MANNING DIVERSIFIED FOREST PRODUCTS LTD.

FMP Implementation

2007 – 2017 Forest Management Plan for FMA 0200041

May 31, 2007

Prepared by:
The Forestry Corp.

2007 – 2017 FMP FOR FMA 0200041

FMA Resources forms one of 10 sections of the 2007 – 2017 Forest Management Plan for Manning Diversified Forest Products Ltd.'s Forest Management Agreement (FMA) 0200041. The Forest Management Plan (FMP) includes the following sections:

1. **Introduction and Plan Development** – Introduces the companies operating on the FMA and describes the FMP development process, including the public consultation process. Includes the FMP Standards Checklist.
2. **FMA Area** – Describes the physical environment of the FMA Area.
3. **FMA Resources** – Describes the natural resources within the FMA Area.
4. **Values, Objectives, Indicators and Targets** (VOITs) – Details the values, objectives, indicators and targets that were instrumental in selecting the Preferred Forest Management Strategy and in developing forest management strategies for the FMP.
5. **Forest Landscape Metrics** – Presents specific information regarding forest vegetation composition and natural disturbance within the FMA Area and/or northwestern Alberta to address VOIT requirements.
6. **Landbase Netdown** – Provides a detailed description of the landbase netdown process, in preparation for the Timber Supply Analysis.
7. **Yield Curves** – Documents the volume sampling and yield curve development process.
8. **Timber Supply Analysis** – Describes how the Preferred Forest Management Strategy, which was selected to meet Values and Objectives, was incorporated into the Timber Supply Analysis and provides an Annual Allowable Cut for both the coniferous and deciduous landbases.
9. **Implementation** – Describes the forest management strategies and operations that will be used to implement the FMP and help ensure that indicators and targets are met.
10. **Monitoring and Research** – Describes monitoring commitments required to ensure indicators and targets are tracked and describes Manning Diversified's approach to supporting research.

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1. Planning Hierarchy

The Forest Management Plan represents only a single step in the forest management planning process. The FMP is a forest-level plan that provides the following:

- Sets the general direction for forest management within the FMA for the FMP period.
- Establishes a set of values and objectives for the FMA and identifies indicators and targets for measuring the success of forest management activities over the FMP period. These are used to derive a Preferred Forest Management Strategy.
- Determines an Annual Allowable Cut and the Spatial Harvest Sequence (SHS) for the FMP period that is consistent with Preferred Forest Management Strategy.
- Identifies the monitoring requirements required to evaluate FMP indicators and targets.

Successful implementation of the FMP relies on coordinated operational planning to translate the forest-level values, objectives and strategies into operational realities. At the same time, operational constraints may impact the ability to fully implement the FMP and the impact of these deviations may need to be evaluated in the context of the overall FMP.

FMA holders within the Province of Alberta are required to submit operational plans each year. The Companies submit a General Development Plan (GDP), a Final Harvest Plan (FHP), an Annual Operating Plan (AOP) and an Annual Silviculture Plan/Report. These operating plans are all submitted to the Province for review. Approval of the AOP by the Province provides the Company with authorization to harvest for the timber operating year (May 1 to April 30). The FMP relates directly to both the GDP, FHP and the AOP through the spatial harvest sequence. An overview of the planning hierarchy and the feedback from operational plans back to the FMP spatial harvest sequence/implementation (via monitoring protocols) is provided in Figure 1-1. The operational plan development process is briefly outlined in the following sections. The role played by the Timber Harvest Planning and Operating Ground Rules is also identified.

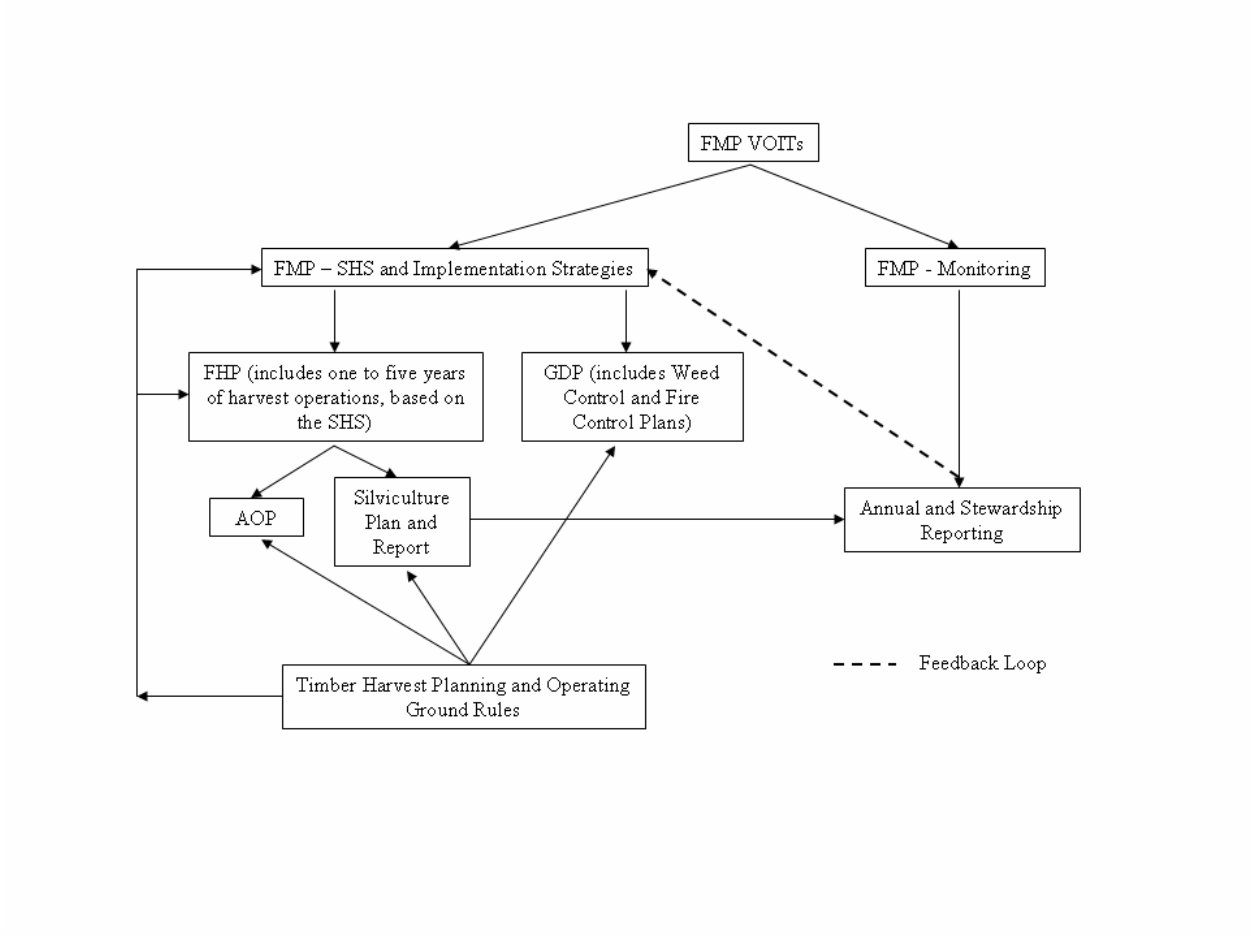

Figure 1-1. Overview of forest management planning hierarchy.

1.1 General Development Plan

Both FMA holders and quota holders are required to submit a GDP annually as part of their AOP submission. The GDP projects forest management activities for a five year period and is updated annually. It's goal is to assist with the integration of activities, particularly with regard to road development and to help scheduling and control of harvesting and other management activities. The GDP helps ensure that all concerns are identified and addressed early in the planning process to an appropriate level of detail.

Within the FMA Area, Manning Diversified, the FMA holder and DMI Ltd., Peace River Pulp (DMI) (as the only quota holder) each submit GDPs. MDFP submits a GDP that incorporates all Company (MDFP) forest management activities within the FMA Area, as well as their quota operations in FMU P15. In the case of DMI, their GDP encompasses their operations within their FMA, as well as their related quota sphere of interest, which includes FMU P16 (previously designated as P6 and P9).

Although the GDPs are specific to each Company's operations, the two Companies work cooperatively during the GDP development process to ensure their joint operations are conducted in manner that

minimizes any potential negative impacts (e.g., cooperative access, overall access reduction, etc.). This is important from both an environmental and economic perspective.

MDFP's GDP also contains the Company's Fire Control and Weed Control Plans.

1.1.1 Weed Control Plan

A Weed Control Plan is submitted annually with the GDP. This plan summarizes weed control activities completed the previous year as well as the activities planned for the coming year. Activities including training, inspections and control initiatives (e.g., spraying, picking, no action) are noted, along with a list of locations of weed infestations that MDFP is responsible for.

1.1.2 Fire Control Plan

A Fire Control Plan is also submitted annually with the GDP. The Fire Control Plan outlines all activities and preparations related fire prevention, detection, reporting, pre-suppression and suppression. The plan describes and maps the location of any operations planned during the fire season such as harvesting (limited because of emphasis on winter harvest operations), planting, debris disposal, surveying, etc. Training activities are identified and detailed emergency contact information is included in the Plan.

1.2 Final Harvest Plan

The Final Harvest Plan (FHP) describes in detail the timber harvesting operations for a minimum of one and a maximum of five timber years. It includes areas and volumes to be harvested and any special operational considerations (e.g., access control, timing of operations, etc.). The Final Harvest Plan includes details regarding road construction (the Road Construction, Maintenance and Abandonment Plan), operational integration with other resource users (where appropriate) and production reports for previous years.

As part of the Timber Supply Analysis for the 2007 – 2017 FMP for FMA 0200041, a Spatial Harvest Sequence (SHS) was developed (see **Timber Supply Analysis**). The SHS identifies where harvesting will occur for the term of the FMP and the period in which harvesting will occur. The SHS will guide the preparation of Final Harvest Plans.

1.3 Annual Operating Plan

The Annual Operating Plan (AOP) identifies the areas within the Final Harvest Plan that will be operated in the timber year.

1.4 Annual Silviculture Plan and Report

The Annual Silviculture Plan and Report provides details regarding how forest renewal will be implemented on the ground. It identifies silviculture systems, strategies and tactics and operational silviculture details for all harvest areas. It also describes any silviculture treatments planned for existing regeneration such as manual tending and herbicide application, as well any reclamation activities that may be undertaken.

1.5 Timber Harvest Planning and Operating Ground Rules

Timber Harvest Planning and Operating Ground Rules provide direction to timber operators for operational planning and for implementation of timber operations. The Ground Rules include standards and guidelines for timber harvest, road development, reclamation, reforestation and integration of timber harvesting with other forest uses.

The Province requires FMA holders to develop FMA-specific Ground Rules, often as part of the FMP process. In the absence of FMA-specific Ground Rules, the Provincial Timber Harvest Planning and Operating Ground Rules are applicable.

As part of the FMP development process for FMA 0200041, a Ground Rule Working Group has been formed. This Working Group is charged with the development of FMA-specific Ground Rules that are consistent with the objectives and strategies that have been identified in the FMP. This helps ensure that planning and operations are aligned, so that FMP objectives are met.

The Ground Rule Working Group consists of MDFP, DMI and Provincial representatives and includes a public involvement component (i.e. stakeholder review).

2. Access Planning and Development

Access planning, construction, maintenance and reclamation play a key role in forest management. Roads are used to transport the harvested timber from the 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, but it also removes land from timber production. Development of any type of access has implications on non-timber resources because of the increased ability for other users to access areas. Construction, maintenance and reclamation of roads, when not conducted carefully, has the potential for negative impacts on the soil resource (e.g., erosion, slumping) and on watercourses (e.g., soil erosion into streams). Road construction often requires construction of watercourse crossings which, in addition to soil and water quality concerns, have the potential to obstruct passage of fish if not constructed properly. Companies also need to ensure that their operations can be accessed safely and economically.

2.1 Access Planning

Both P6 and P9 (currently designated FMU P16) are currently accessed by numerous resource roads and seismic lines which have been constructed by the oil and gas sector or by roads constructed by Municipalities. To date, most forest operations have been carried out within FMU P6. Year-round access into P6 is provided by approximately 286 km of all-weather municipal and industrial roads. Access into P9 is almost exclusively restricted to winter. The FMU contains approximately 35 km of all-weather road. In both FMUs, none of the all-weather roads are Manning Diversified's or DMI's (i.e., all are either Municipal roads or other industrial roads).

It is the Companies' intent to continue past practices of limiting the amount of new road construction within the FMA Area. Manning Diversified and, to a large extent, DMI, conduct operations during the

winter season to reduce the impact on soils and water courses. Access planning strategies are utilized by the Companies' to ensure planned access:

1. Minimizes area of productive forest lost to access development.
2. Maintains soil and water quality.
3. Maintains habitat, wildlife and other resource values (i.e., limiting open access, timing access, etc.)
4. Provides safe roads for staff, contractors, other commercial users and the public.
5. Minimizes access development costs.

Access planning strategies include:

- Reuse of existing access (addresses points 1, 2, 3 and 5)
- Improving/upgrading of existing access (addresses points 1, 2, 3 and 5)
- Minimizing length of new road construction (addresses points 1, 2, 3 and 5)
- Joint access development (addresses points 1, 2, 3 and 5)
- Conducting winter operations (winter only for MDFP, primarily winter for DMI) (addresses points 2 and 5).
- Minimizing number of watercourse crossings (addresses points 2 and 5)
- Selecting appropriate watercourse crossing locations and structures (addresses points 2 and 4)
- Reclaiming decommissioned roadways (addresses points 1 and 2)
- Locating new access routes on non-productive landbase (addresses point 1)
- Construction appropriate to planned utilization (addresses points 4 and 5)
- Access development and utilization will follow requirements associated with special management zones (e.g., access control, timing constraints, etc.).

Strategies which address safety concerns specifically include:

- Development of access suitable for expected traffic (season, type and volume).
- Safety programs for staff and contractors
- Appropriate road signage
- Stakeholder communications regarding log haul.

Where the existing access options do not meet Company requirements, the Companies evaluate options associated with creating new access routes. Planning new road access involves selecting the best route, , to move the timber from one location to another for the expected life of the road. For a main road this means determining the best route from the harvest area to the mill. Where practical, existing roads and corridors are used. For an inner-block road, road planning involves determining the best route within the block and to the nearest inter-block road to promote efficient harvesting. In all cases, the following factors are taken into account:

- slopes,
- watercourses,
- ground conditions,
- environmental impact, and
- road standard.

Details regarding the implications of these factors on route selection, road planning and watercourse crossing construction are provided in the FMA's Road Planning, Construction, Maintenance, Reclamation and Monitoring Strategy (Appendix I).

DMI's guidelines related to watercourse crossings are provided in Appendix II.

MDFP's main objective relating to road development is to construct cost-effective, safe roads that minimize environmental disturbance and limit loss of the productive landbase.

The Company's access program includes the following components:

- Construction, maintenance, abandonment and monitoring of Company roads.
- Re-use of existing roads and seismic lines (other than Company roads).
- Stream crossing construction, maintenance, removal and monitoring.
- Implementation of access restrictions.
- Timing or other restrictions impacting access construction and utilization (e.g., work within the Ungulate Zone).
- Provision of safe transport corridors for staff, contractors and other resource users.

Road construction requirements vary greatly, from all-season main roads to temporary in-block roads. Roads may be built and maintained for years (e.g., main haul roads) or may be very temporary (e.g., winter in-block roads). The amount of traffic a road receives will also vary and will, to some extent, help determine the type of road constructed.

Manning Diversified's road program addresses three types or grades of road:

- Main roads - Connecting main harvest areas with the mill, used for multiple seasons and thousands of loads.
- Inter-block roads - Roads connecting individual blocks to each other and/or main roads, used for one or two seasons and several hundred loads.
- In-block roads - Road systems within block boundaries to facilitate harvest of the block and accommodating relatively small numbers of loads.

Where road construction or upgrading is required, the following steps are taken to ensure protection of forest, land and water resources is considered during the construction of new roadways.

- Construction of new, permanent access will be planned and presented as part of the GDP.
- Stream crossings are 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 Harvesting and Operating Ground Rules.
- Reporting of all road construction activities annually in the Road Construction, Maintenance and Abandonment Plan, which is submitted as part of the AOP.
- A summary of permanent, seasonal and temporary road construction undertaken for forestry operations within the FMA Area will be summarized as part of the Stewardship Report.

Additional details regarding MDFP's road planning, construction, maintenance, reclamation and monitoring are provided in Appendix I.

2.2 Corridor Plan

As part of the 2007 – 2017 FMP, Manning Diversified has prepared a Corridor Plan describing the road network needed to access the FMA Area during the FMP period. Figure 2-1 shows the general location of access corridors that will be utilized on the FMA Area. Key components of the Corridor Plan include:

- The Peace/Upper Hay Area Access Planning Guidelines have been incorporated into the Corridor Plan.
- The Companies will not construct a loop road from Highway 35 across the Botha River to the Chinchaga Forestry Road nor will they construct a road that crosses the Botha River to gain access to Highway 35.
- When the Companies conduct operations within the Caribou Zone approved access control measures will be utilized. Some of these access controls are already in place.
- The Companies will not create any new access within the Twin Lakes Recreation Area buffer, or any other Special Management Zone without appropriate consultation.
- The Companies will make use of existing corridors (cutlines, roads, other dispositions) in their operations, however, safety is paramount, and extra (new cut) roads or loop roads may be required.

The Corridor Plan is included as Appendix III.

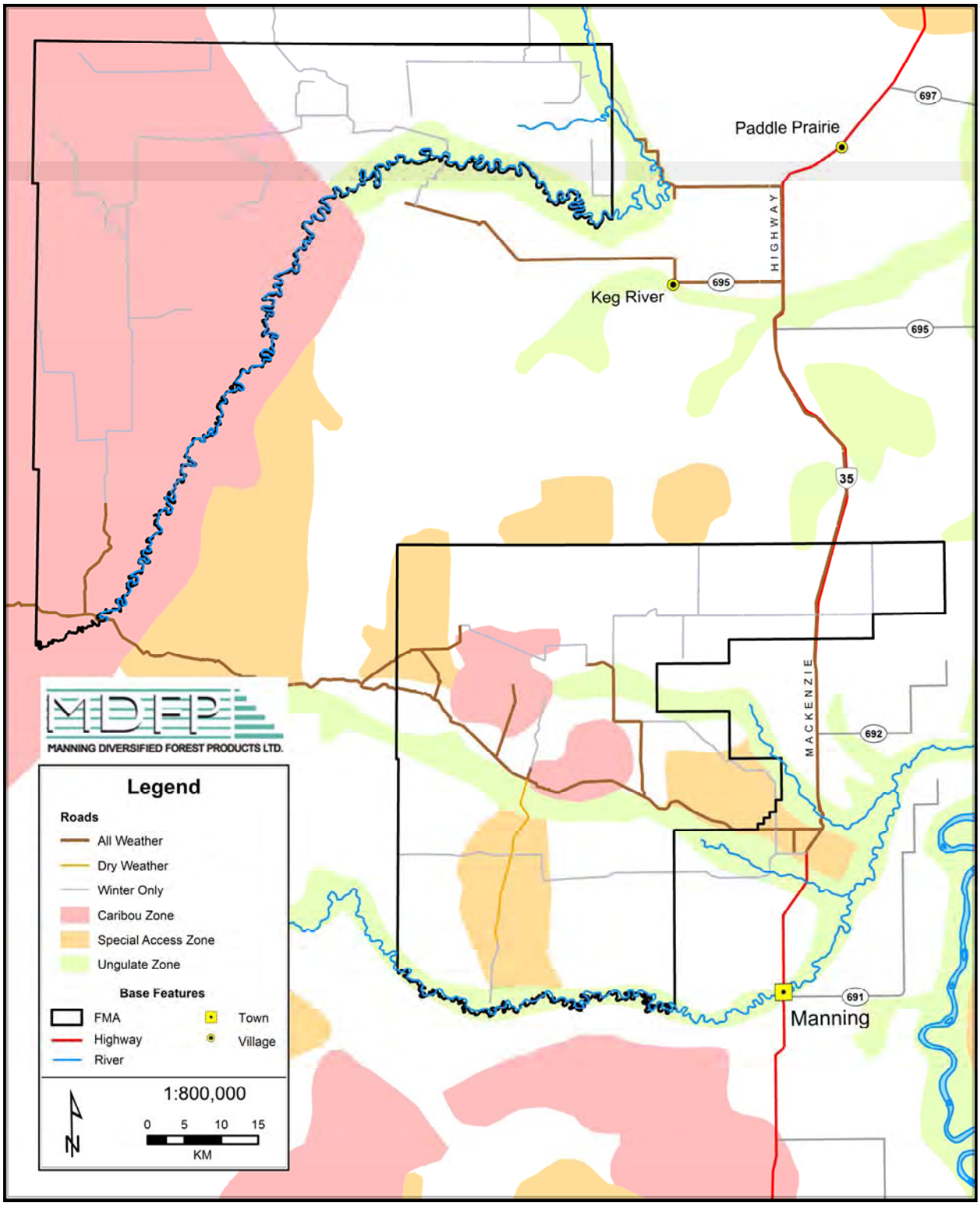

Figure 2-1. FMP Corridor Plan.

3. Timber Harvesting

Careful planning and implementation of the timber harvesting program help Manning Diversified and DMI meet their overall forest management objectives while ensuring the Companies are able to supply their processing facilities with an economically viable source of raw materials.

The Companies work cooperatively during the harvest planning process and during harvest operations to ensure environmental and economic considerations are addressed.

3.1 Harvest System and Methods

Much of the current forest in P16 are in a mixedwood state supporting either mixed conifer (pine and spruce) or mixed conifer-deciduous(spruce and aspen) forests. Utilizing a patch harvest system that focuses on protection of existing conifer understorey and maintenance of structure, it is Manning Diversified's intent to maintain a similar diversity of mixedwood ecosystems.

The patch harvest system with coniferous understorey protection, in conjunction with appropriate stand establishment and tending practices, is well suited to regenerating the predominant species currently found within the FMA Area (i.e., white spruce, lodgepole pine and aspen).

MDFP's harvesting operations within the FMA Area are all full tree systems, with road-side processing. Operations are conducting using a combination of feller-bunchers, skidders and roadside delimbers. This system is efficient, both from an economic and recovery perspective, for patch harvesting in the types of stands the Company operates. The roadside debris is subsequently piled and burned. The structure of the forests being harvested helps ensure that significant woody debris is maintained within the block, despite the roadside processing.

Coniferous understorey protection is a consideration on all harvested blocks. It is addressed using the following strategies:

- All operators receive training in understorey protection.
- Pre-harvest surveys provide a quantitative estimate of the stems per hectare of understorey. If appropriate, spatial information is also provided.

- Operators are informed of expectations regarding the maintenance of the existing conifer understorey.

DMI is responsible for conducting harvest operations within stands sequenced primarily for deciduous fibre. These stands are also harvested using a patch harvest system, with an emphasis on maintaining the existing conifer understorey and preserving some in-block structure. DMI utilizes portable chippers in its harvest operations. Utilizing portable chippers increases fibre recovery by utilizing the entire tree (trees are not delimbed prior to chipping) and reducing breakage. Much of the fibre waste generated in the chipping process (primarily bark) is returned to the block by skidders outfitted with front grapples.

Both Manning Diversified and DMI implement a structural retention strategy which requires that all harvest blocks retain a minimum of 6% forest cover, to help ensure objectives related to biodiversity, soils, hydrography and wildlife are achieved. Section 3.4 describes the structural retention strategy for the FMA Area.

DMI has undertaken limited understorey protection harvesting in the past and will contemplate doing so in the future. However, for the term of this FMP, understorey protection harvesting has not been incorporated as a harvest option (see **Timber Supply Analysis**).

Manning Diversified and DMI work cooperatively in development of harvest plans and this cooperation also extends to their forestry operations. Opportunities for integrating operations are evaluated, with the intent of realizing economic or environmental benefits (e.g., having one company's contractor harvest the other company's block). Integration has become more difficult as harvest operations utilized by the two companies are not similar (e.g., full tree versus chipping).

3.2 Harvest Season

Manning Diversified has traditionally restricted all its harvest operations to the winter months (November 1 to March 31), when soils are most likely to be dry or frozen. Operating on dry or frozen ground helps minimize soil disturbance within harvest blocks and on access routes. Frozen soils are not susceptible to compaction or erosion.

Exclusive winter operation has, until now, allowed the Company to access its timber supply without the need for construction of any permanent roads. Existing public and resource roads, combined with winter roads, have proved sufficient for harvest activities.

DMI conducts approximately 80% of its operations within the winter months. DMI limits its summer harvest operations to areas which have summer access and to harvest sites which have appropriate soil characteristics (i.e., soils that are resistant to compaction, erosion).

3.3 In-block Roads and Landings

Conducting forest harvesting operations requires development of temporary roads and landings within harvest blocks. The Provincial Timber Harvest Planning and Operating Ground Rules require that these areas account for less than 5% of the block area. Manning Diversified and DMI both plan harvest operations so that less than 5% of the block area is comprised of in-block roads and landings and, as a whole, the Companies are able to comply with this requirement. However, in some cases (i.e., very small blocks or blocks with very unusual configurations) the 5% limit may be exceeded in a particular block. Blocks which may have difficulty meeting the 5% requirement will be identified at AOP submission.

In-block roads and landings are considered part of the block for silviculture operations and are generally site prepared and planted. In-block roads and landing are always surveyed as part of the harvest block.

3.4 Structural Retention

In sustainable forest management, emulation of natural disturbances are included as a management strategy. For the boreal forest of Alberta, the predominant natural disturbance agent is fire. When managing for the maintenance of forest structure, past fires provide valuable information for guiding future actions.

A review of relevant literature indicates a great degree of variability in natural disturbance patterns related to wildfire (see Appendix IV Structural Retention Strategy). This variability is inherent in the disturbance regime itself, however, it is also related to the variety of methodologies used to characterize the disturbance.

Despite the variability, some broad conclusions can be drawn:

1. Remnant patches tend to be located close to large watercourses more often than if their location was random. Smaller watercourses tend to have a lower probability of remaining unburned than other upland sites.
2. Remnants are often associated with deciduous and mixedwood vegetation types, rather than pure conifer stands.
3. There is an increase in remnant proportion with an increase in the fire size.
4. There is a great degree of variability within fires and between fires in the amount and distribution of remnants.
5. The remnants are a mix of individual trees, partially burned areas and unburned patches. The patches, especially the larger ones, account for a larger percentage of total remnant area than the individual tree remnants.

Individual fires were the basis for the studies in which these conclusions were drawn. Therefore they only provide insight into stand level retention relationships and characteristics (since they are individual fires and the 'landscape' for any given event is not defined). Consideration should, however, also be given to structural retention at the landscape level. Within the FMA Area, forest management must consider stand level retention targets, landscape level retention targets and how the two interact.

The five conclusions listed above have been considered in development of MDFP's approach to harvest planning and operations, ensuring harvesting more closely emulates fire at a stand level. They were utilized to develop strategies and associated targets for structural retention within the FMA Area. Both landscape level and stand level structural retention strategies are addressed.

3.4.1 Landscape Level Retention

Structural retention at the landscape level is primarily addressed at the time of Forest Management Plan development through the Timber Supply Analysis. Only a portion of the total landbase is considered available for forest management operations. The remaining area is referred to as the passive landbase and it includes watercourse buffers, aesthetic buffers, timber productivity deletions (e.g., open-grown stands), recreation areas, wildlife habitat deletions etc. These areas consist of both merchantable and non-merchantable areas. A review of the landbase summary (in Executive Summary) in the **Landbase**

Netdown indicates that approximately 36% of the total landbase is comprised on forested stands that are classified as part of the passive landbase (i.e. will not be operated).

Landscape level retention must also take the regional perspective into consideration. Parks and protected areas within the region include Notikewin Provincial Park and Chinchaga Wildland Park, along with numerous Recreation Areas.

3.4.2 Stand Level Retention

Stand level structural retention is aimed at individual, or groups of blocks to ensure that cutovers have standing residuals within the block boundaries. Within the FMA Area, a combination of single stems, clumps and patches comprising 6% of the coniferous and deciduous landbases will be retained in harvested areas.

The FMA strategy for the maintenance of standing residuals that is based on the five summarized findings noted above. A matrix of retention targets by stand size and retention patch size (shown below) was developed to achieve the targets. The matrix was derived to meet the following objectives:

1. The amount of standing residual increases as block size increases. This is consistent with findings listed in the background information above, and will help with the other wildlife objectives in the Operating Ground Rules, such as distance to hiding cover and thermal cover.
2. The majority of standing residual is retained in patches rather than single trees. This is consistent with findings in the literature and also safer operationally (i.e., safety of harvesting personnel).
3. Remnant patches represent all harvested stand types, including net landbase and passive landbase.
4. Small retention patches (≤1 ha.) will consist of wind-firm trees that would normally stand for a minimum of 30 years. Overmature conifer retention should be left in larger patches as it has a greater risk of blowdown.
5. Retention will be within the harvested block boundary. A preference will be to have the retention closer to the block boundary.

The total retention target is for 6% of net harvest area, on an annual basis. This 6% is comprised of two components:

- Minimum of 3% from merchantable covertypes (representative of harvest area).
- Maximum of 3% from non-merchantable area in interior patches (3% is the maximum that can be applied to the 6% target; although it is acceptable to leave more non-merchantable retention).

The 6% retention level is lower than most studies identified, but this represents only the stand level target and does not incorporate landscape level retention (i.e., 36% of the overall landbase is classified as passive, forested; see **Landbase Netdown**). Also, the 6% is a minimum, since some additional non-merchantable patches may be left.

Table 3-1 summarizes the annual merchantable retention targets. Stand level retention targets will be evaluated annually, based on total harvest area. For each block size class, total retention, retention patch size, merchantability status and species covertype class will be summarized and evaluated against the target, which represent the minimum retention requirements.

Table 3-1. Annual merchantable retention targets.

Block size range (ha)	Distribution of structure retention for merchantable and unmerchantable stands			
	< 0.4 ha (patches and individuals)	0.4 to 1.0 ha	1.1 to 9.9 ha	10 ha or greater
<5.0	0	0	0	0
5.0 to 9.9	1 assortment of patches and individuals/5 ha.	0	0	0
10.0 to 59.9	1 assortment of patches and individuals/5 ha.	1 patch per 50 ha	1 patch per 300 ha	0
>60	1 assortment of patches and individuals/5 ha.	1 patch per 150 ha	1 patch per 700 ha	1 patch per 700 ha

Non-merchantable retention is difficult to plan, since the extent and/or location of non-merchantable areas with a harvest block is not known until the block is laid out in the field. There is no way to assure that a harvest block will have non-merchantable areas that account for 3% of the harvest block area. Conversely, some harvest blocks may have much more than 3% non-merchantable area.

Achievement of retention targets will be evaluated annually (Section 2.2.2 in **Monitoring and Research**). Shortfalls will be noted in the Stewardship Report, along with a commitment to increase the amount required in the following year to ensure that the retention target is met.

Additional detail regarding the FMA's Structural Retention Strategy is provided in Appendix IV.

3.5 Post-Harvest Block Inspections

ASRD requires that all harvest blocks are inspected after harvesting is completed to ensure compliance with Timber Harvest Planning and Operating Ground Rules. Minimum inspection criteria for the post-harvest inspection have been identified by ASRD and include:

- Area associated with in-block roads and landings
- Presence of rutting
- Adherence to utilization requirements
- Maintenance of riparian buffers
- Adherence to any special conditions.

Manning Diversified continually monitors its harvest operations to ensure compliance with the Timber Harvest Planning and Operating Ground Rules as well as conducting the more formal post-harvest inspection.

3.6 Green-up

In Alberta, a two-pass alternate clearcut harvest system was adopted in 1966 to ensure harvested areas were interspersed with areas with mature or regenerating forest. The system was initiated to curtail progressive clearcutting which had occurred in some areas of the Province prior to 1966. Under the two-pass alternate clearcut system, only 50% of the merchantable area within a timber planning area can be harvested at one time. The remaining 50% of the merchantable area can be harvested once the adjacent regeneration reached a height of two or three metres. The system was meant to:

- Ensure that not all old timber age classes were harvested at one time.
- Ensure that the average cutover size was not too large.
- Enable natural seeding of spruce by ensuring cutovers were less than five tree heights in width.
- Allow for hydrological recovery of the harvested areas prior to harvesting adjacent area.
- Ensure that the wildlife had hiding and thermal cover prior to harvesting adjacent areas.

Although these reasons are, to some extent, still valid, current understanding of boreal ecology has progressed and it is now clear that there are some obvious shortcomings with the two-pass system as it was implemented.

Advances in timber supply modeling, along with an increased knowledge of the ecological impacts of forest management practices, provides the opportunity to move beyond a universal two-pass system with a fixed green-up period. Development of the spatial harvest sequence allows forest managers to choose a future forest state that achieves the benefits of the alternate two-pass system while reducing the negative impacts.

Alberta's Forest Management Planning Standard allows the green-up constraint to be altered as long as the requirements in Standard 5.9.5, Annex 1 of the Standard have been addressed. This provides the Company with the option of achieving the goals associated with the original application of the green-up constraint (via the alternate two-pass harvest system), using the TSA and a Spatial Harvest Sequence (SHS) to ensure the goals are met. Using the SHS to achieve the goals typically associated with implementation of green-up constraints provides the opportunity to reduce some of the negative impacts associated with the two-pass system.

For the FMP for FMA 0200041, green-up was addressed through the TSA and SHS. The Green-up Strategy (Appendix V) provides details regarding the green-up approach utilized and addresses the requirements of Standard 5.9.5, Annex 1 of the Standard.

4. Silviculture Program

Manning Diversified's silviculture program relies on field assessments pre and post-harvest to ensure silviculture decisions made are appropriate for site conditions. Post-treatment assessments are also utilized, providing timely feedback on success of treatments applied.

Since MDFP began harvesting in the FMA Area in 1993, the Company has developed expertise in successful reforestation over the range of sites it operates. This experience and expertise have been formalized in the FMA Reforestation Strategy (Appendix IV). The Reforestation Strategy outlines the types of sites that are harvested, what the reforestation objective is and what treatments will be utilized to achieve the reforestation objective. The Strategy is aligned with strata transitions used in the Timber Supply Analysis (Section 5.4 in **Timber Supply Analysis**).

DMI's reforestation objectives and treatments, which are implemented on the deciduous landbase within the FMA Area, are also outlined in the Reforestation Strategy.

MDFP participates in two regional tree improvement programs, one each for white spruce and lodgepole pine. No other enhanced forest management programs are planned for implementation during the 2007 – 2017 FMP.

4.1 Pre and Post-harvest Inspections

Manning Diversified's silviculture program begins with a pre-harvest inspection (Pre-harvest Site Assessment and Prescription) for every block scheduled for harvesting. The pre-harvest survey describes the current vegetative and site conditions on the proposed block, providing critical information needed for planning silviculture treatments. Pertinent information for silviculture planning collected as part of the pre-harvest survey includes:

- Stand type
- Soil texture
- Understorey species and density

- Vegetative competition (*Calamagrostis*)

Based on the information collected at the time of the pre-harvest inspection, the following initial treatment decisions are made:

- Site preparation – Whether or not site preparation will be conducted and, if it will, what type.
- Plant – Whether or not the block will be planted and, if it will, what stock type will be utilized.

Information from the Pre-harvest Site Assessment and Prescription is transferred to the block map once harvest operations are underway. Immediately post-harvest (prior to skid clearance), the block is inspected to confirm, refine or revise the initial silviculture treatment decisions which were based on the pre-harvest inspection. This assessment also provides the opportunity to assess post-harvest debris conditions, which can affect site treatment decisions.

4.2 Site Preparation

Manning Diversified has traditionally scarified the majority of its harvest blocks. The decision as to whether or not a block is scarified can be made initially during the pre-harvest inspection or, more commonly, once harvesting is completed.

Site preparation for all harvest areas is scheduled for the same season as harvesting. In rare instances, the preparation may be delayed one year (i.e., equipment problems, etc.). All site preparation is completed by contractors during the winter harvest season. Winter site preparation helps reduce the risk of soil compaction/erosion within the harvest areas. It also ensures that MDFP's access needs are restricted to the winter season, further reducing any risk to soil and water quality posed by access development and maintenance.

Two types of scarification equipment are utilized by Manning Diversified. Ripper scarification is most common, accounting for approximately 60 to 65% of the site preparation in most years. It is used on mesic sites. Mounding is used on harvest areas with excess moisture (i.e., poorly drained soils) to create raised planting microsites. Mounding is typically utilized on 30 to 35% of the site prepared area each year. Steep slopes, areas with shallow organic layers and draws are not site prepared, to reduce the chance of damage to the soil.

DMI reforests stands managed for deciduous production through natural regeneration by suckering, without any site preparation. Disturbed areas, such as the in-block roads, chipper sites, and burn pile locations are reclaimed and treated as required to retain the productivity of the block.

4.3 Reforestation

4.3.1 Reforestation Objectives

The reforestation objectives of both MDFP and DMI are two fold. The first objective is to ensure that harvested areas are established and grow according to the assumptions in the Timber Supply Analysis (TSA) for the FMP. Because these assumptions are used to determine the harvest levels, sustainability will be achieved if the actual growth of the stands meets the yield assumptions in the TSA. The second

objective is to ensure that the legislated requirements are met as per the Forests Act, the Timber Management Regulations and the Forest Management Agreement.

4.3.2 Responsibility

This FMP maintains separate coniferous and deciduous landbases within the FMA Area. MDFP has responsibility for harvest planning/operations and reforestation on the coniferous land base while DMI has the responsibility for harvest planning/operations and reforestation on the deciduous land base.

As part of the Preferred Forest Management Strategy determination process, various options for harvest of the DU/A stratum were evaluated. The PFMS allowed for harvest of the DU/A stands, which are part of the coniferous landbase, on either a coniferous or deciduous priority. When the DU/A stands are harvested on a deciduous priority, DMI will be responsible for harvest planning/operations and will be required to conduct the necessary reforestation treatments (including planting of conifer stock as required to meet the DC standard).

4.3.3 Future Forest Composition

Generally, MDFP and DMI's regeneration programs within the FMA Area are designed to create regenerating stands that are similar in composition to the pre-harvest stand, while incorporating the requirements of the Province's Establishment and Performance (regeneration) Standards (see section 2.1.4 in **Monitoring and Research**). Table 4-1 identifies the expected transitions from the pre-harvest strata to post-harvest strata that were incorporated into the TSA and which will form the basis of the silviculture program. Where strata do not transition back to themselves, the changes are generally driven by requirements of the Establishment and Performance Standards (i.e., equivalent to B density stands would not meet Standards and no Standard specifically for DU stands).

4.3.4 Treatments

Most harvested areas harvested by Manning Diversified are replanted to ensure rapid establishment of reforestation. This represents approximately 1,300 hectares per year, with approximately 75% planted to white spruce and 24% planted to lodgepole pine.

In most cases, MDFP reforests using species that were present prior to harvest (e.g., white spruce is replanted on sites where it is harvested, etc.). In some cases a species may be planted that was not on site originally. This may be done because of ecological site conditions, to meet ASRD reforestation strata balancing requirements, because of insect/disease considerations, to meet strata transitions assumptions inherent in the Timber Supply Analysis (Section 5.4 in **Timber Supply Analysis**) or to accommodate other values (e.g., caribou habitat).

Planting is scheduled for the spring or summer after harvesting. The preferred stock for both white spruce and lodgepole pine is 1+0 or 2+0 412B. Generally, higher microsites are preferred for both pine and spruce, based on long-term performance results in the FMA Area.

Where harvest blocks incorporate inactive seismic lines, Manning Diversified generally site prepares and reforests these areas during the course of normal block treatment.

DMI successfully reforests stands managed for deciduous production through natural regeneration by suckering (referred to as Leave For Natural).

A summary of the proposed reforestation treatments, by strata, is presented in Table 4-1. A more detailed description of the Reforestation Strategy for the FMA Area is included as Appendix VI.

Table 4-1. Detailed regeneration strategy.

Stand Strata from the Timber Supply Analysis	Strata Standard (C,CD,etc.)	Regenerated Yield Curve	Pre-harvest Species Proportions	Limitations to Crop Establishment	Silviculture System	Site Prep	Seedling Establishment (includes LFN)	Seedling Target Density (stems per ha.)	Vegetation Management	Seed/Vegetative Collection
Pl (B,C,D) P6 and Pl (B,C,D) P9	C	Pl post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper Plow, Mounder, Chain Drags, None where straight plant options exist.	Plant or LFN for coniferous. LFN when in combination with shark fin barrels and chains.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount and seed zone. Cone Collection from natural stands if needed.
Pl (B,C,D) P6 and Pl (B,C,D) P9	C	Pl post 91 managed stand, Tree improvement	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
Sb (B,C,D) - Comb	C	Sb post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, none where straight plant options exist.	Plant white spruce.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
Sw (B) – P6 and Sw (B) – P9	C	Sw post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
Sw (B) – P6 and Sw (B) – P9	C	Sw post 91 managed stand, Tree Improvement	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment

Stand Strata from the Timber Supply Analysis	Strata Standard (C,CD,etc.)	Regenerated Yield Curve	Pre-harvest Species Proportions	Limitations to Crop Establishment	Silviculture System	Site Prep	Seedling Establishment (includes LFN)	Seedling Target Density (stems per ha.)	Vegetation Management	Seed/Vegetative Collection
C-Sw (C,D) – P6 and C-Sw (C,D) – P9	C	Sw post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
C-Sw (C,D) P6 and C-Sw (C,D) – P9	C	Sw post 91 managed stand, Tree Improvement	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
CD-(B,C,D) Comb	CD	CD - Post 91 managed stand	Mixed 50%-79% conifer	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
CD-(B,C,D) Comb	CD	CD - Post 91 managed stand, Tree Improvement	Mixed 50%-79% conifer	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mound, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
MXU-B- Comb	CD	CD - Post 91 managed stand	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.

Stand Strata from the Timber Supply Analysis	Strata Standard (C,CD,etc.)	Regenerated Yield Curve	Pre-harvest Species Proportions	Limitations to Crop Establishment	Silviculture System	Site Prep	Seedling Establishment (includes LFN)	Seedling Target Density (stems per ha.)	Vegetation Management	Seed/Vegetative Collection
MXU-CD- Comb	CD	CD - Post 91 managed stand	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
MXU-B- Comb	CD	CD - Post 91 managed stand, Tree Improvement	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
MXU-CD- Comb	CD	CD - Post 91 managed stand, Tree Improvement	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
DC-B,C,D – Comb	DC	DC - Post 91 managed stand	Mixed 51%-79% deciduous	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
DC-B,C,D – Comb	DC	DC- Post 91 managed stand, Tree Improvement	Mixed 51%-79% deciduous	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment

Stand Strata from the Timber Supply Analysis	Strata Standard (C,CD,etc.)	Regenerated Yield Curve	Pre-harvest Species Proportions	Limitations to Crop Establishment	Silviculture System	Site Prep	Seedling Establishment (includes LFN)	Seedling Target Density (stems per ha.)	Vegetation Management	Seed/Vegetative Collection
D (B) – comb	D	D - Post 91 managed stand	≥80%deciduous overstory, No identified understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	None	LFN	5000	None	N/A
D (C,D) – comb	D	D - Post 91 managed stand	≥80%deciduous overstory, No identified Understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	None	LFN	5000	None	N/A
D u (A) comb coniferous priority	DC	DC - Post 91 managed stand	50% of the stands with ≥80%deciduous overstory, With identified "A" density Sw understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
D u (A) deciduous priority. (This is coniferous landbase that DMI will harvest and reforest to the DC standard.)	DC	DC - Post 91 managed stand	50% of the stands with ≥80%deciduous overstory, With identified "A" density Sw understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed
D u (b,c,d)	CD	CD - Post 91 managed stand	≥80%deciduous overstory, With identified "B,C,D" density Sw understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.

4.3.5 Monitoring

MDFP requires their planting contractors conduct post-plant surveys. Company staff also complete their own post-plant inspections. Any quality concerns apparent post-planting are addressed immediately.

The Province requires that forest companies conduct formal Establishment and Performance surveys in all harvest blocks. These requirements are summarized in section 2.1.4 in **Monitoring and Research**.

4.4 Stand Tending

The Province has established default reforestation targets for the forest industry within Alberta[1]. Establishment targets for conifer and mixedwoods must be achieved no sooner than 4 years and no later than 8 years after harvest (3 and 5 years respectively in deciduous stands). Performance targets must be achieved no sooner than 8 years and no later than 14 years. Meeting these targets at an early age requires monitoring harvested areas to ensure reforestation is established quickly and on-going assessment to ensure the reforestation is able to thrive. A program of informal assessments and formal surveys are utilized to track reforestation on harvested areas.

Two years after harvest (occasionally one or three), Manning Diversified conducts an assessment on harvested areas to review reforestation status. The assessment records the general status of the reforestation and identifies/schedules areas which may require additional treatment (e.g., fill-in plant, herbicide, etc.). The assessment is generally done aerially to assess *Calamagrostis* competition and does not include a formal block survey. Any harvest areas where reforestation concerns are identified are monitored until all appropriate actions have been taken.

Formal Establishment Surveys are required by the Province for all harvested areas. For coniferous and mixedwood stands, these must be completed achieved no sooner than 4 years and no later than 8 years after harvest. Any areas which are classified as NSR (Not Satisfactorily Restocked) or areas where height requirements have not been achieved are identified and evaluated for additional treatment. These areas continue to be monitored.

Between the Establishment Survey and the Performance Survey (which is conducted from 8 to 14 years after harvesting), MDFP conducts a second assessment. This assessment focuses on identifying areas which may require stand tending to ensure height and free-to-grow targets associated with the Performance Survey are achieved. The assessment is generally done aerially and does not include a formal block survey. Areas where stand tending is being considered will be further assessed on the ground using an assessment protocol. Stand tending may be achieved using manual brushing or through application of herbicides.

Once the Performance Survey is completed (8 to 14 years post-harvest), harvested areas are considered reforested and monitoring of their on-going growth is addressed in the FMA's Growth and Yield Program (section 2.3 in **Monitoring and Research**).

[1] The Planning Standard requires that all FMPs include development of Alternative Regeneration Standards (ARS). These will supercede Provincial Establishment and Performance Survey requirements. Manning Diversified has committed to undertaking development of Alternative Regeneration Standards and implementing ARS once it receives approval from the Province. In the interim, the Provincial surveys and standards will continue to be utilized.

4.4.1 Stand Tending - Manual Brushing

Manual removal of competing shrub and deciduous vegetation has been used by MDFP to ensure its coniferous reforestation meets Provincial targets. Competing vegetation may reduce survival and height growth of the crop trees and its presence interferes with attainment of free-to-grow status (which requires a crop tree be free from competing vegetation).

In addition to its traditional brushing program, the Company is examining the benefits and costs of mechanical brushing combined with spot application of herbicide to reduce re-sprouting.

4.4.2 Stand Tending - Herbicide Program

Application of herbicides to control competing shrub and deciduous vegetation is a cost-effective approach to stand tending, particularly when applied aerially. Aerial herbicide application is not appropriate for use in all situations (i.e., when adjacent areas have values which could be impacted by drift) and skilled application is critical to its success. Evaluation of suitability of harvested areas for aerial herbicide application is therefore completed on a block by block basis.

Manning Diversified historically applies herbicides to approximately 1,500 hectares annually to ensure successful reforestation to conifer. Fully half of this is scheduled for areas harvested prior to 1995 (i.e., MDFP does not hold reforestation responsibility/liability). The remaining area (approximately 750 hectares) represents harvest areas that are MDFP's responsibility (i.e., harvested in 1995 or later).

4.5 Genetic Resource/Tree Improvement Program

In 1995 MDFP, along with several industrial partners, has begun implementation of regional genetic resource/tree improvement programs. These programs are coordinated and implemented with the assistance of ASRD.

The program includes the following components:

- Control of collection and transfer of wild seed/stock for reforestation activities.
- Implementation of controlled parentage programs for both lodgepole pine (Breeding Region J) and white spruce (Breeding Region G2).

4.5.1 Wild Seed/Stock

The Province 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, are sufficiently diverse genetically and are adapted to local conditions.

Currently the Provincial Seed Zones are consistent with the 2005 version of the Province's Natural Sub-regions (Figure 4-1). In total, four Seed Zones are located within the FMA Area. The FMA Area is predominantly within the Lower Boreal Highlands Sub-region/Seed Zone. The Central and Dry Mixedwood Sub-regions/Seed Zones also account for significant area within the FMA. Approximately 120 hectares of the FMA Area falls within the Upper Boreal Highland Sub-region. MDFP ensures that adequate quantities of seed are collected from each Seed Zone to accommodate its projected reforestation requirements.

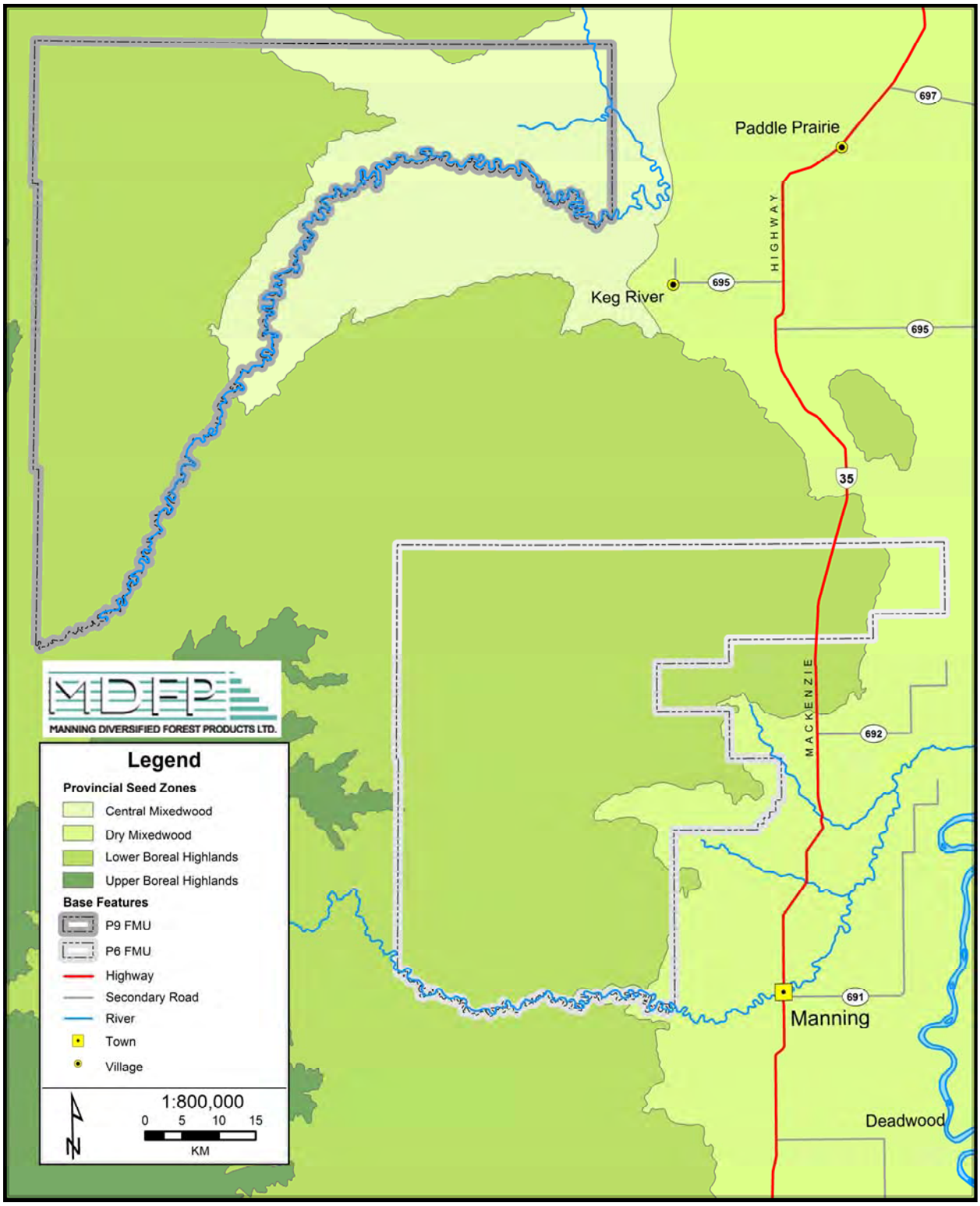

Figure 4-1. Provincial Seed Zones within the FMA Area.

4.5.2 Breeding Programs

MDFP participates in two breeding programs, one each for lodgepole pine (Breeding Region J) and white spruce (Breeding Region G2). Each of these Breeding Regions (J and G2) cover significant portions of the FMA Area (see Figure 4-2). The breeding programs are cooperative, with both Provincial and forest industry participation. Tolko Forest Products, High Level is the other industry participant in the Region J and G2 programs.

Each breeding program requires:

- Development of a Controlled Parentage Program Plan
- Establishment of seed orchards
- Establishment of progeny trials
- Establishment of gene conservation areas.

4.5.2.1 Controlled Parentage Program Plan

The Controlled Parentage Programs for the G2 and J breeding programs were completed by ASRD in late May 2007 (Appendix VII). The Controlled Parentage Program Plans include a detailed program description, calculation of the effective number of parents in the program, a deployment plan and a gene conservation plan. Implications of the Parentage Program Plans have were not incorporated into the text of this FMP because of time constraints.

4.5.2.2 Seed Orchards

The seed orchards for Regions J and G2 are located in Northstar, Alberta (see Figure 4-3). Scions have been collected for the orchards and some graft planting has already been undertaken. Approximately 80% of the white spruce has been planted, with the remaining 20% scheduled for planting by 2009/2010. Approximately 50% of the lodgepole pine has been planted out, with the remaining 50% scheduled for planting by 2011/2012.

Region G2 (white spruce) Stream 2 seed will be deployable seed by 2008, while Region J (lodgepole pine) seed will be deployable by 2010.

4.5.2.3 Progeny Trials

Progeny trials have also been initiated for Regions J and G2. Manning Diversified has established one progeny trial, with both white spruce and lodgepole pine, on private land near Battle Tower (Figure 4-3). A second site, located at Hotchkiss, has also been planted to white spruce and lodgepole pine, but still has room for additional plantings.

ASRD maintains a progeny trial site at Sweeney Creek (northwest of Worsley and west of the FMA) which also contains spruce and pine stock. A pine trial site is planned for Zama Ridge, north of the FMA Area.

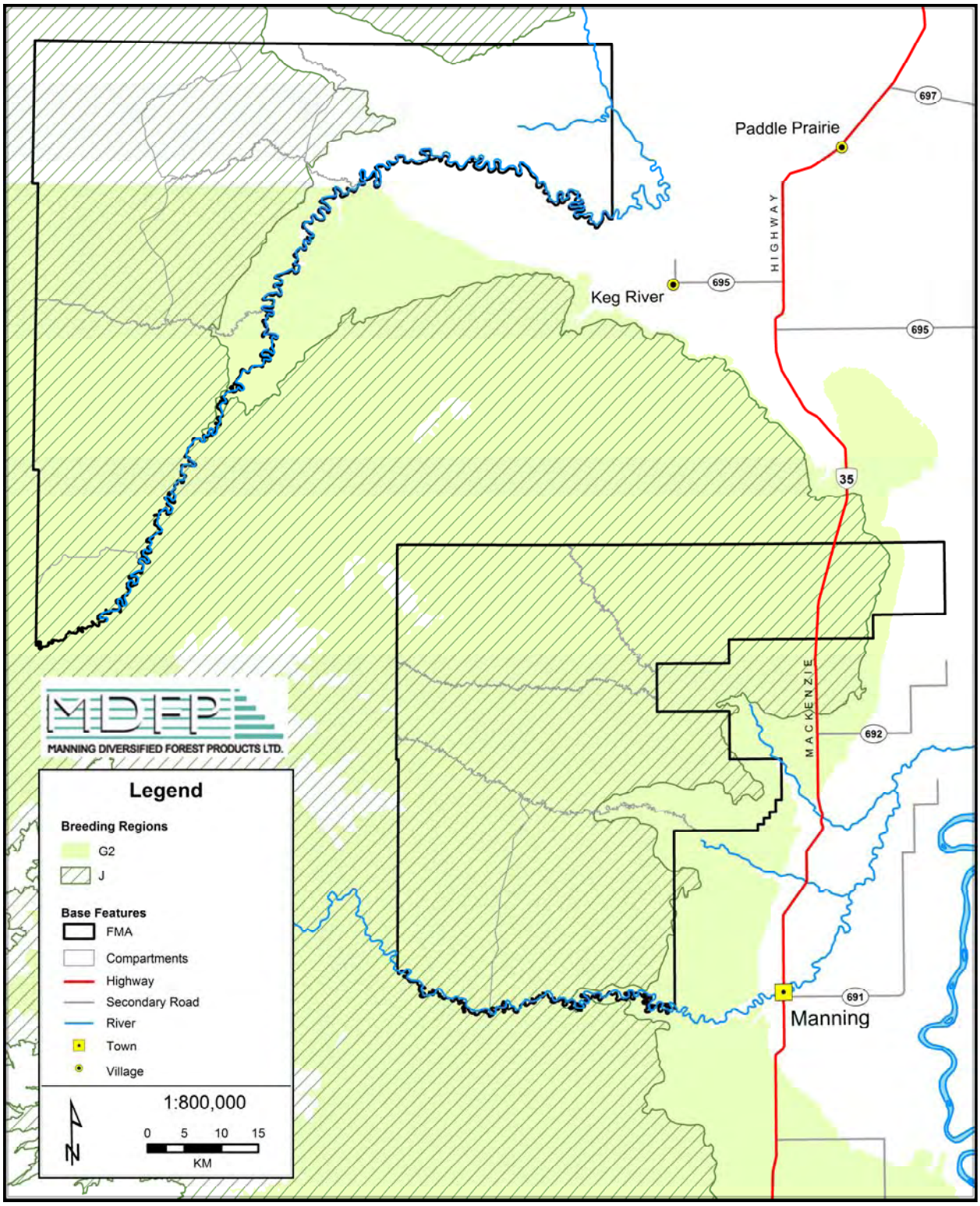

Figure 4-2. Breeding regions encompassing MDFP's FMA Area (Region J for lodgepole pine and Regions G2 for white spruce).

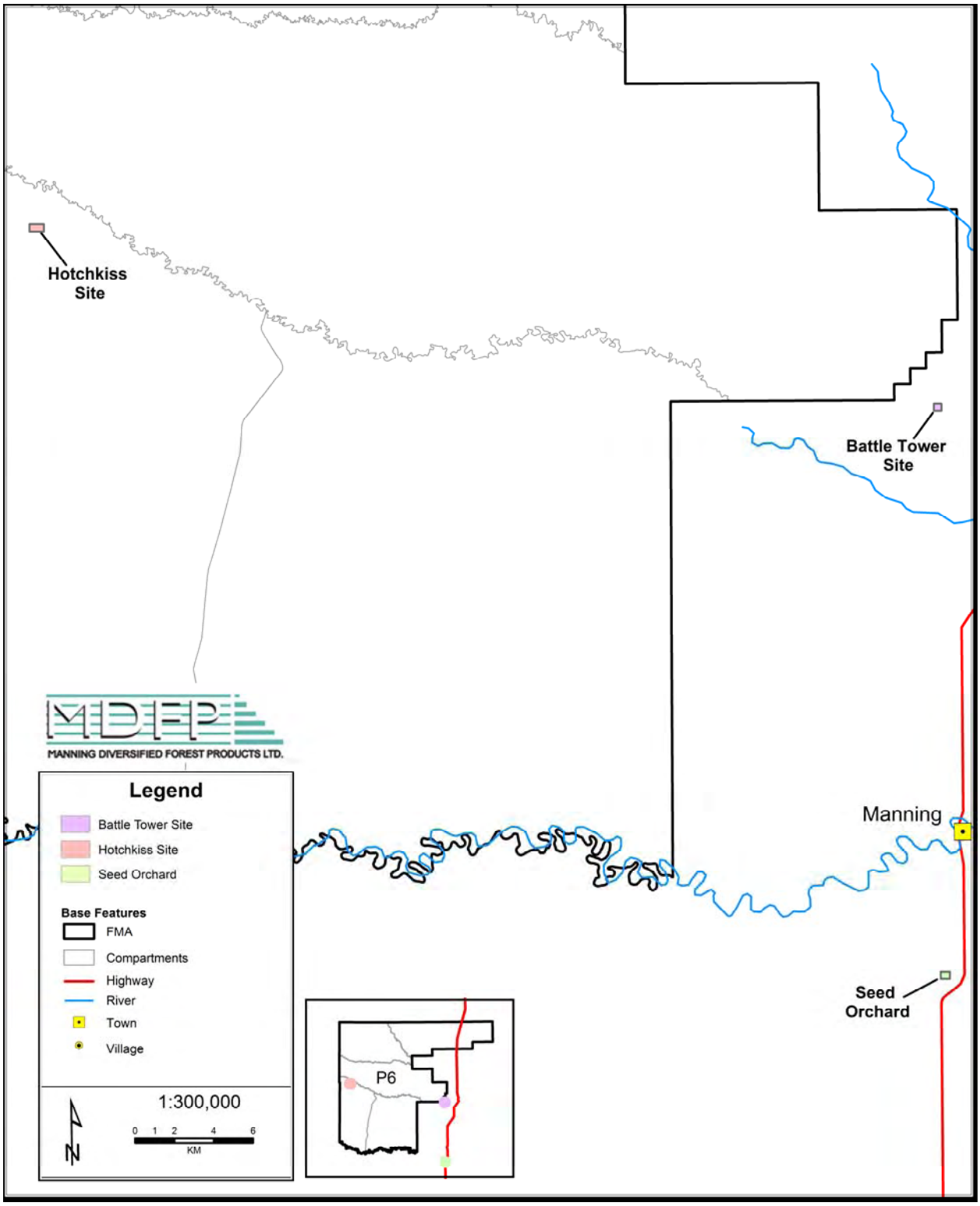

Figure 4-3. Location of seed orchard and progeny trial sites.

4.5.2.4 Gene Conservation Areas

In-situ genetic conservation areas are required for each seed zone, to maintain wild seed sources. The need for in-situ genetic conservation areas regionally and within the FMA Area has not yet been determined by the Province. Potential sites in the region include Chinchaga Wildland Park, a 'never harvest' area within FMU P8 and the Notikewin Habitat Zone (Section 2.7.2 in **Landbase Netdown**).

4.5.3 Deployment Plan

The improved seed will be deployed in a way that strives to:

- conserve genetic integrity, adaptability, diversity and health of wild and managed populations, while recognizing that genetic change will occur through evolutionary pressure, breeding and deployment
- maintain or enhance forest productivity
- be consistent with sustainable forest management principles.

Assuming that the seed orchards will have effective populations of greater than 30 parents, the maximum allowable deployment is 50% of the total area of any strata over a rotation (section 1-4-3 in Standards for Tree Improvement in Alberta). For this FMP, harvested areas within the conifer landbase transition to one of five strata (section 5.4 in **Timber Supply Analysis**). A summary of production limit by strata is presented in Table 4-2 while the full calculations required to determine production limit is included in Appendix VII. Stream 2 pine seed from Region J can be deployed in the PL (pine) stratum, while Region G2 Stream 2 white spruce seed can be deployed in the SW (white spruce), DC or CD (mixedwood), or DU/A (deciduous with conifer understorey strata).

Because stands derived from Stream 2 seed sources are associated with increased yields (section 5.4 in **Yield Curves**), selection of Stream 2 materials was modeled as part of the TSA. The model allowed the selection of improved materials as follows:

- pine within Region J, within the PL stratum
- white spruce within Region G2, within the SW, DC, CD and DU/A strata.

Because the increased yield associated with the genetically improved stock was relatively small and selection of the option was dependent on access to the compartment for the next period (i.e., five years after harvest), the TSA model selected the improved stock option relatively infrequently (**Timber Supply Analysis**). Manning Diversified recognizes that yield increases incorporated into the FMP yield curves are conservative and plans on taking advantage of the opportunity presented by improved seed by deploying Stream 2 materials more frequently than indicated in the TSA model. Deployment within each Breeding Region will not exceed the maximum thresholds indicated in Table 4-2 and Appendix VII.

Table 4-2. Production limits by strata.

Region/Strata	Transition Strata	Area of Target Strata (ha)	Trees/ha	Plants Required	Planned Production[1]
Region G2					
C-SW-B	C-SW-CD	29,994	1,600	47,991,042	23,995,521
C-SW-CD	C-SW-CD	27,758	1,600	44,413,242	22,206,621
MW-CD-B	CD-BCD	2,916	1,200	3,499,651	1,749,826
MW-CD-CD	CD-BCD	9,797	1,200	11,756,369	5,878,184
MW-CDU-B	CD-BCD	4,144	1,200	4,972,879	2,486,440
MW-CDU-CD	CD-BCD	3,620	1,200	4,344,337	2,172,169
MW-DC-B	DC-BCD	2,163	800	1,730,162	865,081
MW-DC-CD	DC-BCD	4,463	800	3,570,690	1,785,345
MW-DCU-B	DC-BCD	5,029	800	4,023,167	2,011,584
MW-DCU-CD	DC-BCD	7,729	800	6,182,854	3,091,427
DU-A (conifer)	DC-BCD	28,809	800	23,046,954	11,523,477
DU-A (deciduous)	DC-BCD	28,809	800	23,046,954	11,523,477
Du-BCD	CD-BCD	39,514	1,200	47,416,764	23,708,382
Total		194,745		225,995,064	112,997,532
Region J					
C-PL-B	C-PL-BCD	6,499	1,600	10,398,928	5,199,464
C-PL-CD	C-PL-BCD	20,141	1,600	32,225,568	16,112,784
Total		26,640		42,624,496	21,312,248

[1] Planned production is based on a cumulative effective population size of > 30 (this was an assumption, if < 30 the production will be adjusted)

4.6 Enhanced Forest Management

Manning Diversified does not currently have an enhanced forest management program (excluding the tree improvement program). No enhanced forest management scenarios, other than that associated with the tree improvement program, have been incorporated into the 2007 – 2017 FMP.

5. Forest Protection

Wildfire and forest pathogens are natural components of the forested ecosystems of northwest Alberta. The forests within the FMA Area developed under conditions dominated by wildfires. Insects and diseases are generally present at low levels within these forests however severe infestations can occur and may destroy or weaken extensive tracts of forest.

Manning Diversified'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.

5.1 Fire Protection Strategy

The forests of northwest Alberta developed under conditions in which wildfires were a dominant landscape factor. Wildfire has the potential to significantly impact the timber resources within the FMA Area. The Company also utilizes fire in its forestry operations (i.e., burning of debris piles). The Fire Protection Strategy addresses both wildfires and operational use of fire.

The Company's Fire Protection Strategy includes the following components:

- Education – Field staff and contractors training is two-pronged, focusing on ignition avoidance and wildfire control.
- Detection – Field staff and contractors will likely be the first to encounter a wildfire, particularly a fire ignited as a result of field operations or a fire associated with a burn pile. Procedures related to equipment checks and burn pile checks are designed to help ensure early detection of an ignition.
- Reporting – Fire reporting requirements are reviewed with field staff and contractors. The Fire Control Plan outlines Company reporting requirements.
- Prevention – Fire prevention strategies include:
  - Reliance on winter harvesting operations

- Incorporation of FireSmart modeling in the Timber Supply Analysis
- Strict procedures related to burning of debris piles.

- Pre-suppression – Assist ASRD staff in their pre-suppression efforts (when MDFP staff are available).
- Suppression – Assist ASRD staff in suppression efforts (when MDFP staff are available).

The Company's Fire Protection Strategy is provided in Appendix VIII.

Wildfire events are a natural part of the boreal ecosystem . They create unique habitats and are important from a biodiversity perspective. Within the FMA Area, the following strategies will be implemented when harvesting burned areas, to comply with objectives, indicators and targets for the FMP:

- Whenever feasible, all unburned trees in green islands will be retained (i.e., recognizing timber condition, access and other non-timber values)
- At the Compartment scale, retain a minimum of 10% of the merchantable black trees in patches greater than 100 hectares.
- At the harvest area scale, retain a minimum of 10% of the merchantable black trees in patches 10 – 100 hectares and retain a minimum of 5% of black trees in small patches and single stems.

5.2 Forest Health Strategy

The FMA forests, like all natural ecosystems, have developed in conjunction with numerous pests. Generally, these pests are endemic and present at low intensity. Occasionally, pest epidemics occur, generally associated with one of a handful of insect species. Epidemics may be cyclical or may be related to vegetation or climatic factors.

MDFP's Forest Health Strategy was developed with a focus on detection of pest outbreaks. The Forest Health Strategy includes the following components:

- Education – Field staff and contractors will be provided with the training required to recognize pests and/or signs of infestation.
- Detection – Field staff and contractors will likely be the first to encounter forest pests and the importance of their role in detection will be stressed. MDFP often contributes to regional detection programs (e.g., detection traps, survey assistance, etc.).
- Reporting - Infestation must be reported internally and MDFP will forward any significant sightings to ASRD.
- Control - Pest control is the mandate of Sustainable Resource Development, but the MDFP has the ability to aid their efforts through its harvesting and silvicultural practices (e.g., emphasis of pine harvest in light of the Mountain Pine Beetle outbreak in Alberta).
- Research – Research related to forest health or forest pathogens may be funded through the Manning Research Fund.

The Company's Forest Health Strategy is provided in Appendix IX.

In 2006, in response to the mountain pine beetle threat, ASRD introduced strategies to reduce the risk associated with the beetle infestation. Strategies related to the Timber Supply Analysis were incorporated into the TSA for this FMP (see section 6.13 in **Timber Supply Analysis**).

5.3 Windthrow

Windthrow is a natural event with can occur in any forest given sufficient winds. There is very little that MDFP can do to prevent windthrow from occurring in mature, natural origin stands. However, the Company can address increased windthrow potential associated with forestry operations.

Forestry operations can increase windthrow potential by creating openings and exposing non-windfirm forest. This is especially a concern in structural retention and watercourse buffers, because of the spatial arrangement of the residual standing forest cover.

Strategies to address windthrow concerns include:

- Incorporation of windthrow concerns into the structural retention strategy (i.e., significant retention in patches rather than single-stem retention).
- Design of harvest blocks to reduce potential windthrow (e.g., potential to incorporate adjacent areas into a harvest block if they are not windfirm).

Natural windthrow events (i.e., not related to forestry operations) create unique habitats and are important from a biodiversity perspective. Within the FMA Area, 10% of stems associated with natural blowdown events will be left unsalvaged.

5.4 Invasive Species

MDFP and DMI are two of the many commercial stakeholders that operate within FMU P16. All commercial stakeholders that operate within the FMA Area have to potential to introduce invasive plant species into the Area, particularly if the stakeholders are involved in road construction or other land clearing operations. To date, invasive species have been limited to herbs/grasses.

Forestry companies within the FMA Area are required to submit, annually, a Weed Control Plan.

Strategies employed by MDFP to reduce the risk of introducing invasive species include:

- Minimize clearing of land that will require reclamation.
- Consider the use of native plant species for reclamation purposes, once appropriate alternatives are available.
- Requiring all construction and harvest equipment entering the FMA Area on the company's behalf to be clean.
- Report infestations to the Province.
- Continue to cooperate with the Province on invasive species initiatives.

6. Protection of Forest Resources

6.1 Forest Soils

Forest soils support the growth of trees and other vegetation. Productivity of forest stands is generally directly related to the nutrient status of a soil and its ability to store and provide water to the vegetation. Maintenance of forest soil quality is important for sustaining forest growth.

Forestry operations can impact soils in the following ways:

1. Nutrient source removal – During forest harvesting trees are removed from the site, rather than burning/decaying or decaying and being incorporated into the soil matrix by decay organisms.
2. Decreased ability to transpire moisture – 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.
3. Compaction – Soils can be compacted during harvesting or silviculture operations by machinery traffic. Compacted soils are less able to support re-growth of vegetation.
4. Erosion and slumping – Removal of the organic soil layer or agitation of soils can result in soil erosion and slumping. Soil erosion and slumping are particularly a concern in the vicinity of riparian areas where the sediment can impact water quality.

MDFP has identified strategies to reduce the risk of impacting soils during forest operations within the FMA Area.

6.1.1 Nutrient Source Removal

The Structural Retention Strategy (section 3.4) ensures at least 6% of harvest areas are retained as structure within the harvest block boundaries. As the retention trees die and decay, they provide additional soil nutrients.

The Downed Woody Debris survey program (Section 2.2.3 in **Monitoring and Research**) will ensure pre-harvest levels of debris is maintained on site after harvest, which provides a nutrient source as it decays.

Stands are not available for harvest until they are at least 80 years of age (section 5.3 in **Timber Supply Analysis**), providing the soil time between harvest to replenish nutrients.

6.1.2 Moisture Transpiration

Forest stands that are likely to have excess moisture concerns have been excluded from the active landbase and will not be harvested (see section 4.4.7 in **Landbase Netdown**). Black spruce and larch stands, which tend to be associated with wet sites, are not available for harvesting unless the Timber Productivity Rating is 'Good'.

The Structural Retention Strategy (section 3.4) ensures at least 6% of harvest areas are retained as structure within the harvest block boundaries. The retained trees utilize soil moisture to continue their growth.

MDFP's silviculture program results in rapid and successful regeneration of harvested areas (see section 4). MDFP's utilizes site preparation equipment that leaves significant amounts of lesser vegetation on-site and, on moist sites, uses equipment that produces raised planting sites (section 4.2). DMI's deciduous harvest operations rely on suckering to rapidly re-establish its harvest blocks. The newly established trees, along with the lesser vegetation retained on the site all utilize soil moisture to support their growth.

6.1.3 Compaction

MDFP conducts forest harvesting and site preparation operations during the winter months, when forest soils are generally frozen (section 3.2). DMI also conducts the majority of its operations during the winter months. Frozen ground resists compaction from the operational equipment.

In-block roads and landings are subjected to repeated machine traffic and have a higher risk of being compacted than other areas of the harvest block. The Provincial Timber Harvest Planning and Operating Ground Rules require that these areas account for less than 5% of the block area.

6.1.4 Erosion and Slumping

Conducting forestry operations during the winter months, maintaining structural retention, rapid regeneration of harvested areas and site preparation techniques that leave significant amounts of lesser vegetation on-site help reduce the risk of soil erosion and slumping within harvest blocks.

Soil erosion and slumping are also a major consideration for access construction. Watercourse crossings are a particular concern, because sediment has the potential to impact water quality. The FMA's Road Planning, Construction, Maintenance, Reclamation and Monitoring Strategy (Appendix I) provides details regarding incorporation of erosion and slumping concerns into the development and construction of access and watercourse crossings.

6.2 Hydrologic Resources

Forestry operations impact hydrologic resources in two basic ways. At a landscape level, harvesting affects watershed dynamics by removing forest cover (which reduces water capture/uptake), resulting in potentially increased run-off until the forest cover is restored. At a site-specific level, operations could impact water quality by interrupting/altering stream flows, introducing sediment into the water, increasing debris within channels, etc. Because lakes, rivers, streams and associated riparian zones provide specific habitats for fish and other fauna, any impacts related to water quality may also impact habitat quality.

There are two general approaches used within the FMA Area to protect hydrologic resources: avoidance (through buffering) and operational practices, primarily related to access development and watercourse crossings.

The following buffers have been incorporated into the Timber Supply Analysis and are excluded from forestry operations (i.e., part of the passive landbase) (section2 in **Landbase Netdown**):

1. watercourse buffers within harvest areas, as outlined in the Timber Harvest Planning and Operating Ground Rules
2. 200 m buffers around all trumpeter swan nesting lakes
3. establishment of the Notikewin Habitat Zone along the Notikewin, Meikle, Hotchkiss and Botha Rivers.

Because forest harvest operations avoid riparian areas, the operational considerations relating to protecting hydrologic resources generally address access development, construction and maintenance. Selection of access routes takes hydrologic resources into consideration, however, it is not possible to avoid hydrologic features completely when planning and constructing access. Construction of watercourse crossings are a particular concern, because sediment has the potential to impact water quality as well as change stream flow and create barriers to fish passage. The FMA's Road Planning, Construction, Maintenance, Reclamation and Monitoring Strategy (Appendix I) provides details regarding incorporation of water quality concerns into the development and construction of access, including watercourse crossing selection, installation, maintenance, removal and rehabilitation.

DMI's watercourse crossings guidelines are provided in Appendix II.

6.3 Aesthetics

Aesthetics is a highly individualized concept. Landscapes that appeal to one person may not be pleasing to another. The forests of northwestern Alberta developed under fire regimes which included large wildfires. Today, these large wildfires would likely be considered unattractive to the public. Aesthetics are important to forest resource managers because it puts a visible face to forestry activities; forest management may be judged by the public on the basis of aesthetics.

Manning Diversified recognizes the importance of aesthetic considerations along the major travel corridors within the FMA Area. However, the Company is also aware that good forest management practices may not always be compatible with preserving current viewscapes.

Within Canada, much of the public perception of forest management is formed by the aesthetics associates with patch (clear cut) harvest systems. The trees are harvested, leaving a tangled mess of

scattered standing trees and woody debris. The general public sees an unaesthetic, 'devastated' landscape. However, patch harvesting is an important component in management of boreal forests. Sound forest management practices need to incorporate patch harvesting where it is appropriate, despite potential public concern regarding the aesthetics of the practice.

Manning Diversified's strategy for managing aesthetic resources along travel corridors will incorporate three steps:

- Highway Management Zone was created along Highway 35 and the Chinchaga Forestry Road (125 m wide, along each side of the roadway) (section 2.9 in **Landbase Netdown**). Within this Zone, aesthetic concerns will be a high priority.
- Design timber harvesting and other forest operations within the Highway Management Zone with the intent of softening the impacts on the viewscapes. Harvest block design will be the primary means of helping to maintain aesthetic values within the Zone.
- Where viewscapes are negatively impacted, incorporate appropriate educational materials into the Company's Public Consultation Plan to educate the public regarding the role of clear cut harvesting and other activities in renewing the forest.

Management for aesthetic resources will be initiated with the development of Final Harvest Plans for any harvest areas within the Highway Management Zone. The GDP will recognize the need for addressing aesthetic concerns in these areas and will provide an overview of how the harvesting will be approached. At this stage (GDP), the Company will include information regarding its operations within the Highway Management Zone into its Public Consultation process. Input from the Public Consultation process will then be incorporated into the Final Harvest Plan.

7. Maintenance of Biodiversity

Biodiversity refers to the variability of living organisms. Like ecosystems, biodiversity can be assessed at different scales, from the landscape level to that of individual species. In 1995, the Canadian Council of Forest Ministers recognized three distinct components of overall biodiversity:

- ecosystem
- species, and
- genetic.

Ecosystem diversity is, to some extent, dictated by regional landforms and climate and their interactions. Landforms as diverse as riparian areas and plateaus occur within the FMA Area, setting the stage for a wide range of vegetation and related wildlife communities.

Species diversity refers to the range of plant and wildlife species present within an area.. Species richness and abundance varies between different habitat types and between seral stages. Some habitats tend to produce 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 vary considerably in their genetic variability.

All three components of biodiversity are important for maintaining the range of habitat types and species that currently and historically have existed within the FMA Area. Manning Diversified's approach to biodiversity maintenance will focus primarily on ecosystem and species components. Genetic diversity is a consideration primarily from the perspective of regeneration of commercial tree species. The Company will utilize a coarse-filter approach to ensure retention of a diversity of ecosystems. This will, in turn, help secure the future of most wildlife species. Several wildlife species that are considered to be at risk, will be the focus of additional management efforts. Genetic conservation of commercial tree species will be addressed by the FMA Tree Improvement Program (section 4.5).

7.1 Ecosystem Diversity

Conservation of ecosystem diversity will be a primary focus for Manning Diversified's biodiversity conservation efforts. According to Smith (1980), 'ecosystems may be as large as vast, unbroken tracts of forest or as small or smaller than a pond'. The ultimate purpose of conserving ecosystem diversity is to ensure that current ecological functions at all scales is maintained. 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.

7.1.1 Seral Stage Representation

Seral stage representation, over a 200 year planning horizon, was ensured through the Timber Supply Analysis (Sections 5.2.7 and 6.5 in **Timber Supply Analysis**). Area of each seral stage was provided as TSA output, to facilitate determination of the Preferred Forest Management Scenario (PFMS). The PFMS was selected to ensure appropriate seral stage representation.

The strategy for maintenance of seral stage representation will be the implementation of the Spatial Harvest Sequence (SHS).

7.1.2 Old Interior Forest

Maintenance of Old Interior Forest, over a 200 year planning horizon, was ensured through the Timber Supply Analysis (Sections 5.2.8 and 6.17 in **Timber Supply Analysis**). Area of Old Interior Forest was provided as TSA output, to facilitate determination of the PFMS. The PFMS was selected to ensure appropriate area was maintained as Old Interior Forest.

The strategy for maintenance of Old Interior Forest will be the implementation of the Spatial Harvest Sequence (SHS).

7.1.3 Disturbance Patches

Creating a distribution of disturbance patches that mimics natural variation, over a 200 year planning horizon, was ensured through the Timber Supply Analysis (Sections 5.2.4 and 6.16 **Timber Supply Analysis**). The TSA targeted creation of disturbance patches 60 – 200 hectares in size, based on the PFMS. Disturbance area (defined as areas 20 years or younger) by patch size was provided as TSA output.

The strategy for creating a distribution of disturbance patches that mimic natural variation will be will be the implementation of the Spatial Harvest Sequence (SHS).

7.1.4 Wetlands

Wetland ecosystems represent some of the most productive habitat from a wildlife perspective and play a key role in watershed dynamics.

Some wetland sites may support forest stands, generally black spruce and larch. These stands have been excluded from the active landbase (**Landbase Netdown**) and are not available for harvesting.

7.1.5 Structural Retention

A structural retention strategy for the FMA Area was developed to ensure harvesting more closely emulates fire at a stand level. The structural retention strategy is described in section 3.4 and Appendix IV.

7.1.6 Downed Woody Debris

Downed woody debris plays an important role in ecosystem functions, providing wildlife habitat and contributing to soil nutrient cycles. Forest harvesting operations generally result in an increase in Downed woody debris within a harvest block, since debris is generated but not removed. Control of excess downed woody debris within harvest blocks is maintained by burning of piled debris after completion of harvest activities.

To determine whether downed woody debris levels are maintained at pre-harvest levels, a Downed Woody Debris Monitoring Protocol has been developed for the FMA Area (section 2.2.3 and Appendix II in **Monitoring and Research**). The Protocol involves establishing transects in a sample of harvested blocks to determine levels of downed woody debris after harvest, for comparison to pre-harvest levels as determined from MDFP's Permanent Sample Plot program (natural stands).

Results from the monitoring will guide future debris disposal programs.

7.1.7 Unique and Rare Components

MDFP is committed to protecting unique and rare sites within its FMA Area. Unique and rare sites can be identified on the basis of a wide variety of criteria, including:

- Ecological
- Archaeological
- Geological
- Environmental
- Cultural.

Manning Diversified has implemented several initiatives to help identify and protect unique and rare sites. The Company's Unique Find Policy outlines the process used for identifying unique finds and ensuring adequate protection measures are identified and implemented. The Unique Find Policy is geared to identification and protection of sites that are relatively small spatially and have not yet been identified. Protection of larger significant sites is generally accommodated through the identification of special management zones (e.g., Notikewin Habitat Zone, Highway Management Zone, etc.).

Protection of rare plant communities, whose locations are not yet known, will fall under the Unique Finds Policy and protection requirements will be implemented in consultation with Alberta Natural Heritage Information Centre.

7.1.7.1 Unique Finds Policy

The Unique Finds Policy is designed to identify and protect relatively small sites that are likely to be identified during the course of forest management activities. Examples of Unique Finds include eagle nests, mineral licks, native burial sites, rock outcrops, rare plants or plant communities, potential recreation sites, etc. The locations of these sites are not all known. Unique Finds are identified on an on-going basis, as staff and contractors work in the field.

Manning Diversified's Unique Find Policy requires:

- The employees and contractors of MDFP will report any unique areas that they find through the normal course of their work, using the Unique Find Reporting Form. Finds will be reported to the woodlands manager.

The woodlands manager, in conjunction with the employee or contractor, will make the decision as to whether the site should be considered a 'Unique Find'. Once a site is considered a Unique Find, the following steps are taken:

- Recommendations for protection will be discussed and the appropriate information recorded on the Reporting Form. A map and photo will be provided where possible. The recommendation for protection must be completed.
- A file of all Unique Finds will be kept and their locations tracked digitally.
- All finds will be reported to appropriate government agencies and, if applicable, to DMI for incorporation into their planning and operations.

A copy of the Company's Unique Find Policy and associated reporting form is provided in Appendix X.

7.1.7.2 Special Management Zones

Special management zones have been identified within the FMA Area to facilitate protection of existing sites with unique values (e.g., habitat, recreation, aesthetics, etc.). The zones are used to identify the location and extent of sites that require special consideration in terms of forest management and/or operations. Special management zones are addressed in section 2 in **Landbase Netdown** and include:

Notikewin Habitat Zone

The Notikewin Habitat Zone is located along the Notikewin, Meikle, Hotchkiss and Botha Rivers. Harvest and other forest operations were excluded from the Notikewin Habitat Zone in the 2007 – 2017 FMP. Operations within this zone may be contemplated if required for non-timber values (e.g., reduction of blowdown, habitat maintenance, etc.).

Twisted Bog Moss Management Zone

A twisted bog moss sighting has been identified by Alberta Natural Heritage Information Centre within the vicinity of Twin Lakes Recreation Area in FMU P6. In order to protect this moss, a 1000 m buffer was established around the sighting location. This area was removed from the active landbase for the 2007 – 2017 FMP.

Highway Management Zone

Highway 35 traverses the northern portion of FMU P6 and the Chinchaga Forestry Road provides access into FMU P6. Relatively heavy use of these roads by the public led MDFP to create a 250 wide zone along the roads (125 m on either side of the road). Any operations scheduled to occur within this Zone will incorporate aesthetic concerns.

Twin Lakes Lodge Management Zone

Twin Lakes Lodge is a commercial stakeholder located within FMU P6. A 100 m buffer was established around the Lodge and this area was removed from the active landbase for the 2007 – 2017 FMP.

Trumpeter Swan Lake Buffers

Two hundred metre buffers have been established around all waterbodies that have been identified as trumpeter swan nesting areas. All forestry operations are excluded from these areas and the areas are not included in the active forest landbase.

Watercourse Buffers

To protect water quality and riparian habitat, buffers have been established along all watercourses, using standards prescribed by the Province in the Timber Harvest Planning and Operating Ground Rules. All forestry operations are excluded from these areas and the areas are excluded from the active forest landbase.

7.2 Species Diversity

Within the FMA Area, management using a coarse filter approach will be relied on to sustain the majority of the species that occur. However, a coarse filter approach alone may not be sufficient in cases where species may be at risk, either through very low population levels or discontinuous populations.

Within the FMA Area, the woodland caribou was identified as a key species of concern. Additional management strategies were developed for the FMA Area to specifically address woodland caribou habitat concerns.

Trumpeter swan and northern pikeminnow were also identified as species of concern. Because their habitat is associated with hydrologic features, strategies to address habitat concerns are based on avoidance.

Three other species identified as a special concern in the FMA Area are the grizzly bear and the cape may and black-throated green warblers. Habitat models were not available for these species for utilization in the 2007 – 2017 FMP. Manning Diversified will cooperate with the Foothills Model Forest and the Province in future efforts related to habitat models for these species.

7.2.1 Caribou Habitat Management Strategy

Woodland caribou (*Rangifer tarandus*) were identified as species of concern within FMA0200041 at the outset of development of the FMP. Recognizing the impact forest management activities, particularly harvesting, can have on caribou habitat, woodland caribou concerns were incorporated into the FMP development process. Additional details regarding the Strategy development are provided in Appendix XI.

The FMA's Caribou Management Strategy includes the following components:

6. Landscape Level - Identify the area in which woodland caribou range and ensure that habitat considerations are incorporated into forest management activities within this area. Identify the preferred habitat within these areas and implement forest management activities which maintain appropriate levels/configurations of habitat. Habitat considerations such as the area of preferred covertype, how these covertypes are arranged spatially and when these area are scheduled are all relevant factors.
7. Operational Level – Identify operational forestry strategies that can be implemented to further reduce the impact of these operations on woodland caribou habitat.
8. All Levels – Participate and/or maintain communications with the Chinchaga Range Planning Team.

7.2.1.1 Landscape Level - Strategies

The FMP incorporates both the Provincial Caribou Zone and the Alternative Patch Management Area (APMA). Within the Caribou Zone and the APMA, forest management strategies to support caribou habitat considerations will be implemented.

If the Caribou Zone is revised in the future, these changes will be incorporated into subsequent FMPs.

Forest covertypes which were considered preferred habitat for caribou were identified, resulting in the removal of some wet white spruce and some productive black spruce stands within the Caribou Zone and the APMA from the active landbase.

Availability of contiguous habitat (i.e., large patches) was identified as significant in determining the quality of woodland caribou habitat. The TSA targeted a larger patch size for harvest within the Caribou Zone and APMA in FMU P6 and in the Caribou Zone in FMU P9. This was accommodated in the model by minimizing harvest patches in the 0 to 300 hectare range. This strategy also served to minimize the amount of open access required.

TSA constraints were introduced to reduce the habitat for ungulates other than caribou in an effort to reduce the predator population. Habitat preferred by other ungulates was generalized as deciduous or mixedwood covertypes (D, DU, DC, DCU, CD or CDU) less than 30 years old. To ensure ungulate habitat was maintained at an acceptable level within the Caribou Zone and the APMA, the area of the landbase under 30 years old was constrained to less than 20% of the gross landbase within each FMU, for each of the following covertype categories: D, DU, DC, DCU, CD and CDU. This strategy also helped ensure significant areas of mature and old forests were retained.

Reducing the number of access entries was accomplished by controlling the number of entries into the Caribou Zone and APMA. Within P6, these areas are bisected by both the Hotchkiss and the Meikle Rivers. The TSA constrained the access to these three sub-zones to permit only one to be open in each

ten-year harvest period. In addition, harvesting a number of small or isolated stands (patches) was deferred until surrounding stands met minimum merchantability criteria. In the Caribou Zone in P9, the TSA was constrained so that harvesting was deferred from a large portion of the Caribou Zone. The mature timber being sequenced was sparse, which would have resulted in opening significant access and requiring multiple entry periods to recover relatively small timber volumes.

7.2.1.2 Operational Level – Strategies

Operational level strategies related to caribou habitat management will be identified in the FMA Operating Ground Rules. Strategies which will be addressed within the Ground Rules include:

- Timing of active operations: Operations have, in the past, been timed to minimize impact on caribou populations. The value and form of timing controls will be discussed as part of the Ground Rule negotiations and may be left for evaluation by the proposed Chinchaga Range Planning Team.
- Access management: The Company will continue to develop Caribou Protection Plans, in consultation with the regional biologist, that may include access management prescriptions.
- Reclamation: Non-native species used for soil stabilization can represent an attractant to alternate prey and their related predators. Once appropriate alternatives are available to the Companies, native plant species will be considered for use.
- Reforestation: The Company will identify opportunities for reforestation within the Caribou Zone and the APMA to favour caribou while discouraging alternative prey (by preferentially selecting harvest blocks within the Zone/APMA for reforestation to pure conifer, while offsetting appropriately in blocks outside the Zone/APMA). These opportunities will be relatively limited (i.e., less than 500 hectares annually) because of reforestation requirements/policies (e.g., ASRD Directive 2005-1).

7.2.2 Trumpeter Swan Habitat

Two hundred metre buffers have been established around all waterbodies that have been identified as trumpeter swan nesting areas (section 2.8 in **Landbase Netdown**). All forestry operations are excluded from these areas and the areas are not included in the productive forest landbase.

7.2.3 Northern Pikeminnow

The northern pikeminnow has been recorded in the Notikewin River. The Notikewin Habitat Zone is has been established along the Notikewin, Meikle, Hotchkiss and Botha Rivers (section 2.7 in **Landbase Netdown**). Harvest and other forest operations were excluded from the Notikewin Habitat Zone in the 2007 – 2017 FMP. Operations within this zone may be contemplated if required for non-timber values (e.g., reduction of blowdown, habitat maintenance, etc.).

7.3 Genetic Diversity

Although very little information is available regarding the genetic diversity of species on the FMA Area, there is a general assumption that natural levels of genetic diversity exist within the regional plant and animal populations.

Manning Diversified and DMI are responsible for forest management activities within the FMA Area but do not have wildlife or non-forestry vegetation management/conservation responsibility. This limits scope of the Companies' involvement in maintenance of genetic diversity to commercial tree species. The Companies, through their reforestation programs, could potentially impact the genetic diversity of commercial tree species within the FMA Area if reforestation seed/stock was obtained from limited sources. The following strategies will ensure genetic diversity of the commercial tree species within the FMA Area is maintained"

- MDFP will continue to utilize wild seed sources along with deploying some improved seed stock.
- MDFP will follow the requirements relating to tree improvement outlined by the Province in Standards for Tree Improvement in Alberta (ASRD 2005).
- MDFP will adhere to the Controlled Parentage Plan for Breeding Regions G2 and J, including requirements for in-situ and ex-situ conservation.
- DMI generally relies on natural regeneration for reforestation.

8. References

Alberta Sustainable Resource Development. 2005. Standards for tree improvement in Alberta. 121 pp.

Smith, R. L. 1980. Ecology and field biology. Third Edition. Harper and Row, New York. 835 pp.

Appendix I MDFP Road Planning, Construction, Maintenance, Reclamation and Monitoring Strategy

MANNING DIVERSIFIED FOREST PRODUCTS LTD.

ROAD PLANNING, CONSTRUCTION, MAINTENANCE, RECLAMATION AND MONITORING STRATEGY

Roads are an essential part of woodlands operations. Their main use is to move the harvested timber from the cutblocks to the mill in a safe and efficient manner. They are also used as access for personnel and equipment for harvesting, scarification and reforestation activities. They can present a significant problem from an environmental perspective in that they disturb the natural environment. Our main objective relating to roads is to construct safe roads in the most cost-effective manner while disturbing the environment and reducing productive landbase as little as possible.

As the title of this strategy suggests, there are five main stages of road strategy that must be considered. There are also different levels of road use, both duration of use (number of years of service), season of use (winter vs. summer) and amount of use (loads that will pass) of individual roads that contribute to the road network. The three main levels that we deal with are: main roads (connecting main harvest areas with the mill for multiple season use with thousands of loads), inter-block roads (roads connecting individual blocks to each other and/or main roads used for one or two seasons and several hundred loads) and inner-block roads (road systems within block boundaries used for the time to harvest the block and seeing relatively small numbers of loads). This strategy is simplified from the extent it could be because all of our current planning is for frozen- ground conditions. We have deliberately chosen this seasonal limitation to reduce our environmental disturbance and to reduce our landbase impact. If operations for non-frozen-ground conditions were to be planned, alternate strategies would be required.

ROAD PLANNING

We plan for using existing roads where possible either in their existing condition or with slight improvements. We can often accomplish this goal by using lines used by oil companies exploring for or extracting petroleum resources. Where the existing possibilities are not adequate for our needs, we are forced to create new routes. This choice is avoided as much as possible because it is a new disturbance to the environment and is generally more expensive than using existing routes. Road planning is selecting the best long-term route to move the timber from one spot to another. For a main road this means determining the best route from the harvest area to the mill. As much as is practical, we combine this route with multiple operating areas and other forest landbase users by using common corridors. For an inner-block road, road planning means determining the best route within the block to promote efficient harvesting and to the nearest inter-block road. In both cases, the following factors must be taken into account: slopes, watercourses, ground conditions, environmental impact and road standard.

Another significant consideration in our road planning is to create a route that is safe for all travelers. We work toward this goal by avoiding sharp, blind comers, significant slopes, narrow sections and other hazards that could put travelers at risk. The planning stage of road development is the prime opportunity to predict hazards that could be created and takes steps to prevent them. Prevention can take the form of choosing alternate routes, specified construction standards or enhanced signage.

In all road planning, we consider the road from the perspective of the log truck and in particular, whether it will be loaded or empty while using a section of road. This is the base point of planning because our business is to move logs from the harvest area to the mill and the loaded log truck is the most common traveler on the roads we construct and the one most likely to have problems in difficult areas. Those roads that are planned for use by only empty log trucks can accept different road standards such as steeper hills and sharper comers. Our harvesting and silvicultural work utilize the same roads as the log trucks and moving this equipment is roughly equivalent to log trucks so no special planning is required for these activities. Part of our reforestation strategy is to reforest all harvested areas as soon as possible after the block is harvested. This strategy allows us to utilize the road system established for harvesting in the same season for scarification. This reduces the impact of our roads by reducing the number of seasons they are used and not needing to re-open lines and install crossings multiple times.

Slopes

There are three types of slopes that we encounter (adverse, favorable and side-slope). The acceptable limits of slope inclination that can be tolerated are determined by the factors of intensity and duration.

Adverse slopes are those that you have to climb. A loaded log truck can climb an adverse slope of 10% if there are no limiting factors. Some of the factors that would limit the truck include: Ground conditions (a smooth, hard, flat, dry surface is ideal. Fresh snow, poor maintenance or soft soil would reduce the chance of the truck climbing the hill). Approach -a straight approach to an adverse climb allows the truck to build up speed that will be shed as it is climbing the hill. If the approach to the hill has a comer at the bottom or part way up, the truck will have to lower his speed to be able to navigate the comer. This can mean he will not be carrying as much speed to the hill and may not be able to climb the hill. Navigating a comer also shifts the center of gravity of the load on the truck that can cause loss of traction. Duration -a truck is able to climb steeper hills for short distances because they are able to carry speed from the flat sections that will assist them part way up the steep sections. If a slope is very long and steep, a truck is less likely to be able to maintain traction on it. Empty trucks are limited by the same factors as loaded trucks but to lesser levels. The upper limit that an empty truck can climb is about 14 %.

Favourable slopes have higher levels of tolerance for intensity. Loaded trucks can handle 14 % slope and empty trucks can handle 18 % if there are no limiting factors. Ground conditions are again important. The truck will need to be able to use their engine retarder systems on the way down to maintain an acceptable speed and this relates directly to the ground condition factors identified above. The escape from the hill now becomes important rather than the approach. The truck must have a path available to shed speed built up on the hill that the engine retarder could not reduce. This means that there must not be a comer on the hill or on the bottom of a hill that is already at the maximum that the truck can tolerate. Also, the longer and steeper the slope, the longer and straighter the escape from the slope must be. The duration of the slope is again important as it was on adverse slopes but for opposite reasons. On adverse slopes, speed is lost because of gravity; on favorable slopes speed is gained because of gravity.

Side-slopes are the sideways tilt of a road that occurs on flat sections and on hills. The intensity of the side-slope that can be tolerated changes based on the land topography and the duration of the inclination. A side-slope of five degrees can be tolerated for a short distance (less than 100 meters) on a flat location but would be unacceptable for even 10 meters on a ten percent

adverse climb. The reason that side-slope is so critical is that log trucks are top-heavy which means they tip over easier than trucks with a lower center of gravity. Side-slopes can also cause loss of traction on the drive wheels on the uphill side of the slope by altering the center of gravity of the load. Empty log trucks can handle slightly steeper side-slopes but also have their limits.

Road planning in relation to slopes comes on three forms: slopes that can be tolerated in the existing condition, slopes that can be modified to suit our needs and slopes that must be avoided because they do not suit our needs and the modification to the slope is more expensive environmentally and-monetarily than an alternate route. The use level of a road being planned also plays a part in determining the limiting factors that can be tolerated. The adverse slopes that can be tolerated on inner-block roads are higher than on a main road. This is because there will not be as many loads attempting a bad section. It may be practical to have a skidder tow 100 loads up a bad hill in a cutblock to avoid a major watercourse crossing but it would not be feasible to tow 10,000 loads up a bad section of main road.

Watercourses

Road planning for watercourses is basically a matter of minimizing the number of locations where watercourse crossings will be required and where they are required, choosing the sites that are the most stable. They are the most sensitive part of the environment we encounter in road planning so care must be taken to ensure proper approaches and escapes are constructed and that the crossing structures used are adequate for the watercourse. The watercourse types we cross most often are ephemeral draws and intermittent streams. We also cross small permanent streams and large permanent streams (refer to the Alberta Timber Harvesting Ground Rules 1994 for definitions). To cross them we use snow fills, log fills, culverts and bridges. The main consideration for planning is to determine if the watercourse can be safely crossed at the point on your route with minimal disturbance to the slopes near the watercourse and no disturbance to the channel of the watercourse. If these factors cannot be satisfied, an alternate route must be found by using alternate existing lines or by creating a new-cut access to obtain more favourable circumstances. The points described above in the section on slopes often are complicated by watercourse crossings because many of the slopes we encounter are associated with a watercourse. Part of the planning phase is to determine how the areas impacted will be reclaimed after our operations are completed. If the site will present serious difficulties in reclamation, consideration to rejecting it must be taken. It is usually better to make the road a few kilometers longer to avoid a bad crossing than to create an environmental problem and a reclamation liability.

Ground Conditions

The nature of our operations, frozen ground, gives some advantages to road planning. We are able to predict with good confidence that our road systems will have hard running surfaces once the frost is set into the ground. This allows us to cross landforms such as muskegs that would be impractical for summer operations. It also puts us under a time constraint that we have no control over i.e. we cannot decide when frost will begin or when spring breakup will happen. We can only follow the timetable set for us by nature. For road planning, we try to predict how quickly each section of road will freeze up on it's own and how easily we can help put frost into the ground with our equipment. Areas of moist soil will freeze relatively quickly on their own as long as the snow is kept off. Open/floating muskeg will be difficult to work on with equipment to

initiate freezing but will be an excellent running surface once frost is established. Dry ground like that typically found under aspen canopies will provide relatively secure early access but is prone to losing frost earlier in the spring. The level of road activity plays a part in assessing ground conditions. A main road that is required early in the season and will be used for the whole year must be able to have frost established early and be maintained for the entire season. An inter-block road that accesses several small blocks can cross an open muskeg area by scheduling it for later in the season.

Environmental impact

This is another way of saying, how long is the road and what kind of country does it cross. The longer a road is, the more impact on the environment is created and the greater the chances of reclamation problems. As was stated above in the section on watercourses, it is sometimes advantageous to plan a longer route to avoid a problem watercourse crossing but this decision does imply that the impact on the environment with a longer route is less than the impact of a watercourse crossing. Road planning is a balance of minimizing the impacts of operations while ensuring the economics of the choices are justified. A straight-line road from the blocks to the mill might be the shortest route but if it involves many major watercourse crossings and hill cuts, it is not justifiable from an environmental impact perspective or an economic perspective.

Road Standard

Road standard is a function of the level of use planned for a section of road. It describes whether the road will be single-lane or two-lane, one-way or two-way traffic and the expected speed of trucks. The standard or quality a road is built to is directly proportional to the environmental impact and the cost of construction. A single-lane inter block road with pushouts for two-way traffic on an existing line intended for 40 km/hr traffic is relatively cheap to build and should present few environmental impacts. A new-cut two-lane main haul road intended for 8Okm/hr traffic will be expensive and have a significant environmental impact. Road planning must determine the best balance of hauling efficiency compared to minimizing environmental impact by deciding the road standard appropriate to the road use level.

ROAD CONSTRUCTION

Road construction for frozen-ground operations is mostly a matter of encouraging the natural freezing process in the fall and early winter. The other parts of construction are cutting new-cut road right of ways, modifying slopes to match the road plan and installing watercourse crossings.

Freezing-in

The equipment we normally use for this is snowmobiles, ATV's, "Snowcats", LGP crawler tractors, LGP rubber-tired buggies and graders. The process on existing lines begins with the lightest, lowest ground pressure units that the site will tolerate entering the site with the intent of removing and/or compacting any snow accumulations and removing as much vegetation from the road as they can without removing topsoil. The vegetation needs to be removed because it's presence under compacted snow on the running surface causes movement between the snowpack and the soil that degrades the surface quality. This can cause surface breakup, potholes and safety issues on the road.

Freezing-in is done as early in the season as practical (when overnight temperatures are below freezing) to try to create some frost for the heavier, high ground pressure units that will follow. The traffic of these low-ground-pressure units disturbs the natural insulating properties of loose snow and duff and allows colder air to reach the ground to start the freezing process. Light units are used at this point because while road plans typically try to use the high, dry ground in route selection, there are almost always some lower, wet areas to cross and rutting of these areas is unacceptable. The light units can cross both types of areas without causing environmental damage and start the freezing process. Small watercourses (ephemeral draws, intermittent and small permanent streams) that are encountered at this stage will have crossing structures installed, either temporary or permanent depending on the equipment onsite and the structure required Small permanent and large permanent streams that are encountered at this point that require bridges, culverts or large log fills can stop the progress of the light units until the crossing structure is installed. The light units can also start building the running surface by moving loose soil and snow into holes in the road and leveling the running surface.

Heavier units follow the light units as soon as conditions permit. Their job is to continue the freezing process, modify slopes as required and ensure all watercourse crossings are constructed to the appropriate standard. Large crossing structures that are required usually need these heavier units to properly install them. They will also establish the running surface that the grader will enhance and maintain through the season.

Freezing-in is done throughout the season as new portions of the operating area are accessed but the main roads into an operating area and the first inter-block roads will be required early in the season. This means that there is a strong desire to start as soon as practical to ensure all work is completed during the most favourable operating season.

New-Cut Roads

New-cut roads are constructed by first removing the standing timber on the right-of-way. If there is merchantable timber, it is salvaged by standard harvesting equipment. This equipment will in almost all cases initiate the freezing-in process to the point that once the timber is removed, road construction equipment can follow immediately behind the harvesting equipment. The construction equipment will first remove all stumps from the site, pile them along the side and smooth out the running surface that will be maintained by the graders.

New-cut roads through non-merchantable timber require a crawler tractor to "walk-down" the vegetation then cut it off and pile it to the side of the ROW. This can be a difficult operation because non-merchantable vegetation can indicate wet ground so extreme care must be taken to minimize environmental damage while creating a suitable road. These areas generally have only light, surface frost early in the season that must be enhanced by stripping the vegetation and exposing the soil to the freezing air to make the road suitable for our use.

One strategy we use to minimize the risks described above is to cut the new-cut roads we will require the year previous to the expected year of need. This allows us to open these roads at a time when the natural frost levels are deepest (January and February) and minimize our risk of environmental damage in areas of non-merchantable vegetation. We are then able to freeze-in these roads in the manner described above for existing lines in the year we need them for harvesting operations.

Inner-block roads are constructed in most cases in the same manner as new-cut roads are constructed. There is not the luxury of building them the previous year however so the wet areas in the block must be entered into cautiously. Luckily, there are few of these. Where practical, existing lines that go through the block can be used for inner-block roads and can be constructed in the same manner as inter-block roads on existing lines are constructed. Watercourse crossings installed inside block boundaries will almost

always be log fills because there is rarely sufficient clean snow available after harvesting the area to construct a snow fill.

Slope Modification

This is the cutting or filling of soil on slopes to create running surfaces at the slopes acceptable for traffic as planned for in the road planning section. This is usually done with crawler tractors moving the soil with their blades from one area on the slope to another. They will also at this time construct the back -slopes required to ensure stable sites that will not contribute to potential environmental problems. Standard back-slopes for cuts are 3: 1 and for fills are 2: 1. This standard is not always practical in all situations however. For example, a back-slope for a side-slope cut into a slope that is just over the tolerance level for side-slope for the road could extend a long way off the line. In this case it may be better to accept a steeper back-slope and reduce the environmental impact of the operations.

As was stated above, slope modification is often associated with watercourses and watercourse crossings so extra care must be taken by equipment operations and supervisors to ensure that no soil is allowed to enter the watercourse.

Watercourse Crossings

The most sensitive part of the environment that we impact with our operations is watercourses and the highest risk to causing environmental damage is during watercourse crossing installation and removal. We mainly use snow or log fills for our seasonal crossing structures but also use culverts on main roads that will be used for multiple seasons and bridges for large permanent streams. Ice crossings are also used in special circumstances. The road planning phase described above will tell the construction crew what type of crossing structure will need to be installed at each location.

Snow fills can be used for any size of stream but are limited by the availability of sufficient quantities of clean snow available at the site at the time of construction. If the crossing is on a small stream and there is sufficient snow available, the crew will simply push clean snow into the channel and pack it to the desired height to create a running surface. Care will need to be taken to minimize the amount of soil or vegetation that mixes with the snow as it is being gathered. If there is any doubt as to being able to keep the snow clean, a layer of burlap shall be placed in the channel prior to moving any snow to act as a barrier between the fill and the stream channel. If there is not enough snow to complete the running surface, a layer of soil may be placed over the snow as long as the burlap layer is in place to keep the soil out of the channel. The burlap shall extend at least one meter beyond the edge of where soil is to be placed. If in doubt, use more burlap to ensure that no soil enters the stream channel. As a final touch to complete a snow fill, a small snow berm should be placed on either side of the fill,

parallel to the running surface to act as a barrier to material on the fill escaping over the edges into the channel.

Snow fills can also be constructed using snow making machines to create snow at sites where there is not enough to build the snow fill required. The sites where this option is used must be chosen with care, as there are restrictions on the machinery required to complete the construction. There must be sufficient water available on site or an adequate road to the site to allow water to be hauled in. Also, the weather will need to be cold enough to allow the snow-making machine to work -about minus 10 ^{C} is required. This method can be used on any size of crossing including large river crossings. As the snow is created, a crawler tractor will push the snow in the channel and pack it to create the running surface.

Log fills are built by placing topped and stumped trees into the stream channel to fill in most of the height to the desired running surface. If the channel has small bends in it, logs may have to be fitted into the channel to provide channel protection then a solid layer of logs will be placed to "bridge" the channel. The width of the log layer should extend up onto the channel banks to provide support and protection for the entire channel. The balance of the height is filled with soil packed in over the logs. In all cases of log fill construction, a layer of burlap is mandatory. The burlap shall extend at least one meter beyond the edge of where soil is to be placed. If in doubt, use more burlap to ensure that no soil enters the stream channel. As with the snow fill, a small berm should be placed along the edges of the fill to prevent soil from escaping over the edges and entering the channel.

Culverts are used for crossing installations where the road is going to be used for multiple seasons and will not be removed between seasons. This means it should only be used on main roads. Culverts are not a preferred crossing structure for our operations because the installation process causes some environmental impact. This is because the installation requires that the streambed be leveled to provide support for the culvert. The culvert is then placed in the channel just below the level of the original streambed. This placement ensures that there is no erosion caused at the inlet end or the outflow end. Soil is then placed around the sides of the culvert and packed in place in layers to build up to the desired level of the running surface. Back sloping of the fill is important to prevent erosion problems. Culverts installed during the winter have a tendency to have their fill settle, which can cause erosion and washout problems. This is because the frozen soil used for fill does not compact very well. These sites will require additional monitoring to ensure they do not create an environmental liability.

For our operations, bridges are normally installed on large permanent streams on main roads. They are used in places where the number of logs required for a log fill is too great or the reliability of snow on site or access for snow making equipment is too low. They are typically installed on sites that will to be used for multiple seasons and may be left installed at remote site pending future harvest operations. They are also used for single season applications typically on large permanent streams. The installation procedure varies with the bridge design and we usually contract professional bridge contractors to perform these tasks for us.

Ice crossings are used on very small ephemeral draws and on large river crossings if the ice conditions are right. The conditions needed for an ice crossing on an ephemeral draw are the absence of channel and slope development and the presence of natural frozen water to the desired level for the running surface. If these factors present themselves, the construction is no more than the freezing-in procedure normal for our operations as described above. It must be

noted that the presence of the water at the site may be a symptom of a spring that may run all winter and create maintenance problems throughout the winter.

The other case where an ice crossing may be used is on a large river such as the Chinchaga River. The construction of this crossing will require repeated layers of flooding with water pumped from the river to build ice to the desired thickness. This task will be contracted out to experienced ice bridge builders.

MAINTENANCE

Seasonal

The roads in our operations are maintained using graders equipped with ice cutting blades for the daily work. Crawlers may be used for special circumstances such as extreme snow-falls and major repairs to problem areas on the roads.

The objective of the grader is to provide a smooth running surface for the log trucks and maintain the road width for the traffic level indicated. The grader will also provide ground conditions suitable for the trucks to maintain traction for climbing and descending hills and on corners.

The grader can help prolong the hauling season into the spring by building up a snow-pack on the running surface that will melt more slowly during spring breakup. This can reduce the risk of the haul program rutting roads as operations are winding down in the spring. The grader operator will need to be cautious all season long to ensure that the material that is being moved at watercourse crossings does not enter the watercourse. The berms placed at the crossings will assist in this and they will be maintained all season. If circumstances arise where continued regular maintenance may put deleterious material into a watercourse, equipment such as excavators and crawlers will be brought in to remove the material to a safe location.

Long Term

The long term maintenance program is tied to the monitoring program that will be discussed later in this document. It is directed at keeping the main roads in our system in satisfactory condition for use and to correct any environmental problems that may occur. As was stated above, we have made the choice of harvesting our timber during frozen ground conditions. This reduces the impact our roads have on the environment and it reduces the need to have these roads in a condition for use all year long. Most of our long-term maintenance takes the form of remediating problem areas and improving sections of roads that will be needed in future operations.

The most common problems we have that require remediation are caused by erosion. As our monitoring program identifies sites, site-specific plans are created to fix the problem. The other main problem we have involves permanent and semi-permanent watercourse crossing structures such as culverts and bridges that deteriorate in quality over time or are damaged. As problems are identified through our watercourse-monitoring program, plans for remediation are developed to suit the site.

We have a small number of roads that are open for all-season and dry-weather access. We have entered into maintenance contracts with the oil company in the area that has a specific use for them during the whole year. These roads are maintained by the oil company and we ensure their maintenance program meets our standard.

RECLAMATION

As operations in an area are complete, the road system in that area will be de-activated or be reclaimed. The difference between the two terms is in the plans that are in place for the road and/or road system for the future. De-activation refers to removal of crossing structures, establishing erosion controls and encouraging vegetation establishment on a road that is intended to be re-opened for use in the near future. Reclamation refers to the same activities but on roads where there is no expectation of use in the near future. The activities required may change depending on the objective. For example, a road that has culverts installed for watercourse crossings would not have the culverts removed if it is being De-activated. The same site being Reclaimed would have the culverts removed, grass seeded, erosion controls established and soil at the site re-contoured.

The watercourse crossing removal strategy differs slightly depending on the type of crossing being removed and whether the site is being is being de-activated or reclaimed. The main strategy difference between the two objectives is where the fill material will be placed and to what degree will vegetation establishment be promoted. Fill material from a de-activated site will normally be placed in a convenient, stable location close to the crossing site to allow for it's re-use in subsequent installations. This may mean that on a particular site, the fill material may be left in a pile on a flat piece of ground near the watercourse to be re-used as a cap for a log fill that is anticipated to be installed next winter. Fill material from a reclaimed site will be placed in locations where it will not create any long-term environmental impacts from erosion or slumping. This may mean that the material is replaced in the site from which it was obtained and re-contoured to match the previously existing site. The decision on where to place fill material is made on a site-specific basis with consideration to soil stability, erosion potential and site hydrology.

The degree of vegetation establishment promotion is also determined by the objectives for the site. A site that is expected to de-activated until the following season will have little effort put into establishing vegetation unless it is determined that the presence of vegetation is critical to inhibiting erosion for the short duration until the next activity at the site. An example of this would be a site where the fill material must be placed in a questionable location in terms of stability. In this case, the introduction of grass seed at the time of crossing removal could encourage enough immature vegetation to stabilize the soil for the season. Sites like this should be avoided at the planning stage so that this difficulty is not introduced.

Sites that are being reclaimed all require vegetation to be established to ensure site productivity and to aid in reducing erosion potential. The term that the site was in use and the amount of disturbance at the site determine how much effort will be required to re-establish vegetation. A snow fill in a natural meadow that had available clean snow to fill the channel and provide a running surface for the single year of use will require very little if any work to re-establish vegetation because the root system to provide new growth already exists. The other extreme is a major cut and fill that was installed and used for several years. The effort to establish vegetation on this reclaimed site may extend beyond grass seed and fertilizer to planting of

seedling and shrubs. The first example described above is relatively common while the second example is very rare but many variations between the two are encountered each year. Each site must therefore be evaluated individually and a prescription created to match the needs of the site.

Once the prescription for the road or road system is determined the work can begin. The work required for crossing removal depends on the type of crossing installed. Ice- crossings on ephemeral draws need to be scraped by a smooth blade to remove accumulations of soil from operations. The ice can then be notched to ensure melting water stays in the channel. The same work is needed on large ice bridges. A bridge construction contractor is usually required to remove a steel and/or concrete bridge and reclaim the site to it's pre-construction state. These are dealt with on a site-specific basis as the site requirements, bridge type and removal techniques are all very specific to these crossing structures.

Culverts may be removed in non-frozen conditions if there is access to the site. This soil is excavated using a backhoe or an excavator and the culvert lifted out of place. This operation may be complicated by flowing water at which time job approvals will be required to disrupt or divert the water flow. Culverts removed in the winter if the water is frozen to the bottom of the channel require the soil around the culvert to be broken up prior to excavation. The channel will then be re-contoured to the original state and revegetated to provide erosion control. These sites will require extensive monitoring to ensure bank stability and vegetation success. Permits may be required to complete this work depending on the size and classification of the watercourse and the season of work and would be obtained prior to work commencing.

Log fills must be removed prior to spring breakup. The soil cap is first broken up, usually with a crawler tractor's ripper, then the soil is removed from the crossing location. The burlap layer installed during installation will aid in ensuring that no soil from the cap enters the watercourse. The logs are then removed and placed up the slope away from the watercourse. They can be re-used for future installations at the same site. We typically have a crawler tractor equipped with a ripper working in tandem with an excavator equipped with a large capacity, smooth edge bucket or blade to remove these crossings.

Snow fills are removed with same equipment using similar techniques. A dirt cap, if present is broken up and removed down to the burlap layer. If clean snow was used, it will need to be scraped then the snow notched to promote water flow in the channel. If burlap was used, it will be removed from the channel.

Soil that has been moved during construction should in most cases be placed back in the location from which it was obtained and re-contoured to match the original landform. This should not be done if replacing it will create an unstable site that could cause erosion problems. These sites should all be returned to a stable location and re-contoured so that soil will not enter watercourses if slumping or erosion occurs. Re-vegetation must be encouraged on all sites to acceptable vegetation to promote site stability. Re-contouring of hill cuts and fills is not always necessary particularly if construction established appropriate back slopes. Erosion controls including roll-back and diversion ditches may be required to ensure soil stability until vegetation is established.

Water accumulation and movement and the subsequent erosion potential can be a significant problem on sites with unstable soil. Erosion controls in our area are primarily intended to divert

water from these sites to more stable areas such as forested land or scarified cutblocks and to slow down the speed that the water travels at. Our main areas of concern for erosion potential are roads, whether inside or outside block boundaries. The steeper slopes generally are potential problem areas but as has been mentioned many times above, each site must be evaluated individually. A very steep but short slope at the crest of a hill with vegetation that will readily re-establish is more stable than a long shallow slope at the base of a large hill with highly erodable soils.

We use erosion ditches to first minimize the accumulations of water on the roads from spring runoff and summer storms. The ditches then slow down the speed of flow by reducing the gradient that the water is traveling down. The ditches direct the water into stable areas for dispersion. Ditches are placed at intervals on slopes angled slightly downhill and across the road. They are constructed using either a crawler tractor or an excavator or both and must extend across the full width of the road and into the dispersion area. They must extend into the dispersion area to ensure the water does not return back to the road, as this would minimize the effectiveness of ditches further down the hill.

Roll-back or the placing of woody debris removed from the site during construction can act in a similar manner to erosion ditches by diverting water from roads and to slowing down the water as it crosses an area. The technique for placing the debris back on the site is fairly easy, a crawler tractor or an excavator scatters the debris back over the exposed area then walks over it with it's tracks. This establishes contact between the debris and the soil to aid in preventing erosion.

The steepness of the slope and the character of the surrounding landforms determine the frequency and size of the ditches. The installation of erosion ditches or roll-back will not indefinitely guarantee proof against erosion, a re-vegetation program must supplement them. In our area, most sites re-vegetate rapidly on their own but each site should be looked at for the potential of assisting nature by hand seeding and/or fertilizing to ensure prompt re-vegetation.

MONITORING

There are two phases to the monitoring program. The first is to inventory all sites as they are constructed to know what will need to be monitored in the future. The second phase is to implement the monitoring protocol of known and potential problem sites.

The inventory list starts out being very large as it contains all roads constructed and all watercourse crossings constructed listed separate from the roads. The watercourses are listed separately because they are often high-risk spots from an erosion potential perspective. Areas of roads that are deemed as high risk may also be listed separately to ensure they are not overlooked in the monitoring process.

This creates the initial list of "Areas of Concern" (AoC) that starts as road construction and harvesting activities begin in the fall. The list is built over the winter until all new construction is complete for the season. The list then begins to be reduced as de-activation and reclamation work is done before spring break-up. Crossings that are removed that required no soil movement in construction need not stay on the AoC list but will stay on our general watercourse crossing list. Roads may also drop off the AoC list if there are no areas assessed as being prone to erosion, seepage areas, vegetation establishment problems or other concerns that

would require extra vigilance. This means that we end the season with a list of those areas of roads, slopes and watercourse crossings that will require annual monitoring until the presence of vegetation and the lack of erosion causes the rating on the site to be reduced and the monitoring intensity to be similarly reduced. The AoC list would include but not be limited to: sections of road containing seepages, sections of roads on slopes with highly erodable soils, steep slopes, side slopes, significant cuts or fills, watercourse crossings associated with any of the preceding characteristics or long term crossings being reclaimed.

MDFP has agreed to provide ASRD with a list of the AoC sites as part of our "As-Built" submission. The listing will include the location of the site, the nature of the site (watercourse crossing, potential erosion site, seepage area, etc.), associated disposition, special site characteristics (watercourse classification, slope characteristics, other) and comments on the site which may include why a site is being removed from the list and will not appear in future submissions. This list will be updated and submitted for review annually.

As was briefly mentioned above, MDFP also maintains a list of watercourse crossings and roads that would not qualify as AoC that are monitored by our staff. These sites are visited through the course of our summer activities or on special, dedicated trips to ensure that we do not miss any developing problems.

Appendix II DMI's Watercourse Crossings

Appendix III Corridor Plan

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CORRIDOR PLAN

PREAMBLE

When developing a corridor plan, there are a variety of considerations particularly to forest users. The first being season of harvest. Because of the extent of muskeg areas within the FMA, harvesting operations are generally limited to winter. This typically minimizes ground disturbance, particularly in environmentally sensitive sites.

There are also other users on the landbase from trappers to oilfield workers. It is in all operators best interest to keep a good working relationship with other users. Along with this, there is a recreation area (Twin Lakes) within the FMA that needs consideration. There is also wildlife concerns. In fact there are policies governing access and harvesting (e.g. exit ungulate zone by January 15) in wildlife areas. The FMA corridor plan tries where possible to minimize the effects of roads on wildlife. The following map shows wildlife areas as defined by Alberta.

All timber companies needs to work under the rules/regulations/acts/directives of all applicable laws, therefore no timber company will knowingly violate any legislation.

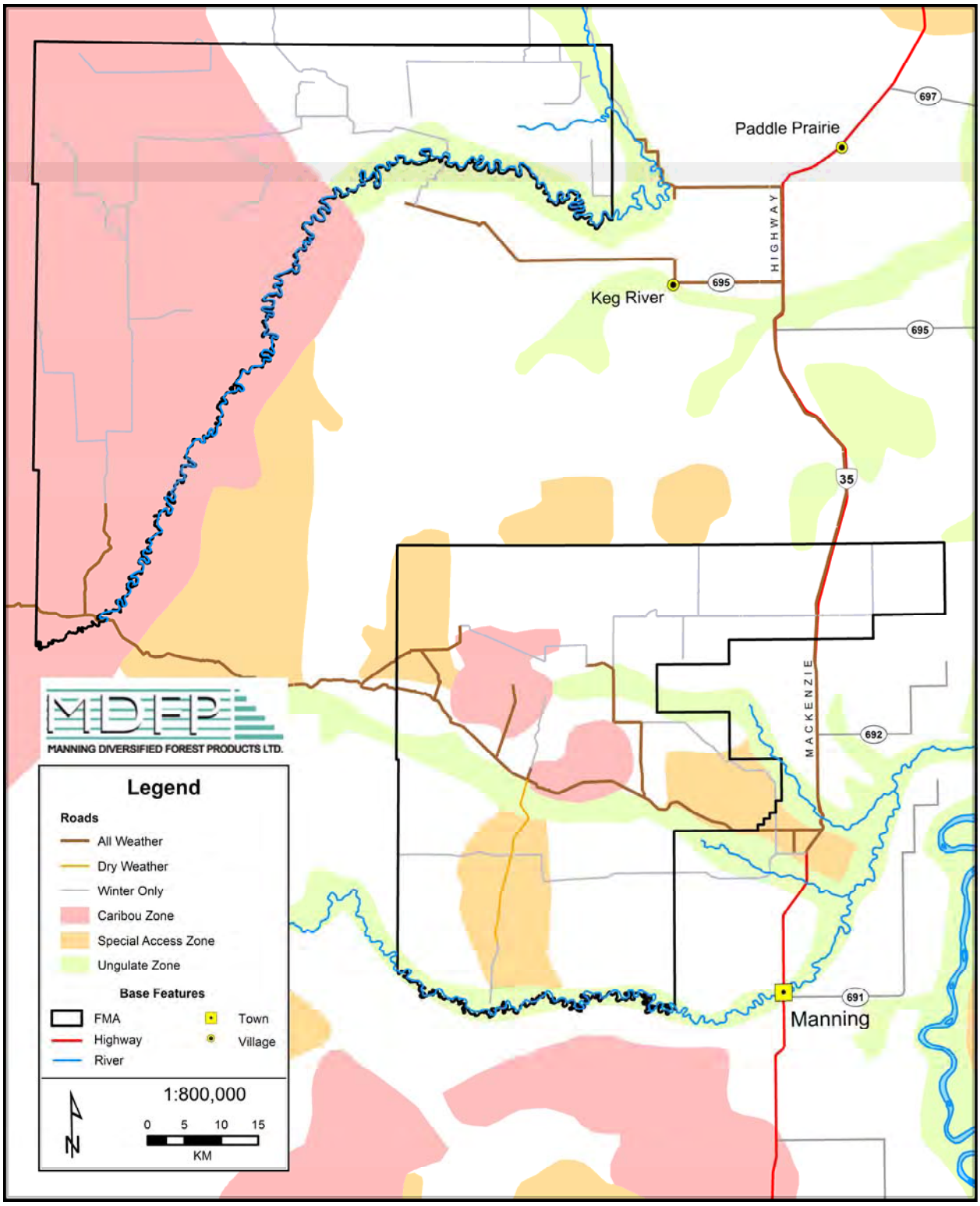
ACCESS PLANNING

The Peace/Upper Hay Area Access Planning Guidelines provides some guidance regarding access planning on the FMA Area. The Guidelines define broad corridors for use and was developed with consultation from a variety of land users. Wherever applicable the timber companies will incorporate this plan into their operations.

LOOP ROADS

Many issues are factored into road planning. Issues such as safety, functionality, operations or business concerns need to be looked at. Wildlife, access management concerns, Integration with other users, watercourses and other environmental concerns must be considered. Existing versus new cut access, one way versus two way travel, anticipated years of use as well as anticipated volume of timber to be hauled are all considered when planning roads and road corridors. Analysis of all these issues results in decisions being made regarding road and road corridors. The final decisions may include two lane roads, one way roads, loop roads or a combination dependant on the results of the analysis.

The Botha River is considered a break point. The timber companies will not make a loop road from highway 35 across the Botha River to the Chinchaga Forestry Road, nor will the timber companies construct a road that crosses the Botha River to gain access to the highway.


Paddle Prairie
697
HIGHWAY
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Keg River
695
35
MACKENZIE
692
691
Manning
MANNING DIVERSIFIED FOREST PRODUCTS LTD.
Legend
Roads
All Weather
Dry Weather
Winter Only
Caribou Zone
Special Access Zone
Ungulate Zone
Base Features
FMA
Highway
River
Town
Village
1:800,000
0 5 10 15
KM

FMP ACCESS CONTROL CONSTRAINT

Some wildlife concerns are incorporated into the modeling portion of the TSA. An alternative patch management area was created to minimize the effects to Woodland Caribou. There are constraints in the model for going into certain areas of the Alternative Patch Management area. In particular there is an alternating method for harvest in 3 areas.

In addition to this, grizzly bears are known to frequent this particular area (from local knowledge). This modeling should also help mitigate grizzly bear concerns.

EXISTING CORRIDORS

All timber companies generally try to make use of existing corridors (cutlines, roads, other dispositions) in their operations. However safety is paramount, and extra (new cut) roads may be required.

CARIBOU ZONES/ALTERNATIVE PATCH MANAGEMENT AREA ACCESS CONTROLS

Some of the caribou zones (eg.P9) and the Alternative Patch Management Area is so large that access will be needed through these zones at various times. There is no avoiding it. There are existing access controls in place that should help mitigate these concerns. In particular there is a common access control point on the Chinchaga forestry road into the caribou zone where a gate is situated. If the timber companies are working in a Caribou Zone or the Alternative Patch Management Area approved access control measures will be utilized.

AQUATIC HABITAT

The timber companies acknowledge that watercourse areas are sensitive and crossings need to properly identified and the appropriate crossing established. Typically roads are established to minimize the number of crossings. The timber companies will continue with that practice. There is also legislation that guide the crossing of waterbodies. Timber Companies operating on FMA0200041 will adhere to the Codes of Practice, Water Act, Ground rule guidelines for road construction and any other pertinent rule/legislation/act or directive required.

RECREATION AND PROTECTED AREAS

Currently any area that has a protective notation which excludes forestry practice has been identified and mapped within the landbase documentation. In addition to this, these areas will be re-evaluated through the yearly LSAS reporting procedure. This process should ensure that there is consultation with the notation holder prior to harvesting. Where possible the timber companies will use existing access to cross protected areas. This should reduce or minimize road conflicts. The Twin Lakes recreation area has a “no operation” buffer placed on it through the FMP. No new access will be created through that buffer without appropriate consultation.

OTHER CONSIDERATIONS

The roads on this plan are the main corridors to access compartments for harvesting operations. As such they are considered to be of long duration (>20 years) however in any

particular time period they may not be used depending on how and when harvest blocks are sequenced. These roads have already been used in the past or are currently being used. This means wherever possible the timber companies will not be constructing new main corridors for access.

With the exception of crossing the Chinchaga River, all major crossings have already been established and approved. There may be a requirement to create winter crossings on the Chinchaga River in the future due to safety concerns, but for now the timber companies propose to use existing crossings. Please refer to the following table for a summary of road kilometers and traplines crossed.

Summary Table Of Road Kilometers													
	Season of Use (generally limited to winter)			Trapline Crossed (Km)						Wildlife Zones Crossed			
	Existing All Season (Km)	Existing Winter (Km)	Existing Dry Weather (Km)							Caribou (Km)	Special Access (Km)	Ungulate (Km)	None (Km)
WC1		26		1258	1397	1601	1603			0	8.9	0.3	16.8
WC2		24	15.5	1601	1603	2442					26.9	3.3	9.3
WC3	90.6	35.6	7.9	1236	1258	1397	1601	1755	2031	17.1	22.9	5.7	88.3
WC4	24.1	30.5		1236	1601	1971	2031			12.4	17.8	4	20.4
WC5	17.5	62.2		2147	2187								79.7
WC6	23.8			2269	2284					23.8			
WC7	3.6	53.6		2049	2269	2362				57.2			
WC8		84.3		1510	2049	2490	2596	2808		83.7			0.6
WC9		17.2		1510	2049	2596	2758			17.2			
WC10		55.2		1510						23.5			31.7
WC11		95.6		1347	1510	1514	1655	2303	2325			24.9	70.7

Appendix IV Structural Retention Strategy

FMA 0200041

STRUCTURAL RETENTION

BACKGROUND

As forest management moves from a sustained yield paradigm to one of sustainable forest management, emulation of natural disturbances must form a part of the strategies. For the boreal forest of Alberta, the natural disturbance agent is predominantly fire. When discussing maintaining forest structure one has to look at past fires to guide decisions on future actions. For this reason, there have been several studies of post-fire residual tree and forest remnants. (Smyth et. al. 2005, Andison 2003 and others). Also, a report by Brad Stellfox is discussed in The Landscape Assessment chapter of this FMP. All of the reported results have shown a great degree of variability by report, by fire and by region. The methodologies used to determine the fire boundaries as well as the fire remnants have also been different. Despite the variability, some broad conclusions can be drawn:

1. The remnant patches distribution tends to be closer to watercourses and, this is more the case for larger watercourses than small. Smaller watercourses tend to have less probability of being unburned than other upland sites.

2. Deciduous and mixedwood types tend to have more remnants than pure conifer sites.

3. There is an increase in remnant proportion with an increase in the fire size.

4. There is a great degree of variability within fires and between fires in the amount and distribution of remnants.

5. The remnants are a mix of individual trees, partially burned areas and unburned patches. The patches, especially the larger ones hold a larger percentage of total remnant area than the individual tree remnants.

All of the reports above concentrated on single fire descriptions, bounded by the fire boundary. These studies should be considered stand level research, since the “landscape” for any given event is undetermined. When management plans are completed for any defined forest areas, one must consider both the stand level targets, landscape level targets and how the two interact.

These conclusions can help in deciding how to plan harvesting operations to more closely emulate fires at a stand level. This proposal will utilize the five conclusions above to develop a template of targets to achieve the objective of structural retention on the landscape.

The Structural Retention Proposal for the FMA landbase has two components; The first is the landscape level retention, and the second is the stand level retention. This strategy will be adhered to by the company that completes the harvesting for their respective blocks. Each company will submit their summarized information to MDFP who will be responsible for reporting it to Alberta.

LANDSCAPE LEVEL RETENTION

The landscape retention is dealt with mainly at the Forest Management Planning (FMP) stage. The areas that contribute to this level of retention are areas deleted from the net landbase such as ground rule watercourse buffers, steep slope areas and other protected areas for parks, recreation areas, wildlife habitat deletions etc. These areas consist of both merchantable and non-merchantable areas such as black spruce and muskegs. A review of the landbase information submitted with this FMP shows that the deletions from the landbase amount to 50% total landbase, with two thirds of the deletions (35% of the total landbase) being forested but not a part of the active landbase. These deletions are water buffers and subjective deletions. The actual area of merchantable stands in buffers is approximately 19,710 hectares.

STAND LEVEL RETENTION

The stand level retention is aimed at individual, or groups of blocks to ensure that cutovers have standing residuals with the block boundaries. This structure retention plan will use a target of 6% stand level retention to add to the landscape level retention listed above. Stand level retention is best dealt with at the operational stage, but requires a strategy to ensure that the targets are met. The following strategy is proposed to meet those targets.

STAND LEVEL STRUCTURAL RETENTION STRATEGY

The strategy for the maintenance of standing residuals is based on the five summarized findings noted above. A matrix of retention targets by stand size and retention patch size (shown below) was developed to achieve the targets while keeping the strategy simple and measurable. The matrix was derived using the following objectives:

1. The amount of standing residual increases as block size increases. This is consistent with findings listed in the background information above, and will help with the other wildlife objectives in the Operating Ground Rules, such as distance to hiding cover and thermal cover.
2. The majority of standing residual is retained in patches rather than single trees. This is consistent with findings in the literature and also safer operationally (i.e., safety of harvesting personnel).
3. Remnant patches represent all harvested stand types, including net landbase and passive landbase
4. Small retention patches (≤1 ha.) will consist of wind-firm trees that would normally stand for a minimum of 30 years. Overmature conifer retention should be left in larger patches as it has a greater risk of blowdown.
5. Retention will be within the harvested block boundary. A preference will be to have the retention closer to the block boundary.

TARGETS

The objectives listed in the previous section were used to set targets for the stand level structural retention. The following targets will be at a total annual harvest level, broken down by block size class, retention patch size, merchantability and species. An example of how these targets are to be achieved in operations is in Appendix A.

The total retention target will be 6% of actual harvest area (net harvested hectares), sub-divided into two classes (Table 1).

- 3% merchantable minimum. This merchantable timber will represent the original stand type (e.g. if the stand type was deciduous then deciduous left, If conifer then conifer left).
- 3% unmerchantable landbase in interior patches is the maximum applicable, although more is acceptable. Where 3% unmerchantable area is not available, the remaining deficiency will be made up with merchantable area.

Table 1: Retention.

Scenario	Merchantable	Unmerchantable (maximum 3%)	Total
Enough Unmerchantable	3%	3%	6%
Enough Unmerchantable	3%	12%	6%
Not Enough Unmerchantable	5%	1%	6%

The assignment of a retention patch to either of the categories (merchantable or unmerchantable) above will be determined by the field call, not the AVI polygon. The field call for the merchantable retention will choose between nine species groups (please refer to table 3 and below). This field call is the most subjective part of the strategy. To calibrate and verify this subjective call, it will be made by the company's R.F.P. on site and listed on the block inspection form that is submitted to ASRD. The Forest Officer can then verify the call. If disputes arise, a field cruise will be completed to verify and calibrate the calls. This cruise will use the number of merchantable stems only.

- SW-CD-P6 >80% conifer, with less than 50% of the conifer being pine
- PL-BCD-P6 >80% conifer, with greater than 50% of the conifer being pine
- SW-CD-P9 >80% conifer, with less than 50% of the conifer being pine
- PL-BCD-P6 >80% conifer, with greater than 50% of the conifer being pine
- CD-BCD-COMB > or equal to 50% conifer
- DC-BCD-COMB <50% conifer
- D-CD-COMB <20% conifer
- DU-BCD-COMB <20% conifer in the overstorey and greater than 250 stems per hectare of understorey spruce (merchantable or unmerchantable) which is more than 3 metres below the aspen canopy with a crown closure of BCD. The crown closure class will be estimated to AVI standards.
- DU-A-COMB <20% conifer in the overstorey and greater than 250 stems per hectare of understorey spruce (merchantable or unmerchantable) which is more than 3 metres below the aspen canopy with a crown closure of A. The crown closure class will be estimated to AVI standards.

The 6% retention level is lower than most studies identified. The reason is that this is only the stand level target, not the landscape level target. The ecological function of unburned patches assumes a large area around the patches is burned. The FMA will not have maximum block sizes that approach the size of larger fires (see the FMP Forest Landscape Metrics for natural disturbance information), therefore the managed landscape will have other areas of mature timber in the vicinity, such as areas that are Operating Ground Rule deletions which contribute to the landscape retention and therefore will not contribute to the stand level structural retention.

The targets will be measured and reported at the compartment level (see FMP Landbase Netdown for compartments), as well as by the FMA total.

MERCHANTABLE TIMBER RETENTION.

Retained areas such as “non-ground rule” buffers and steep zones with merchantable stands that contribute to the net landbase can be used in this calculation. The targets, by patch size, are shown in Table 2. These numbers are minimums.

Table 2: Annual contributing landbase retention targets.

	Distribution of structure retention for merchantable and unmerchantable stands			
Block size range (ha)	**< 0.4 ha (patches and individuals)**	**0.4 to 1.0 ha**	**1.1 to 9.9 ha**	**10 ha or greater**
<5.0	0	0	0	0
5.0 to 9.9	1 assortment of patches and individuals/5 ha.	0	0	0
10.0 to 59.9	1 assortment of patches and individuals/5 ha.	1 patch per 50 ha	1 patch per 300 ha	0
>60	1 assortment of patches and individuals/5 ha.	1 patch per 150 ha	1 patch per 700 ha	1 patch per 700 ha

This breakdown was tested against two past years of MDFP cutovers. The blocks and block groups were real numbers, but the retention patches were created using Table 2. The resulting retention was 3.14% for Non merchantable and 4.08% for merchantable retention. Had non merchantable retention been lower than 3%, merchantable retention would have to be used to compensate.

Small merchantable patches (< 0.4 ha.) and scattered individual stems will have the trees counted (estimated tree count in larger patches), post harvest. To derive % area, a hectare will be considered to have 500 trees. (Total stems retained divided by 500 will provide an area). The number of patches would be rounded off to the nearest patch. i.e. a group of blocks requiring 2.4 patches would have 2 patches, while a number of 2.6 would mean 3 patches.

Larger patches (≥ 0.4 ha.) will be GPS’d for an area. This may be pre-harvest where the areas are ribboned out, or post harvest for other areas that are delineated and left during harvest. These areas must have harvesting along the entire boundary before being counted as a retention patch (retention cannot be joined to a stand outside the block boundary).

The volume left standing in this process is meant to be long term retention and therefore the volume is chargeable against our Annual Allowable Cut.

UNMERCHANTABLE TIMBER RETENTION:

This portion is more difficult to plan for. Their existence in a cutover cannot be ensured by operations. The target of 3% of the block group area is a maximum un-merchantable area that can be utilized in the calculation of the 6% total retention. If we cannot achieve the 3% target, the difference will be made up of merchantable retention. Retention areas such as non-ground rule buffers, steep zones that do not contain merchantable wood and young/immature areas can be used in this calculation. These areas would have to be within the harvested block boundary to contribute.

PLANNING PROCESS

When preparing operational plans, the first step would be to get an approximation of the blocks to be laid out and arrange them into the block group sizes. An initial prescription of retention patch sizes, distribution and species makeup would be provided to the layout crew. Next, the initial layout and GPS work would be completed. The existing deletions (these are areas within a block that get removed for on the ground operability features such as localized slopes, unique finds, unmerchantable patch not captured by AVI, immature patches etc., **that are not ground rule required deletions**) laid out by the field crew would be calculated to get an initial area retained for both the merchantable and non-merchantable areas. Groups of block sizes that do not have sufficient merchantable area would have additional retention area added that is a representation of the original stand. If the area set aside is greater than 3%, the unmerchantable area would only be required up to the 6%. If the merchantable and non-merchantable area were less than 6%, more merchantable area would be added.

Larger patches would have to be laid out and GPS'd prior to harvesting. These would be identified in the Annual Operating Plan (AOP). If the shortage of area post layout was due to insufficient small patches, these could be created during harvesting. The contractor would be informed of the number, size and species composition of the patches that he would have to locate and leave standing in certain prescribed cutovers. If there was any discomfort on the part of the contractor, the timber company would ensure that the patches were located pre-harvest.

REPORTING AND RECONCILIATION

The post harvest reporting would list the actual blocks harvested, area of retention by cutover size group, retention patch size group and species group (refer to table 3). This will be a subjective field call made by the timber company staff, that can be checked by the inspecting forest officer.

It is quite likely that changes in the actual blocks harvested, operational changes and other items will lead to a situation where the planned retention is either higher or lower than the targets. These could be of four kinds.

- Sufficient total retention, but insufficient area in a retention patch size group.
- Sufficient total retention, but insufficient area in the conifer/deciduous percentage.
- Insufficient retention overall, with one or both of the two above.
- Sufficient retention overall but the wrong retention patch size distribution

These shortfalls would be noted in the Annual Stewardship Report, along with a commitment to increase the amount required in the following year to ensure that the retention target is met on the landscape. A five-year rolling total over the years would be used to ensure the targets are met and the results, and mitigation measures are discussed in the five year stewardship report.

Table 3: Retention Strata and Volumes

Stratum	Conifer m^3/ha	Deciduous m^3/ha	Age
SW-CD-P6	188.7	56.5	120
PL-BCD-P6	168.8	17.8	100
SW-CD-P6	250.4	52.1	120
PL-BCD-P9	150.9	18.1	100
CD-BCD-COMB	231.6	80.5	120
DC-BCD-COMB	118.0	143.0	120
D-CD-COMB	23.2	165.9	100
DU-A-COMB	59.6	183.8	100
DU-BCD-COMB	151.2	139.7	100

AAC DRAIN METHODOLOGY

The reporting described above, is to reconcile the area of structural retention left from the operations with the target in the strategy. That reporting alone does not provide any volume information. The trees that are retained would have formed a part of the Annual Allowable Cut for the FMP. Therefore, if this wood is not harvested and utilized, it needs to be accounted for as drain on the harvest level. The following is the proposed method to calculate the volume left standing.

The timber companies' Stewardship Report and reconciliation mentioned above will have a summary of individual trees, the number of patches, area retained, by block and by merchantable/non-merchantable status and species group (Table 3). The volume drain will be determined using the reported retention area and applying a volume per hectare for standing volume, by the broad species group. The volume per hectare will be derived from the Growth and Yield program for the associated C and D density yield curves at an age of 120 for spruce and mixed wood curves, 100 for pine and deciduous curves. These volumes are provided in Table 3.

The example table shows this calculation and the volumes derived. The volumes would then be provided to the appropriate individuals with Alberta for inclusion within TPRS. There would be not timber dues payable on this volume, but it would be considered as lost volume.

DEFINITIONS

- **< 0.4ha merchantable tree retention**: The <0.4ha tree retention has 2 categories 1) individual tree retention and 2) patches (2 or more trees) <0.4ha. These trees retained will meet the same size criteria for the operations and can be either live or dead. That is a tree that has a fifteen centimeter butt diameter, inside bark, and an eleven centimeter top diameter, inside bark, that is at least 2.6 meters long. These are non-ground rule deletions.

- **≥ 0.4ha Merchantable retention**: These are patches of trees that would otherwise have been harvested. These may be of any species or species combination, including black spruce. These will have at least 50% of the stems that meet the criteria of a merchantable tree retention above, and have a merchantable volume of 50 cubic metres per hectare or greater. These are non-ground rule deletions.

- **Un-merchantable retention**: Any area within a block that has not been harvested or traveled by any equipment that is at least 0.2 hectares, but does not meet the definition for merchantable retention listed above and includes both unmerchantable and merchantable non-contributing landbase.

- **Broad species group:** The retention trees and patches will require a classification into one of nine broad species groups. This will allow a calculation of, firstly, whether the retention consisted of all timber types, and secondly, an AAC volume reduction.

REFERENCES

Andison, D. W. 2003. Patch and event sizes on foothills and mountain landscapes of Alberta. Alberta Foothills Disturbance Ecology Research Series Report No. 4. Foothills Model Forest. 54 pp.

Smyth, C., J. Schieck, S. Boutin and S. Wasel. 2005. Influence of stand size on pattern of live trees in mixedwood landscapes following wildfire. For. Chronicle Vol. 81(1) 125-132.

APPENDIX A: INTERPRETATION OF THE EXAMPLE TABLES

This proposal is a little complicated. To demonstrate how it would work, the following is an example using MDFP blocks with retention and tables showing how this information would be summarized and used for reporting and reconciliation. An actual list of cutovers from the 04/05 harvest year was used, with fictitious retention. The following steps would be followed in the process:

Step 1. Use the Spatial Harvest Sequence to develop a Final Harvest Plan (FHP).

Step 2. During layout for the FHP, the layout crew would layout and GPS the block boundary and any obvious retention. These would be un-merchantable areas, non-ground rule buffers etc.

Step 3. A summary of the blocks laid out, retention (merch and non-merch) Table 4 would be assembled and compared against the targets in Table 2 of the strategy and against the wildlife objectives of line of sight and thermal cover.

Step 4. Additional retention areas to be retained would be designed and crews sent out to ribbon those areas. These new areas would be added to the spreadsheet developed in Step 3. This new retention would be compared to the targets again. Step 4 would be repeated until sufficient retention by broad cover group, block size and retention patch size were achieved.

Step 5. Operations would occur and the timber companies operations report would detail the retention by block for the retention trees/patches that were actually achieved. Some re-GPS'ing of some retention patches might be required.

Step 6. Once operations were complete for the winter, the block level reports would be summarized on a spreadsheet. Table 3 is an example of what this summary report would look like. This was created using blocks from 2004/05 (the first three columns), but the actual retention numbers were created for this exercise. These retention numbers would be from the field inspection reports.

The table shows the block list sorted by block area in column 3, as per the area classes provided in Table 2 of the Strategy. The retention (fictional in this case) would show the actual amount of retention achieved per grouping. For example, in the group of blocks less than 5 hectares, there are nine blocks with a total area of 23.8 hectares. While this block size does not require any retention, we can see that in this fictional case we did achieve four assortments in the 1 to 200 tree range and one in the 0.4 to 1.0 ha. patch size. This would be considered an over-achievement, and could be used to meet the overall annual target at the bottom of the table.

Step 7. Now that the blocks have been harvested and the retention is reported, the reconciliation begins. Tables 5, 6 and 7 show the reconciliation process for that fictitious year.

Table 5 produces the AAC deductibility and the broad species group retained (the volumes per hectare are fictitious while we develop actual numbers).

- The volume chargeable would be 8502 cubic metres of conifer and 6128 cubic metres of deciduous.

Table 4: MDFP 2004/05 harvest (example of what report would look like)

		Block		Actual merchantable patches and area achieved												Unmerchantable	
				0 - 100 trees				.2 to 1.0 ha.			1.1 to 9.9 ha.			10+ ha.			
	Comp.	Number	Area	Trees	Patches	Area	Broad Species Group	Patches	Area	Broad Species Group	Patches	Area	Broad Species Group	Patches	Area	Broad Species Group	Patches	Area
Blocks <5 ha.	WC4	358	0.4															
	WC3	3104	1.2															
	WC4	357	1.6															
	WC3	3066	2.2															
	WC3	3067	2.3															
	WC4	355	3.1															
	WC4	352	4.0															
	WC4	315	4.5	10	1	0.02	D											
	WC4	356	4.5	50	1	0.1	D	1	0.4	CD								
				10	2	0.02	Sw											
	9 blocks		23.8	70	4	0.14		1	0.4									
Blocks 5 to 9.9 ha.	WC3	3055	5.7	80	2	0.16	D											
				60	1	0.12	Sw											
	WC4	359	6.3	90	1	0.18	D										1	1.5
				20	1	0.04	Pl											
	WC4	360	6.3	15	1	0.03	Sw											
				25	2	0.05	D	1	0.3	D/u								
				150	2	0.3	Pl											
	WC3	3059	6.6	0	0	0												
	WC4	132	6.7	70	1	0.14	D											
				180	3	0.36	Sw											
				20	1	0.04	Pl											
	WC3	3058	7.9	135	2	0.27	D											
				55	1	0.11	SW											
	WC3	3068	7.9	140	2	0.28	D											
	WC4	361	8.3	80	1	0.16	SW											
	WC4	318	9.0	25	1	0.05	D										1	0.5
				60	1	0.12	Sw											
	9 blocks		46.4	1205.0	13	2.41		1	0.3								2	2.0

	Block			Actual merchantable patches and area achieved												Unmerchantable	
				0 - 100 trees				.2 to 1.0 ha.			1.1 to 9.9 ha.			10+ ha.				
	Comp.	Number	Area	Trees	Patches	Area	Broad Species Group	Patches	Area	Broad Species Group	Patches	Area	Broad Species Group	Patches	Area	Broad Species Group	Patches	Area
Blocks 10 to 59.9 ha.	WC3	3056	10.6	25	15	0.05	SW											
				150	2	0.30	DC											
	WC3	3057	12.4	15	1	0.03	SW											
				300	15	0.60	Du											
				75	2	0.15	CD											
	WC3	3065	13.1	0	0	0.00												
	WC4	306	13.9	400	10	0.80	DC											
	WC3	3060	14.1	125	2	0.25	Du											
	WC4	362	14.7	30	1	0.06	CD											
	WC4	307	15.3	125	2	0.25	DC											
	WC4	363	16.4	400	10	0.80	SW											
				2	2	0.00	D											
	WC3	3054	16.9	0	0	0.00												
	WC4	351	16.9	0	0	0.00											1	2.5
	WC4	343	17.9	0	0	0.00												
	WC4	344	19.3	25	3	0.05	CD											
				65	1	0.13	SW											
	WC4	130	22.4	5	2	0.01	D											
	WC4	340	22.6	28	1	0.06	SW											
	WC4	120	32.1	300	6	0.60	D/u											
	WC4	321n	35.0	10	2	0.02	D	1	0.4	CD								
	WC4	319	44.8	0	0	0.00		1	0.7	CD								
	WC4	317	46.0	0	0	0.00		3	1.2	PL							1	7.2
	WC4	316N	47.0	500	6	1.00	D	2	1.5	DC	1	3	CD					
	WC4	304	50.2	60	2	0.12	SW	1	0.7	D								
	WC4	305	52.2	700	10	1.40	DC	2	0.8	D/U	1	7	D/u					
				300	10	0.60	CD											
	21 blocks		533.8	3640	105	7.28		10	5.3		2	10					2	9.7
Blocks >60 ha.	WC4	334	73.4	80	4	0.16	CD											
	WC4	316S	74.4	350	6	0.7	CD											
	WC4	321s	76.4	800	15	1.6	SW											
				200	5	0.4	D											
	WC3	3103	78.1		0	0		1	0.4	D								
	WC4	336E	93.4		0	0		1	0.8	D/U								
	WC4	345	103.0	20	2	0.04	D	1	0.3	PL				1	15.0	CD	2	23.2
	WC4	322	124.1	240	6	0.48	D/u	1	0.5	CD	1	3.0	CD					
	WC4	119	125.0		0	0		1	0.9	DC				1	10.0	PL		
	WC4	336W	150.0		0	0		1	0.6	D	1	7.0	D/u					
	WC4	316	169.5		0	0		1	0.5	SW							1	17.5
	10 blocks		1067.3	1690	38	3.38		7	4.0		2	10.0		2	25		3	40.7
TOTAL			**1671.4**	**6605**	**160**	**13.21**		**19**	**10.0**		**4**	**20.0**		**2**	**25.0**		**7**	**52.4**

- The area of conifer versus deciduous dominated area retained is 4.21+11.9+24.72= 40.83 hectares, or 59.8%. The deciduous was under achieved. The action plan for the next year would be to have more deciduous dominated retention. When the five year quadrant was finished, the stewardship report would report the five year achievements.

Table 5: AAC deductibility calculation (volume per ha. for demo only)

C or D	Patch Strata	Area	Conifer Volume /ha.	Conifer Volume	Decid. Volume /ha.	Decid. Volume
Conif	SW	4.21	250	1051.5	20	84.12
	PL	11.9	200	2376	10	118.8
	CD	24.72	150	3708	50	1236
Decid	DC	5.15	75	386.25	150	772.5
	D	4.42	20	88.48	180	796.32
	D/u	17.83	50	891.5	175	3120.25
	Total	68.21		8502		6127.99

Conifer volume to be deducted form AAC is 8502 m3 for 2004/05
Deciduous volume to be deducted form AAC is 6128 m3 for 2004/05

Table 6 shows the merchantable and non-merchantable retention split. It shows that the example over achieved on the targets for merchantable (4.1%) and non-merchantable retention (3.1%) as well as the total retention of 7.2%. The numbers would be tracked on a rolling five year basis. Under achievements would require an action plan (lifting or targets) for the following year.

Table 6: Merchantable and non-merchantable retention summary table

Year	Total Area	Merch Retention Area	Merch Retention %	Non-Merch Retention Area	Non-Merch Retention %	Total Retention Area	Total Retention %
2004/05	1671.4	68.2	4.08%	52.4	3.14%	120.6	7.22%
2005/06							
2006/07							
2007/08							
2008/09							
Total Actual	1671.4	68.21	4.08%	52.4	3.14%	120.61	7.22%
Target			3.00%		3.00%		6.00%

Table 7 shows the retention broken down into the retention patch size groups. This table is to ensure that the targets set up in Table 2 are met. Most targets are met, with the exception of the number of individual trees and small retention in the 10 to 59.9 ha. group. These are highlighted. The action plan for 2005/06 would be to have an increased target for retention in these two groups. The reconciliation the following year should show that the overall targets are met

Step 8. The Action plan developed from the tables would state:

There needs to be three extra retention patches in the 10 to 59.9 hectare block grouping. Two patches of less than .4 ha and one of 0.4 to 1.0 hectares.

Step 9. The next years layout and AOP would have to implement the action plan listed in Step 8. The overall reporting in the subsequent years would show whether the action plans are implemented.

Table 7: Merch retention by retention patch size in blocks 5 to 9.9 ha.

Year	Total Area	<0.4 ha. tree patches			0.4 to 1.0 ha. patches			Total		
		Patches	Hectare	%	Patches	Hectare	%	Patches	Hectare	%
2004/05	46.4	13	2.41	0.14%	1	0.3	0.65%	14	2.71	0.16%
2005/06										
2006/07										
2007/08										
2008/09										
Total	46.4	13	2.41	0.14%	1	0.3	0.65%	14	2.71	0.16%
Target		9			0			9		0.15%

Merch retention by retention patch size in blocks 10 to 59.9 ha.

Year	Total Area	<0.4 ha. tree patches			0.4 to 1.0 ha. patches			1.1 to 9.9 ha. patches			Total		
		Patches	Hectare	%	Patches	Hectare	%	Patches	Hectare	%	Patches	Hectare	%
2004/05	533.8	105	7.28	0.44%	10	5.3	0.32%	2	10	0.60%	117	22.58	1.35%
2005/06													
2006/07													
2007/08													
2008/09													
Total	533.8	105			10			2			117	22.58	1.35%
Target		107			11			2					8.50%

Merch retention by retention patch size in blocks 60 ha. and greater

Year	Total Area	<0.4 ha. tree patches			0.4 to 1.0 ha. patches			1.1 to 9.9 ha. patches			10 ha. and over patches			Total		
		Patches	Hectare	%	Patches	Hectare	%	Patches	Hectare	%	Patches	Hectare	%	Patches	Hectare	%
2004/05	1067.3	38	3.4	0.20%	7	4.0	0.24%	2	10.0	0.60%	2	25	1.50%	49	42.4	2.54%
2005/06																
2006/07																
2007/08																
2008/09																
Total	1067.3	38	3.4	0.20%	7	4	0.24%	2	10	0.60%	2	25	1.50%	49	42.38	2.54%
Target		36			7			2			2					2.00%

Appendix V Green-up Strategy

FMA 0200041

GREEN-UP STRATEGY

HISTORY

In Alberta, a two-pass alternate clearcut harvest system was adopted in 1966 to ensure harvested areas were interspersed with areas with mature or regenerating forest. The system was initiated to curtail progressive clearcutting which had occurred in some areas of the Province prior to 1966. Under the two-pass alternate clearcut system, only 50% of the merchantable area within a timber planning area can be harvested at one time, unless conditions such as insects, disease or windthrow were a consideration. The remaining 50% of the merchantable area can be harvested after a period of 20 to 25 years, or whenever the adjacent regeneration reached a height of two or three metres. The rationale for implementing this system is not well documented, however, the system was meant to:

1. Ensure that not all old timber age classes were harvested at one time.

2. Ensure that the average cutover size was not too large.

3. Enable natural seeding of spruce by ensuring cutovers were less than five tree heights in width.

4. Allow for hydrological recovery of the harvested areas prior to harvesting adjacent area.

5. Ensure that the wildlife had hiding and thermal cover prior to harvesting adjacent areas.

Although these reasons are, to some extent, still valid, current understanding of boreal ecology has progressed and it is now clear that there are some obvious shortcomings with the two-pass system as it was implemented. Some of these shortcomings include:

- fragmentation of larger stands of mature timber (i.e., creation of a forested landscape that is a mosaic of small harvest blocks and reserves)

- the creation of many linear boundaries on the landscape (for ease of implementation of the two-pass system, the harvest areas were often laid out in a checkerboard pattern)

- increased access development associated with reduced harvest intensity and subsequent re-entry to most areas

- loss of merchantable timber to windthrow along reserve boundaries

- application of a single system across all natural subregions without consideration of ecological conditions or other resource values.

Advances in timber supply modeling, along with an increased knowledge of the ecological impacts of forest management practices, provides the opportunity to move beyond a universal two-pass system with a fixed green-up period. Development of the spatial harvest sequence allows forest managers to choose a future forest state that achieves the benefits of the alternate two-pass system while reducing the negative impacts.

STRATEGY

Alberta's Forest Management Planning Standard requires application of appropriate green-up constraints within the TSA. However, the current Standard allows the green-up constraint to be altered as long as the requirements in Standard 5.9.5, Annex 1 of the Standard have been addressed. This provides the Company with the option of achieving the goals associated with the original application of the green-up constraint (via the alternate two-pass harvest system), using the TSA and a Spatial Harvest Sequence (SHS) to ensure the goals are met. Using the SHS to achieve the goals typically associated with implementation of green-up constraints provides the opportunity to reduce some of the negative impacts associated with the two-pass system.

The following provides additional detail regarding how each of the original intentions of the green-up constraint are addressed within the TSA and SHS.

1. Ensure that not all old timber age classes are harvested at one time.

The TSA and SHS incorporated several Values, Objectives, Indicators and Targets (VOIT's) related to maintenance of biodiversity across the FMA over the planning horizon. In particular, Objective 1.1.1.1 requires the Company "Maintain biodiversity by retaining the full range of cover types and seral stages". The Indicators and Targets for Objective 1.1.1.1 were selected to emulate natural disturbances. Achievement of the Targets associated with Objective 1.1.1.1 will ensure that older age classes are maintained across the landscape.

2. Ensure that the average cutover size is not too large.

Historically, there was a concern about harvest blocks being too large. This concern was driven by aesthetic and wildlife concerns that dominated at that time. More recently, an increased understanding of boreal ecology has led to a shift in the types of forest landscapes that are considered desirable. ***Emphasis in the current Forest Management Planning Standard is now on emulating natural disturbance patterns by creating a variety of patch sizes, including larger patches.***

Maintenance of a range of patch sizes, including large patches, is addressed in FMP Objective 1.1.1.2 which require the Company "Maintain biodiversity by avoiding landscape fragmentation". The Indicators and Targets for Objective 1.1.1.2 were selected by the FMP Core Team to emulate natural disturbance patterns within the FMA Area.

Achievement of the Targets associate with Objective 1.1.1.2 (via implementation of the SHS), coupled with a maximum block size of 500 hectares, will ensure that harvest blocks are consistent with natural disturbance patterns and limit fragmentation without becoming unacceptably large (from a stakeholder perspective).

3. Enable natural seeding of spruce by ensuring cutovers are less than five tree heights in width.

Reliance on natural regeneration for spruce regeneration was a common practice in the past. Controlling the size of the harvest block helped ensure natural seed from adjacent mature timber was available to seed the entire block. New regeneration practices and standards have virtually eliminated the practice of leaving spruce areas to reforest via adjacent seed; planting of spruce is now extremely widespread.

The Reforestation Strategy for FMA 0200041 indicates that a significant amount of planting will be utilized, eliminating the need to limit the size of spruce harvest blocks as a means of ensuring adequate reforestation.

4. Allow for hydrological recovery of the harvested areas prior to harvesting adjacent area

Removal of the trees from forested areas reduces transpiration (although shrub and other vegetation continue transpiration). This results in a rise in the local water table and an increase in stream flow. The two pass system attempted to minimize this impact by only allowing 50% of an area to be harvested until the previously harvested blocks were able recover their transpiration rates (i.e., through the re-establishment and growth of tree species).

Increased water flows associated with harvesting is a concern, especially where the streams flow to populated areas. Water yield modeling is a requirement addressed in Objective 3.2.1.1. Results of the hydrologic modeling for the TSA and SHS were evaluated as part of the Preferred Forest Management Strategy development process, as described in the FMP 'Timber Supply Analysis' and found to be acceptable by the Core Team.

5. Ensure that the wildlife had hiding and thermal cover prior to harvesting adjacent areas.

Provision of hiding and thermal cover is related to covertype, seral stage and patch size distribution (see item 2, above), with the inclusion of a temporal constraint. Green-up constraints required that the previous cutovers could provide suitable wildlife (usually moose) habitat before the second pass blocks were removed. Objectives 1.1.1.1 and 1.1.1.2 address landscape biodiversity required for coarse filter management by ensuring the distribution of covertypes and seral stages across the landscape over time is related to historic patterns. The Operating Ground Rules and the FMP Structural Retention Strategy address thermal cover and hiding cover within larger openings (e.g., two cutblocks that share boundaries are considered one opening if they are harvested within 20 years of each other). These measures ensure provision of hiding and thermal cover without requiring a specific green up constraint.

FOREST MANAGEMENT PLANNING STANDARD REQUIREMENTS

The current Alberta Forest Management Planning Standard indicates that the green-up constraint may be altered as long as the result is acceptable to Alberta and the requirements in Standard 5.9.5, Annex 1 of the ASRD Planning Standard have been addressed. These requirements are:

- The opening size predicted for the first two 20-year periods falls within the natural range of variability.

- The distribution of proposed harvesting is generally acceptable to stakeholders.
- A biodiversity analysis acceptable to Alberta has been completed.

OPENING SIZE AND NATURAL RANGE OF VARIABILITY

Forest cover and forest fire data was used to characterize natural disturbance patterns within the FMA Area, as described in the FMP 'Forest Landscape Metrics'. The Inventory and fire data shows a range of disturbance patch sizes exist on the FMA Area, with numerous very small patches and fewer very large patches.

Maintenance of a range of patch sizes, including large patches, is addressed specifically in FMP Objective 1.1.1.2. The Indicators and Targets for Objective 1.1.1.2 were selected by the FMP Core Team to emulate natural disturbance patterns within the FMA Area. Selection of the Target for patch sizes, as part of the development of the Preferred Forest Management Scenario (see FMP 'Timber Supply Analysis'). The Core Team reasoned that numerous very small patches already existed on the landscape and would continue to be created because of anthropogenic activities (e.g., oil and gas). It also concluded that creation of extremely large patches (e.g., thousands of hectares), would not be acceptable to the public. The Core Team elected to force the creation of significant patches within the 61-200 hectare size class within the TSA and SHS model.

DISTRIBUTION OF PROPOSED HARVESTING

To maintain an appropriate patch size distribution, the Core Team, representing Provincial and industry stakeholders, elected to force the TSA and SHS model to create significant patches within the 61-200 hectare size class. Patch size distribution was part of the output generated for each of the TSA and SHS model runs (see FMP 'Timber Supply Analysis'), providing the Core Team with the information needed to evaluate model alternatives with respect to Patch size distribution.

Public stakeholders were provided with the opportunity to review the TSA and SHS as part of the FMP public review process (see FMP 'Introduction and FMP Development'). The proposed harvest distribution did not raise concerns amongst the stakeholders.

The SHS, including the resulting Patch size distribution, developed for the Preferred Forest Management Scenario was accepted by the Core Team. The resulting Patch size distribution for each of the first two 20 year periods is provided below:

P6 - Disturbance patch sizes, by strata (Active Landbase).

Year	Disturbance	Area (ha) by Stratum					Total (ha)
		D	MX	PL	SB	SW	
0	0-7	140	219	34	1	403	797
	8-60	1,672	1,622	488	14	2,200	5,996
	61-200	831	848	27	10	1,581	3,298
	201+	379	131	0	0	279	789
Total		3,022	2,820	548	25	4,464	10,880
20	0-7	498	244	385	2	793	1,921
	8-60	1,398	2,302	1,290	48	3,082	8,120
	61-200	2,092	10,725	1,753	311	10,197	25,078
	201+	2,571	5,752	553	20	2,203	11,099
Total		6,558	19,024	3,981	381	16,275	46,219
40	0-7	35	595	111	22	600	1,365
	8-60	160	2,694	291	120	1,738	5,004
	61-200	550	11,034	198	486	5,867	18,135
	201+	0	1,018	0	29	330	1,376
Total		745	15,341	600	657	8,535	25,880

P9 - Disturbance patch sizes, by strata (Active Landbase).

Year	Disturbance	Area (ha) by Stratum					Total (ha)
		D	MX	PL	SB	SW	
0	0-7	0	12	0	0	0	12
	8-60	0	11	0	0	0	11
	61-200	0	0	0	0	0	0
	201+	0	0	0	0	0	0
Total		0	24	0	0	0	24
20	0-7	0	31	67	0	0	98
	8-60	270	295	217	0	9	793
	61-200	1,171	568	139	0	50	1,928
	201+	3,618	470	585	0	0	4,673
Total		5,060	1,365	1,008	0	59	7,491
40	0-7	71	51	303	22	229	677
	8-60	775	638	320	13	624	2,369
	61-200	7,870	3,280	3,851	275	2,786	18,062
	201+	1,761	915	40	0	50	2,766
Total		10,478	4,885	4,513	311	3,688	23,874

FMA - Disturbance patch sizes, by strata (Active Landbase).

Year	Disturbance	Area (ha) by Stratum					Total (ha)
		D	MX	PL	SB	SW	
0	0-7	140	231	34	1	403	809
	8-60	1,672	1,633	488	14	2,200	6,007
	61-200	831	848	27	10	1,581	3,298
	201+	379	131	0	0	279	789
Total		3,022	2,844	548	25	4,464	10,904
20	0-7	498	275	451	2	793	2,019
	8-60	1,668	2,597	1,507	48	3,092	8,912
	61-200	3,263	11,293	1,892	311	10,247	27,006
	201+	6,189	6,223	1,138	20	2,203	15,772
Total		11,618	20,389	4,989	381	16,334	53,710
40	0-7	106	647	414	45	829	2,042
	8-60	936	3,332	611	133	2,361	7,373
	61-200	8,420	14,315	4,048	761	8,653	36,197
	201+	1,761	1,933	40	29	380	4,142
Total		11,223	20,226	5,114	968	12,224	49,754

BIODIVERSITY ANALYSIS

Biodiversity objectives, at landscape and local/stand levels, are incorporated in the FMP for FMA 0200041. Various analyses were used to establish Targets for most of these biodiversity-related objectives. These included:

Retention of full range of covertypes and full range of seral stages (Objective 1.1.1.1) – Existing covertypes and seral stages were documented, using AVI for the FMA Area (see FMP Landscape Assessment). Seral stage output was generated for each of the TSA and SHS model runs, providing the Core Team with the information needed to evaluate model alternatives with respect to seral stage . Seral stage/covertype retention targets for the Preferred Forest Management Scenario are documented in FMP Values, Objectives, Indicators and Targets, Objective 1.1.1.1).

Avoidance of landscape fragmentation (Objective 1.1.1.2) – Existing Patch size distribution and area of Old Interior Forest were documented, using AVI for the FMA Area (see FMP Landscape Assessment). Patch size distribution and area of Old Interior Forest were part of the output generated for each of the TSA and SHS model runs (see FMP 'Timber Supply Analysis'), providing the Core Team with the information needed to evaluate model alternatives with respect to Patch size distribution. Patch size and Old Interior Forest targets for the Preferred Forest Management Scenario are documented in FMP Values, Objectives, Indicators and Targets, Objective 1.1.1.2).

Minimize access (Objective 1.1.1.3) – FMA land use data was summarized to provide statistics regarding forestry-related road densities. Targets for density/road length are documented in FMP Values, Objectives, Indicators and Targets, Objective 1.1.1.3).

Maintenance of uncommon plant communities (Objective 1.1.1.4) – Uncommon plant communities within the FMA area were identified in consultation with Alberta Natural Heritage Information Centre. Targets for retention of these communities are documented in FMP Values, Objectives, Indicators and Targets, Objective 1.1.1.4).

Retention of residual structure within harvest areas (Objective 1.1.2.1). Based on published studies and MDFP experience, a strategy for Structural Retention was developed (see 'FMP Implementation').

Maintenance of habitat for high value species (Objective 1.2.1.1). Area of suitable woodland caribou habitat within the FMA area was identified using AVI for the FMA Area. Maps showing suitable habitat were generated at 0, 10 and 50 years as part of the TSA and SHS model runs, providing the Core Team with the information needed to evaluate model alternatives with respect to woodland caribou habitat. The FMA Woodland Caribou Habitat Strategy (see 'FMP Implementation') summarizes the work undertaken by the Core Team to incorporated caribou habitat concerns into the FMP.

SUMMARY

The TSA for FMA 0200041 will not include specific green-up constraints. The Spatial Harvest Sequence, which was developed to meet landscape biodiversity Objectives, combined with the FMA Ground Rules and other FMP strategies such as Structural Retention and Reforestation

Strategies successfully achieve the results that were the impetus behind Provincial implementation the two-pass with green-up system.

Appendix VI Reforestation Strategy

FMA 0200041

REFORESTATION STRATEGY

The reforestation objectives of both Manning Diversified Forest Products Ltd. (MDFP) and Daishowa Marubeni International Ltd. (DMI) are two fold. The first objective is to ensure that the cutovers continue to grow as per the assumptions in the Timber Supply Analysis (TSA) of the Forest Management Plan (FMP) as these are used to determine the harvest levels. Sustainability will be achieved if the actual growth of the stands meets the yield expectations of the management plan. The second objective is to ensure that the legislated requirements are met as per the Forests Act, the Timber Management Regulations and the Forest Management Agreement.

This management plan divides MDFP's Forest Management Agreement Area (FMA) into coniferous land base and deciduous land base. MDFP will harvest and reforest the coniferous land base and DMI will harvest and reforest the deciduous land base. (The exception to this rule is in the D/u(a) strata, which will be discussed below.) The various strategies listed in the next section will be specific to each company's operations.

The D/u(a) strata is open to harvest by both companies, even though these stands are coniferous land base. In order to increase the stands available to DMI for in-bush chipping and reduce the need to in-bush chip the incidental deciduous within coniferous cutblocks, MDFP has agreed that DMI can harvest approximately 50 % of the D/u(a) stands. These D/u(a) stands consist of a merchantable deciduous overstorey and a coniferous understorey and make up part of the coniferous landbase. All of these stands which are available to DMI within the D/u(a) category will be as generated by the Preferred Forest Management Scenario and as denoted in the Spatial Harvest Sequence. These are to be reforested to the DC standard. The reforestation responsibility for these stands will lie with the company that initially harvests these stands. The stands will be reforested to a DC standard, no matter who cuts them. The success of the D/u(a) strategy (including reforestation to the DC standard and coniferous understorey protection techniques) will be assessed for its continued use in future FMP's.

The companies will use the existing Regeneration Standards until they are replaced by an Alternative Regeneration Standard (ARS). Both companies commit to working with Alberta in establishing an ARS at an appropriate time for Alberta and the parties involved. The intent of the ARS development is to ensure that overall volume commitments to both companies, including incidental volumes, are met. The regeneration monitoring program will be developed as part of the development of the ARS. The timeline and parameters for developing the ARS will be negotiated with Alberta.

The current mixed wood trajectories have both species volumes built into the reforestation standards, therefore maintaining incidental volumes will need to be built into the standard. This is also reflected in the regenerated stand yield curves. Both the pure C and pure D regenerated yield curves have the incidental species included, but the associated existing regeneration standard does not require that the volume be present. Both DMI and MDFP agree that the following list of items will form the basis for maintenance of the incidental volumes:

MDFP will provide for incidental deciduous volume by:

- Creating untreated buffers along block boundaries when completing vegetation management treatments unless they affect the achievement of the desired Free-to-Grow C standard.

- Leaving buffers along ephemeral and intermittent water courses inside block boundaries when completing vegetation management treatments unless they affect the achievement of the desired Free-to-Grow C standard

- Not retreating missed areas and striping from the vegetation management program unless they affect the achievement of the desired Free-to-Grow C standard.

DMI will provide for incidental coniferous volume through:

- Natural ingress over time.

- Protecting understories through avoidance techniques when they harvest their deciduous stands.

- Planting areas of poor deciduous re-growth with coniferous seedlings.

Both companies agree that these tactics will maintain incidental volumes over time. The assumption is that the regenerated yield curves for each species will ensure the incidental volume will be replaced. All harvested secondary species are tracked and historical volumes will be retrieveable. The commitment to developing and implementing an ARS will be the method by which we monitor, adapt and reconcile the results of the tactics. If the results show that the volumes are not maintained, the tactics will be improved. The overall system will be one of continuous improvement.

A small volume of Black Spruce may be harvested. This will come from slivers of merchantable black spruce adjacent to white spruce areas or in transition areas between black spruce and white spruce stands. The spatial harvest sequence estimates the area of these slivers and transition areas to be a total of 61.5 hectares in the first 10 years of harvest. These areas will be re-planted to white spruce.

Section A is MDFP's reforestation strategies, from strategic to operational items. DMI's reforestation strategies are in the **Section B**. **Section C** is the table developed to link the yield curves and trajectories to the strata and the treatments required to get them to a successful completion, as per Annex 1, Appendix C in the Alberta Planning Standard.

MDFP REFORESTATION STRATEGIES

The company has employed several strategies to achieve their reforestation objectives. These include a Seed Strategy (including a Tree Improvement Strategy), a Stand Establishment Strategy, a Vegetation Management Strategy and Record Keeping. While these four strategies are listed separately in this document, the success of the overall program is how they mesh together as part of the larger program. We have used the legs of the table as an analogy. The seed and seedling quality, the site preparation, the planting quality and finally the vegetation

management are all legs of the table. If any one leg is not present, or is even a little wobbly, the table does not stand well. All parts of the program must be done well or the risk of failure is increased.

MDFP Seed Strategy

The objective of this Strategy is for MDFP to have :

- Sufficient supply of unrestricted Stream One seed from all seed zones within the FMA, for white spruce and lodgepole pine reforestation programs.

- Improved stream 2 seed from its Tree Improvement Program to enhance the growth of the reforested stands for both the Region G2 White Spruce and Region J Lodgepole Pine Breeding Regions. The maps of the G2 and J Breeding Regions are located in the Controlled Parentage Plan (CPP) located in 'FMP Implementation' (Appendix VII).

The Standards for Tree Improvement in Alberta (STIA 2005) govern the collection, storage and deployment of forest vegetative material in Alberta. The gathering of seed from natural stands, Stream 1 seed, is the method that MDFP has used in the past. A Tree Improvement Program, Stream 2 seed, was implemented in 1995, with a seed orchard being planted in 2000. That program is scheduled for having sufficient seed to start deployment in approximately 2008. As a partner in G2 and J breeding regions, Alberta has completed the CPP.

Stream 1 Seed

There are four seed zones in the FMA. These are zone DM 1.2, CM 1.3, LBH 1.6 and UBH 1.3.

Zone	White Spruce	Lodgepole Pine
DM 1.2	Need to collect	None required
CM 1.3	Sufficient Inventory	Need to collect
LBH 1.6	Sufficient Inventory	Sufficient Inventory
UBH 1.3	Sufficient Inventory	Sufficient Inventory

There are some zones where the inventory is below the requirement. Those areas have seed inventory from pre-2003 seedlots that were covered by the seed movement rules prior to STIA 2005 and the updated seed zone boundaries. As these older seedlots are depleted, we will ensure that we collect seed from within the new seed zones. The quality of our existing seed is very good with high germination. If a seed collection is planned, it will be stated in our annual Silviculture Plan.

Tree Improvement Program

MDFP implemented a tree improvement program in 1995, with several partners. There are two breeding programs that cover a large portion of the FMA, as well as a lot of area outside the FMA. These are; Breeding Region G2 for white spruce and Breeding Region J for lodgepole pine. The seed orchard is located in Northstar, Alberta, NW32, Township 90, Range 23, west of 5th. These programs will be in compliance with the Standards for Tree Improvement in Alberta (STIA 2005). See the CPP for further information.

Deployment Plan

The improved seed will be deployed in a way that strives to:

- conserve genetic integrity, adaptability, diversity and health of wild and managed populations, while recognizing that genetic change will occur through evolutionary pressure, breeding and deployment.
- maintain or enhance forest productivity
- be consistent with sustainable forest management principles.

Both orchards are planned to be producing deployable seed in approximately 2008. The intent of this plan is to provide the documentation to allow the FMP to incorporate this program using STIA 2005. Several documents are required to meet STIA 2005. One is the Controlled Parentage Plan (STIA 2005, Appendix 18), including a calculation of the effective number of parents in the program. This includes a detailed program description, a deployment plan and a gene conservation plan.

The preferred forest management scenario indicates a minimum of 140 ha. to be planted with improved white spruce seedlings from Region G2 and 190 ha. to be planted with improved lodgepole pine from Region J. MDFP may plant more area than the minimums indicated.

In-Situ Gene Conservation Plan

Section 20.2 of STIA 2005 states the number of in-situ conservation areas required. We will be working with the Alberta Tree Improvement and Seed Centre (ATISC) to develop these areas in the near future. At this time Alberta has not started a regional program in the area covered by MDFP's FMA. Once the regional needs have been identified, MDFP will identify a target for establishment of genetic conservation areas.

Ex-Situ Gene Conservation Plan

The conservation of seed germplasm from wild forest collections is required for tree improvement programs. This conservation is done in cooperation with ATISC. This ex-situ conservation involves:

1. The approval of ATISC to keep some seed from all wild collections.
2. The growing of clones of all trees involved in the Tree Improvement Program in the Provincial clone bank.

The ownership of the germplasm and intellectual property is covered by STIA 2005. The Ex-Situ Gene Conservation Plan is completed in co-operation with ATISC as outlined in the CPP and STIA 2005.

Stand Establishment Strategy

The goal of stand establishment is to get healthy seedlings growing on the cutover sites as soon as possible after harvest. MDFP has established a reputation of having successful reforestation efforts. The success is based on ensuring all parts of the reforestation program meet the quality and timing parameters that we set and monitoring the sites to complete proper intervention before problems develop.

One key to success is information about the sites. MDFP starts with a pre-harvest assessment completed while the block is being delineated in the field. This allows the block layout crew to note the pre-harvest stand condition. An initial prescription and action plan is derived from the site information. A second look post harvest allows for refinement of the initial prescription. The removal of the trees allows for a better perspective on the shape and topography of the block.

Prompt and aggressive stand establishment immediately after logging has proven to be the most effective method of stand establishment. This allows the seedlings an opportunity to get established before competition becomes an issue. The “legs of the table” in stand establishment are site preparation and planting. The planting can be broken down into seedling acquisition, stock quality, shipping, handling, microsite selection, planting quality and finally monitoring and measurement.

Vegetation management is often required prior to passing an establishment survey and is covered in the next section.

Site Preparation

MDFP has shown in several trials that performance of seedlings is increased significantly by completing mechanical site preparation prior to planting. This has held true for white spruce and lodgepole pine on several different site types. MDFP uses winter site preparation, usually the same winter as the harvest of the blocks, to minimize access to the sites and to provide early planting opportunities. The general prescription is to use an excavator mounder on the low sites and a ripper plow on the higher sites. Steep slopes, areas with shallower duff and draws are not site prepared. Site specific changes are made to the general prescription when site factors vary.

Seedling Acquisition and Stock Quality

MDFP has planted a number of different stock types from a variety of nurseries. There have been several research projects in this regard as well. It has become evident that there are differences in seedling performance created from a variety of variables. Therefore, MDFP purchases seedlings and stock types from selected nurseries in both Alberta and British Columbia. MDFP will continue to investigate different nurseries and stock types in an effort to continuously improve the performance of our plantations.

Shipping and Handling

The goal of proper shipping and handling of seedlings is that the time between lifting of the stock and the planting of the same stock is as quick as possible. We do not want the seedlings sitting in covered boxes for any extended period of time. We also do not want the unplanted

seedlings to be exposed to heat or moisture stress. This avoids mould problems as well as shock to the seedlings.

After stock is planted, empty seedling boxes must be buried securely within burn piles for burning (i.e., boxes could not be uncovered by strong winds or wildlife).

Planting Density

The strata transitions and declaration table (see below) shows which strata will be planted and the minimum densities that will be planted. The entire block may not necessarily be planted. Some areas are Left for Natural for deciduous regeneration. The average planting densities will target between 1100 and 1500 seedlings per hectare in the coniferous areas within the blocks, with mounding areas being somewhat lower. These densities reflect the areas that are planted and not necessarily the overall block density as some areas are left for deciduous regeneration.. The target densities were derived using past experience that shows survival in the first five years averages around 90% and consistently achieving the existing regeneration standard. The minimums were provided due to the fact that mounding areas tend to have lower densities, especially in smaller blocks. Planting at the lower densities increases the risk of not meeting the regeneration standards. These low density blocks are monitored closely prior to the establishment survey.

Microsite Selection and Planting Quality

These two items are quite different, yet linked. The planter has the control of both of these items. We choose to have the seedlings planted on higher microsites as much as possible. This has shown to provide the best performance over the longer term, although there is a risk of mortality if very little precipitation occurs in the months after planting. Taking this risk has caused some mortality over the years, but overall has led to some very successful plantations. The planting quality revolves around ensuring the roots are properly placed in the chosen microsite and that the seedling has the ability to grow and perform quickly. In order to ensure high planting quality and proper microsite selection, MDFP generally uses the same planting contractor and also holds a training course for the planting crew prior to the start of each planting contract.

Monitoring and Measurement

Continuous monitoring and measurement of the plantations is required to both identify mortality issues as soon as possible and to provide information on the relative success of individual treatments. This involves both random measurements and structured plots. The random measurements are completed by wandering around the blocks and measuring trees along the way. These measurements provide some information as well as providing the person an overview of the areas. The structured plots provide more statistical numbers of relative performance of the various treatments. In both cases, early detection of problems has allowed prompt re-treatment to take place ensuring successful plantations prior to the legislated surveys. The legislated establishment survey is completed as soon as we feel the blocks will pass, usually in year four. Completing this survey earlier in the allowable time frame provides earlier indications of probable stocking. This allows us to refine the regeneration strata assignment and prescribe appropriate vegetation management treatments.

While all of these activities are important, the quality and coordination of all of the parts determines the ultimate success in stand establishment.

Vegetation Management Strategy

Manning Diversified Forest Products Ltd. objective in vegetation management is to ensure the coniferous growth and yield is sufficient to ensure the long term sustainability of our company for the good of the shareholders, as well as the local community, and Alberta. MDFP must also ensure that we meet our legislated reforestation requirements

There are three sub-objectives: seedling survival (establishment), stand performance of our cutovers and the release of previous conifer cutovers in our operating areas.

MDFP uses five types of vegetation management tools (Aerial broadcast herbicide application, Ground broadcast herbicide application, Basal bark application, Brush saw, and Brush saw with sprout-less application heads. Mechanical treatments have not been used extensively due to their cost and the vegetation control being very short term.

Initial Conifer Survival and Management

MDFP completes an aerial assessment of all blocks from the skid clearance date to three years old for vegetation competition levels. The primary competition in these cutovers is Marsh Reed Grass. The areas of potentially high competition levels are marked on a map. The blocks are then transferred to a list to be ground checked for survival of the seedlings by a walk through. If there are enough seedlings present a herbicide treatment is scheduled for that fall. If there are few seedlings present, the area is assessed for risk of regeneration failure and an action plan for the block is developed. MDFP prefers to treat blocks prior to the mortality of conifer seedlings.

Application of Herbicide

The blocks are scheduled for treatment by MDFP submitting a Herbicide Proposal to Sustainable Resource Development for approval. All blocks scheduled for vegetation control are included in the proposal for herbicide application. The herbicide proposal states in a table format either Aerial or Ground broadcast for application type and the type of herbicide to be utilized (glyphosate or tricolpyr).

Conifer Performance and Management

MDFP completes an aerial assessment of all blocks from six years old to ten years old for vegetation competition levels. The areas of potentially high competition levels are marked on a map. The blocks are transferred to a list to be checked against the declaration tables to ensure the correct percentage of deciduous remains in the block. Regeneration surveys are used to verify the density of competition observed from the aerial assessments along with ground walk through to ensure the areas to be treated have acceptable levels of conifer seedlings.

MDFP will schedule the blocks to be sprayed by either glyphosate or tricolpyr. One of the following application methods depending on the desired results for each specific block will be

used: aerial broadcast, ground broadcast, basal bark and/or brush saw with sprout-less applicators.

MDFP completes an aerial assessment of older blocks from fifteen years old to forty years old for vegetation competition levels. The areas of potentially high competition levels are marked on a map. Ground checks are completed to verify the conifer density is present for release. The moderate to high density areas are aerially treated. The low density conifer areas of blocks are treated with a basal bark application to develop a mixed wood density of conifer and deciduous stems.

MDFP has looked into alternate stand tending ways (sheep and goats) but these are not viable for variety of reasons at this time.

Monitoring

MDFP annually assesses a percentage of all blocks treated from the past two treatment years for quality control of vegetation in the blocks tended. MDFP is continuously improving its stand tending program using the results that have been gathered from past years. There will also be a longer term monitoring program that will be developed with the growth and yield plan and the ARS development.

Records

MDFP uses the Data Inventory of Reforestation Technologies (D.I.R.T.) for silviculture record keeping and as an interface with ARIS. MDFP also keeps a number of project files.

DMI REFORESTATION STRATEGIES (PREPARED BY DMI)

Within FMA 0200041, DMI will harvest the deciduous (D) landbase, and a portion of the deciduous stands with an A-density conifer understory that make up part of the coniferous landbase within the FMA, as generated by the preferred forest management scenario and as denoted in the Spatial Harvest Sequence. DMI will progressively monitor and treat, as required, all lands it harvests to ensure reforestation to the required standard.

Reforestation Strategy on the D-Landbase

DMI reforests stands managed for deciduous production through natural regeneration by suckering - the reforestation strategy called “leave for natural” (LFN). Past success with LFN reforestation supports this strategy, wherein the normal disturbance associated with harvesting operations generally ensures that stands regenerate to sufficient densities and achieve sufficient growth rates to meet or exceed regeneration requirements. DMI’s experience with the LFN strategy, and current published literature regarding natural suckering, have fostered development of harvesting procedures to address the site and operational factors that sometimes impede natural suckering. Disturbed areas, such as the in-block roads, chipper sites, and burn pile locations are reclaimed and treated as required to retain the productivity of the block. Refer to Section C (Strata transitions, treatment decision model and declaration table) for specifics of the silviculture prescription to bring these D landbase stands back to the D standard.

The replacement of incidental conifer equivalent to the volume removed from the deciduous landbase may occur through:

- Natural ingress over time,
- Protecting coniferous understory through avoidance techniques when harvesting deciduous stands, or
- Planting conifer in areas of poor deciduous re-growth in harvested deciduous cutblocks.

There may be opportunities for DMI and MDFP to work collaboratively to meet the incidental conifer replacement objective.

Reforestation Strategy on the D/u(a)-Landbase

When harvesting the D/u(a) stands in the MDFP FMA, DMI will utilize techniques suitable to the individual stand structure to maintain the conifer understory. These techniques may include understory avoidance, understory patch retention or understory protection. An emphasis will be placed on contractor training to ensure best efforts are put forward to cause minimal damage to the understory during the harvest process.

The reforestation objective for the D/u(a) stands is to reforest them back to a DC standard. This will be achieved mainly through the maintenance of the understory, with supplemental conifer planting occurring where necessary to achieve the conifer proportions required for a DC standard. Refer to Section C (Strata transitions, treatment decision model and declaration table) for the specifics of the silviculture prescription to bring these C landbase stands back to the DC standard.

Reforestation Planning Process

Block planners assess each block during layout to verify the AVI call and assess the block for potential limitations to reforestation. In D/u(a) blocks, an assessment will be made as to the need for conifer planting to achieve a DC standard; the most appropriate location in the block for conifer planting if applicable; and the need for site preparation. Post-harvest assessments confirm or modify the pre-harvest assessments, and reforestation plans are then confirmed or modified accordingly.

DMI conducts assessments in all cut blocks scheduled for harvest in non-frozen ground conditions to identify factors which may affect the “leave for natural” reforestation strategy; and to provide information to guide subsequent reforestation efforts.

Chipper Debris Disposal Strategy

As the only Company that uses the in-block chipping process in the boreal forests of Alberta, there are no precedents as to how to dispose of the chipper debris. To investigate potential impacts on sucker regeneration, DMI approached both the Alberta Research Council (Ken Greenway) and the University of Alberta (Simon Landhäusser). In addition the Company used several methods of disposal, and has monitored, and will continue to monitor, regeneration response. Success of regeneration, in conjunction with discussions with ASRD area

supervisors, and researchers will guide future disposal methods. Currently in deciduous blocks, debris is returned to the block in small circular piles according to the harvesting guidelines.

If quantity of debris exceeds the potential for in-block disposal according to the guidelines, the remainder of the debris is piled roadside and burned. The preferred chipper debris disposal strategy in blocks with significant understory is to dispose of the debris or remove it from the block.

Seed Procurement and Seedling Production

Currently, DMI plants only small amounts of seedlings on crown land, relying on the natural suckering ability of aspen to regenerate the deciduous cut blocks. When planting does occur on disturbed areas, or other areas within the block where natural suckering is inhibited, conifer is often used. Deployment of planting stock occurs within the guidelines of the Standards for Tree Improvement in Alberta (STIA, 2005).

Reforestation Surveys

Until applicable Alternative Regeneration Standards are approved, DMI will complete formal regeneration surveys, in accordance with the “Alberta Regeneration Survey Manual” (2006) in the D and D/u(a) stands harvested by DMI. The Company is committed to ensuring all blocks harvested by DMI are satisfactorily stocked according to the required standard. In cases where stocking standards are not achieved in spite of timely treatment interventions, DMI will ensure that the factors contributing to the failure are identified, and that subsequent modifications to reforestation prediction and implementation are made.

Silviculture Monitoring

DMI tracks silviculture activities, both planned and completed, through Genus. The required fields will be transmitted to ARIS annually by May 15 as required.

As the D and D/u(a) stands are harvested, reforested and monitored, block response will be compared to block objectives. Reforestation strategy may be adjusted as necessary to ensure reforestation objectives are being met. Experience and research results may cause assumptions and methods to alter over time.

STRATA TRANSITIONS, TREATMENT DECISION MODEL AND DECLARATION TABLE

The following table provides a decision model on reforestation objectives by stand and strata type. The first column represents the TSA yield stratum. The second column states which strata to which the block will be reforested under Directive 2005-01, or its replacement. The third column states the Regenerated Yield Stratum towards which the stands are expected to transition. The fourth column is a restatement of the pre harvest stand composition. The fifth column is the potential limiting factors to stand establishment, and the remaining columns are the treatment options we will use to achieve establishment. This table will provide a decision model of treatments that can be used to establish the new crop in the manor prescribed by the FMP.

Stand Strata from the Timber Supply Analysis	Strata Standard (C,CD,etc.)	Regenerated Yield Curve	Pre-harvest Species Proportion	Limitations to Crop Establishment	Silvi. System	Site Prep	Seedling Establishment (includes LFN)	Seedling Target Density (stems/ha)	Vegetation Management	Seed/Vegetative Collection
Pl (B,C,D) P6 and Pl (B,C,D) P9	C	Pl post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper Plow, Mounder, Chain Drags, None where straight plant options exist.	Plant or LFN for coniferous. LFN when in combination with shark fin barrels and chains.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount and seedzone. Cone Collection from natural stands if needed.
Pl (B,C,D) P6 and Pl (B,C,D) P9	C	Pl post 91 managed stand, Tree improvement	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
Sb (B,C,D) - Comb	C	Sb post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, none where straight plant options exist.	Plant white spruce.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
Sw (B) – P6 and Sw (B) – P9	C	Sw post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
Sw (B) – P6 and Sw (B) – P9	C	Sw post 91 managed stand, Tree Improvement	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
C-Sw (C,D) – P6 and C-Sw (C,D) – P9	C	Sw post 91 managed stand	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous.	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
C-Sw (C,D) P6 and C-Sw (C,D) – P9	C	Sw post 91 managed stand, Tree Improvement	Pure Conifer (≥80%)	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous	Minimum 1000 conifer	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment

CD-(B,C,D) Comb	CD	CD - Post 91 managed stand	Mixed 50%-79% conifer	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
CD-(B,C,D) Comb	CD	CD - Post 91 managed stand, Tree Improvement	Mixed 50%-79% conifer	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mound, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
MXU-B- Comb	CD	CD - Post 91 managed stand	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
MXU-CD- Comb	CD	CD - Post 91 managed stand	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
MXU-B- Comb	CD	CD - Post 91 managed stand, Tree Improvement	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
MXU-CD- Comb	CD	CD - Post 91 managed stand, Tree Improvement	Mixed 50%-79% conifer overstory with identified coniferous understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment

DC-B,C,D – Comb	DC	DC - Post 91 managed stand	Mixed 51%-79% deciduous	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
DC-B,C,D – Comb	DC	DC- Post 91 managed stand, Tree Improvement	Mixed 51%-79% deciduous	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Improved Genetic Stock Deployment
D (B) – comb	D	D - Post 91 managed stand	≥80%deciduous overstory, No identified understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	None	LFN	5000	None	N/A
D (C,D) – comb	D	D - Post 91 managed stand	≥80%deciduous overstory, No identified Understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	None	LFN	5000	None	N/A
D u (A) comb coniferous priority	DC	DC - Post 91 managed stand	50% of the stands with ≥80%deciduous overstory, With identified "A" density Sw understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.
D u (A) deciduous priority. (This is coniferous landbase that DMI will harvest and reforest to the DC standard.)	DC	DC - Post 91 managed stand	50% of the stands with ≥80%deciduous overstory, With identified "A" density Sw understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 500 conifer and 700 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed

D u (b,c,d)	CD	CD - Post 91 managed stand	≥80%deciduous overstory, With identified "B,C,D" density Sw understory	Winter Desiccation, low moisture events (droughts), Poor microsites (cold/wet soils) etc., Vegetation competition (grasses, deciduous, shrubs), Insects, MicroFauna	Clear cut with retention	Ripper plow, Mounder, None where straight plant options exist.	Plant for coniferous, LFN for deciduous	Minimum 800 conifer and 400 deciduous	Chemical or mechanical where chemical not feasible	Assessment of Seed by amount by seed zone. Cone Collection from natural stands if needed.

Appendix VII Production Limits for Stream 2 Material and Controlled Parentage Programs

STIA Appendix 21
Region G2

1	2	3			4		5	6	7
Tenure Holder	**Total Breeding Region By Tenure**	**Operable Area**	**Strata**	**Transition Strata**	**Area of Target Strata**	**Trees/ha**	**Plants Required**	**Planned Production**	
								< 30	**> 30**
MDFP-P16	536,557	291,542	C-SW-B	C-SW-CD	29,994	1,600	47,991,042		23,995,521
			C-SW-CD	C-SW-CD	27,758	1,600	44,413,242		22,206,621
			MW-CD-B	CD-BCD	2,916	1,200	3,499,651		1,749,826
			MW-CD-CD	CD-BCD	9,797	1,200	11,756,369		5,878,184
			MW-CDU-B	CD-BCD	4,144	1,200	4,972,879		2,486,440
			MW-CDU-CD	CD-BCD	3,620	1,200	4,344,337		2,172,169
			MW-DC-B	DC-BCD	2,163	800	1,730,162		865,081
			MW-DC-CD	DC-BCD	4,463	800	3,570,690		1,785,345
			MW-DCU-B	DC-BCD	5,029	800	4,023,167		2,011,584
			MW-DCU-CD	DC-BCD	7,729	800	6,182,854		3,091,427
			DU-A (conifer)	DC-BCD	28,809	800	23,046,954		11,523,477
			DU-A (deciduous)	DC-BCD	28,809	800	23,046,954		11,523,477
			Du-BCD	CD-BCD	39,514	1,200	47,416,764		23,708,382
			Total		**194,745**		**225,995,064**		**112,997,532**
FMU-P1N (P15)	Total P15 Area=	47,522	C-SBSW-P	Not in Program	10,849	0	0		0
	423,968		C-SW-S	Not in Program	5,807	0	0		0
			CD-SW-S	Not in Program	3,511	0	0		0
			CD/DC-SW-P	Not in Program	2,307	0	0		0
			DC-A-S	Not in Program	2,455	0	0		0
			Total		**24,929**		**0**		**0**
FMU-P7 (P15)	Total P15 Area=	132,592	C-SBSW-P		13,434	1,600	21,494,686		10,747,343
	423,968		C-SW-S		10,079	1,600	16,126,046		8,063,023
			CD-SW-S		10,868	1,200	13,041,596		6,520,798
			CD/DC-SW-P		13,102	1,200	15,722,606		7,861,303
			DC-A-S		14,936	800	11,948,931		5,974,466
			Total		**62,419**		**78,333,867**		**39,166,933**
FMU-P10 (P15)	Total P15 Area=	19,143	C-SBSW-P		2,259	1,600	3,614,338		1,807,169
	423,968		C-SW-S		374	1,600	598,858		299,429
			CD-SW-S		198	1,200	237,974		118,987
			CD/DC-SW-P		396	1,200	475,241		237,620
			DC-A-S		3,379	1,000	3,379,498		1,689,749
			Total		**6,607**		**8,305,908**		**4,152,954**
FMU-P8	284,170	136,188	C-SBSW-P	No Harvest Area	19,408	0	0		0
(No Harvest Area)			C-SW-S	No Harvest Area	4,927	0	0		0
			CD-SW-S	No Harvest Area	1,837	0	0		0
			CD/DC-SW-P	No Harvest Area	3,914	0	0		0
			DC-A-S	No Harvest Area	12,419	0	0		0
			Total		**42,505**		**0**		**0**
DMI-P10D(P13)	253,743	125,629	>20% Sw		31,575	1,400	**44,205,000**		**22,102,500**
DMI-P1S(P13)	59,549	46,535	>20% Sw	Not in Program	12,691				
DMI-P2(P13)	282,772	188,962	>20% Sw	Not in Program	67,296				
DMI-P11(P13)	14,311	8,873	>20% Sw	Not in Program	2,470				
Tolko-F26(P13)	212,555	138,942	>20% Sw		77,666	1,400	**108,732,400**		**54,366,200**
			Total		**191,697**				
	2,067,624	**1,135,928**	**Grand Total**		**522,903**		**465,572,240**		**232,786,120**

STIA Appendix 21

Region J

1 Tenure Holder	2 Total Breeding Region By Tenure	3 Operable Area	Strata		4 Area of Target Strata	Trees/ha	5 Plants Required	6 Planned Production < 30	7 Planned Production > 30
MDFP-P16	484393.288	261032.954	C-PL-B	C-PL-BCD	6,499	1,600	10,398,928		5,199,464
			C-PL-CD	C-PL-BCD	20,141	1,600	32,225,568		16,112,784
			Total		**26,640**		**42,624,496**		**21,312,248**
FMU-P1 (P15)	Total P15 Area=	94,853	C-PL-P	Not in Program	16,045	0	0		0
	570,245		C-PL-S	Not in Program	13,273	0	0		0
			C-PLSB-P	Not in Program	16,096	0	0		0
			CD-PL-P	Not in Program	4,021	0	0		0
			CD-PL-S	Not in Program	4,318	0	0		0
			Total		**53,753**		**0**		**0**
FMU-P7 (P15)	Total P15 Area=	164,274	C-PL-P		13,988	1,600	22,380,682		11,190,341
	570,245		C-PL-S		7,751	1,600	12,401,658		6,200,829
			C-PLSB-P		6,927	1,600	11,082,579		5,541,290
			CD-PL-P		9,802	1,200	11,762,410		5,881,205
			CD-PL-S		2,083	1,200	2,499,335		1,249,667
			Total		**40,550**		**60,126,663**		**30,063,331**
FMU-P10 (P15)	Total P15 Area=	19,143	C-PL-P		1,336	1,600	2,137,966		1,068,983
	570,245		C-PL-S		1,589	1,600	2,542,658		1,271,329
			C-PLSB-P		927	1,600	1,482,507		741,254
			CD-PL-P		2,069	1,200	2,483,285		1,241,642
			CD-PL-S		460	1,200	551,430		275,715
			Total		**6,381**		**9,197,846**		**4,598,923**
FMU-P8	340,465	166,051	C-PL-P	No Harvest Area	57,637	0	0		0
(No Harvest Area)			C-PL-S	No Harvest Area	2,453	0	0		0
			C-PLSB-P	No Harvest Area	11,196	0	0		0
			CD-PL-P	No Harvest Area	12,776	0	0		0
			CD-PL-S	No Harvest Area	644	0	0		0
			Total		**84,705**		**0**		**0**
DMI-P10D(P13)	196,226	103,278	Pine Leading		25,011	1,400	**35,014,700**		**17,507,350**
DMI-P1S(P13)	70,999	56,795	Pine Leading	Not in Program	5,490	0			
DMI-P2(P13)	315,573	211,052	Pine Leading	Not in Program	20,757	0			
DMI-P11(P13)	3,545	3,242	Pine Leading	Not in Program	108	0			
Tolko-F26	467,928	307,141	Pine Leading		19,875	1,400	**27,825,000**		**13,912,500**
			Total		**71,241**				
	2,449,374	1,386,862	Grand Total		283,271		174,788,705		87,394,352

Appendix VIII Fire Protection Strategy

MANNING DIVERSIFIED FOREST PRODUCTS LTD.

FIRE PROTECTION STRATEGY

BACKGROUND

Wildfire is a constant threat to the timber resource within the FMA Area. The Company also utilizes fire in its forestry operations (i.e., burning of debris piles). The Fire Protection Strategy addresses both wildfires and operational use of fire.

MDFP's Fire Protection Strategy includes education, prevention, detection, reporting, control and components.

EDUCATION

Education is always the first step in successful implementation of any strategy. Staff and contractors that are knowledgeable about the risk posed by wildfire and their role in detection, reporting and control of wildfires are essential to implementation of the Fire Protection Strategy. To this end MDFP will ensure:

- Woodland staff and contractors will be educated on the importance of ignition avoidance, wildfire detection and wildfire reporting. A clear reporting hierarchy will be established.
- Woodland staff and contractors will be advised regarding Company expectations for fire suppression equipment.
- MDFP will provide informal and formal opportunities for staff and contractors to participate in fire suppression training.
- Woodland staff and contractors will be advised regarding Company expectations for safe and effective practices related to brush pile burning.

PREVENTION

Fire prevention strategies include the following:

- MDFP conducts harvesting and site preparation activities primarily during the winter months when the risk of a fire start associated with operations is significantly reduced over summer or year-round operations.
- The Company advises all staff and contractors associated with brush pile burning regarding safe and effective practices.
- FireSmart modeling has been incorporated into the Timber Supply Analysis for the 2007 – 2017 Forest Management Plan.

DETECTION

Field staff and contractors will likely be the first to encounter a wildfire, particularly a fire ignited as a result of field operations or a fire associated with a burn pile.

- Woodland staff and contractors will be advised regarding Company expectations for safe and effective practices related to brush pile burning and field operations in general (particularly during operations during fire season).

REPORTING

Prompt reporting of a fire start is the first step in reducing fire losses. Sustainable Resource Development has the mandate for fire suppression in the Province and any wildfires will be reported promptly to ASRD.

- Fire reporting requirements are reviewed annually with field staff and contractors.
- The Fire Control Plan, submitted annually, describes the Company reporting requirements.

CONTROL

Prompt control of a fire is key to reducing fire losses. Although Sustainable Resource Development has the mandate for fire suppression in the Province, Company and contractor staff have the training to determine whether they can safely begin to take suppression action on a fire.

- The Fire Control Plan, submitted annually, describes the resources available for fire suppression (through Company and contractors).
- MDFP will provide informal and formal opportunities for staff and contractors to participate in fire suppression training.

Appendix IX Forest Health Strategy

MANNING DIVERSIFIED FOREST PRODUCTS LTD.

FOREST HEALTH STRATEGY

BACKGROUND

Forest health is important to Manning Diversified Forest Products (MDFP) and the Province of Alberta. A healthy forest provides MDFP with timber it needs while maintaining other benefits to society. While MDFP has no mandate in respect to management of insects and diseases, the Company's forest management and operations impact the structure of the forest, which can either mitigate or exacerbate potential pathogen concerns.

There have not been any recent large insect or disease epidemics related to coniferous forests within MDFP's FMA boundaries. There is a history of relatively small spruce bark beetle outbreaks within the FMA and a major spruce budworm outbreak in close proximity to the FMA. There have been recent outbreaks of large aspen tortrix but they are at endemic levels at the present time. White pine weevil is present at endemic levels but has not proved to be a concern yet (although it might become a concern with increased efforts required to meet free-to-grow reforestation requirements). Finally, the yellow headed sawfly been a problem in the vicinity of the mill and at the Company's seed orchard (i.e., agricultural areas) but is not expected to be a concern within the FMA.

Currently, there is a great deal of concern regarding the advance of mountain pine beetle into Alberta. Although this pest has not yet reached the FMA, its rapid spread in the past few years mean the pine beetle is likely an imminent threat to pine forests within the FMA.

This short list does not describe all the insects and diseases that are present on the FMA or could threaten the FMA. It does, however, list those pathogens that have been a concern or have been identified as risks. There are many other pathogens such as root rots, insects of regenerating stands and even invasive plant species that could become a larger issue at any time.

The Company and its staff must remain vigilant for all signs of pathogens on the FMA, as new outbreaks may appear at any time.

MDFP's Forest Health Strategy includes education, detection, reporting, control and research components.

EDUCATION

Staff and contractors that are knowledgeable about insects and disease and the potential impacts on the forest is the foremost step in having a successful strategy. To this end MDFP will ensure:

- Woodland staff and contractors will be educated on the importance of insect and disease discovery and control.

- MDFP will participate in formal training courses for staff and contractors as required.

DETECTION

MDFP staff and contractors spend a large amount of time in the forest doing a variety of tasks. It is quite likely that they will be the first to notice any significant outbreaks.

MDFP woodland staff and contractors have been instructed to report any significant insects and disease issues that they note in their day today work.

MDFP will has been installing and maintaining a network of 12 spruce budworm trap locations to augment the existing Alberta network. This will continue until this insect is not considered a significant risk.

REPORTING

Sustainable Resource Development has the mandate of Forest Protection. Any outbreaks noted by MDFP will be reported to them.

Areas of suspected insect and disease infestation will be reported to ASRD as well as the company Stewardship Report.

Information from the MDFP Spruce Budworm traps will be relayed to Sustainable Resource Development on an annual basis.

CONTROL

Pest control is the mandate of Sustainable Resource Development but MDFP has the ability to aid their efforts through its harvesting and silvicultural practices.

Pest control may be considered for any outbreak in consultation with ASRD and other users of the forest. At this time, there are no plans for any pest control activities.

The Company will continue its close working relationship with the Forest Protection Branch of ASRD to provide assistance, as appropriate, with control initiatives.

RESEARCH

Insects and diseases, along with fire are the main biological risks to the long term stability of MDFP. The Manning Forestry Research Fund, has supported a variety of research projects, including projects related to forest health and forest pathogens. Through the Manning Forestry Research Fund the following projects have been funded:

- Chemical Ecology and Management of Forest Pests. Dr. John Borden
- Spruce Beetle Epidemiology and Management in North Western Alberta. Dr. David Langor
- A Comparison of Beetles and Spiders Inhabiting Soil, Litter and Coarse Wood Debris in Stands Originating from Harvest and Wildfire. Dr. John Spence, Dr. David Langora and C.M. Buddle
- Assessment of Spruce Budworm Impacts in the Hawk Hills Management Area. Dr. David Watson, Dr. Peter Boxall

Other projects may be funded as Manning Forestry Research Fund continues to operate. For more information on these projects, please see www.mdfpreasearch.ab.ca.

INTEGRATED PEST MANAGEMENT

MDFP has participated in regional integrated pest management projects in the past. If this concept is revived, the Company will participate as appropriate.

Appendix X Unique Finds Policy

MANNING DIVERSIFIED FOREST PRODUCTS LTD.

UNIQUE FINDS POLICY

BACKGROUND

MDFP wants to protect any unique or rare components within its sphere of interest. These areas may be considered unique for ecological, archaeological, geological, environmental or cultural reasons. Some examples include eagle nests, mineral licks, native burial sites, rock outcrops, rare plants or plant communities.

The Company's Unique Finds Policy includes reporting and a training components, as described below.

REPORTING

To this end the following policies will be implemented:

1. The employees and contractors of MDFP will report any unique areas that they find through the normal course of their work. The finds will be reported to the woodlands manager either directly (for staff) or through field supervisors (contractors).

The woodlands manager, in conjunction with the employee or contractor, will make the decision as to whether the site should be considered a 'Unique Find'. Once a site is considered a Unique Find, the following steps are taken:

2. Recommendations for protection will be discussed with the Woodland Manager and a Unique Finds Reporting Form will be completed.

3. A file of all unique finds will be kept. A map and photo's will be provided where possible. A recommendation for protection will be attached.

4. The location of all unique finds will be kept digitally.

5. These finds will be reported to appropriate government agencies and to DMI for their planning where applicable.

TRAINING

Unique finds encompass a wide variety of features, sites, etc. Some of these are easy to identify, while others may require some additional training on the part of staff and contractors. To assist staff and contractors identify potential unique areas, MDFP is committed to providing the following training opportunities.

1. New staff and contractors will review this policy as part of orientation/start-up.

2. When a unique find is reported that is unusual or difficult to identify, the find will be reviewed with both staff and contractors to assist in future identification. This will also provide staff and contractors with on-going reminders about the Policy.

3. Opportunities for more formalized staff and contractor training will be provided as appropriate. Examples include identification of unique plant communities within the FMA Area, recognition of archeological features, etc.

Unique Finds Reporting Form

Type of find	
Area involved (attach map if possible	
Protection required	
Notification of other interested parties	
Other	

Appendix XI Caribou Habitat Management Strategy for FMA0200041

FMA 0200041

CARIBOU HABITAT MANAGEMENT STRATEGY

Woodland caribou (*Rangifer tarandus*) were identified as species of concern within FMA0200041 (Manning Diversified Forest Products Ltd.'s FMA) at the outset of development of the Forest Management Plan (FMP). Recognizing the impact forest management activities, particularly harvesting, can have on caribou habitat, woodland caribou concerns were incorporated into the FMP development process.

Incorporation of caribou management concerns need to be reflected at two very distinct management levels. At the long-term planning level, forest management must make accommodations for caribou habitat requirements (e.g., number of entries, block size, density of harvest etc). At an operational level, forestry operations can be modified to further reduce the impact of harvesting and other activities on caribou populations (e.g., timing, access).

This document addresses caribou management at the landscape planning level. It outlines the issues that were considered as well as which tactics and strategies were recommended for implementation. The impacts of the recommended strategies are also discussed.

Operational level considerations are mentioned briefly and will be further addressed through strategies outlined within FMA 0200041's Ground Rules.

Currently, the knowledge regarding woodland caribou habitat requirements in the FMA Area is somewhat limited. Existing data sources were used to determine the areas caribou are currently utilizing and the types of habitats (vegetation covertypes) that are being utilized. Information sources available for this purpose included:

- Existing Provincial Caribou Zone boundaries
- Caribou locations/sightings (limited data set)
- Vegetation Inventory
- Linear disturbance footprint
- Literature/information regarding caribou habitat preferences/requirements.

Using this information, caribou management areas within the FMA Area were defined and the vegetation covertypes being utilized were identified. Based on the conclusions drawn and existing knowledge of woodland caribou requirements, strategies were developed to reduce the impact of forest management activities on caribou habitat.

The FMA's Caribou Management Strategy includes the following components:

- Landscape Level - Identify the area in which woodland caribou range and ensure that habitat considerations are incorporated into forest management activities within this area. Identify the preferred habitat within these areas and implement forest management activities which maintain appropriate levels/configurations of habitat. Habitat considerations such as the area of preferred covertype, how these covertypes are arranged spatially and when these area are scheduled are all relevant factors.

- Operational Level – Identify operational forestry strategies that can be implemented to further reduce the impact of these operations on woodland caribou habitat.

- All Levels – Participate and/or maintain communications with the Chinchaga Range Planning Team.

LANDSCAPE LEVEL - DEVELOPMENT

To identify the area which woodland caribou frequent within the FMA, the existing Provincial Caribou Zones, which were developed in 1991 by Fish and Wildlife staff from ASRD using a minimal amount of actual caribou population information along with some landsat imagery, were used as a starting point (see FMP 'Landbase Netdown' for Zone map).

Since 1991, some additional information regarding caribou has been gathered, primarily in P6, through sighting cards (BSOD) and collaring information. Three GPS collars purchased by MDFP were deployed in 2005 in the area west of P6. Data from these collars indicate caribou movement between the two distinct Caribou Zones within P6 and with a larger Caribou Zone located to the west of P6, in FMU P15. This indicates clear habitat-use relationships between the P15 FMU and P6/P9 FMUs which was outside of historically defined caribou ranges.

This additional caribou movement information was reviewed and, in the interests of defining an appropriate area within which forest management strategies to support caribou habitat considerations would be incorporated, the decision was made to identify additional areas around the Provincially defined Caribou Zones. The additional area, referred to as the Alternative Patch Management Area (APMA), surrounds the existing Caribou Zones within P6 and extends westward towards P15 (to accommodate movements indicated by the limited collaring data) (see FMP 'Landbase Netdown' for map).

A similar review process was also undertaken for P9. On the basis of a review of cumulative telemetry and historical observations, home-range kernel analysis (use-probability), habitat suitability index (HSI) analysis, DMI coarse peatland inventory, aerial photography, Alberta research and ASRD Regional biologist expertise, creation of an APMA within P9 was not considered necessary, based on the following rationale:

The Zone boundary contains potential high-value habitat and movement corridor opportunity to currently unoccupied areas of range.

Impending initiation of a local Landscape Range Team (Alberta Caribou Committee).

Within the Caribou Zone and APMA, preferred habitat for woodland caribou was identified. Based on the limited information available, the following criteria were used to identify preferred caribou habitat:

- black spruce stands
- wet white spruce stands.

These vegetation covertypes were incorporated into a relatively simple Habitat Suitability Index (HSI) analysis for the Caribou Zone and APMA. Initial HSI runs found that harvesting activities did not impact the HSI model values significantly throughout the planning period. This was the case because:

A major component of the preferred habitat, black spruce stands, was generally not included in the active landbase and subsequently, was rarely harvested.

The existing access network is extensive (primarily developed by the oil and gas industry) and harvesting was generally not contingent on construction of new access.

The baseline (effective date of plan or 'time zero') HSIs for the Caribou Zone and APMA were already quite low and they were not able to recover, regardless of manipulation of forest harvesting activities. Because of this, the HSI modeling approach was abandoned and instead, habitat controls were purposefully incorporated into the Timber Supply Analysis (TSA) and Spatial Harvest Sequence (SHS).

Although the majority of black spruce stands were excluded from the active landbase (and therefore not available for harvesting), the wet white spruce stands and the black spruce on good sites were included in the active landbase. These stands potentially represented preferred caribou habitat, so additional work was undertaken to distinguish those stands that would be considered habitat, from those that would not (in order to not remove stands from the active landbase unnecessarily). These additional stands were only identified within FMU P6, since the majority of harvesting in the next 40 years occurs within P6.

An analysis of the proximal location of the wet white spruce and 'good' black spruce stands was conducted to evaluate the landscape matrix of concentrated peatland complexes, bogs, shrubland and treed muskeg against other areas dominated by less-preferred upland sites. The extent of anthropogenic footprint adjacent to such stands was also considered, as were 'potential' wetland travel corridors or stepping stones between preferred habitat complexes. On this basis, some of the wet white spruce and 'good' black spruce stands were removed from the active landbase in the Caribou Zone and the APMA. Other stands were deemed to be low value for caribou because of their isolation or small size. The total area removed from the active landbase was relatively small but these stands were usually associated with the larger black spruce complexes and should contribute significantly to maintenance of preferred habitat.

To further protect preferred caribou habitat, a mitigation strategy for areas immediately adjacent to some of the lowland sites with high habitat value was considered, to avoid isolating the habitat and/or producing browse succession in close proximity to the habitat. 'Islands' of potential high-value habitat merit consideration of 'adjacency value' to a proposed 250 m zone of influence. Harvest planning in such areas would merit consultation with the ASRD manager to identify operating plans/designs that assist maintaining the integrity and efficacy of the adjacent high-value caribou habitat. 'Buffering' (retention) was identified as one option, however, in some cases, successional browse issues in some stand-types (i.e., deciduous)

make consideration of other alternatives necessary. This mitigation strategy was difficult to model and therefore was not incorporated into the TSA.

The potential merits of developing a reforestation strategy to alter covertype reforestation prescriptions within portions of the Caribou Zone and APMA was also considered. Reforestation to pure conifer where possible is hypothesized to be conducive to encouraging lichen-forage production, as well as in discouraging alternate prey encroachment into suitable caribou habitat areas. The proposed strategy would involve gradually offsetting converted deciduous or mixedwood landbase (i.e., deciduous or mixedwood landbase reforested to conifer) inside the Caribou Zone and the APMA with comparable suitable landbase outside these areas (i.e., confer landbase reforested to deciduous, on a limited basis). This strategy may have merit, however potential concerns were identified (e.g., potential effects of multiple herbicide applications (required for successful reforestation in a conversion situation) on the establishment of ground lichen cover, application of the strategy within current ASRD policies and directives, etc.). This strategy was not incorporated into the TSA.

Most of the landscape level caribou habitat management strategies identified were implemented by setting preferences and constraints in the TSA and SHS. These included:

- preference for mature and old, wet, spruce forests
- a preference for large harvest block sizes,
- discouraging increases in forage and habitat for alternate prey,
- a reduction in the number of access entries collectively between MDFP and DMI
- grouping of operations to minimize open access at any given time

Numerous management scenarios were tested to arrive at a set of preferences/constraints that resulted in an appropriate area and distribution of preferred habitat, over time, while minimizing open access at any given time.

LANDSCAPE LEVEL - STRATEGIES

The FMP incorporates both the Provincial Caribou Zone and the Alternative Patch Management Area (APMA). Within the Caribou Zone and the APMA, forest management strategies to support caribou habitat considerations will be implemented.

If the Caribou Zone is revised in the future, these changes will be incorporated into subsequent FMPs.

Forest covertypes which were considered preferred habitat for caribou were identified, resulting in the removal of some wet white spruce and some productive black spruce stands within the Caribou Zone and the APMA from the active landbase.

Availability of contiguous habitat (i.e., large patches) was identified as significant in determining the quality of woodland caribou habitat. The TSA targeted a larger patch size for harvest within the Caribou Zone and APMA in FMU P6 and in the Caribou Zone in FMU P9. This was

accommodated in the model by minimizing harvest patches in the 0 to 300 hectare range. This strategy also served to minimize the amount of open access required.

TSA constraints were introduced to reduce the habitat for ungulates other than caribou in an effort to reduce the predator population. Habitat preferred by other ungulates was generalized as deciduous or mixedwood covertypes (D, DU, DC, DCU, CD or CDU) less than 30 years old. To ensure ungulate habitat was maintained at an acceptable level within the Caribou Zone and the APMA, the area of the landbase under 30 years old was constrained to less than 20% of the gross landbase within each FMU, for each of the following covertype categories: D, DU, DC, DCU, CD and CDU. This strategy also helped ensure significant areas of mature and old forests were retained.

Reducing the number of access entries was accomplished by controlling the number of entries into the Caribou Zone and APMA. Within P6, these areas are bisected by both the Hotchkiss and the Meikle Rivers. The TSA constrained the access to these three sub-zones to permit only one to be open in each ten-year harvest period. In addition, harvesting a number of small or isolated stands (patches) was deferred until surrounding stands met minimum merchantability criteria. In the Caribou Zone in P9, the TSA was constrained so that harvesting was deferred from a large portion of the Caribou Zone. The mature timber being sequenced was sparse, which would have resulted in opening significant access and requiring multiple entry periods to recover relatively small timber volumes.

OPERATIONAL LEVEL – DEVELOPMENT

Companies operating on the FMA Area will continue to apply best practices from the suite of mitigation actions identified in the former Boreal Caribou Committee document *Strategic Plan and Industrial Guidelines for Boreal Caribou Ranges in Northern Alberta', 2001*[2]) These best practices and the use of annual Caribou Protection Plans, under the standing ASRD interim-policy, form the current industry standard for operational caribou impact reduction.

The Companies stay current with regard to Provincial and regional caribou initiatives and incorporate new recommendations into their operations as soon as possible.

OPERATIONAL LEVEL – STRATEGIES

Operational level strategies related to caribou habitat management will be identified in the FMA Operating Ground Rules. The future Caribou Landscape Range Teams will play a role in refining current best practices guideline documents and it is anticipated that operational considerations will form a significant part of that integrated effort. Strategies which will be addressed within the Ground Rules include:

- Timing of active operations: Operations have, in the past, been timed to minimize impact on caribou populations. The value and form of timing controls will be discussed as part of the Ground Rule negotiations and may be left for evaluation by the proposed Chinchaga Range Planning Team.

[2] http://www.srd.gov.ab.ca/land/m_li_boreal.html

- Access management: The Company will continue to develop Caribou Protection Plans, in consultation with the regional biologist, that may include access management prescriptions.

- Reclamation: Non-native species used for soil stabilization can represent an attractant to alternate prey and their related predators. Once appropriate alternatives are available to the Companies, native plant species will be considered for use.

- Reforestation: The Company will identify opportunities for reforestation within the Caribou Zone and the APMA to favour caribou while discouraging alternative prey (by preferentially selecting harvest blocks within the Zone/APMA for reforestation to pure conifer, while offsetting appropriately in blocks outside the Zone/APMA). These opportunities will be relatively limited (i.e., less than 500 hectares annually) because of reforestation requirements/policies (e.g., ASRD Directive 2005-1).

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