# Integrated Stewardship Strategy for the Mackenzie TSA

## Final Report

Version 1.0

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Project 419-35

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BRITISH COLUMBIA

# 1 Introduction

The British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development initiated an Integrated Stewardship Strategy (ISS) – sustainable forest management analysis – for the Mackenzie Timber Supply Area (TSA). This document is the sixth in a series of documents that succinctly summarizes results, key observations, and recommendations developed through this ISS iteration – including spatial and temporal protections and opportunities to mitigate identified issues. Detailed information can be found in the other six documents of the series, which include: Situation Analysis, Scenario Development, Data Package, Analysis Report, Tactical Plan, and Implementation Monitoring Plan.

# 2 Key Observations

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| ISS Objectives | Mitigate forest health impacts on mid-timber supply by facilitating a respectful and collaborative planning process that supports the delivery of defined stewardship outcomes - which in turn improves business certainty for licensees operating within the Mackenzie TSA. |
| Land Base | The Mackenzie TSA is situated in north-eastern British Columbia, it is the fourth largest TSA in the province covering an area of 6.41 million ha, from which 2.94 million ha is Crown Forested Land Base (CFLB - 45.9%) and 1.13 million ha is Timber Harvesting Land Base (THLB - 17.7%). These area estimates are based on the best known land base assumptions implemented throughout the ISS process. A benchmarking analysis to the latest Timber Supply Review analysis decreased the THLB by 156,000 ha; mostly due to assumptions for excessive haul distance, operability, and isolated stands. Then, by exclusion of the proposed Kwadacha, First Nation Woodland Licenses (FNWL), the working forest was reduced to the values shown above. |
| History of AAC | The Mackenzie TSA was established in 1981 with an Annual Allowable Cut (AAC) of 2,900,000 $m^3$/year. The AAC has since increased due to minor adjustments and establishment of a deciduous stand partition, currently set to 100,000 $m^3$/year. The 2001 AAC determination increased the harvest rate to 3,050,000 $m^3$/year. To facilitate the time-limited salvage of Mountain Pine Beetle (MPB) killed pine, the current AAC was set in November 2014 at 4,500,000 $m^3$/year. |
| Related Plans and Strategies | The Mackenzie Land and Resource Management Plan (MLRMP) finalized on November 14, 2000.<br><br>The Muskwa-Kechika Management Area Plan which covers the North-Eastern corner of the TSA. This management plan area houses four different resource management zones: Protected Areas, Special Wildland Resource Management Zones, Special Resource Management Zones, and Enhanced Resource Management zones.<br><br>Mugaha Marsh Sensitive Area (2002).<br><br>Agriculture Development and Settlement Areas (2006). |

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| | Obo River and Fox landscape units (LU) management objectives (2002).<br><br>Old Growth Areas in southern portion of TSA (2010) and Non-Spatial Biodiversity management objectives elsewhere (2010). |
| Non-Timber Objectives | The non-timber objectives include stand- and landscape-level biodiversity, maximum disturbances within watersheds (including MPB and spruce beetle disturbances), and approved, proposed, and draft wildlife habitat designations. Scenic areas were not included here because of the low impact estimated on harvest flow (<1%).<br><br>A significant amount of effort was spent to understand the impacts of Caribou recovery strategies (provincial and federal) on harvest level.<br><br>Due to the relatively large land base (i.e., nearly 3 million hectares CFLB of which only 38.4% was identified as THLB), most non-timber objectives did not constrain the model. Only an additional 10,000 ha (<1%) of THLB was needed to meet landscape-level biodiversity and other objectives. These areas were used to develop the Reserve Plan. |
| Wildlife Habitat | Spatial delineation of approved, proposed, and draft habitat areas adjusted the landbase description, which increased the no-harvest habitat areas to approximately 108,000 ha (UWR) and 63,000 ha (WHA); 4.2 times <u>more</u> than the latest Timber Supply Review. |
| Watershed Health | The model was configured to monitor and/or implement Equivalent Clearcut Areas within identified watersheds (proposed FSWs, LRMP, and Reserve). In this case, full ECA requirements were typically far from being compromised so the overall harvest flow was not impacted since alternative harvest patterns were available. |
| Patch Size | Patch size distribution objectives for natural disturbance types within the Fox and Obo River landscape units were maintained to ensure that patches of stands less than 20 years old adhere to the established targets. These objectives did not constrain the harvest flow. |
| Caribou Habitat | Implementing the Federal Caribou Recovery Strategy target to maintain at least 65% undisturbed habitat for the Chase and Wolverine herds – while not quite achieving this – would reduce the harvest level by 31% in the short-term, 34% in the mid-term, and 24% in the long-term. |
| Forest Health | Stand yields for both MPB and IBS were developed using a complex and detailed approach to incorporate mortality, estimate volume decline (for 22 years following MPB attack and 5 years following IBS attack), and consider stand regeneration of unsalvaged stands. Spruce beetle mortality was included according to Aerial Overview Surveys conducted to year 2017.<br><br>By the end of the MPB salvage period, approximately 11.25 million $m^3$ (38%) of dead volume was salvaged, out of an estimated 29.7 million $m^3$, estimated in year 2016. In the case of the spruce beetle, approximately 1.15 million $m^3$ (56%) was salvaged out of an estimated 2.05 million $m^3$ estimated at the end of year 2017.<br><br>The current forest inventory was used to develop a spatial assessment of potential salvage and rehabilitation opportunities by applying merchantability |

criteria and shelf-life assumptions. Applying these assumptions highlighted stands that are no longer merchantable since attack and those that will no longer be merchantable after the salvage period – within the THLB and non-harvestable land base.

To offset large areas of salvaged pine stands, salvage zones were implemented and wildlife tree retention levels were adjusted based on (patch) opening size (i.e., conservation uplift) according to guidelines from the BC Chief Forester. This led to a significant area reduction in THLB (~66,000 ha); contributing to 2.5 times the area retained for wildlife tree retention and riparian reserves compared to the 4.7% aspatial reduction used in the latest Timber Supply Review.

Stands identified with extreme fire threat were favoured for harvesting in the first 10 years without negatively impacting the timber objectives and the MPB and spruce beetle salvage.

A 'No Salvage Opportunity Zone' was delineated around Williston Reservoir in early 2018 to reflect the most current operational reality of MPB salvage. In this zone, the MPB salvage was considered complete, thus impacted stands within this zone were immediately available for rehabilitation tactics without negatively impacting other harvest objectives.

**Timber Objectives**

Timber objectives within the Mackenzie TSA include 5 partitions:

| Plan Years | Pl-Leading | Non-Pl-Leading | Non-Pl-Leading from SW TSA | Balsam-Leading | Deciduous-Leading |
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| 1-5 | 67% | <905K $m^3$/yr | <300K $m^3$/yr | <92K $m^3$/yr | <100 $m^3$/yr |
| 6-10 | 67% | <905K $m^3$/yr | <300K $m^3$/yr | <92K $m^3$/yr | <100 $m^3$/yr |
| 11-15 | 67% | <905K $m^3$/yr | <300K $m^3$/yr | <92K $m^3$/yr | <100 $m^3$/yr |
| 16-20 | n/a | n/a | n/a | <92K $m^3$/yr | <100 $m^3$/yr |

The harvest flow was developed such that it does not change by more than 10% per decade and it reached a sustainable level in the last 100 years of the 300-year planning horizon (i.e., harvest is constant and conifer growing stock is non-declining). In addition, any harvest generated during rehabilitation tactic did not count towards the targeted harvest flow.

**Harvest Flow**

The harvest level for the first 10 years was established at 3.00 million $m^3$/year, which declined to 2.56 million $m^3$/year by year 30, then stabilized to a long-term level of 2.89 million $m^3$/year by year 130 of the 300-year planning horizon.

**Access timing constraints**

As a proof of concept, spatial delineation areas potentially valued for wilderness and Grizzly Bear habitat were added to the resultant. Applying timing constraints to these areas did not significantly impact the harvest flow.

**Tactical Plan**

The tactical plan developed through this iteration integrates three separate plans: reserve, harvest, and silviculture. Ultimately, it provides operational direction and bridges strategic, forest-level analyses, and operational planning processes.

**Candidate Reserves**

To efficiently meet non-timber objectives while minimizing impacts on the working forest, candidate reserves were identified through an advanced modelling exercise that grouped reserved areas, as much as possible, to meet landscape-level requirements - including old interior forest. The candidate

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| | reserves determined in this exercise amounted to approximately 10,000 ha of the THLB (<1%). These stands were later restricted from being harvested over the first 40 years of the planning horizon. |
| Harvest Opening Sizes | Harvest opening sizes were controlled in each 5-year planning period to develop openings accordingly: up to 10% between 5 and 20 hectares, 5% between 1 and 5 hectares, and altogether avoid openings less than 1 hectares. Meanwhile, openings greater than 100 hectares were favoured. These modest harvest opening size distributions were achieved as targeted, without a significant impact on the harvest level. |
| Wildfire Management | Mitigating risk of loss due to wildfire was managed by influencing the forest estate model to focus harvesting, over the first 10 years, on stands identified with extreme risk of wildfire and conifer-leading stands within identified fuel breaks. The THLB area identified with extreme wildfire threat was estimated at 120,000 ha (10.6% of the total THLB), from which the harvest plan identifies approximately 62,000 ha harvested over the first 10 years (i.e., 40% of the total harvested area). |
| Cable Harvest | In 25 years, the forecasted harvest that comes from cable harvest systems increases from 3% to 17%. This adjustment is paramount to maintaining the mid-term harvest level – particularly the front end. |
| Silviculture Tactics | Subject to a combined budget of $3 million per year, three silviculture tactics were implemented over the first 20 years of the planning horizon.<br><br><u>Rehabilitation</u> - Rehabilitation was modelled for mature-conifer-leading existing natural stands on slopes <=45% and with site index >=14 that were heavily impacted by MPB and spruce beetle. The cost for marginally economic stands (i.e., standing live volume >=50 $m^3$/ha) was $1,500/ha and for uneconomic stands (i.e., standing live volume <50 $m^3$/ha) was $2,000/ha. An additional cost of $50/ha was added for each extra 2 hours (one way) from the dumping sites or processing facilities. Over the first 20 years, the eligible THLB area was 133,000 ha.<br><br><u>Enhanced basic silviculture</u> - Treatments were set-up for all existing natural and managed stands in the SBS and BWBS BEC zones, with Sx-leading and site index >=14, or with Pl-leading and site index >=17. The enhanced basic silviculture cost was applied at $385/ha. Over the first 20 years, the eligible THLB area totalled 297,000 ha<br><br><u>Fertilization</u> - Up to 2 applications (10-year apart) for existing natural (age 20-60 years) and managed stands (age <=25 years), site index >=14, on slopes <45%, pine and spruce component >=80%, within SBS and ESSF BEC zones, and not impacted by MPB or spruce beetle. Following last application, stands were locked from harvesting for another 10 years. Cost of one application was $450/ha. The eligible THLB area was 98,000 ha.<br><br>Including these silviculture tactics allowed the model to leverage the advantages of each tactic: rehabilitation (i.e., harvest stands that would otherwise not have been harvested and transition them to yields with higher productivity and younger minimum harvest ages), fertilization (i.e., increase growth), and enhanced reforestation treatments (i.e., stands transition to higher productivity |

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| | yields with younger minimum harvest ages). These advantages combined to allow stands to cycle (i.e., harvest, reforest, harvest, etc.) more often over the 300-year planning horizon and allow some stands to be harvested sooner to make more volume available during key periods (e.g., the mid-term trough). In the long term, these silviculture tactics contributed to increasing the harvest level by 3%.<br><br>Most of the $3 million per year budget was spent on rehabilitation and enhanced basic silviculture tactics. These were favoured because they contributed to making more volume available at critical periods along the planning horizon. |
| Implementation Monitoring Plan | While forest licensees are not legally required to follow the tactics proposed in the ISS planning exercise, these tactics provide important guidance for key activities that will be monitored relative to harvesting and other performance indicators. Monitoring will focus on the implementation of these tactics over the life of the Tactical Plan. Ultimately, implementation monitoring is intended inform future ISS iterations and other forest-level analyses. |

# 3 Recommendations

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| Low Productivity | Exclude from the THLB, all low productivity stands that do not meet minimum harvest criteria. Accurately modelling standing volume and minimizing impacts on harvest flow in the long-term requires a robust definition of THLB. |
| Minimum Harvest Criteria | Refine the minimum harvest age criteria. Future stands that are likely more productive than existing ones can meet the minimum harvest criteria at ages under 60 years, especially when including silviculture tactics. Meanwhile, wood products sourced from younger stands can pose potential economic challenges. |
| Caribou Recovery Strategies | Refine the caribou assessment to more accurately determine the impact on harvest flows when maintaining the maximum 35% disturbance threshold. Ideally, a strategy would be developed that avoids post-processing of disturbances and groups mature/old stands into large, contiguous patches to promote old interior forest habitat. |
| | Include patch targets for harvest and fire disturbances within caribou assessment areas to reduce road construction and group blocks with different operability requirements. |
| | Examine alternative disturbance criteria. Road and harvest buffers contributed significantly to the anthropogenic disturbance level. |
| | Refine the anthropogenic disturbance layer to consider permanent and planned features (e.g., wind tenures, cabins, pipelines). The available anthropogenic disturbance data was not clearly defined. Some anthropogenic disturbance features can potentially cover large forested areas and should be considered disturbed when assessing Caribou habitat. |
| | Rehabilitate roads that are no longer in use and seek input from habitat biologists for planning these activities. |

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| | Upgrade and expand the road network to access the entire THLB. This will help to reflect anthropogenic disturbance associated with road buffers. |
| Disturbance in the Non-Harvestable Land Base | Implement patch size criteria within the non-harvestable land base. The natural disturbance schedule imposed on the non-THLB was not spatially realistic as the 'fire' blocks were not grouped into larger patches to more closely mimic reality. Ultimately, this should not affect other modelling results. |
| Scenic Areas | Verify and/or implement maximum disturbance levels assumed for scenic areas. This ISS iteration adopted assumptions from the latest Timber Supply Review that estimated constraining scenic areas would represent a harvest flow impact of less than 1%. |
| Excessive Haul Distance | Refine the haul cycle distance to reflect available road systems, barging opportunities, and other operational realities. This may be further explored as sensitivity analyses. |
| Candidate Reserves | Continue to refine the reserve scenario by influencing the model to stop selecting additional candidate reserves when anchors (i.e., no-harvest zones) have already met targets. In another scenario, develop candidate reserves without favouring stands within the non-harvestable land base. |
| | Conduct a post-processing GIS analysis to identify seral stage edges and verify that the interior old forest targets are met for each assessment unit. |
| | Utilize the candidate reserves to provide context for drafting spatial reserves for further analysis and review at tactical and eventually, operational-levels. This process should involve stakeholders that work collaboratively – for each landscape unit – to verify values are addressed appropriately. |
| IBS spread | Develop appropriate assumptions to characterize the future condition of spruce beetle impacts by applying assumptions related to expansion or spread; an IBS spread model does not currently exist. |
| Harvest Partitions | Reconsider harvest partitions to reduce the mid-term impact on harvest flows. While current harvest partitions are intended to encourage MPB salvage and limit harvesting of non-pine stands, they have a dramatic negative impact on harvest flow, by limiting the harvest of deciduous and balsam volumes. The 5 harvest partitions modelled (i.e., pine; non-pine; go-north; deciduous; balsam) conflicted as they targeted overlapping areas. Once the MPB salvage period was over, large volumes were harvested from balsam stands. |
| Silviculture Tactics | Consider adding more criteria to refine the identification of eligible stands for fertilization and rehabilitation (e.g., haul distance, low density threshold). |
| | Determine the most cost-effective treatment schedule to achieve the highest potential gains in harvest. This might be done by calculating and comparing the net present value for the incremental volume realized over the planning horizon and under increasingly higher funding levels (i.e., multiple runs). |