-timber condition assessments	October 2016	January 2017
Structure Retention Strategy A-I-P	-	January 2017
PDT review of draft DFMP	November 2016	December 2016
Submission of DFMP	December 2016	March 2017
DFMP approval	May 2017	-

5. Plan Development Team

Forest management activities can impact a wide range of stakeholders, while management decisions can have broad ecological, economic and social implications. For these reasons, DFMP development is typically led by a diverse, multi-stakeholder group. For its DFMP, Millar Western formed a Plan Development Team (PDT) that consisted of representatives from Millar Western, several departments of the GoA, other forest companies operating on the DFMP area, as well as forestry consultants with expertise in strategic planning. The PDT was the primary mechanism for stakeholder and regulator integration, and served as a vehicle to address impacts of forest management planning on a range of values across the DFMP area. The PDT was assembled for its first meeting on January 23, 2015, and was disbanded in December 2016, after review of the draft DFMP.

The objectives of the PDT were to:

- Define the direction and scope of the DFMP;
- Guide the DFMP process;
- Advise members on the suitability of different forest management practices in meeting company and government expectations, policies and legislation;
- Identify and resolve issues;
- Coordinate the actions and involvement of others;
- Coordinate the gathering, interpretation, and flow of information (both technical and non-technical) among team members; and
- Coordinate the progressive development and review of plan components and the A-I-P recommendations.

5.1 Plan Development Team Members

In assembling a PDT for the 2017-2027 DFMP, Millar Western sought a comprehensive roster of practitioners, in keeping with its multi-disciplinary approach to planning. PDT membership expanded, over the course of the DFMP development period, to ensure the appropriate expertise was available to address specific or emerging issues. The complete list of members is provided in Table 2-2 below.

Table 2-2. PDT members and affiliations

Name	Affiliation[1]	Role/Responsibility
Bob Mason	Millar Western Forest Products	Chair
Tim McCready	Millar Western Forest Products	Forest Renewal Coordinator
Ken Anderson	Millar Western Forest Products	Planning and Operations Coordinator
Louise Riopel	Millar Western Forest Products	Communications and Consultation Coordinator
Riley Sheehan	Millar Western Forest Products	MWFP Representative
David Wall	Millar Western Forest Products	Director of Fibre Resources
Seena Handel	Government of Alberta - AgFor	GoA Planning Lead, Forest Resource Management Lead, Forest Resource Management Section
Janis Braze	Government of Alberta - AgFor	Section Head, Forest Resource Planning, Forest Resource Management Section
Robert Popowich	Government of Alberta - AgFor	Director, Forest Resource Management Section
Alanda Skrzekowski	Government of Alberta - AgFor	GoA Area Forester, Regional Integrated Approvals
Allison Brown	Government of Alberta - AgFor	GoA Area Forester, Regional Integrated Approvals
Cosmin Tansanu	Government of Alberta - AgFor	Analysis Forester, Forest Resource Analysis Section
Greg Greidanus	Government of Alberta - AgFor	Senior Resource Analyst, Forest Resource Analysis Section
Wayne Johnson	Government of Alberta - AgFor	Senior Forester, Regional Integrated Approvals
Myles Brown	Government of Alberta - Environ. & Parks	Senior Fisheries Biologist, Regional Resource Management
Fauve Blanchard	Government of Alberta - Environ. & Parks	Wildlife Biologist, Regional Resource Management
Marcel Macullo	Government of Alberta - Environ. & Parks	Senior Fisheries Biologist, Regional Resource Management
John Stadt	Government of Alberta – AgFor	Province Forest Ecologist, Forest Program Management Section
Marty O'Byrne	Government of Alberta – AgFor	Senior Forester Silviculture Practice, Forest Program Management Section
Ed Trenchard	Government of Alberta – AgFor	Wildfire Management Specialist
Cassandra Roberge	Government of Alberta – AgFor	Reforestation Data Lead
John Diiwu	Government of Alberta – AgFor	Forest Hydrology Specialist
Colton Briggs	Government of Alberta - Environ. & Parks	Forest Health Officer, Regional Resource

Name	Affiliation[1]	Role/Responsibility
		Management
Paul Scott	Weyerhaeuser	Quota holder representative
Kerri Mackay	Weyerhaeuser	Quota holder representative
Perm Sieusahai	Spruceland	Quota holder representative
Ernie Properzi	Spruceland	Quota holder representative
Ted Gooding	FORCORP	Lead Consultant, Project Management
Becky Doherty	FORCORP	Consultant, Geospatial Analyst, Project Management
Bob Christian	FORCORP	Consultant, Senior TSA Analyst
Nicole Luchanski	FORCORP	Consultant, Resource Analyst
Yanguo Qin	FORCORP	Consultant, G&Y Analyst
David Campbell	FORCORP	Consultant, TSA Analyst

[1]AgFor: Agriculture and Forestry; Environ. & Parks: Environment and Parks

5.2 Meeting Schedule

PDT meetings were held on a regular basis, approximately once monthly. Below in Table 2-3 is a list of all the PDT meetings that were held and their location. Summaries of each meeting are provided in *Appendix 1 - PDT Meeting Summary*.

Table 2-3. Schedule of PDT meetings

PDT Meeting	Date	Time	Location
PDT Meeting #1	January 23, 2015	9:30 AM to 2:00 PM	FORCORP, Edmonton
PDT Meeting #2	February 23, 2015	9:30 AM to 3:00 PM	FORCORP, Edmonton
PDT Meeting #3	March 27, 2015	9:30 AM to 3:30 PM	FORCORP, Edmonton
PDT Meeting #4	April 24, 2015	9:30 AM to 3:30 PM	FORCORP, Edmonton
PDT Meeting #5	June 5, 2015	9:30 AM to 3:30 PM	Millar Western, Whitecourt
PDT Meeting #6	June 29, 2015	9:30 AM to 1:30 PM	FORCORP, Edmonton
PDT Meeting #7	August 28, 2015	9:30 AM to 3:30 PM	FORCORP, Edmonton
PDT Meeting #8	October 16, 2015	9:30 AM to 3:00 PM	FORCORP, Edmonton
PDT Meeting #9	November 27, 2015	9:30 AM to 3:30 PM	FORCORP, Edmonton
PDT Meeting #10	January 15, 2016	9:30 AM to 2:00 PM	FORCORP, Edmonton
PDT Meeting #11	February 19, 2016	9:30 AM to 3:00 PM	FORCORP, Edmonton
PDT Meeting #12	March 18, 2016	9:30 AM to 1:30 PM	FORCORP, Edmonton
PDT Meeting #13	April 22, 2016	9:30 AM to 3:30 PM	FORCORP, Edmonton
PDT Meeting #14	May 27, 2016	9:30 AM to 2:30 PM	FORCORP, Edmonton
PDT Meeting #15	June 22, 2016	9:30 AM to 2:30 PM	FORCORP, Edmonton
PDT Meeting #16	September 16, 2016	9:30 AM to 3:00 PM	FORCORP, Edmonton
PDT Meeting #17	October 20, 2016	9:30 AM to 3:30 PM	FORCORP, Edmonton
PDT Meeting #18	December 1, 2016	9:30 AM to 1:30 PM	FORCORP, Edmonton

5.3 Issues and Decisions

A main function of the PDT was to identify and resolve issues. As issues arose, issue documents were created, which provided a summary of the issue and recommended solutions. Issue documents were presented and reviewed at PDT meetings, with decisions arrived at by consensus. In some instances, Millar Western sought clarity and direction, either from the GoA or quota holders, to aid in the decision-making process, Table 2-4 summarizes these documents.

Table 2-4. Summary of issues and decisions/agreements in PDT

Issue Document Description	Initial Date Presented	Date of PDT Decision/Agreement
Landbase Issue Documents		
Values, Objective, Indicators, Targets (VOITs)	2/23/2015	1/15/2016
FRIAA ARIS Submission Issue Document	4/24/2015	6/29/2015
Data Reconciliation Process and Issues (Cutblocks, ARIS, RSA)	4/24/2015	8/28/2015
ARIS Area Reconciliation	8/28/2015	11/27/2015
Digital Integrated Dispositions (DIDS) as deletions in LB	8/28/2015	11/10/2015
Non Cutblock - CC Records	8/28/2015	10/16/2015
DIDs Refinement compared to AVI	10/16/2015	8/28/2015
ARIS Reconciliation Process	10/16/2015	10/16/2015
Hydrology Dataset for use in LB	10/16/2015	10/16/2015
Seismic Lines	10/16/2015	10/16/2015
RSA Data and Linework Issues	10/16/2015	11/26/2015
SHS Deferrals and Deletions	10/16/2015	4/22/2016
Cross FMA/FMU Boundary Cutblocks	11/27/2015	12/4/2016
Orphan Cutblocks without a matching opening number	11/27/2015	11/26/2015
Cutblock Progress Summary	11/27/2015	11/26/2015
Regenerated Landbase Issue Summary	1/15/2016	3/18/2016
Birch deletions in the landbase	1/15/2016	4/22/2016
RSA Data Process	3/18/2016	4/22/2016
Structure Retention	4/22/2016	4/22/2016
Caribou Range Extent	6/22/2016	6/22/2016
Growth and Yield Issue Documents		
Managed Yield Curve Development	1/15/2016	4/22/2016
Natural Stand Yield Curve Development	1/15/2016	4/22/2016
Natural Stand Yield Curves	3/18/2016	5/27/2016
Managed Stand Yield Curves	3/18/2016	5/27/2016
Timber Supply Issue Documents		
Spruceland Carryover Request	4/24/2015	
Transition Matrix	6/5/2015	4/22/2016
Wildlife Modeling Initial results	2/19/2016	6/22/2016
Seral Stage and Patches	6/22/2016	
NRV Application	1/15/2016	3/18/2016
Minimum Harvest Age	9/16/2016	12/1/2016
ECA	9/16/2016	12/1/2016

6. Public Participation Process

In keeping with its commitment to seek the input of interested parties and develop a DFMP reflective of regional priorities, Millar Western implemented a public participation process, which was executed from 2014 to 2016. The objective was to provide multiple opportunities for stakeholders, including local community residents, recreational and traditional users of the forest resource, non-governmental and special interest groups, and other industrial users, to become involved in plan development and, as well, attain greater understanding of issues related to sustainable forest management.

6.1 Public Advisory Committee

While Millar Western employed various methods to involve the public during the development of the 2017-2027 DFMP, the cornerstone of its public participation program was its Public Advisory Committee (PAC), which was formed in 2007, a commitment of the 2007-2016 DFMP. The Millar Western PAC includes broad stakeholder representation and meets regularly, to review operating and strategic plans and discuss issues relating to forest management, plant operations and the forest products business. GoA representatives and PDT members Wayne Johnson and Allison Brown also attended PAC meetings throughout 2015 and 2016, to observe DFMP-related discussions

PAC members were heavily engaged in the DFMP development process, beginning in October 2014, when they were provided with a detailed overview of the ToR. In addition to offering advice on the public communications and consultation plan (*Annex II – Communications and Consultation Plans*), PAC members agreed to review and approve two key components of the DFMP: the VOITs and the PFMS. In March 2015, Millar Western presented the GoA VOITs and, in May 2015, held an interactive session, where members were asked to identify their own forest values. PAC values were mapped to the GoA VOITs, to determine if the VOITs sufficiently captured the PAC values or if new VOITs would be required. After reviewing the mapping outcomes at the June 2016 meeting, PAC members were satisfied that the VOITs were complete and unanimously approved the VOIT table, without revision.

Project progress updates were provided at all PAC meetings, through to the end of 2016. In April 2016, Millar Western presented the eligibility maps, showing the stands that could be considered for harvesting during the plan period. No issues were identified. More specific harvesting locations were presented on October 2016, as part of the discussion on the Preferred Forest Management Scenario, which was unanimously accepted without revision. A summary of PAC meetings, when they were held, as well as a brief description are provided below in Table 2-5.

Table 2-5. PAC meeting summary

Engagement	Date	Description
PAC Meeting	November 18, 2014	Millar Western presented ToR
PAC Meeting	March 31, 2015	Millar Western presented approved public and First Nation Communication plans, and VOITs
PAC Meeting	May 12, 2015	Reviewed VOITs and important values list from PAC
PAC Meeting	June 16, 2015	Discussed PAC values, VOITs agreed on with no revisions
PAC Field Tour	September 29, 2015	Field tour to demonstrate how PAC values are addressed
PAC Meeting	January 12, 2016	DFMP update, discussion on location/timing/format of DFMP public participation process
PAC Meeting	April 19, 2016	DFMP update, provided eligibility maps
PAC Field Tour	July 6, 2016	Field tour focusing on forest renewal
PAC Meeting	October 4, 2016	Presentation of Preferred Forest Management Scenario
PAC Meeting	March 14, 2017	Provide a DFMP update

In addition to meetings, Millar Western's PAC participated in two DFMP-related field tours, which were organized to give members greater insight into how forest management strategies are executed on the ground. The first of these events, held on September 29, 2015, focused on the values that were raised by PAC. The group travelled to the Virginia Hills compartment, to inspect a culvert replacement and talk about efforts made to protect stream flow and the fishery, and to a cabin belonging to the Trailblazers Snowmobile Club, to discuss recreation and trail management, reclamation, reforestation and block size. Aesthetics and riparian management were the topic of conversation at a stop in the Pass Creek Compartment. The second field tour, which took place July 6, 2016, focused on forest renewal. Participating PAC members travelled to an active planting site and, after an orientation and discussion of regeneration standards, were given the opportunity to meet with tree planters and plant trees of their own. The day also included a visit to a block that was planted the year before, to talk about site preparation techniques and inspect seedling establishment. Both tours were well attended and well received by members, who, in the tour evaluations, said they found them a useful complement to the meeting discussions.

6.2 Broader Public Engagement

Millar Western engaged with the broader public through open houses, both physical (in multiple communities) and virtual (on Millar Western's corporate website). Physical open houses to discuss the VOITs were held on May 6, 7, 13, and 14, 2015, in the communities of Whitecourt, Fox Creek, Swan Hills and Ft. Assiniboine, respectively. At PAC's suggestion, Millar Western held an additional open house at the Whitecourt Trade Show in May 2016, to present and seek input into the eligibility maps. A final physical open house was held in Whitecourt on October 5, 2016, to review the PFMS. All open houses were promoted extensively in surrounding communities, through advertisements in local newspapers, social media (Facebook and Twitter), media releases and the Millar Western website. Despite these efforts, attendance was generally poor, with the exception of the Whitecourt Trade Fair, where 180 visitors completed entry forms for a prize draw; however none indicated that they came specifically to review plans, though some did express an interest in the information made available and engaged in more general discussions on forest management.

In April 2016, Millar Western launched a new corporate website that included a “virtual” DFMP open house (https://millarwestern.com/company/latest-projects/2017-27-detailed-forest-management-plan), giving the public access to all documents made available at the physical open houses as well as other information such as the SHS maps. Coordinates to the virtual open house were included in subsequent advertisements for physical open houses. From the website launch date to December 31, 2016, the DFMP Virtual Open House received 599 page views, according to Google Analytics. As shown in Figure 2-1 below, the two spikes in visits, in April and October 2016, coincided with advertisements for physical open houses.

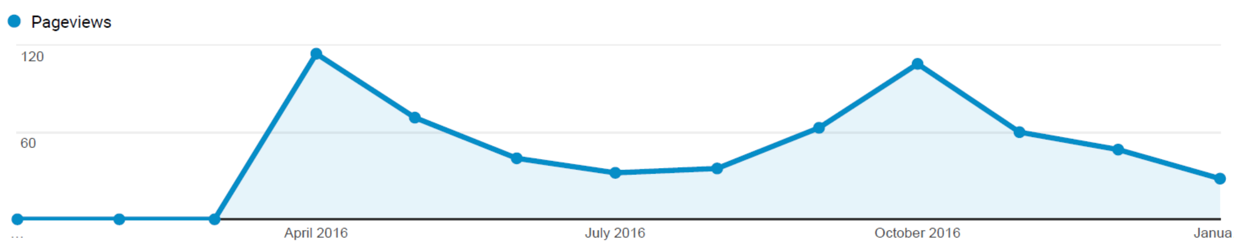


Figure 2-1. Visits to Millar Western's DFMP virtual open house

Millar Western also produced two newsletters, *DFMP Update*, in November 2015 and April 2016, to keep stakeholders informed of the DFMP’s progress. As well as being posted on the virtual open house, the updates were distributed to Millar Western employees, the PAC and the 8 First Nations communities identified in the First Nations Consultation Plan.

As summarized in greater detail in Appendix II - DFMP Communications and Public Participation Summary, Millar Western fully executed all aspects of its communications and consultation plan for the 2017-2027 DFMP (January 2015), and is confident that ample opportunity was provided for stakeholder participation. Table 2-6 details the type of public engagement event and the dates held. Table 2-7 summarizes issues raised through the public engagement events and how Millar Western plans to address them.

Table 2-6. Public engagement events

Engagement	Date	Description
Open House	May 6, 2015	Open house in Whitecourt
Open House	May 7, 2015	Open house in Fox Creek
Open House	May 13, 2015	Open house in Swan Hills
Open House	May 14, 2015	Open house in Fort Assiniboine
DFMP Update	November 1, 2015	Stakeholder progress report
DFMP Update	April 8, 2016	Stakeholder progress report

Engagement	Date	Description
Website Launch	April 21, 2016	Millar Western launched a new corporate website, including a DFMP virtual open house, providing access to a range of DFMP related materials and contact information
Trade Show	May 6-8, 2016	Millar Western participated in Whitecourt and District of Commerce Trade show to consult on DFMP harvest eligibility maps
Open House	October 5, 2016	Open house in Whitecourt, to present the Preferred Forest Management Scenario; information also posted on virtual open house

Table 2-7. Issues raised by the public

Description of Issue	How the Issue was Addressed
May 2016 Open Houses – attendees raised two issues: the desire for healthy moose populations for sustenance and effects of herbicide use on moose populations, and access to the land base for random camping opportunities.	The issue regarding healthy moose populations was discussed at the open house with the concerned individual. Millar Western indicated that the general consensus is that forest operations do not have long-lasting, negative impacts on moose habitat and in fact help create habitat suitable for moose browse. It was acknowledged that herbicide treatments might temporarily limit the utilization of some sites by moose. It was also indicated by Millar Western that the risk for direct toxicity is considered exceedingly low. Regarding concerns related to random camping, Millar Western explained that issues like these are typically addressed during the operational planning stage, and invited the individual to participate in AOP consultation opportunities.
October 2016 Open House – members of the Whitecourt Trailblazers Snowmobile Club attended, to voice concerns about harvesting around snowmobile trails	As the concerns were not related to the DFMP but to the AOP for the current forestry year, club members were referred to Whitecourt planning staff, to discuss and resolve issues.

7. First Nation Consultation

Millar Western takes seriously its responsibility to communicate and consult with First Nations and commits to being clear and transparent about its forest management intentions and to soliciting, listening to and seriously considering the comments and concerns of First Nations in a manner that is in keeping with the company's values of integrity, honesty, trust and respect. To guide its First Nation consultation, Millar Western developed a First Nation Consultation Plan (January 2015). This section discusses plan execution and results.

In total, the GoA Aboriginal Consultation Office identified 8 First Nations that Millar Western needed to consult with respect to the 2017-2027 DFMP: Alexander First Nation, Alexis Nakota Sioux Nation, Kapawe'no First Nation, Sturgeon Lake Cree Nation, Driftpile First Nation, Sawridge First Nation, Swan River First Nation, and Sucker Creek First Nation. The Alexis Nakota Sioux Nation is the only First Nation community with reserve land situated within the Millar Western FMA area. Alexis Whitecourt No. 232, located in Forest Management Unit (FMU) W13 of the Millar Western DFMP area, covers approximately 3,500 ha.

7.1 Project Notification and VOIT Consultation

Millar Western began DFMP consultations with the above mentioned First Nation communities in March 2015. Project notification packages, consisting of an introductory letter, FMA map, DFMP ToR, and First Nation Consultation Plan, were sent by registered mail to each of the First Nation communities.

The second delivery, which consisted of VOIT packages, was successfully sent in April 2015. From April 2015 through to April 2016, Millar Western carried out VOIT consultations with the identified First Nations. On April 1, 2016, Millar Western submitted the finalized ROC logs to the GoA, which deemed the VOIT consultations for all First Nation communities satisfactory, allowing Millar Western to move forward to the next stage. Subsequent to the initial consultations, Millar Western added 2 additional VOITs, in response to input received from the Alexis Nakota Sioux Nation in a letter dated May 15, 2015. These new VOITs were sent to the Alexis on May 26, 2016, for their information. A complete set of VOITs was provided to all 8 First Nations on October 31, 2016, for their records.

7.2 SHS Consultation

In addition to the planned outreach, as described in the First Nations Consultation Plan, Millar Western distributed harvest eligibility maps to First Nations communities in May 2016. The intent of these maps was to identify all of the forest stands from which the SHS could be drawn once age, productivity and legal requirements were considered. The purpose in sharing these with First Nation communities was to encourage early engagement in the development of the SHS, as well as to provide a platform to address First Nations-specific values during development of the SHS.

In November 2016, Millar Western provided SHS maps to the First Nations, for their review and to identify any site-specific concerns regarding Treaty rights and traditional uses.

7.3 Conclusion

As summarized in greater detail in *Appendix III - First Nation Consultation Summary*, Millar Western fully executed its First Nation Consultation Plan for the 2017-2027 DFMP (February 2015), developed in the initial stages of the DFMP development process, and is confident that ample opportunity was provided for First Nation consultation.

Table 2-8 summarizes the dates the packages were sent out to the First Nations groups, as well as the dates they were successfully received by those First Nation groups. Table 2-9 summarizes the concerns raised by First Nations and how Millar Western either has or plans to address any concerns.

Table 2-8. Summary of First Nation consultation packages sent and received

First Nations Groups	Project Notification Package		VOIT Package		Harvest Eligibility Maps		Spatial Harvest Sequence	
	Sent	Successfully Received	Sent	Successfully Received	Sent	Successfully Received	Sent	Successfully Received
Alexander FN	2/27/2015	3/9/2015	4/17/2015	4/21/2015	4/29/2016	5/4/2016	10/31/2016	11/2/2016
Alexis Nakota Sioux Nation		3/10/2015		4/21/2015		5/2/2016		11/2/2016
Kapawe'no FN		3/9/2015		4/21/2015		5/2/2016		11/2/2016
Sturgeon Lake Cree Nation		3/10/2015		4/20/2015		5/2/2016		11/2/2016
Driftpile FN		3/10/2015		4/27/2015		5/1/2016		11/2/2016
Sawridge FN		3/6/2015		4/21/2015		5/1/2016		11/2/2016
Swan River FN		3/9/2015		4/21/2015		5/2/2016		11/2/2016
Sucker Creek FN		3/9/2015		4/21/2015		5/2/2016		11/2/2016

Table 2-9. Issues raised by First Nations

Description of Issue	How the Issue was Addressed
Impacts from timber harvesting (4 sensitive sites were identified as of concern: old cabin, fish camp, gravesite and campsite).	These sites will be noted in the DMFP as requiring specific consultation as part of the General Development Plan consultation process, which is done annually.
Impacts of forestry operations (concerns regarding treaty rights and traditional uses)	Consultation will be ongoing during and beyond the DFMP project, to discuss and address related concerns.
Impacts on water quality and fish (the widths of watercourse buffer, to maintain water quality, were questioned by First Nations)	Forest companies like Millar Western operate under the Operating Ground Rules (OGRs), which are approved by the GoA. The OGRs establish buffer widths, and Alberta's are considered to be quite conservative and stringent.
Impacts on environment: hunting and trapping (access remaining open through reforested cutblocks)	Current road reclamation requirements for more recent cutblocks demand that the roads be deactivated and reforested. Debris is pulled back onto cutblock roads that are no longer required, to limit

Description of Issue	How the Issue was Addressed
	access and aids in successful seedling survival/growth.
First Nation Consultation Capacity (20-year SHS review is too overwhelming and cost prohibitive to perform in any detail that would allow constructive feedback)	It is recommended that site specific consultation be done annually, at the General Development Plan (GDP) phase, at which time any of the blocks from the SHS that are planned for harvest can be reviewed for issues or concerns.
First Nation Consultation Capacity and Knowledge (educating First Nation community members, so they can be involved in consultation in a more meaningful way)	A "Forestry 101" workshop is proposed to be made available by request. For those interested, Millar Western would provide information on how forest companies conduct their business, so that members of First Nations communities are more knowledgeable of forest practices and regulations, and more able to participate in consultation.
Impacts from forest industry operations (project is in close proximity to water crossings and wetlands areas, which are valued as a keystone to the sustainability of the ecosystems)	Regulatory minimum requirements, as set out by the GoA, are to be followed and adhered to throughout the life of the project.
Impacts of forest industry operations to noted plant species (fungus from birch, diamond willow, muskeg vegetation)	Provide adequate notice to First Nation, so plant species can be harvested prior to forestry operations. When requested, hold Millar Western-First Nations field trips, to review these concerns first hand and help educate Millar Western staff, so they have a clear understanding of the issue.
Impacts from timber harvesting (impacts to First Nations trappers from forest industry operations)	Provide First Nations trappers with timber harvest maps showing trapline boundaries (note: this is done currently, as part of trapper consultation). Millar Western to discuss possible improvements to the current notification process.
Road maintenance and deactivation (safety concerns related to road deactivation and safe parking along haul roads, especially during the winter when parking near access to trails off of haul roads is blocked with snow berms from plowing the roads).	When requested, hold Millar Western-First Nations field trips, to review and see these concerns first hand and help educate Millar Western staff, so they have a clear understanding of the issue.

Appendix I - PDT Meeting Summary

PDT Meeting #1 – FORCORP Office, January 23, 2015 (Initial PDT meeting)

Items Reviewed:

- Reviewed current DFMP status: Table of Reference, Communication Plan, AVI, Volume sampling;
- Identified PDT goals, processes and procedures, member roles and responsibility;
- Reviewed DFMP milestones, responsibility, document outline, and preliminary issue list.

Supporting Documentation

- 2017 DFMP Terms of Reference
- Proposed DFMP document outline

PDT Meeting #2 – FORCORP Office, February 23, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Reviewed VOITs.

Supporting Documentation

- Incomplete Task Summary
- Current Task Summary

PDT Meeting #3 – FORCORP Office, March 27, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Demonstration of eTracker – FORCORP's online project management/task tracker program;
- Cutblock reconciliation;
- Consultation plan Update;
- Reviewed VOITs.

Supporting Documentation

- February 23, 2015 PDT meeting notes
- Consultation Plan Update
- Preliminary VOITs
- Updated Gantt Chart
- Cutblock Update Charts (2)
- Cover Types Precautionary Note
- VOIT Summary

PDT Meeting #4 – FORCORP Office, April 24, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Spruceland's carryover request;
- Cutblock reconciliation;
- Reviewed VOITs.

Supporting Documentation

- March 27, 2015 PDT meeting notes
- Consultation Plan Update
- Cutblock Process Update
- Issues and Management Direction
- Preliminary VOITs
- VOIT #14 - MW Fine and coarse filter species modeling- caribou simplified

PDT Meeting #5 – Millar Western Whitecourt Office, June 5, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Mountain Pine Beetle risk rating;
- RSA sampling for yield curve creation proposal;
- Proposed Regeneration matrix for FMU W13;
- Reviewed VOITs.

Supporting Documentation

- MPB Compartment Risk Rating Maps (2)
- Consultation Plan Update (2)
- Proposed Regeneration Matrix
- Utilization Standards
- Uncommon Plant Communities one pager
- Preliminary VOITs Summary & Table

PDT Meeting #6 – FORCORP Office, June 29, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Spruceland's carryover request;
- Data reconciliation (Cutblock, AVI, RSA, ARIS);
- RSA sampling for yield curve creation proposal;
- Proposed Regeneration matrix for FMU W13;
- Reviewed VOITs.

Supporting Documentation

- Consultation Plan Update (Public and First Nations)
- AVI Map
- ARIS Net Landbase Reconciliation Procedures Letter (Feb 10, 2015)
- Spruceland Carryover Request Table
- Utilization Standards Table
- VOIT Summary and Table

PDT Meeting #7 – FORCORP Office, August 28, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Spruceland's carryover request;
- Data reconciliation (Cutblock, AVI, RSA, ARIS);
- Land Disposition (DIDs) issue document review;
- ARIS area reconciliation issue document review;
- Spatial data document review;
- Reviewed VOITs.

Supporting Documentation

- Consultation Plan Update
- Preliminary VOITs Summary & Table
- Issue Documents (LB-010, LB-020, LB-018)

PDT Meeting #8 – FORCORP Office, October 16, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Data reconciliation process issue document review;
- Hydrology input dataset for landbase;
- Past SHS deferrals and deletions for use in landbase;
- Seismic lines issue document;
- Land Disposition (DIDs) issue document review;
- Spatial data document review;
- Reviewed VOITs.

Supporting Documentation

- Consultation Plan Update
- Preliminary VOITs Summary & Table
- Spatial Data Document
- Issue Documents (LB-020, LB-021, LB-017, LB-020, LB-023)

PDT Meeting #9 – FORCORP Office, November 27, 2015

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Reviewed VOITs;
- NRV approach;
- Volume sampling program update;
- Spatial data document review;
- Data reconciliation process issue document review;
- Trans-boundary cutblocks (split between FMA's);
- Orphan cutblock (unidentified cutblocks);
- Chapter 3 – Landscape Assessment review.

Supporting Documentation

- Consultation Plan Update
- Preliminary VOITs Summary & Table
- Spatial Data Document
- Issue Documents (TSA-002, LB-021, LB-026, LB-029)

PDT Meeting #10 – FORCORP Office, January 15, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Reviewed VOITs;
- Timeline review/ToR milestones;
- Growth & Yield – yield curves and volume sampling update;
- Wildlife models – incorporated into TSA process;
- NRV approach;
- Regenerated Landbase Issue Summary;
- Chapter 3 – Landscape Assessment review.

Supporting Documentation

- Consultation Plan Update
- Preliminary VOITs Summary & Table
- Issue Documents (GY-001, GY-002, TSA-002, LB-032)
- Chapter 3 - Landscape Assessment Review

PDT Meeting #11 – FORCORP Office, February 19, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Submitted A-I-P status;
- Wildlife models – incorporated into TSA process;
- Strata conversion
- Growth & Yield – yield curves and volume sampling update;
- Landbase review – process and map/data review.

Supporting Documentation

- Landbase Summary Maps
- Issue Document LB-032

PDT Meeting #12 – FORCORP Office, March 18, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Submitted A-I-P status;
- Growth & Yield – yield curves update;
- Wildlife models – songbird, marten, barred owl, grizzly bear;
- Strata conversion;
- ARIS reconciliation submission spreadsheet;
- Landbase review – updates;
- RSA issue document review.

Supporting Documentation

- Yield Curve Development Preliminary Results
- RSA Data Issue Document (LB-024)

PDT Meeting #13 – FORCORP Office, April 22, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Submitted A-I-P status;
- Silviculture matrix
- Strata transition changes
- Growth & Yield – yield curves update;
- Wildlife models – songbird, marten, barred owl, grizzly bear;
- Structure retention;
- ARIS reconciliation submission spreadsheet;
- Landbase review – submission;
- RSA issue document review;
- SHS deferrals and deletions issue document review;
- Birch landbase deletion issue document review;
- Fisheries presentation by Marcel.

Supporting Documentation

- Communications and Public Participation Summary (April 22, 2016)
- First Nations Consultation Summary (April 22, 2016)
- CURVE_TYPE Flowchart
- DFMP Progress Report (Issue 2, March 2016)
- RSA Data Issue Document (LB-024)
- Deletions and Deferrals Issue Document (LB-025)
- Birch Subjective Deletion Threshold Issue Document (LB-034)
- Proposed Regeneration Transition Matrix for W13 Issue Document (TSA-004)
- Fisheries Values
- Review Landbase Document
- Summary of Yield Curves Presented at PDT Meetings
- Yield Curve Development Preliminary Results
- W11 and W13 Yield Curve Comparison Tables
- Pre-91 (Juvenile) Yield Curves Comparison
- W11 Natural Stand Yield Curves Comparison
- W13 Natural Stand Yield Curves Comparison

PDT Meeting #14 – FORCORP Office, May 27, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- Proposed Aboriginal VOITs;
- Landbase submission status;
- Growth & Yield – yield curves sets and submission;
- Silviculture matrix status;
- Wildlife models – songbird, marten, barred owl, grizzly bear;
- Structure retention strategy;
- TSA and PFMS development.

Supporting Documentation

- Spruceland 10 Year Wood Supply
- Communications and Public Participation Summary May 27, 2016
- Yield Curves Sets for TSA May 26, 2016
- Fine Filter Wildlife Species Assessments
- First Nations Consultation Summary May 27, 2016
- Grizzly Bear Initial Review
- Marten and Barred Owl Initial Review
- MWFP First Nations VOITs
- Whitecourt Trade Fair Advertisement
- Whitecourt Trade Fair Press Release

PDT Meeting #15 – FORCORP Office, June 22, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Consultation Plan Update;
- A-I-P status;
- Proposed Aboriginal VOITs;
- Silviculture matrix status;
- TSA and PFMS development;
- Caribou implications on TSA development;
- Wildlife models – songbird, marten, barred owl, grizzly bear;
- Water modeling;
- Structure retention strategy.

Supporting Documentation

- Issue Document LB-036 Utilization Standards
- Issue Document LB-038 Caribou Range Extent
- Issue Document TSA-001 Seral Stage and Patches
- MWFP 2017-2027 DFMP Structure Retention Strategy
- Review of GoA Songbird Metrics, Marten and Barred Owl Metrics
- Review of fRI Grizzly Bear Model Metrics

PDT Meeting #16 – FORCORP Office, September 16, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Structure retention strategy;
- TSA and PFMS development;
    - Scenario review;
    - Harvest stats;
    - Wildlife models – songbird, marten, barred owl, grizzly bear;
    - Caribou implications on TSA development;
- Communication and consultation plan update;
- Wildfire threat assessment update;
- Silviculture transition matrix status update;
- A-I-P status (landbase, Growth & Yield, ARIS).

Supporting Documentation

- MWFP Structure Retention Strategy
- MWFP PFMS Development presentation
- Communications and Public Participation Summary September 16, 2016
- Wildfire Threat Assessment presentation

PDT Meeting #17 – FORCORP Office, October 20, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Communication and consultation plan update;
- TSA and PFMS development;
    - TSA assumptions;
    - Scenario review;
    - Harvest stats;
    - Water modeling;
    - Wildlife models – songbird, marten, barred owl, grizzly bear;
    - Caribou implications on TSA development;
- Structure retention strategy;
- Silviculture transition matrix status update;
- A-I-P submission status (ARIS).

Supporting Documentation

- Communications and Public Participation Summary October 20 2016
- PFMS presentation
- Direction to MWFP regarding harvest within the Swan Hills and Grande Cache grizzly bear ranges
- Direction to MEFP regarding harvest within the Slave Lake Caribou Range
- MWFP Structure Retention Strategy
- MWFP ARIS Reconciliation Report October 17 2016
- MWFP Transition Matrix

PDT Meeting #18 – FORCORP Office, December 1, 2016

Items Reviewed:

- Reviewed incomplete tasks and issues;
- Reviewed PFMS scenario;
    - Spatial Harvest Sequence;
    - Minimum Harvest Age;
    - ECA;
    - Wildlife models – songbird, marten, barred owl, grizzly bear;
- Communication and Consultation Plan update;
- Structure Retention Strategy;
- Silviculture transition matrix strategy update;
- ARIS reconciliation;
- Ducks Unlimited additions for Chapters 1, 3, and 7.

Supporting Documentation

- First Nations Consultation Summary December 1, 2016
- W11 Scenario 64001 Summary
- W13 Scenario 64001 Summary
- Scenario 64001 SHS Map

Appendix II - DFMP Communications and Public Participation Summary

2014

- **November** – Millar Western presented Terms of Reference to the PAC; PAC members indicated they would like to be involved in the VOITs and SHS development but to a lesser degree than they were during the last DFMP.

2015

- **March** – Millar Western updated the PAC on the Public and First Nations communications plans that had been approved, as well as the introductory and VOIT consultation packages sent to the First Nations. PAC was also advised of the open houses that would be taking place in the spring, to provide the public with opportunities to learn about the DFMP process and offer input into the VOITs. Millar Western also presented to PAC an overview of the forest management planning/DFMP development process in Alberta, including a detailed explanation on VOITs.
- **May** – Millar Western's Chief Forester, Bob Mason, was interviewed by the Whitecourt Star for an article on the upcoming DFMP/AOP open houses.

  Millar Western met with PAC to further review VOITs and discuss the potential gaps; PAC developed a list of values they considered important.
- **June** – Millar Western met with PAC to further discuss the PAC values identified in the last meeting. Millar Western mapped the PAC values to existing GoA VOITs, to determine if additional VOITs were necessary. After discussion, PAC members unanimously agreed to accept the VOITs, with no revisions.
- **July** – Bob Mason presented a DFMP status update to the Millar Western woodlands team at their monthly business review meeting.
- **September** – Millar Western hosted a PAC DFMP field tour to demonstrate how values identified as important to PAC members are addressed on the ground.

- **November** - Millar Western released its first issue of the newsletter, *DFMP Update*.

2016

- **January** – Millar Western provided an update to PAC on the progress of the net landbase, volume sampling, yield curves and First Nations consultations. Members provided input into the location/timing/format of the second round of the DFMP public participation process, planned for the summer, which would focus on the spatial harvesting sequence.
- **March** – Bob Mason provided a DFMP status update the Millar Western woodlands team at their monthly business review meeting.
- **April** - Millar Western provided a DFMP update to PAC, as well as copies of eligibility maps for review and feedback.

  Millar Western released a second issue of *DFMP Update*.

  Millar Western launched its new corporate website, including a DFMP virtual open house that provided access to DFMP related materials and provided directions on how to submit comments directly to Millar Western.
- **July** – Millar Western hosted PAC DFMP field tour, focusing on forest renewal.
- **October** – Millar Western walked the PAC through the PFMS. The PAC unanimously approved the PFMS as presented.

  Millar Western held a PFMS open house in Whitecourt. The majority of visitor comments were related to the 2016-17 annual operating plan and potential impacts on snowmobile trails; no comments were received regarding the PFMS or any aspect of the DFMP.

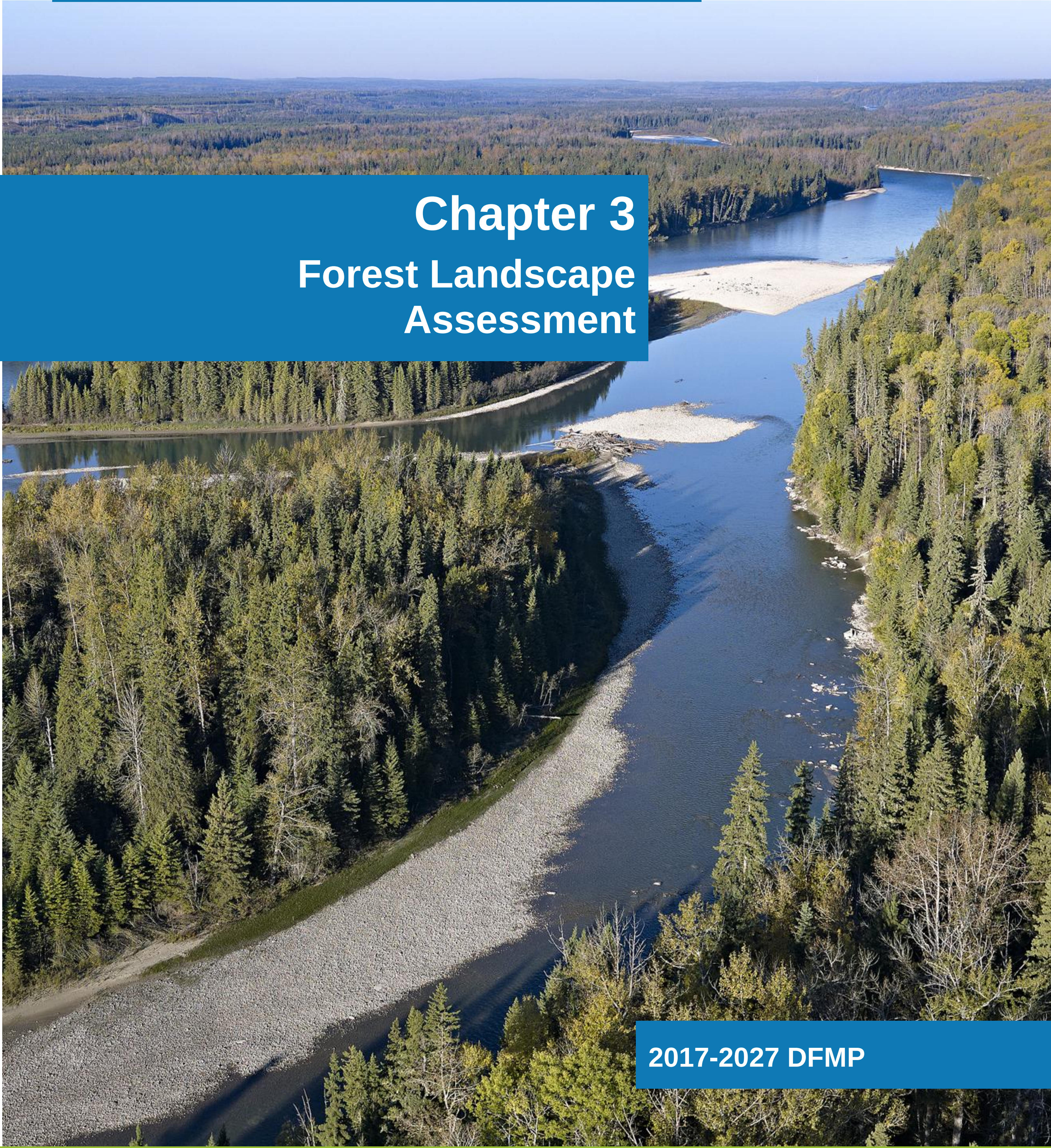
  The PFMS presentation and SHS maps were posted to the virtual open house.

Appendix III - First Nation Consultation Summary

First Nations Consultation adequacy was assessed based on a separate submission to the GoA. The following pages provide a summary of the Consultation process.

Chapter 3

Forest Landscape Assessment



2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

List of Tables

List of Figures

1. Introduction

The information presented in this chapter was derived from data used to prepare the Regional Forest Landscape Assessment Report for the Government of Alberta (GoA); it is current as of December 2012. The only exception to this is the information on Wetlands and Waterfowl, which was provided by Ducks Unlimited Canada. This chapter, which is laid out in a similar format as the Landscape Assessment Report, is included as a reference, to provide background to the development of the Detailed Forest Management Plan (DFMP). Readers should be aware that, due to their age and scale, the data included in this chapter may not align with similar information presented elsewhere within the DFMP.

This chapter was compiled at the Land-use Framework regional level and, therefore, represents broad estimates over the Forest Management Units (FMUs). The information, which relies on forest inventory data, is summarized using comparisons between two inventory datasets: the original forest inventory dataset, which consists mainly of data between 16 and 25 years old and was used to create the Regional Forest Landscape Assessment Report in 2012, and a new forest inventory that Millar Western Forest Products Ltd. (MWFP) completed in 2014.

The source of data for each topic is referenced with the use of end notes. The full data list is presented in APPENDIX I, with appropriate references included in each section. All data-source references are identified by the format (1), where '1' represents the reference in a numerical sequence, listed in APPENDIX I. All initialisms used in the report are defined in the glossary of the DFMP. Maps included in this section reflect a broad representation of each metric and are not intended for operational use.

Some area estimates may not agree with other published information within this report. Due to rounding to the nearest hectare, some area estimates may not, in all tables, add up exactly to the tabulated sums presented.

2. Administrative Boundaries

This Forest Landscape Assessment covers Millar Western FMUs W11 and W13 that, together, comprise Millar Western's DFMP area. For the purpose of the DFMP, these FMUs are broken down into five areas: Whitecourt, Blue Ridge, McLeod and Virginia Hills in W13 and Fort Assiniboine in W11 (Figure 3-1). FMUs W11 and W13 are referred to as the "DFMP area".

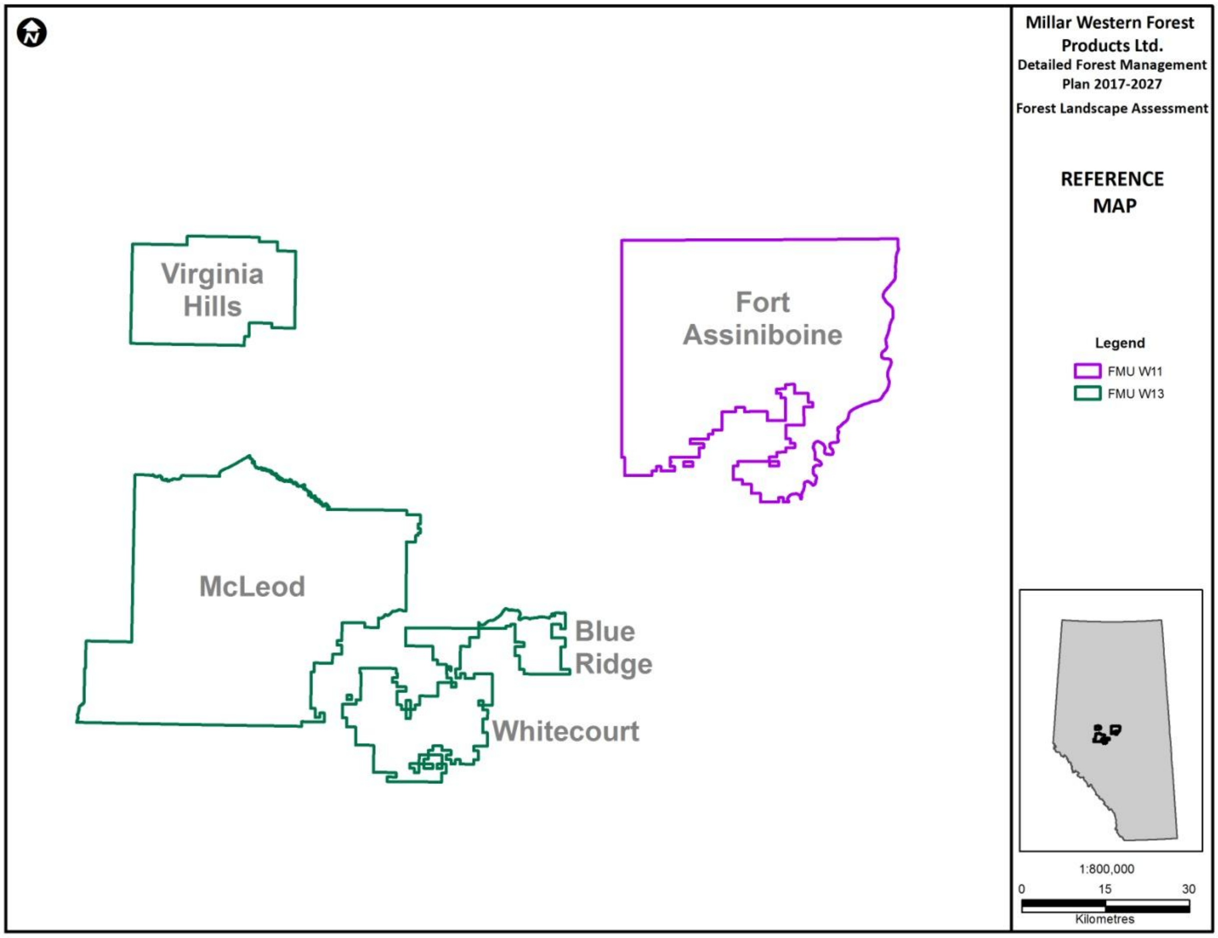


Figure 3-1. Millar Western DFMP area reference map

2.1 Land-use Regions

There are seven land-use regions identified in Alberta's Land-use Framework (Alberta, 2008) (1). The Millar Western DFMP area spans two of the seven land-use regions: the Upper Athabasca and the Upper Peace (Table 3-1).

Fort Assiniboine (FMU W11) and McLeod, Blue Ridge and Whitecourt (majority of FMU 13) are encompassed within the Upper Athabasca region, which is the fourth largest of the seven regions. This region extends from the British Columbia-Alberta border, inclusive of Jasper National Park, and runs to the northeast, to the eastern edge of the County of Athabasca, which contains Lesser Slave Lake (Figure 3-2).

Virginia Hills, the most northerly portion of FMU W13, is located within the Upper Peace region, which reaches from the British Columbia-Alberta border to the northwestern edge of the Upper Athabasca region, and then runs to the northern border of Clear Hills County. This region encompasses Willmore Wilderness Park in the southern portion, as well as the northern foothills, which extend east to the edge of the Municipal District (M.D.) of Greenview. Of the seven regions, Upper Peace is the second smallest (Figure 3-2).

Both regions are known for their significant variety of industrial development, agriculture, and natural resource development, as well as large areas of protected land for conservation purposes.

Table 3-1. Land-use framework regions distribution within the DFMP area

Land-use Region	Area (ha)	Area (%)
Upper Athabasca	399,519	84.5
Upper Peace	73,109	15.5
Total	**472,628**	**100**

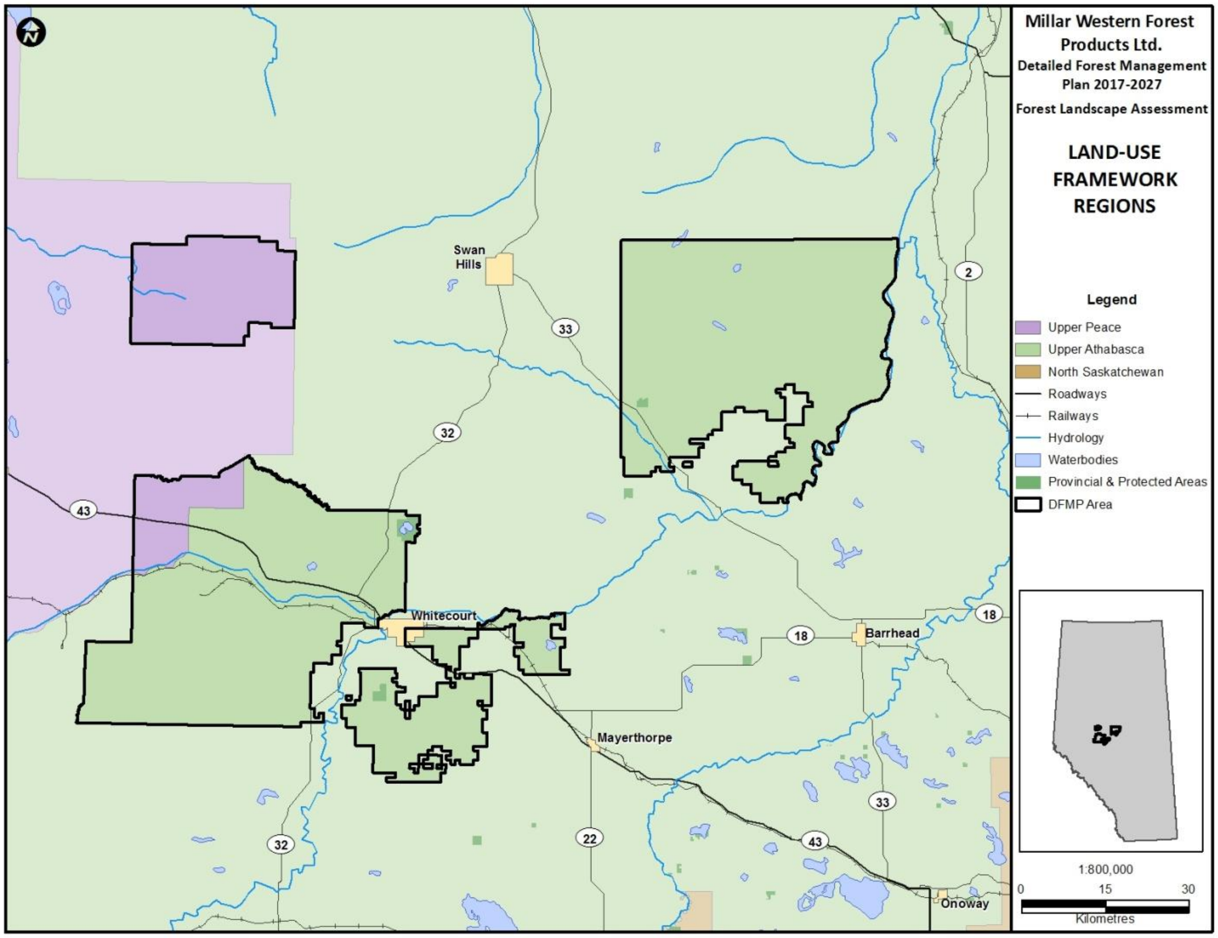


Figure 3-2. Land-use framework regions within the DFMP area

2.2 Green/White Areas

In 1948, to aid in land-use planning, the Alberta government divided the province into two zones: the Green Area and White Area (2). The White Area is primarily private land, often related to agricultural use. The Green Area is referred to as Crown land and managed for natural-resource development, recreation and conservation. Lands excluded from these two areas are lands that are not administered by Alberta, including national parks and military areas. The DFMP area is exclusively located in the Green Area and accounts for 472,628 ha.

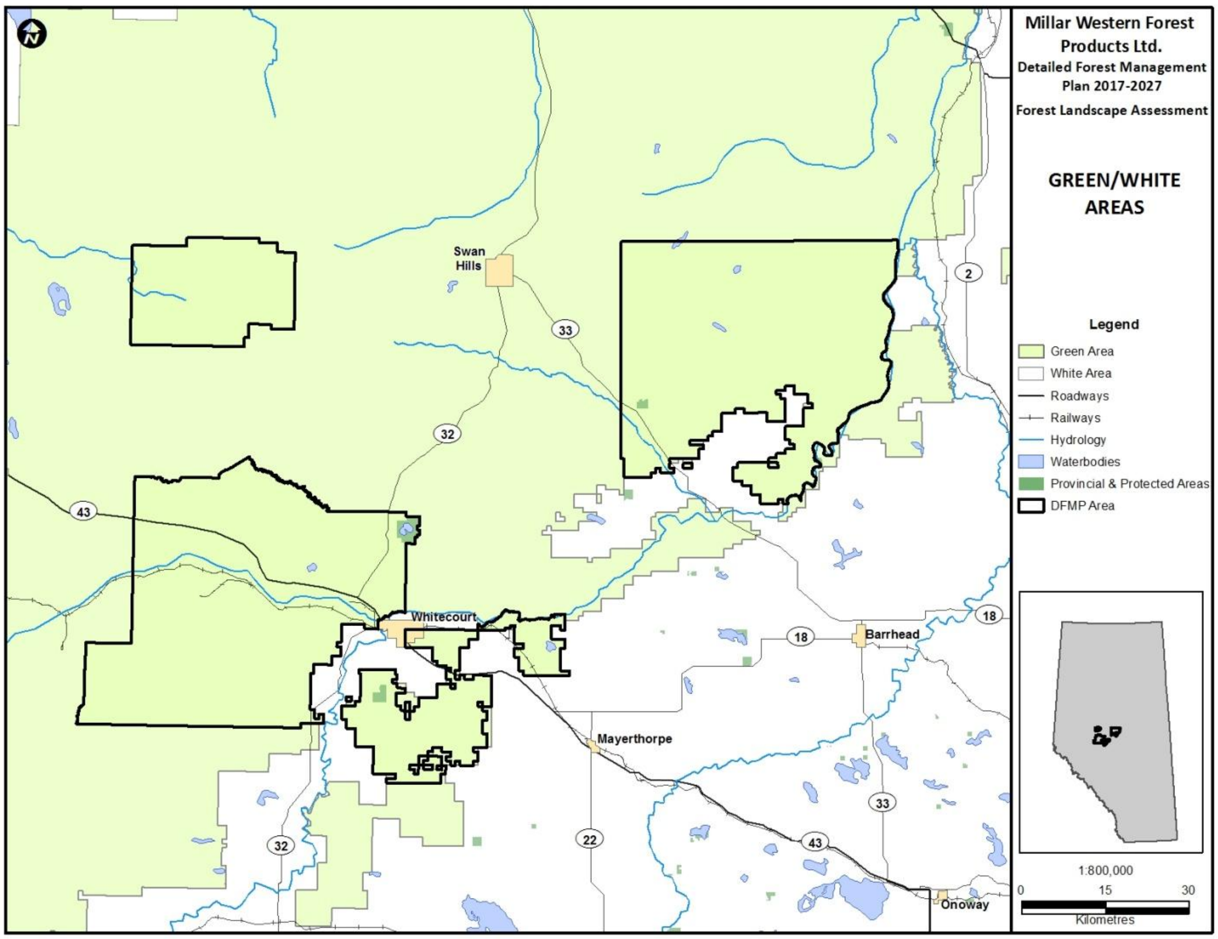


Figure 3-3. Distribution of green/white areas in relation to the DFMP area

2.3 Forest Management Agreement Areas

The Millar Western Forest Management Agreement (FMA) area (3) encompasses two FMUs – W11 and W13. Adjacent to the FMA are seven other FMAs belonging to the following companies: Weyerhaeuser Company Limited (Pembina Timberland), Slave Lake Pulp Corporation, Blue Ridge Lumber Inc., West Fraser Mills Ltd., Vanderwell Contractors (1971) Ltd., High Prairie Forest Products (formerly Gordon Buchanan Enterprises Ltd.), Tolko Industries Ltd., and ANC Timber Ltd. There are no FMA boundaries to the southeast of the Millar Western FMA, as the land falls within the White Area (see section 2.2).

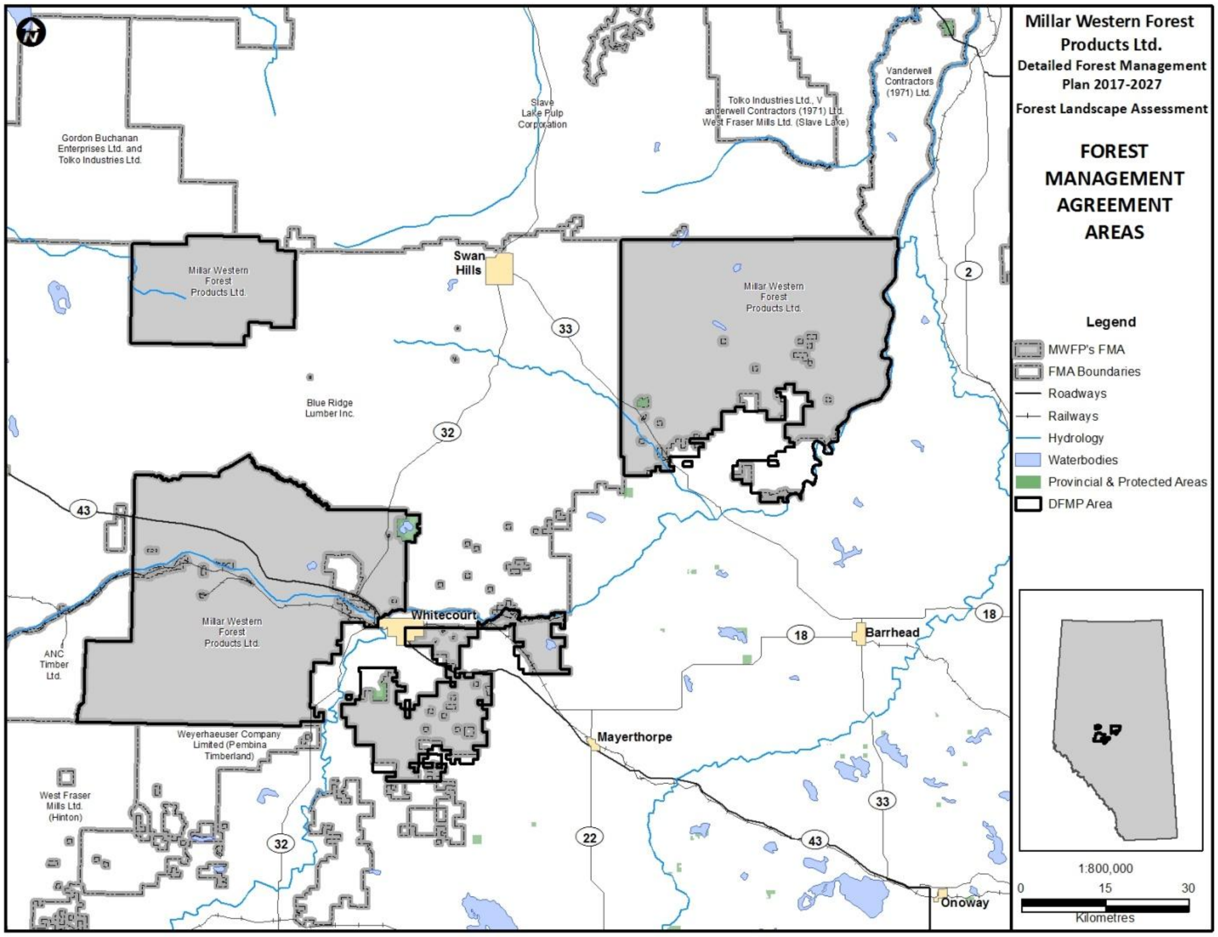


Figure 3-4. FMA areas bordering Millar Western's DFMP area

2.4 Forest Management Units

The DFMP area is made up of two FMUs (4): W11 and W13. FMU W13 is divided into several different areas (see Figure 3-5): McLeod, Whitecourt, Blue Ridge and Virginia Hills. FMU W11 is commonly referred to as Fort Assiniboine (see Figure 3-1). Twelve other FMUs belonging to other companies share boundaries with Millar Western's DFMP area. The majority of these FMUs falls into the Green Area: E2, E14, S7, S20, S21, W5, W14, and W15. In the White Area, there are 4 additional FMUs: E01, W01, W02, and S01.

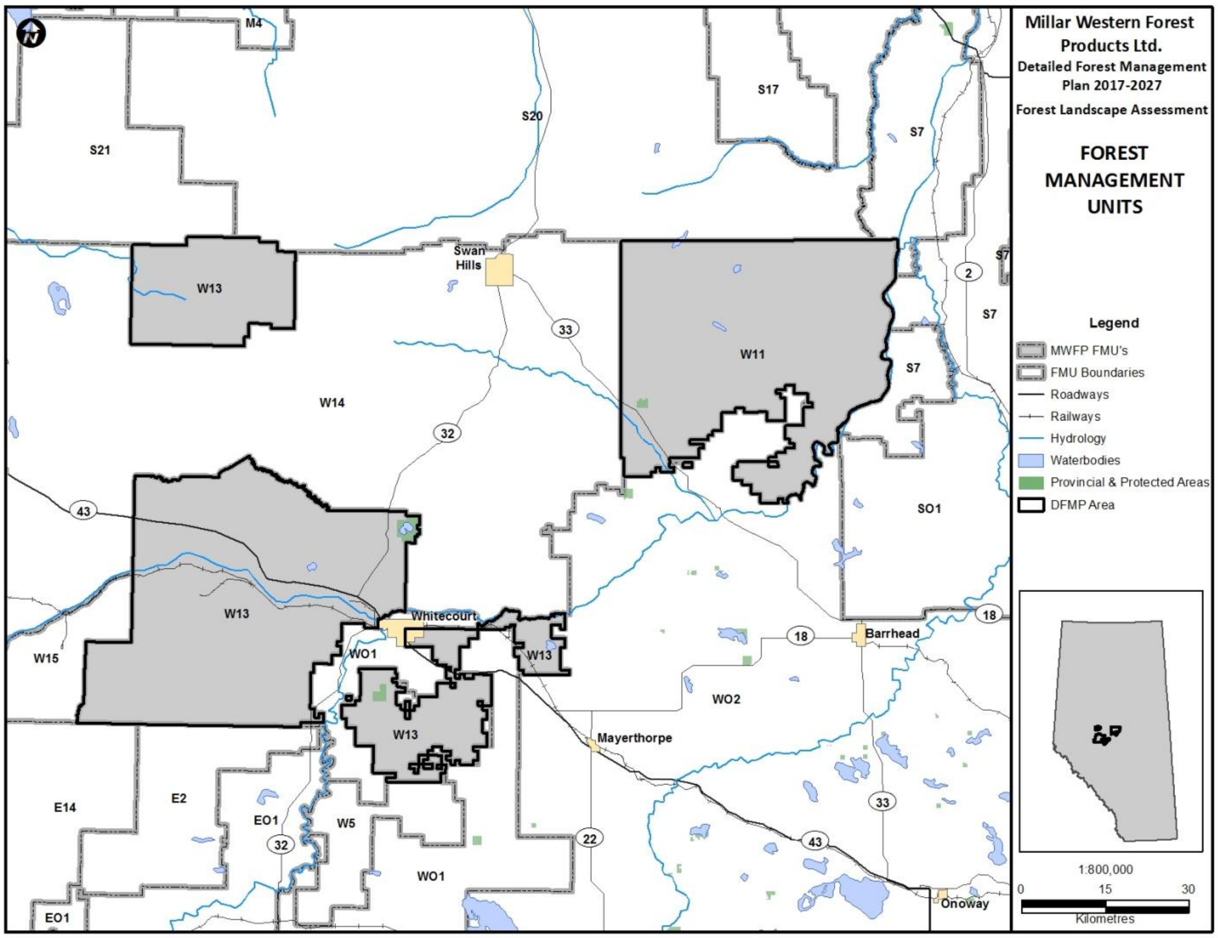


Figure 3-5. FMUs border Millar Western's DFMP area

2.5 Natural Subregions

In 1994, an ecological landscape classification system was developed for the province of Alberta (Alberta 1994), referred to as the Natural Regions and Subregions of Alberta (5). It is widely used by land-management programs, such as the parks and protected areas network, and in the development and application of ecologically-based forest management tools. In the fall of 2000, the Alberta government initiated a project to refine and update the classification. This project took advantage of geographic information system (GIS) technology and an increased knowledge of the ecology of the province. The subregion descriptions that follow are based on documentation dating from 2006 (Natural Regions Committee 2006).

Natural regions are delineated into 6 geographic areas based on similarities in vegetation, soils, topography, climate, geology, hydrology, and wildlife. These natural regions are further broken down into natural subregions on the basis of similar landscape patterns. Within the Millar Western DFMP area, there are two natural regions: Boreal Forest and Foothills. Included in these two natural regions are three natural subregions: lower and upper foothills, and central mixedwood. Table 3-2 summarizes and Figure 3-6 depicts the distribution and location of these natural regions and subregions.

Table 3-2. Natural subregion distribution within the DFMP area

Natural Region	Natural Subregion	Area (ha)	Area (%)
Foothills	Lower Foothills	317,413	67
	Upper Foothills	21,093	5
Foothills Total		*338,507*	*72*
Boreal Forest	Central Mixedwood	134,121	28
Total		**472,628**	**100**

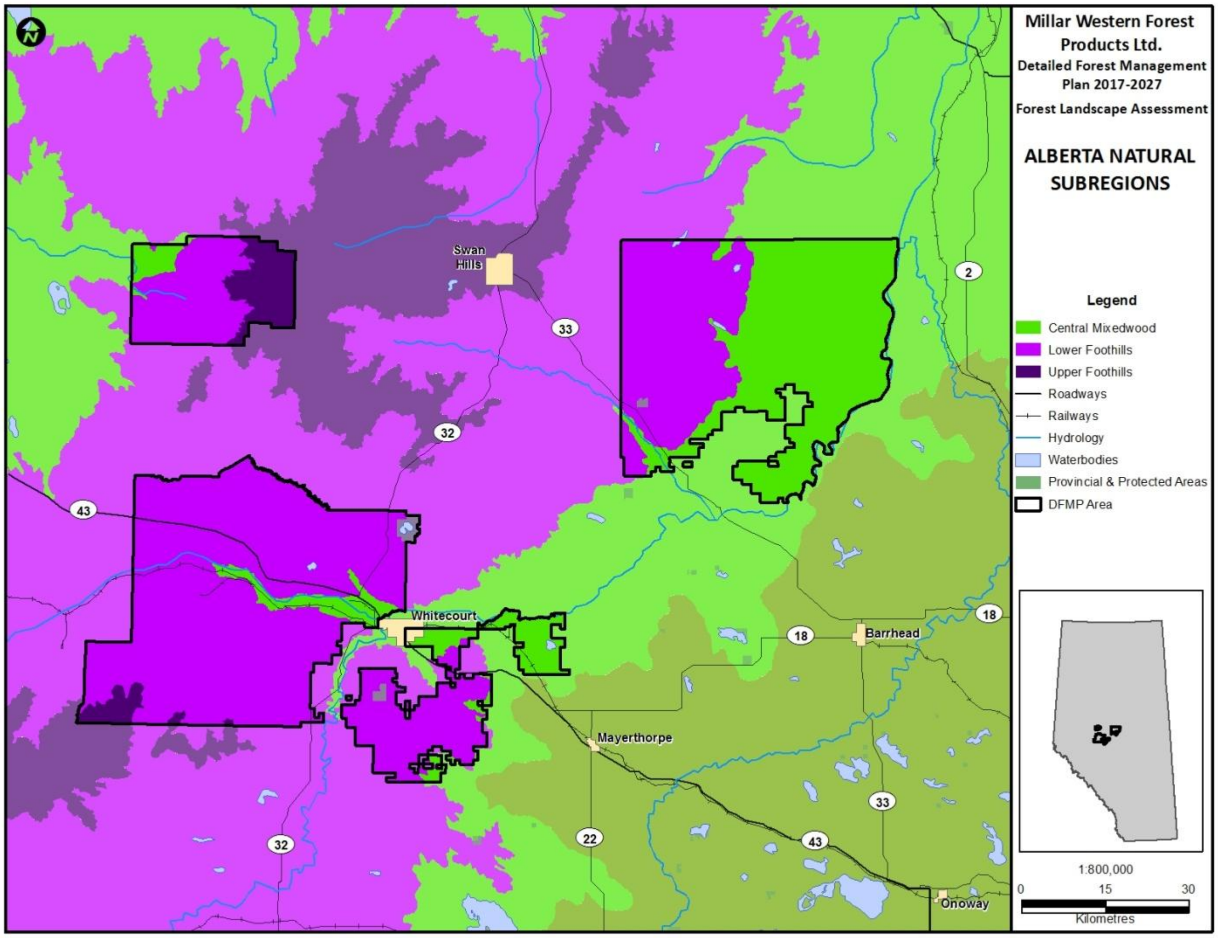


Figure 3-6. Alberta natural subregions within the DFMP area

2.5.1 Lower Foothills Natural Subregion

The Lower Foothills Natural Subregion is the largest subregion within the DFMP area, accounting for 67% of the area. Virginia Hills, McLeod, and Whitecourt fall into this classification, as does a small portion of the western area of Fort Assiniboine. This subregion occurs at lower elevations along the foothills of the Rocky Mountains, and the topography consists of undulating to strongly rolling plateaus. Sandstone and siltstone of Tertiary origin underlie the southern part of the subregion, with similar rock of Upper Cretaceous origin occurring in the northern parts of the subregion. Orthic gray luvisolic soils dominate, accompanied by brunisolic subgroups at higher elevations. Most upland soils are well-to-imperfectly drained, but there may be imperfectly-to-poorly drained mesisol and gleysol soils (accompanied by seepage) in lower slope positions.

The Lower Foothills Subregion has the most diverse forests in the province in terms of stand types and occurrence of individual tree species. Aspen, balsam poplar, white birch, lodgepole pine, balsam fir and larch (tamarack) grow as pure and mixed stands on a wide variety of slopes and aspects. Pure deciduous stands are more common at lower elevations, and coniferous-dominated stands occur at higher elevations.

This subregion is typical of Cordilleran climates, and continental influences are pronounced in the Lower Foothills subregion, resulting in a decrease in both annual and winter precipitation and an increase in growing degree days when compared to conditions in the Upper Foothills subregion. Precipitation is higher than in neighbouring subregions to the north and east.

2.5.2 Central Mixedwood Natural Subregion

The Central Mixedwood Natural Subregion is the second largest subregion, representing 28% of the DFMP area, most of which can be found in the eastern portion of Fort Assiniboine. It also appears in the northwestern corner of Virginia Hills, along the river valley in McLeod, in the northern portion of Whitecourt and throughout most of Blue Ridge. It is represented by undulating plains, with portions of hummocky uplands. Parent materials in this subregion are a combination of glacial till, lacustrine and fluvial materials. Predominant soils consist of orthic gray luvisolic soils, with brunisols occurring over sands. Wetlands are often extensive in this subregion and are generally associated with mesisols, with some fibrisols and gleysols.

On upland areas, vegetation often consists of a mix of aspen-dominated deciduous stands, aspen-white spruce stands and white-spruce dominated stands, all of which are typical of till and lacustrine areas. In areas of coarse material, jack-pine forests are common. In wetlands where fen and bogs occur, black spruce is dominant.

The climate is continental, with short warm summers and cold winters. The northern part of this subregion has lower mean annual temperatures and precipitation compared to the southern part of the subregion. This is most likely due to the increasingly strong influence of dry and cold continental arctic weather systems in these northern areas.

2.5.3 Upper Foothills Natural Subregion

The Upper Foothills Natural Subregion is the smallest subregion represented, accounting for only 5% of the DFMP area. FMU W13 traverses this subregion in the eastern portion of Virginia Hills and in the very southwestern-most corner of McLeod. Strongly rolling to steep terrain with thin glacial deposits and exposed bedrock are typical of this subregion. The bedrock is composed mainly of sandstones and mudstones of Tertiary and Upper Cretaceous origin, with coal seams common in the latter. Surface materials are usually glacial till veneers and blankets over bedrock, with colluviums and exposed bedrock on the steeper slopes. Well-to-imperfectly drained brunisolic gray luvisolic soils are found throughout most of the area. Orthic gray luvisols are associated with moderately well-drained sites; wetlands are a complex of terric and typic mesisols, along with orthic gleysols.

Forests dominate this subregion and are generally even-aged lodgepole pine stands of wildfire origin, often with an understory of black spruce. White-spruce stands occur along river valleys and on lower slopes. Deciduous and mixedwood stands are restricted to southerly and westerly slopes, where growing conditions are similar to lower elevations.

Typical climate patterns indicate short wet summers and snowy cold winters. On average, the Upper Foothills has a shorter growing season than the Lower Foothills and receives heavier summer and winter precipitation. It has the highest July precipitation of any of the subregions in the Upper Peace. These climatic conditions favour the occurrence of conifers over deciduous species, because evergreen needles can begin photosynthesis early in the spring and continue late into the fall. The shorter growing season discourages maturation of twigs and buds of deciduous species.

2.6 Municipal Districts and Counties

Within the DFMP area, there are three municipal districts (M.D.s) and counties, a portion of one town, and three smaller populated centres (6). Table 3-3 summarizes the population within each of these registered areas according to the most recent census (7). The populations of the smaller populated centres are accounted for in the M.D. or county to which they belong.

Table 3-3. Summary of municipal locations within the DFMP area

Municipal Classification	Name	Population[1]
Municipal District or County	M.D. of Greenview No. 16	5,464
	Woodlands County	4,158
	Yellowhead County	10,045
Municipal District or County Subtotal		*19,667*
Towns	Whitecourt	9,202
Populated Centres[2]	Lombell	-
	Two Creeks	-
	Windfall	-
Total		**28,869**

[1] Official population figures are current as of September 1, 2010.
[2] Populated centres' population is accounted for in the MD and county data.

Woodlands County encompasses Fort Assiniboine, Blue Ridge, Whitecourt, and the majority of McLeod. The M.D. of Greenview includes Virginia Hills and the northwestern portion of McLeod. A very small portion of McLeod (southwestern corner) forms part of Yellowhead County. Figure 3-7 shows the M.D. and county boundaries.

The small populated centres of Windfall and Two Creeks are located within the McLeod area while Lombell falls within the Blue Ridge area. A portion of the Town of Whitecourt municipal boundary also falls within the Whitecourt area. Figure 3-8 shows the location of the 1 town (labeled by name) and 3 smaller populated communities that fall within the DFMP area.

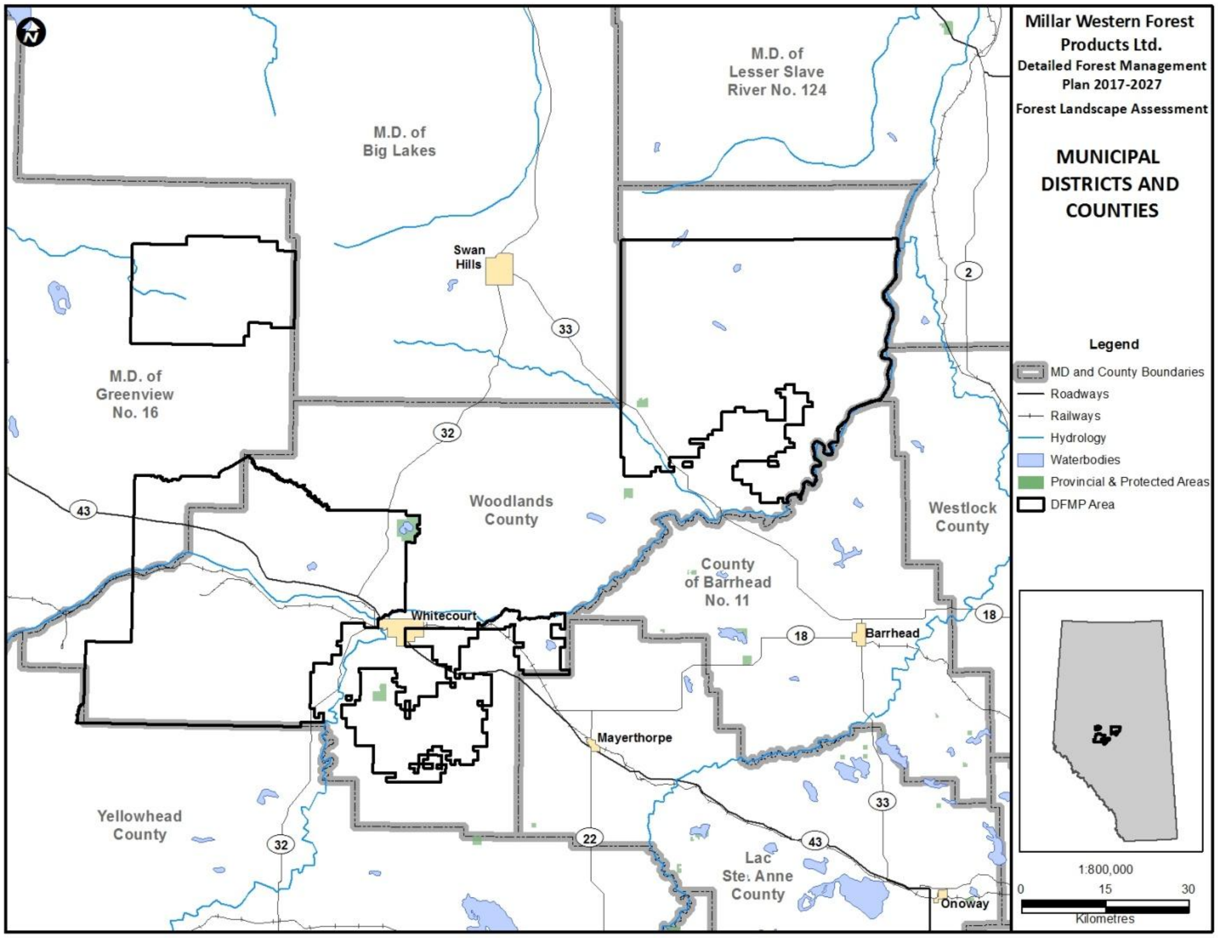


Figure 3-7. M.D. and county boundaries within the DFMP area

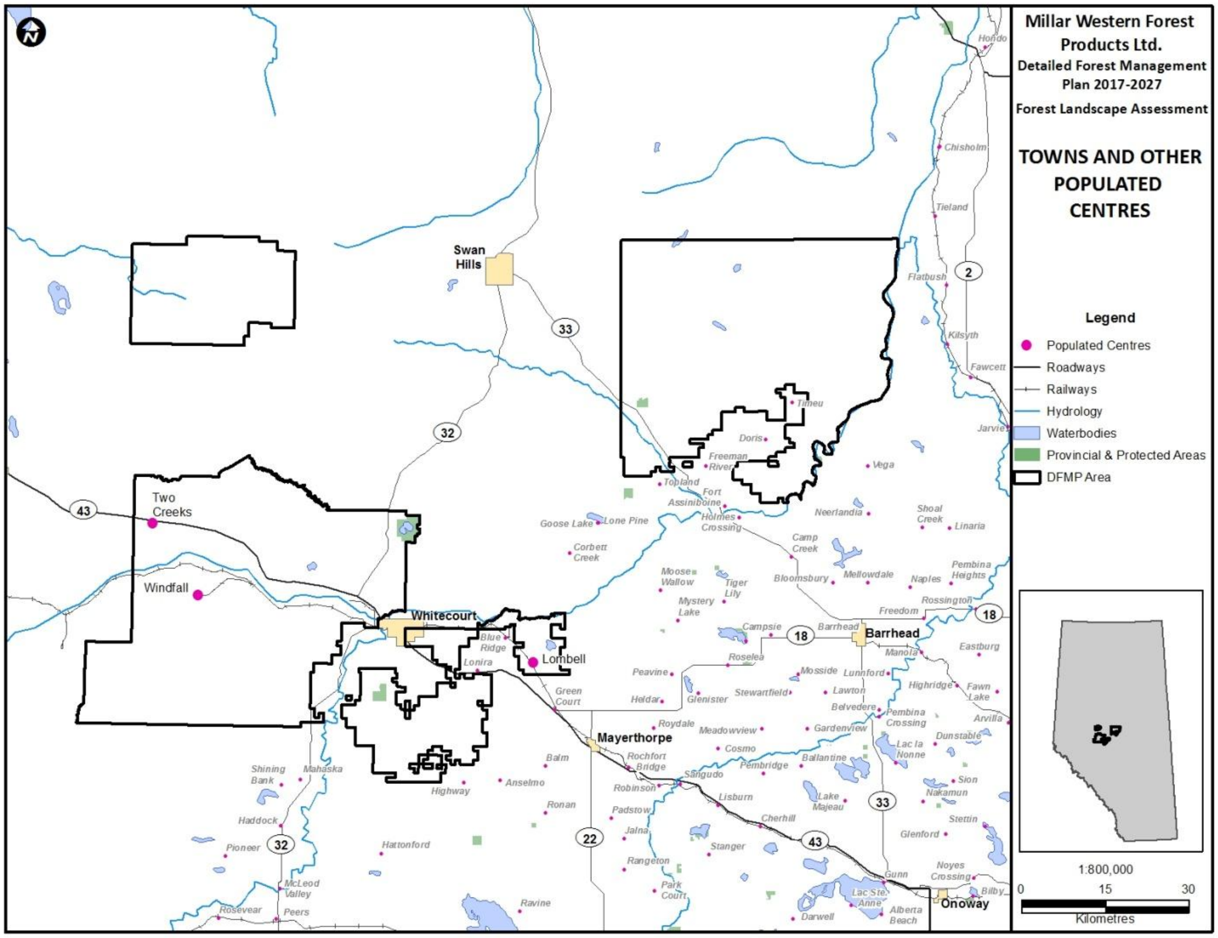


Figure 3-8. Towns and other populated centers within the DFMP area

2.7 Federal Government Lands

With the exception of First Nations lands (see section 2.8), there are no lands managed by the Government of Canada within the DFMP area. The closest federally managed lands are in Jasper National Park (8) and the military bases in Cold Lake and Wainwright (9).

2.8 First Nations

The Alexis Nakota Sioux Nation is the only First Nation community (10) within the DFMP area; the Alexis Whitecourt No. 232 Reserve covers 3,543 hectares and represents 0.7% of the DFMP area.

Table 3-4. First Nation communities within the DFMP area

First Nation Name	Reserve Name	Treaty Number	Area (ha)	Population[1]
Alexis Nakota Sioux Nation	Alexis Whitecourt No. 232	8 (1899)	3,543	1,779

[1]Population figure from Alexis Nakota Sioux Nation Young Men's Program 2015 Project: "Build a Tiny Home"

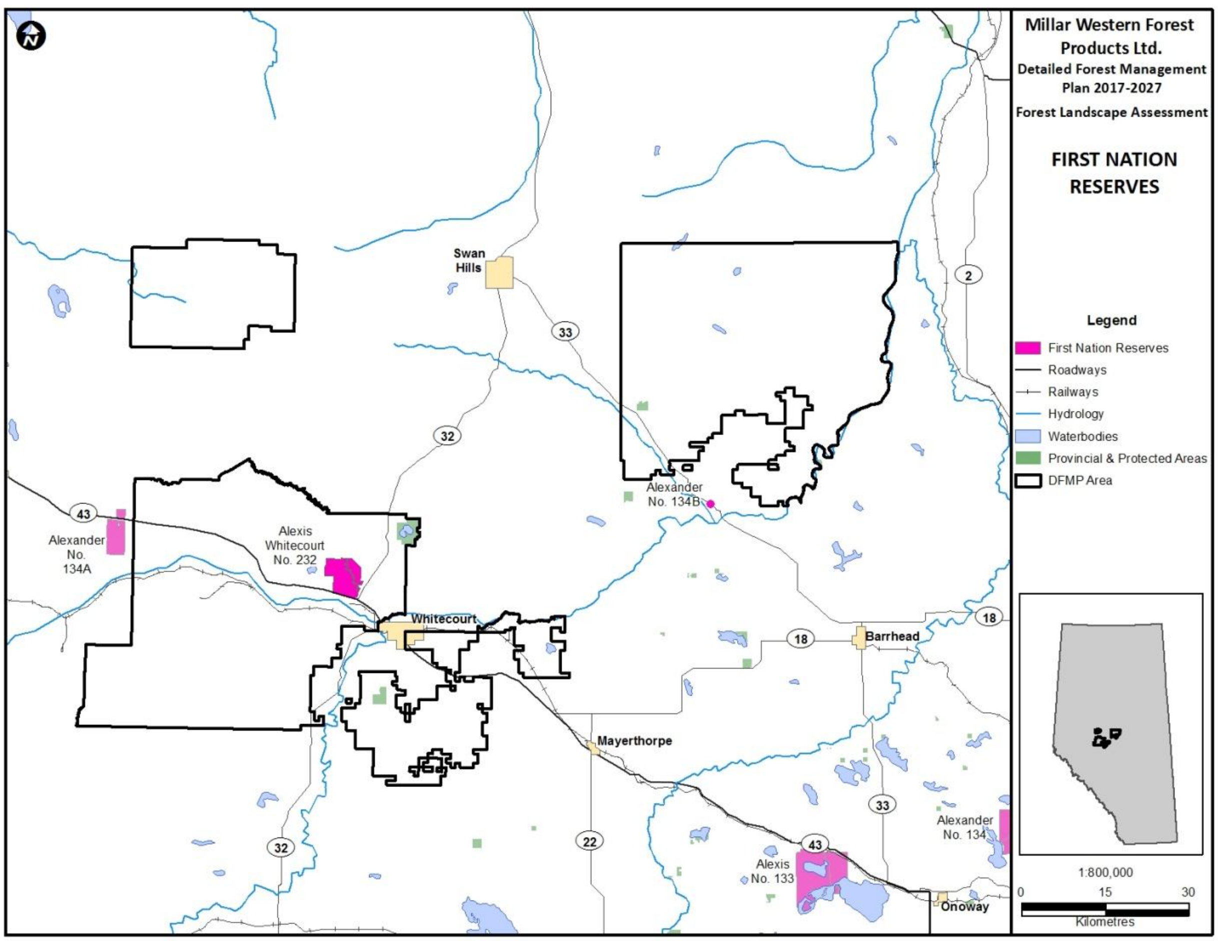


Figure 3-9. First Nations within the DFMP area

2.9 Métis Settlements

There are no Métis settlements within the DFMP area (11). The closest settlement is north of Virginia Hills.

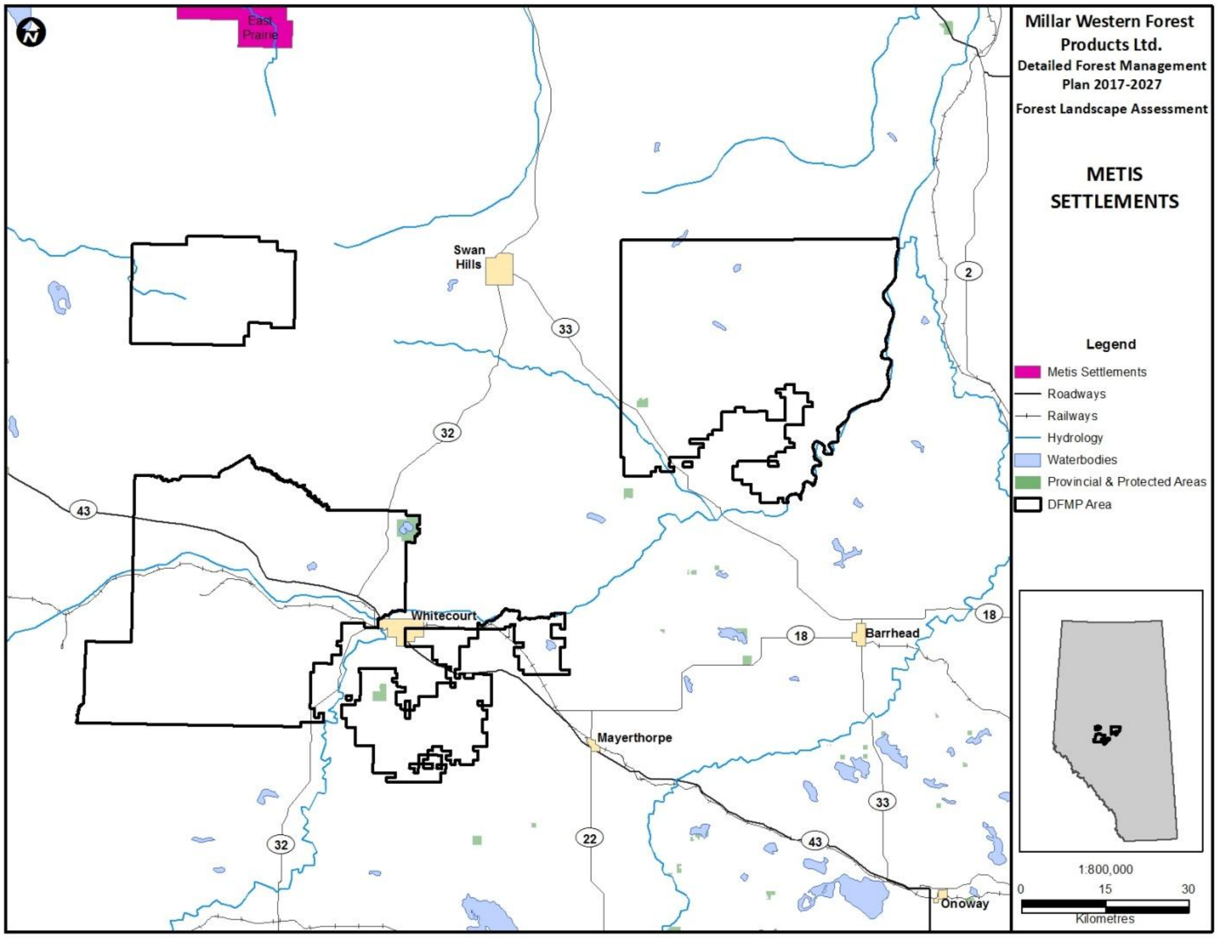


Figure 3-10. Métis settlements located near the DFMP area

2.10 Parks and Protected Areas

Of the many different types of parks and protected areas within Alberta (Alberta, 2015a) (12), there are three within the DFMP area: one provincial park, one wildland park, and two natural areas. These designations are defined in Table 3-5.

Table 3-5. Park and protected-area designations

Type	Definition
Provincial Park	A provincial park represents an area that preserves natural heritage. These parks support outdoor recreation, heritage tourism, and natural heritage appreciation activities that depend upon, and are compatible with, environmental protection. In Alberta, natural, historical and cultural landscapes and features in these parks are protected under the Provincial Parks Act.
Wildland Park	Wildland parks exist to preserve and protect natural heritage and provide opportunities for backcountry recreation. Wildland parks are typically large, undeveloped, natural landscapes that retain their primeval character. Trails and primitive backcountry campsites are provided in some wildland parks, to minimize visitor impacts. Some wildland parks provide considerable opportunities for eco-tourism and adventure activities, such as back packing, backcountry camping, wildlife viewing, mountain climbing and trail riding. Access and use of wilderness and wildland parks is not as restrictive as in wilderness areas – another park category that is not represented in the DFMP area.
Natural Area	A natural area represents natural and near-natural landscapes of regional and local importance for nature-based recreation and heritage appreciation. Natural areas are typically quite small; however, larger sites can be included. Most natural areas have no facilities; in those that do, facilities are minimal and consist mainly of parking areas and trails.

A total of 2% of the DFMP area (9,651 ha) is categorized as either a protected area or a park. The largest of these areas is the Fort Assiniboine Sandhills Wildland Park, which occupies approximately 1.6% of the DFMP area, or 7,558 ha. Table 3-6 summarizes the parks and protected areas within the DFMP area.

Table 3-6. Parks and protected areas within the DFMP area

Classification	Type of Park/ Protected Area	Park Name	Area (ha)	Percentage of DFMP area
Parks	Provincial Park	Carson-Pegasus	1,210	0.3
	Wildland Park	Fort Assiniboine Sandhills Wildland Park	7,558	1.6
Parks Subtotal			*8,768*	*1.9*
Protected Areas	Natural Area	Centre of Alberta	313	0.1
		Whitecourt Mountain	570	0.1
Protected Areas Subtotal			*883*	*0.2*
Total			**9,651**	**2**

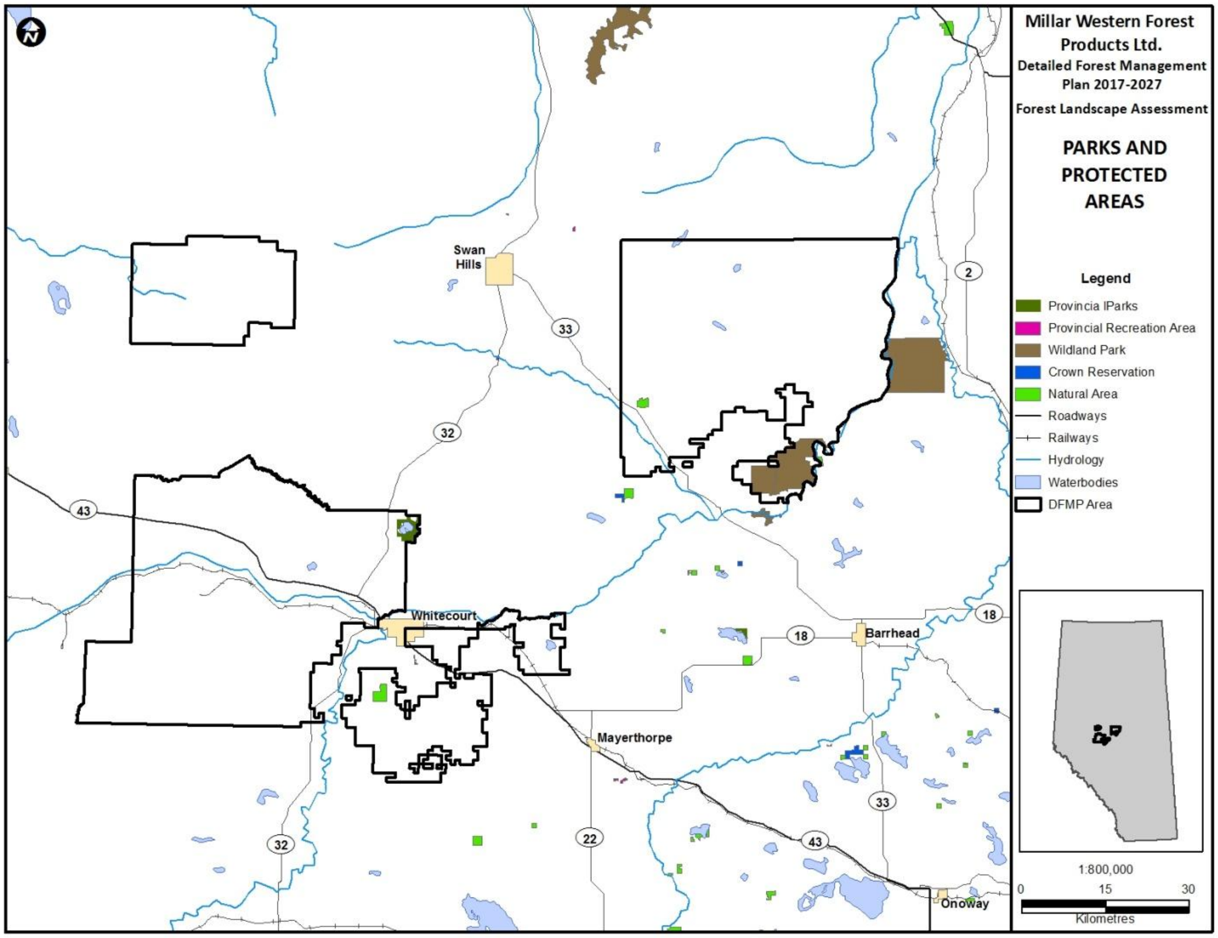


Figure 3-11. Parks and protected areas within the DFMP area

2.11 Wildfire Management Areas

The GoA has established Wildfire Management Areas (WMAs) (13), to define wildfire management responsibilities. The entire DFMP area falls within the Woodlands WMA. To the south of McLeod and Whitecourt lies the Foothills WMA; the Lesser Slave Lake WMA is situated north of Virginia Hills and Fort Assiniboine.

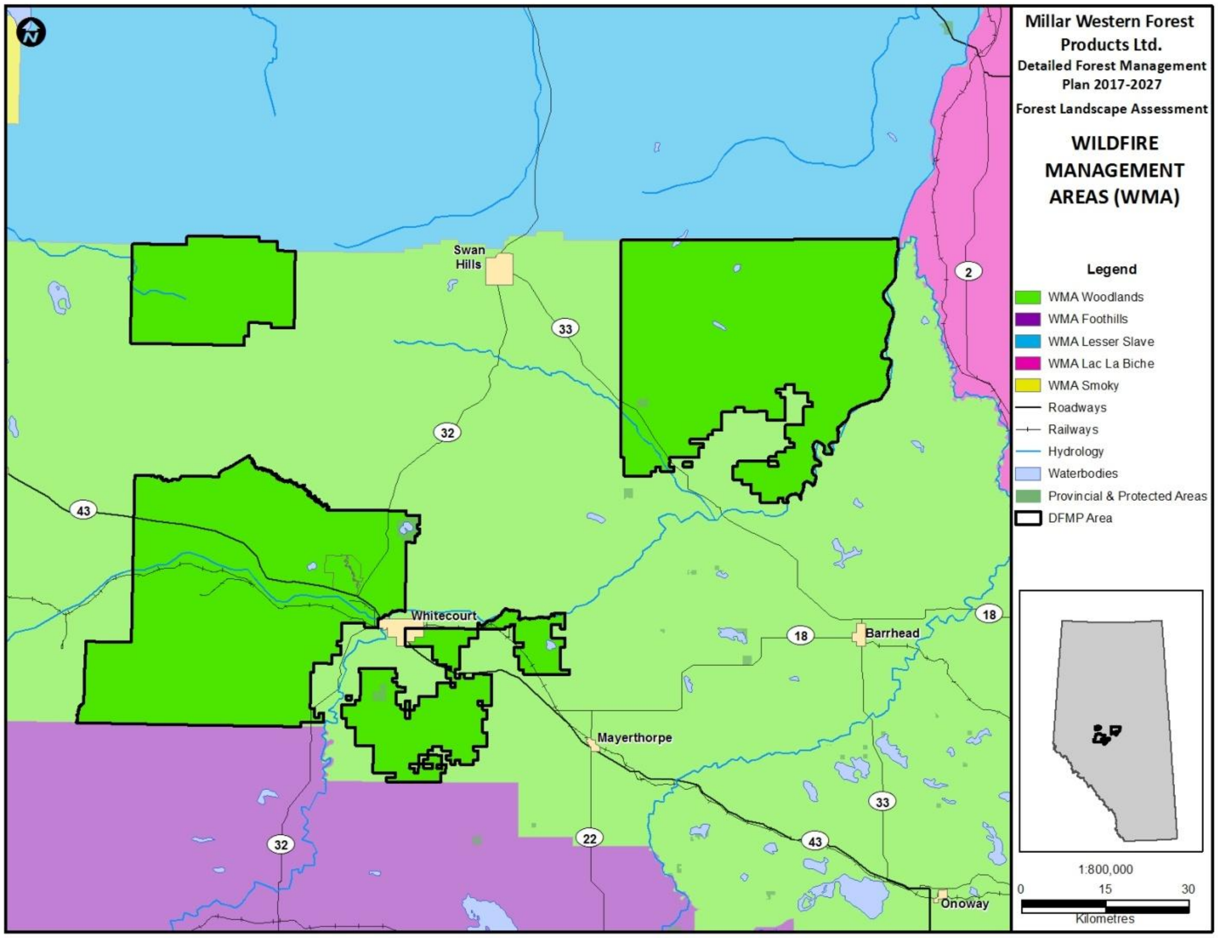


Figure 3-12. Alberta WMAs within the DFMP area

3. Physical Conditions

3.1 Topography

The DFMP area has a fairly uniform landscape (14), with 99.6% of the land base exhibiting a slope of under 30%, deeming it operable land. The majority of areas with steeper slopes are found around river valleys, such as the Athabasca River.

The highest point of elevation in the DFMP area is 1,381 m, which is located in Virginia Hills. The lowest point of elevation is approximately 566 m and can be found on the eastern portion of Fort Assiniboine, where the Athabasca River serves as a border to the southeast. Figure 3-13 illustrates the general topography of the DFMP area.

The important elements of topography to take into consideration in natural resource management are slope and aspect and their relationship with forest development. While these features are described in greater detail in the section describing natural subregions (see Section 2.5), it is relevant to note that slope is an important factor in defining machine operability, as well as assessing the potential for erosion. Four classes of slope were calculated based on generally accepted thresholds for operability, as shown below in Table 3-7. The majority of slopes that are greater than 31% are located in FMU W13.

Table 3-7. Slope classes and corresponding areas within the DFMP area

Slope Classes	Area (ha)	Area (%)
0 - 30%	470,582	99.6
31 - 45%	1,826	0.4
46 - 60%	198	0.04
60% +	22	0.005
Total	**472,627**[1]	**100**

[1]Calculated using pixels, so may not round to exact FMU area due to raster analysis.

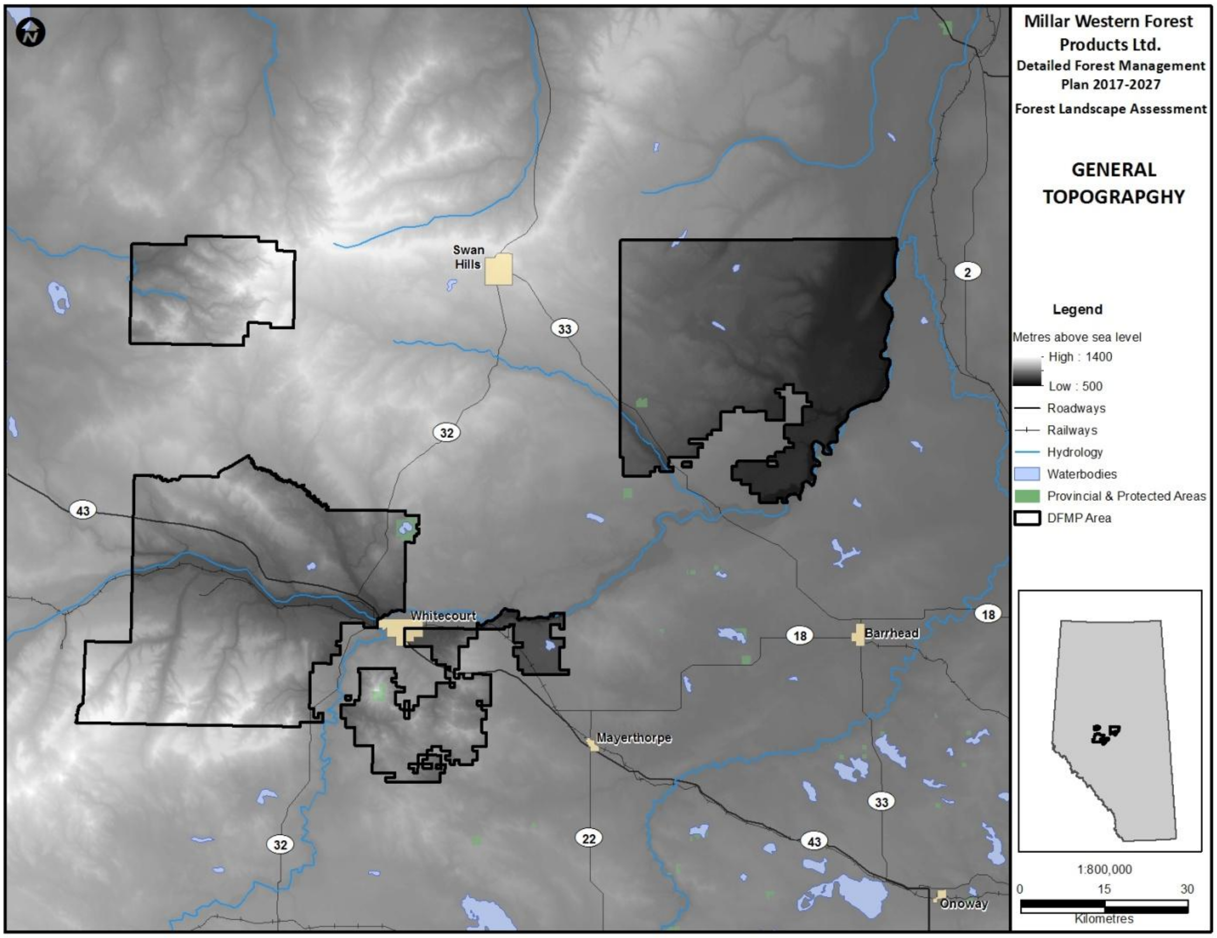


Figure 3-13. General topography within the DFMP area

3.2 Soils and Landforms

There are ten soil orders within Canada, four of which are associated with forested landscapes: Luvisolic, Brunisolic, Podzolic, and Organic. The dominant soil order in the DFMP area (15) is Luvisolic, which is present in approximately 83% of the area (Table 3-9), while Brunisols cover 14%, in areas along the eastern border of Fort Assiniboine and in small portions of McLeod (in the west), Blue Ridge (to the north) and Whitecourt (eastern portion). Organic soil covers 2% of the DFMP area, mostly in Blue Ridge, with some presence in the northeastern corner of Fort Assiniboine. The final soil order found in the DFMP area is Gleysolic, which covers 1% in the western portion of Virginia Hills. Gleysols are found throughout Canada wherever temporary or permanent water saturation causes formation of gleyed features in the profile (University of Saskatchewan, 2016). There are no Podzols in the DFMP area. Table 3-8 describes in further detail some of the main characteristics of the soil orders within the DFMP area. Figure 3-14 illustrates the distribution of soil orders across the DFMP area, as well as one grassland soil (Chernozemic) outside of the boundaries.

Table 3-8. Descriptions of soil orders in the DFMP area

Soil Order	Description
Brunisol	Brunisolic soils have sufficient development and typically have a brownish coloured B horizon. These soils tend to form under forests, giving them their colour, but can exist in a wide range of environments, including the Boreal forest, mixed forest, shrubs, grass, heath and tundra. They are usually well to imperfectly drained. Brunisolic soils are typically interpreted as a “transitional” soil, falling between generally unweathered parent material (common to Regosols) and mature forest soils represented by the Podzolic or Luvisolic orders.
Gleysol	Gleysolic soils are associated with several different moisture regimes and generally display properties of prolonged periods, intermittent or continuous, of water saturation. They are often identified by the appearance of mottling and most commonly occur in shallow depressions and level lowlands that experience intermittent saturation.
Luvisol	Luvisolic soils are generally light coloured and usually occur in well to imperfectly drained areas. They are located under forest vegetation, where the climate is sub-humid to humid and mild to very cold. They are well developed and have sandy loam to clay parent materials.
Organic	Organic soils are mainly composed of organic materials and are saturated with water for prolonged periods. They consist mainly of mosses, sedges, or other hydrophytic vegetation. They occur in poorly and very poorly drained depressions.

Table 3-9. Soil orders within the DFMP area

Order Name	Group Name	Subgroup Name	Area (ha)	Area (%)
Brunisol	Dystric Brunisol	Eluviated Dystric Brunisol	48,715	10
	Eutric Brunisol	Eluviated Eutric Brunisol	14,942	3
Brunisol Total			*63,657*	*14*
Gleysol	Luvic Gleysol	Orthic Luvic Gleysol	4,189	1
Luvisol	Gray Luvisol	Brunisolic Gray Luvisol	36,783	8
		Gleyed Gray Luvisol	33	0.01
		Orthic Gray Luvisol	356,468	75
Luvisol Total			*393,284*	*83*
Organic	Mesisol	Terric Mesisol	11,498	2
Total			**472,628**	**100**

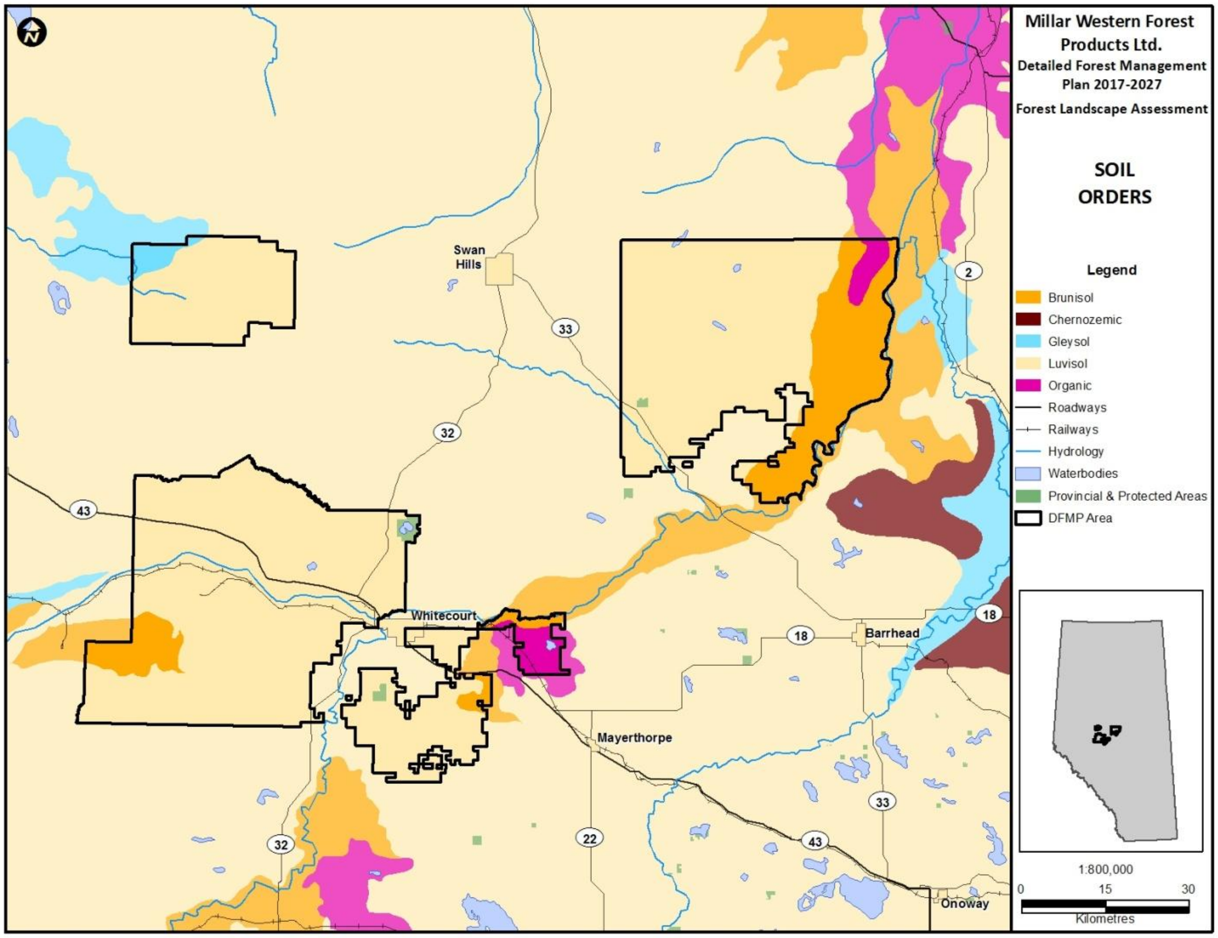


Figure 3-14. Soil orders within the DFMP area

3.3 Hydrography

3.3.1 Water Basins

Within Alberta, there are seven major drainage basins that are loosely based on the Land-use Framework boundaries. The majority of the DFMP area resides in the Athabasca River Basin. Virginia Hills, however, lies mostly within the Peace/Slave River Basin (Figure 3-15).

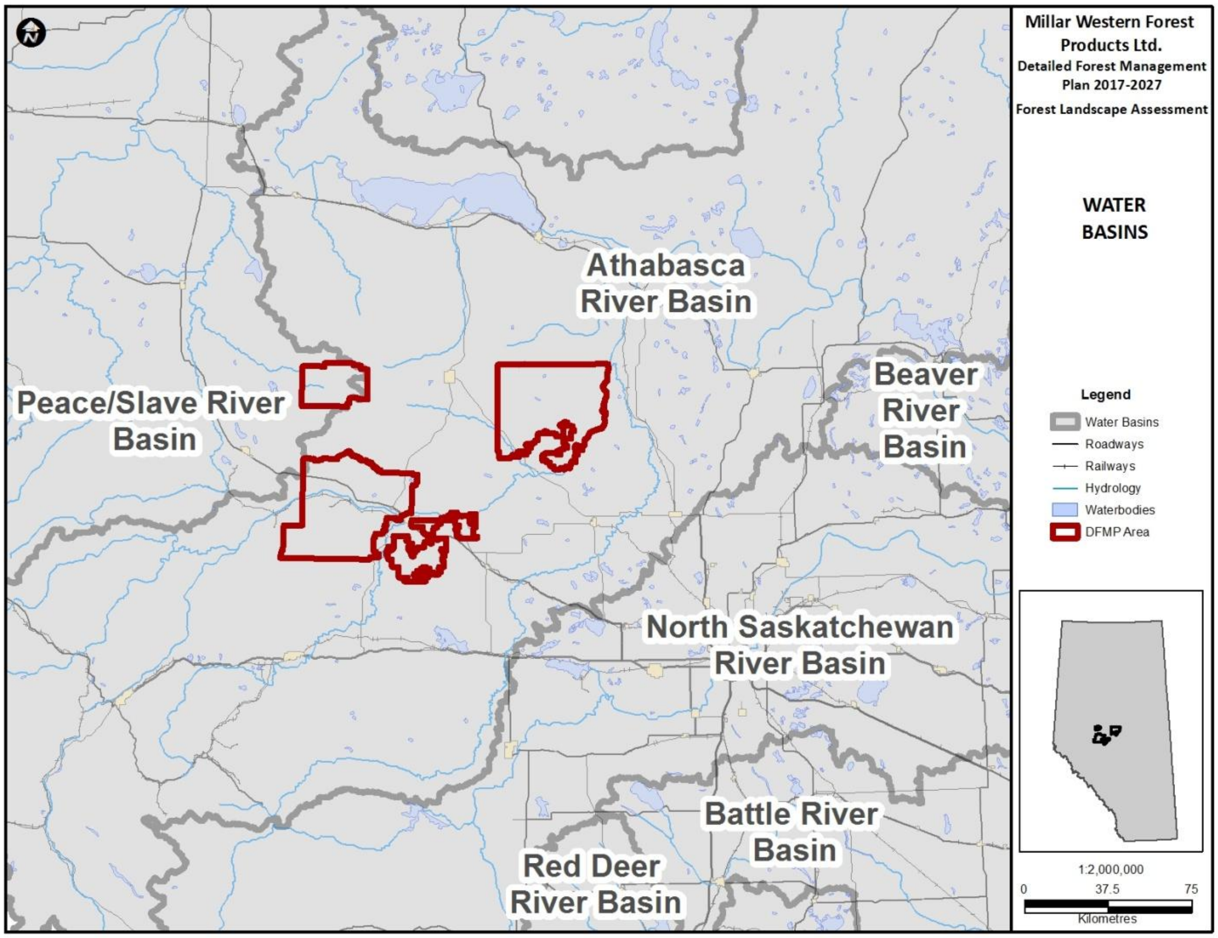


Figure 3-15. Major water basins within the DFMP area

3.3.2 Rivers, Streams and Waterbodies

Hydrologic features (16) within Alberta are mapped and classified according to their water status (e.g. permanent, recurring). There are also man-made hydrologic features that are identified by type (e.g. canal, reservoir, quarry); however, for the purposes of this summary, they are grouped together under one category: man-made features.

Table 3-10 summarizes the area of waterbodies in the DFMP area according to their class and total area. Similarly, Table 3-11 details the length of rivers and streams by their class. The summary of water features specifically excludes wetlands, which are described separately in subsequent sections.

Table 3-10. Waterbody classification within the DFMP area

Waterbody Class	Area (ha)
Major River	2,745
Lake (Permanent)	3,287
Lake (Recurring)	903
Oxbow (Permanent)	65
Oxbow (Recurring)	47
Man-made features	12
Island (Lake)	2
Island (River)	1,198
Total	**8,259**

Table 3-11. River/stream network classification within the DFMP area

River/Stream Class	Length (km)
Major River (Primary)	267
Major River (Secondary)	95
Stream (Permanent)	921
Stream (Recurring)	2,283
Stream (Indefinite)	1,254
Oxbow (Permanent)	7
Oxbow (Recurring)	20
Man-made Features	2
Arbitrary Flow (Manual)	35
Arbitrary Flow (DEM)	10
Total	**4,940**

Figure 3-16 shows the distribution of permanent water features within the DFMP area. In addition, the significant rivers draining into the DFMP area are labeled. In total, there are 14 named lakes in the DFMP area, of which the largest is McLeod Lake (331 ha). There are also 30 named rivers/streams, the longest being the Sakwatamau River (86 km). The 10 most significant rivers and lakes are listed in Table 3-12.

Table 3-12. Significant water features in the DFMP area[1]

Lake Name	Area (ha)[1]	River Name	Length (km)[1]
McLeod Lake	331	Sakwatamau River	86
Foley Lake	247	Timeu Creek	83
Leech Lake	218	Athabasca River	76
Baseline Lake	200	Akuinu River	66
Long End Lake	194	Windfall Creek	65
Windfall Lake	163	Chickadee Creek	56
Roche Lake	109	Doris Creek	55
Erickson Lake	85	Goose River	51
Little McLeod Lake	73	Oldman Creek	47
Kathryn Lake	55	Clearwater Creek	43

[1]Area of the significant lakes and length of the significant rivers refer only to the portion within the DFMP area.

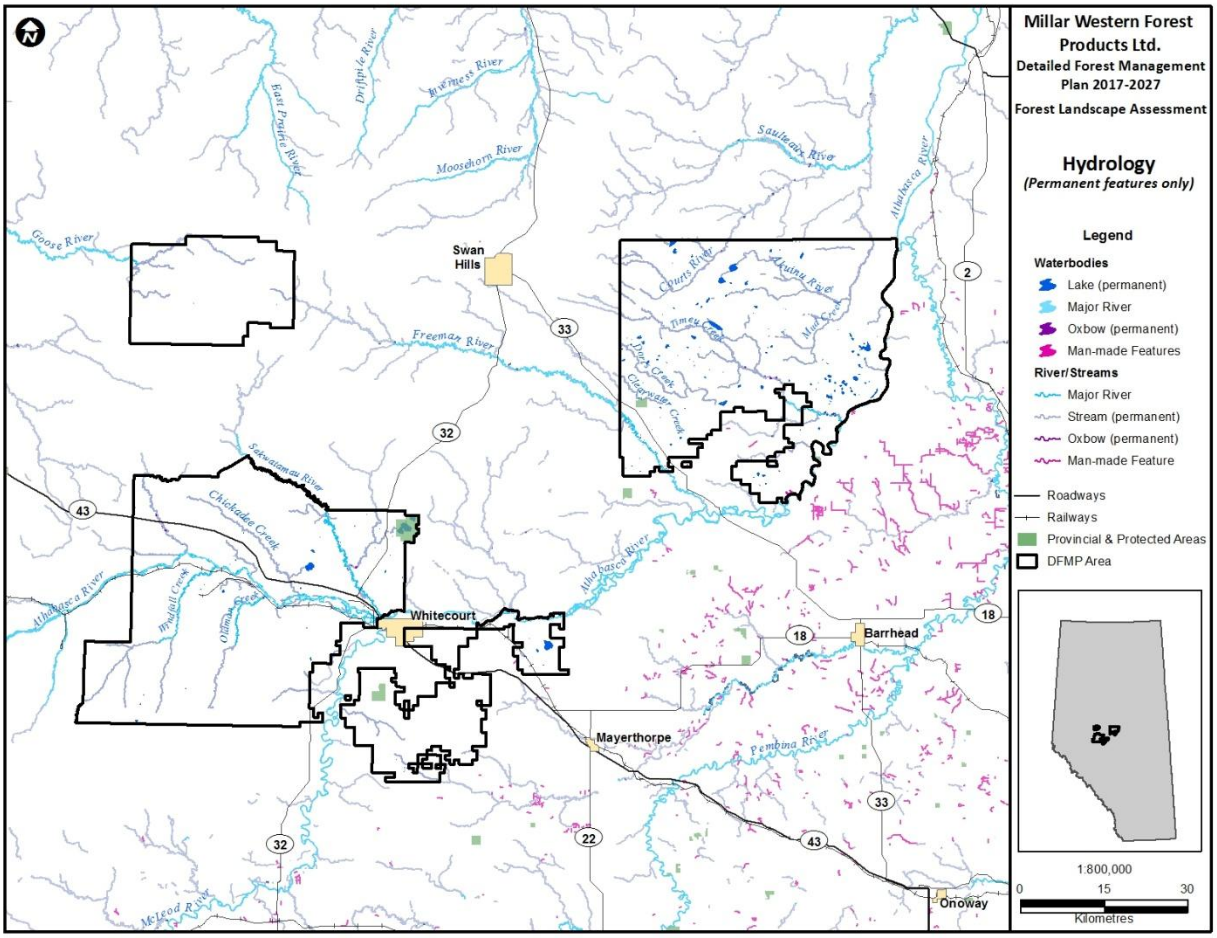


Figure 3-16. Permanent waterbodies and rivers within the DFMP area

3.3.3 Wetlands

Wetlands are prominent features across the boreal forest landscape and provide a variety of ecological goods and services. At the local and regional scales, wetlands influence rainfall and temperature patterns. At the global scale, Canada's wetlands, especially peatlands, play a key role in the regulating greenhouse gases such as methane and carbon dioxide and buffering the impacts of climate change (Gingras *et al.* 2016). Wetlands store water and slowly release it when conditions warrant and therefore help maintain water flow through droughts and floods and regulate flow during storm-water peaks to reduce the risk of erosion. Because wetlands can slow water movement, they can filter suspended sediments that settle to the wetland floor. Excess nutrients and/or pollutants are often either buried within these sediments or are absorbed by plant roots and microorganisms (Gingras *et al.* 2016). Wetlands also provide fresh surface water and replenish ground water supplies for industrial (e.g. petroleum extraction) use and to a lesser extent for domestic and agricultural use (Gingras et al. 2016). Wetlands are defined in Alberta as "land that is saturated with water long enough to promote formation of water altered soils, growth of water tolerant vegetation, and various kinds of biological activity that are adapted to wet environments" (Alberta Environment and Sustainable Resource Development, AESRD 2015b). Under this definition, wetlands can have areas of open water or be temporarily dry, vary in size and be treed, shrubby, or open with mosses, sedges or grasses.

Both the Canadian Wetland Classification System (CWSC, National Wetlands Working Group 1997) and the Alberta Wetland Classification System (AWCS, AERSD 2015b) note that wetlands can be organic (bogs and fens) or mineral (marshes, shallow open waters, and swamps) based. Organic wetland, also referred to as peatland or muskeg, has a surface layer of living roots and plants and a deep layer of decomposing organic deposits (>40cm) that are slowly accumulating over time due to cool and wet conditions (for additional detailed information on bogs and fens, refer to APPENDIX II). Mineral wetlands have shallow organic deposits (<40cm) and are characterized by nutrient-rich soils and water. Swamps (shrubby and treed), marshes (meadow and emergent), and shallow open water are the three types of mineral wetlands found in Alberta (for additional detailed information on these wetland types, refer to APPENDIX II). In some settings, conifer swamps can have >40cm of peat, technically making them a peatland.

Ducks Unlimited Canada (DUC) has developed an ecologically - based enhanced wetland classification (EWC) system for the Boreal plains ecozone further categorizing the 5 major classes of wetlands into 19 minor classes. The AWCS breaks the 5 major classes into 13 forms (Table 3-13).

Table 3-13. Classification of wetlands according to the AWCS and the EWC

EWC/CWCS/AWCS Major Class [1, 2, 3]	AWCS Form [3]	EWC Minor Class [1]
National (n = 5)	Provincial (n = 13)	Ecozone (n = 19)
Shallow Open Water	Submersed and/or Floating Aquatic Vegetation	Aquatic Bed
	Bare Shallow Open Water	Open Water
		Mudflats
Marsh	Graminoid Marsh	Emergent Marsh
		Meadow Marsh
Swamp	Coniferous Wooded Swamp	Tamarack Swamp
		Conifer Swamp
	Wooded, Deciduous Swamp	Hardwood Swamp
	Wooded, Mixedwood Swamp	Mixedwood Swamp
	Shrubby Swamp	Shrub Swamp
Fen	Wooded, Coniferous Fen	Treed Rich fen
		Treed Poor Fen
	Shrubby Fen	Shrubby Rich Fen
		Shrubby Poor Fen
	Graminoid Fen	Graminoid Rich Fen
		Graminoid Poor Fen
Bog	Wooded, Coniferous Bog	Treed Bog
	Shrubby Bog	Shrubby Bog
	Graminoid Bog	Open Bog

[1] Smith, K.B., C.E. Smith, S.F. Forest, and A.J. Richard. 2007. A Field Guide to the Wetlands of the Boreal Plains Ecozone of Canada. Ducks Unlimited Canada, Western Boreal Office: Edmonton, Alberta. 98 pp.

[2] National Wetlands Working Group. 1997. The Canadian Wetland Classification System, 2nd Edition. Warner, B.G. and C.D.A. Rubec (eds.), Wetlands Research Centre, University of Waterloo, Waterloo, ON, Canada. 68 p.

[3] Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System. Water Policy Branch, Policy Division, Edmonton.

Wetlands are not specifically interpreted or identified within the Alberta Vegetation Inventory (AVI) and are often fit into the “non–forested vegetated land” classification that includes closed shrub, open shrub, herbaceous - grassland, herbaceous –forb, and bryophyte. Thus, wetlands, especially those with shallow open water or that are treed, are often unrepresented in forest landscape assessments based on AVI data. Treed wetlands, particularly swamps, are often referred to as lowlands and are included as part of tree stand inventories based on AVI.

Based on DUC’s wetland inventory, wetlands make up 23.2% (109,718.3 ha) of the DFMP area (see Figure 3-17 and Table 3-14). All 5 class of wetlands are found within the DFMP area; however, the majority of wetlands (see Table 3-14 and Figure 3-18) are fens (61% of all wetlands, 67,147.9 ha), followed by swamps (30% of all wetlands, 32,630.3 ha). Wetlands are more prominent on FMU 11, where they comprise 40.1% (70,560.5 ha) of the FMU area, compared to only 13.0% of FMU 13 (Figure 3-17 and Table 3-14). Within FMU 11, the majority of wetlands (see Table 3-14 and Figure 3-18) are fens (69%, 48,848.61 ha), followed by swamps (23%, 16,341.85 ha). Fens and swamps make up a relatively similar amount of area on FMU 13 (~6% of the FMU area, as shown in Table 3-14).

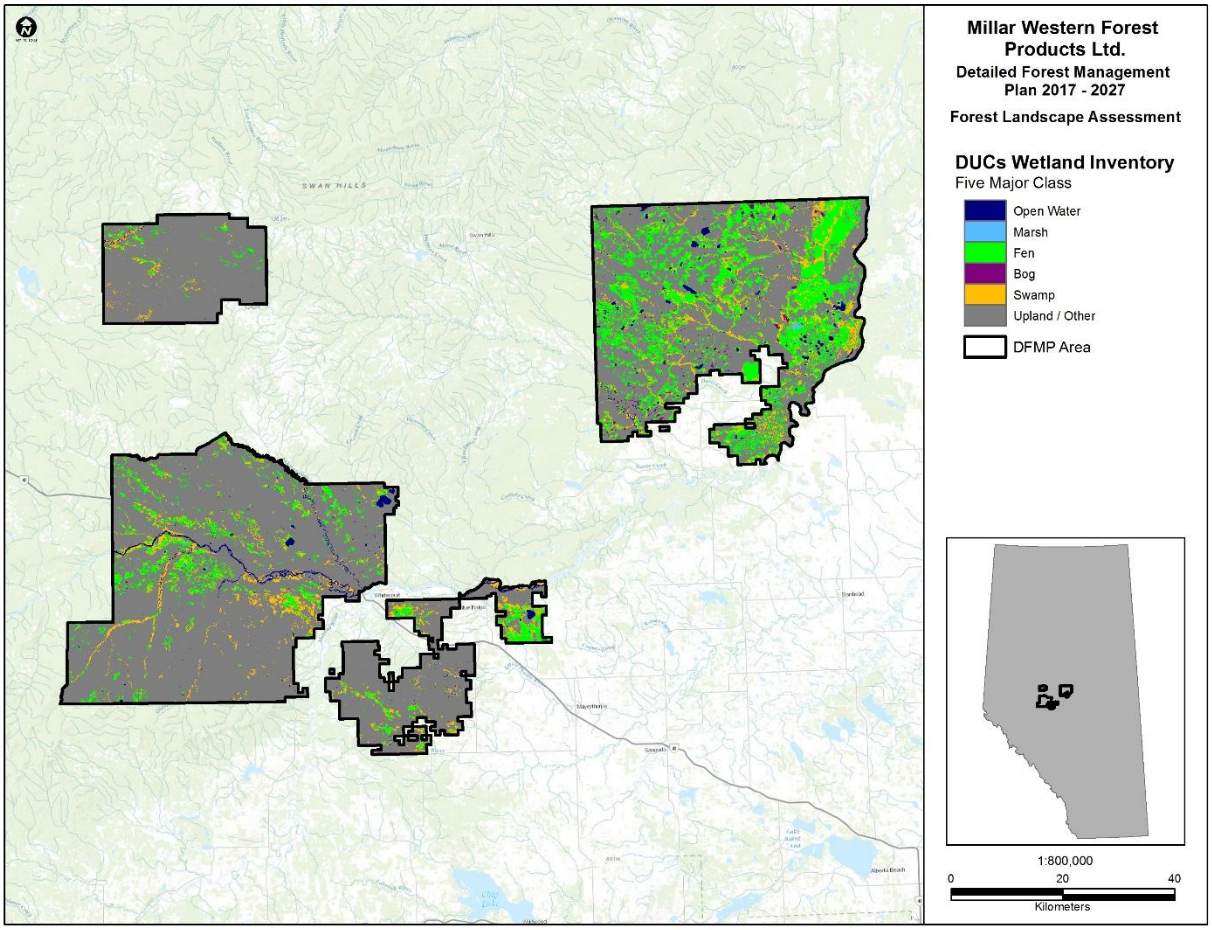


Figure 3-17. Distribution of the 5 major wetland classes within Millar Western's DFMP Area based on DUC's wetland inventory

Table 3-14. The area of the 5 major classes of wetlands, uplands, and other/unclassified landforms in the DFMP Area

	W11		W13		Total DFMP Area	
Major Class	Area (ha)	% of Total Area	Area (ha)	% of Total Area	Area (ha)	% of Total Area
Open Water	2,867	1.8%	3,167	1.1%	6,034	1.4%
Marsh	877	0.5%	266	0.1%	1,144	0.3%
Fen	45,410	28.0%	17,262	6.2%	62,672	14.2%
Bog	1,189	0.7%	114	0.0%	1,303	0.3%
Swamp	14,870	9.2%	14,626	5.2%	29,496	6.7%
Upland	81,471	50.2%	171,407	61.5%	252,878	57.3%
Other / Unclassified[1]	15,718	9.7%	71,902	25.8%	87,620	19.9%
Total	**162,402**	**100.0%**	**278,745**	**100.0%**	**441,147**	**100.0%**

[1]Other/Unclassified area includes cutblocks, cloud, cloud shadow, burn, and no data.

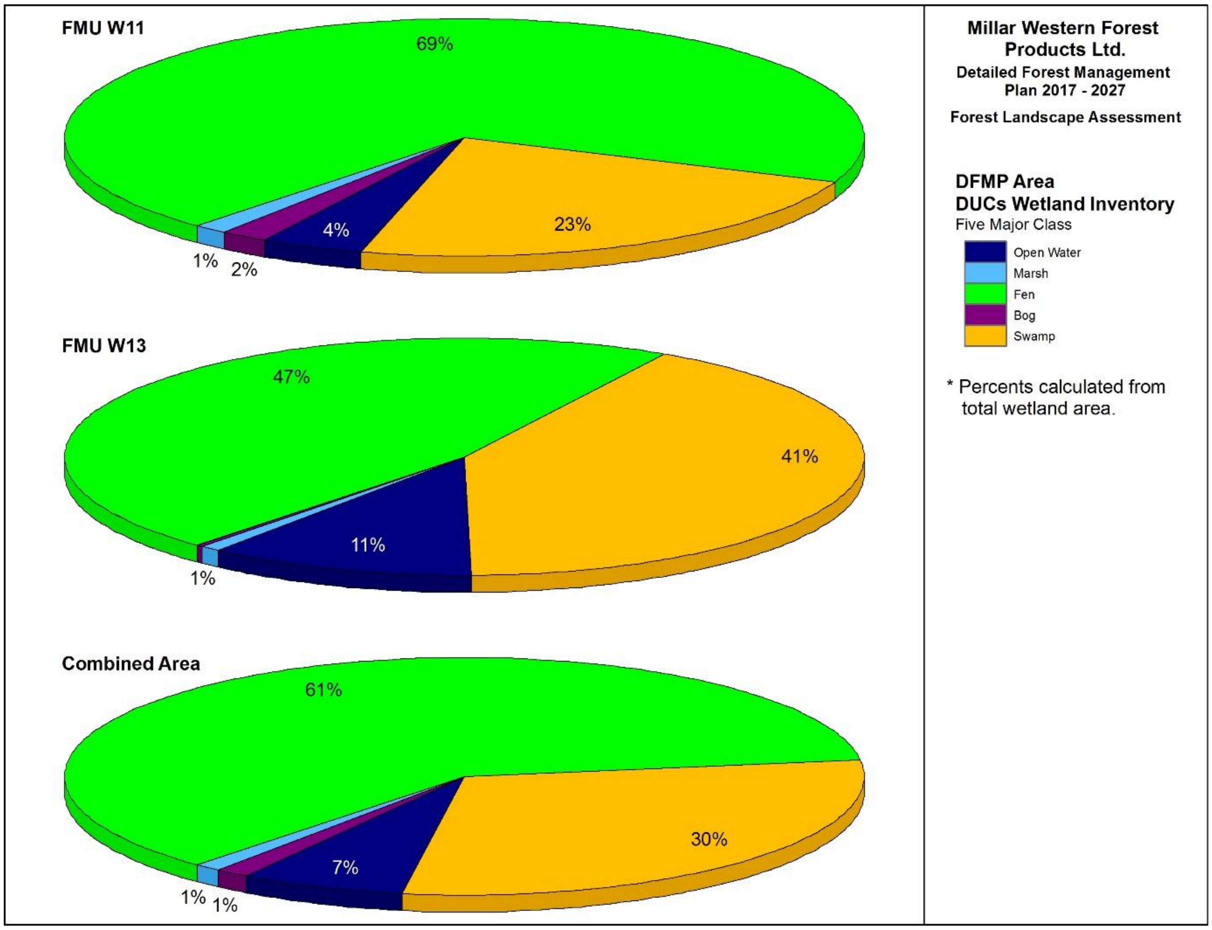


Figure 3-18. Percentage of each of the 5 major wetland classes within the DFMP Area calculated from the total wetland area based on DUC's wetland inventory

An analysis was also conducted for the Forest Management Area and the detailed AWCS classes for the FMUs which are included in APPENDIX III (FMA) and APPENDIX IV (detailed FMU).

3.4 Climate

Alberta has a continental climate that is characterized by a large variation in temperature between summer and winter. Within the DFMP area, the range of climatic conditions is less dramatic, given its relatively small size. Climatic data from 1971 to 2000, summarized by Alberta Agriculture and Forestry and Environment Canada (17), have been used to map general climatic trends throughout the province.

The daily mean temperatures (°C) for January and July, length of growing season (defined as the number of days where the daily temperature exceeds 5°C), and mean annual precipitation (mm) appear, respectively, in Figure 3-19 .

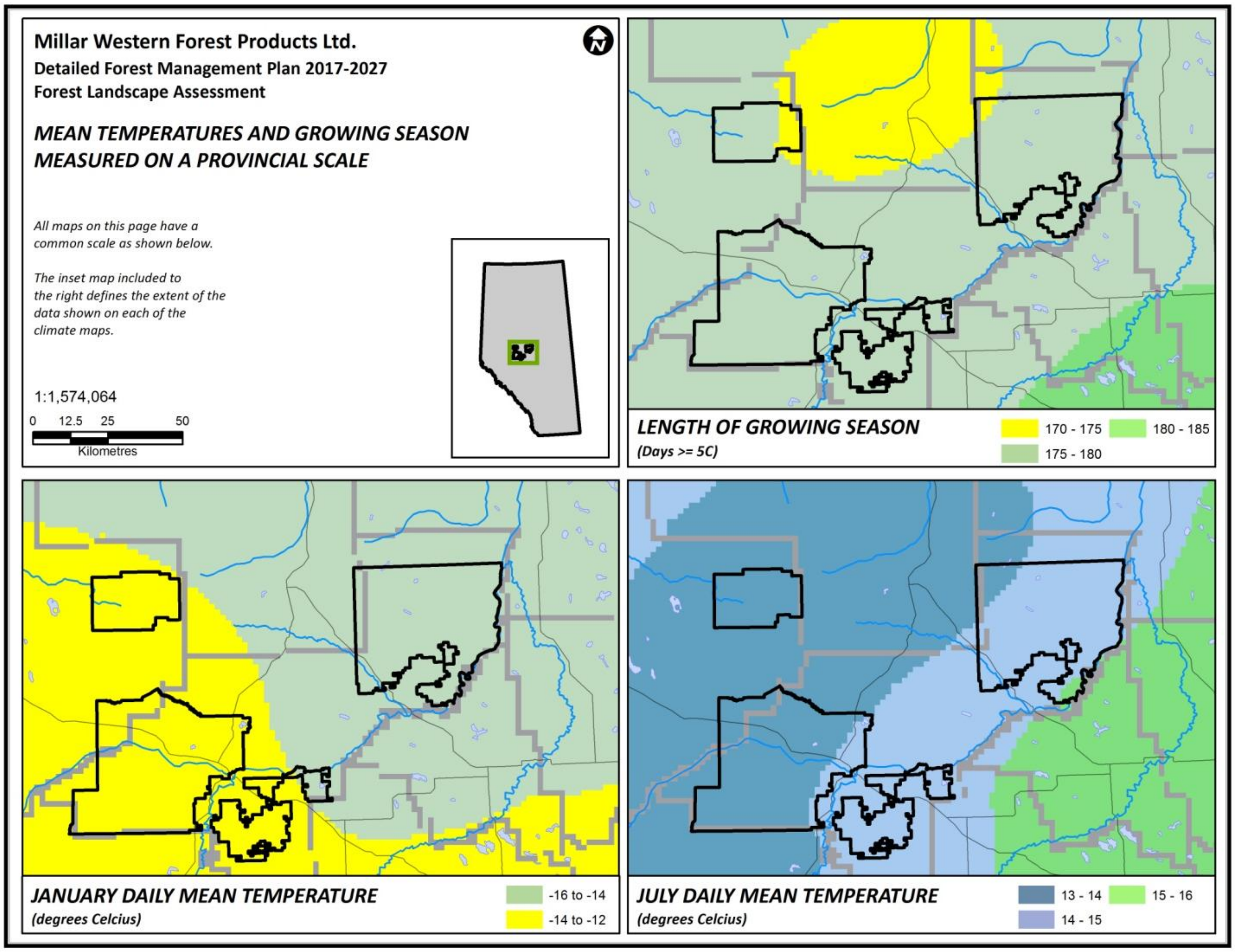


Figure 3-19. Mean temperatures and growing season measures on a provincial scale

The DFMP area experiences a range of only 4 degrees in daily-mean temperatures for January, from -12°C to -16°C. Virginia Hills, McLeod and Whitecourt have daily-mean temperatures of -12°C to -14°C; Blue Ridge and Fort Assiniboine have slightly lower mean temperatures of -14°C to -16°C. Figure 3-19 displays the location of the DFMP area in relation to the provincial ranges.

July daily-mean temperatures are very similar throughout the DFMP area, varying only a couple degrees throughout, from 13°C to 15°C. Virginia Hills' and McLeod's mean temperatures fall between 13°C and 14°C, while Whitecourt, Blue Ridge and Fort Assiniboine have slightly higher mean temperatures, from 14°C to 15°C. Figure 3-19 displays the location of the DFMP area in relation to the provincial ranges.

The length of growing season within the DFMP area is very uniform and ranges from 170 to 180 (days per year that are above 5°C). The exception is a very small easterly portion of Virginia Hills and the very northwesterly corner of Fort Assiniboine, which have a slightly shorter growing season of 170 to 175 days. Figure 3-19 displays the location of the DFMP area in relation to the provincial ranges.

The mean annual precipitation within the DFMP area varies significantly. The western portion of Virginia Hills and McLeod has a range of 600 to 650 mm, while the eastern portion of Virginia Hills and McLeod, as well as Whitecourt, Blue Ridge and the western portion of Fort Assiniboine, has a range of 550 to 600 mm. The eastern to southeastern portion of Fort Assiniboine receives the least precipitation – only 500 to 550 mm annually. Figure 3-20 displays the location of the DFMP area in relation to the provincial ranges.

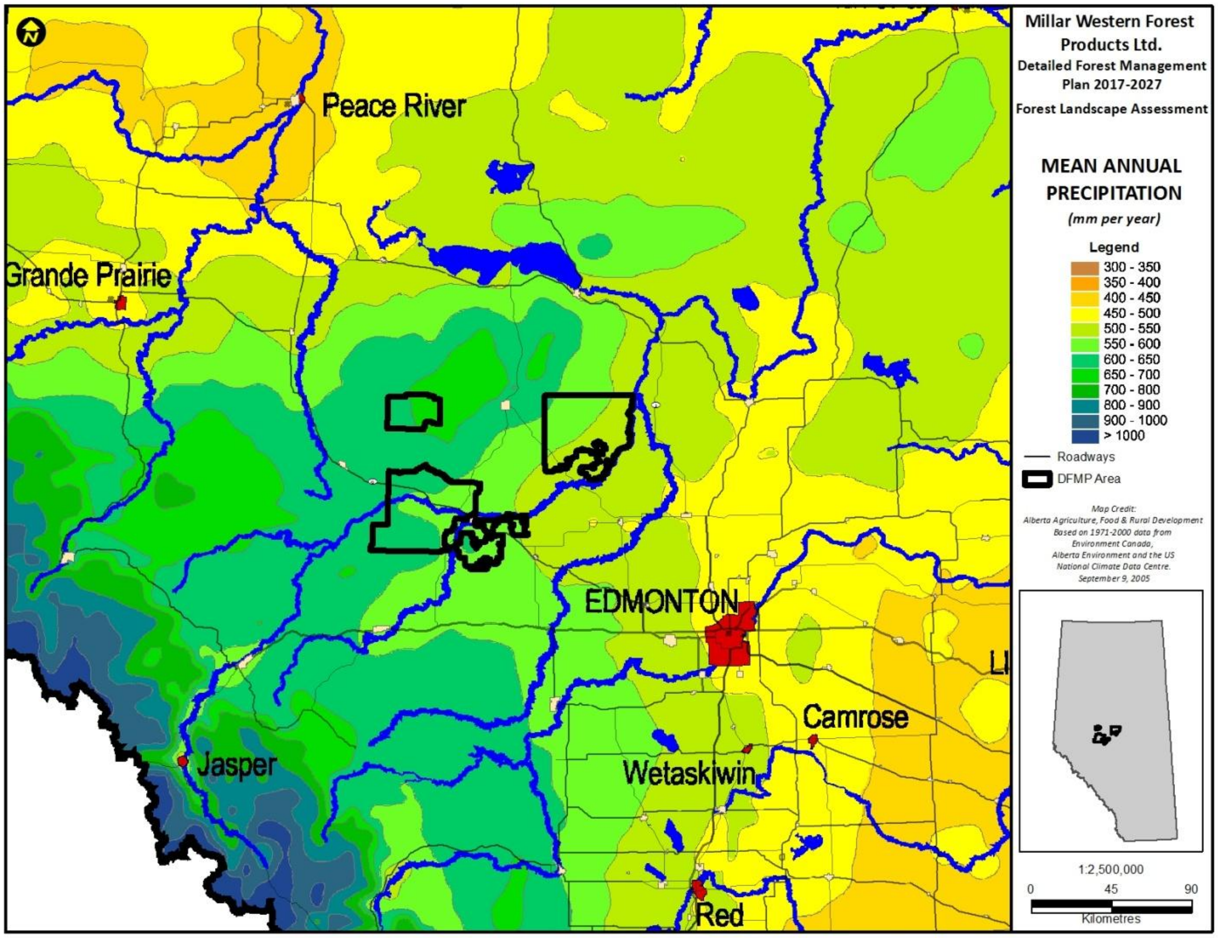


Figure 3-20. Mean annual precipitation

The provincial ecological classification identifies one ecoclimatic province within the DFMP area - the Boreal Plain. The Boreal Plain regime consists mainly of the Central Mixedwood and Dry Mixedwood Natural Subregions. The remaining area is occupied by the Lower and Upper Foothills Subregion, which is considered a transitional zone between Boreal and Cordilleran ecoclimates.

In addition to temperature, length of growing season and precipitation, three other important factors affect reforestation success and tree growth: summer moisture index (SMI), frost-free days, and growing season precipitation (GSP). Summaries of their impacts, taken from the publication Natural Regions and Subregions of Alberta (Natural Regions Committee 2006), are provided below:

- **Summer Moisture Index**: The SMI is a measure of precipitation effectiveness during the growing season. It is calculated by dividing the number of growing degree days over 5°C by the amount of precipitation over the growing season (April through August). A high ratio indicates a greater likelihood that evaporation will exceed precipitation at some time during the growing season. For example, an SMI greater than 4 indicates dry to very dry climatic conditions, while an SMI less than 3 indicates moist to wet climatic conditions, with no moisture deficits during the growing season.

An SMI between 3 and 4 indicates the likelihood of only moderate moisture deficits for short periods of the growing season.

- **Frost-Free Days**: The frost-free period is another indicator of temperature regimes that are favourable or unfavourable to plant growth. Factors contributing to short, erratic, frost-free periods are terrain variability and elevation. Rough terrain and higher elevations tend to experience shorter and more unpredictable frost-free periods, likely due to variations in aspect and cold air drainage from high to low terrain. While general trends and averages are shown in Figure 3-20, the calculations of average frost-free periods are highly unreliable because of year-to-year variations in weather patterns and topographic variability.

- **Growing Season Precipitation**: GSP is the portion of mean annual precipitation that falls from April to August. Higher proportions of precipitation during the growing season indicate continental climatic influences (where the bulk of the precipitation falls during the summer).

General patterns of the SMI, frost-free days and GSP are displayed in Figure 3-21. The SMI within the DFMP area is generally 2.7 but ranges from 2.1 in the east portion of Virginia Hills and the southwest corner of McLeod, to 3.8 in Whitecourt, Blue Ridge, and the eastern portion of Fort Assiniboine. The number of frost-free days is usually between 91 to 100 days; in the eastern part of Virginia Hills and southwestern corner of McLeod, they are slightly less, ranging from 81 to 90 days. The GSP is also quite uniform, with the majority of the DFMP area receiving from 426 to 450 mm; Blue Ridge, eastern portions of Fort Assiniboine, the northwestern corner of Virginia Hills, and smaller portions of Whitecourt and McLeod receive somewhat less, in the range of 301 to 325 mm.

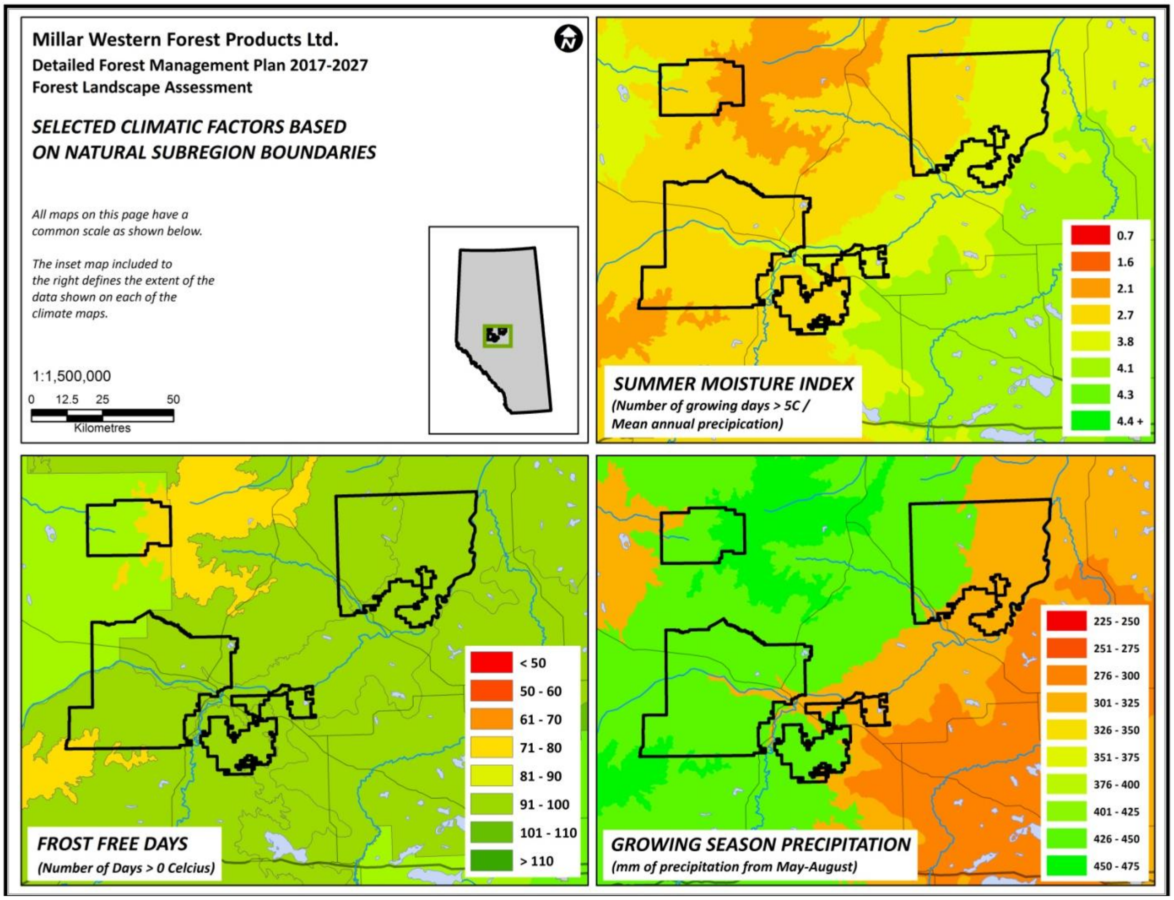


Figure 3-21. Climatic factors associated with natural subregions

4. Landscape Pattern and Structure

4.1 Source of Data

A review of landscape patterns based on vegetation relies on a detailed forest inventory. In developing the Landscape Assessment Report, the GoA compiled digital AVI data using industry and Crown sources (18). This data was also used in assessing species, stand type, age class, seral stage, patch distribution, and interior forest. Figure 3-22 indicates the relative coverage of AVI detail across the DFMP area and the source of that information, with most of the data obtained from FMA holders. All AVI specifications data meet the minimum standard for vegetation classification as described in Alberta (2005).

Since the Landscape Assessment Report was issued in 2012, Millar Western has captured new AVI for its DFMP area, with photo capture as current as 2012. This AVI data was used to compare and contrast against the previously compiled AVI data used in the Landscape Assessment Report, to generate the following assessments of species, stand type, age class, seral stage, patch distribution and interior forest.

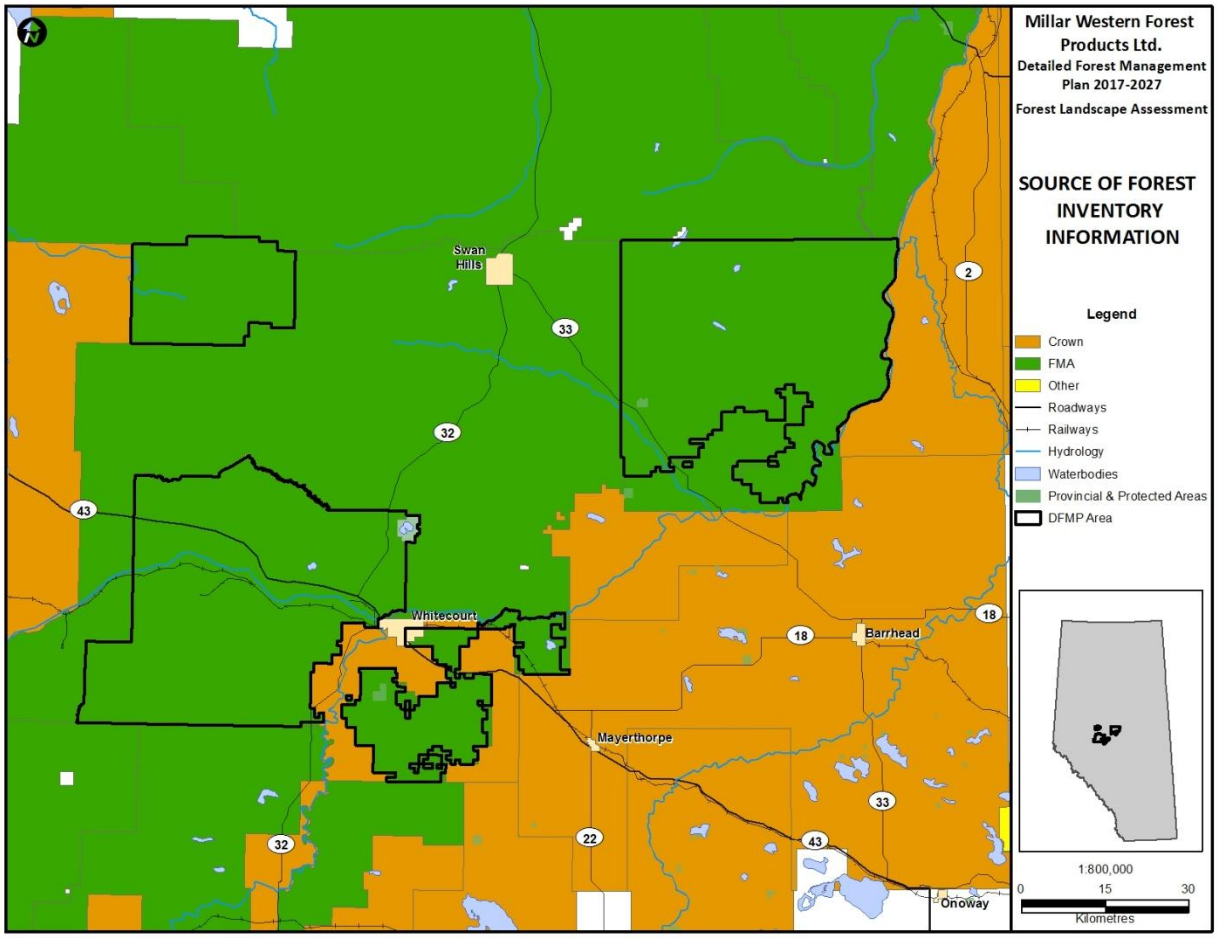


Figure 3-22. Source of AVI information from the 2012 Landscape Assessment Report

As indicated in Table 3-15, the majority of the inventory for the DFMP area (18) included in the 2012 Landscape Assessment Report is greater than 20-years old. Because of its age, it will be referred to as the "old AVI". The most recent AVI data was captured between 2010 and 2012 and will be referred to as the "new AVI".

Table 3-15. Comparison of the age of AVI from old AVI to new AVI

Age of AVI (years)	Old AVI Area (ha)	New AVI[1] Area (ha)
0-5 years	-	474,522
6-15 years	-	-
16-20 years	71,438	-
20-25 years	399,040	-
Greater than 25 years	521	-
Sub-total	*470,999*	*472,522*
No AVI Available[2]	1,629	-
Total	**472,628**	**472,522**

[1]Referencing from May 1, 2015.
[2]No AVI available - includes provincial parks.

For the purposes of the Landscape Assessment Report (the old AVI), the inventory data has been updated with known depletions related to harvesting, wildfire and land-use disturbances (up to and including 2011); stand characteristics, however, have not been modified to reflect changes in stand growth (density, height, species composition). Only the overstory detail was used for the classifications of species, forest types, age class and seral stage; the understory information was not considered. Other FMA holders may adopt different practices for classifying such attributes for their planning and yield estimation, but Millar Western has chosen to base its overall landscape assessments on overstory characteristics only.

4.2 Forest Species

Forest species (19) refers to the general commercial tree species in Alberta but does not include species such as willow or alder, which are typically found in shrub-form in Alberta. In this assessment, the listed species represent the leading overstory tree species in the corresponding inventoried area (see Table 3-16). Note that there is a class of "undifferentiated" species within the old AVI dataset: the class "Pine-undiff" represents areas where lodgepole pine and jack pine are indistinguishable, either because of hybridization between the two species or tree form was not recognizable on the imagery used for interpretation. Fort Assiniboine is on the edge of the pine hybridization zone.

As a group, coniferous species are more prevalent (45%) than deciduous (36%) within the old AVI; in the new AVI, coniferous, at 55%, is more widespread than deciduous, which is at 33%. The deciduous stands tend to be aspen-leading over the area of inventoried lands. Aspen generally occurs in mixed-wood stands but also forms pure stands throughout the DFMP area. Pine is the most prevalent leading coniferous species and exists both in pure stands and mixed-coniferous stands; pine-aspen mixes are the most common mixed-stand types within the DFMP area.

White and black spruces occur commonly throughout the DFMP area. White spruce is found in mixed coniferous, mixed-wood, and pure stands. Black spruce exists primarily in lowland areas. It is important to note that there may be large areas of sparse black spruce and tamarack in some wetlands; however, because wetlands are the dominant feature, these areas would typically be classified as "not forested".

The category "undeclared species" in the AVI datasets refers to areas regenerating from wildfires or harvest areas for which a leading tree species has not yet been established or declared.

The geographic distribution of species is provided in Table 3-16. Coniferous species are most prevalent in Virginia Hills and the western portions of McLeod and Fort Assiniboine, with a trend towards deciduous southeasterly across the DFMP area. Whitecourt, Blue Ridge and an eastern portion of Fort Assiniboine are prevalently deciduous.

Table 3-16. Comparison of leading species distribution from old AVI to new AVI

Tree Type	Common Name	Latin Name	Old AVI Area (ha)	New AVI Area (ha)
Coniferous	Lodgepole pine	*Pinus contorta*	69,852	109,053
	Black spruce	*Picea mariana*	56,198	51,540
	White spruce	*Picea glauca*	45,291	49,656
	Tamarack	*Larix laricina*	31,798	47,757
	Pine (undiff.)	*Pinus sp.*	4,496	-
	Jack pine	*Pinus banksiana*	3,009	-
	Balsam fir	*Abies balsamea*	89	618
Coniferous	*Sub-total*		*210,733*	*258,623*
Deciduous	Trembling aspen	*Populus tremuloides*	156,190	133,989
	Balsam poplar	*Populus balsamifera*	12,069	17,601
	Paper birch	*Betula papyrifera*	1,436	4,552
Deciduous	*Sub-total*		*169,695*	*156,142*
Regenerated	(undeclared deciduous)		47,676	16,240
Not Forested			43,565	41,517
No AVI Data			959	-
Total			**472,628**	**472,522**

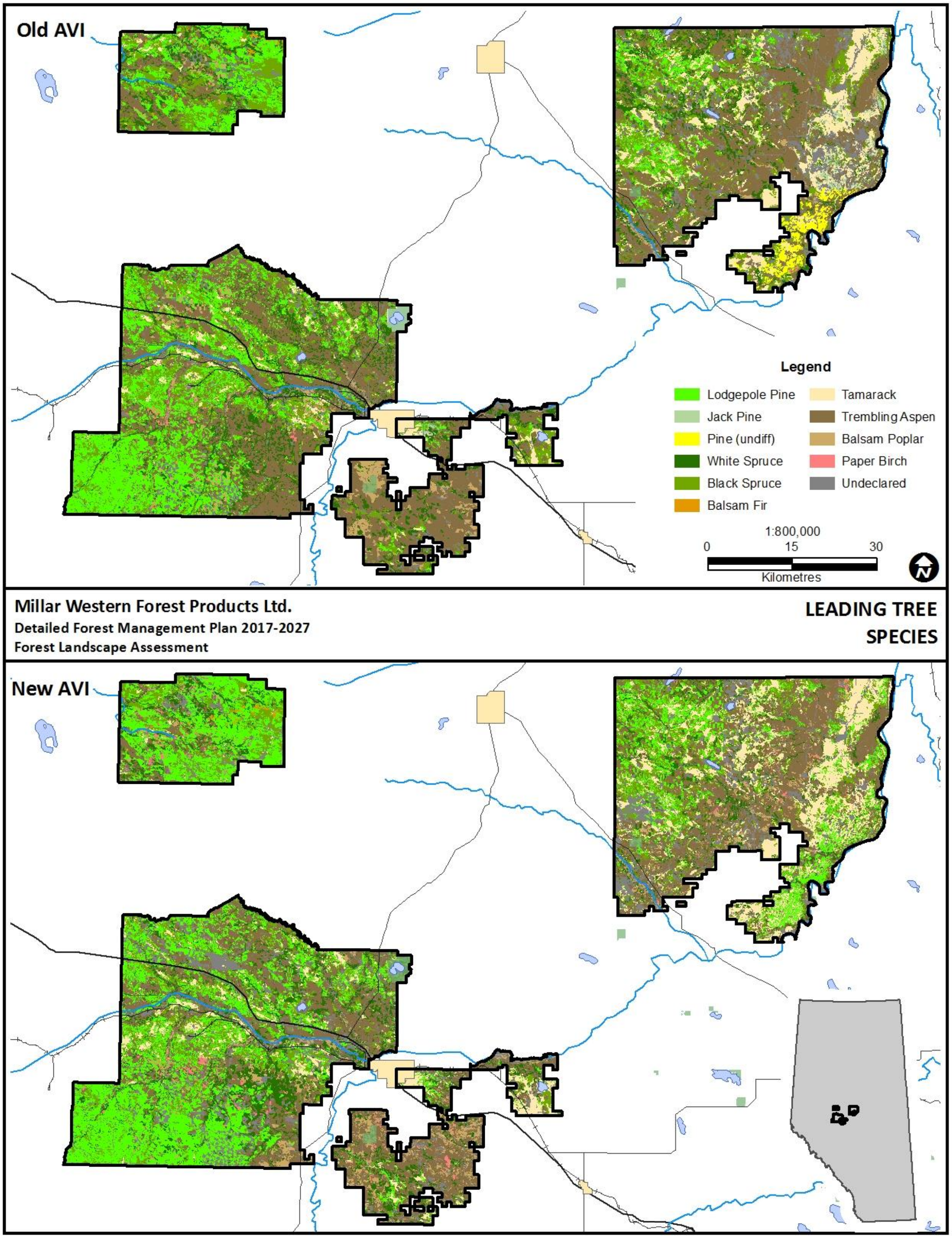


Figure 23. Comparison of leading tree species from old AVI to new AVI.

4.3 Forest Cover Types

Cover-type groupings (19) are based on the provincial strata defined in the yield projection guidelines of the Forest Planning Standard (Alberta 2006). Strata are hierarchical, based first on broad cover group (coniferous, coniferous-deciduous, deciduous-coniferous, deciduous), then by leading coniferous species, except in the case of pure deciduous. There are 10 primary forest cover types defined in the Forest Planning Standard.

The DFMP area is dominated by coniferous cover types (Table 3-17). In the old AVI, 39% of the inventoried area is covered by spruce and pine forest strata, which increases to 49% with the new AVI. These cover types are most common in the western part of McLeod and Fort Assiniboine, and most of Virginia Hills. Deciduous-dominated stands are significant within the DFMP area (30% of old AVI, 26% of new AVI) and are generally found in the southeastern portion of the DFMP area. Higher deciduous concentrations are also found in Whitecourt, Blue Ridge, and the eastern portion of Fort Assiniboine. The "regeneration" category, which accounts for 10% (old AVI) and 3% (new AVI), includes harvested or wildfire-affected areas for which an AVI strata has not been assigned. Most of the large regenerated area in Virginia Hills is due to the 1998 Virginia Hills fire (see Section 5.5), which in the newer dataset has been assigned species information. Figure 3-24 shows the spatial distribution of cover types across the DFMP area.

Table 3-17. Comparison of forest cover type summary from old AVI to new AVI

Description	Code	Old AVI Area (ha)	New AVI Area (ha)
Pine pure or leading	C-P	67,607	97,292
Black spruce pure or leading	C-Sb	87,526	98,533
White spruce pure or leading	C-Sw	29,455	34,231
Pine/Deciduous	CD-P	9,931	14,057
Black spruce/ Deciduous	CD-Sb	549	1,009
White spruce/ Deciduous	CD-Sw	16,240	18,153
Deciduous /Pine	DC-P	7,898	9,425
Deciduous /Spruce	DC-S	20,335	21,428
Deciduous	D	140,888	120,637
Regenerated (undeclared strata)		47,676	16,240
Sub-total		*428,104*	*431,005*
Not Forested		43,565	41,517
No AVI Data		959	-
Total		**472,628**	**472,522**

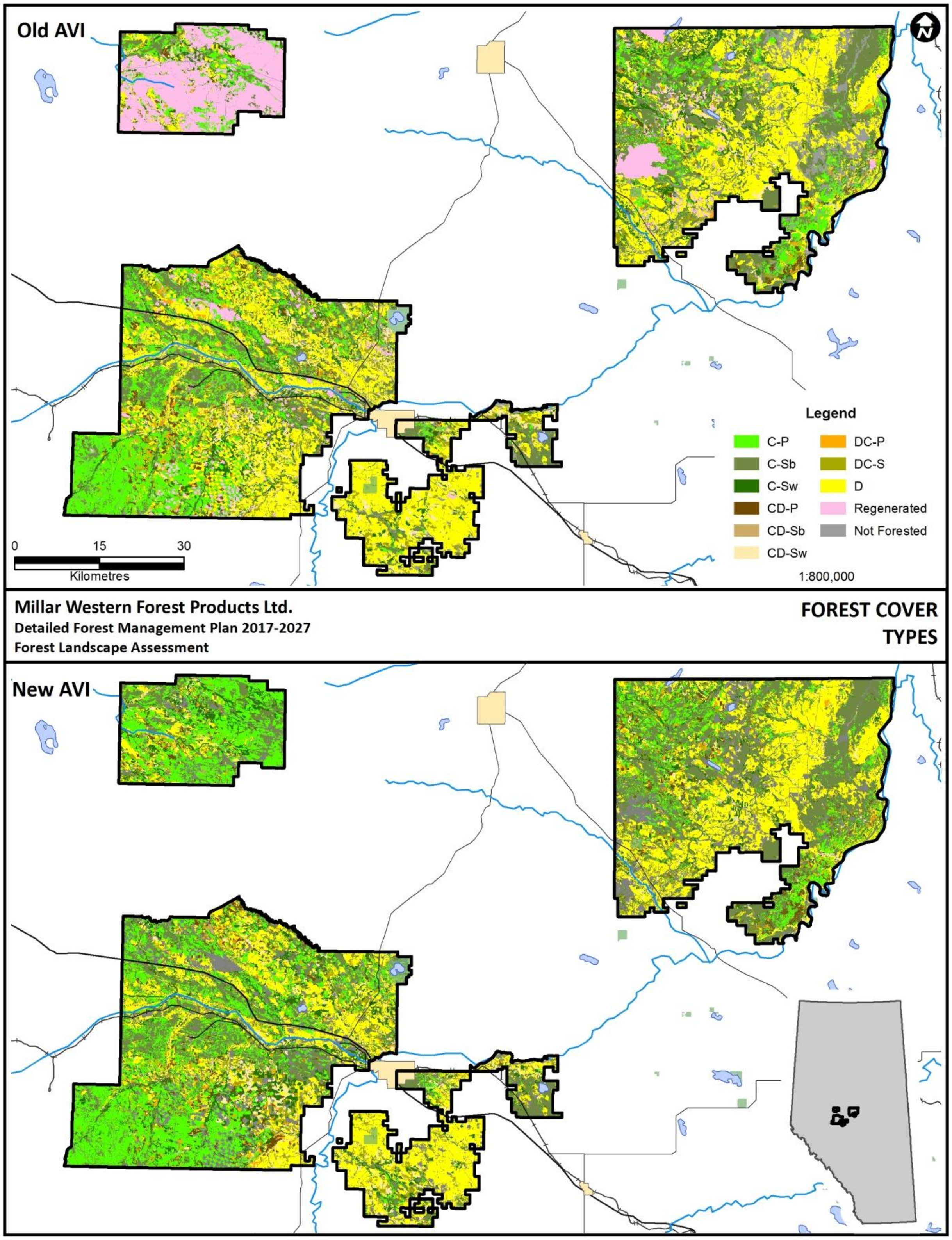


Figure 3-24. Comparison of forest-cover type distribution between old and new AVIs

4.4 Forest Age Classes

The age-class distribution (19) over the forested landscape of the DFMP area is shown in Table 3-18 and Figure 3-25 and highlights a similar trend between the new and old AVIs. In both inventories, the majority of the forest is considered mature, with 35% of the old and 31% of the new AVI representing classes greater than 100 years old. The second largest grouping is an amalgamation of the 70 to 79 and 80 to 89 classes, which represent 16% the old and 19% of the new AVI for the total land base. The prevalence of these two age classes reflects wildfire history (see Section 5.5) in the DFMP area, which saw several large blazes in the 1940s. The third most prevalent class is 10-19 and accounts for 13% of the old and 9% of the new AVI, which is also consistent with the wildfire history, specifically the Virginia Hills fire of 1998. Figure 3-25 displays the age-class differences between old and new AVIs. An overview map of the distribution of age classes appears in Figure 3-26.

Table 3-18. Comparison of age class distribution from old AVI to new AVI

Age Class (years)	Old AVI Area (ha)	New AVI Area (ha)
0 - 9	16,756	17,456
10 - 19	62,359	44,831
20 - 29	13,643	20,494
30 - 39	5,475	8,069
40 - 49	26,292	42,614
50 - 59	29,783	32,756
60 - 69	12,622	7,444
70 - 79	49,502	78,086
80 - 89	27,747	13,850
90 - 99	15,407	20,963
100 - 109	21,909	18,495
110 - 119	51,230	48,985
120 - 129	34,409	38,657
130 - 139	24,784	22,251
140 - 149	16,868	7,438
150 - 159	9,867	6,574
160 - 169	4,346	1,130
170 - 179	1,349	314
180 - 189	1,461	58
190 - 199	1,212	526
200+	271	11
Forest Land Sub-total	*427,291*	*431,005*
Not Forested	44,378	41,517
No AVI Data	959	-
Total	**472,628**	**472,522**

[1]Age Class calculated from original Landscape Assessment report.
[2]Age Class calculated based on year 2015 as age of dataset.

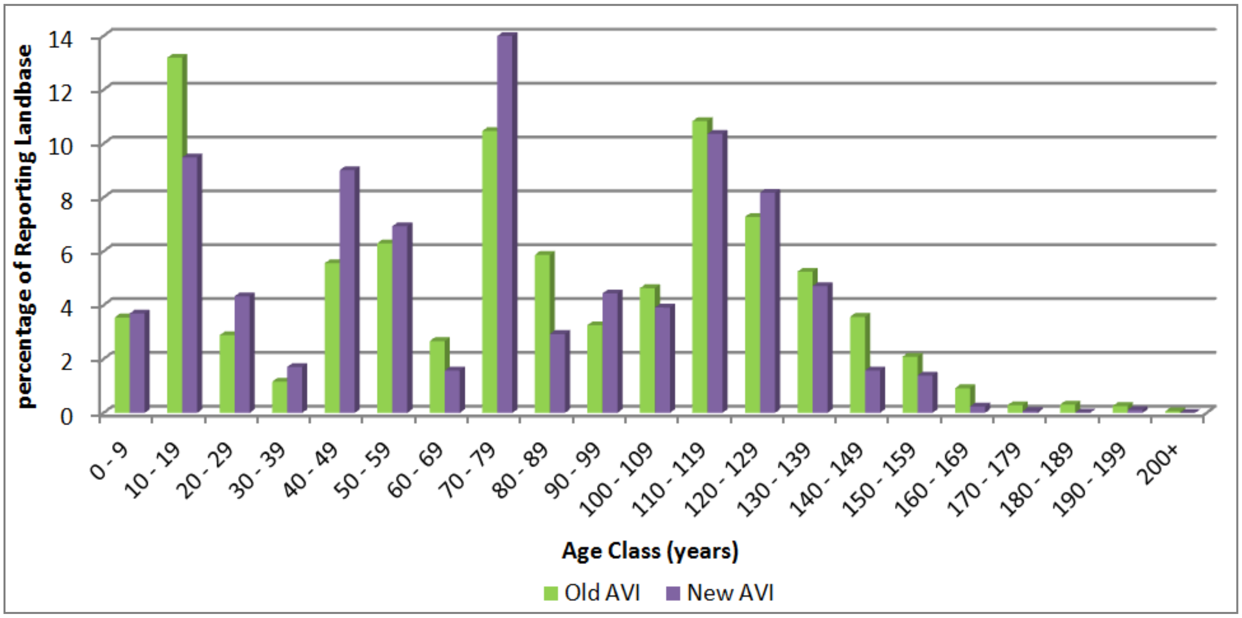


Figure 3-25. Comparison of distribution of age classes from old AVI to new AVI

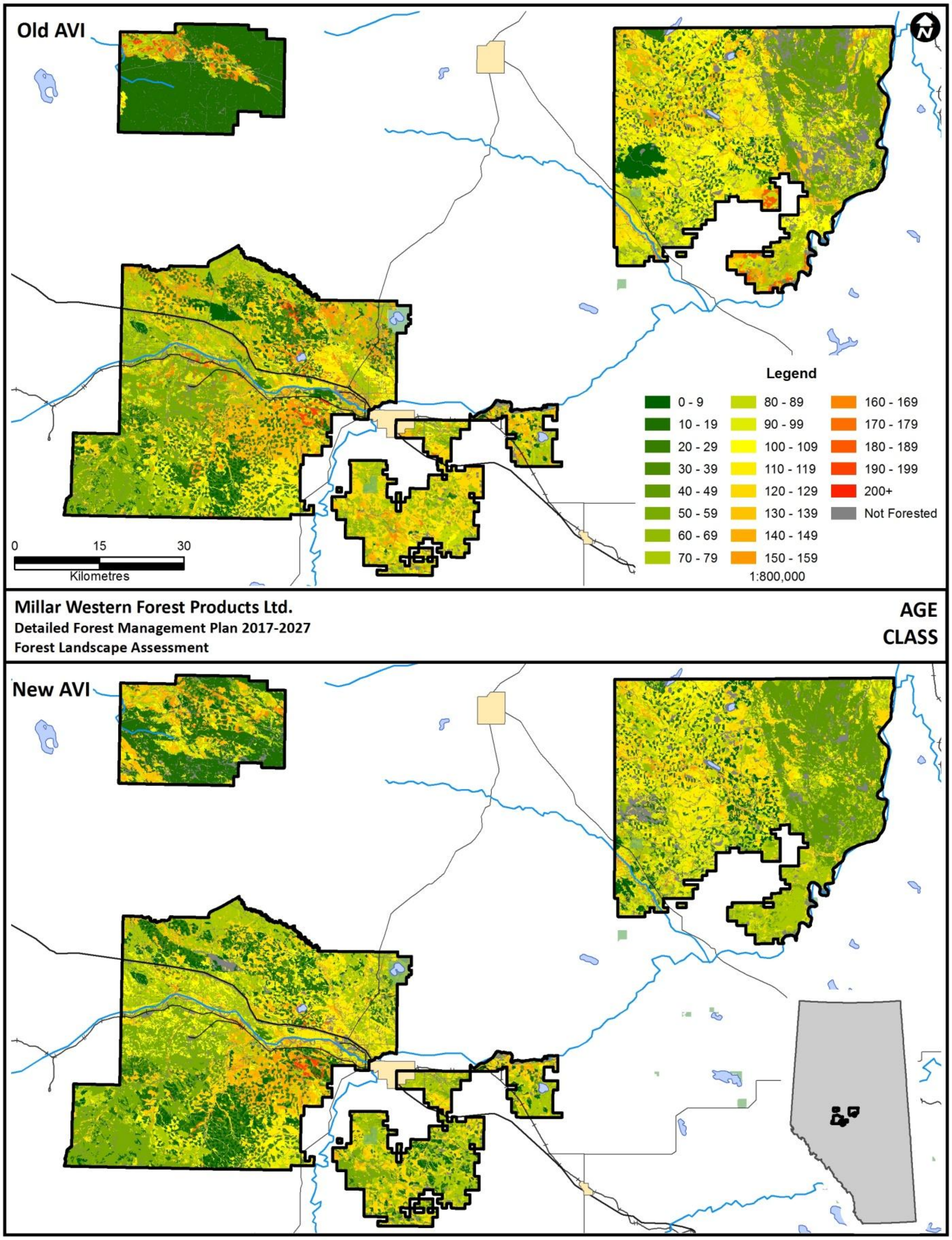


Figure 3-26. Comparison of age class distribution from old AVI to new AVI

4.5 Seral Stages

Seral stages (19) refer to stages in forest succession that are characterized by plant community conditions. For the purposes of this report, seral stages are defined by stand age.

Seral-stage classes across the inventoried area of the DFMP area differ slightly among the categories of young, immature, mature and old forest (Table 3-19). The young class comprises primarily regenerating harvest areas and wildfire-affected areas (see section 5.5), including the Virginia Hills fire, and saw a decline of approximately 21% from the old to the new AVI. Immature forest, which makes up the highest percentage in both datasets, increased 38%. It was followed by mature forest, which saw a 12% decrease from old to new AVIs. Old growth also declined, by 12%, while very-old-growth forest, which makes up the smallest percentage of the landscape, fell by 80% decrease. The most recent AVI data shows that the DFMP area is composed of mostly newer forest, with less area in the mature, old, and very old stages, and more in the immature stage. The spatial distribution of seral stage is shown in Figure 3-27.

Table 3-19. Comparison of seral-stage distribution of seral stage between the old and new AVIs

Seral Stage	Definition	Old AVI Area (ha)	New AVI Area (ha)	Area Difference from Old to New AVI	Percent Difference from Old to New AVI
Young	Stand age < 20 years	79,115	62,287	-16,828	-21
Immature	Stand age 20 to 79 years	137,317	189,464	+52,147	+38
Mature	Stand age 80 to 119 years	116,293	102,293	-14,000	-12
Old	Stand age 120 to 179 years	91,622	76,365	-15,527	-17
Very Old	Stand age >= 180 years	2,944	596	-2,348	-80
Forest Sub-total		*427,291*	*431,005*	*+3,714*	*+0.9*
Not Forested		44,378	41,517	-2,861	-6
No AVI Data		959	-	-	-
Total		**472,628**	**472,522**	**-106**	**-0.02**

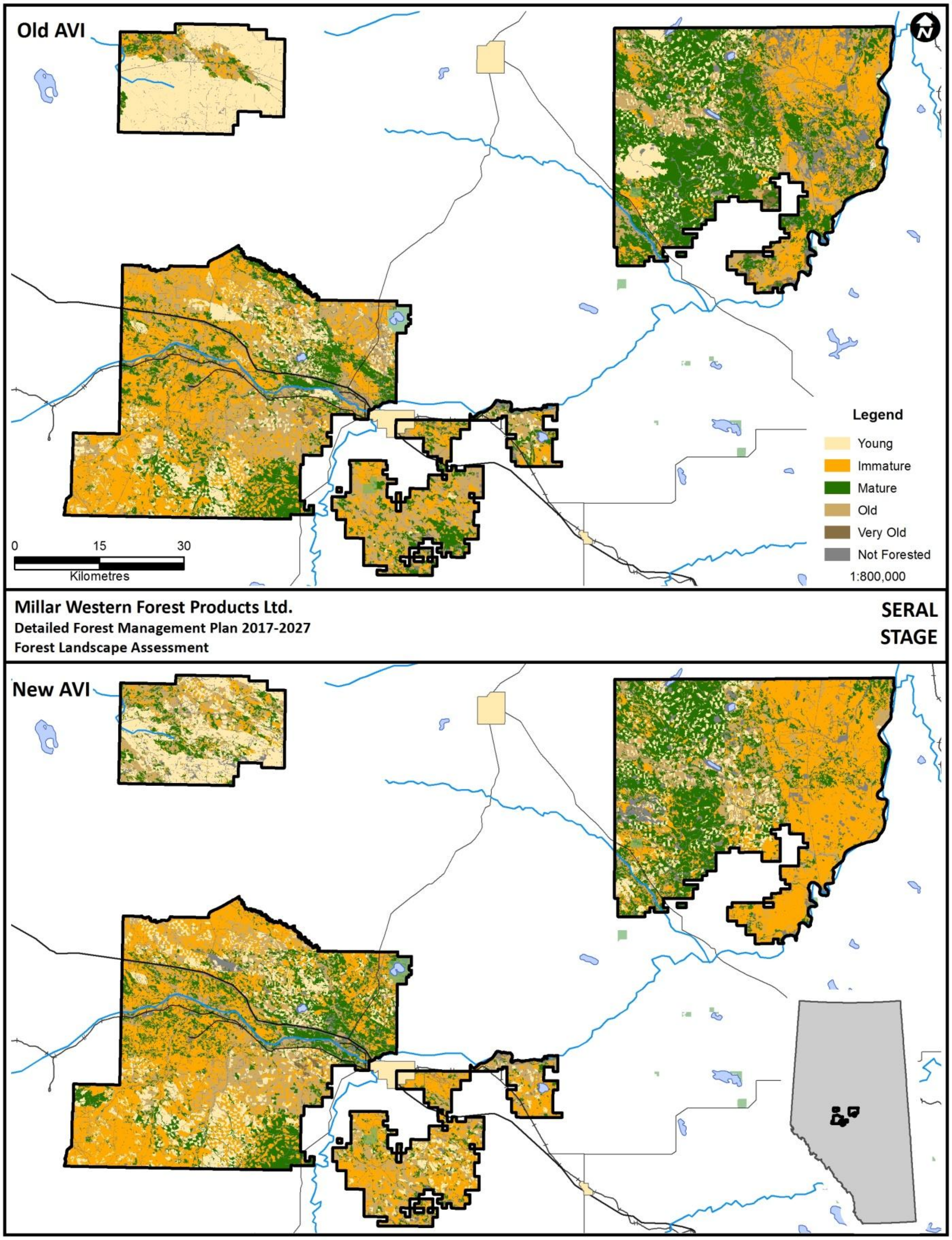


Figure 3-27. Comparison of seral stage distribution from old AVI to new AVI

4.6 Forest Patches

4.6.1 Patch Distribution of Young Stands

Patches are forest stands that are of the same seral stage (19) and not split by any linear feature greater than 8 meters wide. Contiguous patches where the seral stage was classified as "young" (less than 20 years of age) have been further divided into 4 patch-size categories, as show in Table 3-20 and Figure 3-28.

Table 3-20. Comparison of the patch distribution within the young seral stage, between the old and new AVI

	Old AVI		New AVI	
Patch Size Class	Number of Patches	Area (ha)	Number of Patches	Area (ha)
< 20 hectares	7,296	11,467	1,920	12,926
20 - 99 hectares	542	19,384	641	24,950
100 - 249 hectares	32	4,523	62	9,455
250+ hectares	33	43,739	24	14,954
Total	**7,903**	**79,114**	**2,647**	**62,287**

The high prevalence of the +250-hectare patch-size class is primarily the result of the Virginia Hills fire of 1998.

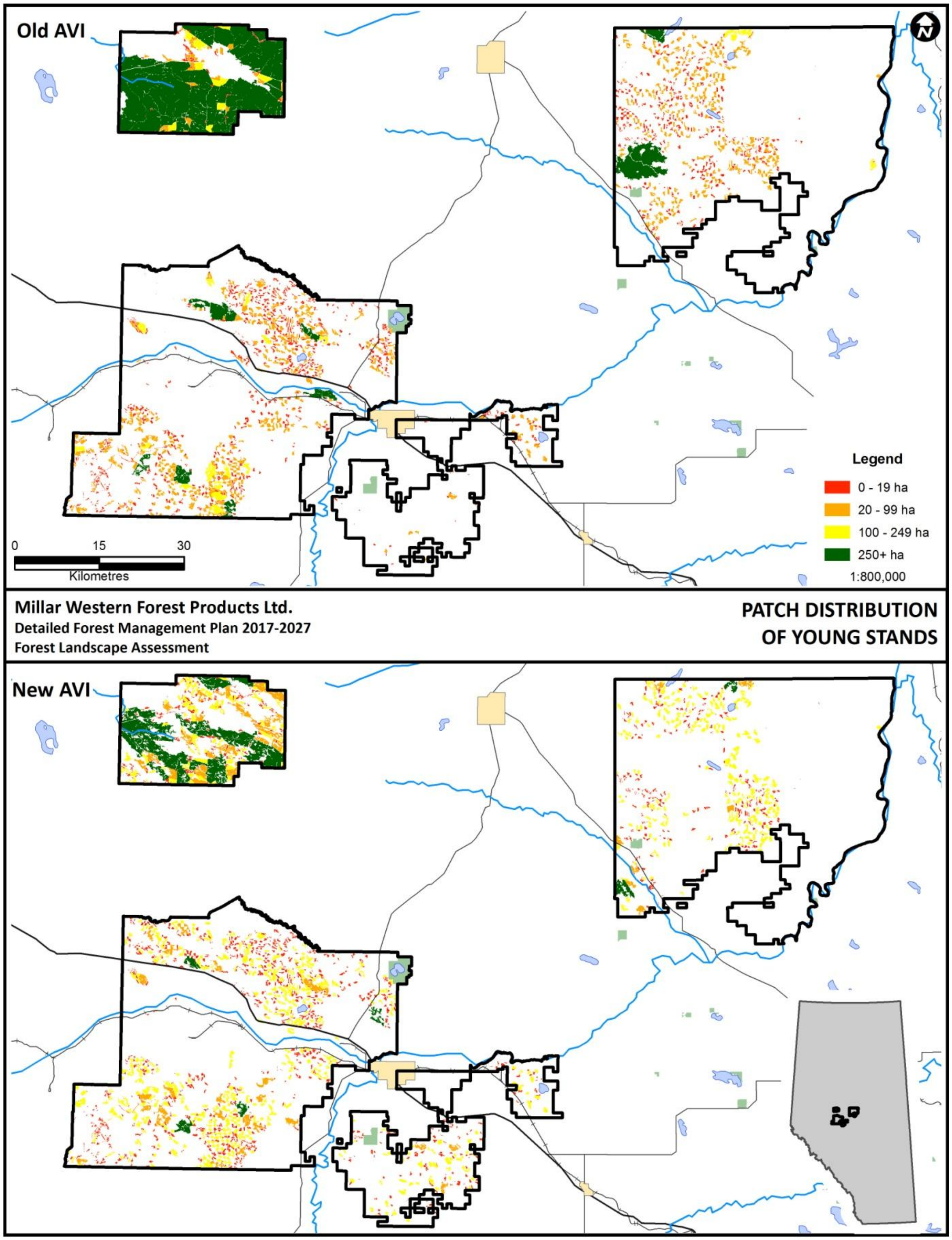


Figure 3-28. Comparison of patch distribution among young stands, between the old and new AVI

4.6.2 Interior Forest

Monitoring the condition of interior forests is one of two FMP reporting requirements that assesses the effect of forest fragmentation and resulting impacts on forest biodiversity. Interior forest is defined as forested areas greater than 100 hectares located beyond a defined edge-effect buffer zone. The edge-effect buffer zone is applied in two cases:

- along any stand edge that shares a common boundary with a linear disturbance greater than 8 meters in width; or
- a stand edge along which the seral stage changes (note that the seral stage definitions used in the interior forest assessment are identical to the definitions presented in Table 3-21).

The edge-effect buffer zone is calculated as:

- 60 meters, where the adjacent area is non-forested or forested, but less than 40-years old; and
- 30 meters, where the adjacent forest stand is greater than or equal to 40-years old but not yet mature forest.

There is no edge effect applied where adjacent stands are mature, old or very old. Using these rules, the resulting interior forest was determined for the DFMP area. The area summary is displayed in Table 3-21, and a map of the calculated interior forest appears as Figure 3-29.

Table 3-21. Interior forest by seral stage from old AVI to new AVI

	Old AVI		New AVI	
Seral Stage	**Number of Patches[1]**	**Area (ha)[1]**	**Number of Patches[1]**	**Area (ha)[1]**
Mature	122	47,879	83	25,768
Old	111	24,836	78	15,763
Very Old	5	1,054	2	257
Total	**238**	**73,769**	**163**	**41,788**

[1]Patches are only those that are greater than 100 hectares.

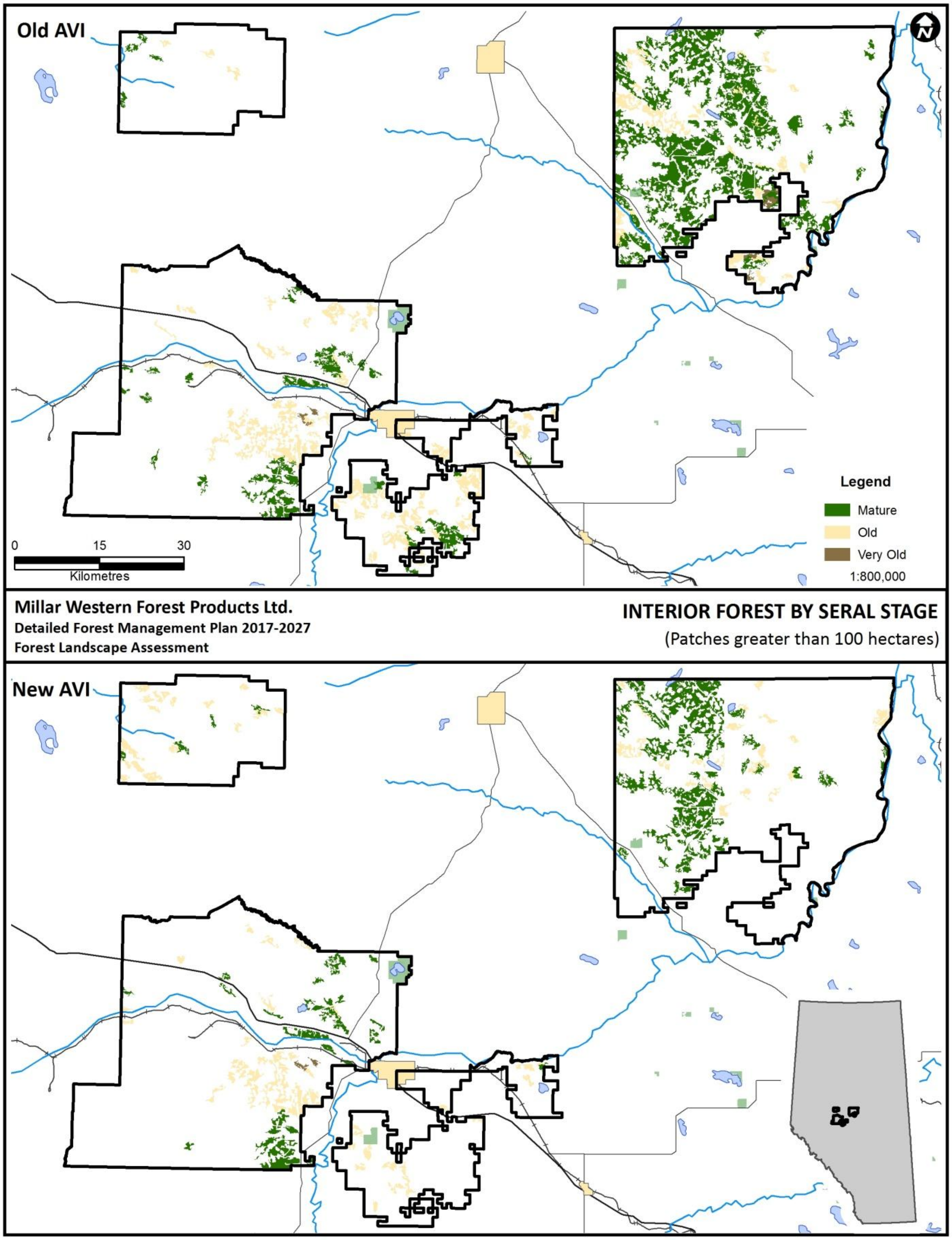


Figure 3-29. Comparison of interior forest by seral stage from old AVI to new AVI

5. Landscape Disturbance and Succession

5.1 Inherent Disturbance Regime

The natural disturbance regime within the DFMP area consists of wildfire and natural pests, with wildfire being the dominant natural factor shaping the composition and distribution of species (Rowe *et al*. 1973). Wildfire disturbance is the primary process introducing variability in the forest mosaic (Andison 1999).

In addition to natural disturbances, the DFMP area is also subject to anthropogenic, or man-made, landscape disturbances, which include establishment of forest access networks (e.g. roads and trails) and settlements, and industrial development by the forest, energy and aggregate (gravel) sectors. Government regulation and policy can also influence the landscape by, for example, limiting the impact of natural disturbances (e.g., wildfire-control and -prevention, and insect-suppression programs).

5.2 Insects and Diseases

Insect surveys conducted by the GoA (Forest Management Branch, Forest Health Section) indicate that, currently, the most prevalent insect pests in the DFMP area are:

- Mountain pine beetle (*Dendroctonus ponderosae*);
- Hardwood defoliators:
  - Large aspen tortrix (*Choristoneura conflicta*);
  - Bruce spanworm (*Operophtera bruceata*);

5.2.1 Mountain Pine Beetle

The mountain pine beetle (MPB) is the most destructive insect threat to older pine forests in North America. Mature and over-mature pine that are under stress are considered the preferred host; however, as populations increase, smaller and healthier trees have become vulnerable as well. Outbreaks will persist as long as a food source is available and climatic conditions are conducive. The beetle kills trees by clogging and destroying their conductive tissue: its larvae feed in the phloem of the tree, disrupting the flow of water and nutrients. In addition, the larvae introduce a blue-stain fungus that prevents the tree from using its pitch to repel attacking beetles.

Figure 3-30 shows the historical spread of MPB into the DFMP area since annual surveys began in 2006 (20), to 2011. Not all of the DFMP area was surveyed by the GoA in 2011, but there is a strong likelihood that the MPB is present throughout. The DFMP-area forests were not as seriously affected by the initial in-flight of beetles from British Columbia in the summer 2006 as other parts of the province. In 2009, however, Virginia Hills and the west portion of McLeod suffered a serious infestation. Though pine mortality rates have decreased since then, the MPB remains a constant threat in the DFMP area, and an issue.

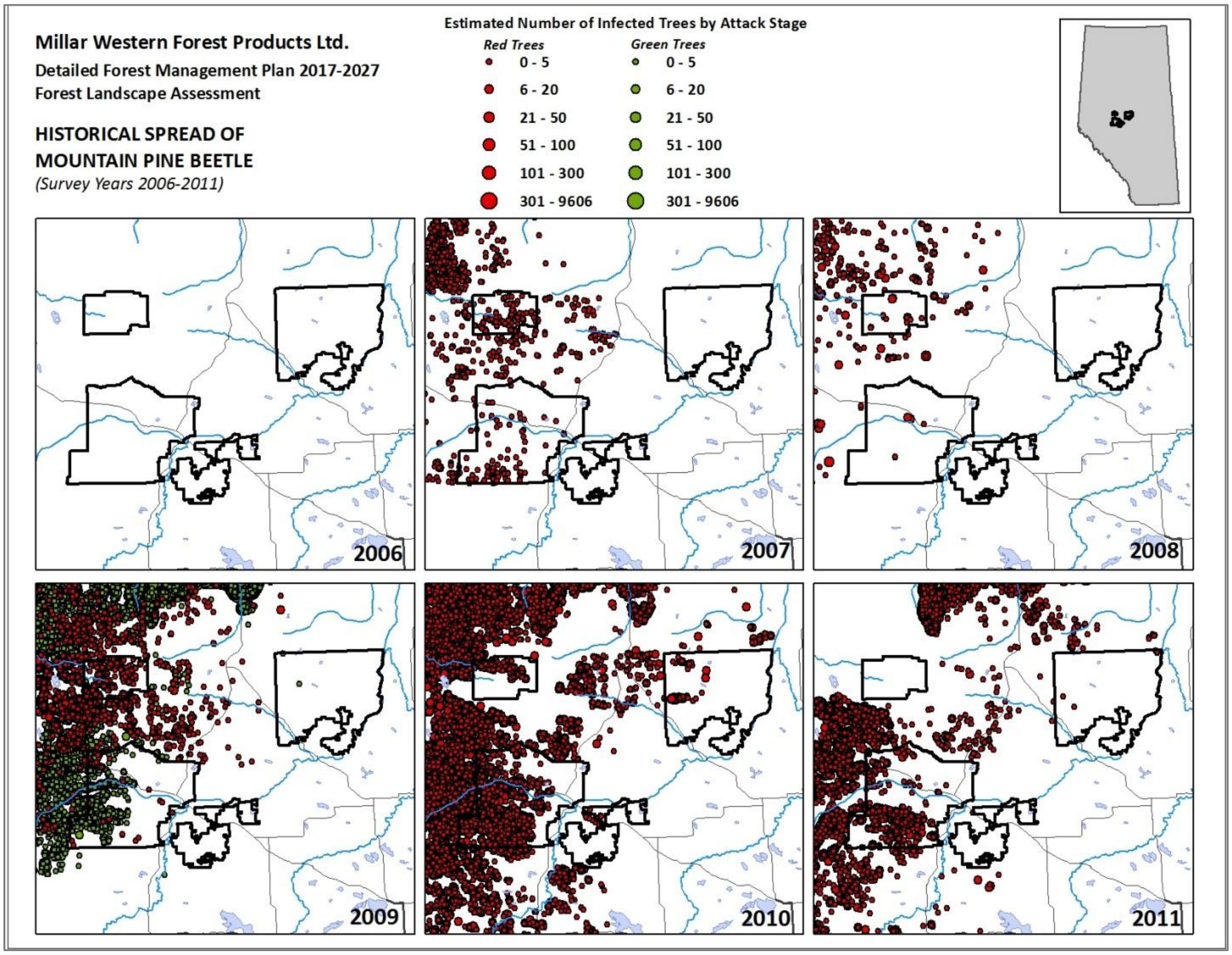


Figure 3-30. Historical spread of mountain pine beetle in the DFMP area

5.2.2 Hardwood Defoliators

Table 3-22 summarizes the total area of hardwood defoliation, according to GoA surveys between 1998 and 2011, inclusive (21).

The hardwood-defoliator agent causing the most damage in the DFMP area is the large aspen tortrix, which accounts for 94% of the total area affected by hardwood defoliators. The majority of the historical infestations are of moderate severity. Of the defoliator agents, typically only one of the species is the dominant defoliator at a given time.

Other hardwood defoliators (gypsy moth, satin moth, spearmarked black moth, aspen leafroller) are present in the province and could potentially be in the DFMP area, but no surveys have detected any populations of note.

Table 3-22. Summary of hardwood defoliation agents in the DFMP area

Common Name	Light Area		Moderate Area		Severe Area		Total	
	(ha)	%	(ha)	%	(ha)	%	(ha)	%
Aspen defoliators	4,135	2	-	-	-	-	4,135	2
Bruce spanworm	31	0.01	5,737	3	3,020	1	8,788	4
Large aspen tortrix	23,459	11	155,002	72	22,942	11	201,403	94
Total	**27,624**	**13**	**160,740**	**75**	**25,961**	**12**	**214,325**	**100**

Figure 3-31 provides an historical overview of the presence of hardwood defoliator outbreaks in the DFMP area. As these defoliators tend to strike in cycles, only those infestations that occurred during 2004 to 2011 are mapped. A detailed summary of the most important of these insect species (large aspen tortrix and Bruce spanworm) is presented in the following sections.

5.2.2.1 Large Aspen Tortrix

The large aspen tortrix occurs across Canada and is one of the most serious pests affecting trembling aspen. Aspen is the preferred host, but the tortrix will also feed on willow, balsam poplar and white birch. Outbreaks may last 3 to 4 years. Damage is predominantly caused by the later larval stages, which may also feed on buds. Massive defoliation can reduce growth increment but rarely results in tree mortality.

In 2006 and 2007, infestations of large aspen tortrix were noted within the DFMP area, the majority in Whitecourt, with smaller infestation areas detected within Blue Ridge and McLeod. Beyond 2007, there were few to no infestations reported.

5.2.2.2 Bruce Spanworm

Bruce spanworm also occurs widely across Canada. Aspen is the insect's principle host, but it will also feed on willow, balsam poplar, white birch and shrubs such as Saskatoon, currants and wild rose. Historically, outbreaks have not lasted more than 2 years and typically decline very quickly; hence, there seems to be little value in adopting control measures for this pest.

Infestations of Bruce spanworm are sporadic in nature. The most recent infestation occurred over 2007 and 2008 but quickly collapsed. Its prevalence in the DFMP area is relatively minimal.

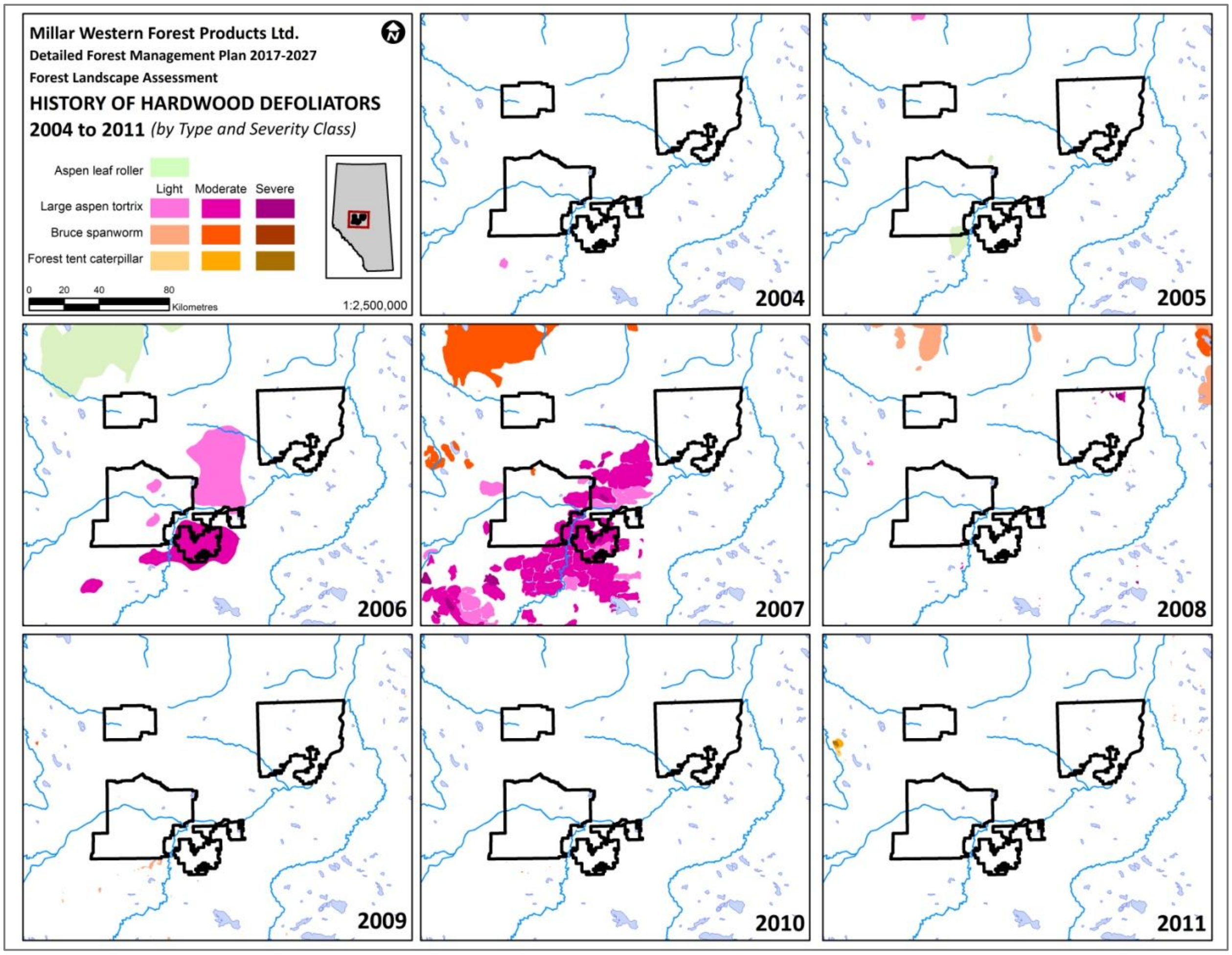


Figure 3-31. History of hardwood defoliation outbreaks (2004-2011) within the DFMP area

5.2.3 Spruce Budworm

The spruce budworm (22) is the most important defoliator pest of spruce-fir forests in North America. In Alberta, white spruce is the preferred host, but black spruce, tamarack and balsam fir can also be affected. While attacks are more visible in pure host stands, mixed-wood stands are also prone, once an infestation is underway. Re-occurrence and length of infestations vary widely. Damage to trees is considerable, as the budworms attack new needle growth as well as buds. After 4 to 5 years of defoliation, dead tops can appear on trees. Additional years of infestation may result in mortality.

Based on historical survey data, there is no evidence of spruce budworm within the DFMP area.

5.2.4 Other Forest Health Agents

Surveys in 2010 and 2011 indicate that other agents affecting forest growth (23) were evident in the DFMP area. Table 3-23 summarizes these other agents and their level of severity. Because these agents are unrelated to each other, the percentage calculated reflects the percentage area of each agent across the levels of severity. Locations of the surveyed agents are shown in Figure 3-32.

Table 3-23. Summary of other forest health agents within the DFMP area

Other Health Agents	Severity of Impact				Total	
	Light		Moderate			
Common Name	Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)
Climatic	4,976	99	77	2	5,053	100
Hail	-	-	5,800	100	5,800	100
Lodgepole pine dwarf mistletoe	2,109	100	-	-	2,109	100
Total[1]	**7,085**	**55**	**5,877**	**45**	**12,962**	**100**

[1]Sum of survey records 2010-2011 inclusive.

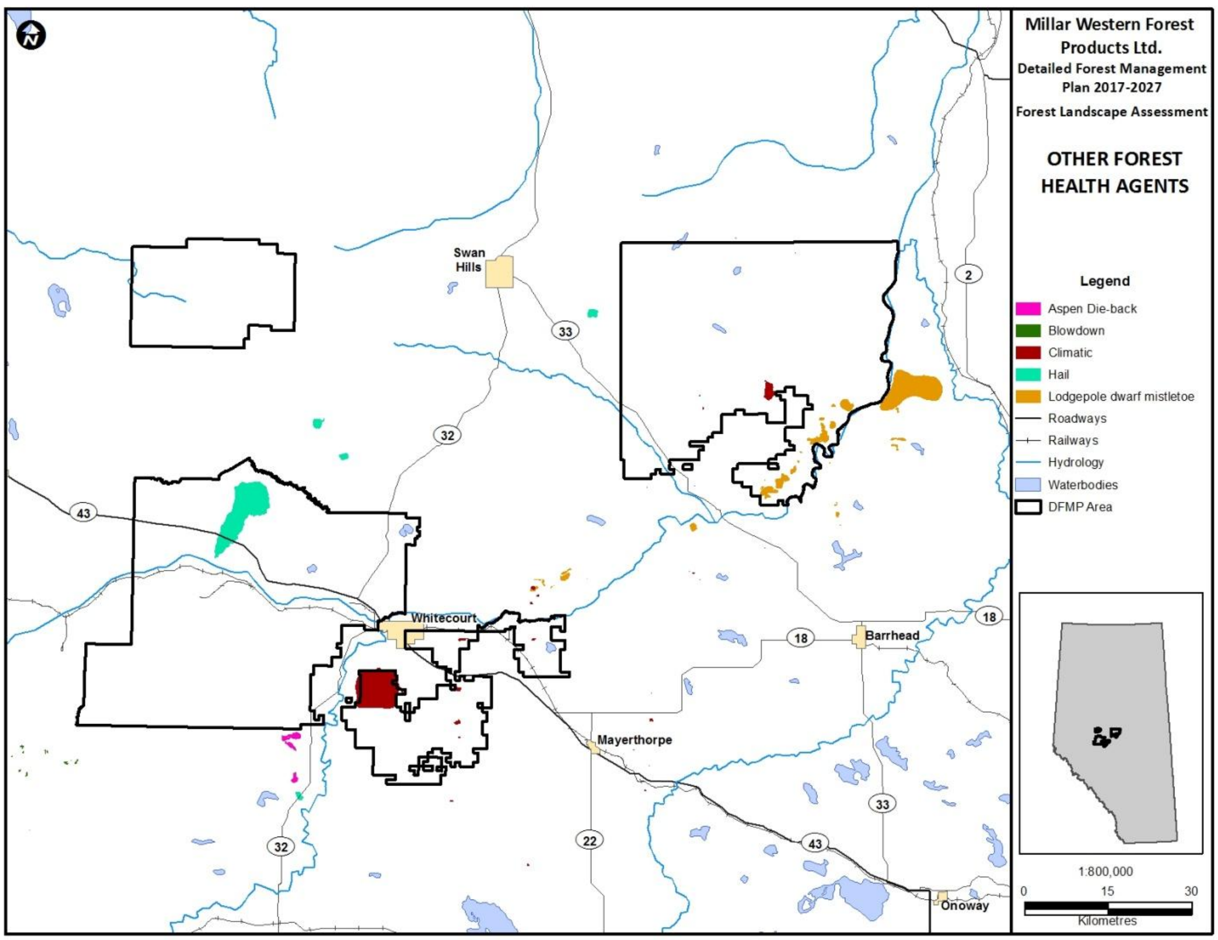


Figure 3-32. Other forest health agents within the DFMP area

5.3 Invasive Plant Species

An invasive species is defined as “a species, subspecies or lower taxon, introduced outside its natural past or present distribution ... whose introduction and/or spread threaten biological diversity” (United Nations Environment Program 1992). Invasive plant species are monitored by the GoA, which classifies invasive plants into two categories (Alberta 2008a):

1. Prohibited Noxious: A noxious plant (including seeds) that must be destroyed by the landowner or person who occupies the land. Destroy means to kill all growing parts or to render reproductive mechanisms non-viable.
2. Noxious: A noxious plant (including seeds) that must be controlled by the landowner or person who occupies the land. Control means that the action may destroy the plant but, at best, must inhibit its growth or spread.

Additionally, plants can be identified as “nuisance”. Such plants are not under legislative control but are identified as potential problem species. In addition to provincial declarations, the Weed Control Regulations of 2010 allow municipalities to pronounce additional plant species as prohibited or noxious and make them subject to current regulations.

Any areas undergoing reclamation are potential problem sites for invasive species, as commercial seed mixes can contain seeds from noxious plants. To determine and monitor the extent of the problem, municipal and provincial inspectors visit sample sites on a regular basis. In the DFMP area, 460 sites were observed to contain invasive species, with some sites having multiple examples.

Table 3-24 shows the invasive-plant status for the DFMP area, by class (only noxious exists within the DFMP area). Of the visited sites, 7% showed no problem weeds, while 93% had incidences of noxious plants, most commonly Canada Thistle and Scentless Chamomile. None of the sites contained prohibited noxious plants.

Table 3-24. Ranking of invasive plant species within the DFMP area

Classification	Weed Name	Incidence of Observed Weeds	Percentage of All Observed (%)
No Weeds Found		34	7
Noxious	Canada Thistle	143	31
	Scentless Chamomile	96	21
	Common Tansy	60	13
	Perennial Sow Thistle	43	9
	Tall Buttercup	42	9
	Oxeye Daisy	41	9
	Common Toadflax	1	0.2
Noxious Sub-total		*426*	*93*
Total		**460**	**100**

Figure 3-33 shows the distribution of invasive plants in the DFMP area. The majority of occurrences are concentrated within McLeod.

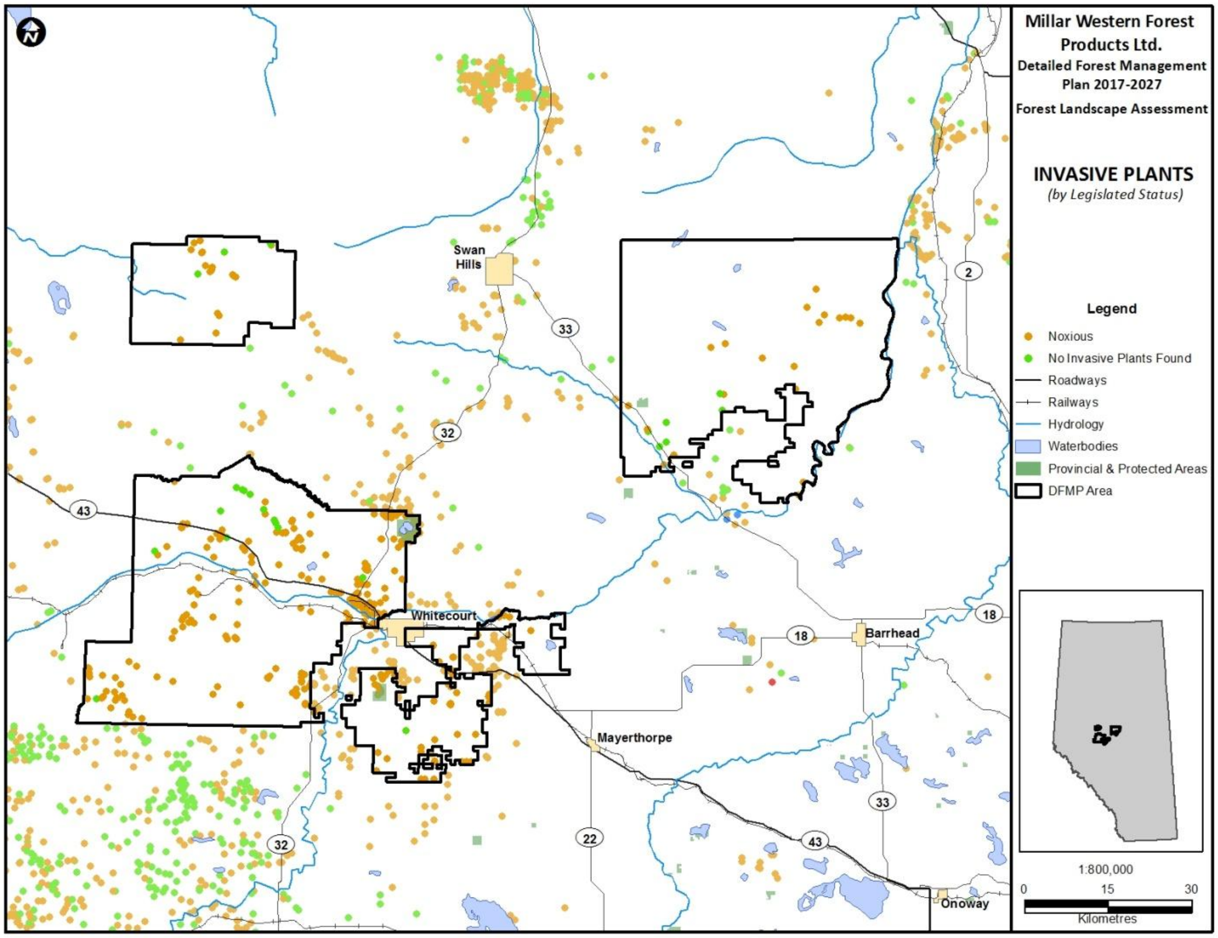


Figure 3-33. Invasive plants distribution within the DFMP area

5.4 Forest Succession

Forest succession is the composition of vegetation communities on a site, over time. The process of succession results in different structural components (e.g. density by species, understory composition, snags or other dead materials) at various time periods. Many of these structural components can undergo a somewhat predictable pattern of change as stands age. The discussion of successional factors and patterns presented here is a compilation of information from the Boreal Centre (2002), Song (2002) and Daishowa-Marubeni (2008). The Boreal Centre report includes a considerable list of papers devoted to the subject of succession in the boreal mixedwood.

Moisture regime has the greatest influence on forest succession (Boreal Centre 2002). In the boreal mixedwood of Alberta, moist sites are characterized by stands of black spruce and larch, medium sites by aspen and white spruce, and dry sites by pine (Boreal Centre 2002, Daishowa-Marubeni 2008). Succession on moist and dry sites indicates that, after fire, the original black spruce (moist sites) and pine (dry sites) tend to be replaced by the same stand type, though often with some component of aspen. In cases where black spruce occurs as an understory to pine, the trajectory may result in a continued mixed-coniferous stand as opposed to a pure-pine stand, particularly in the absence of a fire event.

Following fire, aspen regenerates aggressively on medium sites through root suckering and is virtually always present in regenerating stands (Boreal Centre 2002). The introduction of white spruce on medium sites is more variable for a number of reasons, including inconsistent seed production on neighbouring seed trees and distance from seed sources. Because of the uncertainty in white spruce regeneration, several stand development pathways are possible on medium sites; however, wherever white spruce seed and a suitable seed bed are available, an even-aged mixed stand of white spruce and aspen can be expected. Because aspen is shade intolerant, it will typically not regenerate under a closed canopy, which leads to the conversion of these mixed stands to pure white spruce in approximately 100 years.

Where white spruce seed is available but the seedbed is not be suitable for quick germination, the stand will initially generate to aspen, and spruce will incrementally enter the site. This condition leads to an uneven-aged mixed-wood stand that, too, will eventually become a pure white spruce stand, but over a considerably longer timeframe than under the even-age scenario.

The transition of stands to the mature stage is triggered by canopy closure. Self-thinning of the trees begins at this stage, but stand gaps are not yet prominent features. Mature stands tend to have the lowest level of structural diversity (Boreal Centre 2002).

The transition from mature to old stands is gradual. Key changes include canopy breakup and release of understory vegetation, emergence of secondary canopy species, and accumulation of snags and downed logs (Stelfox 1995). Overall, structural diversity is highest in old stands, as reflected in a high degree of species richness in both plants and animals (Stelfox 1995).

5.5 Wildfire History

5.5.1 Fire History

Disturbances by wildfire have been tracked and recorded by the GoA since devolution of natural resource management from the federal government to the Alberta government in the 1930s (25). Prior to the start of active fire suppression, fire played a dominant role in the development and rejuvenation of stands within the boreal forest. Fires tended to be larger and produce a more homogeneous pattern in structure, species composition and age, and to have rejuvenating qualities that played a role in ecosystem condition and productivity. The introduction of fire control and prevention programs has limited the area of fires within the DFMP area, though numbers have increased due to improved detection. During the period 1990-2015, human-caused wildfires accounted for 54% fires within the DFMP area, while lightning accounted for 46% of fires within the DFMP area. The wildfire records summarized in the following tables and figures represent all wildfires, regardless of their origin (i.e., lightning or human-caused).

5.5.2 Fire Season

Alberta's fire season extends from March 1 to October 31. In compliance with its Fire Control Agreement with the GoA (2013), Millar Western submits a Forest Protection Plan to the GoA prior to March 1 of each year. The plan outlines the strategies that Millar Western will employ to reduce fire risk in its operating area.

5.5.3 Fire Statistics

Table 3-25, Figure 3-34, Figure 3-35, and Figure 3-36 summarize the DFMP area's wildfire history. The data reflects burned areas only, not residual islands that may have been skipped over during a wildfire event. The reporting period is by decade, with the labeled wildfire date representing the start of the decadal period (e.g. period '1930' represents 1930 to 1939 inclusive).

Table 3-25. Wildfire statistics by decade

Fire Period (by decade)	Number of Wildfires	Total Wildfire Area (ha)	Within the DFMP area					
			Wildfire area in DFMP area (ha)	Average Wildfire Size (ha)	Median Wildfire Size (ha)	Maximum Wildfire Size (ha)	Wildfire in DFMP area (%)	Area Burned of DFMP area (%)
1930	1	894	323	323	-	323	36	0.1
1940	41	88,170	47,963	1,170	989	10,321	54	10
1950	46	64,218	39,842	866	173	29,853	62	8
1960	38	158,510	59,033	1,553	33	54,096	37	13
1970	1	9	6	6	-	6	59	0.001
1980	1	13	13	13	-	13	100	0.003
1990	58	162,024	41,416	714	64	31,948	26	9
2000	93	6,096	6,016	65	5	3,220	99	1
2010[1]	28	512	493	18	3	192	96	0.1
Total	**307**	**480,445**	**195,105**	**636**	**33**	**54,096**		**41**

[1]The 2010 decade includes data for 2010 and 2011 only.

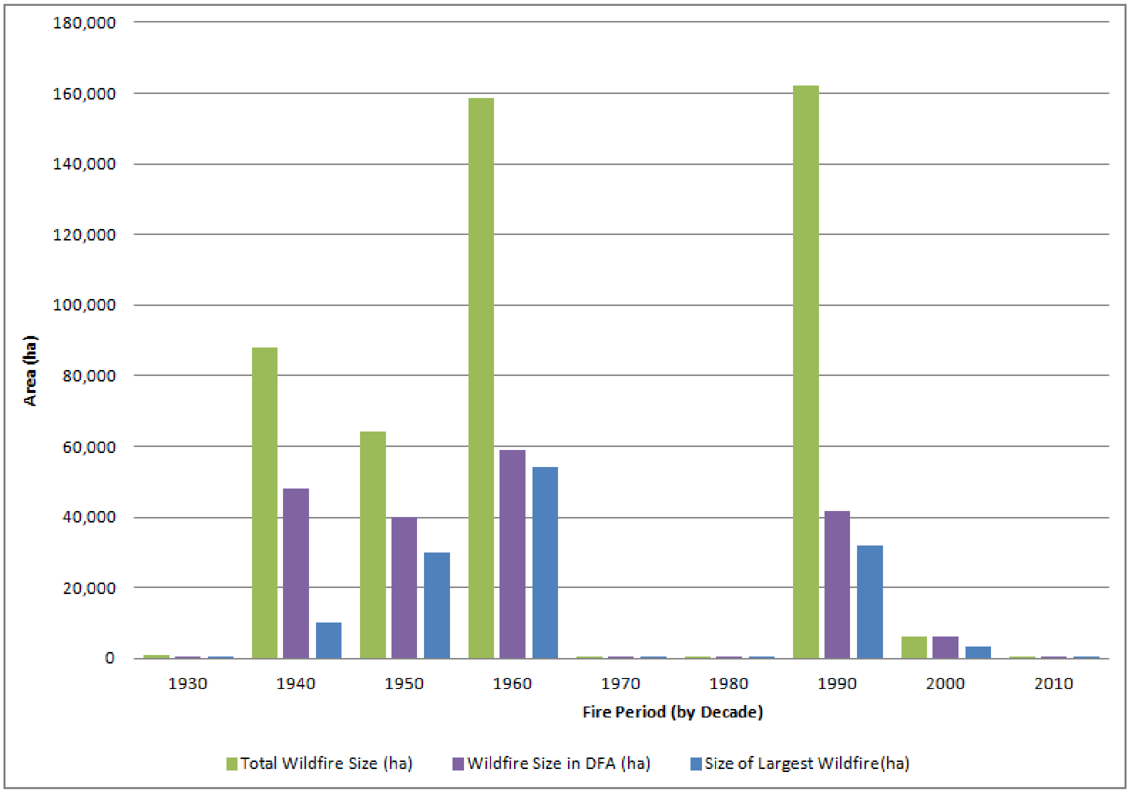


Figure 3-34. Wildfire size statistics within the DFMP area, by decade

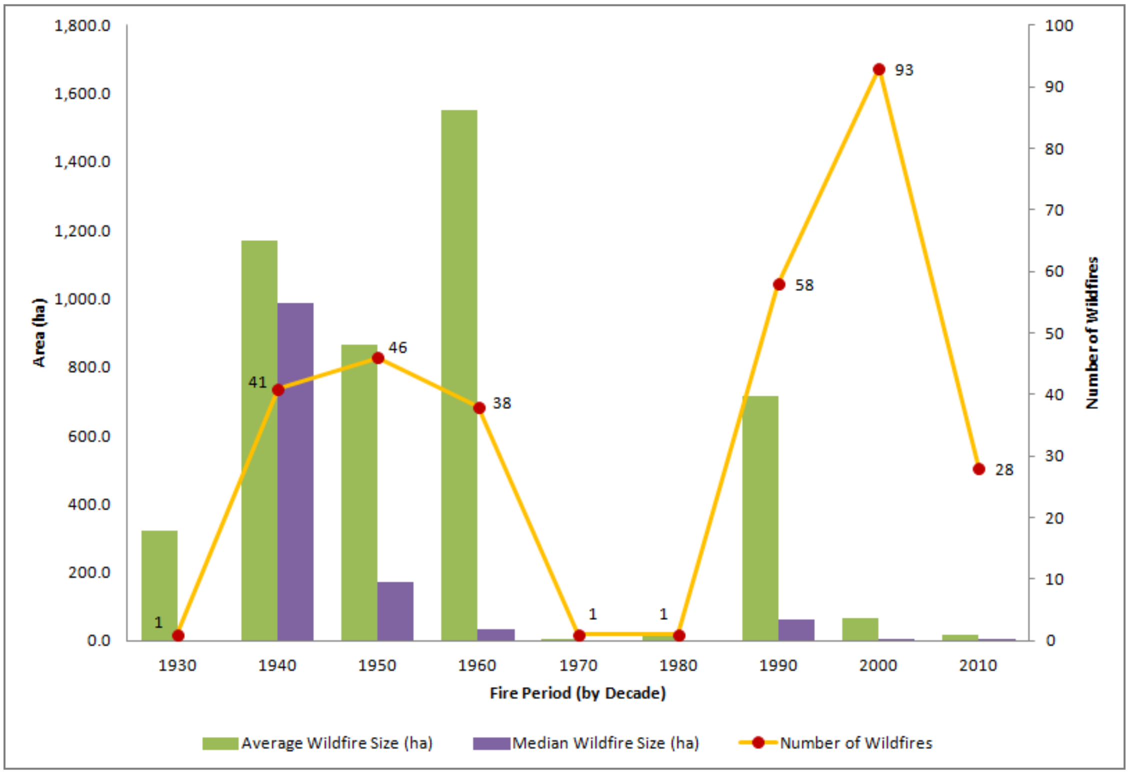


Figure 3-35. Average and median fire size in the DFMP area, by decade

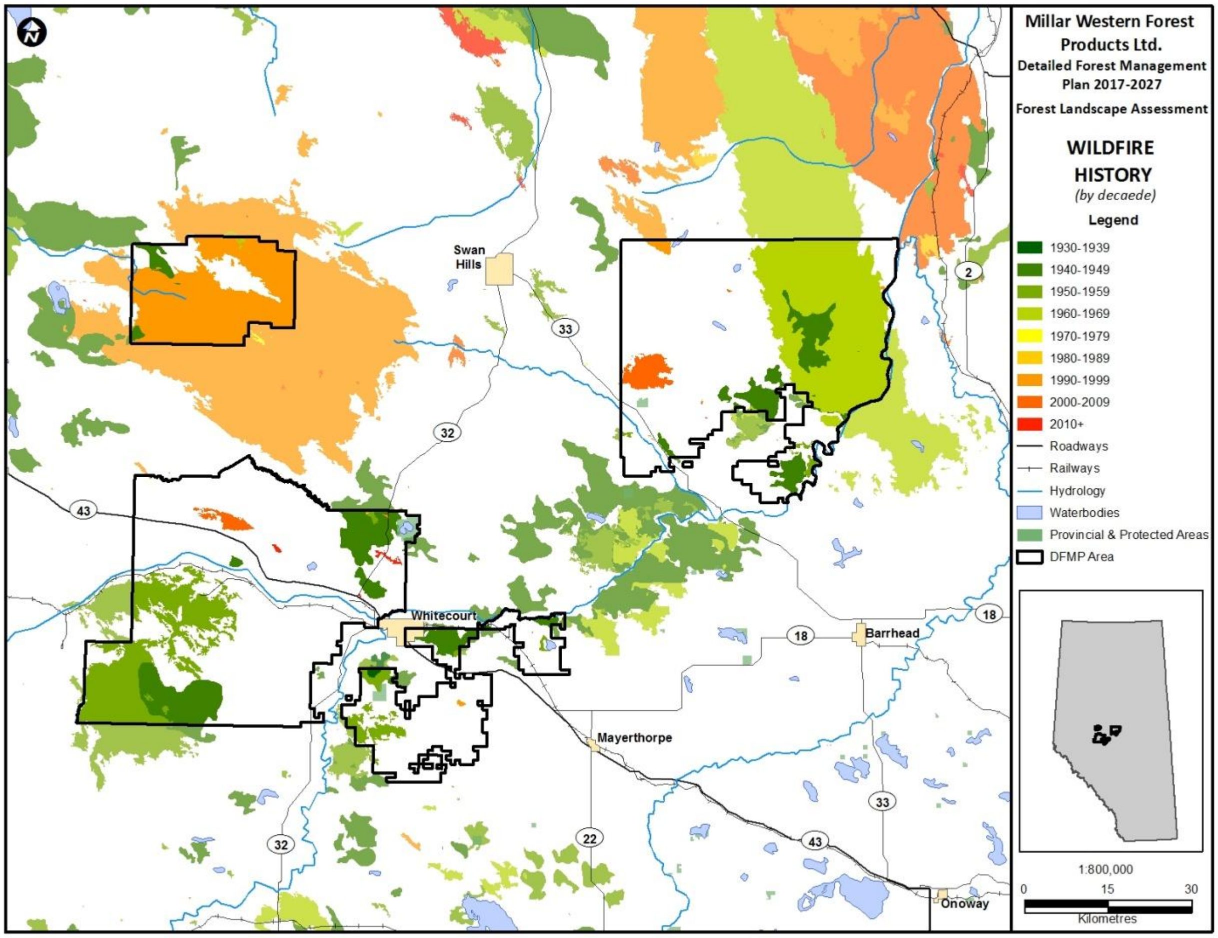


Figure 3-36. Wildfire history within the DFMP area, by decade

5.5.3.1 Fire Size

The average fire size in the DFMP area from 1940-2015 was 1,011 hectares (Table 3-26). Over time, fire size has decreased: from 1940-1989, fires averaged 5,292 hectares in size, compared to only 401 hectares during 1990-2015. The decrease is likely due to substantial proactive wildfire prevention activities, faster wildfire response, and improved wildfire control practices.

Table 3-26. Fire statistics across the DFMP area by year (Alberta, 2016b)[1]

Year	Area Burned (ha)	Number of Fires	Average Fire size (ha)	Year	Area Burned (ha)	Number of Fires	Average Fire size (ha)
1940	5,757	4	1,439.1	1978	0	0	0.0
1941	44,143	12	3,678.5	1979	9	1	9.0
1942	13,368	4	3,342.0	1980	13	1	13.0
1943	2,467	2	1,233.6	1981	0	0	0.0
1944	1,319	2	659.6	1982	0	0	0.0
1945	7,295	6	1,215.9	1983	0	0	0.0
1946	1,116	2	558.0	1985	0	0	0.0
1947	1,436	1	1,436.0	1986	0	0	0.0
1948	1,399	1	1,399.2	1987	0	0	0.0
1949	6,054	5	1,210.8	1988	0	0	0.0
1950	709	2	354.5	1989	0	0	0.0
1951	1,422	1	1,421.7	1990	21	23	0.9
1952	0	0	0.0	1991	3	13	0.2
1953	2,874	2	1,436.8	1992	71	14	5.1
1954	0	0	0.0	1993	5	3	1.5
1955	0	0	0.0	1994	15	3	5.0
1956	54,753	4	13,688.2	1995	218	4	54.5
1957	367	1	366.5	1996	34	1	34.0
1958	87	1	87.2	1997	9	3	3.0
1959	659	1	658.5	1998	153,705	28	5,489.5
1960	0	0	0.0	1999	133	19	7.0
1961	2,415	2	1,207.7	2000	6	9	0.7
1962	0	0	0.0	2001	14	11	1.3
1963	0	0	0.0	2002	32	31	1.0
1964	0	0	0.0	2003	10	27	0.4
1965	0	0	0.0	2004	3	23	0.1
1966	0	0	0.0	2005	6	10	0.6
1967	0	0	0.0	2006	1,670	25	66.8
1968	153,972	2	76,986.2	2007	7	15	0.4
1969	0	0	0.0	2008	21	17	1.2
1970	0	0	0.0	2009	4,040	33	122.4
1971	0	0	0.0	2010	149	15	9.9
1972	0	0	0.0	2011	319	11	29.0
1973	0	0	0.0	2012	11	8	1.4
1974	0	0	0.0	2013	18	14	1.3
1975	0	0	0.0	2014	0	16	0.0
1976	0	0	0.0	2015	22	24	0.9
1977	0	0	0.0	**Total**	**462,177**	**457**	**1,011.3**

[1] GoA data was unavailable for 1984.

5.5.3.2 Fire Frequency

From 1940-2015, the average number of wildfires within the DFMP area was 6 per year (Table 3-26); however, the average frequency has increased over time due to a greater human presence and improved fire detection. For example, the area averaged only 1 fire per year from 1940-1989, rising to 15 per year between 1990-2015.

5.5.4 Landscape Fire Assessment

The GoA operates a program called FireSmart that provides fire-risk reduction strategies to governments, communities, home owners, and industry. In accordance with Annex 3 of the Forest Planning Standard (Alberta 2006), the GoA undertakes wildfire threat assessments that compare the positive ecological impacts of wildfire with the negative impacts of wildfire. According to the assessment, three FireSmart Community Zones overlap Millar Western's DFMP area (Figure 3-37):

- Whitecourt/Blue Ridge FireSmart Community Zone
- Goose Lake FireSmart Community Zone
- Fort Assiniboine FireSmart Community

The forest within these FireSmart community zones is assessed as having relatively low to moderate fire behaviour potential, with only 32% of the area showing high and very high fire behaviour potential; none is identified as extreme (Table 3-27, Figure 3-38). Larger areas outside of the community zones, for example, the West Windfall, Tom Hill, North Goose and Meekwap, are rated by the GoA as having very high fire behaviour potential (Figure 3-39). In response, Millar Western has developed objectives and targets to help reduce the risk of wildfire threat in both the DFMP area and the FireSmart community zones.

Table 3-27. Summer fire behaviour potential within the FireSmart community zones of the DFMP area (Alberta, 2016b)

Summer Fire Behaviour Potential	Area (ha)
Extreme	0
Very High	8,203
High	6,602
Moderate	12,558
Low	15,716
Non-fuel	912
Water	1,104
Total	**45,094**

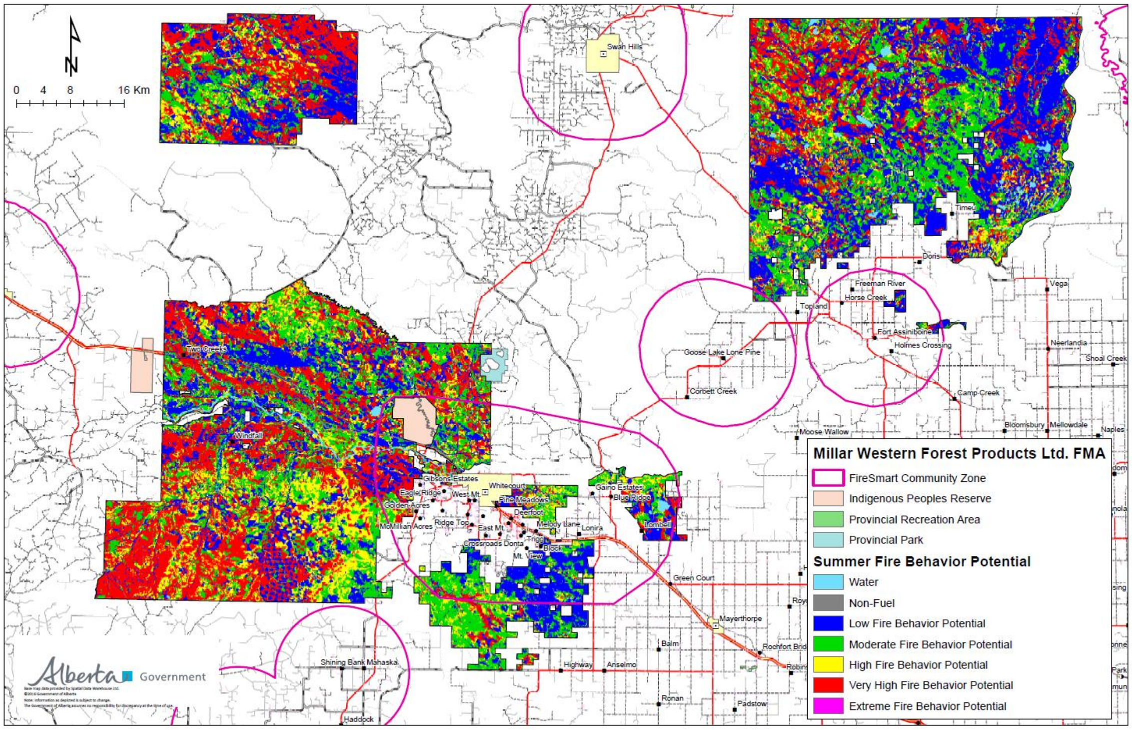


Figure 3-37. Summer fire behaviour potential within the DFMP area and overlapping FireSmart community zones (Alberta, 2016b)

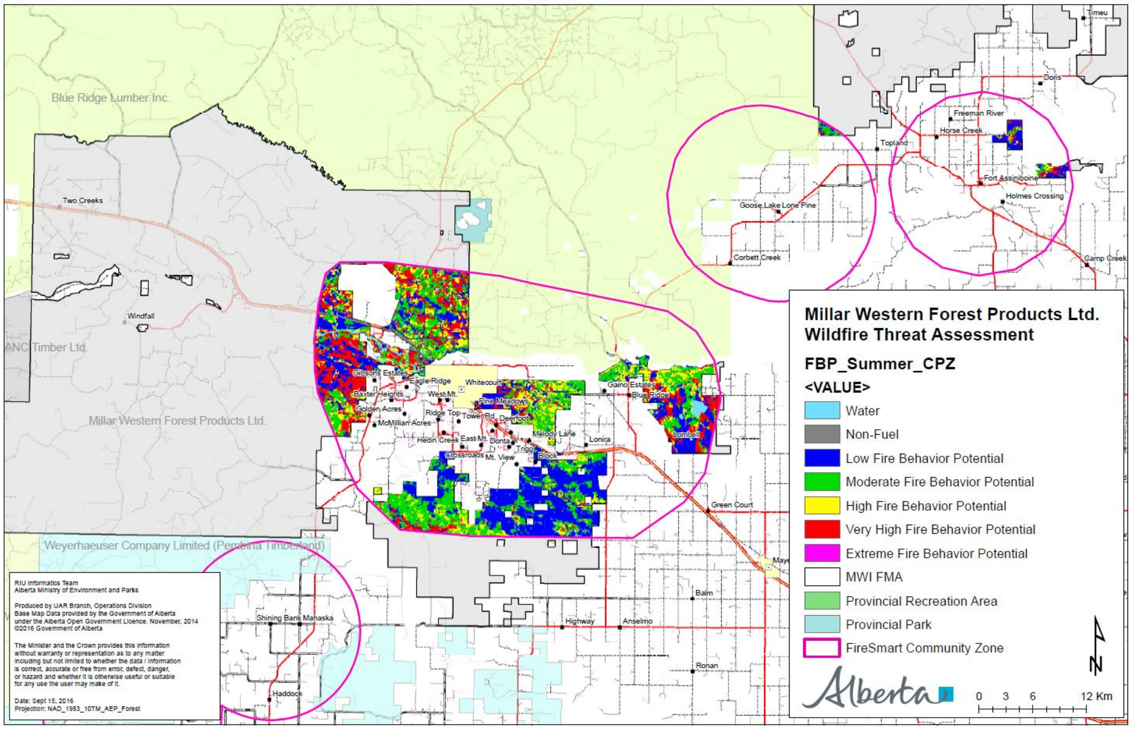


Figure 3-38. Summer fire behaviour potential within FireSmart community zones that overlap the DFMP area (Alberta, 2016b)

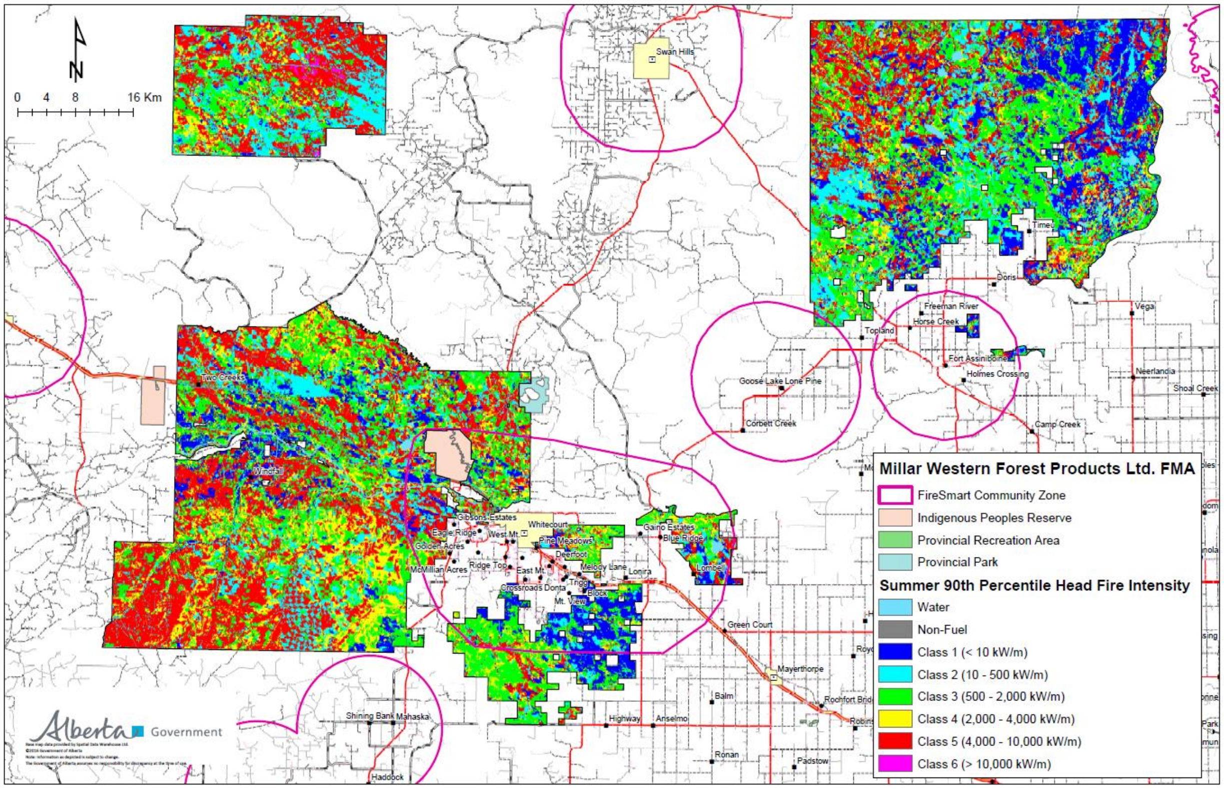


Figure 3-39. Summer 90th percentile head fire intensity within the DFMP area (Alberta, 2016b)

5.6 Timber Harvesting

For over a century, timber harvesting has been a major component of anthropogenic disturbances in the DFMP area. From 1930, when resource management was transferred from the federal to provincial government (Alberta 1930), to approximately the mid-1950s, timber was generally harvested for local or regional use. Over time, however, manufacturers, including Millar Western, sought to broaden their products and markets, resulting in greater and more diverse fibre needs.

Table 3-28 summarizes the total harvest area and number of harvest sites, by decade. Much of the early harvesting in the DFMP area reflected a preference for certain species, such as coniferous from mixed-wood stands, of specific sizes (e.g., sawlogs for lumber production). Although harvesting did not always result in complete stand removal (i.e., a clearcut),

Table 3-28 assumes all trees were taken; consequently, the total harvest area may be slightly over-estimated. This is also true of locations that have been subject to management activities such as green retention or shelter-wood operations, which also result in partial clearings.

For the purposes of this report and for spatial mapping, spatial harvest area boundaries (26, 27) and forest inventory information (19) served as source data for this metric. Harvest area boundaries represent the border of a specific harvest activity and carry its associated year of harvest; inventory information, which is stand rather than block based, may or may not represent a single harvest activity, and often lacks a year of harvest. In many cases, the harvest activity is evident in the inventory photography, but its actual date is not traceable.

The information presented in

Table 3-28 and Figure 3-40 represents all the known harvest area in the DFMP area based on both harvest boundary and inventory datasets, up until the last full decade (2009). The number of actual harvest events is difficult to assess, since the inventory data often does not distinguish individual harvest boundaries. Figure 3-41 illustrates the distribution of these known harvest areas, categorizing them by decade.

Table 3-28. Summary of harvesting by decade

Year of Harvest	Total Harvest Area		Number of Harvest Sites		Average Area per Year[1]
	(ha)	(%)	Count	(%)	(ha)
1960-1969	685	1	46	2	171
1970-1979	4,497	7	279	9	500
1980-1989	12,517	18	558	19	1,252
1990-1999	30,819	45	1,117	38	3,082
2000-2009	18,288	27	870	29	2,032
Unclassified	2,067	3	104	4	-
Total	**68,872**	**100**	**2,974**	**100**	

[1] calculated by taking the average of each year of harvest that there was a record for (Not by taking total harvest and dividing it by 10).

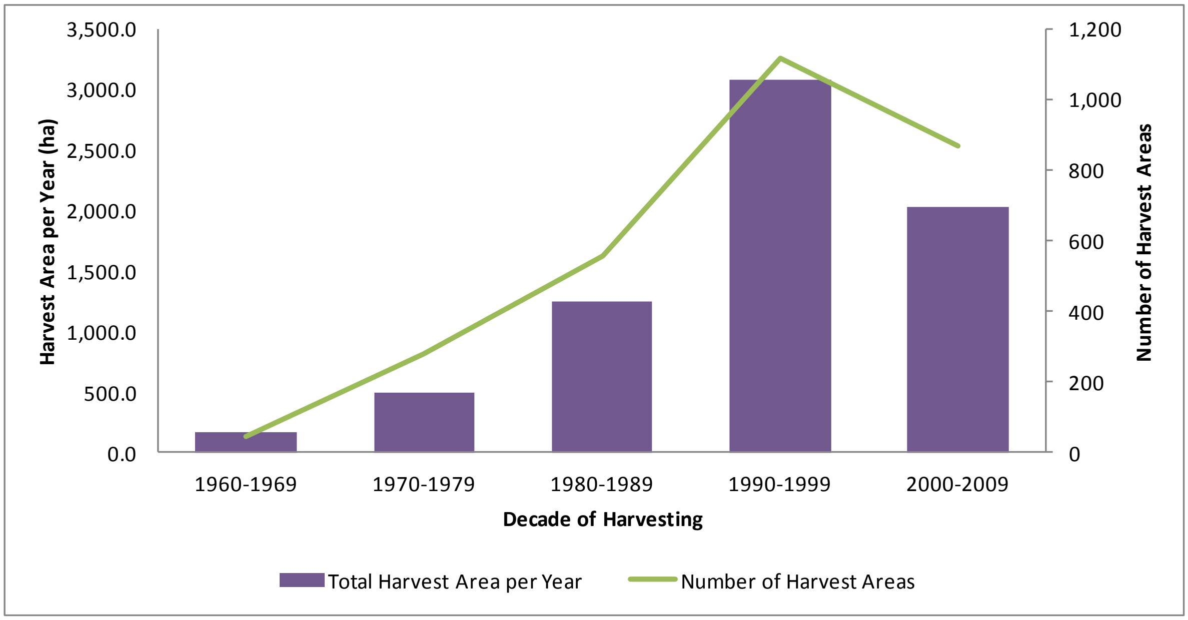


Figure 3-40. Average annual area and count of harvesting activity within the DFMP area

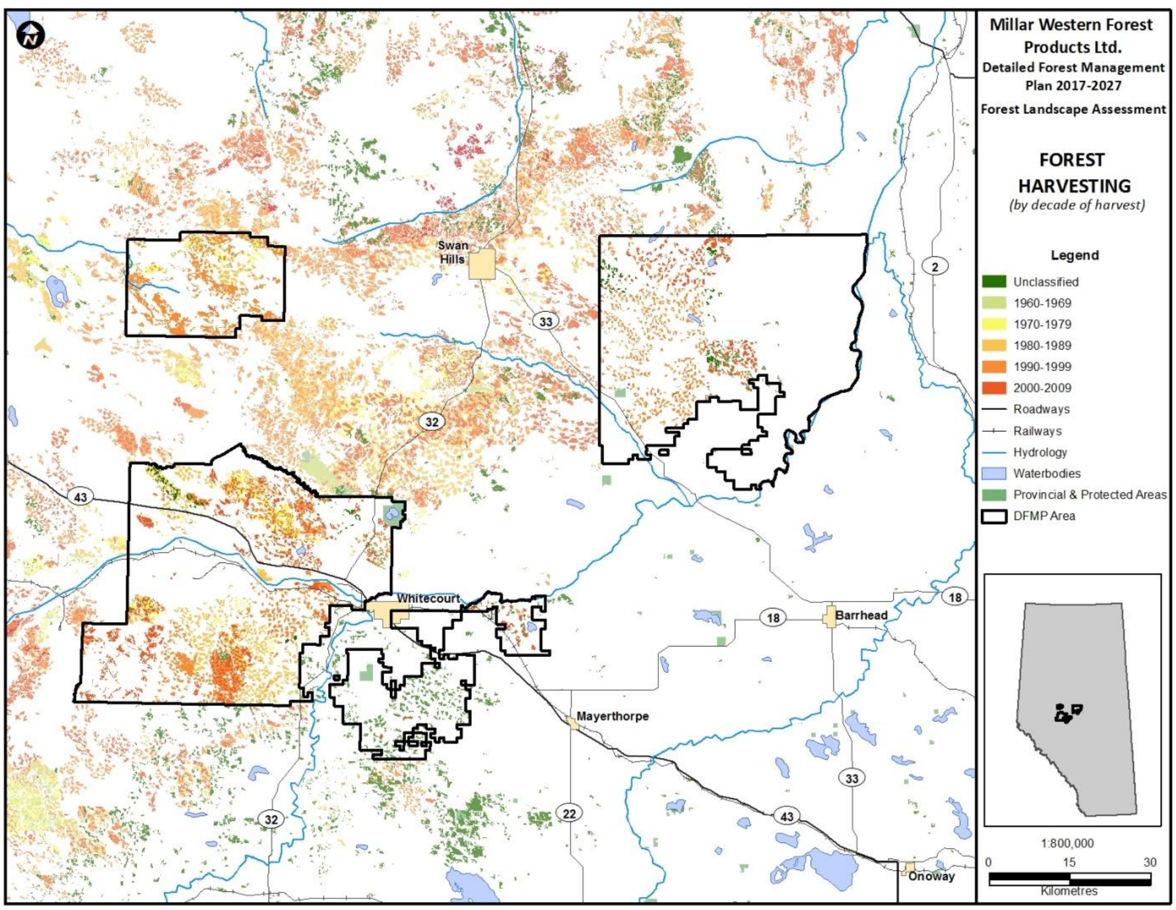


Figure 3-41. Harvest area by decade within the DFMP area

5.7 Access

The well-developed network of roads within the DFMP area (28) is largely the product of resource exploration and extraction (e.g. forestry, oil and gas). Table 3-29 summarizes the length of the different access routes, by classification, within the DFMP area.

Figure 3-42 depicts the location of major transportation routes, including rail lines. The main transportation corridors are:

- Highway 43: running northwest from Edmonton, through Whitecourt up to Grande Prairie.
- Highway 32: running south from Swan Hills to Highway 43 and then south, terminating at the Yellowhead Highway (Highway 16).
- Highway 33: running northwest from Barrhead to Swan Hills.

Table 3-29. Length of access routes, by class, within the DFMP area

Road Classification	Length of Roads (km)
Highway (divided)	110
Highway (undivided)	72
Gravel Road	504
Road (Unimproved)	1,013
Trail (suitable for vehicle access)	317
Total	**2,016**
Railway	82

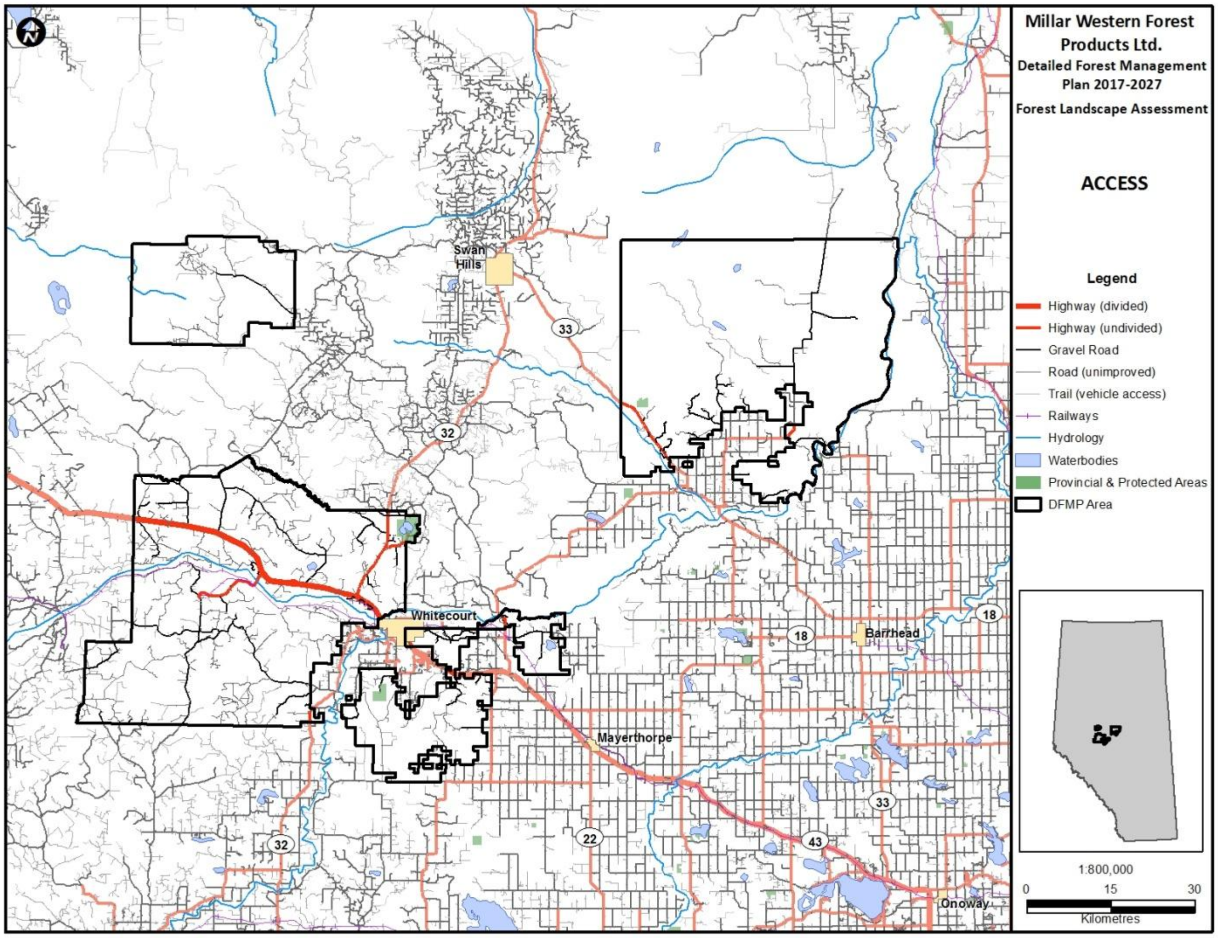


Figure 3-42. Road access by road class within the DFMP area

5.8 Industrial Development

The energy sector accounts for the majority of active surface dispositions in the DFMP area (29). As indicated in Table 3-30, the main dispositions, according to area, are as follows:

- License of Occupation (36%) – typically granted for all-season road access to specific areas.
- Pipeline Agreement (35%) - provided to connect well sites via pipeline for oil and gas shipment.
- Mineral Surface Lease, or MSL (16%) - can be issued for a number of energy industry facilities, such as oil or gas well sites.

Figure 3-43 shows the development of roads, well sites and pipelines throughout the DFMP area. Though development appears dense, the total area occupied by industrial dispositions is only 11,912 hectares, or 3% of the FMUs' area.

Table 3-30. Industrial development dispositions within the DFMP area

Type of Industrial Disposition	Code	Number of Dispositions	Area (ha)	Percent of All Dispositions (by number)	Percent of All Dispositions (by area)	Percent of DFMP area
Easement	EZE	649	1,207	11	10	0.3
License of Occupation	LOC	1,674	4,283	29	36	0.9
Mineral Surface Lease	MSL	1,259	1,992	22	17	0.4
Pipeline Installation Lease	PIL	171	77	3	0.6	0.0
Pipeline Agreement	PLA	1,869	4,168	32	35	0.9
Rural Electrification	REA	34	15	0.6	0.1	0.0
Right of Entry Agreement	ROE	34	122	0.6	1.0	0.0
Vegetation Control Easement	VCE	93	48	1.6	0.4	0.0
Total		**5,783**	**11,912**	**100**	**100**	**2.5**

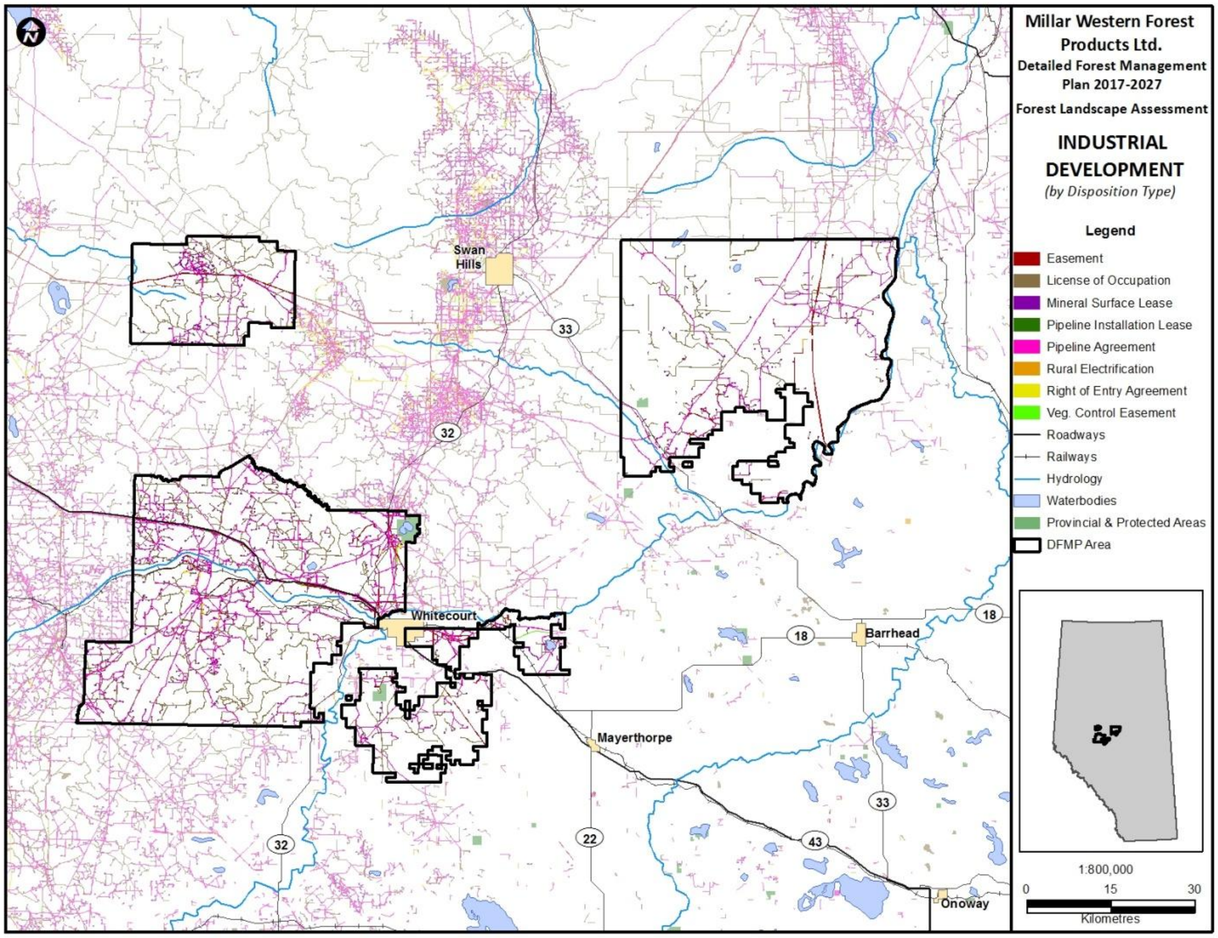


Figure 3-43. Industrial development under permit and lease within the DFMP area

5.9 Monitoring Sites

Permanent monitoring plots, used to collect scientific information in support of sustainable forest management in Alberta, have been established throughout the DFMP area, under a variety of programs. For the purposes of this discussion, monitoring programs are those for which a commitment has been made for ongoing, repeated measurements over time, on a series of established plots. A description of the main types of monitoring systems and programs follows the data summary presented in Table 3-31.

Note that Table 3-31 has values for both the number of installations and the number of plots. A single installation can comprise one or many plots, depending on the type of program under which the plots were established.

In addition, Table 3-31 lists the variety of programs to which the GoA installations belong. Program distinctions for either the Alberta Biodiversity Monitoring Institute or Other Agency plots are not provided, as this information is not available. The distribution of monitoring sites across the DFMP area is displayed in Figure 3-44.

Table 3-31. Monitoring installations within the DFMP area

Monitoring Agency	Plot Classification	Number of Installations	Number of Plots
GoA Permanent Sampling Plots	Permanent Sample Plots	23	68
	Reforestation Monitoring Plots	12	480
	Stand Dynamics Plots	12	12
GoA Sub-total		*47*	*560*
Alberta Biodiversity Monitoring Institute		14	14
Other Agency Permanent Sampling Plots		543	543
Total		**604**	**1117**

5.9.1 GoA Permanent Sample Plots

The GoA has been actively managing a variety of programs that involve the use of permanent sample plots (PSP) since the early 1960s (30).

5.9.1.1 Protection and Registration

Locations of all installations are registered with the Public Lands, Land Status Automated System (LSAS). Most registrations are designated as Protective Notation (PNT), Consultative Notation (CNT) or Disposition Reservation (DRS). Anyone proposing industrial activity near these types of PSPs must first consult with the appropriate government department, so that potential impacts can be assessed. The department may give permission for the activity to proceed but could, in return, require the proponent to provide compensation to re-establish the PSPs, post-disturbance.

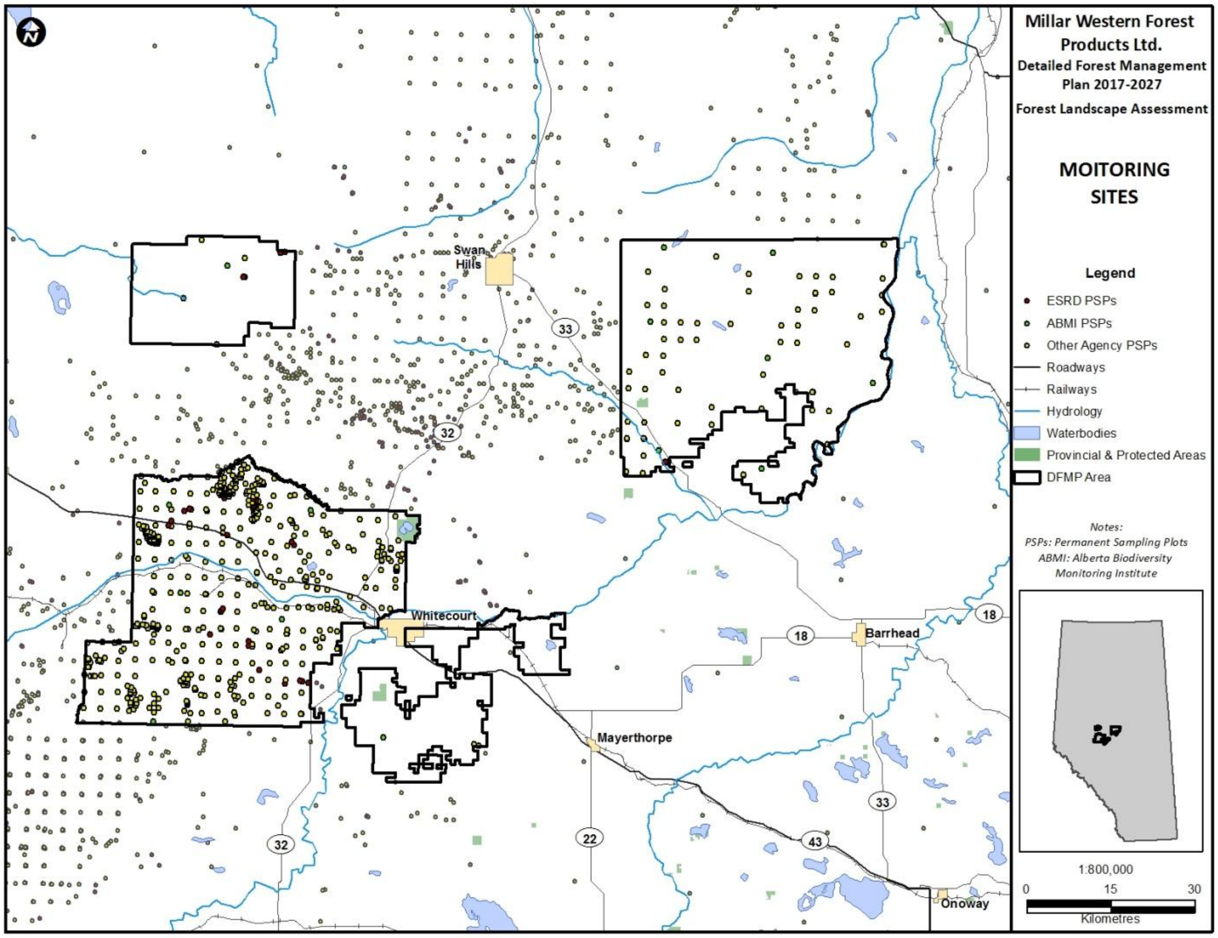


Figure 3-44. Location of permanent monitoring sites within the DFMP area

5.9.1.2 Permanent Monitoring Programs

Table 3-32. Permanent monitoring program types and descriptions

Plot Type	Description
Permanent Sample Plots	Permanent sample plots (PSPs) have been established since 1960, primarily in mature stand types representative of the most common forests in Alberta. Initially, their purpose was to provide volume estimates for the purpose of yield curve construction. Two sample designs are in place: the initial design involves an installation comprising four plots; a later design (approximately 1980) revised the PSP installation to a single plot. The re-measurement cycle for an installation is either 5 or 10 years, depending on stand age.
Reforestation Monitor Plots	Reforestation monitor plots were first established in the early 1980s for the purpose of monitoring initial stand development, from planting to approximately 8-10 years old. An installation is typically made up of 40 plots distributed over a grid on newly reforested cutblocks. The measurement cycle is annual or bi-annual.
Stand Dynamics Plots	Stand dynamics plots are similar in nature to reforestation monitor plots; however, their target dynamic is stand age after the successful establishment of a new forest, to the juvenile stand development stage. The re-measurement schedule is approximately 2 years.

5.9.2 Alberta Biodiversity Monitoring Institute

The Alberta Biodiversity Monitoring Institute (ABMI) monitors more than 2,000 species and habitats, in support of biodiversity decision-making in the province. The network of plots (31) is based on a 20-km by 20-km grid, following the protocol for the Canadian National Forest Inventory (NFI) (Canada 2004).

5.9.2.1 Protection and Registration

Locations of all installations are predetermined, as per the protocol for the NFI. The exact plot locations are not publicly available, to maintain an unbiased measure of biodiversity and the human footprint across the province (map locations are within 5.5 km of the actual survey location). Because they do not require protection, ABMI plot locations are not registered with the Public Lands LSAS system.

5.9.2.2 Monitoring Program

A total of 1,656 ABMI plots are located across the province, 210 of which fall in the DFMP area. Due to the systematic layout of the plots, they theoretically are distributed across the DFMP area. Each location is re-visited every 5 years, at which time a variety of terrestrial and aquatic surveys are completed.

5.9.3 Other Agency Permanent Sampling Plots

Many other agencies establish and monitor sample plots on an ongoing basis. Many FMA holders, including Millar Western, maintain their own PSP programs, in addition to those managed by other forest growth and yield cooperatives (32).

5.9.3.1 Protection and Registration

The locations of most PSPs established by other agencies are registered with the Public Lands, Land Status Automated System, as Industrial Sample Plots (ISPs). This designation is similar to the GoA's Protective or Consultative Notation plots but applies to non-government holdings. ISP registration alerts other land users that monitoring plots are in place and owners may be entitled to compensation if the plots are disturbed without permission.

5.9.3.2 Monitoring Program

The PSPs in this class are established for a wide variety of purposes. Some complement the provincial PSP program and are used for the development of local yield curves; others are collaborative installations established by growth and yield cooperatives. Re-measurement schedules depend on the purpose of the installation.

6. Land Use

6.1 Timber Allocations

Annual allowable cut (AAC) levels are calculated by FMU (Section 2.4) and are set or approved by the GoA (33). Table 3-33 lists the currently approved AAC levels, by FMU, for DFMP area.

Table 3-33. Currently approved net AACs for MWFP's DFMP area (as of May 1, 2007)

FMU Name	Annual Allowable Cut (m^3/year) Coniferous	Deciduous	Total
W11	94,903	106,049	200,952
W13	435,844	209,412	645,256
Total	**530,747**	**315,461**	**846,208**

6.2 Trapping

The fur trade in Western Canada dates back centuries and is often credited with driving the European occupation of modern-day Canada (Foster 2007). Permitting and licensing of trappers was introduced by the Alberta Game Act in 1920, while Registered Fur Management Areas (RFMAs), or traplines, were established in the early 1940s, to manage furbearer populations. The current Wildlife Act (Alberta 2000) regulates open seasons and areas, methods, and reporting requirements for the trapping industry. The GoA has also established Eight Fur Management Zones, to define trapping seasons and quotas for select species (fisher, lynx, otter, and wolverine).

The DFMP area is home to 55 RFMAs (34) totaling 466,332 hectares, or approximately 98% of the DFMP area (Figure 3-45). The average size of an individual trapline is 8,385 ha, though the largest covers 25,547 ha in Virginia Hills. With the exception of bobcat, all Alberta furbearers can be harvested in the DFMP area.

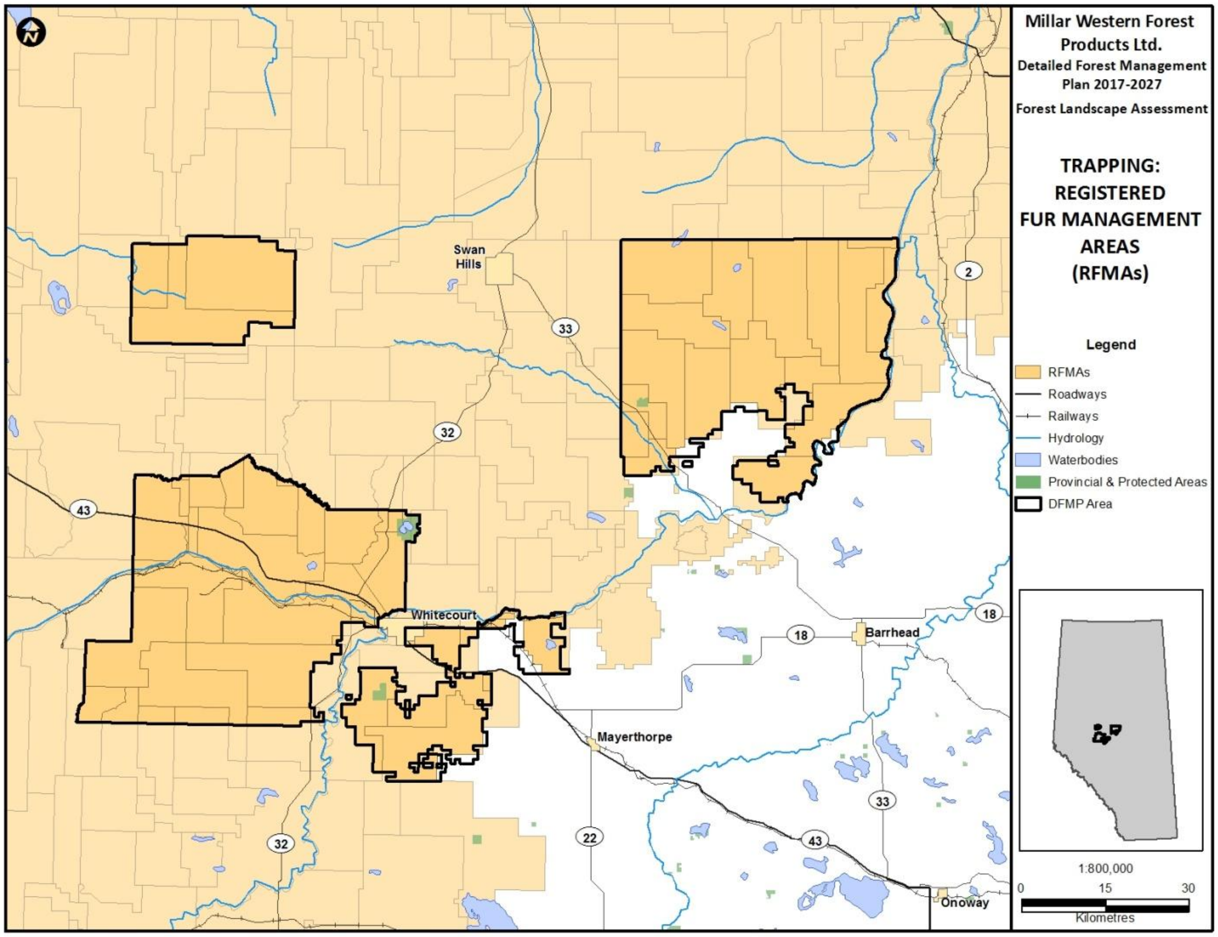


Figure 3-45. Registered fur management areas within the DFMP area

6.3 Grazing

Approximately 3.3 million hectares of Alberta Crown land is used by livestock producers for grazing (35, 37). Various levels of grazing permits are issued based on size, type of forage, and landscape (36). Table 3-34 describes the types of grazing allocations in Alberta. Table 3-35 summarizes the area by grazing types across the DFMP area.

In the DFMP area, the majority of the grazing dispositions are concentrated in Whitecourt, with a few in McLeod, Blue Ridge and Fort Assiniboine (see Figure 3-46).

Table 3-34. Grazing lease types and descriptions

Lease Type	Description
Forest Grazing License	A renewable long-term license (up to 10 years). A licensee cannot control public access. Predominantly issued in forested areas where access for other activities (e.g. recreation, forest harvesting) needs to be accommodated.
Grazing Lease	A renewable long-term (up to 20 years) authorization to individuals, corporations or associations. Access can be controlled, except for timber harvesting.
Grazing Permit	Short-term permits issued on an annual basis and often on land that is fragmented and perhaps periodically wet.

Table 3-35. Grazing dispositions within the DFMP area

Type of Disposition	Code	Number	Area (ha)	Percentage of Grazing	Percentage of DFMP area
Forestry Grazing License	FGL	36	3,826	28	0.8
Grazing Lease	GRL	75	9,901	72	2.1
Grazing Permit	GRP	2	79	0.6	0.02
Total		**113**	**13,805**	**100.0**	**2.9**

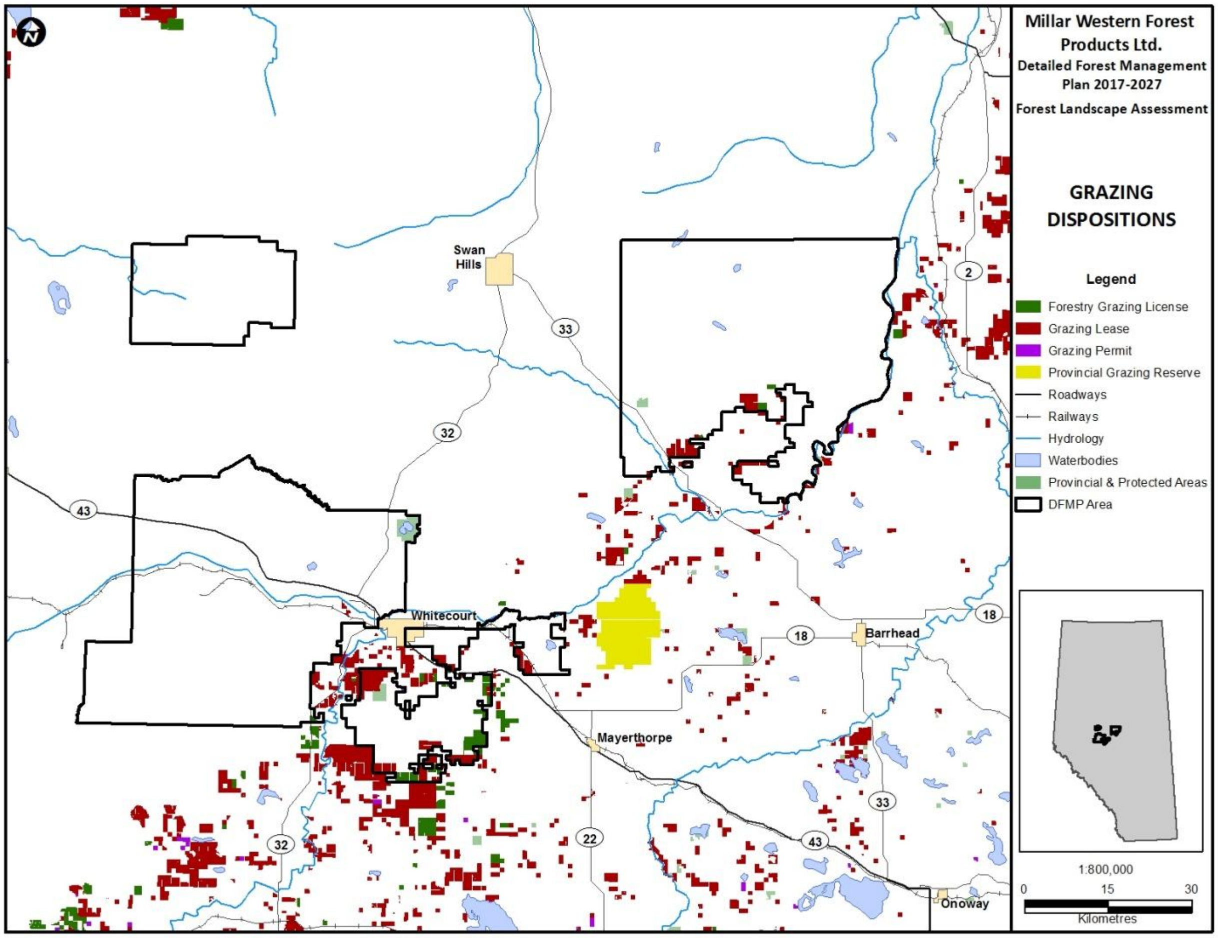


Figure 3-46. Grazing dispositions within the DFMP area

6.4 Guiding and Outfitting

Guides and outfitters are licensed in the province of Alberta and pay annual user fees for their hunting allocations.

The GoA placed no restrictions on big game species until the 1970s, when it began to limit bighorn sheep allocations for non-residents to conserve the resource. The Professional Outfitters Association of Alberta (POAA) was established in the late 1980s, to encourage unity and consensus within an industry that previously had been represented by a number of different organizations. Since 1997, the Alberta Professional Outfitters Society (APOS) has been responsible for managing the outfitting industry on behalf of the GoA. While guiders and outfitters are known to be active in the DFMP area, Millar Western does not track their numbers, incursions or harvests but does invite their input during its regular stakeholder consultations.

6.5 Recreation and Tourism

The GoA created public land-use zones to avoid or minimize land-use conflicts, often between humans and wildlife, but also among different user groups. As shown in Table 3-36, the DFMP area is home to only one public land-use zone (38), the Whitecourt Sandhills Cross-Country Ski Area.

There are many camping and day-use areas southeast of the DFMP area, many of which are in provincial parks or provincial recreation areas, but only a couple actually fall within the DFMP area, as shown in Figure 3-47. The DFMP area includes one provincial park (Carson-Pegasus), two natural areas (Whitecourt Mountain and Centre of Alberta), and one wildland park (Fort Assiniboine Sandhills Wildland). Facilities operated by municipalities, towns or private organizations are not included in this analysis.

Table 3-36. Public land use zones within the DFMP area

Public Land Use Zone	Area (ha) or Length (km)	Camping	Hiking	Off Highway Vehicle	Snowmobile	Equestrian	Cross Country Skiing	Fishing	Hunting	Purpose
Whitecourt Sandhills Cross-Country Ski	1,258.8 (ha)	X	X	X		X	X	X	X	25 km of cross-country ski trails.
Snowmobile Trails	154.3 (km)			X	X				X	Areas used for snowmobiling

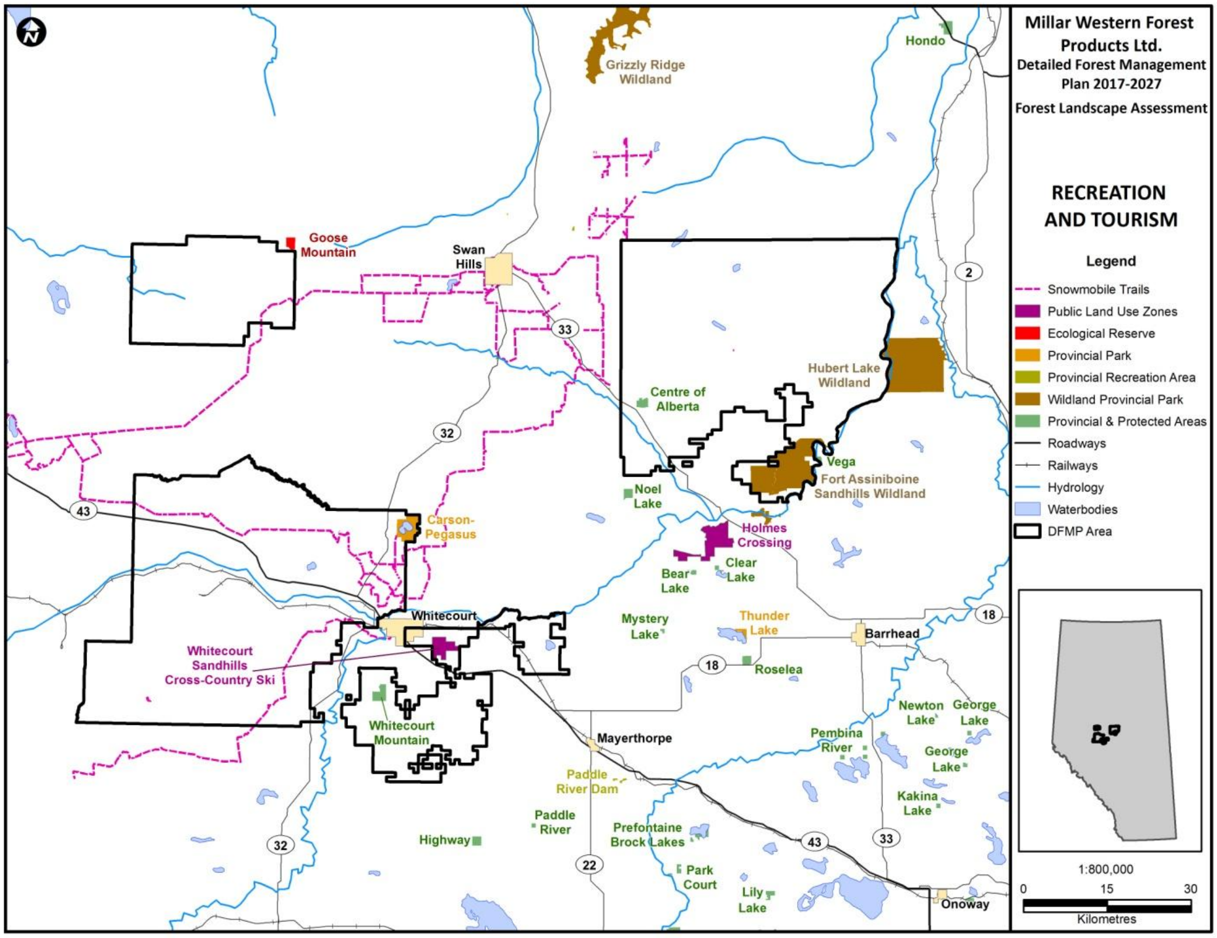


Figure 3-47. Recreation and tourism opportunities within the DFMP area

6.6 Cultural and Historical Resources

The Listing of Historic Resources (39) identifies lands that contain or are believed to contain historic resources, primarily archaeological and paleontological sites, Aboriginal traditional-use sites of a historic resource nature, and historic structures (Figure 3-48). The listing, which provides industry and other developers with advance notification of possible historic resource concerns, is constantly being updated as new resources are found. Formal updates are published semi-annually.

Each land parcel in the listing is assigned a Historic Resource Value (HRV) ranging from 1 to 5, reflecting its historical importance:

- HRV 1: includes lands designated as Provincial Historic Resources under the Alberta Historical Resources Act, and may identify World Heritage Sites;
- HRV 2: designated as a Municipal or Registered Historic Resource;
- HRV 3: contains a significant historic resource that will likely require avoidance;
- HRV 4: contains a historic resource that may require avoidance;
- HRV 5: believed to contain a historic resource.

Table 3-37 outlines the area and percentage of area designated as having historical resources; the area is further broken down by historical resource category and HRV value. Only one area, measuring 32 hectares, is assigned an HRV of 1. The site, categorized as geological, is located southeast of the town of Whitecourt, within the Whitecourt area, and marks the location where a meteorite impact-crater was found in 2007. Archaeological and paleontological sites are the most plentiful types of historical resources in the DFMP area, occupying 71% and 21%, respectively, of the total area listed as having historical resources. The majority of these sites have a ranking of HRV 4 and HRV 5. Most are located in McLeod and Blue Ridge, along or near the Athabasca River.

Table 3-37. Area containing historical resources, by category and assigned HRV

	Relative Importance Ranking (HRV)									
	HRV 1		HRV 3		HRV 4		HRV 5		Total	
Category	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Archaeological	-	-	-	-	880	14	3,582	57	4,462	71
Archaeological, Historical	-	-	-	-	16	0.3	-	-	16	0.3
Cultural	-	-	-	-	309	5	-	-	309	5
Geological	32	0.5	-	-	-	-	-	-	32	0.5
Historical	-	-	-	-	33	0.5	-	-	33	0.5
Natural	-	-	145	2	-	-	-	-	145	2
Paleontological	-	-	-	-	125	2	1,183	19	1,308	21
Total	**32**	**0.5**	**145**	**2**	**1,363**	**22**	**4,766**	**59**	**6,305**	**100**

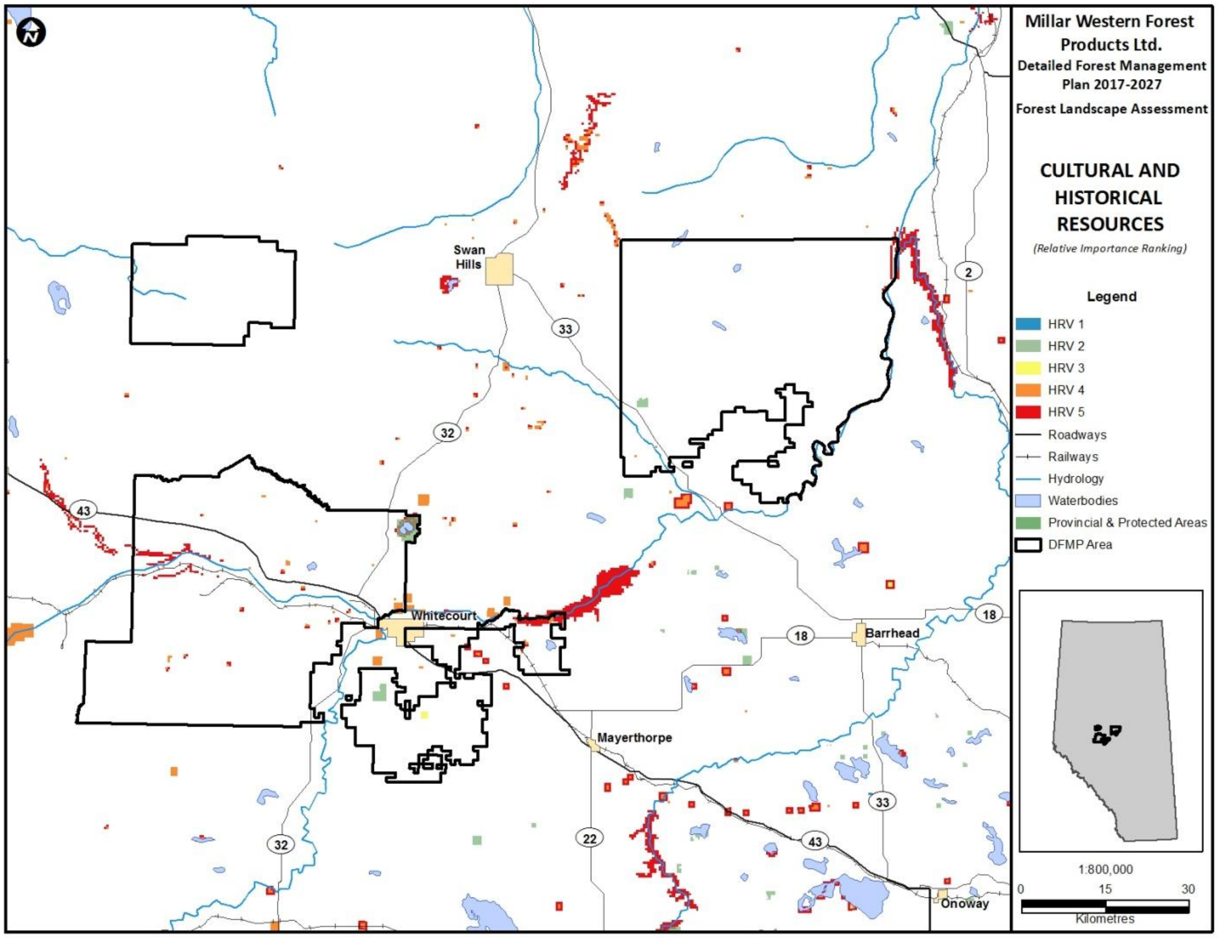


Figure 3-48. Areas of historic resource value within the DFMP area

6.7 Visual Resources

Numerous high-value visual areas are known to exist in the DFMP area, however, no formal inventory has been compiled. These sites are typically found along travel corridors and in recreational areas. Millar Western consults with First Nations and other stakeholders regularly and, in those discussions, seeks to identify a range of values, including areas of high-visual importance, so they can be taken into consideration in forest management planning.

6.8 Fish and Wildlife Resources

6.8.1 Management Zones

6.8.1.1 Fish and Wildlife Districts

The GoA has divided the province into districts for the purposes of fish and wildlife management and regulation. Table 3-38 outlines the size of the districts, while Figure 3-49 shows their distribution across the DFMP area. The Swan Hills district encompasses Fort Assiniboine, Virginia Hills and the northern portion of Blue Ridge. The Whitecourt district covers Whitecourt and the majority of McLeod and Blue Ridge; the remainder of McLeod is covered by the Fox Creek and Edson districts.

Table 3-38. Fish and wildlife districts in the DFMP area

Fish and Wildlife District Name	Entire District	Portion of District in DFMP area		Portion of DFMP area Occupied by District
	Area (ha)	Area (ha)	(%)	(%)
Edson	1,023,570	49,0967	5	10
Fox Creek	593,859	15,631	3	3
Swan Hills	469,345	227,719	49	48
Whitecourt	439,416	180,180	41	38
Total	**2,526,191**	**472,628**	**19**	**100**

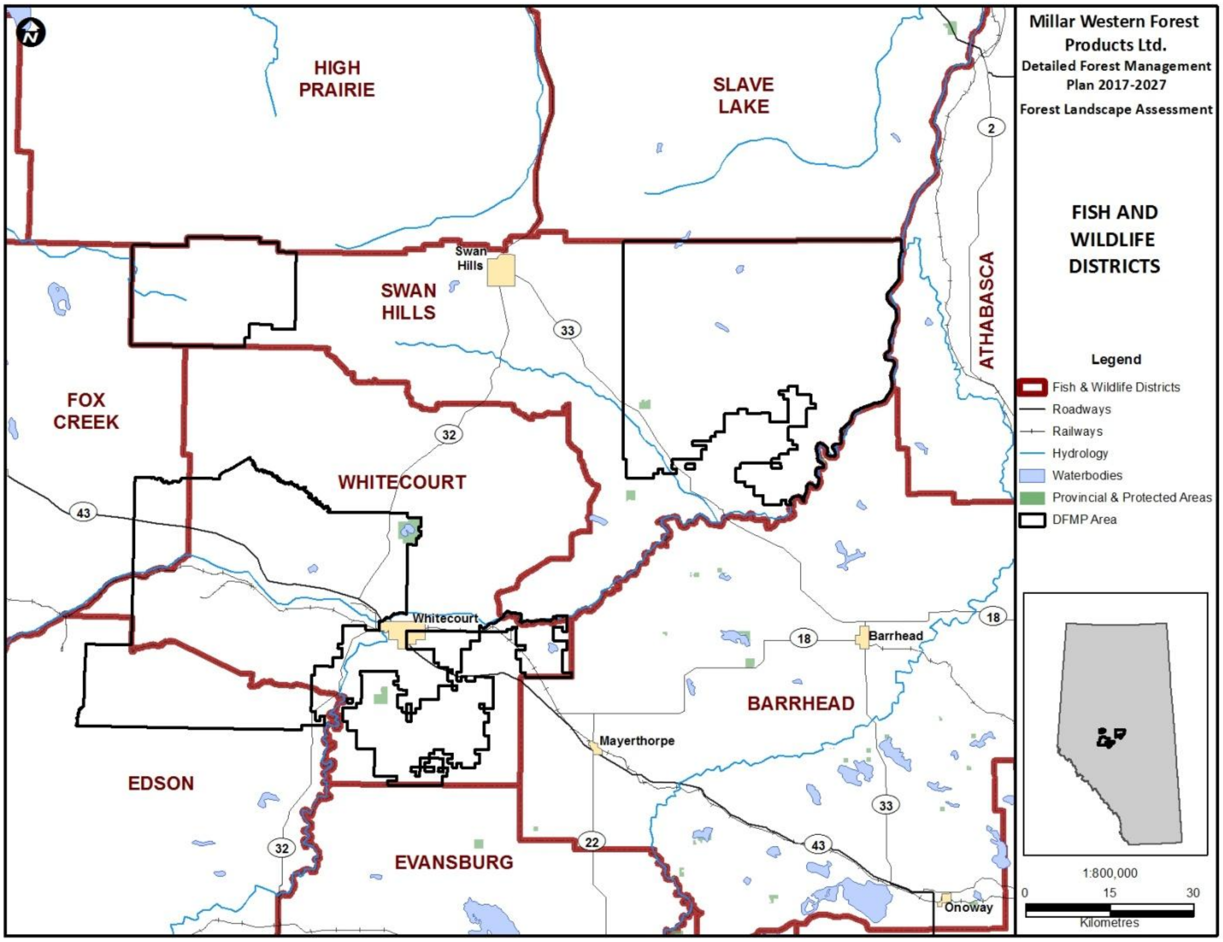


Figure 3-49. Fish and wildlife districts within the DFMP area

6.8.1.2 Wildlife Management Units (WMU)

The GoA manages wildlife according to Wildlife Management Units (WMUs) (41). There are seven different WMUs within the DFMP Area (Figure 3-50), with the Saulteaux River WMU covering the largest area (28%) (Table 3-39).

Table 3-39. Wildlife Management Units (WMU) within the DFMP area

Wildlife Management Unit (WMU)	Entire Unit	Portion of Unit in DFMP Area		Portion of DFMP Area Occupied by Unit
	Area (ha)	Area (ha)	(%)	(%)
Shiningbank	521,629	104,899	20	22
Chip Lake	299,010	35,680	12	8
Swan Hills	648,816	120,886	19	26
Thunder Lake	277,559	52,713	19	11
Marsh Head	157,945	20,553	13	4
Saulteaux River	623,127	131,761	21	28
Goose River North	436,563	6,135	1	1
Total	**2,964,649**	**472,628**	**16**	**100**

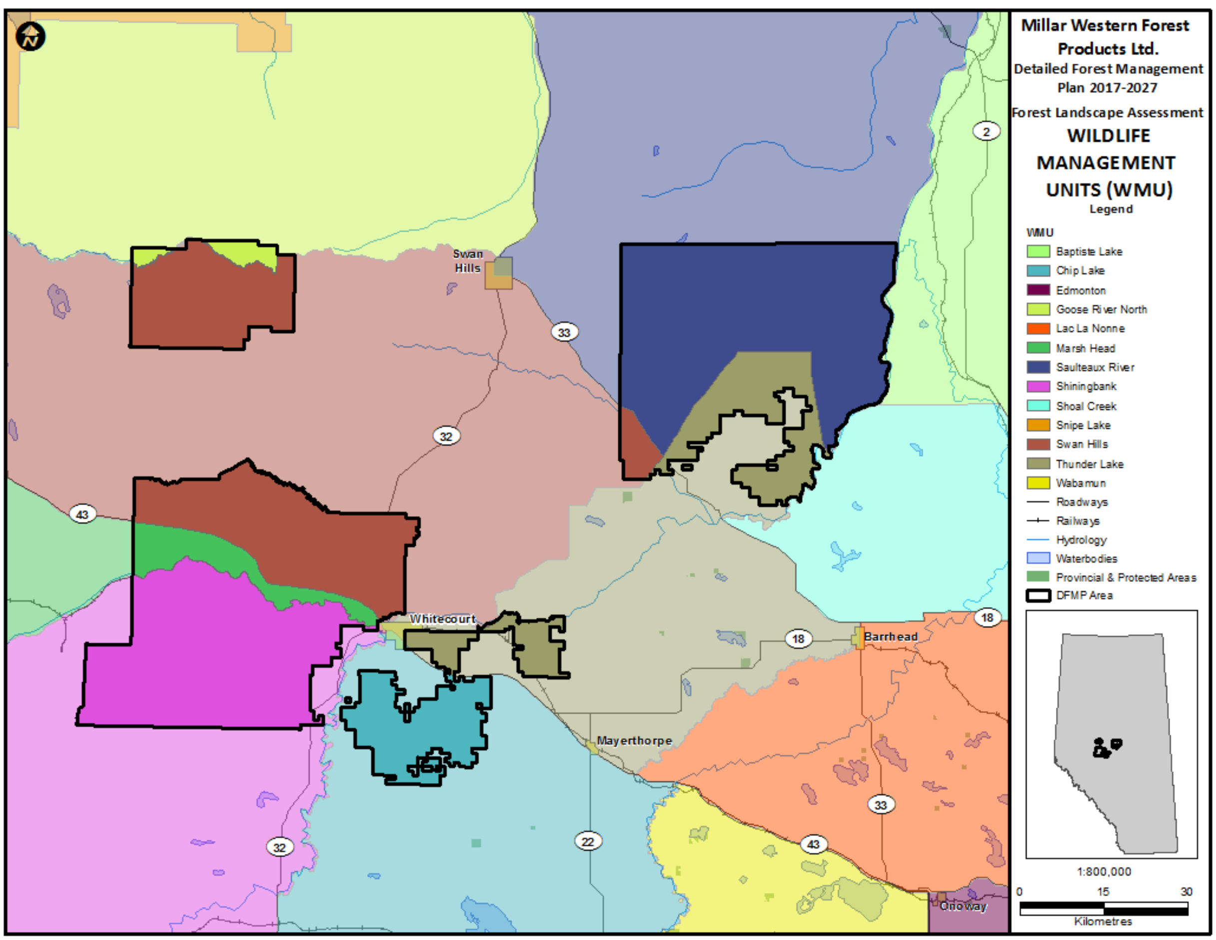


Figure 3-50. Wildlife Management Units within the DFMP area

6.8.1.3 Fur Management Zones

Alberta is divided into eight Fur Management Zones (42), based on common environmental features. The timing and length of the trapping season are established on the basis of these zones, reflecting differences in furbearer status, trapping pressure, and seasonal pelt quality (Alberta, 2015e). The DFMP area is contained entirely within Zone 4, with Fort Assiniboine bordering Zone 3 to the east (Figure 3-51).

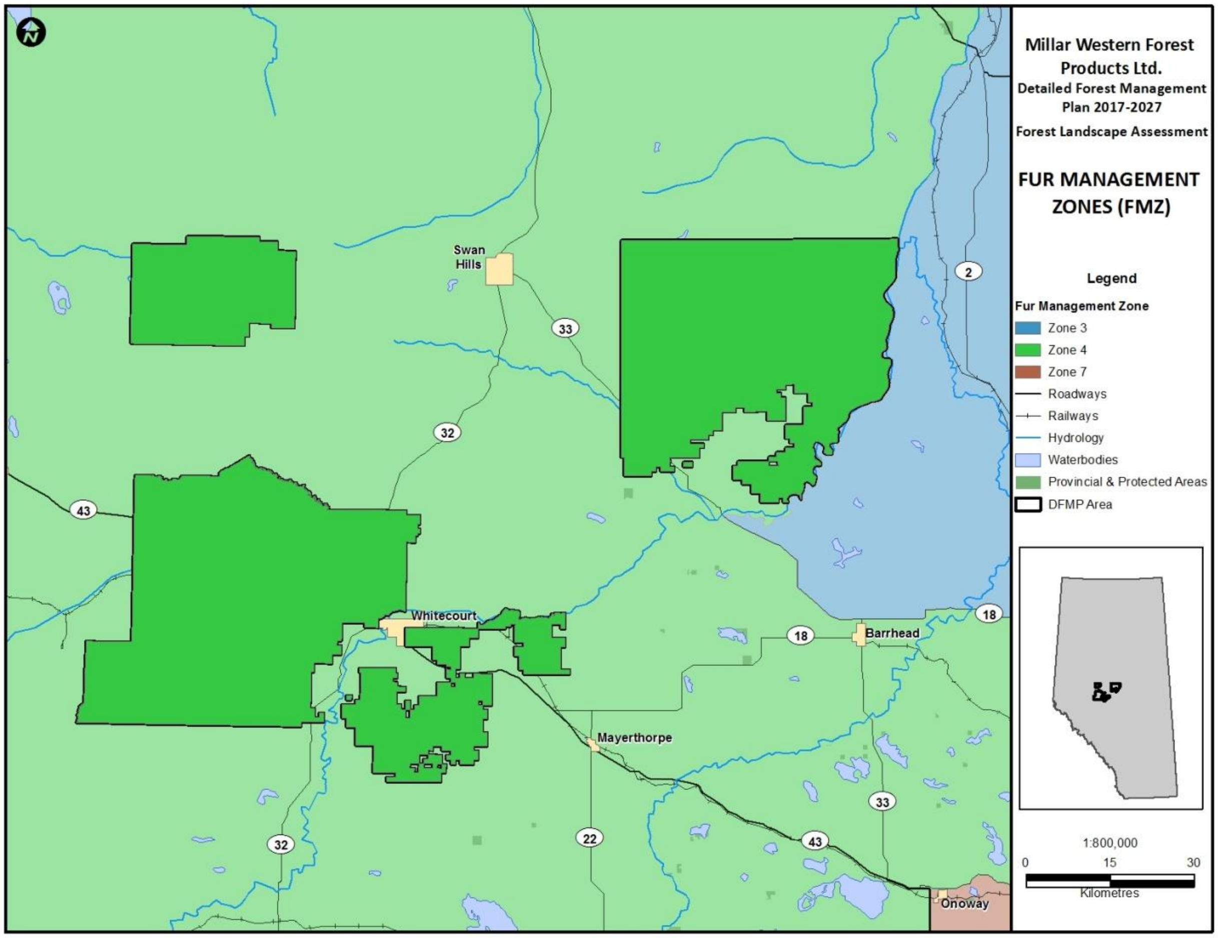


Figure 3-51. Fur Management Zones within the DFMP area

6.8.1.4 Fisheries Hydrologic Unit Code (HUC)

The Hydrologic Unit Code (HUC) watersheds of Alberta (43) represent a collection of four nested, hierarchically-structured drainage-basin feature classes (Alberta, 2016a). The "Athabasca River Above Whitecourt" watershed is the largest within the DFMP area, occupying 30% of the land base (Table 3-40). Figure 3-52 shows the watersheds that overlap the DFMP area at the HUC 8 (finest) level.

Table 3-40. HUC 8 Watersheds within the DFMP area

HUC 8 Watershed ID Number	HUC 8 Watershed Name	Entire Watershed	Portion of Watershed in DFMP Area		Portion of DFMP Area Occupied by Watershed
		Area (ha)	Area (ha)	(%)	(%)
17010501	Athabasca River Above Whitecourt	289,275	143,805	50	30
17010601	Sakwatamau River	117,215	32,632	28	7
17010602	Athabasca River Above Freeman River	189,995	17,486	9	4
17010603	Freeman River	169,177	14,278	8	3
17010701	Athabasca River and Saltwater Creek	86,842	33,920	39	7
17010702	Timeu Creek	88,310	59,569	67	13
17010703	Athabasca River and Rourke Creek	117,855	528	0	0
17020201	Lower Mcleod River	257,966	34,309	13	7
17020204	Trout Creek	62,695	0	0	0
17030203	Paddle River	246,653	17,146	7	4
17040103	East Prairie River	159,392	146	0	0
17040303	Saulteaux River	274,651	71,739	26	15
18020702	Iosegun River	196,816	3,557	2	1
18020704	Goose River	159,476	43,580	27	9
Total		**2,416,317**	**472,696**	**20**	**100**

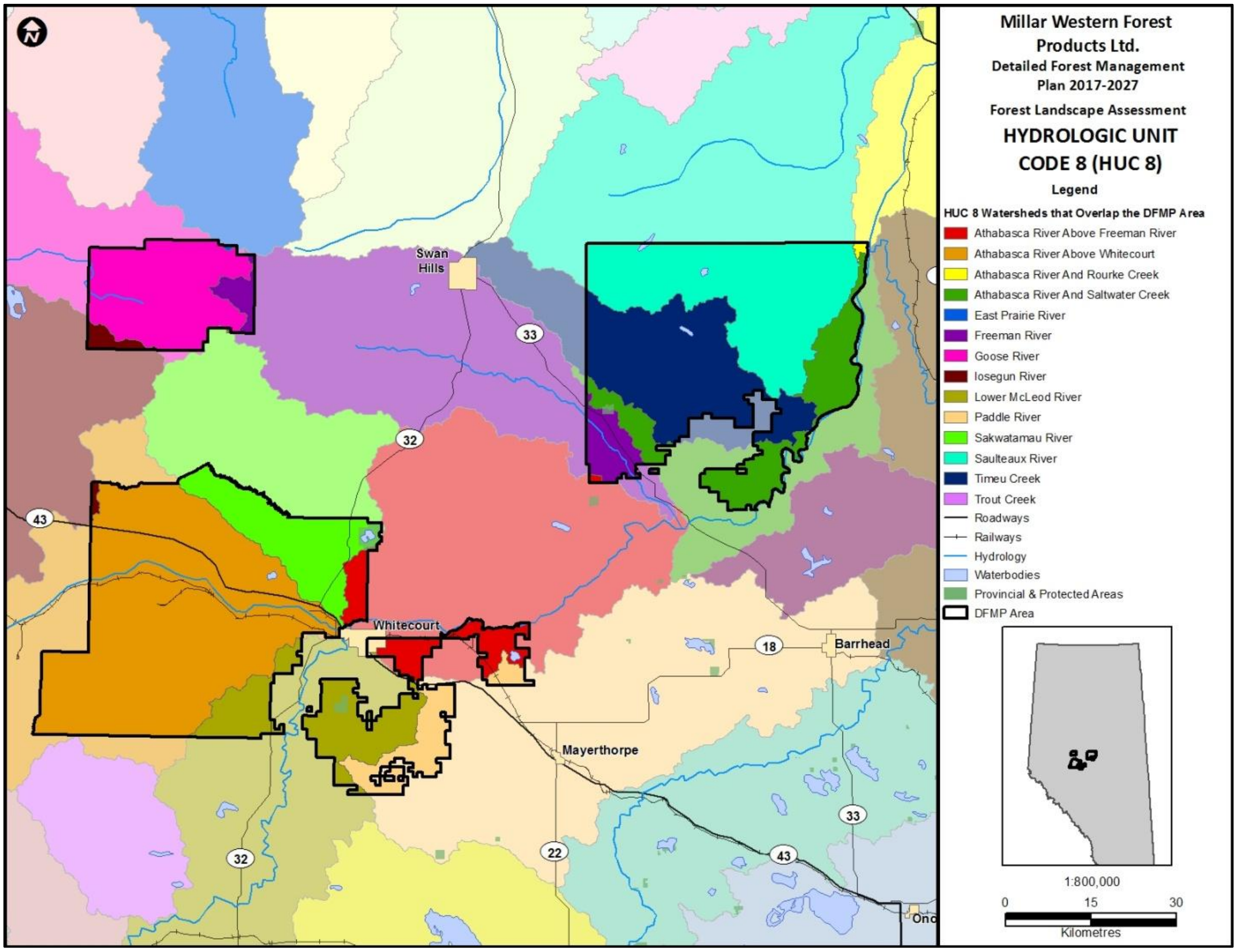


Figure 3-52. HUC 8 watersheds within the DFMP area

6.8.2 Fisheries

The GoA uses Fish Management Zones (40) to determine fisheries health, regulate sport and commercial fishing, and determine fish stocking. The zones are further subdivided into Fish Watershed Units that are based on specific river basins (Table 3-41). Sport fishing regulations generally apply at the Fish Watershed Unit level but, in some cases, are specific to lakes and streams within a unit. McLeod, the majority of Virginia Hills, and a portion of Whitecourt are part of the Eastern Slopes Fish Management Zone. The very eastern portions of Virginia Hills and Whitecourt, the majority of Blue Ridge, and all Fort Assiniboine are included in the Northern Boreal Fish Management Zone. Figure 3-53 depicts the fish management zones that intersect with the DFMP area.

Table 3-41. Fish management zones within the DFMP area

Fish Management Zones	Entire Zone	Portion of Zone in DFMP area		Portion of DFMP area Occupied by Zone
	Area (ha)	Area (ha)	(%)	(%)
Eastern Slopes Zone	12,264,460	268,671	2	57
Northern Boreal Zone	32,972,500	203,956	0.6	43
Total	**45,236,960**	**472,628**	**2.6**	**100**

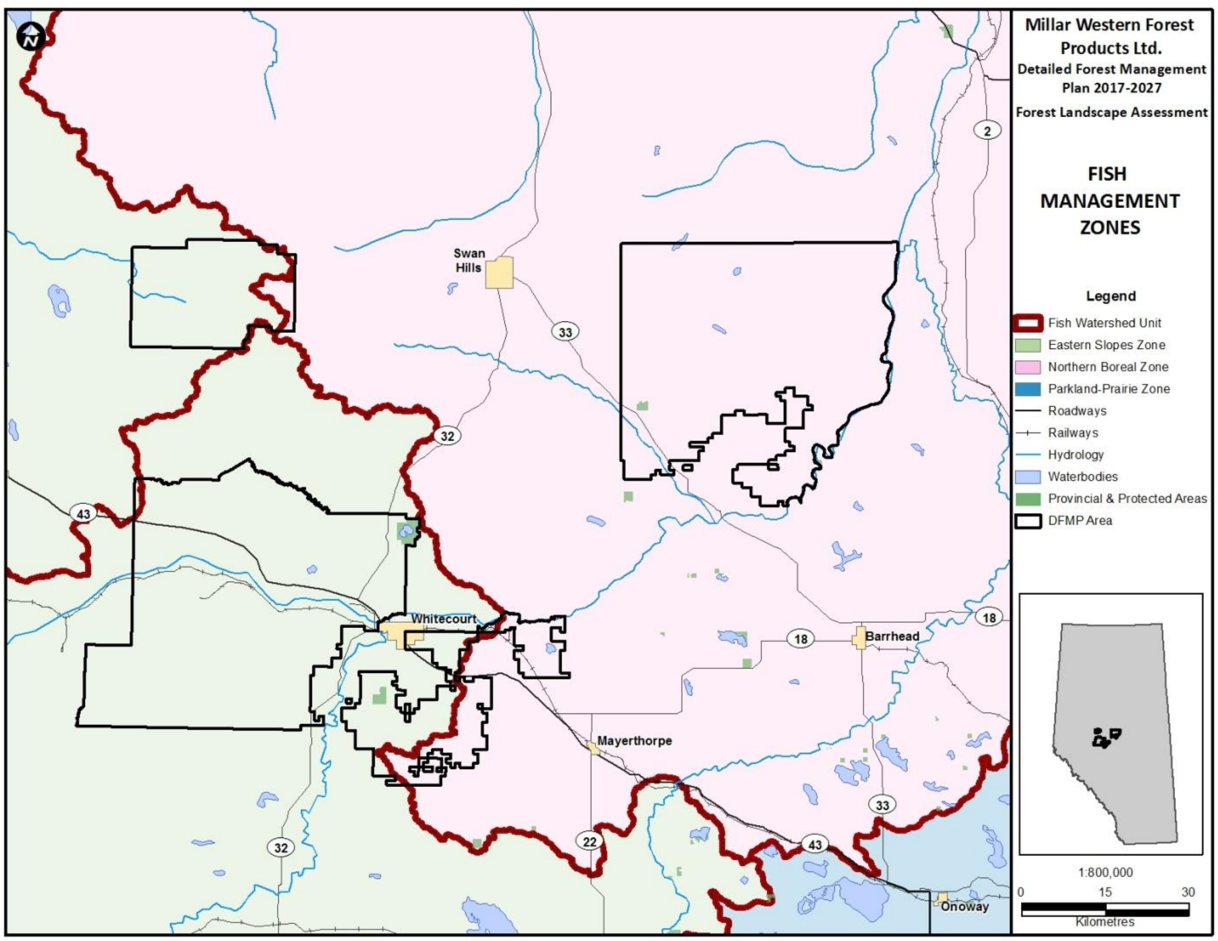


Figure 3-53. Fish Management Zones and Fish Watershed Units within the DFMP area

6.8.3 Wildlife

6.8.3.1 Wildlife Sensitivity Zones

The GoA establishes Wildlife Sensitivity Zones (Table 3-42) using aerial surveys, historical information, movements of collared animals and knowledge of habitat requirements of different species. They represent the best available information on the subject of wildlife sensitivities in Alberta and are used by government departments and industrial operators to aid in operational decision making on Crown land. The species listed in the following table are not representative of all wildlife in the DFMP area, only those of concern to the GoA in terms of their sensitivity to industrial activities. A Landscape Analysis Tool (LAT) has been developed to incorporate the Wildlife Sensitivity Zones (44) in industrial planning. LAT reporting allows for informed decisions, risk mitigation and adherence to standards.

Table 3-42. Wildlife Sensitivity Zones within the DFMP area

Wildlife Species	Wildlife Sensitivity Zone within Alberta	Portion of Sensitivity Zone in DFMP area		Portion of DFMP area occupied by Sensitivity Zone
	(ha)	(ha)	(%)	(%)
Caribou sp. (*Rangifer tarandus*)	9,749,350	12,681	0.1	3
Grizzly Bear (*Ursus arctos horribilis*)				
Core Habitat Zone	3,727,420	119,004	3	25
Secondary Habitat Zone	4,680,902	126,856	3	27
Trumpeter Swan (*Cygnus buccinator*)	157,630	623	0.1	0.1
Colonial Nesting Bird Great Blue Heron (*Ardea herodias*)	31,408	318	1	0.1
Key Wildlife Biodiversity Zone	4,689,713	68,712	2	15
Special Access Zones	1,763,820	50,610	3	11
Total		**378,803**	**12**	**80**

Woodland caribou (*Rangifer tarandus*) is a threatened species in Alberta. The GoA has developed caribou ranges that represent habitat for various herds. The goal of these caribou ranges is to reduce all sources of human-caused direct mortality, excessive predator-caused mortality, habitat loss, impacts to caribou habitat causing partial or complete avoidance by caribou, and to avoid increases in the distribution and productivity of prey species (Alberta, 2013a). To meet these goals, the GoA has developed best management practices and approval conditions for industrial users. As depicted in Figure 3-54, a caribou range that represents habitat for the Slave Lake herd is located in the north-eastern portion of W11.

Grizzly bear (*Ursus arctos horribilis*) is also a threatened species in Alberta. Grizzly bear management areas have been established to reduce sources of human-caused mortality and human-bear conflicts, and avoid industrial development in key habitats and seasons, as well as increases in grizzly bear attractants (Alberta, 2013a). The GoA has developed best management practices and approval conditions for industrial users to assist in meeting these goals. Grizzly bear management areas are delineated into core habitat zones (areas of high habitat value and low mortality risk) and secondary habitat zones (areas of good habitat, reflecting the broader range of grizzly bears) (Alberta, 2013b). As shown in Figure 3-54, both zone types are evident in the DFMP area.

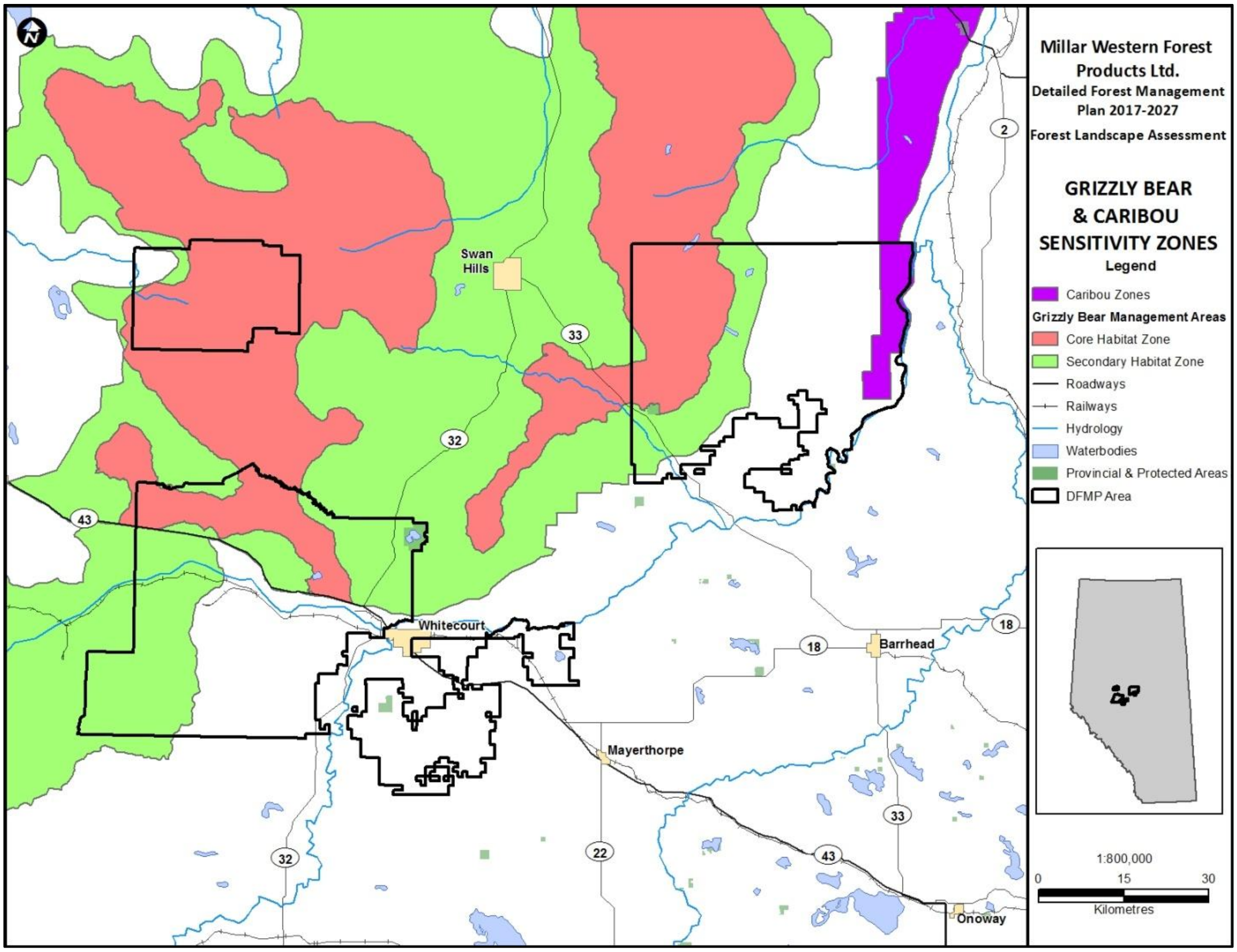


Figure 3-54. Grizzly bear management areas and caribou ranges within the DFMP area

6.8.3.2 Wildlife Biodiversity Zones and Special Access Zones

Wildlife Biodiversity Zones have been established by the GoA to protect areas of high biodiversity habitat potential and key winter ungulate habitat. Typically, these zones follow major river valleys because they contain topographic variation, site productivity conditions, and riparian vegetation complexes that engender increased biodiversity. River valleys also have increased winter browse and reduced snow accumulation and wind chills, which are conducive to winter ungulate survival. Because of the relatively high importance of these areas to biodiversity, and ungulates in particular, the GoA has developed corresponding industrial-user guidelines, which call for minimizing activity during winter months and reducing access development (Alberta, 2015c). The Wildlife Biodiversity Zones in Millar Western's DFMP area are shown in Figure 3-55.

The GoA has created another designation, Special Access Zones, for certain natural habitat areas within an intensively developed landscape. Development plans for these areas are given special consideration, to avoid further fragmenting the landscape and to maintain important contiguous parcels (Alberta, 2013c). Figure 3-55 shows the Special Access Zones within Millar Western's DFMP area.

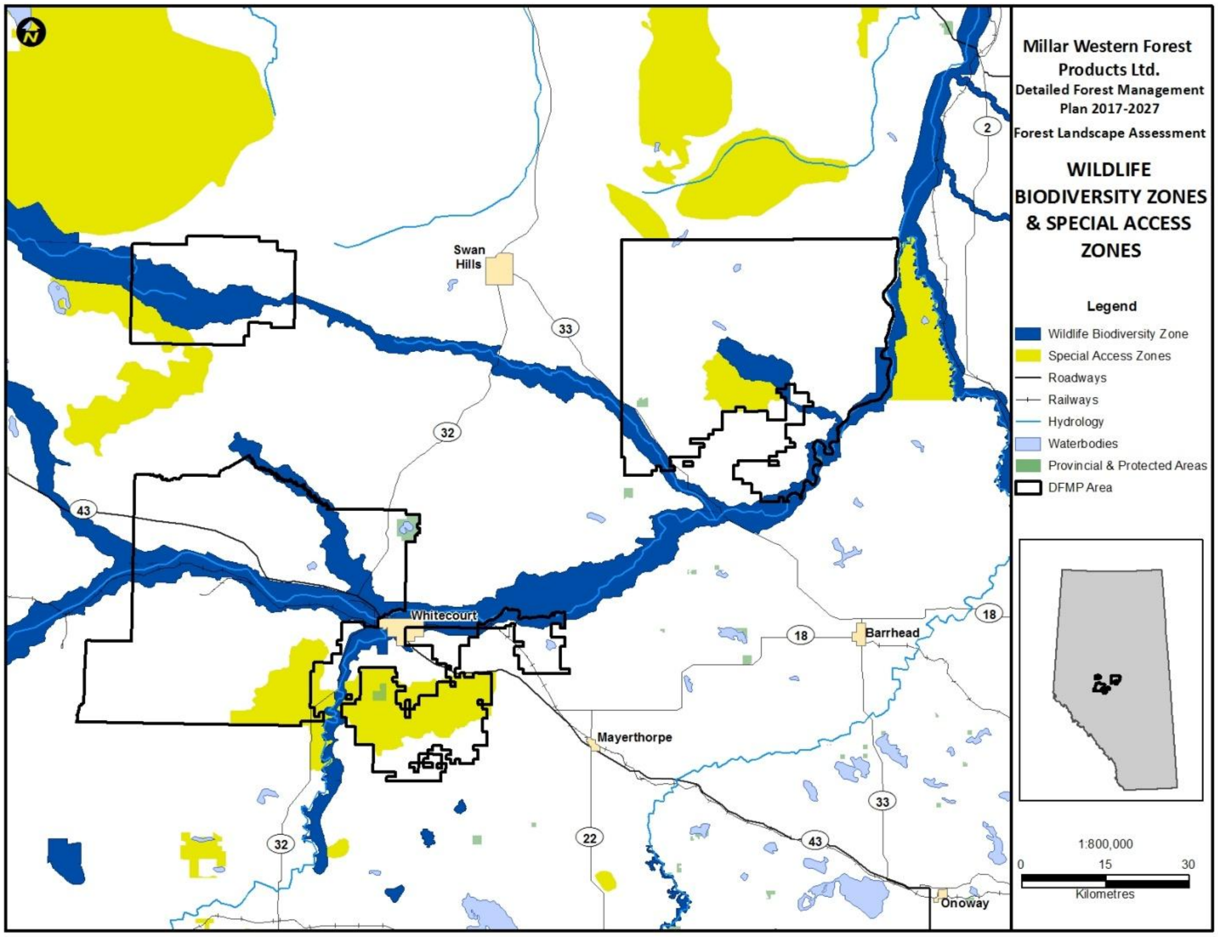


Figure 3-55. Wildlife Biodiversity Zones and Special Access Zones within the DFMP area

The Special Access Zones depicted in the map above are primarily for the protection of several avian species. The DFMP area includes trumpeter swan waterbodies and one colonial nesting bird site. There is also a sharp-tailed grouse lek (45) site, but it is 3.4 km from the DFMP boundary and therefore unlikely to be an issue in cutblock planning (Figure 3-56). Colonial nesting bird colonies and sharp-tailed grouse leks must be buffered during harvesting, while trumpeter swan waterbodies require buffers of 200 m from the high water mark, though the entire Special Management Zone could range in size from between 200 and 500 m from the high water mark (Alberta, 2012b).

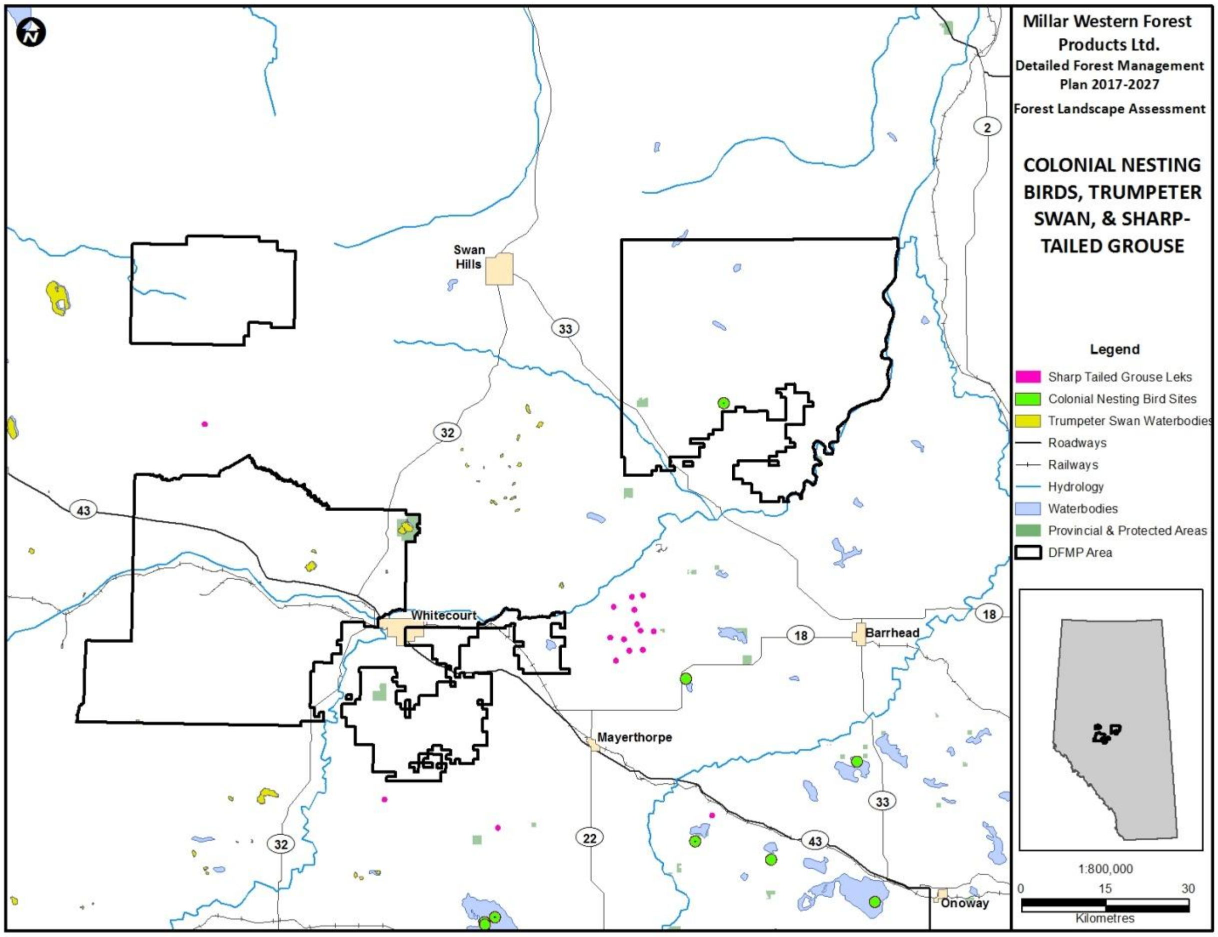


Figure 3-56. Colonial nesting bird colonies, trumpeter swan waterbodies, and sharp-tailed grouse leks sites within the DFMP area

6.8.3.3 Waterfowl Assessment

DUC identifies the western Boreal as a waterfowl conservation priority, due to its importance for nesting, rearing, molting, and staging, and as a migration habitat. Twenty three species and nearly 30% of breeding season waterfowl counted in North America are found in the western Boreal forest (Slattery et al. 2011). A large percentage of the continent's waterfowl use this region during molting and migration periods, including between 25% and 40% of the world's Tundra and Trumpeter Swans (Ducks Unlimited Canada 2006).

While many species of waterfowl in the western Boreal forest are considered to have stable or growing populations, some species for whom the Boreal forest is their primary breeding ground are seeing continental populations fall below population goals, including Scaup *spp.*, Scoter *spp.*, American Wigeon, Northern Pintail, Mallard, and Blue-winged Teal (Ducks Unlimited Canada 2006; Fast et al. 2011; Slattery et al. 2011). Currently no western boreal duck is listed federally as endangered; however, at the provincial level the white-winged Scoter is listed as a species of special concern in Alberta (Alberta Environment and Sustainable Resource Development 2014a).

Millar Western has enlisted the assistance of DUC to map predicted waterfowl abundance in the DFMP area. Total predicted breeding pair abundance was calculated for total ducks and for each nesting guild. Also, cells with the highest predicted pairs relative to all grid cells in the FMA were labeled high relative abundance (red) and cells with the lowest predicted pairs were labeled low relative abundance (green). High and low areas are relative within the FMA and grid cells are approximately 9km by 5km.

The following maps represent *predictions* of waterfowl relative abundance based on breeding pair surveys, and a suite of environmental variables used to characterize the landscape. Thus, maps are best considered over broad areas rather than at fine spatial scales. While some waterfowl species tend to return to the same areas, inter- and intra-annual variation in abundance of waterfowl at any given wetland can occur. Additional information regarding the creation of the waterfowl maps can be found in APPENDIX V.

The predicted total breeding pair abundance for the Millar Western FMA is 2,645 with 1,407 pairs predicted in W11 and 1,238 pairs predicted in W13 (Table 3-43, Figure 3-57). Of the total predicted breeding pairs on the FMA 49% are ground nesters, 31% cavity nesters, and 19% overwater nesters. The breakdown is similar for both FMUs (Table 3-43: W11 48%, 32%, and 20%; W13 51%, 31%, and 18%).

Table 3-43. Predicted pair abundances of total waterfowl, ground nesters, cavity nesters, and overwater nesters in W11 and W13 and total predicted pair abundance for the DFMP Area

FMU	Cavity Nesters	Cavity Nester %	Ground Nesters	Ground Nester %	Overwater Nesters	Overwater Nester %	All Guilds
W11	450	32%	671	48%	286	20%	1,407
W13	379	31%	632	51%	227	18%	1,238
Total	**829**	**31%**	**1,303**	**49%**	**512**	**19%**	**2,645**

Areas of highest predicted total waterfowl breeding pair abundance are located in W11 (Fort Assiniboine), particularly in the south and south east portion (Figure 3-57). Predicted abundances are relatively lower in W13, with the highest abundances predicted in the Blue Ridge area and the eastern portion of the McLeod area. Patterns for the three nesting guilds are similar to those seen for total waterfowl (Figure 3-58). All three guilds had higher predicted abundances in FMU W11 and lower in FMU 13 (Table 3-43; Figure 3-58).

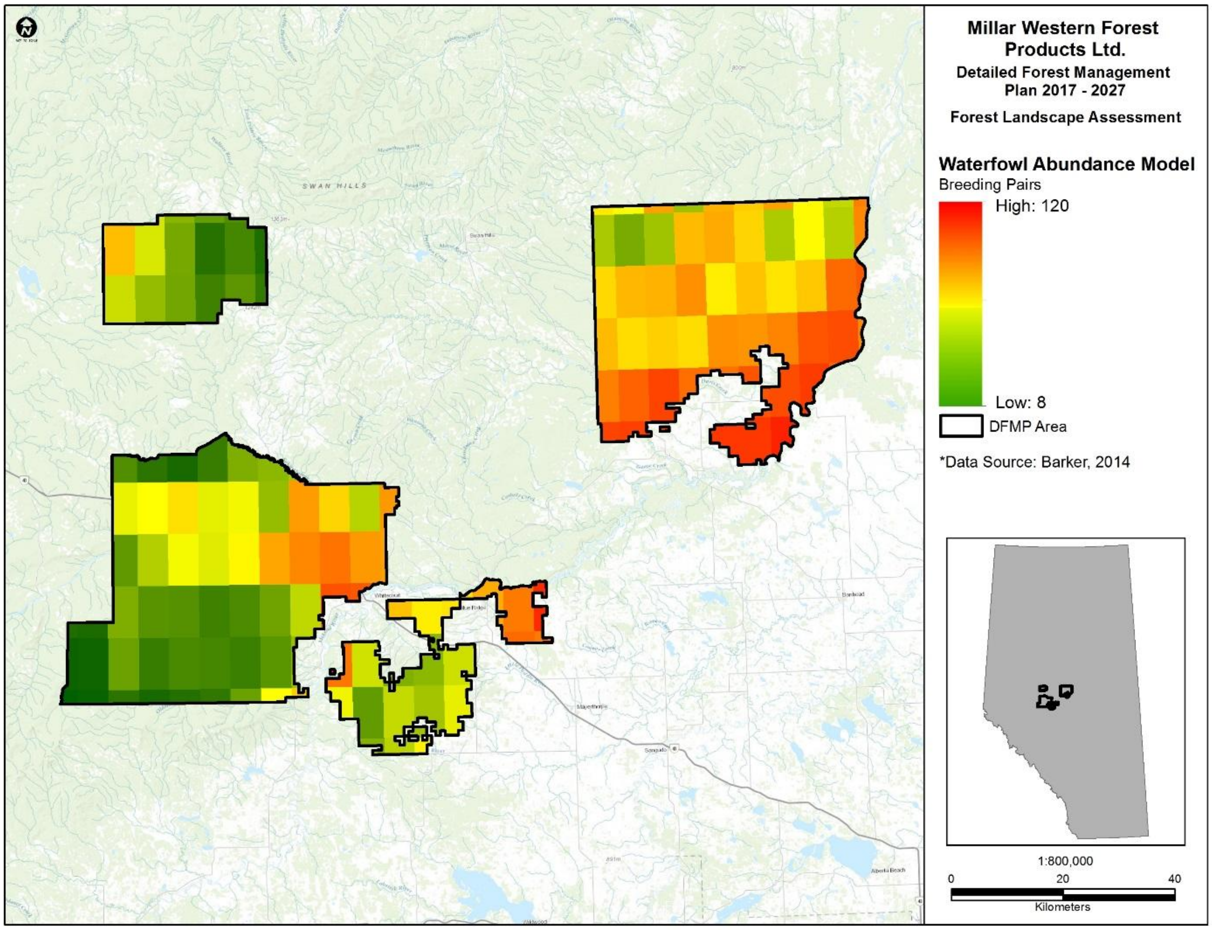


Figure 3-57. Predicted total waterfowl (all guilds) abundances within the DFMP area. Red represents areas of high abundance relative to other areas in the DFMP area, and green reflects areas of relatively low abundance

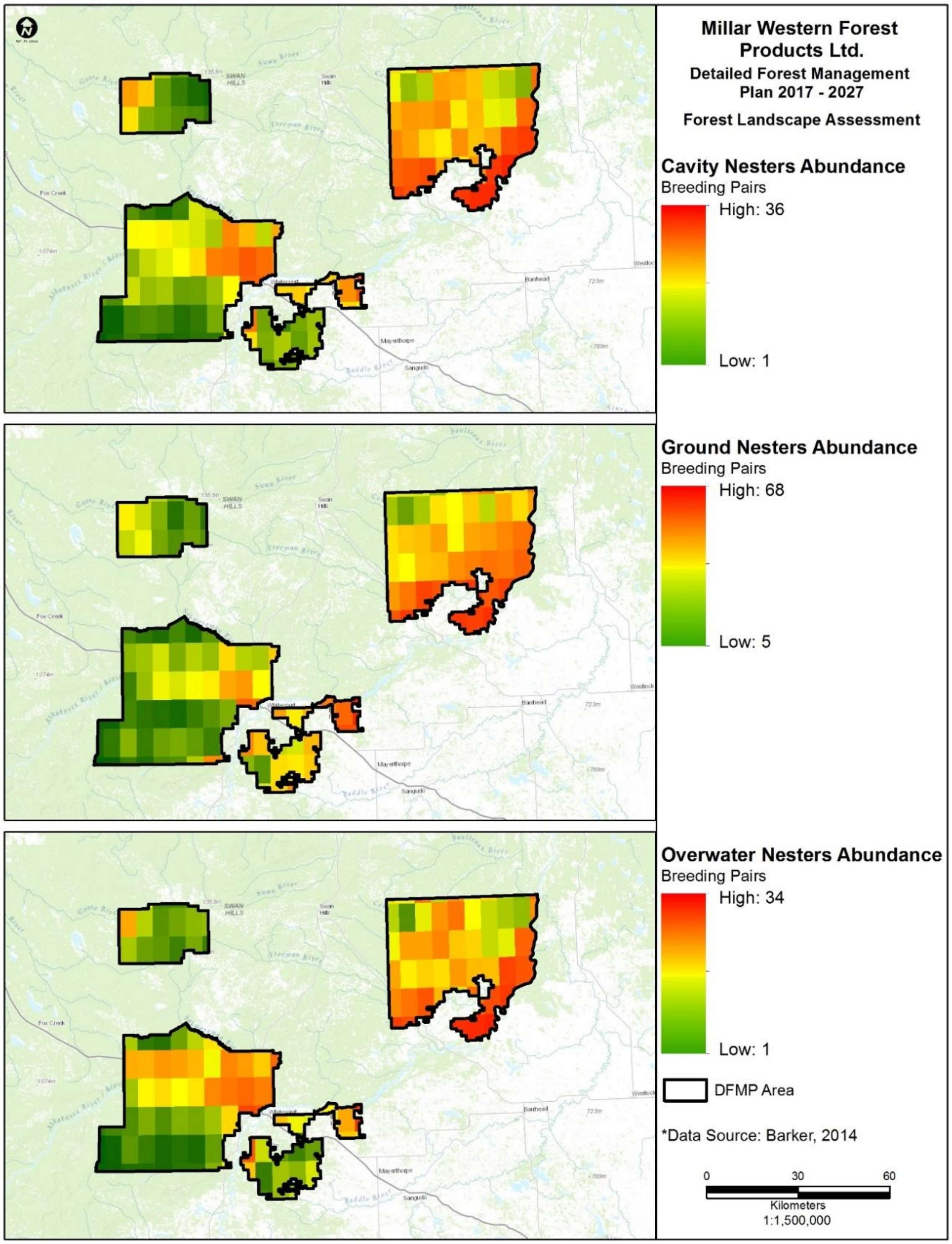


Figure 3-58. Predicted waterfowl abundances by nesting guild within the DFMP area, with red representing areas of high abundance relative to other areas in the DFMP area, and green reflecting areas of relatively low abundance

Waterfowl distribution maps have many potential applications, for example, serving as helping guides to conservation planning for waterbirds and aquatic biodiversity. They can also be used to identify areas that are most likely to support large numbers of breeding waterfowl, and can assist with both strategic and operational planning efforts designed to minimize risks to waterfowl and potentially other wetland-dependent birds (Paszkowski and Tonn 2006). Chapter 7 provides a discussion of how Millar Western intends to use the information to develop operational strategies to conserve and enhance wetlands within the DFMP area.

6.8.3.4 Sensitive Wildlife Sites

In addition to established Wildlife Sensitivity Zones, the Millar Western DFMP area is also home to specific Sensitive Wildlife Site locations. According to GoA wildlife surveys (Figure 3-59), these include black bear dens, garter snake hibernaculums, mineral licks, osprey nests, and other burrows/dens/nests of unknown species (46). Millar Western protects and buffers sensitive wildlife sites at the operational level when designing block and road layout, in compliance with GoA legislation.

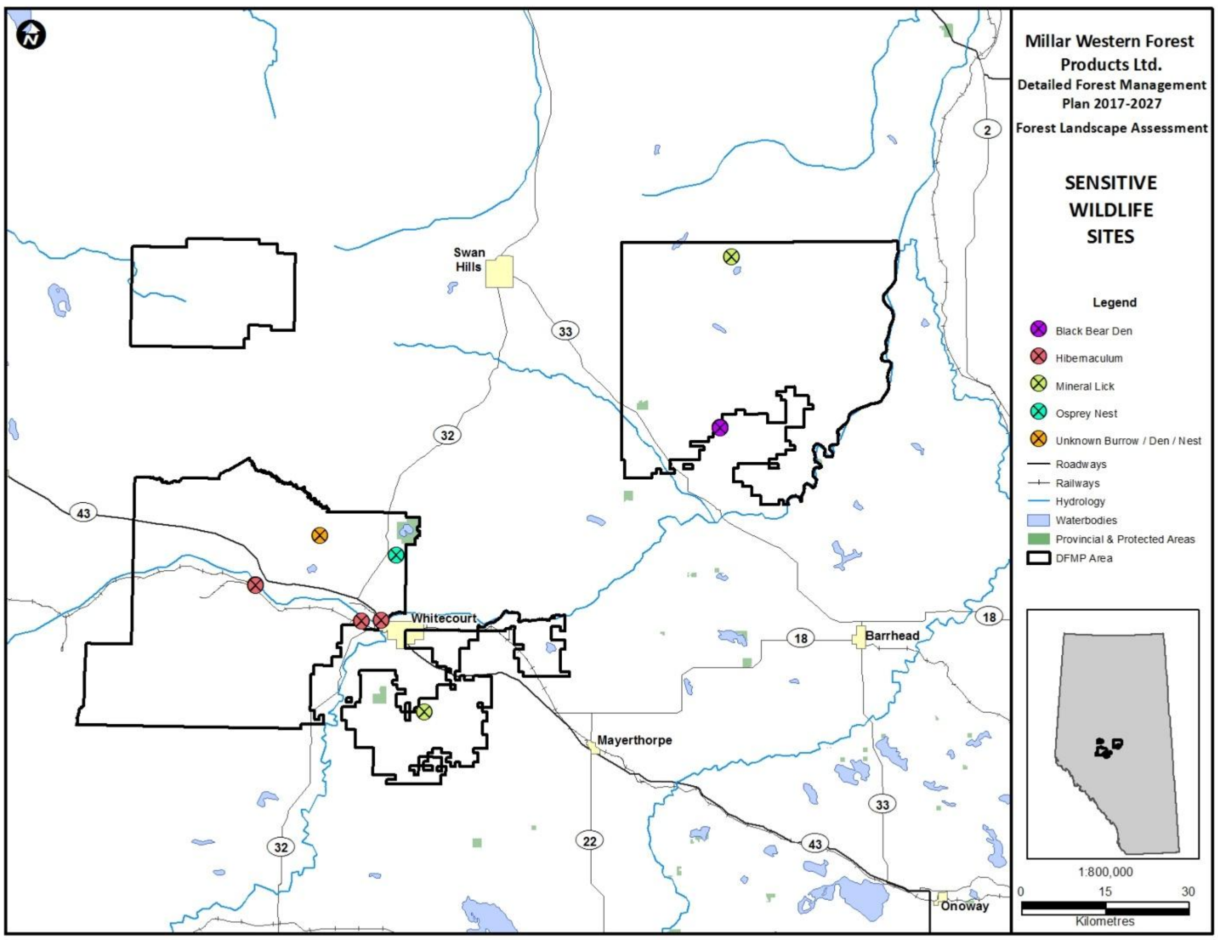


Figure 3-59. Sensitive Wildlife Sites within the DFMP area

6.8.3.5 Species of Special Concern

All species in Alberta assigned a status of endangered, threatened, or of special concern are listed by the GoA (Alberta, 2014b), but their precise spatial locations are not known. Using general range maps (Alberta, 2014c) (NCASI, 2016), the species have been classified into outside, inside, and possibly inside the DFMP area (Table 3-44).

Table 3-44. Alberta species with a status of "endangered", "threatened", and "special concern" and their location relative to the DFMP area

Species Classification	Outside DFMP Area	Inside DFMP Area	Possibly Inside DFMP Area
Endangered	Swift fox (*Vulpes velox*)		
	Bison (*Bison bison athabascae*)		
	Sage grouse (*Centrocercus urophasianus*)		
	Piping plover (*Charadrius melodus*)		
	Ord's kangaroo rat (*Dipodomys ordii*)		
	Whooping crane (*Grus Americana*)		
	Mountain plover (*Charandrius montanus*)		
	Short-horned lizard (*Phrynosoma douglassi*)		
	Burrowing owl (*Athene cunicularia*)		
	Ferruginous hawk (*Buteo regalis*)		
	Tiny cryptanthe (*Cryptantha minima*)		
	Soapweed (*Yucca glauca*)		
	Western spiderwort (*Tradescantia occidentalis*)		
	Porsild's bryum (*Bryum porsildii*)		
	Limber pine (*Pinus flexilis*)		
	Whitebark pine (*Pinus albicaulis*)		
	Slender mouse-ear-cress (*Halimolobos virgata*)		
	Yucca moth (*Tegeticula yuccasella*)		
	Banff springs snail (*Physella johnsoni*)		
Threatened	Barren ground caribou (*Rangifer tarandus groenlandicus)*	Woodland caribou (*Rangifer tarandus caribou*)	Peregrine falcon (*Falco peregrines*)
	St Mary sculpin (*Cottus bairdi punctulatus*)	Grizzly bear (*Ursus arctos*)	Northern leopard frog (*Rana pipiens*)
	Stonecat (*Noturus flavus*)	Athabasca rainbow trout (*Oncorhynchus mykiss*)	Pygmy whitefish (*Prosopium coulteri*)
	Shortjaw cisco (*Coregonus zenithicus*)	Western grebe (*Aechmophorus occidentalis*)	
	Western silvery minnow (*Hybognathus argyritis*)		
	Lake sturgeon (*Acipenser fulvescens*)		
	Small-flowered sand verbena (*Trypterocalyx micranthus*)		
	Westslope cutthroat trout (*Oncorhynchus clarkia lewisi*)		
	Bull trout (*Salvelinus confluentus*)		

Species Classification	Outside DFMP Area	Inside DFMP Area	Possibly Inside DFMP Area
Special Concern	Sprague's pipit (*Anthus spragueii*)	White-winged scoter (*Melanitta fusca*)	
	Long-toed salamander (*Ambystoma macrodactylum*)	Barred owl (*Strix varia*)	
	Long-billed curlew (*Numenius americanus*)	Arctic grayling (*Thymallus arcticus*)	
	Loggerhead shrike (*Lanius ludovicianus*)	Trumpeter swan (*Cygnus buccinator*)	
	Harlequin duck (*Histrionicus histrionicus*)	Black-throated green warbler (*Dendroica virens*)	
	Prairie falcon (*Falco mexicanus*)		
	Western blue flag (*Iris missouriensis*)		
	Weidemeyer's admiral (*Limenitis weidemererii*)		
	Western small-footed bat (*Myotis ciliolabrum*)		
	Great Plains toad (*Anaxyrus cognatus*)		
	Prairie rattlesnake (*Crotalis viridis*)		
	Hare-footed locoweed (*Oxytropis lagopus*)		
Total	**40**	**9**	**3**

6.8.4 Rare Plants

The Alberta Conservation Information Management System (ACIMS) maintains a spatial database of species and ecological communities that are considered rare or of conservation concern, including plants (Alberta, 2015d). ACIMS does not provide spatial data for plants separately; but instead the general area that they have been observed. The element occurrences within the database are divided into sensitive (generalized location provided by township) and non-sensitive (more exact location provided) (47) (48). Figure 3-60 illustrates the non-sensitive element occurrences within the DFMP area. There are no sensitive occurrences near the DFMP area.

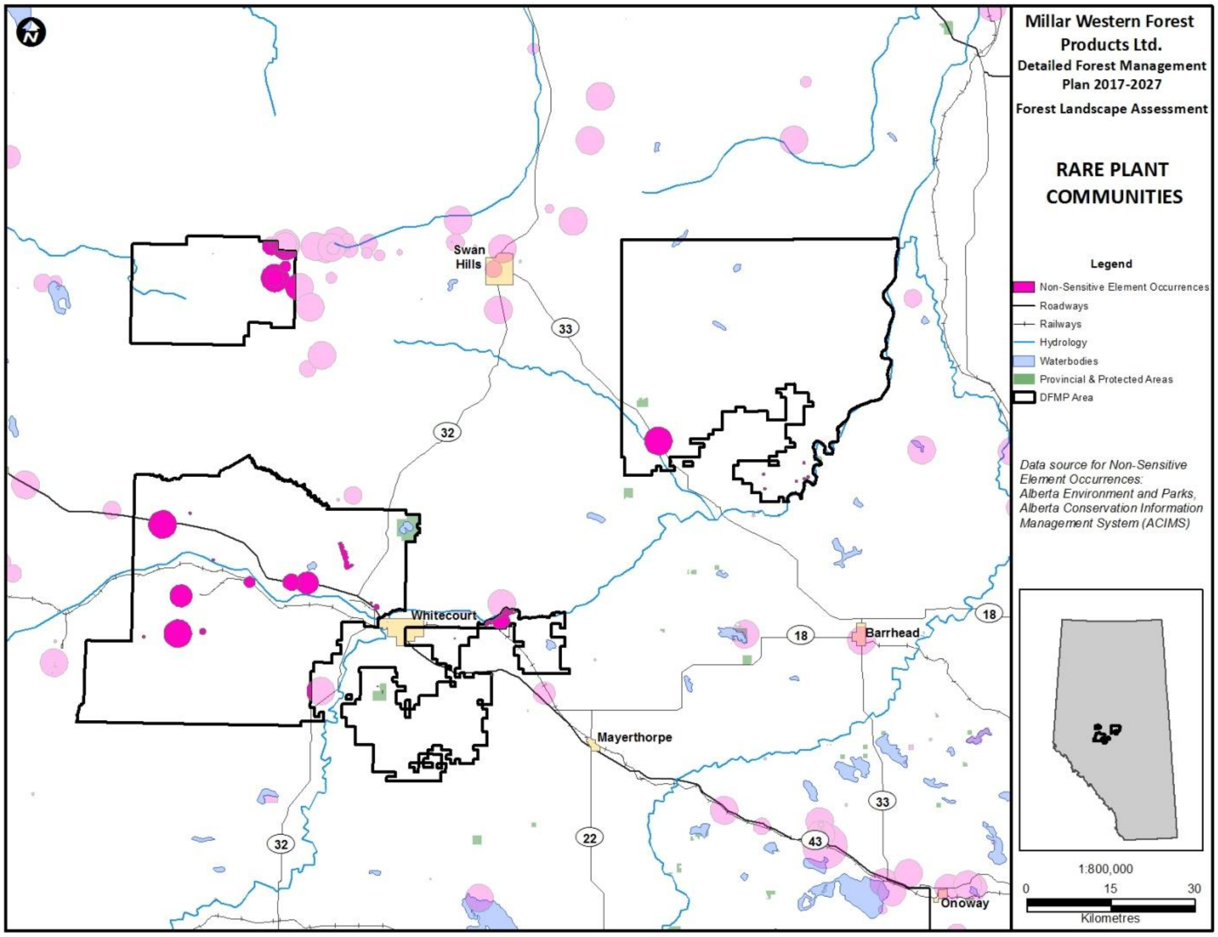


Figure 3-60. ACIMS rare plant communities within the DFMP area

7. References

Alberta. Alberta Natural Resources Act. 1930. S.C. 1930. C.3

Alberta. Environmental Protection. 1994. Natural Regions and Subregions of Alberta: Summary. Alberta Environmental Protection. Pub. No. I/531.

Alberta. Wildlife Act. Revised Statutes of Alberta, (2000). Chapter W-10.

Alberta. Sustainable Resource Development. Resource Information Management Branch. (2005). Alberta Vegetation Inventory Interpretation Standards. Chapter 3 – Vegetation Inventory Standards and Data Model Documents. 99 pp.

Alberta. Sustainable Resource Development. Forest Management Branch. (2006). Alberta Forest Management Planning Standard Version 4.1. 114 pp.

Alberta. Sustainable Resource Development. Resource Information Management Branch. (2006b). Base Features Hydrography Update Specification V. 1.4 October 16, 2006.. 64 pp.

Alberta. Sustainable Resource Development. (2008). Land-use Framework.. 58 pp.

Alberta. Weed Control Act. Statutes of Alberta, (2008a). Chapter W-5.1.

Alberta. Municipal Affairs. Municipal Services Branch (2010). 2010 Official Population List. 12pp.

Alberta. Environment and Sustainable Resource Development. Forest Management Branch. (2011). Retrieved from: http://srd.alberta.ca/LandsForests/ForestManagement/ForestManagementFactsStatistics/documents/AAC-CurrentFactsAndStatistics-2011.pdf

Alberta. Sustainable Resource Development. Recommended Land Use Guidelines for Trumpeter Swan Habitat. 2012. Retrieved from: http://aep.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/documents/RecommendedLandUseGuidelines-TrumpeterSwanHabitat-Sep27-2012.pdf

Alberta. Environment and Sustainable Resource Development. Grizzly Bear Zone. (2013a). Retrieved from: http://data.alberta.ca/data/grizzly-bear-zone-0

Alberta. Environment and Sustainable Resource Development. Enhanced Approval Process (EAP) Integrated Standards and Guidelines. 2013b. Retrieved from: http://aep.alberta.ca/forms-maps-services/enhanced-approval-process/eap-manuals-guides/documents/EAP-IntegratedStandardsGuide-Dec01-2013.pdf

Alberta. Alberta Environment and Parks. Special Access Zone. 2013c. Retrieved from: https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7BE6DC3AB3-BC61-4A6D-97F3-66E27C36027D%7D

Alberta Environment and Sustainable Resource Development (AESRD). 2014a. Alberta Conservation Information Management System: List of tracked and watched elements. Retrieved September 26 2014 from < http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims)/overview.aspx#Methodology>

Alberta. Environment and Sustainable Resource Development. (2014b). Species Assessed by Alberta's Endangered Species Conservation Committee. Retrieved from: http://aep.alberta.ca/fish-wildlife/species-at-risk/documents/SpeciesAssessed-Endangered-Jul18-2014.pdf

Alberta. Alberta Environment and Sustainable Resource Development. (2014c). A Guide to Endangered and Threatened Species, and Species of Special Concern in Alberta. Retrieved from https://issuu.com/esrd/docs/species_at_risk_guidebook_final_for?e=12110136/8006392

Alberta. Alberta Parks. Park designations. 2015a. Retrieved from: http://www.albertaparks.ca/albertaparksca/management-land-use/current-parks-system.aspx.

Alberta Environment and Sustainable Resource Development (ESRD). 2015b. Alberta Wetland Classification System. Water Policy Branch, Policy Division, Edmonton.

Alberta. Environment and Sustainable Resource Development. Recommended Land Use Guidelines: Key Wildlife and Biodiversity Zones. 2015c. Retrieved from: http://aep.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/documents/KeyWildlifeBiodiversityZones-Apr08-2015.pdf

Alberta. Environment and Parks. Alberta Conservation Information Management System (ACIMS) Overview. 2015d. Retrieved from: http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/overview/

Alberta. Environment and Parks. 2015-2016 Alberta Guide to Trapping Regulations. 2015e. Retrieved from: http://www.albertaregulations.ca/trappingregs/important-changes.html

Alberta. Environment and Parks. Hydrologic Unit Code Watersheds of Alberta. (2016a). Retrieved from: http://aep.alberta.ca/forms-maps-services/maps/resource-data-product-catalogue/hydrological.aspx

Alberta. Agriculture and Forestry. Summer Fire Behaviour Potential. 2016b. Provided directly by source.

Andison, D.W. 1999. Assessing forest age data in foothills and mountain landscapes of Alberta. Alberta Foothills Disturbance Ecology Research Series Report No. 1. 24 pp.

Barker, N.K., Cumming, S.G., and M. Darveau**.** 2014. Models to predict the distribution and abundance of breeding ducks in Canada. *Avian Conservation and Ecology.* 9(2): 7.

Batt, B. D. J., M. G. Anderson, C. D. Anderson, and F. D. Caswell. 1989. The use of prairie potholes by North American ducks. Iowa State Universtity Press, Iowa, USA.

Blancher, P., and J. Wells. 2005. The boreal forest region: North America's bird nursery. Canadian Boreal Initiative, Ottawa, Ontario and Boreal Songbird Initiative, Seattle, Washington.

Boreal Centre. 2002. The Natural Disturbance Model. Alberta Environmental Centre, Vegreville, AB. Retrieved from: http:// http://www.borealcentre.ca/reports/reports.html

Canada. Statistics Canada. (n.d.) Population and dwelling counts. Retrieved from: http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/hlt-fst/pd-pl/Table-Tableau.cfm?LANG=Eng&TABID=3&T=302&SR=1&RPP=9999&S=51&O=A&CMA=0&PR=48#C3

Canada. Natural Resources Canada. 2004. Canada's National Forest Inventory Design Overview. 13 pp.

Daishowa-Marubeni. 1999. A Physical, Biological and Land Use Synopsis of the Boreal Forest's Natural Regions of Northwest Albert. In: DMI Pulp River Pulp Division, Detailed Forest Management Plan – 2008. Retrieved from: http://www.dmi.ca/about_dmi/dmi_in_alberta/prpd/detailed_forest_management_plans/landscape_assessment.html

Devito,K. J., I.F. Creed and C.J.D. Fraser. 2005. Controls on runoff from a partially harvested aspen-forested headwater catchment, Boreal Plain Canada. Hydrological Processes. 19:3-25

Devito, K., Mendoza, C., and C. Qualizza. 2012. Conceptualizing water movement in the Boreal Plains. Implications for watershed reconstruction. Synthesis report prepared for the Canadian Oil Sands Network for Research and Development, Environmental and Reclamation Research Group. 164 pp.

Ducks Unlimited Canada. 2006. Waterfowl of the boreal forest. Ducks Unlimited Canda, Edmonton, Alberta.

Fast, P. L. F., M. Collins, and M. Gendron. 2011. Trends in breeding waterfowl in Canada: Technical Thematic Report No 8. Canadian Council of Forest Ministers, Ottawa, ON.

Foster, John E.. 2007 "Fur Trade. The Challenge of Settlement" The Canadian Encyclopedia. Historical Foundation, 2007. Retrieved from: http://www.thecanadianencyclopedia.com/articles/fur-trade

Gingras, B., Slattery, S., Smith, K. and M. Darveau. 2016. Boreal Wetlands of Canada and the United States of America. In: C.M. Finlayson et al. (eds). *The Wetland Book* p 1-23. Springer Netherlands.

Johnson, E.A. 1992. Fire and vegetation dynamics: Studies from the North American boreal forest. Cambridge University Press, Great Britain.

Johnston, J.F., Chapin, F.S., Hollingsworth, T.N., Mack, M.C., Romanovsky, V. and Turetsky, M., 2010. Fire, climate change, and forest resilience in interior Alaska. Canadian Journal of Forest Research, 40: 1302-1312.

McGarigal, K., S.A. Cushman, and E Ene. 2012. FRAGSTATS v4: Spatial Pattern Analysis Program for Categorical and Continuous Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst. Retrieved from: http://www.umass.edu/landeco/research/fragstats/fragstats.html

National Council for Air and Stream Improvement. (2016). Distribution and Range Maps for Species At Risk in Canada: a compendium.

National Wetlands Working Group. 1997. The Canadian Wetland Classification System, 2nd Edition. Warner, B.G. and C.D.A. Rubec (eds.), Wetlands Research Centre, University of Waterloo, Waterloo, ON, Canada. 68 p.

Natural Regions Committee. 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Paszkowski, C.A., and M.T. Tonn. 2006. Foraging guilds of aquatic birds on preductive boreal lakes: environmental relations and concordance patterns. *Hydrobiologia* 567: 19-30.

Petrone, R., Devito, K.J. and C. Mendoza. 2016. Utikuma Region Study Area (URSA)–Part 2: Aspen Harvest and Recovery Study. The Forestry Chronicle 92: 62-65.

Ranney, J.W., M.C. Bruner, and J.B. Levenson. 1981. The importance of edge in the structure and dynamics of forest islands. Pages 67-94 in R.I. Burgess and D.M. Sharpe, eds. Forest Island Dynamics in Man-Dominated Landscapes. Springer-Vergad, New York.

Schiks, T.J., Wotton, B.M., Turetsky, M.R. and B.W. Benscoter. 2016. Variation in fuel structure of boreal fens. Canadian Journal of Forest Research 46: 683-695.

Schneider, R.R., Devito, K., Kettridge, N. and E. Bayne. 2015. Moving beyond bioclimatic envelope models: integrating upland forest and peatland processes to predict ecosystem transitions under climate change in the western Canadian boreal plain. Ecohydrology 9: 899-908.

Slattery, S. M., J. L. Morissette, G. G. Mack, and E. W. Butterworth. 2011. Waterfowl conservation planning: science needs and approaches. p. 23-40. *In* J. V. Wells (ed.) Boreal Birds of North

America: A hemispheric view of their conservation links and significance. University of California Press, Berkeley.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification. Agriculture and Agri-Food Canada. Pub. 1646 (Revised). 187pp.

Steedman, R.J., Kushneriuk, R.S., and R.L. France. (2001). Littoral water temperature response to experimental shoreline logging around small boreal lakes. Canadian Journal of Fisheries and Aquatic Sciences. 58: 1638-1647.

Rowe, J.S. and G.W. Scotter. 1973. Fire in the boreal forest. Quantitative Research 3(3): 444-464.

Song, S.J. (editor) 2002. Ecological basis for stand management: A synthesis of ecological responses to wildfire and harvesting. Alberta Research Council Inc., Vegreville, AB.

Stelfox, J.B. 1995. Relationships between stand age, stand structure, and biodiversity in aspen mixedwood forests in Alberta. Alberta Environmental Centre, Vegreville, AB. Retrieved from: http:// http://www.borealcentre.ca/reports/reports.html

Strong, W.L. and K.R. Leggat. 1992. Ecoregions of Alberta. Publication No. T/245. Alberta Forestry Lands and Wildlife, Land Information Services Division, Resource Information Branch, Edmonton, Alberta Canada. xii + 59 pp.

United Nations Environment Program. 1992. Convention on Biological Diversity, Rio de Janero. 1992.

University of Saskatchewan. 2016. Soils of Canada. Retrieved from: http://www.soilsofcanada.ca/orders/index.php

Waddington, J.M., Morris, P.J., Kettridge, N, Granath, G., Thompson, D.K. and P.A. Moore. 2015. Hydrological feedbacks in northern peatlands. Ecohydrology 8: 113-127.

APPENDIX I – Data Sources

1. Alberta. Resource Information Management Branch. 2012. "BF_LAND_USE_FRAMEWORK" Downloaded from http://www.altalis.com
2. Alberta. Resource Information Management Branch. 2012. "BF_GREEN_WHITE_POLYGON" Downloaded from http://www.altalis.com
3. Alberta. Resource Information Management Branch. 2012. "BF_FMA_POLYGON" Downloaded from http://www.altalis.com
4. Alberta. Resource Information Management Branch. 2012. "BF_FMU_POLYGON" Downloaded from http://www.altalis.com
5. Alberta. Resource Information Management Branch. 2012. " Natural_Regions_Subregions_of_Alberta_2005 " Downloaded from http://www.albertaparks.ca
6. Alberta. Resource Information Management Branch. 2012. "Municipal/City/Town/Settlement/Special Area/Urban Service Area/Village Shape files" Provided directly by source.
7. Alberta. Municipal Affairs. 2012. "Population_2010.xls" Downloaded from http://municipalaffairs.gov.ab.ca/mc_official_populations.cfm
8. Alberta. Resource Information Management Branch. 2012. "National Park.shp" Provided directly by source.
9. Alberta Spatial Data Warehouse "Fed_Military.shp" Downloaded from: http://www.altalis.com
10. Alberta. Resource Information Management Branch. 2012. "Indian Reserve.shp" Provided directly by source.
11. Alberta. Resource Information Management Branch. 2012. "Metis Settlement.shp" Provided directly by source.
12. Alberta. Resource Information Management Branch. 2012. "Provincial Park/Provincial Recreation Area/Natural Area/Wildland Park/Wilderness Park/Wilderness Area/Ecological Reserve/Crown Reservations" Provided directly by source.
13. Alberta. Environment and Sustainable Resource Development. 2012. "SRDAreas.shp" Provided directly by source.
14. Alberta. Resource Information Management Branch. 2012. "DEM by NTS mapsheets" Provided directly by source.
15. Canada. Agriculture and Agri-Food Canada. 2015. “CA_SOIL_V3R2.shp” Downloaded from http://sis.agr.gc.ca/cansis/nsdb/slc/v3.2/index.html

16. Alberta. Resource Information Management Branch. 2012. "Base Features Single Line Network and Base Features Waterbody Polygon" Provided directly by source.

17. Alberta. Agriculture and Rural Development. 2012. "PDF climate maps." Downloaded from: http://agriculture.alberta.ca/acis/climate-maps.jsp

18. Alberta. Environment and Sustainable Resource Development. 2012. "avie_lib_2011.gdb (AVI_INDEX / AVI_PHOTO_YR)" Provided directly by source.

19. Alberta. Environment and Sustainable Resource Development. 2012. "avie_lib_2011.gdb (AVIE)" Provided directly by source.

20. Alberta. Environment and Sustainable Resource Development. 2012. "mpb_Aerial_Survey.gdb" Provided directly by source.

21. Alberta. Environment and Sustainable Resource Development. 2012. "ASPEN_AERIAL_SURVEY.gdb" Provided directly by source.

22. Alberta. Environment and Sustainable Resource Development. 2012. "SBW_AERIAL_SURVEY.gdb" Provided directly by source.

23. Alberta. Environment and Sustainable Resource Development. 2012. "OTHER_FOREST_HEALTH_AGENTS.gdb" Provided directly by source.

24. Alberta. Environment and Sustainable Resource Development. 2012. "Invasive_Plants_1997_2011_Complete.gdb" Provided directly by source.

25. Alberta. Resource Information Management Branch. 2012. "HistoricalWildfireDatabase" Provided directly by source.

26. Alberta. Environment and Sustainable Resource Development. 2012. "weyer-cutblocks.gdb" Provided directly by source.

27. Alberta. Environment and Sustainable Resource Development. 2012. "PROV_CC.gdb" Provided directly by source.

28. Alberta. Resource Information Management Branch. 2012. "Road/Railway/Cutline" Provided directly by source.

29. Alberta. Resource Information Management Branch. 2012. "Digitally Integrated Disposition System Dataset (Active)" Provided directly by source.

30. Alberta. Resource Information Management Branch. 2012. "psp.shp" Provided directly by source.

31. Alberta Biodiversity Monitoring Institute. 2012. "000001_ABMI_2001-01-24_Survey_Locations.pdf" Downloaded from: http://www.abmi.ca

32. Alberta. Resource Information Management Branch. 2012. "Reservation Dispostion.shp (ISPs)" Provided directly by source.

33. Alberta. Resource Information Management Branch. 2012. "AAC-CurrentFactsAndStatistics-2011.pdf" Downloaded from: http://www.srd.alberta.ca/LandsForests/ForestManagement/ForestManagementFactsStatistics/ForestManagementPlanningStatistics.aspx

34. Alberta Spatial Data Warehouse "BF_REG_FUR_MGMT_POLYGON.shp" Downloaded from: http://www.altalis.com

35. Alberta. Resource Information Management Branch. 2012. "Agriculture Disposition.shp" Provided directly by source.

36. Alberta. Public Lands. 2012. Grazing Lease Definitions. Downloaded from: http://www.srd.alberta.ca/FormsOnlineServices/documents/GrazingStatisticsPublicLand-Dec-2003.pdf

37. Alberta. Public Lands. 2012 " Reservation Disposition.shp" Downloaded from: http://www.srd.alberta.ca/FormsOnlineServices/documents/GrazingStatisticsPublicLand-Dec-

2003.pdf

38. Alberta. Resource Information Management Branch. 2012. "Refined_Eastern_Slopes_Land_Use_Zones.shp" Provided directly by source.

39. Alberta. Resource Information Management Branch. 2012. "SocietyListingOfHistoricSitesAndPlacesInAlberta.shp" Provided directly by source.

40. Alberta. Resource Information Management Branch. 2012. "FishAndWildlifeSpeciesManagement.shp" Provided directly by source.

41. Alberta. Resource Information Management Branch. 2012. "BASEFEAT.BF_GEO_WLDLFE_MGMT_UNT_POLYGON" Downloaded from http://www.altalis.com

42. Alberta. Environment and Parks, Informatics Branch. 2016. "BF_GEO_FUR_MGMT_ZONE_POLYGON.SHP" Provided directly by source.

43. Alberta. Resource Information Management Branch. 2012. "HydrologicUnitCode8WatershedsOfAlberta.shp" Provided directly by source.

44. Alberta. Public Lands. 2012 "Wildlife Sensitivity Shape Files" Downloaded from: http://www.srd.alberta.ca/MapsPhotosPublications/Maps/WildlifeSensitivityMaps/Default.aspx

45. Alberta. Environment and Sustainable Resource Development. 2016. "Sharp_tailed_grouse_ESRD.shp" Provided directly by source.

46. Alberta. Environment and Parks. 2016. "SensitiveSites_UTM11N.shp" Provided directly by source.

47. Alberta. Environment and Parks. 2015. "NON_SENSITIVE_EOS_JUL_2015.shp" Downloaded from: http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data/

48. Alberta. Environment and Parks. 2015. "TOWNSHIP_BY__SENSITIVE_EOS_JUL_2015.shp" Downloaded from: http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data/

APPENDIX II – Boreal Wetland Types

Organic wetland

Organic wetland, also referred to as peatland or muskeg, has a surface layer of living roots and plants and a deep layer of decomposing organic deposits (>40cm) that are slowly accumulating over time due to cool and wet conditions. Organic wetlands are the most prevalent wetlands in Canada's temperate and boreal forests. Bogs (open, shrubby, and treed) and fens (graminoid, shrubby, and treed) are the two types of organic wetlands found in the boreal which are detailed below.

Bogs

Bogs are peatlands with a deep layer of peat made up primarily of decomposed Sphagnum mosses. They are raised or level with the surrounding land and are generally isolated from groundwater and runoff thus, they receive water and most nutrients from precipitation (most bogs are nutrient poor) and considered stagnant systems. There is no open water at the surface of the bog, but the peat below is saturated with water. Bogs, particularly during dry periods, may be important sources of water for adjacent forests. Bogs can be treed (e.g., lowland/stunted black spruce), can have low-lying shrubs, (e.g., Labrador tea) or can be open areas dominated by *Sphagnum* moss.

Fens

Fens are peatlands with deep organic deposits of decayed sedges and brown moss. Unlike bogs, fens are highly connected to surrounding areas through ground and surface water flow, making them more nutrient rich than bogs and generally more productive and biologically diverse. They receive or provide water and nutrients to other wetlands and uplands depending on conditions such as the amount of precipitation and soil moisture level. Thus, the water table in fens may fluctuate but is generally within a few centimeters above or below the surface of the fen. Fens can be treed with tamarack with a component of lowland/stunted black spruce can have shrubs, (e.g., bog birch or willow) or can be open areas dominated by narrow leaved sedges, buckbean, grasses, and moss

Mineral wetlands

Mineral wetlands have shallow organic deposits (<40cm) and are characterized by nutrient-rich soils and water. In some settings, conifer swamps can have >40cm of peat, technically making them a peatland. The presence of shallow organic deposits is a result of periodic drying of the wetland allowing for decomposition of the organic layer. Mineral wetlands are a diverse group of wetlands with dynamic water regimes. Swamps (shrubby and treed), marshes (meadow and emergent), and shallow open water are the three types of mineral wetlands found in Alberta (detailed below).

Swamps

Swamps are a common, diverse group of tree or tall shrub (thicket) dominated wetlands occurring in a variety of landscapes and often the least understood wetlands in forested environments. Sometimes called lowlands, forested wetlands, treed swamp forests, wooded swamps, or shrub, swamps are often transition areas between upland forest and other wetland types or shoreline areas. They typically have hummocky ground that may contain pools of water. Swamp soils are predominantly mineral based, although deep wood-rich peat deposits (>40cm) can occur in some settings (e.g., conifer swamps), technically making these wetlands a peatland. Swamps have fluctuating water tables; some of the year the water table can be well below the surface creating an aeration zone in the soil that promotes tree and shrub root development. Swamps support a diversity of trees (typically > than 10 meters in height), shrubs (typically >2 meters in height), and other vegetation.

Marshes

Marshes, sometimes called reed swamps or sedge meadows, often exist as the transition between open water and upland shorelines. Marshes are highly productive due to a dynamic water regime that results in periodic drawdowns which expose the soil. These drawdown periods result in significant aeration, the subsequent release of nutrients, and the re-establishment of emergent vegetation. Aquatic non-woody emergent vegetation dominates and includes sedges, rushes, reeds, grasses, and cattails. Floating (e.g. pond lily) and submerged (e.g. pondweed) aquatic vegetation is also present where open water exists. Marshes are the least common wetland in forested regions.

Shallow Open Water

Shallow Open Water have standing water that is generally <2m deep. These wetlands (often called ponds, pools, oxbows, deep marshes, or sloughs) are usually flooded but may experience water table fluctuations dependent on yearly and seasonal climatic conditions. Vegetation, if present, is dominated by floating or submerged aquatic plants.

APPENDIX III – Forest Management Agreement Area Assessment

According to DUC's wetland inventory, wetlands make up 22.8% (100,648.9 ha) of the DFMP Area (see Table 3-45 and Figure 3-61). Thus, only 0.4% (9,069.3 ha) of wetlands in the DFMP Area are found in excluded areas (i.e., municipalities, First Nations lands, and parks and protected areas). Within the DFMP Area, the majority of wetlands (see Table 3-45 and Figure 3-62) are fens (62%, 62,672.0 ha) followed by swamps (29%, 29,495.91 ha). Following the AWCS (see Table 3-46, Figure 3-63) most of the fens are shrubby or treed poor fens and most of the swamps are conifer.

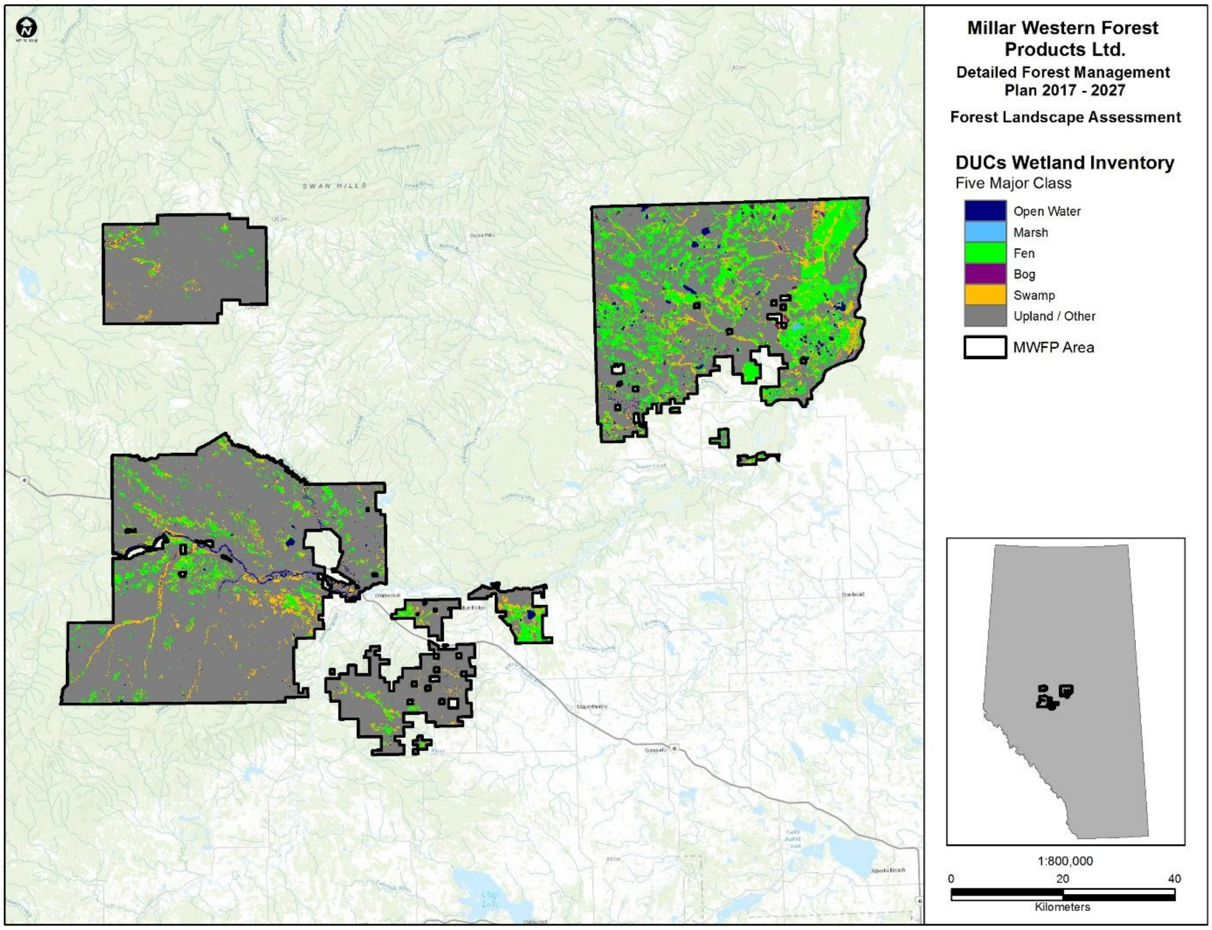


Figure 3-61. Distribution of the 5 major wetland types within the DFMP Area based on DUC's wetland inventory

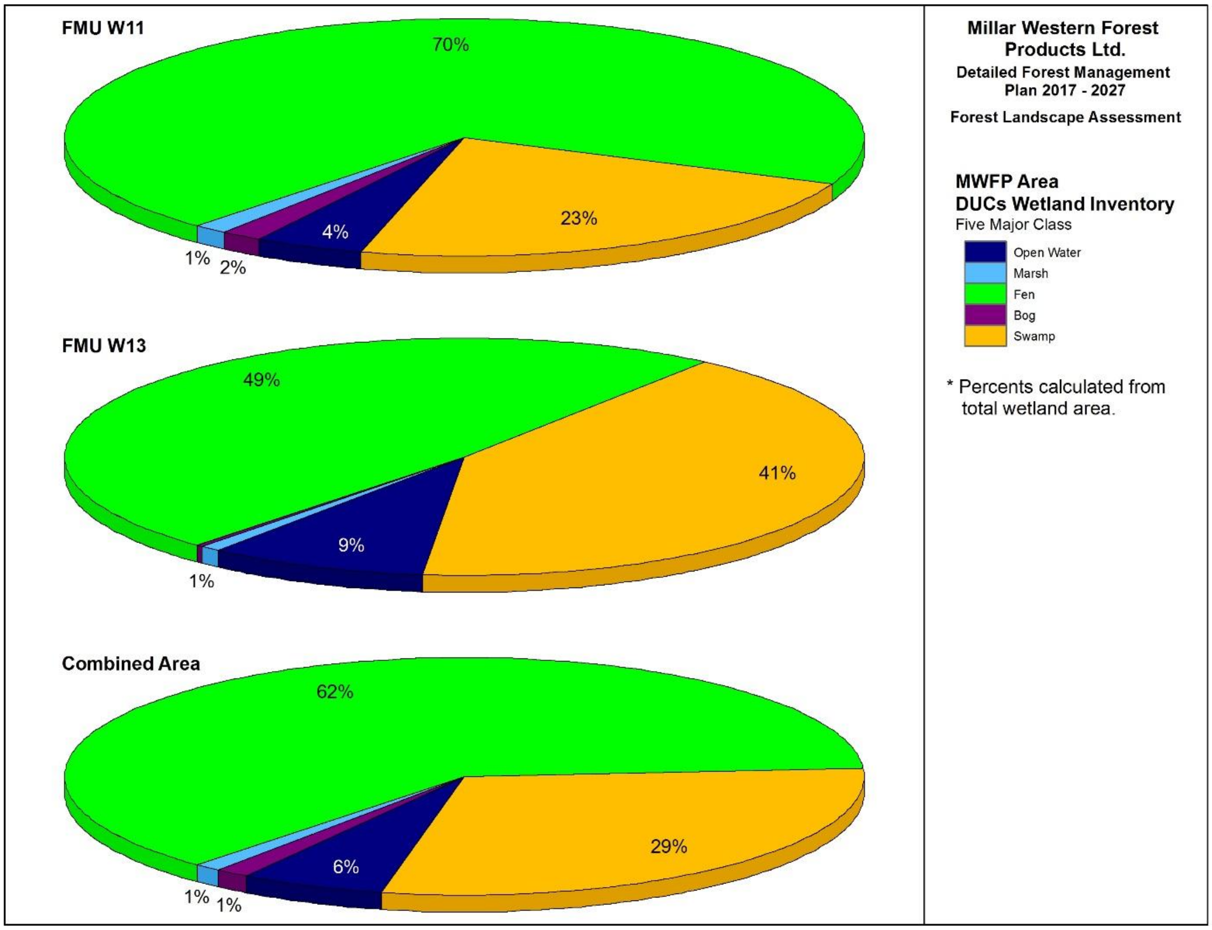


Figure 3-62. Percentage of each of the 5 major wetland classes within the DFMP Area calculated from the total wetland area based on DUC's wetland inventory

Table 3-45. The area of the 5 major classes of wetlands, uplands, and other/unclassified landforms in the DFMP Area

Major Class	W11		W13		Total DFMP Area	
	Area (ha)	% of Total Area	Area (ha)	% of Total Area	Area (ha)	% of Total Area
Open Water	3,019	1.7%	4,254	1.4%	7,272	1.5%
Marsh	944	0.5%	301	0.1%	1,244	0.3%
Fen	48,849	27.8%	18,299	6.2%	67,148	14.2%
Bog	1,308	0.7%	116	0.0%	1,423	0.3%
Swamp	16,342	9.3%	16,289	5.5%	32,631	6.9%
Upland	87,089	49.5%	183,148	61.7%	270,237	57.2%
Other / Unclassified	18,295	10.4%	74,446	25.1%	92,741	19.6%
Total	**175,844**	**100.0%**	**296,851**	**100.0%**	**472,696**	**100.0%**

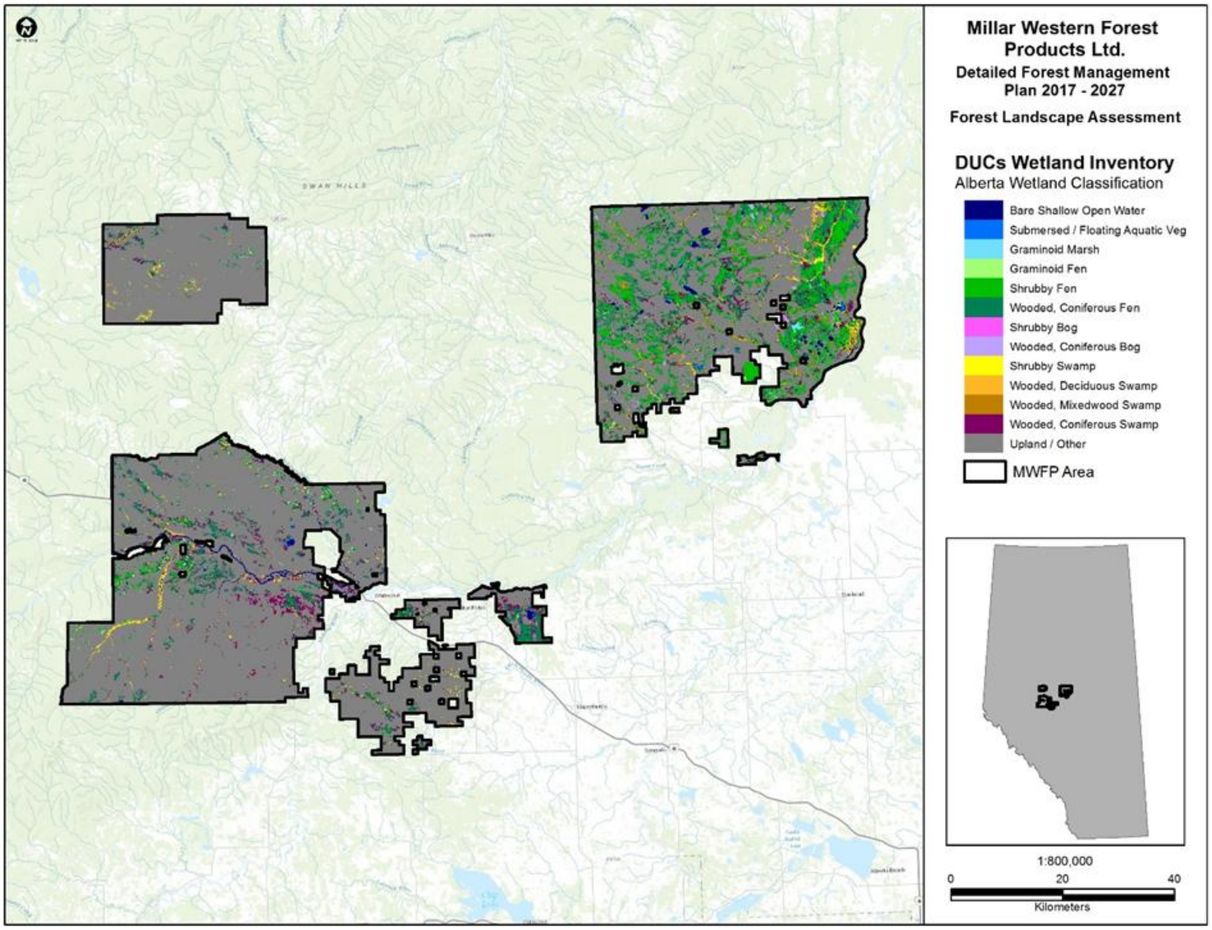


Figure 3-63. Distribution of the 14 wetland forms according to the AWCS within the DFMP Area based on DUC's wetland inventory

Table 3-46. The area of the 14 wetland forms according to the AWCS, uplands, and other/unclassified landforms in the DFMP Area

Wetland Form	W11		W13		Total DFMP Area	
	Area (ha)	% of Total Area	Area (ha)	% of Total Area	Area (ha)	% of Total Area
Submersed / Floating Aquatic Vegetation	347	0.2%	107	0.0%	454	0.1%
Bare Shallow Open Water	2,520	1.6%	3,060	1.0%	5,580	1.3%
Graminoid Marsh	877	0.5%	266	0.0%	1,144	0.3%
Graminoid Fen	24	0.0%	1,306	0.0%	1,330	0.3%
Shrubby Fen	27,798	17.1%	3,223	1.0%	31,021	7.0%
Wooded, Coniferous Fen	17,588	10.8%	12,733	5.0%	30,321	6.9%
Graminoid Bog	0	0.0%	0	0.0%	0	0.0%
Shrubby Bog	24	0.0%	21	0.0%	45	0.0%
Wooded, Coniferous Bog	1,165	0.7%	94	0.0%	1,258	0.3%
Shrubby Swamp	1,800	1.1%	2,256	1.0%	4,056	0.9%
Wooded, Deciduous Swamp	1,465	0.9%	1,870	1.0%	3,334	0.8%
Wooded, Mixedwood Swamp	3,586	2.2%	1,017	0.0%	4,603	1.0%
Coniferous Wooded Swamp	8,019	4.9%	9,484	3.0%	17,503	4.0%
Upland	81,471	50.2%	171,407	61.0%	252,878	57.3%
Other / Unclassified	15,718	9.7%	71,902	26.0%	87,620	19.9%
Total	**162,402**	**100.0%**	**278,745**	**100.0%**	**441,147**	**100.0%**

APPENDIX IV – Wetland Inventory

According to DUC's wetland inventory using the AWCS 14 wetland classes, most of the fens are shrubby or treed poor fens and most of the swamps are conifer. Open water wetlands and marshes, generally considered important habitat to aquatic birds such as ducks, geese and swans, make up only a small portion of the total area (1.8%).

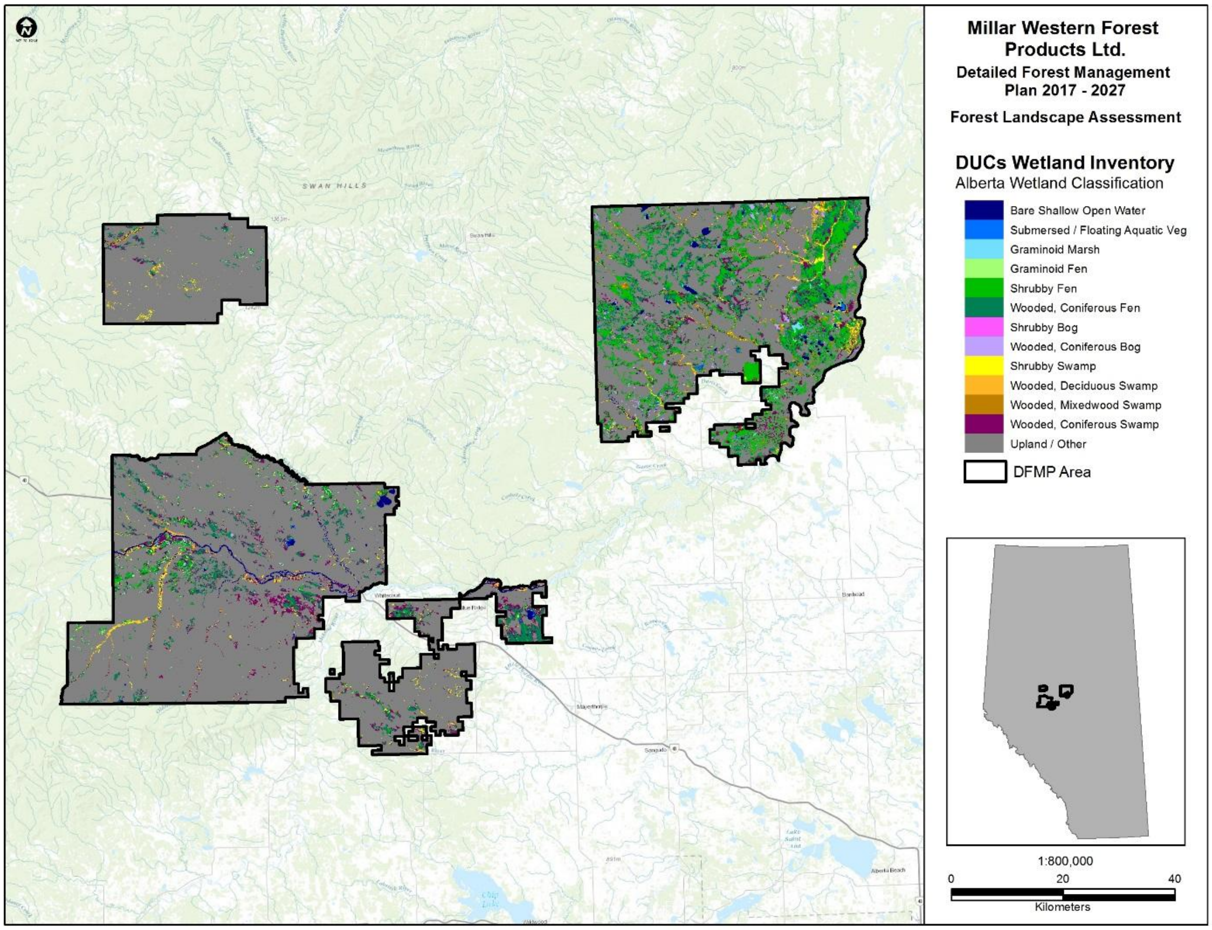


Figure 3-64. Distribution of the 14 wetland forms according to the AWCS within the DFMP Area based on DUC's wetland inventory

Table 3-47. The area of the 14 wetland forms according to the AWCS, uplands, and other/unclassified landforms in the DFMP Area

Wetland Form	W11		W13		Total DFMP Area	
	Area (ha)	% of Total Area	Area (ha)	% of Total Area	Area (ha)	% of Total Area
Submersed / Floating Aquatic Vegetation	365	0.2%	107	0.0%	472	0.1%
Bare Shallow Open Water	2,654	1.5%	4,147	1.4%	6,800	1.4%
Graminoid Marsh	944	0.5%	301	0.1%	1,244	0.3%
Graminoid Fen	25	0.0%	1,405	0.5%	1,431	0.3%
Shrubby Fen	30,629	17.4%	3,478	1.2%	34,107	7.2%
Wooded, Coniferous Fen	18,194	10.3%	13,416	4.5%	31,610	6.7%
Graminoid Bog	0	0.0%	0	0.0%	0	0.0%
Shrubby Bog	24	0.0%	21	0.0%	45	0.0%
Wooded, Coniferous Bog	1,284	0.7%	95	0.0%	1,378	0.3%
Shrubby Swamp	1,902	1.1%	2,558	0.9%	4,459	0.9%
Wooded, Deciduous Swamp	1,555	0.9%	2,102	0.7%	3,656	0.8%
Wooded, Mixedwood Swamp	3,775	2.1%	1,135	0.4%	4,911	1.0%
Coniferous Wooded Swamp	9,111	5.2%	10,494	3.5%	19,605	4.1%
Upland	87,089	49.5%	183,148	61.7%	270,237	57.2%
Other / Unclassified[1]	18,295	10.4%	74,446	25.1%	92,741	19.6%
Total	**175,844**	**100.0%**	**296,851**	**100.0%**	**472,696**	**100.0%**

[1]Other/Unclassified area includes cutblocks, cloud, cloud shadow, burn, and no data.

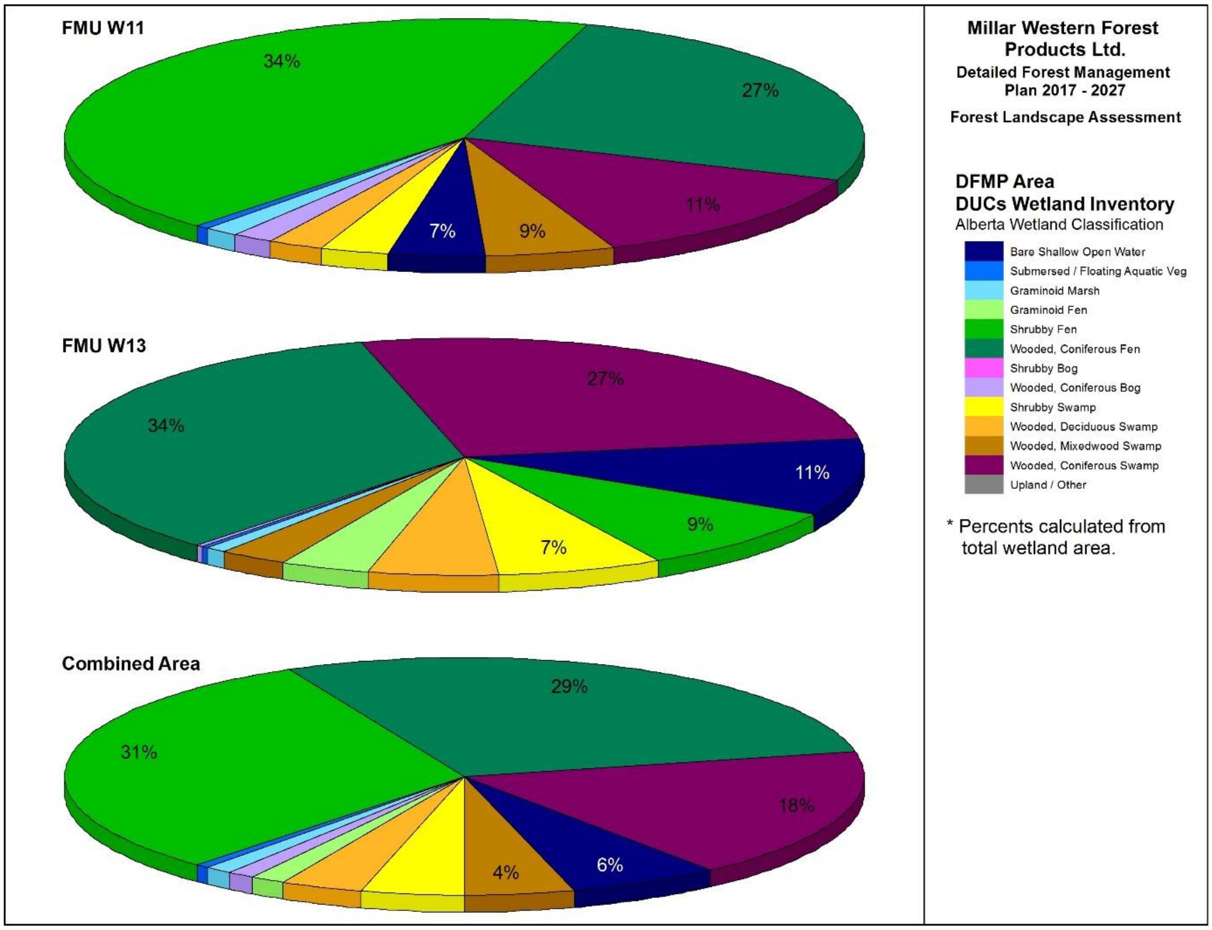


Figure 3-65. Percentage of each of the 14 wetland forms according to the AWCS within the DFMP Area calculated from the total wetland area based on DUC's wetland inventory

APPENDIX V – Building Waterfowl Maps

To predict abundances of waterfowl across much of Canada including the boreal region, Barker et al. (2014) developed statistical models (referred to as the Barker model) that are presented as maps. These models are mathematical relationships between the number of waterfowl counted during the Waterfowl Breeding Population and Habitat Survey conducted annually between May and June and a suite of environmental variables thought to play a role in determining habitat quality. Waterfowl count data were obtained using helicopters and standardized collection protocols over a multi-year period. Barker et al. (2014) used data collected between 1995-2006 and 2008-2010 to encompass the years from which several of the environmental variables were collected. The maps in this report display interpolated results of statistical models for particular project areas, such as the Millar Western FMA.

Using the Barker model we mapped predicted waterfowl abundance for total waterfowl and for each of three nesting guilds based on nest placement (*i.e.*, ground, overwater and cavity nesting). Nesting guilds were chosen because of expected similarities of responses and sensitivities to localized disturbance compared to other guild level groupings.

Total predicted breeding pair abundance was calculated for total ducks and for each nesting guild. Also, cells with the highest predicted pairs relative to all grid cells in the FMA were labeled high relative abundance (red) and cells with the lowest predicted pairs were labeled low relative abundance (green). High and low areas are relative within the FMA and grid cells are approximately 9km by 5km.

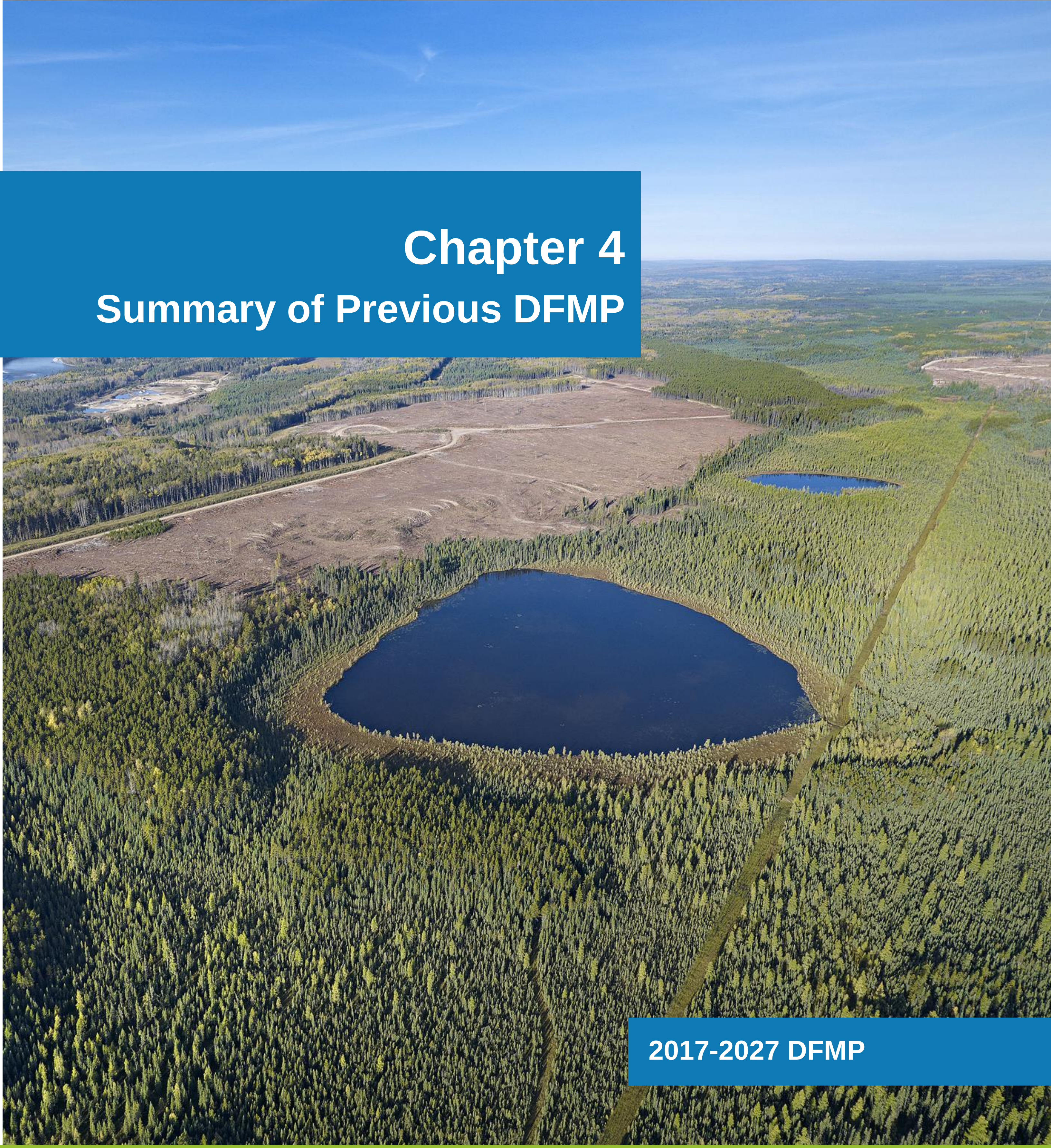
The maps in section 6.8.3.3 represent *predictions* of waterfowl relative abundance based on breeding pair surveys, and a suite of environmental variables used to characterize the landscape. Thus, maps are best considered over broad areas rather than at fine spatial scales. While some waterfowl species tend to return to the same areas, inter- and intra-annual variation in abundance of waterfowl at any given wetland can occur.

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

\\silver\clients\MWFP\Projects\P755_DFMP\Ch3_LA\Ch3_ForestLandscapeAssessment_20170905_Submit.docx

Chapter 4

Summary of Previous DFMP



2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

List of Tables

List of Figures

1. Introduction

Developed over three years, Millar Western's 2007-2016 DFMP involved dozens of stakeholders, including scientists, forest specialists, government representatives, aboriginal communities, and other companies operating in Millar Western's Forest Management Agreement (FMA) area. It was the company's second DFMP but the first to cover Forest Management Unit W11, which was added to the company's FMA in 2002, and the first to include timber volumes supplying the company's newly-acquired Fox Creek lumber operations. It was also one of the first in the province to be developed under the Government of Alberta's (GoA) new Forest Management Planning Standard, which is based on the CSA-Z809 standard for sustainable forest management.

As well as describing the company's proposed forest management activities and impacts over a 200-year planning horizon, the 2007-2016 DFMP also reaffirmed the company's continued leadership and participation in forest research, which was described as "exemplary" in the Alberta government's approval letter. The Alberta government commended Millar Western for research initiatives such as the Forest Watershed and Riparian Disturbance (FORWARD) project, which helped Millar Western better understand the effects of different harvesting scenarios on forest values such as water quality and quantity, and the Biodiversity Assessment Project (BAP), which identified management techniques conducive to the optimization of wildlife habitat.

In announcing approval of the 2007-2016 DFMP on May 6, 2008, Trevor Wakelin, Millar Western's then Director of Fibre Resources, said, "In keeping with our adaptive management approach, we are committed to the ongoing refinement of our practices to reflect the latest science, changing regulatory requirements and, of course, constantly-evolving public expectations with respect to management of provincially owned forests." This chapter documents how the company is following through on that commitment, by assessing the successes and challenges of plan implementation and how lessons learned are being applied to continual improvement of the company's forest management practices. It also looks at the status of the previous DFMP's approval conditions, as well as significant events that have occurred since the submission of the 2007-2016 DFMP.

1.1 DFMP Development History

After receiving its Forest Management Agreement (FMA) in 1997, which at the time consisted of only Forest Management Unit (FMU) W13, Millar Western submitted a Preliminary Forest Management Plan (PFMP), which was followed up with a more comprehensive DFMP in 2000. With the expansion of the FMA in 2002, Millar Western developed a PFMP for the new area, W11, which was submitted in 2004.

The next plan, the 2007-2016 DFMP, was the first to cover both FMUs. It was originally due for submission in 2006; however, its completion was delayed by one year due to the appearance of the mountain pine beetle on the eastern slopes of the Rocky Mountains, requiring a major reformulation of the company's original spatial harvesting sequences (SHSs). The 2007-2016 DFMP was submitted on November 15, 2007, and the GoA granted final approval on April 16, 2008. The 2007-2016 DFMP was retroactively effective to May 1, 2007.

The 2007-2016 DFMP was the first Millar Western DFMP to consolidate a complete list of commitments in one location: *Appendix XXIII – Commitments*. Only commitments contained within this appendix were construed as obligations of the company. While Millar Western did discuss some commitments in its 1997-2006 DFMP, the list was incomplete and scattered throughout the document, which made implementation challenging. This approach, of making commitments clearer and more accessible, has been further refined for the 2017-2027 DFMP, with the creation of *Chapter 7 – DFMP Implementation*. It contains commitments for reporting, as well as implementation direction and strategies.

1.2 About this Chapter

The basis for much of the evaluation in this chapter is the 2007-2011 Stewardship Report, which covers the timber years 2007/08 to 2011/12 for FMUs W11 and W13. This document discusses the status of the commitments made at the mid-way point of the 2007-2016 DFMP implementation period.

2. Status of the Past DFMP

This section provides a general description of the 2007-2016 DFMP, as well as a summary of the GoA's approval conditions and the measures taken by Millar Western to address them. It also includes a review of the DFMP commitments made by Millar Western, emphasizing those that will be carried forward as commitments of the 2017-2027 DFMP. In keeping with its adaptive management approach, this section further discusses the knowledge and experience gained from the completion of the previous plans and explains how this understanding has influenced the development of the 2017-2027 DFMP.

2.1 Contents of the 2007-2016 DFMP

The 2007-2016 DFMP is composed of an executive summary, a DFMP glossary and seven chapters:

1. Corporate Overview and Forest Management Approach
2. Comprehensive Description of the DFA
3. Plan Development
4. Previous FMP's and Significant Events
5. Forecasting and the Preferred Forest Management Scenario
6. Sustainable Forest Management Strategy
7. Building a Case for Integrated Land Management

The following appendices were also included as part of the 2007-2016 DFMP submission:

I. RFP Checklist
II. DFMP Development and Communication Plan
III. Stakeholder Communication Summary
IV. Public Participation Group Report
V. DFMP/SFMP Implementation Communication Plan
VI. Development of the Landbase
VII. Yield Curve Documentation
VIII. Growth and Yield Plan
IX. Silviculture Generic Establishment Regimes
X. Biodiversity Analysis of the Preferred Forest Management Scenario
XI. Biodiversity-based Compartment Prioritization
XII. BAP SHE Yield Curve Document
XIII. BAP Report #2: The Species Selection Procedure
XIV. FORWARD Contributions

XV. Carbon Accounting on the DFA
XVI. Terms of Reference – DFA Harvest Planning Committee
XVII. Terms of Reference – DFA Silviculture Committee
XVIII. Compartment Road Network Access Plan
XIX. Cumulative Impacts Modeling on the DFA
XX. Impacts of Climate Change at the Stand Level
XXI. Population Projections and Impacts
XXII. Peer Review Summary
XXIII. Commitments
XXIV. VOIT Reporting
XXV. VOIT BAP Reporting

3. Performance of the Past DFMP

Commitments associated with the 2007-2016 DFMP have been arranged in the following categories and serve as implementation metrics, measuring Millar Western's performance towards implementing the 2007-2016 DFMP:

- Approval Conditions;
- Company Commitments;
- Performance measures (VOITs);
- Harvesting and regeneration metrics; and
- Additional DFMP metrics.

This chapter provides an overview of the commitments, and Millar Western's efforts to meet all approval obligations, as well as its results in meeting all government requirements.

3.1 Approval Conditions

The GoA's approval of the Millar Western 2007-2016 DFMP was contingent on seventeen conditions, which are listed, along with their due date and current status, in Table 4- 1. Millar Western can report that all conditions were addressed to the GoA's satisfaction. Section 3.2 describes each condition in further detail.

Table 4- 1. Summary of 2007-2016 DFMP approval conditions and status

Condition	Requirement	Due Date	Status
Approval Condition 8.1 (i)	Refined Spatial Harvest Sequence	May 1, 2008	Satisfied
Approval Condition 8.1 (ii)	SHS variance reporting	ongoing	ongoing
Approval Condition 9.1 (i)	Mountain Pine Beetle achievement reporting	ongoing	Not requested
Approval Condition 9.1 (ii)	Mountain Pine Beetle Outbreak Scenario	July 1, 2008	Satisfied
Approval Condition 10.1 (i)	Investigate forest structure opportunities	May 14, 2017	In progress

Condition	Requirement	Due Date	Status
Approval Condition 10.1 (ii)	BAP Analysis On Revised Sequence	November 30, 2008	Waived
Approval Condition 11.1(i)	Implementation of Structure Retention	May 14, 2017	In progress
Approval Condition 11.1(ii)	Protocols for Monitoring, Measuring, and Reporting of Structure Retention	September 1, 2008	ongoing
Approval Condition 11.1(iii)	Ongoing Reporting of Structure Retention	May 14, 2017	In progress
Approval Condition 12.1(i)	Silviculture Strategy Tables	July 1, 2008	Satisfied
Approval Condition 12.1 (ii)	Vegetation Management Strategy	July 1, 2008	Satisfied
Approval Condition 13.1 (i)	Industrial Timber Salvage Reporting	ongoing	Satisfied
Approval Condition 13.1 (ii)	Industrial Timber Salvage: use TDA Tables	ongoing	Satisfied
Approval Condition 13.1 (iii)	Industrial Timber Salvage Tracking and Reporting System	October 31, 2008	Satisfied
Approval Condition 14.1 (i)	Alternative Regeneration Standards	May 1, 2010	Satisfied
Approval Condition 15.1 (i)	Incidental conifer replacement strategy agreement	ongoing	ongoing
Approval Condition 15.1 (ii)	Deciduous stand conversion to conifer requirement	ongoing	ongoing
Approval Condition 15.1 (iii)	Deciduous stand conversion ratio	ongoing	ongoing
Approval Condition 15.1 (iv)	Requirements to Remove Condition	ongoing	Not Enacted
Approval Condition 16.1 (i)	Growth and Yield Plan	September 1, 2008	Satisfied
Approval Condition 17.1 (i)	Adhere to First Nation Consultation guidelines	ongoing	ongoing
Approval Condition 17.1 (ii)	Document Consultation Efforts	ongoing	ongoing
Approval Condition 18.1 (i)	Grizzly Bear Habitat Assessment	November 1, 2008	Satisfied
Approval Condition 18.1 (ii)	Use the revised SHS for the above assessment	November 1, 2008	Satisfied
Approval Condition 19.1 (i)	Watershed Assessment Discussion and Documentation	September 1, 2008	Satisfied
Approval Condition 20.1(i)	Resubmission of Forest Management Plan	January 1, 2009	Satisfied
Approval Condition 20.1 (ii)	Next Forest Management Plan Submission	May 14, 2017	In progress
Approval Condition 21.1 (i)	Annual and Stewardship Reporting Requirements	ongoing	Satisfied
Approval Condition 21.1 (ii)	Stewardship Report	December 1, 2012	Satisfied

3.2 Approval Condition Details

The following section provides additional detail on the status of the approval conditions from the 2007-2016 DFMP.

3.2.1 Approval Condition 8.1 – Refined Spatial Harvest Sequence

Condition 8.1 (i) required Millar Western and its FMA quota holders to refine the SHS, to reflect all stands that were harvested after the Net Landbase (NLB) effective date and the start of the DFMP. When the 2007-2016 DFMP was submitted, there were some known deficiencies with planned blocks prior to the effective date. As a result, an updated SHS was developed after the DFMP was submitted, to better account for planned blocks harvested prior to the effective date and to identify the stands to be harvested by individual operators. The revised SHS and supporting documentation was submitted to the GoA on April 30, 2008, and the approval condition was deemed to have been satisfied, as per GoA correspondence dated October 14, 2008.

Status: Satisfied

Condition 8.1(ii) required all operators to adhere to the SHS within the specified operational flexibility parameters. This condition is ongoing for the life of the 2007-2016 DFMP and is customarily included in all DFMP approvals. Section 3.5.1 reports on the achievement in implementing the SHS.

Status: Ongoing

3.2.2 Approval Condition 9.1 – Mountain Pine Beetle

Condition 9.1 (i) required Millar Western to respond to the GoA's request to report achievements regarding the reduction in mountain pine beetle (MPB) susceptible stands and MPB infested stands. No request for this information has been received by Millar Western; however, as a company operating within the Central MPB Planning Region, Millar Western has reported, on an annual basis, the harvesting of pine stands and the Level 1 single-tree control completed by the GoA on the FMA.

Status: Not Required

Condition 9.1 (ii) required Millar Western to complete and submit a GoA-prescribed MPB outbreak scenario. This scenario, often referred to as the MPB disaster scenario, predicts the impacts on timber harvest levels should a catastrophic MPB infestation kill most of the mature pine in the DFMP area. It is meant to serve as a benchmark scenario, designed to provide the GoA with provincial level planning information. Millar Western completed and submitted the required MPB outbreak scenario on June 26, 2008, thus satisfying the approval condition, as confirmed in GoA correspondence dated October 14, 2008.

Status: Satisfied

3.2.3 Approval Condition 10.1 – Desired Future Forest

Condition 10.1 (i) required Millar Western to investigate and assess opportunities to maintain the presence of mixedwoods and large contiguous patches of forest before submission of the 2017-2027 DFMP. Opportunities and strategies were identified and are discussed in *Chapter 6 – PFMS* and *Chapter 7 – Implementation*, respectively.

Status: Ongoing

In the Stewardship Report, VOIT 1 (area of opening, mature + old, old and oldgrowthness forest by species strata for the gross and managed landbase, for each FMU) aims to "achieve the seral stage class species strata proportions as defined in the target". The 2017 target shows certain hectares for deciduous-coniferous (DC) and coniferous-deciduous (CD) forest types across different age categories for the different FMUs. Overall, more than half of the 2011 mixedwood categories appear to be on track for hitting the 2017 targets.

In the Stewardship Report, VOIT 2 (opening patch size distribution on the gross landbase for each FMU) aims to "achieve the opening patch size distribution targets" at the start of the 2017 timber year. There are three pieces to the stewardship reporting:

(i) Actual harvest size statistics
(ii) Actual opening patch area and proportion of total opening patch area within each opening patch size class
(iii) Variance between actual opening patch area and proportion of total opening patch area within each size class and the PFMS (preferred forest management scenario) forecasted values.

The Stewardship Report includes the 2007 and 2017 targets, as well as the actual harvest size statistics for all operators. In comparing the 2017 targets with the 2011 results, it is apparent that the FMA operators are on track to meeting 2017 targets in some patch size categories but not in others, especially with respect to the largest category, the >=1000 ha patches.

A copy of the Stewardship Report can be found in *Annex III – Stewardship Report*.

Condition 10.1 (ii) required Millar Western to run the Biodiversity Assessment Project (BAP) tools on the revised SHS, which was developed after submission of the 2007-2016 DFMP. BAP tools consisted of coarse and fine filter biodiversity models that produced predictions of the future state of biodiversity. BAP tools were run, analyzed and reported as an integral part of the development of the PFMS. This condition was removed by the GoA on March 18, 2009.

Status: Waived

3.2.4 Approval Condition 11.1 – Structure Retention and Monitoring

Condition 11.1 (i) required all operators to plan harvesting operations, to achieve an average landscape structure retention of a minimum 1% merchantable timber volume. This was an operational condition effective for the life of the 2007-2016 DFMP and is a regular component of DFMP approvals.

Status: Ongoing

The Stewardship Report provided the following summary of the "theoretical volume" (yield-curve calculated volume) for each FMU, for years 2007-2011:

- W11, retention was at least 1% in 4 of the 5 years (1.99% average).
- W13, retention was at least 1% in 3 out of the 5 years (1.46% average).
- Outlook to year 10: Average of at least 1% will be met, although each individual year may not be over 1%.

Condition 11.1 (ii) required Millar Western to develop standard operating procedures (SOPs) for monitoring, measuring and reporting retained structure retention in harvested areas. Shortly after receiving the DFMP approval conditions, Millar Western asked the GoA for clarification, as provisions for measuring and reporting were, in the company's view, already outlined in the DFMP, and a structure retention SOP, to guide operations, had already been implemented (see SOP-PLA-003: Structure Retention). In the absence of further direction from the GoA, Millar Western proceeded to execute its structure retention program in accordance with the DFMP. In October 2014, Millar Western began working with the GoA to prepare a draft structure retention strategy for the 2017-2027 DFMP. During the development period, Millar Western asked the GoA to review the status of the condition and, in correspondence dated November 10, 2016, the GoA confirmed that the terms of Condition 11.1 (ii) had been met, with no further work required.

Status: Satisfied

Condition 11.1(iii) required all operators to report annual structure retention and Millar Western to summarize the data in the Stewardship Report. Retained structure volumes were reported in the 2007-2012 Stewardship Report for Millar Western only. See Condition 11.1 (i) for additional details on how structure retention is included the 2007-2011 Stewardship Report as "theoretical volume".

Status: Ongoing

3.2.5 Approval Condition 12.1 – Silviculture Strategy Table

Condition 12.1 (i) required Millar Western to engage the Silviculture Committee, comprising the FMA-area operators and the GoA, for the purpose of discussion and agreement on the final silviculture strategy table, to be used by all operators. While a silviculture strategy table was developed to satisfy this approval condition, it had not been shared with the GoA. Once made aware of the oversight, Millar Western delivered the material to the GoA on December 8, 2015. Since June 2015, Millar Western has worked with the GoA to prepare an updated silviculture strategy table for inclusion in the 2017-2027 DFMP. As per GoA correspondence of November 10, 2016, this condition has been fulfilled.

Status: Satisfied

Condition 12.1 (ii) required Millar Western to use the Silviculture Committee to finalize the vegetation management strategy. A document titled "Guidelines for Vegetation Management" was developed through the silviculture subgroup, which included GoA representation; however, the document was not provided to the GoA upon completion. Once made aware of the oversight, Millar Western submitted the document, to meet the terms of the condition. The guidelines are specific to the previous DFMP period and not relevant to the 2017-2027 DFMP. This approval condition is now considered met, as per GoA correspondence dated November 10, 2016.

Status: Satisfied

The DFA Silviculture Committee has met three times since the approval of the DFMP: July 3, 2008; March 19, 2009; and June 18, 2009. Issues discussed included DFMP approval conditions, land-base conversion in W11, land-base balancing, MWFP vegetation management strategy, establishment regimes and the Reforestation Standard of Alberta (RSA). Meetings were attended by representatives of AESRD, Millar Western Forest Products Ltd., Weyerhaeuser Company Ltd., Vanderwell Contractors Ltd., Spruceland Millworks Inc. and the Forest Resource Improvement Association of Alberta (FRIAA).

3.2.6 Approval Condition 13.1 – Industrial Timber Salvage

Condition 13.1 (i) requires all timber depleted by non-forestry operations on the DFA to be reported and drained for cut control purposes.

Status: Satisfied

Condition 13.1 (ii) stipulates that volumes used to calculate non-forestry timber depletions be obtained from the published Timber Damage Assessment (TDA) tables or other approved source.

Status: Satisfied

Condition 13.1 (iii) requires Millar Western to develop and implement a salvage timber tracking and reporting system acceptable to the GoA. An acceptable methodology is now in place. Millar Western is tracking all salvage volume acquired within the DFA and reporting this information to the GoA on an annual basis. As salvage volume is delivered across Millar Western's weigh scales, it is tracked, with a theoretical volume calculated for each industrial disposition. At the end of the timber year, the theoretical volume is reversed and replaced with the actual weigh scaled volume, then provided to the GoA by Millar Western staff.

Status: Satisfied

3.2.7 Approval Condition 14.1 – Alternative Regeneration Standards

Condition 14.1 (i) required Millar Western to complete and implement alternative regeneration standards by May 1, 2010. The initiative to develop alternative regeneration standards evolved into the Regeneration Standards of Alberta (RSA), a mandatory province-wide program that became effective on May 1, 2010. Millar Western participated in the early implementation of RSA and produced a program acceptable to the GoA, thus satisfying this condition. The company has since continued to complete its reforestation monitoring, according to this standard.

Status: Satisfied

3.2.8 Approval Condition 15.1 – Incidental Conifer Replacement

Condition 15.1 (i) required Millar Western and the FMA quota holders to come to an agreement on strategies to replace incidental conifer volumes following harvesting, to ensure that these volumes were maintained into the future, according to timber supply analysis (TSA) projections. If no new strategy was developed, then the companies were to replace incidental conifer as per 15.1 (ii, iii, iv). Millar Western has developed strategies for inclusion in the 2017-2027 DFMP, to address this issue; see *Chapter 7 – Implementation, Appendix VI*.

Status: Ongoing

Condition 15.1 (ii) requires that coniferous volumes harvested from pure deciduous stands be replaced by converting area within these stands to pure coniferous, according to the formula described in 15.1 (iii). Spruceland has implemented a stand conversion program in W11.

Status: Ongoing

Condition 15.1 (iii) describes the formula to be used to determine the area to be converted to coniferous (see 15.1 (ii)).

> *[Yield curve estimate of incidental coniferous volume per ha in pure deciduous stands at 80 years] / Yield curve estimate of coniferous volume per ha in pure coniferous stands at 80 years] = [ha of pure deciduous stands to be converted per ha cut] or, 1 ha reforested to pure coniferous for every 2.2 ha of pure deciduous strata harvested.*

Status: Ongoing

Condition 15.1 (iv) permits conversion requirements to be reduced if acceptable documentation is provided regarding the contributions from understory coniferous management and coniferous stocking on pure deciduous block roads. This option has not been exercised by either Millar Western or the quota holders.

Status: Not Enacted

3.2.9 Approval Condition 16.1 – Growth and Yield Plan

Condition 16.1 (i) required Millar Western to develop and submit a growth and yield plan by September 1, 2008. In accordance with the requirement, Millar Western's growth and yield plan was developed and submitted on August 28, 2008. The GoA confirmed its acceptance of the plan in a letter to Millar Western's Director of Fibre Resources, dated November 6, 2008. Since the last plan was submitted, the GoA has changed this condition: whereas growth and yield plans could be submitted after DFMP approval, the GoA now requires that they be included as part of the DFMP.

Status: Satisfied

3.2.10 Approval Condition 17.1 – First Nations Consultation

Condition 17.1 (i) required Millar Western to adhere to the GoA's First Nations Consultation Guidelines for operational plan development and approval. Further consultation was necessary with the identified groups at operational plan development.

Status: Ongoing

Condition 17.1 (ii) requires Millar Western to document First Nations consultation efforts, activities, issues raised and company response. In keeping with the GoA's First Nations Consultation Policy on Land Management and Resource Development (May 16, 2005), and its guidelines, adopted in 2006 and amended in 2007, Millar Western maintains regular contact with a number of First Nations communities whose traditional lands are located on or near the company's forest dispositions. Each year, the company provides each of these communities with consultation packages that outline the annual operating plan for the year ahead. Each package is accompanied by offers to meet in person with interested councils, to discuss issues and explore opportunities for cooperation. Millar Western continues to consult and record outcomes, as directed by the GoA.

Status: Ongoing

3.2.11 Approval Condition 18.1 – Grizzly Bear Model

Condition 18.1 (i) required Millar Western to assess the impact of the preferred forest management scenario (PFMS) on grizzly bear habitat using models and tools developed by the FMF Grizzly Bear Research Program.

Status: Satisfied

Condition 18.1 (ii) required that, in addition to the net landbase information, the grizzly bear assessment include the revised harvest sequence and compartment road network access plan, as presented in Appendix 18 of the DFMP. A report titled "Grizzly Bear Assessment" was completed and submitted to GoA on July 14, 2014, for review. The GoA deemed the submission satisfactory, as per a letter dated September 22, 2014.

Status: Satisfied

3.2.12 Approval Condition 19.1 – Watershed Impact

Condition 19.1 (i) required Millar Western to meet with the GoA to resolve concerns and provide additional information to substantiate chosen thresholds and assumptions for changes in watershed discharge used in the DFMP. This is in response to findings of the Forest Watershed and Riparian Disturbance Project (FORWARD), an ambitious watershed research project designed to collect information on and to predict impacts of forest management activity on boreal watersheds. Findings and products developed through FORWARD were incorporated into the development of the 2007-2016 DFMP, including models for forecasting the changes in water runoff from planned harvesting activities, which that were fed directly into Patchworks for use in sequencing. As the FORWARD models were different than the equivalent clearcut area (ECA) watershed model used by the GoA, condition 19.1 (i) was added to provide clarification and a more thorough understanding of the assumptions and rationale applied to establish thresholds for maximum increases in runoff coefficients. After providing additional information and meeting with GoA officials, the GoA's Robert Stokes provided a letter dated January 29, 2009, stating that Approval Condition 19.1(i) had been met in 2008.

The FORWARD project was completed in February 2012. Ultimately, the FORWARD I and II projects found that the operating ground rules and internal operating policies employed by Millar Western during harvest planning and operations adequately mitigate negative impacts on water quality. In addition, the water runoff models derived from local data predicted that the MPB and surge cutting strategies modeled in the PFMS were within the range of the observed impacts from natural processes.

For the 2017-2027 DFMP, Millar Western elected to use the GoA's ECA hydrology model, to manage the impacts of harvesting on water runoff. While using GoA's ECA provides consistency with other DFMP planning processes, results are not directly comparable with FORWARD's predictions.

Status: Satisfied

3.2.13 Approval Condition 20.1 – Revisions and Future FMPs

Condition 20.1 (i) required Millar Western to submit a revised FMP incorporating the outcome of the approval decision conditions by April 1, 2009 (extended). Millar Western did not submit a revised DFMP; however, the GoA recognizes that Millar Western addressed each approval condition independently, thus satisfying the intent of this approval condition. This approval condition is now considered met, as per GoA correspondence to Millar Western, dated November 10, 2016.

Status: Satisfied

Condition 20.1 (ii) required Millar Western to prepare and submit a FMP that meets forest management planning standards by May 14, 2017. This is a common approval condition, included to record the date by which the next FMP must be submitted.

Status: Ongoing

3.2.14 Approval Condition 21.1 – Performance Monitoring

Condition 21.1 (i) required Millar Western to meet annual reporting requirements and to submit stewardship reports containing specified information. Millar Western continues to comply with annual reporting requirements and submitted a stewardship report for the DFA on February 7, 2014.

Status: Satisfied

Condition 21.1 (ii) required Millar Western to submit a five-year stewardship report current to May 1, 2011 (covering the years 2007 to 2011), by December 1, 2012. The stewardship report was completed and submitted on February 7, 2014.

Status: Satisfied

3.3 Company Commitments

ID	Commitment	Timeline	Reporting
		Forest Management Planning	
1	Reconcile SHS, following DFMP approval	Complete reconciliation by December 31, 2007	**Stewardship Report:** - Summary of the process used and the resulting changes
2	Re-run BAP analysis on SHS submitted with 2007 DFMP	Submit to Alberta gov't. by November 30, 2008	**2007 DFMP Addendum to Alberta gov't.:** - Summary of results and interpretation **Annual Report:** - Condensed version of report to Alberta gov't. - Summary of any additional analysis. Stewardship Report - Same as Annual Report
3	Maintain DFA Harvest Planning Committee	Ongoing	**Annual Report:** - Summary of committee's composition, stucture and key accomplishments. **Stewarship Report:** - Same as Annual Report.
4	Develop and implement industrial salvage tracking process	Submit to Alberta gov't. by October 31, 2008	**Annual Report:** - Summary of progress in developing Alberta gov't's review and approval, and implementation of process **Stewardship Report:** - Same as Annual Report
		Forest Operations	
5	Revise FMA Operating Ground Rules (OGRs)	Implement revised OGRs by April 30, 2008	**Annual Report:** - Summary of progress of OGR revisions and implementation **Stewardship Report:** - Same as Annual Report
		Silviculture	

ID	Commitment	Timeline	Reporting
6	Maintain DFA Silviculture Committee	Ongoing	**Annual Report:** - Summary of committee's composition, stucture and key accomplishments **Stewardship Report:** - Same as Annual Report
7	Develop Alternative Regeneration Standards (ARS)	Begin development of ARS by November 30, 2008	**Annual Report:** - Summary of progress on development, approval and implementation of ARS **Stewardship Report:** - Same as Annual Report
8	Develop specific regeneration strategies to mitigate insect and disease infestations	Initiate development by December 31, 2008	**Annual Report:** - Summary of progress on development and implementation of strategies **Stewardship Report:** - Same as Annual Report
	Growth and Yield		
9	Develop and secure Alberta gov't. approval of a wider suite of managed stand yield curves	Secure approval of data collection program acceptable to Alberta gov't. by February 29, 2008	**Annual Report:** - Summary of the progress in development, approval and incorporation of curves into forest management planning initiatives **Stewardship Report:** - Same as Annual Report
10	Implement growth and yield initiatives	As defined in Growth and Yield Plan (Appendix VIII)	**Annual Report:** - Summary of implementation of each of the programs under the G & Y Plan - Status of the submission / review / approval of the revised G & Y Plan - Summary of any changes to the G & Y Plan from annual internal review **Stewardship Report:** - Same as Annual Report

ID	Commitment	Timeline	Reporting
	Research		
11	Investigate new technologies for developing forest and vegetation inventory for DFA	Ongoing with further investigations completed before the end of 2011	**Stewardship Report:** - Summary of any planned inventory investigations - Summary of the results of any completed inventory investigations
12	Develop and implement operational risk rating system to provide guidance in determining environmental conditions in which forest operations can be conducted in an environmentally sound manner	Implement by October 31, 2008	**Annual Report:** - Summary of the progress in development and implementation of operational assessment tools and techniques **Stewardship Report:** - Same as Annual Report

ID	Commitment	Timeline	Reporting
13	Investigate the need for BAP SHEs and HSMs validation and refinement	Implement investigation and refinements by November 30, 2008	**Stewardship Report:** - Summary of investigative and refinement initiatives planned or undertaken and the progress of each - Summary of the findings and any recommendations for future refinement or incorporation into planning or operational activities

3.3.1 Commitments Not Addressed in Approval Conditions

3.3.1.1 ID 3: Maintain DFA Harvest Planning Committee

Since the completion and implementation of the 2007-2016 DFMP, The DFA Harvest Planning Committee has operated in a less formal manner than originally planned, for several reasons. First, one of the member companies, Mostowich Lumber, was purchased by Millar Western in the fall of 2007. Weyerhaeuser operated within the DFA in only a limited capacity (W13) during the reporting period, while Spruceland operated only in W11. Given the limited presence of these quota holders in the DFA, Millar Western elected to deal with any operational planning issues at the general development plan and annual operating plan stages of the planning process.

3.3.1.2 ID 5: Revise FMA Operating Ground Rules

Millar Western's Operating Ground Rules were revised and approved by GoA on June 6, 2008.

3.3.1.3 ID 6: Maintain DFA Silviculture Committee

The DFA Silviculture Committee has met three times since the approval of the DFMP: July 3, 2008; March 19, 2009; and June 18, 2009. Issues discussed included DFMP approval conditions, landbase conversion in W11, landbase balancing, MWFP vegetation management strategy, establishment regimes and the Reforestation Standard of Alberta. Meetings were attended by representatives of the GoA, Millar Western Forest Products Ltd., Weyerhaeuser Company Ltd., Vanderwell Contractors Ltd., Spruceland Millworks Inc. and FRIAA.

3.3.1.4 ID 8: Develop specific regeneration strategies to mitigate insect and disease infestations

To date, no formal regeneration strategies have been developed to mitigate the mountain pine beetle. Millar Western has suggested converting harvested stands to non-pine species as a possible method for reducing the forest's susceptibility to the mountain pine beetle; however, this type of landbase conversion is currently restricted by the GoA RSA balancing requirements. As specific insect and disease epidemics are impossible to accurately predict over a stand rotation, it is difficult to know whether this type of strategy would be effective. Operationally, Millar Western has, where appropriate, enhanced its employment of "drag and leave-for-natural" treatments for pine regeneration, to try to increase regenerating stand densities and lessen the potential for damage from insects and disease.

3.3.1.5 ID 9: Develop and secure Alberta government approval of a wider suite of managed stand yield curves

During development of the last DFMP, Millar Western identified the need for yield curves that better reflect the growth potential of managed stands. There had been insufficient data to build empirical yield curves in managed stands due to a lack of older managed stands data. As a result, Millar Western was forced to use natural stand yield curves to model growth in managed stands. This resulted in a significant underestimate of growth in managed stands. Since submission of the last FMP, the GoA has released the GYPSY (Growth and Yield Projection System) model, which allows for the development of managed stand yield curves that better reflect the growth potential of managed stands.

Millar Western recognized a need to shift permanent sample plot efforts from natural stands into managed stands. In 2008, Millar Western added 100 managed stand PSP's to its existing PSP network to enhance the availability of managed stand data. For the 2017-2027 DFMP, Millar Western will be using the Growth and Yield Projection System (GYPSY) as opposed to empirical data yield curve data, for forecasting growth and yield. Data collected from Regeneration Standard of Alberta (RSA) surveys, along with PSP and TSP data from managed stands were used to create yield estimates in GYPSY. Millar Western also sampled juvenile regenerating stands aged between 20 and 40 years old to provide data beyond the RSA data to substantiate growth and yield predictions.

3.3.1.6 ID 10: Implement growth and yield initiatives

The Growth and Yield Plan for the 2007-2016 DFMP was submitted and approved on August 29, 2008 (Approval Condition 16.1). The 2007-2011 Stewardship report (refer to Annex III Stewardship Report 2007-2011) summarizes the implementation and progress of each of the programs identified under the Growth and Yield Plan and summarizes the changes to the Growth and Yield Plan resulting from the annual internal review process.

The Growth and Yield Program was updated and has been submitted as part of the 2017-2027 DFMP.

3.3.1.7 ID 11: Investigate new technologies for developing forest and vegetation inventory (AVI) for DFA.

Millar Western completed a new AVI dataset for the 2017-2027 DFMP, replacing the former AVI that was derived from aerial photography gathered between 1994 and 1997. The GoA finalized a dataset audit and approved the AVI for use in forest management and operational planning in January 2015. The AVI dataset exceeded the current requirements of the AVI standard 2.1.1 by including the following additional fields: density, crown closure, moisture regime, nutrient regime, mapcode/ecosite, and canopy pattern.

The new dataset was based on colour imagery collected in 2010, 2011 and 2012. Light Detection and Ranging (LiDAR) data, which was collected by the GoA over 2005, 2006 and 2007, was also used to interpret the AVI dataset. Creation of the AVI dataset included photo interpretation, as well as a program for field calibration and validation. Audits were conducted by Millar Western and the GoA, to ascertain its quality.

As well, beginning in 2011, Millar Western participated in a project that built on some previous work on developing a process for producing a semi-automated forest inventory. The project objectives were to complete technical advancements to the semi- automated forest inventory process already underway, with a focus on providing detailed information more quickly than traditional photo interpretation methods. In this project, significant advancements were made (i.e., increased automation, increased precision and accuracy, and addition of height and volume metrics). It was determined that the height of individual trees could be provided by utilizing SGM (Semi Global Matching). SGM uses complex mathematical computations to provide an elevation for each individual pixel on an image. SGM, in combination with LiDAR, allowed for canopy heights for every position on an image. The results of this project were encouraging, and it is expected that, in the future, more work will be done to enhance the ability of the inventory to more accurately predict stand volume and piece size.

Millar Western has also initiated a project that produces forest metrics using LiDAR, existing AVI and volume sampling information.

3.3.1.8 ID 12: Develop and implement operational risk rating system to provide guidance in determining environmental conditions in which forest operations can be conducted in an environmentally sound manner

In addition to adhering to the operating ground rules, Millar Western has implemented a new pre-harvest assessment (PHA) process, focused on ecosite, soil stability, and soil vulnerability issues, to guide seasonal and other general operability considerations. This PHA process uses LiDAR technologies, high resolution imagery and, as required, on-site assessments.

3.3.1.9 ID 13: Investigate the need for BAP SHEs and HSMs validation and refinement

Millar Western has not undertaken any investigative or refinement initiatives associated with the BAP SHEs and HSMs to date. For the 2017-2027 DFMP, Millar Western incorporated GoA wildlife models into the timber supply process.

3.4 Performance Measures (VOITs)

Values Objectives Indicators and Targets (VOITs) are performance measures developed for DFMPs. In the 2017-2027 DFMP, Millar Western proposed to compare the 2017 predicted condition of the landbase with the targets set in the previous plan. This reporting would be applicable only to those VOITs requiring forecasting of the updated landbase condition.

The 2017 “actual” landbase condition was derived from the 2017 DFMP net landbase. The net landbase effective date was May 1, 2015, and to estimate its condition on May 1, 2017, the planned harvest blocks for the timber years 2015/16 and 2016/17, which were assembled for the PFMS, were used to update the landbase to May 1, 2017. VOIT metrics were then calculated and compared to the predicted 2017 condition made in the 2007-2016 DFMP.

Many of the VOIT metrics (*e.g.* patch metrics) required the use of Patchworks to calculate the metric or required changes in the 2017-2027 DFMP Patchworks model to calculate the metric with the same methodology used in the 2007-2016 DFMP. Some of these metrics were not available at the time of submission due to missing data or timelines and will be submitted for review prior to DFMP approval.

3.4.1 VOIT 1 (1.1.1.1) - Area of opening, mature + old, old and oldgrowthness forest by species strata for the gross and managed landbase for each FMU

Maintain biodiversity by retaining the full range of cover types and seral stages. These tables compare the seral stages using the 2007 definitions of seral stages, applied to the net landbase created for the 2017 DFMP. The oldgrowthness metric was discontinued and is not reported for the 2017 actual landbase.

Table 4-1. Predicted 2017 gross forested landbase seral stage and oldgrowthness area summary, by broad cover group and species strata for W11.

		Maximum Area		Minimum Area							
	Species	Opening		Mature + Old		Old		Oldgrowthness		Total	
BCG	Strata	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	Ha	%
D	AW	7,640	5%	25,796	17%	1,373	1%	11,754	8%	56,566	38%
	BW	-	0%	100	0%	19	0%	32	0%	142	0%
DC	AP	137	0%	1,129	1%	71	0%	378	0%	1,927	1%
	AS	1,089	1%	3,690	2%	245	0%	1,785	1%	5,639	4%
CD	PA	296	0%	1,368	1%	-	0%	127	0%	2,234	2%
	SA	1,482	1%	2,867	2%	88	0%	1,455	1%	5,554	4%
C	LT	60	0%	9,185	6%	1,910	1%	4,237	3%	25,536	17%
	PL	1,309	1%	5,074	3%	135	0%	2,293	2%	13,351	9%
	SB	107	0%	5,641	4%	396	0%	1,975	1%	26,399	18%
	SW	3,003	2%	6,175	4%	-	0%	1,338	1%	10,419	7%
Total		**15,124**	**10%**	**61,025**	**41%**	**4,236**	**3%**	**25,374**	**17%**	**147,765**	**100%**

Table 4-2. Actual 2017 gross forested landbase seral stage and oldgrowthness area summary, by broad cover group and species strata for W11.

		Area		Area							
	Species	Opening		Mature + Old		Old		Oldgrowthness		Total	
BCG	Strata	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	Ha	%
D	AW	4,831	3%	25,401	16%	693	0%	n/a	n/a	53,314	33%
	BW	-	0%	-	0%	-	0%	n/a	n/a	-	0%
DC	AP	118	0%	2,061	1%	28	0%	n/a	n/a	3,160	2%
	AS	1,222	1%	5,175	3%	264	0%	n/a	n/a	8,223	5%
CD	PA	83	0%	2,018	1%	-	0%	n/a	n/a	3,021	2%
	SA	1,248	1%	3,248	2%	146	0%	n/a	n/a	7,050	4%
C	LT	-	0%	4,023	3%	-	0%	n/a	n/a	32,039	20%
	PL	642	0%	7,865	5%	119	0%	n/a	n/a	13,740	9%
	SB	-	0%	8,701	5%	-	0%	n/a	n/a	26,943	17%
	SW	3,010	2%	4,231	3%	-	0%	n/a	n/a	12,354	8%
Total		**11,153**	**7%**	**62,724**	**39%**	**1,249**	**1%**			**159,844**	**100%**

Table 4-3. Predicted 2017 gross forested landbase seral stage and oldgrowthness area summary, by broad cover group and species strata for W13.

		Maximum Area		Minimum Area							
	Species	Opening		Mature + Old		Old		Oldgrowthness		Total	
BCG	Strata	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	Ha	%
D	AW	4,968	2%	41,857	16%	3,411	1%	15,855	6%	65,514	24%
	BW	7	0%	89	0%	-	0%	39	0%	1,238	0%
DC	AP	1,206	0%	2,540	1%	135	0%	711	0%	6,365	2%
	AS	777	0%	14,776	5%	1,269	0%	7,627	3%	20,248	8%
CD	PA	1,542	1%	2,294	1%	93	0%	678	0%	10,421	4%
	SA	3,158	1%	8,639	3%	332	0%	5,560	2%	19,253	7%
C	LT	18	0%	2,800	1%	1,526	1%	1,618	1%	6,523	2%
	PL	8,867	3%	7,425	3%	1,279	0%	3,744	1%	71,242	26%
	SB	5,965	2%	13,278	5%	1,357	1%	5,622	2%	42,936	16%
	SW	10,999	4%	8,722	3%	145	0%	3,650	1%	25,964	10%
Total		**37,507**	**14%**	**102,420**	**38%**	**9,547**	**4%**	**45,103**	**17%**	**269,703**	**100%**

Table 4-4. Actual 2017 gross forested landbase seral stage and oldgrowthness area summary, by broad cover group and species strata for W13.

		Area		Area							
	Species	Opening		Mature + Old		Old		Oldgrowthness		Total	
BCG	Strata	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	Ha	%
D	AW	2,565	1%	30,660	12%	2,086	1%	n/a	n/a	51,291	20%
	BW	-	0%	-	0%	-	0%	n/a	n/a	-	0%
DC	AP	1,493	1%	3,542	1%	45	0%	n/a	n/a	7,582	3%
	AS	1,636	1%	10,849	4%	791	0%	n/a	n/a	15,604	6%
CD	PA	1,414	1%	3,164	1%	9	0%	n/a	n/a	9,689	4%
	SA	2,394	1%	7,689	3%	267	0%	n/a	n/a	13,663	5%
C	LT	3	0%	3,651	1%	447	0%	n/a	n/a	10,504	4%
	PL	7,211	3%	21,160	8%	656	0%	n/a	n/a	78,952	31%
	SB	474	0%	12,002	5%	126	0%	n/a	n/a	36,100	14%
	SW	9,275	4%	10,665	4%	16	0%	n/a	n/a	33,485	13%
Total		**26,465**	**10%**	**103,384**	**40%**	**4,443**	**2%**			**256,869**	**100%**

Table 4-5. Predicted 2017 managed landbase seral stage and oldgrowthness area summary, by broad cover group and species strata for W11.

		Maximum Area		Minimum Area							
	Species	Opening		Mature + Old		Old		Oldgrowthness		Total	
BCG	Strata	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	Ha	%
D	AW	7,538	9%	23,041	26%	1,264	1%	10,888	12%	53,185	61%
	BW	-	0%	91	0%	14	0%	27	0%	130	0%
DC	AP	137	0%	730	1%	71	0%	365	0%	1,505	2%
	AS	1,089	1%	2,927	3%	74	0%	1,520	2%	4,875	6%
CD	PA	296	0%	700	1%	-	0%	126	0%	1,555	2%
	SA	1,480	2%	2,448	3%	20	0%	1,272	1%	5,066	6%
C	LT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PL	1,309	1%	4,893	6%	135	0%	2,229	3%	11,588	13%
	SB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SW	2,991	3%	5,294	6%	-	0%	1,077	1%	9,463	11%
Total		**14,842**	**17%**	**40,124**	**46%**	**1,578**	**2%**	**17,505**	**20%**	**87,369**	**100%**

Table 4-6. Actual 2017 managed landbase seral stage and oldgrowthness area summary, by broad cover group and species strata for W11.

BCG	Species Strata	Area Opening (ha)	Area Opening (%)	Area Mature + Old (ha)	Area Mature + Old (%)	Area Old (ha)	Area Old (%)	Oldgrowthness (ha)	Oldgrowthness (%)	Total Ha	Total %
D	AW	4,782	5%	22,556	26%	613	1%	n/a	n/a	48,826	56%
	BW	-	0%	-	0%	-	0%	n/a	n/a	-	0%
DC	AP	118	0%	1,698	2%	28	0%	n/a	n/a	2,596	3%
	AS	1,210	1%	4,465	5%	224	0%	n/a	n/a	7,022	8%
CD	PA	82	0%	1,231	1%	-	0%	n/a	n/a	2,167	2%
	SA	1,241	1%	2,363	3%	83	0%	n/a	n/a	5,503	6%
C	LT	-	0%	-	0%	-	0%	n/a	n/a	-	0%
	PL	633	1%	5,808	7%	111	0%	n/a	n/a	11,282	13%
	SB	-	0%	-	0%	-	0%	n/a	n/a	62	0%
	SW	2,948	3%	3,093	4%	-	0%	n/a	n/a	10,026	11%
Total		**11,015**	**13%**	**41,214**	**47%**	**1,059**	**1%**			**87,483**	**100%**

Table 4-7. Predicted 2017 managed landbase seral stage and oldgrowthness area summary by broad cover group and species strata for W13.

BCG	Species Strata	Maximum Area Opening (ha)	Maximum Area Opening (%)	Minimum Area Mature + Old (ha)	Minimum Area Mature + Old (%)	Minimum Area Old (ha)	Minimum Area Old (%)	Minimum Area Oldgrowthness (ha)	Minimum Area Oldgrowthness (%)	Total Ha	Total %
D	AW	4,956	2%	34,932	17%	3,151	2%	13,024	6%	55,916	27%
	BW	-	0%	-	0%	-	0%	32	0%	1,105	1%
DC	AP	1,206	1%	2,306	1%	123	0%	601	0%	5,939	3%
	AS	757	0%	12,939	6%	1,229	1%	6,771	3%	17,561	9%
CD	PA	1,542	1%	2,033	1%	86	0%	572	0%	9,821	5%
	SA	2,538	1%	7,510	4%	290	0%	4,700	2%	17,043	8%
C	LT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PL	8,867	4%	6,693	3%	1,201	1%	3,214	2%	67,216	33%
	SB	2,496	1%	3,489	2%	497	0%	2,329	1%	10,595	5%
	SW	9,250	4%	6,355	3%	94	0%	2,356	1%	21,219	10%
Total		**31,612**	**15%**	**76,257**	**37%**	**6,671**	**3%**	**33,599**	**16%**	**206,415**	**100%**

Table 4-8. Actual 2017 managed landbase seral stage and oldgrowthness area summary, by broad cover group and species strata for W13.

BCG	Species Strata	Area Opening (ha)	Area Opening (%)	Area Mature + Old (ha)	Area Mature + Old (%)	Area Old (ha)	Area Old (%)	Oldgrowthness (ha)	Oldgrowthness (%)	Total Ha	Total %
D	AW	2,475	1%	24,543	14%	1,539	1%	n/a	n/a	43,017	24%
	BW	-	0%	-	0%	-	0%	n/a	n/a	-	0%
DC	AP	1,482	1%	3,084	2%	29	0%	n/a	n/a	6,463	4%
	AS	1,617	1%	8,814	5%	633	0%	n/a	n/a	12,918	7%
CD	PA	1,399	1%	2,654	1%	2	0%	n/a	n/a	8,270	5%
	SA	2,179	1%	5,576	3%	167	0%	n/a	n/a	10,496	6%
C	LT	-	0%	-	0%	-	0%	n/a	n/a	-	0%
	PL	7,087	4%	17,201	10%	463	0%	n/a	n/a	66,162	37%
	SB	451	0	2,688	0	34	0%	n/a	n/a	6,437	4%
	SW	9,105	5%	6,393	4%	13	0%	n/a	n/a	25,068	14%
Total		**25,795**	**14%**	**70,953**	**40%**	**2,881**	**2%**			**178,831**	**100%**

3.4.2 VOIT 2 (1.1.1.2A) - Opening patch size distribution on the gross landbase for each FMU

Maintain biodiversity by avoiding landscape fragmentation. The 2017 predicted values are from the previous plan, while the 2017 actual values are from the 2017 DFMP landbase using the 2007 definition of the opening and patch sizes.

Table 4-9. Predicted and actual 2017 gross forested landbase opening patch area for W11.

	> 0 & <= 4 ha		> 4 & <= 100 ha		> 100 & <= 1000 ha		> 1000 ha		Total Patch Area
Year	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)
2017 Predicted	129	0.9%	7,264	48.0%	6,276	41.5%	1,455	9.6%	15,124
2017 Actual	257	2.3%	6,595	59.1%	4,302	38.6%	-	0.0%	11,153

Table 4-10. Predicted and actual 2017 gross forested landbase opening patch area for W13.

	> 0 & <= 4 ha		> 4 & <= 100 ha		> 100 & <= 1000 ha		> 1000 ha		Total Patch Area
Year	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)
2017 Predicted	1,324	3.7%	18,792	52.1%	12,666	35.1%	3,287	9.1%	36,068
2017 Actual	1,338	5.0%	18,538	69.5%	6,792	25.5%	-	0.0%	26,667

3.4.3 VOIT 3 (1.1.1.2B) - Percent of overall oldgrowthness forest area that is interior oldgrowthness forest by FMU for the gross landbase

Maintain biodiversity by avoiding landscape fragmentation. This VOIT was modified to use the 2017 DFMP definition of interior core, that measures the area older than 120 years old and of that area, patches that are greater than 120 ha. The predicted was calculated by aging the 2007 landbase and cutting in the 10 year SHS. In FMU W11, the difference is attributed to only 60% of the SHS being actually harvested (from Table 4-15).

Table 4-11. Predicted and actual 2017 gross forested landbase oldgrowthness and interior oldgrowthness for W11.

Year	Total > 120 years old	Patches > 120ha	% Patches
2017 Predicted	18,325	6,858	37%
2017 Actual	37,334	19,787	53%

Table 4-12. Predicted and actual 2017 gross forested landbase oldgrowthness and interior oldgrowthness for W13.

Year	Total > 120 years old	Patches > 120ha	% Patches
2017 Predicted	57,536	27,611	48%
2017 Actual	61,467	32,885	54%

3.4.4 VOIT 42 (5.2.1.1A) - Percent of Whitecourt FireSmart Community Zone area in the ‘extreme’ and ‘high’ Fire Behaviour Potential rating categories

Since submission of the 2007-2016 DFMP, the Fire Behaviour Potential (FBP) categories have been adjusted by the GoA. To address this, the actual 2017 areas in Table 4-13 have been calculated using the old category thresholds, however problems persist which did not permit an appropriate comparison to the data from the 2007-2016 DFMP. Due to the calculation methods, areas cannot increase over time as presented in the results, and thus the comparision is invalid. Millar Western will continue to investigate and pursue a solution.

Table 4-13. Whitecourt FireSmart Community Zone predicted and actual 2017 FBP ranking area.

FBP Value	FBP Description	Predicted 2017		Actual 2017	
		(ha)	(%)	(ha)	(%)
31 - 70	High	11,792	11%	18,990	17%
71 - 100	Extreme	19,704	18%	23,371	20%
Total		**110,901**	**100%**	**114,731**	**100%**
31 - 100	**High + Extreme**	**31,496**	**28%**	**42,361**	**37%**

3.4.5 VOIT 43 (5.2.1.1B) - Percent of DFA area in the 'extreme' and 'high' Fire Behaviour Potential rating categories

Since submission of the 2007-2016 DFMP, the FBP categories have been adjusted by the GoA. As with the previous VOIT attempts to calculate the appropriate actual 2017 areas with the old thresholds to permit a consistent comparison with data from the 2007-2016 DFMP have not been successful (Table 4-14). Millar Western will continue to investigate and pursue a solution.

Table 4-14. DFA predicted and actual 2017 FBP ranking area.

FBP Value	FBP Description	Predicted 2017		Actual 2017	
		(ha)	(%)	(ha)	(%)
31 - 70	High	56,304	12%	90,242	19%
71 - 100	Extreme	112,905	25%	189,288	40%
Total		**452,471**	**100%**	**472,290**	**100%**
31 - 100	**High + Extreme**	**169,209**	**37%**	**279,531**	**59%**

3.5 Harvesting and Regeneration Metrics

3.5.1 Spatial Harvest Sequence (SHS) Variance

Approval Condition 8.1 required that Millar Western report on any variances between the SHS that had been submitted with the 2007-2016 DFMP and the volumes that were actually harvested. Table 4-15 and Table 4-16 show SHS variances and summarize the differences. Some of the reasons for the spatial and area variances are provided below:

- In 2010 Millar Western began to shift to a Healthy Pine Strategy on the FMA. Although the original DFMP had considered the impact of MPB, there were still a significant amount of spruce stands sequenced. As Millar Western shifted their harvest plans to focus almost entirely on pine leading stands this resulted in variance to the SHS;
- In W13, Millar Western had to prepare harvesting plans for pure aspen, as sequenced mixed stands with SW that were not cut due to the Healthy Pine Strategy implemented for MPB;
- There were a significant number of pine and black spruce stands in the Meekwap compartment that were sequenced but not harvested as they were determined to be non-merchantable at the time of anticipated harvest.
- The Miscellaneous Timber Use (MTU) program operators have never cut their full quota;
- Weyerhaeuser has carryover approved for use in the 2017-2027 DFMP period, because it did not cut its full quota during the last DFMP period;
- Spruceland has accumulated carryover from previous operators in its quota (Vanderwell and Flemming), which were not cutting their full allowance;
- Spruceland has carryover approved for use in the 2017-2027 DFMP period, because it did not cut its full quota during last DFMP period; and

The following subsections (3.5.1.1 and 3.5.1.2) provide additional harvesting and regeneration metric summaries illustrating the differences between planned and actual activities.

Table 4-15. SHS variance in W11 from 2007 to 2017

				Spatial Variance				Area Variance	
				A	B	C	D	E	F
Yield Curve Strata	SHS Area (ha)	Area of Harvested Blocks (ha)	Additions (ha)	Area of SHS Included in Block	Area of SHS Deferred/Deleted	Area of SHS Left Unplanned	Variance from SHS as a %	Area of Planned Blocks and Unplanned SHS	Area of Planned Blocks and Unplanned SHS as a %
AW	6,721	5,134	972	4,162	2,559	-	38%	5,134	76%
BW	0	3	3	0	0	-	0%	3	0%
LT	0	35	35	0	0	-	0%	35	0%
AP	108	40	2	38	69	-	64%	40	37%
AS	954	612	79	534	420	-	44%	612	64%
PA	292	30	1	29	263	-	90%	30	10%
SA	868	625	116	509	359	-	41%	625	72%
PL	1,159	492	158	333	825	-	71%	492	42%
SB	0	263	263	0	0	-	0%	263	0%
SW	1,768	861	240	620	1,147	-	65%	861	49%
X	0	102	102	0	0	-	0%	102	0%
Total	**5,148**	**3,025**	**961**	**2,064**	**3,084**	**-**	**60%**	**3,025**	**59%**

Table 4-16. SHS variance in W13 from 2007 to 2017

				Spatial Variance				Area Variance	
				A	B	C	D	E	F
Yield Curve Strata	SHS Area (ha)	Area of Harvested Blocks (ha)	Additions (ha)	Area of SHS Included in Block	Area of SHS Deferred/ Deleted	Area of SHS Left Unplanned	Variance from SHS as a %	Area of Planned Blocks and Unplanned SHS	Area of Planned Blocks and Unplanned SHS as a %
AW	5,458	4,832	3,209	1,623	3,835	-	70%	4,832	89%
BW	0	18	18	0	0	-	0%	18	0%
LT	0	19	19	0	0	-	0%	19	0%
AP	1,076	1,268	559	709	367	-	34%	1,268	118%
AS	1,770	2,146	1,222	924	846	-	48%	2,146	121%
PA	1,750	1,712	490	1,222	528	-	30%	1,712	98%
SA	1,995	2,126	1,174	953	1,042	-	52%	2,126	107%
PL	8,099	6,870	2,519	4,351	3,748	-	46%	6,870	85%
SB	2,139	1,825	1,230	595	1,544	-	72%	1,825	85%
SW	2,988	2,163	1,138	1,026	1,963	-	66%	2,163	72%
X	0	343	343	0	0	-	0%	343	0%
Total	**19,818**	**18,454**	**8,674**	**9,780**	**10,039**	**-**	**51%**	**18,454**	**93%**

Note:

Spatial Variance = 100-(((Column A + Column C)/(Compartment SHS Area))*100)

Area Variance = (Column E/Compartment SHS Area)*100

3.5.1.1 Area Harvested – Planned versus Actual

Table 4-17. Planned areas harvested by strata, for each FMU

Strata	W11 Area (ha)	W13 Area (ha)	Total Area (ha)
AW	6,721	5,458	12,179
AP	108	1,076	1,184
AS	954	1,770	2,724
PA	292	1,750	2,042
SA	868	1,995	2,863
PL	1,159	8,099	9,258
SB	0	2,139	2,139
SW	1,768	2,988	4,756
Total	**11,869**	**25,276**	**37,145**

Table 4-18. Actual areas harvested by strata, for each FMU

Strata	W11 Area (ha)	W13 Area (ha)	Total Area (ha)
AW	5,134	4,832	9,966
BW	3	19	22
LT	35	18	53
AP	40	1,268	1,308
AS	612	2,146	2,758
PA	30	1,712	1,742
SA	625	2,126	2,752
PL	492	6,870	7,362
SB	263	1,825	2,088
SW	861	2,163	3,024
X	102	343	445
Total	**8,197**	**23,323**	**31,520**

3.5.1.2 AAC versus Actual Harvest Volume

Comparisons of AAC levels to timber volumes harvested are summarized in Table 4-19. Actual harvest volumes are based on reconciled quadrant production volumes for the ten timber years beginning with 2006/07 timber year, which is one year earlier than the 2007-2016 DFMP period. Reconcilied timber volumes were not available for the 2016/17 timber year. Overall, coniferous and deciduous volumes were lower than the approved AAC during the DFMP period.

Table 4-19. AAC compared to actual harvest volumes from 2006/07 to 2015/16

FMU Name	Annual Allowable Cut (m^3/year) Coniferous	Deciduous	Total	Year	Actually Cut (m^3/year) Coniferous	Deciduous	Coniferous Difference	Deciduous Difference
W11	94,903	148,049	242,952	2006/07-2010/11	69,856	106,904	25,047	41,145
				2011/12-2015/16	76,086	149,126	18,817	-1,077
				Total	*72,971*	*128,015*	*21,932*	*20,034*
W13	435,844	209,412	645,256	2006/07-2010/11	369,469	167,409	66,375	42,003
				2011/12-2015/16	330,042	150,477	105,802	58,935
				Total	*349,756*	*158,943*	*86,089*	*50,469*
Total	**530,747**	**357,461**	**888,208**		**211,363**	**143,479**	**54,010**	**35,251**

3.5.1.3 Structure Retention

In the 2007-2016 DFMP, VOIT 11 committed Millar Western to retaining, on an annual basis, 1% of its total AAC volume as residual structure, on each FMU. As part of that commitment, Millar Western was to include in its upcoming 5-year stewardship reports the volume and percentage of AAC that was left on the DFA, by compartment, FMU and timber year. This condition was satisfied in the following manner:

- In 2011, Millar Western delivered a stewardship report that included the required data for the timber years 2007 to 2011.
- Rather than develop a separate stewardship report for 2012-2016, Millar Western has elected to include the data for the next 5-year period (2012-2016) in the 2017-2027 DFMP.

Annual structure retention volumes by timber year are summarized for only Millar Western's operations in FMU W11 (Table 4-20). Retention volume (merchantable coniferous and deciduous) was determined by multiplying the DFMP yield curve values by mapped retained areas inside of block boundaries. Harvested volume was calculated using block areas and DFMP yields. The structure retention target was slightly below the 1% target in FMU W11.

Table 4-20. Structure retention summary for FMU W11

W11	Theoretical Volume by Type		
Timber Year	Retention Vol (m^3)	Harvested Vol (m^3)	% Retention
2007	*1,647*	*52,607*	*3.04*
2008	*121*	*39,452*	*0.31*
2009	*1,122*	*48,750*	*2.25*
2010	*1,611*	*83,751*	*1.89*
2011	*2,490*	*118,935*	*2.05*
2012	*97*	*120,717*	*0.08*
2013	*600*	*153,037*	*0.39*
2014	*418*	*130,635*	*0.32*
2015	*308*	*160,626*	*0.19*
Total	**8,414**	**908,511**	**0.92**

Similarly, structure retention values for FMU W13 are summarized in Table 4-21. In FMU W13, Millar Western was slightly above the 1 % target.

Table 4-21. Structure retention summary for FMU W13

W13	Theoretical Volume by Type		
Timber Year	Retention Vol (m^3)	Harvested Vol (m^3)	% Retention
2007	*2,586*	*314,343*	*0.82*
2008	*9,499*	*540,784*	*1.73*
2009	*15,895*	*723,855*	*2.15*
2010	*6,196*	*682,939*	*0.90*
2011	*5,227*	*391,765*	*1.32*
2012	*10,951*	*543,669*	*1.97*
2013	*1,818*	*441,632*	*0.41*
2014	*1,247*	*263,911*	*0.47*
2015	*1,310*	*517,282*	*0.25*
Total	**54,730**	**4,420,180**	**1.22**

3.5.2 Yield Recovery

Using recorded scale data from 2007-2015, Millar Western undertook an analysis of the accuracy of yield predictions made in the 2007-2016 DFMP. Millar Western extracted a set of 644 blocks with skid clearance assigned and with scale data for the years 2006-2007 to 2014-2015 (Table 4-22). Scale volumes were extracted from LIMS and linked to individual blocks; they were not adjusted to account for any changes in harvest utilization standards throughout that time period.

Table 4-22. The predicted and actual harvest areas and volumes within W11 and W13 (2007-2014)

FMU	Metric		Timber Year 2007	2008	2009	2010	2011	2012	2013	2014	Total
W11	Number of Blocks		0	3	7	20	19	18	21	26	114
	Area (ha)		0	121	306	640	959	693	691	926	4,337
	Deciduous	Predicted	0	8,177	47,299	69,002	124,544	74,159	82,716	107,206	513,103
		Actual	0	10,653	55,250	118,362	164,548	83,318	105,410	120,230	657,771
W13	Number of Blocks		42	67	129	85	51	45	39	72	530
	Area (ha)		1,175	1,966	2,599	2,613	1,566	1,918	1,209	1,197	14,245
	Conifer	Predicted	234,755	348,242	411,165	395,288	255,476	300,249	175,333	171,836	2,292,344
		Actual	252,348	349,639	386,365	474,497	302,668	363,215	209,568	192,219	2,530,519
	Deciduous	Predicted	80,919	194,535	280,259	271,420	135,400	182,792	124,077	94,089	1,363,492
		Actual	57,622	126,885	225,703	153,030	93,515	144,042	103,739	67,317	971,853

As shown in (Figure 4-1), the predicted conifer volumes in W13 were a reasonable match with actual volumes. A comparison was not possible in W11, as the data necessary for this assessment was not available. For both W13 and W11, predictions of deciduous harvest volumes were not as accurate (Figure 4-2 and Figure 4-3).

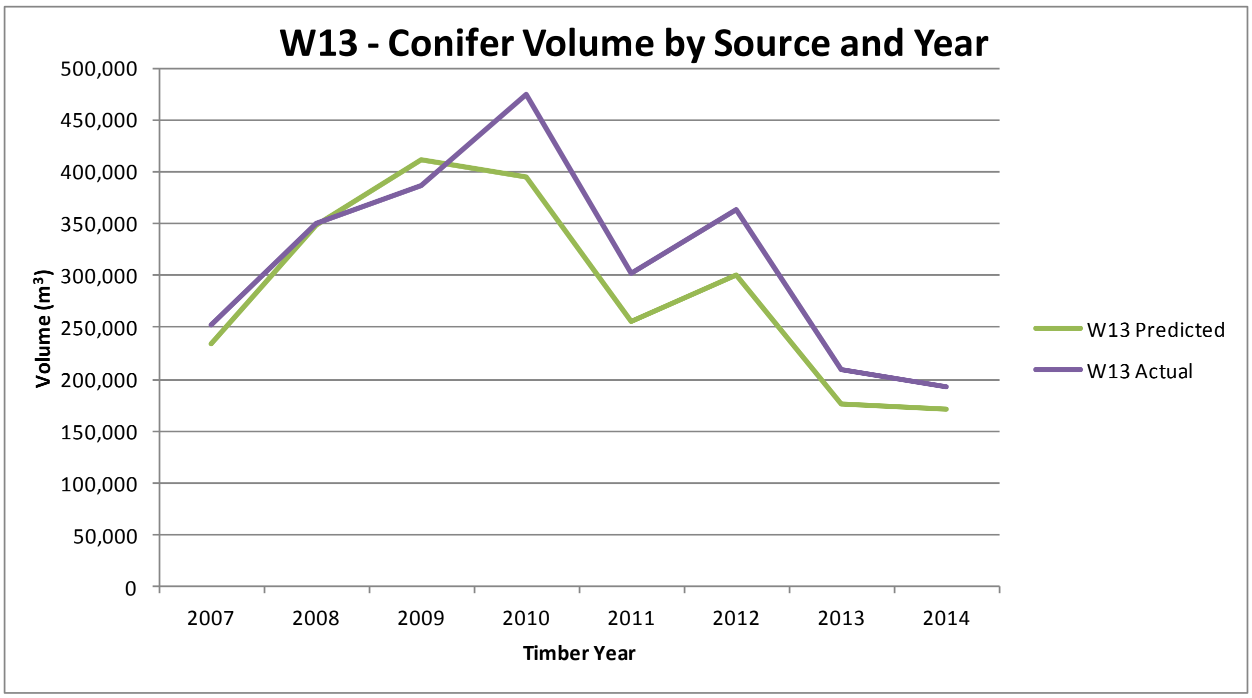


Figure 4-1. Differences in predicted and actual conifer volume in W13 (2007-2014)

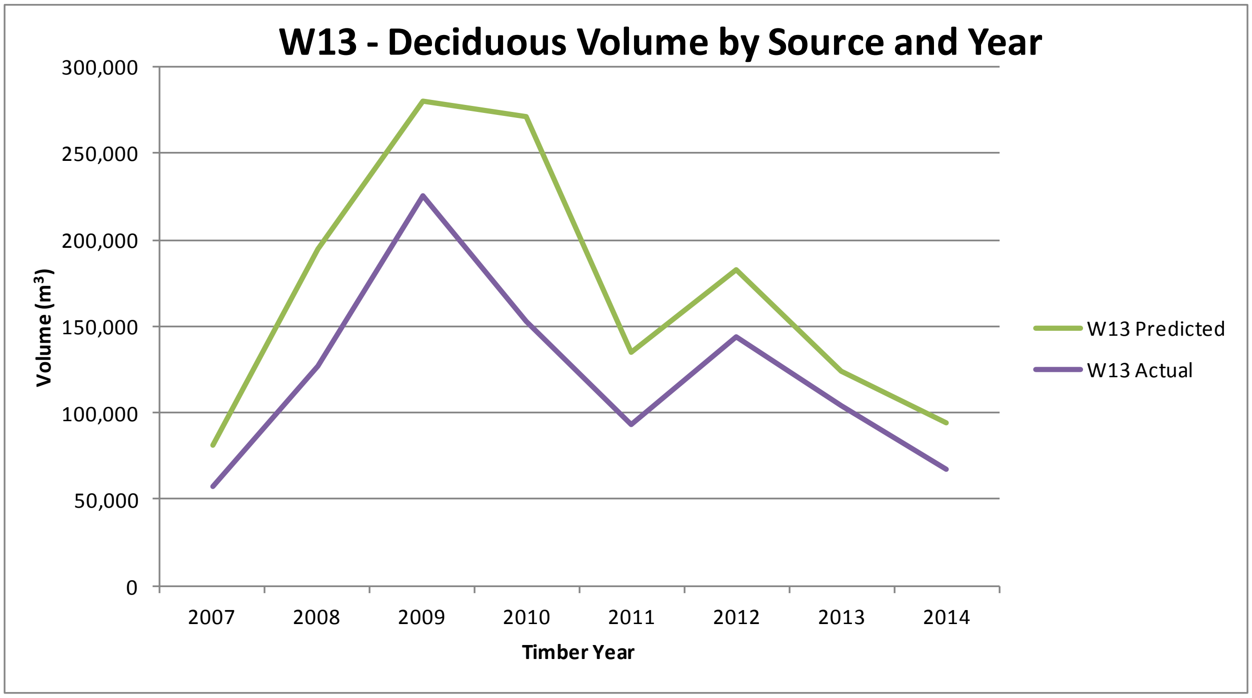


Figure 4-2. Differences in predicted and actual deciduous volume in W13 (2007-2014)

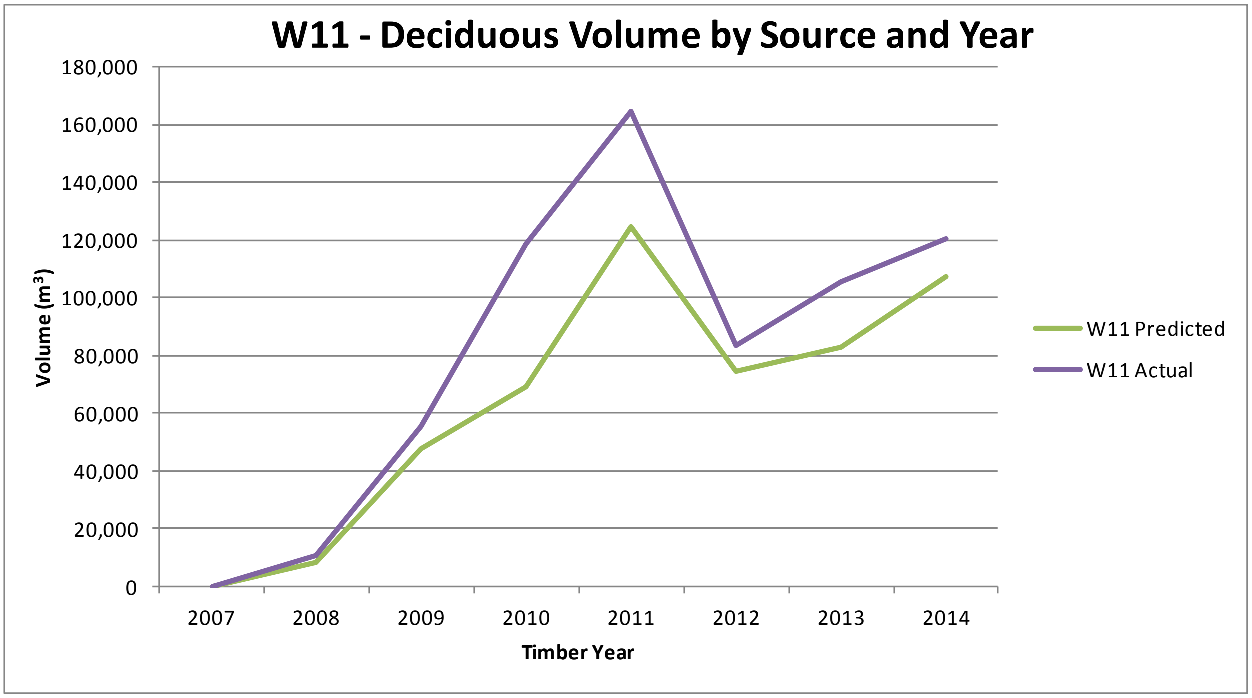


Figure 4-3. Differences in predicted and actual deciduous volume in W11 (2007-2014)

The percentage difference between predicted volume and scale volume varies each year (Table 4-23). For W13 deciduous, the difference was as low as 20% and as high as 77%. Even for the most accurate timber type predictions (W13 conifer), the differences ranged from no difference (0%) to -17%.

Table 4-23. Percent differences in predicted timber volume from scale volume

FMU	Metric	Timber Year 2007	2008	2009	2010	2011	2012	2013	2014	Total
W11	Deciduous	0%	0%	-14%	-42%	-24%	-11%	-22%	-11%	-22%
W13	Conifer	-7%	0%	6%	-17%	-16%	-17%	-16%	-11%	-9%
	Deciduous	40%	53%	24%	77%	45%	27%	20%	40%	40%

Regression analysis supports this variation. Regression analysis was undertaken to compare the correlation between the predicted volumes and the scale volumes (Figure 4-4 and Figure 4-5). The r-squared values are relatively high, meaning that although the chances of the DFMP correctly predicting the scale volumes are low overall, they are predictably so. In other words, the variance of scale volumes from DFMP forecasts is predictably unpredictable. The predictions are consistently off, rather than just in some of the years.

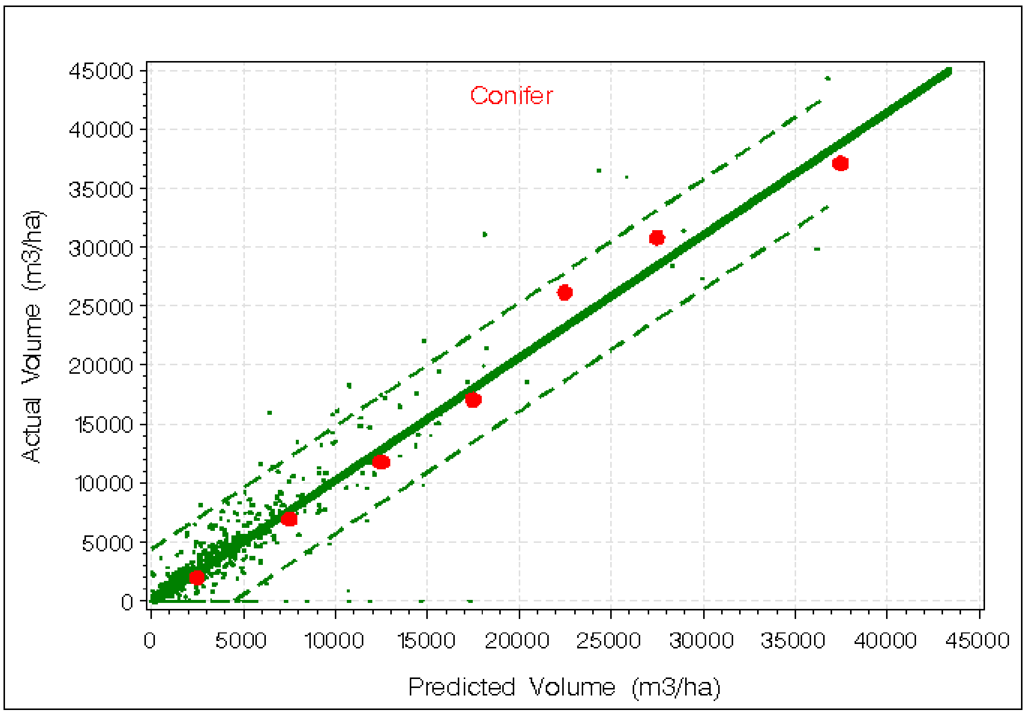


Figure 4-4. Conifer regression analysis

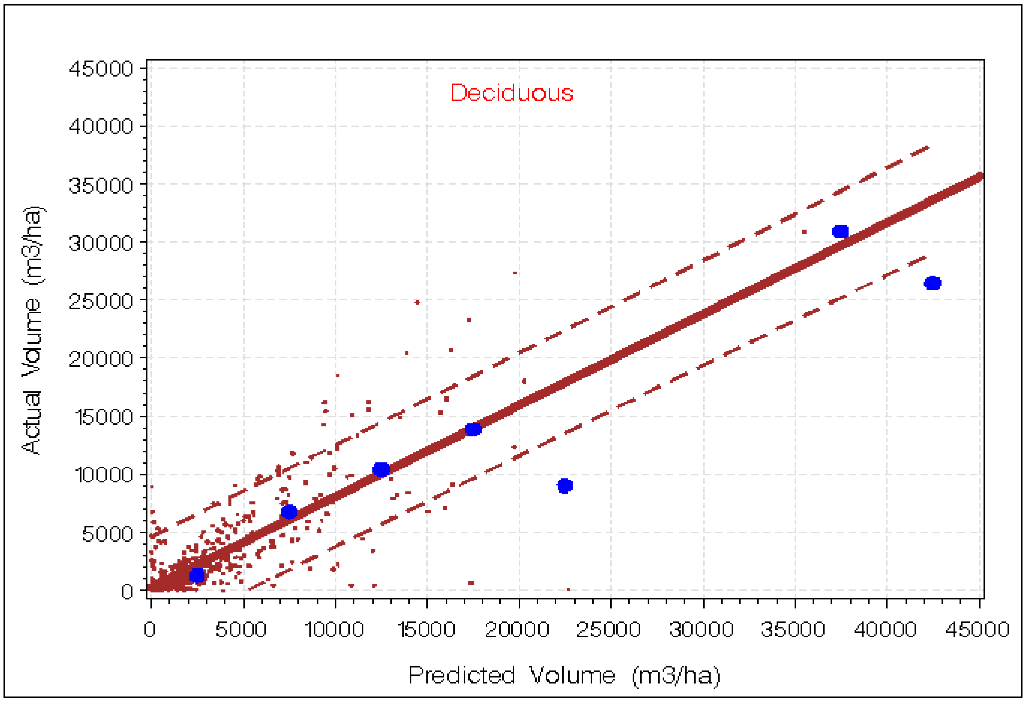


Figure 4-5. Deciduous regression analysis

The conifer points are grouped tightly to the regression line, with an r-squared value of 0.8080. The deciduous points are less tight to the regression line, with an r-squared value of 0.6827. This grouping supports the total percentages in Table 4-23. Overall, the DFMP under predicts conifer volume by 9%. For deciduous volume, however, the DFMP under predicts by 22% and over predicts by 40% in W11 and W13, respectively; the DFMP predictions were less accurate for deciduous volumes. If the deciduous volume was mostly harvested from mixedwood blocks, this variability might be understandable. If a third or more of the blocks were pure deciduous, however, then there would more likely be a serious problem with the DFMP prediction methods. Knowing how much was culled would also be important, as this can drastically affect the final volumes in mature deciduous stands.

For both regressions, there is greater correlation at lower volumes. Volumes become harder to predict when there is more volume per hectare.

3.5.3 FMU W11 Incidental Replacement

Measuring incidental conifer and developing a conifer replacement strategy have been challenging in W11. The problems can be traced to the poor quality of the classification in the W11 forest inventory, especially in the older stands. Much of the area classified as pure stands were actually mixedwood stands. This produced a pure deciduous yield curve with a large amount of conifer incidental volume, which represents a significant portion of the W11 conifer timber supply. Adding to the problem was that much of the younger pure deciduous stands turned out to be pure deciduous with no conifer understory. Once these stands are harvested in 20 years or so, they will not produce the same level of incidental volume as is currently generated.

It is anticipated that the new forest inventory with leaf off photography and recent volume sampling programs will aid in addressing the situation. They will provide more realistic curves that, with supporting empirical sampling (including RSA) data, will show more reasonable incidental conifer levels that are sustainable through implementation of current silviculture management strategies.

Without the incidental coniferous volume being actively replaced in deciduous stands, it was thought that the coniferous AAC would not be sustainable. The current incidental conifer replacement rate calls for the establishment of one hectare of conifer for every 4.22 hectares of deciduous landbase harvested. This was calculated in the timber supply analysis, completed as part of Millar Western's 2007-2016 DFMP. The 4.22 hectare conversion rate was generated by dividing the volume of conifer per hectare from the SW_CD yield curve at 80 years of age (137.8m^3/ha) by the area weighted volume of conifer per hectare from the AW_CD and AW_AB yield curves at 80 years of age (32.6m^3/ha)

In total, 4,099 ha of AW strata was harvested over the last 10-year period (2007-2017); of that, 1,107.6 ha was converted to conifer, which is 1.0 ha reforested to conifer for every 3.7 ha of D harvested.

Table 4-24. Summary of incidental conifer replacement in W11

Harvest Year	Area (ha) Converted
2007/2008	64.2
2008/2009	87.8
2009/2010	74.6
2010/2011	158.9
2011/2012	211.7
2012/2013	102.2
2013/2014	128.5
2014/2015	151.4
2015/2016	128.3
Total	**1107.6**

3.5.4 PSP and TSP Installed and Measured

The table below summarizes the TSP and PSP data used in the development of the 2017-2027 DFMP yield curves, including the TSPs installed (MWFP TSP 2014 and MWFP Juvenile TSPs). A full description of the TSP and PSP measurements made during the 2007-2016 period are included in the Growth and Yield Program and the yield curve development.

Table 4-25. Permanent Sampling Plots (PSPs) installed and measured and Temporary Sampling Plot (TSP) program installed

FMU	Data Collection Program	Protocols	Number of Plots
W11	GoA TSPs 2000		359
	MWFP TSPs 2004	Regular Plot	268
		BAP Plot	53
		Subtotal	*321*
	MWFP TSPs 2014	2014/2015 Season	141
	MWFP PSPs	2004 - 2014 (131 measurements)	92
	RSA[1]	2010 - 2015	134
	Subtotal		*1,047*
W13	MWFP TSPs 1997	Original TSP Program	27
		New TSP Program	437
		Subtotal	*464*
	MWFP TSPs 1998	Core TSP Program	90
		Volume Estimate Improvement Program	30
		Subtotal	*120*
	MWFP TSPs 2004	Regular Plot	195
		BAP Plot	45
		Subtotal	*240*
	MWFP TSPs 2014	2014/2015 Season	210
	MWFP Juvenile TSPs	2013 Pilot Program	40
		2014/2015 Season	195
		Subtotal	*235*
	MWFP PSPs	1996 - 2014 (880 measurements)	361
	RSA[1]	2009 - 2015	266
	Subtotal		*1,896*
Total			**2,943**

[1]Number of sampling units.

4. Significant Events

Since the last DFMP was approved, a number of significant events have taken place that are worthy of noting and are provided below.

4.1 Mountain Pine Beetle (MPB)

Though the province had been experiencing a major MPB infestation since 2006, the Central Region of Alberta, which includes the Millar Western FMA, was subject to a massive Mountain Pine Beetle (MPB) inflight in 2009. In a proactive response, forest companies, including Millar Western, and the GOA developed the 2010 Central Region MPB Plan, to formalize and clarify mitigation processes and procedures, with a view to cooperatively managing the infestation at the regional level.

Over the last several years, it has become apparent that, despite efforts to control populations, the MPB is firmly established in the region; however, the infestation is not as severe as some had anticipated and certainly not spreading at rates previously seen in British Columbia. As the MPB continues to pose a threat to the pine forests across the region and beyond, it will remain a prime consideration in forest management planning for the foreseeable future.

4.2 Millar Western Purchase of Mostowich Lumber

On July 31, 2007, Millar Western Forest Products Ltd. acquired the operating and forestry assets of Mostowich Lumber Ltd. in Fox Creek, Alberta, located 80 kilometres northwest of Whitecourt. The operation had been established in 1944 by Steve Mostowich, and was owned and operated by sons Ron and Arnie Mostowich. Millar Western purchased the operation with the intention of running it at its purchase capacity of 50 million board feet of lumber per year and to offer ongoing employment to the approximately 60 people who made up the mill's workforce. Millar Western sought and was granted GoA approval for the transfer of timber quotas from Mostowich to Millar Western. Forest operations supplying the Fox Creek mill were consolidated in Whitecourt, Alberta.

4.3 Spruceland Purchase of W11 Quotas

A series of quota purchases took place in W11 during the 2007 – 2016 DFMP period: Vanderwell purchased the OK lumber quota between 2005 and 2007, Spruceland purchased all of Vanderwell's quotas in W11 in 2012 and finally, in 2015, Spruceland purchased the Fort Assiniboine quota to hold 100% of the coniferous quota in W11.

4.4 SFI Certification

On November 26, 2009, Millar Western's woodlands operations achieved certification under the Sustainable Forest Initiative (SFI) 2005-2009 Standard for sustainable forest management (SFM), following a third-party audit. Millar Western was previously certified under the CSA-Z809 SFM standard but made the shift to SFI due to its recognition of both volume- as well as land-based tenures, which his reflective of Millar Western's fibre supply. A rigorous, internationally recognized program, SFI promotes sustainable forest management through nine principles, 13 objectives, 34 performance measures and 102 indicators developed by professional foresters, conservationists, scientists and others. The standard addresses key environmental, social and economic forest values – from water quality to bio-diversity, and all aspects of forestry operations, from consultation through harvesting and regeneration. It is the only forest certification program in North America that requires participants to support research to improve forest health, conservation understanding, productivity and sustainable management of forest resources. SFI advances conservation objectives in forests throughout North America through the values expressed in its standard, through carefully targeted research, through direct leadership of critical initiatives, and through partnerships that effectively contribute to multiple conservation objectives. In addition to SFI, the company holds ISO 14001, PEFC and FSC chain of custody, and FORESTCARE certifications.

4.5 FMA Renewal

Millar Western's FMA 9700034 was first awarded in May 1997 and set to expire in April of 2014. As the FMA area is a significant source of its overall fibre requirements, its renewal for another 20-year period was a major priority for the company.

Millar Western began the renewal process with the submission of the FMA Accomplishment Report on June 25, 2010. The report, which was developed according to guidelines set out in Alberta Sustainable Resource Development's (SRD) *Policy and Process for Forest Management Agreement Renewal (September 21, 2005),* summarized the main events associated with the operations linked to Millar Western's Whitecourt FMA area and provided information about the company's performance in meeting FMA expectations. Though focusing on the reporting period of 1997 through 2006, the report updated certain statistical data and other information to 2009, to demonstrate trends and continuity.

In addition to submitting an accomplishment report, the FMA renewal process involved a number of meetings between Millar Western and GoA over a two year period to review and revise the FMA.

On April 2, 2014, the Alberta government advised Millar Western that its FMA had been renewed to April 20, 2034, granting continued right to harvest timber on the FMA area for an additional 20 years. While no changes were made to the FMA area boundaries, the new agreement differs from the old in several key respects. The format and content have been revised to be more consistent with those of other FMAs in the province. Old or obsolete commitments, such as the requirement to build a veneer plant, have been removed, and certain obligations, such as minimum annual research expenditures, have been redefined.

4.6 Fox Creek Sawmill Fire and Rebuild

On August 29, 2008, just over a year after it was purchased, Millar Western's Fox Creek sawmill was lost to an electrical fire that started in the control centre for one of the primary breakdown units. Shortly after the fire, the Fox Creek operation was been shut down. Most mill employees were offered employment at other Millar Western sites, or were successful in finding work elsewhere.

On June 18, 2010, Millar Western announced plans to build an advanced-technology replacement at Fox Creek, Alberta, with a design capacity of 117 million board feet of lumber per year, more the twice that of the original mill. It was expected the new $60 million mill would employ approximately 55 people full-time, working on a single-shift basis. The full project scope included construction of a new sawmill, upgrades to the site's existing planer mill, installation of dry kilns, and site improvements to enhance log storage and handling and fire suppression capability. The sawmill design incorporated two primary breakdown lines, one for large logs and one for small logs, to provide for efficient processing of the operation's timber supply. The mill was built with state-of-the-art technology to achieve optimal lumber recovery and accommodate the production of a range of specialty wood products, in addition to dimension lumber.

The Fox Creek reconstruction was substantially completed in 2011 and started production by the end of the year, with the upgraded planer mill starting up in early 2012. Today, the mill is producing 120 million board feet of lumber per year. The fibre for this mill is provided for through a combination of logs sourced from Millar Western's FMA and quota tenures as well as a fibre supply agreement with a neighboring FMA holder.

4.7 Decommissioning of the Fox Creek Burner

When Millar Western purchased the Fox Creek sawmill in 2007, it inherited a beehive burner that had been granted a permit to operate until the end of 2014. Millar Western applied for and was granted a Certificate of Variance (CoV) from the Alberta government, allowing the burner to continue to operate for another 18 months, to July 1, 2016, until a new wood waste disposal strategy could be implemented.

After completing a number of capital improvements at the site, adding a new loading area and converting the burner into a hog-storage silo, Millar Western began conveying all of Fox Creek's wood waste, which amounted to 65,000 green metric tonnes annually, to Whitecourt Power, which was already receiving all of the biomass from its Whitecourt site. This made Millar Western the sole supplier of wood residuals to Whitecourt Power's 25 MW plant. Having successfully found a use for its waste materials, Millar Western was able to decommission the Fox Creek beehive burner by July 1, 2016, in accordance with the terms of the CoV.

5. Lessons Drawn from the Previous DFMP

Committed to the concepts of adaptive management and continuous improvement, Millar Western works to enhance its practices based on experience, consultation and research. This involves evaluation of its own performance as well as participation in diverse industry associations and regular outreach to stakeholders. In the course of developing and implementing the 2007-2016 DFMP, Millar Western has made observations and drawn conclusions that have informed the development of the 2017-2027 DFMP and will guide its implementation.

5.1 Planning Process

The development of the 2007-2016 DFMP involved a larger PDT, including a Steering Committee, Impact Assessment Groups, Landscape Project Groups and a Peer Review Group. For the 2017-2027 DFMP, Millar Western streamlined project leadership, forming a core plan development team with subject-matter experts, and reaching out to other authorities as required. Not only was this more cost-effective, but it allowed for a more efficient decision making process. As well, Millar Western sought agreement in principle (A-I-P) at more frequent junctures in plan development. Though not final approval, A-I-Ps provided greater assurance that the project was proceeding in accordance with government expectations, reducing the likelihood that major revisions would be required after submission.

5.2 Research Initiatives

As a relatively small company, Millar Western's capacity to undertake research initiatives on its own is limited. It did, however, participate in a several ambitious academic-based initiatives such as FORWARD and the Biodiversity Assessment Project (BAP), to assess harvesting impacts on, respectively, watersheds and biodiversity, in conjunction with the development of the last DFMP. Though these projects were considered innovative at the time, they proved challenging in terms of delivering practical direction at the operations level. Since then, Millar Western has elected to direct its resources to established associations specializing in direct and applied research. As outlined in greater detail in Chapter 8, this includes support of organizations such as NCASI, FPInnovations and, recently, Ducks Unlimited. This approach allows Millar Western to leverage its research investments by pooling them with other contributors and fund a greater spectrum of initiatives that have the potential to improve its forest management and manufacturing operations on a broader scale.

5.3 Operationalizing the DFMP

In developing a high level strategic forest management plan, it is important to ensure that mechanisms are in place to allow objectives to be carried over into operational plans. Among these mechanisms is amalgamation of all DFMP-related company commitments into a single document, Chapter 7, so they can be easily identified and addressed. A few opportunities for improving DFMP execution were identified during implementation of the 2007-2016 DFMP.

5.3.1 Net Landbase

One of the challenges encountered during operational planning associated with the 2007-2016 DFMP was learning that areas identified as part of the active landbase were in fact not harvestable. As a result, inoperable areas had to be deleted from operational plans, including land-use depletions, watercourse buffers, steep slopes and non-merchantable black spruce. While there are a few ways to reduce the impact of land withdrawals in the DFMP area, it is preferable to confirm active areas during the development of the net landbase.

To improve the process for defining the active landbase during development of the 2017-2027 DFMP, Millar Western enhanced the provincial stream layer to identify additional areas that would require OGR watercourse buffers. This was completed using the stream data that was collected during operational plans over the last 10 years. With respect to steep slopes, LiDAR information was utilized to identify and remove all areas that exceed 45% from the net landbase.

In order to better reflect the merchantability of black spruce across the landscape, Millar Western also conducted an analysis of black spruce stands that were harvested in the previous DFMP. This substantiated that moisture class could be used as an effective measure of both merchantable and non-merchantable black spruce stands. It is expected that these steps will reduce discrepancies between the net and active landbase and allow for a smoother transition between strategic and operational planning.

5.3.2 Minimum Harvest Age

Through Millar Western's juvenile sampling program, conducted to produce yield curves for stands not covered under the RSA sampling program but known to be growing better than natural stands, it has been substantiated that regenerated stands can be operated at ages younger than planned for in the past. One main issue constraining the conifer AAC in W13 over the past two DFMPs has been the age class gap that presents itself in approximately 2055, where there is a lack of growing stock for about a twenty year period. Quantifying that stands are available at a lower minimum harvest age from a merchantability perspective and pursuing approval to harvest a portion of these stands has helped address the age class gap.

As well, it has also been found through operations that some natural stands can be harvested below 80 years old. These have been field checked and included in the 20 year shs. This also helps address the age class gap whereby increasing the amount of stands that can be operated leading up to 2055, helping maintain a higher aac than if they weren't able to be sequenced.

5.3.3 Sequencing of Stands

The 2007-2016 DFMP was the first Millar Western DFMP to have a ten-year spatial harvest sequence (SHS) developed developed under the GoA Planning Standard …. Even though efforts were made to operationalize that SHS, there was less knowledge at that time, on the requirements that would be placed on following the SHS, than we know today. To this end, Millar Western has put more emphasis on developing a SHS that will be operable, through field validation and scrutiny of the AVI stand detail. It is acknowledged though that there will still be some lands that will be deleted at the time of harvest layout for reasons such as steep slopes and unidentified watercourses, stands incorrectly identified in the AVI and stands not meeting merchantability specs as it is not possible to assess every hectare in the detail required to ensure 100% operability.

5.3.4 Composite Stratification Rules

The 2007-2016 DFMP stratification used composite rules for some strata where AVI overstory and understory attributes were combined into a blended stand condition for selected strata. In the pine-black spruce mixedwoods, this classified upland pine stands with black spruce understory into pure black spruce stands. Many of these stands were comprised mostly of mature pine, which were by-passed for harvesting due to the black spruce not being merchantable.. This also caused problems for silviculture as these stands were required to be converted to pure black spruce. In the 2017-2027 DFMP, MWFP dropped composite rules for stratification.

5.3.5 Updated AVI (ecosite, improved heights, higher resolution imagery)

With the last two DFMPs being based on an AVI produced in the mid 90s, it was determined that an update to the AVI was necessary. Technological advances in inventory technique (3D softcopy) with high resolution imagery and LiDAR for improved heights provided a more accurate inventory from which to base and make decisions. As well, ecosite was also calculated as part of the new AVI, which aided in determining which stands should be removed from the net landbase based on ecological constraints of the stand. A case in point was the deletion of stands with a moisture code greater than 70%, which removed much of the wetter site black spruce stands which were included in the net landbases in previous plans. MWFP conducted field verification for operability thresholds of the ecosite based moisture code assignment which demonstrated the value of this attribute and the improvement over the TPR based rules traditional employed.

5.3.6 Structure Retention

While the structure retention strategy developed under the previous DFMP had a strong link to the Biodiversity Assessment Project (BAP), it lacked implementation strategies. The result was that Millar Western planning staff had a difficult time implementing these strategies during the operational planning process. For this reason, Millar Western has ensured that the structure retention strategy not only states the expected target but also the process to identify, monitor and report on this target.

5.4 Focus on Core Business

The 2007 – 2016 DFMP had a large emphasis on determining processes to identify and quantify impacts to biodiversity, as well as discussing issues such as climate change and population growth impacts. With the GoA having developed habitat models for use in DFMP planning, Millar Western discontinued the application of its own tools and was able to focus more on considering scenarios to address fibre supply which did not receive as much attention in the previous plan. This helped put a focus on placing emphasis on areas such as minimum harvest age and the spatial harvest sequence review.

5.5 Social License

As a family-owned company that has been in operation in northwest Alberta for more than a century, Millar Western places great importance on maintaining its social license to operate. Not only is approval and support important to maintaining access to public resources but to accessing markets that place a premium on sustainable forest management.

Since the last DFMP, Millar Western has combined separate mill and woodlands consultation groups into a new Public Advisory Committee (PAC), to promote open communication with stakeholders and foster greater understanding of the company's efforts to manage its operations in a responsible manner. Still in existence today and meeting regularly, PAC maintains strong regional representation and has proven an effective vehicle for sharing with stakeholders information relating to company objectives and performance, as well as industry developments. Feedback from PAC members, as recorded in minutes, has been positive, with members stating a stronger appreciation for forest management obligations, investments and results due to their involvement in PAC. Based on its success, Millar Western intends to sustain its PAC for the term of the 2017-2027 DFMP.

Millar Western's desire to build positive working relationships extends to First Nations communities in and around its operations. The company consults with First Nations on strategic and operational forest management plans, in accordance with government requirements. Given that some interactions are more successful than others, Millar Western is in the process of developing engagement policies and frameworks, with a view to enhancing mutual understanding and identifying opportunities for dialogue and cooperation.

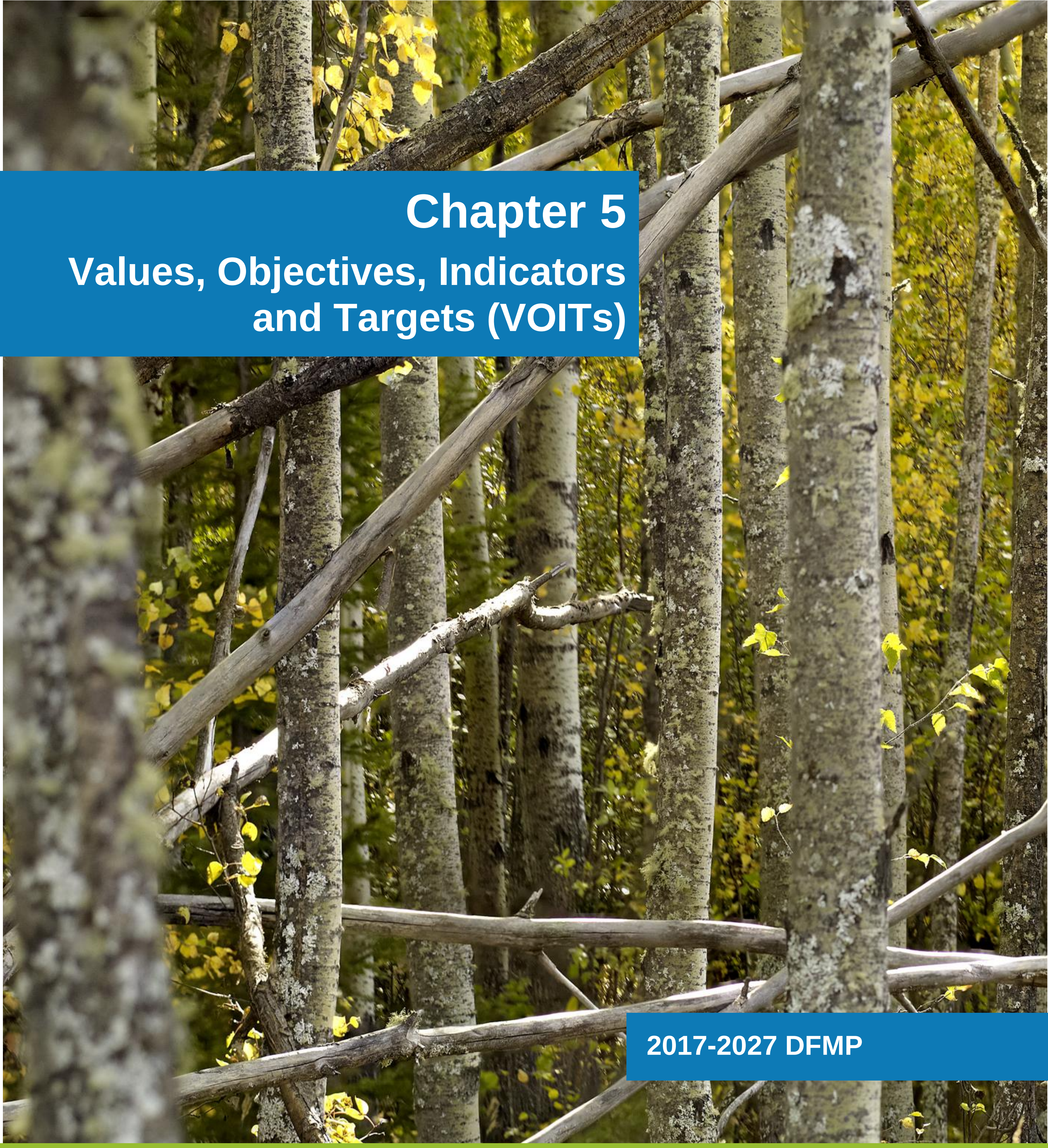
In addition ongoing consultation, Millar Western has taken other steps to be a good corporate citizen and maintain its social license to operate on the land base, including the following:

- maintaining compliance with all relevant legislation and other government policies and directives;
- sustaining certification under internationally recognized, independent certification programs: the SFI SFM standard, as well as the PEFC and FSC chain of custody standards;
- creating a safe, respectful, diverse and collaborative workplace that provides industry-leading compensation and rewarding careers for its employees;
- promoting forest management milestones, such as an event in 2016 to celebrate the planting of the company's 200 millionth tree seedling, which was attended by the Minister of Agriculture and Forestry and Chief Tony Alexis of the Alexis Nakota Sioux Nation;
- participating in educational initiatives at the Huestis Demonstration Forest, located on Millar Western's FMA, that inform younger generations about sustainable forest management and promote careers in forestry;
- investing in projects that improve the company's environmental performance, including construction of an innovative bioenergy plant that converts pulp mill effluent into bioenergy, to reduce consumption of energy derived from fossil fuels and reduce greenhouse gas emissions;
- supporting scholarships at several post-secondary educational institutions (University of Alberta NAIT, MacEwan University) and funding of the Alexis-Millar Western scholarship program that, each year, provides six scholarships valued at $1,000 each to community members seeking higher education;
- investing in projects that enhance the quality of life in communities where Millar Western operates, including a $1 million contribution to the construction of the Allan and Jean Millar Centre in Whitecourt; and,
- maintaining involvement in industry associations such as the Alberta Forest Products Association and the Forest Products Association of Canada, which work to promote the sector's reputation as a global leader in sustainable development and establish Canadian forest products as responsible choices in markets world-wide.

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

--

\\silver\clients\MWFP\Projects\P755_DFMP\Ch4_PrevFMP\Ch4_PrevDFMP_20170905_Submit.docx



Chapter 5

Values, Objectives, Indicators and Targets (VOITs)

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

List of Tables

List of Figures

1. Introduction

Assembling and verifying the Values, Objectives, Indicators and Targets (VOITs) are among the first steps in DFMP development, and the most important. The VOITs not only shape the preferred forest management strategy (PFMS) but serve as a tool to measure the success of DFMP execution. The VOITs establish linkages between social, economic and ecological values identified for the DFMP area and their application in forest management activities.

The Government of Alberta (GoA) prescribes the minimum VOITs required for forest management plans through the Alberta Forest Management Planning Standard version 4.1 (Planning Standard), which is revised on an ongoing basis to reflect policy updates. With government approval, FMA holders can modify or add to these VOITS, to address values and objectives specific to their operating area.

Millar Western first incorporated VOITs into its planning process during the development of the 2007-2016 DFMP. The Plan Development Team (PDT) began the process of developing VOITs for the 2017-2027 DFMP by modifying earlier VOITs to reflect current government expectations and other developments in sustainable forest management. Input from stakeholders and First Nations was also sought and incorporated. Note that plan commitments, including those derived from VOITs, are consolidated in Chapter 7, DFMP Implementation.

1.1 Development Approach

Millar Western's approach to VOIT development was to involve a broad range of stakeholders to ensure the DFMP incorporated new government expectations, multiple perspectives, emerging science, and regional forest management priorities, as identified through consultation. The PDT first compared the 2007-2016 VOITs against the current Planning Standard, as well as to other DFMPs recently completed by other forest companies. Each VOIT underwent extensive review and discussion at the PDT meetings and, if necessary, was amended to comply with new policies or directives, and/or ensure clarity and practicality of obligations, including monitoring and reporting requirements. 20 VOITs from the 2007-2016 DFMP were deleted due to obsolescence.

A draft of the 2017-2027 VOITs was shared with stakeholders and First Nations through separate consultation processes that were initiated in May 2015. As described in greater detail in *Chapter 2 – DFMP Development*, the draft VOITs were vetted by Millar Western's Public Advisory Committee (PAC) and made available at open houses in Whitecourt, Fox Creek, Swan River and Ft. Assiniboine. First Nations consultation was conducted according to the requirements established by the Province's Aboriginal Consultation Office (ACO).

At the conclusion of the consultation processes, the VOITs were submitted to the GoA for Agreement-In-Principle (A-I-P).

1.2 Agreement in Principle

The full set of VOITs was agreed upon at PDT meeting #9, held on November 27, 2015, and then submitted to GoA for Agreement in Principle, which was granted on March 2, 2016. The final complete set of VOITs will be reviewed again by the GoA as part of the DFMP approval process.

1.3 VOIT Development Progress and Status Summary

This section summarizes the key interactions in the development and acceptance of VOITs. As noted, the VOITs were discussed at PDT meetings #2 through #10 (February 23, 2015 to January 15, 2016), while proposed VOITs specific to aboriginal issues were revisited in PDT meetings #14 and #15 (May 27 and June 22, 2016).

Please note that the original (2007-2016 DFMP VOIT reference numbers (Old VOIT #s) were revised to account for the deletion, splitting and addition of VOITs. The old and new VOIT reference numbers are shown in Appendix I and in the section of this chapter that details the development of each individual VOIT. As well, some of the generic VOIT descriptors were updated to make them more relevant to the DFMP area.

February 20, 2015 – MWFP completed an internal review of VOITs 1 through 10, which were then presented at PDT meeting #2.

February 23, 2015 – MWFP presented drafted VOITs 1 through 10 at PDT meeting #2. A series of tasks were assigned for clarification and further input on VOITs reviewed.

March 3, 2015 – MWFP completed an internal review of the remaining VOITs, which were then presented at PDT meeting #3.

March 27, 2015 – MWFP presented draft VOITs at PDT meeting #3. The PDT compared the GoA's current Planning Standard VOITs, MWFP's 2007-2016 DFMP VOITs, Weyerhaeuser's draft VOITs, and Manning Diversified Forest Product's 2012 VOITs. For the FMP VOITs derived from forecasting, MWFP proposed to address GoA's requirement to determine and apply the previous 10-year status to DFMP development by comparing the forecasted 2017 values to the 2017 targets derived from the 2007 DFMP. MWFP would report these VOITs only during FMP development but not in future stewardship reports. John Stadt (GoA provincial forest ecologist) reported that GoA had reviewed this request and that it would likely be acceptable.

April 24, 2015 – MWFP presented draft VOITs at PDT meeting #4. VOITs were reviewed and feedback was provided. VOITs that were unanimously accepted by the PDT were marked as "Agreed Upon" (noted in the Appendix I table), with the understanding that they would not be revisited unless concerns were brought forward, in which case the VOIT will be "Re-opened". VOITs that, with PDT consensus, were not carried forward were marked as "Dropped".

June 5, 2015 – MWFP presented draft VOITs at PDT meeting #5: VOITs 2-27 were reviewed; VOITs 18 and 19 were discussed in detail with the GoA's Senior Forester, Silviculture Practice. A series of tasks were assigned for clarification, and further input on VOITs was reviewed.

June 29, 2015 – MWFP presented draft VOITs at PDT meeting #6, where all remaining VOITs were reviewed. A series of tasks were assigned, seeking clarification on certain issues, and further input on VOITs was reviewed.

August 28, 2015 – MWFP presented draft VOITs at PDT meeting #7; all remaining VOITs were reviewed. A series of tasks were assigned, seeking clarification on certain issues, and further input on VOITs was reviewed. It was agreed that MWFP would submit wording of the VOITs to the GoA for Agreement in Principle. It was noted that some values (left blank in the table) would need to be populated at a later time in the DFMP process, pending completion of the timber supply analysis (TSA) from the PFMS.

October 16, 2015 – MWFP presented draft VOITs at PDT meeting #8; all remaining VOITs were reviewed. A series of tasks were assigned, seeking clarification on certain issues, and further input on VOITs was reviewed.

November 30, 2015 – MWFP presented draft VOITs at PDT meeting #9; all remaining VOITs were reviewed and agreed upon. A series of tasks were assigned, seeking clarification on certain issues, and further input on VOITs was reviewed. The meeting was the last to address the draft VOITs. A commitment was made to compile and distribute the final VOITs table to the PDT.

January 26, 2016 – MWFP submitted the 2017-2027 DFMP VOITs to the GoA for A-I-P.

March 2, 2016 – The GoA granted MWFP A-I-P for the 2017-2027 DFMP VOITs.

April 22, 2016 – MWFP presented VOIT 34 (Impacts to identified cultural and significant sites and features) to the PDT, which received agreement from the PDT. This VOIT had also been presented to the GoA's Aboriginal Consultation Office and found to be acceptable.

May 27, 2016 – At PDT meeting #14, MWFP presented new wording for the Aboriginal-specific VOITs, so they would align with new GoA direction for Aboriginal and Métis terminology. It was agreed that the revised VOITs would not be submitted for A-I-P but, rather, included as part of the final DFMP.

June 22, 2016 – The Aboriginal-specific VOITs were discussed at PDT meeting #15. It was agreed that the original VOITs would remain as submitted for A-I-P, while the new VOIT would appear as first written.

2. VOIT Summary Table

Table 5-1 provides a summary of the 2017-2027 DFMP VOITs; this table should be used as reference only. A more detailed description of the VOITs is provided in Section 3.

Table 5-1. VOIT summary table

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
CCFM Criterion 1 - Biological Diversity										
CSA SFM Element - 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)										
Value - 1.1.1 Landscape scale biodiversity.										
1	1.1.1.1 Maintain biodiversity by retaining the full range of cover types and seral stages.	Area of Old, Mature and Young forest by FMU by Broad Cover Group.	In 2027 achieve**:** a) Gross forested landbase: greater than 4% in W11 and 6% in W13 for old forest, greater than 32% in W11 and 35% W13 for mature plus old forest, and less than 27% in W11 and 31% in W13 for young forest; b) Active forested landbase: greater than 6% in both FMU W11 and W13 for old forest, greater than 35% in W11 and 33% in W13 for mature plus old forest, and less than 22% in W11 and 33% in W13 for young forest. Note: Old forest retention shall include the full natural range of ages.	Targets and seral stage definitions shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes. Target shall ensure representation of natural range of ecosystem attributes (e.g., productivity class).	Planning Standard.	Spatial Harvest Sequence (SHS).	Regular updates to inventory.	**2017 DFMP**: Tables of indicators at ages of 0, 10, 50, 100 and 200 years. Maps of indicators at 0, 10 and 50 years. Compare landbase of the 2007 DFMP at the year 2017 to the 2017 DFMP landbase. **Stewardship Reporting:** None. **Other:** Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP. **Data Source:** FMA holder only.	Area (ha) of old and mature forests in each FMU by broad cover group shall be between 90% and 100% of target areas. Area of young forest in each FMU by broad cover group shall not exceed 110% of target area.	Adjust strategies in subsequent Detailed Forest Management Plans (DFMP).
2	1.1.1.2 Maintain biodiversity by avoiding landscape fragmentation .	a) Range of opening patch sizes by FMU for the gross landbase.	a) A distribution of harvest area sizes that will result in a opening patch size pattern over the 200 year planning horizon approximating patterns created by natural disturbances.	Targets shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes. Target shall ensure representation of natural range of ecosystem attributes (e.g. cover class and productivity class).	Planning Standard.	Spatial Harvest Sequence.	Regular updates to forest inventory.	**2017 DFMP:** Tables of area of forest in each opening patch size class by FMU at 0, 10, and 50 years. Maps of patch size classes at 0, 10, and 50 years. Compare landbase of the 2007 DFMP at the year 2017 to the 2017 DFMP landbase. **Stewardship Reporting:** None. **Other:** Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP. **Data Source:** FMA holder only.	+/- 10% opening patch area, or progress to achieving the 200-year planning horizon target is demonstrated.	Adjust strategies in subsequent DFMPs.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
3	1.1.1.2 Maintain biodiversity by avoiding landscape fragmentation .	b) Area of old interior forest by FMU.	At the start of the 2027 Timber Year, achieve the target proportions of old interior forest by FMU as defined in target tables in 2017 DFMP.	Targets shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes. Target shall ensure representation of natural range of ecosystem attributes (e.g. productivity class).	Planning Standard.	Spatial Harvest Sequence.	Regular updates to forest inventory.	**2017 DFMP:** Tables of area of old interior forest by FMU at 0, 10, and 50 years. Maps of old interior forest at 0, 10, and 50 years. Compare landbase of the 2007 DFMP at the year 2017 to the 2017 DFMP landbase. **Stewardship Reporting:** None. **Other:** Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP. **Data Source:** FMA holder only.	Minimum of 80% of the target value.	Adjust strategies in subsequent DFMPs.
4	1.1.1.3 Maintain biodiversity by minimizing access.	Permanent all-weather forestry road density by FMU.	At the start of the 2027 Timber Year, the target permanent all-weather forestry road densities within the FMU are: - W11: < 0.079 km/km^2 - W13: < 0.283 km/km^2	Targets shall be based on sound science, ecological considerations, harvest planning, wildlife zones, and social values.	Planning Standard.	Coordinating access with other resource users, road closures and decommissioning.	Regular updates to DIDs.	**2017 DFMP:** Amount of permanent all-weather forestry road density by FMU at 0 and 10 years. Map of existing and proposed permanent all weather forestry roads. **Stewardship Reporting:** Table of permanent all-weather forestry road density by FMU. **Other:** None. **Data Source:** All Operators.	A variance not exceeding +20% must be achieved.	Adjust strategies in subsequent DFMPs.
5	1.1.1.3 Maintain biodiversity by minimizing access.	Open seasonal / temporary forestry road length in kilometers by FMU.	Less than 100 km for FMU W11; Less than 220 km for FMU W13.	Analysis of number of kilometers of open seasonal/temporary forestry roads for each timber year for each FMU.	Planning Standard.	Road construction, maintenance and reclamation activities.	Road plan (Operating Ground Rule) OGR 11.2.	**2017 DFMP:** None. **Stewardship Reporting:** Table of open seasonal/temporary forestry roads for each timber year for each FMU. **Other:** None. **Data Source:** FMA holder only.	< 20 % in excess of the target within each FMU.	Adjust strategies in subsequent AOPs.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
6	1.1.1.4 Maintain plant communities uncommon in FMU or province.	Actions taken based on the direction received from ACIMS to maintain uncommon plant communities where identified.	When uncommon plant communities are identified, proceed accordingly using guidance from the Alberta Conservation Information Management System (ACIMS) on 100% of the sites.	Alberta Conservation Information Management System (ACIMS) plant community classification and tracking list. Predict and identify occurrence of uncommon plant community.	Planning Standard.	Coordinating with other resource users, spatial planning of harvest and road construction, OGR.	Periodic updates to inventory.	**2017 DFMP:** Table with descriptive list of identified uncommon plant communities known to exist on the DFMP Area. **Stewardship Reporting:** summary of actions taken, based on the direction received from ACIMS, in the areas where uncommon plant communities have been identified. **Other:** None. **Data Source:** FMA holder only.	None.	Adjust strategies in subsequent DFMPs.
7	1.1.1.5 Maintain unique habitats provided by wildfire and blowdown events.	Area of unsalvaged burned forest that is salvagable.	<u>Fires<1000 hectares of Productive Landbase:</u> Follow FMP structure retention strategy consistent with normal harvesting practices. <u>Fires>1000 hectares of Productive Landbase:</u> Retain all unburned trees in green islands and retained patches recognizing timber condition, access, non-timber needs.	Targets based on "Fire Salvage Planning and Operations - Directive No. 2007-01" Ensure consistency with FireSmart objectives.	"Fire Salvage Planning and Operations - Directive No. 2007-01".	Salvage planning.	Organization reports, FHPs.	**2017 DFMP:** Table and map of fire disturbance history since 2007 by FMU and the percent salvagable and salvaged in the productive landbase. **Stewardship Reporting:** Table and map of fire disturbance history by FMU and the percent salvagable and salvaged in the productive landbase where applicable. **Other:** None. **Data Source:** FMA holder only.	At the end of the 10-year FMP term the target is achieved or exceeded.	Adjust strategies in subsequent AOPs.
8	1.1.1.5 Maintain unique habitats provided by wildfire and blowdown events.	Area of unsalvaged blowdown forest that is salvagable.	In areas of significant (>=100 ha) salvagable blowdown a minimum of 10% will be left unsalvaged.	Targets are to be based on sound science, ecological considerations and disturbance regimes.	Planning Standard.	Salvage planning.	Final Harvest Plans.	**2017 DFMP:** None. **Stewardship Reporting:** Table of blowdown disturbance history by FMU and the percent salvagable and salvaged in the productive landbase where applicable. **Other:** None. **Data Source:** FMA holder only.	At the end of the 10-year DFMP term the target is achieved or exceeded.	Adjust strategies in subsequent AOPs.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
9	1.1.1.6 Retain ecological values and functions associated with riparian zones.	Compliance with Operating Ground Rules (OGR).	No warnings or penalties assessed regarding riparian zones.	OGR.	Federal Fisheries Act, Water Act.	Planning, OGR.	Compliance reporting systems.	**2017 DFMP:** None. **Stewardship Reporting:** Summary of warnings or penalties assessed regarding riparian zones. **Other:** None. **Data Source:** FMA holder only.	No variance.	Immediate remedial action and / or administrative penalty.
Value - 1.1.2 Local/stand scale biodiversity.										
10	1.1.2.1. Retain stand level structure.	a) Percent of volume with merchantable residual structure within the harvested area, representative of the status, sizes, and species of the overstory trees within the harvested areas on the FMU.	A combination of merchantable single stems, clumps, and patches, that are representative of the stands harvested, comprising 3% of the harvested volumes within the FMU area. Note: A wide range in variability in harvest area-level retention is desired as long as the target level is achieved.	Wildlife zones, roadside vegetation screens, recreational values, aesthetics, local knowledge, ANHIC, Biodiversity / Species Observation Database (BSOD).	Occupational Health and Safety Act, Forest and Prairie Protection Act.	Implement residual structure retention strategies in OGRs.	Organization reports, air photo interpretation, ground surveys, post harvest assessments.	**2017 DFMP:** None. **Stewardship Reporting:** Table of the percent of structure retention in harvest areas on the FMU area. **Other:** None. **Data Source:** All operators.	Annually (+/-) 50% of target. At stewardship level (+/-) 20% of target.	Adjust strategies in subsequent DFMPs.
11	1.1.2.1 Retain stand level structure.	b) Percentage of harvested area within the FMU with downed woody debris equivalent to preharvest conditions.	b) 75% or more of the harvest areas will not receive treatments that reduce downed woody debris retained on site (e.g. brush raking, prescribed burns).	Targets are to be based on sound science, ecological considerations, disturbance regimes, fire regulations, and silvicultural requirements.	Planning Standard.	Minimize the occurrences of harvest area debris removal treatments (other than roadside slash).	ARIS, company silviculture record system.	**2017 DFMP:** None. **Stewardship Reporting:** Table with the percent of the harvest areas that did not receive treatments that reduce downed woody debris. **Other:** None. **Data Source:** FMA holder only.	None.	Adjust strategies in subsequent DFMPs.
12	1.1.2.2 Maintain integrity of sensitive sites.	Sensitive sites (e.g. mineral licks, raptor nests, bear dens, unique ecological areas, etc.) by FMU.	Protect and report on all identified sites.	Local knowledge, FHPs.	Planning Standard.	Organization developed standards for sensitive site protection, OGRs.	Final Harvest Plans.	**2017 DFMP:** None. **Stewardship Reporting:** Summary of indentified sites. **Other:** None. **Data Source:** FMA holder only.	None.	Adjust strategies in subsequent DFMPs.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
13	1.1.2.3 Maintain aquatic biodiversity by minimizing impacts of water crossings.	Forestry water crossings in compliance with Code of Practice for Water Course Crossings within each FMU.	No warnings or penalties for non-compliances for the Code of Practice or OGRs for water course crossing.	Code of Practice for Water Course Crossings: Sections 7 - 9 and Schedule 2.	Code of Practice for Water Course Crossings.	Road construction, maintenance and reclamation activities.	Road plan and OGR (Watercourse Crossings).	**2017 DFMP:** None. **Stewardship Reporting:** Summary of warnings and penalties related to non-compliance with Codes of Practice for Water Course Crossings. **Other:** None. **Data Source:** FMA holder only.	None.	Act immediately to eliminate problems and adjust strategies in subsequent DFMPs.
CSA SFM Element - 1.2 Species Diversity: Conserve species diversity by ensuring that habitats for the native species found in the DFA are maintained throughout time.										
Value - 1.2.1. Viable populations of identified plant and animal species.										
14	1.2.1.1 Maintain habitat for identified high value species (i.e., economically valuable, socially valuable, species at risk, species of management concern).	a) Existence of a grizzly bear strategy to guide forest management activities for the DFMP Area; b) percent change in the Barred owl RSF habitat value and potential breeding pairs habitat value from 2017 by FMU; c) percent change in American marten habitat suitability value from 2017 by FMU; and d) percent change in relative abundance value of five songbird species (Canada Warbler, Black-throated Warbler, Brown Creeper, Bay-Breasted Warbler and Ovenbird) from 2017 by FMU.	a) To have the strategy developed and implemented upon DFMP approval; b) maximum 15% reduction in the RSF indicators at 10 and 20 years and a maximum 15% reduction in the breeding pairs indicator at 10 and 20 years; c) maximum 15% reduction in the indicator over the 200 year planning horizon; and d) maximum 15% reduction in the indicator over the 200 year planning horizon.	Habitat modeling (provided by the Government of Alberta (GoA)).	Recovery plans for species at risk, Federal Species at Risk Act.	Spatial Harvest Sequence. fRI Research Sightability Tool.	Updates to vegetation inventory and habitat modeling.	**2017 DFMP:** a) The Grizzly bear strategy documented in the DFMP submission; b) tables of RSF and breeding pairs at 0, 10, and 20 years and maps of RSF value and breeding pairs at 0, 10 and 20 years; c) tables of habitat suitability at 0, 10, 20, 50, 100 and 200 years and maps of habitat suitability at 0, 10, 20 and 50 years; d) tables of relative abundance at 0, 10, 20, 50, 100 and 200 years and maps of relative abundance at 0, 10, 20 and 50 years; **Stewardship Reporting:** None **Other:** Compare suitable habitat of the 2017 DFMP landbase at the year 2027 to the suitable habitat of the 2027 DFMP landbase. **Data Source:** FMA holder only.	At the end of the 10-year DFMP term the target is achieved or exceeded.	Adjust strategies in subsequent DFMPs.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
CSA SFM Element - 1.3 Genetic Diversity: Conserve genetic diversity by maintaining the variation of genes within species.										
Value - 1.3.1. Genetic integrity of natural tree populations.										
15	1.3.1.1. Retain "wild forest populations" for each tree species in each seed zone through establishment of in-situ reserves, where an approved controlled parentage program (CPP) is in place.	Number and area (ha) of in situ genetic conservation areas.	Each seed zone that occurs in the Millar Western FMA area, that requires a conservation area, will have one or more genetic conservation areas established, but those areas may not necessary be on the Millar Western FMA.	Direction and detail as per FGRMCS Section 20.0, "In-situ Gene Conservation", in consultation with the other associate FMA holders participating in a CPP plan.	Standards regulated through Timber Management Regulation 144.2 and the FGRMCS.	Conservation areas are designated by a notation (e.g. PNT, CNT).	Periodic assessment of condition of stands contributing to in-situ tree gene conservation reserves. (e.g. photos or AVI).	**2017 DFMP:** Table showing number of genetic conservation areas required in each seed zone and number provided in FMA. Map showing locations of genetic conservation areas. **Stewardship Reporting:** Report number of hectares of in-situ gene conservation reserves within FMA. **Other:** None. **Data Source:** FMA holder only.	None. Achieve establishment and mapping of in-situ tree gene conservation reserves prior to the end of the first stewardship period.	None.
16	1.3.1.2 Retain wild forest genetic resources through ex-situ conservation for species under CPP programs.	Provenances and genetic lines in gene banks and trials; seedlots in archive.	Active conservation program for all species on the FMA that have a tree improvement program.	In cooperation with the GoA and in accordance with the Alberta Forest Genetic Resource Management and Conservation Standards (Sections 17 & 29).	Standards regulated through Timber Management Regulation 144.2 and the FGRMCS.	Alberta Forest Genetic Resource Management and Conservation Standards and government / industry genetic cooperatives.	Conservation activities related to the FMA are carried out by the GoA and Companies involved in Controlled Parentage Plans.	**2017 DFMP:** Planned Conservation activities specific to Controlled Parentage Plan (CPP) Region. **Stewardship Reporting:** Five year reporting in cooperation with the GoA on activities and amounts for each CPP Region required under section 17 and 29 of the Alberta Forest Genetic Resource Management and Conservation Standards. **Other:** None. **Data Source:** FMA holder only.	None.	Adjust strategies in future FMPs.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
CSA SFM Element - 1.4 Protected Areas: Respect protected areas identified through government processes.										
Value - 1.4.1. Areas with minimal human disturbances within managed landscapes.										
17	1.4.1.1 Integrate trans boundary values and objectives into forest management.	Stakeholder consultation.	Ongoing consultation with relevant protected areas agencies as required.	Outcome of consultation processes.	Planning Standard.	Management planning and Operation Planning.	Documentation of consultation processes.	**2017 DFMP:** Identify and implement known processes. **Stewardship Reporting:** Summary of the status of protected areas. **Other:** None. **Data Source:** FMA holder only.	None.	Adjust strategies in subsequent DFMPs.
CCFM Criterion 2 - Ecosystem Productivity										
CSA SFM Element - 2.1 Ecosystem Resilience:										
Value - 2.1.1 Reforested harvest areas.										
18	2.1.1.1 Reforest all harvested areas.	Annual % of openings that: a) meet or exceed the RSA establishment survey minimum stocking and species composition standards for the declared regenerated yield stratum; and b) meet or exceed the RSA establishment survey minimum stocking and species composition standards for an alternate regenerated yield stratum; and c) do not achieve the RSA establishment survey minimum stocking and/or species composition standards for any regenerated yield strata and are re-treated within one year.Indicators a, b and c are to be reported separately.	The sum of Indicators a, b and c = 100% of openings.	Direction from the GoA.	Timber Management Regulations 141.6(1) and 141.6(2); Reforestation Standard of Alberta.	Implementation of silviculture strategies that ensure the target stocking and species composition is achieved for the opening.	RSA establishment survey protocols.	**2017 DFMP:** None. **Stewardship Reporting**: Summarize the RSA establishment survey minimum stocking and species composition standards for the declared regenerated yield stratum and alternative regenerated yield stratum, as well as what it does not achieve. **Other:** None. **Data Source:** FMA holder only.	None.	Adjust silviculture strategies.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
19	2.1.1.2 Meet or exceed the C and D MAI standard for the population of openings surveyed in a given quadrant.	Summed difference between target and actual C and D MAIs for openings surveyed in a five year quadrant, as reported to ARIS.	100% of target.	Direction from the GoA.	Timber Management Regulation 141.7(1) and 141.7(2); Reforestation Standard of Alberta.	Implementation of silviculture strategies that ensure the target productivity is achieved for the population of openings.	RSA performance survey protocols.	**2017 DFMP:** None. **Stewardship Reporting:** Summarize the difference between target and actual C and D MAIs for openings surveyed in a five year quadrant, as reported to ARIS. **Other:** None. **Data Source:** FMA holder only.	Meet or exceed the target C and D MAI for the DFMP Area.	Adjust silviculture strategies and/ or the GoA adjusts AAC.
Value - 2.1.2 Maintenance of forest landbase.										
20	2.1.2.1 Limit conversion of productive forest landbase to other uses.	Amount of change in forest landbase.	Reporting the loss of the gross forest landbase area.	Forest inventory and land use data.	Planning Standard.	Promoting the minimization of non-forestry impacts to the landbase. Utilize a disposition tracking system.	GoA tracking of withdrawals and cancellations by FMA.	**2017 DFMP:** None. **Stewardship Reporting:** Number of dispositions and area of dispositions withdrawn from the managed landbase; number of dispositions and area of dispositions returned to the managed landbase; cumulative net managed landbase area withdrawn. **Other:** None. **Data Source:** FMA holder only.	Not Applicable.	Adjust net landbase projections in next TSA.
21	2.1.2.2 Recognize lands affected by insects, disease or natural events.	Amount of area affected by significant impacts of insects, fire, windthrow and other natural events.	Report the area (ha) affected by impacts of insects, fire, windthrow or other natural events.	GoA forest health surveys, inventory updates, fire reporting.	Planning Standard, Alberta Forest Health Strategy and Shared Roles and Responsibilities between the GoA and the Forest Industry.	Maintain up-to-date information.	GoA surveys with industry cooperation.	**2017 DFMP:** None. **Stewardship Reporting:** Summarize areas impacted by fire, insects, wind throw and other natural events. **Other:** None. **Data Source:** FMA holder only.	Report actual.	Event specific.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
Value - 2.1.3 Control invasive species										
22	2.1.3.1 Control non-native plant species (weeds).	Noxious weed program.	Noxious weed program in place and implemented.	Noxious weed directive 2001-06.	Directive 2001-06.	Noxious weed program.	Field surveys.	**2017 DFMP:** None. **Stewardship Reporting:** Reporting of control efforts. **Other:** None. **Data Source:** All Operators.	Report actuals.	Adjust noxious weed program if deficiencies are encountered.
CCFM Criterion 3 - Soil and Water Resources										
CSA SFM Element - 3.1 Soil quantity and quality - Conserve soil resources by maintaining soil quality and quantity.										
Value - 3.1.1 Soil productivity.										
23	3.1.1.1 Minimize impact of roading and bared areas in forest operations.	Silviculture strategy to reforest all in-block temporary roads within the harvest area.	Reforest all in-block temporary roads within harvest areas.	Direction from the GoA.	OGRs and Soils Guidelines.	Implement silviculture strategy to reforest all in-block temporary roads within the harvest areas.	Field inspection reports and audits.	**2017 DFMP:** None. **Stewardship Reporting:** None. **Other:** Inspection reporting only. **Data Source:** FMA holder only.	Not Applicable.	Adjust strategies in subsequent DFMPs.
24	3.1.1.2 Minimize incidence of soil erosion and slumping.	Number of incidences with respect to reportable soil erosion and slumping.	Zero (0) warnings or penalties assessed regarding soil erosion or slumping.	Direction from the GoA.	OGRs and Soils Guidelines.	Effective planning and supervision of operations and adherence to relevant OGRs.	Field inspection reports and GoA FOMP reports.	**2017 DFMP:** None. **Stewardship Reporting:** Reporting number of warnings or penalties regarding soil erosion or slumping. **Other:** None. **Data Source:** FMA holder only.	None.	Immediate remedial action to correct.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
Value - 3.2.1 Water quantity.										
25	3.2.1.1 Limit impact of timber harvesting on water yield.	Forecasted changes in water yields by watersheds, resulting from the approved SHS derived from ECA.	To develop a SHS where the predicted increase in watershed yield is < 30% in the majority of compartments.	Equivalent Clearcut Area (ECA) or other water yield modeling.	Water Act, Planning Standard.	Follow the SHS.	SHS area variance as per OGRs.	**2017 DFMP:** Forecasted ECA change by forest hydrology watershed. **Stewardship Reporting:** Area Variance to be reported by compartment or forest hydrology watershed. **Other:** None. **Data Source:** FMA holder only.	As per final approval of SHS area.	During SHS development, adjust SHS if required.
Value - 3.2.2 Effective riparian habitats.										
26	3.2.2.1 Minimize impact of operations in riparian areas.	Riparian buffers maintained as outlined in OGRs.	No warnings or penalties for non-compliances assessed regarding riparian zones.	Direction from the GoA.	OGRs.	Effective planning and supervision of operations and adherence to relevant OGRs.	Field inspection reports and GoA FOMP reporting.	**2017 DFMP:** None. **Stewardship Reporting:** Reporting of warnings and penalties related to non-compliances assessed regarding riparian zones. **Other:** None. **Data Source:** FMA holder only.	None.	Immediate correction and/or administrative penalty.
CCFM Criterion 5 - Multiple Benefits to Society										
CSA SFM Element - 5.1 Timber and non-timber benefits										
Value - 5.1.1 Sustainable timber supplies.										
27	5.1.1.1 Establish and implement appropriate AACs.	a) Compliance with Annex 1 of the Alberta Forest Management Planning Standard (April 2006), regarding the process for establishing appropriate AACs. b) Quadrant timber production.	a) Receive GoA approval of the AAC. b) Harvest 100% of periodic annual allowable cut (PAAC).	Alberta Forest Management Planning Standard (April 2006).	Forests Act and TMR.	a) Effective implementation of planning process. b) Cut control process.	a) Approval of the AAC. b) Timber Production and Revenue System (TPRS).	**2017 DFMP:** AAC. **Stewardship Reporting:** Reporting of quadrant production to date. **Other:** None. **Data Source:** All Operators (for stewardship report).	a) Not Applicable. b) 110% of approved PAAC.	a) Adjust AAC using most current and relevant information. b) Adjust harvest levels to achieve PAAC.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
CSA SFM Element - 5.2 Communities and Sustainability										
Value - 5.2.1 Risk to communities and landscape values from wildfire is low.										
28	5.2.1.1 To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing fire suppression capability.	a) Percentage reduction in Fire Behaviour Potential (FBP) area (ha) within the FireSmart Community Zone.	Reduce the area (ha) in the extreme and high FBP rating categories by 5% within the FireSmart Community Zone.	Wildfire threat assessment.	Planning Standard.	SHS, thinning, partial harvest techniques.	Not Applicable.	**2017 DFMP:** Maps and tables of the FBP rating categories (ha) at 0, 10, 20, and 50 yrs. Compare predicted landbase of the 2007 DFMP at the year 2017 to the landbase of the 2017 DFMP. **Stewardship Reporting:** Summary of area harvested and area remaining within the FBP rating categories. **Other:** Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP. **Data Source:** All Operators.	+/- 10% of the target.	Adjust strategies in subsequent DFMPs.
29	5.2.1.1 To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing fire suppression capability.	b) Percentage reduction in Fire Behaviour Potential (FBP) area (ha) across the DFMP Area.	Reduce the area (ha) in the extreme and high FBP rating categories by 5% across the DFMP Area.	Wildfire threat assessment.	Planning Standard.	SHS, thinning, partial harvest techniques.	Not Applicable.	**2017 DFMP:** Maps and tables of the FBP rating categories (ha) at 0, 10, 20, and 50 yrs. Compare predicted landbase of the 2007 DFMP at the year 2017 to the landbase of the 2017 DFMP. **Stewardship Reporting:** Summary of area harvested and area remaining within the FBP rating categories. **Other:** Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP. **Data Source:** All Operators.	+/- 10% of the target.	Adjust strategies in subsequent DFMPs.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
Value - 5.2.2 Provide opportunities to derive benefits and participate in use and management										
30	5.2.2.1 Integrate other uses and timber management activities.	Adherence to communication initiatives related integrating other uses and timber management activities, as defined in the external communications section of the DFMP Communication Implementation Plan.	Adhere to communication initiatives related to the integration of other uses and timber management activities.	Communication initiatives.	Legislation and policy.	Effective implementation of plans.	Effectiveness tracking, surveys.	**2017 DFMP:** None. **Stewardship Reporting:** Summary of external stakeholder consultation and communication initiatives, and the Company's qualitative assessment of their success. **Other:** None. **Data Source:** FMA holder only.	Issue specific.	Adjust activities.
Value - 5.2.3 Forest productivity.										
31	5.2.3.1 Maintain Long Run Sustained Yield Average.	Regenerated stand yield compared to natural stand yield.	No net decrease from the natural stand productivity.	Yield curve development.	Planning Standard.	Effective implementation of reforestation program.	RSA (MAI).	**2017 DFMP:** Report MAI targets. **Stewardship Reporting:** Report current MAI targets indicated by RSA surveys compared to the Long Range Sustained Yield Average (LRSYA). **Other:** None. **Data Source:** FMA holder only.	None.	Adjust strategy in subsequent DFMPs.
CCFM Criterion 6 - Accepting Society's Responsibility for Sustainable Development										
CSA SFM Element - 6.1 Aboriginal and treaty rights and Aboriginal forest values										
Value - 6.1.1 Compliance with government regulations and policies.										
32	6.1.1.1 Implement First Nations Consultation Plan.	Meet the GoA's current expectations for First Nations consultation.	Consult at the community level with designated representatives of affected First Nations.	The GoA's Guidelines on Consultation with First Nations on Land and Natural Resource Management.	The GoA's Guidelines on Consultation with First Nations on Land and Natural Resource Management.	Effective implementation of First Nations Consultation Plan.	Consultation logs.	**2017 DFMP:** Results of consultations, and how that has been incorporated into the plan. **Stewardship Reporting:** None. **Other:** General Development Plan (GDP) on a yearly basis. **Data Source:** FMA holder only.	Report actual.	Issue specific.

New ID	Objective	Indicator	Target	Means to Identify Target	Legal/ Policy Requirements	Means of Achieving Objective and Target	Monitoring and Measurement	Reporting	Acceptable Variance	Response
Value - 6.1.2 Provide economic opportunities to First Nations.										
33	6.1.2.1. Provide forest contract opportunities to First Nations on an annual basis.	Contract opportunities provided to First Nations (i.e. logging and silviculture).	Provide contract opportunities to First Nations annually.	Not Applicable.	Not Applicable.	Ongoing consultation.	Ongoing consultations.	**2017 DFMP:** None. **Stewardship Reporting:** Summary of contract opportunities offered to First Nations, those undertaken and the status of each. **Other:** None. **Data Source:** FMA holder only.	Not Applicable.	Issue specific.
Value - 6.1.3 Cultural and Traditional Sites										
34	6.1.3.1 Existing sites are maintained on the landscape and not impacted by forest management activities.	Impacts to identified cultural and significant sites and features.	No recorded impacts to the cultural and significant sites and features that are identified by Aboriginals during GDP consultation.	Not applicable.	The GoA's Guidelines on Consultation with Aboriginals on Land and Natural Resource Management.	Aboriginal identification of sites during GDP consultation.	Forest Industry follow up, ongoing Aboriginal consultation.	**2017 DFMP:** None. **Stewardship Reporting:** Summary of recorded impacts. Stewardship Reports from subsequent DFMPs will provide a current summary of recorded impacts as well as compare current results to previous results. **Other:** None. **Data Source:** FMA holder only.	Report actual.	Issue specific.
CSA SFM Element - 6.2 Public participation and information for decision-making.										
Value - 6.2.1 Meaningful public participation is achieved.										
35	6.2.1.1 Implement Public Participation Process.	Number of opportunities provided for public input into forest management.	Hold 4 Public Advisory Committee (PAC) meetings per year; provide annual consultation opportunities around AOP.	Development of public participation plan in consultation with PAC members.	Planning Standard.	Maintain PAC membership, hold PAC meetings, seek public input into AOP's.	Protocols within the Public Participation Process.	**2017 DFMP:** Summary of the development of the Public Involvement Program in the DFMP development process. **Stewardship Reporting:** As defined in the Public Involvement Program. **Other:** None. **Data Source:** FMA holder only.	Report actual.	Issue specific.

3. Detailed VOITs

The following section provides detailed information regarding each of the VOITs in the 2017-2027 DFMP, including:

- Greater detail than is provided in the VOIT table
- Expanded indicator definitions
- History (changes between the 2007-2016 DFMP and the 2017-2027 DFMP).

VOITs are presented in the same order as in the VOIT table provided in Section 2 of this chapter. VOITs can be quickly referenced using the information in heading level 2:

- VOIT index number
- GoA VOIT hierarchy numbering
- A short descriptive name.

The 2007-2016 DFMP established 2017 reporting requirements for some VOITs. Data and information regarding to the status of those VOITs is presented in Section 4.

3.1 Biological Diversity

3.1.1 VOIT 1 (1.1.1.1) Seral Stages by BCG

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.1 Maintain biodiversity by retaining the full range of cover types and seral stages

Indicator

Area of Old, Mature and Young forest, by forest management unit (FMU), by broad cover group

Target

- In 2027 achieve:
  a) Gross forested landbase: greater than 4% in W11 and 6% in W13 for old forest, greater than 32% in W11 and 35% W13 for mature plus old forest, and less than 27% in W11 and 31% in W13 for young forest;

  b) Active forested landbase: greater than 6% in both FMU W11 and W13 for old forest, greater than 35% in W11 and 33% in W13 for mature plus old forest, and less than 22% in W11 and 33% in W13 for young forest.

  Note: Old forest retention shall include the full natural range of ages.

  Refer to VOIT reporting on page 87 for more information.

  Seral stage definitions are described below and are presented with additional context in Chapter 6 (Table 6-8.).

Means to Identify Target

- Targets and seral stage definitions shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes.
- Targets shall ensure representation of natural range of ecosystem attributes (e.g., productivity class).

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Spatial Harvest Sequence

Target Monitoring and Measurement

- Regular updates to inventory

Reporting

2017 DFMP: Tables of indicators at ages of 0, 10, 50, 100 and 200 years; maps of indicators at 0, 10 and 50 years. Compare landbase of the 2007 DFMP at the year 2017 to the 2017 DFMP landbase.

Stewardship Reporting: None

Other: Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP

Data Source: FMA holder only

Acceptable Variance

- Area (ha) of old and mature forests in each FMU by broad cover group shall be between 90% and 100% of target areas
- Area of young forest in each FMU by broad cover group shall not exceed 110% of target area.

Response

- Adjust strategies in subsequent Detailed Forest Management Plans (DFMP)

Definitions

Seral Stages: Stages in forest succession – a series of plant community conditions that develop during ecological succession from a major disturbance to the climax stage. Most common characteristics/classifications include tree species and age (initiation, establishment, aggradation (stem exclusion), mature, old-growth [Song, 2000]). Millar Western's 2017-2027 DFMP uses the following seral stage classes: regenerating (opening), young, immature, mature and old.

		Seral Stage Ranges (years)				
BCG	Strata	Regenerating	Young	Immature	Mature	Old
D	AW	0-10	11-35	36-70	71-130	>130
	DU	0-10	11-35	36-70	71-130	>130
DC	AP	0-15	16-35	36-65	66-130	>130
	AS	0-15	16-45	46-70	71-140	>140
CD	PA	0-10	11-40	41-75	76-160	>160
	SA	0-20	21-45	46-80	81-150	>150
C	PL	0-10	11-40	41-80	81-130	>130
	SB	0-20	21-80	81-120	121-180	>180
	SW	0-20	21-70	71-100	101-160	>160

FMU: An administrative unit of forest land designated by the Minister, as authorized under Section 14(1) of the Forests Act. MWFP's DFMP area includes two FMUs: W11 and W13.

Broad Cover Group: A classification of forest types based on coniferous and deciduous components of the AVI species composition. The broad cover groups are coniferous (C), coniferous-deciduous (CD), deciduous-coniferous (DC), and deciduous (D).

History

- First used in the 2007-2016 DFMP
- The Indicator has become more detailed, to include specific seral stages.
- The Target has become more detailed, to include specific percentages by seral stage.
- Reporting for this metric has been removed from the Stewardship Report.

3.1.2 VOIT 2 (1.1.1.2a) Opening Patch Size

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.2a Maintain biodiversity by avoiding landscape fragmentation (part a)

Indicator

- Range of opening patch sizes by FMU for the gross landbase.

Target

A distribution of harvest area sizes that, over the 200-year planning horizon, will result in an opening patch size pattern over the 200 year planning horizon approximating patterns created by natural disturbances. 2017 DFMP targets for the year 2027 are found in the VOIT reporting in Section 4.2 on page 93.

Means to Identify Target

- Targets shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes.
- Targets shall ensure representation of natural range of ecosystem attributes (e.g. cover class and productivity class).

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Spatial Harvest Sequence

Target Monitoring and Measurement

- Regular updates to forest inventory

Reporting

2017 DFMP: Tables of area of forest in each opening patch size class, by FMU, at 0, 10, and 50 years. Maps of patch size classes at 0, 10, and 50 years. Compare landbase of the 2007 DFMP at the year 2017 to the 2017 DFMP landbase.

Stewardship Reporting: None.

Other: Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP.

Data Source: FMA holder only.

Acceptable Variance

+/- 10% opening patch area, or progress in achieving the 200-year planning horizon target is demonstrated.

Response

- Adjust strategies in subsequent DFMPs.

Definitions

Patch Sizes: Patch sizes defined for opening sizes are as follows:

0-5 ha

5-200 ha

200-500 ha

500 + ha

History

- The target has changed from a table of patch size distribution targets to approximating patterns created by natural disturbances.
- Reporting has been removed from the Stewardship Report.

3.1.3 VOIT 3 (1.1.1.2b) Old interior forest

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.2b Maintain biodiversity by avoiding landscape fragmentation (part b)

Indicator

- Area of old interior forest, by FMU

Target

At the start of the 2027 Timber Year, achieve the target proportions of old interior forest, by FMU, as defined in VOIT reporting of VOIT 3 – 1.1.1.2b on page 97.

Means to Identify Target

- Targets shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes.
- Targets shall ensure representation of natural range of ecosystem attributes (e.g. productivity class).

Legal/Policy Requirement

- Planning Standard.

Means of Achieving Objective and Target

- Spatial Harvest Sequence

Target Monitoring and Measurement

- Regular updates to forest inventory

Reporting

2017 DFMP: Tables of area of old interior forest, by FMU, at 0, 10, and 50 years; maps of old interior forest at 0, 10, and 50 years. Compare landbase of the 2007 DFMP at the year 2017 to the 2017 DFMP landbase.

Stewardship Reporting: None

Other: Compare landbase of the 2017 DFMP at the year 2027 to the landbase of the 2027 DFMP.

Data Source: FMA holder only

Acceptable Variance

- Minimum of 80% of the target value

Response

- Adjust strategies in subsequent DFMPs

Definitions

Old Interior Forest:

Old interior forest was calculated in Patchworks; comprised of all forested stands on the gross landbase greater than 100 years of age and in patches greater than 120 years of age.

History

- The 2007-2017 DFMP version of this VOIT used a non-binary age dependent indicator derived from Biodiversity Assessment Project called "oldgrowthness". Applying this indicator, old growth value gradually increased at older ages, so that very old stands contributed more to old growth than old stands. In addition, for blocks with higher levels of structure retention, some old growth value was present for a period of time after harvest. For the 2017-2027 DFMP, the indicator definition was refined to better align with the GoA's definition for old interior forest. A proxy of 120 ha was applied in Patchworks.
- In the 2017-2027 DFMP the reporting requirement was removed from the Stewardship Report.

3.1.4 VOIT 4 (1.1.1.3a) Permanent all-weather forestry road density

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.3a Maintain biodiversity by minimizing access (part a)

Indicator

- Permanent all-weather forestry road density by FMU

Target

- At the start of the 2027 Timber Year, the target permanent all-weather forestry road densities within the FMU are:
  - W11: < 0.079 km/km^2
  - W13: < 0.283 km/km^2

Means to Identify Target

- Targets shall be based on sound science, ecological considerations, harvest planning, wildlife zones, and social values.

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Coordinating access with other resource users, road closures and decommissioning

Target Monitoring and Measurement

- Regular updates to Digital Integrated Dispositions (DIDs)

Reporting

2017 DFMP: Amount of permanent all-weather forestry road density by FMU at 0 and 10 years. Map of existing and proposed permanent all weather forestry roads.

Stewardship Reporting: Table of permanent all-weather forestry road density by FMU.

Other: None.

Data Source: All Operators.

Acceptable Variance

- A variance not exceeding +20% must be achieved.

Response

- Adjust strategies in subsequent DFMPs.

Definitions

Permanent all-weather forestry road: Department Licenses of Occupation (DLOs) within the DFMP area.

History

- Wording has changed from "open" all-weather forestry road to "permanent" all-weather forestry road.
- Reporting values have been made more general.
- In the 2007-2016 DFMP, a monitoring process was to have been enabled following submission. The monitoring strategy for the 2017-2027 DFMP is regular updates to DIDs.

3.1.5 VOIT 5 (1.1.1.3b) Open seasonal / temporary forestry road density

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.3b Maintain biodiversity by minimizing access (part b)

Indicator

- Open seasonal / temporary forestry road length in kilometers, by FMU

Target

- Less than 100 km for FMU W11;
- Less than 220 km for FMU W13.

Means to Identify Target

- Analysis of number of kilometers of open seasonal/temporary forestry roads for each timber year, for each FMU

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Road construction, maintenance and reclamation activities

Target Monitoring and Measurement

- Road plan (Operating Ground Rule) OGR 11.2

Reporting

2017 DFMP: None.

Stewardship Reporting: Table of open seasonal/temporary forestry roads for each timber year for each FMU.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- < 20 % in excess of the target within each FMU

Response

- Adjust strategies in subsequent AOPs

Definitions

Open seasonal/temporary forestry road: All roads (not including DLOs, or roads under long-term disposition) in the current timber year as identified in Millar Western's database (including in-block roads).

History

- Reporting moved from AOP to Stewardship Report.
- In the 2007-2016 DFMP, a monitoring process was to have been enabled following submission. The monitoring strategy for the 2017-2027 DFMP is completion of the Road Plan from OGR 11.2.
- The definition used for the Stewardship Report excluded the “within” blocks roads. Some “within” block roads were manually added if they provided through block access. Although the Millar Western database includes more than harvest access roads, including all roads provides more consistent reporting than the manual process used in the Stewardship Report. Millar Western used all roads as the definition for the 2027 DFMP and will do so for future reporting. This difference in calculating the length of open seasonal temporary road is why the targets are much higher than what was identified in the Stewardship Report. In addition, an assessment of the proposed SHS in W11 resulted in the target being increased for this FMU due to the increased distance between these stands and existing permanent access.

3.1.6 VOIT 6 (1.1.1.4) Uncommon plant communities

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.4 Maintain plant communities uncommon in FMU or province

Indicator

- Actions taken based on the direction received from ACIMS to maintain uncommon plant communities where identified

Target

- When uncommon plant communities are identified, proceed accordingly, using guidance from the Alberta Conservation Information Management System (ACIMS) on 100% of the sites.

Means to Identify Target

- Alberta Conservation Information Management System (ACIMS) plant community classification and tracking list. Predict and identify the occurrence of uncommon plant community.

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Coordinating with other resource users, spatial planning of harvest and road construction, and OGR.

Target Monitoring and Measurement

- Periodic updates to inventory

Reporting

2017 DFMP: Table with descriptive list of identified uncommon plant communities known to exist on the DFMP Area.

Stewardship Reporting: summary of actions taken, based on the direction received from ACIMS, in the areas where uncommon plant communities have been identified.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

None.

Response

Adjust strategies in subsequent DFMPs.

Definitions

Alberta Conservation Information Management System (ACIMS): ACIMS is a data centre that provides biodiversity information on Alberta's species, natural ecological communities and sites. Information about the location, condition, status and trends of selected elements is collected, updated, analyzed and disseminated (Alberta, 2016a).

History

- The indicator has been refined to include direction taken from the ACIMS.
- The target has evolved from developing a process, to following the ACIMS process.
- Reporting has evolved from summarizing the progress on developing the plan, to reporting the actions taken and the communities identified.
- Acceptable variance has evolved from a timeline to develop a plan, to no variance on following it.
- Response has evolved to adjusting strategies in subsequent DFMPs.
- In the 2007-2016 DFMP, the means of achieving the objective and target included consulting with a specialist to implement a rare plant community list. In the 2017-2027 DFMP, Millar Western will use more progressive methods to protect the communities: coordinating with other resource users, spatial planning of harvest and road construction, and following the OGRs.

3.1.7 VOIT 7 (1.1.1.5a) Wildfire ecosystems

CCDM Criterion: 1 – Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.5a Maintain unique habitats provided by wildfire and blowdown events (part a)

Indicator

- Area of unsalvaged burned forest that is salvageable

Targets

- Fires < 1000 hectares of the productive landbase: Follow the DFMP structure retention strategy, consistent with normal harvesting practices.
- Fires > 1000 hectares of productive landbase: Retain all unburned trees in green islands and retained patches, recognizing timber condition, access, non-timber needs.

Means to Identify Targets

- Targets are based on Fire Salvage Planning and Operations – Directive No. 2007-01
- Ensure consistency with FireSmart objectives

Legal/Policy Requirement

- Fire Salvage Planning and Operations – Directive No. 2007-01

Means of Achieving Objective and Targets

- Salvage planning

Target Monitoring and Measurement

- Organization reports
- Final Harvest Plans

Reporting

2017 DFMP: Table and map of fire disturbance history since 2007 by FMU and the percent salvageable and salvaged in the productive landbase.

Stewardship Reporting: Table and map of fire disturbance history by FMU and the percent salvageable and salvaged in the productive landbase where applicable.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- At the end of the 10-year FMP term, the target is achieved or exceeded.

Response

- Adjust strategies in subsequent AOPs.

Definitions

Salvagable: In regards to trees killed by natural causes (ex. fire, insects, disease, blowdown), those that are still commercially viable as merchantable if harvested.

History

- The indicator was rewritten to clarify that it applies to the area of unsalvaged burned forest *that is salvageable*, not *all unsalvaged* burned forest.
- The target was made more detailed, with metrics for fires that are <1000 and >1000 hectares of the productive landbase.
- The wording of the reporting, acceptable variance, and response sections has changed.
- Target monitoring and measurement has been generalized from aerial photography and GoA TPRS tracking to organization reports and FHPs.

3.1.8 VOIT 8 (1.1.1.5b) Blowdown ecosystems

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.5b Maintain unique habitats provided by wildfire and blowdown events (part b)

Indicator

- Area of unsalvaged blowdown forest that is salvageable

Target

- In areas of significant (>=100 ha) salvageable blowdown, a minimum of 10% will be left unsalvaged

Means to Identify Target

- Targets are to be based on sound science, ecological considerations and disturbance regimes.

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Salvage planning

Target Monitoring and Measurement

- Final Harvest Plans (FHPs)

Reporting

2017 DFMP: None.

Stewardship Reporting: Table of blowdown disturbance history by FMU and the percent salvagable and salvaged in the productive landbase where applicable.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- At the end of the 10-year DFMP term, the target is achieved or exceeded.

Response

- Adjust strategies in subsequent annual operating plans (AOPs).

Definitions

Salvageable: In regards to trees killed by natural causes (ex. fire, insects, disease, blowdown), those that are still commercially viable as merchantable if harvested.

History

- The indicator was rewritten to clarify that it applies to the area of unsalvaged blowdown forest *that is salvageable*, not *all* unsalvaged blowdown forest.
- The target was generalized to a minimum of 10% being left unsalvaged (in areas of blowdown 100 ha and greater).
- The wording was altered for the reporting, acceptable variance, and response sections.
- In the 2007-2016 DFMP, the means of achieving the target was to develop a blowdown strategy; for the 2017-2027 DFMP, the strategy is to complete salvage planning.
- Monitoring has changed from aerial photography to FHPs.

3.1.9 VOIT 9 (1.1.1.6) Maintaining Functional Riparian Zones

CCDM Criterion: 1 – Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.1 Landscape scale biodiversity

Objective: 1.1.1.6 Retain ecological values and functions associated with riparian zones

Indicator

- Compliance with Operating Ground Rules (OGR).

Target

- No warnings or penalties assessed regarding riparian zones.

Means to Identify Target

- Operating Ground Rules (OGR)

Legal/Policy Requirements

- Federal Fisheries Act
- Federal Water Act

Means of Achieving Objective and Target

- Planning
- OGR

Target Monitoring and Measurement

- Compliance reporting systems

Reporting

2017 DFMP: None.

Stewardship Reporting: Summary of warnings or penalties assessed regarding riparian zones.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- No variance

Response

- Immediate remedial action and/or administrative penalty.

Definitions

Riparian Zone: Strips of green vegetation influenced by water and found around creeks, sloughs, rivers, and lakes (Alberta, 2015).

History

- Minor wording changes throughout.

3.1.10 VOIT 10 (1.1.2.1a) Merchantable structure retention

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.2 Local/Stand Scale Biodiversity

Objective: 1.1.2.1a Retain stand level structure (part a)

Indicator

- Percent of volume with merchantable residual structure within the harvested area, representative of the status, sizes, and species of the overstory trees within the harvested areas on the FMU

Target

- A combination of merchantable single stems, clumps, and patches, that are representative of the stands harvested, comprising **3%** of the harvested volumes within the FMU area

Note: A wide range in variability in harvest area-level retention is desired, as long as the target level is achieved.

Means to Identify Target

- Wildlife zones, roadside vegetation screens, recreational values, aesthetics, local knowledge, ANHIC, Biodiversity / Species Observation Database (BSOD)

Legal/Policy Requirement

- Occupational Health and Safety Act
- Forest and Prairie Protection Act

Means of Achieving Objective and Target

- Implement residual structure retention strategies in Appendix II in Chapter 7 and OGRs.

Target Monitoring and Measurement

- Organization reports, air photo interpretation, ground surveys, post harvest assessments.

Reporting

2017 DFMP: None.

Stewardship Reporting: Table of the percent of structure retention in harvest areas on the FMU area.

Other: None.

Data Source: All operators.

Acceptable Variance

- Annually, (+/-)50% of target.
- At stewardship level (+/-) 20% of target.

Response

- Adjust strategies in subsequent DFMPs.

Definitions

Merchantable residual structure: Live, commercially viable trees retained post-harvest to create old forest characteristics in young and mid-aged regenerating stands.

Single stems: Individual trees left standing in a harvest area: a component of dispersed retention.

Clumps: Small groups of trees left standing in a harvest area: a component of dispersed retention.

Patches: Undisturbed islands of trees left standing within the harvest area boundary but not connected to the edge.

Retention: Merchantable timber left standing within the planned harvest area boundary.

History

- The stand-level retention has been increased in the target from 1% to 3%.
- Acceptable variance has been increased to (+/-) 50% annually and (+/-) 20% at the stewardship level.
- Wording has been updating in the indicator and reporting sections.
- Monitoring and measurement has been expanded from aerial photography to include organization reports, ground surveys, and post-harvest assessments.

3.1.11 VOIT 11 (1.1.2.1b) Downed woody debris

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.2 Local/Stand Scale Biodiversity

Objective: 1.1.2.1b Retain stand level structure (part b)

Indicator

- Percentage of harvested area within the FMU with downed woody debris equivalent to preharvest conditions

Target

- 75% or more of the harvest areas will not receive treatments that reduce downed woody debris retained on site (e.g. brush raking, prescribed burns)

Means to Identify Target

- Targets are to be based on sound science, ecological considerations, disturbance regimes, fire regulations, and silvicultural requirements.

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Minimize the occurrences of harvest area debris removal treatments (other than roadside slash).

Target Monitoring and Measurement

- ARIS
- Company silviculture record system

Reporting

2017 DFMP: None.

Stewardship Reporting: Table with the percent of the harvest areas that did not receive treatments that reduce downed woody debris.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- None

Response

- Adjust strategies in subsequent DFMPs

Definitions

Downed woody debris: *For modeling, forecasting and biodiversity assessment purposes:* Dead tree volume with a bole measuring ≥ 10 cm in diameter that is not rooted in the ground. *For operational purposes:* Woody material >1 cm in diameter, stumps and snags < 1.3 m tall and dead trees leaning >45 degrees. The woody material left on site after logging, including both pre-existing and harvest-generated material (downed boles, limbs, tops and stumps); includes highly decomposed and vegetated material, as long as it is recognizable as woody debris.

History

- The target changed from measuring the area with downed woody debris equivalent to pre-harvest conditions, to measuring the area that will not receive downed woody debris-reducing treatments. Reporting was altered accordingly
- Acceptable variance changed from (+/-) 10% to none
- The means of achieving the objective and target has been made more specific, to include “minimizing the occurrences of harvest area debris removal treatments (other than roadside slash)”.

3.1.12 VOIT 12 (1.1.2.2) Sensitive sites

CCDM Criterion: 1 – Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.2 Local/Stand Scale Biodiversity

Objective: 1.1.2.2 Maintain integrity of sensitive sites

Indicator

- Sensitive sites (e.g. mineral licks, raptor nests, bear dens, unique ecological areas, etc.) by FMU.

Target

- Protect and report on all identified sites.

Means to Identify Target

- Local knowledge
- Forest Harvest Plans (FHP)

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Organization developed standards for sensitive site protection
- OGRs

Target Monitoring and Measurement

FHPs

Reporting

2017 DFMP: None.

Stewardship Reporting: Summary of identified sites.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- None

Response

- Adjust strategies in subsequent DFMPs

Definitions

Sensitive sites: Areas that will not regenerate the same unique features if harvested, such as rare ecological areas, mineral licks, raptor nests, and bear dens.

Additional Information

Training on identification:

Millar Western employs experienced professionals in block design and layout. Ongoing field identification of sensitive sites is part of the training and experience associated in block design and layout. Training requirements are directed in the company's Woodlands Staff Training Requirements SOP which includes training requirements for uncommon plan communities and sensitive sites.

Identification: Uncommon plant communities and sensitive ecological sites are identified annually through the ACIMS (Alberta Conservation Information Management System) database. Sensitive sites (bear dens, mineral licks, etc.) are identified either in the planning or field work stage.

Protection of sites: Should a sensitive site be identified within a planned operating area, an application must be made to ACIMS in order to find the exact location and identify the affected species. The management strategy employed will be based on the site-specific details available.

Sensitive sites are protected by retention of a undisturbed, forested buffer (or other management technique) from the edge of the opening associated with these sites, or from the centre of sites without openings. Buffer width will vary depending on the type of site.

History

- The indicator and target were simplified, from non-conformance incidents with the OGRs to protecting and reporting on all identified sites. Reporting, acceptable variance, and response were adjusted accordingly.
- Organization of developed standards for sensitive site protection was added to the means of achieving the target.
- Monitoring and measurement has changed from tracking in MWFP's Environmental Management System to Final Harvest Plans.

3.1.13 VOIT 13 (1.1.2.3) Forestry water crossings

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.1 Ecosystem Diversity: Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the Defined Forest Area (DFA)

Value: 1.1.2 Local/Stand Scale Biodiversity

Objective: 1.1.2.3 Maintain aquatic biodiversity by minimizing impacts of water crossings

Indicator

- Forestry water crossings in compliance with Code of Practice for Water Course Crossings within each FMU

Target

- No warnings or penalties for non-compliances with the Code of Practice or OGRs for water course crossing

Means to Identify Target

- Code of Practice for Water Course Crossings: Sections 7 - 9 and Schedule 2.

Legal/Policy Requirement

- Code of Practice for Water Course Crossings.

Means of Achieving Objective and Target

- Road construction, maintenance and reclamation activities

Target Monitoring and Measurement

- Road plan and OGR (Watercourse Crossings).

Reporting

2017 DFMP: None.

Stewardship Reporting: Summary of warnings and penalties related to non-compliance with Codes of Practice for Water Course Crossings

Other: None

Data Source: FMA holder only

Acceptable Variance

- None

Response

- Act immediately to eliminate problems and adjust strategies in subsequent DFMPs

Definitions

Forestry water crossings: The locations and structures designated within harvest areas for which machinery to move across watercourses.

Additional Information

As part of the company's EMS, Millar Western developed a road inspection SOP which includes both interim and final inspections. Inspections, maintenance and reporting are determined through risk rating and inspection frequency guidelines in the SOP. A bridge inspection SOP addresses inspection and maintenance issues unique to bridges.

History

- Minor wording changes.
- Legal/policy requirements have changed from the Planning Standard to the Code of Practice for Watercourse Crossings.
- Target monitoring and measurement has changed from tracking within MWFP's ISOSoft database to the Road Plan and OGRs (Watercourse Crossings).

3.1.14 VOIT 14 (1.2.1.1) Suitable habitat for native species

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.2 Species Diversity: Conserve species diversity by ensuring that habitats for the native species found in the DFA are maintained throughout time

Value: 1.2.1. Viable populations of identified plant and animal species

Objective: 1.2.1.1 Maintain habitat for identified high value species (i.e., economically valuable, socially valuable, species at risk, species of management concern)

Indicators

a) Existence of a grizzly bear strategy to guide forest management activities for the DFMP area
b) Percent change in the Barred owl RSF habitat value and potential breeding pairs habitat value from 2017, by FMU
c) Percent change in American marten habitat suitability value from 2017, by FMU
d) Percent change in relative abundance value of five songbird species (Canada Warbler, Black-throated Warbler, Brown Creeper, Bay-Breasted Warbler and Ovenbird) from 2017, by FMU

Targets

a) To have the strategy developed and implemented upon DFMP approval
b) Maximum 15% reduction in the RSF indicators at 10 and 20 years and a maximum 15% reduction in the breeding pairs indicator at 10 and 20 years
c) Maximum 15% reduction in the indicator over the 200 year planning horizon
d) Maximum 15% reduction in the indicator over the 200 year planning horizon

Means to Identify Target

- Habitat modeling (provided by the Government of Alberta (GoA)).

Legal/Policy Requirement

- Recovery plans for species at risk, Federal Species at Risk Act.

Means of Achieving Objective and Target

- Spatial Harvest Sequence and fRI Sightability Tool.
- Woodland Caribou Habitat Strategy (Chapter 7, Appendix III)
- Grizzly Bear Habitat Strategy (Chapter 7, Appendix IV)
- Barred Owl Habitat Strategy (Chapter 7, Appendix V)

Target Monitoring and Measurement

- Updates to vegetation inventory and habitat modeling.

Reporting

2017 DFMP:

a) The Grizzly bear strategy documented in the DFMP submission
b) Tables of RSF and breeding pairs at 0, 10, and 20 years and maps of RSF value and breeding pairs at 0, 10 and 20 years

c) Tables of habitat suitability at 0, 10, 20, 50, 100 and 200 years and maps of habitat suitability at 0, 10, 20 and 50 years
d) Tables of relative abundance at 0, 10, 20, 50, 100 and 200 years and maps of relative abundance at 0, 10, 20 and 50 years

Stewardship Reporting: None.

Other: Compare suitable habitat of the 2017 DFMP landbase at the year 2027 to the suitable habitat of the 2027 DFMP landbase.

Data Source: FMA holder only.

Acceptable Variance

- At the end of the 10-year DFMP term, the target is achieved or exceeded.

Response

- Adjust strategies in subsequent DFMPs.

Definitions

History

- In both the 1997-2006 DFMP and the 2007-2016 DFMP, habitat modeling for native terrestrial wildlife species was conducted through the Biodiversity Assessment Project. Changes in predicted level of habitat were used to inform the PFMS. Species modeled were:
  - American marten (*Martes americana*)
  - Barred owl (*Strix varia*)
  - Brown creeper (*Certhia americana*)
  - Canada lynx (*Lynx canadensis*)
  - Elk (*Cervus elaphus*)
  - Least flycatcher (*Empidonax minimus*)
  - Moose (*Alces alces*)
  - Northern flying squirrel (*Glaucomys sabrinus*)
  - Northern goshawk (*Accipiter gentilis atricapillus*)
  - Pileated woodpecker (*Dryocopus pileatus*)
  - Ruffed grouse (*Bonasa umbellus*)
  - Snowshoe hare (*Lepus americanus*)
  - Southern red-backed vole (*Clethrionomys gapperi*)
  - Spruce grouse (*Dendragapus Canadensis franklinii*)
  - Three-toed woodpecker (*Picoides tridactylus*)
  - Varied thrush (*Ixoreus naevius*)
  - Woodland caribou (*Rangifer tarandus caribou*)

  For the 2017-2027 DFMP, habitat modeling was completed using the GoA's models and indicators.
- Wording for the objective was updated and wording for the indicator was changed to list the specific species.
- The target was updated to list metrics for specific species.
- Reporting was updated to include tables for each species.

- The acceptable variance was updated, to targets being achieved or exceeded.
- The legal/policy requirement has been changed from Planning Standard to recovery plans for species at risk and the federal Species at Risk Act.

3.1.15 VOIT 15 (1.3.1.1) In situ genetic conservation

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.3 Genetic Diversity: Conserve genetic diversity by maintaining the variation of genes within species

Value: 1.3.1. Genetic integrity of natural tree populations

Objective: 1.3.1.1 Retain "wild forest populations" for each tree species in each seed zone through establishment of in-situ reserves, where an approved controlled parentage program (CPP) is in place.

Indicator

- Number and area (ha) of in situ genetic conservation areas

Target

- Each seed zone that occurs in the Millar Western FMA area, that requires a conservation area, will have one or more genetic conservation areas established, but those areas may not necessary be on the Millar Western FMA.

Means to Identify Target

- Direction and detail as per Alberta Forest Genetic Resource Management and Conservation Standards (FGRMCS), Section 20.0, "In-situ Gene Conservation", in consultation with the other associate FMA holders participating in a CPP plan

Legal/Policy Requirement

- Standards regulated through Timber Management Regulation 144.2 and the FGRMCS.

Means of Achieving Objective and Target

- Conservation areas are designated by a notation (e.g. PNT, CNT).

Target Monitoring and Measurement

- Periodic assessment of condition of stands contributing to in-situ tree gene conservation reserves (e.g. photos or AVI).

Reporting

2017 DFMP: Table showing number of genetic conservation areas required in each seed zone and number provided in FMA. Map showing locations of genetic conservation areas.

Stewardship Reporting: Report number of hectares of in-situ gene conservation reserves within FMA.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- None. Achieve establishment and mapping of in-situ tree gene conservation reserves prior to the end of the first stewardship period.

Response

- None

Definitions

Seed zone: A geographic area with relatively uniform ecology and genetic population structure. Limiting the reforestation of cutblocks to seedlings from the corresponding seed zone allows native trees, and by extension native plants of all species, to be moved some distance without risk of mal-adaptation or erosion of genetic integrity and conserves genetic biodiversity (Alberta, 2014).

History

- The objective was changed to include CPP.
- The target wording was updated.
- Wording changes to reporting, acceptable variance, and response.
- The means of achieving objective and target, and monitoring and measurement, were added.

3.1.16 VOIT 16 (1.3.1.2) Genetic integrity

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.3 Genetic Diversity: Conserve genetic diversity by maintaining the variation of genes within species

Value: 1.3.1. Genetic integrity of natural tree populations

Objective: 1.3.1.2 Retain wild forest genetic resources through ex-situ conservation for species under CPP programs.

Indicator

- Provenances and genetic lines in gene banks and trials; seedlots in archive

Target

- Active conservation program for all species on the FMA that have a tree improvement program

Means to Identify Target

- In cooperation with the GoA and in accordance with the Alberta Forest Genetic Resource Management and Conservation Standards (FGRMCS), Sections 17 & 29

Legal/Policy Requirement

- Standards regulated through Timber Management Regulation 144.2 and the FGRMCS.

Means of Achieving Objective and Target

- FGRMCS and government/industry genetic cooperatives.

Target Monitoring and Measurement

- Conservation activities related to the FMA are carried out by the GoA and companies involved in controlled parentage plans.

Reporting

2017 DFMP: Planned conservation activities specific to Controlled Parentage Plan (CPP) region.

Stewardship Reporting: Five-year reporting, in cooperation with the GoA, on activities and amounts for each CPP Region required under section 17 and 29 of the FGRMCS.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- None

Response

- Adjust strategies in future FMPs

Definitions

Gene bank: A repository of tree genetic material for the purposes of maintaining diverse samples for reforestation.

Tree improvement program: The regulation and development of forest reproductive materials and gene conservation for the sustained productivity and health of the forest (Alberta, 2016b).

History

- Objective, target, and reporting sections were changed to include CPP.
- Wording changes to acceptable variance and response.
- Monitoring and easurement now includes conservation activities related to the DFMP area that are carried out by the GoA and companies involved in CPPs.

3.1.17 VOIT 17 (1.4.1.1) Trans boundary values

CCDM Criterion: 1 - Biological Diversity

CSA SFM Element: 1.4 Protected Areas: Respect protected areas identified through government processes

Value: 1.4.1. Areas with minimal human disturbances within managed landscapes

Objective: 1.4.1.1 Integrate transboundary values and objectives into forest management

Indicator

- Stakeholder consultation.

Target

- Ongoing consultation with relevant protected areas agencies, as required

Means to Identify Target

- Outcome of consultation processes

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Management planning and operation planning

Target Monitoring and Measurement

- Documentation of consultation processes

Reporting

2017 DFMP: Identify and implement known processes

Stewardship Reporting: Summary of the status of protected areas

Other: None.

Data Source: FMA holder only

Acceptable Variance

- None

Response

- Adjust strategies in subsequent DFMPs

Definitions

Stakeholder: A person, group, agency or other entity that has a share or interest in the DFMP and the activities occurring on the DFMP Area.

History

- The VOIT is mostly unchanged from the 2007-2016 DFMP.
- Wording was updated to reflect that the consultation is in regards to protected areas.

3.2 Ecosystem Productivity

3.2.1 VOIT 18 (2.1.1.1) Reforest all harvested areas

CCDM Criterion: 2 - Ecosystem Productivity

CSA SFM Element: 2.1 Ecosystem Resilience

Value: 2.1.1 Reforested harvest areas

Objective: 2.1.1.1 Reforest all harvested areas.

Indicator

- Annual % of openings that:
  a) meet or exceed the RSA establishment survey minimum stocking and species composition standards for the declared regenerated yield stratum
  b) meet or exceed the RSA establishment survey minimum stocking and species composition standards for an alternate regenerated yield stratum
  c) do not achieve the RSA establishment survey minimum stocking and/or species composition standards for any regenerated yield strata and are re-treated within one year.

  Indicators a, b and c are to be reported separately.

Target

- The sum of Indicators a, b and c = 100% of openings.

Means to Identify Target

- Direction from the GoA

Legal/Policy Requirement

- Timber Management Regulations 141.6(1) and 141.6(2); Reforestation Standard of Alberta (RSA).

Means of Achieving Objective and Target

- Implementation of silviculture strategies that ensure the target stocking and species composition is achieved for the opening

Target Monitoring and Measurement

- RSA establishment survey protocols.

Reporting

2017 DFMP: None.

Stewardship Reporting: Summarize the RSA establishment survey minimum stocking and species composition standards for the declared regenerated yield stratum and alternative regenerated yield stratum, as well as what it does not achieve.

Other: None

Data Source: FMA holder only

Acceptable Variance

- None

Response

- Adjust silviculture strategies.

Definitions

RSA (Reforestation Standard of Alberta): the Alberta government's standard for sustained yield management on crown land. Harvested blocks must meet certain stocking requirements in both the establishment and performance stages for forest operators to successfully meet reforestation obligations.

History

- This VOIT reflects Alberta law. The 2007-2016 DFMP VOIT was refined for the 2017-2027 DFMP to reflect the introduction of the RSA protocols in 2010.
- Three separate indicators were combined into one.
- Wording was updated for reporting and response.
- Acceptable variance was changed from <10%, <10%, and +/- 5% to none.

3.2.2 VOIT 19 (2.1.1.2) Regenerated stand productivity

CCDM Criterion: 2 - Ecosystem Productivity

CSA SFM Element: 2.1 Ecosystem Resilience

Value: 2.1.1 Reforested harvest areas

Objective: 2.1.1.2 Meet or exceed the coniferous and deciduous mean annual increment standard for the population of openings surveyed in a given quadrant.

Indicator

- Summed difference between target and actual coniferous and deciduous mean annual increments (MAIs) for openings surveyed in a five year quadrant, as reported to ARIS

Target

- 100% of target

Means to Identify Target

- Direction from the GoA

Legal/Policy Requirement

- Timber Management Regulation 141.7(1) and 141.7(2); Reforestation Standard of Alberta (RSA)

Means of Achieving Objective and Target

- Implementation of silviculture strategies that ensure the target productivity is achieved for the population of openings

Target Monitoring and Measurement

- RSA performance survey protocols

Reporting

2017 DFMP: None.

Stewardship Reporting: Summarize the difference between target and actual C and D MAIs for openings surveyed in a five year quadrant, as reported to ARIS.

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- Meet or exceed the target coniferous and deciduous MAI for the DFMP area

Response

- Adjust silviculture strategies and/or the GoA adjusts annual allowable cut

Definitions

Mean Annual Increment (MAI): The average annual growth rate of individual trees or stands up to a specified point in time. Expressed as volume/hectare/year.

History

- This VOIT was created for the 2017-2027 DFMP to reflect the introduction of the RSA program in 2010. RSA includes MAI predictions, providing a consistent Alberta-wide approach to monitoring regenerated stand productivity.

3.2.3 VOIT 20 (2.1.2.1) Productive forest conversion

CCDM Criterion: 2 - Ecosystem Productivity

CSA SFM Element: 2.1 Ecosystem Resilience

Value: 2.1.2 Maintenance of forest landbase

Objective: 2.1.2.1 Limit conversion of productive forest landbase to other uses

Indicator

- Amount of change in forest landbase

Target

- Reporting the loss of the gross forest landbase area

Means to Identify Target

- Forest inventory and land use data

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Promoting the minimization of non-forestry impacts to the landbase. Utilize a disposition tracking system.

Target Monitoring and Measurement

- GoA tracking of withdrawals and cancellations, by FMA

Reporting

2017 DFMP: None

Stewardship Reporting: Number of dispositions and area of dispositions withdrawn from the managed landbase; number of dispositions and area of dispositions returned to the managed landbase; cumulative net managed landbase area withdrawn.

Other: None

Data Source: FMA holder only.

Acceptable Variance

- Not applicable

Response

- Adjust net landbase projections in next Timber Supply Analysis (TSA)

Definitions

Timber Supply Analysis (TSA): A process consisting of calculations/computer models, with built-in assumptions regarding forest growth patterns, used to determine the AAC and spatial harvest sequence (SHS).

Gross forest landbase: The area contained within the boundary of the DFMP area. In the case of Millar Western's 2017-2027 DFMP, this includes the company's FMA area and the grazing leases contained within the FMUs: in other words, the active and passive landbase together constitute the gross landbase.

Dispositions: Rights given on Alberta Crown land for resource development

History

- The wording was adjusted and the specific conversion percentage was removed from the target.
- Monitoring and measurement has shifted from MWFP using their Lands Disposition Management application, to GoA tracking of cancellations and withdrawals.

3.2.4 VOIT 21 (2.1.2.2) Impacts of insects, fire, windthrow and other natural events

CCDM Criterion: 2 - Ecosystem Productivity

CSA SFM Element: 2.1 Ecosystem Resilience

Value: 2.1.2 Maintenance of forest landbase

Objective: 2.1.2.2 Recognize lands affected by insects, disease or natural events

Indicator

- Amount of area affected by significant impacts of insects, fire, windthrow and other natural events

Target

- Report the area (ha) affected by impacts of insects, fire, windthrow or other natural events

Means to Identify Target

- ESRD forest health surveys, inventory updates, fire reporting.

Legal/Policy Requirement

- Planning Standard, Alberta Forest Health Strategy, and Shared Roles and Responsibilities between ESRD and the Forest Industry.

Means of Achieving Objective and Target

- Maintain up-to-date information

Target Monitoring and Measurement

- GoA surveys with industry cooperation

Reporting

2017 DFMP: None

Stewardship Reporting: Summarize areas impacted by fire, insects, windthrow and other natural events.

Other: None

Data Source: FMA holder only.

Acceptable Variance

- Report actual

Response

- Event specific

Definitions

History

- Minor wording changes to this VOIT for the 2017-2027 DFMP.

3.2.5 VOIT 22 (2.1.3.1) Noxious weed program

CCDM Criterion: 2 - Ecosystem Productivity

CSA SFM Element: 2.1 Ecosystem Resilience

Value: 2.1.3 Control invasive species

Objective: 2.1.3.1 Control non-native plant species (weeds)

Indicator

- Noxious weed program

Target

- Noxious weed program in place and implemented

Means to Identify Target

- Noxious weed directive 2001-06

Legal/Policy Requirement

- Noxious weed directive 2001-06

Means of Achieving Objective and Target

- Noxious weed program

Target Monitoring and Measurement

- Field surveys

Reporting

2017 DFMP: None.

Stewardship Reporting: Reporting of control efforts.

Other: None.

Data Source: All Operators.

Acceptable Variance

- Report actual

Response

- Adjust noxious weed program if deficiencies are encountered

Definitions

Noxious weed: A plant designated in accordance with the Alberta Weed Control Regulation as a noxious weed and includes the plant's seeds. A person shall control a noxious weed that is on land the person owns or occupies (Alberta, 2011a).

History

- Minor wording changes to this VOIT for the 2017-2027 DFMP.

3.3 Soil and Water Resources

3.3.1 VOIT 23 (3.1.1.1) Reforest in-block temporary roads

CCDM Criterion: 3 - Soil and Water Resources

CSA SFM Element: 3.1 Soil quantity and quality - Conserve soil resources by maintaining soil quality and quantity

Value: 3.1.1 Soil productivity

Objective: 3.1.1.1 Minimize impact of roading and bared areas in forest operations

Indicator

- Silviculture strategy to reforest all in-block temporary roads within the harvest area

Target

- Reforest all in-block temporary roads within harvest areas

Means to Identify Target

- Direction from GoA

Legal/Policy Requirement

- OGRs and Soils Guidelines

Means of Achieving Objective and Target

- Implement silviculture strategy to reforest all in-block temporary roads within the harvest areas

Target Monitoring and Measurement

- Field inspection reports and audits

Reporting

2017 DFMP: None.

Stewardship Reporting: None

Other: Inspection reporting only

Data Source: FMA holder only

Acceptable Variance

- Not applicable

Response

- Adjust strategies in subsequent DFMPs

Definitions

History

- The indicator for this VOIT was refined from avoiding incidents of OGR non-conformance, to implementing a silviculture strategy to reforest all in-block temporary roads within the harvest area. The target, reporting, acceptable variance, and response were updated accordingly.

3.3.2 VOIT 24 (3.1.1.2) Soil erosion and slumping

CCDM Criterion: 3 - Soil and Water Resources

CSA SFM Element: 3.1 Soil quantity and quality - Conserve soil resources by maintaining soil quality and quantity

Value: 3.1.1 Soil productivity

Objective: 3.1.1.2 Minimize incidence of soil erosion and slumping

Indicator

- Number of incidences with respect to reportable soil erosion and slumping

Target

- Zero (0) warnings or penalties assessed regarding soil erosion or slumping

Means to Identify Target

- Direction from Alberta.

Legal/Policy Requirement

- OGRs and Soils Guidelines

Means of Achieving Objective and Target

- Effective planning and supervision of operations and adherence to relevant OGRs

Target Monitoring and Measurement

- Field inspection reports and GoA FOMP reports

Reporting

2017 DFMP: None

Stewardship Reporting: Reporting number of warnings or penalties regarding soil erosion or slumping

Other: None

Data Source: FMA holder only

Acceptable Variance

- None

Response

- Immediate remedial action to correct

Definitions

FOMP: Forest Operations Monitoring Program

History

- Minor wording changes.
- GoA FOMP reports were added to monitoring and measurement.

3.3.3 VOIT 25 (3.2.1.1) Forecasted changes in water yields

CCDM Criterion: 3 - Soil and Water Resources

CSA SFM Element: 3.2 Water quantity and quality - Conserve water resources by maintaining water quality, flow regime and water quantity

Value: 3.2.1 Water quantity

Objective: 3.2.1.1 Limit impact of timber harvesting on water yield

Indicator

- Forecasted changes in water yields by watersheds, resulting from the approved spatial harvest sequence (SHS) derived from the equivalent clearcut area (ECA)

Target

- To develop a SHS where the predicted increase in watershed yield is < 30% in the majority of compartments

Means to Identify Target

- Equivalent Clearcut Area (ECA) or other water yield modeling

Legal/Policy Requirement

- Water Act, Planning Standard

Means of Achieving Objective and Target

- Follow the SHS.

Target Monitoring and Measurement

- SHS area variance as per OGRs

Reporting

2017 DFMP: Forecasted ECA change by forest hydrology watershed

Stewardship Reporting: Area variance to be reported by compartment or forest hydrology watershed

Other: None.

Data Source: FMA holder only.

Acceptable Variance

- As per final approval of SHS area

Response

- During SHS development, adjust SHS if required

Definitions

Equivalent Clearcut Area (ECA): A measure of vegetation change in the preferred forest management strategy (PFMS) that uses stand age to approximate the amount of water that flows overland. As vegetation ages and grows, it intercepts more water and reduces overland flow. This is represented by decreasing ECA.

History

- Millar Western has been using water-yield predictions to refine its PFMS since its first DFMP. The WRENSS water model was used in the 1997-2006 DFMP. In the 2007-2016 DFMP, the FORWARD project developed a customized water-yield model that was incorporated into Patchworks using data from a localized data collection program. This permitted water-yield impacts to be predicted as the PFMS and SHS were developed. In the 2017-2027 DFMP, the GoA's ECA runoff model was used to align with provincial standards. ECA was incorporated into Patchworks in order to permit refinement of the PFMS and SHS to water runoff impacts. Runoff indicators changed with each model applied; however, the threshold of a maximum 30% increase in water runoff has been a consistent target.

3.3.4 VOIT 26 (3.2.2.1) Effective riparian habitat

CCDM Criterion: 3 - Soil and Water Resources

CSA SFM Element: 3.2 Water quantity and quality - Conserve water resources by maintaining water quality, flow regime and water quantity

Value: 3.2.2 Effective riparian habitats

Objective: 3.2.2.1 Minimize impact of operations in riparian areas

Indicator

- Riparian buffers maintained as outlined in OGRs

Target

- No warnings or penalties for non-compliances assessed regarding riparian zones

Means to Identify Target

- Direction from GoA

Legal/Policy Requirement

- OGRs

Means of Achieving Objective and Target

- Effective planning and supervision of operations and adherence to relevant OGRs

Target Monitoring and Measurement

- Field inspection reports and GoA FOMP reporting

Reporting

2017 DFMP: None

Stewardship Reporting: Reporting of warnings and penalties related to non-compliances assessed regarding riparian zones.

Other: None

Data Source: FMA holder only

Acceptable Variance

- None

Response

- Immediate correction and/or administrative penalty

Definitions

Riparian Zones: Strips of green vegetation influenced by water and found around creeks, sloughs, rivers, and lakes (Alberta, 2015).

History

- Only minor editorial changes from the 2007-2016 DFMP.

- GoA FOMP reporting was added to monitoring and measurement.

3.4 Multiple Benefits to Society

3.4.1 VOIT 27 (5.1.1.1) Appropriate AACs

CCDM Criterion: 5 - Multiple Benefits to Society

CSA SFM Element: 5.1 Timber and non-timber benefits

Value: 5.1.1 Sustainable timber supplies

Objective: 5.1.1.1 Establish and implement appropriate AACs.

Indicator

a) Compliance with Annex 1 of the Alberta Forest Management Planning Standard (April 2006), regarding the process for establishing appropriate AACs
b) Quadrant timber production

Target

a) Receive GoA approval of the AAC
b) Harvest 100% of periodic annual allowable cut (PAAC)

Means to Identify Target

- Alberta Forest Management Planning Standard (April 2006)

Legal/Policy Requirement

- Forests Act and TMR

Means of Achieving Objective and Target

a) Effective implementation of planning process
b) Cut control process

Target Monitoring and Measurement

a) Approval of the AAC
b) Timber Production and Revenue System (TPRS)

Reporting

2017 DFMP: AAC

Stewardship Reporting: Reporting of quadrant production to date

Other: None

Data Source: All operators (for stewardship report)

Acceptable Variance

a) Not applicable.

b) 110% of approved PAAC

Response

a) Adjust AAC using most current and relevant information

b) Adjust harvest levels to achieve PAAC

Definitions

Quadrant timber production: The volume of wood harvested within each 5-year period of the DFMP.

TMR: Timber Management Regulations

History

- Only minor editorial changes from the 2007-2016 DFMP.
- TPRS and approval of the AAC were added to monitoring and measurement.

3.4.2 VOIT 28 (5.2.1.1a) Fire Behaviour Potential in FireSmart Communities

CCDM Criterion: 5 - Multiple Benefits to Society

CSA SFM Element: 5.2 Communities and Sustainability

Value: 5.2.1 Risk to communities and landscape values from wildfire is low

Objective: 5.2.1.1a To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing fire suppression capability (part a)

Indicator

- Percentage reduction in Fire Behaviour Potential (FBP) area (ha) within the FireSmart Community Zone

Target

- Reduce the area (ha) in the extreme and high FBP rating categories by 5% within the FireSmart Community Zone.

Means to Identify Target

- Wildfire threat assessment

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- SHS, thinning, partial harvest techniques

Target Monitoring and Measurement

- Not applicable

Reporting

2017 DFMP: Maps and tables of the FBP rating categories (ha) at 0, 10, 20, and 50 yrs. Compare the predicted landbase of the 2007-2016 DFMP at the year 2017, to the landbase of the 2017-2027 DFMP.

Stewardship Reporting: Summary of area harvested and area remaining within the FBP rating categories

Other: Compare landbase of the 2017-2027 DFMP at the year 2027, to the landbase of the 2027-2037 DFMP.

Data Source: All operators

Acceptable Variance

- +/- 10% of the target

Response

- Adjust strategies in subsequent DFMPs

Definitions

Fire Behaviour Potential (FBP): a rating or classification of a forest stand's likelihood of burning, as a reflection of fuel type and topography. FBP is one input into the GoA's Fire Behaviour Prediction model.

History

- The Indicator was expanded to include all FireSmart Community Zones within the DFMP area, not just Whitecourt.
- Reporting was changed to include area harvested within the FBP rating categories and a comparison of the landbase.
- Acceptable variance was increased from none to +/- 10%.
- Response was updated from considering altering harvest location and timing, to adjusting strategies in subsequent DFMPs.
- Thinning and partial harvest techniques were added to the means to identify target.
- Monitoring and measurement has been removed.

3.4.3 VOIT 29 (5.2.1.1b) Fire Behaviour Potential in DFMP Area

CCDM Criterion: 5 - Multiple Benefits to Society

CSA SFM Element: 5.2 Communities and Sustainability

Value: 5.2.1 Risk to communities and landscape values from wildfire is low

Objective: 5.2.1.1b To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing fire suppression capability (part b)

Indicator

- Percentage reduction in Fire Behaviour Potential (FBP) area (ha) across the DFMP area

Target

- Reduce the area (ha) in the extreme and high FBP rating categories by 5% across the DFMP area

Means to Identify Target

- Wildfire threat assessment

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- SHS, thinning, partial harvest techniques

Target Monitoring and Measurement

- Not applicable

Reporting

2017 DFMP: Maps and tables of the FBP rating categories (ha) at 0, 10, 20, and 50 yrs. Compare landbase of the 2007-2016 DFMP at the year 2017, to the landbase of the 2017-2027 DFMP .

Stewardship Reporting: Summary of area harvested and area remaining within the FBP rating categories

Other: Compare landbase of the 2017-2027 DFMP at the year 2027 to the landbase of the 2027-2037 DFMP

Data Source: All operators

Acceptable Variance

- +/- 10% of the target

Response

- Adjust strategies in subsequent DFMPs

Definitions

History

- Thinning and partial harvest techniques were added to the means of achieving objective and target.
- A summary of area harvested and area remaining within the FBP rating categories was added to reporting.
- Acceptable variance was raised from none to +/- 10%.
- Response was updated from considering altering harvest location and timing to adjusting strategies in subsequent DFMPs.
- Monitoring and measurement has been removed.

3.4.4 VOIT 30 (5.2.2.1) Communication Initiatives

CCDM Criterion: 5 - Multiple Benefits to Society

CSA SFM Element: 5.2 Communities and Sustainability

Value: 5.2.2 Provide opportunities to derive benefits and participate in use and management

Objective: 5.2.2.1 Integrate other uses and timber management activities

Indicator

- Adherence to communication initiatives related to integration of other uses and timber management activities, as defined in the external communications section of the DFMP Communication Implementation Plan

Target

- Adhere to communication initiatives related to the integration of other uses and timber management activities

Means to Identify Target

- Communication initiatives

Legal/Policy Requirement

- Legislation and policy

Means of Achieving Objective and Target

- Effective implementation of plans

Target Monitoring and Measurement

- Effectiveness tracking, surveys

Reporting

2017 DFMP: None

Stewardship Reporting: Summary of external stakeholder consultation and communication initiatives, and the Company's qualitative assessment of their success.

Other: None

Data Source: FMA holder only

Acceptable Variance

- Issue specific

Response

- Adjust activities

Definitions

History

- The summary of stakeholder registry was removed from reporting.
- Wording changed for acceptable variance and response.
- Legal/policy requirements were changed from Planning Standard to legislation and policy.

3.4.5 VOIT 31 (5.2.3.1) Regenerated stand yield comparison

CCDM Criterion: 5 - Multiple Benefits to Society

CSA SFM Element: 5.2 Communities and Sustainability

Value: 5.2.3 Forest productivity

Objective: 5.2.3.1 Maintain Long Run Sustained Yield Average

Indicator

- Regenerated stand yield compared to natural stand yield

Target

- No net decrease from the natural stand productivity

Means to Identify Target

- Yield curve development

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Effective implementation of reforestation program

Target Monitoring and Measurement

- Reforestation Standard of Alberta (mean annual increment (MAI))

Reporting

2017 DFMP: Report MAI targets

Stewardship Reporting: Report current MAI targets indicated by RSA surveys, compared to the Long Range Sustained Yield Average (LRSYA)

Other: None

Data Source: FMA holder only

Acceptable Variance

- None

Response

- Adjust strategy in subsequent DFMPs

Definitions

Long Run Sustained Yield Average (LRSYA): the hypothetical timber harvest that can be maintained indefinitely from a management area once all stands have been converted to a managed state under a specific set of management activities.

History

- Only minor editorial changes from the 2007-2016 DFMP.

3.5 Accepting Society's Responsibility for Sustainable Development

3.5.1 VOIT 32 (6.1.1.1) Alberta First Nations Consultation expectations

CCDM Criterion: 6 - Accepting Society's Responsibility for Sustainable Development

CSA SFM Element: 6.1 Aboriginal and treaty rights and Aboriginal forest values

Value: 6.1.1 Compliance with government regulations and policies

Objective: 6.1.1.1 Implement First Nations Consultation Plan

Indicator

- Meet the GoA's current expectations for First Nations consultation

Target

- Consult at the community level with designated representatives of affected First Nations

Means to Identify Target

- The GoA's Guidelines on Consultation with First Nations on Land and Natural Resource Management

Legal/Policy Requirement

- The GoA's Guidelines on Consultation with First Nations on Land and Natural Resource Management

Means of Achieving Objective and Target

- Effective implementation of First Nations Consultation Plan

Target Monitoring and Measurement

- Consultation logs

Reporting

2017 DFMP: Results of consultations, and how they have been incorporated into the plan

Stewardship Reporting: None

Other: General Development Plan (GDP), on a yearly basis

Data Source: FMA holder only

Acceptable Variance

- Report actual

Response

- Issue specific

Definitions

History

- The objective was updated from "Public Involvement Program" to "First Nations Consultation Plan".
- "Aboriginal" wording was changed to "First Nations".
- Reporting was generalized to reporting the results of consultations, and how they have been incorporated into the plan.
- Monitoring and measurement was changed from MWFP's Communication Tracking Application to Consultation Logs.

3.5.2 VOIT 33 (6.1.2.1) Contract opportunities for First Nations

CCDM Criterion: 6 - Accepting Society's Responsibility for Sustainable Development

CSA SFM Element: 6.1 Aboriginal and treaty rights and Aboriginal forest values

Value: 6.1.2 Provide economic opportunities to First Nations.

Objective: 6.1.2.1. Provide forest contract opportunities to First Nation**s** on an annual basis.

Indicator

- Contract opportunities provided to First Nation**s** (i.e. logging and silviculture)

Target

- Provide contract opportunities to First Nations annually

Means to Identify Target

- Not applicable

Legal/Policy Requirement

- Not applicable

Means of Achieving Objective and Target

- Ongoing consultation

Target Monitoring and Measurement

- Ongoing consultation

Reporting

2017 DFMP: None

Stewardship Reporting: Summary of contract opportunities offered to First Nations, those undertaken and the status of each

Other: None

Data Source: FMA holder only

Acceptable Variance

- Not applicable

Response

- Issue specific

Definitions

History

- The 2007-2016 version of this VOIT was written specifically for the Alexis First Nation. For the 2017-2027 DFMP, GoA expanded the number of bands for consultation. This VOIT was expanded to apply to all of the First Nations that Millar Western consults with.

3.5.3 VOIT 34 (6.1.3.1) Cultural and Significant Sites

CCDM Criterion: 6 - Accepting Society's Responsibility for Sustainable Development

CSA SFM Element: 6.1 Aboriginal and treaty rights and Aboriginal forest values

Value: 6.1.3 Cultural and Traditional Sites.

Objective: 6.1.3.1. Existing sites are maintained on the landscape and not impacted by forest management activities.

Indicator

- Impacts to identified cultural and significant sites and features

Target

- No recorded impacts on the cultural and significant sites and features that are identified by Aboriginals during GDP consultation

Means to Identify Target

- Not applicable

Legal/Policy Requirement

- The GoA's Guidelines on Consultation with Aboriginals on Land and Natural Resource Management

Means of Achieving Objective and Target

- Aboriginal identification of sites during GDP consultation

Target Monitoring and Measurement

- Forest industry follow up, ongoing Aboriginal consultation.

Reporting

2017 DFMP: None

Stewardship Reporting: Summary of recorded impacts. Stewardship Reports from subsequent DFMPs will provide a current summary of recorded impacts, as well as compare current results to previous results.

Other: None

Data Source: FMA holder only

Acceptable Variance

- Report actual

Response

- Issue specific

Definitions

History

- The VOIT was moved from Criterion 5, "Multiple Benefits to Society", to Criterion 6, "Accepting Society's Responsibility for Sustainable Development", and now falls under Element 6.1 "Aboriginal and treaty rights and Aboriginal forest values" and Value 6.1.1 "Cultural and Traditional Sites".
- The objective wording has changed from "heritage values" to "existing sites".
- Indicator, target, and reporting wording changed from non-conformances with the Heritage Resources Act, to impacts on identified cultural and significant sites and features.
- The acceptable variance and response wording has been updated.
- Legal/policy requirements changed from Historical Resources Act, to the GoA's Guidelines on Consultation with Aboriginals on Land and Natural Resource Management.
- The focus of the means of achieving target has shifted from adherence to the OGRs and updating GIS, to aboriginal identification of sites during GDP consultation.
- Monitoring and measurement has shifted from tracking within MWFP's ISOSoft database, to forest industry follow up and ongoing Aboriginal consultation.

3.5.4 VOIT 35 (6.2.1.1) Public Participation Process

CCDM Criterion: 6 - Accepting Society's Responsibility for Sustainable Development

CSA SFM Element: 6.2 Public participation and information for decision-making

Value: 6.2.1 Meaningful public participation is achieved

Objective: 6.2.1.1 Implement Public Participation Process

Indicator

- Number of opportunities provided for public input into forest management

Target

- Hold 4 Public Advisory Committee (PAC) meetings per year; provide annual consultation opportunities around AOP

Means to Identify Target

- Development of public participation plan in consultation with PAC members

Legal/Policy Requirement

- Planning Standard

Means of Achieving Objective and Target

- Maintain PAC membership, hold PAC meetings, seek public input into AOPs

Target Monitoring and Measurement

- Protocols within the Public Participation Process.

Reporting

2017 DFMP: Summary of the development of the Public Involvement Program in the DFMP development process

Stewardship Reporting: As defined in the Public Involvement Program

Other: None

Data Source: FMA holder only

Acceptable Variance

- Report actual

Response

- Issue specific

Definitions

Public Advisory Committee (PAC): following through on a commitment made in its 2007-2016 DFMP, Millar Western formed a PAC in June 2007, combining into one group two former committees that separately addressed mill manufacturing and forest operations issues. The PAC includes representation from a number of public interest groups, including municipalities and counties, other industries, recreational groups, contractors and the public. As well as a venue for sharing plans and environmental performance information with stakeholders, the PAC serves as a forum for discussing issues of concern to the forest sector.

History

- The indicator and target in the 2007-2016 DFMP mentioned Section 5 of CSA Z809-2002- Public Participation Requirements. In the 2017-2027 DFMP, this reference has been removed, with the indicator being the “number of opportunities provided for public input into forest management” and the arget being 4 PAC meetings a year and consultation opportunities with the AOP.
- Wording of reporting, acceptable variance, and response has been updated.
- The means of achieving objective and target was specified as maintaining PAC membership, holding PAC meetings, and seeking public input into AOPs.

4. 2017 DFMP VOIT Reporting

This section provides detailed reporting for VOITs with a 2017 reporting requirement, as indicated in the 2017-2027 DFMP. Note that not all VOITs are discussed, since only a subset have reporting obligations for this time period. Where required, 10-year DFMP targets are extracted from the period 10 forecasted values for each applicable VOIT.

4.1 VOIT 1 – 1.1.1.1

Required reporting for old, mature and young forest derived from the Preferred Forest Management Scenario are summarized in this section.

2017-2027 DFMP targets are in 2027 to achieve:

Gross forested landbase, FMU W13: greater than 6% old forest, greater than 35% mature plus old forest, less than 31% young forest.

Gross forested landbase, FMU W11: greater than 4% old forest, greater than 32% mature plus old forest, less than 27% young forest.

Active forested landbase, FMU W13: greater than 6% old forest, greater than 33% mature plus old forest, less than 33% young forest.

Active forested landbase, FMU W11: greater than 6% old forest, greater than 35% mature plus old forest, less than 22% young forest.

Table 5-2. Gross landbase seral stage results for old forest for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Area (ha)	% of Forested Landbase
W13	0	2017	6,101	2%
	10	2027	16,006	6%
	20	2037	23,213	9%
	50	2067	28,909	11%
	100	2117	52,889	19%
	200	2217	118,726	44%
W11	0	2017	1,600	1%
	10	2027	5,645	4%
	20	2037	9,998	6%
	50	2067	12,498	8%
	100	2117	41,766	26%
	200	2217	79,249	49%

Table 5-3. Gross landbase seral stage results for mature plus old forest for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Area (ha)	% of Forested Landbase
W13	0	2017	91,635	34%
	10	2027	96,366	35%
	20	2037	99,922	37%
	50	2067	91,685	34%
	100	2117	124,903	46%
	200	2217	135,948	50%
W11	0	2017	50,405	31%
	10	2027	51,532	32%
	20	2037	46,998	29%
	50	2067	70,050	44%
	100	2117	93,306	58%
	200	2217	96,004	60%

Table 5-4. Gross landbase seral stage results for young forest for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Area (ha)	% of Forested Landbase
W13	0	2017	88,952	33%
	10	2027	84,307	31%
	20	2037	82,117	30%
	50	2067	74,433	27%
	100	2117	53,528	20%
	200	2217	57,165	21%
W11	0	2017	50,023	31%
	10	2027	43,648	27%
	20	2037	46,497	29%
	50	2067	27,821	17%
	100	2117	26,385	16%
	200	2217	25,174	16%

Table 5-5. Active landbase seral stage results for old forest for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Area (ha)	% of Forested Landbase
W13	0	2017	4,144	2%
	10	2027	11,230	6%
	20	2037	14,154	7%
	50	2067	7,921	4%
	100	2117	7,595	4%
	200	2217	37,548	20%
W11	0	2017	1,396	2%
	10	2027	4,982	6%
	20	2037	8,608	10%
	50	2067	6,072	7%
	100	2117	6,272	7%
	200	2217	6,602	7%

Table 5-6. Active landbase seral stage results for mature plus old forest for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Area (ha)	% of Forested Landbase
W13	0	2017	64,888	34%
	10	2027	63,317	33%
	20	2037	61,163	32%
	50	2067	31,553	17%
	100	2117	46,123	24%
	200	2217	54,770	29%
W11	0	2017	38,337	44%
	10	2027	30,714	35%
	20	2037	24,652	28%
	50	2067	20,991	24%
	100	2117	20,671	23%
	200	2217	23,357	26%

Table 5-7. Active landbase seral stage results for young forest for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Area (ha)	% of Forested Landbase
W13	0	2017	54,943	29%
	10	2027	62,396	33%
	20	2037	70,436	37%
	50	2067	71,833	38%
	100	2117	53,528	28%
	200	2217	57,165	30%
W11	0	2017	13,324	15%
	10	2027	19,792	22%
	20	2037	27,011	31%
	50	2067	27,663	31%
	100	2117	26,385	30%
	200	2217	25,174	29%

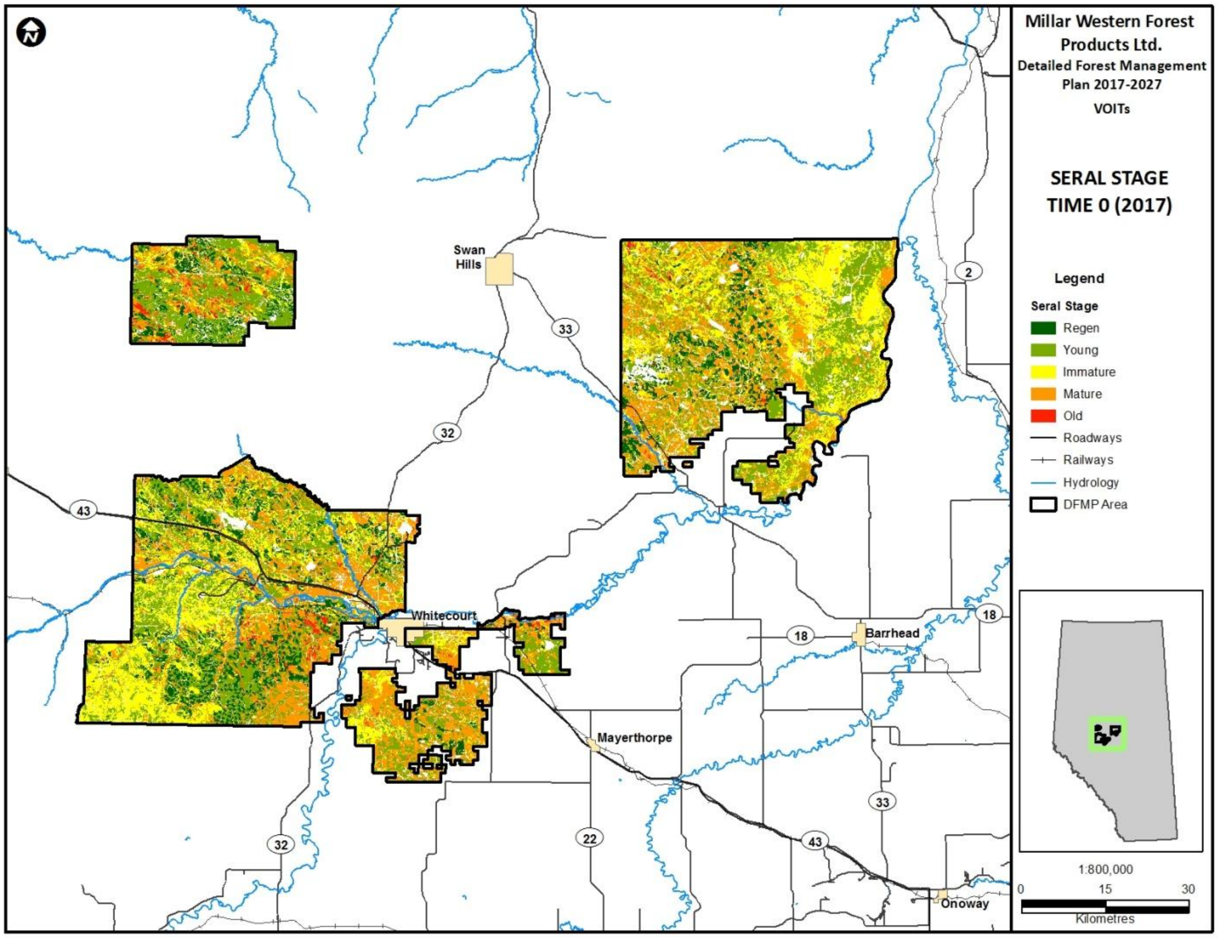


Figure 5-1. Seral stage results across the DFMP area for time 0 (2017)

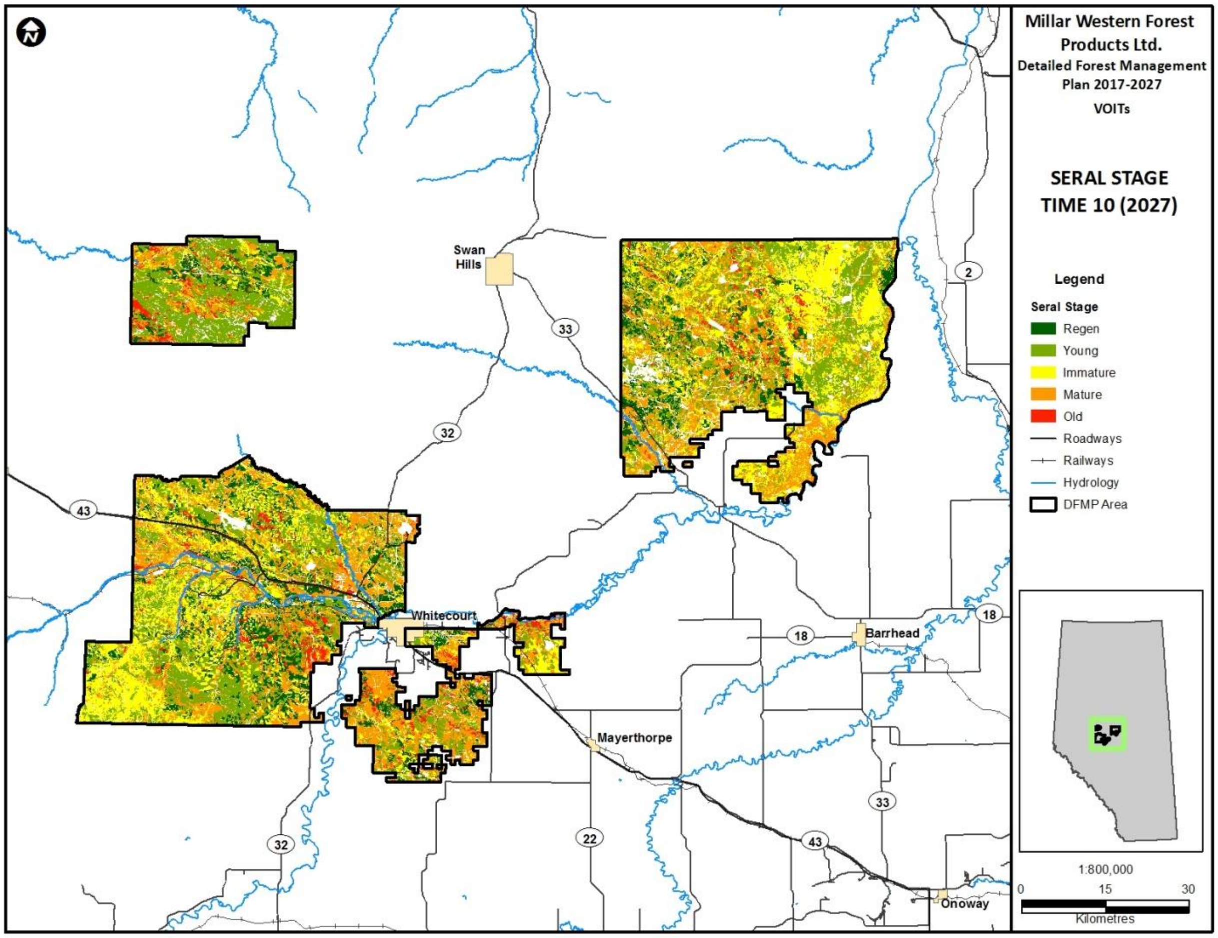


Figure 5-2. Seral stage results across the DFMP area for time 10 (2027)

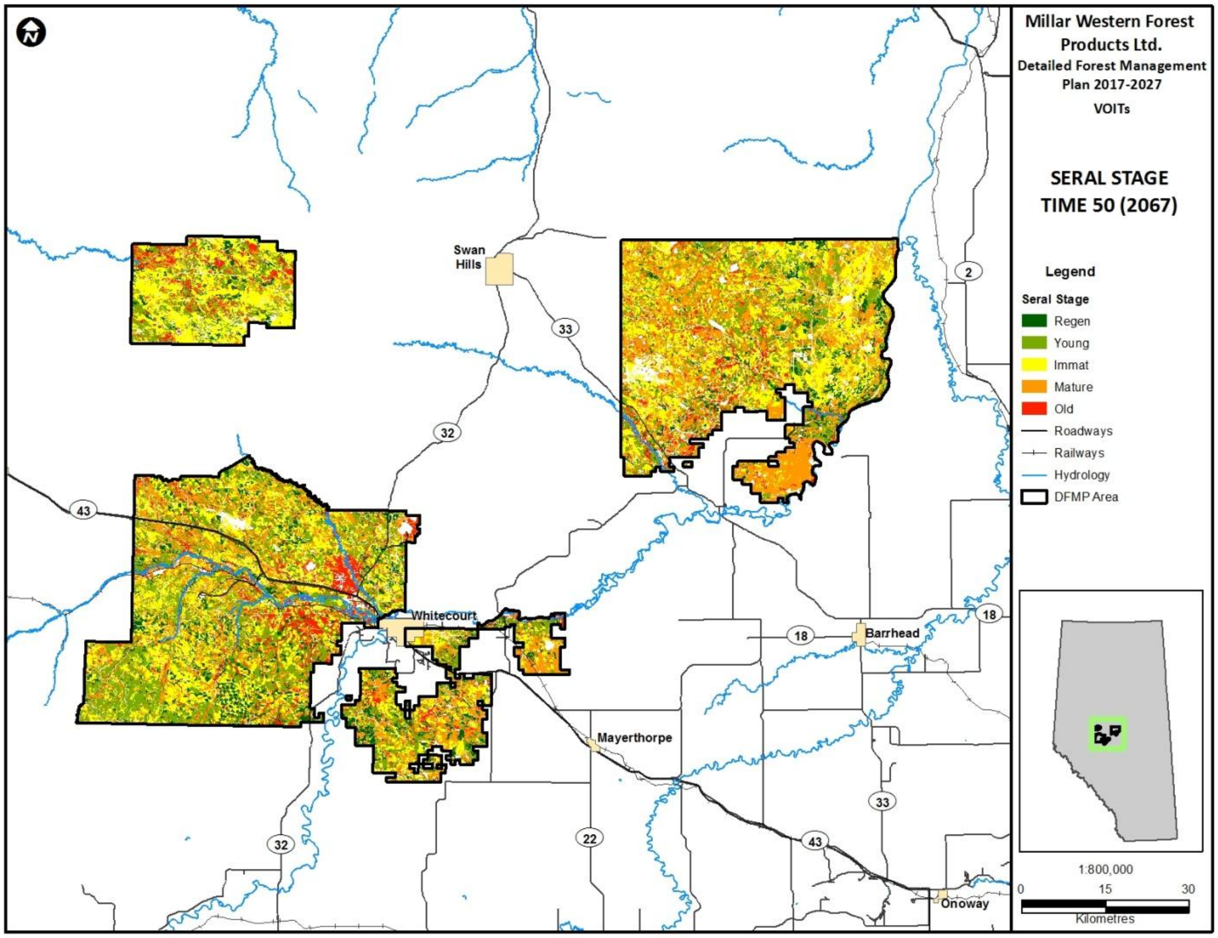


Figure 5-3. Seral stage results across the DFMP area for time 50 (2067)

4.2 VOIT 2 – 1.1.1.2a

Required reporting for opening patch size distribution derived from the 2017 Preferred Forest Management Scenario is presented in the following tables and figures.

2017-2027 DFMP targets are in 2027 to achieve:

Gross forested landbase, FMU W13: greater than 189 ha of opening patches 0-5 ha, greater than 2,740 ha of opening patches 5-200 ha, greater than 784 ha of opening patches 200-500 ha and 0 ha of opening patches 500+ ha;

Gross forested landbase, FMU W11: greater than 158 ha of opening patches 0-5 ha, greater than 945 ha of opening patches 5-200 ha, greater than 134 ha of opening patches 200-500 ha and 0 ha of opening patches 500+ ha.

Table 5-8. Opening patch size results for 0 to 5 hectare patches for time 0, 10, and 50 years by FMU

FMU	Time Period	Year	Area (ha)	% Change from Time Zero Area
W13	0	2017	100.0	-
	10	2027	189.2	89%
	50	2067	330.4	231%
W11	0	2017	102.3	-
	10	2027	158.3	55%
	50	2067	283.4	177%

Table 5-9. Opening patch size results for 5 to 200 hectare patches for time 0, 10, and 50 years by FMU

FMU	Time Period	Year	Area (ha)	% Change from Time Zero Area
W13	0	2017	1,542	-
	10	2027	2,740	78%
	50	2067	2,668	73%
W11	0	2017	776	-
	10	2027	945	22%
	50	2067	2,222	186%

Table 5-10. Opening patch size results for 200 to 500 hectare patches for time 0, 10, and 50 years by FMU

FMU	Time Period	Year	Area (ha)	% Change from Time Zero Area
W13	0	2017	234	-
	10	2027	784	234%
	50	2067	528	125%
W11	0	2017	778	-
	10	2027	134	-83%
	50	2067	20	-97%

Table 5-11. Opening patch size results for patches over 500 hectares for time 0, 10, and 50 years by FMU

FMU	Time Period	Year	Area (ha)	% Change from Time Zero Area
W13	0	2017	0.0	-
	10	2027	0.0	0%
	50	2067	0.0	0%
W11	0	2017	0.0	-
	10	2027	0.0	0%
	50	2067	0.0	0%

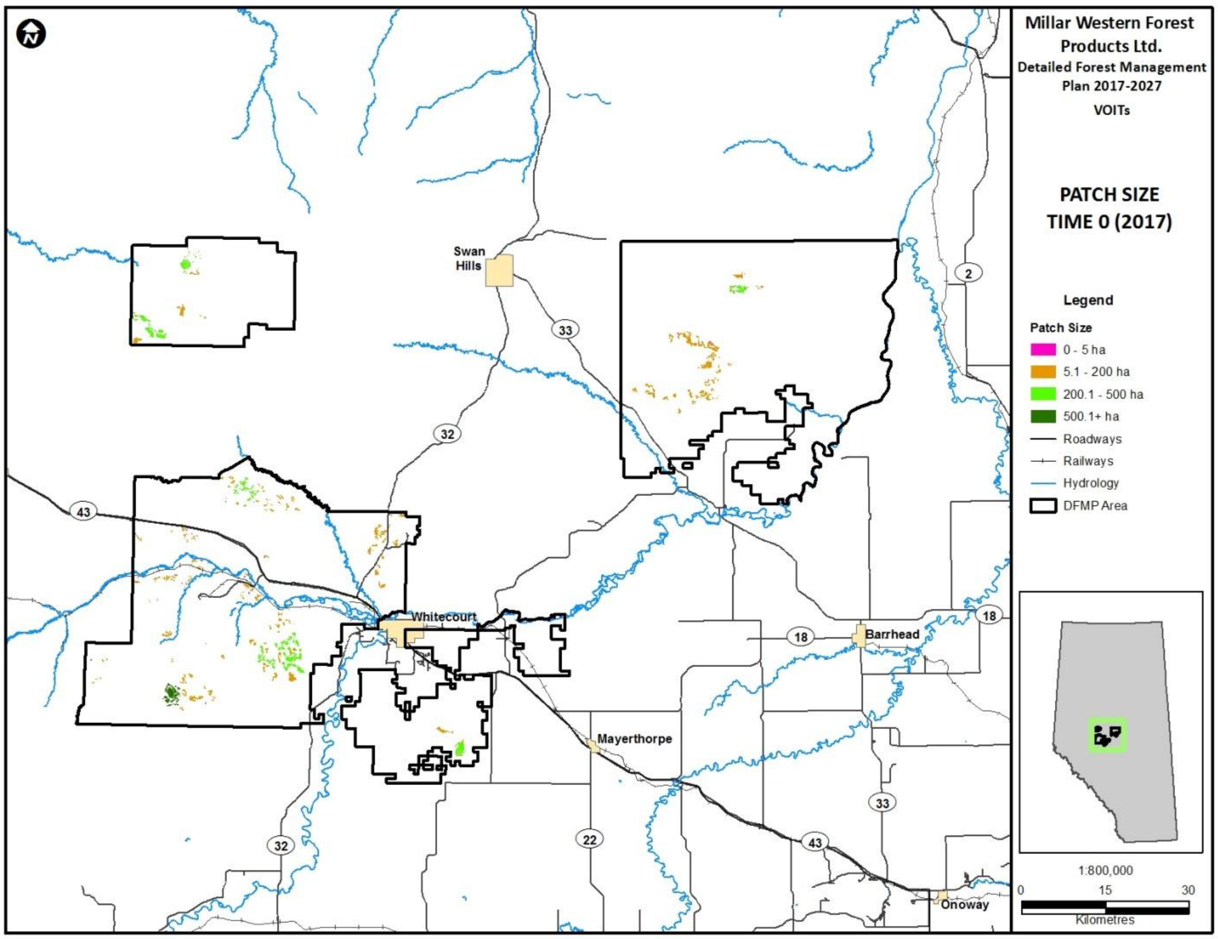


Figure 5-4. Patch size results across the DFMP area for time 0 (2017)

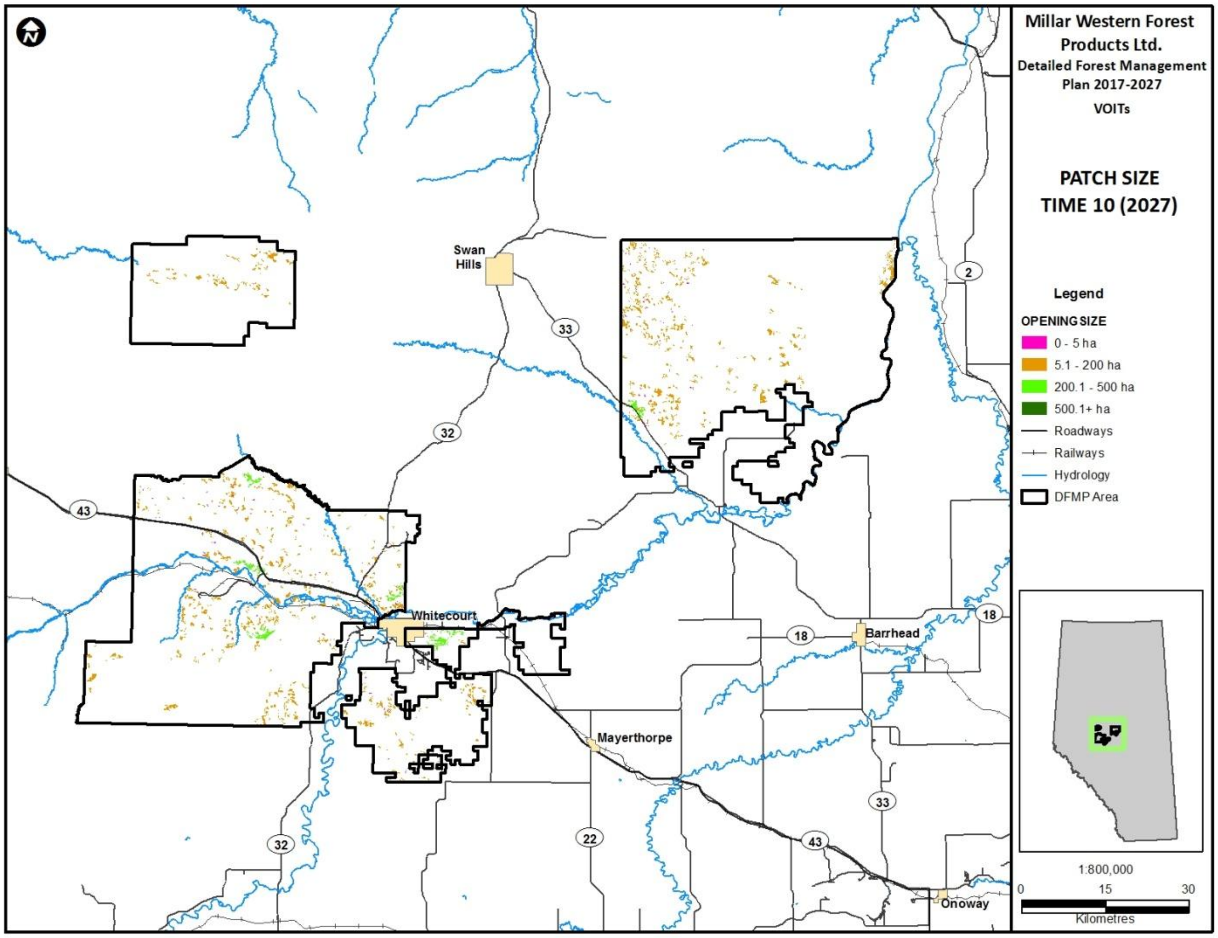


Figure 5-5. Patch size results across the DFMP area for time 10 (2027)

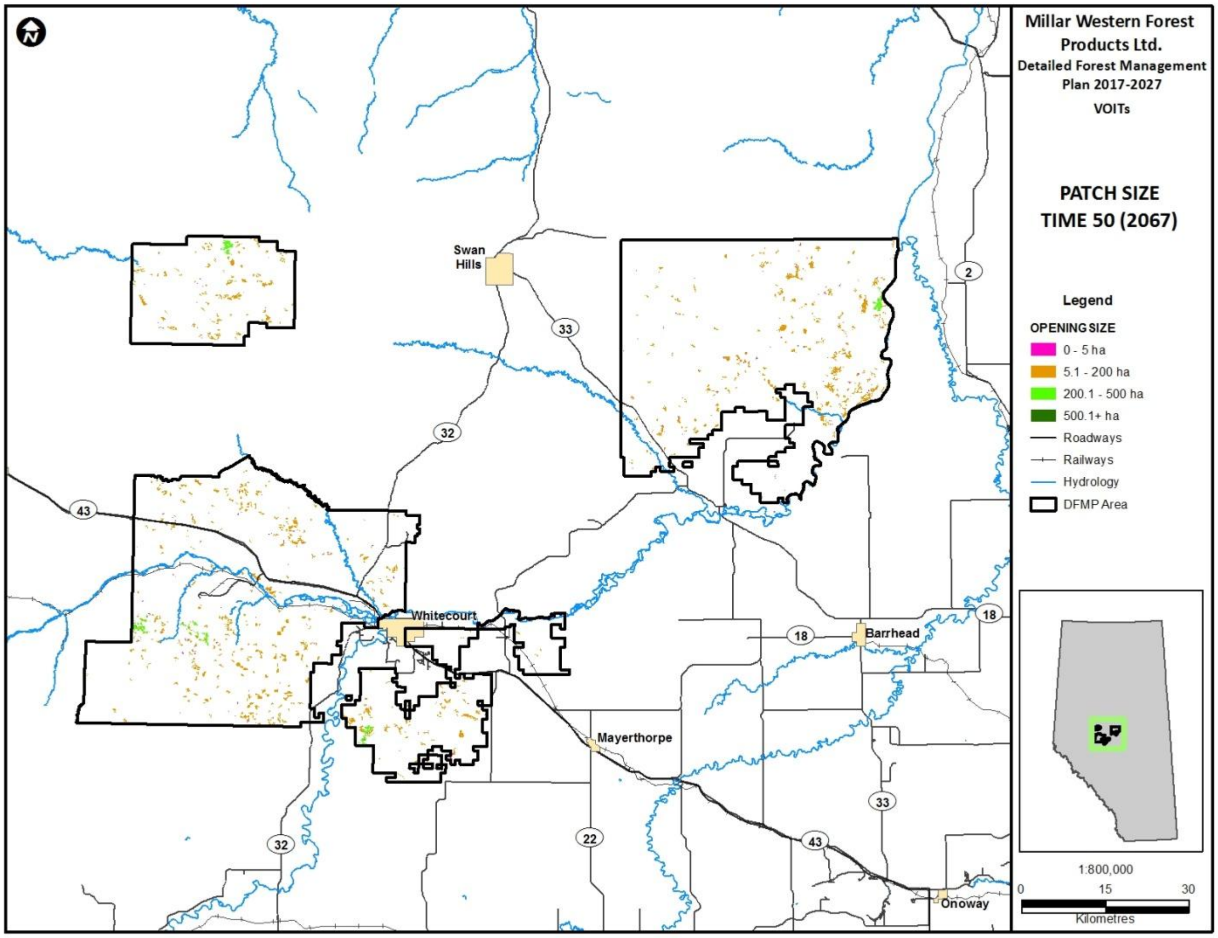


Figure 5-6. Patch size results across the DFMP area for time 50 (2067)

4.3 VOIT 3 – 1.1.1.2b

Required maps and table for old interior forest patches derived from the 2017 Preferred Forest Management Scenario is presented in the following figures.

2017-2027 DFMP targets are in 2027 to achieve:

Gross forested landbase, FMU W13: greater than 27,036 ha of old interior forest patches > 120 ha;

Gross forested landbase, FMU W11: greater than 13,910 ha of old interior forest patches > 120 ha.

Table 5-12. Interior core patches greater than 120 ha for time 0, 10 and 50 years by FMU

FMU	Time Period	Year	Total Area > 120 years old	Area in Patches > 120 ha	% Change from Time Zero
W11	0	2017	37,334	19,801	-
	10	2027	32,494	13,910	-30%
	50	2067	58,709	42,925	117%
W13	0	2017	61,467	32,907	-
	10	2027	57,685	27,036	-18%
	50	2067	72,889	41,935	27%

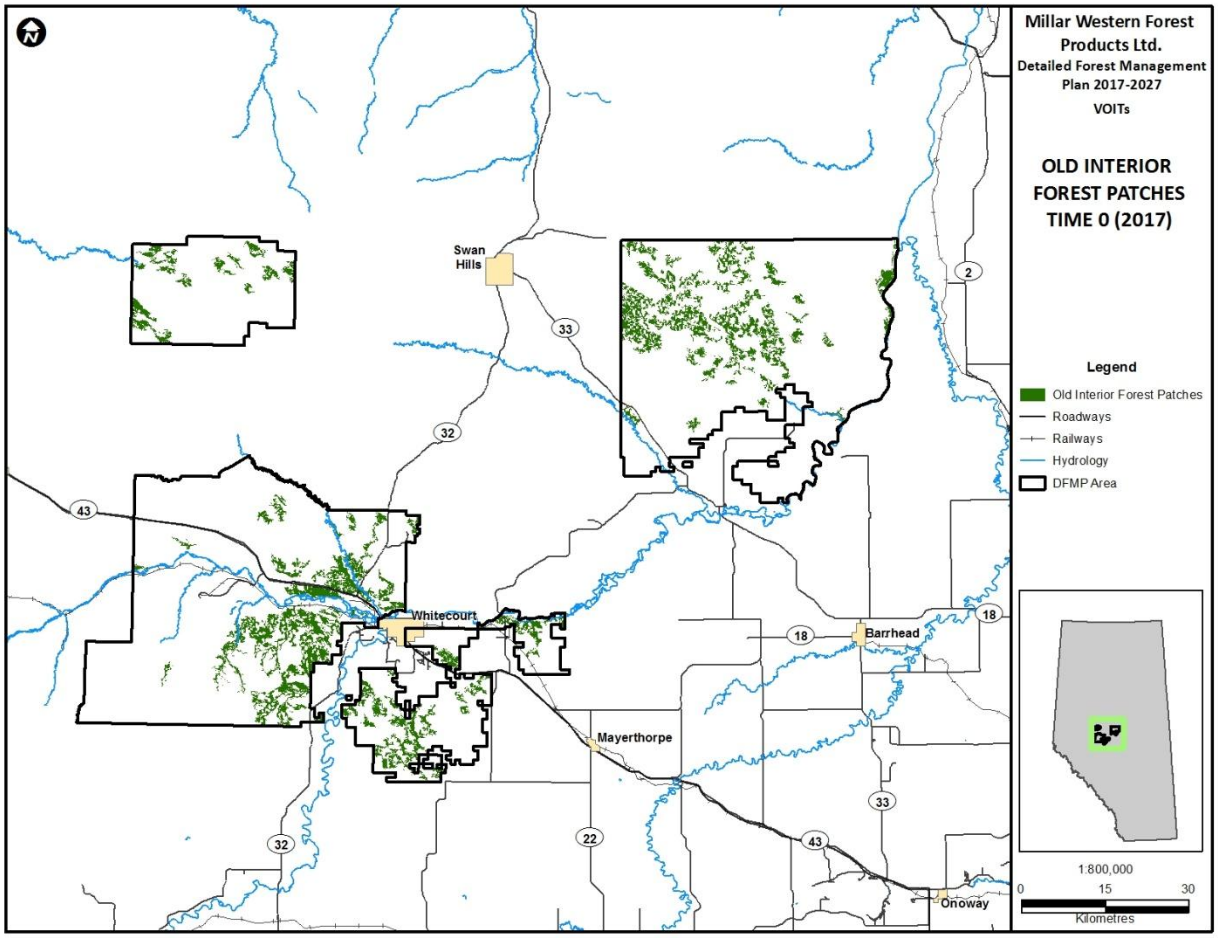


Figure 5-7. Old interior forest patch results across the DFMP area for time 0 (2017)

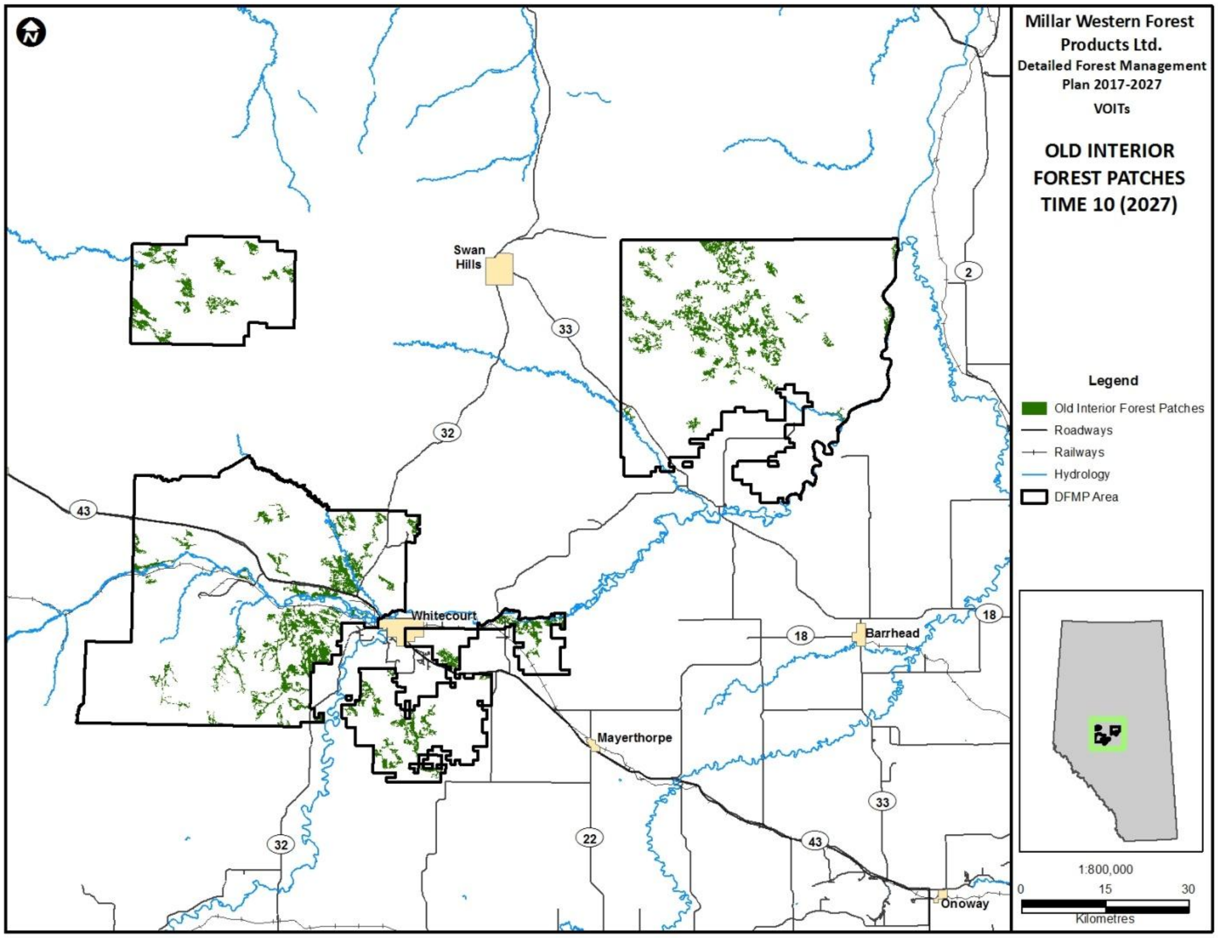


Figure 5-8. Old interior forest patch results across the DFMP area for time 10 (2027)

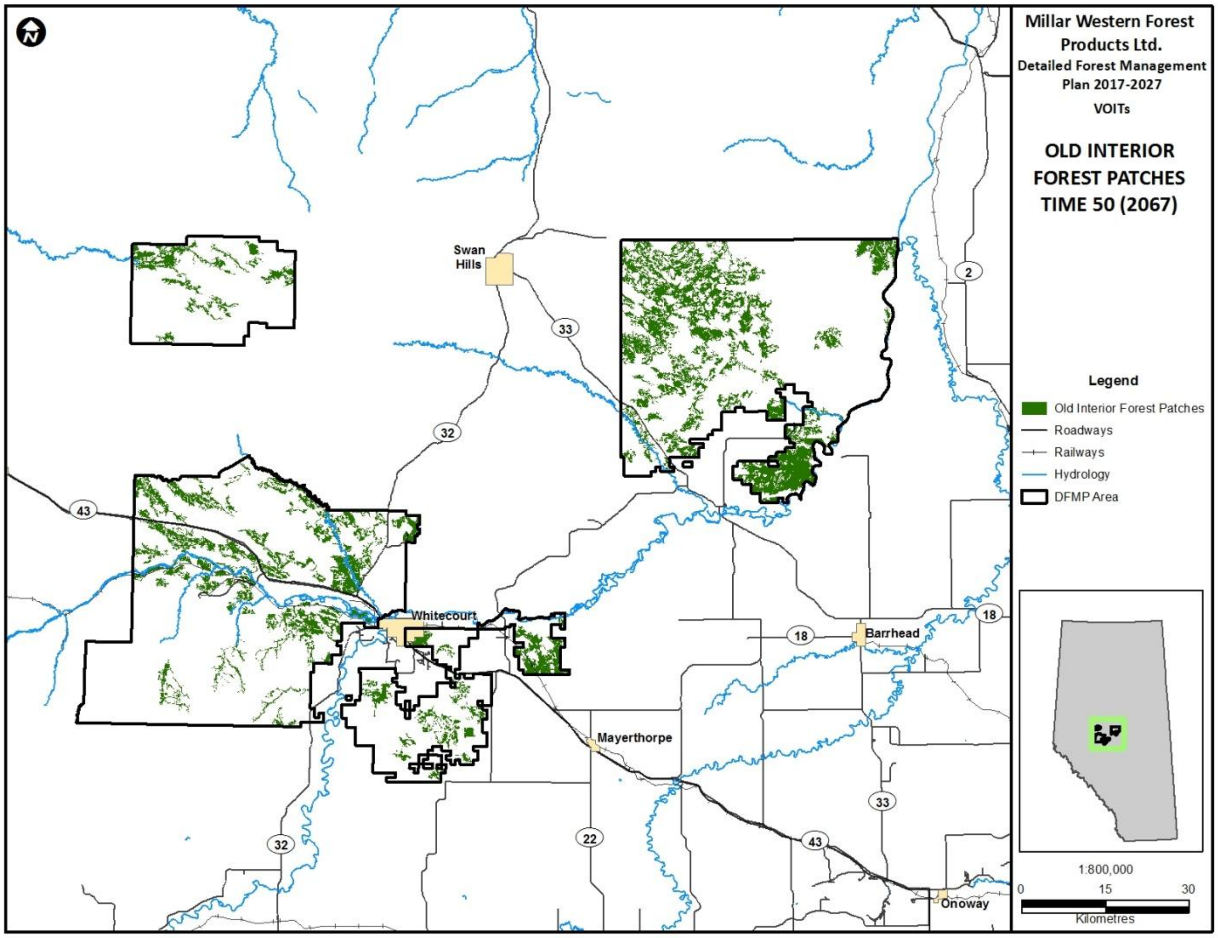


Figure 5-9. Old interior forest patch results across the DFMP area for time 50 (2067)

4.4 VOIT 4 – 1.1.1.3

The Millar Western DFMP area has an already established network of permanent roads which includes roads developed by forestry, energy, oil and gas, etc. This allows for much of the merchantable stands to be accessible for harvest without having to develop a lot of permanent roads. Currently, Millar Western plans on only requiring development of two permanent roads for access into SHS blocks in the next 10 year period. Table 5-13 summarizes the amount of permanent all weather forestry roads currently existing on the Millar Western DFMP area, and the additional amount required by year 10 of the 2017 DFMP, Figure 5-10 illustrates the locations of these roads. Note that the access planned in the caribou zone will be winter only access.

Table 5-13. Permanent all-weather forestry road density for time 0 and time 10

FMU	Permanent all-weather forestry road density	
	Year 0	Year 10
W11	0.067	0.079
W13	0.269	0.283

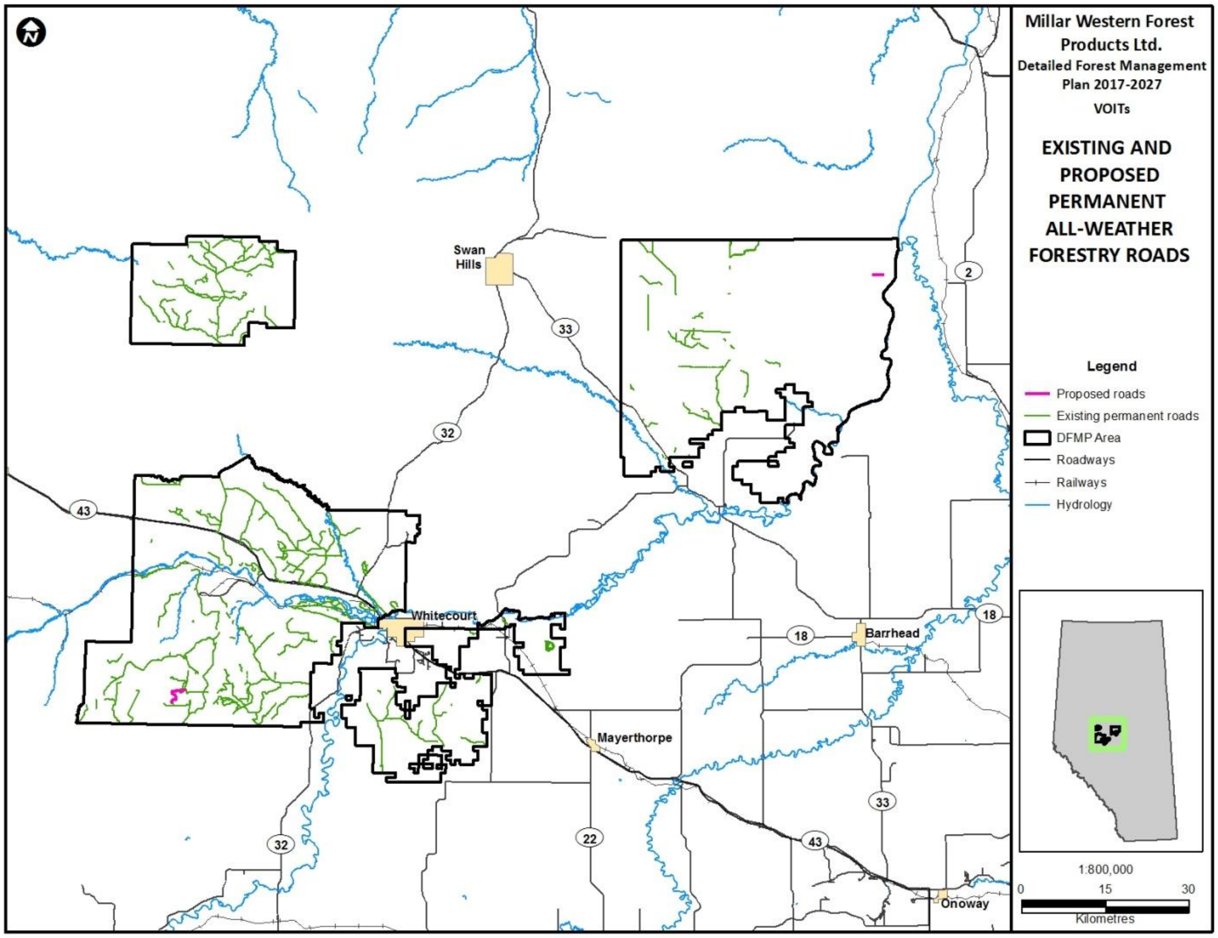


Figure 5-10. Existing and proposed permanent all-weather forestry roads

4.5 VOIT 6 – 1.1.1.4

Millar Western uses the Alberta Conservation Information Management System (ACIMS) which is a biodiversity information management system tool as its source to identify uncommon plant communities within its DFMP Area. Table 5-3 lists identified uncommon plant communities known to exist in the Millar Western DFMP area.

Table 5-14. Uncommon plant communities know to exist in the Millar Western DFMP Area

Scientific Name	Common Name
Blindia acuta	sharp-pointed weissia
Bryum uliginosum	moss
Carex arcta	narrow sedge
Chaenotheca chrysocephala	stubble lichen
Cladonia umbricola	shaded cladonia lichen
Cystopteris montana	mountain bladder fern
Deschampsia elongata	slender hair grass
Dicranella heteromalla	silky fork moss
Dicranella subulata	awl-leaved fork moss
Fontinalis neomexicana	moss
Heterodermia speciosa	powdered fringed lichen
Hygroamblystegium tenax	moss
Hygrohypnum molle	moss
Hygrohypnum ochraceum	moss
Hypocenomyce friesii	clam lichen
Hypopitys monotropa	pinesap
Jungermannia atrovirens	liverwort
Lactuca biennis	tall blue lettuce
Lecania dubitans	bean-spored rim-lichen
Lophozia badensis	liverwort
Luzula acuminata	wood-rush
Mannia pilosa	liverwort
Melanohalea multispora	many-spored camoflage lichen
Melanohalea olivacea	spotted camouflage lichen
Pellia neesiana	liverwort
Peltigera horizontalis	flat fruited pelt lichen
Phegopteris connectilis	northern beech fern
Physcia tenella	fringed rosette lichen
Physconia enteroxantha	frost lichen
Ramalina obtusata	hooded ramalina
Ramalina sinensis	fan ramalina
Rhizomnium magnifolium	moss
Riccardia palmata	liverwort
Salix drummondiana / Scirpus microcarpus - Calamagrostis canadensis	Drummond's willow / small-fruited bulrush - bluejoint
Scapania paludicola	liverwort
Schistostega pennata	luminous moss
Solorina spongiosa	fringed chocolate chip lichen
Splachnum luteum	yellow collar moss
Splachnum rubrum	red collar moss
Splachnum vasculosum	large-fruited splachnum moss
Tayloria serrata	slender splachnum moss
Tritomaria scitula	liverwort

4.6 VOIT 7 – 1.1.1.5

VOIT 7 is aligned with the GoA's "Fire Salvage Planning and Operations - Directive No. 2007-01", the objective of which is to "utilize as much of the fire-killed timber as possible within two years of the fire event, while maintaining environmental values". Companies with tenure in the burned area have the first opportunity to obtain fire-killed timber. Within the fire boundary, however, 10-25% of the merchantable burned trees must be retained. Retention of large, contiguous patches, representing the full range of burn severity, is preferred (Alberta, 2007). Table 5-15 lists the percent of burned areas salvaged and the percent that was salvageable by FMU and fire year, Figure 5-11 displays the locations of these fires. As noted in Table 5-15, no fire salvage occurred between 2007 and 2016.

Table 5-15. Fire disturbance history since 2007 by FMU, and the percent salvageable and salvaged in the productive landbase.

FMU	Fire Year	Area of Fire (within DFMP Area) (ha)	Percent Salvageable (%)	Percent Salvaged (%)
W11	2009	2,694	1%	0%
	2011	13	0%	0%
	2015	13	0%	0%
W13	2010	173	0%	0%
	2011	310	0%	0%
	2012	7	0%	0%
	2013	17	0%	0%

[1] Salvageable is defined as not being previously harvested, is within the active landbase, and is a minimum age of 80 years old

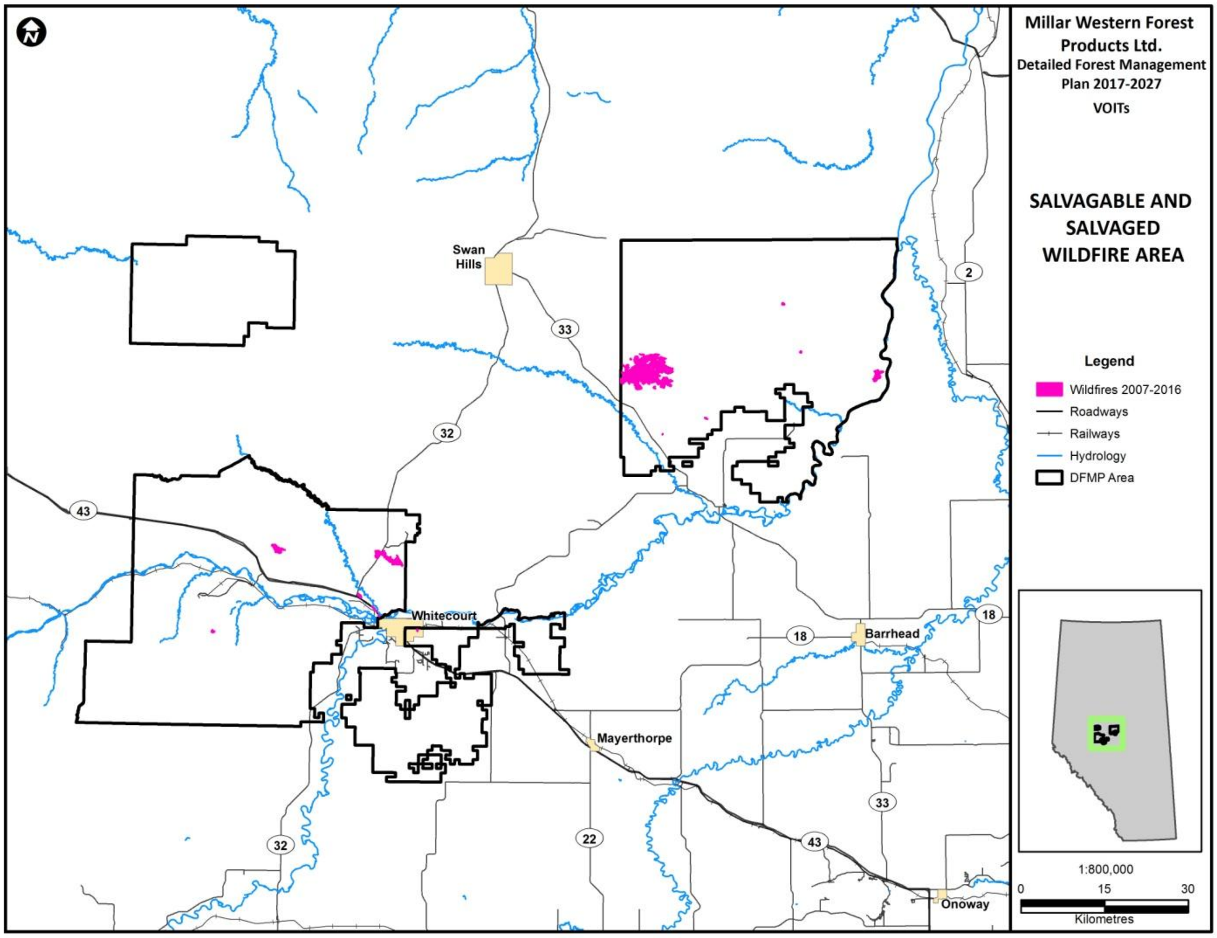


Figure 5-11. Fire disturbance history and salvaged cutblocks (2007-2016)

4.7 VOIT 14 – 1.2.1.1

VOIT 14's objective is to maintain habitat for identified high value species. This was completed by using models and guidance provided by or through the GoA as part of the DFMP process. The following subsections below detail the reporting completed for each of the identified species modeled (i.e. Grizzly bear, Barred owl, Marten and Songbirds).

4.7.1 Grizzly Bear

Grizzly bears were officially listed as a *Threatened* species in Alberta in June of 2010 (Grizzly Bear Conservation in Alberta: 2013 Management Activities and Recovery Implementation, April 2014 Government of Alberta). Access management, particularly minimizing motorized vehicle routes across Grizzly Bear range is essential to maintaining this species on the landscape. In following the intent of the goal and recovery activities in the Draft Alberta Grizzly Bear Recovery Plan 2016-2021 (2016), it is important to minimize access, avoid harvest within primary habitat and prioritize harvest to areas near existing roads.

fRI Research has provided the Grizzly Bear model package which includes several different tools. For the 2017-2027 DFMP only the Habitat States tool and a calculation of road density was used. The Habitat States tool describes grizzly bear habitat states which are a combination of the RSF and mortality risk models. The grizzly bear habitat states model is based on a research paper completed by Nielson et al. in 2006. It uses LiDAR and landsat based landcover products (*i.e.* landcover type, forest canopy, terrain, etc.) and disturbance updates (*i.e.* cutblocks, roads, wellsites, pipelines, etc.) to create a raster output. Millar Western provided disturbance update files which include all the cutblocks and disturbances that are 2011 or newer within the landbase for use as input into the model (as per PDT and fRI feedback).

During the initial review of the grizzly bear model and its outputs, the Virginia Hills region of FMU W13 was identified as possibly not being representative of the actual landscape. This prompted review by FORCORP, fRI and GoA. Taking into consideration the model coefficients (e.g. topography, vegetation) that were derived primarily for the Upper Foothills, these coefficients may not be truly representative of the Lower Foothills. Many of these coefficients are highly correlated to streams and the surrounding 500 meters; therefore, the Virginia Hills region, with high topographic variability and a high density of streams, is primarily symbolized as a habitat sink in fRI's Grizzly bear Habitat States model outputs. Therefore, in FMU W13 north, harvesting will not be prioritized on the model outputs. The model is applicable for the remainder of the DFMP Area.

Table 5-16 and Table 5-17 summarizes the results of the grizzly bear model for habitat state values as well as road densities each time period (*i.e.* time 0, time 10 and time 20), as well as the percent change of value of each time period from time zero for both the whole grizzly bear watershed unit that intersects the DFMP area, as well as by FMU for both grizzly bear populations present within the DFMP area.

Table 5-16. Grizzly bear summary for Swan Hills grizzly population

Area of Interest	Habitat Zone	Area (km^2)	Area (ha)	Index	Current (2017)	Future 10 yr (2027)	Difference +/-	Future 20 yr (2037)	Difference +/-	% Change
S11	Core	7	664	Road Density	0.27	0.27	0.00	0.27	0.00	0%
				Primary Habitat (2)	23	21	-2	20	-3	-12%
				Secondary Habitat (1)	22	21	-1	19	-3	-15%
				Non-critical Habitat (0)	43	43	0	42	0	-1%
				Secondary Sink (-1)	111	111	0	111	0	0%
				Primary Sink (-2)	465	468	3	471	6	1%
S13	Core	6	580	Road Density	0.04	0.04	0.00	0.04	0.00	0%
				Primary Habitat (2)	27	22	-5	20	-7	-24%
				Secondary Habitat (1)	57	45	-12	41	-16	-27%
				Non-critical Habitat (0)	42	38	-4	37	-5	-11%
				Secondary Sink (-1)	167	153	-14	151	-17	-10%
				Primary Sink (-2)	286	322	35	330	44	15%
S18	Core	9	865	Road Density	0.13	0.13	0.00	0.13	0.00	0%
				Primary Habitat (2)	60	59	0	61	1	2%
				Secondary Habitat (1)	67	58	-9	55	-12	-18%
				Non-critical Habitat (0)	61	56	-6	53	-8	-13%
				Secondary Sink (-1)	179	169	-10	159	-20	-11%
				Primary Sink (-2)	498	523	25	538	39	8%
S5	Core	9	855	Road Density	0.03	0.03	0.00	0.03	0.00	0%
				Primary Habitat (2)	58	55	-3	54	-4	-8%
				Secondary Habitat (1)	70	61	-9	59	-11	-16%
				Non-critical Habitat (0)	80	75	-5	74	-6	-7%
				Secondary Sink (-1)	219	212	-7	211	-8	-4%
				Primary Sink (-2)	429	453	24	458	29	7%
S8	Core	12	1,188	Road Density	0.00	0.00	0.00	0.00	0.00	0%
				Primary Habitat (2)	331	331	0	331	0	0%
				Secondary Habitat (1)	167	166	0	166	0	0%
				Non-critical Habitat (0)	71	71	0	71	0	0%
				Secondary Sink (-1)	46	46	0	46	0	1%
				Primary Sink (-2)	573	573	0	573	0	0%

Area of Interest	Habitat Zone	Area (km^2)	Area (ha)	Index	Current (2017)	Future 10 yr (2027)	Difference +/-	Future 20 yr (2037)	Difference +/-	% Change
S10	Secondary	7	667	Road Density	0.00	0.00	0.00	0.00	0.00	0%
				Primary Habitat (2)	72	72	0	72	0	1%
				Secondary Habitat (1)	53	52	-1	52	-1	-2%
				Non-critical Habitat (0)	45	44	0	44	0	-1%
				Secondary Sink (-1)	122	122	0	121	0	0%
				Primary Sink (-2)	376	377	1	377	1	0%
S14	Secondary	7	661	Road Density	0.01	0.01	0.00	0.01	0.00	0%
				Primary Habitat (2)	45	45	0	45	1	2%
				Secondary Habitat (1)	100	100	0	97	-3	-3%
				Non-critical Habitat (0)	285	285	0	284	-1	0%
				Secondary Sink (-1)	122	122	0	122	0	0%
				Primary Sink (-2)	109	109	0	112	3	3%
S15	Secondary	11	1,093	Road Density	0.04	0.04	0.00	0.04	0.00	0%
				Primary Habitat (2)	83	84	1	87	4	5%
				Secondary Habitat (1)	178	167	-11	161	-17	-10%
				Non-critical Habitat (0)	204	197	-7	190	-15	-7%
				Secondary Sink (-1)	209	204	-5	202	-7	-3%
				Primary Sink (-2)	418	441	23	453	34	8%
S3	Secondary	9	949	Road Density	0.00	0.00	0.00	0.00	0.00	0%
				Primary Habitat (2)	25	25	0	25	0	0%
				Secondary Habitat (1)	34	34	0	34	0	0%
				Non-critical Habitat (0)	45	45	0	45	0	0%
				Secondary Sink (-1)	168	168	0	168	0	0%
				Primary Sink (-2)	677	677	0	677	0	0%
S4	Secondary	7	670	Road Density	0.00	0.00	0.00	0.00	0.00	0%
				Primary Habitat (2)	116	116	0	116	0	0%
				Secondary Habitat (1)	213	213	0	213	0	0%
				Non-critical Habitat (0)	234	234	-1	234	-1	0%
				Secondary Sink (-1)	36	36	0	36	0	0%
				Primary Sink (-2)	70	70	0	70	0	1%
S6	Secondary	6	578	Road Density	0.10	0.10	0.00	0.10	0.00	0%
				Primary Habitat (2)	68	67	-1	68	0	-1%
				Secondary Habitat (1)	107	102	-5	100	-7	-7%

Area of Interest	Habitat Zone	Area (km^2)	Area (ha)	Index	Current (2017)	Future 10 yr (2027)	Difference +/-	Future 20 yr (2037)	Difference +/-	% Change
				Non-critical Habitat (0)	94	88	-6	86	-8	-8%
				Secondary Sink (-1)	128	126	-3	122	-7	-5%
				Primary Sink (-2)	180	194	15	202	22	12%
S9	Secondary	5	512	Road Density	0.06	0.06	0.00	0.06	0.00	0%
				Primary Habitat (2)	13	13	0	12	-1	-8%
				Secondary Habitat (1)	33	30	-3	24	-10	-29%
				Non-critical Habitat (0)	49	44	-5	39	-10	-19%
				Secondary Sink (-1)	138	137	-1	134	-4	-3%
				Primary Sink (-2)	280	289	9	304	24	9%
W11	Core	4	425	Road Density	0.11	0.11	0.00	0.11	0.00	0%
				Primary Habitat (2)	22	14	-8	12	-11	-48%
				Secondary Habitat (1)	38	18	-21	12	-26	-68%
				Non-critical Habitat (0)	25	16	-9	15	-10	-41%
				Secondary Sink (-1)	136	114	-22	110	-26	-19%
				Primary Sink (-2)	203	263	59	276	73	36%
	Secondary	3	336	Road Density	0.14	0.14	0.00	0.14	0.00	0%
				Primary Habitat (2)	37	35	-2	38	2	5%
				Secondary Habitat (1)	48	39	-9	31	-17	-35%
				Non-critical Habitat (0)	78	73	-6	65	-13	-17%
				Secondary Sink (-1)	69	65	-4	64	-5	-7%
				Primary Sink (-2)	104	125	21	137	33	32%
W13	Core	8	765	Road Density	0.38	0.38	0.00	0.38	0.00	0%
				Primary Habitat (2)	43	41	-2	41	-2	-4%
				Secondary Habitat (1)	43	32	-10	27	-16	-36%
				Non-critical Habitat (0)	51	45	-6	42	-8	-17%
				Secondary Sink (-1)	154	144	-10	134	-20	-13%
				Primary Sink (-2)	474	502	28	520	45	10%
	Secondary	4	381	Road Density	0.23	0.23	0.00	0.23	0.00	0%
				Primary Habitat (2)	21	23	2	23	2	11%
				Secondary Habitat (1)	42	30	-11	20	-21	-51%
				Non-critical Habitat (0)	50	36	-14	29	-21	-42%
				Secondary Sink (-1)	115	110	-4	102	-13	-11%
				Primary Sink (-2)	154	181	27	206	52	34%

Table 5-17. Grizzly bear summary for Grande Cache grizzly population

Area of Interest	Habitat Zone	Area (km^2)	Area (ha)	Index	Current (2017)	Future 10 yr (2027)	Difference +/-	Future 20 yr (2037)	Difference +/-	% Change
G28	Secondary	777	77,708	Road Density	0.14	0.14	0.01	0.14	0.01	5%
				Primary Habitat (2)	89	89	-0.36	85	-4.36	-5%
				Secondary Habitat (1)	153	155	2.02	159	5.27	3%
				Non-critical Habitat (0)	252	243	-9.12	218	-34.08	-14%
				Secondary Sink (-1)	151	158	6.87	176	25.47	17%
				Primary Sink (-2)	131	132	0.59	139	7.70	6%
G31	Secondary	1,032	103,171	Road Density	0.00	0.00	0.00	0.00	0.00	0%
				Primary Habitat (2)	66	66	0.00	66	0.00	0%
				Secondary Habitat (1)	185	185	0.02	186	0.22	0%
				Non-critical Habitat (0)	314	314	-0.04	314	-0.30	0%
				Secondary Sink (-1)	230	230	0.03	230	0.10	0%
				Primary Sink (-2)	236	236	-0.01	236	-0.02	0%
W13	Secondary	542	54,229	Road Density	0.20	0.21	0.01	0.21	0.01	5%
				Primary Habitat (2)	60	59	-0.36	55	-4.37	-7%
				Secondary Habitat (1)	103	105	2.04	108	5.50	5%
				Non-critical Habitat (0)	171	162	-9.16	137	-34.25	-20%
				Secondary Sink (-1)	114	121	6.91	140	25.46	22%
				Primary Sink (-2)	94	95	0.59	102	7.67	8%

Figure 5-12, Figure 5-13 and Figure 5-14 illustrate the results spatially of the grizzly bear model for habitat state results for each time period.

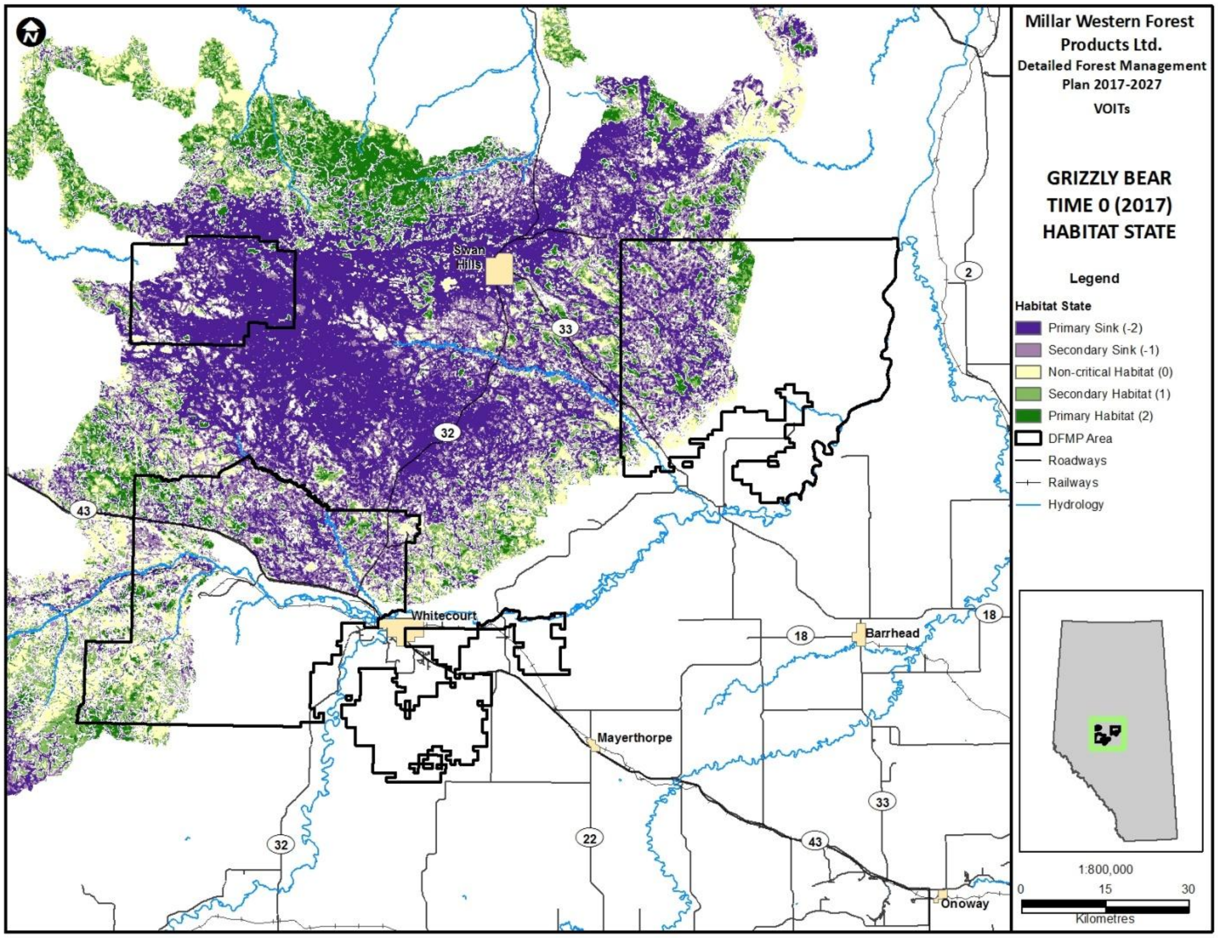


Figure 5-12. Grizzly bear habitat states results for time zero

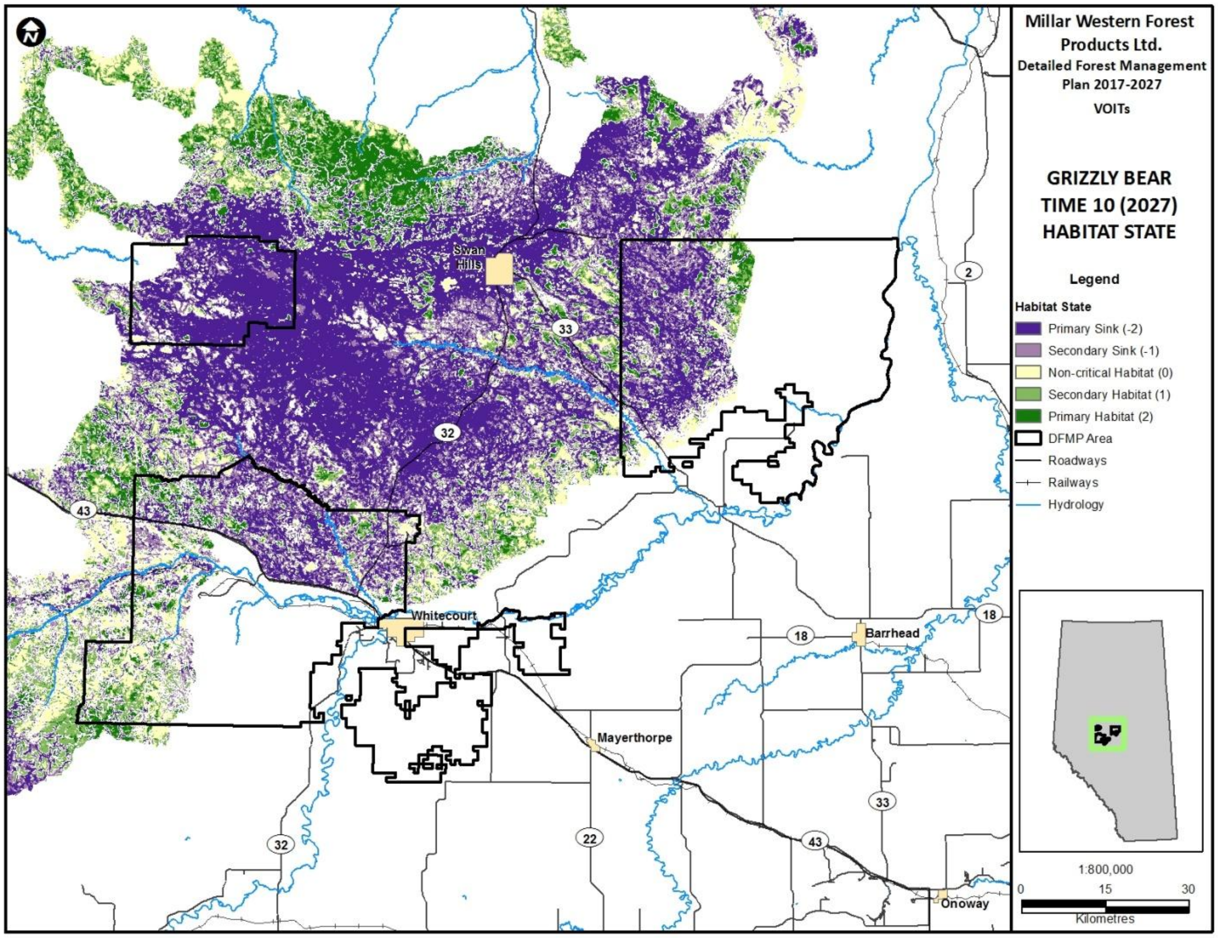


Figure 5-13. Grizzly bear habitat states results for time 10

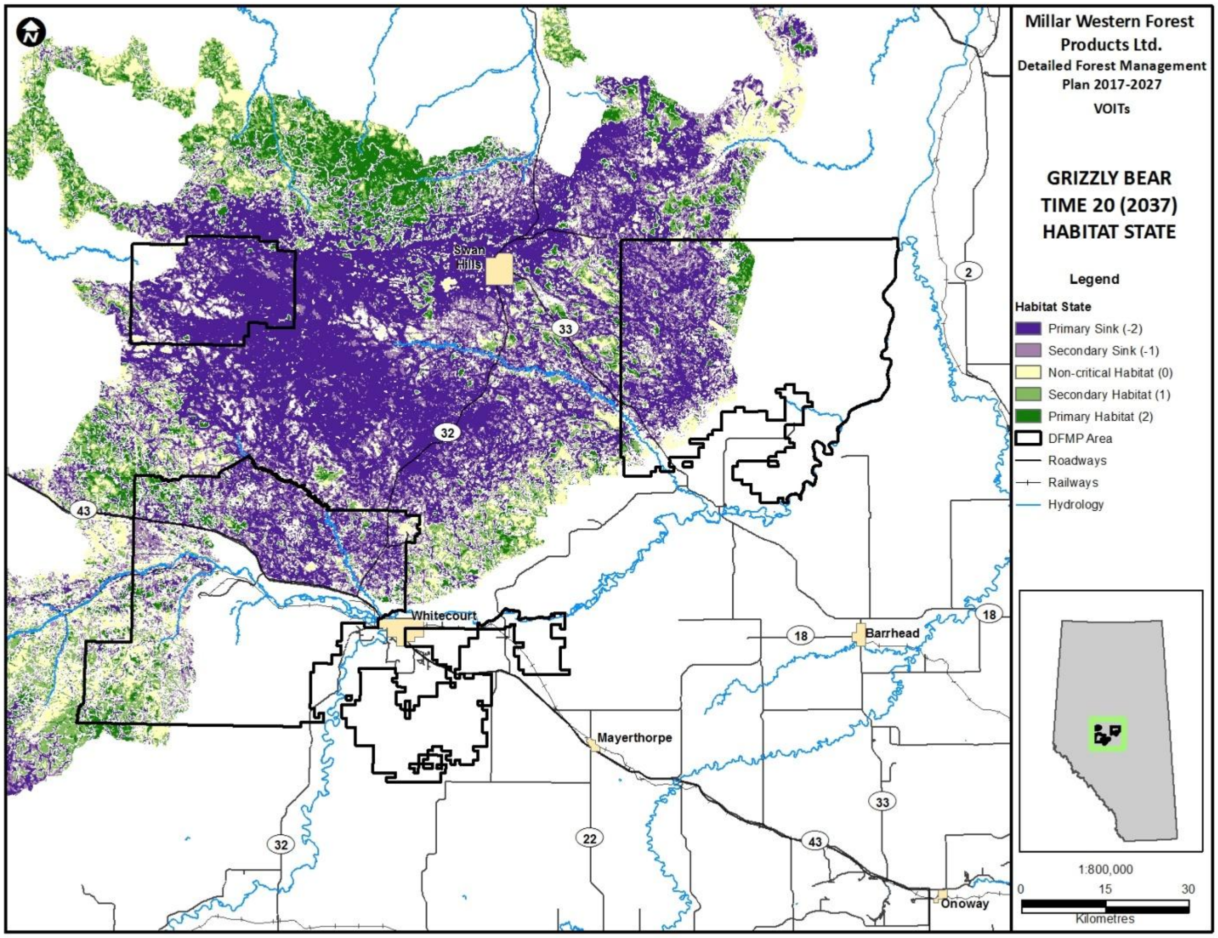


Figure 5-14. Grizzly bear habitat states results for time 20

As part of the 2017 DFMP submission, Millar Western has completed a grizzly bear strategy on ways to mitigate impacts to grizzly bear habitat. This strategy can be found in *Appendix IV* of *Chapter 7 – Implementation.*

4.7.2 Barred owl

In Alberta, the barred owl (*Strix varia*) has been listed as a species of special concern. The barred owl is the larger of the cavity nesting owls in North America. It is a year-round Alberta resident, requiring large decaying or dead trees for nesting. Preferred barred owl habitat generally consists of old mixedwood forest across the boreal, foothills and aspen parkland regions of Alberta. For the Millar Western 2017-2027 DFMP, barred owl was modeled for percent change in both the resource selection function (RSF) habitat value and potential breeding pair habitat value from time zero (2017) to time 10, time 20, time 50 and time 100.

The barred owl model is based on Mike Russell's MSc thesis in 2008. The thesis found that the barred owl is a territorial bird, and that the spatial arrangement of certain landbase features affected the species. As a result, the resulting RSF model uses spatial rasters to determine the overall relative importance of habitat across the landscape. It uses a typical landbase netdown as the input, and generates 5 raster layers of the following attributes:

1. Percent softwood
2. Percent hardwood
3. Distance to nearest young stand less than 30 years old
4. Distance to nearest forest older than 90 years old, and
5. Area to perimeter ratio of forested stands older than 30 years.

Items 3 and 4 are calculated by examining the cells within 150 m of the target cell. Item 5 is calculated by dividing length by area in the ESRI ArcGIS derived length and area columns in metres, which is then converted into a raster. The barred owl RSF is calculated from the 5 raster layers using a formula that is applied to each raster cell. The resulting raster layer is therefore a combination of conifer and hardwood percentages, distances to openings, distance to older forest and the shape of forested polygons greater than 30 years old.

To determine how many breeding pairs there are, the following calculation is undertaken after the model has been completed:

> Using the “BREEDPAIR” raster, take the number under “Count” for Value 1 (e.g. 4,793,719), multiple it by the raster grid size (15m by 15m = 225 m2), and the divide by 10,000 to get the number in hectares.
>
> e.g. (4,793,719 x 225)/10,000 = 107,858.7
>
> Then divide this number by 562 ha (Russels, 2008).
>
> e.g. 107,858.7/562 = 191.9
>
> Round the number, and this gives you the number of breeding pairs.
>
> e.g. 192

The time 10, time 20, time 50, and time 100 of this model was post-processed from the Patchworks model output for the preferred forest management scenario (PFMS) and time period. All time periods were run on the gross landbase, which was aged for each time period processed.

The barred owl time-zero model was run on the W13 and W11 AVI by compartments; the updated origin field (F_AGE) and cutblock modifier-mod1 (LandStatus) fields were used in lieu of AVI, as they are more representative of the landbase for time zero; for following time periods, the age (origin) and (mod1) were updated with the PFMS results. Table 5-18 displays the results of the barred owl model for potential breeding pair numbers and RSF values for each time period, as well as the percentage change of value of each time period from time zero. Figure 5-15 and Figure 5-16 display the trend of potential breeding pairs and RSF values over time, respectively.

Table 5-18. RSF and potential breeding pair model results for barred owl for time 0, 10, 20, 50 and 100 by FMU

Time Period	Year	Number of Potential Breeding Pairs	% Change from Time zero of Potential Breeding Pairs	Mean RSF Values	% Change from Time zero of mean RSF Values
0	2017	183	-	0.1105	-
10	2027	151	-18%	0.1045	-5%
20	2037	174	-5%	0.1082	-2%
50	2067	111	-39%	0.1064	-4%
100	2117	120	-34%	0.1082	-2%

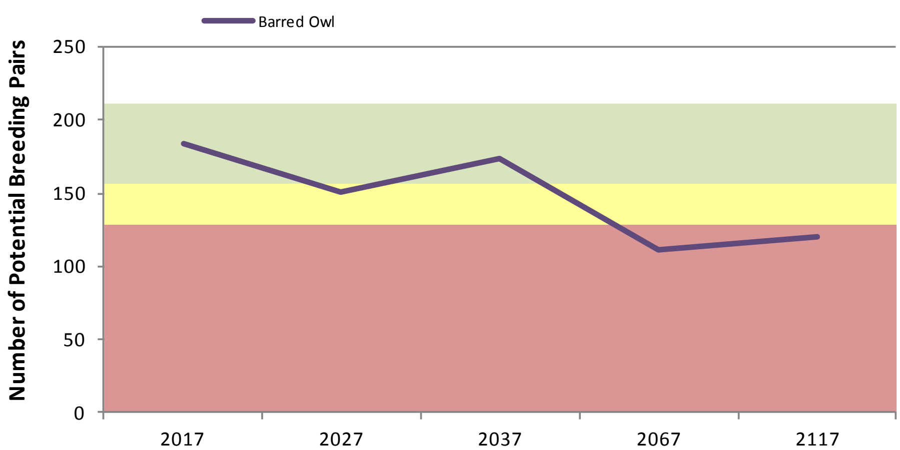


Figure 5-15. Trend of barred owl potential breeding pair values over time and the percent change relative to time zero

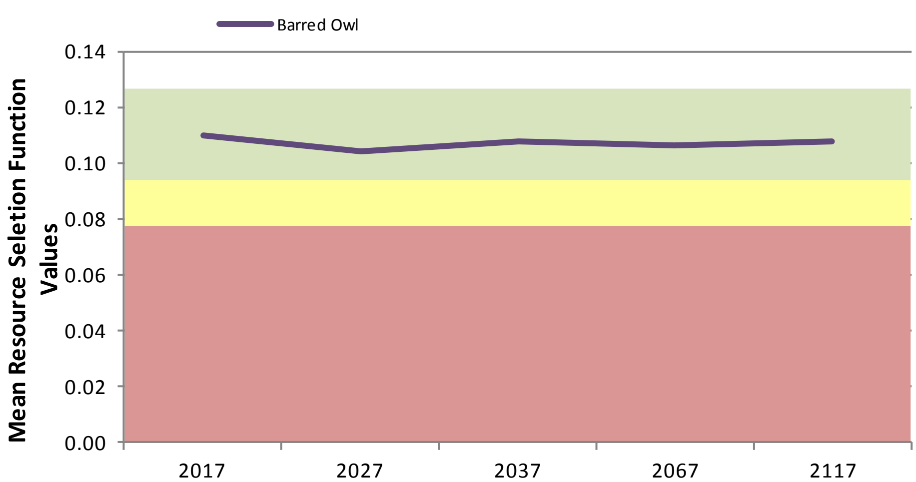


Figure 5-16. Trend of barred owl RSF values over time and the percentage change relative to time zero

Figure 5-17, Figure 5-18 and Figure 5-19 illustrate the results spatially of the barred owl model for potential breeding pair numbers and Figure 5-20, Figure 5-21 and Figure 5-22 display the RSF values for each time period.

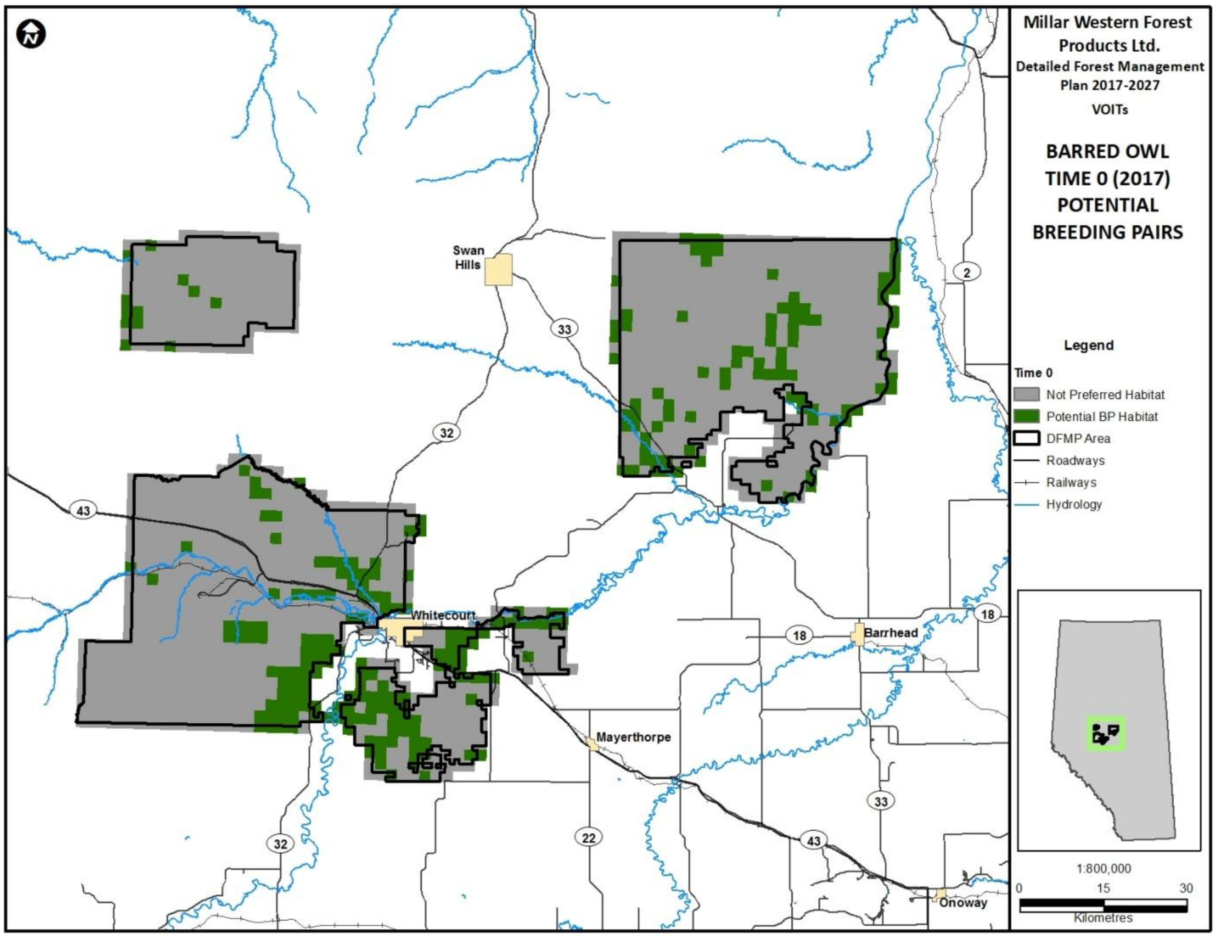


Figure 5-17. Potential breeding pairs at time zero

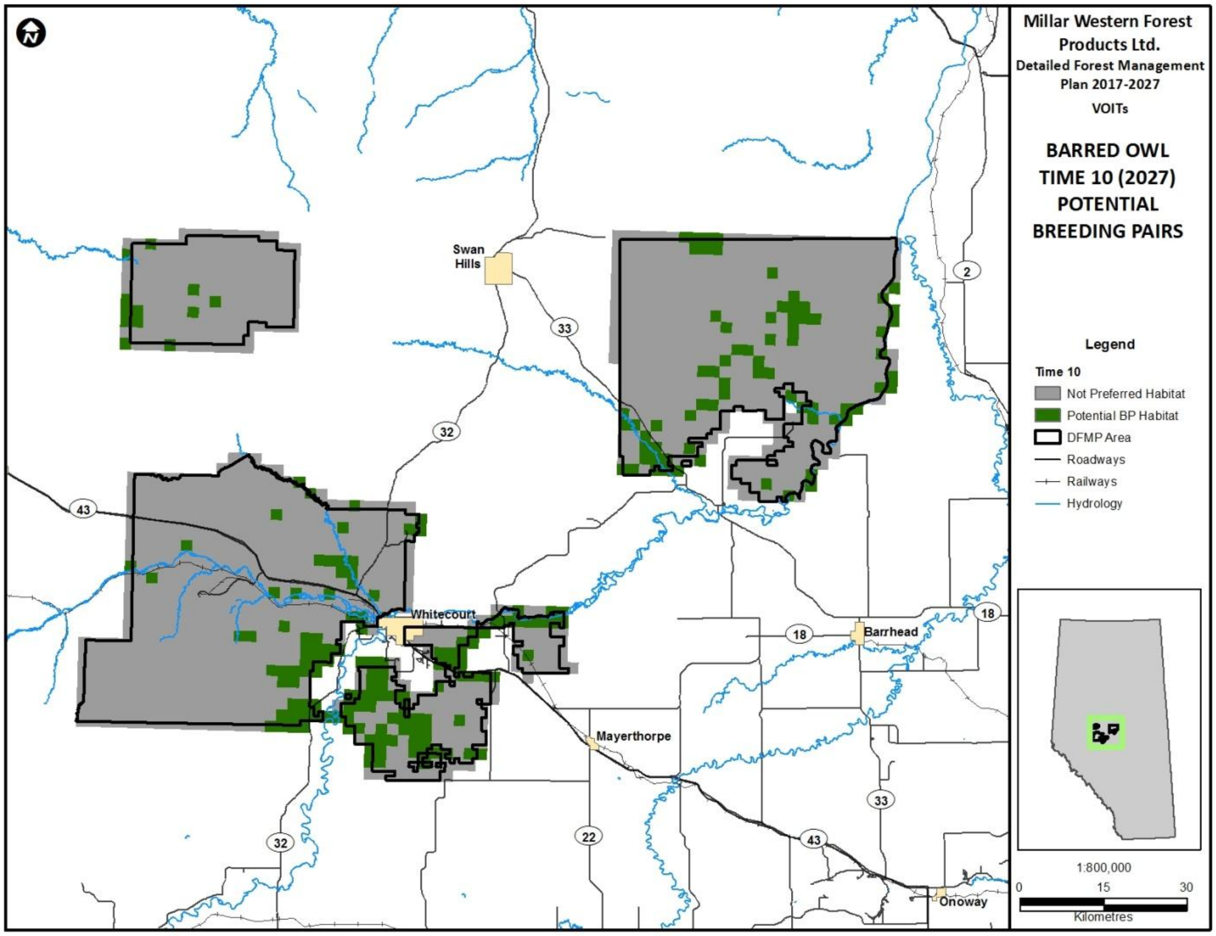


Figure 5-18. Potential breeding pairs at time 10

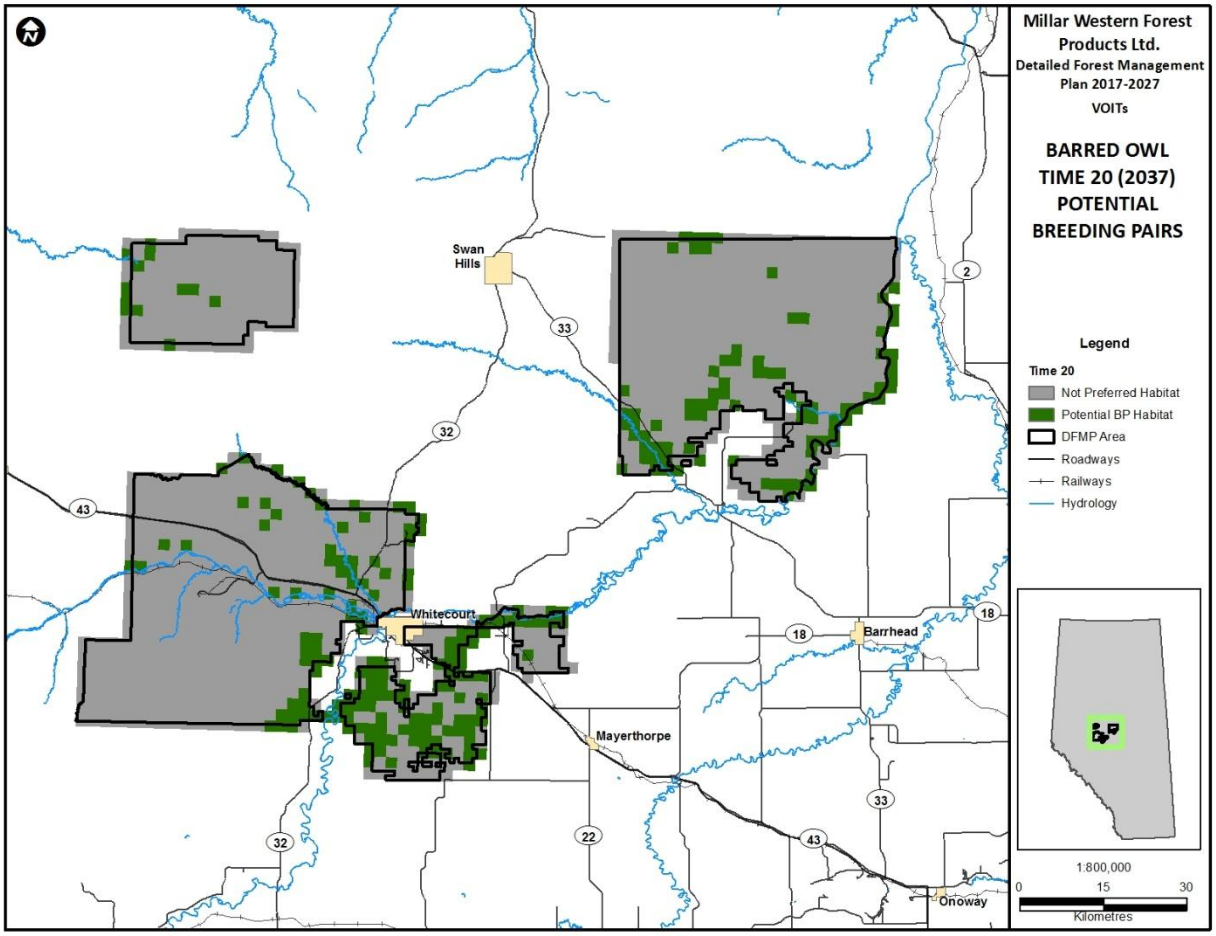


Figure 5-19. Potential breeding pairs at time 20

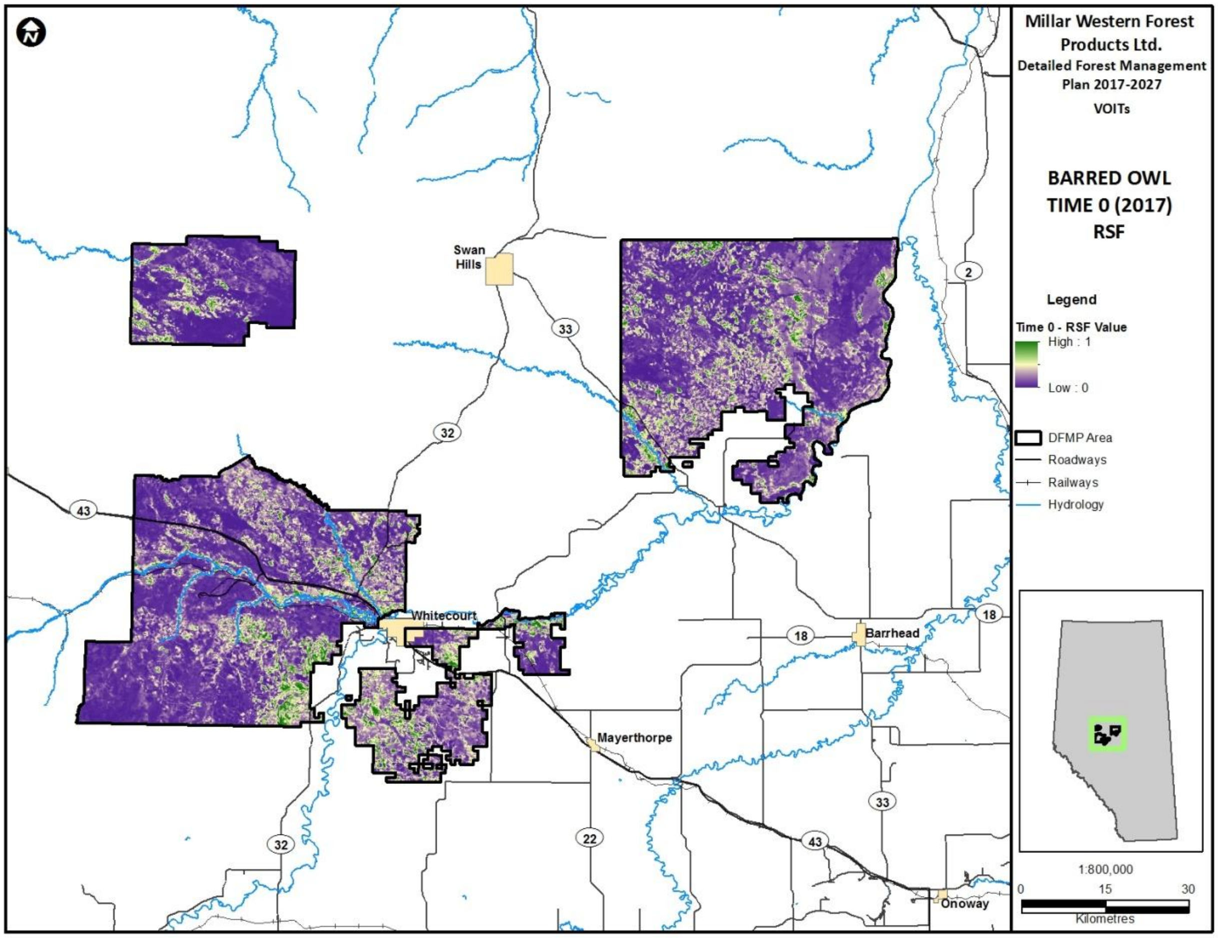


Figure 5-20. Resource selection function values at time zero

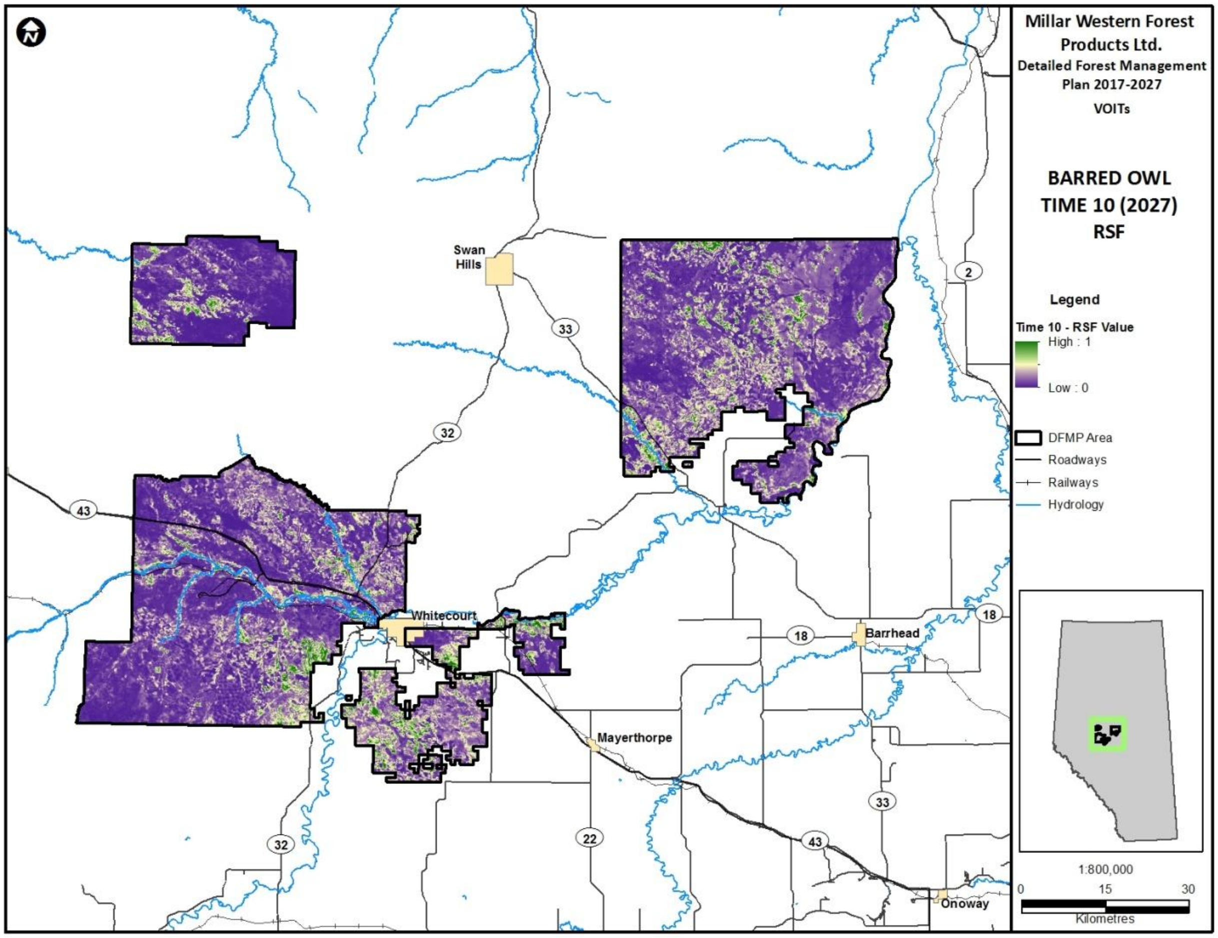


Figure 5-21. Resource selection function values at time 10

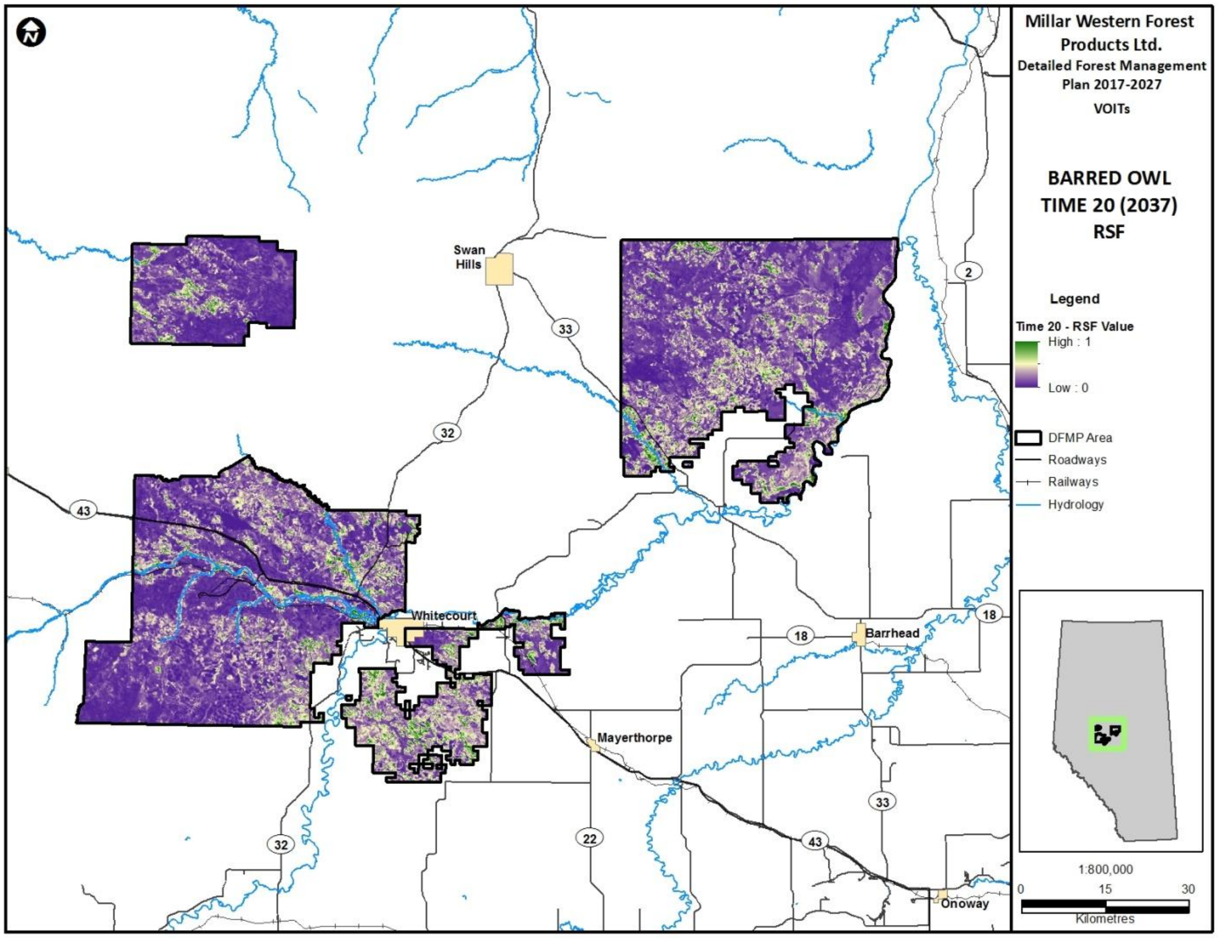


Figure 5-22. Resource selection function values at time 20

As part of the 2017 DFMP submission, Millar Western has completed a barred owl strategy, which describes ways to mitigate impacts to barred owl habitat. This strategy can be found in *Appendix V* of *Chapter 7 – Implementation*.

4.7.3 American Marten

The American Marten (*Martes americana*) has an Alberta status listing of secure, however, it is an indicator species for other at risk species. Marten require forest types that are structurally capable of providing cover, protective thermal microenvironments, and protection from predators. Although marten have been found in young forests providing these characteristics, they are more frequently associated with late-successional coniferous forests. These mature forests also provide habitat for many other species, including many that are at risk (various boreal forest songbirds, small mammals, and species that rely on small mammals for prey (such as owls and other raptors)). Ensuring that sufficient marten habitat is protected is a method for ensuring sufficient habitat is protected for many at risk species.

To predict future marten habitat, Habitat Suitability Index (HSI)-age curves are created to incorporate directly into timber supply modeling. The first step is to create height-age curves using the GYPSY model's species-specific top height-age equations. Curves are delineated by species group and timber productivity rating and split into two density classes. These height-age curves are then converted to HSI-age curves by calculating HSI at each age as a function of height. Variables in the calculation include tree canopy closure, tree canopy height, and percents of different species in the canopy. Similar curves were grouped together to reduce the number of inputs for timber supply modeling.

All time periods were run on the gross landbase, which was aged for each time period processed.

Table 5-19 displays the results of the American marten model for habitat suitability index (HSI) values for each time period, as well as the percent change of value of each time period from time zero. Figure 5-23 and Figure 5-24 display the habitat suitability index (HSI) values' trend over time: the purple line represents change from time zero over time, green zone = range of low risk, yellow zone = range of moderate risk, and red zone = range of high risk.

Table 5-19. HSI results for American marten for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Mean HSI Value	% Change from Time Zero of Mean HSI Value
W13	0	2017	0.157	-
	10	2027	0.167	7%
	20	2037	0.184	18%
	50	2067	0.200	28%
	100	2117	0.199	27%
	200	2217	0.203	30%
W11	0	2017	0.080	-
	10	2027	0.077	-4%
	20	2037	0.079	-1%
	50	2067	0.084	6%
	100	2117	0.079	-1%
	200	2217	0.081	1%

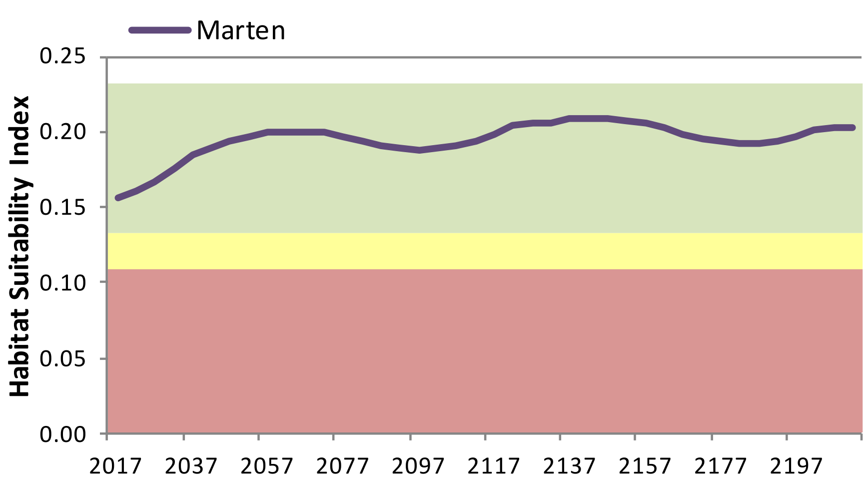


Figure 5-23. Trend of American marten HSI values over time and the percentage change relative to time zero for FMU W13

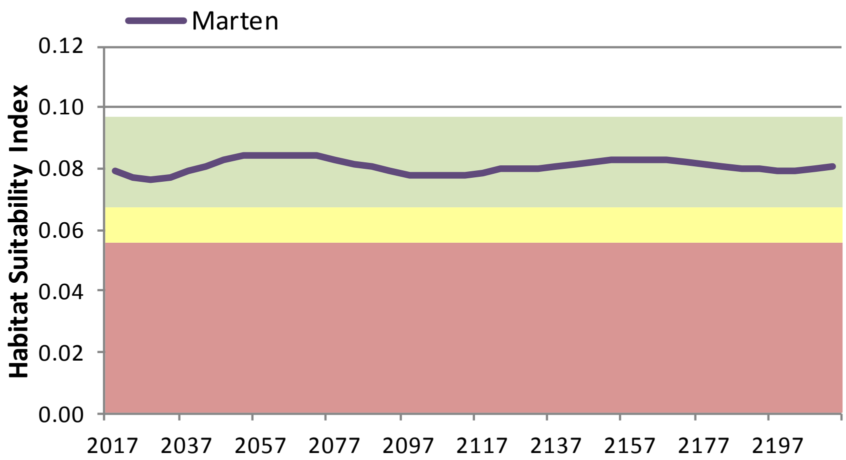


Figure 5-24. Trend of American marten HSI values over time and the percentage change relative to time zero for FMU W11

Figure 5-25, Figure 5-26, Figure 5-27 and Figure 5-28 illustrate the results spatially of the for American marten model for HSI values for each time period.

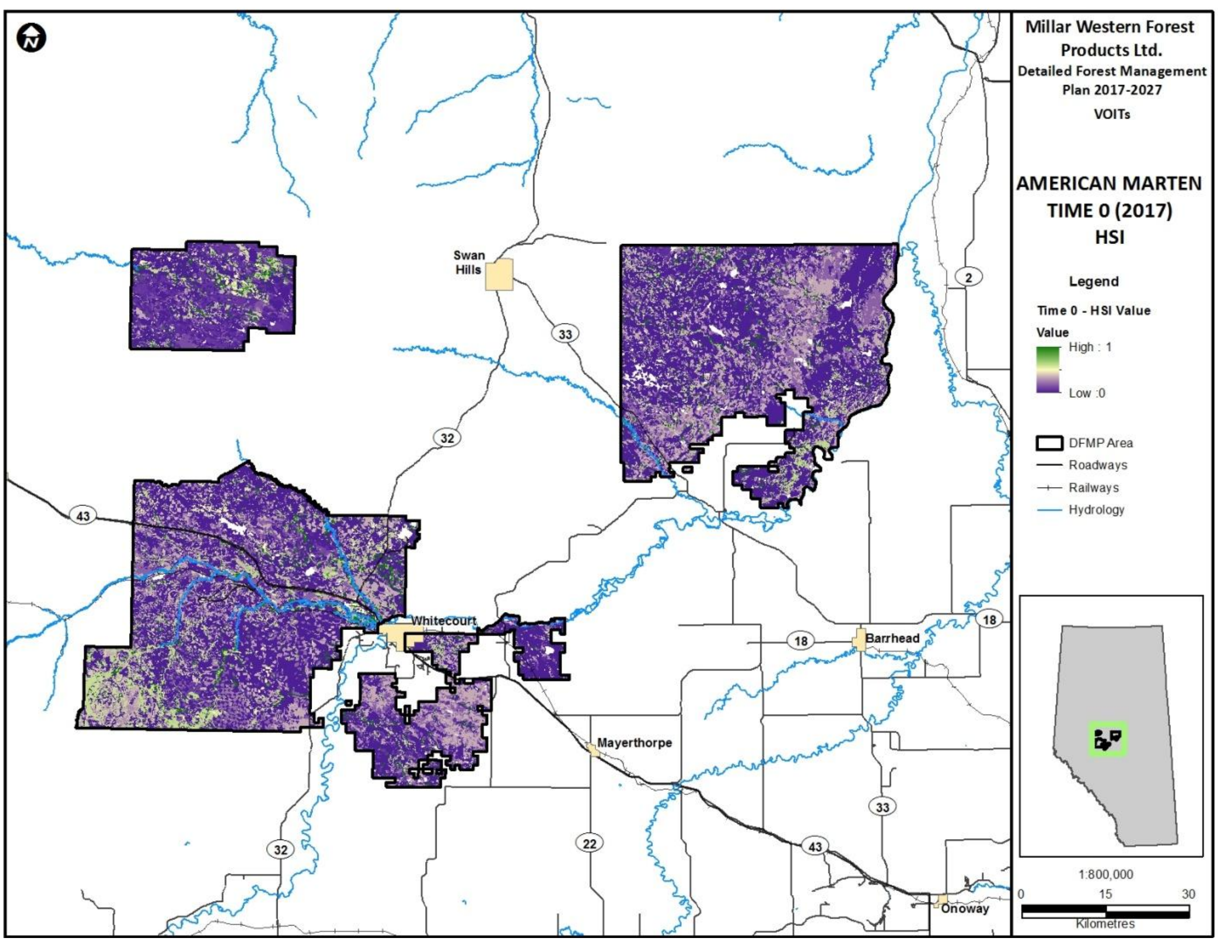


Figure 5-25. HSI values at time zero for American marten

SH

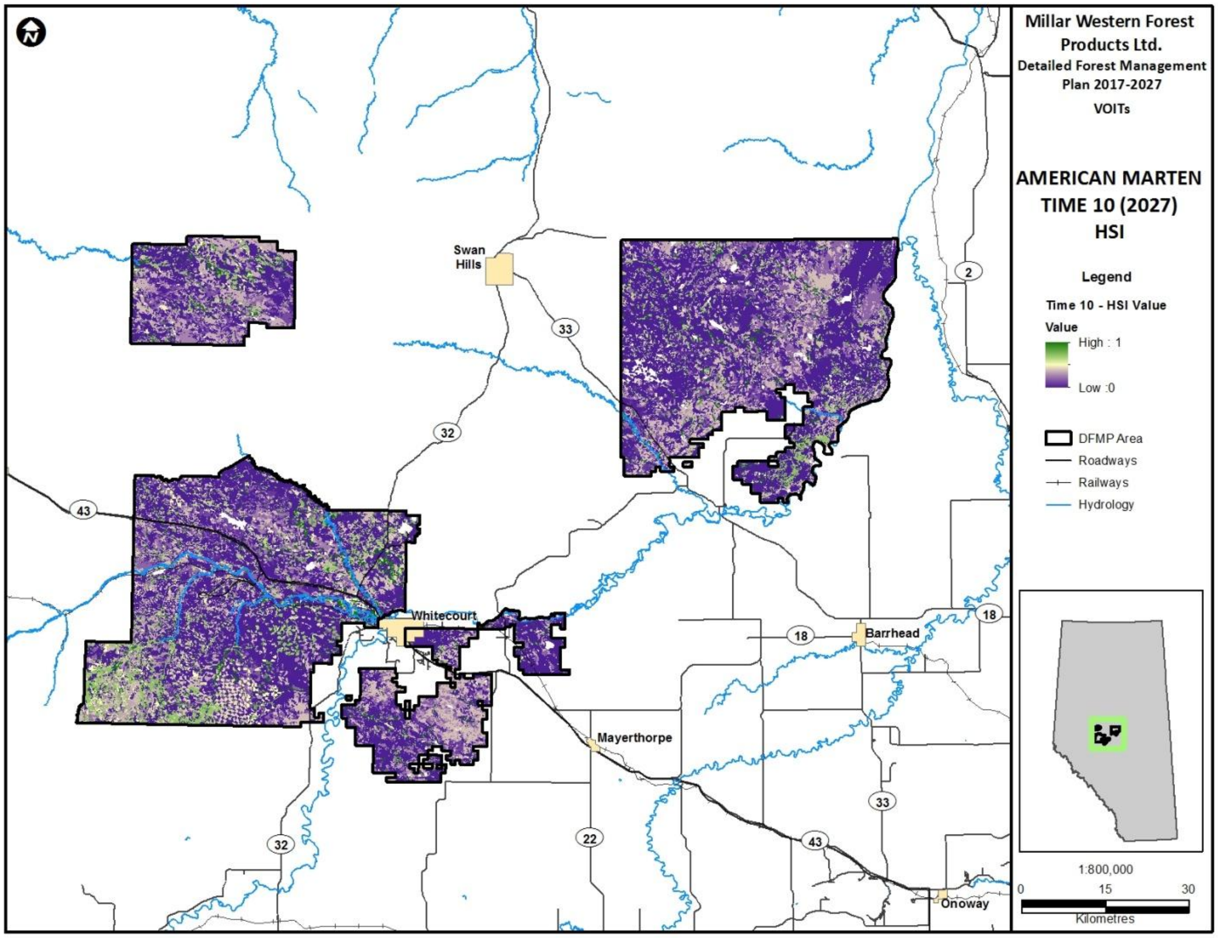


Figure 5-26. HSI values at time 10 for American marten

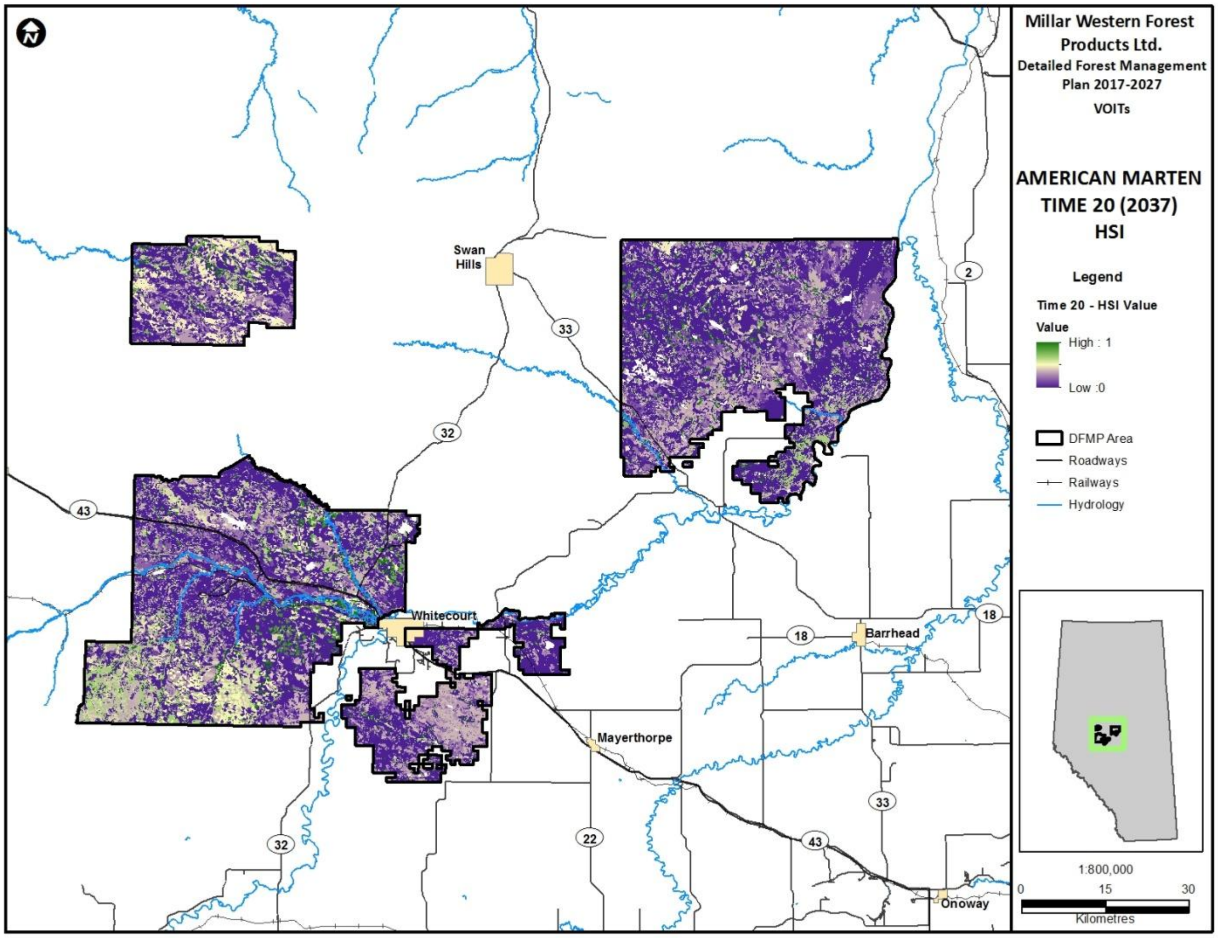


Figure 5-27. HSI values at time 20 for American marten

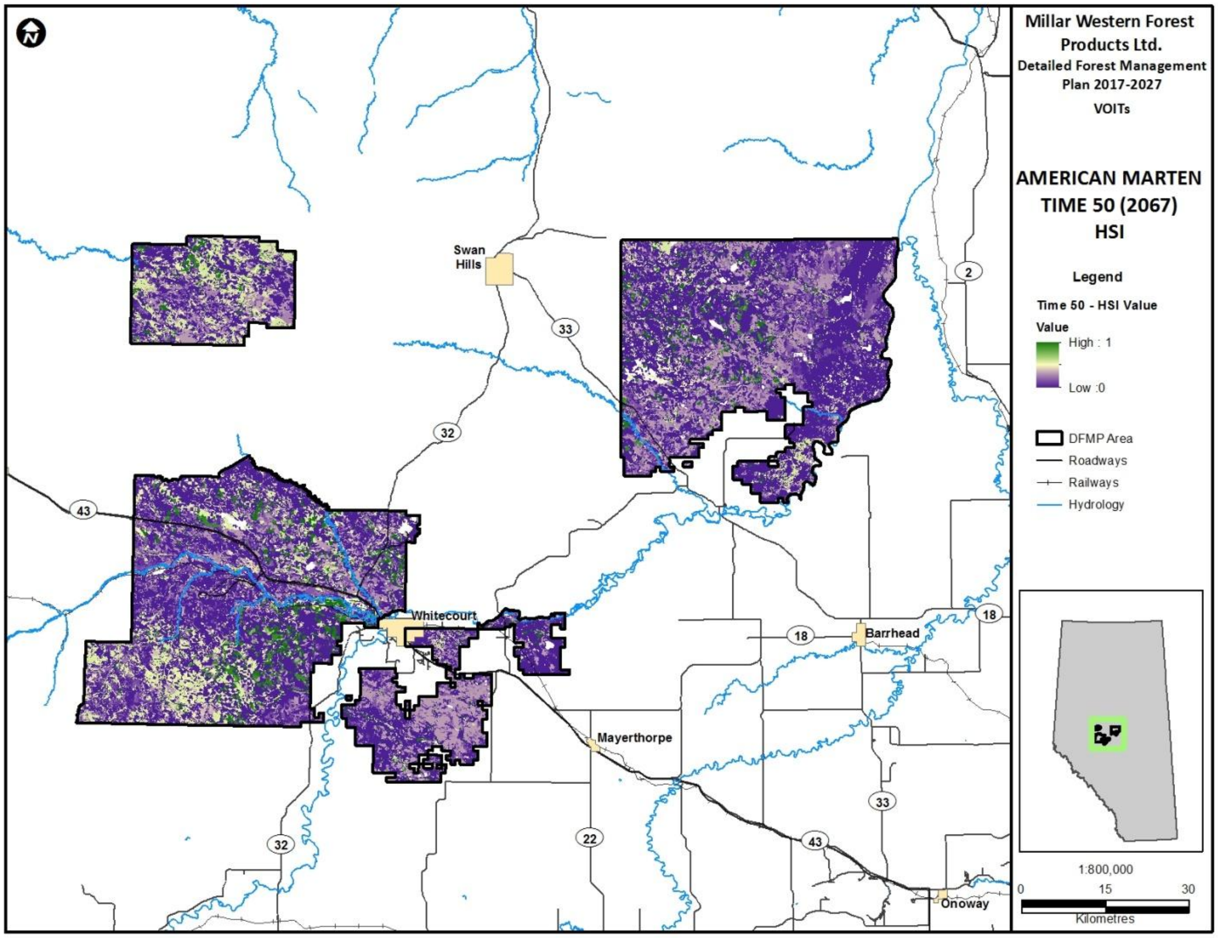


Figure 5-28. HSI values at time 50 for American marten

4.7.4 Songbirds

Five species were selected by GoA for modeling, these include: bay breasted warbler, black-throated green warbler, brown creeper, Canadian warbler and the ovenbird. Songbirds are considered to be good indicators of landscape due to their general abundance and high mobility. Each of the five above listed species was incorporated into the PFMS model based on coefficients provided by the GoA. The species were assessed and interpreted at the stand level (polygon based), then summarized into charts, tables and maps by relative abundance (RA) values in the following subsections.

The RA values are predicted estimated relative abundance values used for comparison over time and are not exact numbers of abundance for that species.

All time periods were run on the gross landbase – which was aged for each time period processed.

4.7.4.1 Bay Breasted Warbler

The Bay Breasted Warbler (*Dendroica castanea*) is a boreal forest species associated with coniferous, mixedwood, and deciduous old growth. It has an Alberta status of “sensitive” and forest management plans must ensure the retention of breeding habitat (Alberta, 2011b).

All time periods were run on the gross landbase, which was aged for each time period processed.

Table 5-20 displays the results of the bay breasted warbler songbird model for relative abundance (RA) values for each time period, as well as the percentage change of value of each time period from time zero. Figure 5-29 and Figure 5-30 display the RA values' trend over time: the purple line represents change from time zero over time, green zone = range of low risk, yellow zone = range of moderate risk, and red zone = range of high risk.

Table 5-20. RA results for bay breasted warbler songbird for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Mean HSI Value	% Change from Time Zero of Mean HSI Value
W13	0	2017	0.102	-
	10	2027	0.096	-6%
	20	2037	0.094	-8%
	50	2067	0.104	2%
	100	2117	0.101	-2%
	200	2217	0.098	-4%
W11	0	2017	0.063	-
	10	2027	0.062	-1%
	20	2037	0.060	-4%
	50	2067	0.059	-6%
	100	2117	0.056	-12%
	200	2217	0.056	-11%

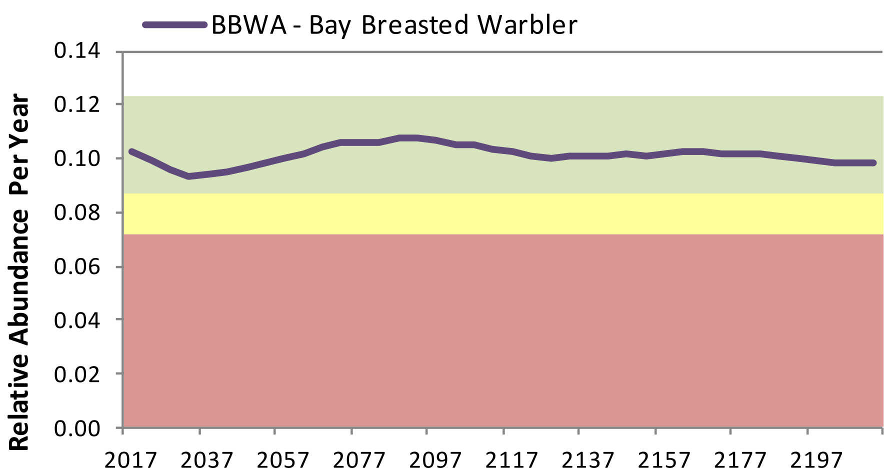


Figure 5-29. Trend of bay breasted warbler songbird RA values over time and the percentage change relative to time zero for FMU W13

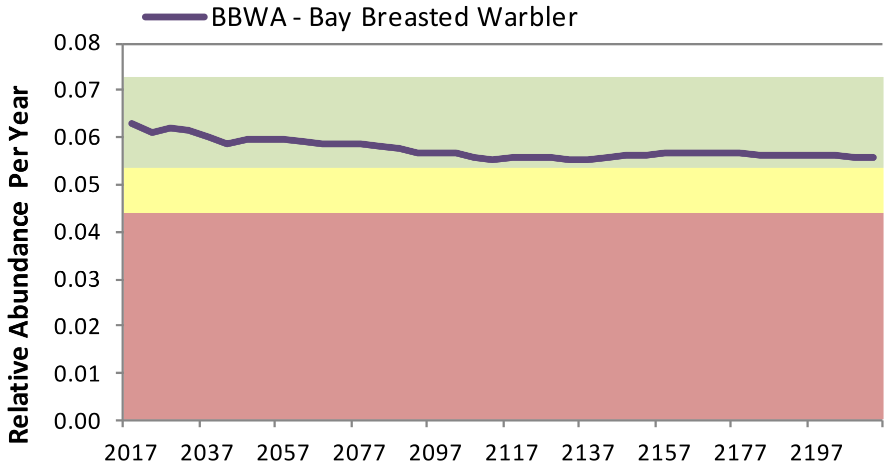


Figure 5-30. Trend of bay breasted warbler songbird RA values over time and the percentage change relative to time zero for FMU W11

Figure 5-31, Figure 5-32, Figure 5-33 and Figure 5-34 illustrate the results spatially of the bay breasted warbler songbird model for RA values for each time period.

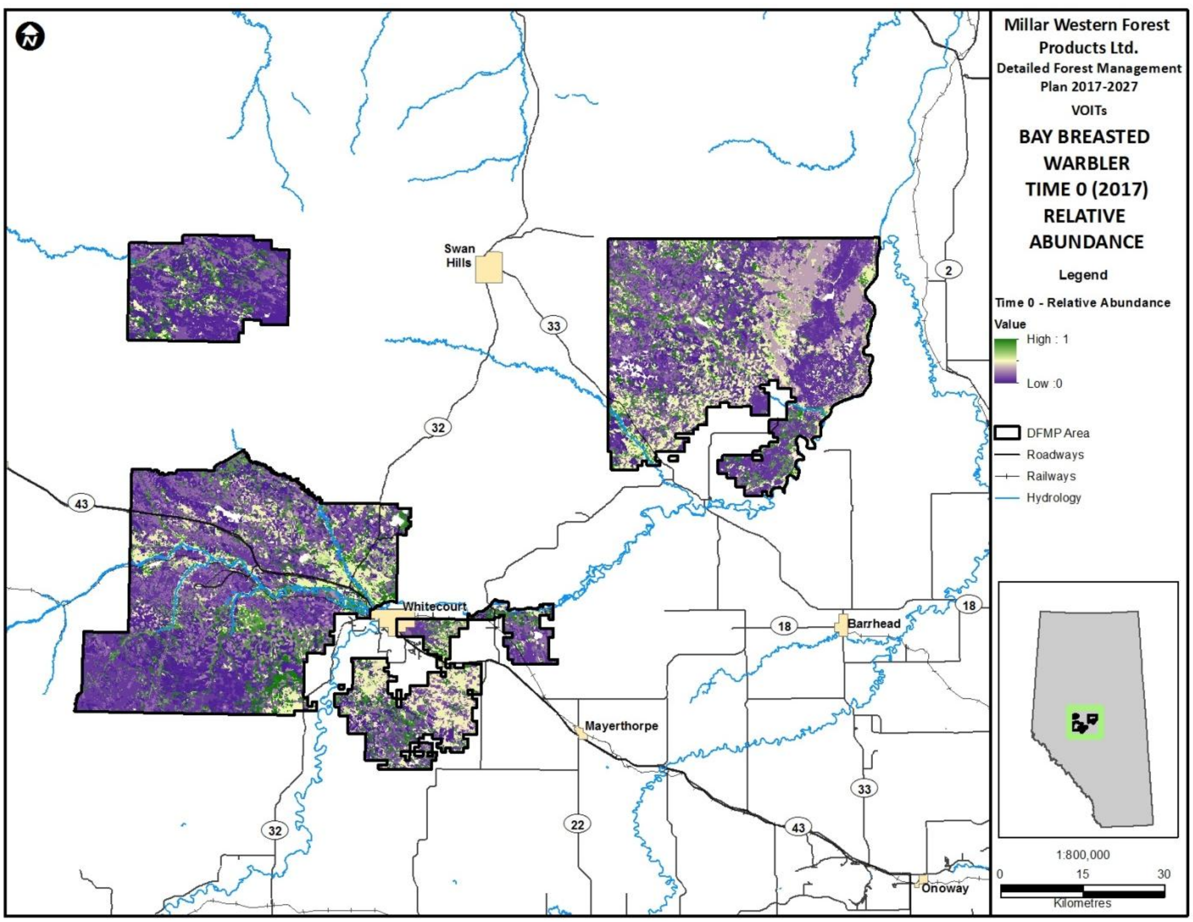


Figure 5-31. Relative abundance values at time zero for bay breasted warbler songbird

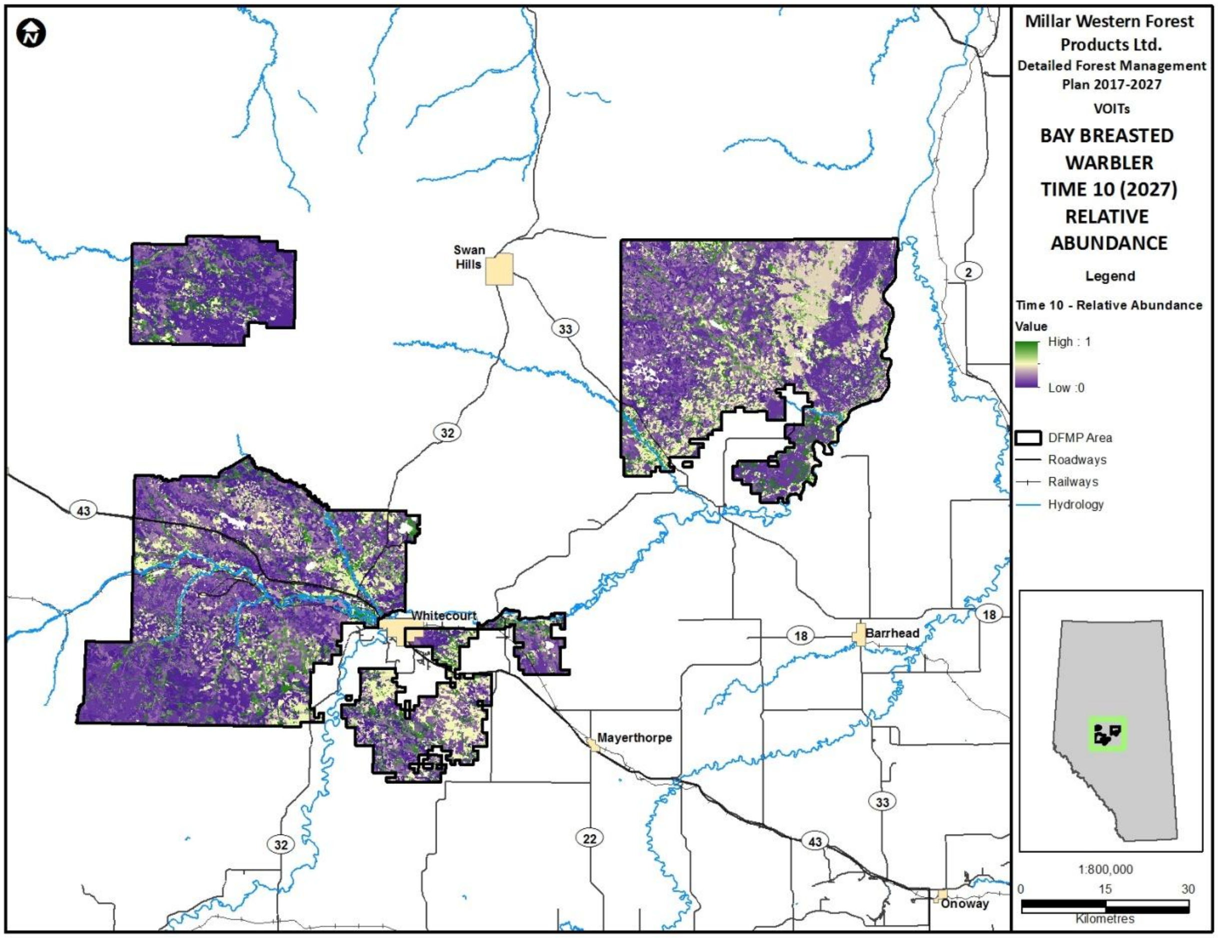


Figure 5-32. Relative abundance values at time 10 for bay breasted warbler songbird

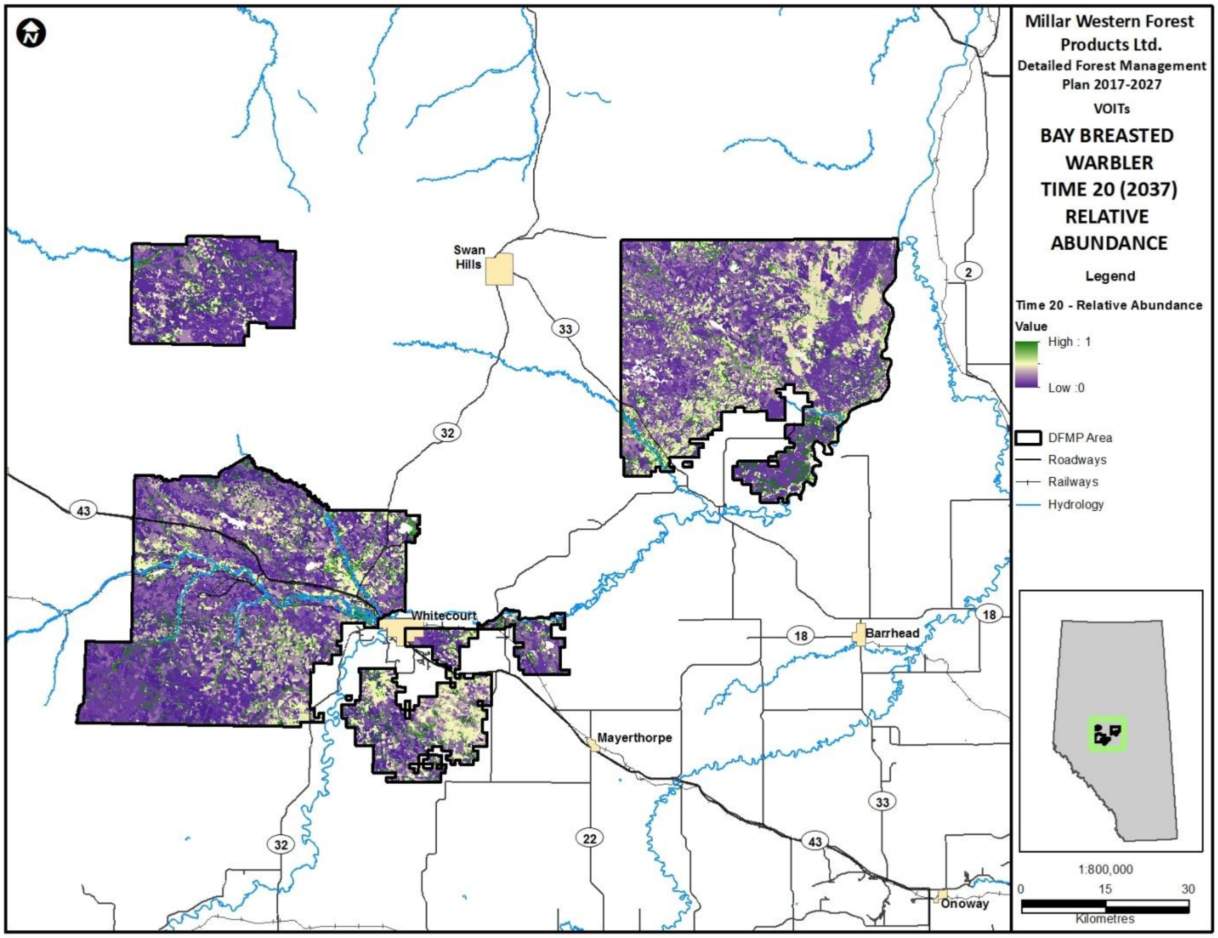


Figure 5-33. Relative abundance values at time 20 for bay breasted warbler songbird

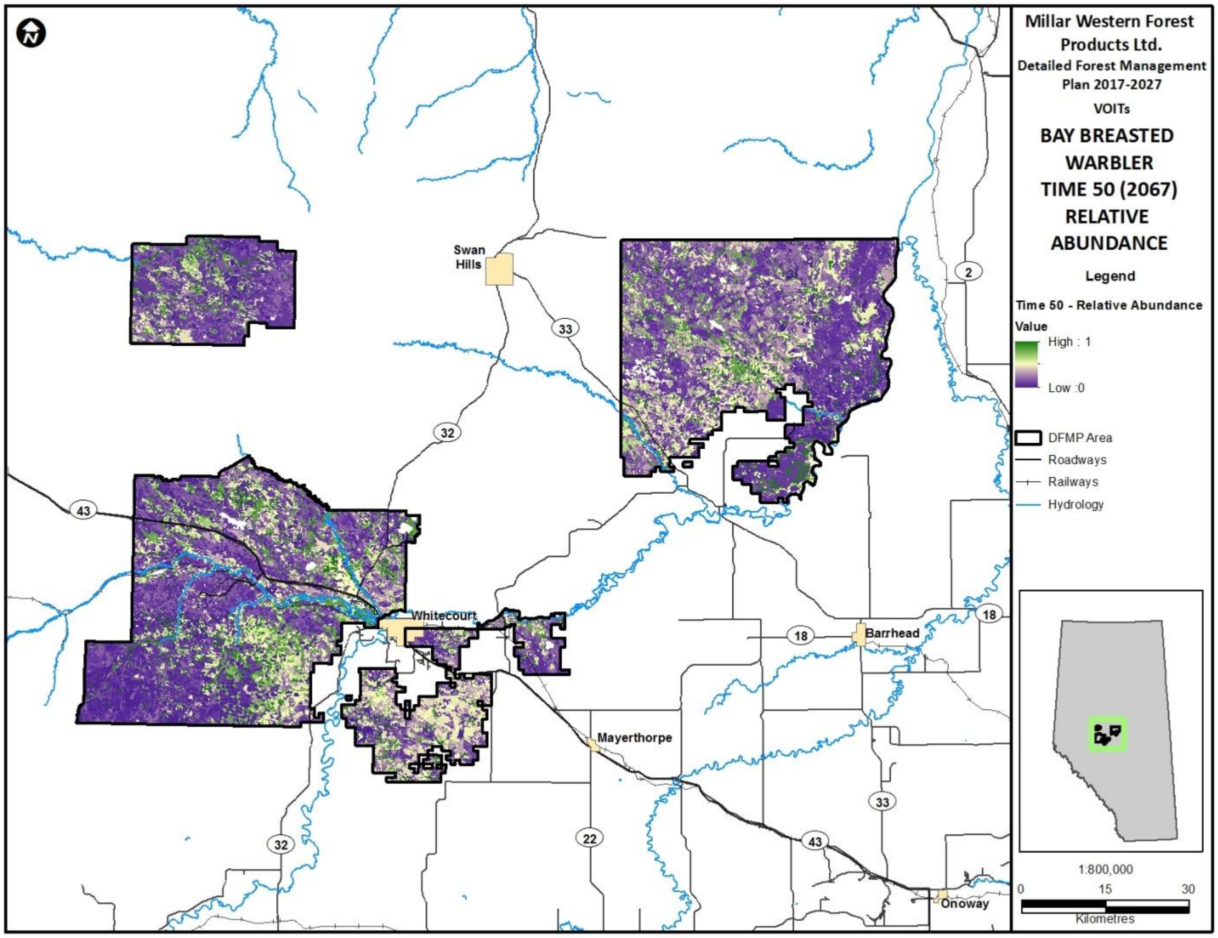


Figure 5-34. Relative abundance values at time 50 for bay breasted warbler songbird

4.7.4.2 Brown Creeper

The Brown Creeper (*Certhia americana*) is associated with pine and white spruce old growth. It has an Alberta status of "sensitive" and is vulnerable to forest fragmentation (Alberta, 2011b).

All time periods were run on the gross landbase, which was aged for each time period processed. Table 5-21 displays the results of the brown creeper songbird model for relative abundance (RA) values for each time period, as well as the percentage change of value of each time period from time zero. Figure 5-35 and Figure 5-36 display the RA values' trend over time: the purple line represents change from time zero over time, green zone = range of low risk, yellow zone = range of moderate risk, and red zone = range of high risk.

Table 5-21. HSI results for brown creeper songbird for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Mean HSI Value	% Change from Time Zero of Mean HSI Value
W13	0	2017	0.053	-
	10	2027	0.052	-2%
	20	2037	0.053	-1%
	50	2067	0.053	-1%
	100	2117	0.064	19%
	200	2217	0.079	49%
W11	0	2017	0.029	-
	10	2027	0.030	4%
	20	2037	0.029	-2%
	50	2067	0.029	-1%
	100	2117	0.030	4%
	200	2217	0.032	9%

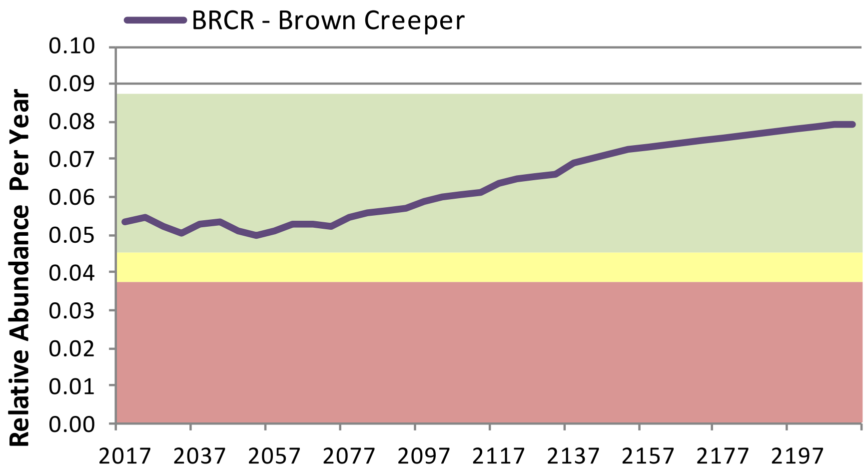


Figure 5-35. Trend of brown creeper songbird HSI values over time and the percentage change relative to time zero for FMU W13

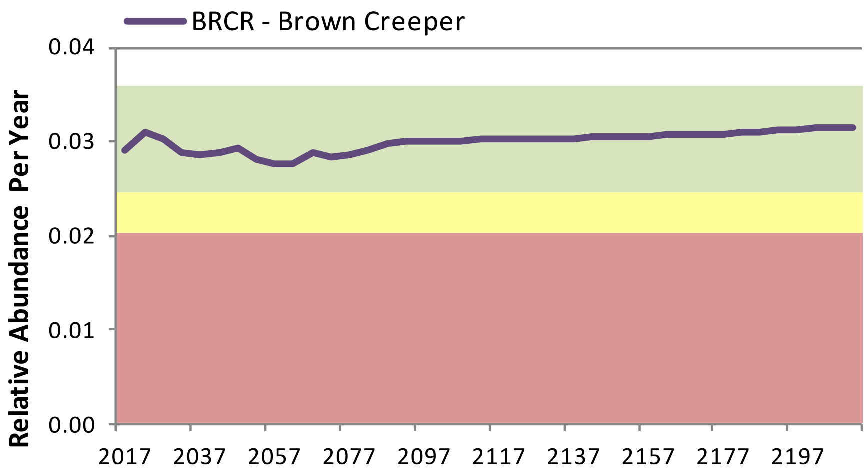


Figure 5-36. Trend of brown creeper songbird HSI values over time and the percentage change relative to time zero for FMU W11

Figure 5-37, Figure 5-38, Figure 5-39 and Figure 5-40 illustrate the results spatially of the brown creeper songbird model for RA values for each time period.

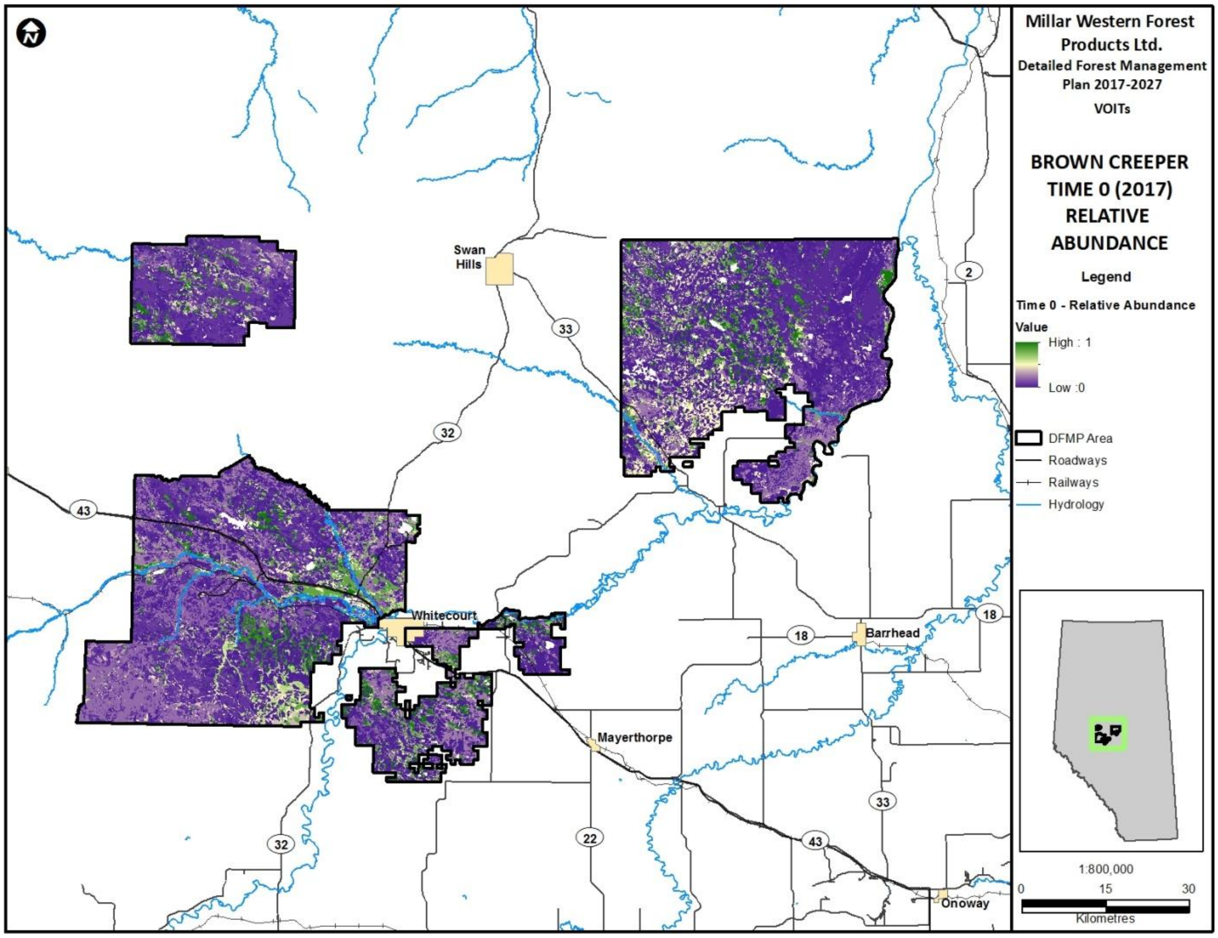


Figure 5-37. Relative abundance values at time zero for brown creeper songbird

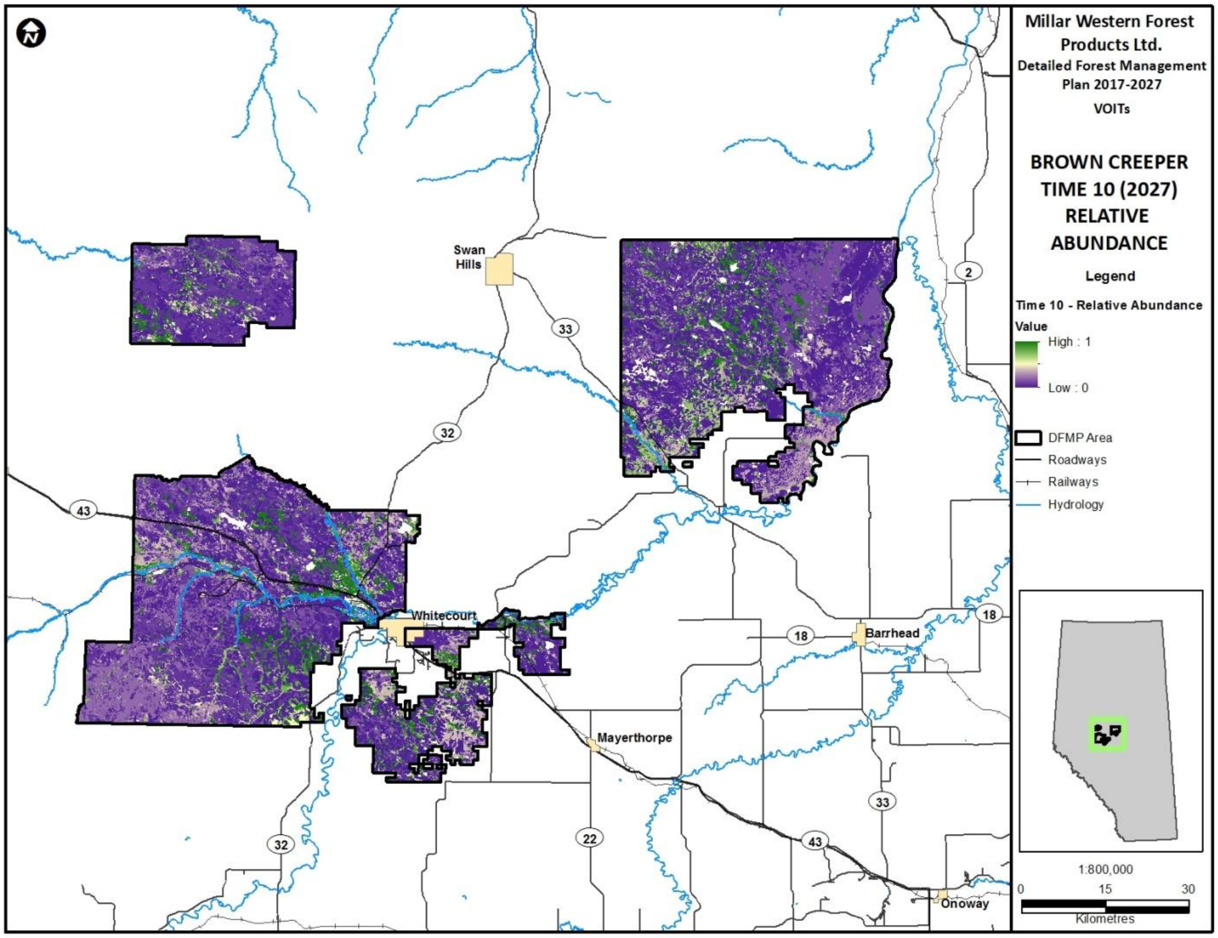


Figure 5-38. Relative abundance values at time 10 for brown creeper songbird

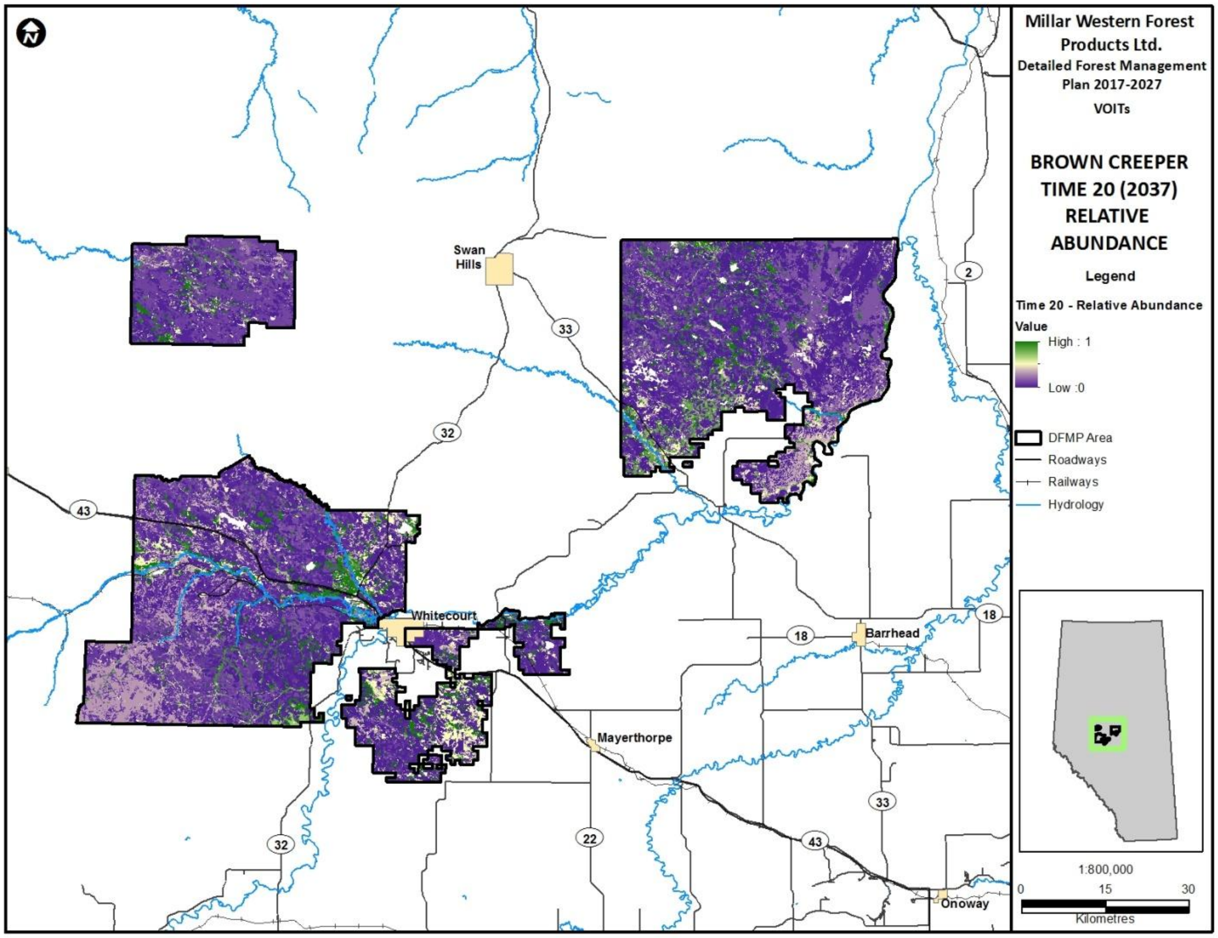


Figure 5-39. Relative abundance values at time 20 for brown creeper songbird

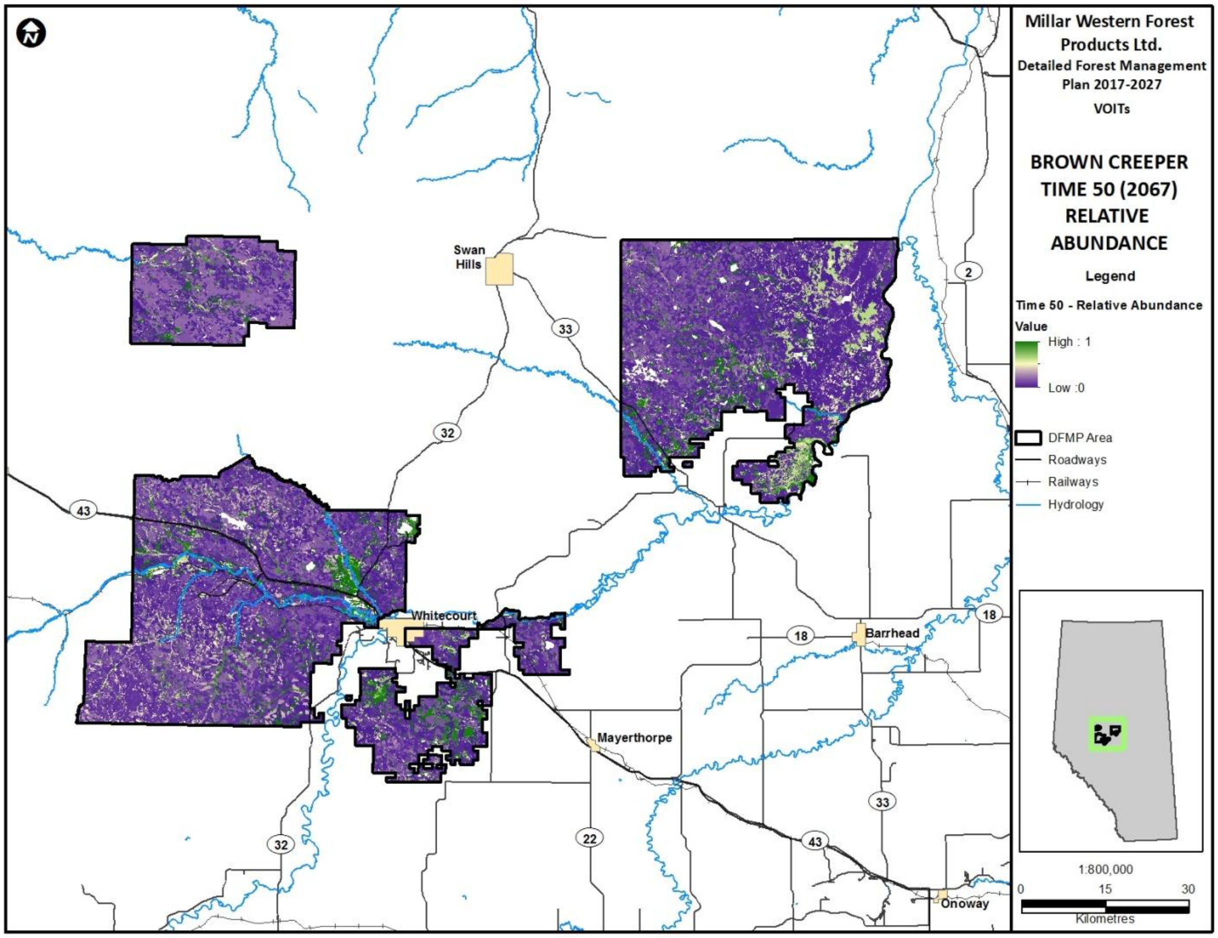


Figure 5-40. Relative abundance values at time 50 for brown creeper songbird

4.7.4.3 Black-throated Green Warbler

Black-Throated Green Warbler (*Dendroica virens*) is a boreal forest species associated with coniferous, mixedwood, and deciduous old growth and is an indicator for many other species dependent on old growth and non-fragmented forests. The warbler has an Alberta status of "sensitive" but is designated a "species of special concern" because habitat loss and fragmentation from industrial development threaten its population (Alberta, 2011b).

All time periods were run on the gross landbase, which was aged for each time period processed. Table 5-22 displays the results of the black-throated green warbler songbird model for relative abundance (RA) values for each time period, as well as the percent change of value of each time period from time zero. Figure 5-41 and Figure 5-42 display the trend RA values over time; purple line represents change from time zero over time, green zone = range of low risk, yellow zone = range of moderate risk, and red zone = range of high risk.

Table 5-22. RA results for black-throated green warbler songbird for time 0, 10, 20, 50, 100, and 200 years by FMU

FMU	Time Period	Year	Mean HSI Value	% Change from Time Zero of Mean HSI Value
W13	0	2017	0.036	-
	10	2027	0.034	-5%
	20	2037	0.033	-7%
	50	2067	0.031	-14%
	100	2117	0.031	-13%
	200	2217	0.030	-15%
W11	0	2017	0.023	-
	10	2027	0.023	2%
	20	2037	0.021	-7%
	50	2067	0.020	-12%
	100	2117	0.020	-14%
	200	2217	0.020	-12%

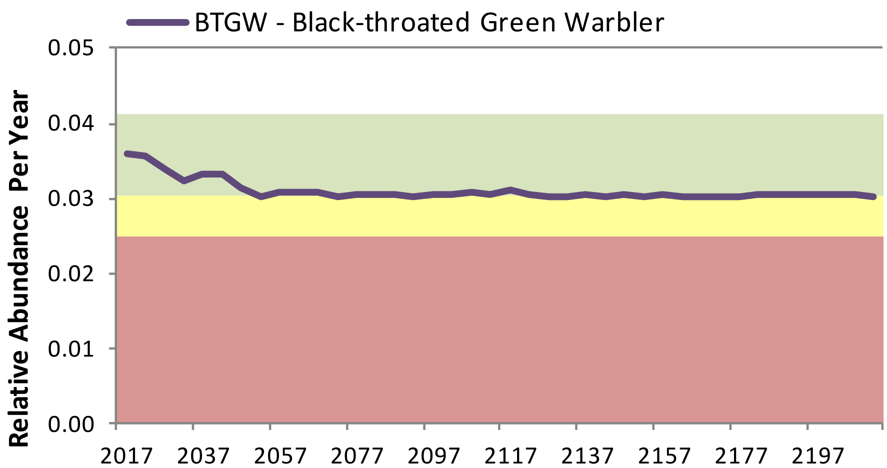


Figure 5-41. Trend of black-throated green warbler songbird RA values over time and the percentage change relative to time zero for FMU W13

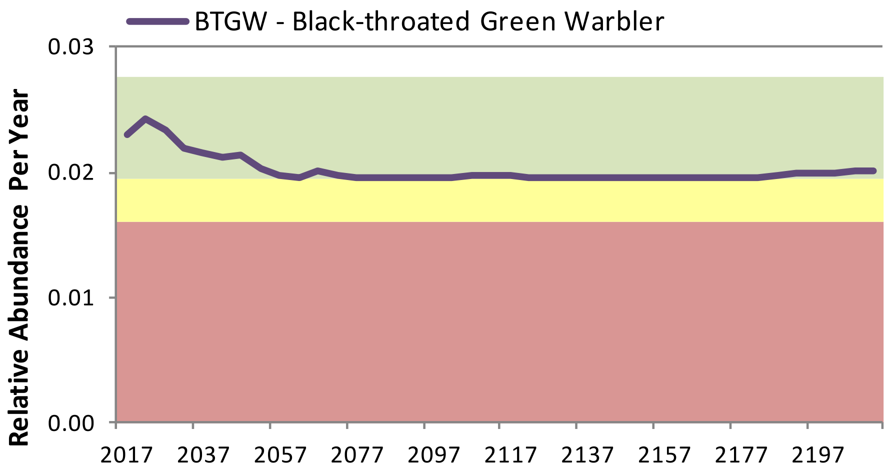


Figure 5-42. Trend of black-throated green warbler songbird RA values over time and the percentage change relative to time zero for FMU W11

Figure 5-43, Figure 5-44, Figure 5-45 and Figure 5-46 illustrate the results spatially of black-throated green warbler songbird model for RA values for each time period.

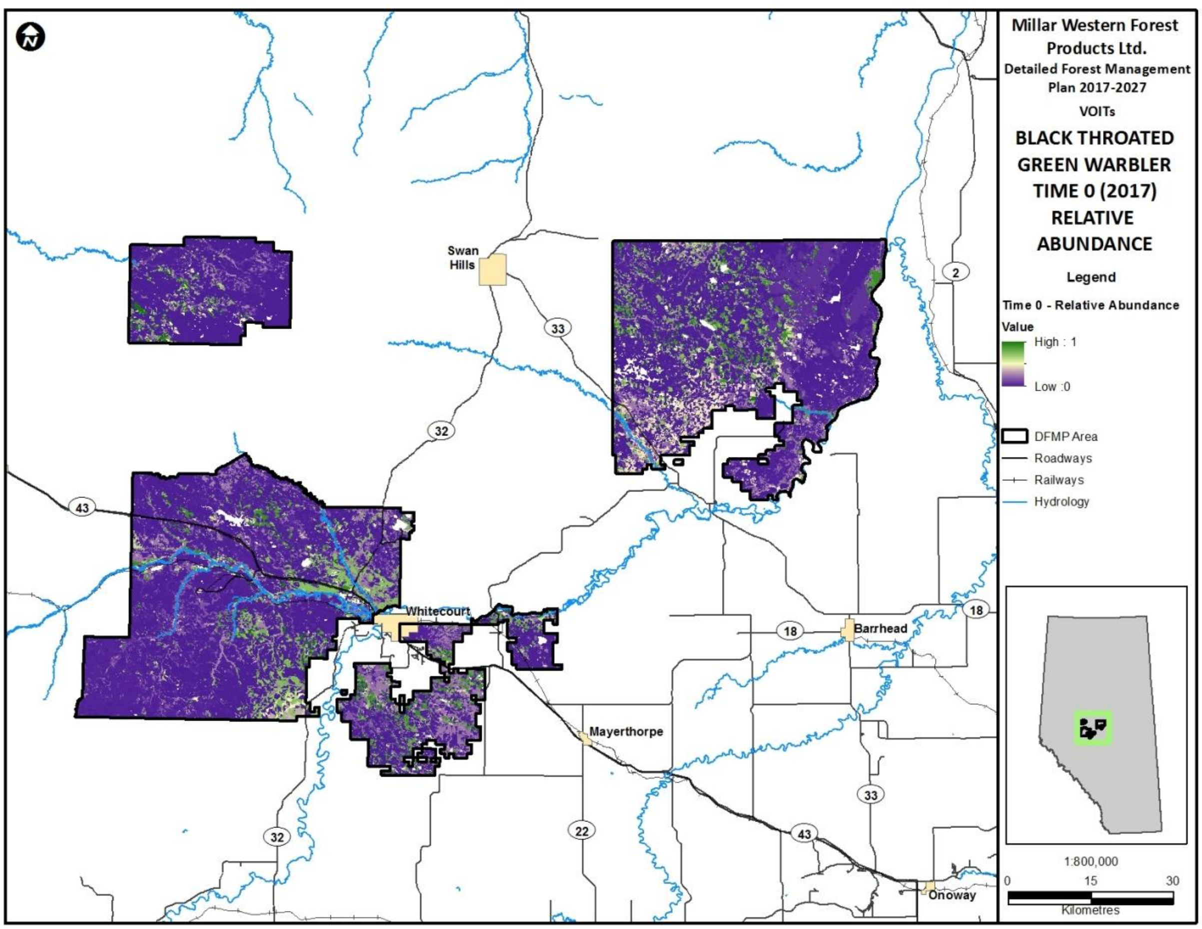


Figure 5-43. Relative abundance values at time zero for black-throated green warbler songbird

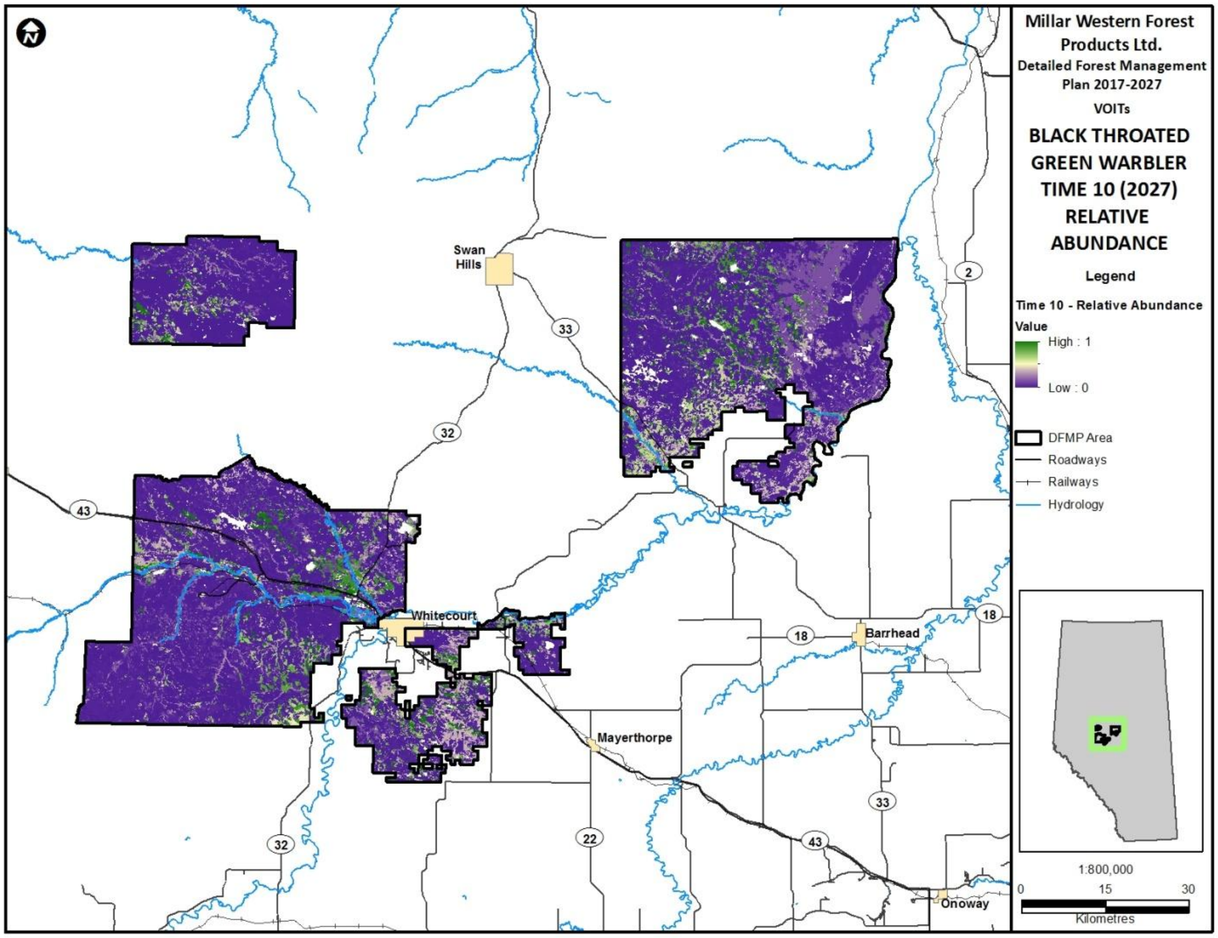


Figure 5-44. Relative abundance values at time 10 for black-throated green warbler songbird

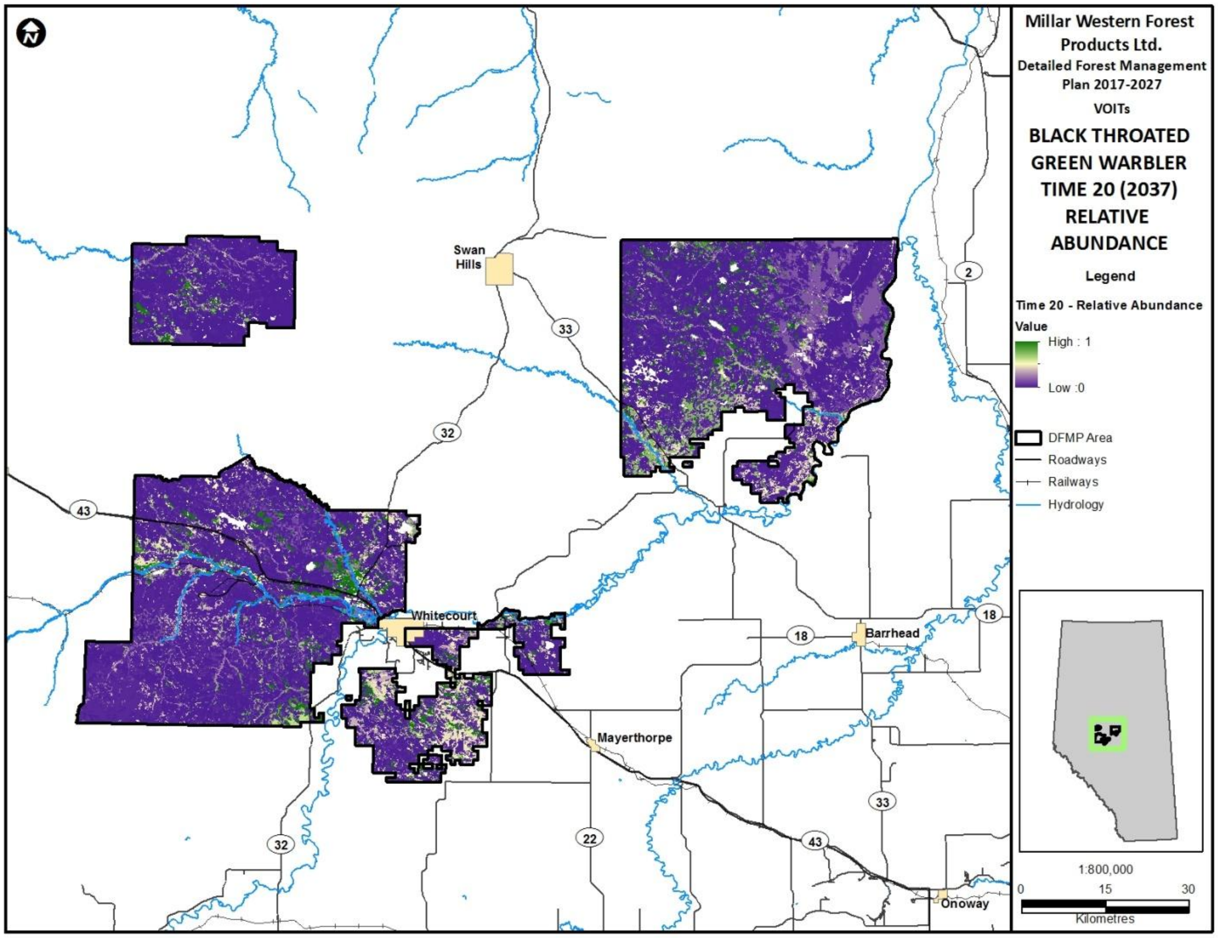


Figure 5-45. Relative abundance values at time 20 for black-throated green warbler songbird

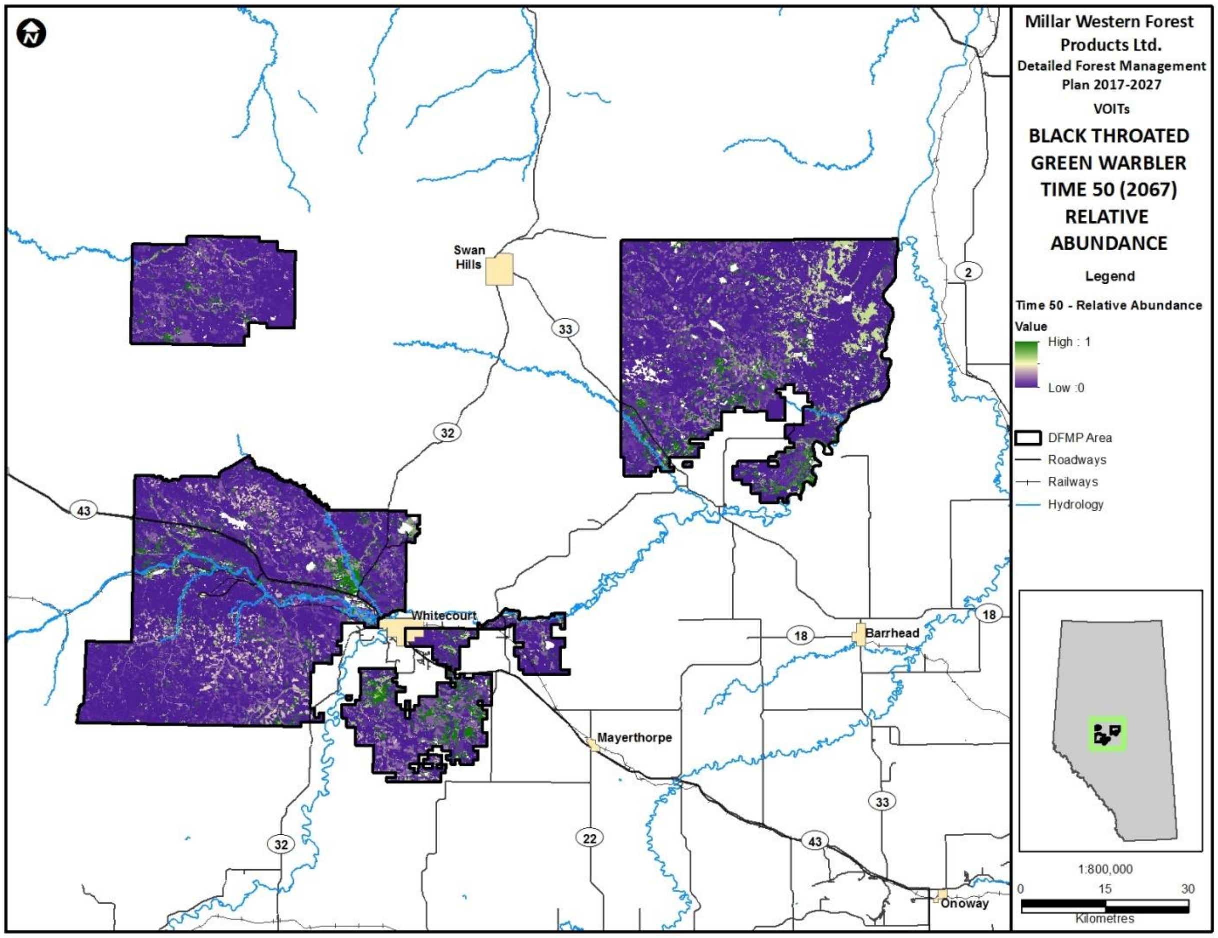


Figure 5-46. Relative abundance values at time 50 for black-throated green warbler songbird

4.7.4.4 Canadian Warbler

The Canadian Warbler (*Wilsonia canadensis*) is a boreal forest species that is associated with deciduous old growth. It has an Alberta status of "sensitive" and has declined throughout its entire Alberta range since the 1960's, likely due to habitat loss and deterioration (Alberta, 2011b).

All time periods were run on the gross landbase, which was aged for each time period processed. Table 5-23 displays the results of the Canadian warbler songbird model for relative abundance (RA) values for each time period, as well as the percentage change of value of each time period from time zero. Figure 5-47 and Figure 5-48 display the RA values' trend over time: the purple line represents change from time zero over time, green zone = range of low risk, yellow zone = range of moderate risk, and red zone = range of high risk.

Table 5-23. RA results for Canadian warbler songbird for time 0, 10, 20, 50, 100, and 200 years, by FMU

FMU	Time Period	Year	Mean HSI Value	% Change from Time Zero of Mean HSI Value
W13	0	2017	0.027	-
	10	2027	0.028	7%
	20	2037	0.031	15%
	50	2067	0.031	15%
	100	2117	0.033	23%
	200	2217	0.035	31%
W11	0	2017	0.018	-
	10	2027	0.019	9%
	20	2037	0.020	14%
	50	2067	0.021	20%
	100	2117	0.024	37%
	200	2217	0.025	39%

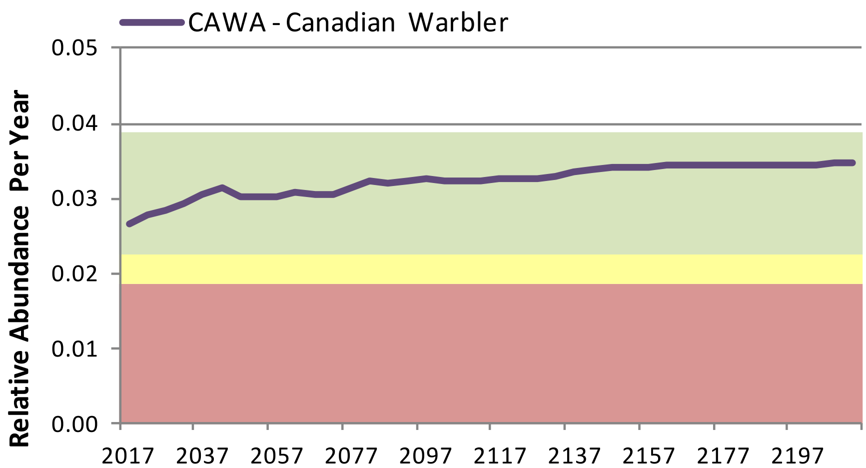


Figure 5-47. Trend of Canadian warbler songbird RA values over time and the percentage change relative to time zero, for FMU W13

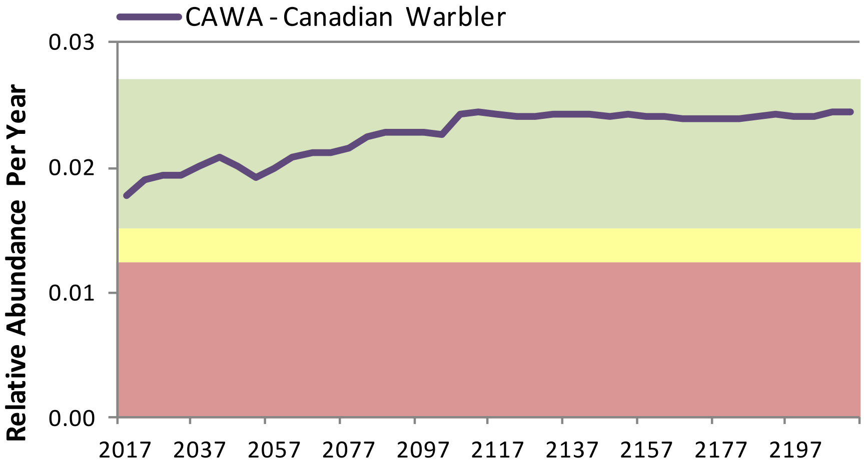


Figure 5-48. Trend of Canadian warbler songbird RA values over time and the percentage change relative to time zero, for FMU W11

Figure 5-49, Figure 5-50, Figure 5-51 and Figure 5-52 illustrate the results spatially of Canadian warbler songbird model for RA values for each time period.

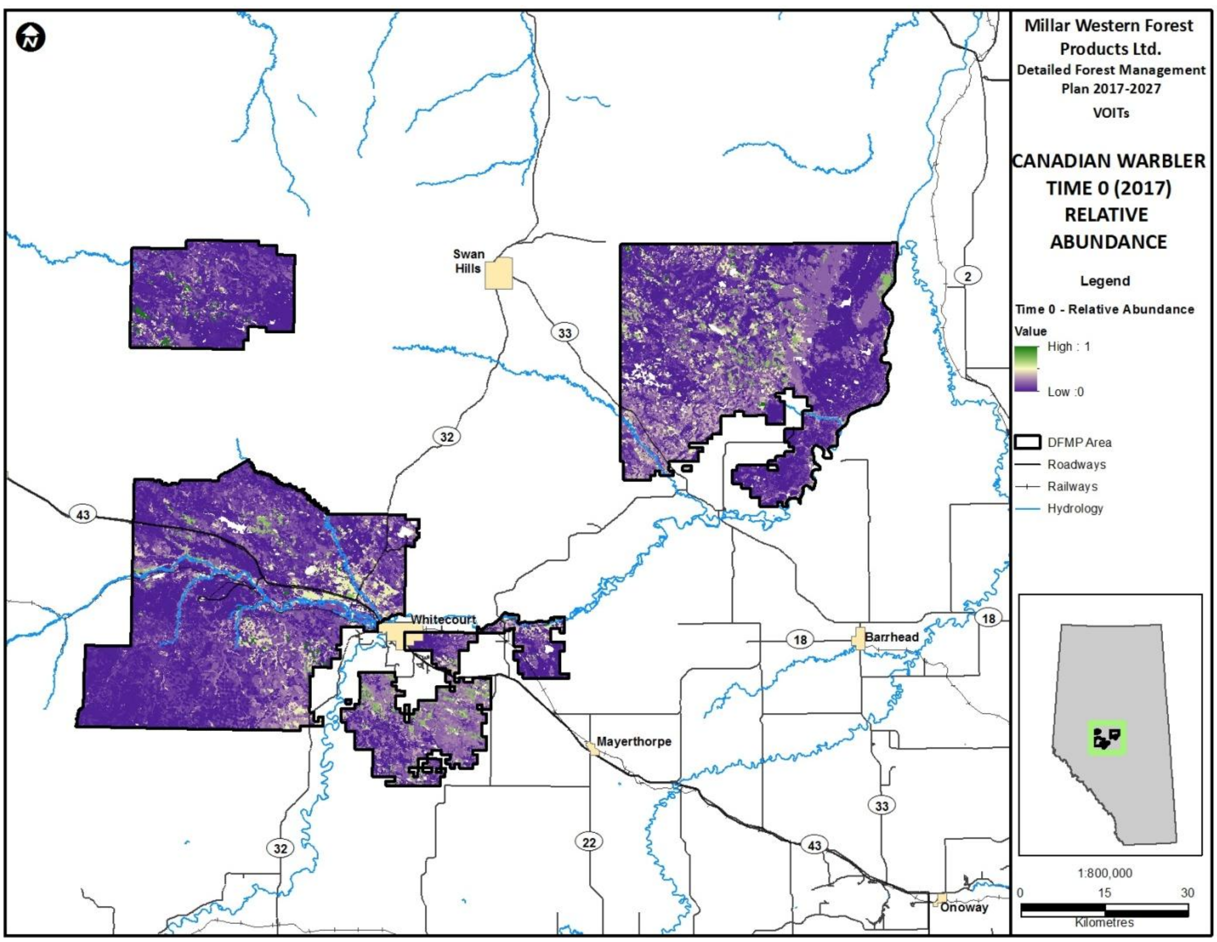


Figure 5-49. Relative abundance values at time zero for Canadian warbler songbird

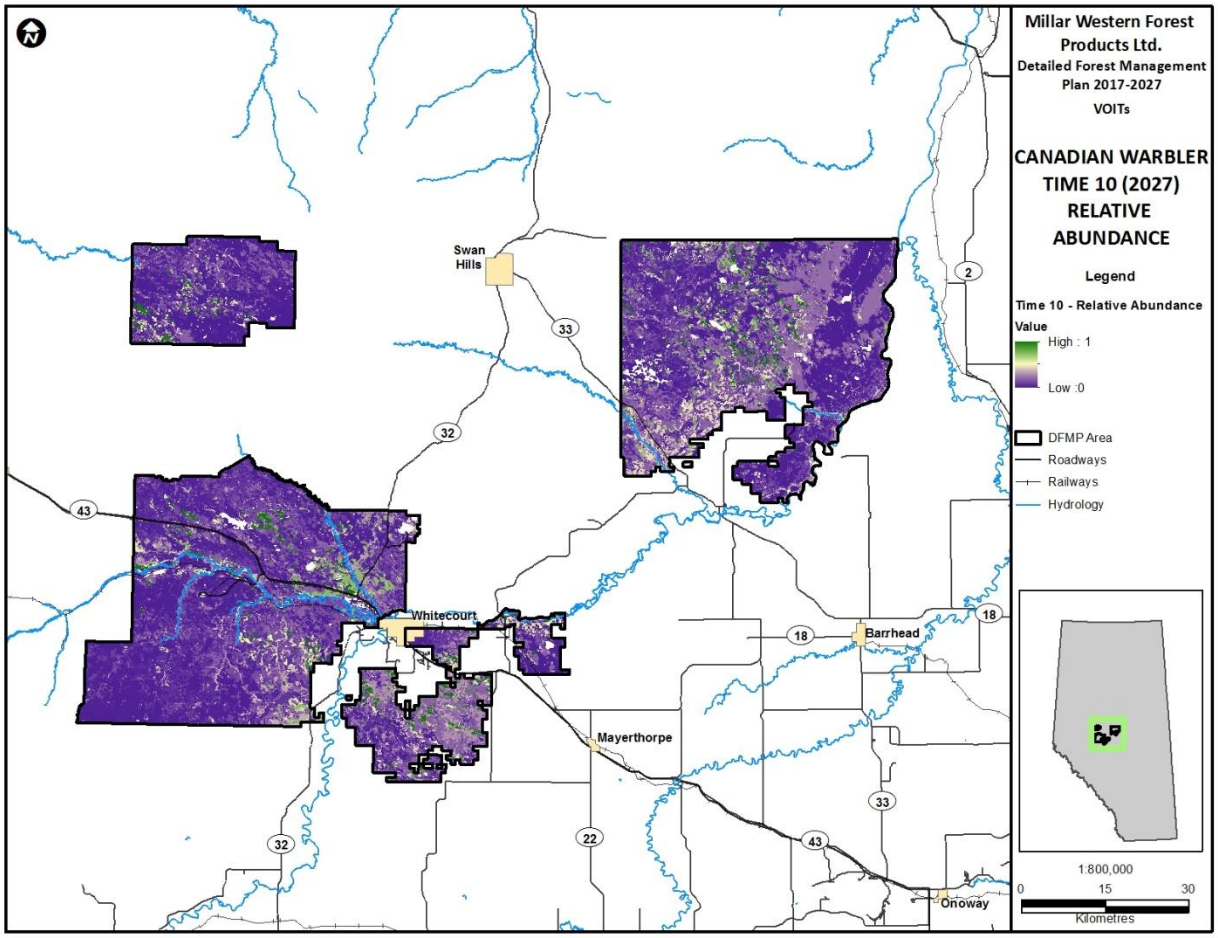


Figure 5-50. Relative abundance values at time 10 for Canadian warbler songbird

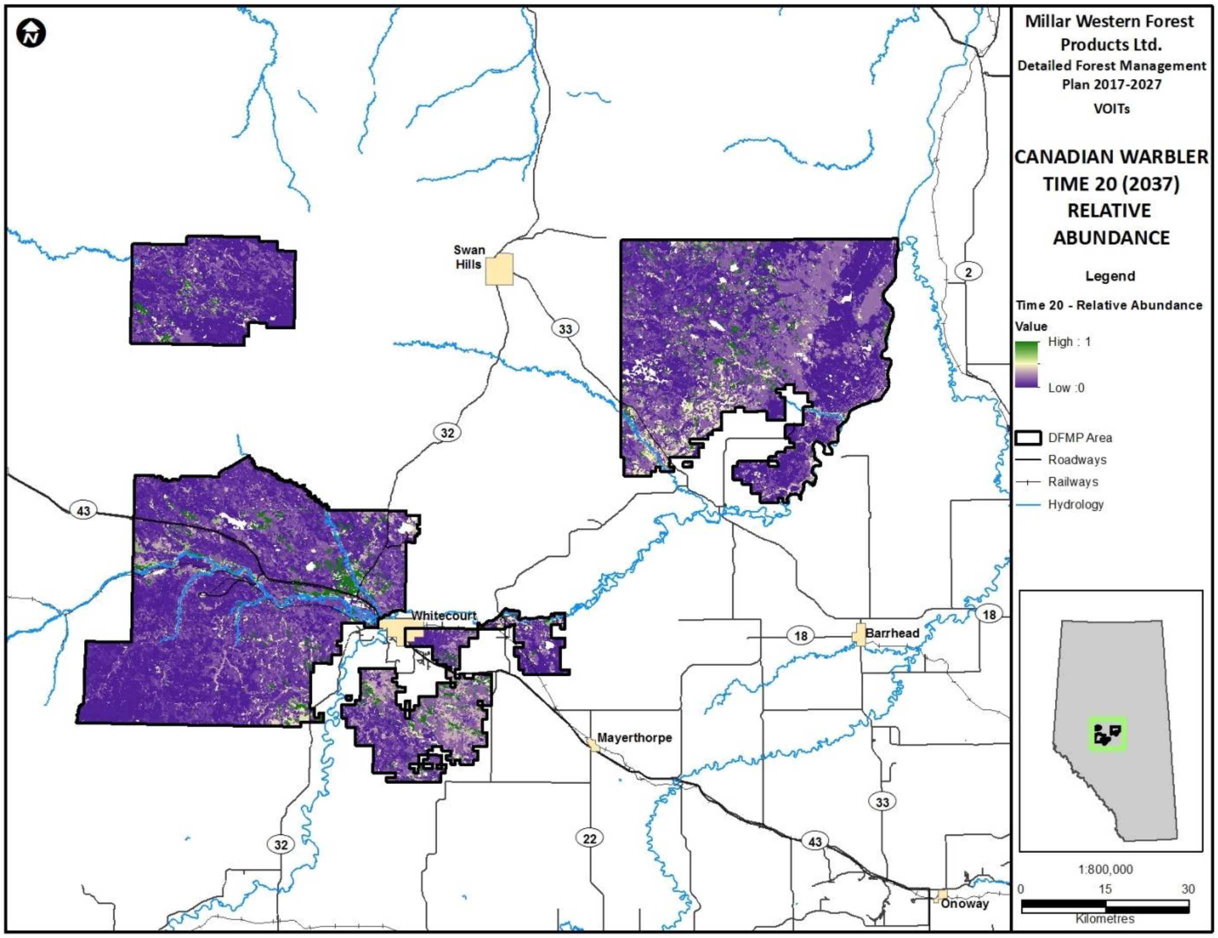


Figure 5-51. Relative abundance values at time 20 for Canadian warbler songbird

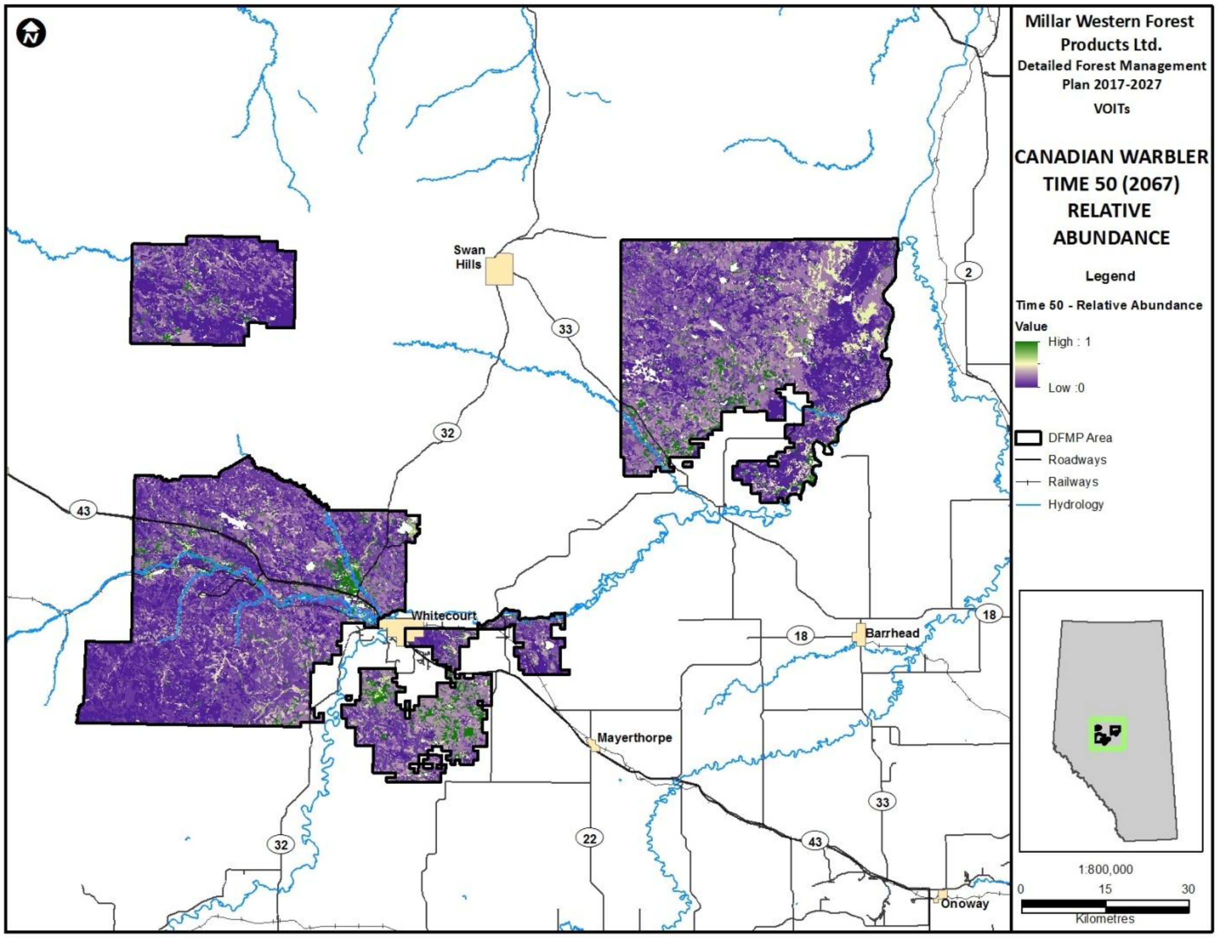


Figure 5-52. Relative abundance values at time 50 for Canadian warbler songbird

4.7.4.5 Oven Bird

The Oven Bird (*Seiurus aurocapilla*) is associated with intact mature deciduous and deciduous-dominated stands. It has a “secure” Alberta status listing but is an indicator species for habitat critical to other species sensitive to fragmentation and in need of mature, intact deciduous forests.

All time periods were run on the gross landbase, which was aged for each time period processed. Table 5-24 displays the results of the oven bird songbird model for relative abundance (RA) values for each time period, as well as the percentage change of value of each time period from time zero. Figure 5-53 and Figure 5-54 display the RA values’ trend over time: the purple line represents change from time zero over time, green zone = range of low risk, yellow zone = range of moderate risk, and red zone = range of high risk.

Table 5-24. RA results for oven bird songbird for time 0, 10, 20, 50, 100, and 200 years, by FMU

FMU	Time Period	Year	Mean HSI Value	% Change from Time Zero of Mean HSI Value
W13	0	2017	0.242	-
	10	2027	0.239	-1%
	20	2037	0.239	-1%
	50	2067	0.246	2%
	100	2117	0.245	1%
	200	2217	0.227	-6%
W11	0	2017	0.180	-
	10	2027	0.178	-1%
	20	2037	0.173	-4%
	50	2067	0.165	-8%
	100	2117	0.165	-9%
	200	2217	0.165	-8%

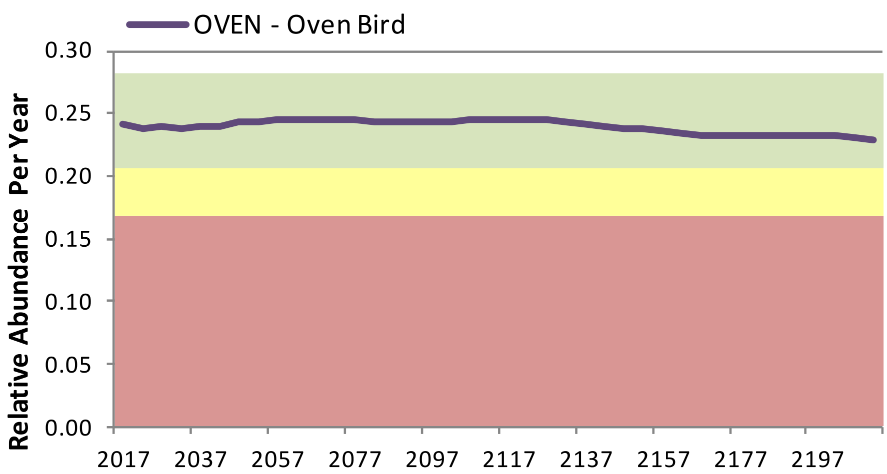


Figure 5-53. Trend of oven bird songbird RA values over time and the percentage change relative to time zero, for FMU W13

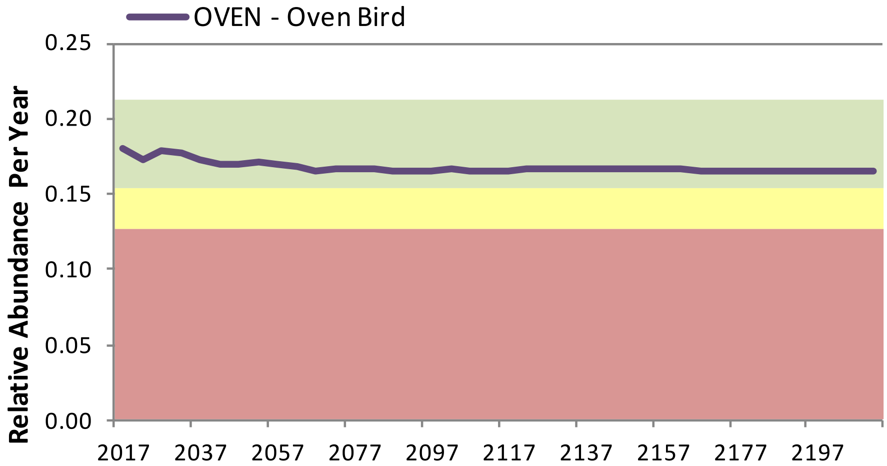


Figure 5-54. Trend of oven bird songbird RA values over time and the percentage change relative to time zero for FMU W11

Figure 5-55, Figure 5-56, Figure 5-57 and Figure 5-58 illustrate the results spatially of oven bird songbird model for RA values for each time period.

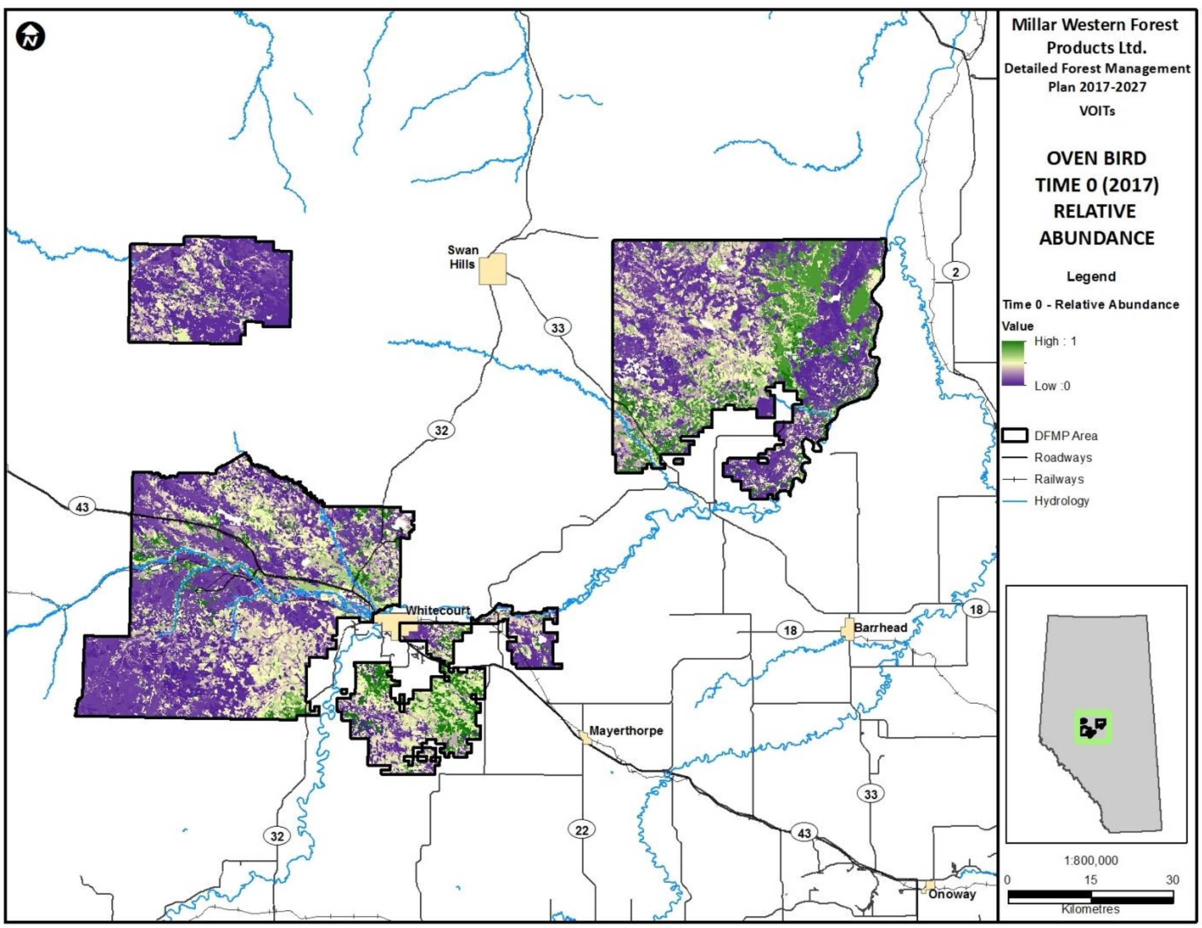


Figure 5-55. Relative abundance values at time zero for oven bird songbird

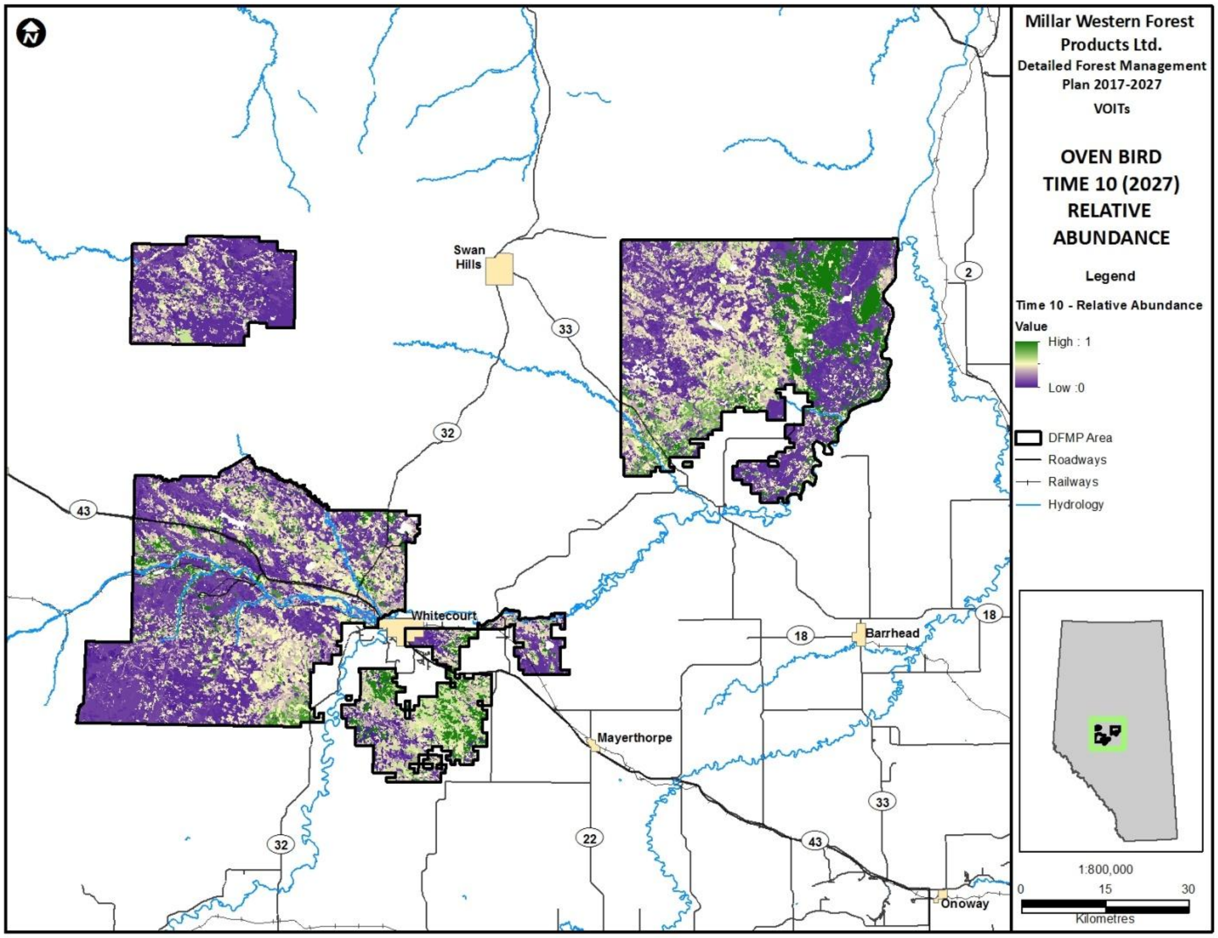


Figure 5-56. Relative abundance values at time 10 for oven bird songbird

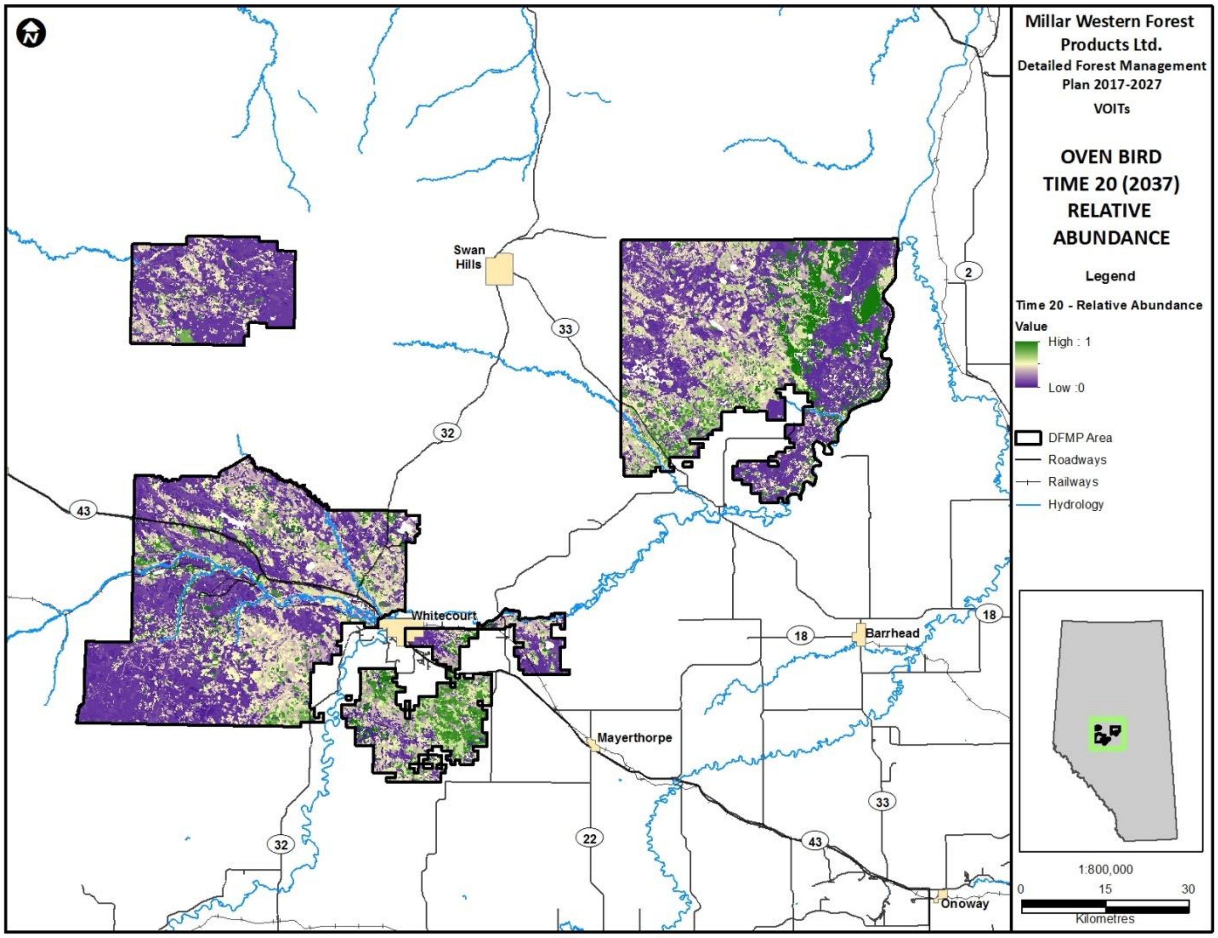


Figure 5-57. Relative abundance values at time 20 for oven bird songbird

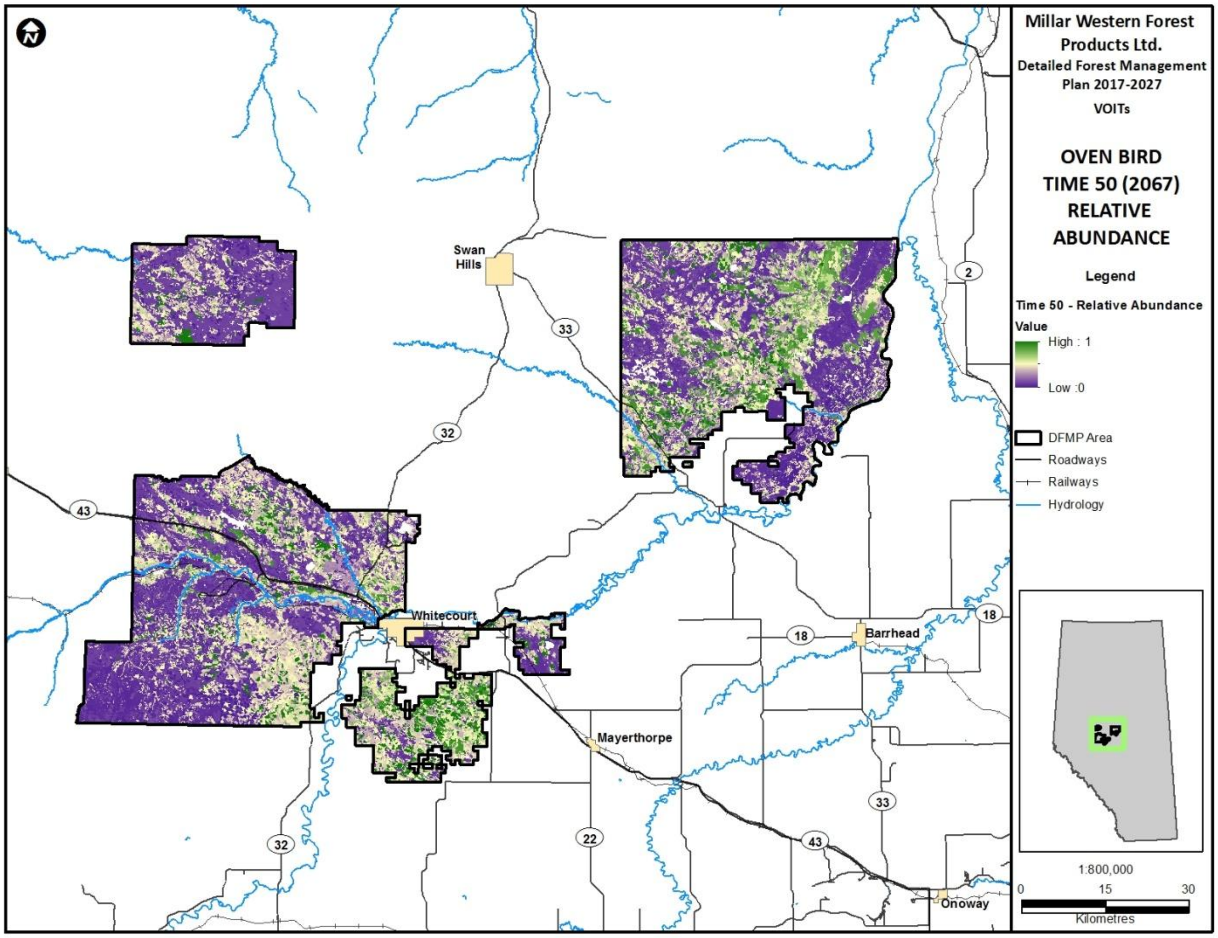


Figure 5-58. Relative abundance values at time 50 for oven bird songbird

4.8 VOIT 15 – 1.3.1.1

As a requirement for the 2017-2027 DFMP, Millar Western was to provide a table showing the number of genetic conservation areas required in each seed zone and number provided in the FMA, as well as a map showing locations of genetic conservations areas. At the time of submission of the 2017-2027 DFMP, the genetic conservation areas had not yet been fully determined by the GoA and, therefore, are not available for reporting.

4.9 VOIT 16 – 1.3.1.2

Millar Western, as well as several other FMA holders within the same seed zone, is still in the development phase in terms of determining what will be the planned conservation activities specific to their Controlled Parentage Plan (CPP) region. Since the commitments have not yet been identified, they are not included in this submission; however, Millar Western will comply with all identified activities and commitments, once finalized.

4.10 VOIT 17 – 1.4.1.1

The current method for considering new protected areas is through the Land- use Framework, the GoA's regional planning process. Millar Western communicates with the GoA on a regular basis to determine the status of any potential protected areas that may be under consideration within the DFMP area. As there is also the potential for protected areas to be created through caribou range plans, Millar Western is involved in consultation processes established by the GoA to influence their development.

4.11 VOIT 25 – 3.2.1.1

The Equivalent Clearcut Area (ECA) analysis is used to address the *Alberta Forest Management Planning Standard* objective of "limiting the impact of timber harvesting on water yield". Watersheds with values placed at risk from the proposed SHS are detected by indentifying changes to flow regime. ECA is one of the measures used to determine the amount of disturbance on each watershed in the DFMP area.

ECA values were forecasted as part of the modeling for the PFMS. From this information, forecasted ECA change by watershed was derived.

Table 5-25. Forecasted ECA change by watershed for W11

FMU	Watershed ID	Area (ha)	Year 20 (2037)	Year 30 (2047)	Year 50 (2067)	Year 100 (2117)
W11	938	552	15%	9%	12%	9%
	940	552	3%	2%	32%	2%
	945	2,193	18%	15%	15%	20%
	954	9,747	19%	18%	17%	15%
	958	14,796	17%	17%	10%	17%
	959	5,754	22%	21%	15%	21%
	961	13,970	10%	11%	18%	11%
	962	3,223	22%	24%	28%	22%
	973	5,812	9%	10%	20%	9%
	977	9,868	21%	19%	9%	15%
	986	1,200	1%	1%	20%	4%
	987	18,787	15%	17%	21%	16%
	988	19,261	21%	18%	9%	20%
	992	7,399	2%	2%	15%	2%
	997	3,338	25%	21%	16%	25%
	998	900	18%	27%	14%	25%
	999	3,119	1%	4%	28%	5%
	1003	1,862	0%	3%	34%	3%
	1004	22,857	15%	15%	11%	15%
	1006	1,540	9%	10%	28%	4%
	1014	10,811	11%	10%	7%	12%
	1021	8,184	17%	19%	18%	16%
	1022	2,417	2%	7%	10%	8%

FMU	Watershed ID	Area (ha)	Year 20 (2037)	Year 30 (2047)	Year 50 (2067)	Year 100 (2117)
	1025	4,220	0%	3%	4%	0%
	1603	2,057	27%	37%	28%	17%

Table 5-26. Forecasted ECA change by watershed for W13

FMU	Watershed ID	Area (ha)	Year 20 (2037)	Year 30 (2047)	Year 50 (2067)	Year 100 (2117)
W13	381	3,263	22%	24%	32%	16%
	383	2,745	23%	27%	21%	14%
	571	1,302	48%	53%	36%	44%
	615	12,409	28%	34%	33%	15%
	616	9,359	40%	28%	28%	24%
	635	8,539	42%	36%	29%	39%
	636	2,604	13%	20%	60%	19%
	638	6,904	36%	32%	23%	37%
	695	6,189	12%	33%	49%	11%
	723	3,585	8%	29%	57%	6%
	947	6,241	36%	24%	13%	26%
	952	14,003	25%	15%	17%	16%
	953	610	13%	20%	16%	18%
	965	7,130	32%	20%	16%	12%
	968	8,529	35%	21%	15%	18%
	975	6,387	32%	14%	7%	12%
	979	4,627	23%	13%	6%	6%
	982	2,782	51%	42%	18%	29%
	1016	713	46%	46%	24%	35%
	1017	5,195	44%	44%	26%	31%
	1019	927	13%	11%	20%	12%
	1020	736	27%	26%	13%	9%
	1027	5,628	31%	22%	19%	34%
	1029	1,491	27%	37%	35%	22%
	1034	10,134	21%	20%	19%	23%
	1035	3,769	19%	19%	18%	16%
	1039	3,816	31%	32%	31%	29%
	1040	7,628	26%	26%	19%	20%
	1043	2,454	29%	32%	26%	31%
	1044	2,096	22%	26%	18%	21%
	1047	9,742	29%	30%	21%	27%
	1048	21,353	30%	26%	22%	25%
	1053	3,008	32%	32%	30%	27%

FMU	Watershed ID	Area (ha)	Year 20 (2037)	Year 30 (2047)	Year 50 (2067)	Year 100 (2117)
	1054	4,262	20%	24%	22%	14%
	1055	6,598	26%	30%	24%	26%
	1058	1,507	20%	20%	19%	7%
	1059	5,638	14%	18%	26%	8%
	1061	6,603	20%	21%	28%	13%
	1062	1,712	39%	37%	18%	32%
	1063	5,070	22%	24%	28%	19%
	1064	3,804	34%	38%	29%	31%
	1065	10,709	22%	19%	11%	19%
	1066	4,545	34%	25%	16%	29%
	1067	2,125	15%	21%	22%	11%
	1070	6,116	46%	34%	21%	37%
	1071	3,091	41%	42%	28%	31%
	1072	892	25%	35%	39%	30%
	1073	1,634	24%	36%	36%	29%
	1075	2,656	9%	8%	9%	11%
	1077	4,100	34%	29%	27%	47%
	1078	9,077	28%	27%	30%	35%
	1080	7,922	33%	35%	33%	29%
	1081	13,050	32%	26%	23%	27%
	1082	2,182	17%	22%	48%	21%
	1139	4,369	14%	23%	30%	10%
	1636	599	35%	35%	28%	45%

4.12 VOIT 27 – 5.1.1.1

Recommended harvest levels derived from Preferred Forest Management Scenario are summarized below. Carryover volumes were included in the Preferred Forest Management Scenario and SHS.

Table 5-27. Recommended AAC for the 2017-2027 DFMP

Company Name	Disposition ID	Type	Recommended Allocation m³/yr	Period 1 [1] Carryover Volume (m³/yr)	Period 1 [1] Harvest Level (m³/yr)	Period 2 [2] Carryover Volume (m³/yr)	Period 2 [2] Harvest Level (m³/yr)
FMU W13							
Conifer Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	311,121	42,000	353,121	0	311,121
Millar Western Forest Products Ltd.	CTQW130001	Grazing [4]	5,879	0	5,879	0	5,879
CTP	[8(2)(d)(i)]	FMA	30,000	0	30,000	0	30,000
Total Coniferous			347,000	42,000	389,000	0	347,000
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	151,472	31,720	183,192	0	151,472
Millar Western Forest Products Ltd.	DTAW130002	Grazing [4]	6,528	0	6,528	0	6,528
Weyerhaeuser Company Ltd.	DTAW130001	FMU	45,000	20,280	65,280	0	45,000
Total Deciduous			203,000	52,000	255,000	0	203,000
FMU W11							
Conifer Allocations							
Spruceland Millworks Inc.	CTQW110008	FMU	103,000	22,674	125,674	22,674	125,674
Total Coniferous			103,000	22,674	125,674	22,674	125,674
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	113,894	26,000	139,894	0	113,894
Millar Western Forest Products Ltd.	DTAW110002	Grazing [4]	1,106	0	1,106	0	1,106
Total Deciduous			115,000	26,000	141,000	0	115,000
FMA							
Area Residents [3]	[8(2)(a)(i)]		1,000				

[1] Period 1: May 1, 2017 - April 30, 2022.
[2] Period 2: May 1, 2022 - April 30, 2027.
[3] Total volume of coniferous/deciduous (including birch); included in Millar Western FMA Volume
[4] Grazing volumes based on 20 year average harvest volume in PFMS
Conifer and Deciduous Utilization is 15/10/15
Volumes are reduced for Cull
Volumes have not been reduced for structure retention

4.13 VOIT 28 – 5.2.1.1a

The FireSmart spatial coverage required to generate these metrics was not available for submission. VOIT to be updated when data is available.

4.14 VOIT 29 – 5.2.1.1b

The FireSmart spatial coverage required to generate these metrics was not available for submission. VOIT to be updated when data is available.

4.15 VOIT 31 – 5.2.3.1

Mean Annual Increment (MAI) values details were described in Annex V – Growth and Yield Document in Section 6.3; the following is an excerpt from that section.

MAI values for all raw GYPSY yield curves are summarized in this section. In addition, the MAI targets required for RSA and silviculture management for each managed strata used in the TSA are summarized at the end of this section.

As each FMU is a Sustained Yield Unit (SYU), culmination mean annual increment (MAI) targets were developed specific to each FMU. MAI targets were selected as follows:

- AW yield strata are managed for deciduous yield, and therefore deciduous culmination age was used to select the year for MAI targets.
- All coniferous, mixedwood, and DU strata are managed primarily for coniferous yield, and therefore for coniferous culmination age was used to select MAI targets.

Culmination MAIs for each raw GYPSY yield curve type are presented in Table 5-28, Table 5-29, and Table 5-30. Note these MAI values are based on gross merchantable timber volumes which does not include cull allowance, and only subset of these curves were based on sufficient data to be used in TSA.

Table 5-28. Culmination mean annual increments of raw GYPSY yield curve for natural stands by FMU

FMU	Stratum	N	Maximum MAI					
			Culmination Age	MAI (m^3/ha/y)				
				CON	DEC	SB	SW	PL
W11	AW	210	77	0.53	2.38	0.02	0.40	0.11
	AP	44	145	1.01	1.08	0.18	0.50	0.33
	AS	60	122	1.35	1.33	0.05	1.05	0.24
	PA	20	106	1.44	1.15	0.12	0.42	0.90
	SA	42	132	1.60	1.09	0.02	1.55	0.03
	PL	131	114	1.73	0.41	0.22	0.26	1.25
	SW	79	128	1.93	0.57	0.20	1.56	0.18
W13	AW	115	94	0.55	2.53	0.03	0.36	0.17
	DU	54	120	0.94	1.78	0.08	0.73	0.13
	AP	41	121	1.49	1.44	0.07	0.60	0.81
	AS	67	138	1.10	1.38	0.05	0.90	0.15
	PA	61	107	1.77	1.17	0.24	0.45	1.08
	SA	52	111	1.39	1.00	0.03	1.32	0.04
	PL	197	108	2.35	0.31	0.34	0.28	1.73
	SB	42	153	1.47	0.13	0.93	0.22	0.32
	SW	96	112	1.99	0.68	0.16	1.51	0.32

Table 5-29. Culmination mean annual increments of raw GYPSY yield curve for Pre-1991 managed stand in W13

FMU	Stratum	N	Maximum MAI					
			Culmination Age	MAI (m^3/ha/y)				
				CON	DEC	SB	SW	PL
W13	PA	73	91	3.14	1.49	0.14	1.18	1.81
	SA	39	96	2.87	2.16	0.02	2.65	0.20
	PL	62	83	3.75	0.88	0.10	0.76	2.88
	SW	42	98	3.02	0.92	0.09	2.61	0.31

Table 5-30. Culmination mean annual increments of raw GYPSY yield curve Post-1991 managed stand by FMU

Declaration	FMU	Yield Stratum	Net Landbase Area (ha)	N	Maximum MAI Culmination Age	MAI (m^3/ha/y) CON	DEC	SB	SW	PL
C/CD/DC	W11	AW	359	22	76	1.06	2.64	0.07	0.69	0.30
		AP	134	11	93	2.27	1.70	0.20	0.52	1.55
		AS	204	12	98	2.52	1.93	0.12	2.16	0.23
		SA	118	13	104	2.22	1.14	0.36	1.09	0.77
		PA	114	14	94	2.69	1.32	0.24	0.60	1.85
		PL	605	32	92	3.14	0.89	0.29	0.59	2.25
		SB	18		99	2.57	0.73	0.14	1.92	0.51
		SW	464	20	100	2.78	0.91	0.27	1.53	0.98
	W13	AW	812	22	72	0.84	2.83	0.01	0.44	0.38
		AP	288	23	86	2.71	1.72	0.03	0.79	1.89
		AS	277	28	98	2.18	1.83	0.02	2.02	0.14
		PA	785	45	89	2.93	1.44	0.26	0.76	1.90
		SA	244	34	98	2.57	1.36	0.07	2.19	0.31
		PL	14,325	61	83	4.20	0.34	0.13	0.89	3.19
		SB	143	4	97	3.13	0.70	0.27	1.80	1.06
		SW	1,777	39	97	3.11	0.74	0.18	2.17	0.76
D	W11	AW	7,769	10	66	0.36	3.96	0.00	0.36	0.00
	W13	AW	10,180	10	71	0.53	3.31	0.01	0.52	0.01

Cumulative MAI RSA performance survey targets derived from the yield curves applied in the TSA process are summarized in Table 5-31. Note the values in this table were derived from gross merchantable volume based on a 15/10/15cm using a 4.88m minimum merchantable tree length. Cumulative MAI targets would require adjusting after the TSA is completed to account for subsequent adjustments.

Table 5-31. Culmination MAI by FMU for RSA performance targets

FMU	Stratum	Treatment	Curve Type	Age	Culmination MAI (m^3/ha/y)		
					CON	DEC	Total
W11	AW	Normal	Basic	77	0.53	2.28	2.81
	AP	Normal	Basic	145	1.01	1.08	2.09
	AS	Normal	Basic	122	1.35	1.33	2.68
	PA	Normal	Basic	106	1.44	1.15	2.59
	SA	Normal	Basic	132	1.60	1.09	2.69
	PL	Normal	RSA	92	3.14	0.89	4.03
	SW	Normal	RSA	100	2.78	0.91	3.68
W13	AW	Normal	Basic	94	0.55	2.78	3.33
	AP	Normal	RSA	86	2.71	1.72	4.43
	AS	Normal	RSA	98	2.18	1.83	4.02
	PA	Normal	RSA	89	2.93	1.44	4.37
	SA	Normal	RSA	98	2.57	1.36	3.93
	PL	Normal	RSA	83	4.20	0.34	4.54
	SB	Normal	Basic	153	1.47	0.13	1.59
	SW	Normal	RSA	97	3.11	0.74	3.85
	SW	Tree Improvement	RSA TI	97	3.23	0.74	3.97

4.16 VOIT 32 – 6.1.1.1

Project Notification

Millar Western began DFMP consultations with the eight First Nations communities in March 2015. Project notification packages, consisting of an introductory letter, DFMP area map, DFMP ToR, and First Nation Consultation Plan, were sent by registered mail to each of the First Nations' communities. Millar Western received little feedback at this stage: one community sent a letter stating its objections to the project, while another acknowledged the project and outlined preliminary concerns.

VOITs

VOIT packages were successfully delivered to identified First Nations communities in April 2015. From April 2015 through to April 2016, Millar Western carried out VOIT consultations and, on April 1, 2016, submitted the finalized ROC logs to the GoA, at which time the GoA deemed VOIT consultation for all First Nations communities satisfactorily concluded.

Harvest Eligibility Maps

Millar Western incorporated a step that was additional to its original plans, developing and distributing harvest eligibility maps to the relevant communities in May 2016. The intent of these maps was to identify all of the forest stands from which the SHS could be drawn, once age, productivity and legal requirements were considered. The purpose in providing these materials to the First Nations communities was to provide early engagement in the development of the SHS, as well as to provide a platform to address First Nations-specific values during development of the SHS.

Spatial Harvest Sequence

In November 2016, Millar Western developed and distributed draft spatial harvest sequence maps.

4.17 VOIT 35 – 6.2.1.1

Public Advisory Committee

Millar Western's Public Advisory Committee (PAC) was formed in 2007, a commitment of the 2007-2017 DFMP, and was a core mechanism for stakeholder engagement during the development of the 2017-2027 DFMP. PAC members were heavily engaged in the DFMP development process, beginning in October 2014, when they were provided with a detailed overview of the Terms of Reference (ToR). In addition to offering advice on the public communications and consultation plan, PAC members agreed to review and approve two key components of the DFMP: the VOITs and the PFMS.

In March 2015, Millar Western presented the GoA VOITs and, in May 2015, held an interactive session, where members were asked to identify their own forest values. PAC values were mapped to the GoA VOITs, to determine if the VOITs sufficiently captured the PAC values, or if new VOITs would be required. After reviewing the mapping outcomes at the June 2016 meeting, PAC members were satisfied that the VOITs were complete and unanimously approved the VOIT table, without revision. Millar Western also organized two DFMP-related field tours for PAC members, in 2015 and 2016, to demonstrate how values were operationalized in forest management activities.

Project progress updates were provided at all PAC meetings, through to the end of 2016. In April 2016, Millar Western presented the eligibility maps, showing the stands that could be considered for harvesting during the plan period. No issues were identified. More specific harvesting locations were presented on October 2016, as part of the discussion on the Preferred Forest Management Scenario, which was unanimously accepted without revision.

Other Public Engagement Efforts

Millar Western engaged with the broader public through open houses, both physical (in multiple communities) and virtual (on Millar Western's corporate website). Physical open houses to discuss the VOITs were held on May 6, 7, 13, and 14, 2015, in the communities of Whitecourt, Fox Creek, Swan Hills and Ft. Assiniboine, respectively. At PAC's suggestion, Millar Western scheduled an additional open house at the Whitecourt Trade Show in May 2016, to present and seek input into the eligibility maps. A final physical open house was held in Whitecourt on October 5, 2016, to review the PFMS. All open houses were promoted extensively in surrounding communities, through advertisements in local newspapers, social media (Facebook and Twitter), media releases (April 28, 2015, and April 30, 2016) and via postings on the Millar Western internal (for employees) and external websites.

In April 2016, Millar Western launched a new website that included a "virtual" DFMP open house (https://millarwestern.com/company/latest-projects/2017-27-detailed-forest-management-plan/), giving the public access to all documents made available at the physical open houses as well as other information such as the SHS maps. Coordinates to the virtual open house were included in subsequent advertisements for physical open houses. From the launch to December 31, 2016, the DFMP Virtual Open House received 599 page views, according to Google Analytics. Although contact information was made available on the website (Chief Forester's and corporate email address), no additional input was received.

Consideration of Input

Despite efforts to provide and promote multiple consultation opportunities, stakeholder participation was generally poor, with a few exceptions. Approximately 180 people visited Millar Western's Whitecourt Trade Show booth in May 2016, though none expressed any concerns with the eligibility maps that were on display. Five members of the Whitecourt Trailblazers Snowmobile Club visited the October 2016 open house in Whitecourt, to voice concerns about the impact of annual operations on the organization's trail system. This matter, which was AOP- rather than DFMP-related, was referred to and addressed by Millar Western's planning department in Whitecourt.

Though consultation activities provided opportunities for Millar Western to share information and engage with stakeholders on numerous issues, they did not result in any input that led to modifications to the DFMP. Millar Western continues to see value in maintaining open lines of communication with those affected by its operations and will, throughout the implementation of the 2017-2027 DFMP, continue to work to raise awareness of its operations and efforts to manage public forests in its stewardship, in a responsible, sustainable manner.

5. References

Alberta. Sustainable Resource Development. (2007). Fire Salvage Planning and Operations, Directive No. 2007-01. Retrieved from: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/formain15847/$file/2007-01-FireSalvagePlanningOperations-Nov2007.pdf?OpenElement

Alberta. Queen's Printer. (2011a). Weed Control Act. Retrieved from: http://www.qp.alberta.ca/1266.cfm?page=W05P1.cfm&leg_type=Acts&isbncln=9780779760602

Alberta. Environment and Parks. (2011b). Wild Species Status Search. Retrieved from: http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx

Alberta. Environment and Sustainable Resource Development. (2014). Seed Zones of Alberta. Retrieved from: https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7BCF48B1D6-C5DD-45C6-9782-6BB01BEAB6C5%7D

Alberta. Environment and Parks. (2015). Riparian Areas. Retrieved from: http://aep.alberta.ca/lands-forests/grazing-range-management/riparian-areas.aspx

Alberta. Environment and Parks. (2016a). Alberta Conservation Information Management System (ACIMS). Retrieved from: http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/

Alberta. Agriculture and Forestry. (2016b). Tree Improvement and Adaptation – Forest Health and Adaptation. Retrieved from: http://www.agric.gov.ab.ca/app21/forestrypage?cat1=Forest%20Health%20and%20Adaptation&cat2=Tree%20Improvement%20and%20Adaptation

Russell, M.S. (2008). Habitat selection of barred owls (*Strix varial*) across multiple spatial scales in a boreal agricultural landscape in north-central Alberta. ProQuest.

Appendix I - VOIT Acceptance Timing

Table 5-32. VOIT acceptance timing

Old VOIT #	New VOIT #	VOIT ID	VOIT Descriptor	Date Agreed Upon	Comments
1	**1**	1.1.1.1	Seral stage area	04/24/2015	Updated VOIT target values
2	**2**	1.1.1.2a	Landscape fragmentation/patch size	11/27/2015	
3	**3**	1.1.1.2b	Old interior forest	04/24/2015	
4	**4**	1.1.1.3a	Open all-weather forestry road density	06/05/2015	Updated VOIT target values
5	**5**	1.1.1.3b	Open seasonal/temporary forestry road length	10/16/2015	Updated VOIT target values
6	**6**	1.1.1.4	Uncommon plant community maintenance	06/05/2015	Additional information provided in VOITs chapter
7	**7**	1.1.1.5a	Unsalvaged burned forest	04/24/2015	
8	**8**	1.1.1.5b	Unsalvaged blowdown forest	04/24/2015	
9	**9**	1.1.1.6	OGRs associated with riparian areas	06/05/2015	
-	-	1.1.1.7	Volume and area harvested in riparian areas	04/24/2015	DROPPED
10	**10**	1.1.2.1a	Retain stand level structure	11/27/2015	
11	**11**	1.1.2.1b	Downed woody debris	06/05/2015	
12	**12**	1.1.2.2	Sensitive sites	06/05/2015	Additional information provided in VOITs chapter
13	**13**	1.1.2.3	Watercourse crossings	06/05/2015	Additional information provided in VOITs chapter
14	**14**	1.2.1.1	Species at risk habitat strategy	11/27/2015	Updated VOIT indicator, target and reporting to properly reflect models being used.
15	**15**	1.3.1.1	Wild forest populations	11/27/2015	
16	**16**	1.3.1.2	Wild forest populations ex-situ	11/27/2015	
17	**17**	1.4.1.1	Trans boundary values	06/05/2015	

Old VOIT #	New VOIT #	VOIT ID	VOIT Descriptor	Date Agreed Upon	Comments
18	**18**	2.1.1.1	Reforestation	11/27/2015	
-	-	2.1.1.1a	Reforestation target	04/24/2015	DROPPED
-	-	2.1.1.1b	Reforestation target	04/24/2015	DROPPED
19	**19**	2.1.1.2	MAI	11/27/2015	
20	**20**	2.1.2.1	Limit forest landbase conversion	04/24/2015	
21	**21**	2.1.2.2	Forest health program	04/24/2015	
-	-	2.1.2.3a	Reduce MPB susceptibility (rank 1&2 stands)	04/24/2015	DROPPED
-	-	2.1.2.3b	Reduce MPB susceptibility (infested stands)	04/24/2015	DROPPED
-	-	2.1.2.4	Reduce MPB susceptibility (alter pine structure)	04/24/2015	DROPPED
22	**22**	2.1.3.1	Noxious weed program	04/24/2015	
-	-	2.2.1.1	Maintain forest health	04/24/2015	DROPPED
23	**23**	3.1.1.1	Roading and bared areas	04/24/2015	
24	**24**	3.1.1.2	Soil erosion and slumping	06/05/2015	
-	-	3.1.1.3	Soil compaction reduction	04/24/2015	DROPPED
25	**25**	3.2.1.1	Water yield impacts (forecasted)	10/16/2015	
-	-	3.2.1.1	Water yield impacts (1st order watersheds)	04/24/2015	DROPPED
-	-	3.2.1.2	Water quality	04/24/2015	DROPPED
26	**26**	3.2.2.1	Riparian buffers	06/05/2015	
27	-	4.1.1.1	Carbon uptake and storage	04/24/2015	DROPPED
28	-	4.2	Forest land conversion	04/24/2015	DROPPED
29	**27**	5.1.1.1	Establish appropriate AAC's	06/29/2015	
-	-	5.1.2.1	Communications initiatives	04/24/2015	DROPPED
-	-	5.1.2.2	Protect heritage values	04/24/2015	DROPPED
-	-	5.1.2.3	Minimize visual impact	04/24/2015	DROPPED
30	**28**	5.2.1.1a	Fire Behaviour Potential in FireSmart Comm. Zone	08/28/2015	Added target value in
-	**29**	5.2.1.1b	Reduce wildfire threat potential	06/29/2015	Added target value in
31	**30**	5.2.2.1	Other uses and timber mgmt activities	06/29/2015	
32	**31**	5.2.3.1	Long run sustained yield average	06/29/2015	
33	**32**	6.1.1.1	First Nations consultation	04/24/2015	
47	**33**	6.1.2.1	Forest contract opportunities to First Nations	04/24/2015	Updated wording to include all first nations groups
48		6.1.3.1	Environmental Co-Stewardship Committee	04/24/2015	DROPPED
NEW	**34**	6.1.3.1	Cultural and Significant Sites	06/22/2016	
37	**35**	6.2.1.1	Public participation process	04/24/2015	
50	-	6.2.2.1	Management plan for Huestis forest	04/24/2015	DROPPED
51	-	6.3.1.1	Virtual open house	04/24/2015	DROPPED

Old VOIT #	New VOIT #	VOIT ID	VOIT Descriptor	Date Agreed Upon	Comments
52	-	6.3.2.1	Establishment of Public Advisory Committee	04/24/2015	DROPPED
53	-	6.3.3.1	Implement 24 hour hotline (toll-free)	04/24/2015	DROPPED
-	-	-	VOIT Footnotes		Detailed in VOIT Chapter

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

\\silver\clients\MWFP\Projects\P755_DFMP\Ch5_VOIT\Documentation\Report\Ch5_VOITS_20170905_Submit.docx

Chapter 6

Preferred Forest Management Scenario

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

List of Tables

List of Figures

1. Introduction

Long winters and short growing seasons in the boreal forest result in relativity slow tree growth and harvesting rotation ages of between 60 and 100 years. This necessitates long forest management planning horizons of up to 200 years, to adequately capture and incorporate the growth dynamics and impacts of forest management activities. Only through modeling can outcomes from different management activities over these extended periods be estimated and the potential trade-offs among values be evaluated.

Innovative and detailed modeling has always been a large part of Millar Western's planning and decision making process, and the 2017-2027 Detailed Forest Management Plan (DFMP) continues this tradition. In developing a recommended management approach for the current DFMP, numerous scenarios were modeled and evaluated by the Plan Development Team (PDT), in order to gain insight into the implications and trade-offs of different management alternatives. The outcome from the modeling process is the Preferred Forest Management Scenario (PFMS), which contains the timber harvesting and regeneration activities planned for the next ten years, as well as predictions for the impacts on other values.

The modeling, or *forecasting* and *timber supply analysis* (TSA), was undertaken in a series of spatially explicit landscape level *Patchworks* scenarios. Scenarios were completed to evaluate various management issues, which ranged from non-timber values (e.g. changes in wildlife habitat) that were addressed through non-timber assessment (NTA), to operational objectives such as harvest block size and block patterns.

Issues evaluated throughout the forecasting process included the following:

- Landscape level objectives
    - Seral stages
    - Habitat analysis using GoA's NTA tools
    - Watershed analysis using the Equivalent Clearcut Area (ECA) model
- Operational Concerns

- *Spatial Harvest Sequence* (SHS) spatial design
- Minimum harvest ages
- Timing of compartment sequencing
- Sequencing deciduous stands with coniferous understory
- Reforestation treatments affecting post harvest transitions and forest growth
- Coniferous and deciduous landbase assignments and transitions
- Minimum merchantable timber growing stock levels, and
- Impacts of planting improved stock.

The scenarios were discussed and reviewed within Millar Western in *Technical Team* (TT) meetings, as well as at PDT meetings attended by quota holders and representatives of the Government of Alberta (GoA), in addition to Millar Western representatives. Of the 18 PDT meetings held from January 2015 until December 2016, approximately 6 focused on analysis results and providing direction to the next analysis. This allowed all PDT members to participate and provide input into the timber supply analysis and, ultimately, the PFMS.

The purpose of this chapter is to describe and document the PFMS. The details on the scenarios leading up to the PFMS are described separately in *Annex VI - TSA*. The PFMS is the final scenario resulting from the series of scenarios completed. It describes the harvesting and silviculture actions that Millar Western and quota holders plan to take over the next ten years, and the predicted response of the forest to these actions over a 200-year planning horizon. The outputs derived from the PFMS are directly used to provide indicators and targets for the VOITs (Chapter 5) and are incorporated into the guidelines for DFMP implementation over the 10-year period, from May 1, 2017, to April 30, 2027, as documented in DFMP Implementation (*Chapter 7 – Implementation*).

This chapter summarizes the forest management objectives and the linkages to the PFMS. It also contains summaries of the landbase and yield curves, details of which are provided in Annex V - Growth and Yield and Annex VIII – Landbase Development. The assumptions and inputs used to develop the PFMS are described separately from the predicted outcomes, which are used to support DFMP implementation.

1.1 Management Philosophy

The management philosophy for the PFMS is to implement forest management practices that result in a sustainable flow of high quality economically viable fiber to sustain mill operations while employing a sustainable forest management approach that maintains biodiversity and ecological integrity.

The management objectives that were used to guide the development of the PFMS are:

- Establish sustainable harvest levels that balance ecological, economic and social objectives;
- Manage forest structure through a coarse filter approach using seral stages and patch targets;
- Mitigate impacts on non-timber habitat values using a fine filter approach for a selected set of species;
- Mitigate impacts of predicted increased water runoff as a result of harvesting by adjusting the location and amount of SHS in a given compartment;
- Promptly regenerate harvest areas to establish productive coniferous, mixedwood and deciduous stands to support and grow sustainable harvest levels;

- Plan and promptly adapt harvesting and regeneration to mitigate impacts from insect and other infestations;
- Apply vegetation management techniques to enhance conifer survival and productivity;
- Manage the delivered log size distribution over the next 20 years;
- Modify the harvest sequence within the Slave Lake caribou range to group harvesting in specific concentrated areas; and
- Integrate conifer and deciduous harvesting operations, where possible, to reduce the annual footprint and access requirements.

1.1.1 PFMS Strategies

To implement PFMS objectives, the following strategies were deployed in the development of the PFMS:

- Model a 200-year planning horizon to estimate strategic implications;
- Use a combined (single) coniferous and deciduous landbase;
- Model even flow total conifer and total deciduous harvest volumes over the planning horizon;
- Incorporate and sequence carryover volume for all operators – volume to be in addition to even flow harvest levels;
- Apply operational sequencing constraints on harvest volumes;
- Apply effective utilization of regenerated stands at economic harvest ages to address age-class dynamics;
- Incorporate existing planned blocks into the Spatial Harvesting Sequence (SHS) to improve operability and reduce variance;
- Retain stand level structure retention within harvest areas;
- Apply regeneration treatments to low density deciduous stands to improve future timber yields;
- Apply silviculture treatments to achieve RSA predicted yields;
- Deploy improved white spruce seed to improve future timber yields;
- Balance the sequencing of mature timber with predicted losses due to insect infestations;
- Manage harvest sequencing to achieve desirable thresholds in the change in predicted habitat levels using GoA NTA tools;
- Alter harvest sequencing to manage predicted impacts on watershed runnoff using the ECA model;
- Apply stand selection as per GoA direction and Woodland Caribou Habitat Strategy (*Chapter 7 – Implementation: Appendix III)* to reduce impacts on caribou; and
- Maintain 10% of the managed forest as old or mature forest and a minimum of 35% percent in contiguous patches greater than 120 ha.

2. Landbase Summary

The Millar Western Forest Products Ltd. Forest Management Agreement (FMA) area includes two Forest Management Units (FMUs), W11 and W13. As part of the 2017-2027 DFMP process, a netdown landbase was developed to support planning and the forecasting and TSA for both W11 and W13, of which the total land area is 472,696 hectares.

The netdown landbase is a spatial representation of the DFMP area on May 1, 2015. Initially developed for the TSA, the landbase contains traditional TSA information such stand age, planning compartments, timber yield strata, timber productivity, as well as areas deferred or excluded from timber harvesting activity. Landbases have evolved, and now support an ever expanding array of non-timber values such as terrestrial and aquatic wildlife habitats; at the same time, the required linkages to other datasets (such as ARIS and DIDs) have tightened. Together, these changes have considerably increased the time and effort required for landbase development and approval. The netdown landbase is one of the key products of the 2017-2027 DFMP; agreement-in-principle for the landbase was received from the GoA on July 15, 2016, representing a significant milestone in DFMP development.

Development of the netdown landbase used in the forecasting and TSA is described in detail in Annex VIII – Landbase Development; a landbase summary is provided in this section of the chapter.

Table 6-1 provides a summary of the DFMP area by deletion category and the area suitable for timber harvesting by broad cover group (BCG) resulting from the netdown process. The column *SUMMARY_GRP* in the netdown landbase dataset reflects the classification in the following table, which is a combination of F_DEL (deletions in the passive landbase) and F_BCG (broad cover group classification in the active landbase). Active landbase distribution by yield strata is summarized in Table 6-2. Figure 6-1 maps the distribution of the deletion categories comprising the passive landbase, and Figure 6-2 maps the distribution of the active landbase by BCG.

Table 6-1. Landbase summary

Landbase Category	W11	W13	Total
Passive			
Administrative Deletions			
FN	0	3,543	3,543
MUN	0	711	711
PPA	7,871	2,197	10,067
PRIVATE	1,730	1,640	3,369
CBUF	1	0	1
SBUF	0	376	376
WBUF	6,583	13,005	19,588
SENSITIVE	4	9	13
Administrative Subtotal	*16,189*	*21,480*	*37,669*
Landscape Restrictions			
ROAD	850	4,985	5,835
ANTHNON	34	123	157
ANTHVEG	1,631	6,196	7,826
DIDs	335	3,769	4,104
AQUATIC	6	34	40
FLOOD	346	601	947
LAKE	2,107	620	2,727
RIVER	470	2,724	3,194
NNF	6,645	5,735	12,380
NNV	3	39	42
BURN	18	122	139
Landscape Subtotal	*12,444*	*24,948*	*37,391*
Operations Restrictions			
MOIST	51,888	41,591	93,479
TPR	17	392	409
DENSITY	1,101	7,904	9,005
SLOPE	182	1,757	1,939
BIRCH	658	2,038	2,696
LARCH	377	657	1,034
NOID	124	120	244
SHS	140	766	906
ISLAND	39	519	559
W11SB	4,232	0	4,232
SUBJ	331	1,823	2,154
ISO	493	2,810	3,303
Operations Subtotal	*59,584*	*60,378*	*119,961*
Passive Landbase Subtotal	*88,216*	*106,806*	*195,022*
Active Landbase			
Deciduous	48,951	53,752	102,703
Deciduous/Coniferous	9,694	19,462	29,156
Coniferous/Deciduous	7,687	18,841	26,528
Coniferous	21,296	97,991	119,287
Active Landbase Subtotal	*87,628*	*190,046*	*277,674*
Landbase Total	**175,844**	**296,851**	**472,696**

Table 6-2. Net landbase (active) yield class area summary

Yield Class	W11	W13	Total
AW	48,951	43,168	92,119
DU	-	10,584	10,584
AP	2,659	6,487	9,146
AS	7,035	12,975	20,009
PA	2,174	8,300	10,474
SA	5,513	10,542	16,054
PL	11,163	66,378	77,541
SB	82	6,456	6,538
SW	10,051	25,157	35,208
Total	**87,628**	**190,046**	**277,674**

Clearly visible on the deletion maps are the large areas of unproductive lands unsuitable for timber harvesting; these are mostly wetland complexes and low density forested areas. Many of these wetlands fall along the major rivers within and adjacent to the DFMP area.

FMU W11 is deciduous dominated with the pure hardwood stratum comprising over half of the active landbase area. Except for the Whitecourt mountain area in the south east, FMU W13 is conifer dominated, with the pure pine stratum comprising the largest proportion of the active landbase.

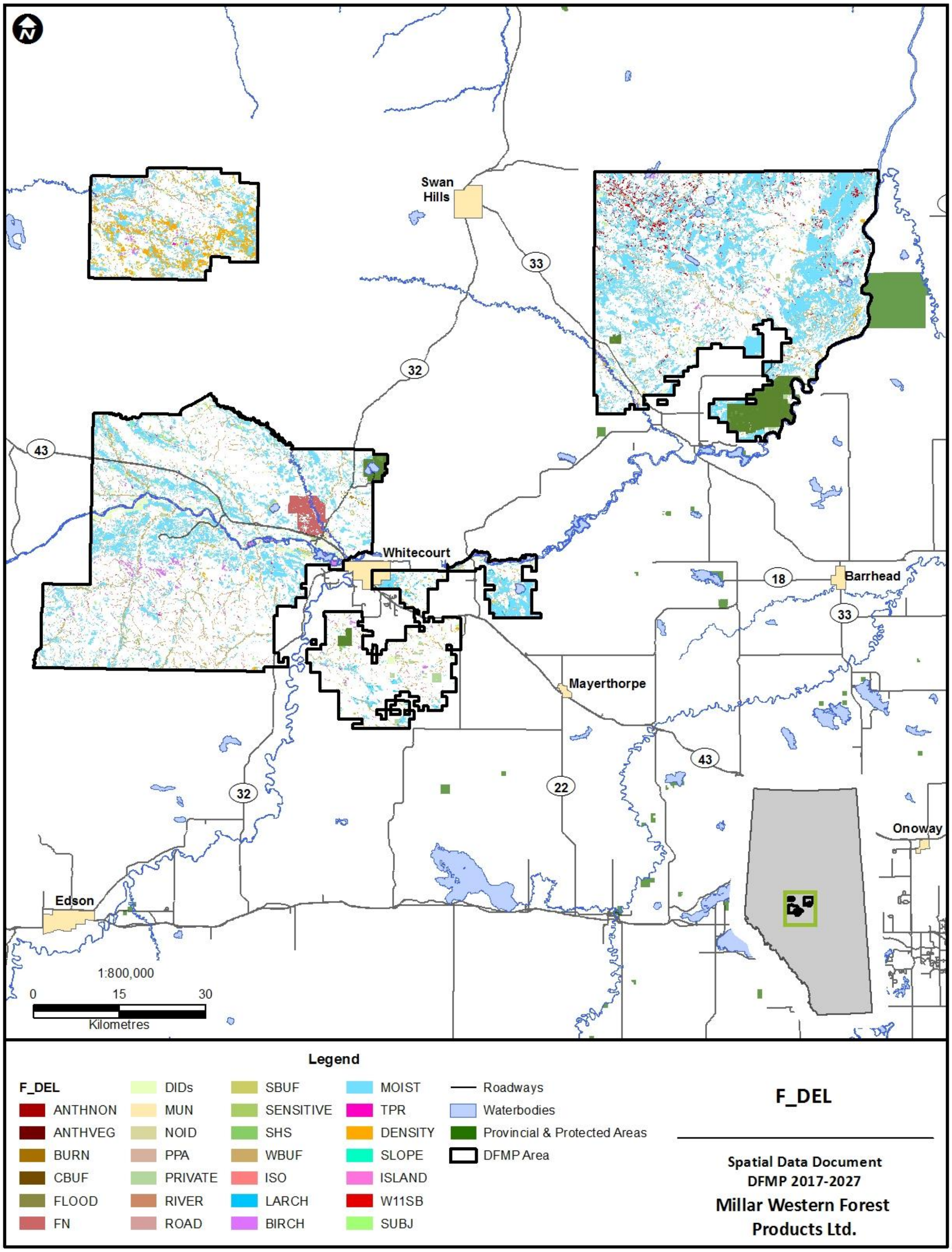


Figure 6-1. Final deletion categories for modeling landbase.

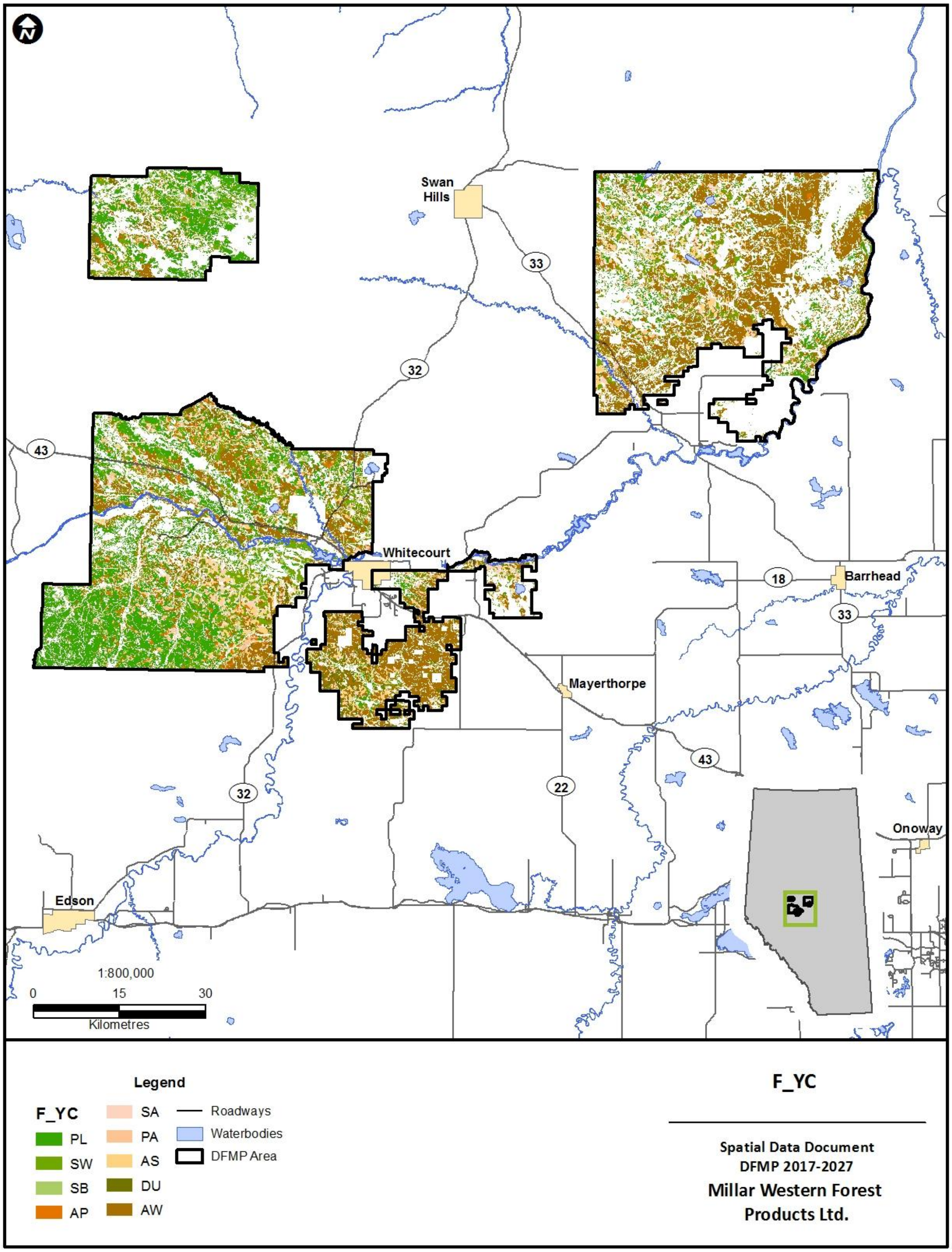


Figure 6-2. Final yield strata on the Active landbase as used in the modeling landbase.

3. Yield Curve Summary

3.1 Overview

Yield curves describe the change in merchantable timber yields over the life of a forest stand. Annex V-Growth and Yield provides a detailed description of the yield curve development process. The yield curves which received agreement-in-principle on August 19, 2016, are those used in the TSA process. Cull deductions were applied in the TSA processes to adjust from gross merchantable to net merchantable timber yields.

Yield curves used in the PFMS were developed from temporary sample plot (TSP), permanent sample plot (PSP), and data from Reforestation Standard of Alberta (RSA) performance survey programs across the DFMP area. Stratification was based on Millar Western's nine base yield strata assigned through the net landbase development process. Yield strata are a modification of the Alberta's base 10 yield strata.

3.2 Timber Yield Curves

Millar Western used three categories of yield curves in the PFMS:

Natural stands: include all fire-origin stands. Curves were derived from TSP and PSP data projected using the GYPSY stand growth model with strata assignment based on AVI attributes.

Pre-1991 managed stands (M91): represents a subsample of the population of managed (regenerated) stands harvested before March 1, 1991. Curve creation was based on TSP and PSP data projected using GYPSY. Strata assignment was based on AVI attributes. This category was limited to pure pine and spruce stands as well as pine and spruce leading mixedwoods in FMU W13.

Post-1991 managed stands (MGD): represents the population of managed stands that were harvested on or after March 1, 1991. Curve creation was based on RSA performance survey data projected using GYPSY. Strata were assigned using RSA sampling units and AVI reconciled with ARIS.

Three intensities of managed stand growth projections were modeled: basic, which usually equaled natural yields; normal, which represents the regeneration treatments typically applied to achieve regeneration standards; and tree Improvement, representing the yields from genetically improved seed.

Coniferous and deciduous decline factors were applied to all yield curves to address stand mortality and decay processes that were not adequately represented with the raw GYPSY outputs.

The set of final yield curves constructed for consideration in the TSA process are summarized in Table 6-3. Annex V contains the full description of the yield curves.

Table 6-3. Yield curves used in the PFMS.

Yield Stratum	Natural	Pre-91 Basic [1]	Pre-91 Juvenile	Post 91 Basic [1]	Post 91 RSA	Post 91 Tree Improvement
FMU W11						
AW	Yes	Yes [2]	-	Yes [2]	-	-
AP	Yes	Yes	-	Yes	-	-
AS	Yes	Yes	-	Yes	-	-
PA	Yes	Yes	-	Yes	-	-
SA	Yes	Yes	-	Yes	-	-
PL	Yes	Yes	-	-	Yes	-
SW	Yes	Yes	-	-	Yes	-
FMU W13						
AW	Yes	Yes [2]	-	Yes [2]	-	-
DU	Yes	-	-	-	-	-
AP	Yes	Yes	-	-	Yes	-
AS	Yes	Yes	-	-	Yes	-
PA	Yes	Yes	Yes	-	Yes	-
SA	Yes	Yes	Yes	-	Yes	-
PL	Yes	Yes	Yes	-	Yes	-
SB	Yes	Yes	-	Yes	-	-
SW	Yes	Yes	Yes	-	Yes	Yes

[1] Basic curves are duplicates of the Natural curves

[2] AW stratum Basic curves are scaled up from Natural curves

3.2.1 Utilization

Gross merchantable tree length volumes were compiled to a utilization standard of 10 cm top diameter inside bark, 15 cm stump diameter outside bark, at a 15 cm stump height using a 4.88 m minimum merchantable length for both coniferous and deciduous species groups. Minimum operable piece size will be defined in the Operating Ground Rules.

3.2.2 Cull

Yield curves produced through the yield curve development process represent gross merchantable volumes, as cull and decay were not accounted for during yield curve development process. Cull and decay loses were accounted for through the application of scaling factors applied to the yield curves during the timber supply process. The conifer yield component was reduced by 2.09%, and the deciduous component was reduced by 8.02%. The cull deductions are the same for both W11 and W13

FMU's. Cull factors were calculated from Millar's Western's and Spruceland's sample scale data over the previous 5 years.

As there has been no TSA deduction for potential harvesting culls due to rot and tree form issues (i.e., natural defects such as crook, forks, catface), this DFMP proposes that some fibre that is included in the TSA model but is unsuitable for production be allowed to be left in the block. As fibre deliveries to mill facilities are costly, Millar Western would prefer not to haul fibre that is unsuitable to its operations. The retained volume would not include merchantable timber volume that is not useable due to specific length merchandising. This proposal specifically refers to volume that would be considered cull if it were delivered and sampled at the mill; it would not qualify as AAC drain or be dues chargeable. These volumes will be tracked as part of a "predicted versus actual" haul monitoring process, to ensure the overall sustainability of the TSA and the parameters considered in its development.

3.2.3 Final Curves

The final curves applied in the TSA modelling were reduced for cull values (refer to Figure 6-3 for W11 and in Figure 6-4 for W13). Some strata have only natural curves, while others have distinct regenerated yields, *e.g.,* juvenile (JUV), RSA and tree improvement curves (RSATI). In most strata, the basic curves are identical to the natural curves, with the exception of the AW strata, where the deciduous component is scaled up from the natural curve.

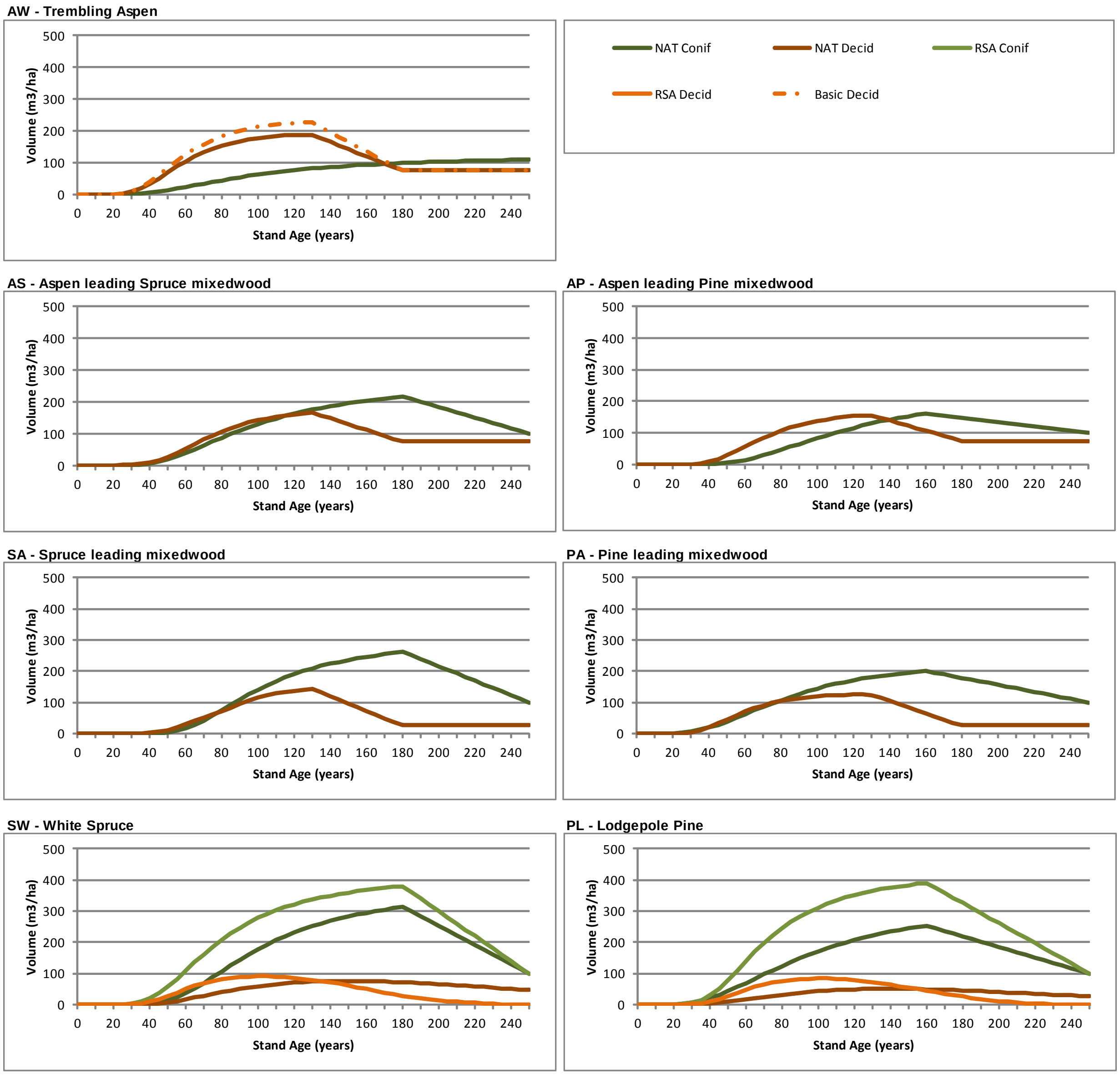


Figure 6-3. Volume yield curves as used in the TSA modeling for FMU W11

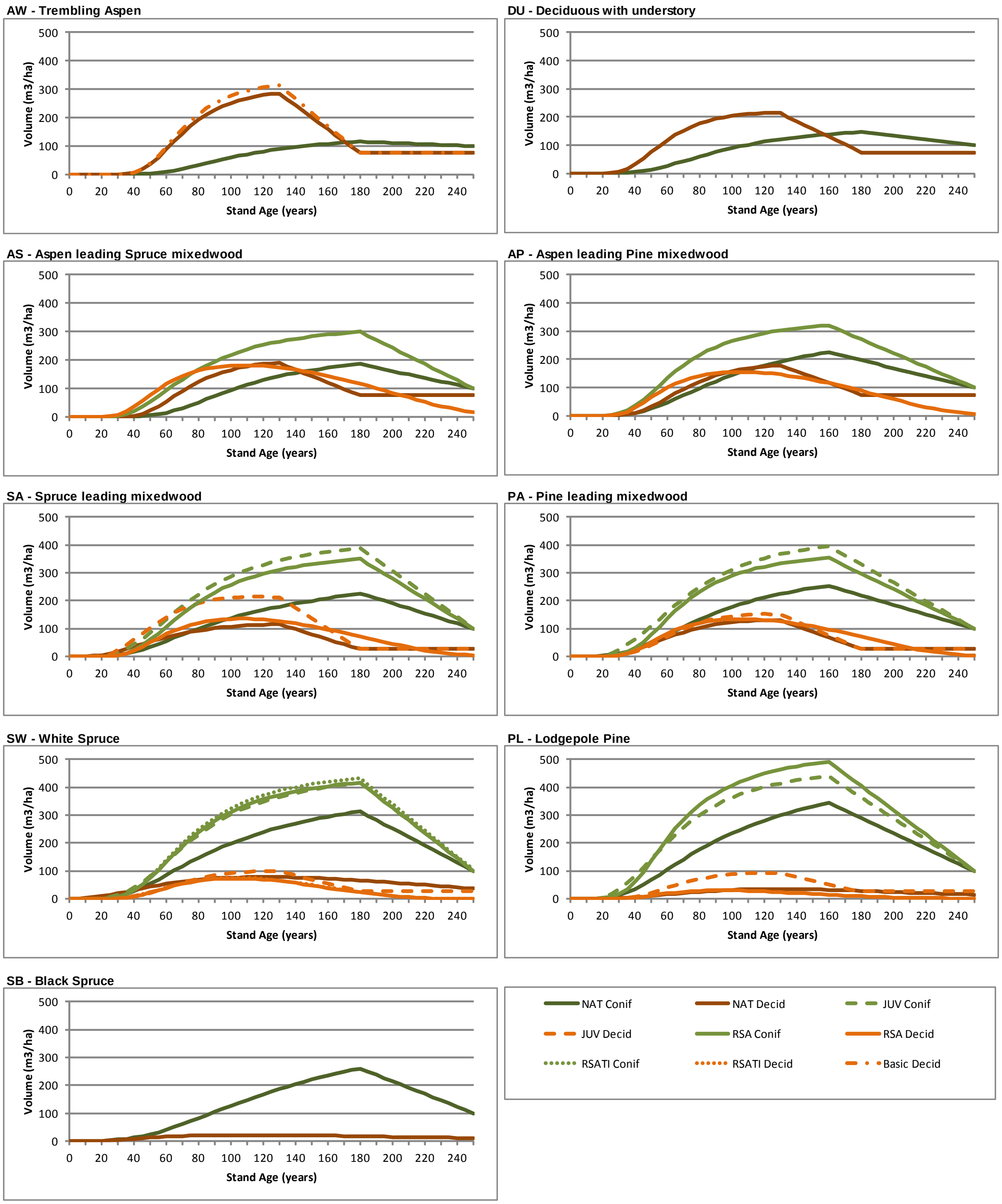


Figure 6-4. Volume yield curves as used in the TSA modeling for FMU W13

3.3 LRSYA

The long-run sustained yield average (LRSYA) represents the maximum theoretical harvest level that could be maintained if the forest was regulated and there were no operating constraints. LYSYA is simply the sum of the maximum Mean Annual Increment (MAI) multiplied by the area for each strata. LRSYA values for both the natural yield curves and regenerated yield curves (most intensive regeneration treatment and conversion of DU to SW) are presented in Table 6-4 and Table 6-5.

Table 6-4. LRSYA values for natural yields

		Natural (Natural Adjusted Curves)						
		MAI			Area	Harvest Level (m^3/yr)		
FMU	**Strata**	**Age**	**Conifer**	**Decid**	**(ha)**	**Conifer**	**Decid**	**Total**
W11	AW	80	0.551	1.903	48,951	26,972	93,154	120,126
	AP	140	1.012	0.998	2,659	2,691	2,654	5,345
	AS	120	1.354	1.338	7,035	9,525	9,412	18,937
	PA	110	1.439	1.115	2,174	3,129	2,425	5,554
	SA	130	1.602	1.103	5,513	8,832	6,081	14,912
	PL	110	1.724	0.420	11,163	19,245	4,688	23,933
	SB				82	0	0	0
	SW	130	1.932	0.563	10,051	19,418	5,659	25,077
W11 Subtotal		-	-	-	*87,628*	*89,812*	*124,072*	*213,884*
W13	AW	90	0.517	2.527	43,168	22,318	109,086	131,404
	DU	80	0.743	2.207	10,584	7,864	23,359	31,223
	AP	120	1.488	1.451	6,487	9,653	9,413	19,066
	AS	140	1.100	1.188	12,975	14,272	15,414	29,686
	PA	110	1.767	1.151	8,300	14,665	9,553	24,218
	SA	110	1.392	1.005	10,542	14,674	10,594	25,268
	PL	110	2.345	0.303	66,378	155,656	20,113	175,769
	SB	150	1.466	0.130	6,456	9,464	839	10,303
	SW	110	1.993	0.695	25,157	50,138	17,484	67,623
W13 Subtotal		-	-	-	*190,046*	*298,704*	*215,854*	*514,559*
Total		**-**	**-**	**-**	**277,674**	**388,516**	**339,926**	**728,442**

Note: DC and CD stands use the conifer max MAI

Note: Gross merchantable final yield curves (cull reduction factors are not addressed)

Table 6-5. LRSYA values for regenerated yields

		Regenerated Stand RSA (post 1991 - Adjusted Curves)						
		MAI			Area	Harvest Level (m^3/yr)		
FMU	Strata	Age	Conifer	Decid	(ha)	Conifer	Decid	Total
W11	AW	80	0.551	1.903	48,951	26,972	93,154	120,126
	AP	140	1.012	0.998	2,659	2,691	2,654	5,345
	AS	120	1.354	1.338	7,035	9,525	9,412	18,937
	PA	110	1.439	1.115	2,174	3,129	2,425	5,554
	SA	130	1.602	1.103	5,513	8,832	6,081	14,912
	PL	90	3.137	0.903	11,163	35,018	10,080	45,098
	SB				82			
	SW	100	2.778	0.906	10,051	27,921	9,106	37,027
W11 Subtotal		-	-	-	*87,628*	*114,088*	*132,911*	*246,999*
W13	AW	90	0.517	2.527	43,168	22,318	109,086	131,404
	DU							
	AP	90	2.704	1.675	6,487	17,541	10,866	28,407
	AS	100	2.184	1.802	12,975	28,336	23,380	51,717
	PA	90	2.933	1.432	8,300	24,343	11,885	36,228
	SA	100	2.565	1.338	10,542	27,039	14,105	41,144
	PL	80	4.197	0.344	66,378	278,588	22,834	301,422
	SB	150	1.466	0.13	6,456	9,464	839	10,303
	SW	100	3.107	0.724	35,741	111,048	25,877	136,924
W13 Subtotal		-	-	-	*190,046*	*518,677*	*218,871*	*737,549*
Total		**-**	**-**	**-**	**277,674**	**632,765**	**351,783**	**984,547**

Note: DC and CD stands use the conifer max MAI

Note: Gross merchantable final yield curves (cull reduction factors are not addressed)

4. PFMS Assumptions and Targets

This section describes the inputs, assumptions and targets applied in the modeling exercise to produce the PFMS. The PFMS is not simply the result of a computer simulation based on model targets but, rather, a combination of numerical targets and manual intervention to address concerns and issues that were not modeled. Each FMU was treated as a separate sustained yield unit (SYU). Given the differences between the units, two separate PFMSs were produced, one for each FMU.

4.1 Common Assumptions

The following assumptions are common between the two PFMSs:

- Even flow of total coniferous and total deciduous harvest volumes;
- Application of a 200-year planning horizon, with model reporting in five-year periods; and
- Operable coniferous and deciduous growing stock constrained to not decline in the last quarter of the planning horizon.

4.2 Harvest and Regeneration Treatments

Clearcut harvesting, with 3% structure retention, was the only silviculture system applied in both W13 and W11.

The PFMS assumes that all stands will be promptly regenerated following harvest. After harvest, coniferous and mixedwood stands will be artificially regenerated using combinations of scarification, planting and natural regeneration and tending; planting improved white spruce stock is an option for pure white spruce stands. Natural regeneration is applied in pure deciduous stands.

Though there were slight differences, a strategy of post-harvest strata retention was applied in both FMUs, as reflected in the Silviculture Matrix (included in Chapter 7 – DFMP Implementation), which is used to direct silviculture activities in the field. In FMU W11, all strata regenerate back to the same species strata. In W13, all strata regenerate back to the same species strata following harvest, with the exception of DU, which is regenerated to SA following harvest. This reflects the mixedwood nature of the DU strata. While the model applied strict deterministic regeneration rules (*e.g.* all pine stands are regenerated to pine), flexibility for individual blocks is permitted on the ground, provided that strata-balancing objectives are achieved. Refer to Chapter 7 – *DFMP Implementation* for more information.

The PFMS includes a limited amount of conversion of low density AW stands to SW stands in FMU W13. Due to the difficulty in identifying where this conversion can be applied and the small amount of area involved, this conversion was not included in the PFMS modeling. Similarly, the PFMS includes regeneration of a portion of the upland black spruce leading conifer stands in W13 to pine leading black spruce mixedwoods and a portion of AP to PL. Due to the small areas involved, these transitions were not modeling in the TSA.

4.2.1 W11 minimum harvest ages

The minimum harvest age (MHA) establishes the minimum age at which a stand can be harvested in the model. MHA is determined by timber harvesting operability considerations (*i.e.* tree piece sizes and stand volume); however, since there is considerable variation in stand structures for any particular age, Millar Western has selected an MHA that represents the average minimum age at which most stands can be economically harvested and processed. In FMU W11, the MHA was set to 65 years for AW strata and 75 or 80 years for the conifer landbase (Table 6-6). In the caribou zone, an MHA of 80 years was chosen for all strata. Natural stands are fire origin stands that have not been previously harvested. Basic and RSA curve types are regenerated stands; within these stands, a more intensive regeneration treatment is assumed, resulting in higher timber yields.

Table 6-6. FMU W11 minimum harvest ages

Strata	Curve Type			
	Natural	Basic	RSA	Caribou zone
AW	65	65	-	80
AP	80	75	-	80
AS	80	75	-	80
PA	80	80	-	80
SA	80	80	-	80
PL	80	80	80	80
SW	80	80	80	80

4.2.2 W13 minimum harvest ages

The MHAs applied in FMU W13 (Table 6-7) were more variable than those in W11. MHAs for RSA stands was divided into three groups, to achieve a balance between the desire to maintain older age stands on the landscape for ecological values and to mitigate age-class induced reductions in harvest levels by harvesting a portion of these stands at a younger age. An MHA of 80 years was applied to a majority of the RSA stands, including those established with improved stock.

Juvenile stands are a subset of the artificially regenerated areas harvested before March 1, 1991. A limited area of juvenile and RSA stands were allowed to be harvested at 65 years of age in the PL and SW strata. According to the PFMS, a per-decade maximum of 5,000 ha of RSA stands can be harvested at less than 80 years.

Table 6-7. FMU W13 minimum harvest ages

Strata	Curve Type					
	Natural	Basic	Juvenile	RSA		
				Majority	Tree Improvement	Limited ha
AW	65	65	-	-	-	-
DU	80	80	-	-	-	-
AP	80	80	-	80	-	-
AS	80	80	-	80	-	-
PA	80	80	65	80	-	-
SA	80	80	65	80	-	-
PL	80	80	65	80	-	65
SB	110	110	-	-	-	-
SW	80	80	65	80	80	65

4.3 Succession and Lifespan

Succession in the modeling is the change between strata to address the natural species conversion and stand breakup over time. The PFMS continued the same approach from the previous DFMP, where stands did not change strata due to aging within the planning horizon. Instead, all forested stands have declining volume curves, which maintain a low volume as they progress past the age of 200 years.

4.4 Seral Stages

Seral stages classify the forest into ecological stand development phases that represent a stand's life cycle. They are commonly used as a coarse filter management tool. The seral stage classification used in the 2017-2027 DFMP (Table 6-8 and Figure 6-5) is similar to that used in the previous DFMP. In the PFMS, seral stage targets were set for a minimum amount of area in the old seral stage, as well as for a minimum amount of area in the old + mature seral stage.

Table 6-8. Seral stages used in 2017 DFMP

BCG	Strata	Seral Stage Ranges (years) Regenerating	Young	Immature	Mature	Old
D	AW	0-10	11-35	36-70	71-130	>130
	DU	0-10	11-35	36-70	71-130	>130
DC	AP	0-15	16-35	36-65	66-130	>130
	AS	0-15	16-45	46-70	71-140	>140
CD	PA	0-10	11-40	41-75	76-160	>160
	SA	0-20	21-45	46-80	81-150	>150
C	PL	0-10	11-40	41-80	81-130	>130
	SB	0-20	21-80	81-120	121-180	>180
	SW	0-20	21-70	71-100	101-160	>160

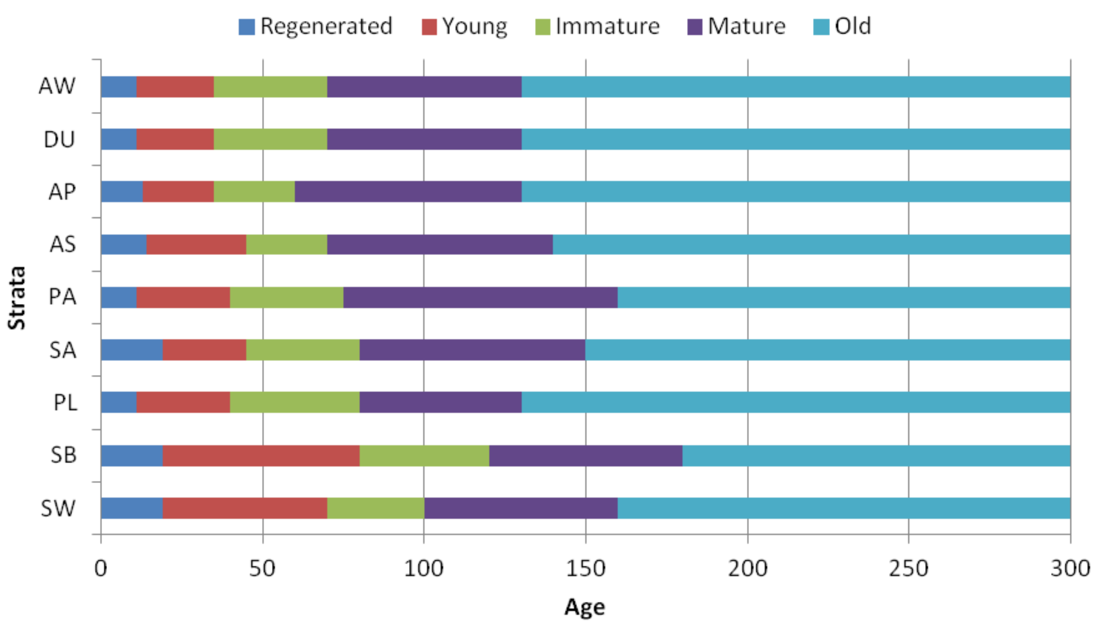


Figure 6-5. Graphical representation of seral stages

The PFMS applied patch targets in each FMU to achieve the objectives for the total old seral stage area, the AP+AS area, the PA+SA area and PL+SW area.

4.5 Interior Old Forest

In the TSA modeling, old interior forest patches are any patch greater than 120 ha that is composed of stands greater than 120 years old. Patches include both the active and passive forested areas of the landbase and all strata. In the PFMS, the interior old forest patch target was applied to the gross landbase in each FMU.

4.6 Landbase Losses

Deterministic modeling processes were used in the TSA. This approach does not permit effective incorporation of fire, which is properly addressed through stochastic processes. No fire loss factor was included in the PFMS. Landbase losses that were not accounted for, such as fire or other factors, will be addressed through the application of triggers that initiate a re-planning process. The mechanism that accounts for large scale losses of productive forest on the landbase is an AAC recalculation trigger. When the managed landbase is reduced by 2.5% or more from the current level, the GoA will evaluate the impact and, if appropriate, apply a reduction to the AAC.

4.7 Natural Disturbances

The spatial arrangement of the existing forest is highly fragmented due to past harvesting and other industrial development, resulting in smaller patches being available for harvest, especially over the next few decades. In the Patchworks model, patch size targets were applied in the PFMS to control the spatial harvest patterns. Patch targets were applied to the regenerating seral stage to control the sizes of openings created across the landscape. The patch size of 5-200 ha was maximized in both scenarios to encourage the model to group harvesting operations and to provide a desirable range of opening sizes. Larger patch sizes greater than 200 ha were also targeted but are limited due to the current state of the forest

4.7.1 Natural Range of Variability

Millar Western is a partner in the LandWeb project, which will estimate the natural range of variability (NRV) for the DFMP area. Unfortunately, the analysis was not completed in time for use in the 2017-2027 DFMP. Millar Western is investigating a strategy for incorporating NRV in its planning processes and future DFMPs. Refer to Chapter 7 – *DFMP Implementation*, for more information

4.8 Mountain Pine Beetle

Since the 2007-2016 DFMP implementation, the area of mature and over-mature lodgepole pine stands has been reduced, thus diminishing the forest's susceptibility to mountain pine beetle. In response, this DFMP shifts the short-term (10-year) focus to harvesting old white spruce stands that have begun to decay and break-up. The PFMS strategy no longer uses the GoA's Healthy Pine Strategy as a main focus for timber harvesting; however, future forest management plans will likely need to re-focus on MPB risk and the Healthy Pine Strategy, as large areas of immature pine age and become more disposed to mountain pine beetle infestation.

4.9 Operational Considerations

Developing a 20-year SHS as part of the forecasting exercise supports forest sustainability, by strengthening the relationship between strategic planning and field operations. It ensures that the long-term consequences of field operations are incorporated into the forecasting and that harvesting activity reflects the strategically determined AAC. For this to be effective, the SHS must be operationally feasible. As part of this process, Millar Western invested considerable time and effort in determining operability thresholds for the new AVI that could be effectively applied in the PFMS and operationally implemented in the SHS. Diameter size distribution, minimum harvest ages and minimum stand crown closure were a large part of this investigation.

All operators in the DFMP area requested that annual harvesting operations be more or less grouped together and that merchantable patches left behind for future harvest be large enough to warrant a return at a later date. These operational considerations were addressed in the forecasting process in the following manner.

4.9.1 Annual Harvest Patches

Annual harvesting was controlled by creating patch goals made up of only recently harvested stands with an age of zero or one year. By setting the topology distance to 200 m and constraining the 100+ ha and 250+ ha patch goals to minimum levels, the model was encouraged to create several clusters of stands each year. This technique removed the requirement to restrict harvesting to annually identified operating unit boundaries.

4.9.2 Operating Units

MWFP uses operating units to restrict access in certain time periods. The operating units were created to help the model combine harvest activities into operationally feasible groups for the remainder of the planning horizon after the SHS period (which covers the first 20 years of the planning horizon). These operating units were constrained using the Access Control feature within Patchworks. The only control on operating units was in the first 20 years of the PFMS.

4.9.3 Stand Height

Stand height was used to refine the operability of coniferous stands in the first 20 years in FMU W13. No height restrictions were employed in FMU W11. The rules were applied to all stands except those identified and excluded by MWFP operations staff. Heights are AVI interpreted; they do not grow within the model and therefore represent the height at time of AVI development. This results in heights that are current as of the last interpretation, which took place during 2010-2012, for most parts of the DFMP area.

Two rules were used in FMU W13 for stands to be included in SHS:

1. Years 1-10 – stands must be greater than 14 m tall, and
2. Years 11-20 – stands must be greater than 12 m tall.

4.10 Wildlife Habitat

Millar Western developed spatial terrestrial wildlife habitat models that were used in both the 1997-2006 DFMP and the 2007-2016 DFMP. For the 2017-2027 DFMP, Millar Western used non-timber assessment (NTA) tools that had been recently introduced by the GoA, with the objective of enabling consistent predictions of habitat to support planning processes across the province.

Millar Western's DFMP was the first to use these new GoA NTA tools to develop wildlife habitat metrics for the PFMS, and the PDT invested considerable effort in understanding and refining the tools. Where possible, these tools were constructed to be incorporated directly into the TSA models. This approach reduced the time between scenario development and habitat prediction while permitting targets to be established directly in the TSA model and PFMS. The barred owl and grizzly bear models could not be processed directly in Patchworks due to the spatial modeling requirements for these species.

The habitat objective in the TSA was to limit the impact of timber management activities on wildlife habitat. The majority of habitat metrics did not require active control in the model to achieve results within the thresholds required by GoA. One songbird and the barred owl habitat metrics required modifications to the SHS.

4.10.1 Song birds

Songbird metrics are derived from curves provided by the GoA (Figure 6-6) that define the relative abundance of each songbird within each forest strata. These curves were then incorporated directly into the Patchworks model to allow control and reporting within the model.

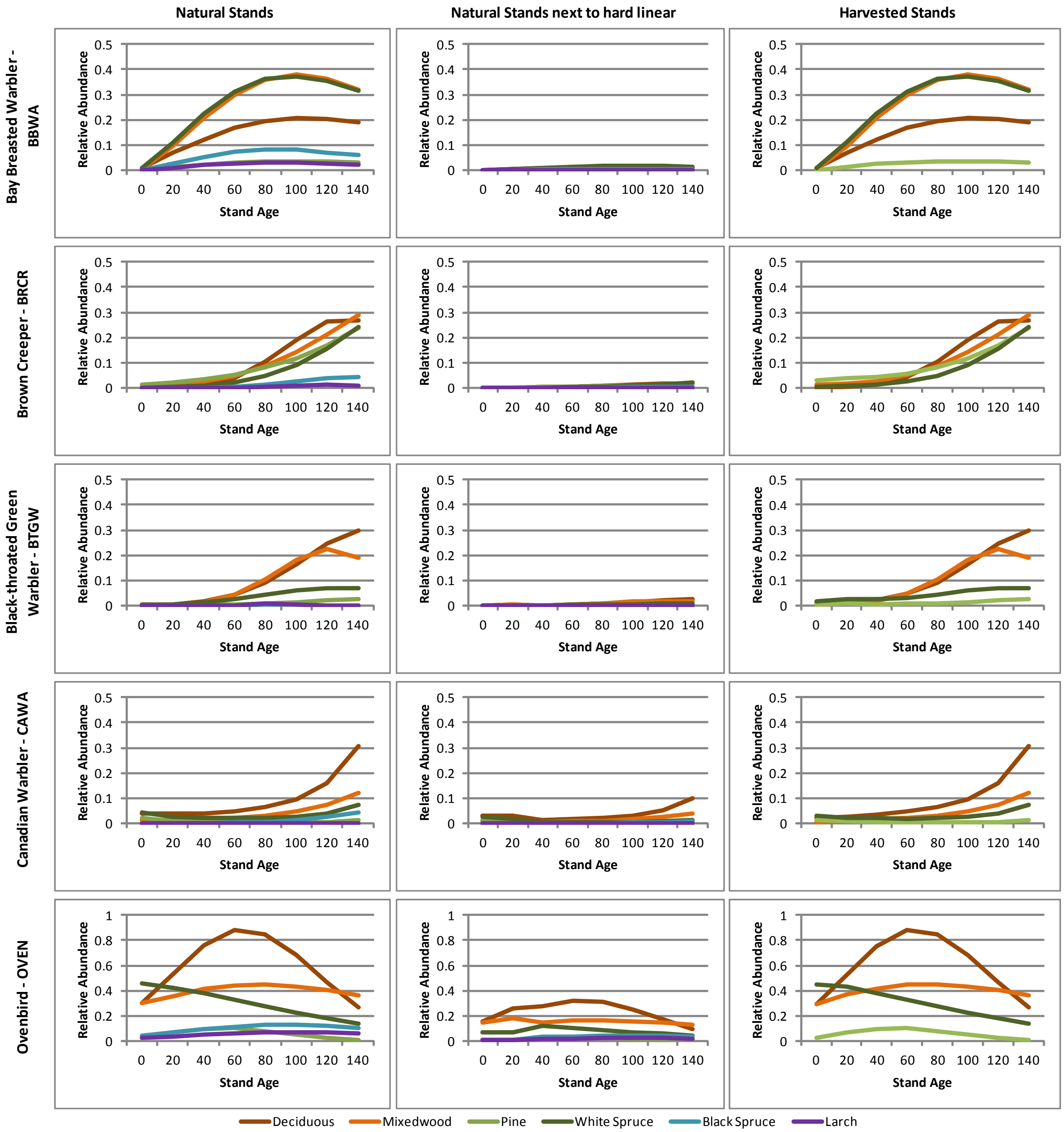


Figure 6-6. Songbird relative abundance curves provided by the GoA

The curves provided by the GoA are defined for natural stands and harvested stands. They are further delineated by a distance from hard linear (HLIN) features, which are defined as roads above a 0.5% density on a 7ha grid. Each songbird species has a separate curve for each forest strata, which describe the bird's relative abundance over the life of each stratum.

The reporting for songbirds is non-spatial, using an area-weighted average relative abundance for each FMU. These are tracked through the planning horizon and measured against the current conditions. If a species drops more than 15% from its current condition, management actions are to be considered to bring it back above the 15% threshold.

In TSA modeling, the black-throated green warbler was the only songbird to drop below the 15% threshold. In the PFMS, it has been constrained to maintain no more than a 15% drop from initial conditions in both W13 and W11. This constraint had little impact on the AAC or other values. No other songbirds were constrained in either FMU.

4.10.2 Pine Marten

The pine marten metric is included in the TSA models the same fashion as the songbirds. The marten model uses a habitat suitability index (HSI) in place of relative abundance, but the methodology of reporting is the same. The curves provided by the GoA are based on a set of strata defining combinations of aspen, pine and white spruce, further split by site condition (Figure 6-7).

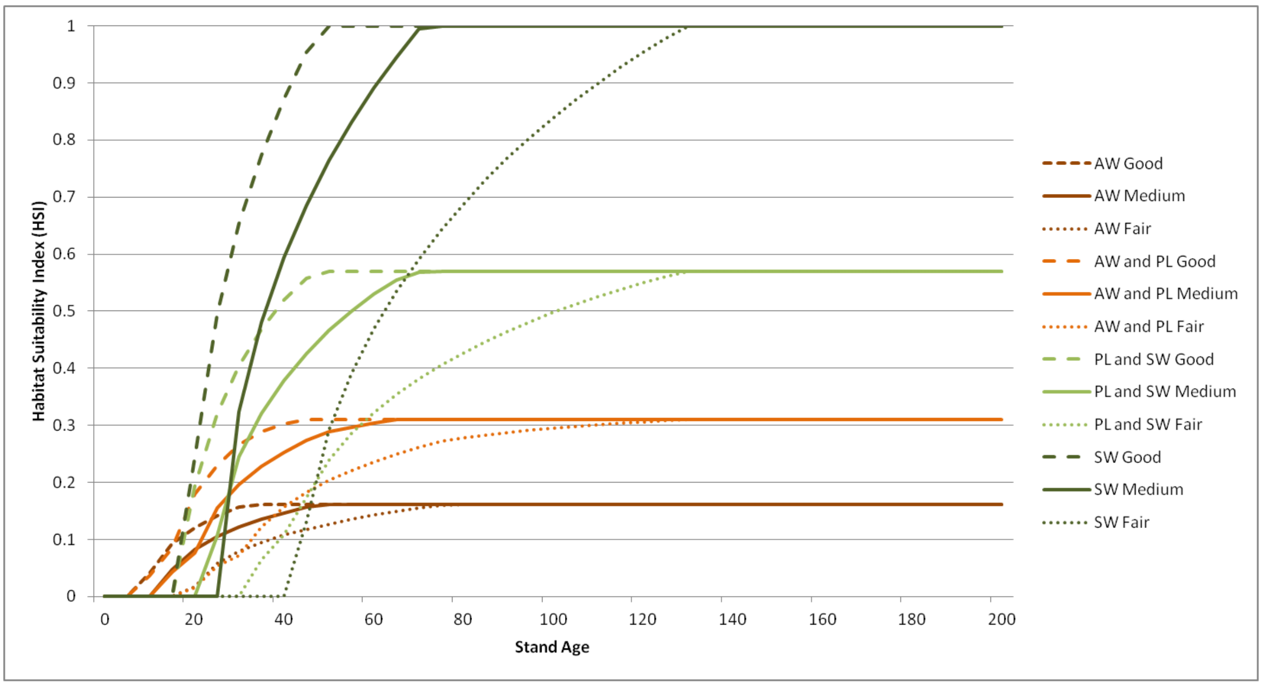


Figure 6-7. Marten habitat suitability index curves

In the PFMS, the reported HSI did not drop more than 15% from initial conditions, and was therefore not constrained in either FMU.

4.10.3 Barred Owl

The barred owl is modeled in a separate habitat model that is run outside of Patchworks. Current and future landbase conditions exported from the Patchworks model were used as inputs into the barred owl model. Landbase conditions were then used to generate a series of raster layers that define the following metrics:

1. Amount and distribution of older hardwood,
2. Amount and distribution of older white spruce,
3. Distance of each raster cell to disturbances (blocks younger than 30 years old),

4. Distance of each raster cell to old hardwood and white spruce (older than 90 years old),
5. Area to perimeter ratio of forested stands greater than 30 years old.

Once these rasters were generated, they were combined together to generate a Resource Selection Function (RSF) raster. The final step was to generate a breeding pair raster layer, which groups the RSF raster into 562 ha cells to determine if a breeding pair could exist within the larger area. The larger raster cells require a specific combination of the five original raster values to count as a breeding pair.

As the barred owl model cannot be directly mimicked within the Patchworks model, direct control on constraining for breeding pairs is not an option. In lieu of direct control, two types of controls were added to the model to improve the barred owl habitat metric:

1. Two patch targets to encourage better grouping of older SW and AW stands
    a. Both include AW, DU, AS, SA and SW strata
    b. First target encourages a better area-to-perimeter metric in these strata over 30-years of age
        i. Patches of 200 ha or more where stands are less than 15 m apart
    c. Second target encourages larger patches of stands greater than 90 years old
        i. Patches of 200 ha or more where stands are less than 15 m apart
2. Control over the limit of the number of compartments open each period after the 20 year SHS
    a. Target added that controls the number of compartments that can be open in each period

These two types of controls resulted in better scores for barred owl breeding pairs, but could not achieve the GoA desired levels. More information on these targets and their effectiveness is described in Annex VI.

To address the predicted change in barred owl breeding pairs, an implementation strategy was developed to mitigate potential impacts. Refer to Chapter 7 DFMP Implementation for additional information.

4.10.4 Grizzly Bear

Grizzly bear habitat was modeled using fRI's grizzly bear assessment tools. Grizzly bear habitat was not explicitly modeled in the TSA, as the majority of strategies are operational level strategies and the tools were not designed for direct incorporation in TSA. To capture the advice from GoA to mitigate impacts on grizzly bear, the TSA model controlled harvest block patterns to be grouped as much as possible in the PFMS. While this is beneficial from an operations perspective, it also advantageous to grizzly bears, as condensed harvesting reduces the amount of time that roads are left open and used.

A grizzly bear habitat strategy was developed for the PFMS. Refer to Chapter 7 – *DFMP Implementation*, for more information.

4.10.5 Caribou

A small portion of the Slave Lake caribou range covers the east portion of FMU W11. This portion of the range has a large area of young forest due to recent burns and a fairly extensive wetland complex. In the absence of a GoA plan for this caribou range, the PDT developed a caribou strategy as part of the DFMP, which includes harvest rules and harvest pattern modifications within the range. The minimum harvest age of all strata, including the AW strata, was set to 80-years old within the range. All harvest blocks in the first 20 years were manually selected, to ensure harvesting occurred in concentrated patches. A Woodland Caribou habitat strategy was developed for the DFMP that included a deferral of harvesting for the first 5 years and winter-only access, using short-term roads as much as possible. Refer to Chapter 7 – *DFMP Implementation* for further information.

4.11 Watershed

Runoff from watersheds was evaluated by using the Equivalent Clearcut Area (ECA) methodology. This method uses ECA curves that match each volume strata curve. Each is based on using a value of one (1) at stand age zero, and a value of zero (0) when the total volume yield curve reaches maximum periodic annual increment (PAI). An example curve showing the volume and resulting ECA curve for the PL natural strata in FMU W13 is shown in Figure 6-8. In this example, the ECA curve reaches zero at age 60. For most volume curve types, PAI is reached between the ages of 50 and 70 (Figure 6-9).

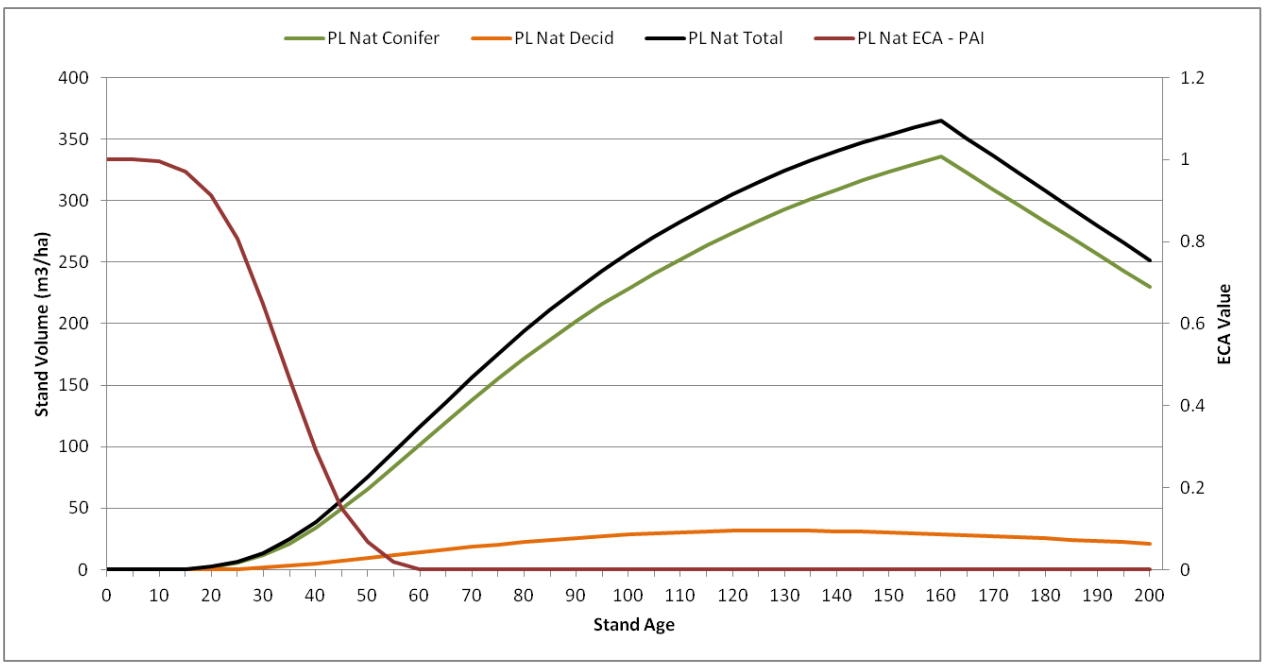


Figure 6-8. Example of ECA curve using PL natural curve for FMU W13

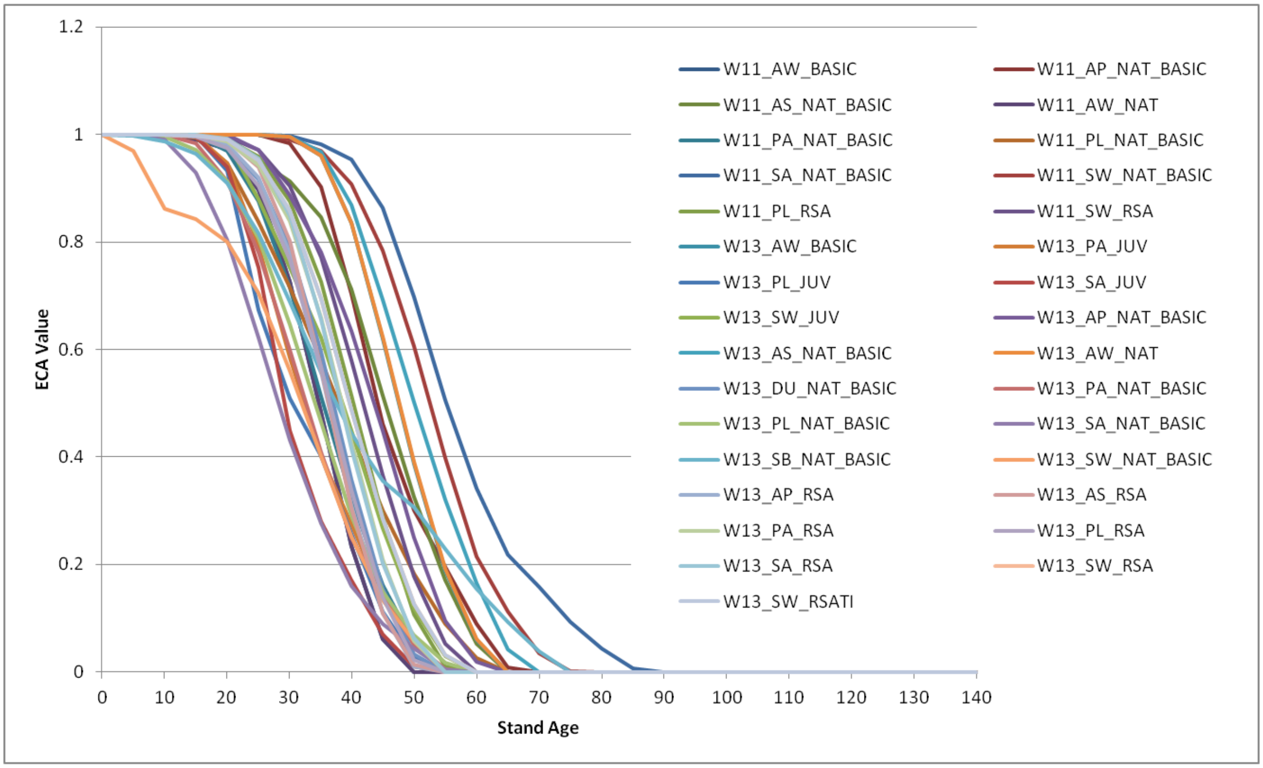


Figure 6-9. All ECA curves for all strata in both FMU's.

Reporting for watershed ECA values is done by watershed and for all watersheds in total. The total ECA value (∑(curve value * stand area)) for each watershed is divided by the total area of each watershed. The result is a percentage, where lower percentages represent watersheds with older forest, and larger percentages represent watersheds with young forests. These percentages are then classified into three classes:

1. Less than 30%;
2. Equal or greater than 30% and less than 50%; or
3. Equal or greater than 50%.

The initial conditions for ECA show that several watersheds with recent fires are above the 50% threshold (Figure 6-10).

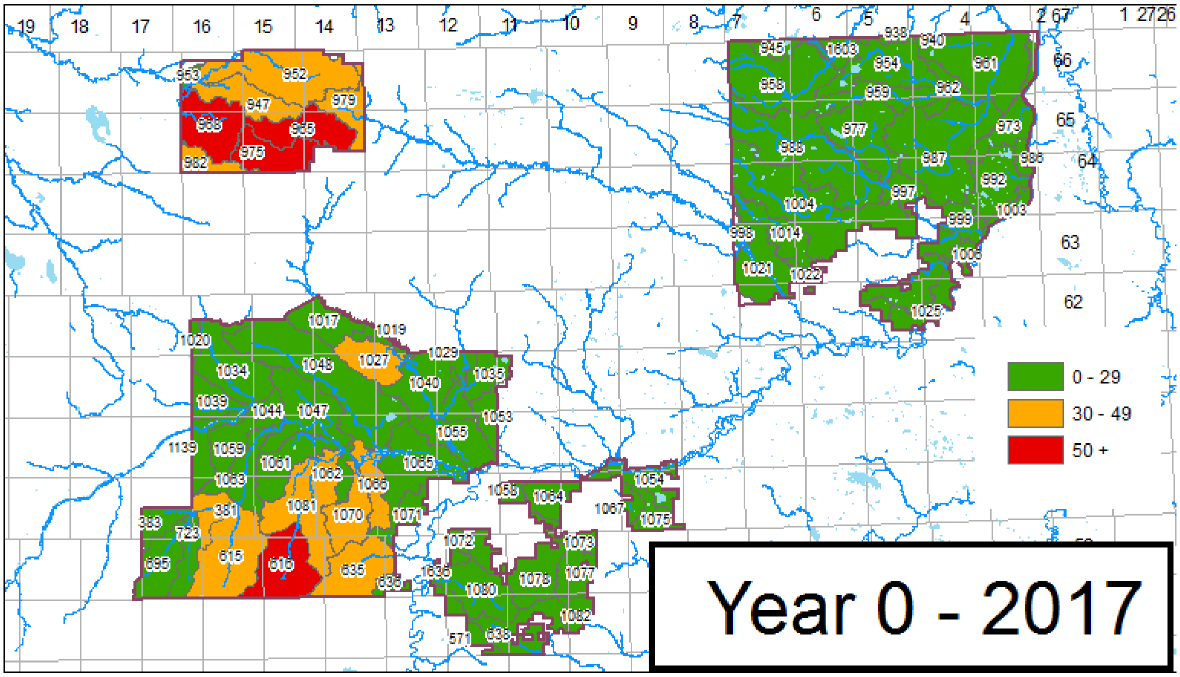


Figure 6-10. Watersheds and their initial ECA value

In the W13 PFMS, where watersheds are highly impacted within the area of the Virginia Hills fire (red colour), the SHS was refined to mitigate the impact on runoff and to reduce the length of time watersheds were greater than 50% impacted. These watersheds are also critical for arctic grayling populations. To further mitigate potential harvesting impacts, the PDT developed a rainbow trout and arctic grayling mitigation strategy for the PFMS. Refer to Chapter 7 – *DFMP Implementation,* for more information.

4.12 Target Weightings

The weighting of individual targets impacts the model's ability to achieve the target values desired by the management team. Greater weighting, relative to another value's weighting, increases the probability a target will be achieved. However, the weighting of the targets is not a mathematical process of determining the actual weights but a process of attempting to obtain the desired outcome of the target values. Some targets are desired to be even flow; some are required to meet a minimum or maximum, with fluctuations allowed above or below the minimum or maximum; and still others can have significant deviation from the target value and still be within accepted values. Once the desired effect is agreed upon, the weights are adjusted to achieve the targets.

Some targets are difficult to achieve, and their weighting will be higher than that of other targets. Other targets will achieve their values with very little encouragement, so very little weighting is required. The relative weighting between targets does not reflect their relative importance but simply the weighting required to achieve the outcome.

5. PFMS

The Preferred Forest Management Scenario is the recommended forest management approach to be implemented over the next ten years. Once approved by the GoA, it will direct the amount and location of timber harvesting and regeneration activities by all forest operators on the DFMP area for the period 2017 - 2027.

The PFMS was developed within the context of forest sustainability, representing a balance between timber and non-timber values. The PFMS was developed and refined by the PDT over a period of almost six months. It was influenced by input from a wide range of interests, including representatives of Millar Western, Spruceland, Weyerhaeuser, Alberta Agriculture and Forestry, Alberta Environment and Parks, First Nations from in and around the DFMP area, Millar Western's Public Advisory Committee and other public stakeholders. It reflects a combination of previous decisions, numerical targets for values of interest, and biological and anthropogenic assumptions with operational considerations. The PFMS is not solely the result of computer analysis but, rather, an iterative refinement of model projections combined with human direction. PDT members combined model projections with their knowledge of the forest and forest management to refine each successive scenario until the overall results were deemed satisfactory to all involved.

The PFMS combines human-refined modeled outputs with implementation rules, such as those provided in operational guidance provided throughout the 2017-2027 DFMP, updated Operating Ground Rules (OGRs), best management practices and applicable federal and provincial legislation, regulations and policy. Implementation and reporting guidance for the DFMP is described in Chapter 7 – *DFMP Implementation*, along with all of the model outputs required for implementation.

There are two primary products derived from the PFMS that are required for DFMP implementation: the recommended harvest level and the SHS. While the PFMS contains a 200-year harvest sequence for long-term modeling purposes, the SHS identifies harvesting locations for only the first 20 years of the harvest sequence: it begins with the 2017/18 timber year and is divided into two periods representing years 1-10 (timber years 2017/18 to 2026/27) and 11-20 (timber years 2027/28 to 2036/37). SHS stands have been allocated to all disposition holders, (*i.e.* Millar Western, Spruceland, Weyerhaeuser and the CTP program) based on timber rights and operating area negotiations.

This section presents the PFMS in detail, including both strategic and operational targets, and their associated results. The section is organized by indicator, with the action-based indicators presented first, followed by the inventory indicators and the patch targets. The PFMS is represented by scenario MWFP_64006. It was generated in the Patchworks modeling environment using the yield curves, landbase, and timber supply assumptions described in this chapter. Appendix I contains a summary of the PFMS for each FMU.

5.1 Forest Products – Harvest Volume

Harvest volume is a major consideration in the development of the PFMS. This volume provides the supply of logs to forest companies to operate their mills in an efficient and cost effective manner. The deciduous and coniferous landbases for W11 and W13 are combined, meaning that the even flow harvest volumes include both primary and secondary harvest volumes.

Harvest volumes reported in this chapter were calculated directly from Patchworks outputs. While strict even flow targets were modeled, the PFMS has some small variation in 5-year periods, which is typical of spatial models and Patchworks.

Carryover volumes are the under-produced harvest volumes from the previous quadrant. Carryover volumes were provided by each company and were included in the modeled harvest targets, however, the maximum carryover volumes modeled were less that the totals requested as limited to a maximum 25% increase over the even flow levels as per GoA policy. Carryover volumes requested were:

Spruceland (coniferous in FMU W11): 226,742 m^3, requested volume over 10 years;

Millar Western (deciduous in FMU W11): 123,186 m^3;

Weyerhaeuser (deciduous in FMU W13): 225,000 m^3;

Millar Western (deciduous in FMU W13): 56,155 m^3; and

Millar Western (coniferous in FMU W13): 235, 800 m^3.

Actual carryover volumes modeled as well as the harvest levels from in the PFMS as summarized in Table 6-9. These values are recommended for approval as the AAC levels for the 2017-2027 DFMP.

Table 6-9. Recommend harvest levels for the PFMS

Company Name	Disposition ID	Type	Recommended Allocation m^3/yr	Period 1 [1] Carryover Volume (m^3/yr)	Period 1 [1] Harvest Level (m^3/yr)	Period 2 [2] Carryover Volume (m^3/yr)	Period 2 [2] Harvest Level (m^3/yr)
FMU W13							
Conifer Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	311,121	42,000	353,121	0	311,121
Millar Western Forest Products Ltd.	CTQW130001	Grazing [4]	5,879	0	5,879	0	5,879
CTP	[8(2)(d)(i)]	FMA	30,000	0	30,000	0	30,000
Total Coniferous			347,000	42,000	389,000	0	347,000
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	151,472	31,720	183,192	0	151,472
Millar Western Forest Products Ltd.	DTAW130002	Grazing [4]	6,528	0	6,528	0	6,528
Weyerhaeuser Company Ltd.	DTAW130001	FMU	45,000	20,280	65,280	0	45,000
Total Deciduous			203,000	52,000	255,000	0	203,000
FMU W11							
Conifer Allocations							
Spruceland Millworks Inc.	CTQW110008	FMU	103,000	22,674	125,674	22,674	125,674
Total Coniferous			103,000	22,674	125,674	22,674	125,674
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	113,894	26,000	139,894	0	113,894
Millar Western Forest Products Ltd.	DTAW110002	Grazing [4]	1,106	0	1,106	0	1,106
Total Deciduous			115,000	26,000	141,000	0	115,000
FMA							
Area Residents [3]	[8(2)(a)(i)]		1,000				

[1] Period 1: May 1, 2017 - April 30, 2022.
[2] Period 2: May 1, 2022 - April 30, 2027.
[3] Total volume of coniferous/deciduous (including birch); included in Millar Western FMA Volume
[4] Grazing volumes based on 20 year average harvest volume in PFMS
Conifer and Deciduous Utilization is 15/10/15
Volumes are reduced for Cull
Volumes have not been reduced for structure retention

5.1.1 Coniferous Harvest

The conifer harvest volume is even flow on the total conifer volume. The PFMS includes carryover volumes in both FMUs, harvested in the first 10 years in W11 (Figure 6-11) and harvested in the first 5 years in W13 (Figure 6-12).

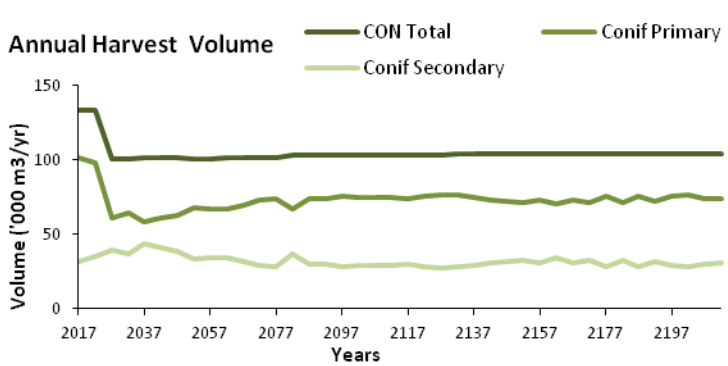


Figure 6-11. Annual coniferous harvest volume for FMU W11.

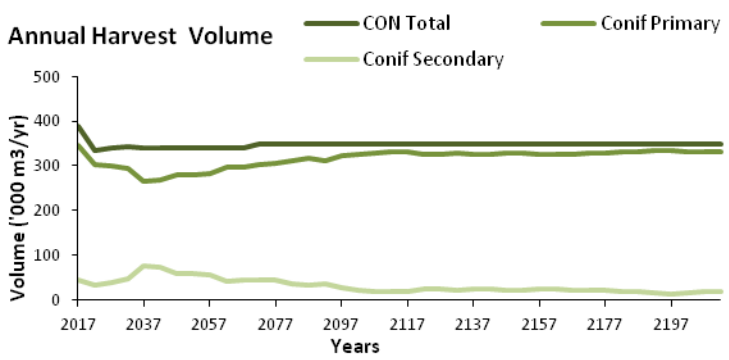


Figure 6-12. Annual coniferous harvest volume for FMU W13.

5.1.2 Deciduous Harvest

Similar to the conifer harvest, deciduous harvest volume is even flow on the total deciduous volume. The PFMS includes carryover volumes in both FMUs that is harvested over the first 5 years in W11 (Figure 6-13) and the first 5 years in W13 (Figure 6-14).

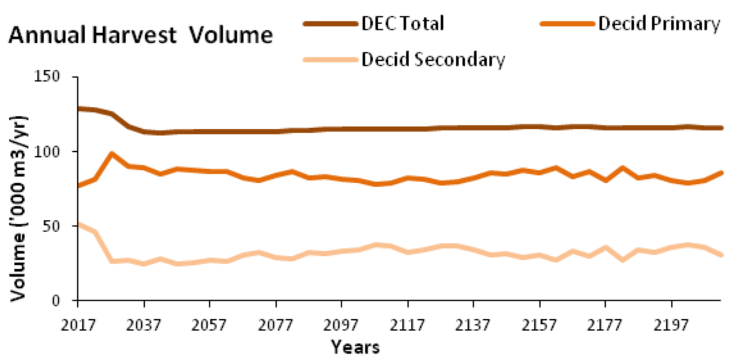


Figure 6-13. Annual deciduous harvest volume for FMU W11.

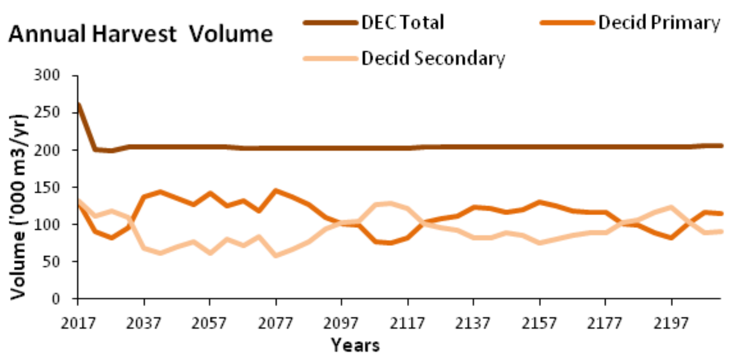


Figure 6-14. Annual deciduous harvest volume for FMU W13.

5.2 Forest Products – Area Harvested

5.2.1 Strata

Harvesting of the pure deciduous strata dominates W11. The increased conifer cut in the first 10 years due to the inclusion of under produced volume 2011 - 2016 period, ending in 2027, and the deciduous carryover volume ending in 2022, will allow the Pl and Sw harvest to return to more constant levels for the remainder of the planning horizon (Figure 6-15).

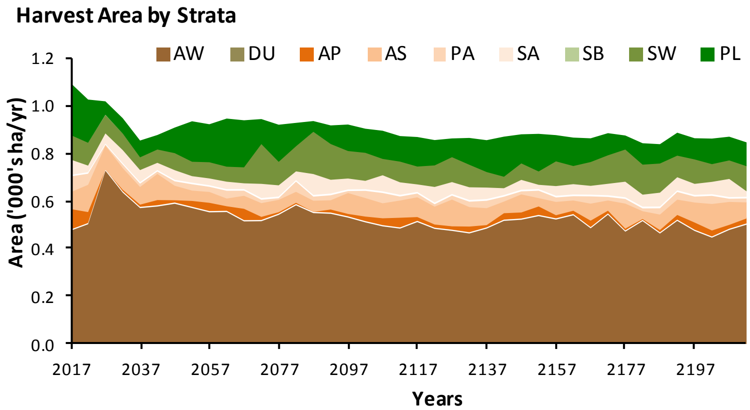


Figure 6-15. Area harvested by Strata for FMU W11

In W13, the harvest strata are much more evenly distributed (Figure 6-16). Pl provides the largest contribution to the harvest area in the first 60 years, while mixed-wood stands contribute more in the first 20 years and after the first 80 years.

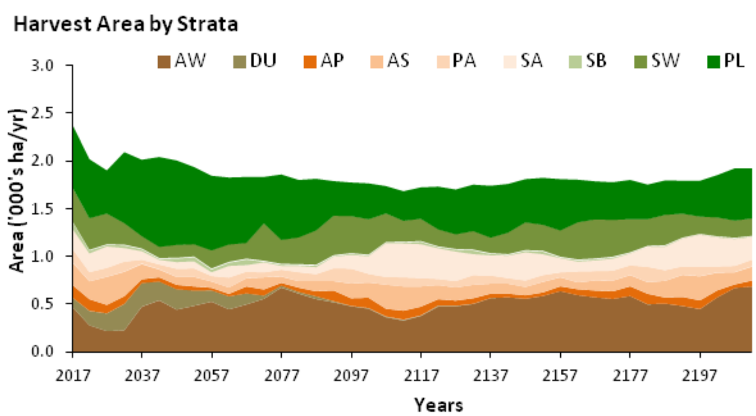


Figure 6-16. Area harvested by strata for FMU W13

5.2.2 Harvest Age

The harvest age for each FMU (Figure 6-17 and Figure 6-18) is represented for each strata and the area weighted average (thick black line).

In W11, the average harvest age decreases from between 100 and 150 years old in the first 60 years of the horizon, to approximately 90 years old for the remainder (Figure 6-17).

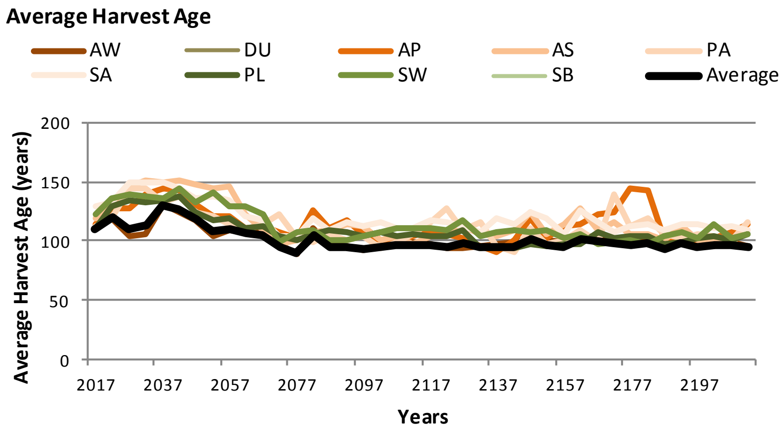


Figure 6-17. Harvest ages by strata for FMU W11

Harvest ages in W13 follow a similar pattern of general decrease at year 60 (Figure 6-18). The large variations in the SB and DU strata are due to the very small amounts of harvest in these strata, which have little influence on the area weighted average.

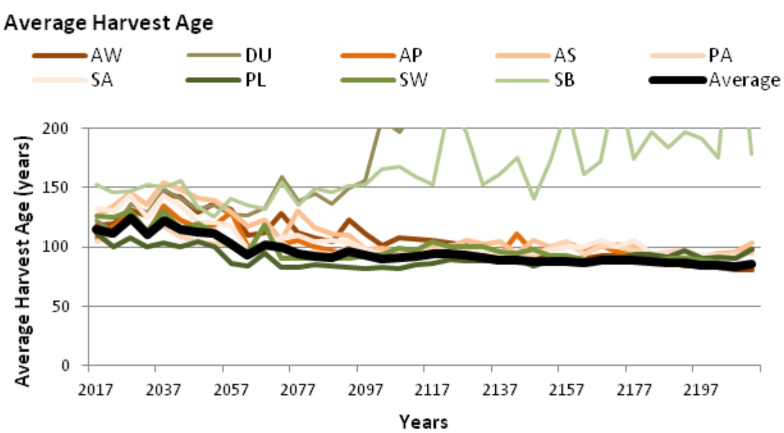


Figure 6-18. Harvest ages by strata for FMU W13

5.2.3 Piece Size

The coniferous piece size in W11 remains close to 3 trees/m^3 over the planning horizon for the major strata. The minor strata (*i.e.* AP, PA, AS, and SA) contain erratic increases after 60 years (Figure 6-19). This variability occurs in strata with relatively small amounts of harvest area and thus has little impact on the area weighted average. The area weighted average is largely stable over time, suggesting a fairly consistent average piece size profile.

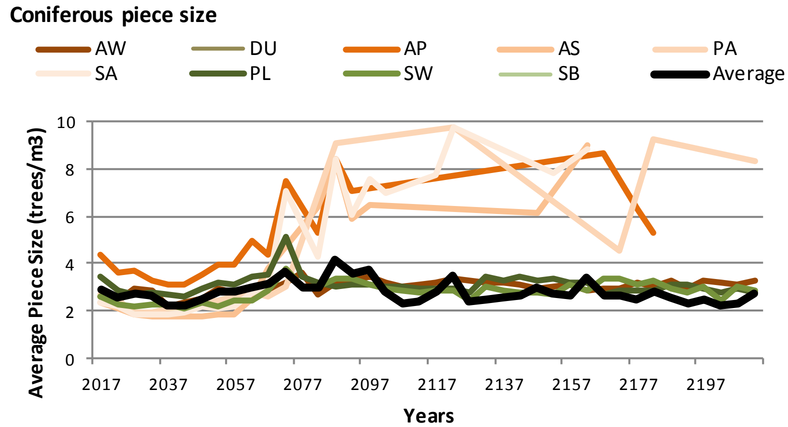


Figure 6-19. Coniferous piece size by strata for FMU W11

Coniferous piece size in W13 is more varied. Piece sizes range from approximately 1 to 10 trees/m^3, although the area weighted average remains fairly stable at around 4 trees/m^3 (Figure 6-20). AP shows a dramatic surge 40 to 70 years into the horizon, while Sb shows erratic spikes for the last 100 years. As in W11, W13's variability occurs in strata with relatively little amounts of area, resulting in little impact on the area weighted average. The stable area weighted average suggests a fairly consistent average piece size over time.

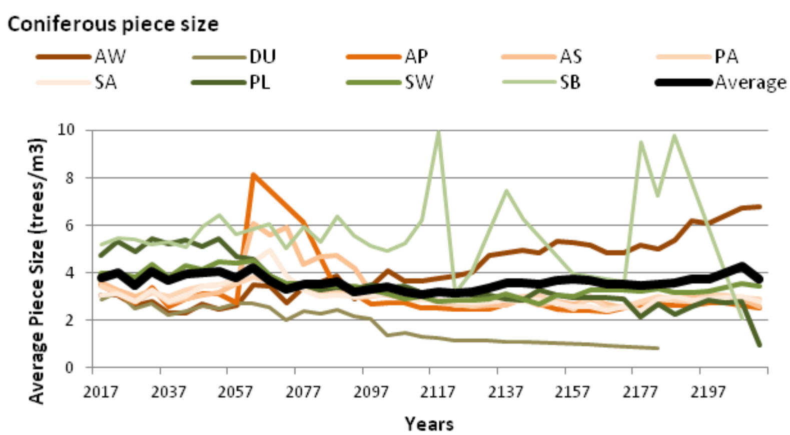


Figure 6-20. Coniferous piece size by strata for FMU W13

5.3 Forest Condition – Growing Stock

Two types of growing stock are reported: active and active operable growing stock. Active growing stock is the total coniferous or deciduous merchantable volume present on the active landbase at each point in time. The active operable growing stock represents the merchantable volume from only those stands on the active landbase that are above the minimum harvest age in that period, and thus represent the volume that is actually available to be harvested in that period.

W11 has more deciduous growing stock than coniferous. In general, the active operable growing stock is lower than the active growing stock by a proportional amount throughout the horizon. Between 20 and

40 years into the horizon, the deciduous active operable growing stock experiences a surge that brings it close to the active growing stock (Figure 6-21). Both coniferous and deciduous operable growing stocks remain above 50% of the existing levels.

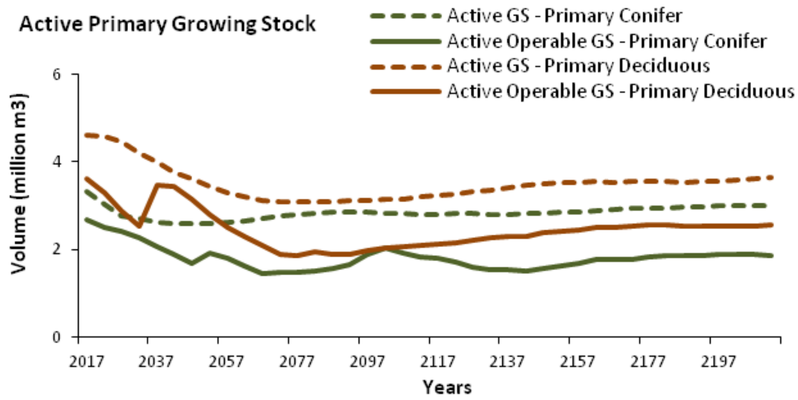


Figure 6-21. Active and operable growing stock for FMU W11

The distribution of the active operable growing stock by strata can provide insight into forest dynamics. For the W11 coniferous operable growing stock, all strata follow a similar pattern of fairly stable volumes with a marked decrease in the first 30 years and slight increase just past year 80 (Figure 6-22).

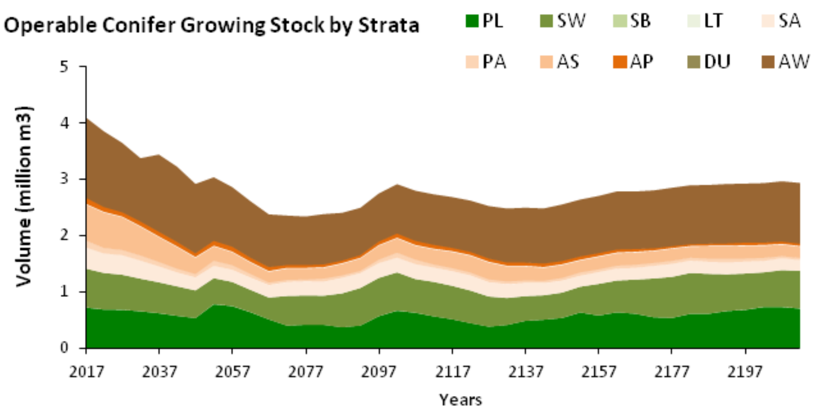


Figure 6-22. Operable conifer growing stock by strata for FMU W11

The deciduous operable growing stock distribution follows a consistent pattern over time (Figure 6-23), decreasing from the start of the horizon to 60 years in, with a surge at 20 years. The volume remains consistent from 60 years until the end of the horizon.

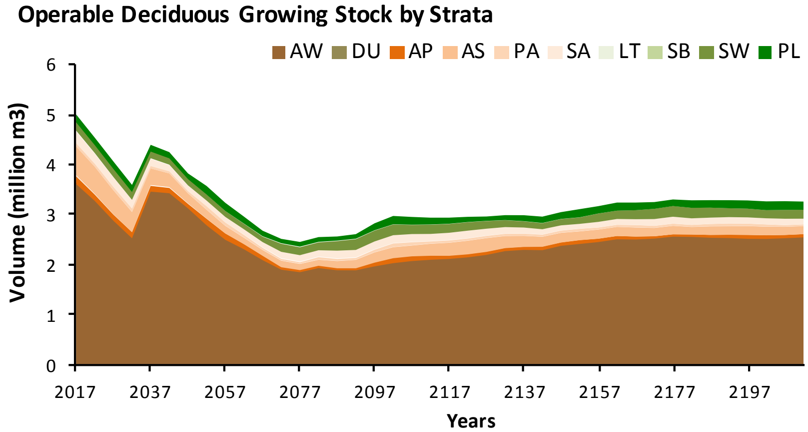


Figure 6-23. Operable deciduous growing stock by strata for FMU W11

In W13 the active growing stock and active operable growing stock are relatively similar until year 50, at which point the coniferous stocks dramatically increase, while the deciduous stocks steadily decrease (Figure 6-24). This rapid increase in conifer growing stock occurs after a period of very low conifer growing stock, when much of the FMU is below the minimum harvest age. This low growing stock period defines a critical period in W13 conifer harvest dynamics, and the minimum level of PL and SW strata growing stock was constrained in the PFMS to ensure it did not drop below 4 million m^3.

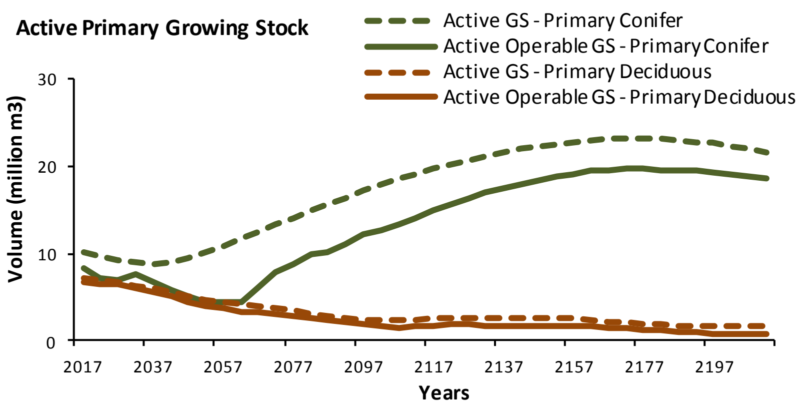


Figure 6-24. Active and operable growing stock for FMU W13

Coniferous operable growing stock strata show similar patterns across the horizon, with a general decrease for the first 50 years and steady increase for the next 100, mainly in the PL strata (Figure 6-25).

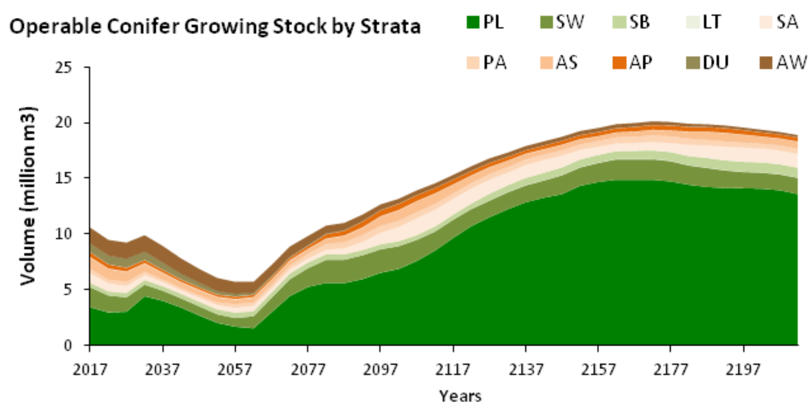


Figure 6-25. Operable conifer growing stock by strata for FMU W13

Deciduous operable growing stock strata also follow a consistent pattern, decreasing quickly for the first 40 years, and gradually for the rest of the horizon (Figure 6-26).

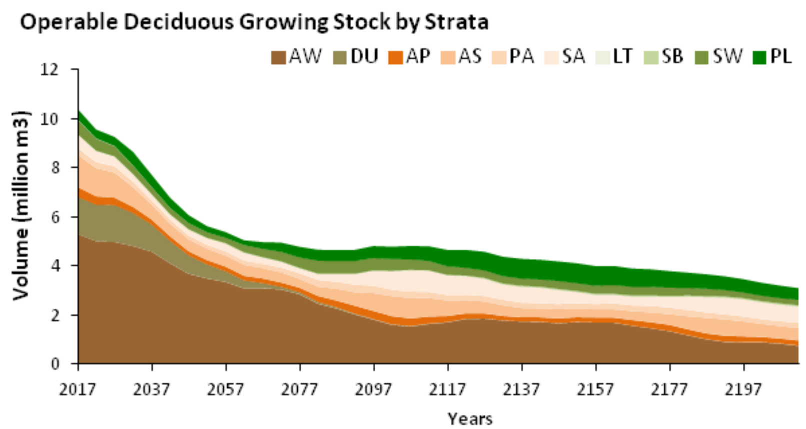


Figure 6-26. Operable deciduous growing stock by strata for FMU W13

5.4 Forest Condition – Area Summaries

Forest condition summaries describe attributes as they are forecasted to exist under the PFMS on the active, passive and gross landbase over the planning horizon. The attributes describe the forest using age, strata and seral stage, in addition to non-timber attributes such as songbirds and pine marten metrics.

5.4.1 Strata

The landbase area in each strata on the gross landbase changes stable over time. In FMU W11, there is no conversion or transition between strata, resulting in no change over time (Figure 6-27). In FMU W13, the DU strata transitions to SA strata when harvested (Figure 6-28). These two strata are the only strata conversion modeled.

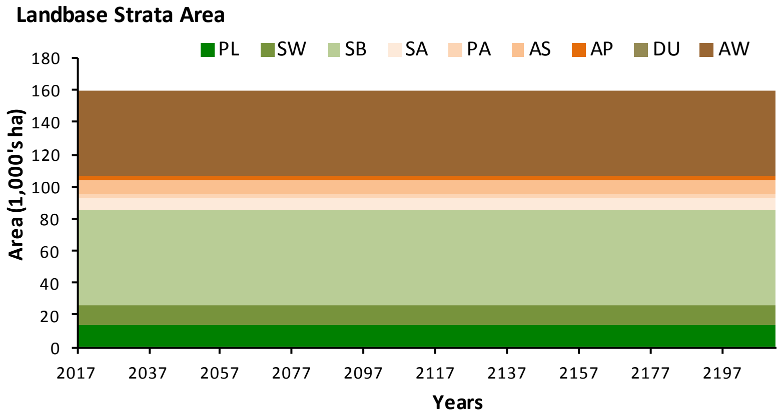


Figure 6-27. Strata area on gross landbase for FMU W11

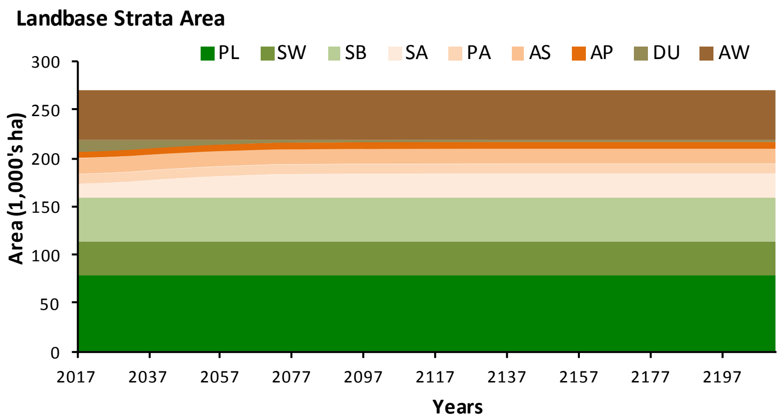


Figure 6-28. Strata area on gross landbase for FMU W13

5.4.2 Age Class

The age class distribution on the active conifer landbase in W11 is forecasted to be fairly constant after becoming a regulated forest after the first 50 years of the planning horizon. Most of the area is contained within age classes from 0 to 80 years of age, but considerable area is present in the 80 to 100 age class (Figure 6-29).

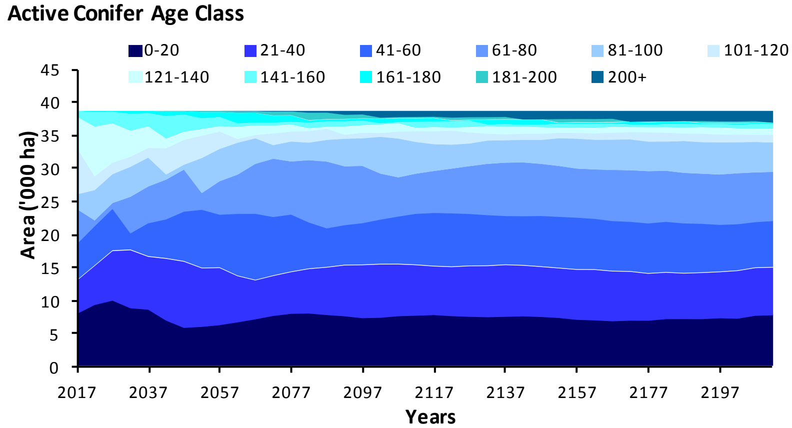


Figure 6-29. Conifer active landbase age Class distribution for FMU W11

The active deciduous age class area distribution in W11 is very similar, but with greater variation in the first 50 years (Figure 6-30).

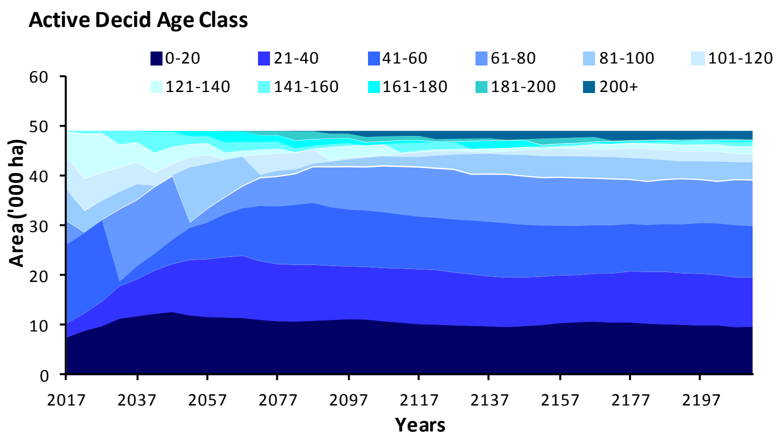


Figure 6-30. Deciduous active landbase age Class distribution for FMU W11

The forecasted age class area distribution in W13 reflects the younger forest condition. The active conifer age class area is youngest in about 40 years, after which time the area in the older age classes increases towards the end of the planning horizon. This dynamic is due to increased volumes in regenerated stands that are not captured with an increase in harvest under the even flow harvest constraint. The age classes from 0 to 80 years of age again hold the most area (Figure 6-31).

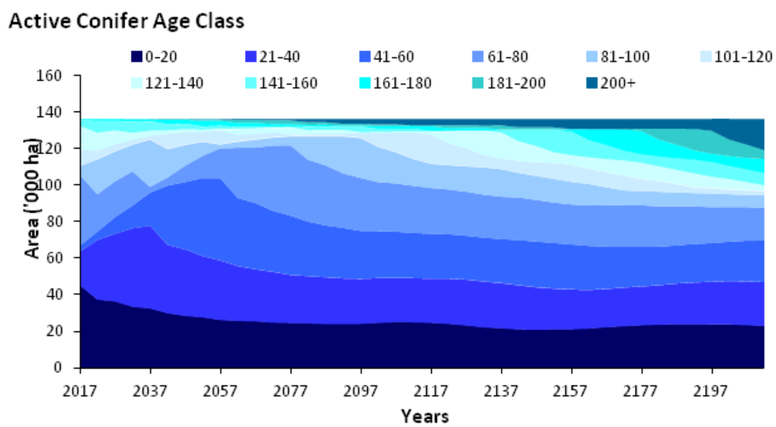


Figure 6-31. Conifer active landbase age Class distribution for FMU W13

The active deciduous age class area in W13 shows a more gradual increase in area present in the mid-age classes than in W11. The age classes from 0 to 80 years hold almost all the area by the middle of the planning horizon (Figure 6-32).

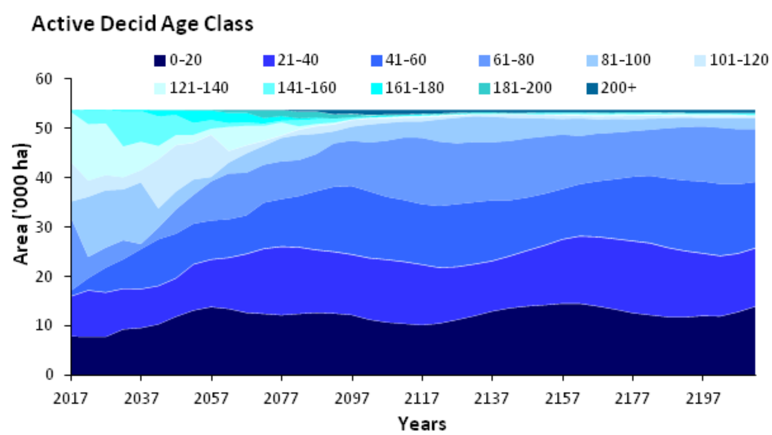


Figure 6-32. Deciduous active landbase age Class distribution for FMU W13

5.4.3 Seral Stage

The forecasted seral stage distribution in W11's active landbase is constant after some initial variation in the first 30 years. Although the mature stage holds a significant portion of the area during this time, the young and immature stages dominate for the majority of the planning horizon (Figure 6-33).

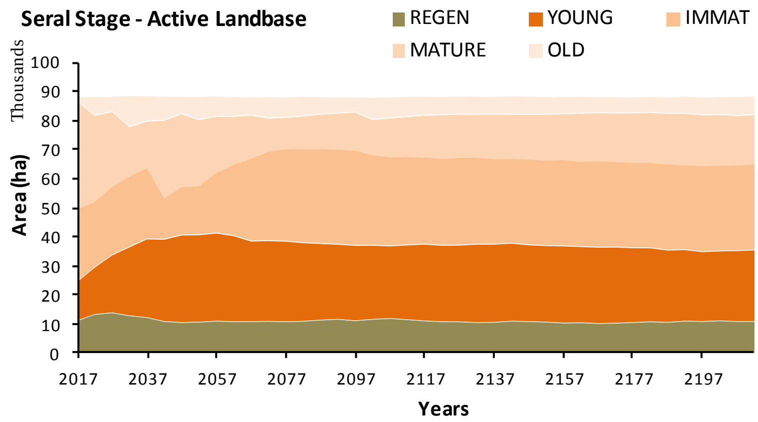


Figure 6-33. Active landbase seral stages for FMU W11

Looking only at the percentage of the active landbase that is in the old and mature seral stages, AW strata dominates W11. In the variable first 40 years, these advanced deciduous forests cover up to almost 30% of the active landbase (Figure 6-34). Coverage does not drop below 20% of the active landbase and is relatively constant by seral stage for the rest of the horizon, increasing slightly as the forest ages.

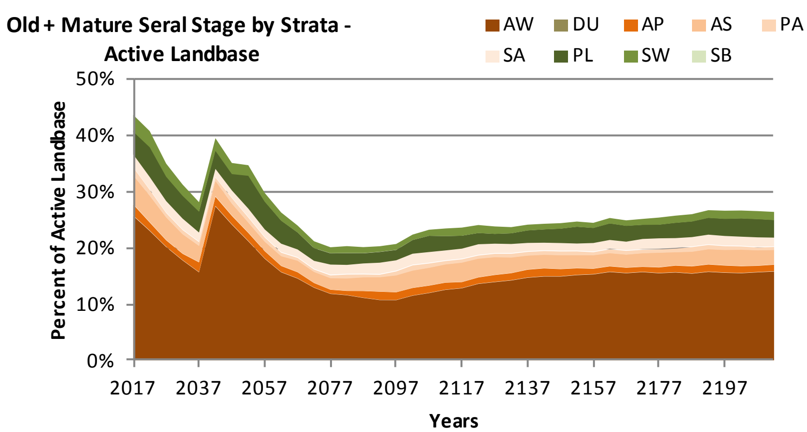


Figure 6-34. Percentage of active landbase in Old + Mature seral stage by strata for FMU W11

The forecasted seral stage variation in W13 is similar to W11, but with less variation in the first 30 years. Again, after an initial abundance of mature forest, young and immature stands hold the greatest area for most of the horizon (Figure 6-35).

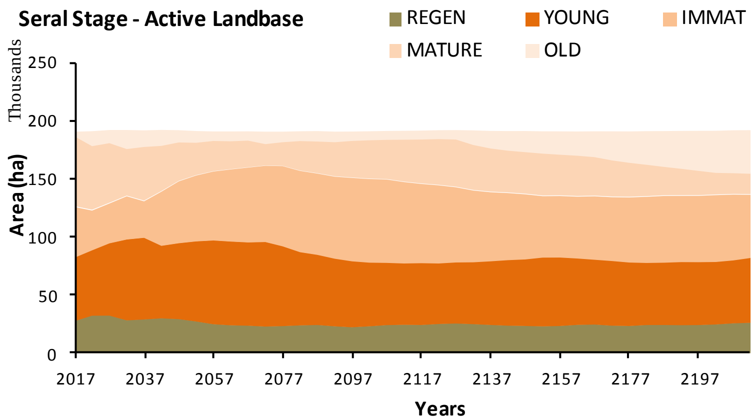


Figure 6-35. Active landbase seral stages for FMU W13

In just the old and mature seral stages, W13 shows more of a steady decline in the first 40 years than W11, but remains higher than 15% of the active landbase at all times. At year 60, the proportion of area in the PL strata increases over the other strata (Figure 6-36).

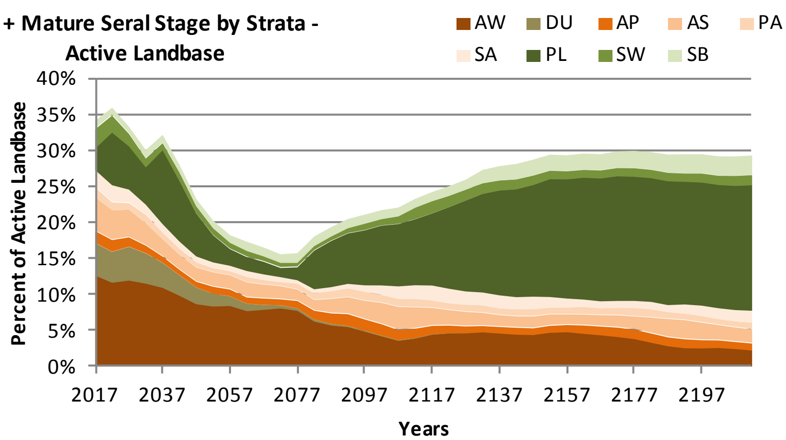


Figure 6-36. Percentage of active landbase in Old + Mature seral stage by strata for FMU W13

5.4.4 Wildlife Habitat

This section provides a summary of the outputs for each of the wildlife habitat models. More in-depth reporting on wildlife metrics is found in Chapter 5 - *VOITs*.

5.4.4.1 Songbird and Marten

Figure 6-37 illustrates the W11 relative abundance of the five songbirds and the habitat suitability index of pine marten over the planning horizon. The green shading represents a change of +/- less than 15% from current levels (range of low risk); the yellow indicates a -15 to 30% change (range of moderate risk); and red shows a greater than -30% change (range of high risk). Black-throated green warbler and bay breasted warbler come close to the range of moderate risk, but all species remain in the range of low risk. All songbird species also show a general pattern of variation in the first third of the horizon, with relatively constant abundance for the rest. The relative abundance for Canadian warbler increases considerably over the first half of the planning horizon. The marten habitat suitability index shows a more undulating pattern, but still becomes more constant towards the end of the horizon.

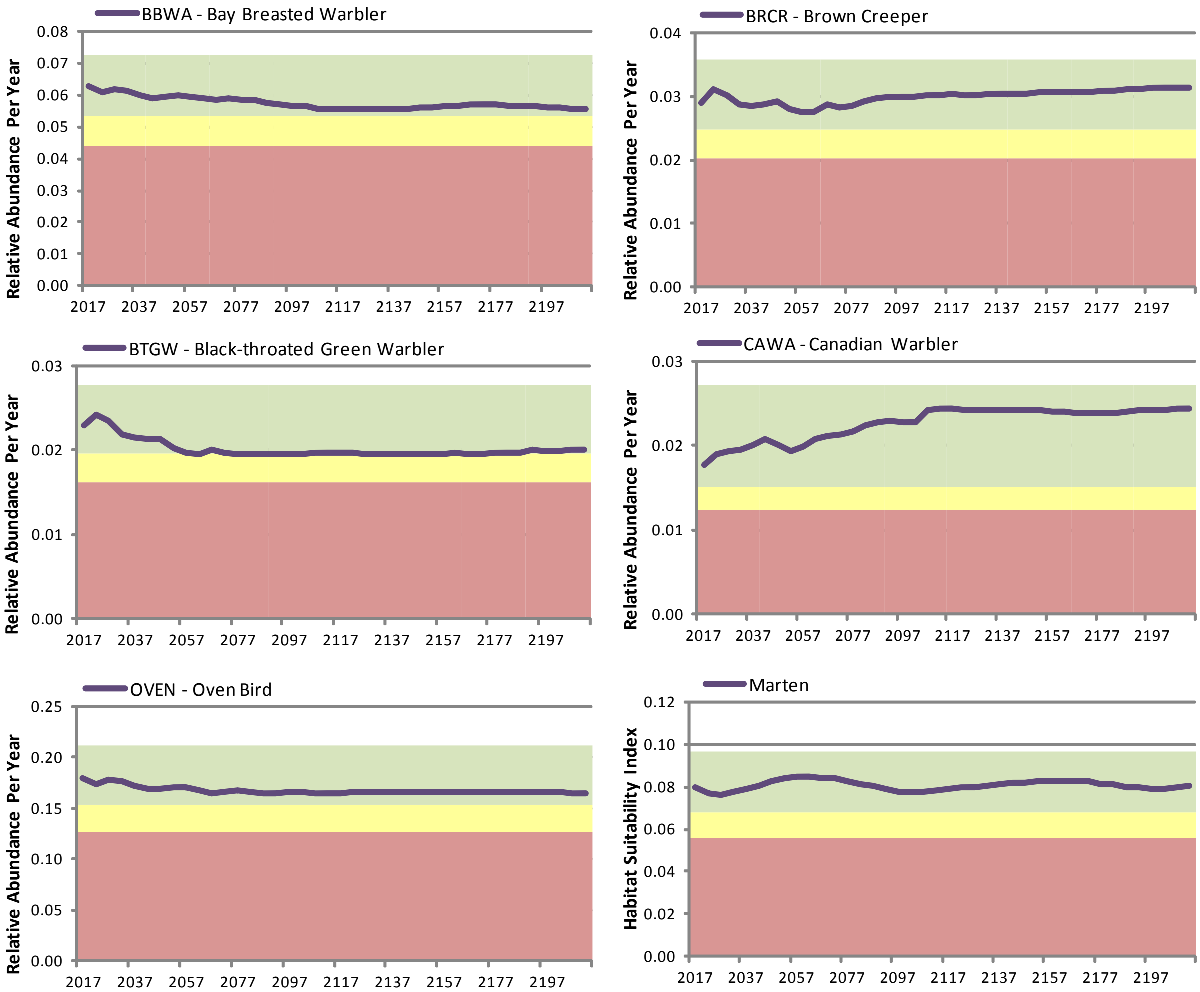


Figure 6-37. Songbird and Marten relative abundance and habitat suitability indexes for FMU W11

In FMU W13, black-throated green warbler comes close to the range of moderate risk, as it did in W11, but all other species remain clearly in the range of low risk throughout the planning horizon (Figure 6-38). Brown creeper and marten show a greater increase over time than in W11, with marten remaining undulating.

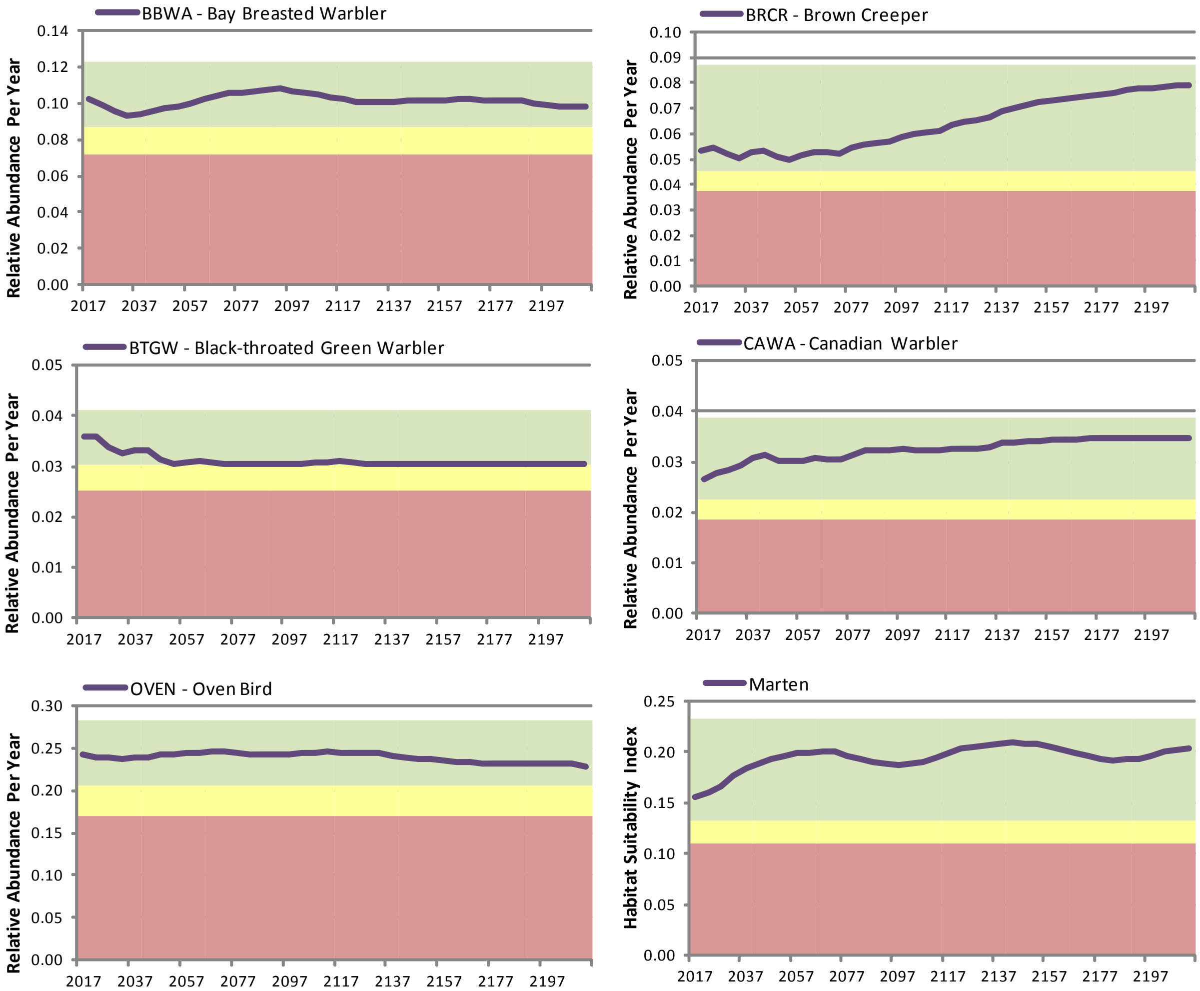


Figure 6-38. Songbird and Marten relative abundance and habitat suitability indexes for FMU W13

5.4.4.2 Barred Owl

Barred owl results were compiled for the time periods of year 10, 20, 50 and 100. The barred owl model was post-processed from Patchworks PFMS outputs. All time periods were run on the gross landbase, which was aged appropriately for each time period processed.

The barred owl breeding pair metric was problematic. Direct control over the metric was not possible in Patchworks, and none of the scenarios or targets applied achieved the targets. To address the issue for the DFMP, a barred owl implementation strategy was developed to guide operations. Refer to Chapter 7 – *DFMP Implementation* for more information.

Figure 6-39 and Figure 6-40 display the trend of potential breeding pairs and RSF values over the specified time periods. The overall RSF is fairly stable over time; however, the breeding pair metric declines below the 30% threshold. An effort was made to maintain the breeding pairs metric using the patch targets in Patchworks (Figure 6-41). This increased the amount of large patches present on the landbase and maintained that amount over the planning horizon; however, barred owl breeding pairs still declined. While some increase in the breeding pair metric was achieved from previous scenarios, as described in the sensitivity analysis in Annex 6, no scenarios achieved the targets for the breeding pair metric over the planning horizon

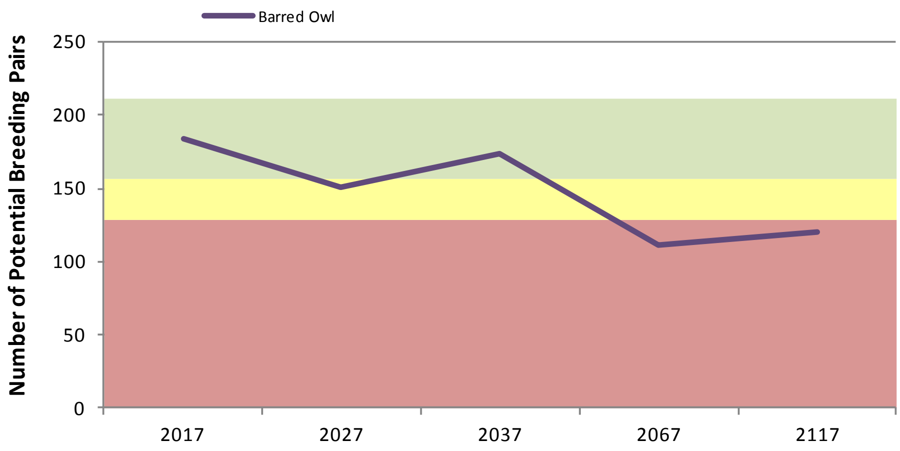


Figure 6-39. Trend of barred owl potential breeding pair values over time and the percent change relative to time zero

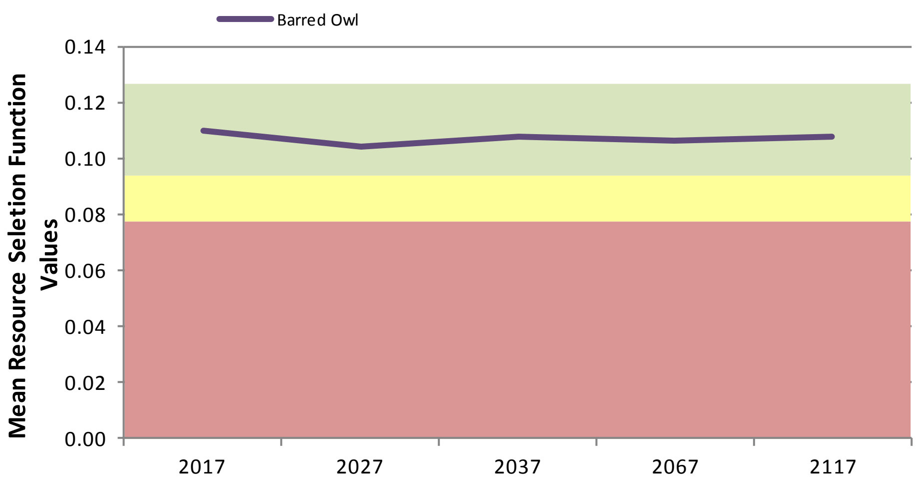


Figure 6-40. Trend of barred owl RSF values over time and the percentage change relative to time zero

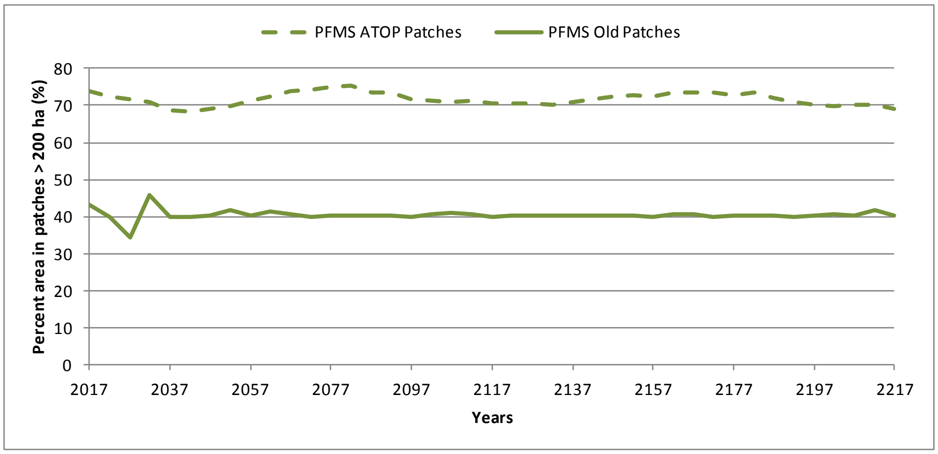


Figure 6-41. Patch targets controlled in model in attempt to maintain barred owl breeding pairs.

5.4.4.3 Grizzly Bear

As directed by the GoA, specific reporting metrics are required for grizzly bear modeling. Table 6-10 provides the requested metrics for the PFMS. Grizzly bear metrics were not constrained in the timber supply model, and there are no additional planned permanent forestry roads within the grizzly bear management areas during the DFMP period.

Table 6-10. Additional reporting metrics for Grizzly bear as requested by GOA

			Grande Cache Population Area (ha)	Swan Hills Population Area (ha)
Total Area of Grizzly bear management areas within the Millar Western FMA	Core		0	118,985
	Secondary		54,398	72,499
Area proposed to be harvested over the next 20 years	Core		0	16,444
	Secondary		5,022	10,785
Area proposed to be harvested over each 10 year interval within each GB management area	Core	0-10	-	10,877
		11-20	-	5,568
	Secondary	0-10	1,649	5,722
		11-20	3,373	5,063
Current road density of the area that overlaps Millar Western's FMA and each GB management area compared to the 0.6 km/km2 in Core zones and 0.75km/km2 in Secondary zones, as referenced in the Draft Alberta Grizzly Bear Recovery Plan (2016-2021)	Core		-	0.28
	Secondary		0.20	0.19

5.4.4.4 Caribou

A caribou strategy was developed as part of the PFMS (refer to Chapter 7 – *DFMP Implementation*). As part of this strategy, the GoA requested specific metrics for caribou reporting. Table 6-11 provides the requested metrics.

Table 6-11. Additional reporting metrics for Caribou as requested by GOA

		Area (ha)
Total Area of Slave Lake Caribou zone within the Millar Western FMA		26,103
Area proposed to be harvested over the next 20 years within the Slave Lake caribou range		1,092
Area proposed to be harvested over each 5 year interval within the Slave Lake caribou range	0-5	0
	6-10	1,092
	11-15	0
	16-20	0
Area of upland coniferous forest[1] > 60 years (hectares and percentage) within the portion of the Slave Lake range that overlaps W11, prior to harvest (time0)		6,260
Area of upland coniferous forest[1] > 60 years in 2036 within the portion of the Slave Lake range that overlaps W11, following proposed harvest (time20)		17,293
Area of *total disturbance footprint*[2] within the portion of Slave Lake range that overlaps the Millar Western FMA, prior to harvest (time0)		25,393
Area of *total disturbance footprint*[2] within the portion of Slave Lake range that overlaps the Millar Western FMA, following proposed harvest (time20)		25,490

[1]upland coniferous forest are stands where the sum of pine, spruce or fir percentages is 50% or greater and overlaps the Slave Lake caribou range in Millar Western's active landbase.

[2] As per the federal Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal population, in Canada definition; "the combined effects of fire that has occurred in the past 40 years and buffered (500m) anthropogenic disturbance defined as any human-caused disturbance to the landscape that could be visually identified from Landsat imagery at a scale of 1:50,000". As per the Draft Little Smokey and A La Peche Caribou Range Plan, harvest and fire disturbances can be removed from the landscape after 60 years, and other anthropogenic disturbances (e.g. oil and gas) can be removed after 40 years.

5.4.5 ECA Analysis

Almost all of W11 has an area weighted ECA value of between 0 and 29 across the planning horizon (Figure 6-42). Between years 20 and 180, there is a small amount of area that falls into the 30-49 category.

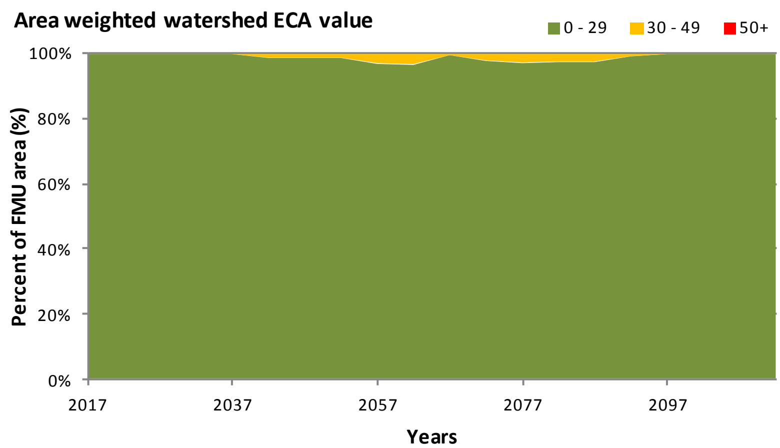


Figure 6-42. Area weighted ECA values over 200 years for FMU W11

For FMU W13, a smaller proportion falls in the 0-29 ECA value category; coverage ranges from approximately 60% to 85%, trending higher over time. The 30-49 category has a constant presence across the horizon, decreasing towards the end. The 50+ category is also present for most of the horizon, with as much as 10% coverage at the beginning in the compartments that have had fires in the last 40 years (Figure 6-43).

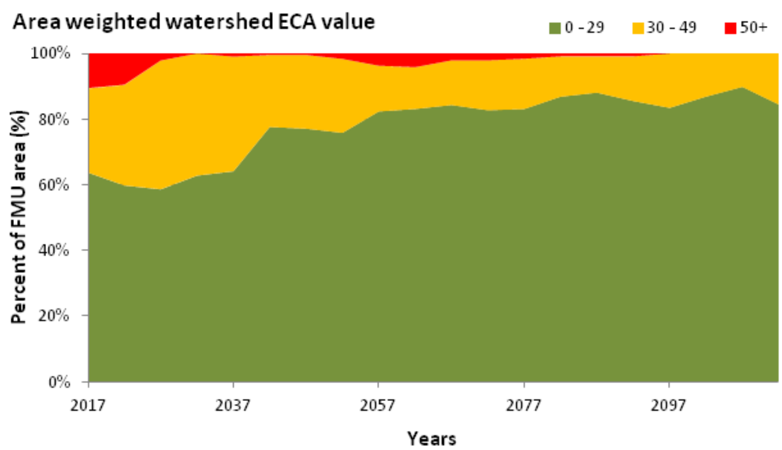


Figure 6-43. Area weighted ECA values over 200 years for FMU W13

5.4.6 Interior Core Patches

The interior core patch metric is the area that that is greater than 120 years old and is in patches greater than 120 ha in size, divided by the total forested area over 120 years of age times 100 (Figure 6-44). The percent in interior core patches declines in the first 40 years of the planning horizon, which matches the decline in operable growing stock. However, once growing stock begins to increase, so does the percent of old forest in interior core patches.

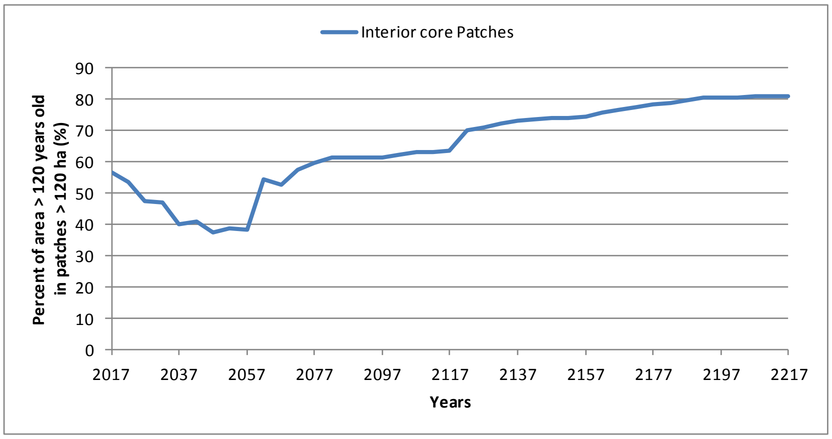


Figure 6-44. Interior core patches. Percent of area greater than 120 years old in patches greater than 120 ha

5.5 Operational Constraints

Several tools were used to improve the operability of the PFMS during and beyond the SHS period. Improved operability beyond the SHS period was undertaken to incorporate the AAC impacts of current operational behavior.

5.5.1 Access Control

Access control is used to define hard limits on which stands are available or not available for harvest. The ACCESS_C5 field was used in the PFMS scenario to control the final round of stand availability in the first 20 years of the model. This final version is the culmination of several refinements to the harvest sequence, modified by company planners to achieve a variety of operational and non-timber goals.

Much of the control in the PFMS is determined by defining stands that are planned or available for harvest in either the first 10 years or the second 10 years. Some polygons are to be deferred, mostly identified portions of stands within existing blocks as identified in the ARIS process. Table 6-1 shows the access control for these planned and optional stands. Green means that stands are allowed to be harvested, and red means that stands are not allowed to be harvested. Descriptions of the ACCESS_C5 items are in Annex VIII.

Access control was applied to access control units created specifically for this purpose and which are smaller than the compartments used for stewardship reporting.

Table 6-12. Access control for deferrals, planned and optional stands

ACCESS_C5	0-5	6-10	11-15	16-20
A_Plan_10	0	0	2	2
A_Plan_20	2	2	0	0
A_Pln20_Opt10_1	0	0	0	0
A_Pln20_Opt10_2	0	0	0	0
A_Pln20_Opt10_4	0	0	0	0
A_Pln20_Opt10_D	2	2	0	0
L410	2	2	0	0
L420	2	2	2	2
Opt10_	2	2	0	0
Opt20_ATH	2	2	0	0
Opt20_BCK	2	2	0	0
Opt20_BLK	2	2	0	0
Opt20_GLK	2	2	0	0
Opt20_HEV	2	2	0	0
Opt20_NOG	2	2	0	0
Opt20_PRV	2	2	0	0
Opt20_ROB	2	2	0	0
Opt20_SAH	2	2	0	0
Opt20_TOH	2	2	0	0
Opt20_WEG	2	2	0	0
Opt20_WHM	2	2	0	0
Opt20_WIN	2	2	0	0
Opt20_WWF	2	2	0	0
PLAN10	0	0	2	2

Stands that were not specifically controlled as a planned or deferred block were controlled by compartment or access control units. The conifer and deciduous landbase stands were separated for each compartment in FMU W11 (Table 6-13) and FMU W13 (Table 6-14 and Table 6-15). In W11, several compartments are open for harvest to provide flexibility in the model. In W13, all compartments are closed in the SHS, as all harvested stands have been locked down by assigning them to a planned or optional status.

Table 6-13. Access control for W11 compartments

ACCESS_C5	0-5	6-10	11-15	16-20
W11C_	2	2	0	0
W11C_AKUINU	2	2	2	2
W11C_CLEARWATER	0	0	2	2
W11C_COUTTS	2	2	0	0
W11C_DORIS	2	2	2	2
W11C_ERICKSON LAKE	2	2	0	0
W11C_FOLEY CREEK	2	2	0	0
W11C_FOLEY LAKE	2	2	0	0
W11C_KLONDIKE	2	2	2	2
W11C_LONG END LAKE	2	2	2	2
W11C_MUD CREEK	2	2	0	0
W11C_NORTH FREEMAN	2	2	2	2
W11C_ROCHE LAKE	2	2	2	2
W11C_SOUTH FREEMAN	2	2	2	2
W11C_TIMEU CREEK	2	2	0	0
W11C_WINDFALL LAKE	2	2	0	0
W11D_	0	0	0	0
W11D_AKUINU	0	0	0	0
W11D_CLEARWATER	0	0	0	0
W11D_COUTTS	0	0	0	0
W11D_DORIS	0	0	0	0
W11D_ERICKSON LAKE	0	0	0	0
W11D_FOLEY CREEK	0	0	0	0
W11D_FOLEY LAKE	2	2	0	0
W11D_KLONDIKE	2	2	0	0
W11D_LONG END LAKE	2	2	2	2
W11D_MUD CREEK	0	0	0	0
W11D_NORTH FREEMAN	0	0	0	0
W11D_ROCHE LAKE	2	2	0	0
W11D_SOUTH FREEMAN	2	2	0	0
W11D_TIMEU CREEK	0	0	0	0
W11D_WINDFALL LAKE	2	2	0	0

Table 6-14. Access control for conifer volume in W13 compartments

ACCESS_C5	0-5	6-10	11-15	16-20
W13C_	0	0	0	0
W13C_ TOM HILL NORTH	2	2	2	2
W13C_ALEXIS RESERVE	2	2	2	2
W13C_ATHABASCA	2	2	2	2
W13C_ATHABASCA HILLS	2	2	2	2
W13C_BASELINE LAKE	2	2	2	2
W13C_BESSIE CREEK	2	2	2	2
W13C_BESSIE CREEK NORTH	2	2	2	2
W13C_BESSIE CREEK SOUTH	2	2	2	2
W13C_CARSON CREEK	2	2	2	2
W13C_CARSON LAKE	2	2	2	2
W13C_CHICKADEE CREEK	2	2	2	2
W13C_GOODWIN LAKE NORTH	2	2	2	2
W13C_GOODWIN LAKE SOUTH	2	2	2	2
W13C_GOOSE	2	2	2	2
W13C_GROAT CREEK	2	2	2	2
W13C_HARDLUCK CREEK	2	2	2	2
W13C_HEADLESS VALLEY NORTH	2	2	2	2
W13C_HEADLESS VALLEY SOUTH	2	2	2	2
W13C_KAYBOB	2	2	2	2
W13C_LEECH LAKE	2	2	2	2
W13C_MEEKWAP	2	2	2	2
W13C_NORTH GOOSE	2	2	2	2
W13C_OCELOT	2	2	2	2
W13C_PADDLE RIVER	2	2	2	2
W13C_PASS CREEK	2	2	2	2
W13C_ROBISON	2	2	2	2
W13C_SAKWATAMAU	2	2	2	2
W13C_SAND HILLS NORTH	2	2	2	2
W13C_SAND HILLS SOUTH	2	2	2	2
W13C_TOM HILL	2	2	2	2
W13C_TWO CREEKS	2	2	2	2
W13C_WEST GOOSE	2	2	2	2
W13C_WEST WINDFALL	2	2	2	2
W13C_WHITECOURT MOUNTAIN	2	2	2	2
W13C_WINDFALL	2	2	2	2

Table 6-15. Access control for deciduous volume in W13 compartments

ACCESS_C5	0-5	6-10	11-15	16-20
W13D_	2	2	2	2
W13D_ TOM HILL NORTH	2	2	2	2
W13D_ALEXIS RESERVE	2	2	2	2
W13D_ATHABASCA	2	2	2	2
W13D_ATHABASCA HILLS	2	2	2	2
W13D_BASELINE LAKE	2	2	2	2
W13D_BESSIE CREEK NORTH	2	2	2	2
W13D_BESSIE CREEK SOUTH	2	2	2	2
W13D_CARSON CREEK	2	2	2	2
W13D_CARSON LAKE	2	2	2	2
W13D_CHICKADEE CREEK	2	2	2	2
W13D_GOODWIN LAKE NORTH	2	2	2	2
W13D_GOODWIN LAKE SOUTH	2	2	2	2
W13D_GOOSE	2	2	2	2
W13D_GROAT CREEK	2	2	2	2
W13D_HARDLUCK CREEK	2	2	2	2
W13D_HEADLESS VALLEY NORTH	2	2	2	2
W13D_HEADLESS VALLEY SOUTH	2	2	2	2
W13D_KAYBOB	2	2	2	2
W13D_LEECH LAKE	2	2	2	2
W13D_MEEKWAP	2	2	2	2
W13D_NORTH GOOSE	2	2	2	2
W13D_OCELOT	2	2	2	2
W13D_PADDLE RIVER	2	2	2	2
W13D_PASS CREEK	2	2	2	2
W13D_ROBISON	2	2	2	2
W13D_SAKWATAMAU	2	2	2	2
W13D_SAND HILLS NORTH	2	2	2	2
W13D_SAND HILLS SOUTH	2	2	2	2
W13D_TOM HILL	2	2	2	2
W13D_TWO CREEKS	2	2	2	2
W13D_WEST GOOSE	2	2	2	2
W13D_WEST WINDFALL	2	2	2	2
W13D_WHITECOURT MOUNTAIN	2	2	2	2
W13D_WINDFALL	2	2	2	2

5.5.2 Opening Patch Size

Harvest blocks were controlled to achieve a distribution of sizes. Small harvest blocks less than 5 ha were discouraged, with the majority of harvest blocks targeted for between 5 and 200 ha in size. Polygons within 5 meters of each other could be aggregated into a harvest block. Figure 6-45 and Figure 6-46 represent the range of harvest blocks in FMU W11 for conifer and deciduous landbases respectively, while Figure 6-47 and Figure 6-48 present the same for FMU W13.

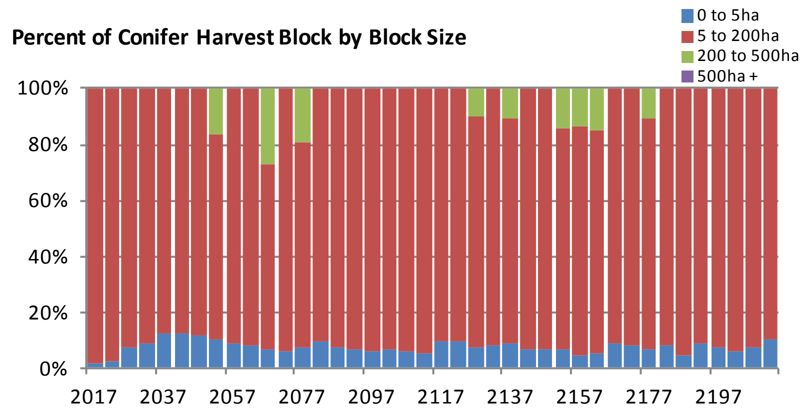


Figure 6-45. Conifer harvest block size for FMU W11

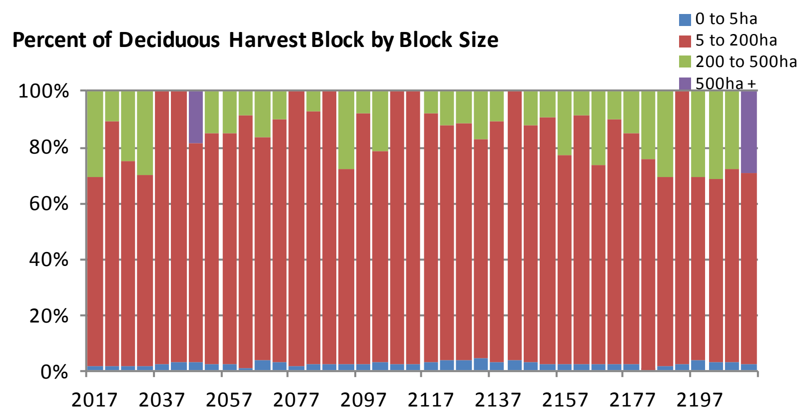


Figure 6-46. Deciduous harvest block size for FMU W11

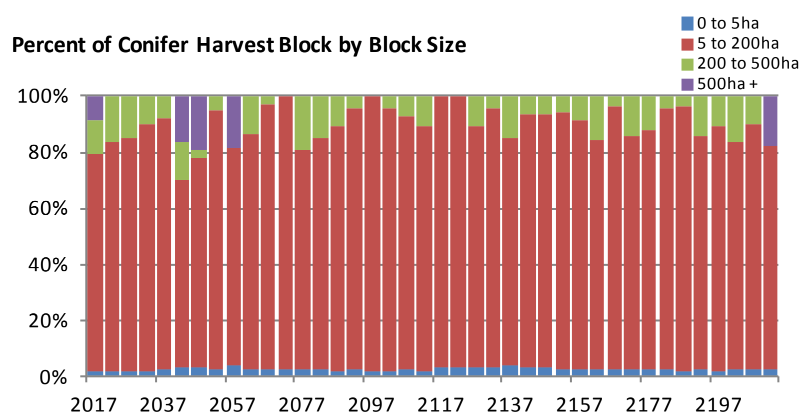


Figure 6-47. Conifer harvest block size for FMU W13

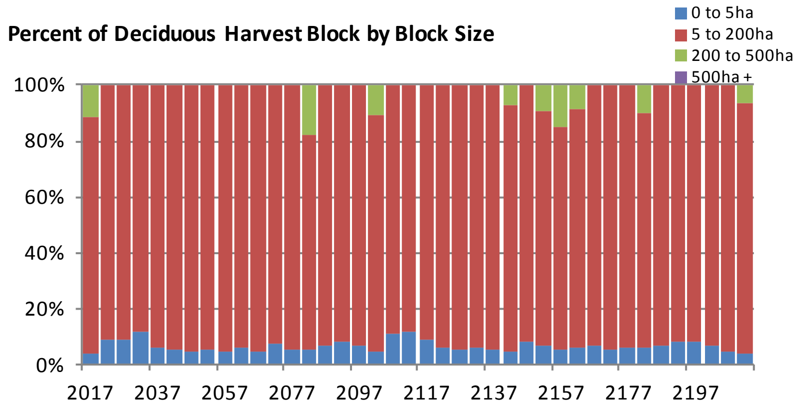


Figure 6-48. Deciduous harvest block size for FMU W13

5.5.3 Annual Harvest Patches

To mimic the annual clustering of harvesting operations and promote a more operational sequence, several annual harvest patch targets were created in Patchworks for the PFMS. Harvest blocks were considered to be part of the same group if they were within 200m of each other. Separate targets were created for conifer and deciduous landbase blocks within each FMU.

In FMUs like W11 and W13, which have a large industrial footprint, it is difficult to achieve large contiguous groups of blocks. The existing two-pass harvest pattern in most compartments establishes the pattern for several rotations. As a result, these targets could not achieve highly concentrated patches that could be accomplished if the forest were less fragmented.

Figure 6-49 and Figure 6-50 show the conifer and deciduous harvest groups for FMU W11, while Figure 6-51 and Figure 6-52 show the harvest groupings for FMU W13.

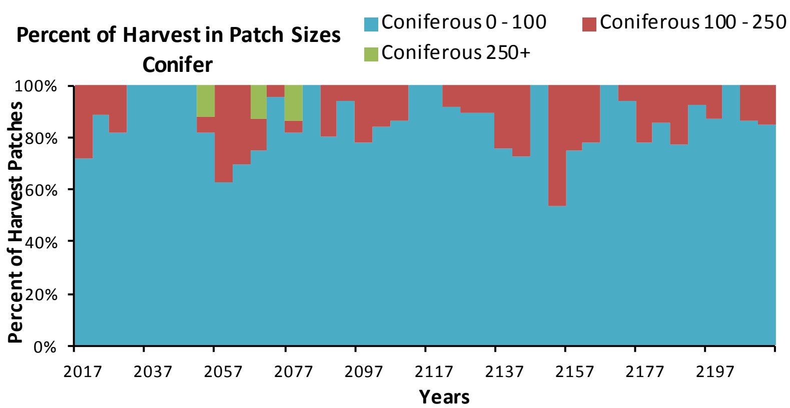


Figure 6-49. Annual conifer harvest groupings for FMU W11

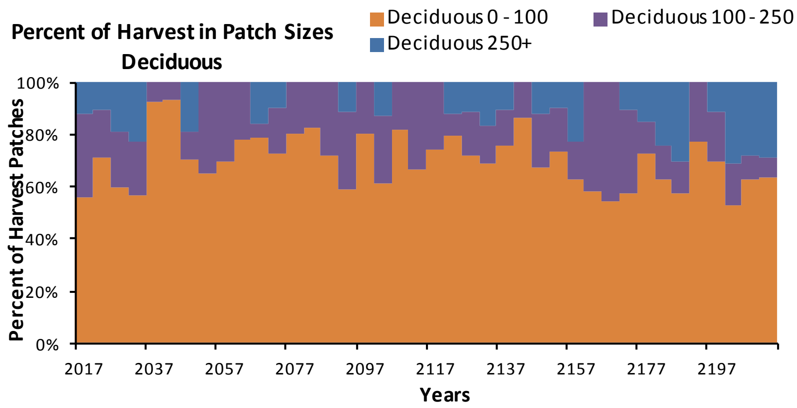


Figure 6-50. Annual deciduous harvest groupings for FMU W11

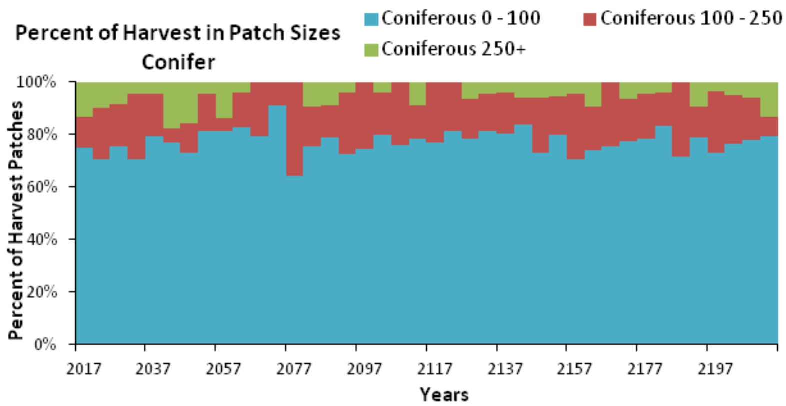


Figure 6-51. Annual conifer harvest groupings for FMU W13

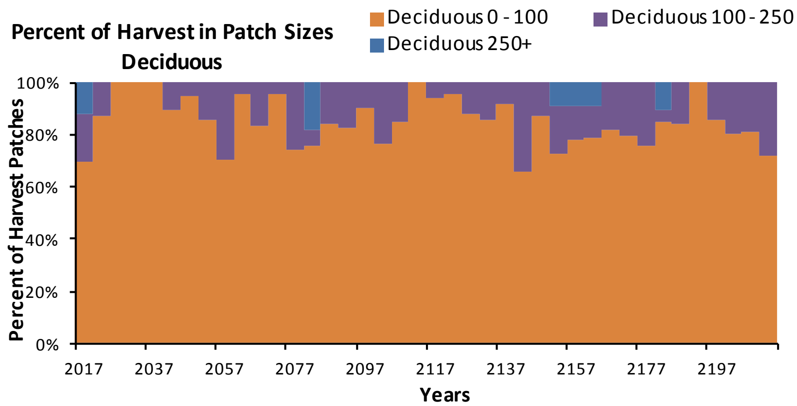


Figure 6-52. Annual deciduous harvest groupings for FMU W13

Appendix I: PFMS 64006 Summary

Includes PFMS 64006 output metrics for FMU W11 followed by FMU W13.

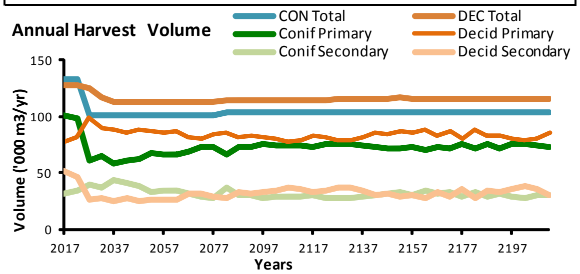
Millar Western TSA - W11

Scenario 64006 (MWFP_64006)

Model Inputs

Objective	Based on PDT - Dec 3 - 5000 ha - includes revised virg hills for ECA
Description	0

Annual Harvest Volume



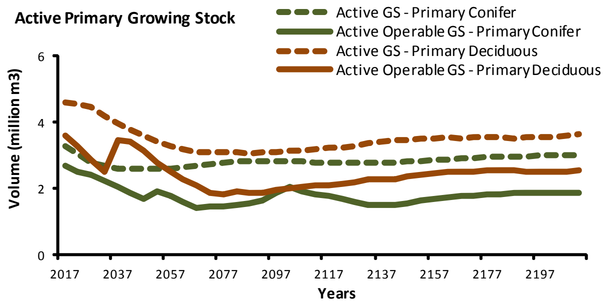
Output Summary

Years	Landbase	Area	Harv Age	Conifer Volume Vol*	Conifer Volume Vol/ha	Deciduous Volume Vol*	Deciduous Volume Vol/ha
1-10	Conif	568	123	99,634	176	48,647	86
	Decid	490	117	33,005	67	79,384	162
	Total	1,057	114	132,639	125	128,031	121
	Piece size (tree/m3)				2.7		2.0
11-20	Conif	299	143	62,673	209	26,529	89
	Decid	682	105	37,903	56	94,154	138
	Total	981	111	100,576	103	120,683	123
	Piece size (tree/m3)				2.7		2.0
21-200	Conif	369	110	71,655	194	31,447	85
	Decid	518	101	31,221	60	83,424	161
	Total	887	100	102,876	116	114,872	130
	Piece size (tree/m3)				2.8		2.3

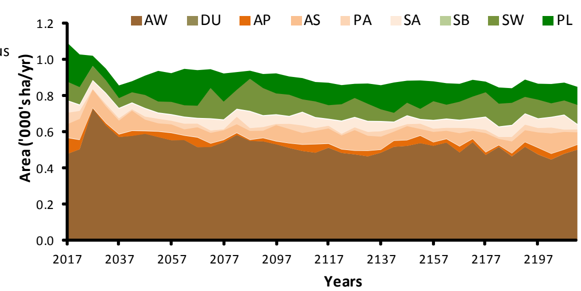
*Volumes are reduced for cull and 0% retention

W11

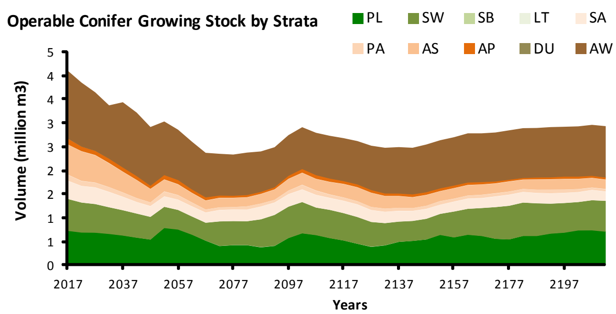
Active Primary Growing Stock



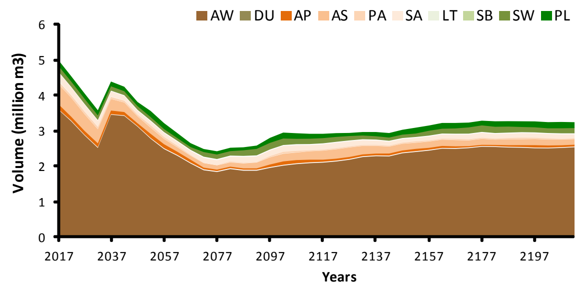
Harvest Area by Strata



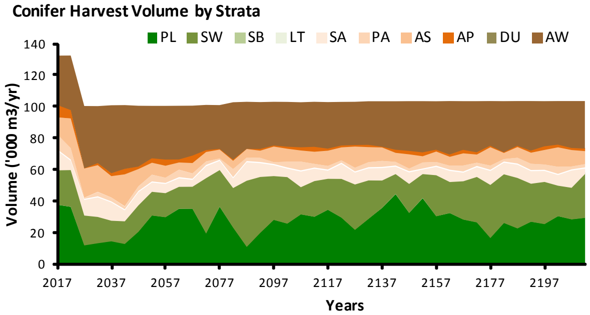
Operable Conifer Growing Stock by Strata



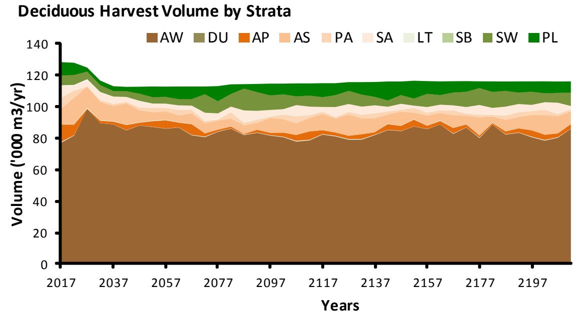
Operable Deciduous Growing Stock by Strata

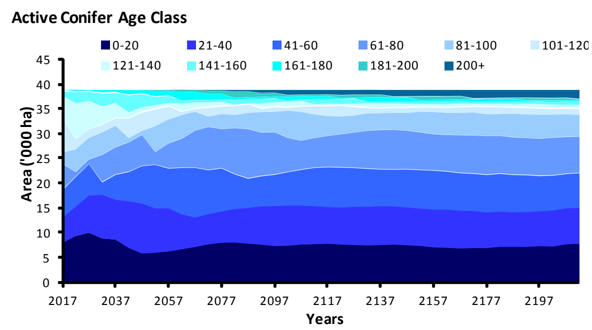


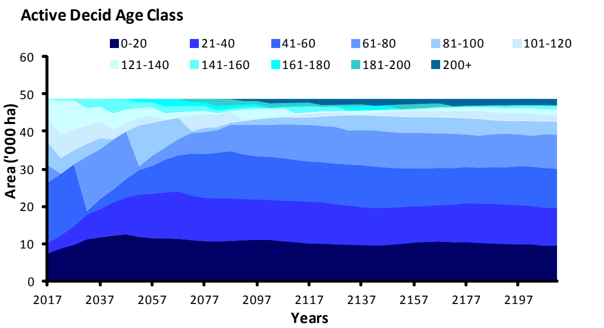
Conifer Harvest Volume by Strata

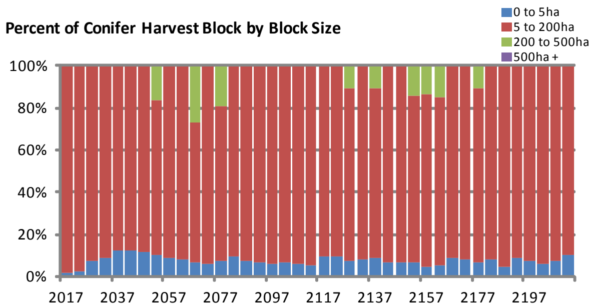


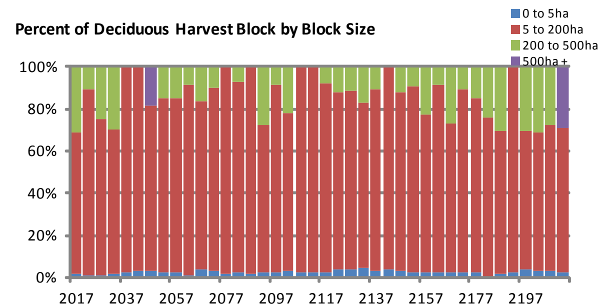
Deciduous Harvest Volume by Strata

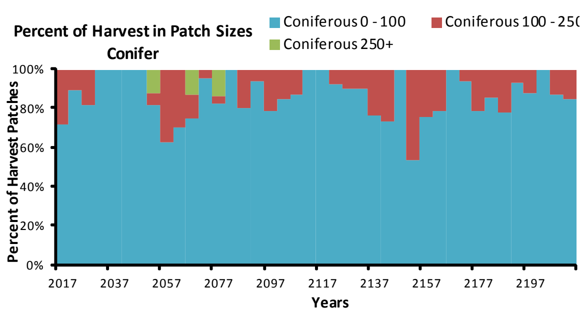


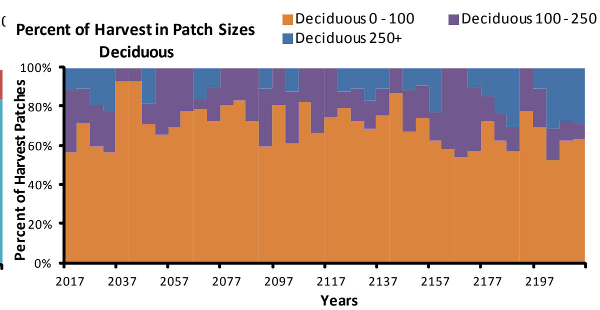

Active Conifer Age Class
0-20
21-40
41-60
61-80
81-100
101-120
121-140
141-160
161-180
181-200
200+
Area ('000 ha)
Years

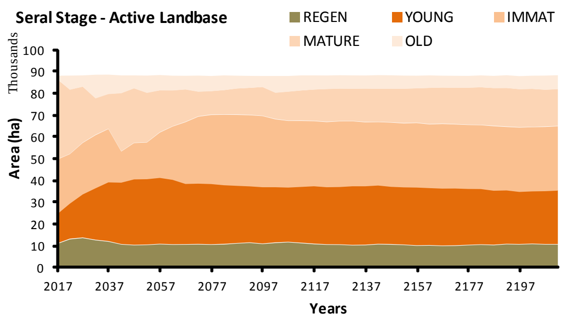

Active Decid Age Class
0-20
21-40
41-60
61-80
81-100
101-120
121-140
141-160
161-180
181-200
200+
Area ('000 ha)
Years

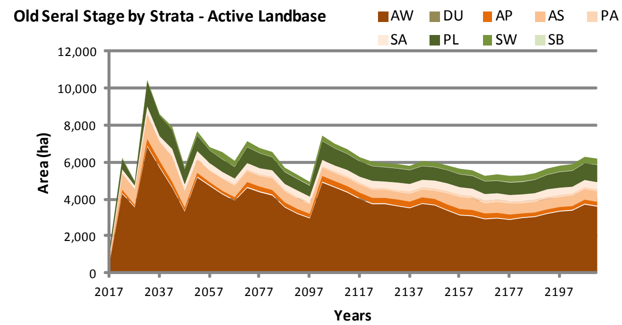

Percent of Conifer Harvest Block by Block Size
0 to 5ha
5 to 200ha
200 to 500ha
500ha +

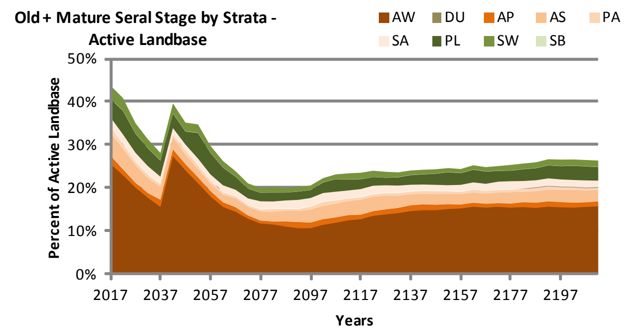

Percent of Deciduous Harvest Block by Block Size
0 to 5ha
5 to 200ha
200 to 500ha
500ha +

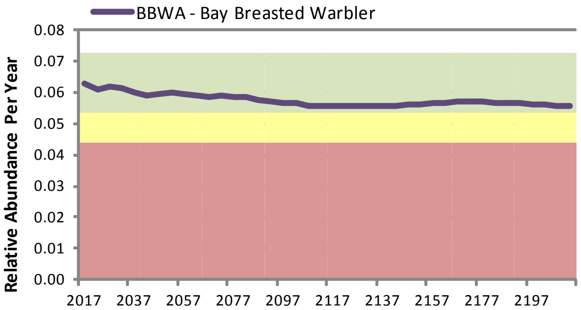

Percent of Harvest in Patch Sizes
Conifer
Coniferous 0 - 100
Coniferous 100 - 250
Coniferous 250+
Percent of Harvest Patches
Years

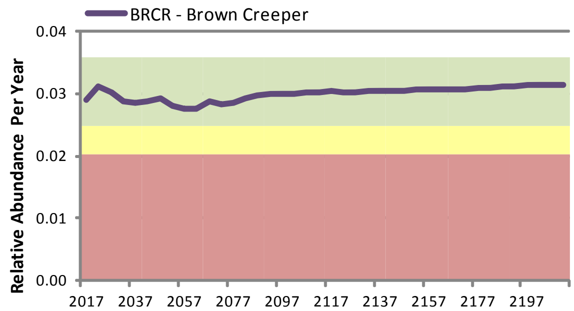

Percent of Harvest in Patch Sizes
Deciduous
Deciduous 0 - 100
Deciduous 100 - 250
Deciduous 250+
Percent of Harvest Patches
Years

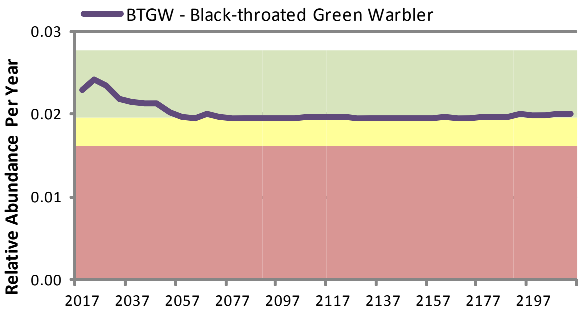

Seral Stage - Active Landbase
REGEN
YOUNG
IMMAT
MATURE
OLD
Thousands
Area (ha)
Years

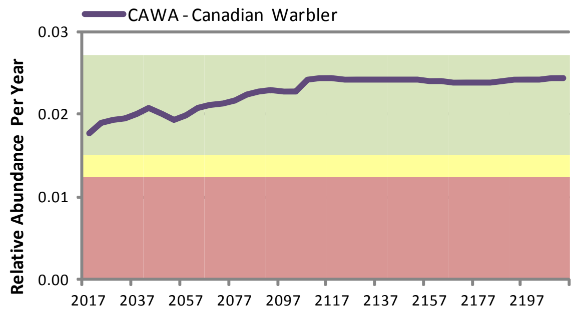

Old Seral Stage by Strata - Active Landbase
AW
DU
AP
AS
PA
SA
PL
SW
SB
Area (ha)
Years

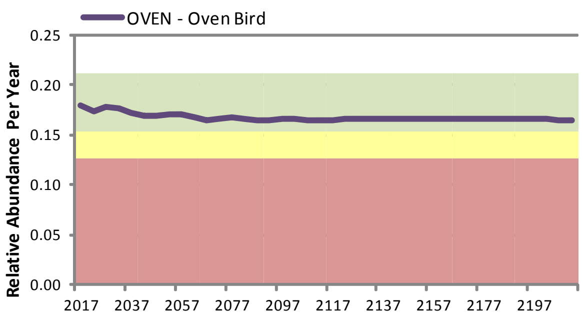

Old + Mature Seral Stage by Strata -
Active Landbase
AW
DU
AP
AS
PA
SA
PL
SW
SB
Percent of Active Landbase
Years

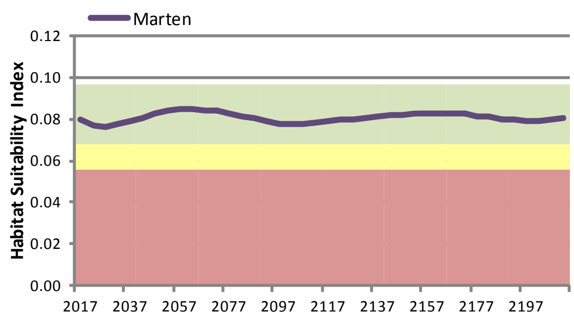


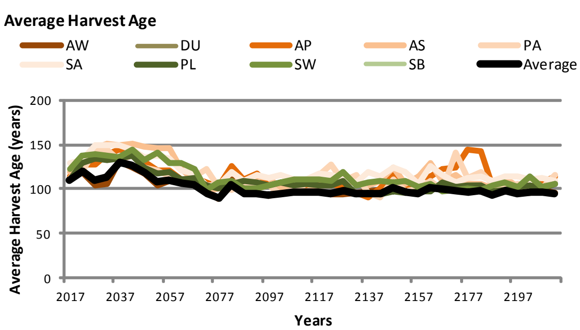


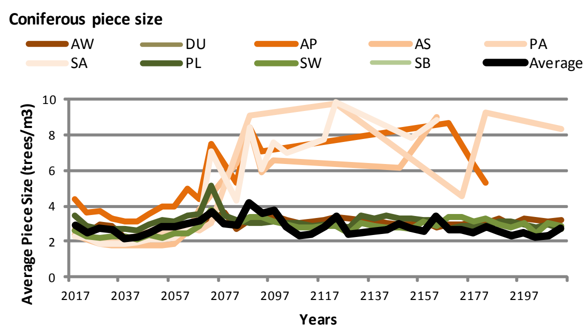


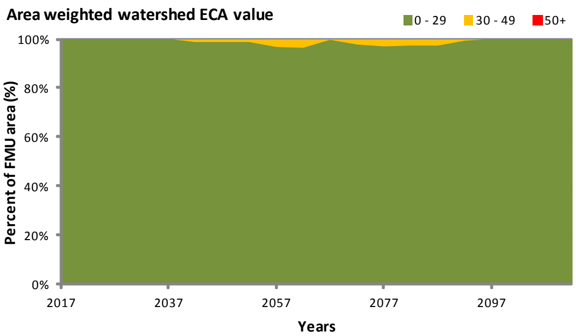












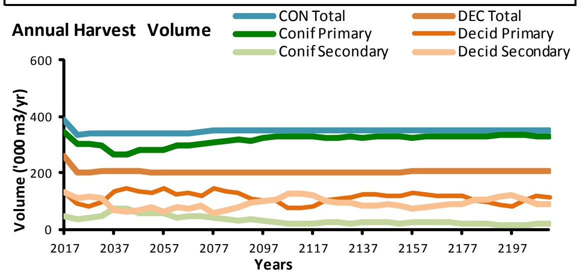
Watersheds in first 20 years

	Count	Area		
			SHS 1-10	SHS 11-20
Total	25	174,420		
Max value >= 50	0		-	-
Max value 30-49	0		-	-

Millar Western TSA - W13

Scenario 64006 (MWFP_64006)

Model Inputs	
Objective	Based on PDT - Dec 3 - 5000 ha - includes revised virg hills for ECA
Description	0

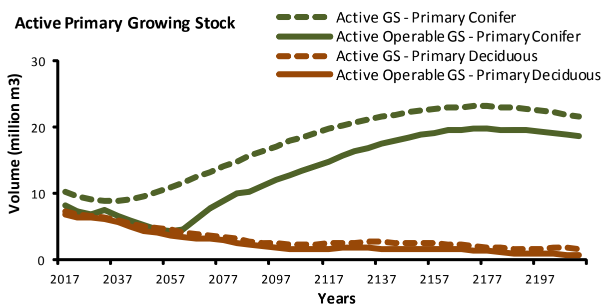


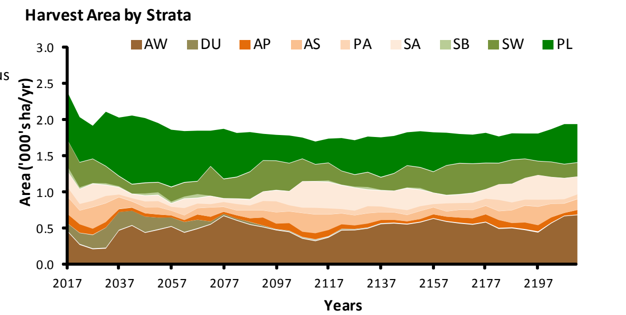
Output Summary

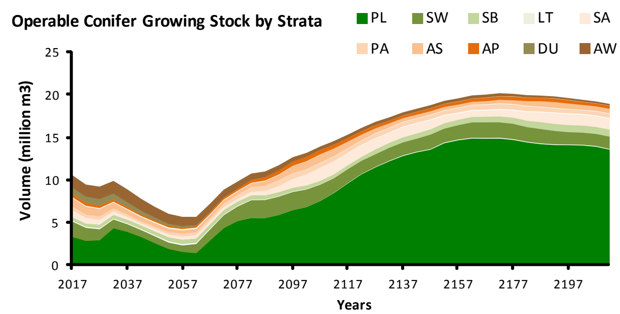
Years	Landbase	Area	Harv Age	Conifer Volume Vol*	Conifer Volume Vol/ha	Deciduous Volume Vol*	Deciduous Volume Vol/ha
1-10	Conif	1,706	118	323,676	190	121,540	71
	Decid	502	119	38,729	77	109,413	218
	Total	2,208	115	362,404	164	230,953	105
	Piece size (tree/m3)				3.9		2.5
11-20	Conif	1,548	120	297,629	192	113,067	73
	Decid	452	131	43,085	95	88,491	196
	Total	2,000	117	340,714	170	201,558	101
	Piece size (tree/m3)				3.8		2.4
21-200	Conif	1,258	96	316,799	252	89,313	71
	Decid	562	104	30,747	55	114,223	203
	Total	1,820	93	347,546	191	203,536	112
	Piece size (tree/m3)				3.6		3.1

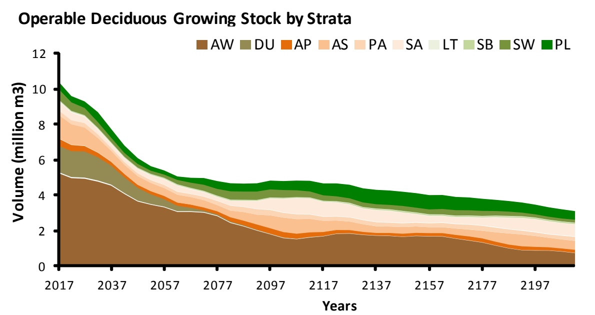
*Volumes are reduced for cull and 0% retention

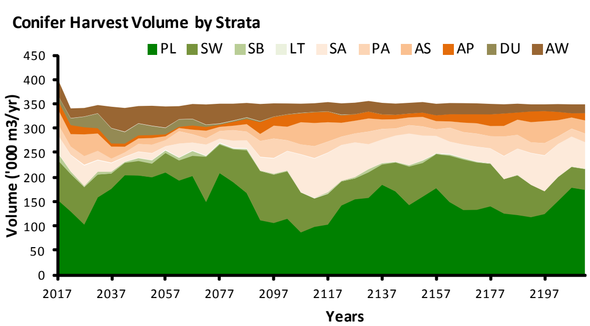
W13

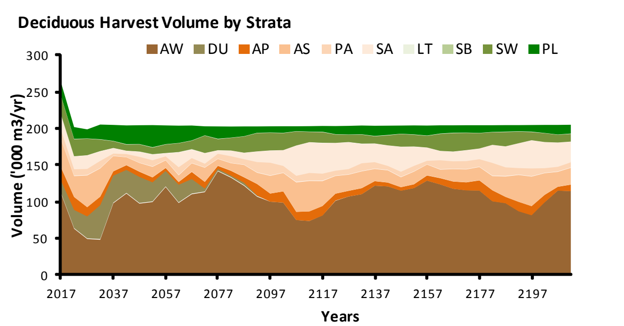


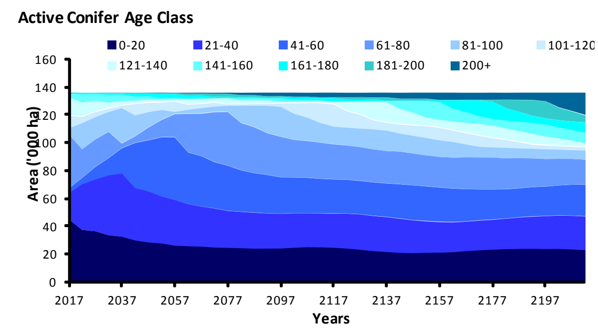


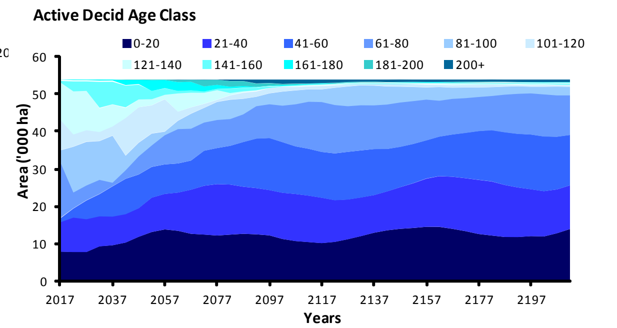


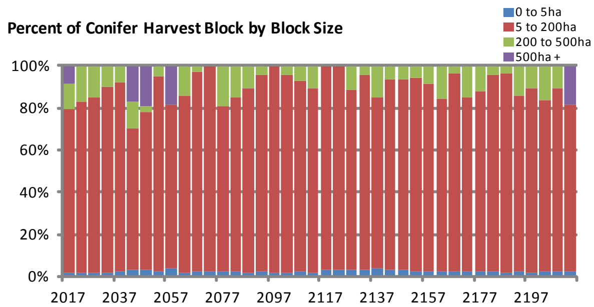


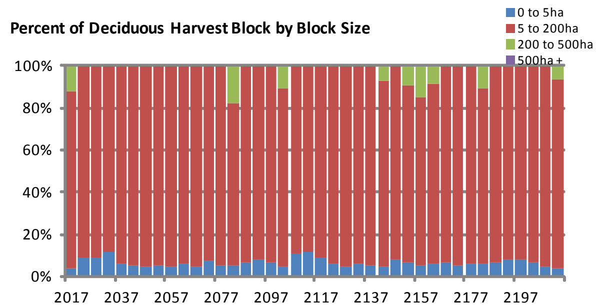


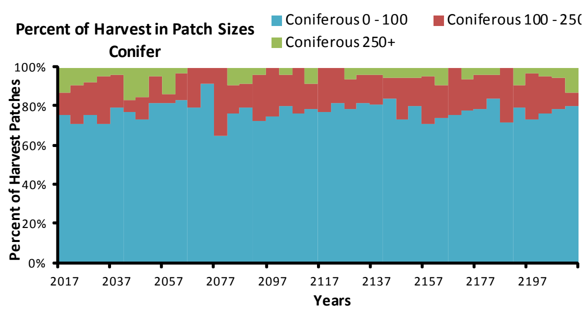


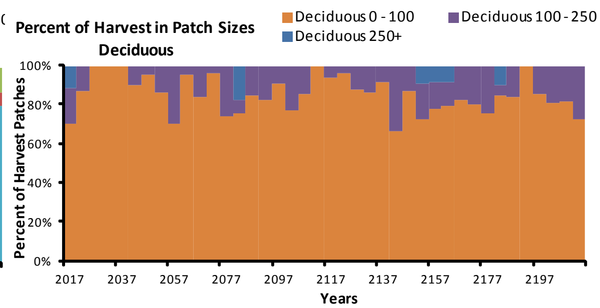

Active Conifer Age Class
0-20
21-40
41-60
61-80
81-100
101-120
121-140
141-160
161-180
181-200
200+
Area ('000 ha)
0
20
40
60
80
100
120
140
160
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197
Years

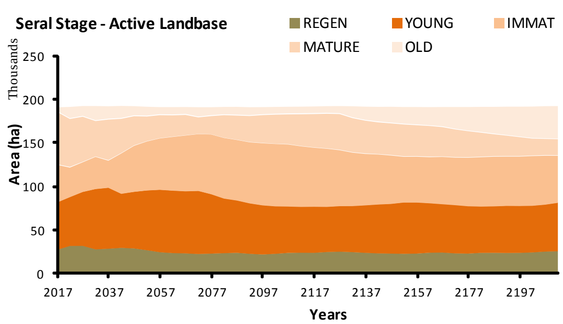

Active Decid Age Class
0-20
21-40
41-60
61-80
81-100
101-120
121-140
141-160
161-180
181-200
200+
Area ('000 ha)
0
10
20
30
40
50
60
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197
Years

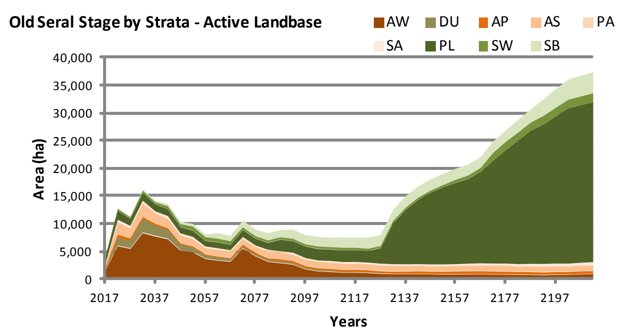

Percent of Conifer Harvest Block by Block Size
0 to 5ha
5 to 200ha
200 to 500ha
500ha +
0%
20%
40%
60%
80%
100%
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197

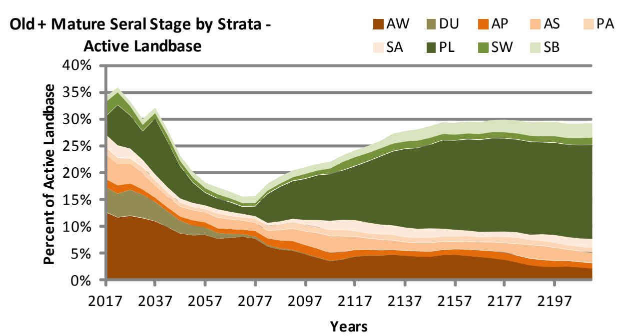

Percent of Deciduous Harvest Block by Block Size
0 to 5ha
5 to 200ha
200 to 500ha
500ha +
0%
20%
40%
60%
80%
100%
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197

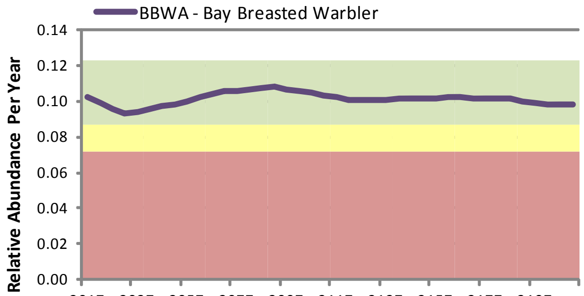

Percent of Harvest in Patch Sizes
Conifer
Coniferous 0 - 100
Coniferous 100 - 250
Coniferous 250+
Percent of Harvest Patches
0%
20%
40%
60%
80%
100%
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197
Years

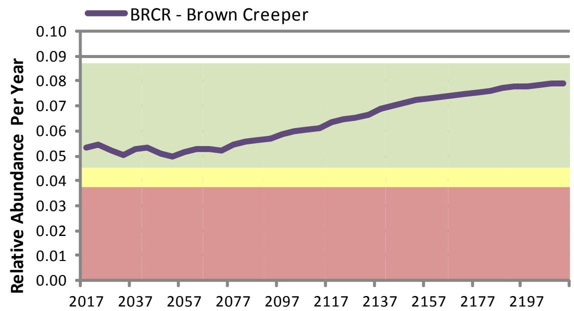

Percent of Harvest in Patch Sizes
Deciduous
Deciduous 0 - 100
Deciduous 100 - 250
Deciduous 250+
Percent of Harvest Patches
0%
20%
40%
60%
80%
100%
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197
Years

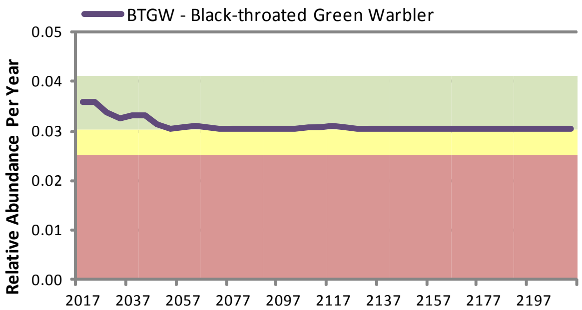

Seral Stage - Active Landbase
REGEN
YOUNG
IMMAT
MATURE
OLD
Thousands
Area (ha)
0
50
100
150
200
250
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197
Years

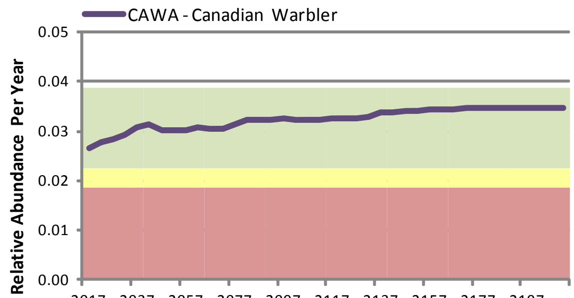

Old Seral Stage by Strata - Active Landbase
AW
DU
AP
AS
PA
SA
PL
SW
SB
Area (ha)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197
Years

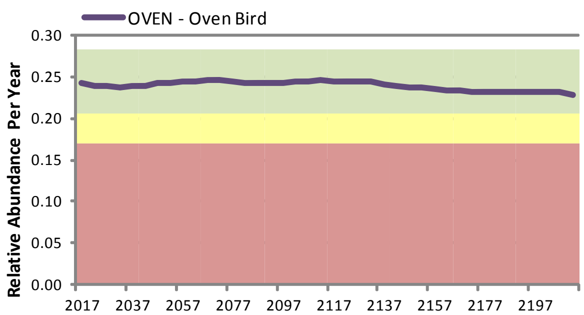

Old + Mature Seral Stage by Strata -
Active Landbase
AW
DU
AP
AS
PA
SA
PL
SW
SB
Percent of Active Landbase
0%
5%
10%
15%
20%
25%
30%
35%
40%
2017 2037 2057 2077 2097 2117 2137 2157 2177 2197
Years

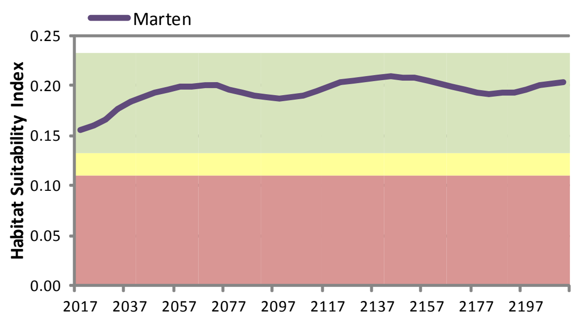


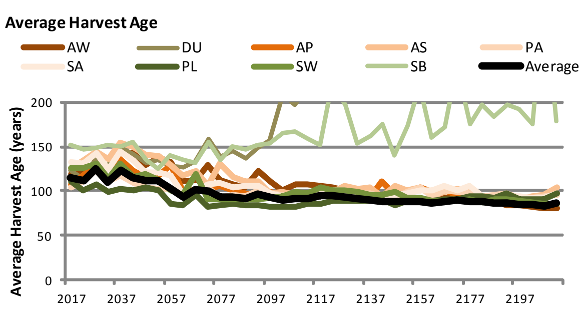


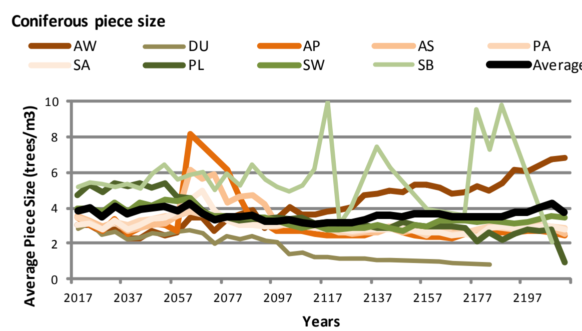


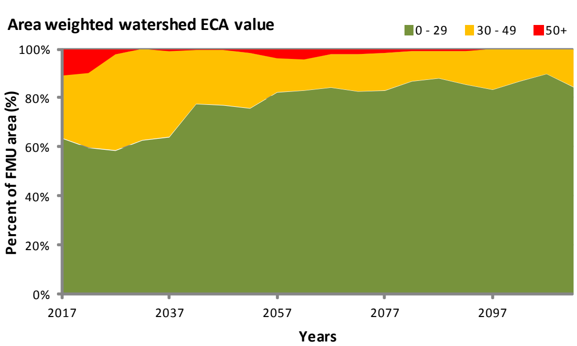












Watersheds in first 20 years

	Count	Area		
			SHS 1-10	SHS 11-20
Total	56	294,159		
Max value >= 50	5		29,845	3,194
Max value 30-49	25		82,935	112,696

Appendix II: PFMS AAC Tables

This appendix contains the tables comprising Table 1 of Annex 1 from the Planning Standard required for AAC approval. Draft table values are included and will be revised and completed during DFMP review.

Millar Western 2017-2027 DFMP AAC allocation

Company Name	Disposition ID	Type	Recommended Allocation m³/yr	Period 1 [1] Carryover Volume (m³/yr)	Period 1 [1] Harvest Level (m³/yr)	Period 2 [2] Carryover Volume (m³/yr)	Period 2 [2] Harvest Level (m³/yr)
FMU W13							
Conifer Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	311,121	42,000	353,121	0	311,121
Millar Western Forest Products Ltd.	CTQW130001	Grazing [4]	5,879	0	5,879	0	5,879
CTP	[8(2)(d)(i)]	FMA	30,000	0	30,000	0	30,000
Total Coniferous			347,000	42,000	389,000	0	347,000
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	151,472	31,720	183,192	0	151,472
Millar Western Forest Products Ltd.	DTAW130002	Grazing [4]	6,528	0	6,528	0	6,528
Weyerhaeuser Company Ltd.	DTAW130001	FMU	45,000	20,280	65,280	0	45,000
Total Deciduous			203,000	52,000	255,000	0	203,000
FMU W11							
Conifer Allocations							
Spruceland Millworks Inc.	CTQW110008	FMU	103,000	22,674	125,674	22,674	125,674
Total Coniferous			103,000	22,674	125,674	22,674	125,674
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	113,894	26,000	139,894	0	113,894
Millar Western Forest Products Ltd.	DTAW110002	Grazing [4]	1,106	0	1,106	0	1,106
Total Deciduous			115,000	26,000	141,000	0	115,000
FMA							
Area Residents [3]	[8(2)(a)(i)]		1,000				

[1] Period 1: May 1, 2017 - April 30, 2022.
[2] Period 2: May 1, 2022 - April 30, 2027.
[3] Total volume of coniferous/deciduous (including birch); included in Millar Western FMA Volume
[4] Grazing volumes based on 20 year average harvest volume in PFMS
Conifer and Deciduous Utilization is 15/10/15
Volumes are reduced for Cull
Volumes have not been reduced for structure retention

Utilization

Disposition Number	Utilization used to determine Harvest Level in PFMS: Top Diameter (cm)	Butt Diameter (cm)	Minimum Length (m)	Stump Height	Operational Utilization: Top Diameter (cm)	Butt Diameter (cm)	Minimum Length (m)	Stump Height (cm)	Deciduous AAC (m3) based on operational utilization	Coniferous AAC (m3) based on operational utilization	Marginal Dues Utilization: Top Diameter (cm)	Butt Diameter (cm)	Minimum Length (m)	Stump Height (cm)
W11	10	15	4.88	15	10	15	4.88	15	115,000	103,000				
W13	10	15	4.88	15	10	15	4.88	15	203,000	347,000				

Chargeability

Disposition Number	Deciduous Species Used in AAC	Coniferous Species Used in AAC	Species Not Chargeable to AAC	Rights to Species Not Chargable to AAC	Structure Retention (%)	Structure Retention (%) Accounted for in AAC	Net Landbase Variations (net landbase not included in AAC, by covertype or by species)	Net Landbase Variation: Rights to Timber	Industrial Salvage Accounted for in AAC
DTAW130001	Aw, Pb, & Bw		N/A		3%	0	0	0	N/A
DTAW130002	Aw, Pb, & Bw		N/A		3%	0	0	0	N/A
FMA9700034	Aw, Pb, & Bw	Fb, Pl, Sb, Sw, & Lt	N/A		3%	0	0	0	N/A
CTQW110001		Fb, Pl, Sb, Sw, & Lt	N/A		3%	0	0	0	N/A
CTQW110008		Fb, Pl, Sb, Sw, & Lt	N/A		3%	0	0	0	N/A
DTAW110002	Aw, Pb, & Bw		N/A		3%	0	0	0	N/A

Fiber Assignment Agreements				
Assignment Type (e.g. FMA, DTA, VSA, CTQ)	**Directed to (Company Name)**	**Disposition Number**	**Species (Coniferous or Deciduous)**	**Volume (m3)**
20-year Volume Supply Agreement - under FMA clause 20(5)	Weyerhaeuser (expires on April 30th, 2018)		Deciduous	30,000 m^3/yr
W13 MTU program - FMA clause 8(2)(d)(i)	W13 MTU program		Coniferous	30,000 m^3/yr
Local timber permits - FMA clause 8(2)(a)(i)	-		Includes birch	1,000 m^3/yr

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

\\silver\clients\MWFP\Projects\P755_DFMP\Ch6_PFMS\Ch6_PFMS_20170905_Submit.docx

Chapter 7

DFMP Implementation

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

List of Tables

List of Figures

1. DFMP Components

1.1 Introduction

Previous chapters describe the process that led to the Preferred Forest Management Scenario (PFMS), which prescribes forest management activities for the next 10 years and outlines the general planning direction for the longer term. This chapter provides details for implementation of the PFMS, including strategies for fulfilling and monitoring DFMP commitments. Those charged with implementing the DFMP need only reference this chapter to obtain the necessary information to understand the DFMP's strategic direction and to successfully execute the PFMS. In doing so, they will meet the DFMP's principle objective, which is to achieve sound environmental stewardship of Millar Western's DFMP area. While written from a Millar Western perspective, the information in this chapter applies, where relevant, to all companies operating within the DFMP area.

1.2 About this Chapter

The purpose of this chapter is to provide, in one location, the following information:

- A summary of all commitments and actions necessary to successfully implement the DFMP;
- An understanding of how the DFMP fits into Alberta's forest management planning hierarchy; and
- Clear guidance and direction for operational planning processes.

This chapter begins with a review of the hierarchy and relationships that comprise Alberta's forest management planning processes, followed by a summary of the products developed during the planning process that will guide DFMP implementation. It ends by providing specific strategies and direction for the following forest management activities:

- Access management
- Timber harvesting
- Silviculture
- Forest protection
- Protection of forest resources
- Maintenance of biodiversity
- Monitoring.

1.3 DFMP Commitments

This chapter lists all Millar Western commitments made during the development of the DFMP that are applicable to plan implementation and the successful execution and monitoring of these DFMP commitments. The commitments and strategies will become effective upon DFMP approval and remain effective for the duration of the DFMP, or until replaced by a subsequent plan or strategy.

Many of the commitments were drawn from Chapter 5: *Values, Objectives, Indicators, and Targets (VOITs)* and from Chapter 6: *Preferred Forest Management Scenario*, but commitments made in other chapters are also summarized in this chapter.

1.4 Managing Uncertainty

The DFMP implementation period spans 10 years and, therefore, must be flexible to deal with the uncertainty that is inherent in any long-term planning process. Developments that may affect implementation include:

- New advancements, events, and changes that were not accounted for during DFMP development; and
- Inaccuracy of long-term predictions.

The DFMP includes several strategies to deal with uncertainty, for example:

- Allowable variance levels and associated reporting (*e.g.* Spatial Harvest Sequence (SHS)); and
- Triggers for action if allowable variance levels are exceeded (*e.g.* net land base loss greater than or equal to 2.5%).

Another approach for coping with unexpected events is adaptive management (D’Eon, 2008), which is described as a six-step cycle that involves assessing the problem, designing the plan, implementing the plan, monitoring the results, evaluating the outcomes, and adjusting subsequent plans. As Millar Western cycles through the steps, it can respond to developments such as new, emerging science, changing public perceptions, or new policy expectations. The following examples show how Millar Western applies adaptive management to DFMP implementation:

- Establishment surveys: these surveys monitor the results of silviculture planning. If the outcomes are not acceptable, then the plan is adjusted with fill planting or vegetation management treatments. This experience is recorded and used to plan for future block regeneration.

- Salvage harvesting: this strategy can be used to address unknown events such as insect infestations or a wildfire.
- Stewardship reporting: produced after the fifth year of DFMP implementation, the report provides initial results for the first half of the DFMP timeframe and can drive strategy adjustments for the remaining period.
- Public Advisory Committee and First Nations consultation: ongoing engagement with stakeholders allows opportunities to identify and assess problems and design plans to addresses concerns.
- VOIT reporting: regular reporting allows for regular results monitoring and operational adjustments to meet VOIT targets within the DFMP timeframe.

Table 7-1 lists potential events that may arise throughout the DFMP's lifetime and potential responses.

Table 7-1. DFMP uncertainty and potential responses

Event	Potential Impact and Response
Regional Land-Use Framework plan completion	In the case of additional protected areas being delineated, the SHS would be impacted. Land-use plan requirements will override the DFMP.
Slave Lake Caribou Range Plan	The impact on the DFMP is unknown at the time of submission, but range plan requirements will override the DFMP and could change the SHS. In an extreme case, a new DFMP process may need to be initiated. In an attempt to proactively deal with range plan requirements, a caribou strategy was developed and implemented in the DFMP.
Biodiversity management framework	Regional Land-Use Framework plans will include a Biodiversity Management Framework, which will set thresholds and may impact the SHS and reporting requirements.
Wildfire	Annual Allowable Cut (AAC) and the SHS will be revised if the Net Landbase (NLB) lost to fire is 2.5% or more (Section 4.3). Smaller fires will be addressed through salvage operations and SHS variance.

2. Planning Hierarchy

The Government of Alberta (GoA) is responsible for defining the forest management planning structure in Alberta. In addition to area based planning, it has also introduced provincial strategies, such as integrated land management (ILM) and regional planning, to guide lower level plans and achieve more coordination among land users, with a view to minimizing environmental impacts and improving forest stewardship.

These concepts are embodied in lower-level plans required of timber harvesting operators within Alberta, including FMA holders: General Development Plans (GDP), Forest Harvest Plans (FHP), Annual Operating Plans (AOP) and Annual Silviculture Plans. GoA approval of these plans authorizes the companies to execute planned forest management activities for the stated timeframe.

Based upon a GoA framework and DFMP direction, Millar Western works with the other operators and the GoA to develop timber harvest planning and operating ground rules (OGRs). OGRs guide the content and implementation of all operational plans.

2.1 Integrated Land Management

Integrated Land Management (ILM) is Alberta's strategic planned approach to managing and reducing the human-caused footprint on public land (Alberta, 2015). It is an over-arching strategy that guides all levels in the planning hierarchy. The goals of ILM are to foster a stewardship ethic among all land users and reduce land-use disturbances and footprint by requiring shared resource planning. Alberta's ILM policy informed the Land-Use Framework (LUF) regional plans that in turn steer the direction of the DFMP and lower level plans.

2.2 Regional Planning

Alberta's LUF regional plans provide direction for ILM throughout the province. The Millar Western DFMP area intersects with the Upper Athabasca and Upper Peace LUF regions. Development of some regional plans is in progress; however, as of the submission of this DFMP, neither the Upper Athabasca nor the Upper Peace plan has been started. As these plans are completed, Millar Western will adjust the plans in its hierarchy, as needed.

2.3 DFMP

The detailed forest management plan (DFMP) is a long-term, forest-level plan that:

- Provides long-term, general direction for forest management within the DFMP area, with more specific guidance for the DFMP period;
- Establishes a set of values and objectives for the DFMP area and identifies indicators and targets (*i.e*. VOITs) for measuring the success of forest management activities over the DFMP period (the preferred forest management scenario (PFMS) is derived from the VOITs);
- Identifies the monitoring requirements necessary to evaluate DFMP indicators and targets;
- Determines the annual allowable cut (AAC); and
- Generates the spatial harvest sequence (SHS) for the DFMP period that is consistent with the PFMS.

Successful implementation of the DFMP relies on coordinated operational planning to translate the forest-level values, objectives and strategies into operational realities. Operational constraints may impact the ability of operators to fully implement the DFMP. The impact of these constraints should be evaluated within the context of the overall DFMP management objectives.

2.4 General Development Plan

Both FMA holders and quota holders are required to submit a General Development Plan (GDP) annually, which helps to ensure that all concerns are identified and addressed early in the planning process to an appropriate level of detail. The GDP projects forest management activities for a five-year period and is updated with every annual submission. It provides a comprehensive description of proposed harvest strategies, road building plans and reclamation operations, to assist in the integration of activities.

2.5 Forest Harvest Plan

The forest harvest plan (FHP) describes in detail the timber harvesting operations in a specified area and is approved for five timber years. The primary components of an FHP are a map and report that clearly document the harvest area boundaries, roads and water crossings, along with area and volume detail for each proposed harvest area. The SHS, which identifies where harvesting will occur for the 10-year term of the DFMP, guides the preparation of the FHP. First Nations concerns identified through the DFMP development process (see Section 8) and any other known sensitive site information are incorporated at this stage of planning.

2.6 Annual Operating Plan

The annual operating plan (AOP) identifies in detail the harvesting and road building activities proposed for the current year. It must also include fire control and reforestation plans, which can be submitted individually under separate cover. Plans must be approved by the GoA before timber operations can begin.

2.6.1 Fire Control Plan

A fire control plan is submitted annually to the GoA by the Forest Protection Coordinator. It outlines all activities and preparations related to fire prevention, detection, reporting, pre-suppression and suppression. The plan describes proposed operations, such as harvesting, planting, debris disposal and surveying during the fire season, as well as locations of bush inventory and satellite volumes. Suppression training activities and fire equipment inventory are identified and included, along with detailed emergency contact information. Millar Western maintains both a fire duty roster of woodlands staff and a helitack crew.

2.6.2 Annual Silviculture Plan

The annual silviculture plan (or reforestation program) contains reforestation prescriptions by stratum, and a schedule of treatments for the upcoming year. It identifies silviculture systems, strategies and tactics, and operational silviculture details for all new harvest areas. It also describes any silviculture treatments planned for existing regeneration, such as manual tending and herbicide application, as well as any reclamation activities that may be undertaken. The annual silviculture plan is essential to ensuring all blocks receive adequate reforestation within the provincially-mandated timeframe of two years following harvest.

2.7 Timber Harvest Planning and Operating Ground Rules

Timber Harvest Planning and Operating Ground Rules (OGRs) outline the practices used in planning and conducting forest management operations. Their purpose is to provide direction to timber operators, setting standards and guidelines for timber harvest, road development, reclamation, reforestation and integration of timber harvesting with other forest uses. The standards direct almost all components within the forest management planning hierarchy, including the DFMP, GDP, FHP, AOP, and silviculture plan. The GoA provides a framework for the OGRs but requires FMA holders to develop DFMP area-specific versions, usually within six months of DFMP approval. The current OGRs for the DFMP area will be updated to reflect the new DFMP.

2.8 VOITs

The development and implementation of Values Objectives Indicators and Targets (VOITs) is an integral part of the process of ensuring that important forest characteristics are accommodated in forest management activities. Millar Western and the plan development team (PDT), along with First Nations and public stakeholders, all have had roles in developing the VOITs; the development process and final list are detailed in Chapter 5: *Values, Objectives, Indicators and Targets (VOIT).* Chapter 5 also provides the implementation and monitoring commitments for each VOIT, including details on reporting requirements, responsibilities, and timeframe (*i.e.* DFMP, stewardship or annual reporting). For those

VOITs which required it, reporting based on the PFMS forecasting can be found in Chapter 5, Section 4: 2017 DFMP VOIT Reporting.

Many of the VOITs are addressed through successful implementation of the OGRs; however, some of the VOITs require specific strategies and procedures to guide successful implementation. All of the VOITs are summarized in Table 7-2 below, with the specific strategies provided later in this chapter.

Table 7-2. VOIT implementation

VOIT	VOIT description	Influences what?	Strategy to implement
1 - 1.1.1.1	Seral stage distribution	DFMP – PFMS & SHS	Follow SHS, report at next DFMP
2 - 1.1.1.2a	Opening patch sizes	DFMP – PFMS & SHS	Follow SHS, report at next DFMP
3 - 1.1.1.2b	Landscape fragmentation	DFMP – PFMS & SHS	Follow SHS, report at next DFMP
4 - 1.1.1.3a	Minimize primary access	Access & Road Corridor Plan; OGR	Access strategy (Access & Road Corridor Plan), reporting at next Stewardship report and DFMP
5 - 1.1.1.3b	Minimize temporary access	OGR - access	Access strategy, annual tracking and reporting at next Stewardship report
6 - 1.1.1.4	Uncommon plants	OGR - harvesting	Uncommon plant SOP, annual tracking and reporting at next Stewardship report
7 - 1.1.1.5a	Wildfire habitat	OGR - harvesting	Fire Salvage Planning and Operations - Directive No. 2007-01, reporting at next Stewardship report
8 - 1.1.1.5b	Blowdown habitat	OGR - harvesting	Forest Harvest Plan, reporting at next Stewardship report
9 - 1.1.1.6	Riparian habitat	OGR – harvesting & tending	OGR, reporting at next Stewardship report
10 - 1.1.2.1a	Stand level retention	OGR - harvesting	Structure retention strategy, reporting at FHP and next Stewardship report
11 - 1.1.2.1b	Downed woody debris	OGR - harvesting	OGR, reporting at next Stewardship report
12 - 1.1.2.2	Sensitive sites: mineral licks, nests, dens	OGR – harvesting & silviculture	OGR, SOP, reporting at next Stewardship report
13 - 1.1.2.3	Minimize watercrossing impacts	OGR - watercrossing	OGR, code of practice for watercourse crossings, reporting at next Stewardship report
14 - 1.2.1.1	Wildlife species and fish habitats	PFMS – wildlife strategies SHS, OGR: access	Follow SHS, access strategy, wildlife strategies (grizzly bear, caribou, barred owl) , report at next DFMP
15 - 1.3.1.1	In-situ genetic conservation	CPP, SHS	Coordinate with CPP partners, reporting at next Stewardship report
16 - 1.3.1.2	Ex-situ genetic conservation	CPP, seed requirements and collection	Collect seeds from under represented seed zones and species combination, reporting at next Stewardship report
17 - 1.4.1.1	Transboundary values	PFMS	GoA direction, reporting at next Stewardship report
18 - 2.1.1.1	Reforest all harvested areas	PFMS, OGR - silviculture	Annual Silviculture Plan, reporting at next Stewardship report
19 - 2.1.1.2	Obtain MAI targets	PFMS, regenerated yield curves, Annual Silviculture Plan	AOP, DFMP Silviculture direction, Annual Silviculture Plan, Plantation monitoring, reporting at next Stewardship report
20 - 2.1.2.1	Limit conversion of productive landbase	PFMS	GoA tracking of withdrawals, reporting at next Stewardship report
21 - 2.1.2.2	Track insect and disease	GoA health surveys	Reporting at next Stewardship report
22 - 2.1.3.1	Control non-native plants	Noxious weed program	SOP, tracking and reporting at next

VOIT	VOIT description	Influences what?	Strategy to implement
			Stewardship report
23 - 3.1.1.1	Minimize roading and bared area	OGR - access	OGR, FHP
24 - 3.1.1.2	Minimize soil erosion	OGR - soil guidelines	OGR, reporting at next Stewardship report
25 - 3.2.1.1	Limit water yield increases	PFMS, SHS	Follow SHS, reporting at next Stewardship report
26 - 3.2.2.1	Maintain riparian buffers	OGR – riparian, SHS	OGR, reporting at next Stewardship report
27 - 5.1.1.1a	Appropriate AAC	PFMS	DFMP approval
27 - 5.1.1.1b	Quadrant timber production	GDP	TPRS, reporting at next Stewardship report
28 - 5.2.1.1a	Reduce FBP in community zones	PFMS, SHS	Follow SHS, reporting at next Stewardship report
29 - 5.2.1.1b	Reduce FBP across the DFA	PFMS, SHS	Follow SHS, reporting at next Stewardship report
30 - 5.2.2.1	Effective communication	Operational planning (GDP, FHP, AOP)	DFMP Communications Implementation Plan, DFMP Chapter 7, reporting at next Stewardship report
31- 5.2.3.1	Maintain LRSYA	Regenerated yields, silviculture	Post harvest transitions, Silviculture plan, RSA program, reporting at next Stewardship report
32 - 6.1.1.1	First Nations Consultation	VOITs, PFMS	Consultation plan, Record of Consultation (ROC) log for the GDP
33 - 6.1.2.1	First Nations contract opportunities	Contract resources	Aboriginal Engagement Strategy, existing First Nations agreement, reporting at next Stewardship report
34 - 6.1.3.1	Cultural and significant FN sites	Operational planning (GDP, FHP, AOP)	Ongoing consultation, SOP (Historical Resources), reporting at next Stewardship report
35 - 6.2.1.1	Public input opportunities	Public consultation plan	Public Involvement Program, reporting at next Stewardship report

VOIT reporting is completed by Millar Western. Where indicated, all operators will provide the necessary data.

2.9 Strategies and Guidance

The following list represents some of the primary strategies and guidance documents that were developed as part of the DFMP process:

- AAC drain (section 4.1.2);
- DFMP Communications Implementation Plan (Appendix I);
- Strategy to address the MPB infestation (section 6.2);
- Woodland Caribou Habitat Strategy (Appendix III - Woodland Caribou Habitat Strategy);

- Grizzly Bear Habitat Strategy (Appendix IV - Grizzly Bear Habitat Strategy);
- Barred Owl Habitat Strategy (Appendix V – Barred Owl Habitat Strategy);
- Hydrologic Runoff - Equivalent Clearcut Area (ECA) (section 7.2 and 9.2.7);
- Fish Habitat – Athabasca Rainbow Trout and Arctic Grayling (section 9.2.7); and
- Structure Retention Strategy (Appendix II – Structure Retention Strategy).

2.10 Preferred Forest Management Scenario

The preferred forest management scenario (PFMS) is the outcome of the planning process and represents the forest management objectives and strategies developed for the 2017-2027 DFMP. VOITs guide both the development of the PFMS and its implementation. The PFMS is modeled in the forecasting stage and implemented using strategies and tactics described throughout Chapter 7. The AAC, SHS, road access, and harvesting and reforestation strategies are all part of the PFMS. The PFMS will be successfully implemented through the forest management strategies referenced in this chapter, enabling Millar Western to achieve its sustainable forest management objectives.

2.10.1 Annual Allowable Cut

The GoA establishes the annual allowable cut (AAC) based on the timber supply analysis, which is part of the PFMS. Upon approval of the timber supply analysis, an AAC will be established for FMUs W11 and W13 and allocated to each operator based on their timber rights. The AAC is regulated through 5-year quadrant cuts, determined by the GoA for each operator. Strategies for charging the timber harvested by each operator ("AAC drain") are included in section 4.1.2.

2.10.2 Spatial Harvest Sequence

The spatial harvest sequence (SHS) is a key component of the DFMP, providing linkages from the DFMP to operational planning and implementation on the ground. The SHS file describes the stands that are to be harvested over the first decade (*i.e.* timber years 2017 to 2026) and the stands that are likely to be harvested over the second decade (*i.e.,* timber years 2027 to 2036). Millar Western, Spruceland, Weyerhaeuser and the CTP program have been allocated stands from the SHS. The SHS is derived from the PFMS and is a reflection of the selected management strategies, VOITs and the AAC. Adherence to the SHS on the ground ensures that DFMP targets can be achieved.

3. Access Planning and Development

The planning, construction, maintenance and reclamation of access roads play key roles in forest management. The main function of roads is to transport the harvested timber from cutblocks to the mill in a safe and efficient manner. They also provide access for personnel and equipment for harvesting, scarification, reforestation and monitoring activities.

Road construction is essential for forestry operations; however, development of any type of access has implications on non-timber values. With this in mind, Millar Western strives to minimize the development of new permanent roads. Construction, maintenance and reclamation of roads must be conducted carefully, to reduce the potential for negative impacts on soil resources (*e.g.*, erosion, slumping), watercourses (*e.g.*, soil erosion into streams) and public safety.

3.1 Access Planning

Currently, a combination of forestry, oil and gas, municipal and provincial roads provide access to and throughout the DFMP area. In keeping with past practices, operators intend to limit construction of new permanent access within the DFMP area. MWFP, Weyerhaeuser, Spruceland and the CTPP operators conduct the majority of operations during the winter season, to help reduce the impact on soils and water courses. When non-frozen conditions permit, operators will utilize existing all-weather roads to the greatest extent possible. Access planning strategies are utilized by the operators to ensure planned access meets the following objectives:

1. Minimize area of productive forest lost to access development;
2. Integrate road use;
3. Maintain soil and water quality;
4. Maintain habitat, wildlife and other resource values (*i.e.*, limiting open access, timing access, etc.);
5. Provide safe roads for staff, contractors, other commercial users and the public;
6. Minimize access development costs; and
7. Minimize impacts to wetlands.

Access planning strategies include:

- Reuse of existing access;
- Improve/upgrade existing access (if required);
- Minimize length of new road construction;
- Joint access development;
- Minimize the number of watercourse crossings;
- Select appropriate watercourse crossing locations and structures;
- Incorporate best management practices, developed with Ducks Unlimited Canada (DUC);
- Reclaim decommissioned roads; and
- Follow requirements associated with access control, timing constraints, sightability, etc.

Strategies that address safety concerns include:

- Development of access suitable for expected traffic (season, type and volume);
- Appropriate road signage; and
- Stakeholder consultation/communication regarding log haul.

Although not anticipated for this DFMP, situations may arise where existing access options do not meet Millar Western's and/or the operators' requirements; should this occur, operators will evaluate options associated with establishing new permanent access (creation of a DLO).

Where new permanent access or upgrading is required, the following steps are taken to ensure that protection of forest, land and water resources is considered during the construction of new access:

- Construction of new, permanent access will be planned and presented as part of the GDP;
- Stream crossings will be constructed in a manner that minimizes risk of erosion and does not impede stream flow;
- Road construction and related stream crossing construction will follow rules and guidelines contained within the Timber Harvest Planning and Operating Ground Rules;
- All road construction activities will be reported annually in the road construction, maintenance and abandonment plan, submitted as a part of the GDP; and
- A summary of permanent all-weather forestry road and open seasonal/temporary forestry road construction undertaken for forestry operations within the FMA area will be summarized as part of the stewardship report.

Additional details regarding Millar Western's road planning, construction, maintenance, reclamation and monitoring can be found in Millar Western's environmental management system in the form of standard operating procedures (SOP), work instructions (WOI) and woodland operating guidelines (WOG).

3.2 Watercourse Crossings

When constructing watercourse crossings, operators will also consider the following, in addition to OGRs:

- Incorporate BMPs developed with DUC (see section 7.3.4); and
- ECA/Athabasca Rainbow Trout (see section 9.2.7).

3.3 Corridor Plan

Millar Western has reviewed the existing access infrastructure throughout the DFMP area and has concluded that there is no requirement for any significant additional corridor development during the DFMP period. Figure 7-1 shows the location of access corridors that will be utilized on the DFMP area, including access corridors in development or planned. Although not significant at the FMA scale, a small extension of existing access will be required for short term access to harvest blocks within the caribou zone in W11 (refer to Appendix III - Woodland Caribou Habitat Strategy).

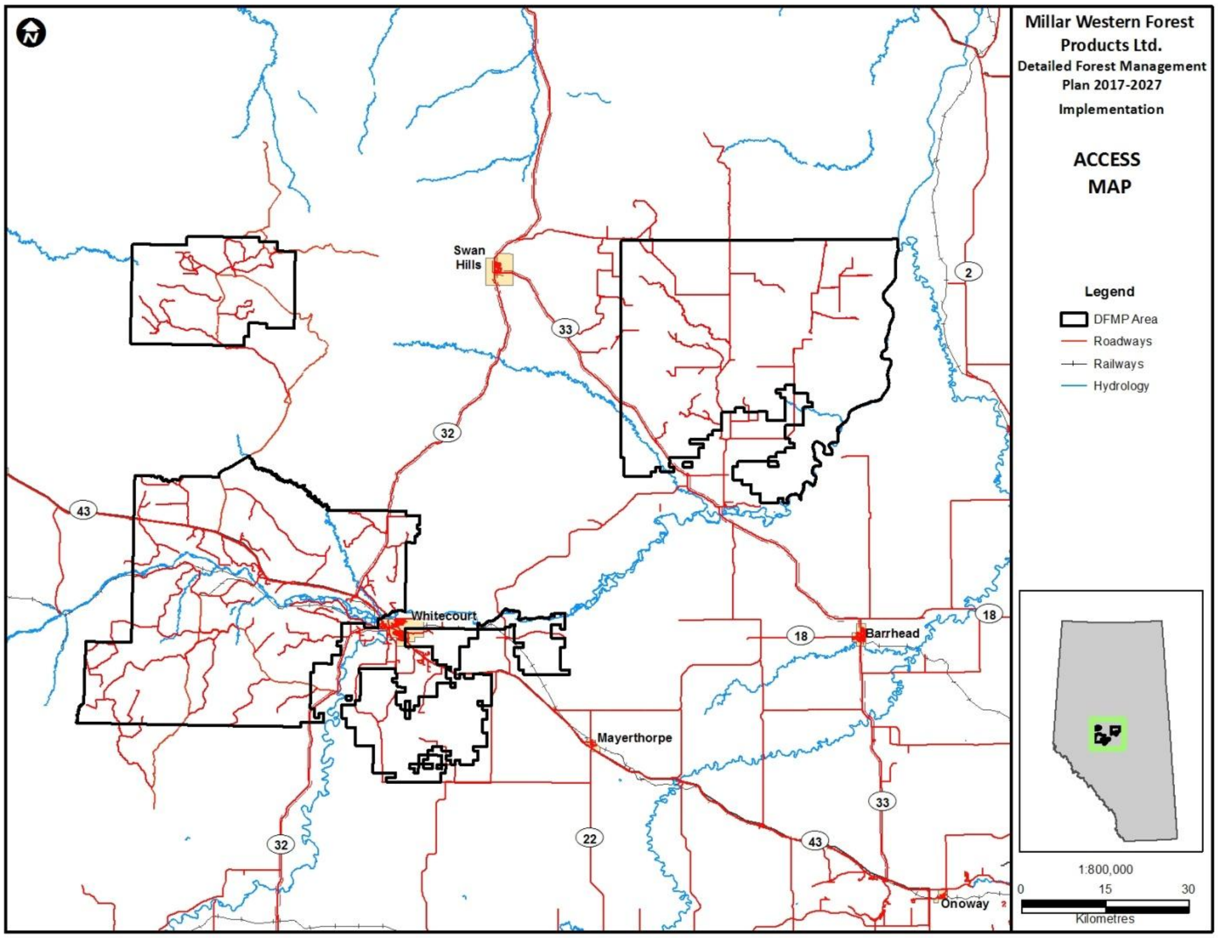


Figure 7-1. Millar Western's main access corridors

4. Timber Harvesting

4.1 Annual Allowable Cut

Upon the GoA's approval of the DFMP, AACs will be established from the recommended harvest levels associated with the PFMS.

4.1.1 Recommended AAC Levels

The recommended coniferous and deciduous AAC levels for the 2017-2027 DFMP period (May 1, 2017 to April 30, 2027) for FMUs W11 and W13, at 15/10/15 utilization, are summarised in Table 7-3. Further details on the harvest levels and AAC determination are documented in Chapter 6 - *PFMS*.

Table 7-3. Millar Western 2017-2027 DFMP Recommended AAC

Company Name	Disposition ID	Type	Recommended Allocation m³/yr	Period 1 [1] Carryover Volume (m³/yr)	Period 1 [1] Harvest Level (m³/yr)	Period 2 [2] Carryover Volume (m³/yr)	Period 2 [2] Harvest Level (m³/yr)
FMU W13							
Conifer Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	311,121	42,000	353,121	0	311,121
Millar Western Forest Products Ltd.	CTQW130001	Grazing [4]	5,879	0	5,879	0	5,879
CTP	[8(2)(d)(i)]	FMA	30,000	0	30,000	0	30,000
Total Coniferous			347,000	42,000	389,000	0	347,000
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	151,472	31,720	183,192	0	151,472
Millar Western Forest Products Ltd.	DTAW130002	Grazing [4]	6,528	0	6,528	0	6,528
Weyerhaeuser Company Ltd.	DTAW130001	FMU	45,000	20,280	65,280	0	45,000
Total Deciduous			203,000	52,000	255,000	0	203,000
FMU W11							
Conifer Allocations							
Spruceland Millworks Inc.	CTQW110008	FMU	103,000	22,674	125,674	22,674	125,674
Total Coniferous			103,000	22,674	125,674	22,674	125,674
Deciduous Allocations							
Millar Western Forest Products Ltd.	FMA9700034	FMA	113,894	26,000	139,894	0	113,894
Millar Western Forest Products Ltd.	DTAW110002	Grazing [4]	1,106	0	1,106	0	1,106
Total Deciduous			115,000	26,000	141,000	0	115,000
FMA							
Area Residents [3]	[8(2)(a)(i)]		1,000				

[1] Period 1: May 1, 2017 - April 30, 2022.
[2] Period 2: May 1, 2022 - April 30, 2027.
[3] Total volume of coniferous/deciduous (including birch); included in Millar Western FMA Volume
[4] Grazing volumes based on 20 year average harvest volume in PFMS
Conifer and Deciduous Utilization is 15/10/15
Volumes are reduced for Cull
Volumes have not been reduced for structure retention

4.1.2 AAC Drain

All timber harvested on the DFMP area will be charged according to the following procedures:

- ***Mill Deliveries*** – each operator must drain the volume harvested from W13 and/or W11 against their AAC allocation. This volume is determined through weigh scaling and sampling and reported into TPRS via a TM-7, which is generated monthly, or other GoA approved processes.
- ***Log Fill Volume*** – Each disposition holder will tally the number of log-fill crossings built each year. A volume per log fill will be calculated for both coniferous and deciduous timber and submitted on a TM-7 at the end of each timber year, or other date sanctioned by GoA, as long as all volume is reported by the end of the quadrant.
- ***Structure Retention*** - Refer to the Stand Level Structure Retention Strategy (Appendix II) for more details on procedures for the calculation of volumes to be drained. Structure retention volume is drained post harvest and submitted on a TM-7 by each disposition holder at the end of each timber year, or other date sanctioned by GoA, as long as all volume is reported by the end of the quadrant.
- ***Watercourse and Pipeline Crossings***- Each disposition holder will tally the number of crossings built each year. A volume per crossing will be calculated, for both coniferous and deciduous

timber and submitted on a TM-7 at the end of each timber year or other date sanctioned by the GOA, as long as all volume is reported by the end of the quadrant.

- ***Other Land-use Industrial Dispositions*** – Based on the assumption that all industrial salvage is directed to Millar Western, the company will drain 100% of the other land-use industrial dispositions. This volume is based on actual deliveries and is determined through weigh scaling and sampling and submitted on a TM-7 at the end of the timber year.

4.2 Harvest System and Methods

The DFMP area is composed of pure coniferous, pure deciduous, as well as mixedwood stands. Millar Western uses a clearcut harvest system with structure left standing throughout the harvest areas (structure retention). At roadside, Millar Western uses both tree-length and cut-to-length systems.

4.3 Spatial Harvest Sequence (SHS)

The SHS is a product of the DFMP process that supports non-timber values that have been modeled (*e.g.* Grizzly Bear, songbirds, etc.). Adherence to the SHS ensures these values are being maintained according to thresholds approved by the GoA. The SHS exists both as a physical paper map within the DFMP and in digital format. The SHS is divided into two periods: the first ten years (May 1, 2017 to April 30, 2027) and the second ten years (May 1, 2027 to April 30, 2037). Operators have been assigned SHS stands, dictating where harvesting will occur over the designated timeframes.

Factors outside of Millar Western's control (*e.g.* Mountain Pine Beetle, forest fires) may lead to SHS variances. If these variances occur, they will be managed through processes outlined in Millar Western's OGRs.

4.4 Harvest Season

Millar Western conducts most of its harvest operations during the winter (November 1 to March 31), to minimize soil disturbance. This is the most likely time for soils to be dry or frozen, which reduces their susceptibility to compaction and erosion. Any harvesting that occurs during the summer months will be conducted in areas that have soil characteristics that are naturally resistant to disturbance.

Focusing harvesting efforts in the winter also allows Millar Western to construct lower grade roads that minimize disturbance, to further avoid the potential for environmental impacts.

4.5 In-block Roads and Landings

Conducting forest harvesting operations requires development of temporary roads and landings within harvest blocks. Millar Western will attempt to minimize the amount of area that is disturbed during operations. In-block roads and landings are considered part of the block for silviculture operations and are reforested along with the rest of the block. They are also considered part of the block when RSA surveys are completed.

4.6 Structure Retention

Emulating natural disturbances is a key component of sustainable forest management. For the boreal forest of Alberta, the predominant natural disturbance agent is fire. Historical fire patterns and the forest structures and patterns they produce are commonly used as a guide for replicating natural disturbance. Retention of structure is a component of natural disturbance, since wildfire often leaves patches of standing trees throughout the disturbance. Since forest harvesting targets merchantable trees for removal, the availability of the biologically beneficial attributes of these trees could become significantly reduced within harvested areas, unless specific provision is made to retain them. Millar Western, in conjunction with the PDT, developed a Structure Retention Strategy to guide retention placement, measurement and reporting, and reconciliation of merchantable timber volumes harvested in the DFMP area.

The Structure Retention Strategy applies to all timber operators harvesting in the DFMP area. For more information, refer to the Structure Retention Strategy in *Appendix II – Structure Retention Strategy*.

4.7 Block Inspections

The GoA requires that companies carry out inspections of active timber operations and report this information to GoA, to demonstrate compliance with the OGRs. Minimum inspection criteria have been identified by the GoA and include:

- Area associated with in-block roads and landings;
- Presence of rutting;
- Adherence to utilization requirements;
- Maintenance of riparian buffers;
- Adherence to structure retention targets; and
- Adherence to any special conditions.

Millar Western continually monitors its harvest and silviculture operations, to ensure compliance with the Timber Harvest Planning and OGRs, and conducts formal GoA-required post-harvest inspections.

4.8 Non-Timber Values

Non-timber values were addressed during the development of the SHS but must also be addressed during forest harvest plan development and during harvesting. In addition to the Operating Ground Rules, DFMP specific strategies were developed to guide harvesting. These strategies must be reviewed and incorporated in harvest planning:

- Strategy to address the MPB infestation (section 6.2);
- Woodland Caribou Habitat Strategy (Appendix III - Woodland Caribou Habitat Strategy);
- Grizzly Bear Habitat Strategy (Appendix IV - Grizzly Bear Habitat Strategy);
- Barred Owl Habitat Strategy (Appendix V – Barred Owl Habitat Strategy);

- Fish Habitat – Athabasca Rainbow Trout and Arctic Grayling (section 9.2.7); and
- FIreSmart strategy (Appendix VII – GoA FireSmart Management Report).

5. Silviculture Program

Millar Western's silviculture program relies on both pre- and post-harvest field assessments, to ensure that silviculture decisions made are appropriate for site conditions. Post-silviculture treatment assessments, such as survival surveys, are also utilized, providing timely feedback on success of reforestation treatments.

Building on Millar Western's experience and expertise in successful reforestation, this section formalizes the company's silviculture program for the DFMP area, outlining the types of sites that will be harvested, the reforestation objectives for those sites, and the treatments will be utilized to achieve the reforestation objectives. Silviculture strategies are aligned with harvesting and strata transitions used in the PFMS (Chapter 6) and TSA (Annex VI).

5.1 Reforestation

5.1.1 Objectives

The reforestation objectives of Millar Western are twofold:

- To ensure that harvested areas are established and grow according to the assumptions used in forecasting and the PFMS. AAC is based on these assumptions, so sustainability will only be achieved if the actual stand growth meets the yield assumptions in the PFMS; and
- To ensure that the legislated requirements are met as per the Forests Act, the Timber Management Regulations and the Forest Management Agreement.

5.1.2 Responsibility

Reforestation responsibility will rest with the operator that harvests a particular opening. In W11, it is understood that Spruceland is liable for reforesting all the conifer landbase, and Millar Western is responsible for harvesting all the deciduous landbase. It is common, however, for each operator to sequence and harvest non-target strata as part of the block design process. To help prevent an operator from ending up with large amounts of non-target strata to reforest, Millar Western and Spruceland have been completing a joint landbase balancing exercise in W11. Often, the amount of incidental deciduous area harvested by Spruceland offsets the amount of incidental conifer area harvested by Millar Western. This minimizes the need to change who is responsible for reforestation liability. In situations where the landbase areas do not balance between companies, required liability changes will be completed through an AOP amendment request signed by both parties.

5.1.3 Growth Targets

Reforestation targets applicable to the PFMS were developed following the policies described in the GoA's Reforestation Standard of Alberta (RSA). Targets are expressed as Mean Annual Increment (MAI) values for each of the reforested strata (Table 7-4). All operators are required to adhere to the currently approved RSA program to manage MAI targets.

Table 7-4. RSA MAI performance targets

FMU	Stratum	Treatment	Curve Type	Culmination			
				Age	MAI (m^3/ha/y)		
					CON	DEC	Total
W11	AW	Normal	Basic	77	0.53	2.28	2.81
	AP	Normal	Basic	145	1.01	1.08	2.09
	AS	Normal	Basic	122	1.35	1.33	2.68
	PA	Normal	Basic	106	1.44	1.15	2.59
	SA	Normal	Basic	132	1.60	1.09	2.69
	PL	Normal	RSA	92	3.14	0.89	4.03
	SW	Normal	RSA	100	2.78	0.91	3.68
W13	AW	Normal	Basic	94	0.55	2.78	3.33
	AP	Normal	RSA	86	2.71	1.72	4.43
	AS	Normal	RSA	98	2.18	1.83	4.02
	PA	Normal	RSA	89	2.93	1.44	4.37
	SA	Normal	RSA	98	2.57	1.36	3.93
	PL	Normal	RSA	83	4.20	0.34	4.54
	SB	Normal	Basic	153	1.47	0.13	1.59
	SW	Normal	RSA	97	3.11	0.74	3.85
	SW	Tree Improvement	RSA TI	97	3.23	0.74	3.97

In addition to the above MAI targets, the operators are expected to meet species proportions for conifer and deciduous, as detailed in each of the regenerated stand trajectories documented in the silviculture matrix (Table 7-6).

5.1.4 Composition Targets

Generally, the operators' regeneration programs within the DFMP area are designed to create regenerating stands that are similar in composition to the pre-harvest stand, while incorporating RSA requirements. Table 7-5 identifies the planned transitions, from the pre-harvest strata to post-harvest strata during the DFMP period. These transitions are an integral part of the forest management strategy that was incorporated into the PFMS. They were intended to provide direction for silviculture program implementation, however, to simplify modeling requirements and to address difficulties in spatially identifying treatments, not all of the transitions were included in the PFMS modeling. The DFMP commitment is to apply the silviculture treatments and transitions identified in the following section.

5.1.5 Transition Matrix

Millar Western is proposing, in this DFMP, to make four strata transitions in W13 (see Appendix VIII – Regeneration Transition Matrix for W13). An estimated 1,895 hectares of transitions have been proposed (less than 200 hectares per year). The actual transition area will depend on the areas sequenced for harvesting. It is Millar Western's intention to apply the percentage transitions to the total strata area harvested; therefore, the estimated transition area may vary from the above estimate. These strata transitions were proposed for three main reasons:

- to promote ecosystem health and productivity;
- to facilitate regeneration and minimize herbicide use; and
- to offset non-desirable transitions from the previous DFMP.

Table 7-5 summarizes the proposed regeneration matrix for W13 and includes strata transitions based on percentage of area harvested for AW, AP, SB and DU strata. The proposed transitions will be carried out by Millar Western and would not apply to any other tenure holder.

These proposed strata transitions will be modeled for the 2017-2027 DFMP period only. There will be no assumption of any strata transitions beyond 2027.

Table 7-5. Summary of proposed regeneration matrix for W13

Harvested Strata	AW	AP	AS	PA	SA	PL	SW	SB	DU
AW	81%						19%		
AP		50%				50%			
AS			100%						
PA				100%					
SA					100%				
PL						100%			
SW							100%		
SB						60%		40%	
DU					100%				

The AW transition is intended to convert open, grassy aspen stands that are moving towards non-forested cover to productive coniferous stands.

The AP transition is proposed in consideration that true dispersed AP stands rarely exist in nature, since both species are shade-intolerant and early successional. Forcefully initiating these stands requires the use of imazapyr herbicide, which persists on site for longer than is desirable, or wide-spread pine planting that usually succumbs to aspen competition. Millar Western will transition 50% of the AP strata to pine and allow for aspen and pine stands to develop separately.

The SB transition aims to capture the natural trajectory of pine-initiated stands, which eventually fill in with a black spruce understory. In the previous DFMP, a large amount of what was previously a PL stratum was classified SB strata as a result of the stand compositing rules that were employed. Struggling to establish black spruce on these high, dry pine landscapes is ineffectual, so Millar Western will convert them back to upland pine sites (which will eventually gain natural black spruce ingress).

The DU transition is intended to offset the loss of conifer growing stock from the natural succession of DU stands to AS or SA as the overstory degenerates. Areas harvested from this stratum will be converted to SA.

5.2 Treatments

5.2.1 Silviculture Systems

Clearcutting followed by reforestation is the primary silviculture system employed in the DFMP area. Most harvested areas will be replanted to ensure rapid initiation of reforestation. On recently harvested areas in the DFMP area, this has represented approximately 2,000 hectares per year, with approximately 30% planted to white spruce and 70% planted to lodgepole pine. Deciduous stands do not require planting and are successfully regenerated naturally through suckering. This treatment is referred to as deciduous Leave for Natural (LFN).

The operators intend to meet the commitments made in Table 7-6 for W13 and Table 7-7 for W11; however, in some cases, a species may be planted that was not originally on site. This may be done for a variety of reasons, such as:

- Ecological site conditions;
- Reforestation strata balancing requirements;
- Insect or disease considerations;
- DFMP strata transitions assumptions;
- To accommodate other values (e.g., caribou habitat); or
- Availability of seedlings.

A summary of the proposed silviculture treatments, by strata, is presented in Table 7-6 for W13 and Table 7-7 for W11.

Table 7-6. Silviculture Matrix for W13

Managed FMP Yield Strata	Managed FMP Yield Strata Landbase Designation Code	FMP Yield Strata Transistion Sources (Mature Stands)	Stand Structure (Species Proportions)	Limitations to Crop Establishment (Site, Climate)	Silviculture System	Site Preparation	Seedling Establishment (includes LFN)	Seedling Density (SPH Target per Species Type)	Reforestation Phase Intervention (Post-seedling establishment)
AW - Basic - FMU W13		AW - Natural - FMU W13	>= 80% Deciduous	Low Vigour of Suckering, Wet Soils, Compaction	Clearcut with retention/Coppice	None	LFN for Deciduous Avoidance/ Natural Ingress for Conifer	10,000 stems/ha deciduous 1000 stems/ha conifer on roads and burn piles	None
AP - Post-91 RSA - FMU W13		AP - Natural - FMU W13	>=50% Deciduous >=30% Conifer (Pl Leading)	Low Vigour of Aspen Grass Competition	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1000-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >2000 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
AS - Post-91 RSA - FMU W13		AS - Natural - FMU W13	>=50% Deciduous >=30% Conifer (Sw Leading)	Low Vigour of Aspen Grass Competition Cold/wet soils	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1000-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >2000 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
PA - Post-91 RSA - FMU W13		PA - Natural - FMU W13	>=50% Conifer (Pl leading) >=30% Deciduous	Grass and Broadleaf Competition	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1200-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >1800 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
SA - Post-91 RSA - FMU W13		SA - Natural - FMU W13 DU - Natural - FMU W13	>=50% Conifer (Sw Leading) >=30% Deciduous	Grass and Broadleaf Competition	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1200-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >1800 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
PL - Post-91 RSA - FMU W13		AP Natural - FMU W13 PL - Natural - FMU W13 SB - Natural - FMU W13	>= 80% Conifer (Pl Leading)	Broadleaf, grass and herbaceous competition	Clearcut with retention	1) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, 2) Chem Site Prep to control competition, 3) Drag Scarification to expose mineral soil and distribute cones, or 4) None (where appropriate)	Planting or LFN-Seeding for Conifer LFN for Dec	1400-1800 stems/ha of conifer 0-1000 stems/ha deciduous	Fill plant LFN areas Chemical Stand Tending PCT in over-dense stands (post yr-14) Fill plant areas with low survival
SW - Post-91 RSA - FMU W13		SW - Natural - FMU W13 AW - Natural - FMU W13	>= 80% Conifer (SW Leading)	Broadleaf, grass and herbaceous competition Cold/wet soils	Clearcut with retention	1) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, 2) Heavy Mech SP - PLRW (elevated microsite) to warm soils, control grass and enhance growth, 3) Chem Site Prep to control competition, or 4) None (where appropriate)	Planting Conifer LFN for Dec	1400-1800 stems/ha of conifer 0-1000 stems/ha deciduous	Chemical Stand Tending Fill plant areas with low survival
SW - Post-91 TI_RSA - FMU W13		SW - Natural - FMU W13 AW - Natural - FMU W13	>= 80% Conifer (Sw Leading)	Broadleaf, grass and herbaceous competition Cold/wet soils	Clearcut with retention	1) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, 2) Heavy Mech SP - PLRW (elevated microsite) to warm soils, control grass and enhance growth, 3) Chem Site Prep to control competition, or 4) None (where appropriate)	Planting of Improved Stock for Conifer LFN for Dec	1400-1800 stems/ha of conifer 0-1000 stems/ha deciduous	Chemical Stand Tending Fill plant areas with low survival
SB - Basic - FMU W13		SB - Natural - FMU W13	>= 80% Conifer (Sb Leading)	High Water Table Cold/wet soils	Clearcut with retention	1) Excavator Mounding or 2) None (where appropriate)	Planting Conifer LFN for Dec	1200-1400 stems/ha of conifer 0-1000 stems/ha deciduous	Fill plant areas with low survival
Roads - FMU W13		ALL - Natural - FMU W13	>= 80% Conifer (Sw or PL Leading)	Compacted Soils Drought Susceptibility	Clearcut with retention	1) Light Ripping or 2) None (where appropriate)	Planting Conifer LFN for Dec	1000-1800 stems/ha of conifer 0-1000 stems/ha deciduous	Fill plant areas with low survival

Table 7-7. Silviculture Matrix for W11

Managed FMP Yield Strata	Managed FMP Yield Strata Landbase Designation Code	FMP Yield Strata Transition Sources (Mature Stands)	Stand Structure (Species Proportions)	Limitations to Crop Establishment (Site, Climate)	Silviculture System	Site Preparation	Seedling Establishment (includes LFN)	Seedling Density (SPH Target per Species Type)	Reforestation Phase Intervention (Post-seedling establishment)
AW - Basic - FMU W11		AW - Natural - FMU W11	>= 80% Deciduous	Low Vigour of Suckering, Wet Soils, Compaction	Clearcut with retention/ Coppice	None	LFN for Deciduous Avoidance/ Natural Ingress for Conifer	10,000 stems/ha deciduous 1000 stems/ha conifer on roads and burn piles	None
AP - Basic - FMU W11		AP - Natural - FMU W11	>=50% Deciduous >=30% Conifer (Pl Leading)	Low Vigour of Aspen Grass Competition	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1000-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >2000 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
AS - Basic - FMU W11		AS - Natural - FMU W11	>=50% Deciduous >=30% Conifer (Sw Leading)	Low Vigour of Aspen Grass Competition Cold/wet soils	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1000-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >2000 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
PA - Basic - FMU W11		PA - Natural - FMU W11	>=50% Conifer (Pl leading) >=30% Deciduous	Grass and Broadleaf Competition	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1200-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >1800 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
SA - Basic - FMU W11		SA - Natural - FMU W11	>=50% Conifer (Sw Leading) >=30% Deciduous	Grass and Broadleaf Competition	Clearcut with retention	1) Chem Site Prep to control competition, or 2) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, or 3) None (where appropriate)	Planting Conifer LFN for Dec	1200-1400 stems/ha of conifer depending on aggregation pattern (ie. higher densities in pure conifer sections of block) >1800 stems/ha deciduous	Chemical stand tending to maintain conifer component Fill plant areas with low survival
PL - Post-91 RSA - FMU W11		PL - Natural - FMU W11	>= 80% Conifer (Pl Leading)	Broadleaf, grass and herbaceous competition	Clearcut with retention	1) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, 2) Chem Site Prep to control competition, 3) Drag Scarification to expose mineral soil and distribute cones, or 4) None (where appropriate)	Planting or LFN-Seeding for Conifer LFN for DEC	1400-1800 stems/ha of conifer 0-1000 stems/ha deciduous	Fill plant LFN areas Chemical Stand Tending PCT in over-dense stands (post yr-14) Fill plant areas with low survival
SW - Post-91 RSA - FMU W11		SW - Natural - FMU W11	>= 80% Conifer (Sw Leading)	Broadleaf, grass and herbaceous competition Cold/wet soils	Clearcut with retention	1) Light Mech SP - DIPO (mixing) or MODO (elevated microsite) to enhance growth, 2) Heavy Mech SP - PLRW (elevated microsite) to warm soils, control grass and enhance growth, 3) Chem Site Prep to control competition, or 4) None (where appropriate)	Planting Conifer LFN for Dec	1400-1800 stems/ha of conifer 0-1000 stems/ha deciduous	Chemical Stand Tending Fill plant areas with low survival
Roads - FMU W11		ALL - Natural - FMU W11	>= 80% Conifer (Sw or PL Leading)	Compacted Soils Drought Susceptibility	Clearcut with retention	1) Light Ripping or 2) None (where appropriate)	Planting Conifer LFN for Dec	1000-1800 stems/ha of conifer 0-1000 stems/ha deciduous	Fill plant areas with low survival

5.2.1.1 Understory Avoidance

Where possible, Millar Western applies understory avoidance during harvesting. This allows for advanced regeneration within the stand and supports structure retention objectives.

5.3 Reforestation Prescriptions

5.3.1 Pre and Post-Harvest Assessments

Millar Western's reforestation program begins with a pre-harvest assessment for every block scheduled for harvesting. The pre-harvest assessment reviews the current vegetative and site conditions of the proposed block to provide information needed for planning silviculture treatments. Pertinent information collected includes:

- Stand composition and ecosite type;
- Soil texture and moisture;
- Site drainage;
- Understory species and density; and
- Vegetative competition (bluejoint reedgrass (*Calamagrostis canadensis*)).

Immediately following harvest, the block is inspected to confirm, refine, or revise information collected during the pre-harvest assessment. The post-harvest inspection also provides the opportunity to assess debris and retention conditions, which may impact the final silviculture prescription. Using the information collected during the pre- and post-harvest assessments, Millar Western completes an annual strata balancing process (as per GoA requirements) for the population of harvested blocks in the FMU, for the operating year. Once this process is complete, a regeneration stratum and generic establishment regime (GER) is assigned to each block.

5.3.2 Generic Establishment Regimes

Millar Western employs generic establishment regimes (GERs) to guide its silvicultural practices. GERs are silviculture prescriptions designed to ensure that the growth and yield targets, both in the RSA and the applicable DFMP, are realized in the field.

GERs use TPR (timber productivity rating), regeneration stratum, and management intensity to prescribe the site preparation, planting, tending and survey activities required to meet or exceed the intended yield expectations for the regeneration stratum.

The GERs listed in Table 7-8 are drawn from operational practice – in effect, they capture the current silviculture practices of Millar Western. Since they were derived from practice, it is reasonable to assume they will attain the desired growth and yield outcomes, and that the timelines associated with the GERs are operationally sound.

The GERs are intended to be a guideline for use by silviculturalists and reflect an average treatment regimen that would apply to most sites in that category. Block specific treatments are expected to vary somewhat from those outlined in the GER based on site-specific conditions. GERs are in no way intended to override field level decisions and do not restrict silviculture practitioners from making site-specific changes to the prescriptions where appropriate.

Table 7-8. Generic establishment regimes for 2017 to 2027 DFMP

Management Intensity	Establishment Regime	Strata	TPR	Year	Mth	Activity	Treatment Type	Density	Species	% Area Treated
Basic	BA-1	AW	All	2	5	Planting	PlantRoadsPiles	1000	SW	7%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-2	PL	F	1	5	Planting	Plant	1400	PL	93%
				2	5	Planting	PlantRoadsPiles	1400	PL	7%
				3	8	Tending	Aerial Chemical			20%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-3	PL	F,M	1	6	Site Preparation	Heavy Drag (DRHV)			80%
				2	5	Planting	PlantRoadsPiles	1000	PL	7%
				4	9	Survey	Survival			100%
				5	6	Planting	FillPlant	1400	PL	25%
				6	8	Tending	Aerial Chemical			40%
				8	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-4	SW	F	1	5	Planting	Plant	1400	SW	93%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				3	8	Tending	Aerial Chemical			20%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-6	PA	F,M,G	1	5	Planting	Plant	1400	PL	53%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			40%
				4	8	Tending	Aerial Chemical			20%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-9	SA	F,M,G	1	5	Planting	Plant	1400	SW	53%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			40%
				4	8	Tending	Aerial Chemical			20%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-11	AP	F,M,G	1	5	Planting	Plant	1400	PL	33%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			35%
				2	9	Survey	Survival			100%
				4	8	Tending	Aerial Chemical			20%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-14	AS	F,M,G	1	5	Planting	Plant	1400	SW	33%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			35%
				4	8	Tending	Aerial Chemical			20%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Basic	BA-15	SB	F,M,G	1	5	Planting	Plant	1400	SB	93%
				2	5	Planting	PlantRoadsPiles	1400	SB	7%
				2	8	Tending	Aerial Chemical			15%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Enhanced	EN-2	PL	M	1	5	Planting	Plant	1400	PL	93%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			80%
				4	8	Tending	Aerial Chemical			40%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%

Management Intensity	Establishment Regime	Strata	TPR	Year	Mth	Activity	Treatment Type	Density	Species	% Area Treated
Enhanced	EN-3	PL	G	1	5	Planting	Plant	1400	PL	93%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			90%
				2	9	Survey	Survival			100%
				4	8	Tending	Aerial Chemical			60%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Enhanced	EN-4	SW	M	1	5	Planting	Plant	1400	SW	93%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			80%
				4	8	Tending	Aerial Chemical			40%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Enhanced	EN-5	SW	G	1	5	Planting	Plant	1400	SW	93%
				2	5	Planting	PlantRoadsPiles	1400	SW	7%
				2	8	Tending	Aerial Chemical			90%
				2	9	Survey	Survival			100%
				4	8	Tending	Aerial Chemical			60%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Intensive	IN-1	PL	M	1	5	Site Preparation	Disc Trenching (DIPO)			90%
				1	6	Planting	Plant	1800	PL	93%
				2	5	Planting	PlantRoadsPiles	1800	SW	7%
				2	8	Tending	Aerial Chemical			80%
				4	8	Tending	Aerial Chemical			40%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Intensive	IN-2	PL	G	1	5	Site Preparation	Disc Trenching (DIPO)			90%
				1	6	Planting	Plant	1800	PL	93%
				2	5	Planting	PlantRoadsPiles	1800	SW	7%
				2	9	Survey	Survival			100%
				3	8	Tending	Aerial Chemical			90%
				5	8	Tending	Aerial Chemical			60%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Intensive	IN-4	SW	M	1	5	Site Preparation	Disc Trenching (DIPO)			90%
				1	6	Planting	Plant	1800	SW	93%
				2	5	Planting	PlantRoadsPiles	1800	SW	7%
				2	8	Tending	Aerial Chemical			80%
				4	8	Tending	Aerial Chemical			40%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%
Intensive	IN-6	SW	G	1	5	Site Preparation	Disc Trenching (DIPO)			90%
				1	6	Planting	Plant	1800	SW	93%
				2	5	Planting	PlantRoadsPiles	1800	SW	7%
				2	9	Survey	Survival			100%
				3	8	Tending	Aerial Chemical			90%
				5	8	Tending	Aerial Chemical			60%
				7	5	Survey	Establishment			100%
				12	9	Survey	Performance			100%

Notes:

1) Strata - Tree Type and Regen Standard Balancing (AP - Aspen/Pine, AS - Aspen/Spruce, AW - Aspen, PA - Pine/Aspen, PL - Lodgepole Pine, SA - Spruce/Aspen, SB - Black Spruce, SW - White
2) TPR - Timber Production (F - Fair, M - Medium, G - Good)
3) Year is based on the forestry year and month is based on the calendar year
4) The months for year 1 would proceed as follows 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 1-12, 1-1, 1-2, 1-3 and 1-4

GERs are classified into one of three management intensities: basic (BA), enhanced (EN) and intensive (IN).

- **Basic GERs** are prescribed on sites where the intensity of management is intended to be lower. This occurs on sites with limited productive capacity and on sites where the intended stratum contains an abundance of deciduous, thereby reducing the potential return on silvicultural investment. The latter condition applies to mixedwood and aspen strata types, where the primary objective is to achieve the proper species composition rather than maximizing conifer growth rates.
- **Enhanced GERs** are prescribed on sites regenerated to conifer that are on medium (and to a lesser extent, good) TPR sites. These are the GERs that are most widely prescribed and are aimed at producing conditions that favour rapid, unimpeded growth. Trees are planted at a density that is expected to result in an overall stocking level that meets or surpasses legal requirements. To the extent that seedling survival is not compromised, some competing vegetation is permitted.
- **Intensive GERs** are prescribed on sites regenerated to conifer that are on good (and to a lesser extent, medium) TPR sites. These GERs are typically prescribed on the best sites and are intended to produce conditions favourable for optimum growth and rapid site occupancy. They include site preparation and higher planting densities. The intent of these GER's is to produce plantations that will yield merchantable timber as soon as possible and that are suitable for future EFM (specifically commercial thinning). These stands are assessed more regularly for seedling survival and competition levels. Strict competition control is employed on these sites so that overall growth can be maximized.

5.3.3 Silvicultural Treatments

5.3.3.1 Deciduous Leave for Natural

Aspen is the primary merchantable deciduous species harvested by Millar Western[1]. Aspen suckers arise from dormant, adventitious stem buds on the root system. Sucker buds are maintained in a dormant condition by polar transport of auxins (hormones) in active stems. Therefore, when stems are cut down and polar transport of auxins is prevented, sucker buds are no longer inhibited and begin to grow, emerging from the soil as new aspen stems. Sucker regeneration usually results in large numbers of individual stems, which are dramatically reduced over time by a variety of environmental factors including herbivory, disease, insect outbreaks, and intraspecific competition. The cumulative effect of these stressors is to reduce aspen sucker density dramatically in the period three to seven years after cutting. Termed "self-thinning", this phenomenon is critical to young aspen becoming a viable crop.

Due to this suckering nature of aspen and the generally limited success in planting aspen, it is reforested by relying on the emergence of suckers – this is the process known as Leave for Natural (LFN) reforestation. This approach is the most successful means of reforesting aspen; however, it is dependent on several conditions:

[1] Balsam poplar is harvested as well, but the silvics are similar enough that the treatment is often the same.

- Adequate vigorous aspen must be present on the site prior to harvest to provide a source for suckers;
- Soil compaction must be avoided to ensure suckers are not physically damaged. Soil compaction is of particular concern when harvesting operations are undertaken on unfrozen, fine textured, or at- or above- field capacity soils. In places where compaction is unavoidable (roads and landings), Millar Western plants coniferous seedlings; and
- Since aspen suckering depends on relatively high soil temperatures to stimulate sucker buds, slash loading that insulates the soil must be avoided. For this reason, Millar Western does not de-limb aspen at the stump and ensures harvest slash and debris are piled and burned on roads and landings after harvest.

Mature aspen stands with a significant bluejoint reedgrass (*Calamagrostis canadensis*) understory pose an issue for LFN regeneration. After harvesting, this highly competitive grass species effectively overwhelms the site with massive reproduction from rhizomes. When regenerating coniferous stands, Millar Western can successfully manage bluejoint reedgrass with herbicide prior to planting coniferous seedlings, but with deciduous LFN, herbicide application would also affect the aspen suckers. Therefore, Millar Western's best option in these areas is usually to apply herbicide and replant with coniferous seedlings, rather than attempting to regenerate a deciduous stand.

5.3.3.2 Coniferous Leave for Natural

Lodgepole pine and jack pine, common throughout the DFMP area, have evolved mechanisms to ensure their continued survival in the face of forest fires. In particular, the cones of these species are usually serotinous; that is, the scales are stuck firmly together by a resin and the seeds are sealed within the cones. The heat generated by a forest fire causes the cones to open and release large numbers of seeds at one time. This allows lodgepole and jack pine to quickly colonize recently burned areas as an early successional species.

Forest managers may take advantage of this cone characteristic to reforest a cutblock following harvest. A mechanical site preparation method (usually drag scarifying) is used to expose and mix the surface soil horizons, and to scatter the cones left on the ground surface following harvest. The heat from the sun combined with the low albedo of the exposed black mineral soil is sufficient to open the serotinous cones, releasing the seed. Due to the early successional nature of lodgepole and jack pine, these released seeds grow quickly into established seedlings, eliminating the need to plant.

5.3.3.3 Site Preparation

A primary function of site preparation is to ameliorate fundamental soil and site conditions that may limit tree seedling establishment or growth, such as wet soil, periodic flooding, cold soil, inadequate soil nutrients, slash loading, and competing vegetation. Site preparation is also prescribed as a means to enhance seedling growth rates on productive sites and to expose mineral soil for seed germination on leave for natural sites. Site preparation is scheduled following the post-harvest assessment and is typically completed within a year of harvest completion. Millar Western employs several broad categories of site preparation:

- **Large, elevated microsites (excavator mounding)** produce favourable planting microsites in areas with poor soil drainage and/or risk of flooding. They also provide some measure of bluegrass reedjoint control for up to 2-3 years on nutrient-poor sites;
- **Small, elevated microsites and mixing treatments** are produced with various equipment and techniques, including Donaren mounding and disc trenching. The combined outcome of mixing the surface humus layers and mineral soil and creating small elevated microsites results in planting locations that are warmer, drier, and better aerated than the original soil profile, with enhanced soil moisture holding capacity and nutrient availability;
- **Raking treatments** are completed to remove slash from the cutblock, and are performed by small cats or tracked hoes mounted with brush rakes or large cats mounted with shear blades. Slash is amalgamated into piles that are subsequently burned;
- **Ripper plow treatments** are a more aggressive form of site preparation that creates large linear berms and a relatively deep furrow. They are typically reserved for blocks with very aggressive (often woody) competition, or blocks with high water tables or thick organic layers that require elevated planting sites. This form of site preparation is carried out mainly in the winter on frozen ground, and is frequently employed in “winter-only” access areas that require site preparation.
- **Dragging treatments** are completed on LFN blocks where the intent is to align cones and expose mineral soil to create an amenable environment for natural seeding. Dragging is usually accomplished using large chains and shark-finned barrels.
- **Chemical site preparation** includes herbicide applications to manage vegetative competition, especially bluejoint reedgrass. Chemical site preparation may also be chosen when later chemical tending treatments would not be plausible. For example, aspen stocking and density are known to be less negatively affected by early broadcast herbicide treatments than later tending treatments.

5.3.3.4 Planting

The current silviculture literature and operational experience at Millar Western support timeliness in all reforestation activities as the key ingredient in silvicultural success. In a broader sense, timeliness and integration of treatments achieves the most effective reforestation.

At Millar Western, timeliness means deploying silvicultural treatments before the condition they are intended to address has had an opportunity to negatively impact seedling growth. In terms of planting, it means that cutovers are planted before competing vegetation is fully established. This provides conifer seedlings an opportunity to establish in a somewhat less competitive environment. Further, conifer seedlings are afforded an opportunity to capitalize on the Assart effect (that is, they benefit from the flush of nutrients released by decomposing vegetative material immediately after forest harvesting.)

Operationally, FMA holders are required to reforest within two years of harvest. Millar Western’s philosophy of timeliness means that most blocks are planted well before this deadline (often the spring or summer after harvest). Along with cutblock areas, roads, landings and inactive seismic lines that are no longer required for access are also planted.

5.3.3.5 Stand Tending

Millar Western’s Vegetation Management Guidelines incorporate an autecology-based community assembly driven approach to vegetation management for forest renewal. The decision to prescribe a vegetation management treatment is based on the autecological characteristics of the crop (white spruce, lodgepole pine, black spruce) and competing (aspen, balsam poplar, bluejoint reedgrass, willow and alder) species. Crop tolerance to competition and impact of competing species on availability of light, moisture regime and nutrients are also factored into the decision making process.

The Vegetation Management Guidelines contain detailed decision trees for each broad cover group that guide stand tending activities. These decision trees factor in species, crop tree size, grass cover, deciduous cover and density, low shrub cover and various site level constraints (e.g. standing water, streams, residual trees), to arrive at the appropriate stand tending prescription.

Millar Western believes prompt stand tending is critical to reforestation success and to achieving the species proportion targets in the PFMS. Previous silviculture experience within the DFA indicates that most conifer and mixedwood blocks require a stand tending treatment at some point, even if just within a small portion of the block. This is reflected in the GERs, which generally prescribe a stand tending treatment of some sort. The actual need for stand tending and the nature and extent of the treatment are always based on field level observations. To this end, Millar Western conducts regular aerial assessments of its cutblocks to determine the general status of the reforestation and to identify areas that may benefit from a release treatment. Where necessary, ground checks are incorporated to confirm seedling conditions and the severity of the competition.

Figure 7-2 shows the Vegetation Management Process employed by Millar Western. The flow diagram shows how the GERs and the biology (autecology) of the crop and competition species serve as the primary inputs into the Vegetation Management Guidelines employed by Millar Western. The Guidelines then dictate the field level block assessment process and the operational implementation of the program.

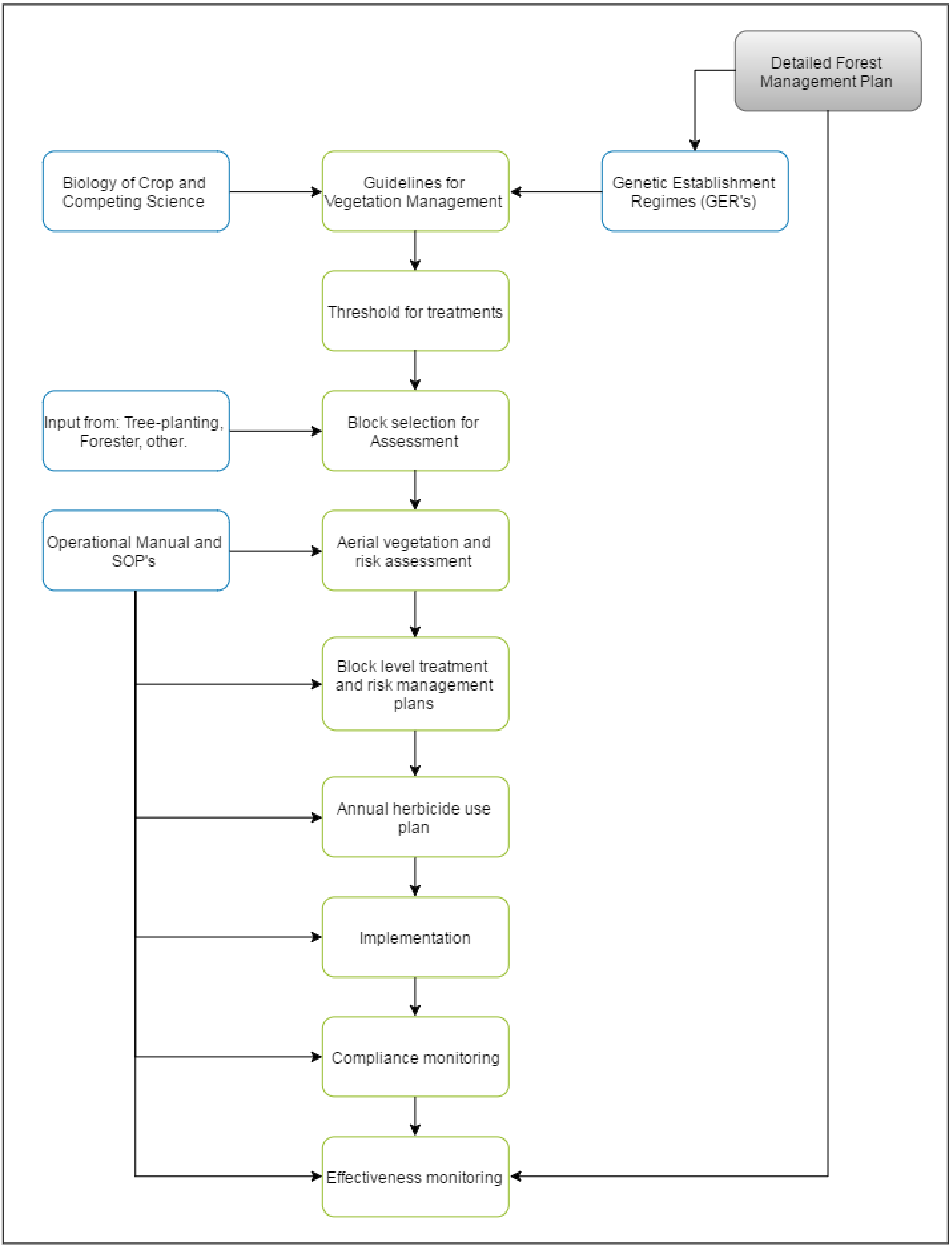


Figure 7-2. Vegetation management process

5.4 Genetic Resources and Tree Improvement Program

Collection of seed for nursery production of conifer seedlings is the responsibility of the conifer timber operators in the DFMP area, and is regulated by the GoA. The Alberta Forest Genetic Resource Management and Conservation Standards (Alberta, 2009) details requirements for all aspects of seed collection, storage and deployment as seedlings. Companies within the DFMP area are committed to following these standards.

Millar Western is a partner in the Region I white spruce orchard at HASOC (Huallen Seed Orchard) and a partner in the Region L1 black spruce orchard at Linaria. Millar Western is also a member of the Tree Improvement Association of Alberta (TIA).

Millar Western has a large inventory of Region I white spruce seed that will be deployed throughout the DFMP area for the 2017-2027 DFMP period. Millar Western also intends to deploy region L1 black spruce throughout the DFMP area, although seed inventories for L1 are less robust than for region I. All deployments will be consistent with the requirements of the Alberta Forest Genetic Resource Management and Conservation Standards.

5.4.1 Wild Seed/Stock

The GoA requires that all seed and stock utilized for reforestation purposes originate within the seed zone in which it is deployed. This ensures that forests are replaced with trees that are genetically similar to previous forest stands, but still sufficiently diverse, and are adapted to local conditions.

Currently the Provincial Seed Zones are consistent with the 2005 version of Alberta's Natural Sub-regions (see Table 7-9).

In total, 9 seed zones are located within the DFMP area (see Figure 7-3). Millar Western ensures that adequate quantities of seed are collected from each seed zone to accommodate its projected reforestation requirements.

Table 7-9. Seed Zone composition within the DFMP area

Seed Zone	Area (ha)	Percentage (%)
CM 3.2	127,769	27.0
CM 3.4	4,924	1.0
CM 3.5	1,441	0.3
LF 1.3	184,593	39.1
LF 1.4	16,587	3.5
LF 1.5	49,619	10.5
LF 2.1	66,601	14.1
UF 1.1	15,309	3.2
UF 1.2	5,122	1.1
UF 1.2	662	0.1
Total	**472,628**	**100.0**

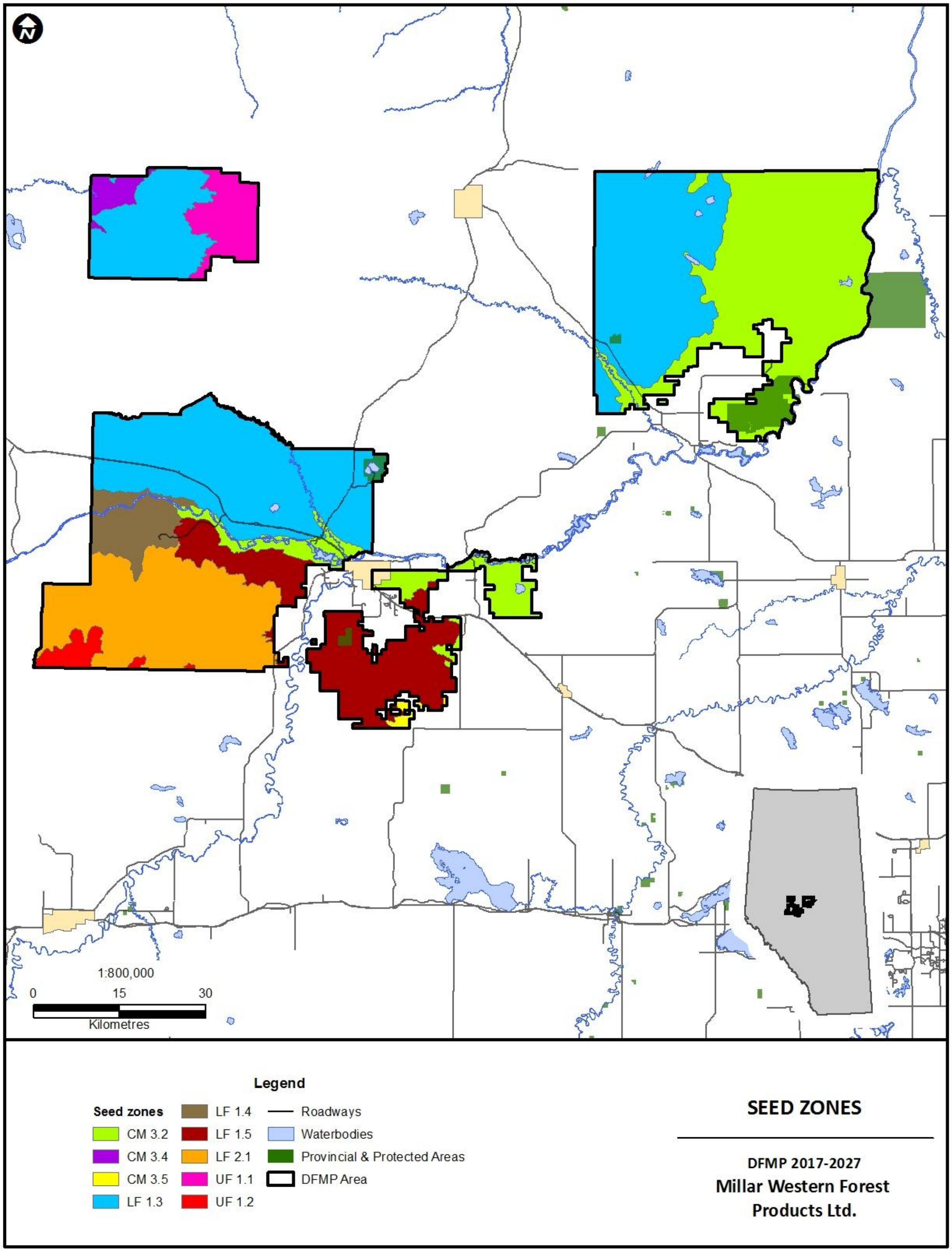


Figure 7-3. Map of provincial seed zones within the DFMP area

5.4.2 Seed Requirements

Millar Western manages the amounts of tree seed on hand to adequately meet reforestation requirements. Table 7-10 summarizes, by seed zone, the amount of seed required to reforest the coniferous landbase portion of the SHS and the MWFP seed currently in storage as of October, 2016 (the deciduous landbase is reforested without seedlings, through natural suckering). Table 7-11 and Table 7-12 list the seed stored by Spruceland and Weyerhaeuser, respectively.

Table 7-10. Millar Western seed resources

Seed Zone	Seed Inventory (kg)	Number of seedlings that could be planted with current seed inventory	Area that could be planted with current seed inventory (ha)	Approximate area to be cut in next 10 years (ha)	Seed required for next 10 years (kg)	Required to collect (kg)
White Spruce						
I	121.0	23,310,651	16,650	4,734	34.4	0.0
CM3.2	17.7	3,569,722	2,550	648	4.5	0.0
CM3.4	39.8	6,509,313	4,650	63	0.5	0.0
CM3.5	0.0	0	0	33	0.3	0.0
LF1.3	297.0	46,199,463	33,000	2,285	20.6	0.0
LF1.4	92.5	19,286,241	13,776	40	0.3	0.0
LF1.5	80.6	19,289,179	13,778	649	3.8	0.0
LF2.1	109.3	21,230,650	15,165	1,016	7.3	0.0
UF1.1	2.8	408,582	292	664	6.3	3.5
Black Spruce						
L1	5.9	2,928,239	2,092	140	0.4	0.0
LF1.3	28.9	8,587,460	6,134	84	0.4	0.0
LF1.5	10.0	3,276,408	2,340	36	0.2	0.0
LF2.1	0.6	83,034	59	19	0.2	0.0
UF1.1	6.7	1,696,263	1,212	207	1.1	0.0
CM3.2	17.7	3,569,722	2,550	17	0.1	0.0
CM3.4	39.9	6,509,313	4,650	3	0.0	0.0
CM3.5	0.0	0	0	3	0.0	0.0
Lodgepole Pine						
CM3.2	0.0	0	0	72	1.0	0.0
CM3.4	12.8	1,300,151	929	741	10.2	0.0
CM3.5	0.0	0	0	20	0.3	0.0
LF1.3	122.5	13,420,137	9,586	7077	90.4	0.0
LF1.4	29.2	2,893,456	2,067	260	3.7	0.0
LF1.5	14.0	1,461,922	1,044	780	10.5	0.0
LF2.1	99.4	9,614,275	6,867	2400	34.7	0.0
UF1.1	186.2	19,801,092	14,144	751	9.9	0.0
UF1.2	16.3	1,650,930	1,179	0	0.0	0.0

Table 7-11. Spruceland seed resources

Seed Zone	Seed Inventory (kg)	Number of seedlings that could be planted with current seed inventory	Area that could be planted with current seed inventory (ha)	Approximate area to be cut in next 10 years (ha)	Seed required for next 10 years (kg)	Required to collect (kg)
White Spruce						
I						
LF1.3	10.2	1,733,023	1,238	2205	18.2	8.0
LF1.4						
LF1.5						
LF2.1						
UF1.1						
CM3.2	288.8	52,682,799	37,631	229	1.8	0.0
Black Spruce						
LF1.3						
LF1.5						
LF2.1						
UF1.1						
CM3.2						
CM3.4						
Lodgepole Pine						
CM3.2				117	1.8	1.8
CM3.4						
LF1.3	2.9	265,318	190	3123	47.8	44.9
LF1.4						
LF1.5						
LF2.1						
UF1.1						
UF1.2						

Spruceland Millworks Inc. currently has low seed inventory in both white spruce and pine. To remedy this, Spruceland is planning to collect 40 kg of white spruce seed and 60 kg of pine seed from LF1.3; and 10 kg of pine seed from CM3.2 in the next 5 years. A cone collection program is planned to begin in September 2017.

Table 7-12. Weyerhaeuser seed resources

Seed Zone	Seed Inventory (kg)	Number of seedlings that could be planted with current seed inventory	Area that could be planted with current seed inventory (ha)	Approximate area to be cut in next 10 years (ha)	Seed required for next 10 years (kg)	Required to collect (kg)
White Spruce						
I	118.6	23,720,000	16,943	0	0.0	0.0
LF1.3						
LF1.4						
LF1.5	126.5	25,300,000	18,071	130	0.9	0.0
LF2.1						
UF1.1						
CM3.2				10	0.1	0.0
Black Spruce						
LF1.3						
LF1.5						
LF2.1						
UF1.1						
CM3.2						
CM3.4						
Lodgepole Pine						
CM3.4						
LF1.3						
LF1.4						
LF1.5						
LF2.1						
UF1.1						
UF1.2						

5.4.3 Tree Improvement Program

Millar Western is currently invested in two seed orchards. The black spruce orchard is only partially intensively selected, and no realized gains are assumed for growth and yield calculations. The white spruce orchard is fully intensively selected and has an assumption of realized gains, which will increase once first rouging is completed. The white spruce seed orchard was established in 1998, and progeny tests were initiated in 2001 on 5 member sites, one of which is within the Millar Western FMA area (Virginia Hills) (Renaud *et al*. 2005b). Measurements begin at age 12 (in 2011).

The objective of tree improvement progeny trials is to provide accurate family and provenance rankings, precise estimates of genetic parameters, a new population for advanced generation selections, scientific information on regional geographic variation and genetic diversity, and an *ex situ* germplasm archive (Renaud *et al*. 2005b). Tree improvement activities are restricted to FMU W13 only. Seedling trials were generally planted at spacings of 2.2 x 2.2 m (exceptions are the Weyerhaeuser site, planted at 2.0 x 2.0 m, and the Linaria site, planted at 1.0 x 3.0 m), and sites were fenced to prevent browse. Data collected will include survival, height, vigour, and insect and disease occurrence. DBH may also be assessed beginning at 16 years, when variation in DBH begins to be expressed as a trait.

A progeny trial was also established for the black spruce seed orchard, which was established in 1999, with replacements made in 2004 (Renaud *et al*. 2005a). The progeny trial is in West Fraser's FMA area; no progeny trial has been established to date within the Millar Western FMA area.

5.5 Enhanced Forest Management

Enhanced forest management (EFM) refers to improvements in forest growth resulting from thinning, fertilizing, or drainage (Alberta, 2016c). Millar Western has used EFM in the past, and may implement it in the future beyond this DFMP, as appropriate.

Millar Western may implement a pre-commercial thinning (PCT) program in young pine stands where densities exceed an acceptable threshold. This treatment is more of a stand tending operation than enhanced forest management, as the primary objective is to bring over-dense stands back in line with density targets identified in the establishment regimes and avoid situations where growth repression will occur. The density threshold for prescribing PCT is typically in the 5,000 to 10,000 stems per hectare range, with post-thinning targets ranging from 2,000 to 3,000 stems per hectare.

6. Forest Protection

Wildfire and forest pathogens are natural components of the forested ecosystems of west central Alberta. The forests within the DFMP area are developed under conditions dominated by wildfires. Insects and diseases are generally present at low levels within these forests; however, severe infestations can occur (e.g. mountain pine beetle) and may destroy or weaken extensive tracts of forest.

Millar Western's forest protection strategies are aimed at reducing the risk, occurrence and severity of wildfires and pathogen outbreaks. The company also addresses the risk associated with windthrow, which has the potential to affect standing timber adjacent to forest harvesting operations.

6.1 Fire Protection Strategy

The boreal forest within Alberta was developed under conditions in which wildfires were a dominant landscape factor. Today, they continue to be the prime natural disturbance and have the potential to significantly affect timber resources within the DFMP area. Millar Western's Fire Protection Strategy, described below, addresses the risk of wildfire to the timber resource.

Prior to the start of each fire season, the Forest Protection Coordinator produces and submits a fire control plan to the GoA for approval. The fire control plan includes details of Millar Western's pre-suppression and suppression plans for the upcoming season.

6.1.1 Helitack Program

Millar Western is unique in that it is the only forest operator in Alberta to employ its own Helitack crew (initial attack wildfire crew transported by helicopter). The crew suppresses fires in the DFMP area both alone and in conjunction with GoA wildfire crews. All members of the Helitack crew are certified as Type 1 Wildland Firefighters and undergo frequent physical fitness testing, fire-pump and hoselay drills, and special aircraft operations (e.g. bucketing, long-lining, hose retrieval).

6.1.2 Fire duty Roster

To supplement the Helitack crew, the Forest Protection Coordinator constructs a fire duty roster annually. The fire duty roster identifies staff who are available on an as-needed basis during the fire season, to provide extra suppression manpower. The Forest Protection Coordinator will determine when employees are required to work on "stand-by" or "man-up" for fire pre-suppression operations.

6.1.3 Fire Training

The Helitack crew is trained to the same standard as GoA wildfire crews, while those on the fire duty roster are provided training as necessary. It is the intent of the fire protection strategy to train a number of woodlands staff to the Industry Dozer Boss Standard. Since field staff will likely be the first to encounter a wildfire in the DFMP area, particularly if a fire is ignited as a result of field operations or originates in a debris pile, detection training is provided to them as well. Procedures related to equipment checks and debris pile checks have also been developed and are designed to help ensure early detection of an ignition.

6.1.4 Awareness and Liaison

The Forest Protection Coordinator regularly provides the GoA forest protection staff with locations of company field operations, current suppression operations, and training requests. The GoA provides Millar Western with fire hazard information for the purpose of forest management decision making, staff/contractor advisories, and operational restrictions such as early shifts and shutdowns.

6.1.5 Fire Equipment Inventory

Wildfire suppression equipment will be inventoried and maintained at a designated location for each Woodlands division. The Forest Protection Coordinator will be responsible for inventory, maintenance, and dispensing of fire tools.

6.1.6 Prevention and Salvage

Direction in the GOA's "Millar Western Forest Products FireSmart Management 2017" report (Appendix VII) provides the following recommendations:

- Areas with continuous coniferous fuel types are susceptible to large wildfires. Where possible, harvesting should be designed to reduce the continuity of these coniferous fuel types.
- Harvest should align with community protection objectives and harvest sequencing should occur early within the SHS.
- Work with Wildfire Management Staff to identify priority areas within the contributing landbase and explore opportunities to mitigate high risk black spruce stands in the non-contributing landbase.

In order to prevent fire starts, Millar Western focuses on three prevention strategies:

- Conducting operations in accordance with the fire control plan;
- Incorporation of FireSmart modeling in the DFMP; and

- Strict procedures related to burning of debris piles.

Wildfire events are a natural part of the boreal ecosystem. They create unique habitats and are important from a biodiversity perspective. Millar Western will follow the "Fire Salvage Planning and Operations - Directive No. 2007-01" when harvesting fire salvage. Additionally, the following strategies will be implemented in the DFMP area when harvesting burned areas, to comply with VOIT #7 (1.1.1.5a) of the DFMP:

- For fires greater than 1000 ha , all unburned trees in green islands will be retained (i.e., recognizing timber condition, access and other non-timber values)
- For fires less than 1000 ha, Millar Western will follow the structure retention strategy (*Appendix II – Structure Retention Strategy*).

6.2 Forest Health Strategy

Within the DFMP area, insects and diseases are a natural part of the ecosystem. Generally, these are present at low intensities across the landscape; however certain conditions may lead to an increase in population, leading to an epidemic.

Millar Western's Forest Health Strategy focuses on detection of insect and disease outbreaks and includes the following components:

- **Detection** – Field staff will likely be the first to encounter forest pests, and the importance of their role in detection will be stressed. Millar Western often contributes to regional detection programs (e.g., detection traps, survey assistance, etc.).
- **Reporting** - Infestations must be reported internally, and Millar Western will forward any significant sightings to the GoA.
- **Control** - Pest control is the mandate of the GoA, but Millar Western has the ability to aid their efforts through its harvesting and silvicultural practices. For example, aggressive control of mountain pine beetle infested stands will be undertaken through harvesting, which may cause operators to deviate from the approved SHS. Millar Western will also work with the GoA, to develop targeted programs to address infestations, where appropriate.

Stands or trees are ranked for treatment/harvest according to the Millar Western OGRs:

- **Rank 1:** Stands or trees with the presence of mountain pine beetles or spruce beetles.
- **Rank 2:** Stands with a significant number of dead or dying trees resulting from fire, insects or disease, and windthrow.
- **Rank 3:** Stands infected with mistletoe, spruce budworm, forest tent caterpillar, root disease (Tomentosis, Armillaria) or jack pine budworm.
- **Rank 4:** Stands infected with needle cast, Western gall rust, root collar weevils, Atropellis or other miscellaneous forest health agents.

Millar Western successfully implemented the 2007-2016 DFMP's MPB strategy, which was developed to address the unprecedented MPB infestation in the DFMP area. This comprehensive strategy influenced all phases of Millar Western forest management activities, from access to harvesting and reforestation (refer to the Millar Western 2007-2016 DFMP for more information). With a large amount of pine approaching prime susceptibility, the MPB is expected to remain a serious threat in the DFMP area.

A MPB Identification SOP has been developed and helps Millar Western staff and contactors to understand how to identify, monitor, and report the presence of MPB, as part of control efforts.

6.3 Windthrow

Windthrow, the uprooting and overthrowing of trees, is a natural event that can occur in any forest given sufficient winds, with the likelihood of windthrow increasing as the stand ages. There is very little that can be done to prevent windthrow from occurring in natural origin stands; however, forest operators can address the potential of increased windthrow associated with forestry operations.

Strategies to address windthrow concerns include:

- Incorporation of windthrow concerns into the structure retention strategy, considering distribution and placement to ensure the majority of the retention remains standing; and
- Design of harvest blocks to reduce potential windthrow (*e.g.* utilize more windfirm stand types along the block edge where adjacent timber is subject to windthrow).

Natural windthrow events (*i.e.,* not related to forestry operations) create unique habitats and are important from a biodiversity perspective. Within areas of significant salvageable blowdown (greater than or equal to 100 ha), a minimum of 10% of stems will be left unsalvaged.

6.4 Invasive Species

All land-use dispositions that are held by Millar Western are subject to noxious weed monitoring and control, to reduce the detrimental impacts of invasive species. All sites identified with noxious weeds are tracked and actioned within two years. Treated sites are then monitored for two more years, to determine if further action is required. All forestry operators in the DFMP area must ensure that their contractors are aware of the obligations under the Alberta Weed Control Act.

7. Protection of Forest Resources

7.1 Forest Soils

Soil conditions, with their capacity to store nutrients and water, directly impact the productivity of forests; therefore maintenance of forest soil quality is crucial. Forestry operations can have the following impacts on soils:

- **Nutrient source removal** – the practice of forest harvesting (i.e. tree removal) prevents decay organisms associated with natural processes (e.g. burning or decay) from incorporating organic matter into the soil matrix;
- **Increase in soil moisture content** – vegetation removes moisture from the soil as the vegetation transpires. If forest cover is removed from wetter sites, excess water may create problems for re-growth of vegetation;
- **Compaction** – soils can become compacted during harvesting or silviculture operations by machinery, which can alter subsurface water movement, as well impede the ability of vegetation growth; and
- **Erosion and slumping** – removal of vegetation through forestry operations can lead to soil instability, causing erosion and slumping. This can be of particular concern in the vicinity of riparian areas, where the sediment can impact water quality.

Millar Western has implemented the Soil Conservation SOP, to ensure that staff and forestry contractors are aware of and implement consistent processes for managing soil disturbance in relation to forest operations:

- During the planning phase, Millar Western staff will identify sensitive soil sites – sites that require special protection beyond precautions normally applied to management activities due to soil, water, slope, and/or other characteristics;

- An appropriate harvest and/or treatment season is selected (winter, if possible), to minimize the potential for site disturbance, compaction, and slumping;
- Sensitive sites will be identified to contractors during pre-work meetings, and contractors will communicate this information to equipment operators;
- Operations are monitored for potential site disturbances and adjusted as necessary;
- If acceptable disturbance levels are surpassed, Millar Western's Stop Work Policy will be followed; and
- The disturbance area will continue to be monitored and an action plan will be prepared with appropriate timelines to mitigate additional soil disturbance in sensitive areas.

7.1.1 Nutrient Source Removal

The Structure Retention Strategy (*Appendix II – Structure Retention Strategy*) ensures at least 3% of the merchantable area is left as stand level retention within the harvest areas. As the retention trees die and decay, they contribute to coarse woody material on the ground, providing additional soil nutrients.

The minimum harvest ages associated with this DFMP provide ample time for the soil nutrients to replenish between harvest events.

7.1.2 Compaction

Millar Western conducts its forest harvesting and site preparation operations during frozen or dry ground conditions. Avoidance of wet conditions reduces the risk of compaction from equipment. In-block roads and landings are subjected to repeated machine traffic and are more likely to be compacted compared to other areas of the harvest block. In cases where compaction occurs, the affected areas will be treated to enable reforestation.

7.1.3 Erosion and Slumping

Within harvest areas, there are four main strategies for reducing the risk of soil erosion and slumping:

- Conducting forestry operations during frozen or dry ground conditions;
- Maintaining structure retention;
- Rapidly regenerating harvested areas; and
- Using site preparation techniques that leave significant amounts of non-merchantable vegetation on-site.

7.2 Hydrologic Resources

Forestry operations have the potential to impact hydrologic resources by removing forest cover. This reduces water capture/uptake, potentially resulting in increased run-off, at least until forest cover is restored. Impacts related to water quality may influence habitat quality for fish and other fauna in water features such as lakes, rivers, streams and associated riparian zones.

There are two general approaches used within the DFMP area to protect hydrologic resources:

1. Avoidance (through OGR buffering) and SHS development related to proposed harvesting within watersheds; and
2. Operational practices, primarily related to access development and watercourse crossings.

The following buffers have been incorporated into the PFMS and are excluded from forestry operations (*i.e.* not part of the active landbase):

- Watercourse buffers within harvest areas, as outlined in the OGRs;
- 200-meter buffers around all trumpeter swan nesting lakes; and
- Buffers around colonial nesting bird sites.

Millar Western incorporates water quality concerns into the development and construction of access, including: watercourse crossing selection, installation, maintenance, removal of crossing and reclamation. Some considerations are:

- Sound road location practices and the use of tools such as wet areas mapping and LiDAR bare earth model (this is especially important for non frozen operations);
- Timely reclamation of temporary roads;
- Ensuring that watercourse crossings adhere to the OGRs and Code of Practice;
- Avoidance of sensitive and wet soil areas, in order to minimize site disturbance associated with road construction and skidding (using tools such as wet areas mapping); and
- Suitable timing and location of proposed operations will be used in order to minimize the risk of erosion. Operations in wetter areas will generally occur during frozen ground conditions and non frozen operations will be shut down in the event of excessive precipitation.

The details pertaining to the above will be clarified in the OGRs.

7.3 Wetland Stewardship

Boreal wetlands are prevalent across the western boreal forest and an important landscape and habitat feature on Millar Western's DFMP area, representing over 20% of the landbase. Chapter 3 provides an overview of the types of boreal wetlands found on the DFMP area and the numerous ecological, social and economic benefits they provide. Within the context of this DFMP, Millar Western commits to wetland stewardship through responsible planning and management and appropriate implementation of sustainable land-use practices that conserve wetlands. These efforts, in combination with the implementation of land-use and caribou planning processes and the Alberta Wetland Policy, demonstrate the company's recognition of the importance of ecosystem-based forest management.

Outlined below are specific activities and projects that will assist and guide Millar Western in implementing wetland stewardship when planning and operating in the DFMP area.

7.3.1 Wetland Mapping

Ducks Unlimited Canada (DUC) has completed a comprehensive spatially explicit wetland inventory for the Millar Western DFMP area that conforms to the DUC Enhanced Wetland Classification (EWC) standard described in Chapter 3. This classification also conforms to the Alberta Wetland Classification System at both the Class and Form levels. The EWC is the primary tool DUC uses when developing conservation products to guide wetland conservation efforts. An example of one of these products is a tool developed to map wetland flow characteristics, with the purpose of assessing the risk of blocking flow when planning road networks. This tool also guides the choice of road construction techniques to minimize the potential impacts of roads on wetlands (for example, where roads need to cross a flowing fen system). Other products include mapping preliminary wetland carbon storage and biodiversity values associated with the different wetland types found throughout the DFMP area.

Millar Western will work with DUC to acquire the EWC and relevant conservation products to strengthen wetland stewardship activities on the DFMP area. DUC will also deliver the training needed to interpret and use the EWC and associated products.

7.3.2 Wetlands Training

Fundamental to wetland stewardship is to extend, through knowledge exchange and training, a comprehensive understanding of the various types of wetlands, along with their values and functions, to planning and operations staff. This is a logical and significant complement to the previously noted wetland mapping products: it brings wetland classification and knowledge to the strategic planning level and the operational level, where on-site decisions are made. Collectively, a wetland inventory and a complementary knowledge transfer and training program will serve as a contribution to a wetland stewardship program, meet components of the Sustainable Forestry Initiative (SFI) forest certification requirements, and address the intent of the Alberta Wetland Policy. Millar Western will work with DUC to determine the best approach to develop a wetland training program that will meet its needs.

7.3.3 Forest Management and Wetland Stewardship Initiative (FMWSI) Projects

The FMWSI is a three-year collaborative working agreement initiated in 2016 among DUC, a coalition of forest industry partners, including Millar Western, and the Forest Products Association of Canada. The initiative has identified priority projects of joint interest to all parties, including establishing wetland stewardship guiding principles and developing wetland and waterfowl best management practices (BMPs). Each project will be designed to directly engage forest industry partners, to ensure the outcomes are practical and achievable. The intent of this initiative is to make certain that information flowing from these projects is integrated into forest management plans and operations. It will also provide support for ongoing forest certification programs and meet the intent of the Alberta Wetland Policy. As the FMWSI projects are completed, Millar Western is committed to working with DUC to determine how the results can form part of its ongoing sustainable forest management activities.

FMWSI projects currently underway include:

1. **Guiding Principles to Conserve Wetlands for Forest Management – Planning Considerations**

This project will present a range of strategic planning considerations for working in wetland environments and will include wetland stewardship principles, wetland stewardship objectives, and considerations for planning, to accommodate wetland conservation actions. The end goal of this project is that forest companies that choose to implement the results of this work will contribute to reducing potential impacts on wetland hydrology and ecology.

2. **A Guide to Best Management Practices to Reduce the Incidental Take of Waterfowl during Forest Management Activities**

This guide will establish a risk assessment tool, mitigation strategies, and guidance on how to apply the tool to reduce the risk of incidental take of migratory birds (specifically targeted at waterfowl) in the boreal forest by the forest industry. The results will promote the proper management, conservation, and protection of migratory birds nesting in the boreal forest and assist industry in meeting their regulatory (Migratory Bird Convention Act, 1994) and voluntary (*e.g.*, forest certification) requirements.

3. **Guide to Wetland Best Management Practices for Planning and Operations**

Designed to reduce the potential impact on wetlands, this guide will present a range of current planning and operating BMPs for consideration when working in or near wetlands. The final products will be a report that presents existing recommended practices to be considered at the planning and operating stages of forest management and one or more plain language handbooks for field staff. These products will link back to the "Guiding Principles" document and provide descriptions regarding implementation of recommended practices.

7.3.4 Best Management Practices (BMPs)

Certain wetland types can create challenges when developing road crossings. For example, fens (which are the dominant wetland type in the Millar Western DFMP area) have slow lateral flow that is often blocked by road crossings. This blockage can result in impacts to the wetland and create operational and maintenance challenges for the company. Millar Western will work with DUC to better understand the risks associated with road development to enhance road planning and associated construction techniques to avoid and minimize impacts.

Millar Western will implement an annual road wetland/watercourse monitoring program to identify problem crossings. Where hydrologic connectivity has been blocked these problem sites will be repaired.

7.3.5 Operating Ground Rules

Following the approval of the DFMP, Millar Western will engage DUC to assist in strengthening the Operating Ground Rules related to wetland and waterfowl conservation.

As information and practices that enhance wetland stewardship in the boreal forest become available, Millar Western will work with DUC to develop relevant BMPs to promote the conservation of wetlands on the DFMP area. This can include practices that assist in avoiding/minimizing impacts to wetlands and soils/water resources. These practices can be used to strengthen the environmental performance of Millar Western and may assist in meeting Alberta Wetland Policy or forest certification requirements.

7.3.6 Additional Activities

Approximately 23% of the Millar Western DFMP area is wetland. Fens make up the majority of wetland areas; bogs, shallow open water, and marshes are relatively uncommon, representing just over 2% of the wetlands on the DFMP area. Given that these wetland types are rare on the DFMP area, special consideration will be required to maintain their integrity. Millar Western will work with DUC to identify the location of these uncommon wetlands and develop a conservation strategy.

7.4 Aesthetics

Areas of known aesthetic value, generally along highways and major waterways, that were mainly identified through Millar Western's public participation group (now known as Public Advisory Committee), have been incorporated into Millar Western's spatial database. These areas are managed according to a Millar Western SOP.

Within the Swan Hills and Grande Cache grizzly bear ranges, Millar Western will consider leaving buffer strips along primary roads to reduce visibility, if it is operationally feasible to do so and if other objectives are not impacted. These buffers are intended to reduce sightlines into harvest areas, helping to protect grizzly bears that frequent them from poaching activities. These buffers also double as an aesthetic tool, helping to reduce visibility of harvest areas.

7.5 Historical Resources

The Historical Resources SOP exists to ensure all Millar Western staff and contractors are aware of and implement a consistent process for identifying and protecting historical and cultural resources, such as ancient burial sites, historical trails, prisoner of war sites, trapper cabins, simple tools (arrows, sharpening stones), and ornaments. The SOP outlines procedures to be followed through the phases of planning, harvesting and silviculture.

8. First Nations

Through the First Nation consultation process for the 2017-2027 DFMP, Millar Western reached out to First Nations to solicit site-specific concerns related to the location of proposed harvest operations. This was done by providing a draft SHS to the First Nations and having them review the maps against their traditional land-use layers. Identifying sites of concern prior to the SHS being finalized provided the opportunity to either make changes to the SHS or to note where follow up would be required at the forest harvest plan development stage.

8.1 Site Specific Concerns

As part of the consultation process, First Nations identified specific harvest areas within the SHS as containing or being in proximity to sites of cultural interest. These blocks have not been removed from the SHS in this DFMP; rather, further steps will be taken at the operational level, to discuss, in a collaborative manner, the areas of interest (AOI) identified by First Nations and potential mitigation. The following figures (Figure 7-4, Figure 7-5, Figure 7-6, and Figure 7-7) display the blocks that have already been identified by First Nations as AOIs. The TSA UKEY that is identified in each of the figures references a portion of the AOI identified, which links to the landbase and SHS files.

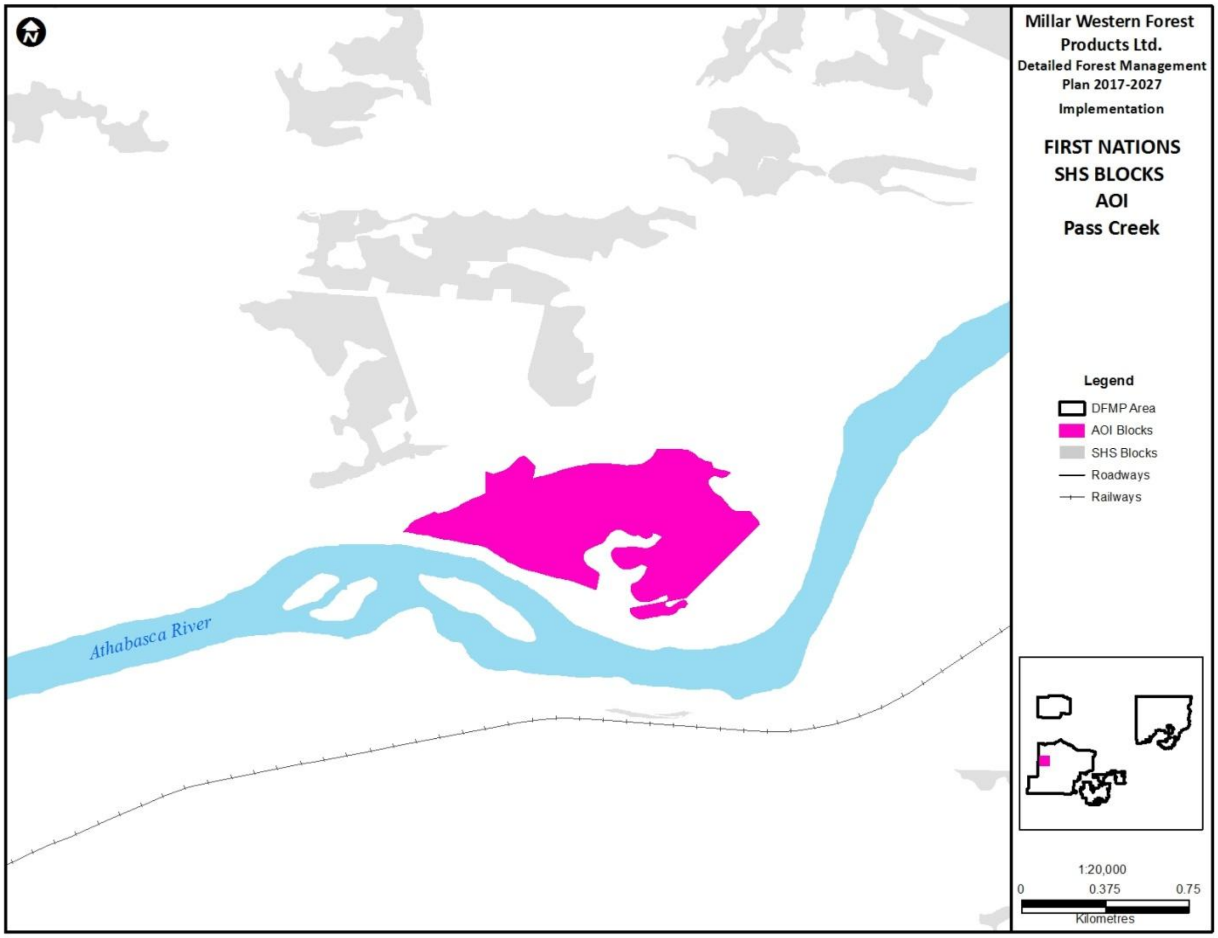


Figure 7-4. First Nations SHS block of interest – Pass Creek compartment (TSA UKEY = 142365)

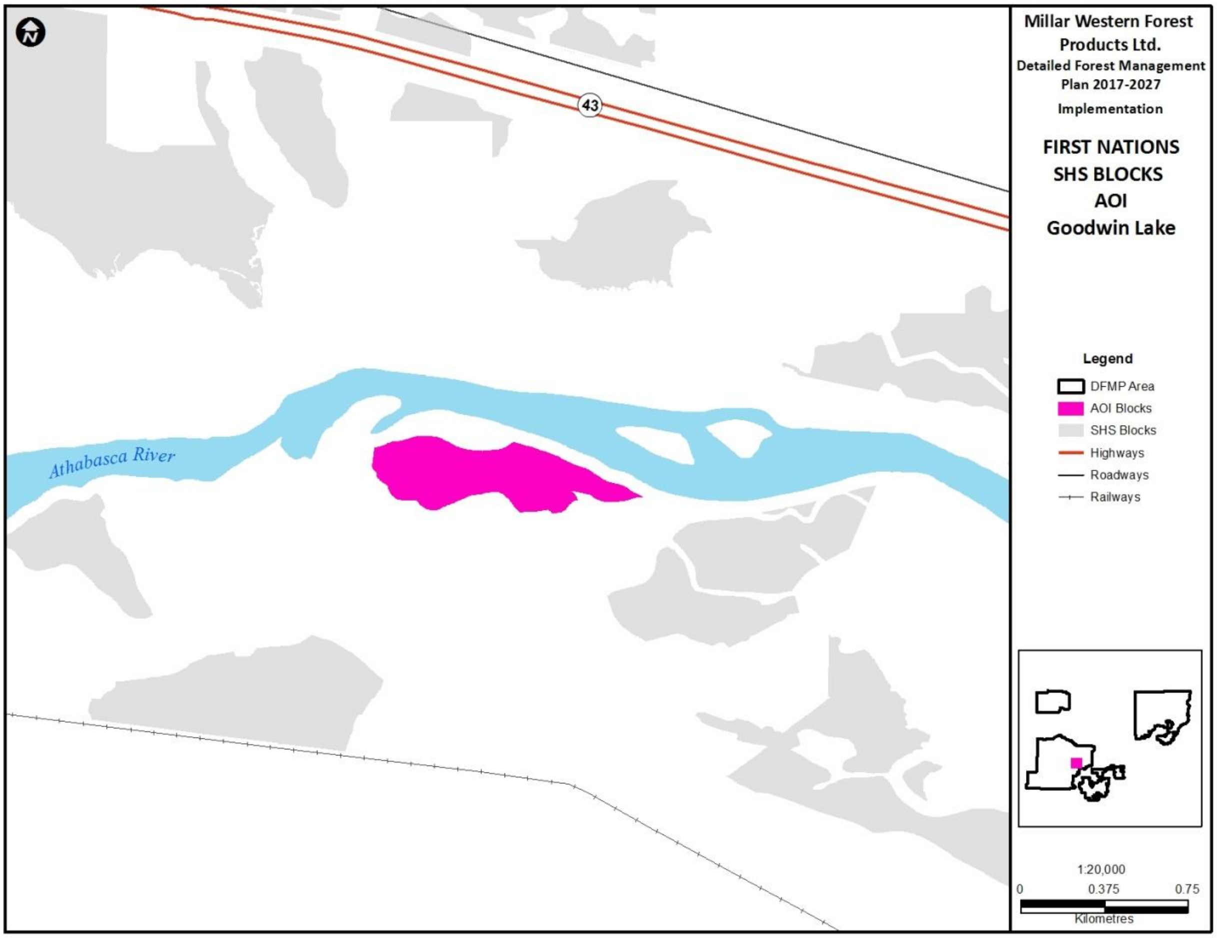


Figure 7-5. First Nations SHS block of interest – Goodwin Lake compartment (TSA UKEY = 165548)

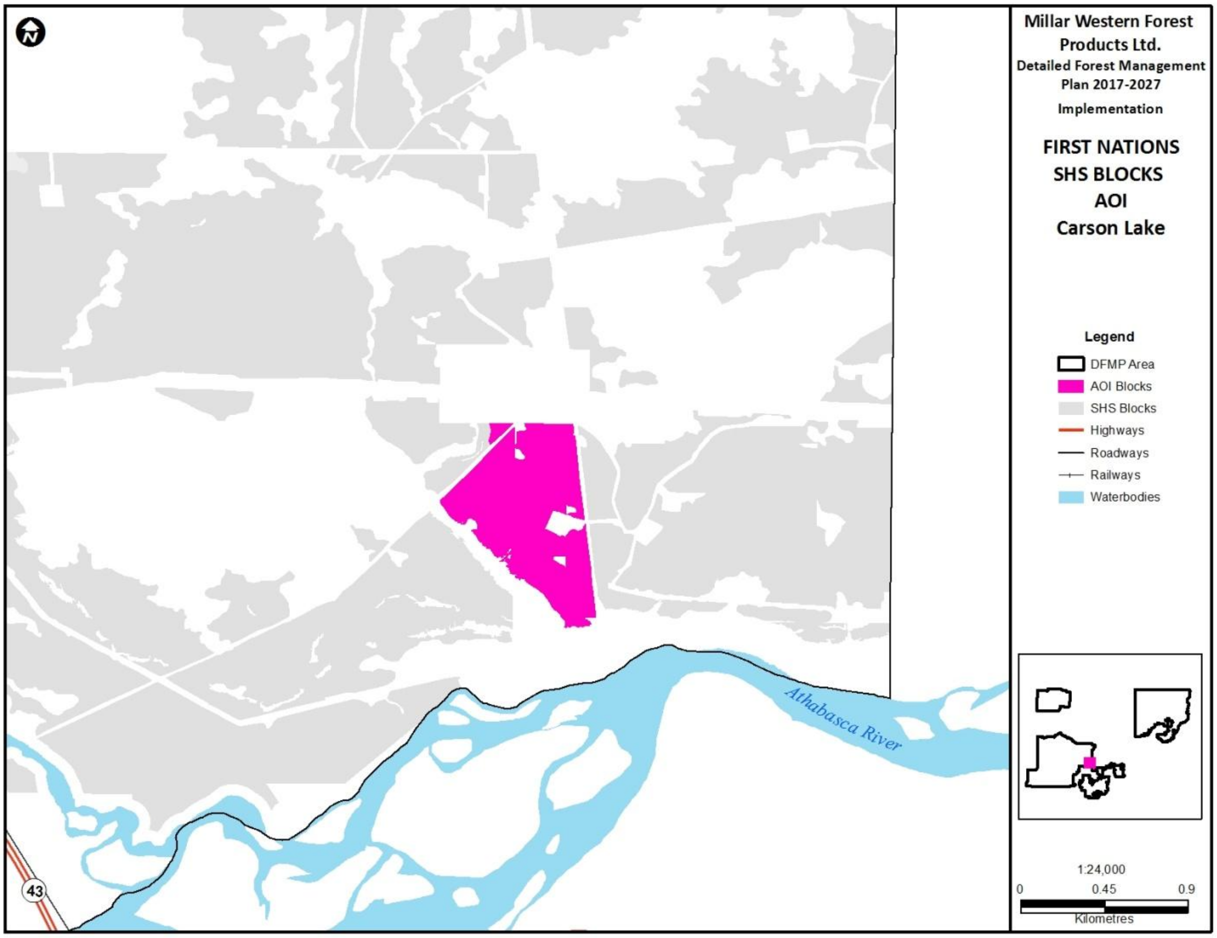


Figure 7-6. First Nations SHS block of interest – Carson Lake compartment (TSA UKEY = 181835)

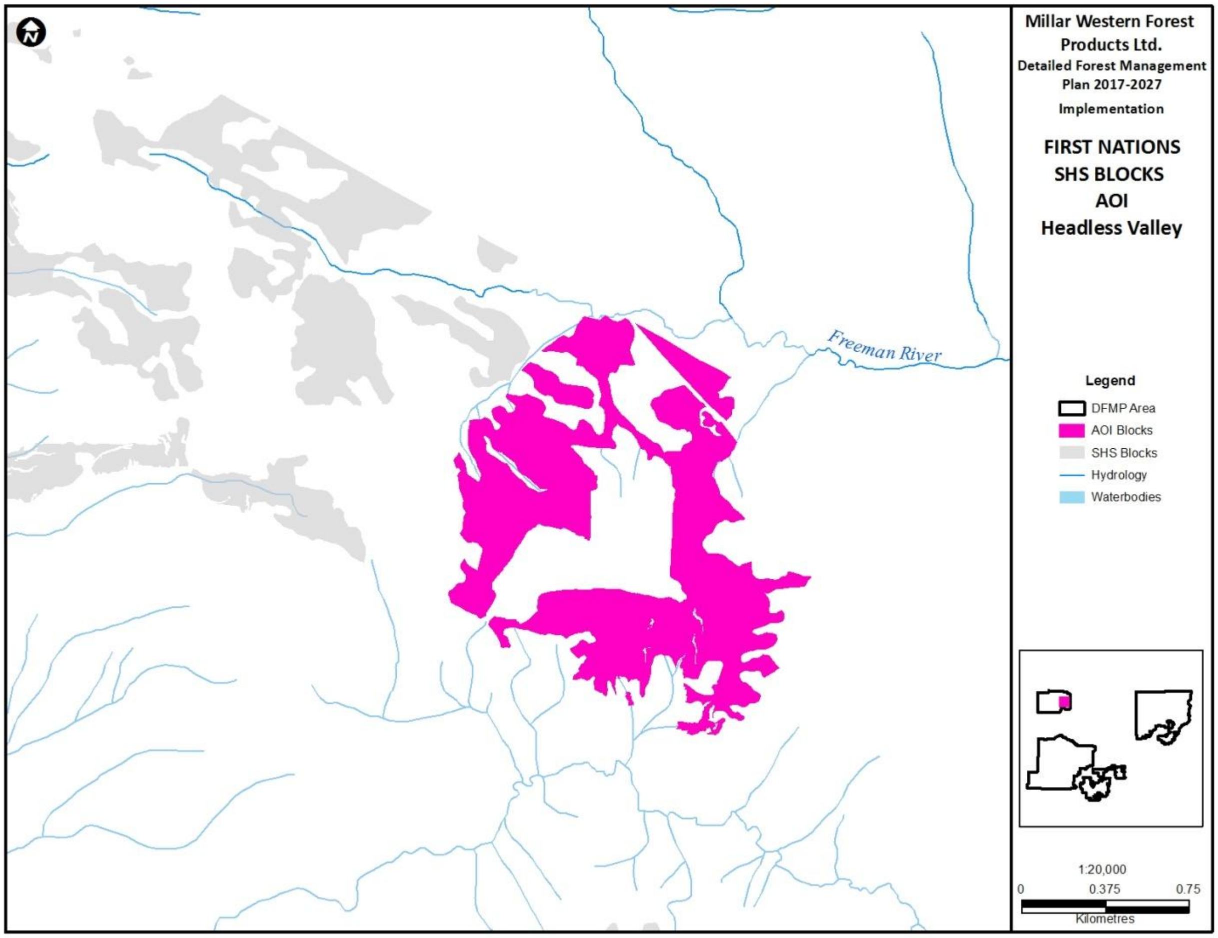


Figure 7-7. First Nations SHS block of interest – Headless Valley compartment (TSA UKEY = 235396)

9. Maintenance of Biodiversity

Biodiversity, or the ability of the land area to support a variety of living organisms, reflects a healthy environment and is therefore a goal of sustainable forest management. In 1995, the Canadian Council of Forest Ministers recognized three distinct yet interrelated components of overall biodiversity:

- **Ecosystem diversity** deals with species distribution and community patterns. Ecosystems are, to some extent, dictated by regional landforms and climate and their interactions. Diverse landforms occur across the DFMP area, setting the stage for a wide range of vegetation and related wildlife communities. This is the least understood component of biodiversity, due to the complexity of interactions within the natural environment.
- **Species diversity** refers to the range of plant and wildlife species present within an area. Maintaining species diversity is important, because each species can be considered to have a particular "role" in the ecosystem, so the addition or loss of single species may have consequences for the system as a whole. Species richness and abundance can vary between different habitat types and between seral stages, with some producing communities with a rich mix of species, while others may be more limited.
- **Genetic diversity** addresses the inherent variability within the genes of an individual species. Genetic diversity reflects the evolutionary history of a species and its historic and current distribution. Species can demonstrate significant genetic variability. More genetic diversity in a species or population means a greater ability for some of the individuals in it to adapt to changes in the environment. Less diversity leads to uniformity, which can adversely affect their ability to adapt to changing conditions.

These biodiversity components contribute to the range of habitat types and species that currently exist and have been present historically within the DFMP area. Millar Western's approach to biodiversity maintenance will focus primarily on ecosystem and species components. Millar Western will utilize a coarse-filter approach to ensure retention of a diversity of ecosystems. This will, in turn, help secure the future of most of the wildlife species in the DFMP area. Several wildlife species that are considered to be at risk will be the focus of additional management efforts. Genetic diversity is a consideration primarily from the perspective of regeneration of commercial tree species, and is addressed in selection of seed stock (Section 5.4.1).

9.1 Ecosystem Diversity

Conservation of ecosystem diversity is desired because it ensures that current ecological functioning is maintained at all scales. To ensure the spatial and temporal distribution of future forests are similar to current (and historic) conditions, targets were established for seral stage representation and for Old Interior Forest analysis. Unique or rare habitats, communities and ecosystems are addressed through a number of management commitments and policies designed to identify and protect these resources.

9.1.1 Seral Stage Representation

The forecasting process, described in Chapter 6 – *PFMS*, addresses a distribution of representative seral stages over the 200-year planning horizon. Seral stage targets were included in the forecasting and the development of the PFMS. Millar Western is investigating seral stage distributions and potential implications for management through involvement in the LandWeB project.

9.1.2 Old Interior Forest

Maintenance of old interior forest over the 200-year planning horizon was addressed through the PFMS. An old interior forest target was included in the forecasting and the development of the PFMS and SHS. The strategy for maintenance of this condition will be to implement the SHS.

9.1.3 Disturbance Patches

The PFMS contains specific targets for the creation of a range of disturbance patches, and the outcomes are reflected in the SHS. Implementation of the SHS will create a distribution of disturbance patches that meets management objectives and targets. Through its involvement in the LandWeB project, Millar Western is investigating potential implications for the management of disturbance patches.

9.1.4 Downed Woody Debris

Forest harvesting operations generally result in an increase in downed woody debris within a harvest block, since debris is generated but not removed. Excess downed woody debris can hinder site preparation and planting operations and is sometimes removed, via brush raking or prescribed burns after completion of harvest activities. However, downed woody debris plays an important role in ecosystem function, providing wildlife habitat and contributing to soil nutrient cycles. Therefore, Millar Western intends to leave 75% or more of its harvest areas without treatments that reduce downed woody debris retained on site. Note that roadside slash will not be subject to these restrictions.

9.1.5 Uncommon Plant Communities and Sensitive Ecological Sites

Millar Western is committed to protecting uncommon plant communities and sensitive ecological sites within its DFMP area. Millar Western has developed an SOP to identify and protect uncommon plant communities and sensitive ecological sites within the DFMP area.

9.2 Species Diversity

A coarse filter management approach will be relied upon to sustain the majority of species that occur within the DFMP area; however, a coarse filter approach alone may not be sufficient in cases where species may be at risk, threatened or of concern. To address this, the process to develop the PFMS included fine filter tools to manage habitat for certain species. In some cases, specific management strategies have been included in the DFMP, as identified below.

9.2.1 Caribou Habitat Management Strategy

Woodland caribou (*Rangifer tarandus*) were identified as species of concern within the DFMP area at the outset of development of the 2017-2027 DFMP. A small portion of the Slave Lake caribou range overlaps with Millar Western's DFMP area in FMU W11. Recognizing the impact that forest management activities, particularly harvesting, can have, a caribou strategy was developed. The caribou strategy can be found in *Appendix III - Woodland Caribou Habitat Strategy.*

9.2.2 Grizzly Bear Habitat Management Strategy

Grizzly bears were identified as species of concern within the DFMP area at the outset of development of the 2017-2027 DFMP. Two different populations inhabit Millar Western's DFMP area, around Grand Cache and Swan Hills. Recognizing the impact forest management activities, particularly harvesting, can have on grizzly bear habitat, strategies to mitigate impacts were incorporated into the DFMP development process. The grizzly bear strategy can be found in *Appendix IV - Grizzly Bear Habitat Strategy.*

9.2.3 Barred Owl Habitat Management Strategy

Barred owl (*Strix varia*) was listed as a species of special concern within the DFMP area at the outset of development of the 2017-2027 DFMP. Recognizing the impact forest management activities, particularly harvesting, can have on barred owl habitat, strategies to mitigate impacts were incorporated into the DFMP development process. The barred owl strategy can be found in *Appendix V – Barred Owl Habitat Strategy.*

9.2.4 Trumpeter Swan Habitat

Trumpeter swans are identified as a species of concern. Trumpeter swan nesting areas are buffered around identified waterbodies (refer to *Annex VIII - Landbase document*). All forestry operations are excluded from these areas, and the areas are not included in the active landbase.

9.2.5 Colonial Nesting Birds

Colonial nesting birds such as the great blue heron are identified as a species of concern. Their nesting areas are buffered around identified waterbodies (refer to *Annex VIII - Landbase document*). All forestry operations are excluded from these areas, and the areas are not included in the active landbase.

9.2.6 Migratory Birds

Migratory birds, the nests of migratory birds and/or their eggs can be inadvertently harmed or disturbed as a result of many activities, including but not limited to forest industry activity. To minimize the possibility or frequency of such “incidental take” and to therefore minimize long-term consequences to migratory bird populations, Millar Western will be working with other forest companies in Alberta to develop a migratory bird risk ranking matrix for all forest stands of Alberta and a guidance document, including beneficial management practices for forest-dwelling migratory birds.

9.2.7 Athabasca Rainbow Trout and Arctic Grayling

Athabasca Rainbow Trout

The ***Alberta Athabasca Rainbow Trout Recovery Plan 2014-2019*** designates the Oldman, Windfall and Chickadee watersheds as ecologically significant habitat (ESH) for the survival and recovery of Athabasca rainbow trout (ARTR). Due to the unique features of these habitats, streams designated as ESH are at moderate to high risk of damage. Consequently land use activities in watershed areas contributing to stream reaches with ESH have a higher potential for cumulative adverse effects to downstream ARTR populations.

Rainbow trout in the Athabasca river tributaries near Whitecourt are somewhat unique in that they tend to be functionally isolated within the tributaries and at high risk of extirpation. Any adverse effects on ESH in the Athabasca River tributaries will potentially affect Athabasca rainbow trout production and depending on extent can adversely affect food production, recruitment of juveniles, fish passage, and suitability of residential habitat. As a result, continual reduction in Athabasca rainbow trout production can lead to extirpation of the species from these tributaries, because recolonization from other Athabasca rainbow trout populations is unlikely.

Arctic Grayling

The provincial fish sustainability index (FSI) assessment showed that of the 66 watersheds historically supporting arctic grayling, 53 were collapsed and only 2 remained at very low risk, including the Upper Little Smoky River HUC6 located in the northern portion of W13. The watersheds in that HUC are vital to repopulating the rest of the connected watersheds that are collapsed. The high FSI score of the Little Smoky River also biases the scores of other rivers and masks the potential problems that are likely occurring to other rivers within that HUC (e.g. Upper Goose River).

Mitigations

Athabasca rainbow trout and arctic grayling are temperature dependent species. Forest operations should be done in a way that avoids or minimizes increases to water turbidity, sedimentation or water temperature.

Mitigation strategies include providing improved thermal buffering, removing barriers to fish passage and sources of sedimentation, and removing, reclaiming and reducing roads. Many mitigation options are within the scope of the operating ground rules and will be addressed there.

The PFMS included direction from the GoA that, in watersheds that are above 30% ECA change and on specified streams that are ecologically significant habitat (Figure 7-8) for Athabasca rainbow trout, MWFP will commit to incorporating as many of the following mitigation options as possible:

- Follow best management practices for road and water crossing construction, maintenance, removal and remediation;
- Participate in shared or integrated access plans with other road owners as appropriate;
- Conduct operations so that soil surface disturbance is minimized and sediment is prevented from entering the stream during and after work;
- Utilizing LiDAR and Wet Areas Mapping, consider retention of merchantable and non-merchantable structure along ephemeral and intermittent streams, to increase thermal buffering of the water or to cover wet areas or conduct operations to avoid wet areas;
- Plan roads, landing sites, skidding, site preparation, and cutblocks, to minimize impacts to hydrologically sensitive areas (*e.g*. using Lidar and wet areas mapping);
- Minimize the construction of new temporary and permanent roads and crossings; time operations to minimize disturbance of soil surface (e.g. operations in winter versus summer); and
- Close roads to public access (active roads have more erosion risk than inactive roads).

It is recommended that these same mitigation strategies be implemented in other ecologically significant habitat identified in fisheries recovery plans during the implementation of this DFMP.

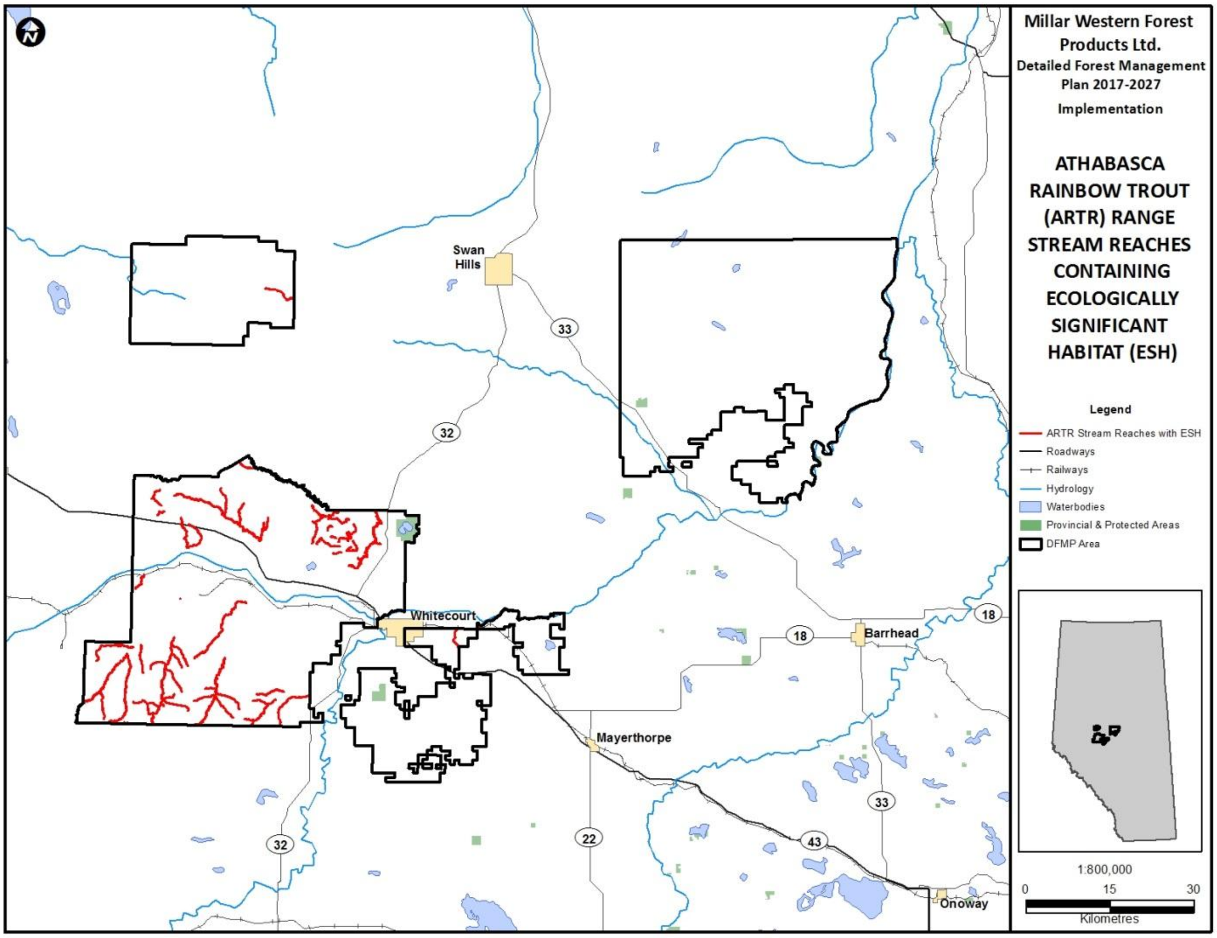


Figure 7-8. Athabasca Rainbow Trout (ARTR) range stream reaches within the DFMP area containing ecologically significant habitat

9.3 Genetic Diversity

This scope of Millar Western's involvement in maintenance of genetic diversity is limited to commercial tree species. Millar Western, through its reforestation program, could potentially impact the genetic diversity of commercial tree species within the DFMP area if reforestation seed/stock was obtained from limited sources. The following strategies will ensure genetic diversity of the commercial tree species within the DFMP area is maintained:

- Millar Western will work with the controlled parentage program (CPP) to retain "wild forest populations" for each tree species in each seed zone through establishment of in-situ reserves, where an approved CPP is in place. Each seed zone that occurs in the DFMP area that requires a conservation area will have one or more genetic conservation areas established, but those areas may not necessarily be in the Millar Western DFMP area.

- Millar Western will also retain wild forest genetic resources through ex-situ conservation for species under CPP programs. An active conservation program will be established for all species in the DFMP area that have a tree improvement program, involving provenances and genetic lines in gene banks and trials, as well as seedlots in archive.
- In both in-situ and ex-situ conservation, Millar Western will follow the requirements relating to tree improvement outlined by the Alberta Forest Genetic Resource Management and Conservation Standards.

10. Monitoring Program

The 2017-2027 DFMP is a long-term, forest-level plan that sets the general direction for forest management within the DFMP area for the DFMP period (*i.e.* from May 1, 2017 to April 30, 2027). Successful implementation of the 2017-2027 DFMP relies, in part, on ongoing monitoring, to ensure that the targets established for the DFMP are attained. Monitoring is an important tool in adaptive forest management, because it links forest management activities with their outcome. This ensures forest management techniques improve and also increases the ability to predict outcomes for forest management activities which, in turn, leads to improved forecasting.

Millar Western is committed to implementing monitoring programs to track progress toward attainment of DFMP targets, as well as to ensure efficacy of its forest management activities. Monitoring programs are required to:

- Meet regulatory requirements;
- Achieve DFMP objectives; and
- Meet DFMP reporting requirements.

Other operators within the DFMP area are required to conduct monitoring associated with regulatory requirements and to meet commitments of the 2017-2027 DFMP.

The following sections outline the monitoring commitments associated with implementation of the 2017-2027 DFMP for the DFMP area. Monitoring programs associated with regulatory requirements are identified, but not described in detail, since they follow direction set by the GoA.

10.1 Regulatory Requirements

To meet the GoA's regulatory requirements, a number of sampling and/or monitoring programs are completed by Millar Western and the other operators on the DFMP area. These reporting requirements are linked but are not specific to the 2017-2027 DFMP. Regulatory reporting is required at ongoing periodic specified intervals, such as during AOP and the GDP submissions. While the 2017-2027 DFMP does not alter these reporting requirements, a few products developed as part of the 2017-2027 DFMP process clarify regulatory reporting and are identified in this section. The information provided below is intended to serve as a listing of the requirements and to guide the reader to the relevant portion of the DFMP.

10.1.1 AAC Drain

Procedures to charge all timber harvested on the DFMP area were developed and summarized in section 4.1.2.

10.1.2 RSA Targets

Reforestation targets were developed following the policies described in the Reforestation Standards of Alberta (RSA). Targets are expressed as Mean Annual Increment (MAI) values for each of the reforested strata. All operators are required to adhere to the RSA program to manage MAI targets. Refer to section 5.1.3 for more information.

10.1.3 Seed Requirements

In order to ensure an adequate supply of seed is available to carry out the reforestation requirements as a result of this harvesting plan, refer to section 5.4.2 for a summary by seed zone. Included are the amount of seed available and the amount of seed required.

10.1.4 Tree Improvement Program

The AAC for the 2017-2027 DFMP was determined with the use of improved stock for white spruce in FMU W13. Millar Western commits to report on any deployment of improved stock during the DFMP period. Refer to section 5.4.3 for more information.

10.2 DFMP Monitoring Requirements

Monitoring requirements derived from the 2017-2027 DFMP are identified in Table 7-2. VOIT implementation. Each VOIT provides a detailed description of the values, objectives, indicators and targets, as well as its reporting requirements. Refer to *Chapter 5 - VOITs* for more information.

In addition to the DFMP VOIT monitoring requirements, Millar Western will also be tracking annually the "predicted versus actual" hauled volumes at a cutblock level, to ensure the overall sustainability of the TSA and the parameters considered in its development.

10.3 Growth and Yield Program

Millar Western's Growth and Yield Program is outlined in a separate document and included in Annex IV of the DFMP. The program describes the monitoring of timber yields and forest growth over the next 10 years which are required to validate the assumptions made in this DFMP and to improve timber yield projections for subsequent plans. The Growth and Yield Program is a working document and will be periodically updated as the program is implemented.

11. References

Alberta. Forestry Division, Alberta Sustainable Resource Development. 2009. Alberta Forest Genetic Resource Management and Conservation Standards. Downloaded from http://esrd.alberta.ca/lands-forests/forest-management/documents/FGRMS-GeneticConservationStandards-2009.pdf

Alberta. 2015. Integrated Land Management. Alberta Environment and Parks. Retrieved from: http://aep.alberta.ca/lands-forests/integrated-land-management/default.aspx

Alberta. 2016b. Alberta Grizzly Bear Recovery Plan Draft. Alberta Environment and Parks. Retrieved from: http://aep.alberta.ca/files/GrizzlyBearRecoveryPlanDraft-Jun01-2016.pdf

Alberta. 2016c. Forest Management Planning – Forest Management. Alberta Agriculture and Forestry. Retrieved from: http://www.agric.gov.ab.ca/app21/forestrypage?cat1=Forest%20Management&cat2=Forest%20Management%20Planning

D'Eon, Robert. 2008. Adaptive management: learning from doing in the face of uncertainty. Sustainable Forest Management Network. Retrieved from: http://www.sfmn.ales.ualberta.ca/Portals/88/Documents/ResearchNotes/RN_E29_Adaptive_Management.pdf?ver=2016-02-23-155808-707

Renaud, D., D. Weedon, D. Chicoine and S. John. 2005a. Region L1 Black Spruce Program Workplan. Prepared for Huallen Seed Orchard Company (HASOC).

Renaud, D., D. Weedon, T. Gylander, D. Chicoine and S. John. 2005b. Region L1 White Spruce Controlled Parentage Program Plan. Prepared for Huallen Seed Orchard Company (HASOC).

Appendix I – DFMP Communications Implementation Plan

This plan has been developed to implement DFMP communications over the period 2017 – 2027.

Millar Western Forest Products Ltd.
2017-2027 DFMP
DFMP Communication Implementation Plan
March 31, 2017

Purpose

The purpose of this plan is to outline strategies for providing First Nations and other stakeholders with access to information about Millar Western's forest management activities and opportunities to influence the planning process over the 10-year term (2017-2027) of the DFMP.

Audiences

- Aboriginal communities
- Millar Western Public Advisory Committee (PAC)
- Other industrial forest users operating in the FMA (e.g., oil and gas companies, grazing lease holders and trappers)
- Other non-industrial forest users, such as recreational groups
- Government representatives, elected and non-elected, at the provincial and municipal levels
- Communities in and adjacent to Millar Western's FMA area
- Media
- General public.

Objectives

The objectives of this plan are to:

Meet regulatory and certification requirements with respect to aboriginal and stakeholder outreach

Provide and promote opportunities for aboriginal communities and stakeholders to influence forest management planning

Maintain Millar Western's reputation for responsible resource management and extend its social license to operate.

Strategies

The company will, over the DFMP period, use a number of different approaches to engage First Nations and stakeholders in its forest management activities.

- *Build Positive Working Relationships with Aboriginal Communities* - In keeping with the Government of Alberta's Policy on Consultation with First Nations on Land and Natural Resources Management and accompanying guidelines, Millar Western will adhere to established processes for gathering aboriginal input into its forest management activities. This includes providing comprehensive information packages in advance of each project and working to mitigate any traditional land-use impacts identified through consultation. In addition, Millar Western will continue to invest effort in enhancing its relationships with communities, including exploring ways to bolster aboriginal participation in the forest sector.

- *Maintain a Public Advisory Committee* - Millar Western will maintain its Public Advisory Committee (PAC), established as a result of the communications implementation plan for the 2007-2016 DFMP. The Millar Western PAC includes broad stakeholder representation from throughout the DFMP area and has, since it was launched in 2007, has provided an effective mechanism for exchanging information, seeking input into forest management and other company plans, and raising awareness of the forest industry's socio-economic contributions to the region.

- *Hold Physical and Virtual Open Houses* - Millar Western will continue to host open houses in communities throughout its operating area, to seek input into annual operating plans. Where possible, it will coordinate with other regional forest companies, to arrange joint open houses and provide "one-stop shopping" for interested parties. With internet delivery of information now commonplace, Millar Western will also rely on providing information through its website, including through its "virtual open house" website page, which experienced strong traffic during the DFMP development period.

- *Use Traditional/New Media to Reach Multiple Audiences* - The company will sustain its practice of placing advertisements with and/or issuing press releases to traditional media (i.e., print and radio), to advise the public about upcoming open houses, events and certain seasonal activities, such annual herbicide programs or startup of the annual winter log haul. Millar Western has also established a presence on social media, primarily Facebook and Twitter, and will use these platforms to further promote consultation opportunities and other newsworthy developments.

- *Respond Effectively to Public Requests for Information/ Concerns* - Millar Western is committed to providing the public with access to information about its operations and to addressing public concerns in a timely and respectful way. Complaints and requests for information will be handled through established processes within the company's Woodlands department.

- *Continue to Support Educational Programming in the Huestis Demonstration Forest* - Millar Western has played a leadership role in promoting the Huestis Demonstration Forest as a showcase for sustainable forest management. Partnering with Inside Education, and with financial support from regional companies, the Alberta Forest Products Association and FRIAA, Millar Western will continue to support the delivery of field-based, in-forest educational programs covering topic areas including the forest ecosystem, issues in sustainable forest management, and career opportunities within the forest sector.

- *Retain Membership in the Industry Associations* – Millar Western will leverage the resources available through its involvement in organizations such as the Forest Products Association of Canada and the Alberta Forest Products Association, to promote sector efforts in responsible forest management and to advance the interests of the forest industry.

Reporting

As per VOITs, Millar Western commits to reporting on its communications and consultation in the following ways:

- VOIT 30 - 5.2.2.1, external consultation and communication initiatives will be summarized in the next stewardship report
- VOIT 32 - 6.1.1.1, aboriginal consultation will be report via the Record of Consultation
- VOIT 33 – 6.1.2.1, First Nations contract opportunities will be summarized in the next stewardship report
- VOIT 35 – 6.2.1.1., progress on implementing public involvement programs will be provided in the next stewardship report.

Appendix II – Structure Retention Strategy

The Structure Retention Strategy for MWFP's 2017-2027 DFMP, dated December 22, 2016 received Agreement-In-Principal from the GoA on January 20, 2017. Revisions requested by the GoA have been implemented into the following strategy.

Millar Western Forest Products Ltd.

2017-2027 DFMP

Stand Level Structure Retention Strategy

January 24, 2017

Background

The following strategy provides the details for the retention of stand level structure in the 2017 – 2027 DFMP.

In this strategy, stand level structure retention is defined as merchantable trees left standing within the **harvest area**[1], in order to provide legacies of the pre-harvest forest, in the regenerating forest, that will be established following harvest. The purpose of stand level structure retention is to maintain habitat and structural complexity by retaining older and larger trees and eventually contribute to coarse woody material on the ground as well. Since forest harvesting targets merchantable trees for removal, the availability of the biologically beneficial attributes of these trees could become significantly reduced within harvested areas unless specific provision is made to retain them.

This structure retention strategy deals only with merchantable stand level retention that is to be left standing within the harvest area boundary. Merchantable riparian and proximal structure retention, outside of the harvest area, has been classified in the net landbase and will be reported elsewhere in the DFMP.

Application

This strategy will be adhered to by all companies conducting harvesting operations on the FMA/DFMP area and will be applied by each company to their respective harvest areas. Each company will submit their summarized information to Millar Western who will be responsible for reporting it to Alberta in the Stewardship Report. The strategy will be effective as of the implementation date of the 2017-2027 DFMP, anticipated to be May 1, 2017.

Stand Level Retention

For the purposes of this strategy, stand level retention is the merchantable timber left standing within the harvest area boundary, either left in islands (undisturbed patches) or dispersed retention (single trees/clumps) within the harvest area boundary. This stand level structure retention strategy will use a target of 3% of the merchantable area to be left as stand level retention. The volume represented by the structure retention area will be drained from the AAC. The 3% target is an increase from the 1% target approved in the 2007 DFMP. Identification of stand level retention will be dealt with at the operational stage. The following objectives were developed to guide implementation, and to successfully achieve the structure retention target.

[1] ***Harvest area:*** *includes both the area where trees have been removed by harvesting as well as the area where trees have been retained in island patches and dispersed retention. Individual harvest areas are identified by unique opening numbers.*

Stand Level Structure Retention Objectives

Retention targets will be met using the following structure retention objectives:

1. The primary goal will be to ensure that the 3% retention is representative of the forest harvested. In certain situations, it will be better to emphasize retention that would be likely to survive fire such as: natural openings, deciduous areas, adjacency to non-merchantable and less fire vulnerable forest cover types, higher soil moisture, wet areas, and similar features. Such areas have high ecological value within a regenerating forest stand, and provide a variety of horizontal and vertical structure linked to higher species richness and greater ecological stability.
2. Non merchantable structure may be retained to supplement the merchantable structure retention but would not contribute to the 3% target.
3. Retention shall be left as islands (undisturbed patches) as well as dispersed (single trees/clumps). Island retention is safer operationally (i.e. safety of harvesting and silviculture personnel from overhead hazards presented by single trees throughout a harvest area). The retention of single trees/clumps will be considered on a site specific basis and will be included in achieving the 3% retention target. Examples of different types of retention are illustrated in Figure 1.
    a. Example a and c in Figure 1 width to depth ratio of the proximal retention dimensions must be at least 1:1 (i.e. patch adjacency to harvested area boundary must be equal or less than patch width perpendicular to harvested area boundary);
    b. Example b in Figure 1 will not be the only type of structure retention left within the majority of harvest areas – the primary purpose of this structure retention example is reducing line of sight into harvest areas and should be considered in situations where line of sight into the harvest area is a primary concern;
4. Structure retention strategies utilizing pre-harvest assessment and design are preferred over strategies that use logging contractor discretion.
5. Harvest areas smaller than 8 ha in size may have less than 3% (including in some cases 0%) merchantable structure retention. Harvest areas 8 ha and greater would require the target of 3% structure retention. All area harvested, including those harvest areas less than 8 ha, will contribute to the area used in the calculation determining the success in meeting the overall 3% target. Justification will be provided when less than 1.5% structure retention within a block is preplanned.
6. The size of retention patches will increase as block size increases. This will help with the other wildlife objectives in the Operating Ground Rules, such as line-of-sight, distance to hiding cover and distance to thermal cover. Larger retention patches will generally be located in larger blocks. It is to be noted that due to the previous harvesting pattern within the DFMP area, there has been and will be a prevalence of second pass harvest areas within the spatial harvest sequence (SHS) thus limiting the occurrence of larger harvest areas.
7. Small retention patches (<1 ha) will consist of wind-firm trees that would normally stand for an extended amount of time. Over mature conifer retention should only be left in larger patches as it has a greater risk of blowdown. Distribution and placement of any retention should consider

windfirmness to ensure the majority of the retention remains standing in the years following harvest. This consideration may influence how much retention is in islands versus being distributed in small clumps and single trees.

8. Buffers around features such as mineral licks, dens, and nests within harvest areas can be classified as structure retention and contribute to the 3% target; some of these types of buffers may be attached to the edge of the harvest area and can still contribute to the 3% as stated above. While this structure retention pattern is permitted to contribute to the 3% target, it should not comprise the majority of retention.
9. All retention will be excluded from harvest for one rotation (based on minimum harvest ages as indicated in the TSA section of the DFMP), unless otherwise approved to be harvested within a lesser timeframe.

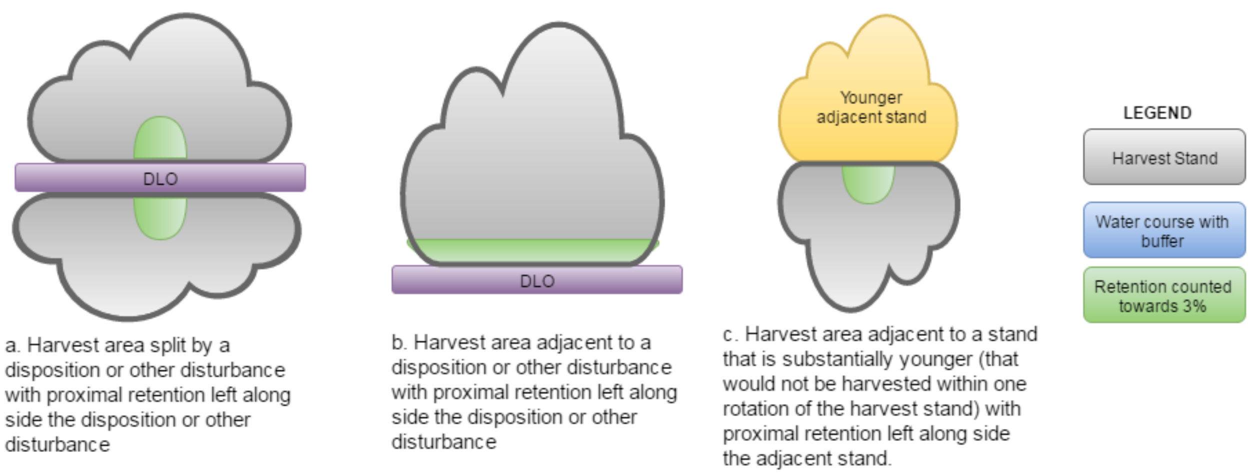


Figure 7-9. Examples of proximal structure retention that would count towards the structure retention target

Stand Level Structure Retention Target

The 3% target shall be achieved over the 10 year DFMP period. Annual and landscape variations are permitted, providing the 10 year target is achieved (refer to VOIT #10; 1.1.2.1a). Planning for retention is required and it will be noted in the FHP as to how the target will be met by indicating the location of retention patches and a summary of how the 3% target is being achieved.

Monitoring, Measuring and Reporting Structure Retention

1. Merchantable structure retention retained in harvest areas will be determined and drained annually (by January 1 following the end of the timber year) by each applicable operator. There may be a lag of one timber year in reporting structure retention. For example, a block logged in December of 2016 may be reported in the 2017/18 timber year and will be reported by January 1, 2019.
2. All operators operating on the FMA must layout and retain structure retention in their harvest areas.
3. A minimum 3% of the harvest area must be drained by each operator every 5 years. Annual variation is anticipated. The 3% metric will be measured and submitted as part

of a structure retention table in each Forest Harvest Plan (FHP). Islands will be identified on FHP maps and flagged during block layout.

4. Dispersed retention can be converted to an area by using the following formula. Dispersed retention should be determined following site preparation treatments.

   Area = (number of live trees/piece size) / (average volume per ha)

   where piece size = number of trees equaling 1 m^3 net merchantable volume

   Eg. # live trees = 54, piece size = 3 trees /m^3, average volume/ha = 180 m^3/ha.

   Area = (54 trees/3 trees/m^3) / (180m^3/ha) = 0.1 ha of structure retention

5. The percent of the total ***harvest area*** left as structure retention for each 5-year period shall be reported in the Stewardship Report or next Forest Management Plan. (see Appendix A for tabular format of information)

Reporting

It will be the responsibility of each operator to review their progress towards achieving the structure retention targets, on an annual basis. Each operator will provide their information to the GoA as requested. Each operator will be required to provide Millar Western their structure retention data in a digital format (*e.g.* table of area retained in each block).

In preparation for the Stewardship report each operator will submit their summarized information to MWFP who will be responsible for reporting it to GoA. If targets are not achieved, an action plan will be proposed by each operator for inclusion in the Stewardship Report to ensure that the 10 year target is achieved (refer to VOIT #10; 1.1.2.1a).

Appendix III - Woodland Caribou Habitat Strategy

The Woodland Caribou Habitat Strategy for MWFP's 2017-2027 DFMP, dated December 22, 2016 received feedback from the GoA on January 23, 2017. Any reporting the GoA requested is presented in *Chapter 6 – PFMS.*

Millar Western Forest Products Ltd.

2017-2027 DFMP

Woodland Caribou Habitat Strategy

February 22, 2017

Background

Woodland Caribou is listed as a threatened species in Alberta. Since the development of Millar Western's current 2007-2017 DFMP, much attention has been drawn to caribou ranges throughout Alberta. In 2012, the federal government released the Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population in Canada, and in accordance, the Government of Alberta (GoA) will be releasing range plans, specific to each caribou range across Alberta; the anticipated release of these plans is the end of 2017. Once approved, range plans will supersede strategies in place for caribou within the DFMP. This has added complexity for companies whose FMA area contains caribou ranges and that are currently developing DFMPs planned to be submitted before the anticipated release of the Alberta Caribou range plans.

A portion of FMU W11 is within the Slave Lake caribou range and thus the DFMP is influenced by the Government of Alberta's Woodland Caribou Policy for Alberta (June 2011) and the Alberta Woodland Caribou Recovery Plan 2004/05–2013/14 (July 2005). Alberta's woodland caribou policy statement recognizes that "stabilizing, recovering and sustaining woodland caribou populations is an investment in maintaining Alberta's diverse natural environment. Successfully achieving this result will require the identification, maintenance and restoration of sufficient caribou habitat". GoA will accomplish this through the establishment of range-specific plans containing caribou population and habitat objectives and specific measurable targets.

Caribou recovery plans identify how range-specific caribou plans will be developed and the relationships to and implications for industrial activity, which includes forestry and forest management planning. The GoA has identified the Spatial Harvest Sequence (SHS) as the key component of a DFMP where caribou management concerns can most effectively be addressed. Without an approved caribou plan in place for the Slave Lake range to guide the development of MWFP's 2017-2027 DFMP, Millar Western in cooperation with the PDT developed this caribou habitat strategy to supplement the development of the SHS for this DFMP as well as guiding implementation at an operational level.

Caribou habitat is the component of the caribou recovery plan or caribou landscape plan which forest management planning and operations can influence. With caribou habitat as the focus, and without an approved caribou range plan in place for the Slave Lake range, the Woodland Caribou Habitat Strategy for MWFP's 2017-2027 DFMP was developed to manage the impact on caribou habitat.

The GoA, on November 30, 2016, provided Millar Western with direction on the development of a strategy regarding harvesting within the Slave Lake Caribou Range. Using the direction provided, Millar Western has developed a strategy for planned harvest within the Slave Lake Caribou range to address principals outlined in the direction provided. The objective of the caribou habitat strategy is to mitigate the impacts of harvesting on the portion of the Slave Lake range within FMU W11.

Overview

Millar Western's FMA contains only a portion of the Slave Lake Caribou range (see Figure 1). Approximately 17% of the Slave Lake Caribou range is contained in FMU W11, which is approximately 15% (26,103 ha) of the gross FMU W11 area (175,714 ha).

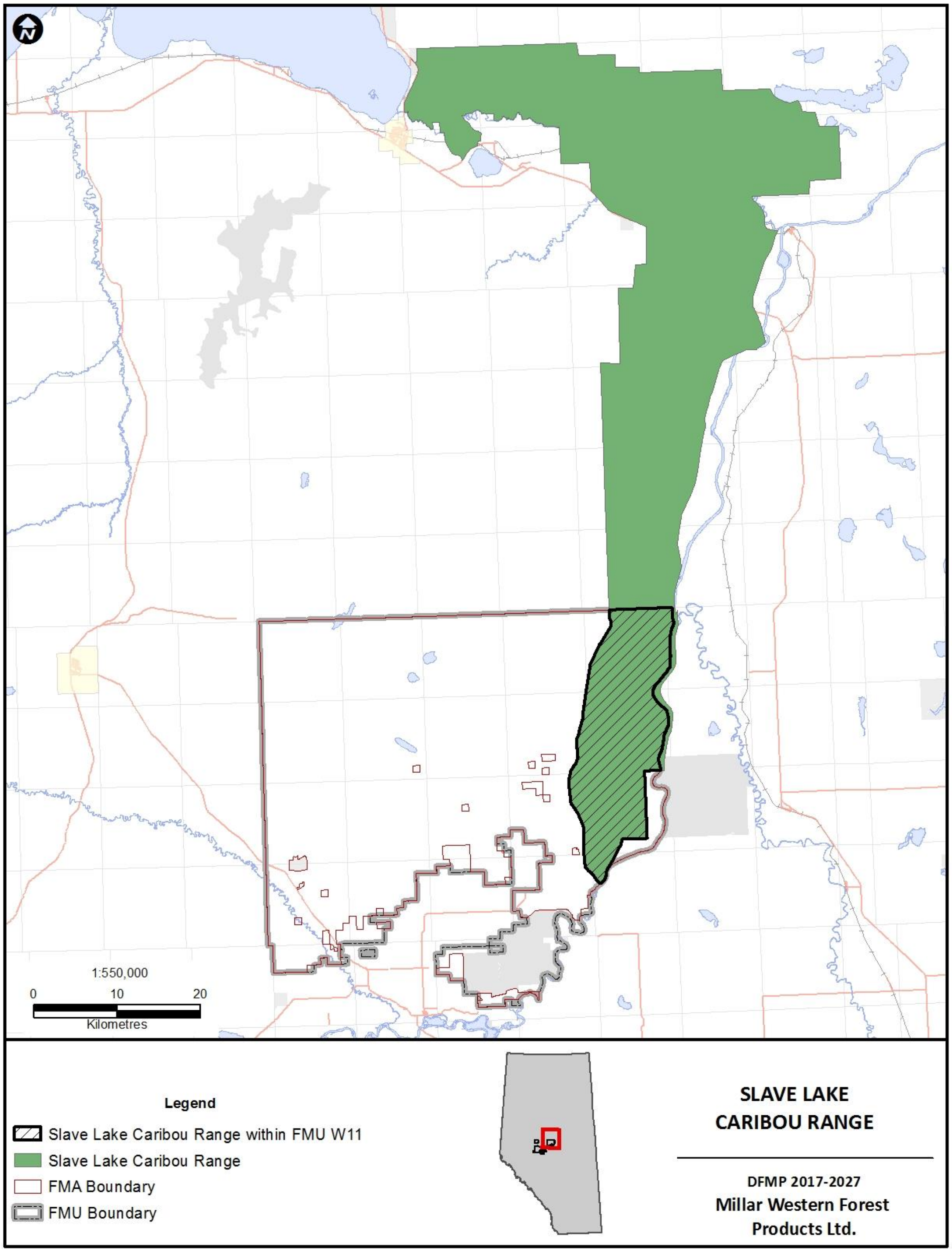


Figure 7-10. Slave Lake Caribou Range in respects to the Millar Western FMU W11

In relation to the federal Caribou recovery strategy – critical habitat for caribou requires habitat that meets a minimum of 65% undisturbed. Analysis was completed which summarizes the area in hectares as well as the percentage of land that is disturbed according to the federal Caribou recovery strategy – inclusive of a 500 metre buffer on anthropogenic disturbances. This information is current as of May 1, 2015 and includes:

- Dispositions and roads from DIDs and anthropogenic disturbances noted in AVI;
- Seismic lines (no attributes to determine whether they are reclaimed or not – so includes all captured seismic lines);
- Cutblocks that are younger than 40 years old (none were identified within the portion of the Slave Lake range in FMU W11); and
- Wildfires that are younger than 40 years old.

97% of the Caribou range that falls within FMU W11 is classified as disturbed according to the Federal Caribou recovery strategy – this includes all linear disturbances (specifically seismic lines) with a 500 metre buffer applied. 64% of the Caribou range that falls within FMU W11 is classified as disturbed without including specifically seismic lines and their buffers. There are large wetland complexes within the W11 portion of the caribou range that limit harvesting opportunities. Only 36% of the Caribou range is productive timber area that could be harvested over the long term, *i.e.* comprised of active landbase; which is only 5% of FMU W11's active landbase. In addition, the caribou range is relativity young with only 12% of the caribou range old enough that is eligible for harvesting in this DFMP (which is only 2% of FMU W11's currently eligible area). Due to the younger age class structure, there has been very little harvesting inside the range but there is significant energy exploration and development.

To deal with the interim period before caribou range plan approval, guiding principles and interim strategies were developed to address caribou habitat and to guide harvesting for the 2017-2027 DFMP. These guiding principles, strategies and their implementation in the DFMP are subject to review and revision when the caribou range plan is approved.

2017-2027 DFMP Strategies

Millar Western's guiding principles to address caribou habitat for the 2017-2027 DFMP are:

- Sequence a limited amount of harvesting in the first 10 years with longer term harvest sequencing within the range;
- Provide adequate time for range plan development before harvesting;
- Apply extensive forest harvesting and regeneration strategies that support long term habitat within the range;
- Apply footprint reduction techniques where applicable within the range; and
- Be an active participant in the development of the Slave Lake range plan process.

<u>Minimizing and Clustering Footprint</u>

Cluster coniferous and deciduous harvesting together and into a few large patches and do not sequence small scattered stands. For the purpose of this strategy, harvesting has been clustered into one portion of the range within FMU W11, reducing the overall footprint and access points into the Caribou range to harvest.

Older Minimum Harvest Ages

As part of the fiber resource strategy and to assist in optimizing the AAC, Millar Western has implemented younger minimum harvest ages where appropriate. For the caribou range an older minimum harvest age or 80 years for all stands will be used for the DFMP.

Reforest Historical Footprint

Historical footprints that are adjacent or within planned conifer harvest blocks will be reforested as part of the block regeneration; this includes features such as seismic lines. Millar Western, on a FMA wide basis, already implements regeneration of historical footprints such as seismic lines that are adjacent or within harvested conifer blocks; unless there is identified values in keeping that footprint open (*e.g.* trapping, recreation trail, etc.).

Integrated Land Management Participation

Millar Western plans on of participating in integrated land management if the opportunity arises for harvesting activities planned within the Slave Lake range within FMU W11.

Carryover Volume

Carryover volume will only be harvested outside of the range before proceeding to harvest inside the range.

Harvest Deferral

Millar Western has agreed to the deferral of planned harvest blocks in the SHS for a minimum of 5 years, or until the Slave Lake/Nipisi range plan has been completed which would provide long-term guidance on the forest management within the range, whichever comes first. Currently the SHS submitted with the 2017-2027 DFMP, identified planned blocks within the range to be harvested in the second quadrant of the first ten year sequence, *i.e.* 2022 to 2027.

Access

For planned harvest blocks that have been identified within the Slave Lake caribou range in W11, winter access will be used to access the blocks. Existing access will be utilized where possible to minimize the footprint needed to access the stands; however, approximately 2 kilometres of road will be required to access these stands. Under the current provincial framework, a permanent disposition would be necessary on this access road based on the period of time that this road will be needed. Millar Western would be open to discussing alternative strategies with the GoA for the management of this access rather the requirement to take out a permanent disposition. Once inside the area to be harvested, only temporary access winter roads will be established. These roads will be decommissioned once stands are harvested and conifer stands are regenerated.

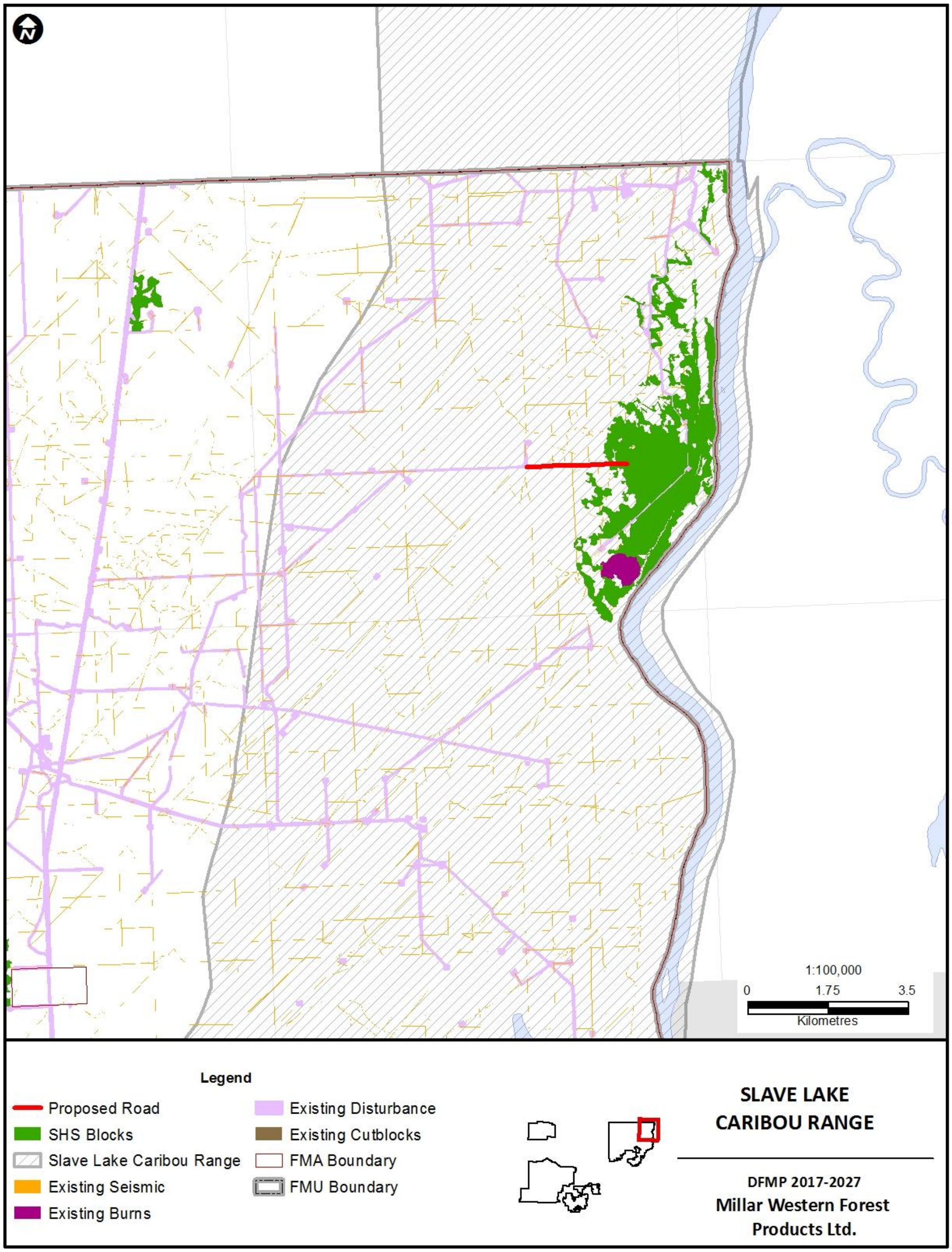


Figure 7-11. Proposed access to SHS blocks within Slave Lake Caribou range in FMU W11

Appendix IV - Grizzly Bear Habitat Strategy

The Grizzly Bear Habitat Strategy for MWFP's 2017-2027 DFMP, dated December 22, 2016 was approved by the GoA on January 23, 2017. Any reporting the GoA requested in addition to VOIT requirements *(which can be found in Chapter 5 – VOITs) is presented in Chapter 6 – PFMS. VOIT reporting of predicted impacts on grizzly bear is summarized in Section 4.7.1 of Chapter 5.*

As part of the direction provided by the GoA, it was recommended that Millar Western identify or commit to existing or new operating ground rule items, pertaining to grizzly bears, that would be carried forward into the next set of operating ground rules. Current OGR's that pertain to grizzly bears include: B 4.1 (6.0), B 4.2 (7.0), and C 2.0 (2.6). OGR C 2.0 (2.6) refers to following direction within the higher order plans which would include the strategy within this DFMP.

Millar Western Forest Products Ltd.

2017-2027 DFMP

Grizzly Bear Habitat Strategy

February 23, 2017

Background

The Government of Alberta (GoA) developed draft guidelines for conducting analyses of forest management activities on grizzly bear habitat. These draft guidelines served as the basis for the Grizzly Bear Strategy. These guidelines evolved from GoA's work with the Grizzly Bear Program and the Alberta Grizzly Bear Recovery Plan team.

Grizzly bears were officially listed as a *Threatened* species in Alberta in June of 2010 (Grizzly Bear Conservation in Alberta: 2013 Management Activities and Recovery Implementation, April 2014 Government of Alberta). Access management, particularly minimizing motorized vehicle routes across Grizzly Bear range is essential to maintaining this species on the landscape. In following the intent of the goal and recovery activities in the Draft Alberta Grizzly Bear Recovery Plan 2016-2021 (2016), it is important to minimize access, avoid harvest within primary habitat and prioritize harvest to areas near existing roads.

Overview

In Alberta, prime grizzly bear habitat is classified into core and secondary habitats. The area occupied by Millar Western's FMA is only a small portion of the Alberta grizzly bear population area. Over one third of the FMA is outside core and secondary grizzly bear habitats. The Swan Hills grizzly bear population comprises a majority of the core and secondary habitat within the FMA, including portions of both FMU W13 and W11; while the Grande Cache population within the FMA area is restricted to the main portion of FMU W13 and consists only of secondary habitat (Figure 1).

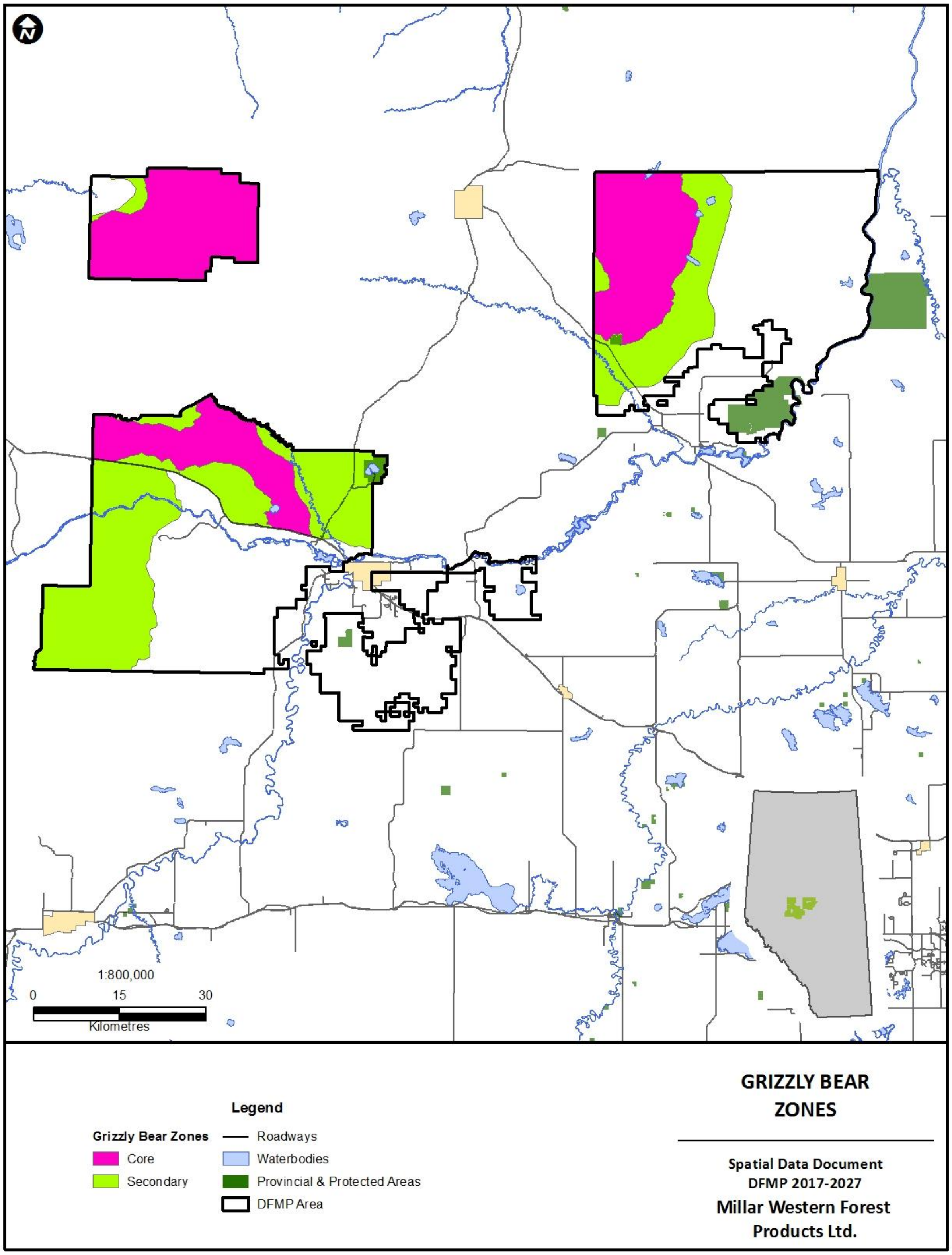


Figure 7-12. Grizzly Bear zones within the Millar Western FMA

2017-2027 DFMP Strategies

Millar Western in cooperation with the Plan Development Team (PDT) identified the following strategies for grizzly bear habitat. It was recognized that much of the grizzly bear strategies will be operational in nature rather than strategic. Operating ground rules for grizzly bears describe some of the operational considerations employed.

Cluster and Minimize Footprint

For the purpose of this strategy, harvesting has been clustered by controlling which compartments can allow for harvest for certain time periods. Grouping of harvest blocks was also applied to try and reduce the amount of access required to access areas.

For annual harvest sequencing, harvest grouping of blocks in the same year to reduce the amount of open access will occur.

Access

Grouping of harvest blocks was also applied in an attempt to try and reduce the amount of roads required to access areas. Existing access will be used wherever possible to try and reduce the amount of new roads required to access blocks. Where practicable, Millar Western will use winter access within core and secondary habitat zones. Where possible Millar Western will not leave temporary roads open for longer than 2 years.

Integrated Land Management

Where possible, Millar Western will coordinate with other operators on the landbase to reduce footprint and coordinate the timing of operations.

Open Area and Sightability

Millar Western will consider leaving buffer strips along primary roads to reduce visibility where operationally feasible and where other objectives are not impacted. Additional considerations could include using the fRI sightability tool in operational planning, increased harvest block edge, the retention/deferral of visually critical or high value areas, the scheduling of blocks to manage access and the amount and timing of disturbances, restrictions on the timing of activities permitted within the block, and restrictions on access to operating areas.

Appendix V – Barred Owl Habitat Strategy

The Barred Owl Habitat Strategy for MWFP's 2017-2027 DFMP, dated February 8, 2017, was reviewed by the GoA, and comments and recommended revisions were provided to Millar Western on March 9, 2017. The following strategy addresses these recommendations. Additional reporting requirements relating to barred owl, supplemental to those associated with the VOITs, are presented in *Chapter 6 – PFMS* and *Annex VI – TSA. VOIT reporting of predicted impacts on barred owl is summarized in Section 4.7.2 of Chapter 5.*

Millar Western Forest Products Ltd.
2017-2027 DFMP
Barred Owl Strategy
April 5, 2017

Background

In Alberta, the barred owl (*Strix varia*) has been listed as a species of special concern. The barred owl is the larger of the cavity nesting owls in North America. It is a year round Alberta resident requiring large decaying or dead trees for nesting. Preferred barred owl habitat generally consists of old mixedwood forest across the boreal, foothills and aspen parkland regions of Alberta. Millar Western began modeling barred owl habitat as part of the Biodiversity Assessment Project (BAP) incorporated in to the 1997-2007 and the 2007-2016 DFMP. Modeled predictions of suitable barred owl habitat in the FMA area have been low. Three barred owl models predicting foraging, cover and nesting habitats were used in the BAP process (refer to 1997-2006 DFMP Chapter 3: Impact Assessment, page 39). All predicted low HSI levels but the spatial arrangement of the nesting habitat was generally consistent with predictions for the 2017-2027 DFMP.

Overview

For the 2017-2027 DFMP, barred owl was one of the eight species included as part of the GoA's non-timber assessment (NTA) process. All of the NTA models predict the amount of suitable habitat and species population levels, however there is no guarantee that the population will be present. The barred owl model that was used in this process was constructed by the GoA, based on Mike Russell's thesis. During the application of the model it was determined that three revisions would improve the effectiveness of the model:

- The thesis used 30 as the age cut-off for the DISTOPEN metric. Model updated to use the same age as the cut-off for the forested vs. non-forested polygons for the ATOP calculation;
- The landbase was dissolved into forested and open polygons, this implements the intent of the thesis ensuring that ATOP values will be within the designed range of the thesis statistical analysis; and
- Removed two lines of code which identify MOD1 records with "CC" attributes. In the future, time periods, the stands are identified by the age field.

These improvements were implemented in the final version used for the DFMP.

The model contains two main components: a Resource Selection Function (RSF) component and a breeding pair habitat prediction. As part of the function for calculating Breeding Pairs – large square raster cells (562 ha) were used to calculate the habitat to support potential breeding pair locations/numbers. This approach may also require refinement, as the model formulation does not integrate well with the future forest spatial representation generated by the timber supply modeling process. The barred owl model uses future forest predictions as the input to predict breeding pair habitat.

2017-2027 DFMP Strategies

Unlike many of the other GoA NTA models, it was not possible to build a target into Patchworks that was comparable to the breeding pair determination in the barred owl model. In attempts to improve breeding pair predictions without an excessive impact on AAC (which has already been constrained due to maintaining other values such as black-throated green warbler habitat, seral stage targets and ECA), targets controlling harvest patterns were added into 2017-2027 Patchworks modeling but were limited in their success to improve the solution for barred owl breeding pairs. Section 4.3 in Annex VI has details on scenarios completed to compare strategies. Chapter 6, section 4.10.3 describes the patch targets used in the PFMS to modify the sequence for barred owl purposes.

As a result it was recognized that for this DFMP, strategic solutions would be limited but that operational strategies could be employed. Millar Western in cooperation with the Plan Development Team (PDT) identified the following strategies for barred owl habitat to be incorporated as much as possible in the primary compartments (Whitecourt Mountain, Hard Luck Creek, Paddle River, Groat Creek, Goodwin lake, and Bessie Creek) and where possible, in the secondary compartments Sand Hills and Robison) and general areas of concern (along the Athabasca River/Long End Lake and Klondike, along the Freeman River/South Freeman and North Freeman, and around the Alexis reserve).

Strategic Mitigation

Maintain Mature Mixedwoods

Barred owl prefers relatively undisturbed patches of mature mixedwood forest. The preferred forest management scenario (PFMS) retained patches of mature mixedwood across the landbase over time. The GOA has indicated concerns that not enough habitat above 80 years of age is being maintained. From summaries of the spatial harvest sequence (SHS) produced for the first ten year period, 92% of deciduous and mixedwood stands scheduled for harvest are a minimum of 80 years of age, in the second ten year period, 97% of deciduous and mixedwood stands scheduled for harvest are a minimum of 80 years of age across the FMA. Specific to the primary compartments of concern identified by the GOA, 98% of the first ten years of the SHS, and 89% of the second ten years is harvested at a minimum of 80 years of age (see Annex VI, Section 4.3.2.2 for more details). In the compartments of secondary concern, the values are 99% of the first ten years of the SHS, and 100% of the second ten years of deciduous and mixedwood stands are scheduled for harvest at a minimum of 80 years of age.

Minimize Habitat Fragmentation through Strategic Implementation of SHS

During scenario development and creation of the PFMS, considerable effort was spent on grouping of harvesting blocks as well as maintaining a range of patch sizes, including maintaining larger patches of mature mixedwood stands. Harvesting should be sequenced to minimize the fragmentation of future barred owl habitat (see Chapter 6, Section 4.10.3 for more details).

Operational Mitigation

Minimize Permanent/Temporary Access and Duration

As the FMA has extensive existing permanent access throughout it; much of which is from the energy sector, Millar Western requires few new permanent roads (approx. 5 km in all of FMA). Temporary roads following access already established access (e.g. seismic lines) should be used where possible.

Structure Retention Strategies

As part of achieving the 3% structure retention target, where possible in compartments identified as primary and secondary Barred Owl habitat, Millar Western will retain integrity of large diameter snags and decadent poplar overstory trees (>34 dbh), with surrounding retention retained to provide larger clumps of trees for more preferable nesting habitat. Large structure retention patches approximately 300 meters from block edges of mature mixedwood may provide foraging areas.

Harvest Activities Timing

Where possible, Millar Western will avoid harvesting barred owl habitat during the critical nesting and fledgling period of March 14th to July 15th.

Appendix VI – Incidental Conifer Strategy

To address incidental conifer in W11, a new strategy was developed and implemented for the 2017-2027 DFMP.

Millar Western Forest Products Ltd.
2017-2027 DFMP
Incidental Conifer Replacement Strategy
February 23, 2017

Background

Millar Western completed a Preliminary Forest Management Plan (PFMP) for W11 in 2004, when FMU W11 was added to its FMA area. Sustainability of the timber resource is dependent upon regenerating yields, which includes both primary volume and incidental or secondary volumes. The GoA recognized this and identified the maintenance of coniferous incidental volumes as an issue. The GoA's premise of the PFMP timber supply was that, without incidental coniferous volume being actively replaced in deciduous stands, the coniferous AAC will not be sustainable. The PFMP approval letter stated the following regarding the coniferous volume replacement:

> *"Millar Western shall monitor and report area of pure deciduous stands harvested annually. Coniferous volumes from pure deciduous stands will be replaced by converting pure deciduous stands to pure coniferous stands according to the following formula:*
>
> *[Yield curve estimate of incidental coniferous volume per ha in pure deciduous stands at 80 years] / [Yield curve estimate of coniferous volume per ha in pure coniferous stands at 80 years] = [ha of pure deciduous stands to be converted per ha cut] or, 1 ha reforested to pure coniferous for every 2.2ha of pure deciduous strata harvested."*
>
> *Millar Western and the embedded operators shall develop an incidental replacement strategy for coniferous volumes acceptable to the Executive Director, Forest Management Branch, for inclusion in the DFMP due in 2006."*

An incidental replacement strategy for coniferous volumes was implemented as required by the approval condition. Upon approval of the 2007-2017 DFMP, the GoA included a similar incidental coniferous replacement approval condition, with the formula adjusted to reflect changes in the yield curves. Millar Western and Spruceland have been implementing the conversion of pure deciduous stands to pure coniferous to meet the approval condition. Incidental conifer replacement has been reported on for the 2007-2017 DFMP period, and is summarized in Chapter 4 of this DFMP, under the Harvesting Metrics section.

2017-2027 DFMP Strategies

Millar Western has always considered incidental conifer and the development of a conifer replacement strategy to be problematic in W11. The root cause of the problem was that the classification of the W11 forest inventory was of poor quality, especially in the older stands; much of the area that was classified as pure stands was actually mixedwood stands, which produced a pure deciduous yield curve with a large amount of conifer incidental volume. This incidental volume supports a large part of the W11 conifer timber supply. The problem was made more complex by the fact that much of the younger pure deciduous stands were in fact pure deciduous and had no conifer understory. When these stands were harvested in the following 20 years, they did not produce the same level of incidental volume as did the current stands. The issue is compounded by the scale of the problem: the large area of the pure deciduous stratum is forecast to produce almost one third of the coniferous timber volume in FMU W11. Millar Western's approach to this issue has been to generate better information upon which to base incidental conifer volumes, including developing improved forest inventories and applying regenerated yield curves that reflect the incidental coniferous volumes actually achieved from silvicultural activities.

With the 2017-2027 DFMP, the situation has changed. A new forest inventory and volume sampling program have been completed, providing the current baseline information required to address this issue. In addition, regenerated yield curves created from data collected from the sampling of regenerated stands for the 2017-2027 DFMP better represent actual incidental volumes than the curves available in previous timber supply analyses. The result is that the new timber supply better represents the current condition and the results achieved from actual regenerated activities. Incidental conifer regeneration in aspen blocks will be assessed through performance surveys as per the Regeneration Standards of Alberta (RSA) and will compare actual conifer MAIs to the MAI targets derived from the regenerated AW yield curve. Millar Western believes that the RSA will serve as the mechanism for ensuring that incidental conifer is maintained in regenerating aspen cutblocks in W11 over time, and, since there is no longer any conifer being "lost", replacing this conifer elsewhere on the landbase is unwarranted.

Appendix VII – GoA FireSmart Management Report

The FireSmart Management report was received from the GOA on March 29th, 2017. The recommendations listed in this report are included in the "Forest Protection" section of Chapter 7, under "6.1.6 Prevention and Salvage".

Alberta Government

Millar Western Forest Products FireSmart Management 2017

Completed by: Alberta Agriculture and Forestry, Forestry Division, Wildfire Management Branch

Millar Western Forest Products FireSmart Management 2017

Introduction

Wildfire is the dominant natural disturbance agent on this landscape, responsible for a significant part of landscape and site level diversity.

The aim of wildfire management is to balance the ecological role of fire while protecting human life, communities, watersheds and sensitive soils, natural resources, and infrastructure. The intention of the Alberta FireSmart program is to integrate fire, forest management, land management and community protection planning through a broad risk and resource management approach.

The goal of FireSmart forest management planning is to create a landscape in which catastrophic fire is minimized. This is accomplished through a combination of:

• Reducing the fire behaviour potential,

• Reducing the exposure of values at risk to fire,

• Targeting harvest to locations with problematic forest fuel types,

• The consideration of species conversion, reduced stand stocking densities and reduced coarse woody debris retention in locations harvested near communities, and

• Ensuring linkages to other Fire Smart strategies—such as Community Wildfire Mitigation Strategies.

Landscape –Natural Subregions

The Millar Western Forest Products FMA is comprised of three Natural Subregions (NSR). These include the Central Mixedwood, Lower Foothills, and Upper Foothills.

The combined Lower Foothills NSR and Central Mixedwood NSR cover the majority of the FMA with a smaller area of Upper Foothills NSR. Wildfire within the three Natural Subregions is characterized by the following attributes from a Fire Regime Analyses (Alberta Wildfire Regime Analysis- Tymstra, Wang, and Rogeau, 2005). These characteristics are of the Natural Subregions from a Provincial perspective, not just the Millar Western Forest Products FMA area:

Central Mixedwood

- Fire cycle: 226 years (Alberta Wildfire Regime Analysis – 2005)
- Human caused spring fires common
- Lightning caused fires occur predominately in the summer months

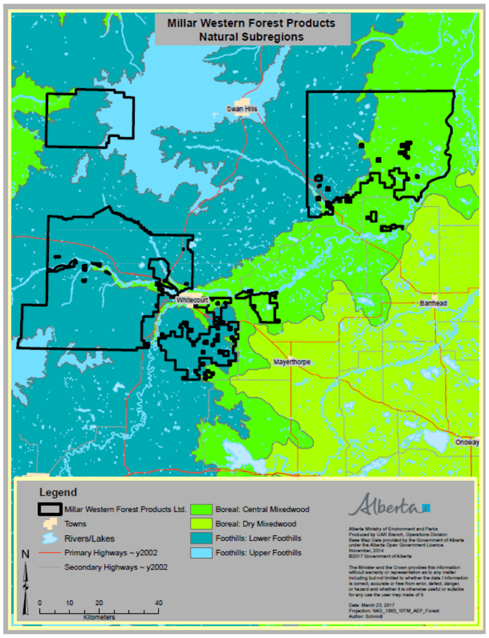
- May is a critical month because Aspen mixed wood stand do not reach green-up until late May
- Areas with infrequent, large wildfires, and areas with frequent small wildfires

Lower Foothills

- Fire cycle: 475 years (Alberta Wildfire Regime Analysis – 2005)
- Human caused spring fires common
- Lightning fires occur predominately in the Summer months
- Frequent, medium sized wildfires

Upper Foothills

- Fire cycle: 627 years (Alberta Wildfire Regime Analysis – 2005)
- Experiences more lightning-caused wildfires than the Lower Foothills NSR
- Frequent, medium-sized wildfires and infrequent, large wildfires

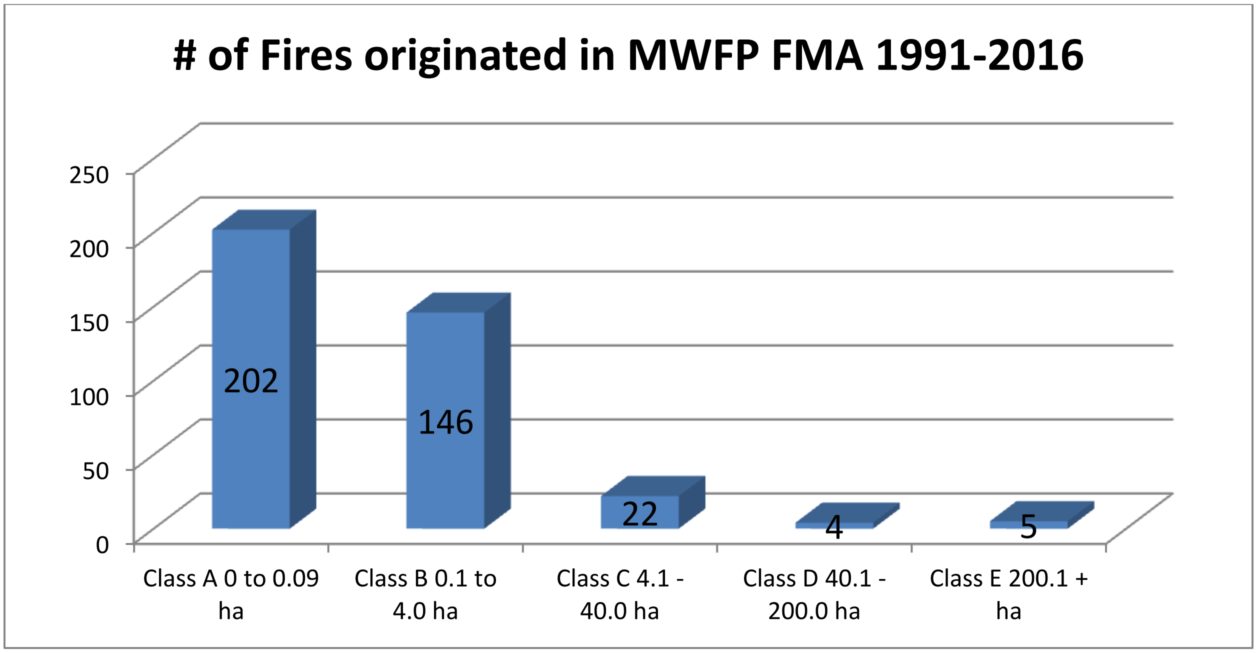


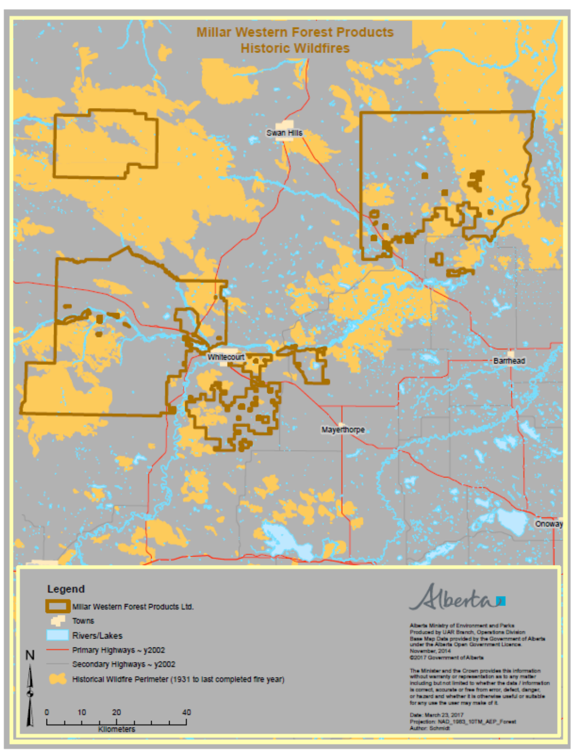
Fire Type -25 Year Analysis of Fire Size and Historical Fires 1991-2016

379 fires originated within Millar Western Forest Products FMA, and one large fire (Virginia Hills Fire, 1998) burned into the FMA during this 25 year span. They ranged in size from 0.01 to 4875 hectares, with a total area burned of 12,276 hectares. There was almost an even split of human caused (57%) and lighting caused (43%) fires.

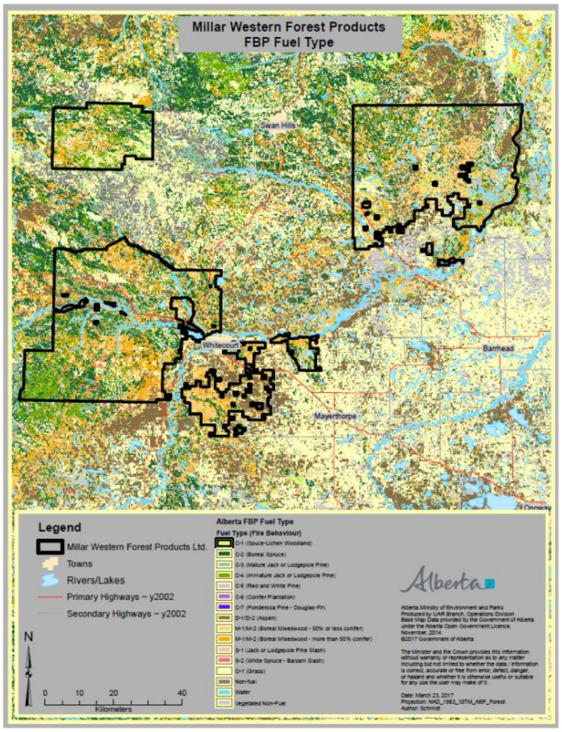
Large wildfires on the landscape are usually characterized as fires that escape initial attack and burn at high intensity (crown fire) over multiple burning periods.

There have been five E class fires (>200 ha's) that originated in the MWFP FMA during the last 25 years. The Roche Lake fire (4875.3ha) was the largest. The Virginia Hills Fire of 1998 (163, 138 ha) originated outside Millar Western's FMA and burnt across 3 FMA's.





Forest Fuel Types



Recommendations

- Areas with continuous coniferous fuel types are susceptible to large wildfires. Where possible, harvesting should be designed to reduce the continuity of these coniferous fuel types.
- Harvest should align with community protection objectives and harvest sequencing should occur early within the SHS.
- Work with Wildfire Management Staff to identify priority areas within the contributing landbase and explore opportunities to mitigate high risk black spruce stands in the non-contributing landbase.

References

Tymstra, C., D. Wang, and M-P. Rogeau. 2005. Alberta wildfire regime analysis. Wildfire Science and Technology Report PFFC-01-05. Alberta Sustainable Resource Development, Forest Protection Division, Wildfire Policy and Business Planning Branch. Edmonton, AB.

Appendix VIII – Regeneration Transition Matrix for W13

The Regeneration Transition Matrix was submitted as part of the silviculture strategy in FMU W13. The document received Agreement in Principle from the GoA on June 17, 2016.

Proposed Regeneration Transition Matrix for W13

Millar Western is proposing to make three strata transitions in W13 for the 2017-2026 DFMP. These strata transitions are being proposed for three main reasons:

- to promote ecosystem health and productivity
- to facilitate regeneration and minimize herbicide use
- to offset non-desirable transitions from the previous DFMP

Table 1 summarizes the proposed regeneration matrix for W13 for the 2017-2026 DFMP and includes strata transitions based on percentage of area harvested for AW, AP, SB and DU strata. The proposed transitions would be carried out by Millar Western and would not apply to any other tenure.

These proposed strata transitions will be modeled for the 2017-2026 DFMP period only. **There will be no assumption of any strata transitions beyond 2026.**

Table 1. Summary of proposed regeneration matrix for W13 for 2017-2026 DFMP

	Regenerated Strata								
Harvested Strata	**AW**	**AP**	**AS**	**PA**	**SA**	**PL**	**SW**	**SB**	**DU**
AW	81%						19%		
AP		50%				50%			
AS			100%						
PA				100%					
SA					100%				
PL						100%			
SW							100%		
SB						60%		40%	
DU					100%				

Proposed AW Strata Conversion

Proposal

Many hectares of AW in W13 are in a serious state of decline. These stands exist on rich sites, many of which were high-grade logged in the 1950's and 1960's. The resulting stands are very open and grassy and do not regenerate well to aspen after harvesting. In many cases it would be impossible to pass the regeneration standard for a D block. These stands are in the process of converting to non-forested stand types, and in an effort to keep these stands as part of the productive forest landbase, Millar Western is proposing to transition these stands to conifer following harvest. Figure 1 provides an example of a grassy, low-density aspen/balsam poplar stand that was ultimately regenerated to conifer because of high competition levels and a low likelihood for aspen suckering following harvest.

Image 1. Example of a grassy low-density Aspen/Balsam Poplar Stand with Low Suckering Potential

Unfortunately, there is no way to effectively identify these stands in advance of the operational planning process. Although these stands are often the result of previous logging activities, the activities are so old that there are no records of these activities. In general, however, these stands are typed as A and B density stands in the AVI.

An analysis of the current net landbase indicates that there are over 17,000 hectares of aspen strata (AW) in W13 that is over 80 years of age. An age of 80 years was used in this summary to represent the stands that are most likely to be selected for harvesting in the spatial harvest sequence (SHS). Of the stands in W13 that are 80 years of age and older, roughly 3,200 hectares or 19% is composed of low density stands. The majority of these are B density stands, since most of the A density stands were removed from the productive landbase during the netdown process. These low density stands are the ones that Millar Western is proposing to regenerate to SW.

Table 2. Breakdown of AW strata > 80 years of age by density class in 2017-2026 net landbase

AW area > 80 years	Area (ha)	% of Total
AB Density	3,224	18.8%
CD Density	13,925	81.2%
Total	17,149	100%

<u>Implementation</u>

Millar Western is proposing that all A and B density AW stands harvested during the 2017-2026 DFMP period convert to SW after harvesting. This would only apply to blocks harvested by Millar Western. This methodology would enable the stands slated for conversion to be identified in the spatial harvest sequence and the resulting transitions could be incorporated into habitat modelling processes, thereby providing some tangible impacts on habitat availability over time. This conversion will be presented in the annual landbase balancing submission to the Alberta government.

Magnitude

The magnitude of this conversion will not be known until the spatial harvest sequence is completed, although it is reasonable to assume that the total area of AW harvested between 2017 and 2026 will be similar to that sequenced in the 2007-2016 DFMP. Millar Western's percentage of the aspen harvest will increase, however, due to the termination of a volume supply agreement between Millar Western and Weyerhaeuser in 2017/2018. This equates to a roughly 270,000m3 (1500ha) reduction in harvest for Weyerhaeuser. This 1,500ha reduction was added onto Millar Western's projected harvest. The resulting harvest distribution is presented in the table below.

Table 3. Anticipated AW harvest for Millar Western and Weyerhaeuser for 2017-2026

Company	2007-2016 Planned AW Harvest Area (hectares)	% of Total AW Harvested	**2017-2026 Estimated Harvest Area (hectares)**	**% of Total AW Harvested**
Weyerhaeuser	4,236	78.5%	2,736	50.7%
Millar Western	1,158	21.5%	**2,658**	**49.3%**
Total	5,394	100.0%	5,394	100.0%

Subject to the development of a new SHS, Millar Western will harvest an estimated 2,658ha of AW in the 2017-2026 DFMP. Roughly 19% of this is anticipated to be A and B density stands, resulting in **roughly 505ha of AW landbase being planned for transition to SW**.

Proposed AP Strata Conversion

Proposal

It is very difficult to regenerate AP stands that meet the true intent of the AP species assemblage. Aspen and pine are both shade intolerant species and do not co-exist very well in stands. Where they do co-exist, they tend to form clumps, with the pine growing in areas where the aspen regeneration is sparse. True intimate mixtures (ie. salt and pepper mix) do not exist in abundance in nature and the practice of putting them back on the landscape is extremely difficult and usually requires one of two treatments:

1) Chemical site preparation of small patches using imazapyr herbicide. This herbicide has the undesirable characteristic of persisting on site for much longer than glyphosate, and has been the topic of some public concern as of late, or

2) Wide-spread planting across the site, in the hope that enough pine survive to satisfy the regeneration standard. Many of the planted trees in this scenario succumb to aspen competition which is a waste of the Company's investment.

Neither of the above treatments is an overly reliable way of establishing an intimate mixture and stands regenerated in this manner are prone to migration into non-target strata (AW or PA). From a cost perspective it is about the same cost to establish an intimately mixed AP stand as it is to establish a PL stand. As a result, many AP mixedwoods are regenerated by splitting the blocks into 2 portions – 1 for pine and one for aspen, and regenerating each of them discretely.

Since many of these regenerating stands are being created through segregation of the key components (ie. PL and AW), it seems logical to simply convert some of these strata to PL. This would allow for the company to realize the greatest return on its investment of planting PL across the whole block, without watching large quantities of the trees die from overtopping by aspen. It would also allow the Company to reduce its use of imazapyr herbicide.

Millar Western is proposing to convert 50% of the AP area harvested to PL

Implementation

Millar Western is proposing a straight conversion of 50% of the harvested AP stratum area. Areas slated for conversion would be identified post-harvest. This conversion will be presented in the annual landbase balancing submission to the Alberta government.

Magnitude

The total area of AP in W13 is roughly 6,500 hectares, which is similar to the AP area in the 2007-2016 net landbase. As such, the AP stratum harvest area for 2017-2026 is estimated to be the same as the previous spatial harvest sequence, which was 988ha. At a 50% conversion rate, **this equates to roughly 494 hectares of conversion.**

Proposed SB Strata Conversion

Proposal

In the 2007-2016 DFMP, a large amount of what was previously a PL stratum was classified SB strata as a result of the stand compositing rules that were employed. These compositing rules forced PL stands with lower density overstories and dense black spruce understories into the SB strata. As a result, many hectares of high, dry pine ground were regenerated to SB in order to satisfy the provincial landbase balancing requirements. Planting black spruce on these sites has reduced their productive capacity and forced Millar Western to incur additional expenses to collect additional black spruce seed, which is very costly. Millar Western would like to offset some of the area shifted to SB in the last DFMP by converting upland SB stands to PL as part of the 2017-2026 DFMP.

In the first 8 years of the current DFMP (2007-2015), 1,561 hectares of SB net landbase was harvested. An examination of the AVI shows that only 616 hectares of this area had SB as the leading species in the overstory. The other 945 hectares had a non-black spruce overstory, which was predominantly lodgepole pine. Table 4 shows this breakdown and identifies the fact that less than 40% of the harvested SB stratum area was actually black spruce leading.

Table 4. Breakdown of Harvested SB by Leading Overstory Species

Leading Overstory Species	2007-2015 Harvested SB Landbase (hectares)	% of Total Area Harvested
SB	616	39.5%
Other	945	60.5%
Total	1,561	100.0%

From an ecological perspective, these pine/black spruce mixtures tend to follow a fairly predictable trajectory, regardless of the silviculture treatment employed. Pine tends to take over these sites, regenerating prolifically from seed, even when black spruce is planted. Black spruce takes longer to regenerate naturally, but eventually forms a dense understory from seed. The resultant stand is dominated by pine in the overstory with black spruce in the understory. Rather than trying to create SB plantations that invariably turn out to be pine dominated, Millar Western would like to convert these stands to PL to increase stand productivity and capture the naturally occurring black spruce ingress.

Millar Western is proposing to convert 60% of the SB stratum area harvested in the 2017-2026 DFMP to PL in order to compensate for some of the lost growth potential from over planting SB in the current DFMP.

<u>Implementation</u>

Millar Western is proposing a straight conversion of 60% of the harvested SB stratum area. Areas slated for conversion would be identified post-harvest. This conversion will be presented in the annual landbase balancing submission to the Alberta government.

<u>Magnitude</u>

Due to the elimination of compositing, the area of SB planned for harvest by MWFP will be less than that of the 2007-2016 DFMP, where roughly 2,000 hectares of SB was scheduled for harvesting. In the new net landbase, there are only 7,000 hectares of SB, so assuming that no more than 15% of this will be harvested in the next SHS, a maximum of 1,050 hectares will be harvested. **At a conversion rate of 60%, this equates to roughly 630 hectares**, which will be far less than the amount of non-black spruce landbase that was converted to SB during the current DFMP.

Proposed DU (deciduous with conifer understory) Strata Conversion

Proposal

Most of the harvesting in this stratum is expected to be relatively incidental in nature, since it was created largely as a mechanism for delaying harvest until conifer merchantability thresholds are achieved. In this regard, it is a bit of an odd stratum because once the conifer reaches a significant volume, the overstory has begun to fall apart and the stratum switches to AS or SA. In essence, the purpose of this stratum is to allow natural succession to occur, until the stand shifts towards conifer landbase. Since harvesting in this stratum will truncate this successional shift and reduce conifer growing stock, Millar Western proposed to offset this loss of conifer growing stock by converting areas harvested from this stratum to SA.

Millar Western is proposing to convert 100% of the DU stratum area harvested in the 2017-2026 DFMP to SA to better align with the anticipated ecological condition at harvest and to compensate for the loss of SW growing stock associated with harvesting the DU stratum.

Implementation

Millar Western is proposing a straight conversion of 100% of the harvested DU stratum area. Areas slated for conversion would be identified post-harvest. This conversion will be presented in the annual landbase balancing submission to the Alberta government.

Magnitude

The total area of DU in W13 is roughly 14,441 hectares, however, as mentioned above, it is not expected that there will be much harvesting in this stratum in the 2017-2027 DFMP where most of it would be attributed to areas added in as part of the operational planning process and in future DFMPs. Blue Ridge Lumber uses a deciduous with conifer understory D(c) curve as part of its landbase in W14. Harvesting completed in Millar Western's DTA in W14 shows that on average 1 hectare of D (c) is harvested for every 10 hectares of hardwood. Assuming that the ratio of DU to AW will be similar in W13, and that the amount of AW harvested will be roughly 2,658 hectares (see table 3), **266 hectares of DU will be harvested and regenerated to SA.**

Operational Implementation and Forecasting

In total Millar Western is proposing 1,975 hectares of strata transitions over the life of the 2017-2026 DFMP. This equates to less than 200 hectares per year on average. Operationally, stands will typically be scheduled for conversion following harvest. It would be ideal to identify these stands pre-harvest but there are too many field level variables that will determine the blocks that are best suited for conversion. Some of these include: ecosite, stand health and vigour, site limiting factors (moisture, slash, grass) and the type and amount of other strata comprising the block. Most harvested blocks are composed of multiple strata, so the decision on which stands get switched involves some significant analysis of which strata types are present and their juxtaposition. The only feasible way of implementing this is through the strata balancing process, where a percentage conversion is applied on the stratum total.

The low density AW stratum will be tracked in the landbase balancing process as a subset of the AW stratum and 100% will subsequently be converted.

On the ground, Millar Western will endeavor to minimize large-scale stratum transitions in key wildlife and special access zones and will spatially distribute these transitions as evenly as possible across the landbase.

Due to the small scale of these strata transitions, the impacts on the timber supply assessment are expected to be minimal, however Millar Western will commit to modeling these transitions independently to determine the impact of each stratum transition.

Transitions in Relation to Total Strata Area

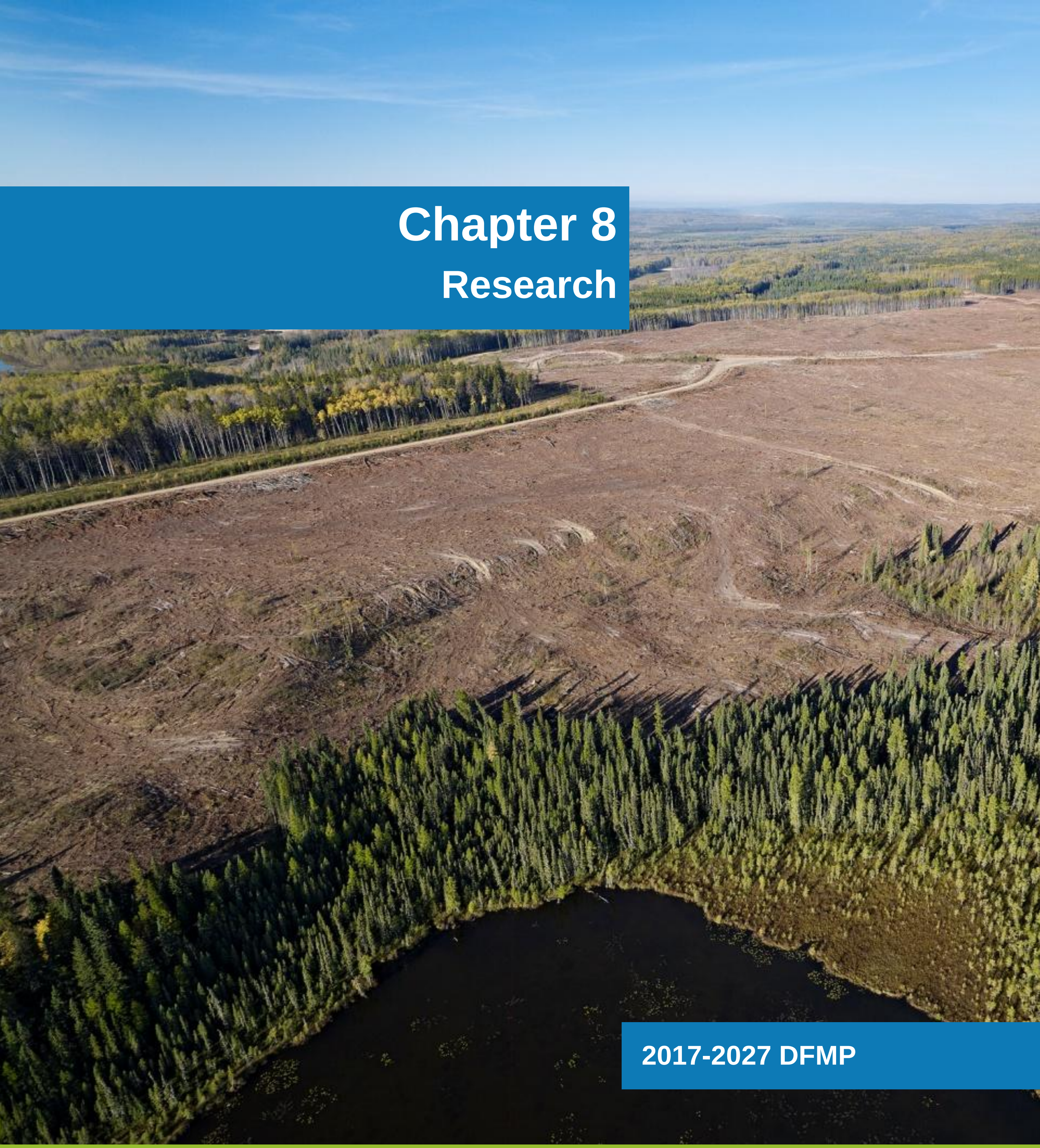
Table 5 provides a breakdown of the area in both the passive and active landbase by stratum. In most cases the amount of area that transitions is in the range of 1% to 2% of the total landbase. The only exception is the AP stratum, where roughly 6.5% of the stratum is expected to transition to PL. This is due to the fact that there is so little AP on the landbase to begin with.

Table 5. Breakdown of W13 Area by Stratum and Landbase Type (Active vs. Passive)

Yield Stratum	Active Landbase Area (ha)	Passive Landbase Area (ha)	Total Landbase Area (ha)	Estimated Transition Area (ha)	% of Total Stratum Area
AW	43,169.6	8,439.0	51,608.6	505.0	1.0%
DU	10,569.8	2,147.3	12,717.1	266.0	2.1%
AP	6,461.2	1,174.7	7,635.9	494.0	6.5%
AS	12,877.4	2,864.4	15,741.8	0.0	0.0%
PL	66,359.5	13,046.1	79,405.6	0.0	0.0%
PA	8,283.7	1,491.0	9,774.7	0.0	0.0%
SB	7,353.3	39,398.1	45,751.4	630.0	1.4%
SW	24,903.7	8,954.2	33,857.9	0.0	0.0%
SA	10,544.9	3,257.9	13,802.8	0.0	0.0%
No Strata	0.0	25,577.0	25,577.0	0.0	0.0%
Total	**190,523.2**	**106,349.6**	**296,872.8**	**1,895.0**	**0.6%**

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

\\silver\clients\MWFP\Projects\P755_DFMP\Ch7_Implmnt\Ch7_DFMP_Implementation_20170905_Submit.docx



Chapter 8
Research

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

1. Research and Technical Studies

Millar Western is committed to the principle of adaptive management, striving for continual improvement in forest management. To enable this, Millar Western supports a variety of research initiatives and technical studies that generate new information, ideas and approaches to sustainable forest management, for application in the DFMP area. In addition to financial investments, Millar Western representatives also participate on boards, committees and task forces, to help direct the course of research, share information, participate in trials and ensure that knowledge transfer takes place within the organization, with a view to enhancing the company's environmental performance.

This chapter discusses the associations and cooperatives that MWFP is involved with and provides an overview of the research that is being conducted in support of progressive, sustainable development of forest resources.

1.1 National Council for Air and Stream Improvement (NCASI)

NCASI's Canadian forestry program addresses important technical questions related to sustainable forest management in Canada. NCASI staff work with leading researchers in wildlife, hydrology, forest ecology, biometrics, soil science, and silviculture, to undertake research and technical studies to respond to challenges facing the industry. Key areas of study include wildlife and biodiversity, watershed management, and conservation planning. Programs are designed by teams of industry experts and conducted in collaboration with the best available scientists in NCASI member companies, government agencies, and leading universities.

NCASI's forestry staff manage forestry research projects with oversight and direction from a task group comprising senior forest managers and leading scientists from NCASI member companies. NCASI research and technical support play important roles in the forest products industry's overall response to challenges and opportunities related to forest environmental management and sustainable forestry.

To ensure knowledge gained from research is transferred to industry, NCASI compiles and distributes a variety of publications, including newsletters, current awareness memos, and handbooks. The results of NCASI's research studies are usually published in the form of technical bulletins or special reports, which are widely respected for their rigour. These research results are used extensively, not only within the industry but in academic circles and by regulatory agencies and others needing reliable environmental data and information on the forest products industry. NCASI frequently sponsors research projects at universities and other research institutes, and encourages external researchers to publish their work as appropriate in peer-reviewed journals.

Millar Western has been a member of NCASI since 2011 and has staff members who sit on the forestry and environmental task groups. One of the research programs that Millar Western is taking special interest in is the nutritional ecology study on woodland caribou, a species that is considered at risk. Researchers are seeking to understand how well different habitats in the boreal forests provide for the nutritional needs of female caribou and their calves. There is some caribou range in the Millar Western DFMP area, hence its concern in the project. Initiatives like this help the industry and government better grasp habitat requirements of caribou herds, so their needs can be better accommodated within the working forest.

1.2 Tree Improvement Alberta

Millar Western is a member of Tree Improvement Alberta (TIA), which was begun in 2011 in the wake of a severe economic downturn in the forest industry. Forest industry participants were concerned about continuity of funding for tree improvement research programs, due to perceived insufficient return on investment and lack of clarity on how benefits of tree improvement might be realized. The group identified the need for greater communication and coordination amongst industry, government and academic representatives, to create clear objectives for tree improvement in Alberta and mechanisms for achieving them. As of April 1, 2016, TIA was established as a project team under FGrOW (see Section 1.3).

The mandate of TIA is to:

- Advance forest genetics and tree improvement in Alberta by coordinating, implementing, or supporting collaborative research projects in forest genetics and operational tree improvement activities to maximize efficiency among its members and collaborators.
- Promote communication among members through business meetings, workshops and field excursions, which enhance learning and knowledge transfer, making it easier for members and other stakeholders to coalesce to common tree improvement priorities in Alberta.
- Provide an avenue for constructive dialogue between forest companies involved in tree improvement and the Alberta government.
- Promote and facilitate communication among Forest Genetics, Growth and Yield, and Silviculture practitioners on all forest genetics related matters.
- Maintain communication and collaboration with the Alberta Forest Genetic Resources Council and other stakeholders with interest in the management of forest genetic resources in Alberta.

Millar Western is involved in the following initiatives that are coordinated under the auspices of TIA:

1.2.1 Huallen Seed Orchard Cooperative (HASOC)

Millar Western participates in the Region "I" white spruce tree improvement program and is a partner in the Huallen Seed Orchard Cooperative (HASOC), which produces all of the seed for Region "I".

1.2.2 Progeny Test Sites

In 2001, Millar Western established, and has since maintained, two seedling progeny test sites for Region "I". These sites are regularly brushed, weeded and re-tagged to preserve their integrity and are periodically measured to provide data to test the performance of the Region "I" families.

1.2.3 Realized Gain Trials

With support from FRIAA, TIA will conduct Controlled Parentage Programs (CPPs), or operational realized gain trials, to assist in the validation of expected volume gains from deployment of improved stock (area-based volume at rotation). These will be the first trials of their kind in Alberta, requiring significant dialogue with the GoA (Alberta Agriculture and Forestry), to ensure that the design and subsequent results will be recognized as valid for integration into future growth and yield models. All seedlots to be tested and produced from these programs, and their associated seed orchards, are for operational deployment, with the intent of enhancing the value of Alberta's forest resources.

As a partner in this project, Millar Western has committed to establish and maintain 10 installations. The installations will be established over the next 2 years.

1.3 Forest Growth Organization of Canada (FGrOW)

Millar Western has been a member of the Forest Growth Organization of Western Canada (FGrOW) since its inception in April of 2015. FGrOW was an amalgamation of the following growth-and-yield associations: Alberta Forest Growth Organization (AFGO), Foothills Growth and Yield Association (FGYA) and Mixedwood Management Association (MWMA). The newest member is the Western Boreal Growth and Yield Association (WESBOGY), which joined January 1, 2016. The amalgamation was undertaken to improve efficiencies and attract more funding to growth-and-yield initiatives in Western Canada. FGrOW operates under the umbrella of fRI Research (formerly the Foothills Research Institute), which acts as a coordinating agency, providing accounting and administrative support.

FGrOW's vision is to be the leader in cooperative growth-and-yield research, model development and data management in Western Canada. FGrOW drives the advancement of the science of forest growth and provides information to support policy development and changes in forestry practices. The organization serves its members by providing access to better forest growth data and knowledge, and to tools that support forest management decision-making. It also facilitates collaboration, seeks partnerships, identifies efficiencies for its members, and pursues alternative funding sources to advance member-defined priorities.

Millar Western is an active partner in the following FGrOW project teams:

1.3.1 Foothills Pine Project Team (FPPT)

The focus of the FPPT is:

- Forecasting and monitoring responses to silvicultural treatments;

- Facilitating the scientific development and validation of yield forecasts used by members in managing their tenures; and
- Promoting knowledge, shared responsibility and cost-effective cooperation.

The FPPT has four active projects:

- *The Regenerated Lodgepole Pine (RLP) Project*, which is a long-term study aimed at assessing site and treatment effects on stand development following harvesting and planting of lodgepole pine;
- *Cooperative Management of Historical Research Trial*, which involves the re-measurement and analysis old Canadian Forest Service (CFS) trial data, focused primarily on nutrition and density management in lodgepole pine;
- *Stand Dynamics after MPB Attack*, a project aimed at developing a decision support tool for stands attacked by MPB, and monitoring PSPs attacked by MPB, to determine stand response following attack; and
- *Establishment of PSP Network to Monitor Stand Dynamics and Establish Yield Curves for Stands Killed by MPB*, which will provide statistically sound data regarding stand dynamics, regeneration recruitment, and growth rates across a range of natural sub-regions and ecosites at varying rates of mortality.

1.3.2 Mixedwood Project Team (MPT)

The Mixedwood Project Team (MPT) seeks to address practical and scientific issues around the management of mixedwood stands, to sustain their mixed species characteristics. The MPT's goals are to:

- Increase knowledge through financial and in-kind support of basic and applied research;
- Enhance the forest community's understanding of mixedwood through support for workshops and conferences; and
- Improve information collection, sharing, dissemination, and application to day-to-day forest management activities.

The MPT has three active projects:

- *The Dynamic Aspen Density Experiment (DADE),* which is investigating white spruce growth response to varying aspen overstory densities at two ages of stand development;
- *Strip Cut Understory Protection (SCUP) Trial*, which aims to provide data to support growth and yield projection of aspen-dominated mixedwood stands treated with strip cut understory protection harvesting; and
- *Mixedwood Silviculture Guide Project*, which aims to repackage the original mixedwood silviculture guide created in Microsoft Excel 2003 into a more accessible format.

1.3.3 Policy and Practice Project Team (PPPT)

The PPPT's main goal is to improve forest management practice and influence Alberta policy as it pertains to growth and yield. The PPPT has three active projects:

- *Provincial Growth and Yield Initiative (PGYI),* which aims to collectively obtain data on tree growth through repeated measurements of Permanent Sample Plots (PSPs), to develop, calibrate and validate growth models for forest management yield curve development;
- *Cutblock Inventory Classification Project*, which was initiated to answer questions about the accuracy of the photo interpreted labels developed through Reforestation Standard of Alberta (RSA) performance survey programs, and whether the rules used to assign sampling units into strata are suitable for use in landbase stratum assignment; and
- *Growth and Yield Model Support,* which involves working with the model developers to support and facilitate enhancements through existing and new projects and data sharing.

1.4 fRI Research – Mountain Pine Beetle Ecology Program (MPBEP)

The Mountain Pine Beetle Ecology Program (MPBEP) began in 2007. The program conducts research, knowledge transfer and collaboration regarding mountain pine beetle in Alberta. Established under the Landscape Dynamics Program Theme of fRI Research's five-year Business Strategy, the MPBEP's research and other projects examine the effects of mountain pine beetle infestations in the foothills and mountainous areas of Alberta. Lending importance to this work is the ongoing mountain pine beetle infestation in Alberta, including in the DFMP area, which raises concerns about potential impacts on forest ecology and related areas. Among the topics being explored are:

- Natural disturbance and stand dynamics research, including the relationship of fire and pine beetle and their impacts on communities;
- Forest management implications and options associated with pine beetle infestations;
- Quantification of the short- and long-term changes to the fire regime, including fire intensity and severity in beetle infested stands; and
- Understanding mountain pine beetle biology and impact in Alberta.

Through research, collaboration, communication, extension and partnership development, the MPBEP will identify tasks that will be led by a partner-driven Activity Team, to achieve these outcomes:

- Maximize the ecological integrity of the affected forest landscape;
- Adjust practices to minimize disturbance factors affecting the landscape;
- Understand and mitigate related disturbance factors, such as wildfire occurrence and intensity, and hydrology changes; and
- Develop a better understanding of the changes to the forest ecology and landscape, to improve resource management planning.

Millar Western is an active member on the MPBEP Activity Team, which consists of industry and government representatives that have a direct interest in understanding the impact of MPB in Alberta. The Activity Team reviews the progress of research projects and considers suggestions for new research.

1.5 FPInnovations

FPInnovations is among the world's largest private, non-profit research centres working in forest research. With a view to enhancing the forest sector's global competitiveness, the organization helps the Canadian forest industry to develop path-breaking solutions based on the unique attributes of Canada's forest resources. It favours a sustainable development approach and takes full advantage of the industry's considerable scientific, technological and commercial capital. It is ideally positioned to perform research, innovate, and deliver state-of-the-art solutions for every area of the sector's value chain, from forest operations to consumer and industrial products.

Millar Western has been a member of FPInnovations, and its predecessor organizations Forintek and FERIC, since 1984. Millar Western is active within the Forest Operations Group and participates on the Program Advisory Committee. National in scope, this committee is focused on addressing high-priority industry member and government partner needs in specific research themes and provides advice to optimize synergies with other FPInnovations programs, universities and research organizations worldwide. It also provides advice to FPInnovations in the area of appropriate technology transfer, knowledge sharing and cross-program projects that contribute to the achievement of FPInnovations mission, which is to fuel growth and prosperity in the forest sector.

Millar Western benefits from its membership through active participation in research projects and by applying research findings from other projects to its own operations. On occasion, Millar Western also seeks technical or professional assistance from the organization, for example drawing on the expertise of its engineers to aid in projects relating to winter weights, log-haul configurations and new product development. FPInnovations participates on several provincial committees in which Millar Western is also involved, including those examining log hauling and fire management. Furthermore, Millar Western takes advantage of FPInnovations' annual research reports, as well as its training sessions, workshops and seminars.

1.6 Ducks Unlimited Canada (DUC): Forest Management Wetlands Stewardship Initiative (FMWSI)

The FMWSI is a three-year collaborative working agreement initiated in 2016 among DUC, a coalition of forest industry partners, and the Forest Products Association of Canada. As an industry partner, Millar Western will take part in priority projects of interest to all parties, including establishment of wetland stewardship guiding principles and development of wetland and waterfowl best management practices (BMPs). Each project will be designed to encourage direct engagement of forest industry partners, to ensure the outcomes are practical and achievable. A key goal of this initiative is to ensure that information flowing from these projects is integrated into ongoing sustainable forest management activities. As FMWSI projects are completed, Millar Western will work with DUC, to determine how the results can best influence ongoing forest management planning and operations. The FMWSI will also provide participants support in meeting wetlands conservation obligations under forest certification programs and in complying with the GoA's Alberta Wetland Policy.

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

\\silver\clients\MWFP\Projects\P755_DFMP\Ch8_Research\Ch8_Research_20170906_Submit.docx

Glossary and Acronyms

2017-2027 DFMP

Prepared by FORCORP
March 2017

MILLAR WESTERN

Binder	Type	ID	Name
ONE	Executive Summary		
	Chapter	1	Corporate Overview and Forest Management Approach
	Chapter	2	DFMP Development
	Chapter	3	Forest Landscape Assessment
	Chapter	4	Summary of Previous DFMP
	Chapter	5	Values, Objectives, Indicators, and Targets (VOITs)
	Chapter	6	Preferred Forest Management Scenario
	Chapter	7	DFMP Implementation
	Chapter	8	Research
	Glossary		
TWO	Annex	I	Forest Management Agreement (FMA)
	Annex	II	Communication and Consultation Plans
	Annex	III	Stewardship Report 2007-2011
	Annex	IV	Growth and Yield Program
	Annex	V	Growth and Yield
	Annex	VI	Timber Supply Analysis
	Annex	VII	Spatial Harvest Sequence
THREE	Annex	VIII	Landbase Development Document

Table of Contents

1. Glossary

Access schedule – Group of forest stands classified solely for the purpose of harvest sequencing in the timber supply modeling process.

Active landbase – The area contained within the boundary of the DFA that is covered by stands that possess forested cover types but which have not been assigned a deletion code under the landbase classification process. Deletion codes are assigned to stands or portions of stands based on the deletion rationale, including riparian buffers, dispositions, subjective deletions (i.e. larch and black spruce).

Adaptive Management – A structured rigorous process designed to improve management policies and practices by learning from the outcomes of operational programs. It is this structured process at an operational scale, and a focus on deliberately designing management to enhance learning, that distinguishes it from trial and error, field trials, and other less structured approaches (D'Eon, 2008).

Alberta Biodiversity Monitoring Institute (ABMI) – A non-profit organization that measures the state of Alberta's biodiversity though a systematic grid surveys.

Alberta Conservation Information Management System (ACIMS) – A data centre that provides biodiversity information on Alberta's species, natural ecological communities and sites. Information about the location, condition, status, and trends of selected elements is collected, updated, analyzed, and disseminated (Alberta, 2016a).

Alberta Natural Heritage Information Centre (ANHIC)[1] – Established in 1996, ANHIC was the precursor to the Alberta Conservation Information Management System.

Alberta Reforestation Information System (ARIS) – The province-wide tracking system for reforestation activities. Companies must submit their reforestation activities to ARIS by May 15 annually.

Alberta Vegetation Inventory (AVI) – A spatial inventory of a landbase, focusing on attributes of both vegetated and non-vegetated polygons, completed to specific standards as defined by the Alberta government.

Alternative Regeneration Standards (ARS)[1] – In the 2007-2016 DFMP, ARS were requirements to be achieved for the reestablishment of forests on Crown land that may apply to an FMA or a larger regional area. These requirements, when approved by the Alberta government, replaced those established by the Alberta Regeneration Survey Manual. The ARS have been replaced by the Reforestation Standard of Alberta for the 2017-2027 DFMP.

Annual Allowable Cut (AAC) – The volume of timber that can be harvested under sustained-yield management in any one year, as stipulated in the pertinent approved forest management plan. In Alberta, the AAC is the quadrant cut divided by the number of years in that quadrant (usually five).

Annual Operating Plan (AOP) – A plan prepared and submitted to the Alberta government by the forest operator each year. An AOP approved by the Alberta government provides the forest operator with authorization to undertake harvesting, reforestation and road construction activities on their operating areas. The AOP is a requirement of the Timber Management Regulation.

Annual Report – A required report as defined within the Alberta Forest Management Planning Standard and committed to in the DFMP that summarizes certain activities or performance measures over each timber year. Examples of items reported on include area harvested, area reforested, area surveyed and the results of those surveys, etc.

Aspect – The direction in which a slope faces that is normally expressed in broad terms using the cardinal directions (north, south, east and west).

Back-to-itself (BTI) – A modeling transition that returns a stand to the same yield strata following harvesting.

BAP strata[1] - Stratification of the forest inventory based on the biodiversity attributes, as defined by the Biodiversity Assessment Project IAG.

Bared Areas – Surfaces that have been disturbed or compacted with the organic layers of soil and vegetation removed.

Biodiversity (biological diversity) – The variety, distribution and abundance of different plants, animals and microorganisms at the regional or landscape levels of analysis. Biodiversity has five principal components: (1) genetic diversity (the genetic complement of all living things); (2) taxonomic diversity (the variety of organisms); (3) ecosystem diversity (the three-dimensional structures on the earth's surface, including the organisms themselves); (4) functions or ecological services (what organisms and ecosystems do for each other, their immediate surroundings and for the ecosphere as a whole; i.e., processes and connectedness through time and space); and (5) the abiotic matrix within which the above exists, with each being interdependent on the continued existence of the other.

Biodiversity Assessment Project (BAP)[1] – A project that quantifies the impact of forest management on biodiversity through the analysis of coarse (landscape) and fine-filter (individual species) indicators.

Bleached chemi-thermo-mechanical pulp (BCTMP) – The type of pulp produced at Millar Western's mill in Whitecourt, where hardwood and softwood chips are broken down using a process of mild chemicals, heat and mechanical action.

Broad Cover Group (BCG) – A classification of forest types based on coniferous and deciduous components of the AVI species composition. The broad cover groups are coniferous (C), coniferous-deciduous (CD), deciduous-coniferous (DC) and deciduous (D).

Canadian Standards Association (CSA) – An independent, not-for-profit membership-based service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards, certification and related services to meet national and international needs.

Carryover – Timber volume that is not harvested by a company in one quadrant and that is brought forward to the next quadrant for harvesting; carryover volumes are in addition to the AAC.

Company commitment – A commitment that Millar Western is making within their 2017-2027 DFMP, that is independent of the requirements contained within the Alberta Forest Management Planning Standard.

Compartment – A subsection of a DFA for which operational plans are developed.

Coniferous Timber Quota (CTQ) – A volume-based timber allocation granted to a forestry operator for the purposes of harvesting a set proportion of the coniferous AAC within a defined area. The specific rights are allocated as a percentage of the conifer AAC, usually for a period of 20 years. Actual volumes to be harvested are at a minimum, updated every five years (quadrant).

Controlled parentage program (CPP) - A stock production program that includes in its population a number of selected individuals. Production of deployment stock for the program occurs in a production facility (such as a seed orchard or stoolbed) where parents are propagated vegetatively or sexually (Alberta Forest Genetic Resources Council, 2016).

Crop plan – A regeneration and treatment regime applied to a harvested area, for the purpose of improving the timber attributes (growth, yield, piece size, etc.).

Crown land – Land within the province under the jurisdiction of the Alberta government.

CSA Z809-02 – A sustainable forest management standard (SFM) established by CSA. The standard describes the SFM requirements for a forest manager or owner wishing to achieve and maintain CSA Z809-02 certification, including the nature of the commitment, the requirements for public participation, the performance requirements, the management framework, the review of actions, and continual improvement. It also lists the specific points that must be addressed, audited, and approved before certification can be recommended.

Cull – Trees or logs or portions thereof that meet the minimum utilization standards, but are rendered non-merchantable due to the presence of defects.

Deciduous Timber Allocation (DTA) – A volume-based timber allocation granted to a forestry operator for the purposes of harvesting a set volume of deciduous timber within a defined area. Unlike CTQs, DTAs do not grant the rights to a specific proportion of the AAC but rather to a specific volume. At the government of Alberta's discretion, volumes may or may not be updated when the AAC changes.

Defined Forest Area (DFA) - A specified area of forest, including land and water (regardless of ownership or tenure), to which the requirements of the CSA Z809-02 standard or Alberta Forest Management Planning Standard apply.

Detailed Forest Management Plan (DFMP) - A long-term plan used to outline higher-level management objectives, and sustainability and timber production assumptions for a Forest Management Agreement area.

DFMP Area – The area included in all FMUs of a DFMP; in the case of the MWFP 2017-2027 DFMP, W11 and W13.

Downed Woody Debris (DWD) – *For modeling, forecasting and biodiversity assessment purposes:* Dead tree volume with a bole measuring ≥ 10 cm in diameter, that is not rooted in the ground. *For operational purposes:* Woody material >1 cm in diameter, stumps and snags < 1.3 m tall and dead trees leaning >45 degrees. The woody material left on site after logging including both pre-existing and harvest-generated material (downed boles, limbs, tops and stumps). Includes highly decomposed and vegetated material, as long as it is recognizable as woody debris.

Early wood – Timber volume that is scheduled to be harvested in the early part of winter, when non-frozen to partially frozen access is possible.

Ecosystem – A dynamic complex of plants, animals, and micro-organisms and their non-living environment, interacting as a functioning unit.

Eligible landbase – The area of the active landbase that is old enough for harvesting, as defined by the Minimum Harvest Age.

Environmental Co-stewardship Committee (ECSC)[1] – A committee created under FEDA and composed of representatives from the Alexis Nakota Sioux Nation and Millar Western

Environmental Management System (EMS) – A management system that recognizes and manages primary environmental issues through awareness and assessment of applicable legal requirements, objectives for improvement, assignment of responsibilities, competent personnel, communications, procedures, controls and monitoring, emergency response capability, self correction and assessment, and internal reviews.

Final Harvest Plan (FHP) – A compartment-level operational plan requiring the approval of the Alberta government; precedes the AOP and details the laid-out access and harvesting activities for a set period.

Fire Behaviour Potential (FBP) – A rating or classification of a forest stand's likelihood of burning as a reflection of fuel type and topography. FBP is one input into the Alberta government's Fire Behaviour Prediction model.

FireSmart – A Government of Alberta program designed to incorporate management techniques that seek to mitigate large, high intensity, high severity wildfires and incorporate natural disturbance emulation.

Fish Management Zone – A geographical division of Alberta based on unique assemblages of water bodies, game fish species, and management regimes (Alberta, 2009).

Forecasting – the process of determining explicit statements of the expected future condition of the forest and its indicators.

Forest Cover Type – Hierarchical broad cover group classification based on the provincial strata in the yield projections guidelines of the Forest Planning Standard.

Forest Management Agreement (FMA) - A contract between the province of Alberta and the FMA holder whereby the province provides an area-based timber supply from Crown land. In return, the FMA holder commits to the following: 1) Managing the timber resource on a perpetual sustained yield basis, taking into consideration a broad range of forest values in determining forest management practices; 2) Meeting defined economic objectives, including capital investment and job creation, and seeking out new business opportunities that provide measurable economic benefits for both the province and the FMA holder.

Forest Management Unit (FMU) - An administrative unit of forest land designated by the Minister, as authorized under Section 14(1) of the Forests Act.

Forest Watershed and Riparian Disturbance Project (FORWARD)[1] – A research project initiated in 1998, to study the impacts of fire and harvest disturbances on watersheds in Millar Western's and Blue Ridge Lumber's FMA areas and deliver recommendations and models on approaches for watershed management in multi-user forests on the Boreal Plain.

FOREST*CARE* – The Alberta forest industry's stringent code of practice for mill and woodlands operations.

Forested Landbase – The area contained within the boundary of the DFA covered by stands that possess forested cover types. This landbase excludes areas such as shrub cover types, water, roads, etc.

Forestry Economic Development Agreement (FEDA)[1]– An agreement between Millar Western and the Alexis Nakota Sioux Nation that provides for sharing in the benefits of responsible resource development and joint participation in the planning process.

Fur Management Zone (FMZ) – Divisions within Alberta based on common environmental features. The timing and length of the trapping season are established on the basis of these zones, reflecting differences in furbearer status, trapping pressure, and seasonal pelt quality (Alberta, 2016b).

Generic Establishment Regimes (GER) – An integrated package of silvicultural interventions associated with a yield group and a management intensity; used to guide silviculturists in treatment deployment and integration to meet higher level planning objectives.

Genetic Diversity (within species populations) – In a group such as a population or species, the possession of a variety of genetic traits that frequently result in differing expressions in different individuals. The variation of genes within a species, the material upon which the agents of evolution act. Loss of variation may prevent adaptive change in populations of a species and reduce its ecological fitness (Alberta Forest Genetic Resources Council, 2016).

Genetic Integrity (regarding natural tree populations) – the conservation of genetic diversity in a group such as a population or species. Such diversity is the result of long-term evolutionary processes and is key to biological adaptation to regional habitats and to maintenance of future evolutionary potential (Alberta, 2014).

Geographic Information System (GIS) – A collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.

Goal – A desired outcome placed on a forecasting model indicator which the model will aim to achieve but which can be deviated from under the goal programming or heuristic modeling approaches.

Green Area – Alberta-government-owned land that is managed primarily for timber production, but on which other uses are permitted.

Gross landbase – The area contained within the boundary of the DFA. In the case of Millar Western's 2017-2017 DFMP, this includes the company's FMA area and the grazing leases contained within the FMUs. In other words, the active and passive landbase together constitute the gross landbase.

Growing stock - The sum (by number, basal area or volume) of trees in a forest or a specified section of the forest.

Healthy Pine Forest Strategy – An Alberta government strategy whose goal is to alter the current age-class structure of susceptible pine forests to increase their long-term resistance to MPB infestations.

Heritage resource – Sites of historical, architectural, archaeological, paleontological, or scenic significance to the Province.

Hydrologic Feature – A water feature such as a lake, river, stream, or oxbow. Hydrologic features can be natural or man-made, permanent or recurring. For the purposes of this DFMP, wetlands are classified separately from hydrologic features.

Hydrologic Unit Code (HUC) Watersheds of Alberta – A collection of four nested hierarchically structured drainage basin features classes that have been created using the Hydrologic Unit Code system of classification developed by the United States Geological Survey with accommodation to reflect the pre-existing Canadian classification system (Alberta, 2016c).

Indicator – A variable that measures or describes the state or condition of a value.

Integrated Land Management (ILM) – A strategic planned approach to managing and reducing the human-caused footprint on public land (Alberta, 2015a).

Intensive forest management – Utilization of a wide variety of silvicultural practices (e.g. planting, thinning, fertilization, release, harvesting, and genetic improvement) on a limited scale, in an effort to improve the attributes of the fibre occupying the site, generally volume, piece size or quality.

International Organization for Standardization (ISO) – An international body, represented by various national standards organizations, that develops and publishes industrial and commercial standards.

Institut Québécois d'Aménagement de la Forêt Feuillue (IQAFF)[1] – a Québéc based private research institute contracted by Millar Western for the BAP IAG and some of the LPGs. Frédérik Doyon, Stephen Yamasaki and Robin Duchesneau are members of institute, who contributed to various aspects of the 2007 – 2016 DFMP.

ISO 14001 – A standard that defines the requirements for an environmental management system. ISO 14001 applies to environmental aspects over which the organization has control and can be expected to have an influence.

Key Wildlife and Biodiversity Zone (KWBZ) – Areas established by the GOA to protect regions of high biodiversity habitat potential and key winter ungulate habitat. Because of the relatively high importance of these areas to biodiversity, and ungulates in particular, the GOA has developed corresponding industrial-user guidelines, including minimizing activity during winter months and reducing access development (Alberta, 2015b).

Land-Use Framework (LUF) – The GOA's regional integrated land-use planning system. The province is divided into 7 land-use regions, of which two have completed plans and the others are in development. The purpose of the land-use framework is to manage the competing demands on Alberta's land and natural resources for the achievement of long-term economic, environmental, and social goals. The land-use framework regional plans are the highest level plans in Alberta, under which all other plans must align (e.g. DFMPs, recreation plans, energy plans, etc).

Leave for Natural Regeneration (LFN) – Reforestation of a stand through reliance on natural suckering or seeding, not planting of seedlings.

Linear optimization – A mathematical method of solving problems (such as the allocation of resources) by means of linear functions where the variables involved are subject to constraints.

Long Run Sustained Yield Average (LRSYA) - The hypothetical timber harvest that can be maintained indefinitely from a management area.

Managed Stand - A forest stand that has had any anthropogenic action applied to it (previously harvested, thinned, etc).

Mean Annual Increment (MAI) – The average annual growth rate of individual trees or stands up to a specified point in time. Expressed as volume/hectares/year.

Merchantable residual structure – live, commercially viable trees retained post-harvest to create old forest characteristics in young and mid-aged regenerating stands.

Minimum Harvest Age (MHA) – The average age at which a stand is operable. This age is a function of the stand's species strata and timber productivity rating or density.

Mountain pine beetle (MPB) - *Dendroctonus ponderosae*, or mountain pine beetle, is one of the most destructive pests affecting mature pine. Adults emerge from host trees and attack green trees in mid-summer, inflicting serious damage in the form of blue stain and checking. Infested trees usually die within a year. Milder weather is thought to be the main cause of the beetle's migration from B.C., where it has claimed 9.2 million hectares of forest, into north-western Alberta, including Millar Western's DFMP area.

Natural region – Natural regions are the largest mapped ecological units in Alberta's land classification system. They are defined geographically on the basis of landscape patterns, notably vegetation, soils and physiographic features. The combined influence of climate, topography and geology is reflected by the distribution of these features (Achuff 1994, Marshall et al. 1996).

Natural subregion – Natural subregions are subdivisions of a natural region, generally characterized by vegetation, climate, elevation, and latitudinal or physiographic differences within a given region (Natural Regions Committee 2006).

Natural stand – A forest stand in which its initiation is a result of natural (non-anthropogenic) disturbance, such as fire, pest or pathogen outbreak, etc.

Not satisfactorily restocked (NSR) – A regeneration classification, based on survey results, that indicates a lack of sufficient regeneration, as per provincial or regional/company standards.

Noxious Weed - A plant designated in accordance with the Alberta Weed Control Regulation as a noxious weed and includes the plant's seeds. A person shall control a noxious weed that is on land the person owns or occupies (Alberta, 2011).

Objective function – One or more objectives incorporated into a mathematical expression that are being maximized or minimized.

Old interior forest – Forest patches greater than 100 ha in the "old" seral stage (120-179 years old) that are located beyond a defined edge-effect buffer zone. The edge-effect buffer zone is applied in two cases: along any stand edge which shares a common boundary with a linear disturbance greater than 8 meters in width; or stand edge along which the seral stage changes. The edge-effect buffer zone is calculated as: 60 meters where the adjacent area is non-forested, or forested but less than 40 years old; and 30 meters where the adjacent forest stand is less than or equal to 40 years old but not mature forest. There is no edge effect applied where adjacent stands are mature, old or very old forest.

Oldgrowthness[1] – A term developed by F. Doyon of the Institut Québécois d'Aménagement de la Forêt Feuillue (IQAFF), oldgrowthness is a continuous measure of old growth. The assignment of oldgrowthness is based on the premise that a certain state is not fixed or absolute but, rather, possesses a probability of being in that state. In the case of oldgrowthness, a stand starts to attain the probability of oldgrowthness at the mid-point of the mature seral stage period, at which point it is assigned a value of 0.5. When the stand's oldgrowthness value reaches 0.75, it transitions from mature to oldgrowthness. At a value of 1.0, it fully becomes an old-growth stand. If the stand is naturally initiated after a natural catastrophic disturbance, it inherits many old-growth biological legacies from before the disturbance and retains a value of oldgrowthness that is greater than zero. Oldgrowthness rapidly declines, however, as the biological legacies disappear over time. If no efforts are made to retain any biological legacies after clearcutting, oldgrowthness reverts to a factor of zero after harvesting.

Opening patch – Area containing either clearing or regeneration seral stages.

Operating Ground Rules (OGR) – Standards for operational planning and field practices that must be measurable and auditable and which are based on forest management plan objectives. Also known as Timber Harvest Planning and Operating Ground Rules.

Overstory – The tallest layer of multi-storied stands.

Patchworks – A spatially-explicit wood supply modeling tool developed and serviced by Spatial Planning Systems. Designed to provide the user with operation-scale decision-making capacity within a strategic analytical environment. Allows trade-off analyses of alternative operational decisions to be quickly determined and visually displayed.

Performance Standards – criteria used to develop the PFMS, while taking in to account the natural processes which influence the landscape. Performance standards are applicable for plan implementation, monitoring, and reporting, and take the form of VOITs.

Permanent all-weather forestry road – Department Licenses of Occupation (DLOs) within the DFMP area.

Permanent Sample Plot (PSP) – A fixed or variable area plot established for (forest) sampling and measurement purposes, and designed for re-measurement.

Plan Development Team (PDT) – the team assembled to coordinate and guide the development of Millar Western's 2017-2027 DFMP. The PDT consisted of representation from Alberta Agriculture and Forestry, Alberta Environment and Parks, quota holders, Millar Western and technical support.

Planned block – An area defined for harvest at date following the start date of the forecasting process (May 1, 2015).

Planning horizon - The length of time over which a series of defined management actions occur. For the purposes of modeling for sustainability, the 2017-2027 DFMP planning horizon is 200 years.

Planning standard – The Alberta Forest Management Planning Standard (Version 4.1 – April 2006) is the standard guiding the preparation and implementation of forest management plans in Alberta, including the Millar Western 2017-2027 DFMP.

Preferred Forest Management Scenario (PFMS) –The result of the forecasting and VOIT development processes, the PFMS is the scenario that forms part of the 2017-2027 DFMP and that will be submitted to the Alberta government for review and approval.

Preliminary Forest Management Plan (PFMP) - A plan submitted by FMA holders within 12 months of signing an FMA (includes a major revision to an existing agreement). It establishes an interim harvest level and cut sequence complete with justifications. This plan is the basis for harvest authorization until replaced by a DFMP.

Prohibited Noxious Weed – A plant designated in accordance with the Alberta Weed Control Regulation as a prohibited noxious weed and includes the plant's seeds. A person shall destroy a noxious weed that is on land the person owns or occupies (Alberta, 2011).

Provenance - The original geographic source of seed or other propagules. Also, the test population resulting from seed collected from a particular location (Alberta Forest Genetic Resources Council, 2016).

Public Advisory Committee (PAC) – Following through on a commitment made in its 2007-2016 DFMP, Millar Western formed a Public Advisory Committee (PAC) in June 2007, combining into one group two former committees that separately addressed mill manufacturing and forest operations issues. The PAC includes representation from a number of public interest groups, including municipalities and counties, other industries, recreational groups, contractors and the public. As well as a venue for sharing environmental performance information with stakeholders, the PAC will serve as a forum for discussing issues of concern to the forest sector. During the development of the previous (2007-2016) DFMP, the comparable public consultation mechanism was called the Public Participation Group (PPG).

Public Land Use Zone (PLUZ) – An area of public land to which legislative controls apply under the authority of the Public Land Administration Regulation to assist in the management of industrial, commercial, and recreational land uses and resources (Alberta, 2016d).

Quadrant Timber Production – the volume of wood harvested within each 5-year period of the DFMP.

Reforestation Standard of Alberta (RSA) – The GOA's standard for sustained yield management on crown land. Harvested blocks must meet certain stocking requirements in both the establishment and performance stages for forest operators to successfully meet reforestation obligations (Alberta, 2016e).

Regenerated stand – A forest stand in which its initiation is a result of anthropogenic disturbance such as harvesting.

Regenerated Yield Stratum – A delineation of stands that share the quality of being human-origin.

Regeneration lag - The period of time between harvest and establishment of the regenerated stand. In timber supply analysis terms, the established stand is defined as age 0 on the regenerated yield curve. Also referred to as regen delay.

Riparian Buffer – Vegetated areas around water features left untouched during harvesting to protect riparian ecosystems.

Riparian zone – Strips of green vegetation influenced by water and found around creeks, sloughs, rivers, and lakes (Alberta, 2015c).

Salvageable – In regards to trees killed by natural causes (ex. fire, insects, disease, blowdown), those that are still commercially viable as merchantable if harvested.

Satisfactorily restocked (SR) – A regeneration classification, based on survey results, that indicates sufficient regeneration, as per provincial or regional/company standards.

Seasonal/temporary forestry road – a forestry road available for harvesting/hauling use during certain seasons or for a set amount of time only.

Seed Zone – A geographic area with relatively uniform ecology and genetic population structure. Limiting the reforestation of cutblocks to seedlings from the corresponding seed zone allows native trees, and by extension native plants of all species, to be moved some distance without risk of mal-adaptation or erosion of genetic integrity and conserves genetic biodiversity (Alberta, 2014).

Seral stage - A stage in forest succession. A series of plant community conditions that develop during ecological succession from a major disturbance to the climax stage. Most common characteristics/classifications include tree species and age. Millar Western's 2017-2027 DFMP uses the following seral stage classes: regenerated, young, immature, mature, and old.

Sightability – Foothills Research Institute developed the Sightability tool as an aid for harvest design and retention placement to decrease sightlines from roadsides into young cutblocks, therefore reducing vulnerability to poachers. The Sightability tool uses Bare Earth and Full Feature LiDAR surfaces to predict the area within a planned cutblock that will be visible from the roadside in order to optimize the placement of retention patches for visual screening. The tool will also simulate regenerating stand conditions within the block according to a user-specified density and height to determine the green-up period for sightlines (fRI, 2014).

Site preparation – Any of a number of actions taken in conjunction with a reforestation effort (natural or artificial) to create an environment favorable for survival of trees during the first growing season. Actions can include altering the ground cover, soil or microsite conditions; using biological, mechanical or manual clearing; prescribed burns; herbicides or a combination of methods.

Snag – A dead tree that is taller than 2 m.

Soil order – The highest taxonomic level in the Canadian System of Soil Classification, reflecting the nature of soil environment and the effects of dominant soil-forming processes (Natural Regions Committee 2006).

Spatial Harvest Sequence (SHS) – A mapped harvest sequence showing the inventory cover types scheduled for harvest in the first two 10-year periods of the planning horizon.

Special Access Zone – Natural areas within an intensively developed landscape that have been designated by the GOA to received special development considerations, to avoid further fragmenting the landscape and to maintain important contiguous parcels (Alberta, 2013a).

Species strata - A stratification based upon broad cover group and species group composition. Used to classify every forested stand (operable and non-operable) within the FMA area.

Stakeholder - A person, group, agency or other entity that has a share or interest in the DFMP and the activities occurring on the DFMP Area.

Stand Susceptibility Index (SSI) - A measure of a stand's capacity to produce beetles (i.e. new populations of MPB in the next year) in the event it is attacked. It is a function of four variables: 1) relative abundance of susceptible pine basal area in the stand; 2) age of dominant and co-dominant live pine; 3) density of the stand; and 4) the climatic suitability of the stand.

Stewardship report – A required report as defined within the Alberta Forest Management Planning Standard and committed to in the DFMP. The report summarizes certain activities or performance measures over a five-year period. For every 10-year period covered by a DFMP, Millar Western must submit two stewardship reports.

Structural retention - Standing live or dead trees left in harvested areas for the purpose of maintaining biological diversity.

Subjective deletion – A type of landbase deletion applied on an operational basis as opposed to a legislatively or otherwise prescribed basis.

Surge cut – A short-term accelerated harvest over and above the long-term even-flow harvest level that is followed by a harvest dropdown at a future time.

Sustainable forest management (SFM) – A way of using and caring for forests so as to maintain their environmental, social, and economic values and benefits over time (Natural Resources Canada, 2016).

Sustained Yield Unit (SYU) - The area on which timber supply is calculated.

Target - A specific statement describing a desired future state or condition of an indicator. Targets should be clearly defined, time-limited, and quantified, if possible.

Temporary Sample Plot (TSP) – A fixed or variable area plot established for (forest) sampling and measurement purposes; usually assessed only once.

Timber Productivity Rating (TPR) – The potential timber productivity of a stand based on height and age of dominant and co-dominant trees of the leading species.

Timber Supply Analysis (TSA) – A process consisting of calculations/computer models with built-in assumptions regarding forest growth patterns that is used to determine the AAC and SHS.

Timber year – The period in which forest management planning and reporting is applicable to. In Alberta, the timber year spans May 1 – April 30. The year assignment is based on the year in which the timber year begins (i.e. 2017 timber year: May 1, 2017 through April 30, 2018).

Trade-off analysis – A process that involves an iterative assessment of various indicators, for the purpose of selecting an optimally balanced final set of indicator levels.

Uncommon plant community – A distinct collection of similar plant species of similar species composition and structure within a particular environmental ecosystem.

Understory – The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth (Dunster, 1996).

Utilization Standard – The portion of the stand or individual tree used for manufacture of wood products, defined in terms of piece length and diameter at each end. Minimum standards for utilization are defined in the timber disposition.

Values, Objectives, Indicators and Targets (VOITs) – reflect forest management objectives and form the basis for sustainable forest management strategies. Some objectives are defined by the Alberta government, while others have defined through collaboration and consultation with PDT members and other stakeholders. The values and objectives set the strategic direction for the DFMP, while the indicators and targets drive the management practices at an operational level necessary to meeting those objectives.

Visual Quality Objective (VQO) – Broad objectives for visual resource management that set limits as to the form and scale of visible alteration considered acceptable to the average viewer.

Wetland – An area where water continually or periodically gathers, because inflow equals or exceeds outflow. Periodically can refer to a daily or yearly cycle, as long as it is ecologically significant. The wetland area supports hydrophytic vegetation, and, in the boreal region, plant production generally exceeds decomposition, creating peat. A wetland contains soil indicative of high water tables or poor drainage for extended periods of time.

White Area – Land that is mostly privately-owned, that is managed primarily for residential development and agriculture.

Wildfire Management Area (WMA) – The administrative level accountable for wildfire management in the province (Alberta, 2013b); WMAs divide Alberta's Green Area into zones of responsibility by wildfire base.

Wildfire Threat Assessment Area (WTAA) – An area extending 30 km past the boundary of the W11 and W13 FMUs, covering a total of approximately 2.2 million km^2. This area is used to quantify the Wildfire Threat Assessment attributes of the DFA, including fire-behaviour potential, fire-occurrence risk, values at risk and suppression capability.

Wildlife Management Unit (WMU) – Geographic divisions through which the GOA manages wildlife according to the Wildlife Act.

Woodstock - A non-spatial forest-planning tool, developed by Remsoft Inc., capable of either simulation or optimization.

Yield strata - A stratification based upon species strata, broad cover group, crown closure class and TPR. Does not include non-operable species strata. Yield strata form the basis for the development of yield curves; each yield stratum has one or more associated yield curves (e.g. Aspen open (AW_AB)).

2. Acronym Listing

AAC – Annual Allowable Cut

ABMI – Alberta Biodiversity Monitoring Institute

ACIMS – Alberta Conservation Information Management System

AFGO – Alberta Forest Growth Organization

A-I-P – Agreement in Principle

ANHIC[1] – Alberta Natural Heritage Information Centre

AOP – Annual Operating Plan

APOS – Alberta Professional Outfitters Society

ARIS - Alberta Regeneration Information System

ARS – Alternative Regeneration Standards

AVI – Alberta Vegetation Inventory

BAP[1] – Biodiversity Assessment Project

BCTMP – Bleached chemi-thermo-mechanical pulp

BCG – Broad Cover Group

BSOD – Biological/Species Observation Database

BTI – Back-to-itself

CBFA – Canadian Boreal Forest Agreement

CFS – Canadian Forest Service

CPP – Controlled parentage program

CSA – Canadian Standards Association

CBM – Carbon Budget Model

CWD – Coarse woody debris

CTQ – Coniferous Timber Quota

DFA – Defined Forest Area

DFAHPC – Defined Forest Area Harvest Planning Committee

DFASC – Defined Forest Area Silviculture Committee

DFMP – Detailed Forest Management Plan

DIDs – Digital Integrated Dispositions

DLO – Department License of Occupation

DTA – Deciduous Timber Allocation

ECA – Equivalent Clearcut Area

ECSC[1] – Environmental Co-stewardship Committee

EFM – Enhanced Forest Management

EMS – Environmental Management System

ESRD[1] – Environment and Sustainable Resource Development

FBP – Fire Behaviour Potential

FEDA[1] – Forestry Economic Development Agreement

FGL – Forest Grazing Lease

FGRMCS – Forest Genetic Resource Management and Conservation Standards

FHP – Final Harvest Plan

FMA – Forest Management Agreement

FMU – Forest Management Unit

FMZ – Fur Management Zone

FOMP – Forest Operations Monitoring Program

FORWARD[1] – Forest Watershed and Riparian Disturbance (project)

GDP – General Development Plan

GER – Generic Establishment Regime

GIS – Geographic Information System

GFA[1] – Greater FORWARD area

GOA – Government of Alberta

GRL – Grazing Lease

GRP – Grazing Permit

GSP – Growing Season Precipitation

GYPSY – Growth and Yield Projection System

HRV – Historic Resource Value

HSM – Habitat Supply Model

HUC – Hydrologic Unit Code

IAG[1] – Impact Assessment Group

ILM – Integrated Land Management

LAT – Landscape Assessment Tool

LFN – Leave for Natural

LPG – Landscape Projection Group

LRSYA – Long Run Sustained Yield Average

MAI – Mean Annual Increment

MGM – Mixedwood Growth Model

MOU – Memorandum of Understanding

MPB – Mountain Pine Beetle

MWFP – Millar Western Forest Products Ltd.

NLB – Net Landbase

NRV – Natural Range of Variation

NSR – Not satisfactorily re-stocked

OGR – Operating Ground Rules

PAAC – Periodic Annual Allowable Cut

PAC – Public Advisory Committee

PLB – Pre-Landbase

POAA – Professional Outfitters Association of Alberta

PSP – Permanent Sample Plot

PFMS – Preferred Forest Management Scenario

PFMP – Preliminary Forest Management Plan

PGYI – Provincial Growth and Yield Initiative

PLUZ – Public Land Use Zone

RC – Runoff Coefficient

RFMA – Registered Fur Management Area

RSA – Reforestation Standard of Alberta

RSF – Resource Selection Function

SWAT – Soil and Water Assessment Tool

SHS – Spatial Harvest Sequence

SHE – Special Habitat Element

SMI – Summer Moisture Index

SSI – Stand Susceptibility Index

SOFA – Study of Forestry and Amphibians

SOP – Standard Operating Procedure

SFM – Sustainable Forest Management

SR – Satisfactorily Restocked

SYU – Sustained Yield Unit

TIA – Tree Improvement Association of Alberta

TMR – Timber Management Regulation

TPR – Timber Productivity Rating

TPRS – Timber Production and Revenue System

TSP – Temporary Sample Plot

TSA – Timber Supply Analysis

VOIT – Value, Objective, Indicator and Target

VQO – Visual Quality Objective

WOG – Woodlands Operating Guideline

WOI – Work Instruction

WMU – Wildlife Management Unit

WRESS[1] – Water Resource Evaluation for Non-Point Silvicultural Sources

WTA – Wildfire Threat Assessment

[1] Term that is referenced in Chapter 4 (Previous DFMP) but is not relevant for the 2017-2027 DFMP.

3. References

Achuff, P.L. 1994. Natural Regions, Subregions and Natural History Themes of Alberta: A Classification for Protected Areas Management. Prepared for Parks Services, Alberta Environmental Protection, Edmonton, Alberta.

Alberta. Statutes of Alberta. 2008. Weed Control Act. Chapter W-5.1.

Alberta. Environment and Parks. 2009. Fish Management Zones. Retrieved from: http://aep.alberta.ca/fish-wildlife/fisheries-management/fish-management-zones/default.aspx

Alberta. Environment and Sustainable Resource Development. 2012. Alberta Timber Harvest Planning and Operating Ground Rules Framework for Renewal. 98 pp. Retrieved from: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/formain15751/$file/TimberHarvest-OperatingGroundRules-Jun2012.pdf?OpenElement

Alberta. Alberta Environment and Parks. Special Access Zone. 2013a. Retrieved from: https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7BE6DC3AB3-BC61-4A6D-97F3-66E27C36027D%7D

Alberta. Environment and Sustainable Resource Development. 2013b. Wildfire Management Areas of Alberta. Retrieved from: https://geodiscover.alberta.ca/geoportal/catalog/search/resource/fullMetadata.page?uuid=%7BD039FE48-D1A8-4579-A622-E5CDAB55EC54%7D

Alberta. Environment and Sustainable Resource Development. 2014. Seed Zones of Alberta. Retrieved from: https://geodiscover.alberta.ca/geoportal/catalog/search/resource/fullMetadata.page?uuid=%7BCF48B1D6-C5DD-45C6-9782-6BB01BEAB6C5%7D

Alberta. Environment and Parks. 2015a. Integrated Land Management. Retrieved from: http://aep.alberta.ca/lands-forests/integrated-land-management/default.aspx

Alberta. Environment and Sustainable Resource Development. 2015b. Recommended Land Use Guidelines: Key Wildlife and Biodiversity Zones. Retrieved from: http://aep.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/documents/KeyWildlifeBiodiversityZones-Apr08-2015.pdf

Alberta. Environment and Parks. 2015c. Riparian Areas. Retrieved from: http://aep.alberta.ca/lands-forests/grazing-range-management/riparian-areas.aspx

Alberta. Environment and Parks. 2016a. Alberta Conservation Information Management System (ACIMS). Retrieved from: http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/

Alberta. Environment and Parks. 2016b. 2016-2017 Alberta Guide to Trapping Regulations. Retrieved from: http://www.albertaregulations.ca/trappingregs/important-changes.html

Alberta. Environment and Parks. 2016c. Hydrologic Unit Code Watersheds of Alberta. Retrieved from: http://aep.alberta.ca/forms-maps-services/maps/resource-data-product-catalogue/hydrological.aspx

Alberta. Environment and Parks. 2016d. Public Land Use Zones. Retrieved from: http://aep.alberta.ca/recreation-public-use/recreation-on-public-land/public-land-use-zones/

Alberta. Agriculture and Forestry. 2016e. Reforestation Standard of Alberta. 310 pp. Retrieved from: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/formain15749/$FILE/Reforestation StandardAlberta-web.pdf

Alberta Forest Genetic Resources Council. 2016. Glossary. Retrieved from: http://abtreegene.com/glossary/

D'Eon, Robert. 2008. Adaptive management: learning from doing in the face of uncertainty. Sustainable Forest Management Network. Retrieved from: http://www.sfmn.ales.ualberta.ca/Portals/88/Documents/ResearchNotes/RN_E29_Adaptive_Management.pdf?ver=2016-02-23-155808-707

Dunster, Julian and Katherine. 1996. Dictionary of Natural Resource Management. UBC Press, ISBN 0-7748-0567-6.

fRI. 2014. Foothills Research Institute Grizzly Bear Program. User Guide: 2014 Deliverables.

Greig, L.A., P.N. Duinker, C.H.R Wedeles, and P.Higgelke. 1991. Habitat supply analysis and modelling: State of the art and feasibility of implementation in Ontario. Unpublished Report. Wildlife Branch. Ontario Ministry of Natural Resources, Toronto, Ontario. 81 pp.

Marshall, I.B., C.A.S. Smith and C.J. Selby. 1996. A National Framework for Monitoring and Reporting on Environmental Sustainability in Canada. Environmental Monitoring and Assessment 39:25-38.

Natural Resources Canada. 2016. Sustainable forest management in Canada. Retrieved from: https://www.nrcan.gc.ca/forests/canada/sustainable-forest-management/13183

FORCORP - Project Number: P755
For additional information, please contact:
FORCORP Solutions Inc.
200-15015 123 Avenue NW
Edmonton, AB
T5V 1J7
(780) 452-5878
www.forcorp.com

--
\\silver\clients\MWFP\Projects\P755_DFMP\zzGlossary\Glossary and Acronyms_20170906_Submit.docx