Chapter 6: Forest Management Plan Implementation

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6. FOREST MANAGEMENT PLAN IMPLEMENTATION

This chapter of the 20-Year Forest Management Plan describes how the long-term strategic objectives will be implemented operationally at the ground-level. Operating Plans (OP's)will be developed and implemented, based on the Strategic Harvest Schedule of the Preferred Management Scenario.

A strategic plan was developed to help achieve long-term goals. Ideally, the strategic plan comes first, followed by a robust and measurable Operating Plan. Operating Plans support the strategic planning efforts and directions. The strategic plan needs to be linked to future Operating Plans. Both the strategic and operational plans are utilized simultaneously, there is no choosing one plan over the other.

What is Strategic Planning?

A strategic plan outlines high-level goals for the next 20 years across the entire landscape. It also estimates how well these goals are achieved in the future. Strategic plans are successful due in large part to focused effort. It's nearly impossible to focus on hundreds of strategic items.

Strategic plans help identify ways to achieve planned goals (*e.g.* balance cover types). They also can create new capabilities (*i.e.* moose habitat modeling, new road construction reductions) to help achieve future opportunities.

What is Operational Planning?

Operational plans are detailed short-term plans made under the umbrella of strategic planning. An Operating Plan (OP) has block-level details for a very small portion (0.5 to 0.7% annually) of the landbase. OPs currently detail activities planned over a two-year period, with three years of planned projection areas.

Operational planning is done to support strategic planning efforts. Operating Plans focus on proposed roads, crossings, and cut blocks at the operational or ground level. Completing the Operation Plan activities assists in achieving the strategic goals.

Linkages between strategic and operational plans

Strategic plans have a goal to maintain biodiversity at a landscape level. Strategic plans provide the framework which is used to develop operational plans. The operational plan refines strategic data to maintain and/or enhance biodiversity at the ground level. Operational plans do this using techniques such as variable block sizes, buffers, leave areas within blocks, wildlife debris piles, water crossing prescriptions and access management.

Strategic Planning vs. Operational Planning

A strategic plan enables the creation of an operational plan. An operational plan should not be formulated without guidance from a strategic plan (Table 6.1). Strategic planning has a wide influence on the forest management activities, but operation planning has a narrow influence on forest management activities. Strategic planning remains constant over time. Operational planning is an action plan that can be changed to suit site-specific or weather conditions. Operating plans help run the month-to-month forest management activities.

Table 6.1 Comparison of Strategic and Operational Plans.

Category	Strategic Planning	Operational Planning
Overview	Strategy and general guide for forest management (*e.g.* balance cover types) Strategic plan does not stipulate annual tasks and activities Set direction for the forest, devised goals, objectives, and identified strategies to pursue	Specific plan for forest management activities (*e.g.* roads, crossings, cut blocks) Operational Plan does present highly detailed information about annual tasks and activities.
Focus	Strategy and guidance to achieve goals - vision, mission and objectives. Patches (aggregates of blocks)	Planning routine activities; Action (details activities); Blocks
Time	Long-term; 20 years – Strategic Harvest Schedule; 200-year sustainability analysis	Short-term; What to do in the short term to achieve strategic goals; Two years – block-level detail Three years – projection with little detail
Area	Entire landbase (approximately 2.5 million ha)	Two years of potential harvest for Quota Holders and LP (approximately 6,000 ha over two years)
General	May be a one-time goal (e.g. balance cover types)	Reoccurring items (e.g. proposed harvest blocks)
Plan Duration	Once created, the strategic plan does not change significantly from year to year	Operational plan details may differ significantly from year to year, but remain linked to the strategic plan

6.1. Overview to Implementing the FMP

An overview of the steps to implementing the 20-Year Forest Management Plan at the operational level is described in the steps below:

1. The Spatial Harvest Schedule from the Preferred Management scenario is operationalized by the LP planner.
2. The Spatial Harvest Schedule is used as a strategic guide to layout proposed harvest blocks and associated roads and water crossings.
3. Proposed harvest blocks, roads and crossings are designed. Proposed blocks are Preharvest surveyed. Most roads and crossings are field checked for inclusion in the operating plan.
4. The proposed harvest blocks and associated roads and water crossings are mitigated between the Province of Manitoba's Western Region IRMT (Integrated Resource Management Team), Quota Holders, and LP staff.
5. Input on proposed forest management activities is received from stakeholder involvement, including Stakeholder Advisory Committee meetings, public engagement meetings hosted by LP, and engagement with Indigenous communities. Input is documented and considered in the development of operational plans. This input may change proposed harvest blocks and associated roads and water crossings or modify related forest management activities.
6. Mitigated proposed harvest blocks, roads, and water crossings are documented in the Operating Plan, then submitted to the Province of Manitoba. The submission date for the Operating Plan is the end of February.
7. Crown consultation is done by the Province of Manitoba with Indigenous communities n on the Operating Plans for FML #3. Additional changes to the operating plans may be made at this stage.
8. The Province of Manitoba reviews the Operating Plans from March 1st, to May 31st.
9. The Province of Manitoba approves the Operating Plan on June 1st.
10. Work Permits are issued at the Regional level authorizing harvest of blocks, building of roads and installation of water crossings.
11. The Quota Holders and LP implement the Operating Plan on the ground, subject to both internal and provincial field supervision.

6.2. Strategic Linkages to the Operating Plan

There are linkages between the strategic 20-year Forest Management Plan (FMP) and the Operating Plans (Table 6.2). Linking the strategic direction of the FMP to the operational implementation of the Operating Plans, ensures that the expected benefits from the strategic objectives will be realized in FML #3.

Table 6.2 Strategic linkages to Operating Plans and Forest Reports.

FMP Year (post FMP approval)	Planning	2 yr Reports	5 yr Forest Reports
	submission of FMP **Terms of Reference** (signed: July 29th, 2019)		
	Submission of **new FMP** (Dec. 31st, 2019)		
	FMP approval by provincial government – *expected Dec. 2021*	2-year reports due	Five-year reports due 5 years after the FMP is approved
1	**1st year of approved FMP**		
2	Two-Year Operating Plan	2-year Report	
3			
4	Two-Year Operating Plan	2-year Report	
5			5-yr Report (FMP Years 1- 5)
6	Two-Year Operating Plan	2-year Report	
7			
8	Two-Year Operating Plan	2-year Report	
9			5-yr Report (FMP Years 6 - 10)
10	Two-Year Operating Plan	2-year Report	
11			
12	Two-Year Operating Plan	2-year Report	
13			
14	Two-Year Operating Plan	2-year Report	
15			5-yr Report (FMP Years 11 - 16)
16	Two-Year Operating Plan	2-year Report	
17			
18	Two-Year Operating Plan	2-year Report	
19			5-yr Report (FMP Years 16 - 20)
20	Two-Year Operating Plan	2-year Report	

Multiple timeframes are interlinked to translate a 20-year strategic plan into operating plans. Modeling the future forest condition of ecosystems and sustainability is evaluated over 200-year modeling run, while the FMP is a 20-year plan. The Province of Manitoba also requires a 5-year report, entitled the 'Forest Report' which compares 20-year FMP planned operations to actual operations. This comparison of planned to actual helps evaluate the short-term Operating Plan's progress in achieving the values and objectives of the long-term strategic Forest Management Plan.

How do we maintain linkages between these different plans with different timeframes? Two methods have been utilized to link these different timeframes: bottom-up linkages and top-down linkages.

6.2.1. Bottom-Up Linkages

Before modeling started, the desire was to link operational realities to the FMP by the following method. Typically, this method is referred to as a 'bottom up' linkage.

Operational -> Tactical -> Strategic

To accomplish this the model included all real-world constraints, existing cutover boundaries, exclusions, buffers and other net-down areas in the land base data set. An example of bottom-up linkage is how mineral licks are considered. Mineral licks receive any where from a 50 to 200 m buffer, as per provincial terrestrial buffer guidelines. All mineral licks were buffered by 200 m in the modeling land base, to avoid erroneously scheduling harvest on or near a mineral lick. This buffer, now incorporated into the scenario model, affects the way all other harvest block, roads, and buffers are planned. Mineral lick buffers are then mitigated with the IRMT and determined at an operational level.

Additional real-world constraints at the tactical level were addressed as Patchworks (computer modelling) scenario characteristics. One constraint incorporated was the provincial Annual Allowable Cut limits for both hardwood and softwood. Limits were also placed on the amount of road that can be built.

6.2.2. Top-Down Linkages

Operational implementation of the objectives is accomplished following a top-down approach.

Strategic -> Tactical -> Operational

For example, strategic retention of some old forest in the Duck Mountains at all times (0 to 200 years) was desired to benefit biodiversity and wildlife species that utilize the habitat provided by old forest.

6.2.3. Utilizing the Strategic Harvest Schedule

The Strategic Harvest Schedule (Figure 6.1) acts to guide future operations but is not a precise blue print. Operationalization of the Strategic Harvest Schedule is still required by planners.

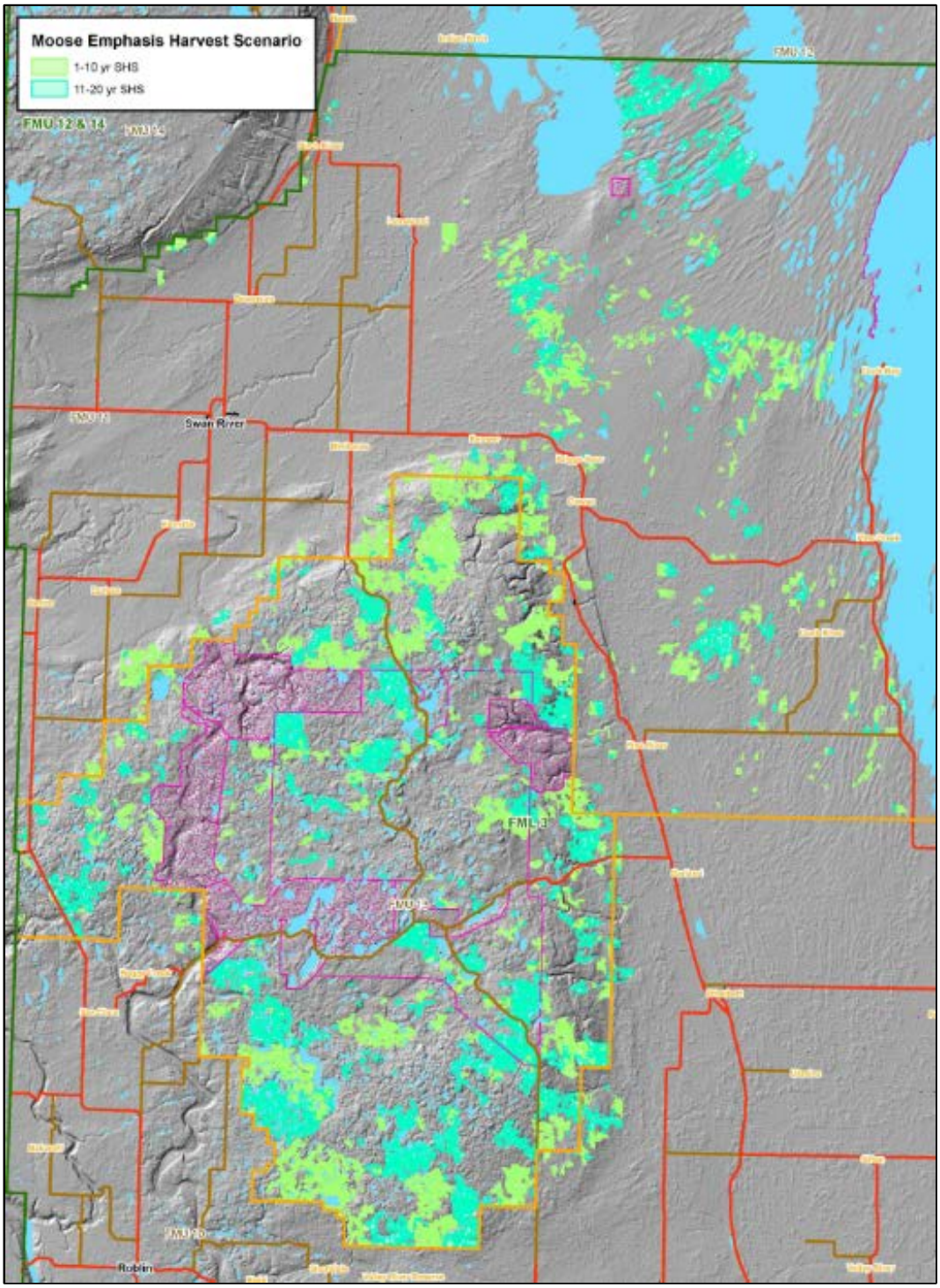

Figure 6.1 Overview of the Spatial Harvest Schedule for the next 20 years.

Operationally, the Moose Emphasis scenario provides a Strategic Harvest Schedule (*i.e.* proposed harvest blocks based on scenario objectives and targets) in two 10-year periods. The LP planner for FML 3will take the Strategic Harvest Schedule and operationalize these proposed patches into Operating Plans.

Proposed harvest blocks need a Pre-Harvest Survey (PHS) prior to mitigation and harvest. Potential changes to the blocks could be made based on the results of the PHS field findings. Mitigation of each proposed harvest block occurs with Provincial staff, Quota Holders, and LP staff. Mitigated blocks are incorporated into the Operating Plan.

Mitigation often brings up other issues such as elk management in some area. If blocks are considered important habitat for elk LP will implement reduced line of sight requirements. Some blocks have also been temporarily deferred.

The submitted Operating Plan's proposed harvest blocks may be similar to the original Strategic Harvest Schedule's patches. The Strategic Harvest Schedule patches are a tool for decision making and should not be viewed as an exact operational blueprint. Instead, the computer model provides a virtual strategic outlook. Ultimately, real-world change and consequent adjustments are typically made to meet operational requirements.

Provincial forest practice guidelines, both present and future versions, may also necessitate changes to forest management activities, such as how blocks are harvested. These guidelines could include access management or wildlife guidelines which give new guidance and require changes be made to the operational plans. Further changes to proposed blocks can be made by the Integrated Resource Management Team (IRMT), stakeholders, and the public.

6.2.3.1 Operational Planning Concepts

Operational planning often changes the strategic harvest boundaries due to consideration of the following

- changing a block boundary to follow natural boundaries
- variable-width buffers instead of strategic buffers
- Excluding non-operable areas such as wetlands
- Excluding non-merchantable areas such as undersized timber or blowdown areas
- not harvesting small isolated blocks
- leaving more wildlife tree clumps through variable retention harvest within a proposed cut block

- aggregating small adjacent blocks into a bigger block (that would otherwise trap wood as inaccessible)
- adding small areas within the larger proposed cut block boundary
- actual harvested area is typically less area than the planned area (typically 70 -85% of planned area, as per FML #3 Annual Reports), due to wildlife tree clumps and variable retention harvest

6.2.3.2 Large Patches

First and second-pass harvest blocks combine to form harvest patches. A range of patch sizes are proposed in the Moose Emphasis scenario by these size categories:

- 5 - 50 ha
- 50 – 250 ha
- 250 - 500 ha
- 500 - 1,000 ha
- 1,000 ha plus

The larger patch locations proposed in the Moose Emphasis scenario are shown in Figure 6.2.

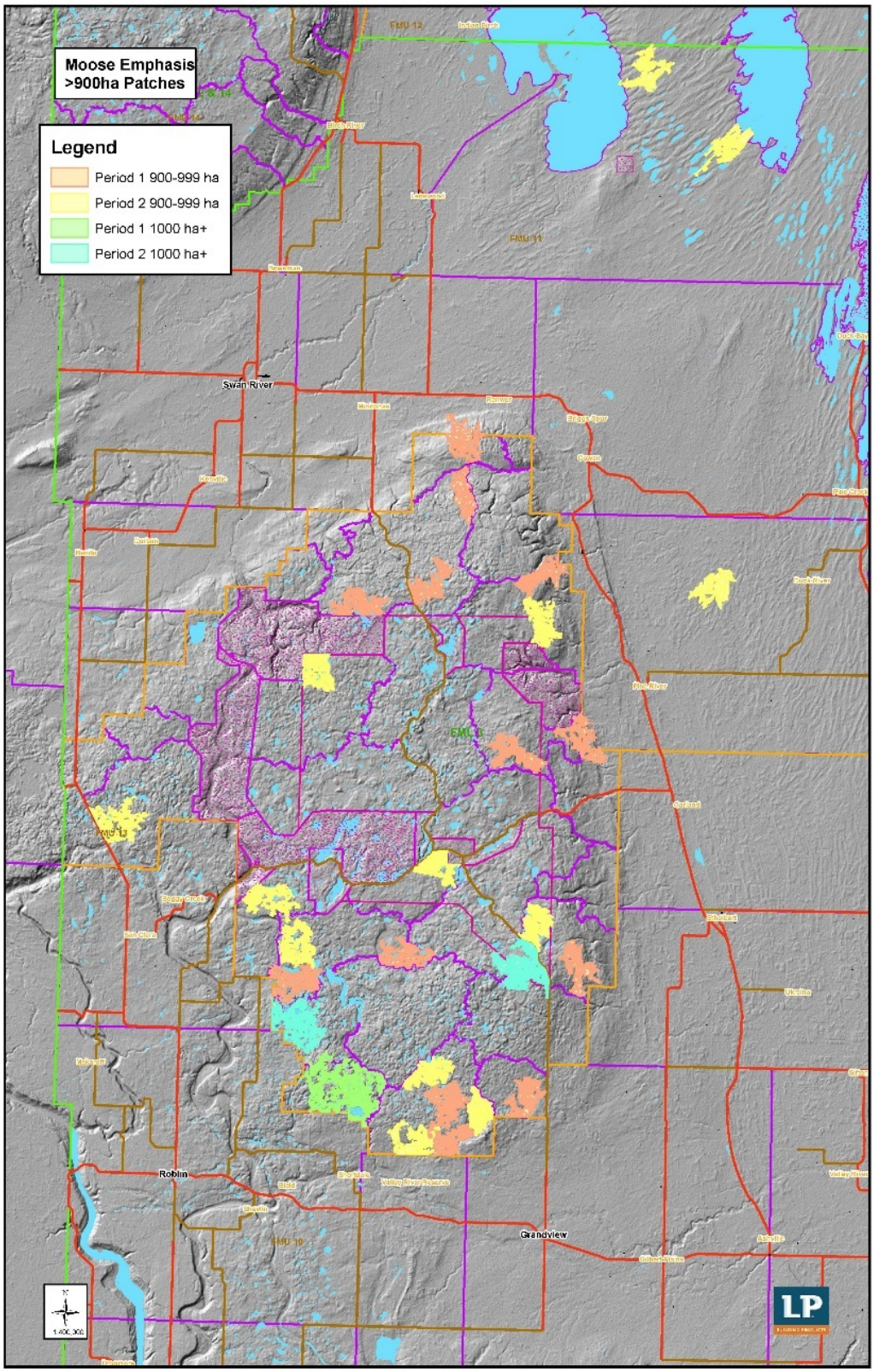

Figure 6.2 Proposed large patches in planning periods 1 and 2 (1-10 years and 11-20 years).

6.2.4. Planning Example

An example of operationalizing one proposed harvest block at an operational scale helps show the previously-mentioned operational planning concepts. Silver Creek (SLC) operating area was selected as an example (Figure 6.3).

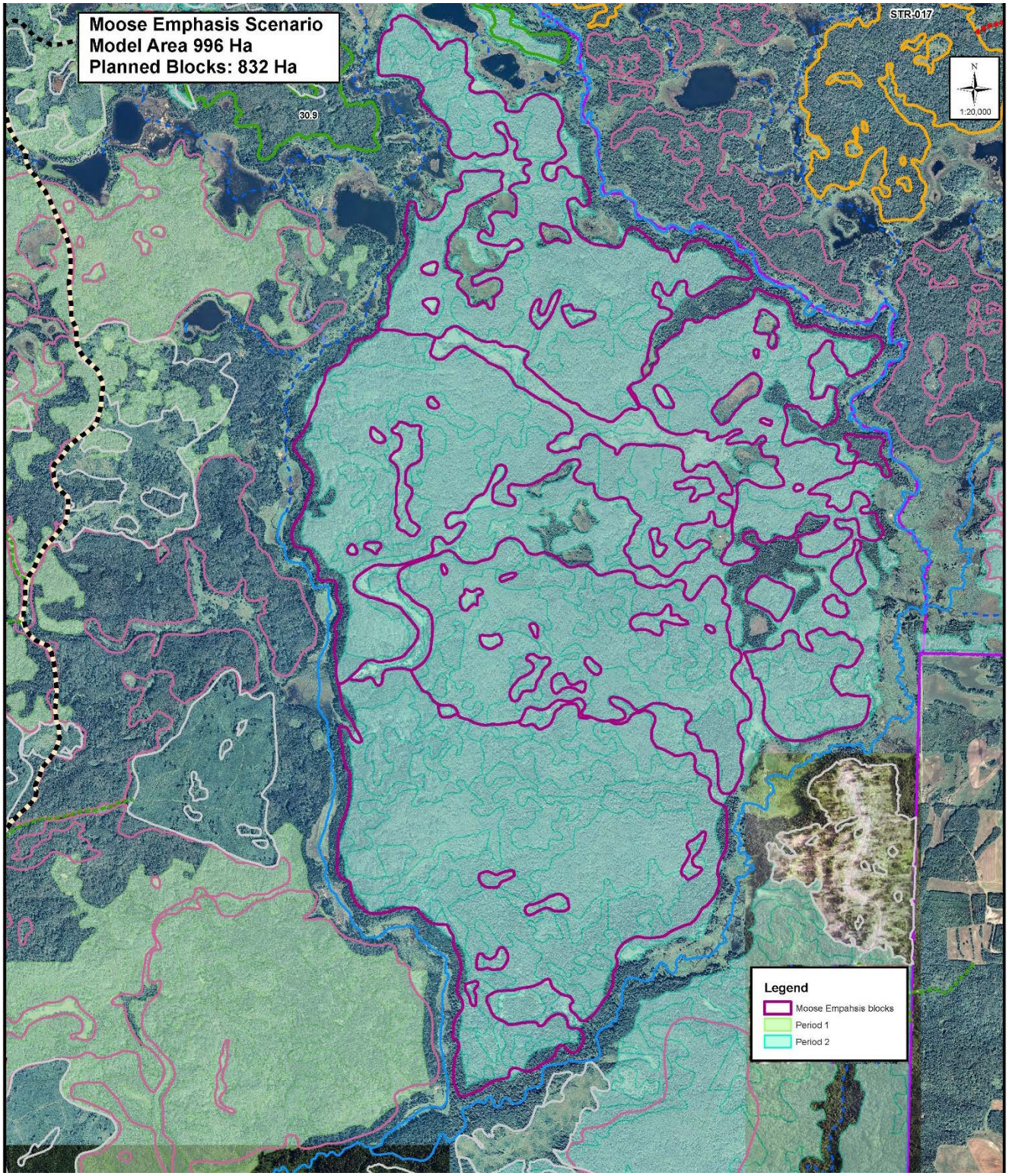

Figure 6.3 Strategic to operational planning example.

The blue-green large polygon in Figure 6.4 is a large (996 ha) computer-generated proposed harvest block from the Strategic Harvest Schedule. The proposed harvest block is bounded by creeks and water features on all sides.

Figure 6.4 Overview of one proposed harvest block in Silver Creek operating area.

6.2.4.1 Not harvesting small isolated blocks

On the north tip of the large block, the computer has chosen to include a long, narrow peninsula (Figure 6.5 - circled in red on the left). The planner has decided to separate this 10 ha (1%) area from the original block and exclude it. The benefits of this decision include:

- avoids crossing the wetland
- avoids building a lot of extra in-block road for a small amount of wood
- still being able to harvest the isolated 10 ha by merging it with a block (green boundary) north of the small waterbodies (Figure 6.5 - right) making it no longer isolated

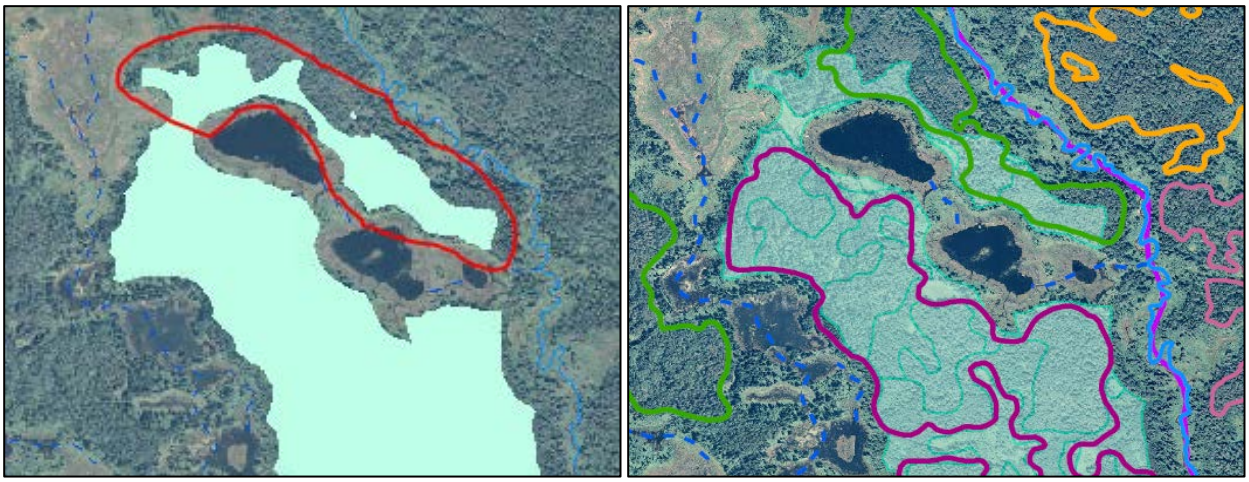

Figure 6.5 Small isolated blocks (left) are manually separated (right).

6.2.4.2 Excluding non-merchantable areas

The computer-generated large block for Silver Creek also contains some areas that were merchantable, but due to the forest changing are now non-merchantable. A significant example of this concept is the wind-damaged tornado area (Figure 6.6) above the centre of the block.

Figure 6.6 Wind-damaged tornado area within the Silver creek block (1:2,000 scale).

Therefore, the planner manually delineated the tornado area of approximately 20 ha (2% area) and excluded it from the operationalized block (Figure 6.7).

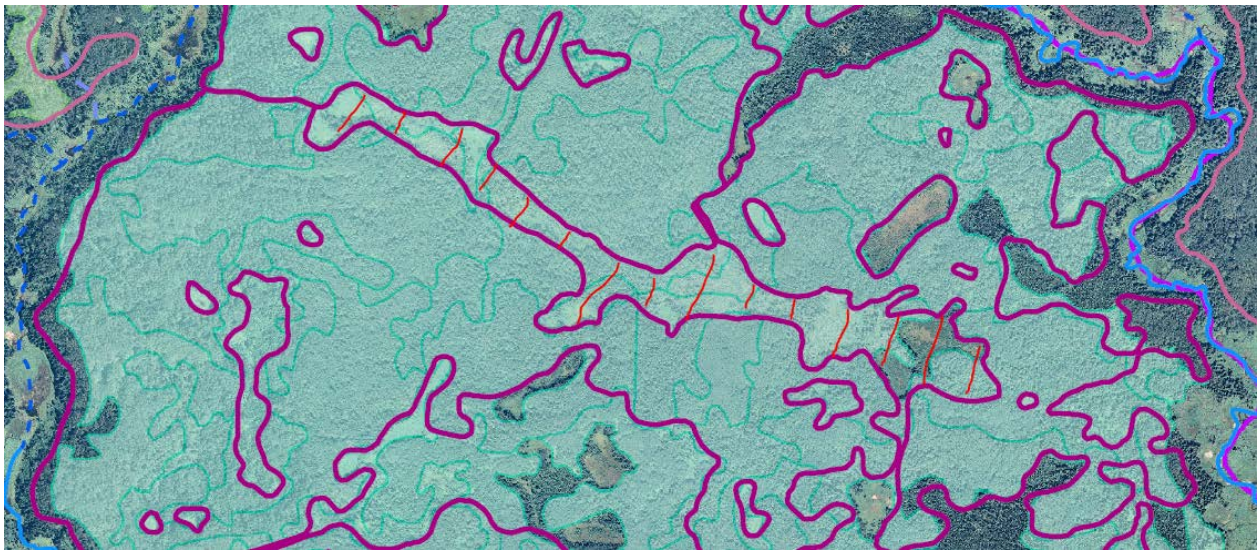

Figure 6.7 Tornado area delineated (red cross-hatch) and manually excluded from the Silver Creek block.

6.2.4.3 Excluding non-operable areas

There are fine-scale, non-operable areas that the computer doesn't know about (Figure 6.8 - left). Often these areas are due to changes in the forest such as stand decline from old age, beaver flooding, and other agents of change. Furthermore, the forest ecological inventory can only separate non-operable areas that are approximately two ha or greater in area. Smaller non-operable areas are simply a natural part of larger forested stands.

Figure 6.8 Southern tip of the Silver creek block appears all operable (left) but has non-operable areas that are manually removed (red polygons on right).

Therefore, the planner utilizes the newest imagery available and excludes non-operable areas. Some of these non-operable areas are treed, such as undersized black spruce on wet organic soil, and therefore excluded as red polygons within the block (Figure 6.8 - right). The largest non-operable exclusion is 8.0 ha in size. The two smaller exclusions are 1.2 and 0.5 ha in area.

6.2.4.4 Leaving more wildlife tree clumps

In the entire Silver Creek block, there are approximately 10 larger wildlife tree clumps strategically planned (Figure 6.9 - left). Of course, more wildlife trees clumps would be left during harvest operations, but operator-chosen wildlife tree clumps at the ground level and can't be mapped yet. After the planner has operationalized the block, there are approximately 40 wildlife tree clumps planned (Figure 6.9 - right), in addition to the operator-chosen 8-12 wildlife trees per hectare that will be left during harvest operations.

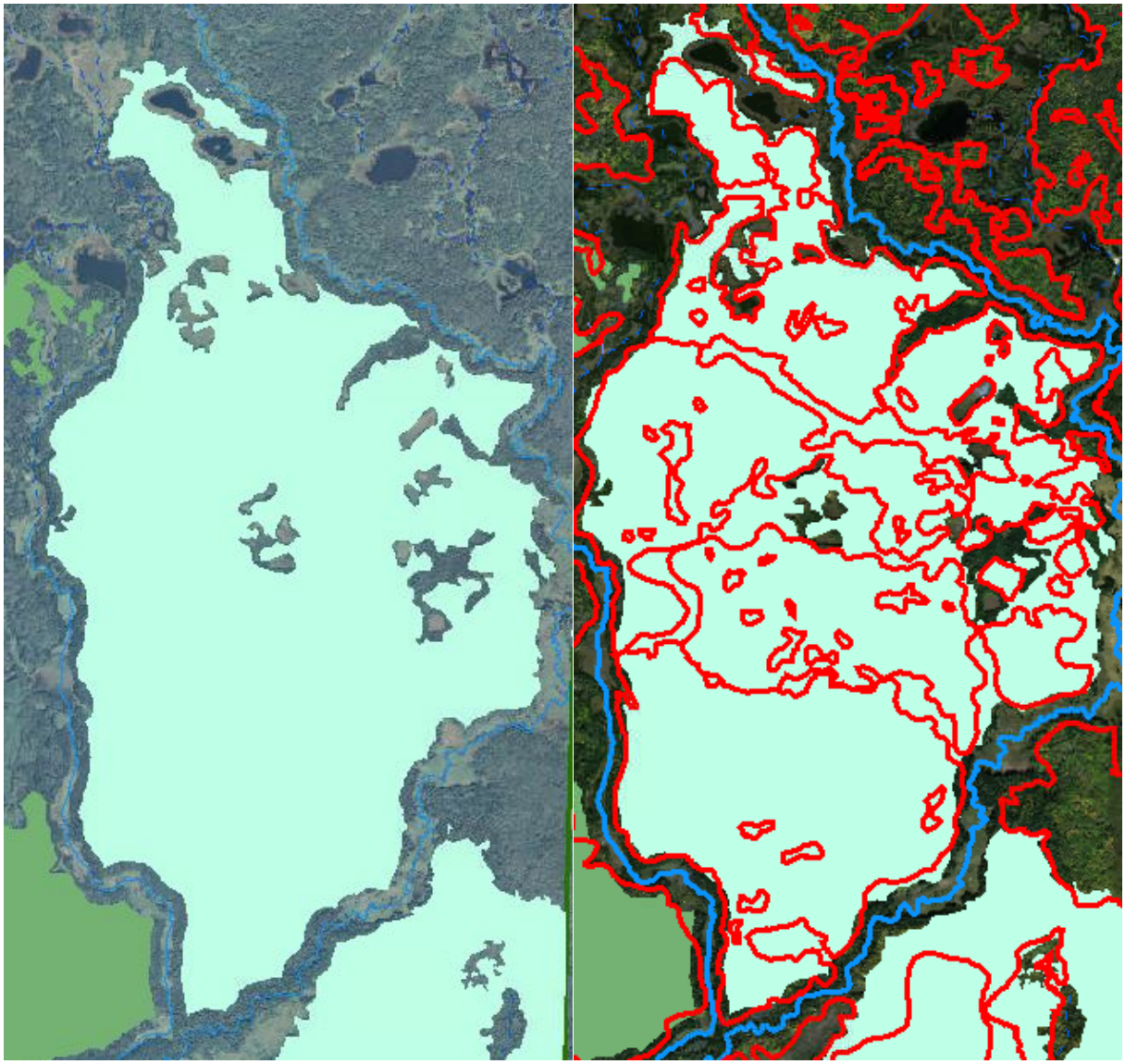

Figure 6.9 Planned wildlife tree clumps (strategic-left, and operational-right).

6.2.4.5 Aggregating Non-Operable Areas

In the centre of the Silver creek block, the computer leaves non-merchantable forest wetlands (Figure 6.10 - left) out of the scheduled harvest. These three wetlands are sized 1.5, 1.8, and 4.3 ha in area. However, the computer wants to harvest the wood in between these wetlands.

Therefore, the planner will often aggregate these non-operable areas into a single larger leave area (Figure 6.10 – right). Note that additional area has been aggregated to the west and to the east of the wetlands.

Figure 6.10 Non-operable areas (left) are aggregated by the planner (right).

6.2.4.6 Water Buffers

Strategically, water buffers are pre-determined in the land base file with a constant buffer width (100 m) on larger water features such as perennial creeks. Operationally, buffers can be variable-widths to match the terrain and trees and shrubs that protect the waterway. Also, intermittent creeks that do not appear on the inventory can be field identified on the ground and buffered.

On the south-east side of the Silver Creek block, strategic and operational buffers are compared. The strategic buffer is exactly 100 m all the time along the perennial creek and is shown as green-coloured imagery in Figure 6.11 – left. A variable-width operational buffer (70 m to 210 m wide) is detailed in Figure 6.11 (right) as follows:

a. Operational buffer width is 70 m. A smaller buffer is possible due to the terrain, and still provides significant protection to the creek.

b. Operational buffer width is 210 m. The larger buffer was chosen to ensure significant protection to the creek by trees, and not just shrubs.

c. Operational and strategic buffers are both 100 m.

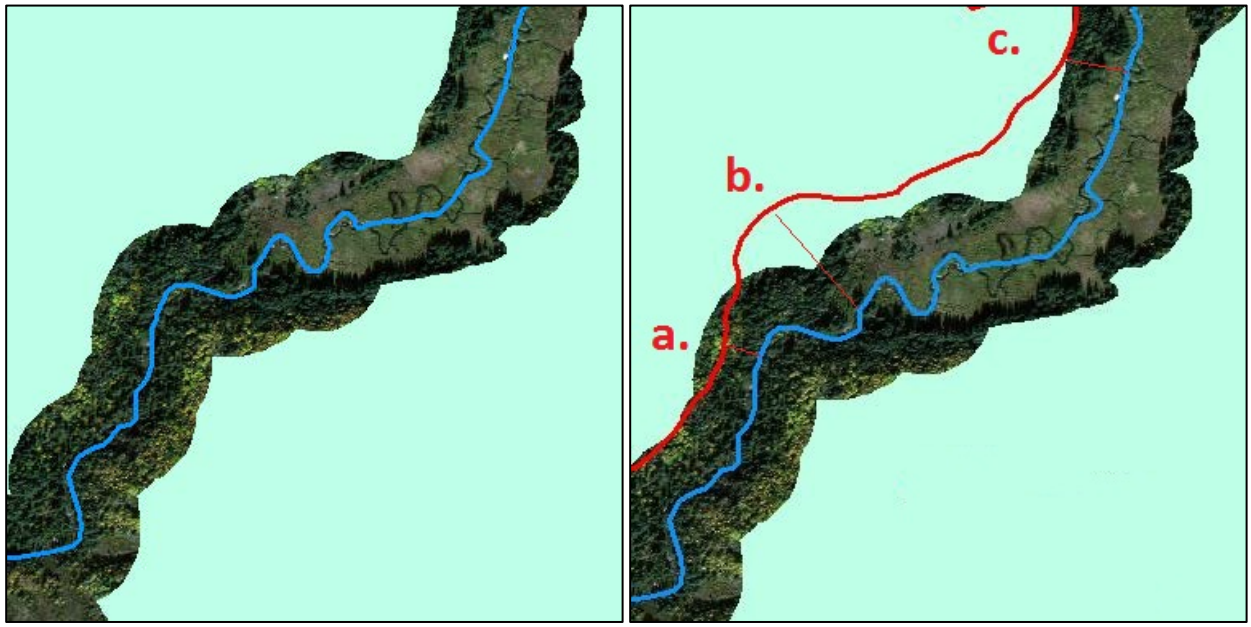

Figure 6.11 Water buffer example on Silver Creek block.

6.2.4.7 Adding small areas

Small areas outside the strategic harvest area sometimes make sense to add to the main block, if harvesting will 'trap' the small area. On the east side of the Silver Creek block, a 2.6 ha addition was operationally added to the block. If not harvested, this small area would be trapped between a perennial creek and regenerating cutover. To harvest this small area in the future, either the creek would have to be crossed or a new road made through regenerating forest.

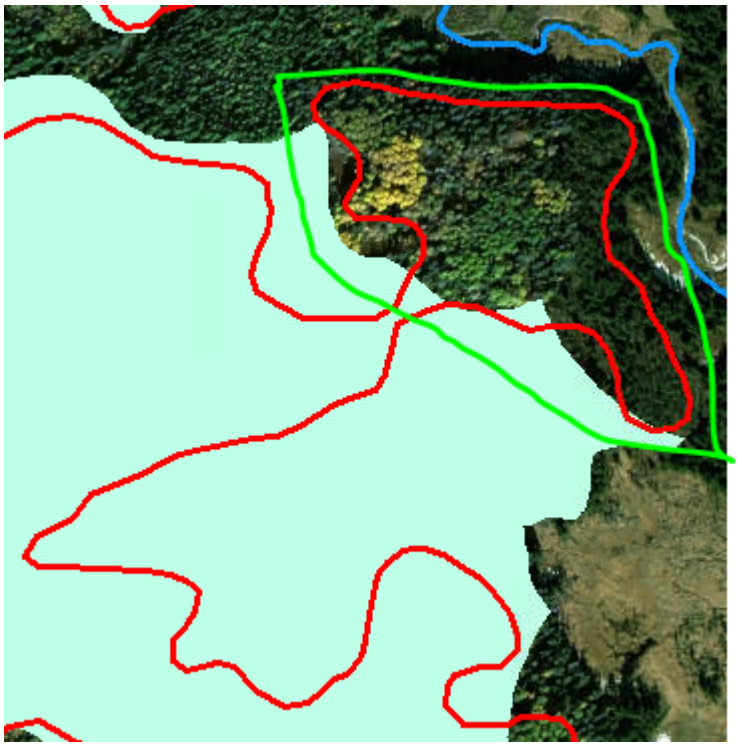

Figure 6.12 Small area added to the strategic harvest block.

6.2.4.8 Planning Example Summary

The Strategic Harvest Schedule is valuable at the landscape-level and provides many benefits. However, the many details of operational planning and making site-specific decisions based on a changing forest is far beyond what any computer can do. Therefore, an operational planner needs to use the Strategic Harvest Schedule as a guideline and template but then refine and improve the planning based on site-specific knowledge and experience (Appendix 2).

The actual harvested area of a cut block is typically less than the original planned area. Proposed block boundaries can decrease or increase in area, depending on PreHarvest Survey information, such as the presence of exceptional features. Most of the planning concepts detailed above (e.g. wildlife tree clumps, excluding non-merchantable areas) contribute to the actual area being smaller than the planned area. Good planning is more about the structure, arrangement, and connectivity of what areas you leave behind than it is about what gets harvested.

6.3. FMP Implementation Strategy

As described in Chapter 5, the Moose Emphasis scenario was chosen as the Preferred Management Strategy. Therefore, the Moose Emphasis scenario will be implemented as the template for sustainable forest management in Forest management Licence #3 for Quota Holders and LP operations for the next 20 years.

By implementing the Moose Emphasis scenario, the mutually agreed upon forest management objectives (fully described in Chapter 5) can be managed sustainably:

- Moose habitat
- Roads
- Natural Range of Variation (seral stages by cover group)
- Watershed Limits
- Patch Size Distribution
- Cover Group
- Species-At-Risk (one bird species – Canada Warbler)
- Indicator Bird Species
- Marten Winter Cover

How the strategic Moose Emphasis scenario will be carried out as Operating Plans include:

- harvest operations;
- road development and access management;
- forest renewal; and
- forest health.

6.3.1. Harvest Operations

Harvest operations are an important part of implementing the Forest Management Plan. Specific guidelines for FML #3 harvest operations are described in the Forest Operations - Standard Operating Guidelines (Appendix 1).

6.3.1.1 Criteria used in identifying and selecting areas for harvest

The Moose Emphasis Scenario that will be implemented builds upon the approved Baseline Management Scenario. The Baseline Scenario harvest pattern was modified to benefit moose habitat, while still meeting ecological and economic sustainability objectives. Moose forage (aspen and aspen-mixedwood 0 to 20 years old) will be intermixed with thermal cover, which is generally mature or old seral stage forest, to improve moose habitat.

6.3.1.2 Overview of Annual Wood Requirements

An overview of annual wood requirements in FML #3 is shown in Table 6.3. This table is for the FML #3 geographic area only (*i.e.* Forest Management Units 10, 11, and 13). Wood harvested outside FML #3 (e.g. FMUs 12, 14, and private wood) is not included.

Table 6.3 Overview of annual wood requirements.

Licencee or Quota Holder	Product	*FMU	Softwood (m3)	Hardwood (m3)	Total Annual Volume (m3)	Comments
Spruce Products Ltd.	Sawlogs and chipperwood	13	165,430	12,743	178,173	Includes 10,000 m^3 special allocation hardwood
LP Building Solutions	Siding (OSB)	13	0	255,626	255,626	Hwd AAC**
All other Quota Holders	various	13	11,507	43,565	55,072	Includes 5000 special allocation hardwood
		Sub-totals	**176,937**	**311,934**	**488,871**	
Spruce Products Ltd.	Sawlogs and chipperwood	11	5,122	78	5,200	
LP Building Solutions	Siding (OSB)	11	0	89,909	89,909	Hwd AAC**
All other Quota Holders	various	11	527	2,017	2,544	
		Sub-totals	**5,649**	**92,004**	**97,653**	
LP Building Solutions	Siding (OSB)	10	0	7,850	7,850	Open crown land only/not including lease land AAC**
		Sub-totals	**0**	**7,850**	**7,850**	Hwd AAC**
		GRAND TOTALS	**182,586**	**411,788**	**595,374**	

*FMU - Forest Management Unit; **ACC – Annual Allowable Cut

6.3.1.3 Projected Harvest Area

Harvest area by ecological strata (i.e. Habitat Element Curve strata) and age class for planning period one (1 - 10 years) is shown in Table 6.4 and Figure 6.13. The age classes are generally 20-year age classes, with a few exceptions. The first age class (0 to 50 years) is all the unmerchantable wood that is too young to harvest. The second age class (50 to 60 years) only has a 10-year range, due to the 50-year old harvest minimum age.

Table 6.4 Annual forecast of sequencing for the first 10-year planning period.

		Age Class (years)										
strata		0 50	50 60	60 80	80 100	100 120	120 140	140 160	160 180	180 200	200 +	*Strata Total Area (ha)*
S	SWD1	0	0	0	11	25	11	13	0	0	0	**60**
	SWD2	0	0	1	24	70	71	15	5	0	0	**185**
	SWD3	0	0	5	77	161	165	52	12	0	0	**474**
	SWD4	0	0	0	6	60	84	9	3	0	0	**163**
M	MWD1_M	0	0	0	0	0	0	0	0	0	0	**0**
	MWD2_M	0	0	3	42	127	62	8	0	0	0	**242**
	MWD3_M	0	0	0	1	3	2	0	0	0	0	**6**
N	MWD1_N	0	0	6	18	52	11	8	0	0	0	**95**
	MWD2_N	0	0	5	88	365	211	19	2	1	0	**691**
	MWD3_N	0	0	2	16	39	19	3	0	0	0	**78**
H	HWD1	0	4	68	34	137	0	0	0	0	0	**244**
	HWD2	0	19	375	347	897	46	0	0	0	0	**1,685**
	HWD3	0	17	272	34	44	1	0	0	0	0	**368**
	Age Class Total Area (ha)	**0**	**40**	**737**	**698**	**1,979**	**683**	**128**	**23**	**1**	**0**	**4,290**

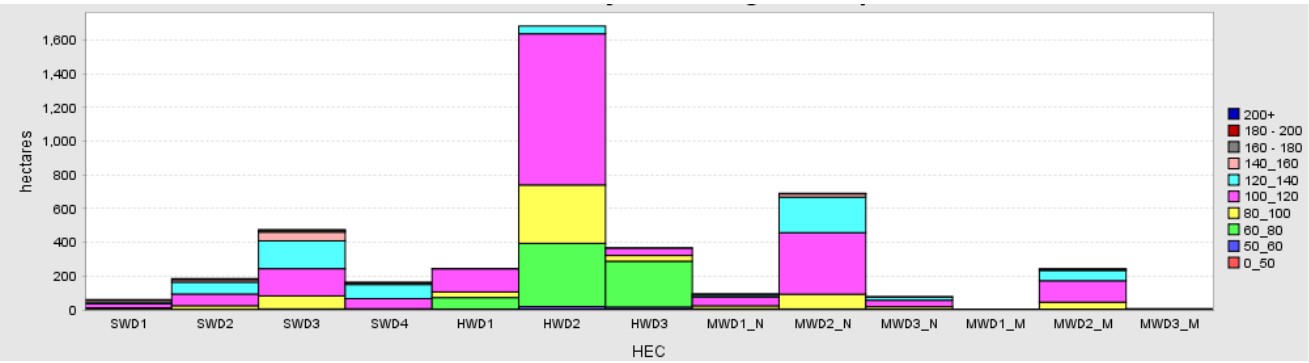

Figure 6.13 Annual harvest area by strata and age class for planning period 1 (1 to 10 years).

Note that the strata proposed to be harvested are in proportion to the strata on the landbase. HWD2 (aspen-hazel on mesic clay), MWD2_N, and SWD3 are the most common strata on the landbase and would be harvested in proportion to the landbase.
Harvest area by strata and age class for the second planning period (11 - 20 years) is shown in Table 6.5 and Figure 6.14.

Table 6.5 Annual forecast of sequencing for the second 10-year planning period.

		Age Class (years)										
strata		0 50	50 60	60 80	80 100	100 120	120 140	140 160	160 180	180 200	200 +	*Strata Total Area (ha)*
S	**SWD1**	0	0	11	1	22	5	0	1	0	0	**40**
	SWD2	0	0	38	13	60	96	36	9	0	0	**252**
	SWD3	0	0	94	29	75	95	65	22	4	0	**385**
	SWD4	0	0	0	9	29	78	28	1	1	2	**147**
M	**MWD1_M**	0	0	0	0	0	0	0	0	0	0	**0**
	MWD2_M	0	0	38	19	75	95	24	6	0	0	**256**
	MWD3_M	0	0	1	0	1	3	1	0	0	0	**6**
N	**MWD1_N**	0	0	8	10	28	27	7	0	0	0	**79**
	MWD2_N	0	0	27	57	340	420	56	6	0	0	**905**
	MWD3_N	0	0	4	10	33	31	5	0	0	0	**82**
H	**HWD1**	0	0	20	36	50	44	2	0	0	0	**153**
	HWD2	0	15	324	352	666	459	53	0	0	0	**1,870**
	HWD3	0	12	196	84	20	12	1	0	0	0	**324**
	Age Class Total Area (ha)	**0**	**27**	**761**	**620**	**1,400**	**1,366**	**277**	**44**	**5**	**2**	**4,501**

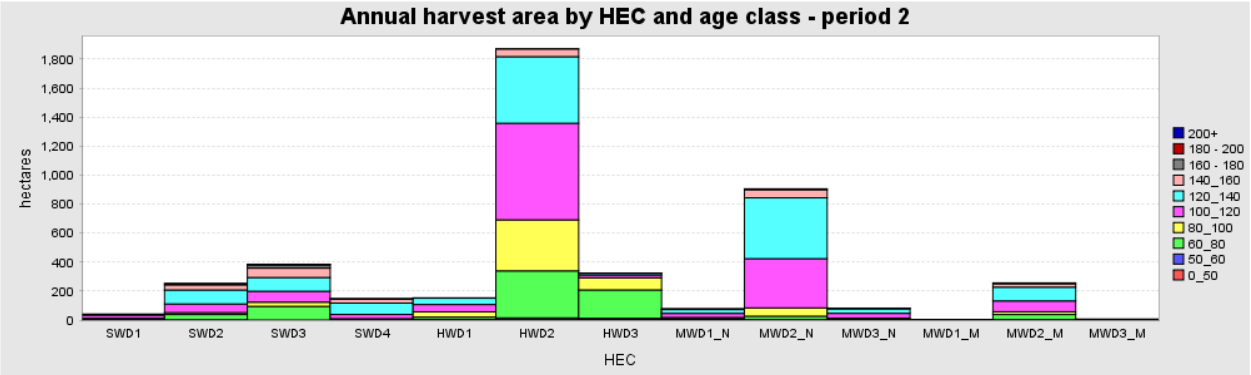

Figure 6.14 Annual harvest area by strata and age class for planning period 2 (11 to 20 years).

6.3.1.4 Harvesting Methods

The primary harvest method is Variable Retention harvesting. Variable retention harvesting provides a variety of wildlife habitats and helps conserve biodiversity at the stand level. The practice of variable retention harvesting retains both live and dead standing wildlife trees, protects understorey vegetation, and leaves coarse woody material behind after harvest. The characteristics of variable retention harvesting varies depending on the nature of the harvest area.

All harvest operations consist of mechanical logging operations. The harvest equipment used varies slightly, but typically consists of the following equipment by harvesting stage.

Felling – Feller bunchers are used to cut standing trees. A saw cuts each tree, while the accumulator arms allow for several trees to held and form a 'bunch'. The 'bunch' of trees is then laid on the forest floor (Figure 6.15).

Figure 6.15 Feller-buncher machine (left) and bunches of tree length ready for skidding.

Topping and limbing – Power saws or stroke delimbers are used to delimb the branches off the stems, and to cut off the tree's top. Power saws are more commonly used for topping and limbing hardwood, while softwoods are often stroke delimbed with a machine (Figure 6.16).

Figure 6.16 Topping and limbing with power saws (left) and a stroke delimber (right).

Skidding – A grapple skidder (Figure 6.17) is used to move bunched tree stems to roadside for processing and hauling.

Figure 6.17 Grapple skidder skidding softwood (left) and hardwood (right).

Slashing – Either a slasher or a processor head on an excavator processes tree-length stems (Figure 6.18). Hardwood tree-lengths are processed into 2.54 m (8 foot) lengths. Softwood tree-lengths that are sawlogs are processed into 5.1 m (16 foot), 3.8 m (12 foot), or 3.2 m (10 foot) lengths. Softwood chipperwood has variable lengths.

Figure 6.18 Slasher (left) slashes tree-length logs into 2.5 m bolts, a processor head on an excavator (right) performs the same task.

Loading- A swing loader on a tracked excavator is used to load processed logs onto a haul truck (Figure 6.19).

Figure 6.19 Swing loaders in action.

Hauling – Processed wood is then hauled to a mill. Trailer configurations include Super B (8 axle) (Figure 6.20), B-train (7 axle), or Tridem (6 axle).

Figure 6.20 Super B haul trailer with a load of 2.5 m aspen bolts.

6.3.1.5 Understory Protection Approaches

Understory protection of softwood strategies are dependent upon the density of softwood understory, as well as the softwood species. The methods used to protect softwood understory include (Province of Manitoba 2017):

- avoidance
- patch retention
- designated skid trails

Immature white spruce occupying the understory of the hardwood ecosystems is protected, when the density of white spruce was high enough to warrant understory protection (Appendix 3). Logging contractors are encouraged to leave softwood understory trees within variable retention clumps, wherever possible. Softwood understory protection is common in small localized areas, even within pure hardwood areas with only a few mature softwood trees.

6.3.2. Road Development and Access Management

6.3.2.1 Road Operating Practices

Road construction standards are outline in the Forest Roads and Crossings Standard Operating Guidelines (Appendix 4). Road types are defined by season of road use.

All-Season roads are designed for all-season use and include ditching and graveling the road surface. Existing provincial gravel highways and Rural Municipality grid roads are generally considered all-season.

Dry/Frozen roads typically have clay base. Sections of dry/frozen roads may need ditching and graveling. Traffic ceases on these roads after a significant rainfall and must wait for the road to dry out. Dry-frozen roads are the most common type of forestry road.

Frozen roads are winter-only roads that cross wet areas. Only when road is frozen can these wet areas be crossed in a portion of the winter season.

6.3.2.2 Future Roads

Under the Moose Emphasis scenario, it was modeled that 25% less new roads could be built to access the same volume of wood (*i.e.* the full allowable cut of softwood and hardwood). The estimated amount of new (candidate future) roads is summarized in Table 6.6.

Table 6.6 Length of roads by type and planning period in FML #3.

Road Type	Road Length (km) Period 1 (1 10 yrs)	Road Length (km) Period 2 (11 20 yrs)
Candidate Future Roads	288.4	322.8
Existing All-Season	45.2	50.2
Existing Dry-Frozen	285.3	256.6
Totals	**618.8**	**629.6**

An overview map of the candidate futures roads for planning periods one and two (1-10 years and 11-20 years) combined is displayed in Figure 6.15.

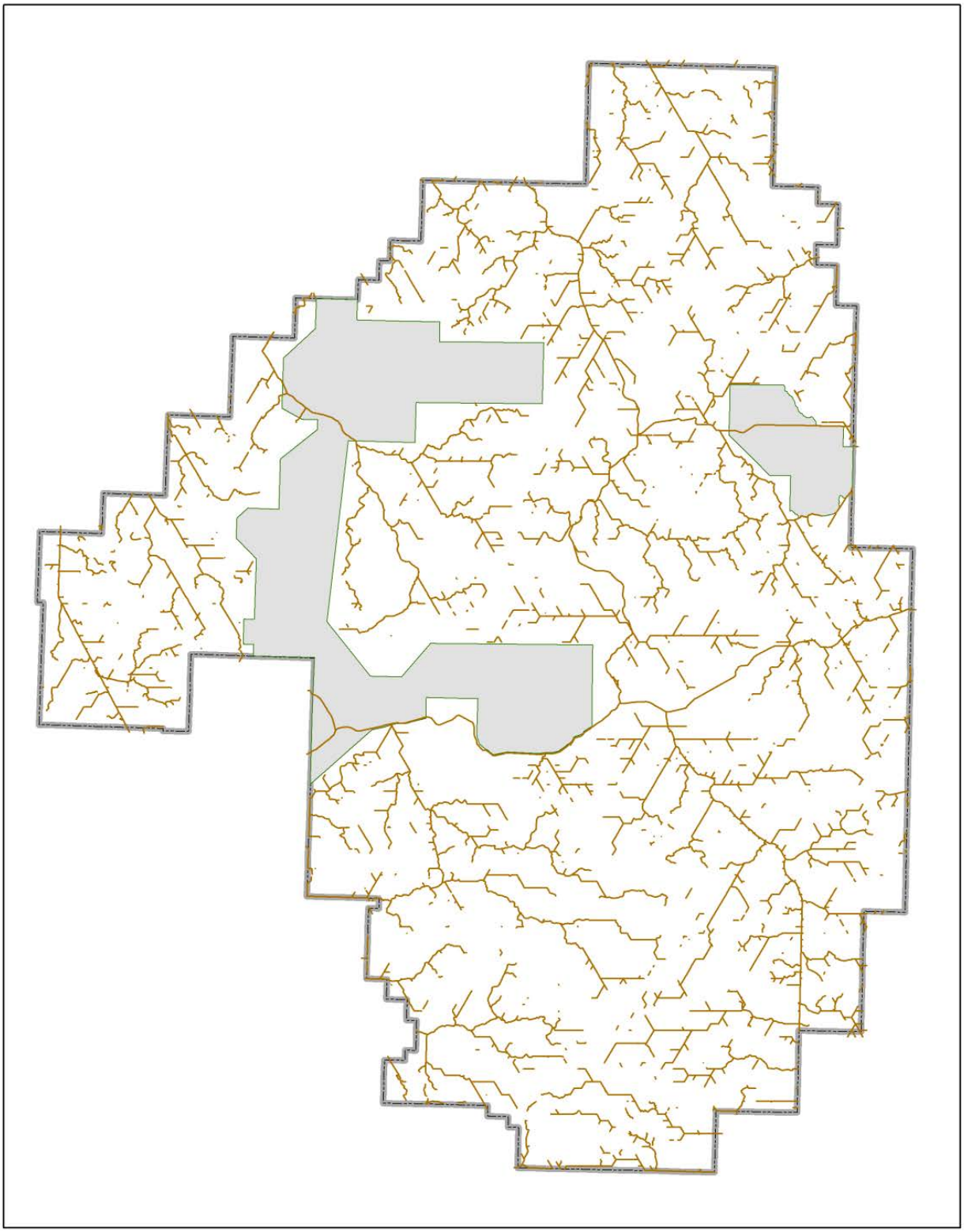

Figure 6.21 Existing and candidate future roads for planning periods one and two (20 years total).

6.3.2.3 *Road Related Activities*

Broad management strategies for road use are in the Forest Roads and Crossings SOG (Appendix 4), and the provincial forestry road management guideline (Manitoba Conservation and Water Stewardship 2012). Specifics on roads and access management are contained within individual Forest Road Development Plans (FRDP's) and the access management portion of the Operating Plan.

Water crossings are identified and prescribed at an operational level in the Operating Plans. The crossing prescriptions include detailed crossing descriptions, proposed crossing structures and photographs of the water course. Water crossings are not practical at the strategic level. Procedures for crossings are contained in the Forest Roads and Crossings Standard Operating Guidelines (Appendix 4). Forest road wetland crossings have an operational guide (Ducks Unlimited Canada 2014) to assist with maintaining the natural hydrologic flow of wetlands.

Wood stockpile and processing sites are handled at an operational level. These sites can change depending on mill requirements, suitability of potential sites, and weather. Stockpile sites are usually on private land, active harvest blocks, or gravel pit areas. These locations change depending on where harvest is occurring, season of harvest, and the need to stockpile. These ground-level details are handled operationally at the Work Permit or General Permit level (Appendix 5).

6.3.2.4 *Access Management*

Access management and its' relationship to wildlife is consistently the most significant concern. Therefore, a significant emphasis is placed on access. The Moose Conservation Closure (Regulation 122/2011) is yet another reason to closely manage access.

Access is managed cooperatively with the provincial Integrated Resource Management Team (IRMT) and the public. Existing or traditional access remains open, while all candidate future roads will be closed with berms, crossing removal, slash roll-back, and/or gates. Once harvesting and renewal activities are complete in an area, new forest access roads are closed or decommissioned.

6.3.3. Forest Renewal

An important part of forest sustainability is the forest renewal of all harvested areas. Strategically, the balance of aspen, mixedwoods, and softwood cover types across the landscape is also important to avoid large-scale conversion of the forest over time.

6.3.3.1 Forest Renewal Operating Practices

An overview of forest renewal operating practices is described in both the FML #3 Hardwood Silviculture Standard Operating Guidelines (Appendix 5) and the Softwood Silviculture Standard Operating Guidelines (Appendix 6).

Some renewal practices are rarely used and are therefore not discussed further. These practices include tending and tree improvement. It is possible that these practices would be re-initiated in the future. The Manitoba Government is working to reinvigorate the tree improvement program due to the dwindling seed supply.

Mechanical site preparation methods are used on a site-specific basis to encourage natural or assisted regeneration of harvested areas. Pre-harvest survey and post-harvest field assessments are used to assist with making this decision. Typically, scarification using barrels and chains is used on jack pine and black spruce mixed conifer sites to prepare suitable planting microsites.

Planting softwood seedlings is done annually in FML #3 by the Mountain Forest Softwood Renewal Company (MFSRC). Planting is usually done in May and June. Area planting without any site preparation is the most common method. Larger container stock is preferred, which helps the seedling outgrow the competing shrubs, herbs, and forbs.

Forest Renewal Assessments (softwood and hardwood) are done on 10-year old softwood sites, and three to five-year old hardwood sites. The survey system chosen by the province of Manitoba (Manitoba Sustainable Development 2019) is a systematic grid survey with a random start. 10 m^2 survey plots are laid out on a grid system, and then surveyed.

The criteria used in identifying and selecting areas for renewal and tending operations follows the guidance that 100% of all sites harvested will be renewed through either natural regeneration or by planting softwood seedlings. The criteria used in general is softwood sites are renewed to softwood, mixedwood sites get renewed to mixedwood, and hardwood sites are renewed to hardwood. This is the strategic strategy to balance cover types. Operational (ground-level) renewal is subject to site-specific criteria, as well as the influence of Province of Manitoba block-specific mitigation.

6.3.3.2 Forest Renewal Treatments

Renewal activities are linked to the overall management objective of balancing and maintaining cover types at the landscape-level. The implementation strategy relates to forest renewal treatments by strata. Forest renewal treatments by strata (*i.e.* H, N, M, S) vary by strata:

H -Hardwood - natural regeneration (LFN)

N – hardwood-mixedwood - natural regeneration (LFN) and or/planting softwood seedlings

M – softwood-mixedwood - planting softwood seedlings

S – softwood - planting softwood seedlings

Expected responses of forest renewal treatment by strata (*i.e.* S, M, N, and H) are shown in Table 6.7 for plantations. For example, if a **M** – softwood-mixedwood stand will be harvested then planted, it is expected to return to an **M** – softwood-mixedwood stand, 44% of the time. Other renewal possibilities for the **M** – softwood-mixedwood stand include becoming an S-softwood (31%), N hardwood-mixedwood (21%), or H - hardwood (4%). These percentages by post-harvest cover groups, are based on previous plantation success at the time of the survey

Areas planted to softwood seedlings are expected to maintain the softwood component of the pre-harvest strata across the landscape.

Table 6.7 Expected responses to plantation silviculture by cover group.

	Post Harvest Cover Group			
Pre Harvest Cover Group	**post-S**	**post-M**	**post-N**	**post-H**
pre-S	**62%**	29%	8%	1%
pre-M	31%	**44%**	21%	4%
pre-N	24%	48%	**23%**	5%
pre-H	8%	40%	33%	**19%**

Expected responses forest renewal treatment by cover group (*i.e.* S, M, N, and H) are shown in Table 6.8 for natural regeneration or Leave-For-Natural silviculture. For example, if an H - hardwood stand is to be harvested, there is a 91% chance it will regenerate to the same cover group H-hardwood. There is a small chance that the same H – hardwood stand could have enough softwood regeneration (without planting) that 6%, 2%, or 1% of the cut blocks would be N, M, or S, respectively.

Hardwood sites mostly regenerate to hardwood. Softwood sites under natural regeneration typically have less softwood success than planted softwood. The softwood cover group includes all softwoods, such as lowland black spruce and upland jack pine.

Table 6.8 Expected responses to Leave-For-Natural silviculture.

	Post Harvest Strata			
Pre Harvest Strata	**post-S**	**post-M**	**post-N**	**post-H**
pre-S	**51%**	34%	10%	5%
pre-M	28%	**56%**	8%	8%
pre-N	1%	6%	**19%**	74%
pre-H	1%	2%	6%	**91%**

A forecast of the treatment types and levels of activity for forest renewal planned for the FMP period of 20 years is shown in Table 6.9.

Table 6.9 Area of planned forest renewal treatments by planning period.

Planning Period	Leave-For-Natural (ha)	Plant Softwood Seedlings (ha)	Total Area (ha)
Period 1 (1-10 yrs)	2,887	1,403	**4,290**
Period 2 (11-20 yrs)	3,083	1,418	**4,501**

6.3.4. Forest Health

Insects and diseases are a natural part of forest ecosystems. Insects especially contribute to the food chain and are eaten by birds, bats *etc*. Insects also pollinate many flowering plants. However, it is important to know when population levels change from normal or endemic levels to localized extremes, or epidemic levels.

Harvest and renewal planning must be aware of the presence and severity of insects and disease to properly manage the forest and ensure adequate regeneration. Failure to account for insects and disease may have serious impacts on the future forest.

The best opportunity to identify any localized forest health problems is during operational field work, such as a Pre-Harvest Surveys and Forest Renewal Assessments. The Province of Manitoba's forest health requirements are followed by:

- training field staff to identify significant insects and diseases with help from Forest Health and Ecology section;
- tallying trees with health problems at each plot;
- rating each pest by tree species and severity level when traveling between plots; and
- sending forest health data to Urban Forestry, Forest Health and Field Services section for a 'coarse filter' screening.

Previous field work has found severe infestations of *Armillaria* root rot, western gall rust, forest tent caterpillar, hypoxylon canker, and poplar borer. Recently, an outbreak of spruce budworm has occurred in the south-west corner of the Duck Mountains.

6.4. CONCLUSIONS

The 20-year Forest Management Plan (FMP) provides strategic direction, including a strategic harvest layout for the Moose Emphasis Scenario for 20 years. The FMP will still be subject to the existing Province of Manitoba approvals and permits processes. This includes Pre-Harvest Survey, mitigation, an Operating Plan and written approval, followed by Work Permits. In addition, there is also Indigenous community, stakeholder, and public input.

The strategic harvest schedule is valuable at the landscape-level and provides many benefits. However, the many details of operational planning and making site-specific decisions based on a changing forest is far beyond what any computer can do. Therefore, an operational planner needs to use the Strategic Harvest Schedule as a guideline or template but refine and improve the planning based on site-specific knowledge and experience.

Strategically, the Moose Emphasis scenario can harvest the full Annual Allowable Cut, but with 25% less new roads. Operationally, the harvest schedule subsequent roads need to follow the strategic guidance of the Forest Management Plan. If we depart significantly from the strategic guidance, the 25% road reduction may not be achieved.

6.5. LITERATURE CITED

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6.6. APPENDICES

APPENDIX 1. Harvest operating areas map – Spatial Harvest Schedule - Moose Emphasis Scenario

APPENDIX 2. Planning Standard Operating Guidelines

APPENDIX 3. Biodiversity Standard Operating Guidelines

APPENDIX 4. Forest Roads and Crossings Standard Operating Guidelines

APPENDIX 5. Forest Operations Standard Operating Guidelines

APPENDIX 6. Hardwood Silviculture Standard Operating Guidelines

APPENDIX 7. Softwood Silviculture Standard Operating Procedures