Fort St. John Pilot Project

Sustainable Forest Management Plan #4

to be submitted for approval to:

Regional Executive Director,
Ministry of Forests

and

Acting Director of Resource Stewardship Operations,
Ministry of Water, Lands, and Resource Stewardship
Northeast Region

Public Review draft version

July 11, 2025



LAND ACKNOWLEDGEMENT

We would like to begin by acknowledging the traditional, ancestral and unceded territory of Treaty 8 and Dane-Zaa Peoples who have lived on and cared for these lands since time immemorial.

PREFACE

This document represents the continuation of a process started in 2001 and includes many of the foundational aspects of the first three SFM Plans. There have been a number of events and changes that have impacted the Fort St. John Timber Supply Area since the start of the Pilot Project, and the plans have been adapted accordingly. The changes resulting from events since the approval of SFMP#3 have been some of the most profound, such as the 2021 *Yahey vs. BC* decision and subsequent Implementation Agreement, and the huge area impacted by the wildfires of 2023, have been some of the most profound that the Participants have had to address in the history of the Pilot Project.

The Sustainable Forest Management Plan #4 for the Fort St. John Pilot Project area was prepared in accordance with the *Fort St. John Pilot Project Regulation*, and with reference to the Sustainable Forestry Initiative® (SFI) Forest Management Standard. This plan is based upon SFMP# 3, with several revisions required to address expectations articulated in the April 24, 2024, letter that officially extended the term of SFMP #3, and others that came about through the planning process. Changes to indicators were discussed with the Public Advisory Group as part of the revision process. The Participants would like to thank the members of the Public Advisory Group and advisors, and members of the SFMP Planning Team, for their continued interest and significant contributions in the development of this plan. An important aspect of this plan is that it was guided in part by engaged representation by several local First Nations on the Planning Team.
Although this public document is intended to be informative to a variety of readers, emphasis is placed towards:

- Employees of the Participants who will use the plan to guide plans and activities, and have responsibility for implementing ,
- Government agency representatives involved in the approval process of the portions of this Sustainable Forest Management Plan that pertain to the SFMP content requirements of the *Fort St. John Pilot Project Regulation*.

Several authors and many reviewers contributed to developing key components of this plan. Preparation and submission of this draft plan was coordinated on behalf of the Pilot Project Participants (Participants) by representatives of BC Timber Sales, Canadian Forest Products Ltd., and Louisiana-Pacific Canada Ltd.

TABLE OF CONTENTS

LAND ACKNOWLEDGEMENT II

PREFACE III

TABLE OF CONTENTS IV

LIST OF FIGURES VII

LIST OF TABLES VII

1.0 INTRODUCTION 9

1.1 PURPOSE 9
1.2 SFM CERTIFICATION 10
1.3 DESCRIPTION OF EXISTING STRATEGIC PLANS 12
1.4 DESCRIPTION OF THE SFM PLANNING AREA 14

2.0 DESCRIPTION OF THE PILOT PROJECT 20

2.1 DESCRIPTION OF THE PARTICIPANTS 20
2.2 STRUCTURE AND RESPONSIBILITY 24
2.3 DESCRIPTION AND ROLE OF PAG 25
2.4 FIRST NATIONS PARTICIPATION 26
2.5 DESCRIPTION AND ROLE OF STAC 26

3.0 SUSTAINABLE FOREST MANAGEMENT 26

3.1 SUSTAINING BIOLOGICAL RICHNESS 27
3.2 NATURAL DISTURBANCE UNIT PLANNING 29
3.3 MANAGED STAND MONITORING 32
3.4 CONTINUOUS IMPROVEMENT 33

4.0 LANDSCAPE LEVEL STRATEGIES 34

4.1 TIMBER HARVESTING STRATEGY 37
4.2 ROAD ACCESS MANAGEMENT STRATEGY 41
4.3 RIPARIAN MANAGEMENT STRATEGY 44
4.4 RANGE AND FORAGE MANAGEMENT STRATEGY 46
4.5 PATCH SIZE, SERAL STAGE DISTRIBUTION AND ADJACENCY STRATEGY 48
4.6 FOREST HEALTH MANAGEMENT STRATEGY 50
4.7 REFORESTATION STRATEGY 53
4.8 SOIL MANAGEMENT STRATEGY 59
4.9 VISUAL QUALITY MANAGEMENT STRATEGY 60
4.10 BIODIVERSITY AND WILDLIFE HABITAT MANAGEMENT STRATEGY 60

5.0 VALUES, OBJECTIVES, INDICATORS AND TARGETS 65

5.XX INDICATOR TEMPLATE 66
5.1 FOREST TYPES 67
5.2 SERAL STAGES 72
5.3 PATCH SIZE 83
5.4 SOIL DISTURBANCE 89
5.5 DISPERSED RETENTION 91



5.6 Coarse Woody Debris Volume 94
5.7 Coarse Woody Debris Structure 97
5.8 Shrubs 100
5.9 Wildlife Tree Patches 102
5.10 Protection of Sites of Biological Significance 107
5.11 Guidelines for Species at Risk and Species of Management Concern 112
5.12 Migratory Birds Risk Reduction 118
5.13 Forest Workers' Safety 120
5.14 Seed Use 121
5.15 Deciduous Regeneration 123
5.16 Parks and Protected Areas 124
5.17 Ungulate Winter Ranges, Wildlife Habitat Areas and MKMA 127
5.18 Deletions to Forest Area 129
5.19 Graham Harvest Timing 133
5.20 Graham Merchantable Area Harvested 137
5.21 Graham Connectivity 141
5.22 MKMA Harvest 144
5.23 River Corridors 146
5.24 Riparian Reserves 150
5.25 Value And Total Number of Contracts Awarded To First Nations 152
5.26 Permanent Access Structures 153
5.27 Forest Health in Silviculture Obligation Areas 155
5.28 Salvage and Sanitation Harvest 157
5.29 Noxious Weed and invasive Plant Content 159
5.30 Preventing The Spread of Invasive Plants 161
5.31 Species Composition 163
5.32 Reforestation Assessment 165
5.33 Establishment Delay 174
5.34 Site Index 177
5.35 Peak Flow Index 178
5.36 Water Quality Effectiveness Evaluation 185
5.37 Small Streams and NCD Management 188
5.38 Spills Entering Waterbodies 190
5.39 Coordinated Developments and Access Management 191
5.40 Range Action Plans 193
5.41 Damage to Range Improvements or Natural Range Barriers 195
5.42 Recreation Sites 198
5.43 Visual Quality Objectives 199
5.44 Visual Screening 203
5.45 Recreation Opportunity Spectrum 204
5.46 Actions Addressing Guides, Trappers and Other Interests 207
5.47 Timber Processing 208
5.48 Forest Health FOS Planning 210
5.49 Participants' Coordination 214
5.50a AAC Partition – Deciduous Planning 215
5.50b AAC Partition – Deciduous Harvest Performance 215
5.51a AAC Partition - Conifer Planning 218
5.51b AAC Partition - Conifer Harvest Performance 219
5.52 Cut Control 222
5.53 Dollars Spent Locally on Each Woodlands Phase 224

5.54 Number of Known Values and Uses Addressed in Operational Planning 226
5.55 Terms of Reference (TOR) for Public Participation Processes 227
5.56 Public Inquiries 228
5.57 Educational Outreach 229
5.58 Herbicide Use 231
5.59 PAG Satisfaction Surveys 232
5.60 Availability of Information on SFM 238
5.61 Representative Examples of Ecosystems 239
5.62 Rare Ecosystems 246
5.63 Effective Communication – Non-Timber Resources 252
5.64 Effective Communication – First Nation Communities 254
5.65 Residual Fibre Utilization 255
5.66 Incorporation of New Land Use Plans 256

6.0 CHANGES IN REQUIREMENTS 259

6.1 Revised Field Performance Requirements 259
6.2 Revised FOS Requirements 267
6.3 Recommendation to Revise Select sections of the FSJPPR 270

LITERATURE CITED 272

APPENDICES 280

APPENDIX 1: SUSTAINABLE FOREST MANAGEMENT POLICIES 281

Sustainable Forest Management Policies 282

APPENDIX 2. LRMP RMZS WITHIN EACH LANDSCAPE UNIT 290

APPENDIX 3: LRMP OBJECTIVES BY LU 294

APPENDIX 4: SUSTAINABLE FOREST MANAGEMENT INDICATOR MATRIX 303

APPENDIX 5: GROWTH & YIELD MONITORING PLAN 317

APPENDIX 6: REFORESTATION STRATEGY: STOCKING ESTIMATORS AND FUTURE VOLUME 318

APPENDIX 7: COMPLETE DATA SET 326

APPENDIX 8: REFORESTATION STRATEGY: SURVEY DESIGN AND FIELD PROCEDURE 329

APPENDIX 9: REFORESTATION STRATEGY STOCKING STANDARDS AND CROP TREE REQUIREMENTS 336

APPENDIX 10: STAND SURVEY & GROWTH MODELING FOR THE FORT ST. JOHN TSA 345

APPENDIX 11: LISTING OF INVASIVE PLANTS 364

APPENDIX 12: SOIL DISTURBANCE INFORMATION 371

APPENDIX 13: MIXEDWOOD MANAGEMENT GUIDELINES 373

APPENDIX 14: PROCEDURE FOR SELECTING SAMPLE TREES IN OPERATIONAL CRUISING FOR USE IN SITE INDEX CALCULATIONS 387

APPENDIX 15: STREAM CROSSINGS, WETLAND CROSSINGS, AND SEASONAL BRIDGE INSTALLATION AND REMOVAL PROCEDURES 390

APPENDIX 16: ROS POLYGON DELINEATION STANDARDS 405

APPENDIX 17: WTP RETENTION TARGET CALCULATION 409

APPENDIX 18: FORT ST. JOHN TSA TIMBER SUPPLY ANALYSIS REPORT 413

APPENDIX 19: SILVICULTURE SURVEY METHODOLOGY FOR BOREAL MIXEDWOODS (FARNDEN REPORT) 414

APPENDIX 20: MIGRATORY BIRDS BMP COMPENDIUM 415

APPENDIX 21: STICK NEST IDENTIFICATION AND MANAGEMENT GUIDE 416

APPENDIX 22: GLOSSARY 417

LIST OF FIGURES

FIGURE 1. PROJECT AREA MAP 16
FIGURE 2: FORT ST. LANDSCAPE UNITS AND RESOURCE MANAGEMENT ZONES 17
FIGURE 3. PILLARS OF SUSTAINABLE FOREST MANAGEMENT 26
FIGURE 4: NDU BOUNDARIES WITHIN THE FORT ST. JOHN DFA 31
FIGURE 5. WILDFIRE AREA 2016-2024 (SOLID FILL), AND ACTIVE AS OF JUNE 6 2025 (HATCH) 69
FIGURE 6: NDU'S OF THE PRINCE GEORGE FOREST REGION 85
FIGURE 7 - MODERATE TO VERY HIGH MOOSE HABITAT SUITABILITY AND CAPABILITY IN THE FSJ TSA 114
FIGURE 8. GRAHAM RIVER IRMP HARVEST CLUSTERS 135
FIGURE 9. CORRIDORS WITHIN THE GRAHAM RIVER AREA 143
FIGURE 10. MAP OF STREAMS AND RIVERS WHERE RIVER CORRIDOR INDICATOR APPLIES 148
FIGURE 11. PEAK FLOW INDEX - EXAMPLE CALCULATION 178
FIGURE 12. FORT ST. JOHN TSA VISUAL QUALITY POLYGONS. 202

LIST OF TABLES

TABLE 1: LANDSCAPE UNIT INTENSITY CLASSES 19
TABLE 2: BIOLOGICAL RICHNESS AND ITS INDICATORS AND SUB-INDICATORS (WELLS ET AL., 2003) 27
TABLE 3: HABITAT AND LANDSCAPE ELEMENTS IDENTIFIED BY BUNNELL ET AL. (1999) 28
TABLE 4: CONTINUOUS IMPROVEMENT PROCESS FOR THE SFMP 33
TABLE 5: LANDSCAPE LEVEL STRATEGIES AND RELATED PERFORMANCE INDICATORS SUBMITTED FOR APPROVAL 35
TABLE 6. BASELINE TARGETS FOR FOREST TYPES AND CURRENT STATUS 70
TABLE 7: NATURAL DISTURBANCE UNIT LATE SERAL STAGE TARGETS 76
TABLE 8: CONIFER CURRENT SERAL STAGE AND TARGET 78
TABLE 9. BOREAL PLAINS DECIDUOUS CURRENT SERAL STAGE AND TARGET 80
TABLE 10: NATURAL DISTURBANCE UNIT EARLY PATCH DISTRIBUTION TARGETS 86
TABLE 11: EARLY PATCH SIZE CLASS CURRENT STATUS 87
TABLE 12: SHRUB HABITAT 2025 AREA, AND BASELINE BARGETS 101
TABLE 13: CUMULATIVE HARVEST AREA AND PROPORTION OF WTPS BY LANDSCAPE UNIT (2001-2024) 106
TABLE 14: SARA-LISTED, OR RED OR BLUE-LISTED BIRD SPECIES OCCURRING IN THE DFA 111
TABLE 15: STAND LEVEL MANAGEMENT GUIDELINES FOR MOOSE 116
TABLE 16: RESTRICTED PERIOD BY GEOGRAPHIC AREA AND RELATIVE STAND RISK-RANK 120
TABLE 17 - LRMP PROTECTED AREAS AND PARKS 125
TABLE 18 - ECOLOGICAL RESERVES 126
TABLE 19: AREA SUMMARY FROM FSJ TSA DISCUSSION PAPER (2016) 130
TABLE 20: ROAD CONSTRUCTED BY MANAGING PARTICIPANTS 2004-2011 (SFMP #1) 132

TABLE 21: ROAD CONSTRUCTED BY MANAGING PARTICIPANTS 2011-2018 (SFMP # 2) 132
TABLE 22: ROAD CONSTRUCTED BY MANAGING PARTICIPANTS 2018-2024 (SFMP # 3) 132
TABLE 23: ROAD CONSTRUCTED BY MANAGING PARTICIPANTS 2004-2024 AS A PERCENTAGE OF TSR 3 CFMLB ..132
TABLE 24: GRAHAM RIVER IRM PLAN- CLUSTER AREA AND TIMING SCHEDULE 138
TABLE 25: RIVER AND STREAMS TO WHICH RIVER CORRIDORS INDICATOR APPLIES 147
TABLE 26: 2022-2024 PAS PERCENTAGES FOR PARTICIPANTS....154
TABLE 27: PFI BASELINE TARGETS AND CURRENT CONDITION (WATERSHEDS ABOVE THRESHOLD IN RED TEXT) 180
TABLE 28: PROJECTION OF CHANGES TO ROS CLASS FROM 1996 TO 2016....205
TABLE 29: PROPORTION OF TOTAL VOLUME LOCALLY PROCESSED 209
TABLE 30: SUMMARY OF FOR AOS DATA FROM 2023 SHOWING CURRENT INCIDENCE AND SEVERITY OF FOREST HEALTH DAMAGING AGENTS ACROSS THE FSJ DFA. 213
TABLE 31. PARTICIPANTS' PLANNED DECIDUOUS HARVEST BY GEOGRAPHIC AREA....217
TABLE 32. PARTICIPANTS' DECIDUOUS VOLUME HARVESTED DURING 3 REPORTING YEARS 217
TABLE 33. PARTICIPANTS' PLANNED HARVEST BY GEOGRAPHIC AREA 220
TABLE 34. CONIFER VOLUME HARVESTED DURING 3 REPORTING YEARS 221
TABLE 35: VOLUME HARVESTED BY CUT CONTROL YEAR PER LICENSE 224
TABLE 36: NET-DOWNS FROM CFMLB (FROM 2016 FSJ TSA DISCUSSION PAPER) 242
TABLE 37: CURRENT (2022) PROPORTION OF LEADING SPECIES BY NDU UNMANAGED (FROM FOS AMENDMENT #411) 243
TABLE 38: FORT ST JOHN DFA REPRESENTATION OF ECO-GROUPS IN THE NHLB 248
TABLE 39: ECO-GROUP ABUNDANCE IN THE FORT ST. JOHN MU 249
TABLE 40: RARE ECO-GROUPS BEC SITE SERIES AND ASSOCIATION 250
TABLE 41. PERFORMANCE STANDARDS FOR WELL GROWING DECIDUOUS AREAS 263
TABLE 42. LRMP RMZS WITHIN EACH LANDSCAPE UNIT 291
TABLE 43: LRMP OBJECTIVES BY LANDSCAPE UNIT....295
TABLE 44: LRMP TIMBER STRATEGIES BY LANDSCAPE UNIT 300

1.0 INTRODUCTION

1.1 PURPOSE

As society has been increasingly affirming a wider set of values that forests can provide, the forest industry has witnessed a distinct change in the philosophy of forest management. Though timber may still be the primary economic value from the forests, a wider range of economic, environmental, and social values is being demanded. Forest management now involves the sustainable management of a much larger spectrum of values such that the benefits we enjoy from the forests today do not impact on the ability of following generations to enjoy benefits from the forests in the future. This concept is commonly referred to as "Sustainable Forest Management" (SFM) and has gained acceptance at the international, national, and local levels.

Furthermore, SFM has attracted the attention of buyers of forest products who are increasingly demanding that the industry demonstrate that products are derived from forests managed on a sustainable basis. As a result, forest certification now represents a significant assurance to buyers of wood products that the management of forests meets identified standards that are considered critical for SFM. In addition to considering public objectives and forest management issues, this plan incorporates the Participants' broad business objectives. These include:

- Participants either have a significant long term capital investment in manufacturing plants or rely on selling timber to manufacturing plants to provide important revenues. Participants therefore have a vested interest in ensuring timber supplies are sustainably managed to provide relatively continuous deliveries of reasonably priced, high-quality timber that meets manufacturing plants' requirements over the long term.
- Participants are interested in maintaining certification of their forest management to maintain or increase access to resources and markets. This entails ensuring management strategies that are implemented providing for the sustainability of other non-timber forest resources.
- Participants must be cost competitive provincially and globally within their business sectors. This needs to be achieved by having a stable cost structure and maximizing value within a sustainable forest management framework.
- In mixedwood areas the Participants' business objectives are to optimize the net value of the mixedwood stands by coordinating activities where practical to minimize harvesting and access costs, and by working to reduce administrative barriers to economic and environmental sustainability of this component of the timber resource.

1.2 SFM CERTIFICATION

The Sustainable Forest Management Plan (SFMP) has been structured to meet both regulatory requirements as well as Sustainable Forest Management (SFM) certification needs. The first three plans were guided by the Canadian Council of Forest Ministers SFM Criteria and 17 CSA SFM Elements from the Canadian Standards Association Sustainable Forest Management Standard CAN/CSA-Z809-16, in addition to the legal requirements of the *Fort St. John Pilot Project regulation*, and input from the Public Advisory Group to set values, objectives, indicators. SFMP #3 for the Fort St. John Pilot Project area was prepared according to the *Fort St. John Pilot Project Regulation* and in 2019, the participants moved towards certification with the Sustainable Forestry Initiative® (SFI). BCTS and Canfor were registered to the SFI® Forest Management Standard in the spring of 2019. LP received registration to the standard in September 2022. All three participants are registered to the SFI 2022 Forest Management Standard.

The SFI Forest Management Standard is a voluntary tool that provides independent third-party assurance that an organization is practicing Sustainable Forest Management. The standard emphasizes the sustainable harvesting of forest resources, protection of biodiversity and wildlife habitats, conservation of water, and respect for indigenous rights. It aims to ensure that forest operations are environmentally sound, socially responsible, and economically viable, supporting healthy forests for current and future generations.

1.2.1 Sustainable Forest Management Certification

The SFI® *Forest Management Standard* is based on 13 Principles that guide its philosophy:

1. Sustainable Forestry
2. Forest Productivity and Health
3. Protection of Water Resources
4. Protection of Biological Diversity
5. Aesthetics and Recreation
6. Protection of Special Sites
7. Legal Compliance
8. Research
9. Training and Education
10. Community Involvement and Social Responsibility, and Respect for Indigenous Rights
11. Transparency
12. Continual Improvement
13. Responsible Fiber Sourcing

Further, the standard's structure includes 17 Objectives, 41 Performance Measures, and 114 Indicators that make up the standard.

Objectives: Derived from the principles, objectives specify the desired outcomes of sustainable forest management. They provide clear goals that forest managers aim to achieve, such as maintaining forest productivity, safeguarding wildlife habitat, and minimizing environmental impact.

Performance Measures: These are the specific criteria used to evaluate whether the objectives are being met. They set the standards for assessing management practices and outcomes, ensuring accountability and continuous improvement.

Indicators: These are measurable variables or data points used to demonstrate progress toward meeting the performance measures. They provide concrete evidence of management effectiveness, such as water quality metrics, or harvest levels.

To achieve SFI forest management certification, organizations must implement all applicable requirements set out in the Forest Management Standard. An application for participation in the program is submitted to SFI and once it is approved, an on-site audit is completed by an accredited certification body to verify that operations meet the standard. An initial registration audit performed by an accredited certification body involves a team of experienced trained auditors including a lead auditor, technical experts in areas such as plant and wildlife ecology, conservation, forestry and hydrology, as well as knowledge of a region's socio-demographics and cultural issues. The team performs a forest audit verifying that requirements are being performed on the ground and a desk audit verifying required plans and documentation are in in place.

Once a certification body approves the certification, a public summary document is prepared and submitted to SFI to post on the website.

1.2.3 Audits and Reporting

Certified program participants must complete surveillance audits annually to verify ongoing conformance to the SFI Forest Management Standard, with a full re-certification every five years. The Participants make audit summaries available to the public on the SFI website and the Fort St John Pilot Project website.

Each year the Participants compile the SFM Pilot Project Annual Report that summarizes results for each of the indicators. A review of this report is a key reference for the SFI auditing teams. This annual report is also provided to the Public Advisory Group for review and comment. Annual monitoring of the achievement of the Plan and comparison of the actual results to forecasts will enable the effectiveness of the SFM Plan to be continually improved, to support conformance to the SFI Forest Management Standard, and to meet regulatory requirements.

In addition to certification audits, the Participants must submit to independent audits by a qualified auditor to evaluate compliance with the regulation and the SFMP at least once every 2 years.

1.2.4 Management Review

Each year, management staff of the Participant's conducts a review of performance in achieving the targets. This information is used to evaluate trends in moving toward or away from the objectives and targets in the Participants Environmental Management System and the SFMP. The information is used to make recommendations for improvement to the plan to achieve the Environmental Management System and Sustainable Forest Management Plan objectives and targets.

1.3 DESCRIPTION OF EXISTING STRATEGIC PLANS

1.3.1 Fort St. John Land and Resource Management Plan

Objectives for values and resources, and acceptable uses on Crown land were outlined in the LRMP, a public land use process that was completed in 1997. The Fort St. John Land and Resource Management Plan (LRMP) was approved by Cabinet in October 1997. The plan incorporates the principles of integrated resource management into a long-term plan for resource development on Crown land within the Fort St. John Timber Supply Area (TSA). The Fort St. John pilot project area falls entirely within the LRMP area.

The Fort St. John LRMP is the outcome of the deliberations of a range of local private citizens, stakeholders, including forest industry members, and government agency representatives. The Fort St. John LRMP process incorporated a form of consensus-based decision-making that enabled general agreement on all issues.

The Fort St. John LRMP adopted the following principles as stated in the approved document.

- Sustainable use of renewable natural resources, and
- The management of any one resource shall take into consideration other resource values, rights, tenures, and development opportunities and shall recognize the biological and physical limitations of the land and resources. In addition, land and resource management objectives and strategies will incorporate the need to maintain or enhance the local quality of life, social and economic stability, and vitality of the local communities (FSJ LRMP, 1997).

The FSJPPR requires that forest resource planning conducted by the Participants, including the Sustainable Forest Management Plan, be consistent with the objectives of the Fort St. John LRMP. The Fort St. John LRMP also includes strategies for meeting the stated objectives. Table 43 in this SFMP summarizes the LRMP objectives that are impacted by forestry activities. The Participants believe that the SFMP is generally consistent with these strategies and objectives, however, the LRMP was developed in the 1990s without meaningful input from First Nations communities, reflecting the values and priorities of that time. Since then, significant changes have occurred in how land and resources are valued, particularly with increased recognition of First Nations' treaty rights, cultural connections, and traditional knowledge. Additionally, multiple agreements between the BC government and First Nations have been signed that are not reflected in the LRMP. The Participants are required to be consistent with the LRMP (as per *FSJPPR* sec. 35(1)(b)), and as such Section 1.4.1 of this plan is included for completeness and acknowledging the regulation. However, many things have changed since the approval of the LRMP and the enactment of the *FSJPPR*, and current, and potentially competing values must now take precedence. This may necessitate deviations in this plan from the LRMP's original objectives to better align with increased involvement and inclusion of First Nations in decision making, contemporary land use, cultural considerations, and evolving societal values.

1.3.2 Muskwa-Kechika Management Area

A portion of the Fort St. John pilot project area is contained within the Muskwa-Kechika Management Area (MKMA), as defined in Bill 37-1998, the *Muskwa-Kechika Management Area Act*. The Preamble to the Act describes government's intent regarding the area and states:

> *"Whereas the Muskwa-Kechika Management Area is an area of unique wilderness in northeastern British Columbia that is endowed with a globally significant abundance and diversity of wildlife, and whereas the management intent for the Muskwa-Kechika Management Area is to maintain in perpetuity the wilderness quality, and the diversity and abundance of wildlife and the ecosystems on which it depends while allowing resource development and use in parts of the Muskwa-Kechika Management Area designated for those purposes including recreation, hunting, timber harvesting, mineral exploration and mining, oil and gas exploration and development, and whereas the long-term maintenance of wilderness characteristics, wildlife and its habitat is critical to the social and cultural well-being of first nations and other people in the area, and whereas the integration of management activities especially related to the planning, development and management of road access within the Muskwa-Kechika Management Area is central to achieving this intent and the long-term objective is to return lands to their natural state as development activities are completed. Therefore, her majesty, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows (the Act):"*

Section 8(1) of the *Muskwa-Kechika Management Area Act* specifies that a prerequisite to the approval of a forest development plan in the Muskwa-Kechika Area is an approved landscape unit objective.

1.3.3 Graham River IRM Plan

Sustainable resource values, including timber, fishery, wildlife, recreation, and scenic values, were assessed in the Graham River valley, as part of an Integrated Resource Management Plan (IRM Plan) prepared by Canfor. The Graham River IRM Plan includes the Crying Girl Landscape Unit (LU) in the

Boreal Foothills Natural Disturbance Units (NDU), and the portion of the Graham LU that falls within the Omineca NDU.

The plan brought together existing resource information and collected new information through discussions with resource user groups and government agencies, and extensive photo and field assessments of various resources. The final plan document discusses the resource values and issues in the valley and presents a general timber harvest strategy which addresses the key resource issues in the drainage. The objectives were *to "plan the use of the area without prejudice to the value, use or sustainability of any one resource at the expense of other resources within the area or dependent on it"* (Lance, 1997). Following public, agency, and First Nations reviews, the plan was approved by MFRR and MELP in September of 1998. The four primary management strategies to be implemented are the application of sequential clustered development, maintenance of connectivity corridors, access management, and adaptive management.

Forestry Operations within the Crying Girl LU and the portion of the Graham LU that falls within the drainage will be consistent with the intent of the Graham River IRM Plan. Strategies are designed to implement key components of the Graham River IRM Plan in these areas within these LUs.

The Ministry of Forests District Manager and a designated official of the Ministry of Environment, Lands and Parks jointly approved the Graham River IRM Plan in September 1998.

1.4 DESCRIPTION OF THE SFM PLANNING AREA

The Fort St. John TSA is in the northeastern interior of British Columbia. The TSA covers about 4.8 million hectares and is bounded by the Peace River in the south, the Alberta border in the east, the Fort Nelson TSA in the north, and the Rocky Mountains in the west. The Fort St. John pilot project area (the "defined forest area", or DFA) covers approximately 4.1 million hectares (Figure 1) within the Fort St. John TSA. Private lands and woodlots located within the TSA are excluded from the DFA. The TSA is in the Northeast Natural Resource Region and is administered by the Peace Natural Resource District.

The eastern portion of the TSA is dominated by a plateau (primarily the Alberta Plateau ecoregion), while the western portion consists of the Rocky Mountains and foothills. Four Biogeoclimatic zones occur in the TSA: the Boreal White and Black Spruce zone in the plateau and lower elevations; the Englemann Spruce-Subalpine Fir and Spruce-Willow-Birch zones at medium to high elevation in the mountains and foothills; and the Alpine Tundra zone at higher elevations. White spruce, lodgepole pine, aspen, and black spruce are the dominant tree species in the area. Minor amounts of subalpine fir, birch, balsam poplar and tamarack are also present in the DFA.

In 2016, the population of the Fort St. John TSA was estimated at 31,015 people. The city of Fort St. John is the largest community in the TSA, with a population of 21,465 (2021). First Nations communities in the TSA include settlements at Halfway River, Blueberry River and Doig River. An additional nine First Nations have declared interests within the TSA: Fort Nelson, Tsay Keh Dene, McLeod Lake, Prophet River, Dene Tha', Horse Lake, Saulteau and West Moberly. The general TSA area falls within the provisions of Treaty 8 (B.C. Ministry of Forests, 2016).

The Fort St. John TSA is unique in several ways. Oil and gas exploration and development has occurred throughout most of the planning area over the past few decades. The southern and southeastern

portion of the planning area is predominantly used for agriculture and has a high concentration of privately held lands. Forest harvesting and management, although a major part of the current local economy, is relatively recent with some areas yet to be developed for timber harvesting. The mineral resources of the area are relatively unexplored, and significant potential exists in the western portion of the TSA near the Rocky Mountains. Energy development is the largest economic sector in the TSA, with agriculture and forestry ranking second and third respectively, in terms of local employment. It should be noted that the permanent closure of Canfor's mill in 2024 may impact this ranking in the future.

Nationally and internationally recognized wildlife resources are an important feature in the in much of the western portion of the TSA. The TSA incorporates the southern portion of the Muskwa-Kechika Management Area. The *Muskwa-Kechika Management Area Act* was passed in June 1998 and establishes management intent for a series of protected areas and special management areas in the "Northern Rockies". Management of the Muskwa-Kechika area for its high wildlife, biodiversity and wilderness values is a key goal of several resource sectors and provincial, national, and international interest groups (FSJ LRMP, 1997).

As noted in the November 2016 Fort St John TSA Timber Supply Analysis Discussion Paper, about 56% of the Fort St. John TSA (about 2.8 million hectares) is considered productive forest land managed by the Crown. Currently about 37% of this area or 21% of the total TSA is considered available for timber harvesting under current forest management practices, called the Timber Harvesting Land Base (THLB). The current THLB is 1,020,817 hectares, consisting of 415,472 (40.7%) hectares dominated by deciduous species and 605,345 (59.3) hectares dominated by coniferous species. The THLB does not contain stands of black spruce.

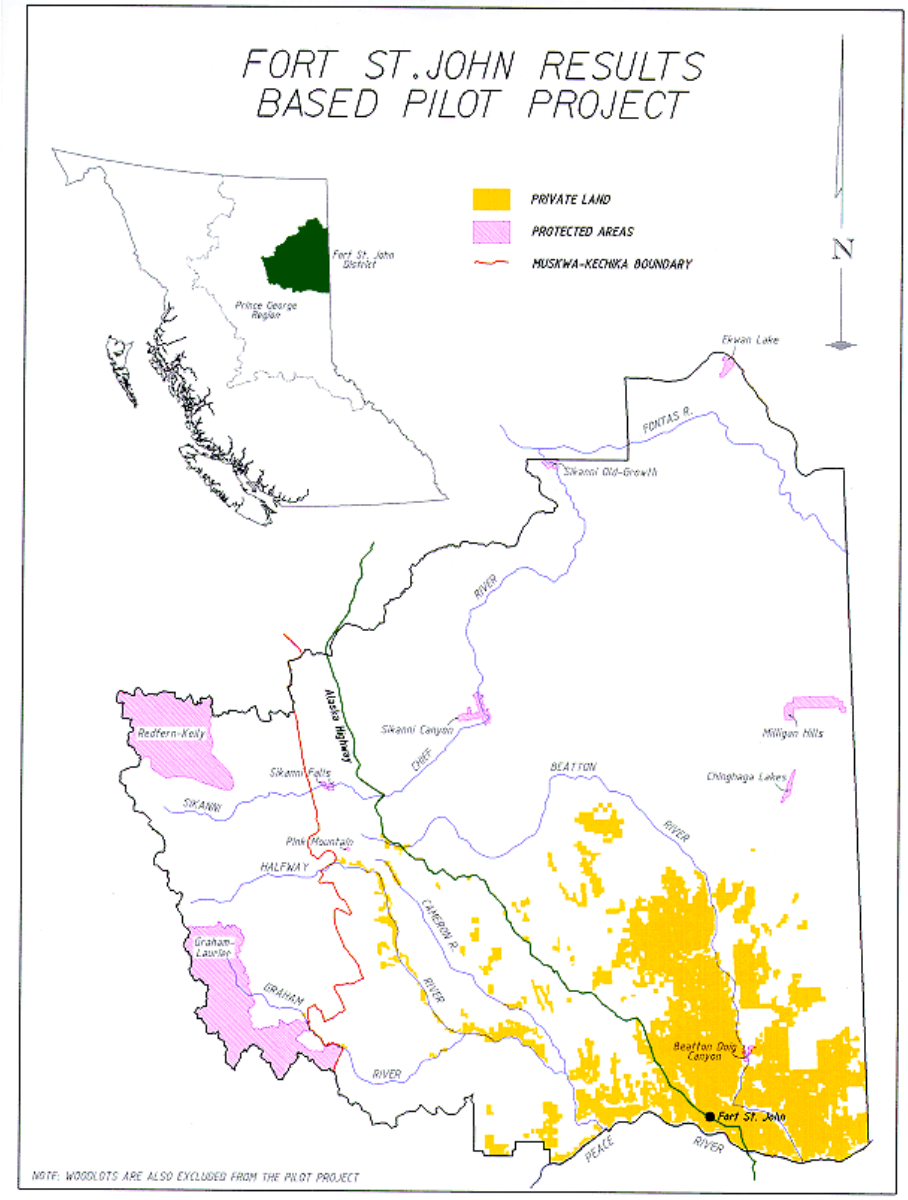


Figure 1. Project Area Map

1.4.1 Description of The Landscape Units

Landscape Units (LU) are based on updated Biogeoclimatic Ecosystem Classification (BEC) mapping, ecosection boundaries, Natural Disturbance Units (NDU), and important administrative boundaries such as the revised district boundaries and the strategic land use boundaries of the Muskwa-Kechika Management Area. In the absence of an administrative boundary, resource features such as main stem rivers (midpoint) or height of land were used wherever possible to provide logical natural boundaries for each LU. These boundaries often encompass multiple watersheds in mountainous terrain, and reflect similar BEC units, eco-sections, and Natural Disturbance Units.

The current LU boundaries are consistent with strategic boundaries and their respective objectives at the LRMP Resource Management Zone (RMZ) level and allow the administrative areas to be managed without overlapping LU boundaries and fragmenting objectives during implementation (Figure 2).

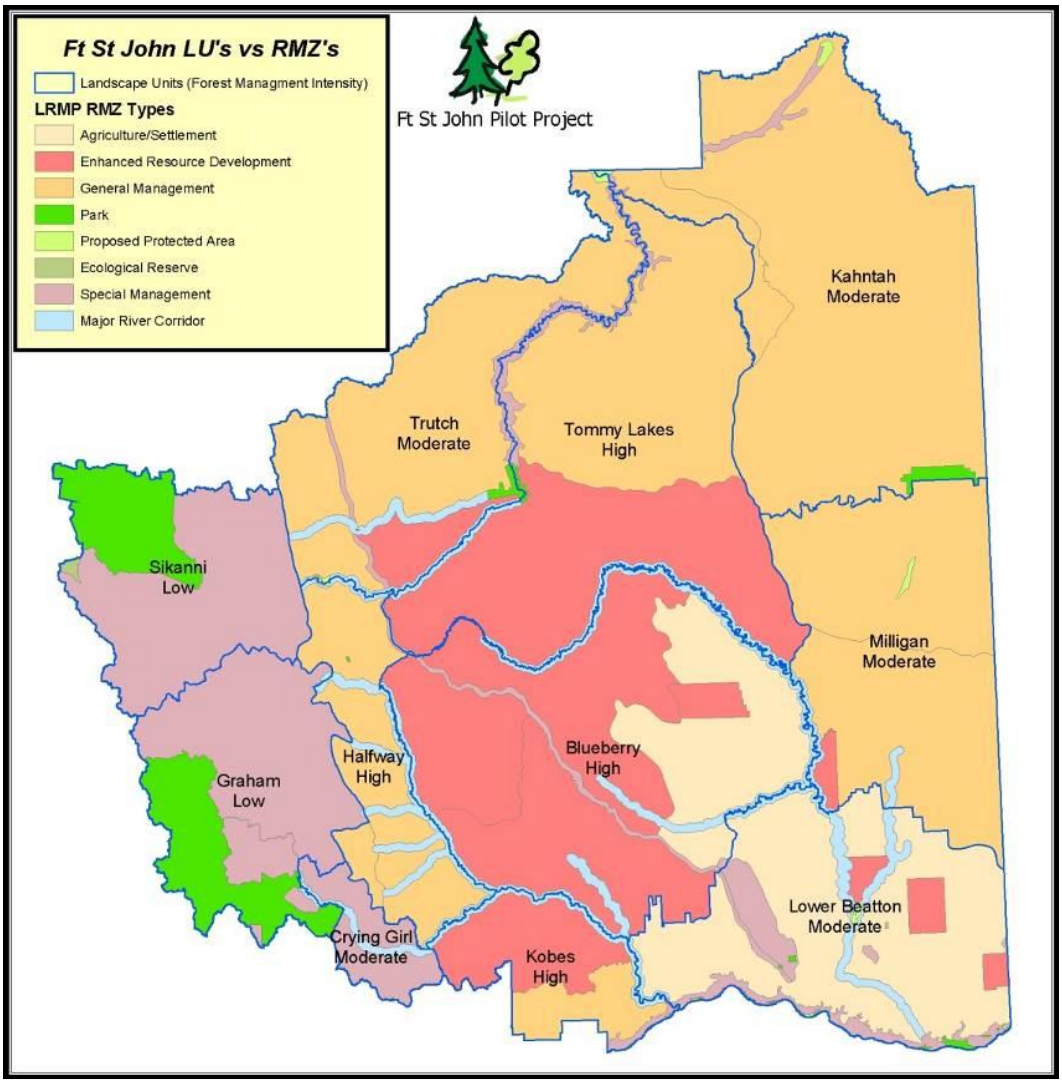


Figure 2: Fort St. Landscape Units and Resource Management Zones

Based on a combination of the LRMP timber objectives and timber strategies, as well as the biodiversity emphasis strategies outlined in the LRMP, relative management intensity levels were assigned to the landscape units. Targets for wildlife tree patch retention levels were originally based on the variable management intensity levels.

1.4.1.1 High Intensity Forest Management LUs

The Blueberry, Halfway, Kobes and Tommy Lakes LUs are included in this zone. The LRMP's predominant timber objective in the RMZs that make up the majority of these landscape units is to enhance timber harvesting and a sustainable long term timber supply. The LRMP's predominant

timber strategy in the RMZs that make up the majority of these landscape units is to establish forest production targets consistent with high intensity forest management regimes. Similarly, the predominant biological diversity emphasis identified in the LRMP for these zones is low. To meet other non-timber objectives identified in the LRMP, some unique areas within these LUs will receive special management attention.

1.4.1.2 Moderate Intensity Forest Management LUs

This includes the Crying Girl, Kahntah, Lower Beatton, Milligan and Trutch LUs. The LRMP timber objectives in the RMZs that make up the majority of these landscape units include maintaining timber harvesting and forest management opportunities, and in some cases enhancing timber harvesting for a sustainable long term timber supply. The predominant LRMP timber strategy in the RMZs that make up the majority of these landscape units is to establish forest production targets consistent with moderate intensity forest management regimes. Similarly, the predominant biodiversity emphasis identified in the LRMP for these zones is intermediate. To meet other non-timber objectives identified in the LRMP, some unique areas within these LUs will receive special management attention.

1.4.1.3 Low Intensity Forest Management LUs

The Graham and Sikanni LUs make up this zone, which also coincides with the Muskwa-Kechika Management Area. The LRMP objective is to maintain timber harvesting and forest management opportunities, and the predominant timber strategy in the RMZs that make up the majority of these landscape units is to establish forest production targets consistent with either low and/or moderate intensity forest management regimes. Similarly, the biodiversity emphasis identified in the LRMP for these zones is predominantly high. Timber harvesting operations will occur in these LUs, but an enhanced emphasis will be placed on ensuring other resource values are protected. Timber harvesting within these areas will be consistent with the Muskwa-Kechika Management Plan and any other approved plans which specifically apply to forestry operations.

1.4.1.4 Protected Areas

Protected Areas identified in the LRMP are imbedded within the LU areas noted above. Regardless of the assigned LU intensity classification, there will be no timber harvesting activities planned within those portions of the LUs identified by the LRMP as protected areas. Table 1 summarizes the LU areas by forest management intensity level.

Table 1: Landscape Unit Intensity Classes

LU by Intensity Classes	Total area (ha)	% Distribution
HIGH INTENSITY		
Blueberry	731,433	15.6
Halfway	206,438	4.4
Kobes	159,807	3.4
Tommy Lakes	705,677	15.1
Total High Intensity:	**1,803,355**	**38.6**
MODERATE INTENSITY		
Crying Girl	67,343	1.4
Kahntah	749,247	16.0
Lower Beatton	498,200	10.7
Milligan	473,968	10.1
Trutch	436,724	9.3
Total Moderate Intensity:	**2,225,482**	**47.6**
LOW INTENSITY		
Graham	335,209	7.2
Sikanni	312,285	6.7
Total Low Intensity:	647,494	13.8
TOTAL AREA	**4,676,330**	**100**
PROTECTED AREAS	**234,439**	**5.0**

1.4.2 Unique Management Areas within High or Moderate Intensity LUs

In addition to protected areas, portions of some landscape units have unique values that require enhanced management consideration. While these areas are included in the larger landscape units to reflect the broad natural disturbance patterns, specific management strategies will be tailored to address the concerns in these areas.

- Major river corridors requiring some special management considerations transect portions of several LUs in the moderate and high intensity forest management regimes. These areas include the Blueberry River, downstream of approximately 56 degrees 46 minutes latitude, the Beatton River below its confluence with Julienne Creek, the Sikanni River, Halfway River, Graham River, Chowade River, Peace River, Cameron River below 56 degrees 35 minutes latitude, the lower reaches of the Osborn (downstream of 56 degrees, 36 minutes), the Doig River (downstream of 56 degrees 49 minutes), Bluegrave Creek, Horseshoe Creek and Cypress Creek. These major river systems are very important to the sustainability of a wide variety of resource values. Wildlife, fisheries, water, and timber values are all very high within these areas, and some modified management strategies are needed to minimize impacts on non-timber resources.

- The Charlie Lake water supply area was also identified as a special management area, which requires particular attention to water management concerns.
- The Alaska Highway, which winds through several landscape units, requires added management consideration for visual resources.

2.0 DESCRIPTION OF THE PILOT PROJECT

In June 1999 the BC government added Part 10.1 to the Forest Practices Code of BC Act to enable results-based pilot projects. The intent of the pilot projects is to test ways to improve the regulatory framework for forest practices while maintaining the same or higher levels of environmental standards.

Canadian Forest Products Ltd., Slocan Forest Products Ltd., Louisiana-Pacific Canada Ltd., and the Ministry of Forests Small Business Forest Enterprise Program prepared a detailed pilot project proposal that provided for the basis for the Fort St. John Pilot Project Regulation. Beginning in 2000, the Participants established a public advisory group (PAG) comprised of local people representing a variety of interests. The public advisory group reviewed the draft detailed project proposal and draft regulation, reviewed comments from the general public, and provided advice to government on the suitability of the project. Cabinet accepted the proposal and a draft regulation late in 2001.

The *Fort St. John Pilot Project Regulation* requires the establishment of a strategic plan for the pilot project area, to be known as a Sustainable Forest Management (SFM) Plan. The Participants have prepared the SFMP with the guidance of a local Public Advisory Group, and a multi-representative SFMP Planning team. Upon government approval, by the Ministry of Forests and the Ministry of Water, Land, and Resource Stewardship, the SFMP will provide continued strategic stewardship direction to forest operations carried out in the pilot project area.

The Participants also intend that the Sustainable Forest Management Plan (SFMP) for the pilot project area meet the requirements of the SFI 2022 Forest Management Standard. The Public Advisory Group (PAG) has worked with the Participants to identify and select values, objectives, indicators, and targets to be considered in the development of the SFMP for the pilot project area. The PAG will continue to have a role in monitoring and evaluating the results of the SFMP and in recommending improvements.

After a sustainable forest management plan has been approved the Participants may prepare and submit to the District Manager FOR, Peace Natural Resource District, a Forest Operations Schedule (FOS). The FOS identifies the areas where timber harvesting and road construction are proposed. All forest operations carried out under a FOS must be consistent with the SFMP. The FOS is subject to a public review and comment process. The District Manager does not formally approve the FOS but may withhold the authorization of specific operations if they are not consistent with the FOS or SFMP.

2.1 DESCRIPTION OF THE PARTICIPANTS

The BC Timber Sales Manager and any holder of an agreement under the Forest Act who carries out forest practices in the pilot project area may become a Participant in the Fort St. John Pilot Project. Reference to "**Participants**" throughout this SFMP refers to those forest companies or government agencies who have agreed to participate in the Fort St. John Pilot Project. Some Participants have delegated the forest management activities in the TSA, related to their licences, to other Participants through legal Memoranda of Agreement (MOA). Reference to "**Managing Participants**" is to those government agencies, or those

companies who, through these MOA, will be principally responsible for forestry operations conducted under this SFMP. The following agencies and forest companies are Participants in the pilot project:

2.1.1 BC Timber Sales

BC Timber Sales (BCTS) was founded in 2003 and is a self-financing program within the Ministry of Forests (the Ministry). BCTS sustainably manages the harvesting and reforestation of approximately 20 percent of the timber available for harvest from British Columbia's timber harvesting land base. "Timber harvesting land base" is public land where environmentally sound timber harvesting is allowed and economically feasible.

BCTS VISION: To be an effective timber marketer generating wealth through sustainable resource management.

BCTS MISSION: Committed to pursuing excellence in all aspects of our business, maintaining effective relations and focusing on results, BC Timber Sales generates economic prosperity for all British Columbians through the safe, sustainable and reliable development and auction of public timber, and by playing a pivotal role in the Ministry's reforestation strategies.

BCTS achieves its vision and mission by planning, developing, and selling through auction a substantial and representative portion of the province's annual available timber volume as well as reforesting harvested areas. The bid prices received from auctioned timber support the Market Pricing System (MPS) in setting stumpage rates for most non-BCTS cutting authorities throughout the province. The costs incurred by BCTS also provide data for the tenure obligation adjustments, contributing to another integral part of the MPS.

Within three overarching principles, BCTS has one goal and three objectives. The achievement supports the core outcomes of economic prosperity, sustainability, business excellence, safety and reconciliation.

Principal 1. Forest Sector Safety

Principal 2. Reconciliation with Indigenous Peoples

Principal 3. Sustainable Forest Management

BCTS GOAL: Provide credible representative price and cost benchmark data for the Market Pricing System through auctions of timber harvested from public land in British Columbia.

Through 12 Business Areas and an operational presence in 33 locations, BCTS manages some 20 percent of the provincial Crown allowable annual cut.

BCTS achieves its goal with the following objectives:

1. Sell the full BC Timber Sales' apportionment over the business cycle, consistent with safe practices and sustainable forest management and reconciliation with Indigenous peoples.
2. Generate direct net revenue and indirect revenue for the Province over the business cycle; and
3. Pursue continuous business improvements across government and with third part partners and customers.

The BC Timber Sales Peace-Liard Business Area geographically encompasses the Fort Nelson and Peace (formerly Dawson Creek and Fort St. John) Forest Districts. The administrative, planning and management centre for the business area is the Timber Sales Office (TSO) located in Dawson Creek. In addition to the

TSO, field teams comprised of field-oriented staff reporting to the main TSO are located in Dawson Creek, Fort Nelson, and Fort St. John.

BCTS currently has a coniferous apportionment in the Fort St. John TSA of 372,059 m^3 per year and a deciduous apportionment of 180,000 m^3 per year which are auctioned competitively.

Refer to Appendix 1 for BCTS's SFM policy. BCTS is one of the **Managing Participants** referred to in this SFMP.

2.1.2 Cameron River Logistics.

Cameron River Logistics. (CRL) operates as a custom manufacturer of softwood products in Taylor BC (approximately 15km south of Fort St. John) for distribution to various value-added manufacturers.

CRL was the holder of Forest Licence A59959 that had an allowable annual cut (AAC) of 70,000 m^3 of timber from coniferous leading stands located in the Fort St. John TSA. This was a non-replaceable forest licence with a term of 15 years, which expired in 2017. The company retained the services of Canfor to manage all aspects of its forest licence (i.e., planning, harvesting, reforestation, etc.) on their behalf. CRL became a Participant on December 19th, 2002.

2.1.3 Canfor (Canadian Forest Products Ltd.)

Canfor Corporation is a Canadian integrated forest products company based in Vancouver, BC., with holdings in BC and Alberta, the southeast United States, and Sweden. The company is a major producer of lumber and bleached kraft pulp. It also produces semi-bleached and unbleached kraft paper and remanufactured lumber products. The main operating company is Canadian Forest Products Ltd., from which the name Canfor is derived.

Canfor formerly operated three facilities in the Fort St. John area. A random length dimension mill near Fort St. John produced SPF lumber for the North American and Asian housing markets and the British Columbia secondary manufacturing industry; Canfor's Taylor Pulp mill produced pulp for overseas pulp markets, and a pellet plant on the Fort St. John site produced wood pellets for the Japanese market to offset coal use. In September 2024 Canfor announced the permanent closure of the Fort St. John sawmill, citing "*…persistent challenge accessing economic fibre, ongoing financial losses, weak lumber markets and increased US tariffs*…".

The Fort St. John sawmill consumed 1 million m^3 of conifer sawlogs annually during normal operating conditions, with all residual fibre being used either on site or shipped to other facilities. The primary sources timber were forest license tenures in the Fort St. John TSA, and BCTS timber sales. Additional volume was purchased from other sources in the area, woodlots, oil and gas salvage, and private landowners. Canfor continues to hold and manage Forest Licence A18154 and Pulpwood agreement #12.

Canfor's Fort St. John/Taylor operations employed approximately 350 persons directly and another 200 contractor employees in woodlands operations.

Canfor is one of the **Managing Participants** referred to in this SFMP.

2.1.4 Louisiana-Pacific Canada Ltd. and Peace Valley OSB

Founded in 1972 and headquartered in Nashville, Tennessee, Louisiana-Pacific Corporation (LP) is a leading manufacturer of high-performance building solutions in North America and South America. LP has more than 20 manufacturing facilities throughout the U.S., Canada, Chile, and Brazil.

For over 50 years, LP has been Building a Better World™ by helping customers construct beautiful, durable homes while shareholders build lasting value. LP's extensive portfolio of innovative and dependable products meets the demands of builders, remodelers, and homeowners worldwide.

As a leader in high-performance building solutions, LP provides industry-leading customer service and warranties. Louisiana-Pacific Canada Ltd. is the Canadian arm of LP Building Solutions. Operating Canadian facilities are in Quebec, Manitoba, and British Columbia.

LP holds one Non-Replaceable Forest License in the DFA. The timber from this tenure supplies an oriented strand board plant run by LP Peace Valley OSB (PVOSB). This plant was previously a joint venture between LP and Canfor until 2013, when Canfor sold its interests to LP, including timber volume associated with a Pulpwood Agreement (now expired).

The Sustainable Forestry Initiative is a strategic priority for LP. Innovation, adaptation, and continual improvement of forest management practices on all forested lands are key components to sustainable forest management. The Fort St. John Results Based Pilot Project provides unique opportunities and unique challenges in leading the forest industry in BC into a new era of forest management. Data sharing, joint planning efforts, innovative silviculture activities, innovative management of mixedwood forests and a landscape level approach to forest management will help address the sustainable management of timber and other forest resources.

Refer to Appendix 1 for Louisiana-Pacific Canada Ltd. SFM policies.

2.1.5 Doig River First Nations

Doig River First Nation (DRFN) is Tsáá? ché ne dane, a proud Dane-zaa people indigenous to the upper Peace River region of BC and Alberta. DRFN's traditional base extends in all directions from Gat Tah Kwâ, now called the city of Fort St. John. The ancestors of the members of the present-day Doig River First Nation adhered to Treaty 8 in 1900 as part of the Fort St. John Beaver Band. DRFN is committed to honouring Treaty 8 and protecting Dane-zaa knowledge, culture, and way of life.

Doig River First Nation was awarded Forestry License to Cut A99370 through a Wildfire Salvage Opportunity Agreement with the Province of BC. This license allows for the harvesting of timber that is dead or damaged from wildfires within the Fort St. John Timber Supply Area. A99370 has a license term of 2 years, expiring on December 19, 2025, and allows for a maximum harvested volume of 250,000 m^3.

2.1.6 Holders of Forest Licence A56771 – West Moberly First Nation and Canfor

West Moberly First Nation and Canfor jointly hold conifer Forest License A56771 in the Fort St. John TSA. This licence had an AAC of 150,000 m^3 per year, and was administered by Canfor through a Memorandum of Agreement. FL A56771 expired in 2023. Canfor continues to manage the outstanding obligations for this license.

2.1.7 Holders of Forest Licence A60972 – Tembec, Paper Excellence, Mackenzie Pulp mill Corporation, Domtar

As part of the purchase of the Chetwynd Pulp Mill from Louisiana-Pacific Ltd. in October 2002, Tembec acquired the rights to FL A60972, a non-replaceable conifer forest licence in the Fort St. John TSA, with an annual allowable cut of 83,498 m^3 per year. Paper Excellence acquired the Chetwynd Pulp mill and eventually transferred the licence to Mackenzie Pulp Mill Corporation (MPC). In 2024 Paper Excellence rebranded their company under the Domtar name. FL A60972 expired in 2021. Domtar has indicated that they will apply to cease to be part of the Pilot Project. Canfor managed the woodlands operations during the term of the license, and continues to manage outstanding obligations for this licence on the companies' behalf.

2.1.8 Halfway River First Nation

Halfway River First Nation (Halfway) is comprised of Dane Zaa people whose relationship with the boreal forests of what is now western Canada has spanned millennia. Land stewardship laws guide the Halfway community on how to interact with the land. Halfway's Reserve #168 is located within the Fort St John Timber Supply Area. Halfway's participation in the SFMP review process has been guided by the community's desire to have the SFMP better reflect Halfway member observations, recommendations, and knowledge of the land.

2.1.9 Prophet River First Nation

Prophet River First Nation was issued a Wildfire Salvage Opportunity Agreement by the Province of British Columbia in January of 2023. Prophet River First Nation opted to join the Fort St John Pilot Project as a participant for the SFMP#4. Prophet River First Nation is committed to protecting the treaty rights of our Nation and all Treaty 8 signatory Nations within Northeast BC. Prophet River First Nation is committed to sustainable natural resource management that benefits all the people of Northeast BC while protecting the traditional and treaty rights of our Nation and neighbouring Nations enshrined in the context of Treaty 8.

2.2 STRUCTURE AND RESPONSIBILITY

A Steering Committee and a Working Group have provided governance to the Fort St. John Pilot Project. The Steering Committee, comprised of senior management representing the Participants, originally provided broad guidance to the Working Group. The steering committee has not been in effect since the implementation of SFMP #3, and the working group is the main governance of the Pilot Project for the implementation of Pilot Project maintenance and initiatives. The Managing Participants appoint local management representation to the Working Group to develop and implement pilot initiatives, including the SFMP.

The Regional Executive Director and Resource Management Director FOR currently have the authority to approve a Sustainable Forest Management Plan, or amendments to a Plan, under the *FSJPPR*.

2.3 DESCRIPTION AND ROLE OF PAG

The Participants are committed to provide ongoing opportunity for the public to be involved in the Fort St. John Pilot Project planning and monitoring activities. A key element in the public overview component is the establishment of a Public Advisory Group (PAG).

The PAG consists of a representative for local interests, including:

i. Commercial recreation
ii. Environment/conservation
iii. Forest contractors/workers
iv. Labor
v. Non-commercial recreational – fishing/hunting
vi. Non-commercial recreation – non-consumptive
vii. Range
viii. Rural communities
ix. Trapping
x. Urban communities
xi. Energy
xii. First Nations representatives

The role of the Fort St. John Pilot Project Public Advisory Group (PAG) is to provide input on the pilot project as described in the approved regulation and pilot proposal. In addition, the group will also meet the needs of the SFM Standard certification process, which includes providing input to help ensure that the Participant's forest management decisions *"…are made as a result of informed, inclusive, and fair consultation with local people who are directly affected by or have an interest in sustainable forest management."* The PAG will represent the diverse range of interests in the Defined Forest Area (DFA) and will:

- ensure that the Participants' Forest management decisions, as contained in the sustainable forest management plan, are made as a result of informed, inclusive and fair consultation with local people who are directly affected by or have an interest in sustainable forest management (*FSJPPR Section 47*);
- review proposed sustainable forest management plans and amendments to sustainable forest management plans (*FSJPPR Section 37*);
- review audits (*FSJPPR Section 50*), and
- review annual reports (*FSJPPR Section 51*).

The Public Advisory Group has the opportunity to work with the Participants to:

- identify and select values, objectives, indicators and targets, based on the CSA SFM elements and any other elements of relevance to the DFA,
- develop one or more possible strategies,
- assess and select one or more strategies,
- review the SFMP,
- design monitoring programs,
- evaluate results and recommend improvements,

- and discuss and resolve any issues relevant to SFM on the DFA.

2.4 FIRST NATIONS PARTICIPATION

The SFM planning process has the potential to provide First Nations with enhanced opportunities to participate in forestry planning through participation on the Public Advisory Group, or a parallel process as a separate group from the PAG, if First Nations so requested. Three First Nations have formally signed on to be participants of the Fort St. John Pilot Project - Doig River First Nation, Halfway River First Nation, and Prophet River First Nation. These nations, and other local First Nations, participated significantly in the development of SFMP#4, via the SFMP Planning Team table.

2.5 DESCRIPTION AND ROLE OF STAC

The overall role of the Scientific Technical Advisory Committee (STAC) was to provide input for consideration in the development and implementation of the Sustainable Forest Management Plan (SFMP #1). The STAC included well known and respected academics and professionals possessing a diverse set of knowledge in of aspects of sustainable forest management. They aided the Participants in the identification of appropriate indicators, objectives, or implementation methods to address values and goals derived through the public advisory process. The Committee also provided an overview and commented on the adaptive management framework that is in use by the pilot Participants.

Since the completion of SFMP # 1, the STAC has not formally met, although individual STAC members and other experts have been consulted, providing presentations to the PAG on technical issues, and guidance to the Participants.

The Participants, who are ultimately responsible for the development and implementation of the SFMP, carefully evaluated and considered the recommendations of the Public Advisory Group, and the advice of the STAC members and other experts during the development of the SFMP. Government advisors attend PAG meetings and provide information and advice to the Participants and the PAG from time to time.

3.0 SUSTAINABLE FOREST MANAGEMENT

Sustainable forest management is often depicted as the intersection between the sets of management options that are ecologically appropriate, socially acceptable, and economically viable (Figure 3).

Achievement of this best set of options is based on the application of Ecosystem Management, a forest management system that recognizes the natural variability of an ecosystem and attempts to emulate these natural responses with man-made disturbances while managing forests for a range of environmental, social, and economic values.

Designing a forest management system that recognizes the natural variability of ecosystems and attempts to emulate patterns of natural disturbance is delivered through the application of two key concepts:

1. Sustaining biological richness and
2. Natural disturbance unit planning.



Figure 3. Pillars of Sustainable Forest Management

Both concepts are discussed in the sections below. To demonstrate that ecosystem management is being achieved to meet a range of environmental, social, and economic values, a series of indicators (performance measures) and targets are established within the SFMP (see *Section 5.0 Values, Objectives, Indicators And Targets*).

3.1 SUSTAINING BIOLOGICAL RICHNESS

The concept of "sustaining biological richness" as described in this SFMP was derived from the work initially developed by Dr. Fred Bunnell and the Weyerhaeuser Adaptive Management Working Group (Bunnell et al., 2003). This concept is further described in discussion papers completed for Canfor's TFL 48 (Bunnell, 2002), and for the Prince George TSA (Wells et al., 2003b). The following section describes the importance of sustaining biological richness as it relates to biodiversity and three indicators that may be used to assess achievement. The term "indicator" used by Bunnell et al., 2003; Bunnell, 2002; and Wells et al., 2003a, b is used in the context of providing broad qualitative tests not to be confused with the indicators in *Section 5.0 Values, Objectives, Indicators And Targets* of this Plan, which are specific measures of performance.

Table 2 identifies biological richness and the indicators and sub-indicators defined by Wells et al., 2003a, b. Performance indicators are contained in *Section 5.0 Values, Objectives, Indicators And Targets* that measure and demonstrate performance with regard to the conservation of biological richness over time.

Table 2: Biological Richness and its Indicators and Sub-indicators (Wells et al., 2003)

Biological Diversity Criterion: Biological richness and its associated values are sustained within the management unit.	
Indicator 1: Ecologically distinct ecosystem types are represented in the non-harvestable land base of the management unit to maintain lesser-known species and ecological functions.	
Indicator 2: The amount, distribution and heterogeneity of habitat and landscape structure important to sustain biological richness is maintained over time.	Coarse woody debris
	Large live trees
	Cavity trees (snags)
	Shrubs
	Broad-leaved trees
	Riparian areas
	Late seral and early seral
	Adjacent or continuous canopy
Indicator 3: Productive and well-distributed populations of forest dwelling species are maintained over time.	

Table 3 identifies the critical habitat and landscape elements (sub indicators in Table 2) defined by Bunnell et al., 1999 and their importance for ecosystem management.

Table 3: Habitat and Landscape Elements Identified by Bunnell et al. (1999)

Coarse-woody debris-(downed wood)	Important habitat for a wide range of invertebrates, small vertebrates, and cryptogams (mosses, liverworts, and lichens). Large variations in persistence exist by size (diameter) and species.
Large live trees	Important contributors to snags and coarse woody debris. Important for larger sized cavities. Abundance dramatically affected by forest management.
Cavities (snags)	Snags form critical habitat for at least a portion of the life cycle for a significant portion of all animal species. Tree species preferences exist. Large variations in persistence exist by size (diameter) and species.
Shrubs	Important as food sources for many species (leaves and berries). Important as a habitat component for small mammals and birds, including nest sites. Species diversity increases in early seral, riparian, and open stands.
Broad-leaved trees	Mixtures of coniferous and deciduous trees frequently increase niche diversity. Deciduous snags are frequently preferred as habitat for cavity dwellers. Broad-leaved trees are frequently early seral colonizers, and abundance may decline in low intensity managed and unmanaged area protected from fire.
Riparian	Unique assemblages of species and stand structures. Frequently large impacts on aquatic habitat through temperature controls and biotic inputs. Potentially large impact on water quality.
Late seral and early seral	Very old and very young stands have the greatest niche diversity. Many species appear dependant on either late or early seral stands. Relative importance varies with NDT and large impact on habitat. Influences water quality and quantity through leaf area (evapotranspiration) and runoff.
Adjacent or continuous canopy	Important habitat attribute for some species through influences on species movements. When coupled with spatial considerations, has a large impact on habitat connectivity. Closely associated with patch size and seral stage distributions. Relative frequency of forest opening of different sizes. Major influence on decisions related to scale. Large impact on interior forest and thus habitat.

The term "**biodiversity**" is complex and difficult to demonstrate the conservation of the value over time. Biological richness is a much more concise term and is a credible surrogate for biological diversity (Bunnell, 1998; Wells et al., 2003a, b). The intent of sustaining biological richness is to maintain productive, well-distributed populations of species in a defined management area over time and can be assessed through the use of the three (3) indicators identified in Table 2:

1. Ecosystem representation
2. Habitat and landscape elements
3. Species productivity and distribution

Biodiversity: The variability among living organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems. (Canadian Biodiversity Strategy 1995)

Ecosystem representation is a coarse filter approach intended to ensure a proportion of ecologically distinct ecosystem types are maintained within the non-harvestable land base (NHLB). Maintaining representative ecosystems in an unmanaged state (i.e., NHLB) is important for three (3) reasons (Wells et al., 2003): 1) They sustain poorly understood ecological functions and species habitat requirements; 2) They act as a precautionary buffer against errors in efforts intended to sustain species in the managed forest, and 3) They provide an ecological baseline against which the effects of human activities can be compared.

Habitat and landscape elements are structural attributes that occur at a variety of temporal and spatial scales. Maintaining these elements is a medium filter approach and is important for two (2) reasons (Bunnell and Kremsater, 1990; Lindenmayer and Franklin, 2002; Wells et al., 2003): 1) Studies have shown that most forest dwelling species require these elements as a habitat requirement, and 2) Forest management activities have a strong influence over the abundance, distribution, and functionality of these elements.

Species productivity and distribution is a fine filter approach intended to monitor the presence and trends of species in response to changes in habitat structure and pattern. This indicator is a long-term adaptive approach, which tests the "effectiveness" of the provisions designed to manage indicators 1 and 2 (above). This approach is often referred to as "effectiveness monitoring" and relies on the results of long-term forest monitoring and research programs such as, forest inventory monitoring plots, and wildlife research that supports species accounts (distribution and abundance). As stated above, effectiveness monitoring can be used to support adaptive management, or continuous improvement of forest practices related to indicators 1 and 2 over time. Section 3.4 Continuous Improvement discusses the SFMP process for continuous improvement.

3.2 NATURAL DISTURBANCE UNIT PLANNING

The Biodiversity Guidebook (1995) was the first attempt in British Columbia to present guidance for forest management based on the natural disturbance template. Since the completion of the Biodiversity Guidebook, more information on natural disturbance dynamics has become available. Within the Northeast Region a number of studies have investigated particular aspects of natural disturbance (DeLong, 1998; DeLong and Kessler, 2000; Lewis and Lindgren, 2000; Rogeau, 2001; DeLong, 2011).

The concept of natural disturbance unit planning was introduced in 2011 by S. Craig DeLong in a document entitled "*Land Units and Benchmarks for Developing Natural Disturbance-based Forest Management Guidance for Northeastern British Columbia*". DeLong provides a summary of research findings to illustrate the range of natural variability for some of elements described in Table 3 (above) across a set of Natural Disturbance Units (NDU). The geographical distribution of NDUs in the DFA is presented in Figure 4Figure 4. The guidance provided by DeLong is a synthesis of scientific information regarding the natural range of variability for habitat management in the northeast of BC, and forms an important foundation for many of the indicators and targets identified in Section *5.0 Values, Objectives, Indicators And Targets*.

The underlying assumption of NDUs is that the biota of a forest is adapted to the conditions created by natural disturbances and thus should cope more easily with the ecological changes associated with forest management activities if the pattern and structure created resemble those of natural disturbance (Hunter, 1993; Swanson et al., 1993; Bunnell, 1995; DeLong and Tanner, 1996; Bergeron and Harvey, 1997; Angelstam, 1998; DeLong and Kessler, 2000). Adopting forest management practices that approximate the natural range of variability is an appropriate way to ensure the current and future needs of many organisms are met.

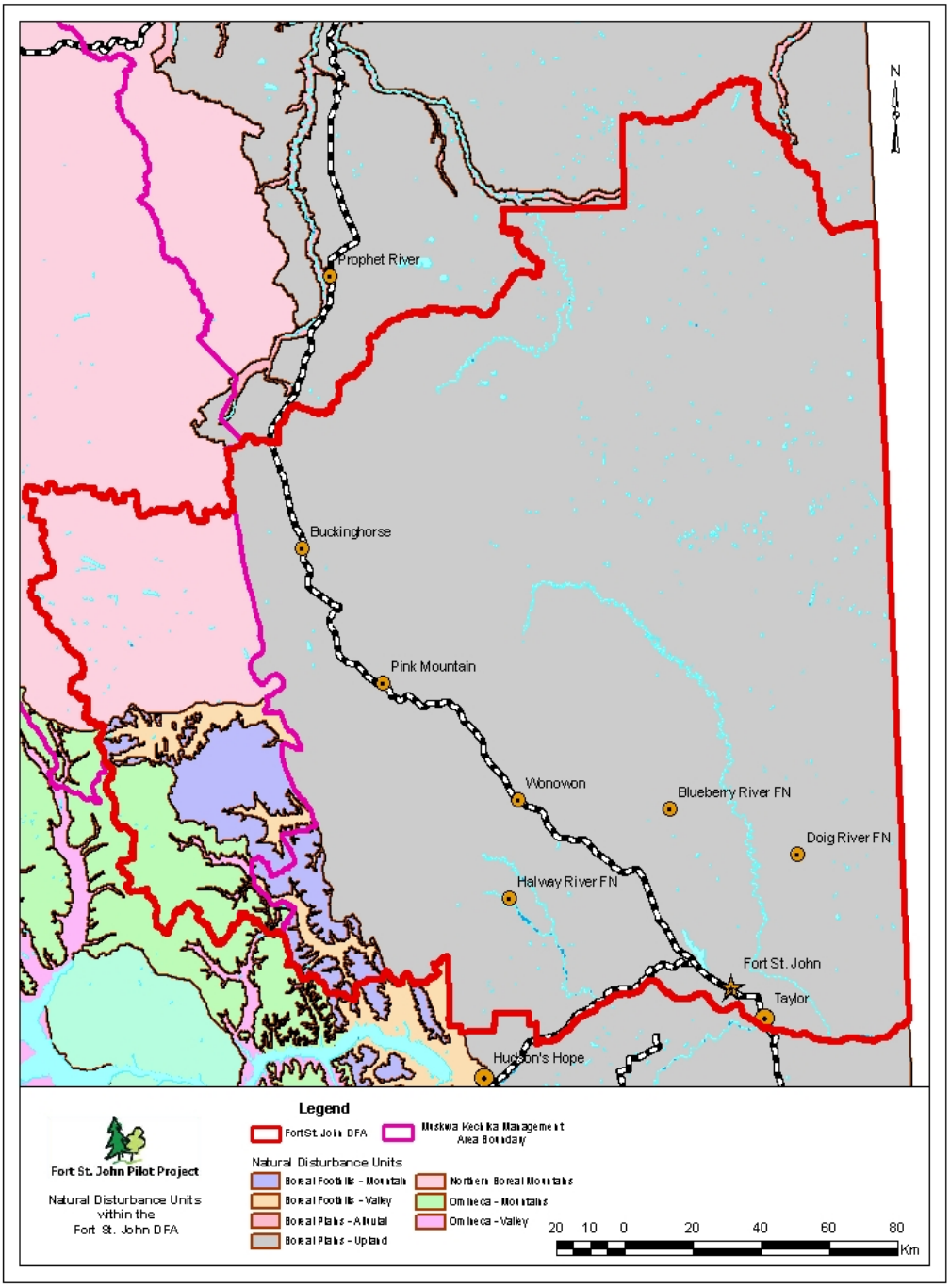


Figure 4: NDU Boundaries within the Fort St. John DFA

The Natural Disturbance Units presented by DeLong (DeLong, 2011), better delineate areas based on differences in disturbance processes, stand development, and temporal and spatial landscape pattern. DeLong (DeLong, 2011) contains guidance on management of old forest, young natural forest, patch size distribution, and stand species composition and structure. Most of the guidance relates to approximating

wildfire as the key stand replacement disturbance agent in most landscapes, and the one that we have exhibited the most control over.

Examples of how this plan has adopted the principles identified in DeLong (DeLong, 2011) include:

1. Harvest patterns that represent a more natural patch size distribution.
2. Providing for stand-level characteristics (e.g., species composition, stand structure) that emulate natural baseline information as much as possible.
3. Commitment to managing areas as mixedwoods

To move towards a more natural range of variation and emulate patterns of natural disturbance many of the indicators and targets identified in *Section 5.0 Values, Objectives, Indicators And Targets*, are set for a landscape or DFA level, as opposed to a block-by-block approach.

3.3 MANAGED STAND MONITORING

Under the principles of SFM, monitoring is defined as the periodic measurement and assessment of change of an indicator, where an indicator is a variable used to report progress towards achieving an objective. Objectives are broad, general statements that describe a desired state or condition related to one or more forest values. In this context, two broad categories of monitoring can be recognized. The first, which may be referred to as "administrative monitoring", checks that planned SFM activities are carried out (i.e., did we do what we said we were going to do?). An example is monitoring to ensure conformance with late seral targets.

The second category of monitoring may be referred to as monitoring the state of the forest, which includes activities that measure timber and non-timber variables over time. Growth and Yield (GY) monitoring, which is the process of checking GY estimates for a defined population, is in this broad category. Monitoring the state of the forest requires a long-term commitment to establishing and re-measuring plots over time.

Monitoring is a key process in adaptive management. It is a feedback loop that provides information for continuous improvement. The level of success in achieving objectives can be evaluated, and planning and management activities can be improved accordingly.

The Participants have implemented a GY monitoring program for managed stands within the DFA. This program is based upon a 3-km grid covering the whole DFA. When any one of the points is harvested a GY monitoring plot will be established 15 years post-harvest and periodically re-measured over time. The GY monitoring objectives for the Fort St. John DFA are as follows:

1. Monitor the change in volume, species composition, top height, and site index in managed stands from 15 years post-harvest onwards.
2. The intent is that this data will be compared with predicted values of the same attributes used in timber supply analysis. This is to develop a level-of-confidence in the accuracy and precision of projections used in timber supply analysis. This data can also be used to address several SFM indicators pertaining to maintaining or improving the harvest level over time.
3. Provide data on snags, coarse woody debris, and shrubs to address SFM objectives

4. Provide data on stand growth and development that can be used as a subset of the data required for developing new GY models.
5. Use a sample design that can be modified in the future to incorporate establishment of plots in mature stands and linkages with other inventory sampling.

See Appendix 5 for a detailed description of the sample design and objectives developed for the DFA.

3.4 CONTINUOUS IMPROVEMENT

In keeping with the principles of SFM, opportunities to continuously improve the SFMP are built into the SFM process. Continuous improvement relies on the ability to recognize, plan for, and adapt to change as it occurs. As time goes by, changes will occur to both the practice of forest management and the process in which it is delivered. Ensuring that a process is in place to accept and adapt to change is a necessary part of SFM. To ensure continuous improvement occurs means that the sources of change are recognized, and strategies developed to accept and adapt to these changes. Table 4 identifies the sources of change regarding forest management and the strategies that are in place to adapt.

Continual improvement includes the incorporation of new information and knowledge, the identification of other information gaps, and undertaking research to address such gaps. The incorporation of new knowledge and understanding allows for better management approaches to evolve. Continual improvement activities also include modifications to the adaptive management system as a result of what is learned from indicator monitoring. Indicator results provide a means to evaluate the achievement of objectives and to determine whether values are being maintained. This process may also reveal issues with the SFM system that requires adjustment to the SFM system in part, or as a whole.

Following the performance management evaluation and review, non-conformance issues related to organizational management and/ or practices will be addressed within an Action Plan which will be implemented by the applicable organization(s). If it is determined that non-conformances are related to issues regarding the SFM system, Action Plans will be produced and implemented by the Participants.

The SFMP is intended to be delivered and implemented through each of the Managing Participant's existing forest management system organizational structure. Since the EMS is designed as a performance management loop, the SFMP will continuously improve, adjust, and adapt to changing circumstances.

Table 4: Continuous Improvement Process for the SFMP

Source of Change	Adaptation Strategy
Change in environmental circumstance i.e., natural events such as large fires.	Performance monitoring as outlined in *Section 6.0 Changes in Requirements,* will occur on a periodic basis. Conduct an annual performance management evaluation and review of monitoring results and compare to original targets. Adjustments to practices and/or targets are made, if required.
New information that can reveal assumptions, targets	Annually, plans are developed that demonstrates how resources are allocated and prioritized with regard to research, effectiveness monitoring, and adaptation of measures and targets in the SFMP.

or measures are incorrect or could be improved.	The plans will seek to collaborate wherever possible with other associations having mutual interests in SFM. Examples include, The McGregor Model Forest Association, other industry partners and Government Agencies. The results of the plans will be reviewed on an annual basis. Adjustments to practices and/or targets are made as a result of the new information.
Changes resulting from government policy changes, agreements, or other legal proceedings, changing social values, or SFM standards	Periodic meetings are held with the Public Advisory Group, which is a venue to gather local changes in public values over time. The annual performance management evaluation and review will consider government policy and land base planning and zonation changes. Annual audits will be completed to verify conformance to the existing SFM Criteria/Standards. Adjustments to practices and/or targets are made as a result of the new information, including amendments to the plan

4.0 LANDSCAPE LEVEL STRATEGIES

The landscape level strategies (LLS) provide the strategic direction to the Participants' plans and operations. The Fort St. John Pilot Project Regulation (*FSJPPR*) specifies the required content of the SFMP. A sustainable forest management plan at a minimum must include landscape level strategies for all the following:

- Timber Harvesting,
- Road Access Management,
- Patch Size, Seral Stage Distribution and Adjacency,
- Riparian Management,
- Visual Quality Management,
- Forest Health Management, and
- Range and Forage Management.

This SFMP also includes the following (optional) landscape level strategies:

- Reforestation Strategy,
- Soil Management Strategy,
- Biodiversity and Wildlife Habitat Management Strategy, which is newly introduced in this Plan.

The *FSJPPR* requires the Participants ensure that each regulatory strategy contained in the plan specifies one or more performance indicators for evaluating whether the strategy has been successfully implemented. The Participants will review regularly each of these indicators for appropriateness and evaluate performance and progress towards the associated targets. A summary of these reviews and any

proposals for change will be reported in the SFMP annual reports. The targets will be managed within the continuous improvement process as described in 3.4 Continuous Improvement.

This comprehensive SFMP is designed to meet not only the regulatory requirements included in the *FSJPPR*, but also SFI Forest Management standard certification requirements, as well as the business needs of the Participants. Many of the above noted Landscape Level Strategies included in this SFMP consist of several specific sub-strategies and indicators. Some of the strategies and indicators are directed more at the certification and business needs objectives, while others are specifically identified for regulatory compliance purposes as Performance Indicators for evaluation of the Landscape Level Strategies (Section 42 of the *FSJPPR*). **Specific strategies, the headings for the indicators, targets, acceptable variances, and other sections that specifically address the legal requirements of the *FSJPPR* are identified in red text throughout this plan to facilitate government review. Other strategies, sub strategies and indicators in this SFMP are included to meet SFI certification standards. These other strategies and indicators are not intended to meet the regulatory requirements and therefore do not require regulatory approval and are in black text throughout the plan**. They identify the Participants' commitments and targets to meet objectives derived from First Nations, the Public Advisory Group, certification bodies, or business needs. A summary of the landscape level strategies and related performance indicators being submitted to the government for approval are included in the following table (Table 5).

Table 5: Landscape Level Strategies and Related Performance Indicators Submitted for Approval

Landscape Level Management Strategy	Legal Indicators for Evaluating LLS (S.42 of *FSJPPR*)	Indicators Affecting Part 3 Div. 5 (Sec 35(5) or 35(6)) of *FSJPPR*	Related 'Non-Legal' Indicators
4.1 Timber Harvesting	19 - Graham Timing 20 - Graham Merchantable Area 21 - Graham Connectivity 22 - MKMA 49 - Coordination 50A - AAC Partition-Deciduous Planning 50B - AAC Partition Deciduous Harvest Performance 51A - AAC Partition-Conifer Planning 51B - AAC Partition Conifer Harvest Performance		52 - Cut Control 65 - Residual Fibre Utilization
4.2 Road Access	26 - Permanent Access Structures 39 - Coordinated Developments and Access Management 45 - Recreation Opportunity Spectrum	26 - Permanent Access Structures	
4.3 Riparian	23 - River Corridors 24 - Riparian Reserves 35 - Peak Flow Index 37 - Small Streams and NCD Management	23 - River Corridors 24 - Riparian Reserves	

4.4 Range & Forage	29 - Noxious Weed and Invasive Plant Content 41 - Damage to Range Improvements or Natural Range Barriers		40 - Range Action Plans
4.5 Patch, Seral, and Adjacency	2 - Seral Stages 3 - Patch Size 6 - CWD Volume 7 - CWD Structure 9 – Wildlife Tree Patches	6 - CWD Volume 9 - Wildlife Tree Patches	
4.6 Forest Health	1 - Forest Types 2 - Seral Stages 3 - Patch Size 14 - Seed Use 27 - Forest Health in Silviculture Obligation Areas 48 - Forest Health FOS Planning		28 - Salvage and Sanitation Harvest
4.7 Reforestation	14 - Seed Use 15 – Deciduous Regeneration 31 - Species Composition 32 - Reforestation Assessment 33 - Establishment Delay	14 - Seed Use 32 - Reforestation Assessment	
4.8 Soil	4 - Soil Disturbance		
4.9 Visual	43 - Visual Quality Objectives	43 - Visual Quality Objectives	
4.10 Biodiversity & Wildlife Habitat Management	1 - Forest Types 2 - Seral Stages 3 - Patch Size 5 - Dispersed Retention 6 - CWD Volume 7 - CWD Structure 9 – Wildlife Tree Patches 10 - Sites of Biological Significance 11- Guidelines for Species at Risk and Species of Management Concern 21 - Graham Connectivity 23 - River Corridors 24 - Riparian Reserves 37 - Small Streams and NCD Management 44 - Visual Screening	6 - CWD Volume 9 – Wildlife Tree Patches 23 - River Corridors 24 - Riparian Reserves	12 - Migratory Birds Risk Reduction

The SFMP must specify the provisions, if any, of Part 3 Division 5 of the *FSJPPR* and the schedules that are to be affected through the application of the proposed landscape level strategy and include rationales on how these will provide at least equivalent protection for forest resources, be consistent with the preamble to the Act, and provide for adequate management and conservation of forest resources. The SFMP must

also include any applicable performance standards that are to be used for the purposes of Part 3 Division 5, and the associated schedules, of the *FSJPPR*. These can be found in *Section 6.0 Changes in Requirements* of the SFMP.

4.1 TIMBER HARVESTING STRATEGY

The Participants' timber harvesting activities supply most of the raw material necessary to operate the forest industry's local processing facilities. The total delivered cost of fibre (harvesting, hauling, and indirect costs), and the availability of secure and affordable sources of fibre, largely determine the economic viability of these processing facilities. In a sustainable forest management framework, the economic considerations of harvesting activities must be balanced with ecological and social values. The strategies included in this section are intended to address key issues within the DFA that relate to forest harvesting activities. It should be noted that in the fall of 2024 Canfor announced the permanent closure of their Fort St. John Sawmill and at the time of writing, only LP has an active processing facility in the DFA.

The timber harvesting strategies will provide direction for the Participants at the DFA, landscape unit level, and site level for forest harvesting activities, with respect to the following:

- Timber harvesting objectives identified in the Fort St. John Land and Resource Management Plan (LRMP), specifically those related to areas of special concern such as the MKMA (which includes the Sikanni and Graham LUs), the Graham River Integrated Resource Management Plan area, and the major river corridors.
- Key assumptions within the Timber Supply Review that support the maintenance of sustainable timber production levels, particularly as they relate to the timber harvesting profile.
- Timber harvesting objectives, indicators, and targets that have been identified by the Public Advisory Group and incorporated into the SFI SFM matrix, including those related to utilizing silviculture systems consistent with the local ecology, harvesting at sustainable levels, and maintaining viable processing facilities to support the local economy.
- Business objectives relating to timber harvesting, including optimizing fibre flow and value, and the coordination of operations between Participants to minimize costs.

The Graham River Integrated Resource Management Plan (GRIRMP)

Forestry operations within the Crying Girl LU and the portion of the Graham LU that falls within the Graham River drainage will be consistent with the intent of the 1998 GRIRMP. *Section 1.3.3 Graham River IRM Plan*, of this SFMP summarizes the key features of the GRIRMP, including clustered sequential development, connectivity corridors, access management, and adaptive management.

Since the 2004 SFMP, there have been significant developments that need to be considered in the context of adaptive management of the GRIRMP area. The creation of substantial Wildlife Habitat Areas and Ungulate Winter Ranges for caribou in and adjacent to the GRIRMP area has enhanced wildlife protection. As well, rapid, unforeseen changes to forest conditions (e.g., Mountain Pine Beetle) and challenging economic conditions are compelling the forest industry to be very flexible in their harvest planning.

The following strategies are designed to implement key components of the Graham River IRM Plan that relate to timber harvesting, while addressing some of these developments.

4.1.1 Graham IRM Plan Sequential Development Strategy

Timber harvesting within the Crying Girl LU and the portion of the Graham LU that falls within the Graham River valley will be based on sequential clustered development. Operational harvest activities will be concentrated in one 'cluster' during a harvesting season to minimize costs, and to minimize the extent of industrial disturbance to wildlife. The total extent of allowable harvesting area will be consistent with the GRIRMP harvest schedule. Exceptions to this that may be required to address abnormal forest health and damaging events will be reviewed with the PAG and government agencies prior to conducting activities.

This strategy will limit operational harvesting (i.e., falling and/or skidding of trees, other than for predevelopment of roads) to one 'cluster' as envisioned in the GRIRMP, thereby providing relatively low overall disturbance impacts to wildlife, recreation, and other non-timber activities at any one time. Predevelopment of road right of ways to facilitate timely entry into future clusters may still occur concurrently while operational harvesting is being completed. The road predevelopment strategy will employ appropriate techniques such as operating within least risk timing windows to minimize negative impacts to wildlife. Limits on the total amount of timber harvesting allowed per period will be retained to maintain consistency with the intent of the GRIRMP to maintain forested areas and other resource values. Within the total allowable harvest levels, the revised strategy does allow the flexibility for the Participants to determine which cluster will be harvested at a given point in time to address changing forest health, economic, or other conditions.

Please refer to **Section 5.19 Graham Harvest Timing and Section 5.20 Graham Merchantable Area Harvested**, for the specific details for each the indicator, target, and acceptable variances, that will be used to determine if forest practices are consistent with this landscape level strategy.

For the purposes of Section 42 of the *FSJPPR*, Indicator # 19 Graham Harvest Timing and Indicator # 20 Graham River Merchantable Area Harvested will be the legal indicators that determine if forest practices are consistent with this landscape level strategy.

4.1.2 Graham River Plan Connectivity Strategy

The Forest Connectivity Corridors that are identified in the GRIRMP area provide substantial connectivity for wildlife. Operational plans will respect the long-term primary components of these connectivity corridors. To ensure consistency with the original objectives of the GRIRMP, government agencies will be consulted, and their agreement obtained prior to proposing harvesting activities in any portion of the permanent corridors.

There are two key permanent components of the connectivity corridors that are expected to remain relatively constant, and provide for the essential habitat requirements of most species in the Graham River valley (Lance, 1997):

1. *The alluvial valley floors of the Graham River and major streams which flow into the Graham River*. These riparian corridors provide a habitat complex consisting of shelter, foraging sites, and travel routes, and were identified in the Graham River IRM Plan as the most important habitats in the plan area.

2. *The non-productive, non-commercial areas, including treeless or low productivity forested alpine areas, and meadows, swamps, and other NP areas*. Other than the riparian habitats, the alpine habitats and wetlands were identified as the second most important habitats for key species such as caribou within the Graham.

This strategy will provide direction for timber harvest planning in the GRIRMP area and ensure these connectivity-corridors may continue to function as high value habitats though time.

Please refer to **Section 5.21 Graham Connectivity**, for the specific details on the indicator, target, and acceptable variances, that will be used to determine if forest practices are consistent with this landscape level strategy.

For the purposes of Section 42 of the *FSJPPR*, Indicator # 21 Graham Connectivity will be the legal indicator used to determine if forest practices are consistent with this landscape level strategy.

Muskwa-Kechika Management Area (MKMA)

As a result of the Fort St. John and Fort Nelson LRMPs, the MKMA was established. The MKMA was established by Order in Council in 1997 (order #1367/97) and subsequently the *MKMA Act* passed in 1998. The MKMA includes Special Management Zones (SMZs) and Protected Areas (PAs). The Order in Council for the MKMA establishes that: *"The management intent for the MKMA is to ensure that wilderness characteristics, wildlife, and its habitat are maintained over time while allowing resource development and use, including recreation, hunting, timber harvesting, mineral exploration and mining, oil and gas exploration and development."* (Government of British Columbia, 1997)

The MKMA Regulation requires the establishment of one or more landscape unit objectives prior to the approval of timber harvesting, other than 'grand parented' blocks. Blocks and roads included in approved FDPs that existed prior to the regulation are exempt from this requirement (grand parented) and may be harvested prior to landscape level objectives being established. No grand parented blocks remain at this point in time.

4.1.3 Muskwa Kechika Management Area (MKMA) Strategy

Long term harvest plans will be prepared depicting the approximate location of blocks and roads, to address key wildlife and road access issues for one or more drainages within the MKMA. These plans will be submitted to government and the public for review and comment prior to inclusion of any new proposed blocks in any FOS or similar plan.

The two main requirements of any proposed harvesting plans in the MKMA will be consistency with any legally established landscape unit objectives for the MKMA, and economic viability of the proposed developments. An evaluation of the applicability of using the clustered harvest planning concept used in the GRIRMP to meet these two requirements in the MKMA area should be completed once the MKMA objectives are known. Harvesting in drainages within the MKMA will not commence until the proposed plan is completed.

Please refer to **Section 5.22 MKMA Harvest**, for the specific details on the indicator, target, and acceptable variances, that will be used to determine if forest practices are consistent with this landscape level strategy.

For the purposes of Section 42 of the *FSJPPR*, Indicator # 22 MKMA Harvest will be the legal indicator used to determine if forest practices are consistent with this landscape level strategy.

Allowable Annual Cut Levels and Timber Profile Assumptions

Effective May 10th, 2018, the Chief Forester determined that the allowable annual cut (AAC) for the Fort St. John TSA to be 2,115,000 m^3 per year. The approved cut is partitioned, with 1,200,000 m^3/year from coniferous leading stands, and 915,000 m^3/year from deciduous leading stands. In addition, a geographical partition was introduced that limits that amount of overall coniferous and deciduous AAC and AAC coming from spruce leading stands within the 'core' area of the TSA. The core area consists of the Blueberry, Kobes, Halfway, Lower Beatton and South portion of the Tommy Lakes LU.

The Chief Forester set the approved AAC level below the theoretical LTHL after considering the risks and uncertainties inherent in the Timber Supply Review. To ensure sustainable timber supplies for the manufacturing facilities, it is desirable for the Participants to consider the management assumptions used in the TSR when developing their harvest plans.

4.1.4 AAC Rationale Assumptions Strategy

Participants will plan harvesting activities in a manner that supports the maintenance of the current AAC over the term of the SFMP, balancing economic considerations with the management assumptions included in the current AAC determination (TSR3) rationale.

The Participants will plan their operations to be consistent with the geographical and species partitions. If forest health concerns (e.g., Mountain Pine beetle, fire damaged timber, etc.) require urgent attention, harvesting may alternatively be directed into those priority stands.

Please refer to **Sections 5.50a AAC Partition – Deciduous Planning, 5.50b AAC Partition – Deciduous Harvest Performance, 5.51a AAC Partition - Conifer Planning and 5.51b AAC Partition - Conifer Harvest Performance,** for the specific details on the indicator, target, and acceptable variances, that will be used to determine if forest practices are consistent with this landscape level strategy.

For the purposes of Section 42 of the *FSJPPR*, Indicator # 50A AAC Partition - Deciduous Planning, Indicator #50B AAC Partition - Deciduous Harvest Performance, Indicator # 51A AAC Partition - Conifer Planning and Indicator #51B AAC Partition - Conifer Harvest Performance will be the legal indicators used to determine if forest practices are consistent with this landscape level strategy.

4.1.5 Sustainable Timber Harvest Level Strategy

Support sustainable harvest levels by managing cut control levels and timber sale volumes sold that are consistent with the approved apportioned volumes within the TSA.

In addition to supporting the retention of a sustainable long term cut in the TSA through their management practices, there is a need to demonstrate to the public that the short-term harvest levels are consistent with the allocated cut levels as determined by the Chief Forester.

Refer to **Section 5.52 Cut Control**, for details on the indicator, the target and the strategy implementation.

This performance indicator does not affect Part 3 Division 5 of the *FSJPPR* and is not intended for the evaluation of the LLS as per section 42 of the *FSJPPR*. This performance indicator is intended to address other objectives of the Participants.

Coordination of Operational Activities between Participants

Significant utilization of deciduous resources on Crown land occurs in the Fort St. John TSA. The interconnectivity of the deciduous and coniferous timber resources and overlapping tenures of the various Participants presents unique environmental and economic challenges. To minimize environmental impacts, and maximize economic efficiencies, it is essential that there be a very high level of coordinated planning between the Participants. The Participants are required to have one SFMP that addresses Landscape Level strategies that apply to all Participants. In addition, the Participants have prepared a consolidated FOS and are in the process of developing another. The FOS demonstrates consistency with those SFMP indicators that can reasonably be forecasted and provides each Participant with a fair and transparent distribution of timber resources. Joint preparation implies that the FOS will be prepared for or on behalf of all the Participants involved in forest management, and any amendments to the FOS will be reviewed for acceptability prior to completion by those same Participants.

4.1.6 Coordination of Planning Strategy

Participants will coordinate the planning of forestry operations to achieve business efficiencies, facilitate analyses of cumulative forest management impacts in relation to SFMP strategies, and provide consolidated information sharing and consultation products to interested parties in a FOS.

Refer to **Section 5.49 Participants' Coordination** for the specific details on the indicator, target, and acceptable variances that will be used to determine consistency with this landscape level strategy.

For the purposes of Section 42 of the *FSJPPR*, Indicator # 49 Participants' Coordination will be the legal indicator used to determine if forest practices are consistent with this landscape level strategy.

4.2 ROAD ACCESS MANAGEMENT STRATEGY

There are many industrial roads being constructed within the Fort St. John TSA on an annual basis, primarily by the forest industry and the oil and gas industry. There is a necessity to coordinate access and linear development and manage existing access to minimize the negative effects on other resource values. First Nations have also expressed concerns over the amount of linear disturbance present on the landscape and emphasize the need to minimize road density as much as possible. The Participants are cognizant of the extent of road development that is occurring on the DFA and are committed to working together, with the oil and gas industry, other industries and government to minimize impacts of access development.

Six years or more of planned forestry road and cutblock development are presented in the FOS prepared by the Participants. This information is referred to government agencies, the public and other interested parties well in advance of actual construction. This up-front planning provides the oil and gas industry and

others the opportunity to review and increase the coordination of access management activities. Further opportunities exist for the forest industry to more easily modify plans to utilize newly constructed oil and gas roads that were not known during the identification of road access corridors presented in the FOS. Major achievements in coordinating access development between the oil and gas and forest industry, such as the jointly constructed Tommy Lakes Road, and access management coordination in the GRIRMP area, have already occurred, and the Participants are committed to proactively engaging other industries in coordinated developments.

Coordinated access can be encouraged by identifying minimum road construction standards that are needed by both industries to ensure that the road infrastructure meets the physical requirements of each industry, wherever practical. Critical components of a road construction standard may be maximum road grade, minimum load rating for bridges, and standard road width for mainlines. Providing forest industry standards in the SFMP is one way of providing useful information for access plans to other industries interested in coordinated developments.

The following road access management strategies for the Fort St. John TSA are intended to provide strategic direction to the pilot Participants at the DFA and landscape unit level with respect to the following:

- Co-ordination of access and linear development to minimize negative effects on other resource values, and managing access to minimize impacts on wildlife and other resources, including sustainable long term timber production,
- Road access management objectives, indicators and targets that have been identified by the Public Advisory Group and incorporated into the SFI SFM matrix, including area occupied by permanent access structures and coordinated developments,
- Business objectives of the Participants, including improving coordination and flexibility to manage road development.

Minimizing Access Impacts on Resource Values

Limiting the amount of land taken up by permanent access structures (PAS) on the THLB (THLB) reduces impacts on long term sustainable timber production, and directly or indirectly reduces impacts on soils, water, wildlife and other resource values. The Participants' objective is to target the amount of PAS in the TSA significantly below the maximum level allowed in the FSJPPR (i.e., 7% of the total cutblock area), but provide the flexibility in the regulatory performance standards to vary the amount of PAS in individual cutblocks. This flexibility allows the Participants to address site conditions that impact the amount of road development required, such as block size, steepness, season of harvest, and the impacts of other features (e.g., pipelines etc.).

4.2.1 Permanent Access Strategy

The field performance requirement for total amount of PAS is a maximum of 5% of the total area harvested. The percentage of permanent access structures may vary significantly within cutblocks, depending on block size, terrain, season, and the need to address other resource features. Permanent Access Structure % will be assessed on a DFA-wide basis, rather than block-by-block, using a three-year rolling average measure expressed as a percent value. The 3-year rolling average will be defined as a

population of cutblocks that have completed harvesting by the FSJ Pilot Project Participants, in the 3 years previous to the submission date of the annual report (on or prior to October 31 annually). The value will be less than the original regulatory field performance requirement.

This strategy addresses the SFI Objectives: *Forest Management Planning; Forest Health and Productivity.*

Please refer to **Section 5.26 Permanent Access Structures** for the specific details on the indicator, target, and acceptable variances that will be used to determine if forest practices are consistent with this landscape level strategy. Also refer to "Section 8.0 Changes in Requirements" for a summary of changes to regulatory performance requirements.

For the purposes of Section 35(5) of the *FSJPPR*, the indicator statement, target statement and acceptable variance will replace section 30(1) of the *FSJPPR* as the Applicable performance standard.

For the purposes of Section 42 of the *FSJPPR*, Indicator # 26 Permanent Access Structures will be the legal indicator used to determine if forest practices are consistent with this landscape level strategy.

4.2.2 Manage Access in Low Management Intensity LUs to support the Recreation Opportunity Spectrum

Minimizing access impacts in low management intensity LUs to maintain wildlife and recreational values in near natural states, as supported by LRMP objectives, necessitates a long-term access management strategy to address this issue in these areas.

Forest industry road access in the Sikanni, Graham and Crying Girl LUs will be planned to maintain over time the primitive Recreation Opportunity Spectrum (ROS) class at 1996 levels and maintain a component of semi-primitive non motorized ROS classes.

Following the development of each FOS, in which all proposed forest operations for a six-year period are identified, a sensitivity analysis will be completed to quantify the impact of proposed forest management developments on the updated ROS classifications. Short-term fluctuations to the ROS classification areas due to forestry activities are expected. Where these occur, mitigating access deactivation measures will be implemented that will minimize the impacts on the current ROS factors, and ensure that the targets for the primitive and semi primitive non-motorized areas can be achieved. New non-forestry related roads, and forest industry roads taken over by other industries will not be considered in the ROS analysis.

Please refer to **Section 5.45 Recreation Opportunity Spectrum** for the specific details on the indicator, target, and acceptable variances, that will be used to determine if forest practices are consistent with this landscape level strategy.

For the purposes of Section 42 of the *FSJPPR*, Indicator # 45 Recreation Opportunity Spectrum will be the legal indicator used to determine if forest practices are consistent with this landscape level strategy.

4.2.3 Strategy to Coordinate Road Development with Other Industries

Participants will communicate and provide the opportunity for forest industry access management plans to be shared with the energy sector through the BC Energy Regulator (BCER). This includes providing critical forest industry road construction standards so that the forest industry road specifications can be linked with those of the energy sector. Forest industry access plans encompassing

all the Participants' activities will be clearly identified within the FOS. By making this information well known and easily available to the energy sector, coordinated infrastructure developments within common operating areas can be implemented, thus eliminating duplicate entries and thereby reducing the amount of forest land converted to non-forest conditions and minimizing the negative impacts on other resources. Where deactivation is planned on Participant roads greater than 5 km in length, access management plans will include engagement with First Nations and stakeholders to ensure that access to roads potentially required by other industries or users are not being deactivated unnecessarily.

This strategy addresses objectives to coordinate developments to minimize impacts on resources due to access development. The business objectives of increased access coordination and reduced access costs are also supported by this strategy.

Refer to **Section 5.39 Coordinated Developments and Access Management** for details on the indicator, the target, and strategy implementation. This indicator also includes a summary of key minimum road standards for third party roads that will allow the forest industry to utilize these structures.

For the purposes of Section 42 of the *FSJPPR*, Indicator #39 5.39 Coordinated Developments and Access Management will be the legal indicator used to determine if forest practices are consistent with this landscape level strategy.

4.3 RIPARIAN MANAGEMENT STRATEGY

Riparian areas often support high timber and non-timber values concurrently. Some of the most productive timber sites in the DFA are in riparian areas, which also are some of the most biologically diverse habitats. These areas provide important wildlife habitat, act as natural connectivity corridors, protect adjacent aquatic ecosystems and help maintain stream bank stability and water quality.

Management issues revolve around maintaining non-timber resource values inherent in these areas while still capturing some of the high timber values. Current practices around streams include adherence to Schedule D of the FSJ Pilot Project Regulation. This regulatory requirement is specific to maintenance of minimum reserve zones on certain streams and waterbodies, and the identification of riparian areas around streams and waterbodies in which constraints to forest practices may apply for the purpose of maintaining the integrity of streams, wetlands, or lakes, and associated habitats. Strategies also need to address the protection of stream banks and stream channel stability.

The following riparian management strategies will provide direction to the Participants at the landscape, watershed, and site levels, with respect to the following:

- Riparian and wildlife habitat values identified by First Nations.
- Relevant indicators and targets identified by the PAG.
- Riparian and related objectives identified in the Fort St. John LRMP, including major river corridor considerations.

4.3.1 Riparian Reserve Strategy

Forestry operations adjacent to S1, S2 and S3 streams will minimize negative effects on water quality by maintaining regulatory riparian reserve zones that meet or exceed the minimum widths included in Schedule D of the *FSJPPR*.

Refer to **Indicator # 24** included in **Section 5.24 Riparian Reserves** for details on the indicator, target and implementation strategy.

For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance in **Section 5.24 will be used to determine if forest practices are consistent with the landscape level strategy**.

For the purposes of Section 35(5) of the *FSJPPR* this indicator statement, target statement and acceptable variance will be used in replacement of Section 28(1)(b)(i)(a) of the *FSJPPR* through the application of the riparian reserve landscape level strategy.

4.3.2 Strategy to Address Riparian Management on Small Streams

All streams within 100m of proposed harvest areas will have riparian classification assessments conducted by qualified personnel. Riparian areas that do not have mandatory reserve zones (RMA of small streams and areas adjacent to NCDs) will have site-specific management practices including retention incorporated into SLPs to protect streambanks, stream channel stability, riparian vegetation, water quality, and other riparian values. These site-specific management practices include minimum retention targets based on riparian classification, as outlined in indicator # 37.

For more detailed information, refer to **Indicator # 37**, included in **Section 5.37 Small Streams and NCD Management**. **For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statements and acceptable variances in Section 5.37 will be used to determine if forest practices are consistent with the landscape level strategy**.

4.3.3 Major River Corridor Strategy

Plans developed for harvesting within the riparian corridors of major rivers will provide for a high level of forest retention for wildlife habitat, with new patch openings normally being one hectare or less in size within 100 meters of a major river's Riparian Reserve Zone. A variety of silviculture systems can potentially be used to achieve this, including clearcut with reserves and partial cutting systems, employing methods such as strip cuts or patch cuts.

Major river corridors requiring some special management considerations transect portions of several LUs, as noted previously in "Section 1.4.1 Description of The Landscape Units". This strategy applies only to those Major River corridors noted in Section 1.3.1 and listed in Section 5.23.

Refer to **Indicator # 23** included in **Section 5.23 River Corridors** for details on the indicator, target, acceptable variances and implementation strategy. **For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance included in Section 5.23 will be used to determine if forest practices are consistent with the landscape level strategies.**

4.3.4 Strategy to Manage Excessive Runoff Impacts to Riparian Habitats

Excessive runoff at the watershed level, which can disturb stream channel integrity and adjacent habitats, will be managed by limiting the extent of harvesting within watersheds, as determined through peak flow index analyses and watershed reviews.

Refer to **Indicator # 35** included in **Section 5.35 Peak Flow Index** for details on the indicator, target, acceptable variances and implementation strategy. **For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance included in Section 5.35 will be used to determine if forest practices are consistent with the landscape level strategies.**

4.4 RANGE AND FORAGE MANAGEMENT STRATEGY

Grazing tenures and grazing leases for domestic livestock on Crown range are authorized under the *Range Act*, and *Land Act* respectively, while grazing practices are governed by the *Forest and Range Practices Act*. Livestock may be grazed in community pastures, in which several ranchers' livestock are grazed in common under a tenure issued to an association, or more commonly, across the DFA area under a tenure issued directly to the rancher. Most of the tenured crown range use in the DFA is associated with the beef-cattle industry, although a few tenures are issued to Guide/Outfitters who graze their saddle and packhorses on Crown range as part of their activities.

Forest industry access, harvesting and reforestation activities occur throughout the DFA, and in many cases overlap numerous range tenures.
Forestry activities can impact domestic grazing in many ways, including:

- the removal of natural range barriers (heavy timber) that previously limited cattle movement
- disruption to herds due to summer logging
- the temporary damage or removal of range improvement structures (e.g. fences)
- the use of roads during summer harvesting operations while grazing is occurring, creating road dust and other issues for cattle
- an increase in the potential for the introduction of invasive noxious weeds in forest management areas
- a reduction in available forage volume following harvesting in deciduous stands, attributable to the high density of regeneration aspen affecting livestock access for up to several decades following harvesting
- restricting the movement of unmanaged cattle herds due to their reluctance to graze in dense regenerating deciduous stands
- increasing forage production for several years in regenerating coniferous forests
- increasing forage along road right of ways created by forestry
- reducing forage production for one or two years after herbicide treatments in conifer plantations, followed by several years of increased forage production due to the long-term removal of much of the woody vegetation.
- changing access conditions (creation of new access, reclamation of existing access), which can either enhance or limit range use, depending on the situation

Range grazing and management can likewise affect forestry harvesting and reforestation in many ways including:

- Increasing costs resulting from mitigation measures done to address range concerns
- Reductions in tree survival, growth and fibre quality for both conifers and deciduous due to physical damage from cattle, or soil compaction in heavily grazed mature and regenerated forests
- Reduced effectiveness of siltation controls due to grazing management or cattle use damaging deactivation structures (e.g. water bars)
- Although understory prescribed burning may improve forage quality, damage to existing advanced crop tree regeneration and mature deciduous and thin barked coniferous stands may result from understory burning.
- Damage to regenerating stands from escaped range burns
- Reduced timber harvesting opportunities due to range requirements (e.g. removal of areas from the THLB for range or forage burns) affecting both timber supply and delivered wood costs

The focus of this range and forage management strategy is to address these overlapping tenure issues by promoting mutual understanding between the Participants and the Crown range community within the pilot project area, and ensuring Participants fulfill their responsibilities and meet their commitments to range tenure holders.

The Range and Forage Management Strategy will provide strategic direction for Participants at the DFA and site level with respect to the following:

- Range and Forage objectives, indicators and targets identified by the Public Advisory Group and incorporated into the CSA SFM matrix, including those related to providing opportunities for a mix of timber and non-timber commercial activities, and maintaining suitable habitat elements
- Range and Forage objectives in the Fort St. John Land and Resource Management Plan including those related to controlling the spread of noxious weeds. and restoring functioning and healthy ecosystems

4.4.1 Strategy to Repair Range Improvements

The Participants will ensure range improvements damaged as a result of Participants' activities are restored to the standard specified in the Ministry of Forests Peace Resource District range structure guidelines in a timely manner, or as otherwise agreed to between the range tenure holder and Participant.

Refer to **Indicator #41** located in **Section 5.41 Damage to Range Improvements or Natural Range Barriers.** **For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Range and Forage Management Landscape Level Strategy.**

4.4.2 Noxious Weed and Invasive Plant Management Strategy

The Participants will implement measures for grass seeding activities to minimize the risk of introduction or spread of invasive plants due to forest management activities.

Refer to **Indicator #29** located in **Section 5.29 Noxious Weed and Invasive Plant Content** for a detailed description of the indicator, target, acceptable variance and strategy implementation**. For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Range Management Landscape Level Strategy.**

4.4.3 Timber and Range Action Plan Strategy

The Participants will endeavor to create and implement mutually agreed action plans (e.g. T.R.A.P.s) with range tenure holders that address forage and forest management overlap issues and other concerns, over the areas identified in the current FOS.

Refer to **Indicator #40** located in **Section 5.40 Range Action Plans** for a detailed description of the indicator, target and strategy implementation. **This performance indicator is not intended for the evaluation of the Landscape Level Strategy as per section 42 of the *FSJPPR*. This performance indicator is intended to address other objectives of the Participants.**

4.5 PATCH SIZE, SERAL STAGE DISTRIBUTION AND ADJACENCY STRATEGY

The underlying assumption of Natural Disturbance Units (NDUs) is that the biota of a forest is adapted to the conditions created by natural disturbances and thus should cope more easily with the ecological changes associated with forest management activities if the pattern and structure created resemble those of natural disturbance (Hunter, 1993; Swanson et al., 1993; Bunnell, 1995; DeLong and Tanner, 1996; Bergeron and Harvey, 1997; Angelstam, 1998; DeLong and Kessler, 2000). Adopting forest management practices that approximate the natural range of variability is widely accepted as an appropriate way to manage for the needs of many organisms. The Biodiversity Guidebook (1995) was the first attempt in British Columbia to present guidance for forest management based on the natural disturbance template. Since the completion of the Biodiversity Guidebook, more information on natural disturbance dynamics has become available. Within the former Prince George Forest Region, several studies have investigated aspects of natural disturbance (DeLong, 1998; DeLong, 2011; DeLong and Kessler, 2000; Lewis and Lindgren, 2000; Rogeau, 2001).

Instead of adopting the NDTs presented in the Biodiversity Guidebook (1995) DeLong 2011 presents information for 9 NDUs. These units offer a better separation of areas based on differences in disturbance processes, stand development, and temporal and spatial landscape pattern. DeLong 2011 provides guidance on management of old forest, young natural forest, patch size distribution, and stand species composition and structure. Most of the guidance relates to approximating wildfire as it is the key stand replacement disturbance agent in most landscapes, and it is the one that we have exhibited the most control over. In other words, it is the disturbance process forest management attempts to emulate with harvesting.

This strategy deals with the pattern and relative distribution of disturbance across the landscape and maintenance of structure at the stand level.

4.5.1 Seral Stage Distribution Strategy

Forests occurring in different seral and structural stages over space and time are recognized as an important part of the landscape and provide different habitat elements for a variety of species. The research publication "Natural Disturbance Units of the Prince George Forest Region: Guidance for Sustainable Forest Management" (DeLong, 2002) has estimated the natural range of variation for different NDUs within the DFA. The Participants' strategy will be to manage activities to achieve late seral stage (old forests) targets by NDU in the DFA consistent with the natural range of variation.

Refer to **Indicator # 2** located in **Section 5.2 Seral Stages** for a detailed description of the indicator, target, acceptable variance, and strategy implementation. **For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance included in Section 5.2 will be used to determine if forest practices are consistent with the landscape level strategy.**

4.5.2 Patch Size Distribution Strategy

A patch is defined as a stand of similar-aged forest resulting from either a natural disturbance or created by timber harvesting. A patch may be composed of either a single disturbance event or an aggregate of events (natural, timber harvesting, or a combination of both). In forested landscapes patches represent a legacy or history of disturbances and as such may have a variety of species, stocking and ages contained within one patch. Forest patches are created naturally by disturbances such as fire, wind or pest outbreaks. In the absence of these natural disturbances forest management, through harvesting, affects the distribution and size ranges of forest patches. Over a rotation or more of the forest, harvesting can then lead to either inflating or fragmenting the landscape beyond the limits of the natural variability of the landscape, which has developed over centuries from natural disturbances. It is therefore important to establish target ranges for the size of patches that are consistent with the natural pattern of forested landscapes. The Participants' strategy will be to manage harvesting activities to move towards early seral stage (young forests less than 40 years old) patch size targets by NDU in the DFA.

Refer to **Indicator # 3** located in **Section 5.3 Patch Size** for a detailed description of the indicator, target, acceptable variance, and strategy implementation. **For the purposes of Section 42 of the FSJPPR the indicator statement, target statement and acceptable variance included in Section 5.3 will be used to determine if forest practices are consistent with the landscape level strategy.**

4.5.3 Adjacency and Forest Structure Strategy

The previous two strategies and indicators deal with patch size and seral stage distribution, and control both the amount and spatial distribution of the forested land base affected by forest management. The seral stage indicator influences the amounts of old growth on the land base, while the patch size indicator addresses the size of patches at the landscape level through time. Combined, the two

strategies partly determine the pattern of the forest mosaic that will occur on the landscape. Coarse Woody Debris Volume, Coarse Woody Debris Structure, and Wildlife Tree Patches will be addressed in managed stands to ensure provision of important structural elements that support ecological processes and wildlife habitat elements. The various aspects of the five indicators combined manage the structural characteristics, and the temporal and spatial distribution of forest patches, and therefore negates the need for specific adjacency requirements.

Refer to **Indicator # 6** located in **Section 5.6 Coarse Woody Debris Volume** for a detailed description of the indicator, target, acceptable variance, and strategy implementation. **For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the landscape level strategy. For the purposes of Section 29(2) of the *FSJPPR*, the applicable performance standard is specified by this indicator statement, target statement and acceptable variance.**

Refer to **Indicator # 7** located in **Section 5.7 Coarse Woody Debris** Structure for a detailed description of the indicator, target, acceptable variance, and strategy implementation. **For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance included in Section 5.2 will be used to determine if forest practices are consistent with the landscape level strategy.**

Refer to **Indicator # 9** located in **Section 5.9 Wildlife Tree Patches** for a detailed description of the indicator, target, acceptable variance, and strategy implementation. **For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the landscape level strategy. For the purposes of Section 29(1) of the *FSJPPR*, the applicable performance standard is specified by this indicator statement, target statement and acceptable variance.**

This strategy addresses the requirements of the *FSJPPR* Section 97 to allow harvesting adjacent to areas that are not greened up if resultant openings are consistent with the patch size and seral stage targets.

4.6 FOREST HEALTH MANAGEMENT STRATEGY

Forest health is defined as an ecological condition of the forest ecosystem, such that its productivity and resilience are retained in the face of natural and managed disturbances. Maintaining or enhancing forest ecosystem diversity, condition and productivity at the landscape level, and to a lesser extent at the stand level, is generally the best strategy to achieve forest health. Management on this basis is thought to reduce the risk of catastrophic damage to forest productivity and maintain ecosystem resiliency.
The Participants' primary forest health objectives are to:

- Ensure forest management plans are designed to support the maintenance of healthy forest ecosystems
- Minimize losses of mature timber due to forest health factors
- Minimize risks to silviculture investment due to forest health factors

The focus of this forest health strategy is to plan forestry operations to be consistent with the principles that support the maintenance of forest ecosystem health, while addressing site specific health issues that have a direct or indirect impact on timber availability or operational costs.

The forest health strategy will provide strategic direction to the Participants at the DFA, landscape unit and site level with respect to the following:

- Forest health objectives, indicators and targets identified by the Public Advisory Group and incorporated into the SFM matrix, including those related to maintaining the diversity and pattern of ecosystems within a natural range, and maintaining a natural range of variability in ecosystem function, composition and structure to allow ecosystems to recover from disturbance and stress.
- Forest health objectives in the Fort St. John Land and Resource Management Plan.
- Business objectives related to the impacts of forest health on operations.

4.6.1 Integrated Forest Health Management Strategy

To minimize the potential of catastrophic forest health events, the Participants will apply the principles of Integrated Forest Health Management in the planning and implementation of forestry activities.

The principles of Integrated Forest Health Management (a variant of Integrated Pest Management) are:

- know the land base and resource management objectives
- proactively manage from an ecological perspective
- do not make the situation worse, and
- practice adaptive management

Management practices consistent with the natural disturbance patterns (see Section 3.2) are appropriate from an ecological perspective, and therefore most likely to support the maintenance of healthy forest ecosystems. Forest management planning impacts this through, among other things, seral stage distribution, patch size distribution, forest types distribution, and by allowing some natural disturbance influences to occur without intervention.

Refer to **Indicator #1** (Forest Types) located in **Section 5.1 Forest Types** for a detailed description of indicator, target, and acceptable variance and strategy implementation designed to maintain the relative distribution of pure and mixedwood types across the landscape. **For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Forest Health Landscape Level Strategy.**

Refer to **Indicator #2** (Seral Stages) located in **Section 5.2 Seral Stages** for a detailed description of indicator, target, and acceptable variance and strategy implementation designed to retain seral stage distributions within acceptable ranges through time. **For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Patch Size, Seral Stage and Adjacency and Forest Health Management Landscape Level Strategies.**

Refer to **Indicator #3** (Patch Size) located in **Section 5.3 Patch Size** for a detailed description of indicator, target, and acceptable variance and strategy implementation designed to make harvest patch size more reflective of natural disturbance patterns. **For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Patch Size, Seral Stage and Adjacency Strategy.**

Refer to **Indicator #28** (Salvage and Sanitation Harvest) located in **Section 5.28 Salvage and Sanitation Harvest** a detailed description of the indicator, target and strategy implementation designed to accommodate some natural disturbances on the land base. This indicator encourages variable salvage levels of burned areas to support ecological processes, consistent with LU management intensity classifications. **This performance indicator is not intended for the evaluation of the Landscape Level Strategy as per section 42 of the *FSJPPR*. This performance indicator is intended to address other objectives of the Participants.**

4.6.2 Forest Health Strategy for Silviculture Obligation Areas

The Participants will identify potential forest health issues within their silviculture obligation areas (harvested blocks) and prioritize those that may have a significant impact on forest resources. Within their silviculture obligation areas, the Participants will detect and monitor significant forest health agents in a timely manner, and, where potential impacts are significant, implement cost effective treatment controls where practical.

The Participants will identify potentially significant forest health issues within harvested areas on which they have silviculture obligations and develop treatment plans that address the forest health issues and support the successful reforestation of the areas.

Refer to **Indicator #27** (Forest Health in Silviculture Obligation Areas) located in **Section 5.27 Forest Health in Silviculture Obligation Areas** for a detailed description of the indicator, target and strategy implementation designed to accommodate some natural disturbances on the land base. **For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Forest Health Landscape Level Strategy.**

4.6.3 Planning Strategy to Reduce Forest Health Impacts to Mature Timber

Where practical, prioritize harvesting of conifer blocks to those areas that are most susceptible to prevalent significant and/or catastrophic forest health damaging agents.

When major forest health concerns have the potential to become widespread, the Participants' FOS plans will accommodate a significantly higher proportion of susceptible forest types to reduce timber losses and limit the spread of the forest health problem.

Refer to **Indicator #48** (Forest Health FOS planning) located in **Section 5.48 Forest Health FOS Planning** for a detailed description of the indicator, target, acceptable variance, and strategy implementation designed to accommodate some natural disturbances on the land base. **For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Forest Health Management Landscape Level Strategy.**

4.6.4 Planning Strategy to Reduce Forest Health Impacts from Climate Change

Where practical, manage the potential impacts of climate change by implementing standards specified in the Chief Forester's Standard for Seed Use (CFSSU).

Participants can manage the potential impacts caused by climate change by following CFSSU flexibility provided to mitigate the risks identified by climate change. Climate models predict increases in temperature in NE BC. Summer and annual precipitation is also predicted to increase slightly, but because of large increases in summer temperature and annual drought index will increase. In addition, a general increase in extremes of all sorts (wind, cold, winter warm events, drought, etc.) are predicted.

The impacts to existing forests that may arise from these types of events include altered tree phenology combined with increased susceptibility to damage from weather events, existing and new pests. FOR provenance tests suggest that climate change could result in reduced growth, increased stem form defects and increased damage due to pests.

Participants will be made aware of climate change strategies that can be implemented to mitigate climate change by press releases, workshops, webinars, which are presented by FOR, Forest Professionals British Columbia (FPBC) and others.

This strategy applies primarily to class B seed lots (Pine) because the required diversity is being built into class A seed lots (Spruce) via seed orchard collection.

> Refer to **Indicator #14** (Seed Use) located in **Section 5.14 Seed Use** for a detailed description of the indicator, target, acceptable variance, and strategy implementation designed to adapt to future climate change impacts on the land base. **For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy. For the purposes of Section 35(5) the indicator this indicator statement, target statement and acceptable variance will replace the requirements of Schedule F Section 99 (Seed Use).**

4.7 REFORESTATION STRATEGY

The Fort St. John TSA timber supply consists of a complex, dynamic mosaic of deciduous, coniferous and mixedwood forests, across a wide range of age classes. This ecologically rich mix of species and age classes presents some significant challenges to reforestation. The historical (i.e. pre-2004) practice of assessing reforestation success using a block-by-block approach, and requiring a rigid adherence to full site occupancy of crop trees aligned well with a timber production objective, but greatly limited the ability of forest managers to address the wide range of values in the DFA, and often resulted in expensive interventions to treat small areas of cutblocks that were not conforming to a single-species approach (e.g. developing as mixedwood). The approval of SFMP #1, including the Landscape Level Strategy for Reforestation and its multi-block approach, and the Forest Types indicator, effected a paradigm shift in a direction that acknowledged the natural variability of the forests and sites within the DFA, and provided greater flexibility to reforestation approaches. The application of this strategy allows

The focus of this strategy is to:

- Link reforestation standards to landscape level timber production objectives, and the management of vegetation patterns across the landscape over time, and:
    - Provide flexibility to incorporate First Nations' input, treaty rights considerations.
    - Provide flexibility at the block level to use natural variability as a tool to address multiple objectives, including stand-level biodiversity, and allow for more 'natural' forest types to occur in managed stands.
    - Ensure timely reestablishment of trees on harvested areas.
    - Emphasize results-based management and provide foresters with discretion to allocate silviculture resources to treatments that will have the greatest positive impacts on future timber production, biodiversity objectives, First Nations values, wildfire mitigation, climate change adaptations, etc.

4.7.1 Reforestation Strategy

- Discrete areas within cutblocks will be assigned an initial forest type designation (conifer, deciduous, or mixedwood). Applicable reforestation standards (coniferous, deciduous, or intimate mixedwood standard) that apply to each area will be tied to stocking standard IDs, that correspond to conifer, deciduous, or mixedwood stocking standards (i.e., declarations). These IDs will be submitted into the government's tracking system (RESULTS). Changes to stocking standard designations within cutblocks may occur prior to final assessment and will be revised in RESULTS.
- Timely establishment of new forests is important to support timber production objectives and will be assessed based on the average length of time to establish trees on harvested sites.
- Flexibility in the intensity of silviculture treatments will be used to enhance landscape level timber production, while allowing natural variability in stand development. This will be enabled by assessing reforestation success based on a cumulative 'landscape level' assessment of the area from each year's harvesting. Assessments will be completed separately for all deciduous and all coniferous declarations, based on a comparative measure of projected future volume production.

The strategy includes the following components which are addressed below:

1. Assigning Reforestation Standards to areas within cutblocks
2. Landscape Level Assessment of Reforestation
3. Stocking Standards and Crop Tree Requirements
4. Silviculture Performance Indicators

1. Assigning Reforestation Standards to Areas Within Cutblocks

Section 23.1 of the *FSJPPR* requires Participants to declare to reforest an area within a cutblock as a coniferous area, a deciduous area, or a mixedwood area before, or at the time, of a harvest authorization request, so that the appropriate reforestation standards may be applied to that area. The mixedwood forest type class is further defined as either deciduous-leading or coniferous-leading mixedwood areas.

These mixedwood areas will normally be declared based on proportionate areas, as conifer and deciduous reforestation areas, unless intimate mixedwoods are prescribed for an area. Further details regarding the treatment of mixedwoods can be found in Appendix 13, "Fort *St. John Pilot Project Mixedwood Management Guidelines*". These guidelines serve an important role in the application of the Reforestation strategy.

The **Forest Types** indicator (section 5.1) identifies the maintenance of relatively consistent forest type composition over time as being important for ecosystem diversity. As that indicator ultimately relies on the species composition from reforested harvested areas, it is necessary to maintain a relatively consistent methodology for defining pure and mixedwood stands in young and old stands. Consistent with Section 5.1, a revised process will be implemented to define 'mixedwoods' as blocks in which the coniferous and deciduous components constitute between 25% and 75% of the gross cruise volumes[1]. 'Pure' coniferous or deciduous stands will be defined as blocks where greater than 75% of the gross volume is contained in one type or the other.

The process for tracking the areas of forest type declarations needs to be flexible enough to allow foresters to exercise their professional judgment at the cutblock level to vary regimes and/or make corrective actions as required to achieve the landscape level targets. A declaration may, therefore, be revised prior to the end of the reforestation period, although compensating revisions elsewhere on the landscape may be needed to maintain a balance of forest types consistent with **Section 5.1 Forest Types.**

The Participants recognize the importance of having some intimate mixtures present in managed stands and shall continue to manage a portion of the area under reforestation obligation this way. The approach outlined in this plan will ensure the persistence of intimate mixtures within the THLB without undue impacts to timber supply and increasing silviculture costs, while allowing for a diversity of forest types maintaining resilient landscapes – landscapes better positioned to support First Nations values, treaty rights, climate change, and biodiversity.

The following guidelines will be used in establishing or designating areas as intimate mixtures.

- 'Intimate mixtures' will comprise at least 15% of the total of mixedwood area harvested, by managing participant, with a harvest start date of November 15th, 2001, or later. Areas subsequently removed from the THLB for other uses (e.g., Oil and gas facilities) shall not be included in the participants' tracking of this target.
- "Mixedwood area" is determined using the limits described earlier in this section (gross volume, 75%/25%).
- Areas designated and managed as intimate mixtures will be tracked annually by Managing Participants. Results shall be reported regularly in SFM Annual Reports.
- The participants will consider impacts, positive and negative, to other resource values, commitments, and objectives when classifying areas to be 'intimate mixtures' (e.g. avoidance of herbicide application, First Nations' treaty rights, biodiversity and wildlife habitat objectives, wildfire mitigation, climate change, range, visual quality, etc.)

[1] Gross cruise volume is a readily available, simple measure with a high correlation to basal area % which is used in the Forest Types indicator.

2. Landscape Level Assessment of Reforestation Success

The landscape level reforestation assessment system measures reforestation performance and determines if reforestation obligations are complete. Block level reforestation requirements are replaced with landscape level (multi-block) reforestation requirements. The system was initially developed for conifer reforestation in the first SFMP and has been extended to deciduous reforestation in SFMP #3. The participants completed the development of a deciduous compiler, which utilizes Ministry of Forests' deciduous yield curves and "Draft Stocking Guidelines for Hardwoods in the BWBS" for 15-year-old stands. The interim block level standards for deciduous regeneration identified in SFMP#2 no longer apply (see part 3 below *"Stocking Standards and Crop Tree Requirements*").

The key components of the landscape level assessment system are:

- The assessment will measure success with a comparative estimate of predicted yield (volume) to actual yield (volume).
- The system will be based on data from individual cutblocks, but the data will be assessed over many blocks across the landscape.
- Areas are evaluated at a predetermined age following harvest.
- The results are tracked at the landscape and cutblock levels.
- Foresters will have flexibility at the cutblock level to vary regimes and provide for other values as they progress to a landscape level target for yield.
- The system will provide data to improve silviculture regimes and targets over time.

Details of the landscape level assessment system itself, the research background and development for Fort St. John, Survey Procedures, and the Applicable performance standards are detailed separately as follows:

a) **A detailed description of this assessment system is found in the "Implementation and Monitoring Procedure" in Section 5.32 Reforestation Assessment**

This includes definitions of the variables involved in the assessment, the objectives of the assessment survey, identification of the target population of areas to be assessed, the sample design and data collection, and actions to address populations less than the allowable minimums.

b) **Research background, and model development to support the landscape level assessment process in the Fort St. John TSA is documented in Appendix 6 and Appendix 10.**

The document *"Stocking Estimators and Future Volume"*, located in Appendix 6, assesses and compares the reliability of the MSQ system to predict future volumes, relative to other surveying systems.

The J.S. Thrower report *"Stand Survey and Growth Modeling for the Fort St. John TSA"* can be found in Appendix 10. This document outlines the model development using TASS simulations to predict future volumes using species, MSQ, site index, effective stand age, and general stand survey requirements in Fort St. John. It also identifies the steps needed to summarize the survey data and determine predicted

merchantable volumes for a population. Processes for surveys and summarizing data may change over time. Current procedures can be found in Participants' contract standards, manuals and standard work procedures.

c) **Detailed assessment survey procedures for Fort St. John are documented in Appendix 8**

"*The Survey Design and Field Procedures"* in Appendix 8 describe the detailed survey methods to be used in the Fort St. John DFA to meet the requirements of yield assessment and inventory labels. It outlines where count plots and full measure plots should be established, the information to be collected at each, specific areas that need to be mapped out in the field, and the information that must be captured, and acceptable data formats.

d) **Applicable Performance Standard**

The minimum legal requirements required to be met by a population of cutblocks for these assessments are defined by the acceptable variance to the target in **Section 5.32 Reforestation Assessment.**

3. Stocking Standards and Crop Tree Requirements

Appendix 9 includes additional information and requirements for use at the well growing and/or the establishment assessment phases. The Appendix includes:

- descriptions of crop tree requirements related to vegetative competition
- minimum inter tree distances, for coniferous areas within blocks (only for use during the establishment assessment if using a well-spaced assessment), and assessments of deciduous areas within blocks (for assessments completed prior to the full implementation of the landscape level assessment)
- stocking requirements for coniferous areas within blocks at the establishment assessment,
- stocking requirements for areas within blocks declared as intimate mixedwoods, both at the time of establishment and well growing assessments.
- stocking requirements for areas within a block declared as deciduous, for assessments completed prior to the full implementation of the landscape level assessment

4. Reforestation Performance Indicators

Legal Indicators

The indicators that will be used to assess conformance to this strategy are described in brief below.

i) The reforestation landscape level assessment strategy will be measured based on the predicted merchantable volume at a predetermined post harvest stand age in a population of reforested block areas, compared to a theoretical maximum predicted merchantable volume that those block areas could produce.

Refer to **Indicator #32** (Reforestation Assessment) located in **Section 5.32 Reforestation Assessment** for a detailed description of the indicator, target, acceptable variance, and strategy and implementation.

For the purposes of Section 35(5) of the FSJPPR this indicator statement, target statement and acceptable variance will be used in replacement of the portions of affected Section 32 of the FSJPPR through the application of the landscape level strategy for coniferous and deciduous areas logged after November 15, 2001. This will also apply to coniferous and deciduous area in cutblocks with commencement dates before November 15, 2001, if the Participant currently carries reforestation liability and has submitted a statement to the District Manager that the cutblock(s) will be subject to the SFMP under Section 42 of the *FSJPPR* (see section 8.1.3).

For the purposes of Section 42 of the *FSJPPR* this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.

ii) Establishment delay assesses the overall timeliness of prompt reforestation in the TSA at the landscape level by determining the average age of those harvested areas which do not yet have regeneration established.

Refer to **Indicator #33** (Establishment Delay) located in **Section 5.33 Establishment Delay** for a detailed description of the indicator, target, acceptable variance, and the strategy and implementation.

For the purposes of Section 42 of the *FSJPPR* this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.

iii) Maintaining a balance of spruce and pine on the land base following reforestation efforts supports natural species diversity within coniferous forests. This will be assessed based on a comparison of spruce and pine cruise volumes to the relative numbers of spruce and pine seedlings planted.

Refer to **Indicator #31** (Species Composition) located in **Section 5.31 Species Composition** for a detailed description of the indicator, target, acceptable variance, and the strategy and implementation.

For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.

iv) Use of seed and planting according to certification seed use standards helps ensure the identity, adaptability, diversity and productivity of the Province's tree genetic resources are used in the DFA. Recent awareness concerning the potential impacts of climate change on future forests has prompted increased flexibility, and the recognition that additional changes may be forthcoming to transfer rules, as outlined in the Chief Forester's Standards for Seed Use (Nov.20, 2004), as amended from time to time. To address these changes efficiently without requiring regulatory revisions, the Participants are including conformance to this Standard as a legal indicator for the Reforestation Strategy.

Refer to **Indicator #14** (Seed Use), located in **Section 5.14 Seed Use**, for a detailed description of the indicator, target, acceptable variance, and the strategy and implementation.

For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.

For the purposes of Section 35(5) the indicator this indicator statement, target statement and acceptable variance will replace the requirements of Schedule F Section 99 (Seed Use).

v) Using predominately natural regeneration for deciduous reforestation ensures reestablishment of genetically appropriate stock on deciduous areas.

Refer to **Indicator #15** (Deciduous Regeneration), located in **Section 5.15 Deciduous Regeneration** for a detailed description of the indicator, target, acceptable variance, and the strategy and implementation.

For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.

4.8 SOIL MANAGEMENT STRATEGY

The sustainability of long-term timber supply depends largely on the quality and quantity of soil resources available to support commercial forestry activities. Soil disturbance can be classified into two types, namely the areas impacted by dispersed soil disturbance across harvested areas that will be reforested (the net area to be reforested, or NAR), and the area occupied by permanent access structures such as roads, which has been addressed already in Section 4.2.

The most significant management issue in the DFA related to soil that the Participants believe needs to be addressed in a management strategy is:

- The extent of soil disturbance in the NAR that may negatively affect the physical, chemical, and biological properties of the soil

The soil management strategy will provide strategic and operational direction for the Participants at the DFA and site level for managing impacts to soil productivity, with respect to the following:

- Soil management and productivity objectives identified in the Fort St. John LRMP
- Soil quality and quantity objectives, indicators and targets that have been identified by the Public Advisory Group and incorporated into the SFI SFM matrix, including those related to soil productivity

4.8.1 Soil Disturbance Strategy

Managing soil resources to maintain productivity will focus on minimizing detrimental soil disturbance during forestry operations. This will be done by implementing effective systems to identify risks, to determine suitable equipment depending on site sensitivity, and to monitor operations to promptly address changing ground conditions when necessary.

The Participants will implement measures that ensure operations are conducted in a manner that addresses the inherent sensitivity of a site to soil degrading processes.

This strategy identifies the processes used to manage activities to minimize detrimental soil disturbance, how changing site conditions will be monitored to ensure activities can be modified to avoid unacceptable soil disturbance, and how soil disturbance will be determined and reported.

Refer to **Indicator # 4** located in **Section 5.4 Soil Disturbance** for a detailed description of indicators, targets, acceptable variance and strategy implementation designed to manage soil disturbance on harvested cutblocks.

For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variances will be used to determine if forest practices are consistent with this landscape level strategy.

4.9 VISUAL QUALITY MANAGEMENT STRATEGY

Visual quality management in the TSA is focused on achieving pre-set visual quality objectives in sensitive areas. Visual quality objectives (VQOs) are the extent to which the visual or scenic resources of a landscape may be altered compared to the pre-existing or natural condition. VQOs are resource management objectives established by the District Manager or contained in a higher-level plan that reflect the desired level of visual quality based on the physical characteristics and social concern for the area.

4.9.1 Visual Quality Objectives

All forest operations carried out in scenic areas covered by an established visual quality objective (VQO) will be consistent with the objective, and in scenic areas without established VQOs all forest operations will be designed using appropriate visual design techniques to minimize visual impacts.

Refer to **Indicator # 43**, located in **Section 5.43 Visual Quality Objectives** for a detailed description of the indicator, target, acceptable variance and strategy implementation to achieve VQOs in the DFA. **For the purposes of Section 35(5) of the *FSJPPR* this indicator statement, target statement and acceptable variance will be used in replacement of Section 28(1)(c) of the *FSJPPR* through the application of the visual quality landscape level strategy.**

For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the landscape level strategies.

4.10 BIODIVERSITY AND WILDLIFE HABITAT MANAGEMENT STRATEGY

The Participants propose to include the strategy outlined below, in SFMP #4, as an optional strategy as per Part 4, Division 1, section 35 of the *Fort St. John Pilot Project regulation*. The previous SFM Plans have included several indicators that address biodiversity and wildlife habitat management either directly or indirectly, many of which were included as components within other landscape level strategies. The Participants felt that the inclusion of a specific "Biodiversity and Wildlife Habitat Strategy" was an important addition to the Plan, particularly given the focus of biodiversity and wildlife in many recent agreements with First Nations, and various government objectives. In addition, it was felt that this strategy will reflect the participants' increased knowledge and awareness of biodiversity and wildlife, as well as the evolution of some of their management practices.

A review of the publicly available documentation relating to agreements signed between BC and local First Nations, and other relevant related documents such as the *Halfway River First Nation Forestry Guidelines*, was conducted by the Participants prior to the start of the SFMP rewrite process. As part of this review, areas were identified with respect to the current SFMP that needed to be added or revised. Several of the

identified items related to "wildlife" or aspects directly or indirectly related to biodiversity and/or habitat for wildlife. The approval letter for the SFMP#3 extension request included reference to many items that the government expects to be addressed in a revised SFMP. It should be noted that the practice of "wildlife management" per se, is out of the scope and jurisdiction for an SFMP, the participants, and their employees. The BC government has responsibility for the management and monitoring of wildlife populations within the province. It is well acknowledged, however, that forestry practices can have a significant impact on wildlife and their habitat, both positive and negative, and it is appropriate that this plan includes a strategy to address this.

In the 20 years since the first SFMP was approved, much has been learned regarding the importance of protecting key wildlife habitat features from the disturbance of forestry operations, and the provision or retention of habitat elements within regenerating managed stands. The Participants' practices have evolved along with these learnings, and with strong advocacy from local First Nations. The Participants' site plans and prescriptions regularly include requirements for coarse woody debris (CWD) piles, tree retention targets, and provision of wildlife tree patches (WTPs) that protect habitat features such as stick nests, dens and mineral licks, and contain suitable habitat for certain focal species. The timing of forestry operations has also been recognized as something that can have a significant impact on many wildlife species. Of note, there are the many migratory bird species that nest in the DFA during spring and summer months. Using a combination of Environment Canada guidance to avoid incidental take of bird nests (the accidental destruction of birds or nests during an otherwise legal activity) along with a science-based risk matrix of forest stands (based on age and tree species composition) and an associated compendium of Best Management Practices, the participants have included management options such as timing restrictions and extra habitat protection as part of the suite of management tools used to reduce the impact to migratory birds.

The following sub-strategies will provide direction to the Participants at the landscape and site levels, with respect to biodiversity and wildlife habitat related objectives identified during the SFMP rewrite process, including expectations expressed by local First Nations and the provincial government, SFM certification requirements, and input from the Public Advisory Group.

4.10.1 Coarse Woody Debris Strategy

The Participants will implement measures that ensure continuation of minimum levels of Coarse Woody Debris (CWD) are retained in harvested areas (i.e. managed stands), both in structural piles and as dispersed pieces.

Refer to **Indicators #6 and #7** included in **Sections 5.6 Coarse Woody Debris Volume and 5.7 Coarse Woody Debris Structure** for details on the indicators, targets, and implementation strategy.

> **For the purposes of Section 42 of the *FSJPPR*, the indicator statements, target statements and acceptable variances outlined in sections 5.6 and 5.7, and the Participants' performance relative to the targets, will be used in part to determine if forest practices are consistent with the landscape level strategy**.

4.10.2 Retention Strategy

The Participants will implement measures to ensure suitable levels of vegetation structure are retained in harvested areas (i.e. managed stands), to provide cover, visual screening, and habitat for wildlife, and to promote stability of soils in riparian areas.

Refer to **Indicators #s 5, 8, 9, 23, 37, and 44,** included in **Sections 5.5 (Dispersed Retention), 5.8 (Shrubs), 5.9 (Wildlife Tree Patches), 5.23 (River Corridors), 5.37 (Small Streams and NCD Management)** and **5.44 (Visual Screening).**

For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statements and acceptable variances in Sections 5.5, 5.9, 5.23, 5.37, and 5.44 and the Participants' performance relative to the targets, will be used to partly determine if forest practices are consistent with the landscape level strategy.

Performance indicator in Section 5.8 is not intended for the evaluation of the Landscape Level Strategy as per section 42 of the *FSJPPR*. This performance indicator is intended to address other objectives of the Participants.

4.10.3 Moose Habitat Strategy

Included in the SFMP#3 Extension letter is a reference to "*specific management commitments related to moose habitat and features, such as significant moose licks*". To address this expectation the Participants have included the following Moose Habitat Strategy to highlight the interaction between some key aspects of the Plan, and other management commitments, and moose habitat in the DFA.

Moose are iconic and are one of the most important wildlife species in the culture of the local First Nations people. Having a sustainable moose population for the future is consistently referenced as a primary interest by First Nations. Moose are a preferred source of food for Treaty 8 members, and a robust moose population is a key in affording food security to the communities (RSEA, 2022). Moose are highly sought after by First Nations and non-native hunters alike. They also represent an important food source for many of the region's other animals. Moose populations are the responsibility of the BC Government and are primarily managed directly through population surveys and hunting regulations, but also through mechanisms such as Ungulate Winter Range designations. Land use decisions can impact moose populations – both negatively and positively - via alteration to their habitat. Most moose habitat in the Boreal Forest is transitory, effectively 'moving' around the landscape through time as forests age and disturbances occur. However, some important moose habitat or moose habitat features are relatively stable (Rea and Child, 2007) (e.g. high elevation shrub complexes, alluvial deltas that inhibit forest establishment, large mineral licks). Through the development of early successional habitats, with associated mature forests, moose can be expected to thrive (Rea and Child, 2007). Stand-replacing type events that 'reset' forest age to an early seral state are broadly beneficial, through the provision of high-quality browse sites. However, there are many human-caused conditions that pose problems to moose populations. For example,

- linear developments or land conversion that facilitate human and wildlife predator access and subsequent hunting mortality,
- modifications that compromise key moose habitat elements, particularly stable habitats,

- excess hunting pressure,
- removal of security or thermal cover to the extent that moose cannot effectively use early-seral browse sites

The Participants acknowledge that their forest management activities can have an impact on localized moose populations, by way of habitat modification, construction of roads, impacts to key habitat features, and the scale and pattern of harvest on the landscape. There has been a concerted effort by the Participants in the past several years to mitigate concerns raised consistently by First Nations regarding moose and other wildlife. The implementation of increased tree retention in managed stands, retention of shrub complexes in riparian areas, significant buffers on mineral licks, increased training and knowledge for field staff, retention of roadside screening vegetation, and modification to silviculture treatments are some examples.

The participants will implement measures that support continuation of the spectrum of habitats required by moose at a landscape level, both temporally and spatially, including those outlined in the following sections:

- Reforestation Strategy (section 4.7)
- Forest Types (section 5.1)
- Seral Stages (section 5.2)
- Patch Size (section 5.3)
- Graham Connectivity (section 5.21)
- River Corridors (section 5.23)

The participants will implement measures that support protection of key habitat features and provision of thermal and visual shelter required by moose at a site level, both temporally and spatially, including those outlined in the following sections:

- Dispersed Retention (section 5.5)
- Wildlife Tree Patches (section 5.9)
- Protection of Sites of Biological Significance (section 5.10)
- Guidelines for Species at Risk and Species of Management Concern (5.11)
- Riparian Reserves (section 5.24)
- Small Streams and NCD Management (5.37)
- Visual Screening (section 5.44)

In addition to the commitments and management provisions of the above indicators, the Participants have ceased the aerial application of herbicide.

For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statements and acceptable variances in Sections 5.1, 5.2, 5.3, 5.5, 5.9, 5.10, 5.11, 5.21, 5.23, 5.24, 5.37, and 5.44, and the participants' performance relative to the targets, will be used to partly determine if forest practices are consistent with the landscape level strategy.

4.10.4 Sites of Biological Significance Strategy

An important aspect of forest management is identifying and applying management measures for the many features important to wildlife. These features include, but are not limited to, mineral licks, wallows,

stick nests, and dens. Some of these features have a large importance for one individual or family unit of a given species, while others may support generations of multiple species. All things on the landscape are inherently dynamic and eventually subject to change given time, and some of these features may be relatively short-term (e.g. the nest of a migratory bird) while others are static and tied to a specific location indefinitely (e.g. mineral lick). Applying measures that protect the integrity of such features depends on many contextual factors, and assessment of the animals to which the features is important but are important to address during forest management prescriptions. The Participants have developed an indicator new to this plan that outlines many of the features, collectively referred to as "sites of biological significance", and management measures that will be applied when these sites are encountered during forest management activities.

The participants will implement measures to protect the integrity of identified sites of biological significance.

Refer to **Indicator #10**, included in **Section 5.10 Protection of Sites of Biological Significance** for more information on the sites referenced, and the protection measures.

For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statements and acceptable variances in Sections 5.10, and the participants' performance relative to the targets, will be used to partly determine if forest practices are consistent with the landscape level strategy.

4.10.5 Migratory Birds Strategy

The participants will implement measures to avoid, reduce the risk, and mitigate incidental take of migratory bird nests and eggs during forestry activities.

Refer to **Indicator #12**, included in **Section 5.12**. **Migratory Birds Risk Reduction**.

Performance indicator in Sections 5.12 is not intended for the evaluation of the Landscape Level Strategy as per section 42 of the *FSJPPR*. This performance indicator is intended to address other objectives of the Participants.

4.10.6 Species at Risk Strategy

The participants will implement measures to retain habitat for forest-dwelling species at risk that may be impacted by forestry operations.

Refer to **Indicator #11**, included in **Section 5.11 Guidelines for Species at Risk and Species of Management Concern**.

For the purposes of Section 42 of the *FSJPPR* the indicator statement, target statements and acceptable variances in Sections 5.11, and the participants' performance relative to the targets, will be used to partly determine if forest practices are consistent with the landscape level strategy.

5.0 VALUES, OBJECTIVES, INDICATORS AND TARGETS

Values & Objectives: What is locally important and what is desirable?

An important part of developing a plan of this nature and scope is to identify what is locally important and have a vision of desirable future states. This includes reviewing SFM standards and comparing them to the local area so that values that are considered important in the local context are identified and accommodated. Once values are identified, one or more objectives can be developed to describe the future state or condition of each of the values. Objectives are broad, general statements that are qualitative as opposed to quantitative. To develop the first SFMP, local values and objectives were derived from input from the PAG and STAC, alignment with the LRMP, and referencing relevant SFM standards. During the revision of SFMP#3 and the development of this plan, a review of the current SFI Forest Management objectives was done.

Indicators & Targets: How do we know we have been successful?

In order to link forest management practices to objectives, performance measures, referred to as "indicators", are established. Indicators are variables that measure the state or condition of an object for which one or more targets is set. One or more targets are identified for each indicator. Targets are established so they relate directly to the indicator and are specific, measurable, realistic, and time bound. Indicators can be structured in a variety of ways, and depend on aspects such as available data, reporting feasibility, and what specifically is being measured. Indicators can be divided into three groups: *context*, *process*, and *response indicators* (Duinker, 2000):

1. **Context Indicators** – These indicators measure the output of a system where the outcome cannot be controlled at the local level. An example is measuring climate variables such as temperature or precipitation. These indicators provide useful data to help us understand the context in which we operate but provide relatively low value within a plan because the outcome is not directly linked to local management actions.
2. **Process Indicators** – These indicators measure the output of an agreed upon practice or process. An example is measuring the number of seedlings planted each year or season. These indicators are usually very effective because it is relatively easy to establish targets and measure and record data. However, they assume that the practice or process is correct in the first place. Further investigation and validation of the assumptions used can help mitigate these uncertainties and facilitate continuous improvement.
3. **Response Indicators** – These indicators measure the output of a system as a direct response to actions applied. An example is the change in site index of a managed stand as various silviculture or harvesting practices are applied. These indicators are very useful but are often difficult to measure, or the results are difficult to interpret. The lack of knowledge of biological systems and/or the expense of providing meaningful results can be preventative in the short term. Gathering more knowledge about biological systems, coupled with technological improvements aids in the development of these types of indicators.

4. **Mix of Indicators** - To be most effective, an SFMP should contain both process and response indicators. Once all SFM objectives are covered by one or more of these types of indicators, the addition of context indicators will provide enhanced value.

Indicators are not necessarily 'weighted' equally. It is the collection, of indicators together that provides the strength to measure performance towards sustainable forest management.

This section includes a description of each SFM indicator and target included in this plan. The following template and description illustrate the format used to present the information.

5.XX INDICATOR TEMPLATE

Indicator Statement	Target Statement
A reiteration of the indicator as identified in the landscape level strategy or the SFM matrix.	A specific statement describing a desired future state or condition of an indicator. Targets are s**pecific, measurable, achievable, realistic**, and **time bound**, and relate directly to the indicator statement.
SFM Objective: The title of the SFI SFM objective(s) to which the indicator relates	
Linkage to *FSJPPR*: If applicable, a brief statement regarding whether this indicator affects performance requirements of the FSJPPR, or if it will be used to evaluate success of the implementation of the landscape level strategy.	

Acceptable Variance:

Outlines any acceptable variance to the applicability of the indicator or associated target.

What is this indicator and why is it important?

Description of the indicator, including relevant background information and current state, if applicable.

Implementation and Monitoring Procedure:

Description of the implementation and monitoring methods specific to the indicator, and reporting progress to established targets. Forecasting may be included in this section where appropriate.

5.1 FOREST TYPES

Indicator Statement	Target Statement
Percent distribution of forest type (deciduous, deciduous mixedwood, conifer mixedwood, conifer) >20 years old by landscape unit	All forest type groups by landscape unit will meet or exceed the minimum area percentage in Table 6
SFM Objective: Forest Management Planning; Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Forest Health Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

A Forest Type's area within an LU may be allowed to decline to 50% of the minimum targeted area of a forest type, provided a plan can demonstrate that projected ingrowth will allow the minimum targeted area to be achieved within ten years.

Targets may be adjusted in the event of large natural disturbances impacting a forest type's area within a landscape unit.

What is this indicator and why is it important?

Forest Type groups are the designation of stand types into one of four ecologically significant groups – pure deciduous, deciduous leading mixedwood, conifer leading mixedwood, and pure conifer. The classification is based on the British Columbia Land Classification System (BCLCS). For the purposes of this indicator the BCLCS code 'Treed-Broadleaf' (TB) is deciduous, 'Treed-Mixed' (TM) is mixedwood and 'Treed-Conifer' (TC) is conifer. Treed-Mixed is further delineated into either deciduous mixedwood or conifer mixedwood based on the leading species.

Forest planning decisions and operations can have a significant influence over the composition of forest types across forested landscapes. This influence increases with the duration and intensity of management, and it is important to monitor changes over time as harvest and reforestation activities are applied.

This indicator monitors the change in the proportion of forest type groups (> 20 years old) within each group over time. Stands younger than 20 years of age are not included, as young stands can exhibit significant fluctuations in tree species composition within that time span as a result of silviculture practices, natural ingress of species in regenerating stands, competing vegetation dynamics, etc. Considering only stands over 20 years of age focuses the targets on stands that are most likely on a consistent 'trajectory' regarding one of the four classifications.

Stands with Black Spruce (*Picea mariana*) and Tamarack (*Larix laricina.)* as the leading species are not included in the conifer Forest Type class. Black spruce and larch stands are not typically targeted for timber harvesting in the DFA, and the large amount of area represented by these stands would overly weight the

conifer forest type away from the other species such as white spruce (*Picea glauca*) and pine (*Pinus contorta*), that have been traditionally targeted by the forest industry, and make this indicator less sensitive to the effects of forest management activities.

The relative proportions of forest types with each LU can fluctuate with harvesting levels, silviculture regimes, new forest inventories, young stands 'aging-in', and especially natural stand-replacing disturbances. The acceptable variances for this indicator acknowledge the potential significant impact of the aspects outside the participants' control (e.g. large fires). Targets were established initially at no less than 20% of the 2010 Current Status area and then adjusted to provide a realistic value for groups that have a very low occurrence, to a minimum of 1%. Minimum targets are used, as ingress over time due to maturation and natural succession can distort maximum percentage targets.

Current Status:

Table 6 summarizes the target minimums for this indicator and shows the current status as of 2025. As mentioned elsewhere in this plan, the DFA was impacted significantly by wildfire in the past several years. 2023 was by far the most significant since the start of the Pilot Project, with conifer-leading types in the Tommy Lakes, Kahntah, and Trutch LU's being especially influenced (experiencing drops of 9%, 4%, and 2% respectively). Since the last SFMP rewrite was initiated, there have been several other years with notable fire area – 2016, 2018, and 2024. As of the writing of this plan there are active fires burning in the Trutch, Tommy Lakes, Kahntah, and Milligan LUs. Figure 5 is included below to provide a visual representation of the location and extent of wildfires in the DFA since 2016. With a few very small exceptions, the fires have occurred in the Boreal Plains NDU, which is to be expected. Since 2016 the total area impacted by wildfire in the Boreal Plains NDU has exceeded 980,000 ha[2] (note that a small amount of this area burned more than once in that time span). While some of the burned over area will be reforested artificially (i.e. planted conifer seedlings), most will regenerate naturally, and it is too early to know what forest types these new stands will become. It is reasonable to assume that a lot of area will regenerate as similar types to their pre-2023 grouping, but there certainly will be type replacement (e.g. former deciduous-leading mixedwood stand becoming 'pure' deciduous) and shifts in the previous type proportions over time. The impacts of the relatively recent Mountain Pine beetle infestation (potential reduction in Pine seed) and climate change may cause a trend away from pure conifer types towards mixedwoods, on suitable sites.

The GIS analysis results for this indicator shows that conifer-leading types in the Tommy Lakes LU are below the target threshold set in 2010 (41.4% vs. 45%) and will only get to 43% within the next 10 years. Not surprisingly, this LU experienced the largest magnitude and proportional impacts of the Donnie Creek fire of 2023, and conifer-leading stands would have been particularly vulnerable.

In recognition of the impacts of the recent and ongoing fires, and as per the Allowable Variance for this indicator, there are new targets being proposed with this plan. Consistent with past target setting, a minimum threshold of no less than 20% below 'current status' levels is proposed. New target minimums are shown in the last column of Table 6, highlighted in green.

[2] Total gross area of wildfires. Will include some areas within wildfire boundaries that did not burn (i.e. 'skips')

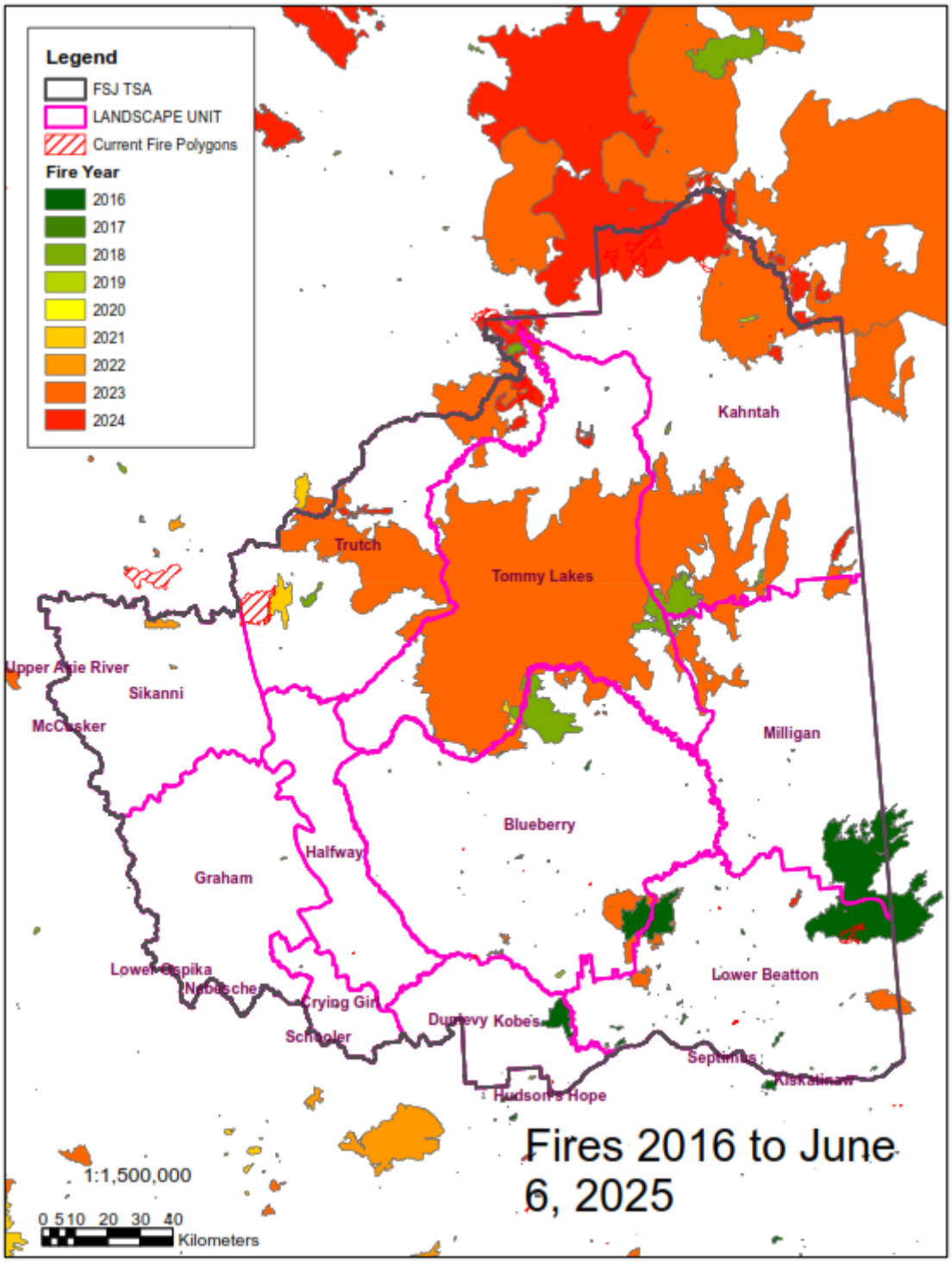


Figure 5. Wildfire area 2016-2024 (solid fill), and active as of June 6 2025 (hatch)

Table 6. Baseline Targets for Forest Types and Current Status

(orange – below SFMP#3 target; green – new target minimum)

Landscape Unit	Forest Type	2025 Current Status		SFMP#3 Target Minimum	SFMP 4 Target Minimum
		Area (ha)	% of L.U.	(%)	(%)
Blueberry[1]	Deciduous	114,982	**33.4**	**28**	**28**
	Deciduous Mixedwood	50,333	**14.6**	**11**	**11**
	Conifer Mixedwood	40,815	**11.8**	**8**	**8**
	Conifer	138,398	**40.2**	**33**	**33**
Blueberry Total		344,528	**100**		
Crying Girl[2]	Deciduous	589	**1.0**	**1**	**1**
	Deciduous Mixedwood	1,074	**1.9**	**1**	**1**
	Conifer Mixedwood	1,653	**2.9**	**1**	**1**
	Conifer	53,909	**94.2**	**76**	**76**
Crying Girl Total		57,225	**100**		
Graham[2]	Deciduous	2,769	**1.3**	**1**	**1**
	Deciduous Mixedwood	2,937	**1.3**	**1**	**1**
	Conifer Mixedwood	4,804	**2.2**	**1**	**1**
	Conifer	210,586	**95.2**	**77**	**77**
Graham Total		221,096	**100**		
Halfway[1]	Deciduous	13,927	**12.0**	**9**	**9**
	Deciduous Mixedwood	8,660	**7.5**	**4**	**4**
	Conifer Mixedwood	8,073	**6.9**	**3**	**3**
	Conifer	85,558	**73.6**	**62**	**62**
Halfway Total		116,218	**100**		
Kahntah[2]	Deciduous	77,259	**38.9**	**30**	**30**
	Deciduous Mixedwood	30,389	**15.3**	**10**	**10**
	Conifer Mixedwood	20,863	**10.5**	**10**	**10**
	Conifer	70,336	**35.4**	**29**	**28**
Kahntah Total		198,847	**100**		
Kobes[1]	Deciduous	24,513	**32.0**	**28**	**28**
	Deciduous Mixedwood	8,850	**11.5**	**9**	**9**
	Conifer Mixedwood	8,804	**11.5**	**8**	**8**
	Conifer	34,534	**45.0**	**35**	**35**
Kobes Total		76,701	**100**		
Lower Beatton[1]	Deciduous	55,146	**72.5**	**56**	**56**
	Deciduous Mixedwood	6,275	**8.2**	**7**	**7**
	Conifer Mixedwood	4,688	**6.2**	**5**	**5**
	Conifer	9,960	**13.1**	**11**	**11**
Lower Beatton Total		76,069	**100**		

Landscape Unit	Forest Type	2025 Current Status		SFMP#3 Target Minimum	SFMP 4 Target Minimum
		Area (ha)	% of L.U.	(%)	(%)
Milligan[2]	Deciduous	37,545	**28.8**	**24**	**24**
	Deciduous Mixedwood	9,169	**7.1**	**5**	**5**
	Conifer Mixedwood	9,094	**7.0**	**6**	**6**
	Conifer	74,547	**57.2**	**45**	**45**
Milligan Total		130,382	**100**		
Sikanni[2]	Deciduous	2,073	**1.7**	**1**	**1**
	Deciduous Mixedwood	1,728	**1.4**	**1**	**1**
	Conifer Mixedwood	2,441	**2.0**	**1**	**1**
	Conifer	117,894	**95.0**	**75**	**75**
Sikanni Total		124,136	**100**		
Tommy Lakes[3]	Deciduous	61,278	**30.6**	**18**	**18**
	Deciduous Mixedwood	32,787	**16.4**	**9**	**9**
	Conifer Mixedwood	23,246	**11.6**	**8**	**8**
	Conifer	82,889	**41.4**	**45**	**33**
Tommy Lakes Total		200,200	**100**		
Trutch[2]	Deciduous	42,676	**24.0**	**17**	**17**
	Deciduous Mixedwood	23,032	**12.7**	**9**	**9**
	Conifer Mixedwood	17,159	**9.5**	**7**	**7**
	Conifer	97,815	**54.1**	**48**	**43**
Trutch Total		180,682	**100**		
	Deciduous	432,757	**25.1**		
All L.U.'s	Deciduous Mixedwood	175,261	**10.2**		
	Conifer Mixedwood	141,640	**8.2**		
	Conifer	976,426	**56.6**		
Total All		1,726,084			

[1] Landscape unit completely in 'Core' geographic AAC partition area

[2] Landscape unit completely in 'Periphery' geographic AAC partition area

[3] Landscape unit partly in 'Core' and partly in 'Periphery' geographic AAC partition areas

Implementation and Monitoring Procedure:

In order to confirm consistency with the SFMP commitments and progress to targets, analyses of the effects of proposed harvesting and forest aging is conducted as part of developing Forest Operations Schedules. Adjustments to proposed harvesting may be necessary in order to achieve Forest Type targets.

Data sources include Vegetation Resource inventory (VRI), Landscape Unit boundaries, and participants' block data. These data sources are usually updated and replaced in five-to-ten-year intervals. Recent fire spatial information and satellite imagery may be necessary where VRI has not been recently updated.

To assess the current state, forest inventory data is projected to the current date, and recent harvesting is considered by overlaying participants' block spatial information. Each inventory polygon is assigned to a Forest Type group then summed for each LU and expressed as a percentage of the productive forested area of the LU. Only stands above 20 years of age will be monitored and reported in this calculation. In order to report and assess the effects of potential harvest, all proposed FOS blocks are included in the overlay and then modelled as harvested by a future date (estimated by dividing the total proposed FOS volume by AAC projections). The other forest polygons are 'aged' to this future date, so current young stands' contribution to future Forest Type area is accounted for.

To monitor this indicator, analyses will be done at the start of each SFMP, or FOS or major amendment, and when each SFMP expires (presented in Annual Reports). The results will be compared to the overall target minimums.

The data will be used by the Participants to guide future harvest planning (i.e. FOS development), to review long term trends in reforestation policies, and to adjust silviculture practices where necessary.

Prior to commencing harvest, each block must have a declaration filed stating the intended species group that the managing Participant proposes to reforest the area to - conifer, deciduous, mixedwood (sec. 23.1(1) of the *Fort St. John Pilot Project Regulation*). It is not necessarily the intention to match regeneration of the same species composition as was harvested on a block-by-block basis, although this is often the case, but rather across landscape units. This reflects the inherent variability and dynamic species patterns within the DFA. The participants have flexibility through the Reforestation landscape level strategy to vary species composition between managed stands after initial declarations, keeping in mind the targets set through this indicator.

5.2 SERAL STAGES

Indicator Statement	Target Statement
The minimum proportion (%) of late seral stage forest retention by NDU by LU	All Periods: The minimum proportion (%) of late seral stage forest retention by NDU by LU as identified in Table 7 will be met

SFM Objective: Forest Health and Productivity; Conservation of Biological Diversity
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Patch Size, Seral Stage and Adjacency, Forest Health Management Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.

Acceptable Variance:

A 1% variance below the target is permissible provided projections (i.e. FOS analysis) indicate the target can be met within 20 years. (e.g. Boreal Foothills Valley NDU/Crying Girl LU minimum allowable would be 22%)

What is this indicator and why is it important:

In the 1990's the retention of old forests within all forested landscapes was recognized as important for maintaining biodiversity. The basic principle being that all landscapes have some level of old forests and the more a managed forest resembles the forests that were established as a result of natural processes the more likely that all native species and ecological processes will be maintained.

The Craig DeLong 2011 paper entitled *"Land Units and Benchmarks for Developing Natural disturbance Based Forest Management Guidance for Northeastern British Columbia, Technical Report 059"* is a synthesis of the scientific information and regional professional judgement available. The NDU guidance uses updated local research and separates areas based on differences in disturbance processes, stand development, and temporal and spatial landscape patterns. Unlike the Biodiversity Guidebook, this document presents goals based on the "natural range of variability" and does not present any numbers that represent a compromise between biodiversity and timber management. The guidance in this document would result in the least possible differences between harvesting and natural disturbance.

There are four NDUs within the Fort St. John TSA; Boreal Plains Uplands in the east, Northern Boreal Mountains in the northwest, the Omineca in the central and eastern mountains and the Boreal Foothills south of the Halfway River.

In the Boreal Plains Uplands NDU, upland climax forests are dominated by hybrid white spruce and/or black spruce depending on topographic position and the time since the last stand replacement event. Trembling aspen and to a lesser extent lodgepole pine and paper birch dominate younger stands. Wetlands are very common; there are 7 forested and 9 non-forested wetland types recognized in this NDU. (Delong, 2002)

In the Northern Boreal Mountains NDU, upland climax forests have sparse crown closure and are dominated by hybrid white spruce and/or subalpine fir. Subalpine fir dominance increases with elevation. Lodgepole pine and to a lesser extent trembling aspen dominate younger stands. Black spruce occurs along with white spruce or lodgepole pine on upland sites especially on north aspects. Wetlands are common along the broader valleys and in flatter terrain in the mountains. (Delong, 2002).

Forests occurring in different seral and structural stages over space and time are recognized as an important part of the landscape, providing distinct habitat elements for a variety of species. The

publication *Land Units and Benchmarks for Developing Natural disturbance Based Forest Management Guidance for Northeastern British Columbia, Technical Report 059; 2011,* has estimated the natural range of variation for different Natural Disturbance Units within the DFA.

Late seral "old" forest is defined as stands greater than 140 years old for coniferous leading stands and as greater than 100 years old for deciduous leading stands. Deciduous stands are typically made up of short lived early seral species, and if left undisturbed for long periods of time (>150 years) will eventually convert to coniferous stands or die and cycle back to a similar species composition. Therefore, it would be inappropriate to manage for the same distribution of ages for deciduous as for conifer species. Late seral deciduous stands are structurally distinct from young and mature stands. These stands provide lower tree densities and hence produce larger diameter trees and higher levels of coarse woody debris and, it is therefore important to maintain some occurrence of these stands on the landscape over time.

As deciduous stands make up approximately 28% of the Boreal Plains land base, targets are applied to both deciduous and coniferous in the Boreal Plains NDU. In the Boreal Foothills, Omineca and Northern Boreal Mountains NDUs however, deciduous stands comprise an insignificant amount of the remainder of the TSA (approximately 3%, 1.5% of which is THLB) and therefore only conifer late seral stage targets are applied to the forested land base in these NDUs.

There have been no separate targets set for mixedwood stands in the DFA. Approximately one third (33%) of the productive forested land base of mixedwood stands is within the non-harvesting land base (NHLB) which is not actively managed by the Participants. This provides some assurance that there will be a significant amount of unmanaged mixedwood stands to meet seral stage targets. The remainder of the mixedwood stands will be managed to the targets for the deciduous and conifer leading stands, based on leading species, for the appropriate NDU/LU unit. The late seral stage forest retention targets identified in

Table 7 are planned to be achieved through an evolving combination of spatially identified areas through various Land Use Planning processes (such as the Blueberry River First Nation's Watershed Management Basin planning) land designations in the Crown Forest Management Land base (CFMLB) that prohibit timber harvesting such as Wildlife Habitat Areas (WHAs), Ungulate Winter Ranges (UWRs) and Parks and protected areas, and non-spatially identified old forest. Over time, the contribution from non-spatially identified old forest will be reduced as the target for spatially identified areas is achieved. The target for spatially identified areas will vary, depending on the location and Land Use Plan (LUP) that covers that area and the applicable Nation's desire to see spatial versus non-spatial management of late seral. The participants will update this indicator accordingly as each LUP that includes late seral management is finalized. Only areas not covered under a finalized LUP that includes late seral management will be included in this indicator going forward.

Table 7: Natural Disturbance Unit Late Seral Stage Targets

Natural Disturbance Unit	Landscape Unit	Minimum Age of Late Seral (years)	Targets for Late Seral Forest Retention (%)
Boreal Plains Uplands (BPU)	Blueberry	Coniferous - 140 Deciduous - 100	16 16
	Halfway		
	Kahntah		
	Kobes		
	Lower Beatton		
	Milligan		
	Tommy Lakes		
	Trutch		
Boreal Foothills Valley (BV)	Crying Girl	All- 140	23
	Graham		
	Halfway		
Boreal Foothills Mountain (BM)	Crying Girl	All- 140	33
	Graham		
	Halfway		
Northern Boreal Mountains (NBM)	Graham	All- 140	37
	Sikanni		
Omineca Mountains (OM)	Graham	All- 140	41
Omineca Valley (OV)	Graham	All- 140	16

The following Table 8 and Table 9 show the 2025 status of seral stage distribution for the NDUs by LU in the DFA.

The current existing late seral stage state is met for all NDU/LU units except for the Kahntah, Lower Beatton and Tommy Lakes LUs in the Boreal Plains Upland NDU for conifer, and the Milligan LU in the Boreal Plains Upland NDU for deciduous. The large-scale wildfires that took place in 2023 are accounted for in this analysis and are the reason for these units being below target. It is projected to take 14 years for the Kahntah LU, 11 years for the Lower Beatton LU and 7 years for the Tommy Lakes LU conifer old seral targets in the Boreal Plains Upland NDU to be met. It is projected to take 16 years for the Milligan LU deciduous target in the Boreal Plains NDU to be met.

During the SFMP #4 rewrite process, some of the First Nations voiced concern over the scale of NDUs being used for late seral retention. Concerns were raised that due to the large size of the Boreal Plains NDU specifically, this meant that the distribution of late seral would not necessarily be equally represented in all First Nation's area of interest. Therefore, the SFMP #4 Planning Team agreed to change the scale of units to NDU by LU, similar to how the indicator was written under SFMP #1 to address this concern. Although 10 ha of the Crying Girl LU overlaps with the Boreal Plains NDU, no targets were established for this unit as it is insignificant in size and impractical to manage. This unit is included in table 12 for thoroughness. If a block is proposed completely in this unit in the future, the closest adjacent unit would be used for this indicator.

Another key point of discussion during the SFMP#4 rewrite process was the preference for spatial or aspatial late seral management. While most First Nations preferred spatial management, one was strongly opposed to this method. Overall, there was understanding that due to several LUPs that are ongoing and will spatialize late seral, it didn't make sense for the SFMP #4 Planning Team to try and tackle a spatial component of this indicator knowing that the LUPs would supersede any work we did. It is understood that as each LUP that addresses late seral management is finalized, the SFMP will need to be amended to incorporate that plan. For this reason, the target statement was updated to remove the previous targets for spatializing old seral in Old Forest Management Areas (OFMAs).

Table 8: Conifer Current Seral Stage and Target

Table 8 identifies the current conifer seral condition for all NDU/LU units in 2025. Units below the old seral target are shown in red text.

Natural Disturbance Unit	Landscape Unit	Current Young (<40yrs)	Current Mid (40-100yrs)	Current Mature (101-140yrs)	Current Old (>140yrs)	Current Old %	Old % Target	Surplus/(Deficit) of Old (ha)
Boreal Plains Uplands (BPU)	Blueberry	84,166	128,698	75,170	58,759	17	16	3,272
	Crying Girl	0	0	0	10	100	N/A	8
	Halfway	13,908	21,484	35,920	59,194	45	16	38,313
	Kahntah	133,636	244,686	124,645	42,995	8	16	(44,359)
	Kobes	13,719	7,812	31,235	23,020	30	16	10,894
	Lower Beatton	5,057	12,779	15,759	4,307	11	16	(1,757)
	Milligan	24,904	191,631	44,425	62,213	19	16	10,505
	Tommy Lakes	245,210	113,549	117,394	74,513	14	16	(13,594)
	Trutch	74,149	91,365	89,962	81,446	24	16	27,538
	TOTAL	**594,749**	**812,004**	**534,510**	**406,457**	**17**	**N/A**	**30,822**
Boreal Foothills Valley (BV)	Crying Girl	3,071	1,529	8,030	7,842	38	23	4,566
	Graham	469	3,314	15,452	25,055	57	23	17,969
	Halfway	10	193	314	1,016	66	23	771

Natural Disturbance Unit	Landscape Unit	Current Young (<40yrs)	Current Mid (40-100yrs)	Current Mature (101-140yrs)	Current Old (>140yrs)	Current Old %	Old % Target	Surplus/(Deficit) of Old (ha)
	TOTAL	**3,550**	**5,036**	**23,796**	**33,913**	**51**	**N/A**	**23,306**
Boreal Foothills Mountain (BM)	Crying Girl	3,043	2,606	14,526	21,090	51	33	14,488
	Graham	4,669	4,949	26,675	34,245	49	33	22,959
	Halfway	81	1,058	3,057	7,491	64	33	5,621
	TOTAL	**7,793**	**8,613**	**44,258**	**62,826**	**51**	**N/A**	**43,068**
Northern Boreal Mountains (NBM)	Graham	2,382	1,487	4,669	13,121	61	37	9,655
	Sikanni	4,993	9,223	34,865	81,297	62	37	60,437
	TOTAL	**7,375**	**10,710**	**39,534**	**94,418**	**N/A**		**70,092**
Omineca Mountains (OM)	Graham	1,531	3,447	16,102	67,029	76	41	52,931
Omineca Valley (OV)	Graham	214	845	3,486	3,706	45	16	2,386

Table 9. Boreal Plains Deciduous Current Seral Stage and Target

Table 9 identifies the current deciduous seral condition for all NDU/LU units in 2025. Units below the old seral target are shown in red text.

Natural Disturbance Unit	Landscape Unit	Current Young (<40yrs)	Current Mid (40-100yrs)	Current Old (>100yrs)	Current Old %	Old % Target	Surplus/(Deficit) of Old (ha)
Boreal Plains Uplands (BPU)	Blueberry	32,351	82,758	65,376	36	16	36,498
	Crying Girl	0	4	2	40	N/A	1
	Halfway	2,146	7,080	12,667	58	16	9,164
	Kahntah	11,749	71,920	31,430	27	16	13,014
	Kobes	8,132	6,087	24,385	63	16	18,208
	Lower Beatton	12,148	42,081	16,536	23	16	5,214
	Milligan	3,375	38,808	5,537	12	16	(2,098)
	Tommy Lakes	25,755	41,338	45,563	40	16	27,538
	Trutch	5,916	31,657	29,509	44	16	18,661
	TOTAL	**101,572**	**321,733**	**231,005**	**35**	**N/A**	**126,201**

Implementation and Monitoring Procedure*:*

Does forecasting apply (y/n)? Yes

The following process is used to calculate the current and future state for this indicator:

1. To calculate the current state, the forest cover for all disturbances including harvesting to the current reporting period will be updated. Each stand is assigned to either the deciduous or coniferous group based on the leading species and a seral stage based on the age of the leading species. The area of each stand is then summed for each NDU/LU unit and expressed as a percentage of the productive forested area within the NDU/LU unit.

2. To calculate the future state, all proposed harvesting will have ages projected to the end of the proposed development period and have the seral stage distribution calculated as described in step 1. To forecast the future state for this indicator, the existing FOS is incorporated into the forest inventory. Stands that are proposed to be harvested are removed, and existing inventory polygons area aged to the appropriate year depending on how many years' worth of volume exists in the FOS. Results are reviewed and compared to the targets for each NDU/LU unit. Adjustment to proposed FOS blocks may be required in order to ensure conformance to targets. Units that are not projected to meet minimum target(s) should have projections carried forward 20 years past the modelled end date of all FOS harvest to assess whether or not they would meet the minimum old seral target, as per the Acceptable variance.

The FOS will be consistent with this indicator; an analysis will be completed when each FOS is developed or there is a major amendment to assess impact of the harvesting activity proposed by the FOS on late seral retention and the FOS will be modified if necessary to ensure consistency.

Four broad types of constraint are considered to directly contribute to old forest retention; old forests in parks, old forest in Ungulate Winter Range (UWR) and Wildlife Habitat Areas (WHA) where timber harvesting is prohibited, riparian reserve zones and old forest in wildlife tree patches (WTP) in existing and proposed cut blocks.

Parks - While parks are not part of the crown forested land base, the area of old forest within parks is counted as contributing to the old growth target.

Ungulate Winter Range - The high elevation UWR in the Fort St John TSA has established objectives that restrict forest harvesting and road building. Therefore, any old forests within the UWR are expected to remain undisturbed and are considered as contributing to the old growth targets.

Riparian Reserves. Current forest management practices preclude harvesting of riparian forests along many streams. The current timber supply review for the Fort St John TSA produced a data coverage that removed riparian forests from the THLB. This data may be used to determine the amount of old forest reserved along streams and these riparian reserve areas have been recognized as contributing to the old growth targets.

Wildlife Tree Patch - WTPs form part of the stand level objectives for the maintenance of biodiversity. Any WTP that meets the age criteria for old forests and is greater than 2 hectares in size is also considered to contribute to the old growth targets.

Other Protected Areas – Other areas under protection from harvesting, such as Blueberry River First Nation's HV1 areas and the Treaty 8 consensus agreement areas will be counted as contributing to the old growth target. As other protected areas are designated, they will be considered as counting towards the old growth target as well.

The old growth targets apply to the Crown Forest Management Land base (CFMLB) within the Fort St John TSA. The CFMLB is the productive forested crown land which does not include area that is non-crown, non-forest, and non-productive forest. Area within Woodlots and First Nations Reserves do not contribute to meeting the old forest retention targets. Area within Parks and Protected areas will contribute to maintaining old forest retention in accordance with the Landscape Unit Planning Guide.

Seral targets, as described earlier, are based on ranges appropriate to a very large natural disturbance unit (NDU). The Fort St. John DFA only includes a portion of these large NDUs that span areas outside the DFA. As a result of this, some flexibility in reaching the targets is appropriate. During development of the FOS Participants will consider the current seral stage state versus target when developing the plans. Plans will normally be developed that maintain consistency with the target. Circumstances may warrant short term deviations from the target (e.g. forest health, large disturbances, poor economic conditions etc.) and are acceptable. Harvesting in older stands can still occur provided an analysis is completed to demonstrate there is a high likelihood of achieving the target within a 20-year time frame.

In phase one the technical working group reviewed the Delong 2002 direction and agreed to set the legal old growth retention target at the lower end of the natural range of variation. While the old growth retention targets are set at the lower end of the natural range of variation it should be noted that the result is an equivalent or greater area under old forest management objectives than required by the Provincial Non-Spatial Old Growth Order.

In determining the old growth area targets, it was discovered that the Boreal Plains NDU may not achieve the old forest retention target for two reasons. The primary reason is the considerable amount of pine forest in the Boreal Plains NDU and that the pine stands in the Fort St John TSA rarely survive to the age of 140 years. The second factor is the level of natural and anthropogenic disturbances in the area. This NDU has a high incidence of natural forest fires and an extensive history of industrial development.

In landscape units where there is:

- An immediate recruitment situation due to insufficient old forest in a variant; or
- An epidemic or catastrophic natural event such as wildfire or insects

A recruitment strategy, prepared in collaboration with, and endorsed by, the appropriate First Nations, can be used to meet the old forest requirement. A recruitment strategy prepared by the Participants will spatially identify stands that do not currently meet the requisite old growth characteristics but are intended to develop those characteristics in the shortest amount of time that is practicable. These identified stands will contribute to old growth targets in landscape units where there are not enough old growth forests to meet targets.

Recruitment areas should be delineated to maximize their value to biodiversity conservation. The following criteria should be considered:

- Capture rare old growth site series, providing their locations are known;
- Create areas large enough to provide old growth interior condition;
- Maximize connectivity value
- Utilize old and near old forest (80-100 years for deciduous and 100-120 years for conifer) where possible

5.3 PATCH SIZE

Indicator Statement	Target Statement
Percent area by Patch Size Class (0-50, 51-100, and >100 ha) by NDU	A minimum of 9 of 18 of the baseline targets for early patches will be achieved during the term of this SFMP (Table 10)
SFM Objective: Forest Health and Productivity; Conservation of Biological Diversity; Management of Visual Quality and Recreational Benefits	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Patch Size, Seral Stage and Adjacency Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

Natural disturbance events that shift the patch size distribution to such a level that it cannot be accommodated in a short (decade) time frame

If harvesting is needed to meet early patch targets but would put the LU under the old seral target, the old seral targets will take precedence over early patch targets. Variance from the early patch targets for this reason is allowed.

Patch size distributions will need to be recalculated when a new forest inventory is completed, and targets and thresholds assessed to determine if they are still appropriate.

What is this indicator and why is it important?

A patch is defined as a stand of similar-aged forest resulting from either a natural disturbance or created by timber harvesting. A patch may be composed of either a single disturbance event or an aggregate of events (natural, timber harvesting, or a combination of both). In forested landscapes patches represent a legacy or history of disturbances and as such may have a variety of species, stocking and ages contained within one patch. Forest patches are created naturally by disturbances such as fire, wind or pest outbreaks. In the absence of these natural disturbances, forest management, through harvesting, affects the distribution and size ranges of forest patches. Over a rotation or more of the forest, harvesting can then lead to either inflating or fragmenting the landscape beyond the limits of the natural variability of the landscape, which

has developed over time from natural disturbances. It is therefore important to establish target ranges for the size of patches that are consistent with the natural pattern of forested landscapes.

This indicator will monitor the consistency of our harvesting patterns compared to the natural pattern of our landscapes.

The distribution of early patches is monitored based on Natural Disturbance Units (NDUs). NDUs are the stratification level as they represent areas with similar disturbance patterns, and they are expected to have similar landscape level size distributions of early and mature patch sizes. The NDUs are based on natural disturbance regime research by Craig Delong, Regional Ecologist, BC Ministry of Forests & Range, Prince George Forest Region (DeLong, 2002). NDUs encompass large areas that in many cases exceed the size of the DFA (Figure 6).

Target ranges are applied for early patches (less than 40 years old) in each NDU. The targets are established in this way as the distribution of early patches predetermines the future distribution of old patches as the forests age. There are 6 NDUs with 3 patch size classes in each NDU.

The 18 patch size target ranges are summarized in Table 10 “Natural Disturbance Unit Early Patch Distribution Targets”. The target to meet 9 of 18 targets will mean that harvesting activities have maintained or improved on the current natural patch size distribution over the term of this SFMP.

At this time targets are not applied to the proportion in interior forest condition, as baseline data is not available to determine an appropriate target.

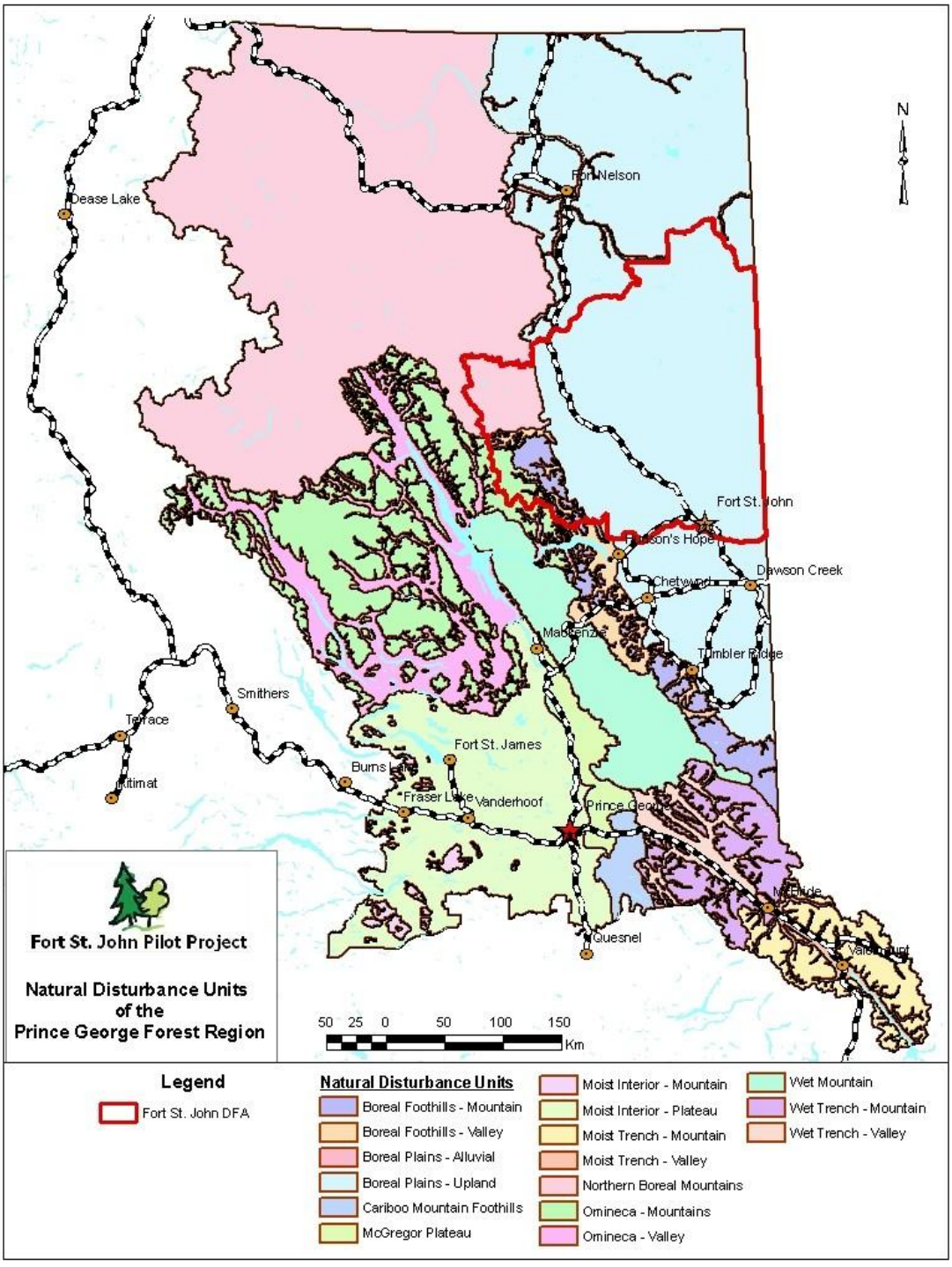


Figure 6: NDU's of the Prince George Forest Region

Table 10: Natural Disturbance Unit Early Patch Distribution Targets

Natural Disturbance Unit	Early (<40 yrs.) Patch Size Target (%) (acceptable range)		
	100+ ha	51-100 ha	<50 ha
Boreal Plains Uplands (BPU)	90 (65-90)	5 (5-15)	5 (5-15)
Boreal Foothills Valley (BV)	70 (55-85)	10 (5-15)	20 (15-25)
Boreal Foothills Mountain (BM)	70 (55-85)	10 (5-15)	20 (15-25)
Northern Boreal Mountains (NBM)	90 (65-90)	5 (5-15)	5 (5-15)
Omineca Mountains (OM)	70 (55-85)	10 (5-15)	20 (15-25)
Omineca Valley (OV)	90 (65-90)	5 (5-15)	5 (5-15)

Current Status:

Table 11 summarizes the current status of early patch size distribution by NDU. The majority of harvesting completed over the course of SFMP# 3 occurred in the Boreal Plains Upland NDU with some harvesting occurring in the Boreal Foothills Mountain and Boreal Foothills Valley. No harvesting has taken place in the Northern Boreal Mountains, Omineca Mountains or Omineca Valley and the patch size distribution is driven by natural disturbance. The 2025 current status shows that 7 of 18 patch size NDU targets have been achieved. This is a decrease from the 11 NDU patch size targets that were met in the previous analysis completed in 2022. The reason for this decrease is due to significant wildfires in 2023 through to 2025 that are creating large early patch sizes on the landscape. Notably, the Boreal Plains Upland NDU is offside from all patch targets, being above the large early patch size target and below both the small and medium early patch size targets. Although the target is currently not being met, it is within the allowable variance due to natural disturbance events, and it recognized that due to the scale of recent wildfires it will take several decades for the targets to be met, especially in the Boreal Plains Upland NDU and will be dependent on stand maturation more than harvesting activities.

Table 11: Early Patch Size Class Current Status

	2025 Current Early (< 40 years) Patch Size Distribution							
	Large (> 100 ha)		Med. (50-100 ha)		Small (< 50 ha)		Total All Patches	
Natural Disturbance Unit (NDU)	**%**	ha	**%**	ha	**%**	ha	%	ha
Boreal Plain Upland (BPU)	95	684,699	2	14,151	3	21,890	100.0%	720,740
Boreal Foothills Valley (BV)	72	2,573	10	343	18	635	100.0%	3,551
Boreal Foothills Mountain (BM)	68	5,326	8	658	23	1,812	100.0%	7,796
Northern Boreal Mountains (NBM)	44	3,219	15	1,138	41	3,027	100.0%	7,384
Omineca Mountains (NBM)	12	189	22	341	66	1,007	100.0%	1,537
Omineca Valley (OV)	49	104	33	70	19	40	100.0%	214
Total DFA (All NDU's)		**696,110**		**16,701**		**28,411**		**741,222**

Red = above target range Blue = below target range Black = within target range

Forecasting and Monitoring Procedure:

Early patches are defined as those patches of forest that are less than 40 years old. Recognizing that there could be great variability within the defined patch, that the patch may change over time and to ensure that a reasonable functional estimate of the size of young patches is reported, a 100m buffer is applied to young patches. Young patches that fall within the 100m buffer or are within 200m of each other have their areas summed and are reported as one patch.

There are two steps that are required to be completed for reporting this indicator. The calculations are described below:

- To determine the current state, the first step is to update and project ages of the forest cover for all disturbances to the current reporting period based on LRM block data. Contiguous areas are dissolved into each other based on age of the leading species for the rank 1 layer. Early patches within 200m of each other are considered to be part of the

same patch. The area of an early patch is then summed and treated as one patch. The area of early patches is then summed by NDU and expressed as a percentage of early area within the LU. All stands less than 40 years old are included in the early patch classes.

- To determine the future state, include all proposed harvesting, project ages to the end of the proposed development period and calculate the post FOS condition patch size distribution as described above.

The targets are recognized as being a desired future condition and will not necessarily be initially achievable; in fact, it may take more than one forest rotation to fully achieve the desired distributions. Additionally, throughout parts of the Fort St John TSA achievement of the patch size targets will be limited due to the large extent of non-commercial and non-forest areas which will not be harvestable. Also, large natural disturbance events may occur which suddenly change the distribution of patch size classes. This will require an adjustment of planning strategies to reflect the new distribution, however it may take several decades or more to adjust to a large natural disturbance within some NDUs.

In general, requirements for smaller patches may be required in more sensitive areas such as visually sensitive areas and in the major river corridors, consistent with other indicators included in this SFMP. Otherwise harvesting will be planned to be consistent with the targeted patch size distribution presented in Table 10, to the extent the distribution and size of merchantable patches allows. If harvesting is proposed in an NDU that has patch size deficiencies, efforts will be made to develop blocks that address the deficient patch size classes, to the extent practical.

Data sources for this include VRI, LRM block data, NDU and DFA boundaries. All Participants are using LRM to track their operational data, which includes harvesting and silviculture information. Forest inventory cover (VRI) will be supplemented with harvesting data from LRM as required to complete patch size analysis. Disturbances due to fires and other industrial users are generally updated less frequently (approximately 5-year intervals) and are the responsibility of the Provincial Government.

The monitoring of this indicator will occur with the development of a new or majorly amended FOS. Each FOS will be analyzed and adjusted if necessary to ensure they are consistent with this indicator prior to final publication.

5.4 SOIL DISTURBANCE

Indicator Statement	Target Statement
Number of blocks with non-conformances to soil disturbance limits, by Managing Participant	Zero blocks will have non-conformances to soil disturbance limits
SFM Objective: Forest Health and Productivity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Soil Management Strategy.	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator measures the effectiveness of the Participants' management strategies to limit detrimental soil disturbance on harvested cutblocks. Detrimental soil disturbance is defined as disturbance that negatively impacts the physical, chemical or biological properties of the soil. It applies to blocks on which harvesting commenced on or after the approval date of SFMP #2 (April, 2010).

By following the indicator strategy, it is anticipated that productive forest soils will be maintained and losses from forest operations will be minimized. Maintenance of site productivity is a core prerequisite for maintaining sustainability. Minimizing the area of detrimental soil disturbance will help to retain the productive capacity of the land base.

The default targets for maximum detrimental soil disturbance will be 5% dispersed disturbance in the Boreal Plains NDU, 10% dispersed disturbance in the other NDU's located in the foothills and mountains, and 25% detrimental soil disturbance for all roadside work areas. The lower target for the Boreal Plains NDU reflects the preponderance of fine textured soils in these areas, whereas the other NDU's typically have medium to coarse textured soils which are less sensitive to disturbance.

Implementation and Monitoring Procedure:

Management practices are implemented by the Participants to minimize disturbance on cutblocks. The majority of the Participants' harvesting operations occur during the winter months, during frozen ground conditions, which typically results in little or no disturbance to soils. When summer operations are required, mitigation measures are implemented from the planning stage through to block completion to ensure site productivity is not compromised.

Planning

Proposed blocks in the FOS will be initially assessed to indicate if a block has potential for summer logging or hauling based on leading tree species, slope position, and access conditions. Identified candidate blocks will be assessed during field data collection to determine if moisture regime, soil conditions, and access opportunities are potentially conducive to operations during frost-free periods.

Forest professionals may incorporate different soil disturbance limits in SLPs if they determine soil conditions warrant these changes.

Operational Practices and Field Monitoring

In potential summer or fall harvest areas, the following measures will be implemented to minimize detrimental soil disturbance:

- Streams and wet areas will be identified, and measures will be prescribed in SLPs to protect these areas during summer harvest conditions.
- Low ground pressure equipment will be used on fine textured soils during frost free conditions to reduce compaction risks.
- Areas proposed as summer harvesting areas will be ranked as higher risk than similar areas proposed for winter logging. Higher risk-ranked areas will receive increased monitoring from supervisory staff. Careful monitoring of ongoing operations will determine when ground conditions become unfavorable due to excessive moisture, at which time operations will cease until conditions dry out.
- "Boot survey" or ocular site degradation assessments will be implemented by qualified/experienced personnel where and when needed to monitor site degradation and provide guidance on when to cease operations.
- If the access conditions are favourable (e.g. roads can be placed in drier areas that can support summer activity), but cutblock site conditions preclude summer harvesting activities on the block, timber may be harvested in the winter and decked in the block on landings or at roadside for summer loading and hauling.
- Inspections will note any potential concerns regarding detrimental soil disturbance and indicate actions necessary to address these concerns. Where visual inspections indicate that operations may be in non-compliance, the incident will be tracked, and the appropriate government agency notified.

Soil disturbance surveys are not mandatory. However, if visual inspections indicate that the Participants' operations may be in non-compliance, a formal survey may be completed to assess the detrimental soil disturbance percentage in the NAR or at roadside. Appendix 12 (Soil Disturbance Information) includes Site Disturbance Cards, which specify the criteria to use to determine soil disturbance, and information on soil disturbance classification and transect methodology.

An annual review will be completed of incidents related to detrimental soil disturbance that occurred because of the Participants' activities between April 1st of one year and March 31st of the following year. The results of the will be presented in the Annual Report.

5.5 DISPERSED RETENTION

Indicator Statement	Target Statement
Level of dispersed retention (stems/ha) on harvested areas	Retain at least 8-20 snags or live trees per hectare on harvested areas, of which 6 must be >23 cm dbh
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

To address matters of safety and forest health, this indicator need not apply to Roadside Work Areas, steep slopes, or where sanitation harvesting is required.

What is this indicator and why is it important?

This indicator measures the dispersed retention of snags and/or live trees, of which 6 must be greater than 23 cm dbh (diameter at breast height) per hectare, over the harvested area. The remainder may be made up of any other merchantable sized stems (12.5 cm minimum dbh for Lodgepole Pine; 17.5 cm minimum dbh for all other species).

“Snags” are dead standing trees, and include ‘stub trees’, which are the lower portions of trees that are naturally occurring or have been created by feller bunchers. Stub trees are greater than 3 metres in height.

The dispersed retention of snags and live trees within the perimeter of a block can provide cavity sites and other habitat values for several decades following disturbance, provided they remain standing. Hoyt and Hannon, 2002, for example, note that trees averaging 16 cm and 23 cm dbh provide feeding and nesting habitat respectively for Black-backed and Three-toed Woodpeckers in recent burns.

Snags and/or residual live trees are a common component of young stands following natural disturbance. Fires (the predominant natural disturbance in the DFA) burn at variable intensities, depending on site and climatic conditions. This results in the natural retention of live trees and snags at variable densities across the landscape. Retaining some dispersed snags or live trees in suitable portions of managed stands supplements sources of this habitat element occurring in wildlife tree patches, non-managed naturally disturbed areas, and in the non THLB.

While the retention of standing material in managed (non-burned) stands may be at relatively low levels, the duration of retention of the vertical structure is likely longer than average, due to the lack of fire damage. Application of this indicator thereby contributes to maintaining ecosystem function, composition and structure that assists recovery from logging disturbance.

Harvested stands on the DFA tend to be relatively uniform, with smaller tree sizes, and fewer dead trees than similar stands in other parts of the province. This is apparently due to the frequency of fires on the landscape, and the relatively young age of the forest stands. Delong, 2002, reports densities of snags greater than 15 cm averaging 12, 59, 73, and 126 per ha in young, mature, remnant and old stands, within the SBS mk1.

Relatively little research exists on desired levels of retention, particularly in the boreal forest. Bunnell ("Vertebrates and stand structure within the Arrow TSA") reports that in conifer forest types little use is gained by sustained provision of more than about 3 snags/ha greater than 30 cm. Hiebert reports (personal communication) that bird species presence in managed stands did not increase significantly above 6 snags/ha, attributing it to territoriality. Six snags per hectare greater than 23 cm is proposed as a reasonable retention level in other jurisdictions (Province of Ontario, 2001), consequently this level has been adopted as the target average for this indicator. Additional retention targets of 8-20 stems/ha are being adopted at the request of local First Nations to enhance wildlife habitat.

Implementation and Monitoring Procedure

This indicator is designed to encourage the retention of snags and live trees capable of providing cavity sites within the harvested portion of the THLB. It is intended to supplement the retention of this habitat element found in WTPs, burn areas not salvaged, and the approximately 63% of the CFMLB that is not in the THLB (B.C. Ministry of Forests, 2016). It is not required that retention be evenly distributed across prescribed areas. Retention should be distributed in areas where the risk of damage to the retained snags or trees is minimal.

Snags or live trees may be stubbed at 3-5 metres height in some cases, particularly in areas to address safety concerns, where windthrow is a relatively high risk, or to assist with delineation of sensitive areas (e.g. riparian zones, areas of archaeological potential). These features do serve a function in managed stands as perching sites, and very windfirm candidates for some cavity nesting and denning animals. It is not the intent to have stub trees make up a significant part of the overall retention target.

Prescribing Foresters will identify in SLPs the minimum retention levels required on the harvest area of each block, with consideration of the following guidelines:

- Retention should broadly reflect the preharvest stand conditions. In non-salvage stands, the majority of trees are live and so too should the retention be. In salvage stands where most trees are dead and dying, retention could include a much higher proportion of dead trees, but it is expected that live (and non-infested) trees will still form a significant part of retention, where they are available.
- Retention will be prescribed using the following preference hierarchy as a guideline:
    - Live trees, especially deciduous, and those with visible defects
    - Dead trees, especially high-value snags (equal or greater than average diameter for the stand, visible signs of wildlife use)
    - Stubs (min. 3m high).

- If forest health is a concern, and sanitation harvesting is required, this indicator need not apply. If, in the opinion of the prescribing forester, leaving stubs or standing live trees wouldn't lessen the treatment effectiveness, or worsen the outbreak, then retention can still be prescribed. If the forest health concern is limited to one species, retention of non-infested tree species will be targeted, if applicable.
- Where worker safety is an overriding concern, this indicator need not apply. An example is areas in blocks impacted by wildfire. Leaving standing trees that have their root systems damaged could present a serious risk to worker safety, and the indicator need not apply in these cases. However, consideration should be given to the use of stubs to mitigate the risk to worker safety and still provide the habitat element in the managed stand post-harvest.
- In stands where the average tree diameter is less than 23 cm dbh and there is a lack of suitable candidate trees to meet the requirement to retain 6 snags >23 cm DBH, the indicator will still be considered met by retaining 8-20 merchantable-sized stems/ha. The prescribing forester will need to indicate this in the SLP as documentation. Efforts should be made to retain some of the larger stems present in these small piece-size stands, particularly deciduous species.
- In areas of moderate-high moose habitat suitability or capability, retain at least some small patches containing Aspen or Balsam Poplar (cottonwood) with approximately 30 trees, as part of the dispersed retention

Prior to the commencement of operations, implementing staff will review SLPs to determine if this indicator is applicable to a block. The intent is to end up with 8-20 or more snags or live trees per hectare (of which 6 must be >23 cm dbh) over the cumulative harvested area, but not to require a minimum of 8-20 stems/ha on every hectare. Operational and logistical considerations make it impractical to have an even distribution of snags or live trees across all prescribed areas. Some variability in retention levels across the land base is natural, and appropriate in managed stands.

Supervisors review the requirements pertaining to this indicator in preworks with harvesting and silviculture workers and discuss methods and procedures to create and/or retain these habitat elements to the target levels. Coordination between harvesting and silviculture phases is important, particularly if site preparation is being considered.

The target will be assessed through conformance with SLPs, where the target statement requirements will be prescribed, and any non-conformances will be summarized in annual reports.

The actual level of retention on harvested areas will be determined during harvesting and/or silviculture monitoring, including post-harvest inspections.

Data from a sample of blocks with area prescribed for snag/live tree retention will be collected. A minimum of 10% of each participant's harvest area will be sampled annually. Harvest area will be randomly selected for sampling, and all qualifying retention will be tallied. In blocks with large numbers of residual trees, where it is readily apparent that the retention exceeds the prescribed density, it will be acceptable to estimate the number of residual trees left instead of counting

each individual stem. In blocks where it is not readily apparent that retention exceeds the target density, a sample area can be used to calculate retention and apply it to the remainder of the block.

5.6 COARSE WOODY DEBRIS VOLUME

Indicator Statement	Target Statement
Average retention level of Coarse Woody Debris volume (m^3/ha) on blocks logged in the DFA between June 15, 2025, and December 31, 2032	Average retention level over the DFA will be a minimum of 46 m^3/ha on harvested blocks assessed between June 15, 2025, and December 31, 2032
SFM Objective: Forest Health and Productivity; Conservation of Biological Diversity; Efficient Use of Fiber Resources	
Linkage to *FSJPPR*: For the purposes of Section 29(2) of the FSJPPR the applicable performance standard is specified by this indicator statement, target statement and acceptable variance. For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Patch Size, Seral Stage and Adjacency Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

CWD plots will not be assessed for the purposes of this indicator if they fall in blocks where management of non-timber resource values was identified as an overriding priority that was not compatible with CWD retention (e.g., community pastures, fire hazard reduction, etc.).

What is this indicator and why is it important?

Coarse Woody Debris (CWD) refers to sound and rotting logs or stumps, which can provide important habitats for a wide variety of organisms, including invertebrates, vertebrates, fungi and cryptograms (mosses, liverworts and lichens). For the purposes of this indicator, CWD refers to material greater than 7.5 cm in diameter, which is consistent with VRI and NIVMA measurement criteria. Maintenance of CWD across the DFA within natural ranges of variability provide for the specific habitat needs of numerous organisms. Management of CWD retention within managed stands is necessary, as there is often an economic incentive to minimize debris which could, over time, have significant habitat and nutrient cycling implications on some sites.

CWD is a common component of natural stand replacement, and plays important roles in nutrient recycling, and assisting in the reestablishment of organisms after disturbance. The occurrence of CWD following harvesting, therefore, is also an indicator of the ability of the ecosystem to recover from disturbance.

Based on NIVMA plot data, the target is set at a minimum average of 46 m^3/ha (50% of the estimated average pre-harvest volume). It is recognized that a range of CWD levels is desirable,

and it is expected that this will be achieved with the measures proposed in SLPs. Using the average volume/area of CWD in the DFA is intended to provide a reasonable indication that operational measures to protect CWD within the DFA are effective. It is important to note that the target does not apply separately to each block and is intended to reflect the inherent landscape variability.

CWD within managed stands is complemented by CWD retained within WTPs, non-salvaged burns, and the substantial component of non-THLB within the DFA. Assessing post-harvest CWD levels compared to pre-harvest CWD levels provides an assessment of the relative effectiveness of SLP measures to retain CWD on the site. Lee et al., 1995, reported average CWD volumes in young aspen mixedwood stands (20-30 years) of ~109 m^3/ha, versus 'old' stand CWD average volumes of 124 m^3/ha (120+) years. Delong also reported CWD ranges in young coniferous stands of 5-590 m^3/ha compared to 23-283 m^3/ha in mature stands. The target level proposed for this indicator is a minimum average that is significantly greater than the lower CWD range limit for either young or mature stands observed above. The target therefore should provide CWD levels that fall within the natural range of variation.

This indicator has been in all versions of the FSJ Pilot Project SFMP and replaces the field performance requirement in the *FSJPPR* (sec 29(2)) for Coarse Woody Debris retention. Between 2016 and 2022 the Participants collected CWD data for 91 post-harvest samples. Average CWD retention was 83 m^3/ha for this sample period. There was very little variation observed between conifer, deciduous, and mixedwood stands – 86 m^3/ha, 79 m^3/ha, 83 m^3/ha respectively, and the sample data ranged between 26-263 m^3/ha.

Implementation and Monitoring Procedure:

Management practices will be identified in SLPs to promote the retention of variable levels of CWD within harvested cutblocks, with a cumulative retention target of 50% or more of the total estimated average pre-harvest levels of CWD on harvested areas assessed between June 15, 2025, and December 31, 2032. SLPs will identify site-specific management practices to contribute to the maintenance of CWD levels at the DFA level that fall within the natural range of variation. These practices will complement the retention or recruitment of CWD from WTPs, riparian areas, non-salvaged burns, and the non-THLB.

The objective of CWD management strategies will be to maximize the ecological value of the CWD left on site without increasing operating costs significantly, within the constraints of current utilization standards and avoidable waste benchmarks.

The following principles are examples of operational practices or guidance that may be included in SLPs:

- Minimize CWD accumulations at roadside or landings to the extent practical. Small CWD piles dispersed in blocks may be appropriate in some cases to provide habitat for some animals (see also Section 5.7 Coarse Woody Debris Structure).
- Consider if CWD management should be accentuated to address guidelines included in Section 5.11 Guidelines for Species at Risk and Species of Management Concern for identified cutblocks where species at risk are of concern.
- Larger pieces of CWD are more valuable than smaller pieces.

- Maintaining a wide range of decay, diameter classes, and species is ecologically appropriate.
- Standing live and dead trees and/or stubs retained on cutblocks will provide important sources of CWD recruitment.
- CWD within riparian areas can be particularly beneficial.
- The retention of CWD must be harmonized with silvicultural objectives.
- Maintain variability in the levels of CWD at the landscape level.

In the rare event management priorities for other resource values require the active minimization of CWD from the site (e.g., community pastures, etc.) this should be noted in the SLP, and "the post-harvest CWD sampling activity" or similar tracking method should indicate that a plot is not to be in the block for that reason.

Average post-harvest CWD will be estimated using data collected at the 3 km UTM grid long-term monitoring points in cutblocks that have been harvested, and assessed during the term of the SFMP (note: harvesting may have occurred before the term of the SFMP). Data will be collected after completion of harvesting and primary silviculture operations. Field sampling methodology will follow the Resource Inventory Committee standard described in the VRI ground sampling procedures (i.e. two perpendicular 24m transects). The first azimuth should be randomly predetermined (e.g. spreadsheet random function) prior to going to the field to prevent biasing data collection and results. The average CWD volume determined from these samples will be monitored annually, as data are available. A minimum of 10% of the applicable survey transects will be measured during the SFMP period. Depending on the results of monitoring, revisions to the prescribed management practices within SLPs may be implemented to ensure Participants are on track to meet the indicator target. It should be noted that 3km grid sample points may not be available for sampling every year, depending on harvesting levels and locations. The intention however is to sample points annually, as they are available, to provide timely feedback to operational practices. A minimum of 10% of the number of eligible (i.e. harvested) sample points of block harvested during the term of the plan will be assessed during the SFMP term. For example, if there are 50 eligible CWD sample points harvested during the term of the plan, the participants will have collected CWD data from at least 5 of them. However, data collection is not restricted to cutblocks harvested after the approval of SFMP#4. Sample points assessed after July 15, 2025 on blocks harvested prior to the SFMP#4 term shall contribute towards the minimum.

The average CWD volume attained at all 3 km sample points assessed between July 15, 2025, and December 31, 2032, will be used to assess conformance to the target. The Participants will report annually the CWD sample data that was collected, as progress toward the SFMP-term target.

5.7 COARSE WOODY DEBRIS STRUCTURE

Indicator Statement	Target Statement
Number of Coarse Woody Debris 'pile equivalent' structures* retained for wildlife habitat structure, in harvested areas	A minimum of one Coarse Woody Debris 'pile equivalent' structures* retained for wildlife habitat structure per 5 hectares, in harvested areas
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Patch Size, Seral Stage and Adjacency Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

* 'pile equivalent' structure = 1 CWD round pile, or 10m CWD linear corridor (see below)

Acceptable Variance:

The indicator target need not apply in areas where fire hazard reduction is a primary management objective, and retention of CWD piles conflicts with this objective in the opinion of the prescribing forester. The indicator target shall not apply in areas where retention of accumulated CWD may contribute to a significant increase of forest health damaging agents.

What is this indicator and why is it important?

This indicator is a new addition for SFM Planning in the DFA and reflects the growing practice of prescribing CWD pile construction during forestry operations, in recognition of the importance of the structural characteristics and arrangement of CWD in managed stands. CWD piles provide cover for many of the smaller animals present in the forested ecosystems of the DFA. CWD piles and linear windrow 'corridors' are used by animals for resting, denning, foraging, and nesting (Sullivan, 2021). They can aid in the crossing of open areas and dispersal of small animals throughout recently harvested areas sooner than would be possible without this hiding cover. Both marten and weasels use CWD as cover and focal points for finding prey species such as voles and other small mammals (Sullivan and Sullivan, 2021). Harvested areas with some CWD linear corridors have been found to have greater diversity and overall abundance of small mammals when compared to areas with just dispersed CWD (Sullivan et al., 2012; Sullivan and Sullivan, 2012; Sullivan and Sullivan, 2019). In a study conducted on two of the Participants' cutblocks Tew (2024) found higher diversity of small animals, and higher use, in CWD corridors than CWD piles or dispersed CWD. However, allocating a significant share of piled CWD in discrete round piles throughout harvested areas is of high importance to ensure recovery of habitat utility, and it has been suggested that no more than half of CWD pile habitat structure created should be in corridor form when planning for Fisher habitat recovery (B.C. Fisher Habitat Working Group, pers. comm.).

Although of prominent value in the first few years post-harvest, CWD piles and corridors can continue to function as important habitat structural features on a site after regenerating trees and shrubs have become established and provide increased overhead cover for small animals. As the CWD breaks down, over decades, it continues to provide important ecosystem benefits, as discussed in Section 5.6 Coarse Woody Debris Volume.

CWD piles and linear corridors are typically created during the harvesting phases of forestry operations but may be created or modified during other phases, such as silviculture operations. Although the positive benefits for wildlife and ecosystem function that comes with CWD retention, especially large woody debris, participants of the forest industry need to be careful when allocating CWD amounts on managed sites. The BC provincial government's Waste and Residue procedures direct that "*Coarse Woody Debris is tallied as waste*", and that "*The waste volume data compiled from the assessments are used to invoice licensees for monetary and cut control charges*" (B.C. Ministry of Forests, 2018*).* CWD in the form of utilizable fibre left on site, could result in substantial monetary expense, lost manufacturing opportunities, and reductions in available harvest volume. In addition, with the ever-shrinking access to economical fibre supply, companies are motivated to relax utilization specifications and deliver as much usable fibre as possible to manufacturing facilities. Ensuring that CWD piles and linear corridors contain high proportions of 'off-grade' material lessens the potential negative business impacts noted above and can support the intention of this indicator (defective stems often have rot, natural cavities, and misshapen form, which can increase hiding locations, and air spaces under snowpack). The challenge for forest managers and on-site personnel in finding the balance is to communicate clearly to operators: the objectives of this indicator, SLP direction, and waste and residue specifications.

Implementation and Monitoring Procedure:

When developing SLPs, prescribing foresters will identify that CWD piles and/or linear corridors, are required. This will complement the retention or recruitment of CWD from WTPs, riparian areas, areas impacted by natural disturbance but not salvaged, and the non-THLB. The objective of the CWD management practices outlined here will be to ensure substantial habitat value of the CWD left on site, within the framework of government fibre utilization policy and standards.

For the purposes of prescribing, implementing, and assessing conformance to this indicator a 'pile equivalent' is:

- One discrete CWD pile, or
- A 10-metre length of linear CWD windrow ("corridor"),

that meet the dimension criteria outlined below.

The following principles will be considered when prescribing and creating CWD structural features on harvested areas, and assessing performance for this indicator:

- Piles should be approximately 2 meters in height (minimum 1.5 meters), with a 'footprint' of approximately 15 m² (i.e. 3m x 5m, or 4.5 m diameter)

- CWD corridors should be an average of 2 meters in height and an average of 3 meters at the base, and gaps of at least 10 meters should be present in the corridor at least every 100 meters.
- No more than 50% of CWD 'pile equivalent' structure targets shall be achieved by CWD in linear corridors. At least half of the CWD structure target must be achieved by discrete single piles.
- CWD should be arranged as loosely layered (jumbled) pieces such that pockets and gaps are present in the pile and may contain a mixture of sizes of CWD but should contain some large (>25cm diameter) pieces where the site timber profile supports this. Very fine wood material is to be avoided, as it fills in gaps, decomposes more rapidly than larger material, and may increase fire hazard.
- Larger pieces of CWD have more ecological and habitat value than smaller pieces and should be included in piles and corridors.
- Piles should be located throughout blocks, to maximize habitat recovery and utility well into the future, when regenerating stands have reached crown closure. Piles located within 50 meters of edges with adjacent treed cover will encourage utilization of the harvested areas by wildlife in the first few years following harvest, while those further from edges will become increasingly important as regenerating vegetation fills in.
- In the rare event that management priorities for other resource values require the active minimization of CWD from the site (e.g. to reduce potential future fire impacts), this will be recorded in the SLP.
- Measures should include retention of CWD in both concentrated form (e.g. piles) as well as dispersed patterns, since different organisms favour each of these strategies. Concentrating solely on one method could disadvantage some groups of species (Bunnell).
- Pile and corridor configuration, location, recommendations, and densities may be adapted to reflect guidance provided for the management of habitat for species of concern (e.g. Fisher)

The actual retention level of Coarse Woody Debris piles, or equivalent structures, on harvested areas will be determined during post-harvest inspections and documented by the Participants (either harvesting inspections or silviculture surveys). CWD linear corridors ('windrows') that meet the criteria referenced above will count towards the target as 1 'pile' for every 10 metres in length of the corridor.

Data from a sample of blocks with area prescribed for CWD pile retention will be collected. Non-conformities to block retention targets will be summarized in annual reports.

SLPs will identify site-specific management strategies to retain CWD piles or windrow corridors.

5.8 SHRUBS

Indicator Statement	Target Statement
The proportion of shrub habitat (%) by Landscape Unit	Each landscape unit will meet or exceed the baseline target (%) proportion of shrub habitat
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

Acceptable variance is no more than 20% below the baseline target (e.g. Crying Girl target is 5%, minimum acceptable is 4 %).

What is this indicator and why is it important?

Shrubs are defined in the Vegetation Resource Inventory (VRI) BCLCS Level 4 as either shrub low (SL) or shrub tall (ST). Forest or harvested sites less than 20 years old are also considered to contribute to shrub habitat in the DFA, as this indicator represents a structural stage of forested areas, as well as long-term shrub complexes.

Shrubs are common in riparian areas, and readily occupy larger forest openings, especially on moist sites. As stands close shrubs are often suppressed by the taller trees and reduced in density and vigour until stands age and the canopy opens and allows more light to reach lower levels. Many wildlife species respond positively to shrub abundance, and shrub abundance is influenced by forest practices (Bunnell et al., 1999).

In a review of the vertebrates in the Sub-boreal Spruce (SBS) zone of BC, Bunnell et al., 1999, found that 42% of birds and 59% of mammals depended on a shrub structural stage for their breeding habitats. In the Fort St. John DFA, Manning and Cooper, 2003, indicates that 6 out of 20 birds and 1 out of 7 mammals considered to be species at risk or of regional significance are dependent on shrub habitats for some part of their life requisites.

Current Status:

Targets were established for this indicator by reviewing the amount of naturally occurring shrub areas by landscape unit, as well as forested areas less than 20 years old. Landscape units with low levels of naturally occurring shrubs generally have lower targets than areas with higher levels of shrubs. Landscape units within the Boreal Plains NDU generally have higher levels of shrubs than the other units within the DFA, concomitant with the shorter fire return interval and higher average wildfire size. The following table (Table 12) shows the current (2025) condition of shrub habitat levels within the DFA, by Landscape unit, as well as the change since 2022. The proportions of shrubs increased in all but the Halfway LU. Those LUs impacted most by the recent wildfires have shown the most significant increases. The Kahntah LU, which has been reported as having shrub levels below target for several years, is now showing levels well above target. Currently, all LUs are above the baseline target for shrub levels.

Table 12: Shrub habitat 2025 area, and baseline bargets

Landscape Unit	LU Net Area (ha)	2025 shrub area (ha)	2025 shrub % of LU	Baseline Target (%)	Change in shrub area (ha) 2022 to 2025
Blueberry	582,619	120,764	21	8	16,093
Crying Girl	67,105	6,439	10	8	253
Graham	333,938	63,654	19	15	5,488
Halfway	185,244	20,836	11	6	-875
Kahntah	739,176	188,576	26	21	106,114
Kobes	130,656	25,430	19	8	2,346
Lower Beatton	140,436	24,010	17	7	3,480
Milligan	452,153	91,967	20	13	15,689
Sikanni	231,369	39,280	17	6	4,763
Tommy Lakes	704,076	277,744	39	8	214,504
Trutch	432,422	99,557	23	6	71,416
Total All LUs	**4,056,782**	**958,257**	**24**	n/a	**439,269**

Implementation and Monitoring Procedure:

Does forecasting apply (y/n): Yes.

Quantitative forecasting was completed for this indicator by tracking the proportion of forest stands that are less than 20 years old over the full 250-year planning horizon. There was no site conversion or brush rehabilitation to forest forecasted in the analysis.

Early forest less than 20 years old can provide important shrub habitat and this can be created through harvesting. Harvesting and silviculture practices can influence the abundance and distribution of shrubs over time. The elimination of aerial herbicide in the DFA, the reduction in overall herbicide use, and the retention of more shrub complex areas (e.g. along riparian corridors) will serve to increase the overall amount of shrub species present in managed stands.

Data sources include vegetation resource inventory (VRI), landscape unit polygons, and participant block data (currently managed in the LRM system).

VRI information is the responsibility of the provincial government, with infrequent updates. The LRM system is a ‘real-time’ database that is maintained and updated by the Participants’ staff as they carry out their daily activities. The base layer used to help derive current status for this plan incorporated the wildfire activity that has occurred in the DFA since the last plan was written.

The status of shrub structural levels by LU is calculated as follows below, and will be redone for FOS amendments that add or remove blocks (i.e. ‘major’ amendments), and shown in Annual Reports. Other than FOS amendments, this indicator will be monitored at an SFMP term frequency.

1. Forest cover is projected to the current date by overlaying LRM information. Stands less than 20 years old plus stands identified as SL or ST in the VRI are summed for each LU and expressed as a percent of the total area of the LU.

2. Number LUs meeting the baseline targets / the total number of LUs (11), expressed as a percent.

The data can be used at the Forest Operation Schedule level to guide future harvest planning and also by silviculture staff to review long term trends in reforestation policies and to adjust practices where necessary.

5.9 WILDLIFE TREE PATCHES

Indicator Statement	Target Statement
Cumulative Wildlife Tree Patch percentage in blocks harvested under the FSJPPR in each Landscape Unit	Cumulative Wildlife Tree Patch % will meet or exceed the minimum target in each LU **Landscape Unit** — **WTP %** Blueberry — 9% Halfway — 7% Kahntah — 5% Kobes — 8% Lower Beatton — 3% Milligan — 4% Tommy Lakes — 8% Trutch — 5% Sikanni — 4% Graham — 7% Crying Girl — 7%
SFM Objectives: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of 29(1) of the FSJPPR the applicable performance standard is specified by this indicator statement, target statement and acceptable variance. For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Patch Size, Seral Stage and Adjacency Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

Aggregate WTP percentages will only apply if 200 hectares or more has been harvested under the *FSJPPR* in a landscape unit.

What is this indicator and why is it important?

Wildlife Tree Patches (WTPs) are forested areas of timber within or immediately adjacent to a cutblock that are retained primarily for their value in providing a source of habitat elements, or for the protection of important habitat features.

WTPs provide sources of shrubs, large live trees, broadleaf trees, coarse woody debris (CWD), and snag/cavity sites. These elements can provide key habitat components that support the residual populations, the reintroduction of populations expatriated by the disturbance, and overall ecosystem function (Bunnell et al., 1999).

WTPs within managed stands have been shown to be important in the reestablishment or maintenance of a variety of species, including moose (Gasaway and Dubois, 1985), and birds (Seip and Parker, 1997). Residual patches include both 'islands' within the block (internal WTPs) and designated patches immediately adjacent to logged areas that may also adjoin areas not harvested (external WTPs). Both internal and external patches may be suitable for WTPs provided they can function as sources of habitat elements, which will depend on their site-specific attributes. External WTPs connected to adjacent unharvested areas are typically more windfirm within the DFA and may receive higher initial use by some wildlife species due to the proximity of adjacent unharvested habitats.

Maintaining habitat elements in Wildlife Tree Patches contributes to enhancing species richness by providing the critical features needed to support a variety of species. Designating areas that have composition and structure like natural remnants as WTPs will contribute to maintaining a natural range of variability in ecosystem function. Providing diverse habitat structures, including WTPs, within managed stands is consistent with the pattern of natural disturbances. Fire is the most prevalent natural disturbance in the DFA. Maintaining a component of Wildlife Tree Patches in managed stands over the landscape is analogous to fire 'skips. Skips occur where areas are burnt, but undamaged or lightly burnt patches persist within the perimeter, or on the edge of the fire within a similar forest type. These residual patches in otherwise disturbed areas typically vary substantially in size, shape and composition, so variability in these characteristics of WTPs is desirable. WTPs can also be used to protect site-specific habitats, such as mineral licks and raptor nesting sites and provide a source of local genetic material.

The establishment of WTP targets by L.U. was based on the following factors:

- Amount of area in the Non-Timber Harvesting Land Base,
- Relative intensity and historical forest management levels,
- Levels of 'retention' in areas impacted by natural disturbance in the Boreal forest,
- Amount of area where forest management is not permitted.

In addition to the above, the process for the creation of this plan included a reflection on the past performance for the 2001-24 time period. WTP levels were subject to a structured review during the development of SFMP #3, and revisions were made to some of the LU targets.

The relative importance of WTPs as sources of habitat elements in a landscape unit is related to the amount of non-harvest area that functions as sources of habitat elements. This is particularly significant in the Fort St. John TSA, where a very high percentage of the DFA is not assumed to contribute to available timber supply. The most recent Timber Supply Review for the TSA showed that only 21% of the overall area contributes to THLB (compared to 39% for the Prince George TSA), which leaves a huge amount of area assumed to be in a non-managed state. Note that the TSR process is a large-scale modelling exercise and does not always correlate directly with on-the-ground operations. That is, cutblocks may include some area not assumed to be THLB, and

there are areas assumed as THLB for the purposes of cut determination that will not be brought under forest management. For the most part though, NHLB areas will remain in an 'unmanaged' state and be available to provide habitat elements and cover for wildlife. In LUs with relatively low levels of harvesting, the higher amount of non-managed forest acts as the primary source of habitat elements, and the retention of WTPs plays a relatively smaller role in providing these habitat elements. In areas with relatively high harvest levels and other industrial or agricultural activity, the importance of WTPs to contribute to these elements becomes more significant.

The relative intensity of the level of forest management was considered as a modifier of WTP target levels, with a greater relative emphasis placed on biodiversity in low and medium management intensity zones. In these LUs, WTP retention levels will account for this by using targets consistent with lower biodiversity risk (i.e., utilize retention level targets assuming LU objectives are not in place). Conversely, in high management intensity LUs, retention levels will be consistent with a higher biodiversity risk (i.e., utilize the WTP retention level targets consistent with LU objectives being in place).

Residual (non-burned) vegetation levels in areas of the boreal forest impacted by wildfire vary considerably, but are often within the range of 3% - 15% (Eberhart and Woodward, 1987).

The WTP levels are intended to be a source of habitat elements. In those LUs with less than 200 hectares cumulative logging under the pilot project, there is unlikely to be a significant concern with habitat, so the WTP levels will not be applied until after harvesting exceeds 200 hectares.

Implementation and Monitoring Procedure

Wildlife tree patches will be established across landscape units to act as sources of key habitat elements, provide stand level structural characteristics, and protect site-specific habitats. WTP retention levels will be assessed at the landscape level to reflect the natural variability in residual retention levels in natural disturbance patches. Retention targets will consider the relative potential importance of WTPs to contribute to habitat element supply, the intended forest management intensity consistent with the LRMP timber strategies, and the range of forested cover retained following natural disturbances**.**

To manage the entire landscape in a coordinated manner, consistent WTP retention levels have been developed which are intended to replace the Applicable Performance Standard in the *FSJPPR* Regulation (Section 29 (1)) and therefore apply to the cumulative harvesting of all the Participants.

New WTPs will be designed consistent with the following:

1) Wildlife Tree Patch minimum size will be 0.25 hectares. Reserves less than this size will not be included in the calculation. WTPs should be of various sizes, including areas larger than 1 hectare in larger blocks particularly (i.e. greater than 100 ha)
2) Corridor WTPs (meaning WTPs connected to adjacent cover at the edge of cutblocks) will be preferred to stand-alone patches. Corridor WTPs are important to First Nations and help to break up larger openings and provide shelter to wildlife travelling through larger cutblocks after harvest and before green-up. Corridors do not necessarily need to connect one side of the block to another but should significantly decrease the distance an animal would need to travel outside of the corridor to pass through a cutblock.

3) It is prudent when designing larger openings (i.e., greater than 500 ha) to increase the proportional amount of wildlife tree patch area (Delong, 1999). In the boreal forest the amount of area disturbed decreases with fire size, with smaller fires (20-40 ha) typically containing no residual non-burned vegetation, and unburned islands increasing in frequency as fire size increases (Eberhart and Woodward, 1987). Delong and Tanner, 1996, reported average remnant area of about 6% for 500-1000 ha fires, and about 9% for fires greater than 1000 ha. Blocks greater than 500 hectares in size, therefore, will have at least 7% WTP retention unless requirements are waived due to forest health concerns, as determined by a professional forester.
4) WTPs should contain a representation of the vegetation contained in the general cutblock area, both merchantable and non-merchantable.

The following are guidelines to be used by prescribing foresters when determining the amount and placement of WTPs:

- Areas that can provide important wildlife habitat elements or features - large snags or defective live trees, mineral licks, significant wildlife trails, stick nests, broadleaf trees in 'pure' conifer stands, CWD accumulations, riparian complex vegetation, and ephemeral pools.
- In areas with species of management concern, locate WTPs consistent with stand level management guidelines (see Section 5.11 Guidelines for Species at Risk and Species of Management Concern) where practical,
- Internal WTP's should extend to adjacent cover in most cases.
- Areas of operational concern that can contribute significantly to the provision of key habitat elements should be considered for WTP designation.
- Tree species that are uncommon in an LU may provide some important and locally scarce niche habitats (e.g. cottonwood or birch in the Crying Girl LU)
- Other windfirm forested stands that can provide these habitat elements.
- Including 'feathered edges' to make edges appear more natural, where concern of windthrow is not too high.
- WTPs should be retained for a full rotation, unless there are overriding forest health concerns, or as otherwise approved by the applicable government agency. To that end, blowdown risk should be assessed. Consideration must be given to topography, soil profiles and moisture regimes, and the species, age, and condition of trees present. WTPs may be more windfirm if located adjacent to treed areas.

An objective of the Participants is to integrate the management of all their planning and harvesting activities to the extent practicable. The revised wildlife tree patch applicable performance standards therefore will apply to all harvesting by the Participants within an LU.

WTP targets and current status must be considered in the delineation of WTPs in new SLPs, using the current status results and projections for previously prepared SLPs planned for harvesting.

Participants will track the WTP areas and SU areas to calculate prorated, cumulative WTP percentages by LU in a common database.

If a Participants' blocks planned in an LU for the year have less than the LU target WTP%, and the current state reported in the previous annual report for that LU is less than 1% over the targeted WTP %, that Participant will notify the other Participants and:

a) Demonstrate to the other Participants' satisfaction that this will not result in a non-conformance to the overall target, or

b) Obtain their formal consent to proceed, if WTPs from other Participants will assist in avoiding a non-conformance, or

c) Revise the proposed blocks as needed to ensure a non-conformance is avoided.

Monitoring results will be reported in each Annual Report. The Report will include the Cumulative Actual WTP% by LU for all Pilot Project blocks up to March 31 of the reporting year.

Current Status

Table 13 below indicates the amount of harvest area and proportion of Wildlife Tree Patches by each Landscape Unit since the beginning of the Pilot Project in 2001 to March 31, 2024.

Table 13: Cumulative Harvest Area and Proportion of WTPs by Landscape Unit (2001-2024)

Landscape Unit	LU area (ha)	NHLB* contribution (ha)	NHLB* (%)	Gross Block area (ha)	Actual WTP Area (ha)	Actual WTP level (%)	Target WTP level (%)
Blueberry	731,433	406,097	56%	60,883	4,327	7.1	9
Halfway	67,344	52,539	78%	6,775	718	10.6	7
Kahntah	335,208	306,747	92%	2,220	206	9.3	5
Kobes	206,437	146,946	71%	16,136	1,493	9.3	8
Lower Beatton	749,247	599,377	80%	7,162	511	7.1	3
Milligan	159,858	89,430	56%	326	40	12.3	4
Tommy Lakes	498,457	429,577	86%	17,651	1,413	8.0	8
Trutch	473,968	401,717	85%	2,102	227	10.8	5
Sikanni	312,285	302,109	97%	0	0	n/a	4
Graham	705,675	511,899	73%	234	32	13.7	7
Crying Girl	436,725	342,198	78%	2,071	182	8.8	7
TOTAL	**4,676,636**	**3,588,636**	**77%**	**115,560**	**9,149**	**7.9**	n/a

*derived from TSR 3 THLB data

5.10 PROTECTION OF SITES OF BIOLOGICAL SIGNIFICANCE

Indicator Statement	Target Statement
The percentage of identified "Sites of Biological Significance" * that have protection measures prescribed in operational plans	100% of identified "Sites of Biological Significance" * will have protection measures prescribed in operational plans
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Biodiversity and Wildlife Habitat Management Strategy.	

*Sites of Biological Significance defined below

Acceptable Variance:

Minimum protection measures may not be prescribed in situations where forest health, or worker or public safety, are of an overriding concern, and may include direction from government agencies, OR in cases where a Registered Professional Biologist has confirmed that the site is no longer in use or of significance. The proposed variance must be supported by the applicable First Nation(s). In these situations, a rationale detailing the reasons for not implementing the minimum protection measure(s) will be included in each operational plan to which this applies.

What is this indicator and why is it important?

For the purposes of this indicator, the "Sites of Biological Significance" include the following:

- Mineral licks and wallows,
- Stick nests,
- Pileated Woodpecker nest cavities,
- Active nests of SARA-list, or Red or Blue-listed bird species** occurring in the DFA,
- Carnivore and omnivore dens,
- Dens of groundhogs, marmots, or porcupines,
- Bat hibernacula,
- Bat maternity roosts
- Ephemeral ponds or vernal pools, and
- High value wildlife trails, and other sites identified by Registered Professional Biologists and/or First Nations.

**the list of bird species to which this applies is found in the Strategy and Implementation section.

Mineral licks and Wallows

Natural mineral licks are key habitat features used by all ungulates found in the DFA and are used as important sources of mineral supplementation for these animals, especially during the seasonal vegetation transitions (Jones and Hanson, 1985). Licks may exert a significant localized influence on the spatial distribution of moose populations (Panichev et al., 2002). There are two types of mineral licks used by ungulates – wet licks and dry licks – the former being the kind typically encountered in the course of forest management in the DFA. Wet licks are often associated with seepages or springs and can often be found at the base of slope breaks.

Wallows are bare, shallow depressions used by wildlife for several purposes, including relief from biting insects and for social aspects (B.C. Ministry of Environment and Climate Change Strategy 2019). While potentially more common on the landscape than mineral licks, they are important features for moose during the breeding season (Wall et al., 2011).

Maintaining and protecting the integrity of habitat features such as mineral licks and wallows, and providing sufficient screening cover to allow moose and other ungulates to safely visit and use them must be provided for in forestry plans (Rea and Child, 2007).

Stick Nests

Stick nests are the platforms that birds, predominantly raptors, construct to lay their eggs and raise their young in. These structures are often re-used over many years by the same individuals, and often by generations of the same species. Further, nests built by one species (e.g., Goshawks) may subsequently be used by other species (e.g., Great Grey Owls). As such, stick nests serve important ecological functions beyond their utility for a single individual of a given species, even if they are inactive in any given year (Bachman, 2017). There is legal protection for all stick nests when occupied by a bird or its egg. The nests of some species are protected whether they are occupied or not. Some species (e.g. Goshawks) have multiple nests in a breeding area and can cycle through the nests in their territory in different years.

Pileated Woodpecker nesting cavities

The Pileated Woodpecker is a year-round resident of mature forests in the DFA and considered a ‘keystone’ species throughout its range, thanks to the holes they excavate. Keystone species are those whose activities govern the well-being of many other species (Simberloff, 1998). The nest cavities these birds create are used by them for one breeding season but persist on the landscape and are of vital importance for many other birds and mammals for breeding and resting habitats. In recognition of the importance of Pileated Woodpecker nesting cavities, provisions for their protection were added to Scheule 1 of the federal *Migratory Bird Regulation* in 2022.

Active nests of SARA-listed, or Red or Blue-listed bird species occurring in the DFA

The period during which birds are nesting is one of the times when they are quite vulnerable, and particularly likely to abandon nests in the early stages of laying and incubation when disturbed (Baicich and Harrison, 1997). There are several species of birds that breed in the DFA, both migratory and non-migratory, that have ‘species at risk’ listing either federally (SARA), or

provincially (Conservation Data Centre). Their populations may be endangered or threatened and are worth including in this indicator to provide extra awareness.

Carnivore / Omnivore Dens

Several mammals found in the DFA use dens for either hibernation (e.g. bears), or breeding / raising young (e.g. wolves). Dens are important for shelter as well as escape cover. Some dens may be reused over time, although the frequency of reuse may be linked to the supply of suitable den sites (Davis et al., 2012).

Dens of groundhogs, marmots, or porcupines

Woodchuck/groundhog/marmot dens are often re-used by these and other species. Porcupine dens are typically re-used by generations of these animals and are often in a large hollow tree or rock crevice. Although porcupines have often been considered forest pests, they are naturally occurring residents of the DFA. The population in central and northeastern BC was severely reduced a few decades ago and is only now starting to recover.

Vernal pools (ephemeral ponds)

Vernal pools are small, ephemeral collections of water that may be present in low-lying forest areas in the spring (after the Latin vernalis, meaning “spring’), and often disappear by late summer. These features are often used as breeding sites by amphibians, including Western Toad, and invertebrates, or resting sites for migrating birds. As the features are not connected to bodies of water containing fish, the risk of egg and larva predation is much reduced (Yeager and Brittingham, 2016). These sites may also be used as a water and food source by many different animals.

Bat Hibernacula

Most often these sites are caves or abandoned mines, but they can also be a large fissure in a rock face or a narrow rock crevice. Karst landscapes, with their many caves and sinkholes, are significant areas for bat hibernacula. Bat droppings are often present at the base of the entrance and the smell of ammonia can be detected at active hibernacula.

Bat Maternity Roosts

Often natural sites like large hollow trees, broken-top snags, wildlife trees with sloughing bark or hollow branches, fire-scarred/frost-cracked trees, or rock crevices. Maternity roosts are often on south-facing aspects, to help keep the young warm while they are developing.

Implementation and Monitoring Procedure:

Participants will ensure that staff and contractor employees receive appropriate training to recognize the sites described in this section and understand the minimum protection measures. Participants will ensure that species lists are reviewed for currency on an annual basis. Registered Professional Biologists may be required to assist in identifying features, or to design or confirm appropriate protection measures.

Mineral licks and Wallows

"Significant" mineral licks or wallows are those with multiple, well-established trails leading to them, and evidence of multi-species use, or use by many individuals of one species. Size is also a good indication of importance: significant lick/wallows are usually large (> 100 m²). Significant licks and wallows require a minimum reserve of 100m. The reserve should incorporate at least 2 of the trails coming into the feature and must connect the feature to some form of effective cover. Consideration must be given to the site context (i.e. soil profile, timber types, windthrow hazard, topography) when establishing the reserve area. Timing restrictions should be placed on blocks adjacent to licks from May 1st through July 31st, and for wallows from Sept 1st through October 31st.

Forestry roads and other linear developments can provide access for humans and other animals that prey on moose and other ungulates. Road construction can disrupt and/or concentrate both overland and subsurface water flow. To reduce the potential impact from hunters and predators to animals using significant mineral licks, newly constructed roads must be kept >300m away from the licks, wherever practicable. If roads must be constructed within 300m of significant mineral licks, then sections of road within 300m of the lick will be made completely impassable for motorized equipment as soon as possible after harvesting is completed. New road construction in the vicinity of mineral licks must not result in the disruption of the hydrologic processes that support the licks (e.g. diversion or concentration of water).

Smaller, less significant licks and wallows require forested reserves large enough to be windfirm (as determined by a Qualified Registered Professional) and provide security cover to the animals using the site and include cover connectivity wherever possible.

Stick Nests

The overall objective of stick nest protection and management is to maintain the integrity of the breeding area so continued use of the feature can occur. This may not always be possible, depending on several factors including when a nest is discovered, and the extent of forest-damaging agents in an area.

Management Actions regarding stick nests in and adjacent to the Participants' tenured areas will focus on the following objectives:

1. Protection of the tree with the nest,
2. Retention of some habitat surrounding actives and alternate nests, preferably in one contiguous patch,
3. Avoidance of operations in the breeding area during the breeding season.

If a stick nest is discovered during harvesting operations, further felling must cease within 500 m of the nest until an appropriate species-specific plan can be made by a qualified registered professional that meets the above objectives. Forest-damaging agents that may render stick nest ineffective may be those that result in the die-off of most trees around the nest site

For help with identifying stick nests and species associations, and specific management actions refer to Appendix 21.

Pileated Woodpecker nesting cavities

Active nests should have a 100m buffer; inactive nests should have windfirm and WorkSafe BC buffer (minimum 1.5 tree length). The nest site must be confirmed vacant by ANY migratory bird species for 36 months from the time of reporting, before eligible for removal. The 36-month period restarts after occupancy by any migratory bird.

Active nests of SARA-listed, or Red or Blue-listed bird species occurring in the DFA

The species listed in Table 14 below are either listed federally (SARA) or provincially (Red or Blue). The habitats preferred by the species range from mature forest to recently cleared areas, to wetlands, so all phases of forestry operations have potential to impact one or more of these species during the breeding season. These birds typically do not reuse their nests from season to season, but the ones with an asterisk may sometimes reuse them.

Table 14: SARA-listed, or Red or Blue-listed bird species occurring in the DFA

Sharp-tailed Grouse	Common Nighthawk*	Ruby-Throated Hummingbird
Killdeer	Lesser Yellowlegs*	Short-Eared Owl
Olive-sided Flycatcher	Winter Wren*	Canada Warbler
Connecticut Warbler	Bay-Breasted Warbler	Cape May Warbler
Black-throated Green Warbler	Rusty Blackbird	Baltimore Oriole
Evening Grosbeak		

When active nests are discovered, the location must be recorded and an avoidance strategy determined. A Registered Professional Biologist will be consulted in the development of measures appropriate to protect the nest sites during the breeding season. This will at a minimum be a timing restriction on further disturbance, with the goal of allowing the birds to have a successful breeding season (i.e. fledging young). Note that further protection protocols are outlined in Section 5.12 Migratory Birds Risk Reduction.

Carnivore Dens

Grizzly bear and **Wolverine** dens require a 100m minimum reserve. If multiple Grizzly bear dens are found within a small area, the reserve should be buffered around all of them.

Wolf dens should be buffered by a forested reserve large enough to offer security cover and so they cannot be seen from a road and require a timing restriction from March 1st through July 31st.

Coyote and Fox dens should have a small WTP placed around them, large enough to offer security cover (animals can't be seen when at the den entrance).

Black Bear dens in rock, tree roots or hollow trees may be re-used and should have a windfirm WTP placed around them (>1 tree length; 20-50m), large enough to offer security cover (animals can't be seen at the den entrance). Dens excavated in earth are less often re-used by bears but may be used by other species. Inclusion within a windfirm WTP is advisable but a machine-free zone of 10m around the den is also acceptable if necessary.

Dens of groundhogs, marmots, or porcupines

Woodchuck/groundhog/marmot dens are often re-used by these and other species but generally do not require a significant reserve. A machine-Free zone of 5-10m around the den site (with larger trees stubbed at height of 3-5m) will reduce the potential of the burrow from being crushed and allow future use.

Porcupine dens should be buffered by a windfirm WTP (>1 tree length) if possible.

Bat Hibernacula and Maternity Roosts

An appropriate reserve and timing restrictions (hibernacula - October through May; maternity roosts – May through August) should be designed by a qualified professional to prevent disturbance to hibernating or breeding bats.

Vernal pools (ephemeral ponds)

The ponds will receive variable treatment depending on their size and the characteristics of the surrounding forest. The minimum treatment for ephemeral ponds includes a Machine Free Zone and retention of understory trees and vegetation where present. Ensuring that some shade is present post-harvest will help prevent the pools drying out sooner than may be normal. The smallest ponds will be marked on the harvest plan maps but may not be ribboned in the field. Ponds >0.25 ha will be ribboned in the field and excluded from the harvest area or included in a reserve. Note that not all ephemeral ponds will include riparian vegetation or appear as a non-classified wetland. Also, note that some ephemeral ponds may also serve as wallows. No roads or skid trails should cross any ephemeral pond, and ATVs should be kept out.

A report will be completed annually for blocks and roads with SLPs completed that year (April 1st-March 31st), which shows (by managing Participant), how many blocks or roads should have had some form of protection measure applied to Sites of Biological Significance, and how many had measures applied.

5.11 GUIDELINES FOR SPECIES AT RISK AND SPECIES OF MANAGEMENT CONCERN

Indicator Statement	Target Statement
The percentage of SLPs prepared annually for 'effected' cutblocks that incorporate stand level management guidelines	100% of SLPs prepared annually for effected cutblocks will incorporate stand level management guidelines
SFM Objective: Forest Management Planning; Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

A 15% variance below the target will be acceptable. (i.e., 85% or more of SLPs in effected cutblocks must have one or more SLMG applied). The variance from 100% to 85% of effected SLPs would only be invoked in situations where forest health, worker or public safety, make implementation of the management guidelines impracticable. In these situations, a rationale detailing the reasons for not implementing stand level management guidelines will be included in the effected SLPs and discussed with the appliable First Nation(s).

What is this indicator and why is it important?

This indicator measures the proportion of SLPs in 'effected cutblocks' that include:

- one or more of the stand level management guidelines related to a species at risk or of management concern, whose habitat needs may not be met by landscape level ("coarse filter") biodiversity management measures
- the 6 required and 1 additional management guidelines prescribed in moderate to very high moose habitat capability and/or suitability.

'Effected cutblocks' refers to a cutblock being identified as having the geographical, geophysical and vegetative characteristics that suggest it could provide the suitable niche habitats needed for one or more of the species at risk or of management concern identified, as well as those blocks where moderate-very high moose habitat capability and/or suitability exists, as per **Error! Reference source not found.**. Participants will continue to implement similar stand level management practices as employed during the previous SFMP and will continue to refer to those guidelines included in the November 2004 document entitled "Stand-level Management Guidelines for Selected Forest-Dwelling Species in the Fort St. John TSA" prepared by Manning, Cooper and Associates for direction. That document summarizes forest dwelling species of interest that may be impacted by forestry operations, the estimated likely geographical extent of the local habitat of these species, the specific niche habitat characteristics applicable to those species, and some stand level management guidelines that may help retain habitat or otherwise support these species. Other sources to determine species of management concern, and specific guidance regarding them may also be used, as appropriate.[3]

[3] E.g. "Identification and Management Action Guide for Species of Management Concern in Canfor's BC Peace Region Operating Areas

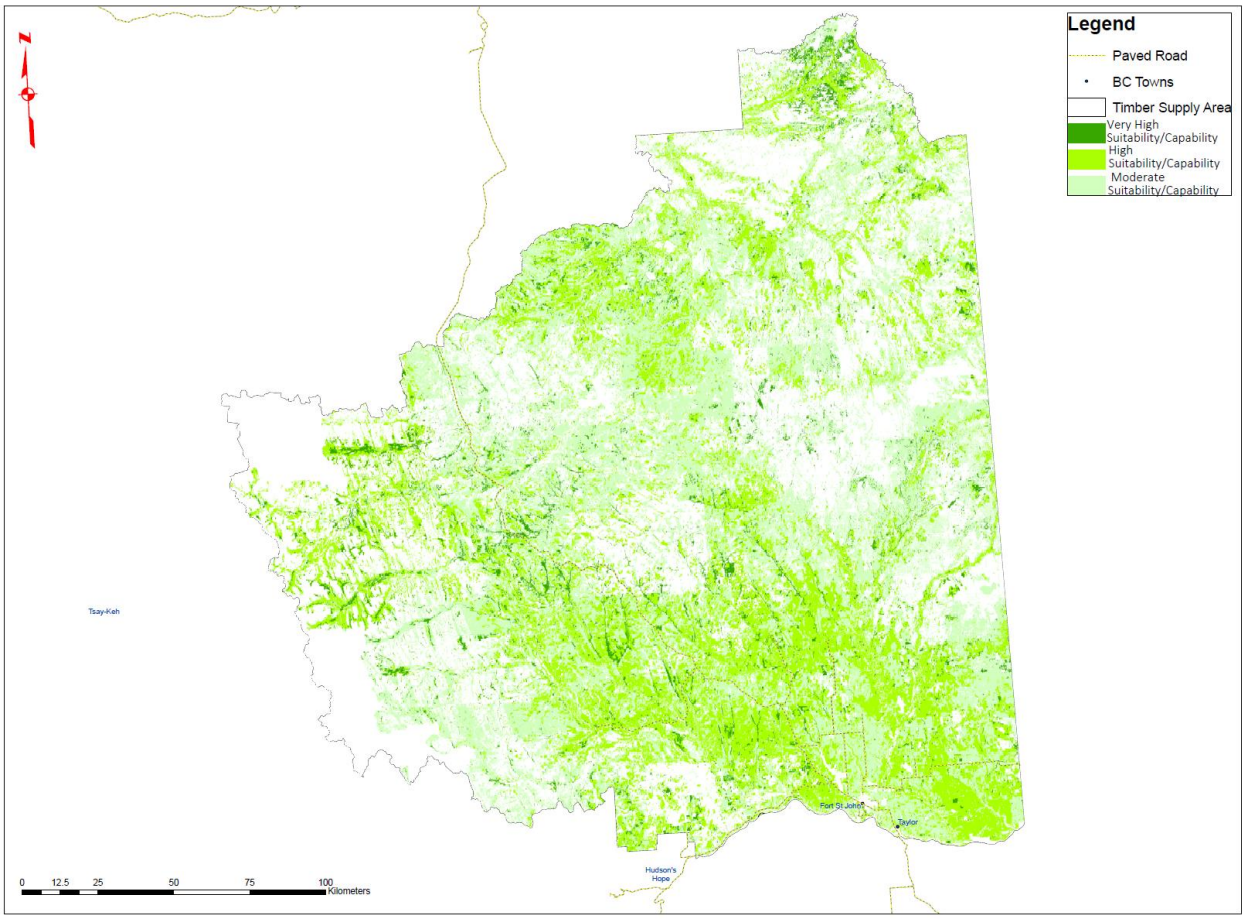


Figure 7 - Moderate to very high moose habitat suitability and capability in the FSJ TSA

Species at Risk

Species at risk included in the Stand Level Management Guidelines (SLMG) are derived from reviewing available information and authoritative sources:

1) Federal Species at Risk Act Schedule 1, 2 or 3,
2) Provincially red and blue listed forest dwelling species (MSRM 2004) that are directly and negatively impacted by forestry operations,
3) Regionally rare species that are sensitive to forestry operations (Sandhill Crane). and
4) Information on forest dwelling species from local MOE staff: Local government staff provided input on which local forest dwelling species might benefit significantly by inclusion in the Stand Level Management Guidelines.

The list of species of management concern for SFMP #4 includes the following birds,

Bank Swallow,
Barn Swallow,
Bay-breasted Warbler,
Black-throated Green Warbler,
Canada Warbler,
Cape May Warbler,
Connecticut Warbler,
Common Nighthawk,

Evening Grosbeak,
Horned Grebe,
Great Blue Heron,
Northern Goshawk,
Olive-sided Flycatcher,
Pileated Woodpecker,
Rusty Blackbird,
Sandhill Crane

and the following mammals (Wood Bison, Fisher, Wolverine, Grizzly Bear, Woodland Caribou-Northern and Boreal Ecotypes) one amphibian (Western Toad) and one fish (Bull Trout).

Moose Habitat

Moose hold significant cultural, nutritional, and economic importance to First Nations in Northern BC. They are vital sources of food, materials for clothing and tools, and play a central role in traditional practices and ceremonies. This indicator is being updated in SFMP#4 to reflect the local significance of moose and at the direction of FOR to outline specific management commitments related to moose habitat.

Moose distribution is primarily linked to food availability and quality, with forage availability being the most significant factor influencing habitat selection, followed by antipredator behaviors (Hjeljord et al., 1990; Street et al., 2015a). Key forage areas are typically found in moist environments, such as floodplains, regenerating burns, cutblocks, deciduous/mixedwood forests, and avalanche chutes (Wall et al., 2011; Street et al., 2015a). Moose habitats include both open and closed canopy forests, each serving critical functions for the animals (Peek, 1998; Poole and Stuart-Smith, 2004; Courbin et al., 2014). Open canopy forests typically offer more forage, while closed canopy forests provide essential security cover, thermal protection, and shallower snow depths that ease movement (Thompson and Stewart, 1998; Poole and Stuart-Smith, 2005). Additionally, forest cover helps to moderate temperatures, safeguarding moose from extreme weather conditions.

In 2018, the Participants, the Forest Products Association of Canada (FPAC), and the Ministry of Forests initiated a project to map moose habitat and develop best management practices for the Fort St John TSA. The resulting report, “Beneficial Management Practices for Moose in the FSJ TSA” (Anderson *et al*., 2018) provided guidance in the development of the management strategies outlined in the section below.

Implementation and Monitoring Procedure:

Training on the implementation of the stand level management guidelines will be done for staff involved with preparing plans or implementing the guidelines during field layout.

Following the preparation of each FOS or major amendment, a population of applicable “effected cutblocks” that require management guidelines for a particular species will be developed. This block selection will use the guidance provided in the SLMG for species at risk and moose, and use the best digital information available (e.g., based on the location, stand type, block size and structural characteristics of the block) to develop a GIS generated block list. For most species, this list will be the main determinant on whether blocks qualify for management.

Once the block list is developed, each identified block will have an activity scheduled and progress tracked (in LRM, or a similar activity tracking system) to address Stand Level Management Guidelines.

Species at Risk

The forester in charge of SLP development will review the SLMG for the species noted and identify at least one guideline to incorporate into the SLP or layout plan. The *SLM Guidelines Activity* status would be changed to *done* after a SLMG is actually incorporated into the SLP, and the specific guideline(s) would be noted in the activity comments section to facilitate future reporting requirements.

For any species that have habitat attributes discussed in the SLMG, or other supporting guidance documents, but who's presence is difficult to predict using GIS analysis, or for those species that can be readily identified from field work (e.g. Sandhill Crane, or Great Blue Heron), field staff will follow the same process if key habitat attributes noted in the SLMG, or the physical presence of a species is confirmed within or immediately adjacent to a block or road.

A supplementary source of information field staff can use to assist in identifying species of risk is the document "*Identification and Management of Species and Plant Communities at Risk in Northeastern British Columbia*" prepared by Timberline Natural Resource Group Ltd. and Alpha Wildlife Research & Management Ltd.

In the spring of each year (prior to the field layout season), the Participants will review the current list of species at risk that are likely to be impacted by their activities and discuss with biologists and/or local government officials knowledgeable with species at risk whether any changes to species at risk lists relevant to forestry activities are recommended. If any new information is available which would require changes to the list, or to the management guidelines, revisions to the SLMG will be made, and the changes will be noted in the Annual Report.

Moose Habitat

"Effected cutblocks" for the purposes of moose habitat guideline application are those that overlap mid-high moose habitat capability and/or suitability. They will require supplemental protection measures for moose habitat, in addition to the management measures outlined in the Biodiversity and Wildlife Habitat landscape level strategy and the Sites of Biological Significance indicator #10, which includes mineral licks. As per Table 15, management guidelines highlighted yellow, as well as 1 additional management guideline, will be prescribed in all "effected blocks" as described above.

Table 15: Stand Level Management Guidelines for Moose

Order of perceived benefit to moose	Management Guidelines
1. Reducing road lifespan and density, reclaiming roads, buffers on habitat features.	Deactivate and restrict motorized access to in-block roads as soon as possible post-harvest.
	Keep roads >200m from classified wetlands where practicable. Where roads must be built within 200m, that section of road will be fully reclaimed immediately post-

	harvest, or immediately after planting if planting was prescribed.
	For in-block roads, loosen soil surface (to act as seedbed), and restore stream crossings, as soon as possible post-harvest.
	Plan in-block road network to the minimum density required to safely and efficiently develop harvest areas. Utilize existing linear disturbance where practicable, and when those locations do not result in an increased risk of erosion and reduces the probability of impacts to soil productivity when compared to alternative road locations.
2. Protect wetlands and riparian areas with buffers of intact forest	Create a windfirm buffer on classified streams, lakes and wetland complexes of 50-100m where >25% of the shrub cover of preferred moose browse* species exists for >200m in length in areas that have less than 30% slope. Consider including well defined NCDs as well.
4. Use understory protection or avoidance techniques where aspen is harvested as a commercial species	Implement strip shelterwood silviculture system where the conifer understory is judged to be of suitable density and quality to contribute to future site stocking
	Protect good understory with preferred moose browse species shrubs >25% when harvesting overstory.
5. Retain moose browse and allow moose browse to grow post-harvest	Use mechanical brushing when vegetation control is required
	Leave a 30m wide unbrushed strip at the forest edge when brushing.
	Retain moose browse (>25% of preferred moose browse* shrub species) by placing in reserve or using MFZ ribbon or use other methods to protect the understory.
	Where mechanical site prep or prescribed burning are done, protection of moose browse is not necessary
6. Use irregular cutblock boundaries	Design cutblocks with irregular boundaries, where practicable.
7. Limit line of sight	Retain visual screening where it exists along road or other linear features, unless doing so would result in an increase to road area (existing roads + PAS) of more than 20% of Gross Block area.
	Limit line of sight to 400m in block design
8. Leave shelter in cutblocks but do so without increasing the road density	Cutblocks with a merchantable area greater than 50 ha will have a minimum of 3 ha designated as internal WTP. Cutblocks with a merchantable area greater than 60 ha will have the minimum WTP% for the LU designated as internal WTP, or 4 ha, whichever is greater. "Corridor" WTPs that

	act functionally as internal patches will contribute to these minimums.
10. Vary target merchantable volume variance between cutblocks	Minimize the number of brushing treatments, to the extent required to ensure crop tree survival.
11. In silviculture surveys where white spruce is the crop trees, do not count shrubs that are moose browse as overtopping vegetation	Do not count highbush cranberry, beaked hazelnut, red-osier dogwood or saskatoon as overtopping competing vegetation for white spruce in silviculture surveys
12. Avoid girdling aspen, balsam poplar and paper birch	Use mechanical brushing (cutting) instead of girdling.

**Preferred moose browse is willow, dogwood, saskatoon, cranberry, aspen, and birth <3m tall.* \

Annually, a report will be completed for blocks with SLPs completed that year (April 1- March 31), which shows (by managing Participant), how many SLPs should have had SLMG applied, and how many had SLMG applied. The report is currently pulled from the SLMG activity record in LRM. The results, as well as any change requirements to the SLMG will be presented in Annual Reports.

5.12 MIGRATORY BIRDS RISK REDUCTION

Indicator Statement	Target Statement
Application of Participants' Migratory Birds Standard Work Procedures and beneficial management practices to reduce risk of incidental take during the nesting season	Participants will maintain and implement Standard Work Procedures and beneficial management practices for reduction of the risk of incidental take of migratory birds during the nesting season
SFM Objective: Conservation of Biological Diversity, Legal and Regulatory Compliance	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator is a new addition for the SFM Plan and reflects management practices that have been implemented for several years by the Participants, to reduce the risks that their forestry activities have on migratory birds. As a broad cohort, populations of forest-dwelling birds in Canada have experienced a small decline since 1970, however those migrating from tropical

regions to breed in the Boreal Forest have suffered significant declines. Other disturbing trends are for aerial insectivores (43% decline) and long-distance migrants (29% decline) (Birds Canada / Environment and Climate Change Canada 2025). Habitat loss and disturbance while on breeding grounds substantially increases the risk to migratory birds (Environment and Climate Change Canada 2025). There are several legal statutes applying to the Participants operations that protect birds and their nests and eggs in BC:

- Migratory Birds Convention Act (federal),
- Wildlife Act (provincial),
- Species At Risk Act (federal), and
- Forest and Range Practices Act (provincial).

Any activity, industrial or non-industrial, that inadvertently harms, kills, or disturbs migratory birds or their nests or eggs is referred to as "incidental take". In 2016 a multi-organizational working group (including COFI, ILMA, BCTS, Canfor, and LP) developed a guidance document and management tool designed to "reduce the risk of incidental take and to contribute to the sustainability of populations of migratory birds", and consists of a risk matrix, GIS layer, and compendium of beneficial management practices to be used together (Appendix 20).

Implementation and Monitoring Procedure:

The Participants have developed or adopted standard work procedures and beneficial management practices to support forest management decisions that reduce the risk and/or mitigate the impacts of incidental take of migratory birds. As part of block and road planning (permitting, or development), road maintenance, or in preparation for silviculture treatments, Participant staff will use the available resources to determine the relative risk of incidental take of migratory birds and apply beneficial management practices (BMPs) as necessary. Examples include, but are not limited to, scheduling activities to occur outside nesting periods, surveys conducted by a qualified professional to determine presence or absence of breeding migratory birds, and avoidance of high-value habitat and/or designating it as WTP.

The following is an excerpt from "Guidance for Forest Sector Management of Nesting Migratory Birds in the Interior of British Columbia (2016)":

> *The risk matrix assigns relative ranks (1-6) to forested stands in the interior of BC. Forest stands have been categorized into stand types using a combination of BEC zones, age, height and species groupings. Nest density rankings have been assigned primarily on ecological principles rather than actual bird data. The rankings are intended to inform forest managers of the relative importance of various forest types to nesting birds, in terms of the density of nests likely to occur. The lower the ranking, the lower the density of nests expected to be found. Stands ranked 4 and higher, warrant a higher level of management emphasis for migratory birds versus stands ranked 3 or lower.*

The SWPs identify the 'restricted periods' (i.e. when a high proportion of migratory birds are nesting) by broad geographic area, as there are some differences based on latitude and elevation. Operations need to either be conducted outside the restricted periods (Table 16) or be subject to one or more BMPs, depending on the stand / risk rank configuration.

Table 16: Restricted period by geographic area and relative stand risk-rank

Area	**Restricted Period 1 for all but ESSF** (stands risk-ranked 5,6)	**Restricted Period 2 for all but ESSF** (stands risk-ranked 4)	ESSF	Environment Canada Nesting Zone
Chetwynd, southern portions of Fort St. John	May 13 through August 03	May 25 through July 23	Add 1 week to both ends of date ranges to account for later nesting due to higher elevation	B5
Fort Nelson and the northern portion of Fort St. John	May 15 through August 04	May 29 through July 23		B6

Each managing Participant will report annually the number of blocks with any areas of stands with a risk rank of 4-6 where they had forest management operations active during the restricted period (i.e. nesting season), and the number of these blocks that had the SWP fully applied.

For this indicator "forest management operations" are felling and skidding, including clearing road rights-of-way, site preparation, and mechanical vegetation management. Loading out logs that were processed and decked outside of the nesting season is not included, nor are tree planting and silviculture surveys.

5.13 FOREST WORKERS' SAFETY

Indicator Statement	Target Statement
Implementation and maintenance of certified safety program	Each managing Participant will implement and maintain a certified safety program
SFM Objective: Training and Education	
Linkage to *FSJPPR*: None	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator identifies whether or not a certified safety program is in place for the Managing Participants' forestry staff.

A certified safety program to forest industry wide standards provides some assurance that the policies, procedures, and practices occurring in the DFA provide a safe work environment for forestry workers. Continued implementation of certified safety programs is expected to result in forest planning and operations being conducted with a genuine focus on worker safety, in increased awareness and reporting of safety issues, and should result in fewer safety incidents.

Implementation and Monitoring Procedure:

Annually, a review of the status of the Managing Participants certification will be completed, and any change to the status will be presented in Annual Reports.

Currently BCTS, Canfor, and LP are certified to the B.C. Forest Safety Council S.A.F.E. Companies Standard. Surveillance and certification audits are completed at regular intervals to ensure safety programs meet the S.A.F.E. Companies safety criteria, and to identify where there may be opportunities for improving the safety programs. The Managing Participants will report the maintenance of their individual certifications to the B.C. Forest Safety Council S.A.F.E. Companies Standard in Annual Reports.

5.14 SEED USE

Indicator Statement	Target Statement
The percentage of seedlings & vegetative material used and planted in accordance with the Chief Forester's Standards for Seed Use (April 2022), as amended from time to time	100% of seedlings and vegetative material will be used and planted in accordance with the Chief Forester's Standards for Seed Use (April 2022), as amended from time to time
SFM Objective: Forest Health and Productivity; Climate Smart Forestry	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy. For the purposes of Section 35(5) the indicator this indicator statement, target statement and acceptable variance will replace the requirements of Schedule F Section 99 (Seed Use).	

Acceptable Variance:

As per Section 8 Transfer Limits in the Chief Forester's Standards for Seed Use, no fewer than 95% of the combined total of the number of seedlings and vegetative material planted during each fiscal year within the DFA will comply with the transfer requirements of section 8.2 through 8.7 of those standards. As the standards are amended from time to time, the allowable variance will change consistent with any amendments.

What is this indicator and why is it important?

This indicator measures the Participants' adherence to the standard designed to ensure reforestation efforts in the DFA use genetically appropriate material.

Genetic diversity of seedlings used for reforestation is ensured through the Ministry's Seedlot registration policies and standards. Cones and seed obtained from wild forest stands must be collected from a minimum of ten trees. The Ministry licenses tree seed orchards to ensure that their design and management practices maintain genetic diversity.

Seed derived from licensed orchards must also contain a minimum level of genetic diversity - or effective population size (Ne) – as measured by the quantity of pollen and cones from each contributing tree in the orchard. Orchard seed lots must have a minimum Ne of 10. Similar registration requirements also apply to vegetatively propagated reforestation materials. These rules ensure that planted forests contain sufficient genetic diversity, so they are able to withstand any biotic (e.g. insect or disease) or abiotic (e.g. wind, snow, frost, or climate change) event as well as a naturally regenerated forest.

> *"Transfer guidelines minimize the risks of maladaptation or growth loss associated with moving seed or vegetative material from its source to another location. Exceeding the transfer limits may decrease productivity or increase susceptibility to frost, insects or disease. Poor survival or outright mortality may occur when seed is transferred past its ecological tolerance; however, losses in productivity can be substantial even over relatively short distances, particularly where elevation is concerned."* (Ministry of Forests Tree Improvement Branch publication).

Recent concern about climate change and the impact it may have on forests' ability to adapt has illustrated the need for increased flexibility in seed transfer rules, as outlined in the Chief Forester's Standards for Seed Use (April 2022, and amendments) which can be accessed on line at Chief Forester's Standards for Seed Use - Province of British Columbia. Seed transfer rules are based on provenance and progeny testing conducted by government genetic research scientists. Increases in upper elevation limits by 100-200 metres were made in a recent amendment to seed transfer standard to anticipate climate change over the next 15-20 years. As improved information may result to changes to this standard, the Participants will modify their future activities to be consistent with any amendments to the CFSSU standard.

Implementation and Monitoring Procedure:

Does forecasting apply (y/n)? Yes

By following the Chief Forester's Standards for seed use, it is anticipated that healthy, productive and genetically diverse forests that are ecologically suited to the site will be maintained.

Seeds will be collected and planted in accordance with the Chief Forester's Standards for Seed Use (April 2022) as amended from time to time. Participants preparing seedling orders and planting programs will use the seed lot registration information to determine the allowable geographical and elevational range in which a seedlot may be planted. SLPs will be referenced to determine the location and elevation of cutblocks planned for reforestation, to match with suitable feedlots.

Where exceptions to these guidelines are contemplated because of unanticipated changes to plans, or other logistical considerations, the number of seedlings or vegetative material that fall outside the guidelines will be tracked and reported.

All reforestation activities are documented and tracked in Participants' database systems. Seedlots are tracked and recorded for every area planted.

A report will be generated identifying the amount of area (ha) planted by seedlot that falls outside of the seedlots' acceptable geographic or elevational range. The total number of seedlings that fall outside the range will be determined by multiplying the area (ha) times the average density of seedlings planted per hectare. The total of all seedlings that fall outside of the range, divided by the total number of seedlings planted will provide the percent conformance for comparison to the indicator.

5.15 DECIDUOUS REGENERATION

Indicator Statement	Target Statement
% natural regeneration of deciduous	100% natural regeneration for deciduous
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.	

Acceptable Variance:

A maximum of 10% of the area prescribed for deciduous regeneration may be restocked with deciduous vegetative propagules or seedlings (e.g., 90% minimum natural regeneration of deciduous) in accordance with the Chief Foresters Standards for Seed Use, as amended from time to time. In such cases, records must be kept of vegetative lots used and locations where vegetative lots are planted.

What is this indicator and why is it important?

This indicator identifies the percentage of reforested deciduous areas that will be from natural sources, and therefore genetically appropriate for the site.

Natural regeneration maintains the genetic diversity of harvested deciduous species. Maintenance of genetic diversity is important for adaptive processes of deciduous species, and for the maintaining the health, productivity and resiliency of the tree species and ecosystems in the face of changing environmental conditions. Some allowance for introducing stock that is not natural to address underperforming natural regeneration concerns, as trials to assess the impacts of climate change, or to increase timber production volumes are considered acceptable, as at low levels of introduction they are very unlikely to have any measurable impact on the local naturally occurring genetic stock.

Implementation and Monitoring Procedure:

Natural reforestation will be the default prescription where areas are expected to be reforested to deciduous species. Reforestation failures will normally be reforested to coniferous species. In the event artificial reforestation of deciduous is planned, the Participants will determine the amount of deciduous area that is to be declared 'established' in that year and ensure that any planned plantings of deciduous is consistent with the acceptable variance for this indicator.

All reforestation activities are documented and tracked in LRM or a similar database. Planted deciduous areas will be spatially identified in LRM or similar database, as will the total deciduous area designated as 'established' (i.e., combined natural and planted deciduous areas). Annual Reports will include the percent natural deciduous regeneration achieved (i.e., unplanted established deciduous area divided by the total established deciduous area).

To date, all deciduous reforestation in the DFA has been from natural regeneration, either by coppice (i.e., root and stump suckering) or natural seed in. Some deciduous leading areas that had low initial restocking, or were otherwise expected to not meet deciduous reforestation standards have been planted to coniferous species. To date there have been no plantings of deciduous seedlings or vegetative material in the DFA.

5.16 PARKS AND PROTECTED AREAS

Indicator Statement	Target Statement
Amount of forestry-related harvesting or road construction within parks and protected areas	No forestry-related harvesting or road construction within parks or protected areas
SFM Objective: Conservation of Biological Diversity; Legal and Regulatory Compliance	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

No variance, other than government direction requiring the forest industry to conduct operations in these areas.

What is this indicator and why is it important?

This indicator is included for completeness, with regard the entire Fort St. John Pilot Project area, and articulates a recognition that no forestry operations shall be conducted by the participants in the areas identified below, other than at the direction of government (e.g. to address an immediate and significant forest health risk).

Protected areas and sites of special biological significance within or adjacent to the DFA have been identified through a variety of processes. Since the approval of SFMP #3, several new areas have been identified that are now included under this indicator. The Blueberry River

Implementation Agreement identifies several large polygons of “High Value” (HV) areas, where commercial forestry has, for all intents and purposes, been indefinitely deferred. Other Treaty 8 Nations have also delineated Consensus Protection Areas (CPA) and Halfway River First Nation has a Conservancy area, both being areas where harvest has been deferred.

No forestry related harvesting or road construction has occurred, nor was any harvesting planned by the participants, in Parks, Ecological Reserves, or LRMP Designated Protected Areas.

To avoid operating in these areas, forestry activities need to clearly identify the status and location of parks and protected areas. Digital boundaries of all known protected areas are used during the preparation of the FOS to ensure proposed blocks or roads do not fall within any of the protected areas.

LRMP Protected Areas and Parks

Goal 1 protected areas are established primarily for ecological representation to protect viable examples of natural diversity such as major terrestrial, marine, and freshwater systems, characteristic habitats, hydrology and landforms and/or characteristic backcountry recreational or cultural and heritage features.

Goal 2 protected areas represent special features such as cultural, heritage and recreation sites, rare and endangered species and critical habitats, outstanding or unique botanical, zoological, geological and paleontological features, outstanding or fragile culture and heritage features, and outstanding outdoor recreational features such as trails.

Potential protected areas were initially identified through a technical team formed from government agencies (RPAT). This group delineated Areas of Interest which met the above criteria. The Fort St. John LRMP then used this information to finalize proposed Protected Area (PA) boundaries.

Table 17 is a summary of the classified protected areas in or adjacent to the DFA, and their primary value.

Table 17 - LRMP Protected Areas and Parks

Park or Protected Area	Value
Milligan Hills Provincial Park	Woodland caribou habitat, for endangered Alberta populations.
Graham-Laurier Park	Habitat for caribou, grizzly bear, moose, and furbearers. High fisheries values, First Nations traditional use values, and several undeveloped intact watersheds. Popular destination for recreationalists.
Redfern-Keily Park	Habitat for caribou, Stone's sheep, and Rocky Mountain elk. Old growth habitat for furbearers. First Nations traditional use values, major lake system, and recreational opportunities.

Butler Ridge Provincial Park	High elevation winter range habitat for caribou and Stone sheep. Low elevation winter range habitat for moose and elk.
Peace-Boudreau Provincial Area	Representation of the BWBS mw1 Biogeoclimatic zones.
Northern Rocky Mountains Park	Diverse water features. Old growth white-spruce forests and native grasslands.
Pink Mountain Provincial Park	Significant diversity of wildlife species, and features paleontological sites.
Sikanni Old Growth Provincial Park	Significant alluvial old growth white spruce forests of the Muskwa Plateau and the associated wildlife species typical of old growth forests.
Sikanni Chief Canyon Protected Area	Locally significant mountain goat populations.
Ekwan Lake Protected Area	First Nations, fish, and wildlife values.
Beatton-Doig Canyon Protected Area	Unique cutbank and grassland areas.
Sikanni Chief Falls Protected Area	Recreational and paleontological values.
Chinchaga Lakes Protected Area	Ecological values of local lakes and critical habitat for endangered Alberta population woodland caribou. First Nation values.
Peace River Corridor Provincial Park	Prime migratory waterfowl staging area. Wintering habitat for ungulates, and spring calving site for moose.
Beatton River Provincial Park	Riparian habitat.
Beatton Provincial Park	Recreational value.
Taylor Landing Provincial Park	Peace Lowland ecosection.
Peace River/Boudreau Protected Area	Cultural heritage sites and habitat for wildlife.

Ecological Reserves

Ecological reserves are areas selected to preserve representative and special natural ecosystems, plant and animal species, features and phenomena. The key role of ecological reserves is to contribute to the maintenance of biological diversity and the protection of genetic materials. Scientific research and educational purposes are the principal uses of ecological reserves. The benefits of these areas are that they provide for the maintenance of biological diversity, they provide outdoor laboratories and classrooms for studies, and they can act as benchmarks against which environmental changes can be measured.

Three ecological reserves are identified in the DFA and outlined in Table 18.

Table 18 - Ecological Reserves

Ecological Reserve	Value
Cecil Lake Reserve	Important waterfowl area.
Clayhurst Reserve	Conservation of grassland and aspen grove communities.
Sikanni Chief River Reserve	Conservation of alpine and subalpine ecosystems.

Implementation and Monitoring Procedure:

It is anticipated that implementing the indicator strategy will result in forest management operations that respect and reflect the interests of non-timber resource users, local public and First Nations, resulting in the maintenance of existing recreation opportunities offered by the established recreational sites, trails, ecological reserves and protected areas in the Fort St John DFA.

As new areas are identified and declared for protection and made known to the Participants, within one-month detailed location and management information will be requested from the government by the planning staff.

Map information will be digitally stored within 1 month of this information being made available by the government, and planning maps will display this information, provided the data is not considered sensitive (e.g., Some WHA's will not be shown on public maps).

Applicable management information will be circulated to effected staff by planning staff for consideration in all planning activities within 1 month of receipt of this information from government.

Changes to protected areas will be reported in future Annual Reports, and conformance to this target will be included in the Annual Report. FOS will report on the consistency of the proposed harvesting to this indicator.

Staff members will refer to base maps or digital coverages to locate protected areas when preparing operational plans. When planned activities are in the general vicinity of the identified areas, staff members will ensure operational plans are consistent with any management guidelines for these protected areas.

5.17 UNGULATE WINTER RANGES, WILDLIFE HABITAT AREAS AND MKMA

Indicator Statement	Target Statement
Proportion of Pilot Participant activities consistent with objectives of the Muskwa-Kechika Management Area (MKMA) and general wildlife measures for Ungulate Winter Ranges (UWR) and Wildlife Habitat Areas (WHA)	All Pilot Participant activities will be consistent with the objectives of the MKMA and the general wildlife measures for UWR and WHA
SFM Objective: Conservation of Biological Diversity; Legal and Regulatory Compliance	
Linkage to *FSJPPR*: None	

Acceptable Variance:

No variances unless authorized by the relevant government agency.

What is this indicator and why is it important?

Maintaining plans and operations that are consistent with the objectives of Wildlife Habitat Areas (WHA) and Ungulate Winter Range (UWR) ensures that the Participants' management activities will not have a negative impact on the specific features and/or critical habitat protected by the WHAs and UWRs. The objectives designed for these areas may in some cases allow limited industrial forestry activities provided that protection of the special features or habitat of these areas is maintained.

> **Wildlife Habitat Areas** are spatially defined areas of habitat that are biologically limiting to a species. They are established by the provincial government to protect critical habitat elements for one or more species of Identified wildlife, and include General Wildlife Measures. Identified Wildlife re considered to be sensitive to habitat alteration associated with forest and range practices and are considered to be at risk (i.e., endangered, threatened, vulnerable, or regionally important). Identified Wildlife include Species at Risk and Regionally Important Wildlife.
>
> **Ungulate Winter Range** refers to an area that is identified as being necessary for the winter survival of ungulate species.
>
> **MKMA** related objectives as specified in the LRMP are the objectives noted in Table 43 that apply to the Sikanni LU.

There are currently 64 unique WHA totaling 444,105 ha and 78 UWR areas totaling 646,817 ha within the Fort St John TSA. There is some overlap between some of the areas, and 185,217 ha of WHA is 'on top' of some UWR areas. There are 58 'stand-alone' WHAs, of 258,888ha. General Wildlife Measures –the legal management regimes that will be required in these areas – have been developed and are in effect. The Participants will follow the General Wildlife Measures for each specific area when forestry operations are proposed within these areas.

The total cumulative area logged by the Participants to date in the MKMA is 209.2 ha, all of which took place in 2005/2006. Harvesting operations within the MKMA were consistent with previously approved Forest Development Plans, as well as provisions within the MKMA Act that 'grandparent' previously approved blocks. There is no harvesting or road construction currently proposed within the MKMA, in the FOS.

Implementation and Monitoring Procedure:

Does forecasting apply (y/n)? Yes

It is anticipated that implementation of the indicator strategy will result in the short and long-term maintenance of a supply of desirable habitat for species of management concern on the DFA.

The spatial datasets identifying the locations of WHA's and UWR's are maintained within the Participants' GIS. The Participants will identify any activities proposed near or within WHAs and UWRs. Prescribing foresters developing SLPs for blocks or roads within UWR and/or WHA will ensure that plans are consistent with the objectives and General Wildlife Measures.

Refer to Section 5.22 MKMA Harvest for measure to ensure consistency with the objectives of the MKMA. When activities are proposed and/or implemented within UWR and WHA a summary

of these activities will be presented in the annual report. The Participants' FOS will specifically note if proposed activities are proposed to occur in these areas, and if these activities are consistent with the indicator's targets.

5.18 DELETIONS TO FOREST AREA

Indicator Statement	Target Statement
The percentage of the Crown Forest Management Land Base* in the DFA converted to non-forest land use through the forest management activities of the participants during the term of SFMP# 4	Less than 0.14% of the Crown Forest Management Land Base* in the DFA will be converted to non-forest land use through the forest management activities of the participants during the term of SFMP# 4
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: None.	

*based on 2016 CFMLB of 2,757,161 ha

Acceptable Variance:

An additional +0.02% during the term of the SFMP is required to provide the Participants flexibility to exceed the target, in the event that additional permanent road construction is needed to address unforeseen catastrophic forest disturbance events such as wildfires, insect or disease outbreaks, etc.

What is this indicator and why is it important?

Productive soil is a nonrenewable resource, and essential to support the forests that produce timber and supply many important ecosystem services (Powers et al, 1998), One key principle of SFM is the protection and maintenance of long-term soil productivity (SFI 2022). This plan contains several indicators related to this topic (Sections 5.4 Soil Disturbance, 5.26 Permanent Access Structures,

5.34 Site Index).

Given the Crown tenure situation in British Columbia, forest companies generally have little influence on any additions or deletions to the forest area, which are a result of government approvals, or the establishment or varying of land use objectives. Where forest companies can have a direct influence is through their management practices on tenured areas, particularly the practices pertaining to access structures such as roads, trails, and landings. Unless rehabilitated, these access structures may occupy otherwise productive land suitable for growing forests. The Participants have a vested interest in keeping the amount of road constructed and maintained to the minimum required for safe and efficient access and block development, from both a cost and AAC point of view.

This indicator is focused on deletions to productive forest land resulting from access management activities for which the participants have management responsibility.

Current status

The current status of forest deletions resulting from forest management activities is shown below in Table 19. The information is sourced from the "*Fort St. John TSA Timber Supply Analysis Discussion Paper – November 2016"*, which is the latest summary available. It is acknowledged that a new timber supply review for the Fort St. John TSA will be required, given the many changes that have occurred in the DFA since the last AAC determination. Previous versions of the SFMP cited figures from TSR II, which was published in 2003. Some of the land classifications and terminology differ between the two TSRs, but the general process is the same. One notable difference is the amount of area attributable to road structures. The 2003 TSR netted out 6,670 ha for roads, trails, and landings, but the Chief Forester did note in their Rationale that this was underestimated significantly. The 2016 timber supply analysis discussion paper reports reductions to the Crown Forest Management Land Base (CFMLB) attributable to "Current Roads" of 117,483 ha, or 2.3% of the TSA, and a unique 'footprint' (i.e. no overlap with other factors) of 63,045 ha. This area includes all roads, both public and industrial.

Table 19: Area summary from FSJ TSA Discussion Paper (2016)

Land class	Total Area (ha)		
TSA boundary	**4,864,884**	**Unique Area excluded (ha)**	**Percent total area excluded**
Wetlands (from Fresh Water Atlas)	729,945	729,945	15.0
Wetlands (from VRI BC Land Class)	268,738	105,201	2.2
Lakes	24,659	3,637	0.1
Rivers	27,225	1,517	0.0
Water	48,057	20	0.0
Alpine	142,683	142,285	2.9
Non-vegetated	137,539	26,008	0.5
Vegetated non-treed	964,503	682,872	14.0

Non-Crown from Forest Cover ownership	911,646	416,202	8.6
Crown Forest Management Land Base	**2,757,197**	**2,107,687**	**43.3**
Exclusions from CFMLB	**Total Area (ha)**	**Unique Area excluded (ha)**	**Percent area excluded**
Oil and gas imprint	102,016	50,801	1.8
Current roads	117,483	63,045	2.3
Stream management area	164,864	74,148	2.7
Lake management area	2,934	837	0.03
River management area	41,602	22,530	0.8
Low productivity sites	1,966,293	1,009,275	36.6
Steep ground	552,232	92,668	3.4
Unstable ground	199,252	35,208	1.3
Economically inoperable	54,330	1,323	0.05
Problem forest types	1,683,748	207,156	7.5
Does not meet min harvest age (MHA) criteria on VDYP curves	2,681,354	75,568	2.7
Wildlife and range burns	59,170	8,085	0.3
Wildlife habitat areas	321,456	16,599	0.6
Ungulate winter range	293,099	14,717	0.5
Recreation sites	2,297	571	0.02
Archaeology sites	1,513	181	0.01
Permanent sample plots for growth and yield	175	147	0.01
Wildlife Tree retention	35,865	35,865	1.3
THLB	**1,020,817**	**1,708,724**	**62.0**

The areas in the above Table 19 were taken directly from the TSA Discussion paper. An important part of a Timber Supply Review and subsequent Allowable Annual Cut determination is to identify the productive forested Crown land (CFMLB), which is a subset of the total area in a TSA. Further area net downs are applied to the CFMLB to determine the area that is considered both acceptable and economically feasible for timber harvesting (THLB). It should be noted that the sum of the THLB and the CFMLB exclusions provided in the document do not equal the total CFMLB area, and there is a 1% discrepancy. These data are presented as published however, for completeness and transparency. The reader is directed to the yellow-highlighted row (“Current Roads”) with regard insight to this indicator.

Table 20, Table 21, and Table 22 below identify the amount of new road constructed by the Participants during the three SFMP periods. Table 23 is included to show the relative amount of road Constructed by Managing Participants between 2004 and 2024 as a percentage of TSR 3 CFMLB

Table 20: Road Constructed by Managing Participants 2004-2011 (SFMP #1)

	2004-05 (m)	2005-06 (m)	2006-07 (m)	2007-08 (m)	2008-09 (m)	2009-10 (m)	2010-11 (m)	Total (m)	Total (ha)
BCTS	121,435	169,810	71,994	57,873	50,288	33,745	22,281	527,426	1,055
Canfor	144,376	177,226	221,155	191,347	126,425	90,483	127,398	1,078,410	2,157
Total	**265,811**	**347,036**	**293,149**	**249,220**	**176,713**	**124,228**	**149,679**	**1,605,836**	**3,212**

Table 21: Road Constructed by Managing Participants 2011-2018 (SFMP # 2)

	2011/12 (m)	2012/13 (m)	2013/14 (m)	2014/15 (m)	2015/16 (m)	2016/17 (m)	2017/18 (m)	Total (m)	Total (ha)
BCTS	26,918	19,547	42,963	81,896	103,967	73,555	55,983	404,829	810
Canfor	234,983	258,571	217,563	164,800	231,137	177,502	296,508	1,581,064	3,162
Total	**261,901**	**278,118**	**260,526**	**246,696**	**335,104**	**251,057**	**352,491**	**1,985,893**	**3,972**

Table 22: Road Constructed by Managing Participants 2018-2024 (SFMP # 3)

	2018/19 (m)	2019/20 (m)	2020/21 (m)	2021/22 (m)	2022/23 (m)	2023/24 (m)	Total Length (m)	Total Area (ha)
Canfor	251,723	100,970	138,424	136,246	67,365	140,657	835,385	1608
BCTS	67175	57,973	133,834	62,038	5,025	1,707	327,752	656
LP	*	*	*	39,434	0	3,748	43,182	86
Total	**318,898**	**158,943**	**272,258**	**237,718**	**72,390**	**146,112**	**1,206,319**	**2,350**
** LP values for 2018-2021 included in Canfor Totals*								

Table 23: Road Constructed by Managing Participants 2004-2024 as a percentage of TSR 3 CFMLB

SFMP Period	Road Construction (% of 2016 CFMLB)
2004-2011 (#1)	0.12
2011-2018 (#2)	0.14
2018-2024 (#3)	0.09

Implementation and Monitoring Procedure

Due to the multitude of recent changes impacting land use decisions, as well as ongoing land use planning exercises, forecasting would be very difficult, and of dubious value, as of the development of this plan. The proposed target and variance are based on the past performance

of the Participants, and the 2016 CFMLB. Although the total amount of tenured volume held by the Participants is lower than it has been in the previous three plans, it is expected that the amount of road as a proportion of volume delivered will be higher than the previous three SFMP periods during the term of this plan. With increasing merchantable volume left on site as dispersed retention and WTPs, more road area will be required, on a m^3/lineal metre of road basis, to supply a fixed amount of volume (i.e. AAC). It was with this in mind, and to acknowledge the uncertainty of future CFMLB and THLB levels, that the Participants proposed the target of 0.14%. The 0.02% acceptable variance to the CFMLB maximum deletion target allows room for the Participants to react to events such as large wildfires.

Upon completion of a new TSR Discussion paper with an updated area disposition, this indicator will be amended.

Staff preparing operational plans will plan road networks to the minimum required to safely and efficiently develop blocks, within the bounds of other aspects of SFM (e.g. setbacks from wildlife features, provision of wildlife corridors). The Participants will continue to keep forest area deletions at low levels through adherence to the SFMP road access management strategy and the Permanent Access Structures indicator. The Participants will continue to coordinate access development activities with the oil and gas industry whenever possible. Where practicable, the Participants will use existing access infrastructure including those roads created by other industries, such as oil and gas roads, to access areas planned for harvest. This approach will minimize the total amount of productive forest land taken up by the participants' road structures.

During timber supply analysis, net downs to the CFMLB are completed to determine the THLB. Included in the net down of the CFMLB is the area occupied by "current roads". On an annual basis, the participants will report the total area of permanent access structures (roads) constructed by them during the subject reporting year, as a proportion of the 2016 CFMLB.

Upon completion of the term of SFMP# 4 - end of reporting period 2031-32 (March 31, 2032), the sum total area of permanent access structures constructed by the participants during the term of SFMP# 4 will be reported as a proportion of the CFLB. Any additions to the land base effected by the participants will be included in annual reports.

5.19 GRAHAM HARVEST TIMING

Indicator Statement	Target Statement
The number of clusters in the Graham IRM Plan area where active operational harvesting is concurrently occurring	Operational harvesting within the Graham IRM Plan area will be constrained to no more than one 'cluster' of cutblocks at any one time
SFM Objective: Conservation of Biological Diversity	

Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy.

Acceptable Variance:

Operational harvesting (i.e., falling and/or skidding of timber, *excluding predevelopment of road rights of way*) in more than one cluster at a time may occur concurrently, if required to address significant forest health concerns (e.g. Mountain Pine Beetle infestations, wildfire), with the authorization of the applicable government agency.

What is this indicator and why is it important?

The intent of the GRIRMP harvest scheduling is to concentrate harvesting in one area or subdrainage (i.e., cluster) at a time. This is designed to limit the extent of disturbance to wildlife, recreational, and other non-timber values over the entire Graham drainage at any one time and supports the objective of providing opportunities for a mix of activities within the Graham drainage area.

The approximate locations of the clusters are shown in Figure 8 below. Note that cluster 4 has been partitioned into two clusters in this plan, so that a new cluster (#4A, which includes block 11058) is identified west of the main body of cluster 4. This area requires a separate access route from the cluster 4 blocks and can be developed separately.

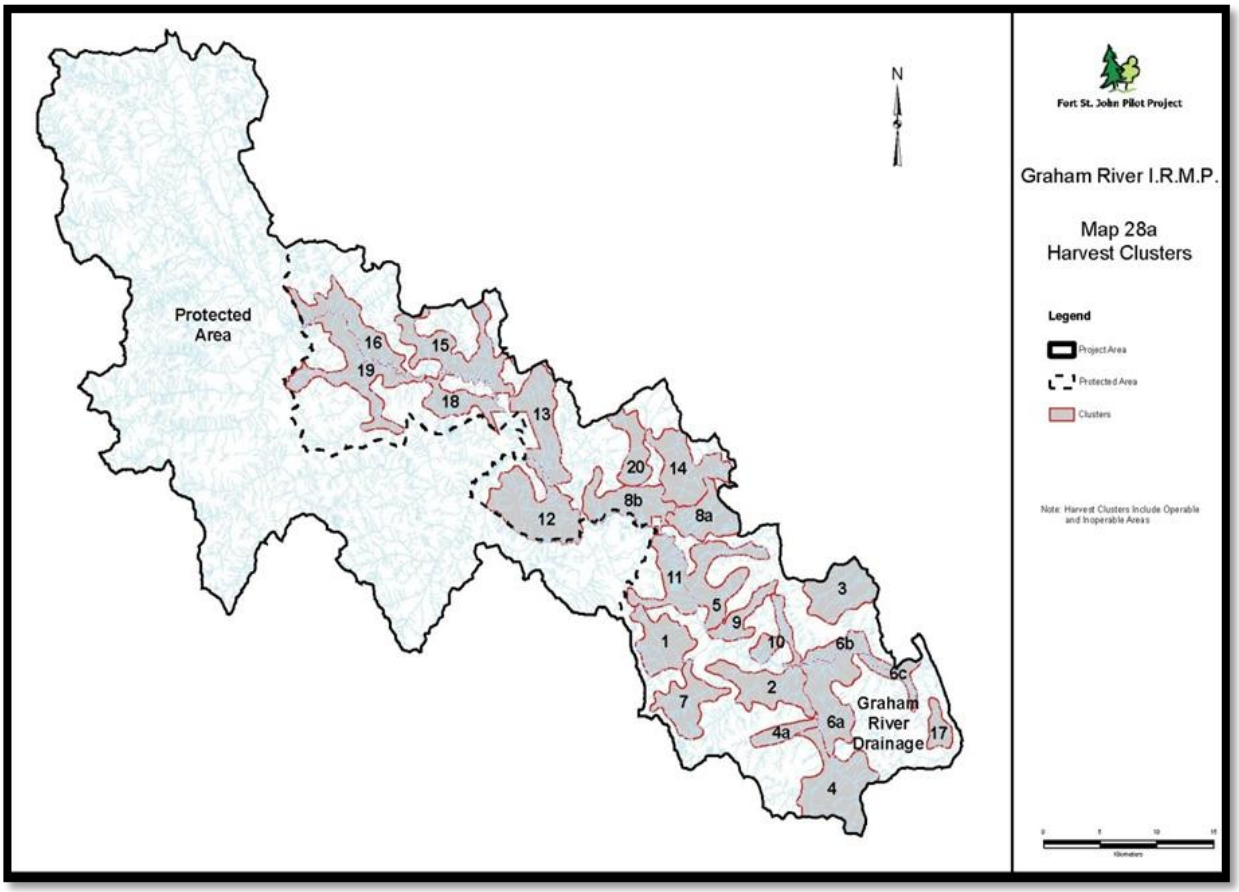


Figure 8. Graham River IRMP Harvest Clusters

Implementation and Monitoring Procedure

Harvest planning will ensure that the commencement of operational harvesting will not occur in a second cluster of blocks in the Graham IRM Plan area while operational harvesting is active in any other cluster in the GRIRMP area. It is recognized that predevelopment of access routes in a future cluster may be necessary to allow orderly development, and this is acceptable while operational harvesting is being completed in another cluster.

In the event that other industries propose development in a separate cluster, the Participants will review the feasibility of modifying harvest schedules to accommodate a joint entry into the cluster.

Scale records and inspections reports will be used to determine and report the timing of operational harvesting applied to a cluster of cutblocks within the Graham River IRM Plan area. This will be presented in Annual Reports, which will indicate whether or not the target is being achieved.

Planners will identify in the FOS which blocks within the Graham IRM area are proposed for harvesting during the term of the plan, and will note which cluster each block is in. Harvest schedulers will be responsible for ensuring operational plans do not schedule the timing of operational harvesting activities in separate clusters such that they overlap.

Current Status:

Harvesting has been completed in clusters 1,2,3 and 17. Cluster 17 was advanced in the schedule to coordinate with a proposed oil and gas development. Harvesting in cluster 4 was started in 2004 but was not completed when operations pulled out of the Graham River to address pine salvage in other areas of the DFA in 2007. Between August 2007 and March 2023 no harvesting occurred in any clusters. In March 2023, cluster 5 was advanced in the schedule to prioritize areas of pine salvage, which is a top priority for Halfway River First Nation. Clusters 8 and 8a are also being advanced in the schedule for the same reason, with harvesting planned to occur after the completion of cluster 5.

5.20 GRAHAM MERCHANTABLE AREA HARVESTED

Indicator Statement	Target Statement
Cumulative merchantable area (hectares) within blocks harvested within the Graham River IRM Plan area since 1997	The cumulative merchantable area (hectares) within harvested blocks will not exceed the planned maximum cumulative harvest areas as measured at the end of each time period Period # 4 (ending April 2022): 10,858 ha Period # 5 (ending April 2027): 13,400 ha Period #6 (ending April 2032): 16,033 ha
SFM Objective: Forest Management Planning; Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy.	

Acceptable Variance:

Operations may only exceed the target in the event of urgent forest health concerns that necessitate increased harvest rates, and after reviewing with the Public Advisory Group, and with the approval of the government.

What is this indicator and why is it important?

This indicator measures the relative level of conformance to the planned maximum harvest levels in the Graham River IRM Plan (GRIRMP) area. The estimated area planned for harvest in each time period is shown in the column entitled “Estimated IRM net area”, and the permissible maximum cumulative harvest, as measured at the end of each of the 9 time periods, is in the column “Maximum Cumulative Merch ha within blocks to be Harvested” in Table 24.

The GRIRMP area covers 198,140 hectares. As a result of the LRMP discussions approximately 50% (99,904 ha) of the plan area was incorporated into protected areas, which is intended to meet the vast majority of biodiversity needs in the drainage. The plan identifies an estimated 15,748 ha of area for logging based on broad operability mapping, over the rotation (1997-2042). This is 7.9% of the total land base in the GRIRMP area.

The GRIRMP noted that that the delineation of actual harvest areas would need more detailed work. As better information becomes available, including inventory and operability information, changes to the timber harvesting plan should be made (Lance 1997 p. 43). To account for potential changes, 25% additional area was incorporated into the 2004 SFMP maximum harvest area, which brings the plan’s total maximum harvest level to 19,685 ha (9.9% of the plan area). This leaves a minimum of approximately 90% of the land base within the plan area available for the maintenance of other forest values and not available for inclusion into cutblocks.

General consistency with the intent of the harvest schedule to restrict the total area logged still allows for timber harvesting activities to occur, while maintaining other values in the large areas not planned for harvest and supports many of the objectives associated with this special management zone.

The indicator targets in this SFMP are specific to the maximum amount of harvesting permissible, as measured at the end of the two time periods that overlap the term of this SFMP (Table 24).

Table 24: Graham River IRM Plan- Cluster Area and Timing Schedule

Definitions:							
Total Area:				**The total size of a Cluster including inoperable areas**			
Gross Contributing Area:				**The Contributing Area (base area) for FPC Biodiversity calculations**			
IRM Net Harvest Area:				**Estimated amount of Gross Operable area considered harvestable after IRM factors are considered**			
Proposed Schedule:				**General timing of harvest sequence over the course of the Plan**			
Maximum Cumulative Merch Area (ha)				**The maximum cumulative merch area (hectares) (all previous periods) allowed in cutblocks to period end (indicator)**			
Cluster #	**Resource Management Zone**	**Total Area (ha)**	**Gross Contributing Area (ha)**	**Estimated IRM Net Harvest Area (1) (ha)**	**Estimated Proportion of Cluster Proposed for Harvest**	**Initial Proposed Harvest Schedule (start-end)**	**Maximum Cumulative Merch Area (ha) within blocks to be harvested**
1	Graham-South	1,946	1,922	706	36%	June 1998 - July 1999	
17	Graham-South	627	620	294	46%	Nov. 1999 - April 2000	
2	Graham-South	2,208	2,085	312.9	14%	July 2000 - April 2002	
3	Crying Girl	2,439	2,115	620.5	25%	Nov 2002 - April 2003	
4	Graham-South	3,975	3,705	976.6	290%	July 2003 - April 2007	
Sub-total Harvest Period 1		11,195	10,447	2910		1998 - 2007	3638
5	Crying Girl	2,228	2,181	748.6	33%	April 2007 - Nov. 2008	

6a&4B	Graham-South	2,508	2,369	1078.8	35%	Nov. 2008 - Nov. 2009	
6b	Graham-South	884	775	257.5	29%	Nov. 2009 - April 2010	
6c	Graham-South	726	541	260	35%	April 2010 - April 2012	
Sub-total Harvest Period 2		6,346	5,866	2344.9		2007 - 2012	6569
7	Crying Girl	1,848	1,812	577.2	31%	April 2012 - April 2013	
8a	Crying Girl	1,904	1,638	840	44%	April 2013 - April 2014	
8b	Crying Girl	2,184	1,877	812.3	37%	April 2013 - April 2017	
Sub-total Harvest Period 3		5,936	5,327	2229.5		2012 - 2017	9355
9	Crying Girl	952	840	291	30%	April 2017 - Nov. 2017	
10	Crying Girl	966	788	317	32%	Nov. 2017 - April 2018	
11	Graham-South	1,768	1,717	594	33%	April 2018 - April 2022	
Sub-total Harvest Period 1		3,686	3,345	1202		2017 - 2022	10858
12	Graham-North	3,439	3,249	1289	37%	April 2022 - April 2024	
13	Crying Girl	2,493	2,359	745	29%	April 2024 - April 2027	
Sub-total Harvest Period 5		**5,932**	**5,608**	**2034**		**2022 - 2027**	**13400**
14	Crying Girl	2,643	2,583	1034	39%	April 2027 - April 2028	
15	Graham-North	3,258	2,666	1072	32%	April 2028 - April 2032	
Sub-total Harvest Period 6		**5,901**	**5,249**	**2106**		**2027 - 2032**	**16033**
16	Graham-North	2,108	1,917	903	42%	Apr. 2032 - April 2035	
Sub-total Harvest Period 7		2,108	1,917	903		2032 - 2035	17162
18	Graham-North	1,341	1,217	468	34%	Nov. 2035 - Nov. 2037	
19	Graham-North	3,121	2,782	1022	32%	Nov. 2037 - April 2040	

Sub-total Harvest Period 8		4,462	3,999	1490		2036 - 2040	19024
20	Crying Girl	1,317	1,188	527	40%	Nov. 2041 - April 2045	
Sub-total Harvest Period 9		1,317	1,188	527		2042 - 2045	19683
Totals (Cluster only)		46883	42946	15746			19683
D. Total Plan Area		198,140	145,053	15,746	8%		10%

Notes on Table 24:

IRM Plan areas were based on available operability data in 1997 and subject to change. Proposed Blocks are estimates at time of the GRIRMP (1997) and will be refined as a portion of the "Operable Area" as they become included in successive FOSs.

Yellow highlighted text notes approved revisions made in October 2006, and blue highlighting updates renaming of block 11058 as cluster 4B (was part of cluster 4, but area moved to cluster 4B because separate access route required).

The 2004 SFMP set the 'Maximum Cumulative Merch Area at 25% above the estimate net IRM harvest area.

Implementation and Monitoring Procedure:

Harvest areas from the approval date of the GRIM Plan onwards will be included in assessing this indicator.

Table 24 identifies the original harvest plan. Scheduling of clusters and blocks for harvesting may be modified from the original plan to address forest health, economic or logistical concerns, provided that the total area logged is consistent with the target for this indicator, and that the temporal extent of logging is consistent with indicator # 18 (i.e. No operational harvesting in more than one cluster at any one time).

Detailed aerial photo inventory, and reconnaissance work will refine proposed cutblock boundaries and road locations within the clusters, consistent with the target for this indicator. These refined boundaries will be included in FOSs. SLP fieldwork may further refine boundary locations in the field based on detailed reviews of site conditions, however all proposed changes must still fall within the indicators target range.

The total updated harvested area logged since 1997 in cutblocks within the Graham River IRM area will be reported in each Annual Report. Compliance to the indicator cumulative target will be assessed at the end of time period 5.

FOSs will schedule harvesting areas and note the maximum area that can be harvested during the term of the FOS that will demonstrate consistency with the targets. SLPs must be consistent with the FOSs. Harvest schedules must ensure operational timber harvesting does not occur in more than one cluster at a time.

Current Status:

- Period 5 began April 2nd, 2022, and will end April 1st, 2027. As of April 14th, 2025, 431 ha has been harvested during the 5-yr period, bringing the cumulative harvest area up to 3,947 ha (vs. maximum allowed of 13,400 ha.)

- Period 4 began April 2nd, 2017, and ended on April 1st, 2022. No harvesting took place during period 4, which had a maximum cumulative harvest area of 10,858 ha.
- Period 3 began April 2nd, 2012, and runs to April 1st, 2017, with a maximum cumulative harvest area target of 9,355 ha. No harvesting has taken place within the Graham during the first 2 years of Period #3. The Participants performance to date is in conformance with this indicator.
- April 1st ,2007 to March 31st ,2012 marks the duration of time period 2, which has a cumulative merchantable harvest target (i.e., including areas logged in period 1) of 6,569 ha. No harvesting has occurred in the Graham plan area since April 1st ,2007 through March 31st, 2009 (time period # 2 to date).
- March 31st, 2007 marked the completion of Harvest Period #1 for this indicator, which covered all logging in cutblocks in the GRIRMP area from June of 1998 to April 2007. The area harvested to the end of Harvest Period #1 was 3,516 ha, which is less than the Period 1 maximum allowable cumulative merchantable area of 3,638 ha.

5.21 GRAHAM CONNECTIVITY

Indicator Statement	Target Statement
Area harvested in cutblocks in the Graham River IRMP area, within the permanent alluvial and non-productive/non-commercial components of the connectivity corridors	No area harvested within cutblocks in the permanent alluvial and non-productive/non-commercial components of the Graham River IRMP connectivity corridors
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

Variances may be allowed on a site-specific basis where government approval is attained. The indicator target excludes road rights-of-way needed to cross streams.

What is this indicator and why is it important?

This indicator measures the level of harvesting in cutblocks within the two important designated long term connectivity corridors

There are two key permanent components of the connectivity corridors that are expected to remain relatively constant, and provide for the essential habitat requirements of most species in the Graham River valley (Lance, 1997):

1. **The alluvial valley floors of the Graham River and major streams which flow into the Graham River.**

The riparian corridors provide a habitat complex consisting of shelter, foraging sites and travel routes, and were identified in the Graham River IRM Plan as the most important habitats in the plan area.

The Graham River IRM Plan specifically notes that within these alluvial areas, provided that a suitable silviculture regime can be applied, some timber harvesting could potentially be beneficial in places where forest cover has been encroaching onto open ground, as open grown forage has decreased significantly over the past few decades in the plan area. Such places were also identified as priority candidates for monitoring and adaptive management (Lance, 1997).

In the event harvesting is proposed in a riparian corridor, government staff responsible for wildlife habitat will be consulted, and operations will only proceed where mutually agreed plans can be developed for these areas. Such agreements have been made previously for strip cuts in some of the blocks within the Meadow Creek drainage.

2. **The non-productive, non-commercial areas, including treeless or low productivity forested alpine areas, and meadows, swamps, and other NP areas.**

Other than the riparian habitats, the alpine habitats and non-productive wetlands have been identified as the next most important habitats to key species such as caribou within the Graham. The approximate location of these corridors is shown in Figure 9.

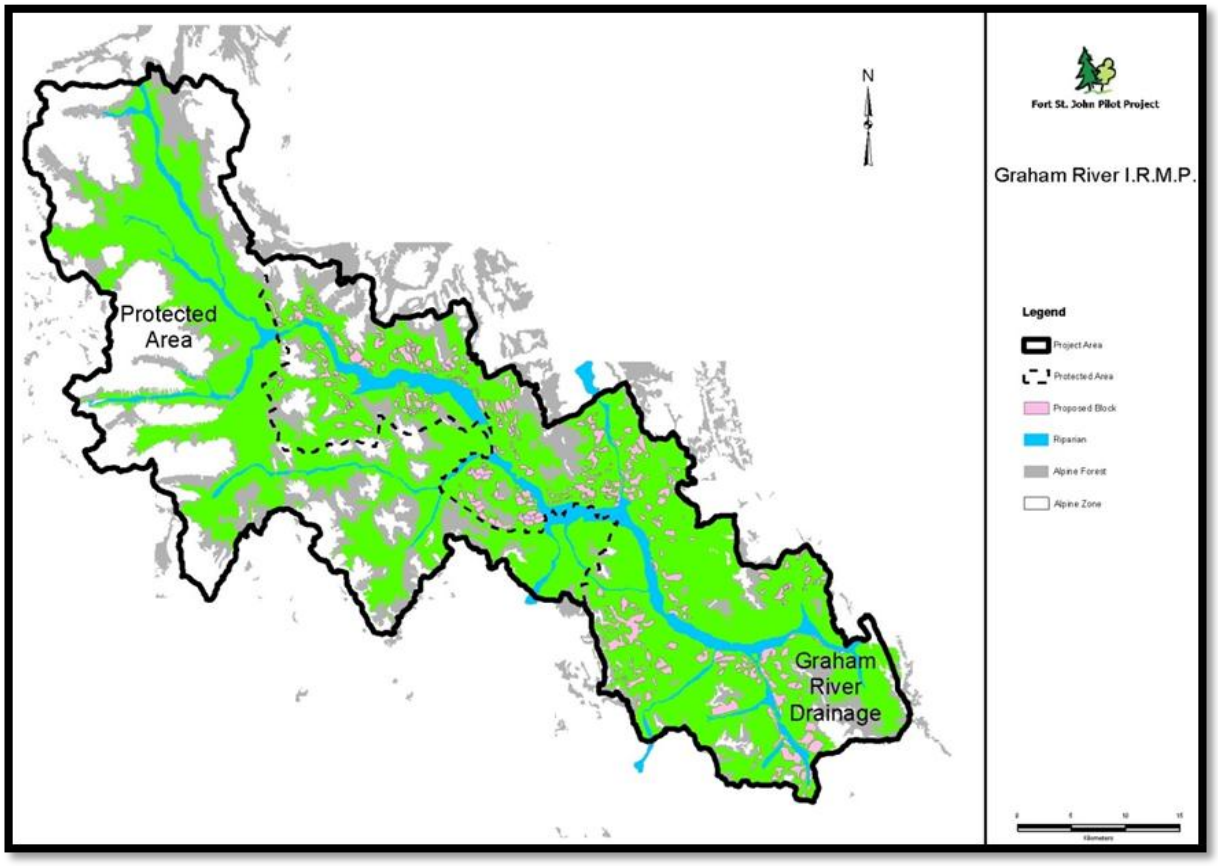


Figure 9. Corridors within the Graham River Area

The large area of inoperable timber within the Graham drainage provides additional extensive connectivity. These areas are generally of less habitat significance than the alpine and riparian areas (Lance 1997), and the location and extent may vary somewhat as inventory information is improved.

Providing for connectivity in the key habitat areas of the Graham supports ecosystem functions, and the habitat needs of a variety of local species.

Implementation and Monitoring Procedure:

During preparation of FOSs these two connectivity corridors will be identified using the digital coverage or maps. FOS block boundaries will be drawn consistent with avoiding harvesting these areas and block specific comments will be included in LRM or other tracking systems to advise forestry supervisors of the rationale for the block boundary location.

During field layout in blocks adjacent to these corridors, the mapped extent of the corridor will be established by GPS or other means, and harvesting will be excluded from this area. Forestry staff may, however, elect to include corridor areas adjacent to cutblocks as WTPs.

In the event harvesting within the corridors is proposed for habitat enhancement, and agreed to by government, SLPs will identify the specific measures to be implemented to accommodate habitat values.

GIS overlays of the digital coverage of the corridors and timber harvesting planned and completed blocks will be used to report compliance to this indicator in Annual Reports.

FOSs will demonstrate that the block design is consistent with maintaining the identified corridors. SLPs will identify the corridors and specifically exclude the areas from operational harvesting. If harvesting for habitat enhancement within the corridor was approved by the government, the SLP will identify what specific measures are to be implemented.

5.22 MKMA HARVEST

Indicator Statement	Target Statement
The number of long-term harvest plans within the MKMA completed and submitted to government	A minimum of one long-term harvest plan submitted no later than one year following government approval of a landscape unit objective under the MKMA Act, which applies to the Fort St. John TSA portion of the MKMA
SFM Objective: Forest Management Planning; Conservation of Biological Diversity.	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy.	

Acceptable Variance:

Timing of submission may be delayed no more than one additional year.

What is this indicator and why is it important?

This indicator measures progress towards planning long-term harvesting in the MKMA that will be consistent with the *MKMA Act* requirements.

Developing a long-term plan provides a useful tool for optimizing the mix of timber, recreational activities, non timber commercial activities, and the protection of wildlife habitat. Prior to proposing harvesting in a drainage in the MKMA a long-term harvest plan for that drainage will be developed consistent with applicable legal objectives and any other relevant local strategic plans (e.g. MKMA Wildlife Management Plan). The harvest plan will be submitted for review and comment to the government. Harvesting in drainages within the MKMA will not commence until this plan is completed, other than in grand parented blocks, as allowed for in the *MKMA Act*.

No new harvesting is proposed in the MKMA, other than that previously approved under grand parenting provisions of the Muskwa-Kechika Management Act and Regulation, for the duration of FOS#2.

Initial planning for development of an MKMA harvest plan commenced in 2006 and continued in 2007. An area has been selected for plan development. However, Landscape Unit Objectives must be developed for the area by the government, with input from the participants. Progress

towards the completion of this plan has been made, however the participants must wait for Landscape Unit Objectives to be approved by government before a plan can be finalized, submitted to government for review and endorsed. As a result of the lack of approval of Landscape Unit Objectives no new clustered harvest plans have been prepared for the MKMA to date.

To date, harvesting has only occurred in the MKMA on a few previously approved 'grand parented' blocks. Blocks 20015, 20016 and 20027 are grand parented blocks not yet harvested that are carried forward from these previously approved plans.

A long term "clustered harvest plan" was prepared in 1997 in the upper Graham River drainage (west of Crying Girl Prairie) within the MKMA, as part of the Graham River IRM Plan, prior to the requirements of the *MKMA Act*. No harvesting has occurred in these proposed blocks, and this area of the Graham IRM plan will be revisited and modified as needed, once government objectives for this portion of the MKMA are determined.

Implementation and Monitoring Procedure:

Does forecasting apply (y/n)? Yes

It is anticipated that implementing the indicator strategy will result in the development of a long-term harvest that will optimize the mix of timber, recreational activities, non timber commercial activities, and the protection of wildlife habitat within the MKMA.

Following the formal approval by government of landscape unit objectives related to timber harvesting, the Participants will identify one or more drainages to commence harvest planning. The Participants will, in consultation with government, review the applicability of using a sequential clustered harvesting pattern, similar to that employed in the Graham River drainage, to concentrate effects of harvesting in relatively small areas at any one time in the MKMA.A long-term harvesting plan for a specific drainage will be developed that will include the approximate location of cutblocks and roads, and identify how the approved landscape unit objective(s) will be achieved. The plan will be completed and submitted to government, consistent with the target or acceptable variance of this indicator. The harvesting plan will be consistent with approved MKMA plans prepared by Government.

Progress on the identification of landscape unit objectives by the government, and the subsequent development of harvest plans within the MKMA will be reported in Annual Reports in the year they occur.

Development of a drainage plan will assist in access control, provides some flexibility to coordinate access with other industries, and restrict the amount of harvesting disturbance at any point in time. This provides for greater proportions of the drainage to be available for wilderness recreation, guide outfitting, and other non timber uses, by providing larger areas of forested wildlife habitat availability than provided by conventional harvesting patterns. The strategy also minimizes development costs, thereby enhancing the efficiency of timber harvesting operations.

5.23 RIVER CORRIDORS

Indicator Statement	Target Statement
Percentage of harvested area in cutblocks that create openings greater than 1 hectare within 100 meters of RRZs in identified major river corridors	No more than 10% of the harvested area in cutblocks will create openings greater than 1 hectare within 100 meters of RRZs in identified major river corridors
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Riparian Management Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

10% of openings may exceed 1 hectare, but no openings greater than 2 hectares, except where required otherwise by a forest health treatment plan and reviewed with applicable First Nations.

What is this indicator and why is it important?

This indicator is intended to measure, and limit, potential interruption of riparian connectivity caused by forest harvesting in identified major river corridors 1.4.1 Description of The Landscape Units.

The land immediately adjacent to the large streams in the DFA often contains relatively higher productivity and higher value forest than non-riparian areas. Riparian corridors of the identified 'major rivers' are thought to function as important travel corridors for large animals and provide high levels of key habitat elements required by many wildlife species (e.g. potential for large cavity sites, large broadleaf trees, high densities of important shrub species). Site productivity and timber values can be high in these significant riparian corridors, particularly in mid-age stands, and the incidence of large trees often higher than surrounding upland sites. However, many stands in large river corridors are overmature due to the relatively lower fire-return interval often seen in riparian areas and can present significant challenges to forest operations (e.g. high levels of decay, waste, and breakage). The riparian corridors of the major river corridors have been identified as of very high cultural significance to the local First Nations and have been significant travel routes for generations.

This indicator will provide one measure of the implementation of the strategies designed to protect habitat elements and provide some connectivity within these corridors while allowing some timber harvesting.

During the development of SFMP #4, in response to concerns raised by local First Nations, several more stream reaches were included in the area that this indicator applies to. All FOS blocks not previously authorized and occurring within the expanded River Corridor areas will be subject to

the limitations outlined by this indicator. See below Table 25 for a list of the stream reaches to which this indicator applies. Each stream covered by the indicator is assigned a 100-metre buffer to the applicable riparian reserve zone (RRZ) that is based on inventory information, if known, or defaulted to S1 classifications if unknown. This coverage is displayed on all 1:50,000 FOS maps where the applicable stream reaches occur (Figure 10).

Table 25: River and streams to which River Corridors indicator applies

Stream Name	Riparian Class
Beatton River	S1, S2 west of Jedney creek, S3 west of unnamed creek just west of Apsassin Creek op area boundary.
Bedji Creek	S2
Blue Grave Creek	S2
Blue Grave Creek	S2
Blueberry River	S1
Buckinghorse River	S2, S3 west of junction with Grassy creek at Minaker River op area boundary
Cameron River	S1
Cautley Creek	S2
Chinchaga River	S2
Chowade River	S1
Cypress Creek	S1
Doig River	S1
Etthithun River	S2
Flick Creek	S3
Fontas River	S1, S2 east of junction with Ettithun river
Graham River	S1
Guilbault Creek	S2
Gutah Creek	S2
Halfway River	S1
Helicopter Creek	S2
Horn Creek	S2, S3
Horseshoe Creek	S2
Kathtah River	S1, S2 south of junction with Helicopter creek
Lapp Creek	S2
Milligan Creek	S2
Needham Creek	S2, S3
Needham Creek	S2, S3
Osborn River	S2

Peace River	S1
Poutang Creek	S2, S3
Ring Reid Creek	S3
Sidenius Creek	S1, S2 past junction with Gorrie creek
Sikanni Chief River	S1
Wendy Creek	S3
West Milligan Creek	S2

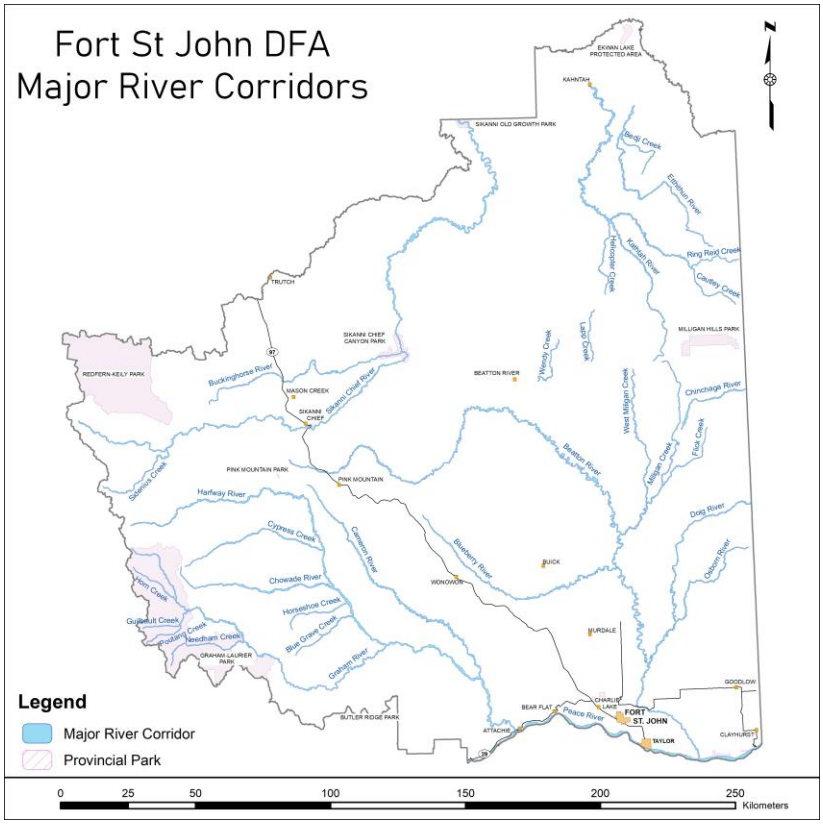


Figure 10. Map of streams and rivers where River Corridor indicator applies

Implementation and Monitoring Procedure:

It is expected that the continued implementation of this indicator will contribute to the maintenance of connectivity corridors for wildlife, support functionality of key ecosystems, and ensure provision of some key habitat elements for many wildlife species.

The 'Major River Corridor' digital coverage and FOS maps will be used by operations staff to identify where planned harvest blocks may be proposed within the corridor. Where blocks are proposed in these areas, operations staff will prescribe silviculture systems SLPs that provide for the retention of forested habitat (i.e. capable of providing cover for wildlife) through time outside of the RRZ, to minimize impact on the connectivity of forested stands.

Selection of a suitable silviculture system will be based on relative habitat values, wind firmness, timber values, and site characteristics such as slope, topography and moisture conditions. Where clearcut openings are proposed, they will not exceed one hectare in size, other than as per the acceptable variance. For the purpose of this indicator "openings" are defined as "*areas cleared of timber and without sufficient vegetation to act as wildlife cover*" (e.g. typical clearcut type openings that are not advanced enough to have been declared as well-growing), with less than half of the total area of the cutblock within one tree-height from the base of a tree or group of trees. Roads or trails are NOT included in the harvested area determination for the purposes of this indicator, nor are crossing sites. Crossing sites of the rivers to which this indicator applies are relatively infrequent.

The acceptable variance to the indicator target is intended to address instances where it may occasionally be logical to increase block sizes and allow boundaries to follow natural features (e.g. slope breaks or timber type changes) or where more extensive harvesting is identified as being required to address forest health issues. Any proposed variances to the target will be reviewed with applicable First Nations.

Implementation of the silviculture system will be assessed during inspections of field layout, harvesting, and silviculture operations.

In the event harvesting in one of the above river corridors is required to salvage damaged timber, or otherwise required to address forest health concerns the Participants will note the rationale for implementing the acceptable variance in the SLP or another plan and will be reviewed with applicable First Nations.

Field inspections of operational activities will ensure that the prescribed silviculture systems prescribed SLPs are implemented to achieve the indicator's targets.

Conformance to this indicator will be determined by overlaying the digital corridor coverage over areas harvested during an annual reporting period. The associated silviculture system employed on those harvested areas within the coverage area will be identified. Where clearcut type openings occur, the number of openings one hectare or less, and the number greater than one hectare in size (excluding areas identified for forest health or salvage harvesting) will be recorded and used to calculate conformance to the indicator target.

5.24 RIPARIAN RESERVES

Indicator Statement	Target Statement
The number of non-compliances to riparian reserve zone standards	No non-compliances to riparian reserve zone standards
SFM Objective: Forest Health and Productivity; Conservation of Biological Diversity; Protection and Maintenance of Water Resources	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Riparian Management Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy. For the purposes of Section 35(5), Section 28(1) (b)(i)(A) of the FSJPPR may be affected by the application of this Riparian Management Landscape Level Strategy, specifically the acceptable variance for this indicator.	

Acceptable Variance:

A variance to the riparian reserve zone requirements, where approved by the District Manager, will be permitted for site-specific issues as identified in an SLP. A rationale prepared by a Qualified Registered Professional must be completed indicating the reasons, and what measures will be implemented to ensure disturbance to the riparian reserve will be limited to the minimum necessary to address the site-specific issue. The rationale must be documented and retained by the Participant. The situations where this variance will be applied include felling trees that are a safety hazard, creating a corridor for full suspension yarding and carrying out a forest health sanitation treatment. Where variances are required, BMPs will be included in rationale to minimize impact.

What is this indicator and why is it important?

Riparian areas occur adjacent to wetlands or bodies of water such as rivers, streams, or lakes, and include stream bank and flood plain areas. On larger streams particularly, riparian areas often provide productive, structurally diverse habitats. In addition to providing ready access to water, these areas also support important habitat features such as coarse woody debris, cavity sites, shrubs and broadleaf trees, which have been identified as key habitat elements necessary to support species richness.

Riparian reserve zones (RRZ's) are specific areas on larger fish bearing streams, and some wetlands (W1) and lakes (L1) in which harvesting is not normally permitted, in order to protect significant riparian and aquatic habitats. Maintaining RRZ's provides many of the habitat elements needed to support a diverse species mix across the landscape.

Minimum RRZ's widths are identified in Schedule 'D' of the *FSJPPR* and relate to activities carried out under the pilot regulation by the Participants, excluding road rights of way necessary to cross streams. An indication of the success in protecting riparian areas and the associated habitat elements is the number of non-compliances to the Schedule 'D' requirements.

The variance provides that prescribing foresters may vary the reserve requirements under certain circumstances and includes the requirement to get District Manager approval of the site-specific variance in those circumstances.

Implementation and Monitoring Procedure:

By following the indicator strategy, it is anticipated that healthy ecosystems with a diversity and abundance of native species and habitats will be maintained. Implementing the strategy will result in properly functioning riparian systems leading to the conservation of fish habitat and maintenance of water quality. It is anticipated that the amount of in-block retention will trend towards the target levels over time. This will result in harvested areas with riparian habitat attributes that will help to sustain biological and ecological processes.

All streams, wetlands, and lakes in or immediately adjacent to a planned harvest area will be classified and mapped in the field prior to the commencement of operations. Riparian Reserve Zones (RRZ) that meet or exceed the RRZ widths noted in Schedule D of the *FSJPPR* will be located and clearly marked in the field. Information on Riparian Classification will be documented as per the Participant's EMS or FMS (e.g., SLPs, checklists, etc.)

Locations of riparian reserve zones, and any site-specific protection measures relating to the RRZs, will be identified during preworks completed prior to harvesting, road construction, or silviculture activities.

Current practice when establishing reserve boundaries in the field on S1, S2, and S3 streams is to utilize natural topographic breaks and timber type boundaries that result in irregular shaped edges. In practice reserve widths are normally wider than the minimum but vary significantly in distance from the stream along their length, based on the natural breaks that are typically used for the boundary. These natural boundaries are usually inherently more windfirm than fixed width RRZ's, and easier to implement, so this practice is the preferred strategy for delineating RRZ's in the field. Other measures such as feathering edges may also be considered, depending on their potential to be effective for the given site conditions, as well as their economic feasibility.

The location, classification and, where applicable, RRZ requirements of waterbodies will be included in SLPs and/or operational maps used for timber harvesting, road construction and silviculture activities.

Field foresters will identify site-specific requirements for the protection of reserve zones, and management practices will be included in SLPs.

Preworks completed prior to harvesting, road construction, or silviculture activities will review the size and location of RRZs, and any site-specific protection measures prescribed.

Inspections completed on field layout activities will include some review of boundary adherence to riparian reserve zones. Operations supervisors completing inspections of harvesting, road construction and silviculture activities will identify and record any transgressions into the RRZ,

which will be documented in tracking systems (e.g., Incident Tracking System), with clear wording identifying it as a compliance issue regarding riparian reserves. Non-compliances will be reported promptly to the appropriate government officials. Annual reports will summarize the number of compliance issues identified, specifically identifying any incidents involving RRZ's.

5.25 VALUE AND TOTAL NUMBER OF CONTRACTS AWARDED TO FIRST NATIONS

Indicator Statement	Target Statement
Value and total number of contracts awarded annually to First Nations	Report the annual total value and number of contracts awarded to companies or groups owned or operated by First Nations
SFM Objective: Recognize and Respect Indigenous People's Rights	
Linkage to *FSJPPR*: None	

Acceptable Variance:

This is a reporting indicator, so no variance is required.

What is this indicator and why is it important?

This indicator measures the value and total number of contracts awarded annually to First Nations, either to companies or groups owned, operated, or sponsored by First Nations.

Value may be expressed in monetary terms, or, alternatively, in terms of cubic metres logged, number of people employed etc. This indicator provides evidence of efforts to promote the meaningful participation by First Nations in the forest industry within the DFA.

Implementation and Monitoring Procedure:

It is anticipated that implementing the indicator strategy will result in a strengthening of local First Nations participation in the forest economy of the DFA.

Some contracts may be direct awarded, while others are available for First Nations to submit competitive bids. First Nations companies or groups may also bid on BCTS contracts or timber sales. For the purposes of this indicator, BCTS Timber Sales licenses are considered as the equivalent of a contract.

An annual review will determine the number of contracts and values (actual or estimated value expressed either in terms of monetary worth or in terms of goods or services provided or produced) of forestry work directly awarded to, or competitively won, by known companies or groups owned, operated or sponsored by First Nations.

5.26 PERMANENT ACCESS STRUCTURES

Indicator Statement	Target Statement
Percentage of the total area in cutblocks occupied by permanent access structures in which harvesting was completed	A maximum of 5% of the total area in cutblocks occupied by permanent access structures in which harvesting was completed, as determined on a 3-year rolling average
SFM Objective: Forest Management Planning; Forest Health and Productivity	
Linkage to *FSJPPR*: For the purposes of Section 35(5) of the FSJPPR, this indicator statement, target statement and acceptable variance will replace Section 30(1) of the FSJPPR. For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Road Access Management Landscape Level Strategy.	

Acceptable Variance:

None.

What is this indicator and why is it important?

Permanent access structures (PAS) include roads, landings, trails, borrow pits, quarry or other similar structure in a cutblock that are developed or used for timber harvesting or other forest management activities, and whose use and/or construction material precludes the production of a commercial crop of trees. This indicator measures the proportion of area that is removed for long periods of time from the productive forest land base within a harvested cutblock boundary for forest industry purposes. Limiting the extent of permanent access structures supports the maintenance of a natural range of variability in ecosystem function, composition, and structure on the DFA.

The percentage of a block's productive area that is occupied by PAS should be dependent on the block size, shape, geography, logging method, season of logging and location of other resources or structures. Small, steep, gullied, irregular shaped blocks, or blocks with pipelines or well sites, require relatively more roading to safely and efficiently harvest timber than large, flat blocks with no streams. Managing PAS at a broader DFA level and using a three-year rolling average allows the flexibility to address variable cutblock conditions and variations in annual harvesting levels that might distort short term results.

Current Status:

The Participants proposed a change to the formula for this indicator during the SFMP#4 rewrite, to address the challenges in meeting the indicator target due to the shift towards designing WTP corridors that connect to adjacent timber (as often requested by First Nations). This has the consequence of increasing the amount of designated external reserve area and increasing the PAS percentage, without any change in the amount of road. The change allows inclusion of external WTP area in the denominator of the PAS formula, which gives a more accurate and

proportional measure of PAS. The current 3-year average area in permanent access structures ending March 31, 2024, is presented in the following Table 26. The target for this period is a maximum of 5% of total area in PAS. All participants' permanent access structure values, according to the SFMP#3 formula, were consistent with the targets during the reporting period – Canfor 4.6%, and BCTS 3.7% and LP 4.8%.

Table 26: 2022-2024 PAS percentages for Participants

Managing Participant	Annual Reporting Period (Ending Mar. 31st of Year Indicated)	PAS Area (ha)	Total Area (ha)	PAS of Total Area (%)
Canfor	2022	103.2	2,498.6	4.1
Canfor	2023	90.4	2,185.8	4.8
Canfor	2024	84.8	1639.2	5.2
Canfor Total:		**276.6**	**6,000.7**	**4.6**
LP	2022	43.7	900	4.85
LP	2023	0.0	0.0	0.0
LP	2024	4.5	104.2	4.52
LP Total:		**48.2**	**1,004.2**	**4.8**
BCTS	2022	15.0	397.9	3.8
BCTS	2023	7.0	184.0	3.8
BCTS	2024	0.94	30.2	3.1
BCTS Total:		**22.9**	**612.1**	**3.7**
Combined Participant Totals:		**347.7**	**7,617.0**	**4.6**

Implementation and Monitoring Procedure:

The approval of this indicator in the 2004 SFMP effectively replaced the *FSJPPR* regulatory Performance Requirement of 7% per cutblock maximum PAS, with the target: *A maximum of 5% of the total area in cutblocks occupied by permanent access structures in which harvesting was completed, as determined on a 3-year rolling average.*

Foresters preparing SLPs will clearly differentiate in map and GIS labeling PAS that will be used for forestry operations from those structures which cannot be used (e.g., pipelines, well sites, etc.). Prescribing foresters who are proposing road developments within cutblocks in excess of 5% need to be cognizant of the relative status of the rolling average percentage for the cutblocks and modify plans accordingly if needed to meet the indicator target.

Assessment of the compliance to the indicator's target is determined on a three-year rolling average basis. Developments created by other industries (e.g., Oil and gas) are not included in the PAS summary if they are not used for forestry harvesting operations within cutblocks.

Areas designated as PAS within each cutblock that had harvesting completed during the three most recent Annual Reporting periods will be summarized from the Participants database information The 'Total' cutblock area for the same population of blocks will be determined from GIS information as the 'Gross' block area. The total amount of applicable PAS within blocks harvested divided by the Total cutblock area provides the annual PAS percentage.

For each Managing Participant:

(3-yr PAS area - 3-yr Total Area) x 100 = 3-yr average PAS %

Where:

'Total Area' is Gross Area and,

'PAS area' is the area designated as Permanent Access Structures within cutblock areas

WTPs will not be added to blocks for the sole purpose of meeting the PAS target and will be located with biodiversity and wildlife habitat objectives in mind. Participants will provide information regarding the purpose of WTPs when requested by First Nations or stakeholders.

Operational plans prepared by Participant staff will continue to prescribe the most appropriate methods to minimize losses to the forest land base. Staff will be responsible for ensuring that area occupied by PAS not be disproportionate to the planned harvest area.

5.27 FOREST HEALTH IN SILVICULTURE OBLIGATION AREAS

Indicator Statement	Target Statement
Percentage of silviculture obligation areas with significant detected forest health damaging agents which have treatment plans developed for them	100% of silviculture obligation areas with significant detected forest health damaging agents will have treatment plans developed for them and initiated within 1 year of detection
SFM Objective: Forest Health and Productivity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Forest Health Landscape Level Strategy.	

Acceptable Variance:

A variance of 1 additional year for completing the treatment plan is permissible to provide time for additional information collection and consultation with forest health specialists.

What is this indicator and why is it important?

This indicator describes the effectiveness of the forest health management strategy in addressing identified forest health problems within plantations.

Forest health issues that have been identified to date as impacting reforested areas in the DFA are numerous. Most significant have been several abiotic factors (frost damage, winter desiccation, fire, snow press, and flooding). Numerous insects including spruce gall aphids, spruce

leader weevil, Northern pitch twig moth, root collar weevil, and eastern Spruce Budworm are known to occur, but have had relatively minor isolated impacts on conifer plantations, while defoliating (tent caterpillar and others) and other insects (*Eriophyid* mites) may similarly impact deciduous plantations. Foliar diseases have been noted in deciduous (*Venturia* sp.) and conifer areas but impacts on local plantations to date are thought to be relatively low. Gall rusts in pine plantations have the potential to have significant impacts on plantation success on some sites.

Identifying and addressing forest health problems in plantations ensures forest health issues which can affect the forest throughout its life are addressed and if practicable, corrected at an early stage. This ensures reforestation objectives, and ultimately, timber production objectives can be achieved.

Implementation and Monitoring Procedure:

It is anticipated that implementing the indicator strategy will result in action plans designed to limit losses to damaging forest health agents thereby improving the likelihood of achieving regen delay milestones, or well growing requirements within target time frames. This will in turn reduce timber losses and downward pressure on the timber supply.

The above referenced damaging agents may occur regularly at low levels across the DFA. For the purposes of this indicator a significant forest health damaging agent is one that has caused, or is likely to cause, the stocking level of preferred and acceptable tree species within a cutblock or standards unit to fall below minimum stocking levels as per Appendix 9.

SLPs will identify significant pre-existing forest health concerns which may persist and impact future reforestation success (e.g., gall rusts spruce budworm etc.). Reforestation plans will consider issues identified in SLPs in selecting reforestation stocking standards and site preparation treatments to apply to a cutblock.

Within their silviculture obligation areas, the Participants will detect and monitor significant forest health agents in a timely manner, and where potential impacts are significant, implement cost effective treatment controls where practicable.

Silviculture surveyors will be required to be competent in the identification of forest health agents that impact plantations. Surveys will be the primary source for identifying new forest health issues. Treatment prescriptions will be developed when surveys indicate there may be a risk to the success of the plantation. The most common treatment plans are likely to include replanting areas, planting resistant tree species, physically removing infected materials, herbicide treatment to remove cover for browsing animals, or no treatment, although other treatment options may be considered depending on circumstances.

Forest health experts within the provincial or federal government, or elsewhere, will be consulted in the event the Participants lack the expertise to evaluate either the impact of the forest health agent, or the potential effectiveness of a proposed treatment plan.

The Participants' silviculture staff will review surveys and retain a record of all significant forest health damaging agents detected in the survey or otherwise, as well as the date they were detected in the silviculture obligation areas.

SLPs will identify significant pre-harvest forest health concerns that may affect reforested areas, and potential treatment options. Treatment plans will be developed by silviculture staff within

one year of identification. The treatment plan will be documented, and the implementation of the treatment plan will be tracked.

Information on the identification of forest health damaging agents in silviculture obligation areas, and the development and implementation of treatment plans will be reported out in each Annual Report.

5.28 SALVAGE AND SANITATION HARVEST

Indicator Statement	Target Statement
The percentage of AAC/volume allocation requested for harvest authorization between April 1st and March 31st that focuses on salvage and sanitation harvest	Report annually the percentage of AAC/Volume allocation requested for harvest authorization between April 1st and March 31st that focuses on salvage and sanitation harvest
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: None	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator measures the success of a timber salvage strategy designed to prioritize salvage harvesting across the DFA above green harvest, wherever practicable. Salvage harvest will be defined as harvesting in stands that have greater than 30% of the gross volume dead or dying. While 30% is the minimum threshold for salvage harvest, blocks with the highest amount of dead or dying volume will be prioritized. In the situation of sanitation harvest, where a stand is at imminent risk of a serious forest health issue, lower percentages will be considered and reviewed with applicable First Nation and government.

Studies have suggested that some species may be heavily dependent on fire killed forests and occur at much reduced numbers after forest salvage operations (Delong, 2002). Black-backed and three toed woodpeckers may decrease in abundance due to a lack of fire killed stands (Huuto 1995), and some fungi and insects are fire obligates, or heavily reliant on fire (Stepnisky, unpublished data). To provide unique habitats not available in young managed stands (e.g., burnt snags), and maintain a proportion of forests that follow natural successional pathways, it is ecologically desirable to have some proportion of natural disturbances, including those in otherwise merchantable stands, left in an unmanaged state on the landscape. Allowing for some unmanaged damaged areas contributes to maintenance of a natural range of variability in ecosystem function, composition and structure. It is important to note that since this indicator was first written, several agreements have been signed that have had large impacts to the land base and effectively increased the amount of area where commercial forest harvesting is

prohibited. It is for this reason that the indicator was changed in the SFMP#4 update to remove the proportional harvesting across LRMP management intensity classes.

It is still necessary, however, to protect timber resources from various abiotic (e.g., fire, wind and flooding) and biotic (e.g. pests and diseases) damaging agents. Salvaging some timber values following damaging events, including fire, supports the basic assumptions of the TSR, and addresses forest health concerns and ensures that salvage of these stands is prioritized above green harvest wherever practicable to ensure the long-term viability of a forest industry and address First Nation's concerns. The DFA's forest composition includes large areas of non-merchantable stands, due to low productivity. Natural disturbances, particularly fires, are largely random events which may or may not occur in merchantable stands, so the degree to which areas follow natural disturbance pathways will be influenced significantly by the types of stands that burn, therefore absolute measures of salvage levels is not a reliable indicator.

Current Status:

This indicator was updated during the SFMP #4 update process in 2024-2025. The update removed references to the LRMP management intensity classes. This was deemed an important shift by the SFMP #4 Planning Team as significant changes have taken place regarding land use planning since the LRMP was finalized, effectively making the management intensity classes irrelevant and out of date. The status of this indicator will be reported yearly in the Annual Report.

Implementation and Monitoring Procedure:

Following a natural disturbance such as fire or spruce beetle, the Participants will assess the viability of salvage harvesting which will include an offer to review tentative plans with the applicable First Nations. If there is potential, the Participants will initiate a FOS amendment if necessary to bring the salvage blocks into the FOS and generally prioritize development and permitting of the salvage blocks to ensure that salvage harvesting can be initiated in a timely manner and maximized in order to minimize green harvest during the period where salvage harvesting is viable.

On a yearly basis the Participants will report the proportion of their AAC or allocated volume that is salvage. In addition, a description of the magnitude of potential available salvage from that year will be provided to provide context. Commentary on challenges to initiating salvage harvest will also be provided.

The strategy and implementation schedule will be used to determine if FOSs will be amended to propose salvage of merchantable burnt areas, and in the development of SLPs.

This strategy provides for some burnt areas with merchantable sized timber to follow natural successional pathways by not being subject to salvage operations, while allowing for the salvage of some timber values. This supports species that rely heavily on such features as burnt snags and provides significant sources for snag and CWD habitat elements important to ecosystem function.

5.29 NOXIOUS WEED AND INVASIVE PLANT CONTENT

Indicator Statement	Target Statement
The percentage of noxious weeds and known invasive plant species of concern in the seed mix analyses	Seed lots utilized by the Participants will meet standards established by the Canadian Seed Growers Association regarding allowable content of seeds of noxious weeds and invasive plants as identified in the most current Provincial and Federal Regulations, and Regional District guideline
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Range Management Landscape Level Strategy.	

Acceptable Variance:

The Canadian Seed Growers Association certification process tests the weed content of the seed. If the amount of weed seed in the sample is below the allowable amount, the seed lot is considered to be “weed free”.

What is this indicator and why is it important?

The primary objective of seeding is to control erosion to protect water resources, with a secondary objective to discourage the establishment of invasive weeds and in some cases provide forage opportunities for cattle and/or wildlife. There are 10 categories of seed certification according to the Canada Seeds Regulations and referenced in the British Columbia Rangeland Seeding Manual. All of them list a specific amount of allowable "weed" content, weed meaning any seed that is not the designated seed (so not necessarily invasive). It should be noted that both "Canada Certified" seed categories also permit inclusion of a small amount of identified primary and secondary noxious weeds. A seed lot’s certification is not based on the number of weeds it has, but on its vigour and purity. Therefore, a "common" seed certification could have a lower percentage of weeds and noxious species than a "pedigreed" or "certified" seed certification. The intent here is to use seed lots appropriate to the site conditions and management intent with as little weed seed content possible.

Natural species diversity can be negatively impacted by the aggressive germination and growth of noxious or invasive weeds. These weeds may occupy sites that might normally be occupied by naturally occurring vegetation such as herbs or shrubs and may negatively impact natural or seeded domestic range and wildlife forage resources.

Following road construction, rights-of-way are grass seeded to minimize erosion and provide forage. This is the most significant manageable potential source of weed introduction to forested landscapes. By using site appropriate seed mixes certified to be free of specified weed species,

complete with Canada Certified seed analyses, the Participants forestry operations can minimize the likelihood of accidentally introducing invasive plants and noxious weeds.

Implementation and Monitoring Procedure:

It is anticipated that implementing the indicator strategy will reduce the potential for the introduction of invasive weed species through the road reclamation activities of the Participants. This will contribute to the maintenance of healthy ecosystems.

For the purposes of this indicator, the Participants will refer to the most current versions of the following documents:

1) The Canada Weed Seeds Order
2) The List of Regulated Invasive Plants in BC
3) The Peace River Regional District's Invasive Plant Program Strategic Plan and Profile

Within those documents the following categories are applicable to the implementation of this indicator:

- Prohibited noxious and primary noxious weeds as identified in the Canada Weed Seed Order
- Provincially noxious and regionally noxious species on the List of Regulated Invasive Plants in BC
- Regional Early Detection and Rapid Response as indicated in the Regional District Strategic Plan
- Category A and Category B species as indicated in the Regional District Strategic Plan

The Licensee Participants will review Canadian seed analysis certificates prior to purchasing seed lots to ensure there are no species in any of the above categories present. The seed analysis certificates will be reviewed with interested First Nations and feedback considered when purchasing seeds. The licensee Participants will retain the Canadian seed analysis certificates after purchasing seed, to verify that species in the above categories are not present.

BCTS will request and retain seed tags from TSL holders and review the associated seed analysis certificates to determine conformance to the indicator target.

Staff responsible for grass seeding will refer to the federal, provincial and regional noxious weed and invasive plant lists in the above noted documents to determine if changes to the lists have occurred in the last year. The staff will then confirm from the certificate that the seed is free of species in the above categories and file the seed analysis certificate for future reference. In the rare event that urgent circumstances require the use of seed that does not meet the target, the supervisor will report the variance to the person responsible for the SFMP annual report. For these variance areas the supervisor will schedule action items in the incident tracking system to inspect the seeded areas within one year. In the event any weeds of concern are noted during the inspection, the supervisor will consult with government agencies on a site-specific basis on how to address the weed occurrence.

In situations where certified "weed free" seed is not available; the Participants will consider implementing alternative erosion control measures where practicable and appropriate.

This indicator will be monitored by an annual review of the seed analysis certificates and a review of the incident tracking system. Inspection and actions to address variances will be recorded and clearly identified and tracked in the Participants' incident tracking system by the responsible supervisor. Variances and follow-up inspections and actions will be noted in the Annual Report.

This indicator will assist in minimizing the spread of noxious weeds, which will enhance the establishment of plant species that meet other objectives, such as erosion control and foraging opportunities. Controlling noxious weeds has positive impacts on other non-timber resource values (e.g., Range).

5.30 PREVENTING THE SPREAD OF INVASIVE PLANTS

Indicator Statement	Target Statement
The percentage of SLPs prepared annually for 'effected' cutblocks that incorporate one or more best practices for preventing the spread of invasive plants during forest management activities	100% of SLPs prepared annually for 'effected' cutblocks will incorporate one or more best practices for preventing the spread of invasive plants during forest management activities
SFM Objective: Forest Health and Productivity; Conservation of Biological Diversity	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator measures the proportion of Site Level Plans in effected blocks that include one or more best practices for preventing the spread of invasive plants during forest management activities. 'Effected blocks' refers to those where known invasive plant sites are within, or adjacent to (within 500 m), the cutblock boundary. Managing Participants will use provincial and regional invasive alien plant site spatial data to determine if a block is 'effected'.

Invasive plant species can alter habitat and disrupt essential ecosystem functions. They can displace native vegetation through competition for water, nutrients, and space. Once established they can reduce soil productivity, impact water quality and quantity, degrade range resources and wildlife habitat, threaten biodiversity, and introduce disease.

This indicator will assist in minimizing the spread of noxious weeds, which will enhance the establishment of plant species that meet other objectives, such as erosion control and foraging opportunities. Controlling noxious weeds has positive impacts on other non-timber resource values (e.g., Range).

Implementation and Monitoring Procedure

At the FOS planning level, Managing Participants will use provincial and regional invasive alien plant site spatial data to determine if a block is 'effected'. SLPs and operational plan maps for effected blocks will include information necessary to implement any best practices for preventing the spread of invasive plants during forest management activities.

The Participants will implement the following measures to prevent the introduction and spread of noxious weeds and invasive plants:

1) Complete employee training and improve contractor awareness about noxious weeds and invasive plants.
2) Report any invasive plants or noxious weeds found during forest operations.

Where existing sites are found within, or adjacent to, cutblocks, one or more of the following activities will be implemented on that block:

- Avoid disturbing the infested site where feasible.
- Complete operations when there is a decent snowpack where feasible.
- Where known sites couldn't be avoided during forestry activities, visually inspect workers and equipment and remove any plant parts and mud prior to leaving the block and document this occurrence.
- Minimize unnecessary soil disturbance and revegetate road surfaces as quickly as possible.
- Work in non-infested sites before moving to infested sites.
- Avoid infested sites for staging, parking, and log sorting, both in the bush and storage yards.
- Clean equipment before moving to a new work site or region and document this occurrence.
- Inspect and ensure fill and erosion-control materials are free of invasive plants before transport and use.
- Develop treatment plans.
- Or other BMPs as identified by the Invasive Species Council of BC.

Current Status

This indicator was updated in October 2024 as part of the SFMP #4 re-write. With the approval of SFMP #4, SLPs completed within the annual reporting period (April 1- March 31) will now list (by managing Participant) how many SLPs should have had BMPs applied, and how many had BMPs applied. The report will be generated using block activity tracking in each Participant's LRM database. Additionally, the occurrences of cleaning equipment prior to moving, to prevent spread of invasive plants, will be summarized in Annual Reports and available for review.

5.31 SPECIES COMPOSITION

Indicator Statement	Target Statement
Relative change in plantation composition versus harvest composition for spruce and pine	The relative proportion of spruce and pine planted annually will equal the proportions harvested annually (excluding fill planting)
SFM Objective: Forest Management Planning; Conservation of Biological Diversity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.	

Acceptable Variance:

An annual variance of +/- 20% absolute difference between the planted Pine/Spruce percentages and cruise Pine/Spruce percentage estimates is allowed to reflect potential annual harvest composition fluctuations, site treatment impacts, annual seedling delivery fluctuations (i.e. nursery production shortfalls/overruns), and to allow site-level variance decisions to be signed off by Professional Foresters (e.g. to address potential forest health concerns such as areas highly susceptible to rusts, insects, etc.)

What is this indicator and why is it important?

This indicator illustrates the relative proportion of spruce and pine being planted annually, compared to the relative cruise volumes of spruce and pine from the same areas. It provides an approximation of the extent of change of species composition as a result of forest management activities on coniferous licenses. Spruce and pine make up in excess of 95% of the coniferous species harvested in the DFA, and 99% of the species planted.

Maintaining relatively consistent proportions of spruce and pine between pre-harvest and post-harvest stands helps to maintain a natural range of diversity and pattern of plant communities and ecosystems. Comparing the percentage planted to the cruise volume percentage of each species on the same areas will provide an indication of whether similar proportions of spruce and pine are being maintained on the land base.

This indicator applies to coniferous licensees and BCTS only and does not apply to the replanting or fill planting of areas previously planted.

Implementation and Monitoring Procedure:

Projections for seedling orders are done one or two years prior to planting, based on information in SLPs, when available, and/or best estimates of harvesting schedules. Continued implementation of this indicator will help to maintain a natural range of diversity and pattern of plant communities and ecosystems across the DFA.

Currently Participants plant nearly 100% of harvested area that will be managed as coniferous reforestation, with spruce or pine seedlings. Planting occurs as soon as practical following harvesting.

SLPs identify proposed silvicultural treatment regimes prior to harvesting, based on stand and site characteristics, including species selection options. Silviculture supervisors place seedling orders by species using information provided in the SLPs, cruise data, and projected harvest plans. Preharvest species composition, as well as species site suitability, are two of the major factors used to determine what species will be planted on a harvested block.

Plans for planting programs are reviewed and updated periodically, based on any changes that may have occurred to harvest plans, site preparation plans, or in inventory updates from nurseries on the number of projected deliverable seedlings from seedling orders. Block cruise compilation information is stored digitally in the Participants' databases, and to provides the baseline for spruce and pine volumes on planted areas. Detailed records of planting activity, including the number of trees planted by species, are completed following each summer field season. Cruise compilations provide information on the net volume by species for each of the planted coniferous blocks. Records will be reviewed, and results summarized for the April 1-March 31 fiscal year.

A report from the Participants' silviculture information systems will be produced annually for all blocks planted in the last year. The report will compare the percentage of spruce planted (total spruce planted divided by the total spruce and pine planted) to the percentage of spruce cruise volume (total spruce volume divided by the total pine and spruce cruise volume) in the blocks planted. Similarly, the percentage of the total pine planted will be compared to the overall percentage of pine cruise volume. The target is met where the absolute difference between the planted pine/spruce percentages and cruise pine/spruce percentage estimates is less than 20%.

5.32 REFORESTATION ASSESSMENT

Indicator Statement	Target Statement
Predicted Merchantable Volume (PMV m^3) coniferous and separate deciduous surveyed areas	PMV will meet or exceed the Target Merchantable Volume (TMV m^3). The TMV is set at 95% of the Maximum Predicted Merchantable Volume attainable on both coniferous and deciduous areas
SFM Objective: Forest Management Planning; Forest Health and Productivity; Climate Smart Forestry; Fire Resilience and Awareness; Forestry Research, Science, and Technology	
Linkage to *FSJPPR*: For the purposes of Section 35(5) of the FSJPPR this indicator statement, target statement and acceptable variance will be used in replacement of the portions of affected Section 32 of the FSJPPR through the application of the landscape level strategy for coniferous and deciduous areas logged after November 15, 2001. This will also apply to coniferous and deciduous area in cutblocks with commencement dates before November 15, 2001, if the Participant currently carries reforestation liability and has submitted a statement to the District Manager that the cutblock(s) will be subject to the SFMP under Section 42 of the FSJPPR (see section 8.1.3). For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.	

Acceptable Variance:

A variance of 5% below the Target Merchantable Volume will be acceptable (i.e. 90.25% of the Maximum Predicted Merchantable Volume). The variance accounts for the complexity of ecosystems and silviculture regimes combined with the long timeframes and variety of influences on reforestation outcomes.

If the conifer target population's Predicted Merchantable Volume is less than the Target Merchantable Volume, individual cutblocks will be required to meet a minimum cutblock Mean Stocked Quadrant (MSQ) value of 2.0 well growing crop trees, for a target stocking of 1200 stems/ha or greater. For a target stocking of 1000 stems/ha and 800 stems/ha the minimum cutblock MSQ values will be 1.7 and 1.3 respectively. If the cutblock has areas of different target stocking the MSQ will be prorated by area.

If the deciduous target population's Predicted Merchantable Volume is less than the Target Merchantable Volume, individual cutblocks will be required to meet a minimum cutblock Mean Stocked Quadrant (MSQ) value of 3.0 well growing crop trees, for a minimum cutblock value of 1200 stems/ha or greater.

Damage events beyond the control or influence of the Participants (e.g., wildfire) will result in the block being deleted from the assessment population and assessed as noted in the Strategy and Implementation section.

Situations may arise in which despite due diligence in prescribing and implementing the silviculture regimes the Participant has not met the target. Where further treatment options are limited the District Manager may waive a requirement for further treatment.

What is this indicator and why is it important?

This indicator measures the ultimate success fifteen years after harvest of reforestation regimes in establishing well growing forests that meet long term TSA level timber supply objectives, while providing cutblock level flexibility to address other considerations. The indicator assesses two separate populations - one for pure coniferous strata, and the other for pure deciduous strata. These deciduous and conifer strata may be in separate blocks or be in separate strata in the same block (e.g., unmixing a mixedwood).

MPMV is the **Maximum Predicted Merchantable Volume** from models that a population of harvested sites can produce under ideal conditions. The **Target Merchantable Volume (TMV)** percentages are a relative volume that the silviculture regime on those sites might be reasonably expected to achieve, given normal constraints. The **Predicted Merchantable Volume (PMV)** is the area weighted average projected volume that survey results indicate will be achieved as a result of the silviculture activities on those blocks. A detailed description of the landscape level assessment system that will be implemented is included in the 'Strategy and Implementation Section' below. Ensuring that harvested stands are replaced with a well growing plantation is an indication that the harvested area has recovered from a disturbance and maintained its resiliency and productive capacity. Reforesting harvested areas also contributes to carbon uptake and storage objectives.

The assessment on a landscape level allows reforestation regimes to be varied at the cutblock level to accommodate other resource values, and to allocate reforestation funds to achieve maximum effectiveness.

Implementation and Monitoring Procedure:

A deciduous volume compiler has been developed and approved for use in assessing reforestation performance on areas to be managed to produce deciduous forests. The MSQ values for deciduous were developed in conjunction with development of a deciduous volume compiler. The TMV target for deciduous blocks was reviewed with appropriate government staff in conjunction with development of the deciduous compiler and MSQ values. The deciduous compiler will be used to assess reforestation performance on deciduous stands harvested under this SFMP.

Future yields are calculated based on a TASS model. Inputs of stocking, species group, effective age, harvest age, and site index are used to calculate a theoretical yield. The target (**TMV**) is set at 95 % (conifer) or 95% (deciduous) of the theoretical maximum predicted merchantable volume (**MPMV**) and the actual predicted merchantable volume (**PMV**) is calculated using field data. This predicts the theoretical timber volume yield expected given the actual silviculture activities implanted on a given cutblock.

The conifer strategy is currently implemented, while the deciduous strategy will be implemented on similar principles to the conifer strategy. The deciduous compiler has been developed and is utilizing government TASS (TASS) outputs derived from deciduous yield curves. The Participants

are planning on evaluating the applicability of extending this survey methodology to mixedwoods during the term of this SFMP. The development of a landscape level mixedwood survey methodology will be based on the research document "A Silviculture Survey Methodology for Boreal Mixedwoods" developed by Craig Farnden, which is included in Appendix 19.

The following principles of the Assessment System will be applied to both conifer and deciduous areas. The key components of the assessment system are:

- The assessment will measure success with a comparative estimate of theoretical predicted potential yield (volume) to actual expected yield (volume).
- The system will be based on data from individual managed stands, but the data will be assessed over many blocks across the landscape.
- Areas are evaluated at a predetermined age following harvest.
- The results are tracked at the landscape and stand level.
- Foresters will have flexibility at the stand level to vary regimes and accommodate other SFM values as they progress to a landscape level target for yield.
- The system will provide data to improve silviculture regimes and targets over time.

The **Maximum Predicted Merchantable Volume (MPMV)** is a theoretical maximum volume that could be attained at a defined post-harvest time for a population of cutblocks, assuming a very aggressive reforestation regime.[4]

MPMV = function (Species, Site Index, Effective Age_p, Harvest Rotation Age, MSQ_p)

The **Target Merchantable Volume (TMV)** is determined by multiplying the MPMV for the population of cutblocks by a factor to provide flexibility in the application of silviculture treatments to recognize operational constraints, damaging agents and other resource values.[5]

TMV = *α* * MPMV

Predicted Merchantable Volume (PMV) is the predicted volume that will be attained at a defined post-harvest rotation age for a population of cutblocks[6].

Conifer PMV = function (Species, Site Index, Effective Age_m, Harvest Rotation Age, MSQ_m)

Deciduous PMV = function (Species, Site Index, Harvest Rotation Age, MSQ_m)

Conifer PMV

[4] See Section 3.4 of Appendix 10

[5] Section 3.4 of Appendix 10 discusses setting the current TMV at 90% of the theoretical Maximum PMV attainable

[6] See Section 3.3.3 of Appendix 10 "Stand Survey and Growth Modelling for the Fort St. John TSA"

Reforestation obligations will be met when PMV for a population of cutblocks at a defined post harvest time meets or exceeds TMV (i.e., ≥ *a**MPMV), or is consistent with the acceptable variance. Where:

MPMV = Maximum Predicted Merchantable Volume
PMV = Predicted Merchantable Volume
TMV = Target Merchantable Volume
Species = Species group (measured)
Site Index = Site Index (measured)
***Effective Age*$_p$** = Effective Age (Prescribed). Set at 14 years.
***Effective Age*$_m$** = Effective Age (Measured).
Harvest Rotation Age = Estimated Harvest Rotation Age. (100 years)
***MSQ*$_p$** = stocking (prescribed)
***MSQ*$_m$** = stocking (measured)
a = coefficient to estimate the effects of damaging agents, operational constraints and other values

Future volume is predicted using methods developed by J.S. Thrower & Associates, Riverside Forest Products and the Ministry of Forests. The modeling system has been adapted for the Fort St. John Pilot Project area. A full report can be found in Appendix 10. The modeling system is designed to predict future stand merchantable volumes at 80, 90, and 100 years after harvest using only key inputs. The following inputs are used in the model:

Deciduous PMV

Reforestation obligations will be met when PMV for a population of cutblocks at a defined post harvest time meets or exceeds TMV (i.e., ≥ *a**MPMV), or is consistent with the acceptable variance. Where:

MPMV = Maximum Predicted Merchantable Volume
PMV = Predicted Merchantable Volume
TMV = Target Merchantable Volume
Species = Species group (measured)
Site Index = Site Index (measured)
Harvest Rotation Age = Estimated Harvest Rotation Age. (80 years)
***MSQ*$_p$** = stocking (prescribed)
***MSQ*$_m$** = stocking (measured)
a = coefficient to estimate the effects of damaging agents, operational constraints and other values

Development of Models to Predict PMV from MSQ Statistics for Deciduous Stands (Farnden 2013), *section 1.0 Introduction*, describes the creation and application of set of models intended to support development of Mean Stocked Quadrant (MSQ) surveys and related stocking standards for deciduous stands in the Peace River region of northeastern British Columbia. It should be

considered as an addendum to *Stand Survey and Growth Modeling for the Fort St. John TSA* (J.S. Thrower and Assoc. 2003), and it is assumed here that readers are familiar with the contents of that document. The basic theory and field methods described in the antecedent report continue largely unchanged, except for a few minor alterations at noted in *Section 2.0 Model Fitting* (Farnden 2013). A full report can be found in Appendix 10. The modeling system is designed to predict future stand merchantable volumes at 80 years after harvest using key inputs. The following inputs are used in the model:

Conifer Site Index:
A site index (SI) of 20 was used in the TASS simulations. Adjustment factors were developed for other site index values and are applied when estimating both the target and predicted maximum volumes. Adjustment factors are found in Table 3 of Appendix 9. Site index will be calculated using the growth intercept method, if possible, otherwise the site index may be obtained from SIBEC or pre-harvest cruise data. Field site index data is used in the MPMV and PMV calculation.

Deciduous Site Index:
Development of Models to Predict PMV from MSQ Statistics for Deciduous Stands (Farnden 2013), *Section 3.0 Model Fitting*. To utilize site index within the PMV/MSQ assessment procedure, a reasonably reliable estimate of age is required. There are at least two options for achieving this including:

1. Assuming that total age is equal to years since harvest (10 years) and that SI is then simply a function of height
2. Counting age using bud scale scars on branch whose origin on the stem is immediately below breast height

The first option is the most likely to be easily applied in the field and is recommended. Based on values derived from the computer program Site Tools, a function to derive site index from total height assuming a total age of 10 years was developed as:

$$\mathbf{SI} = 2.54 + 4.15 \times HT - 0.0845 \times HT2$$

Where HT is the stand top height (in metres) based on a sample of the fattest tree in each of a set of 0.01 ha plots. The validity of this model is restricted to a SI 50 range from 14 to 28 metres. Given that total age is fixed in this method at 10 years, care will be needed to avoid sampling trees that were already established prior to harvest. Such trees will typically be recognized as emergents, or trees that are obviously taller than the main canopy. In some cases, it may be possible to confirm that a tree is too old by counting bud scale scars on branches.

Effective Age: Conifer only
The impacts of variables, such as brush, delayed or more intensive silviculture treatments, disease, etc. are accounted for by assigning an effective age to the plantation. An effective age is calculated by comparing the actual site tree height to a height-age curve for the appropriate site index. For trees that have diminished height growth the effective age is less than the actual age while those with better than average height growth have effective ages greater than their actual age. The effective age is used for the calculation of actual Predicted Merchantable Volume (PMV).

In the calculation of the theoretical Maximum Predicted Merchantable Volume (MPMV) the effective age is assumed to be fourteen years based on a two-year establishment delay and planting with a one-year-old tree. Blocks logged over more than one year will be entered into the appropriate assessment year based on the harvest year with the most volume removed from the block. Effective age will be adjusted for area with volume removed from earlier or later years.
Development of Models to Predict PMV from MSQ Statistics for Deciduous Stands (Farnden 2013), *Section 2.0 Model Fitting.* There are two primary differences between conifer and deciduous MSQ surveys and proposed stocking standards:

1. Where conifer stands are assessed at year 15, deciduous stands are assessed at year 10.
2. For conifer stands, management-induced acceleration in growth of newly planted trees is reflected in a reduced number of years to breast height and is recognized through application of the *effective age* concept. Uncertainties in age determination for trembling aspen make this impractical. Corresponding changes have been necessitated in the deciduous compilation procedure, where impacts of *effective age* have been eliminated.

Species Group:
The model was developed for pure Pl (>80%), Pl/Sx (21-79%) and pure Sx (>80%) based on stand density at the time of survey. Survey data provides the basis for MPMV and PMV calculations.

The deciduous model was developed for pure deciduous, and all species are entered as Aspen. Survey data provides the basis for MPMV and PMV calculations.

Stocking:
The model assesses stocking based on a Mean Stocked Quadrant (MSQ). The theoretical MPMV is calculated based on the target stocking initially prescribed in the SLP. The target well-spaced stocking standards (TSS) for each stratum set the MSQ value to be used. The PMV is calculated using field MSQ data.

The above inputs are used to calculate the following predicted and actual yields:

Maximum Predicted Merchantable Volume (MPMV):
The Maximum Predicted Merchantable Volume (MPMV) is calculated for all blocks 15 years post harvest for conifer, and 10 years for deciduous stands (i.e. 15 or 10 complete growing seasons following logging start date) based on target stocking and an aggressive and timely implementation of current silviculture regimes.

The collected survey data is summarized by stratum. Maximum Predicted Merchantable volume (MPMV) is calculated based on actual data for site index and species composition and theoretical data for stocking and effective age.

Predicted Merchantable Volume (PMV):
Predicted Merchantable volume is calculated using actual field data for site index, species composition, effective age and stocking.

Target Merchantable Volume:
The Target Merchantable Volume (TMV) is set at 95% of the Maximum Predicted Merchantable Volume for conifer areas and 90% for deciduous areas, to account for the effects of damaging agents, operational constraints, and consideration of other values. At the time of assessment, the calculated volume based on actual field data (i.e. the Predicted Merchantable Volume) is compared to the TMV.

Several important differences exist between this strategy and the assumptions used in the TSR. This assessment of reforestation provides a relative measure of success, however, as the system is employed, and data collected it will provide feedback to the silviculture regimes and guidelines and may eventually be able to provide feedback to the TSR to improve assumptions and yield calculations. The predicted merchantable volume under this system should not be used for analysis under the Timber Supply Review.

Assessment Survey:
The assessment survey has the following objectives:

- Identify areas not meeting well growing requirements.
- Provide basic data required to predict future volume.
- Provide inventory labels.

Defining the Target Population:
The conifer target population to sample is the total NAR based on all blocks fifteen growing seasons following harvest-start date. Fifteen years or growing seasons has been selected, based on current field experience in the Peace, to provide sufficient time for the silviculture regimes to be implemented and for the plantations to reach a stable well-growing state.

The deciduous target population to sample is the total NAR based on all blocks ten growing seasons following log start date. Ten years or growing seasons has been selected, based on current field experience in the Region, which provides sufficient time for natural reforestation to establish on a site.

Conifer SU's in a block will be surveyed separately in year 15 and the data will be used to contribute towards the appropriate volume calculation.

Deciduous SU's in a block will be surveyed separately in year 10 and the data will be used to contribute towards the appropriate volume calculation.

As previously noted, the indicator may apply to coniferous and deciduous areas in cutblocks with commencement dates before November 15, 2001, if the Participant submits a statement to that effect. This population may include blocks previously declared as "well growing" by the Participant, as the intent is to measure the cumulative effectiveness of silviculture treatments to meet predicted volume targets.

The target population requires further stratification to define sample populations. Stratification occurs both pre- and post-survey.

Pre-survey stratification is based on the initial stocking requirements, inventory polygons (species composition, site productivity, stand density) and actual stocking levels. Stocking levels below minimum stocking are stratified separately. Post-survey grouping is done based on inventory labels and initial stocking requirements to group strata across the landscape for future yield calculation. Field stratification procedures can be found in Appendix 8.

Sample Design and Data Collection

The sample method follows a systematic sampling design. Plot centers are established on a one hundred metre grid based on UTM coordinates. Two types of plots are established: Full Measure Plots at every fourth plot location to record site quality measurements and Count Plots at every plot to record stocking. Details can be found in Appendix 8.

The above method follows current accepted survey procedures under FOR guidelines except for the assessment of stocking using quadrants. The method is referred to as Mean Stocked Quadrant (MSQ). The method is simple and cost effective to implement. MSQ compares favourably with other methods in estimating stocking and predicting future volume. A detailed comparative review of stocking estimators can be found in Appendix 6. For deciduous refer to Appendix 10, *Development of Models to Predict PMV from MSQ Statistics for Deciduous Stands* (Farnden 2013).

Actions to Address Populations Less than the Allowable Variances

When the populations' Predicted Merchantable Volume is less than the acceptable variance to the Target Merchantable Volume (TMV) corrective action will be as follows:

- Survey data is required to be maintained at the cutblock level and include areas of low stocking or areas requiring treatment. The data will be reviewed to locate the best candidates for further treatment.
- An action plan will be prepared detailing the areas selected for treatment, treatment types, expected results relative to the target, and timelines for completion. Areas selected for treatment will be considered in view of the expected success and the diligence of the Participant in implementing the original plan (see below).The action plan will be included in the Annual Report that documents the survey results and that acts as the notification to the appropriate government agency of a non-compliance to the landscape level reforestation strategy.
- For conifer areas requiring brushing treatment a mandatory period of three years for manual methods and one year for chemical treatments will be required before areas can be reassessed unless otherwise agreed to by the District Manager.
- Options for deciduous stands with low stocking are limited to fill plant (mixedwood) or conversion to a conifer stand.
- Only those areas selected for treatment will remain under Licensee obligation with the remaining areas released from further obligation.

- Once the timelines for the treatments have been met MSQ data will be collected from the treated areas, combined with the original survey data and merged with the original population data to demonstrate achievement of the target. The results will be documented in the Annual Report.
- Situations may arise in which, despite due diligence in prescribing and carrying out the silviculture regimes, the target has not been met. Where further treatment options are limited or may result in a significant negative impact to another identified value, the District Manager may waive the requirement for further treatment. When damage to the plantation (e.g. fire, etc.) requires replanting, the reduction in effective age will lower the future yield. Timely and aggressive silviculture regimes can help to moderate this effect, but it is largely out of control of the Participant. The Participant is not required to direct extraordinary effort into the area under management to try to correct this problem.
- In cutblocks that have had an event causing significant damage (e.g., falls under Section 108 of FRPA) to a plantation or site the participants may:
- Elect to drop the block from its original population group (e.g., Based on the harvest start year) and use the year of the damaging event as the new commencement date to reset the late well growing date from that point in time or,
- Maintain the block in the current population group if they believe the overall performance of the population will still meet the target
- Request relief from all obligations, consistent with legislated provisions.
- In these situations, the Participants may seek funding and/or relief from obligations by government. Where the obligation no longer remains with the Participants, the block will be dropped and not assessed as part of this indicator.

Monitoring Procedure:

The progress of reforestation monitoring through the establishment phase is addressed in Section 5.33 Establishment Delay. Stands will normally be monitored at key points in time to ensure reforestation outcomes are unfolding as expected.

Progress Review:

Planting will typically be carried out over the entire conifer area to be reforested as prescribed in SLPs, although in some instances treatment plans may prescribe natural regeneration in conifer stands. Deciduous stands are typically prescribed for natural regeneration.

Following planting, or after determining that natural regeneration is likely, blocks will be reviewed to assess progress towards achieving SLP requirements where necessary.

Progress reviews will normally occur within the first eight growing seasons following harvest commencement. The forester managing each block will summarize the progress to date, and the likelihood of maintained success. Assessment methods are at the discretion of the forester and may vary from an aerial assessment to a walk through, or even a detailed plotted survey.

Deciduous stands will be surveyed at year six or seven to assess if stand is predicted to continue forward on its current successional pathway. Survey methods are at the discretion of the forester

and may vary from an aerial assessment to a walk through, or plotted MSQ survey if stocking appears low.

If stocking is low options available are to fill plant conifer for full conversion to a conifer plantation or partially to a mixedwood stand.

This review is intended to be an internal monitoring activity to provide the Participants with an approximate measure of success. At this time the forester can also decide whether areas below the minimum standards in the SFMP/SLP require further treatments or can be carried forward in their existing condition if the areas will not impact the success of landscape level targets set out in the SFMP.

Final Assessment

Assessment of achievement of the indicator's target will be calculated using the standards noted above in the 'Strategy and Implementation' section. Assessments will be completed separately for each Participants' group of blocks (including all applicable tenured area managed by a Participant on behalf of other licensees). Assessments will provide detail on individual cutblock MSQs, as well as separate rolled up Predicted Merchantable Volume (PMV) totals for coniferous areas and deciduous areas, and the percentage achievement of the target (TMV). This information will be presented in Annual Reports.

5.33 ESTABLISHMENT DELAY

Indicator Statement	Target Statement
Establishment Delay (years)	The area weighted average establishment delay for coniferous regeneration will not exceed two years. The area weighted average establishment delay for deciduous regeneration will not exceed three years. The area weighted average establishment delay for mixedwood stands regeneration will not exceed three years
SFM Objective: Forest Health and Productivity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Reforestation Landscape Level Strategy.	

Acceptable Variance:

To allow for variations in site preparation requirements, access, and delays in harvest the acceptable variance for establishment delay is an additional one-half year (e.g. 2.5 years for conifer, 3.5 years for deciduous and mixedwood).

What is this indicator and why is it important?

Establishment delay is the period from the start of harvest on the area to be reforested to the completion of initial establishment of a future crop of commercially acceptable species.

This indicator is important because delays in the replacement of harvested species can negatively impact future harvest levels. Assessing the delay in establishment on an area weighted basis provides a comprehensive assessment of overall establishment success, encourages prompt reforestation, and provides some flexibility to Participants to employ efficiencies in silviculture plans. Ensuring that harvested stands meet the prescribed establishment delay is an indication that the harvested areas have maintained the ability to recover from a disturbance and thereby maintaining their resiliency and productive capacity.

Implementation and Monitoring Procedure:

It is anticipated that implementation of the indicator strategy will result in prompt reforestation that will reduce delays in developing well growing stands, thereby maximizing use of the productive capacity of the forest land base to grow trees. Early establishment of a viable crop of trees reduces the need for subsequent interventions (i.e., planting, brushing) and positively contributes to carbon sequestration and reducing harvest rotation periods.

The Landscape Level Reforestation Strategy identifies targets and timelines for reforestation success. Site level plans (SLPs) provide information to develop silviculture regimes on a cutblock level. Information systems (e.g., LRM) are used to track harvesting activity, as well as planned future treatments based on SLPs and post harvest block reviews. Within the first or second growing season after harvesting, coniferous blocks are normally planted, unless natural regeneration is prescribed.

Deciduous blocks typically rely on natural regeneration. Initial assessments may be completed shortly after logging to assess the likelihood of achieving natural regeneration. Obvious areas requiring supplemental conifer planting will be prescribed at that time, but typically a visual or plotted assessment will be done two to four years after harvesting to confirm the establishment of naturals.

The establishment delay is usually within two years where planting is prescribed and two to four years where the stand is expected to reforest naturally.

Survey Procedures:

For artificial regeneration a survey of well spaced trees will normally be carried out during the same growing season as establishment to confirm stocking levels are consistent with the requirements of the SLP. A further survey (well spaced or MSQ) may be carried out within three growing seasons if deemed necessary to confirm stocking is being maintained above minimum levels. The surveys will consider current standards at the time of the survey for measuring well-spaced and total trees. Inclusion of any other parameters, such as brush, health, inventory labeling, etc. will be at the discretion of the implementing forester. Surveys will be completed at an intensity level sufficient to assess regeneration survival and performance. The minimum strata size is 2 hectares.

For natural regeneration a survey of well spaced trees or MSQ may be carried out during the three growing seasons post harvest to confirm stocking levels meet the requirements of the SLP. A minimum of five plots will be placed in each stratum on 100-metre UTM coordinates in a random fashion and meet required confidence limits. A minimum stratum size of 2 ha will be applied.

For areas designated as intimate mixtures a preliminary survey based on the mixedwood stocking standards (Appendix 6) will be completed to determine if establishment delay has been achieved

***Monitoring Procedure*:**

Records of silviculture treatments are entered and tracked in information systems (e.g., LRM). On an annual basis these records are reviewed and all harvested areas that are not completely re-established are identified. The area weighted average age from harvesting start date of all blocks is calculated.

Establishment delay is reviewed annually by summarizing data from LRM on all unstocked cutblocks and calculating the area weighted average age of unstocked area. The establishment delay calculation is as follows:

1) A report will be run from LRM that identifies all blocks that had operational harvesting commence and areas not having met initial establishment according to SLP requirements.
2) The total NAR of these harvested blocks with unestablished areas constitutes the data population.
3) The number of days from harvest start date to March 31 of the reporting year will be determined for each block. The number of days is then multiplied by the NAR in each block, and the product is summed is summed for all blocks.
4) This summation of all blocks (i.e., # days x NAR) is then divided by the total area of NAR to create an area weighted establishment delay in days and converted to establishment delay in years by dividing by 365.
5) In the rare instance where harvesting is started in a block but not completed within 36 months of the harvest start date (e.g. as might occur to address major sanitation or salvage issues) the NAR will apply only to the harvested portion of the block, and only that portion of the harvested NAR that does not have a crop established will be used in the calculation of establishment delay.

5.34 SITE INDEX

Indicator Statement	Target Statement
Site Index	Average post harvest site index will not be less than average pre-harvest site index on blocks harvested under the Pilot Project Regulation
SFM Objective: Forest Health and Productivity	
Linkage to *FSJPPR*: None	

Acceptable Variance:

A maximum negative variance of 15% post harvest site index versus pre harvest site index, for statistical variability.

What is this indicator and why is it important?

Site index is a relative measure of forest site quality. It is a measure of the height growth that can be expected 50 years after trees reach 1.3 metres in height for a tree species on a given site. Site index is highly sensitive to changes in ecological site conditions including soil nutrients, moisture and other variables, and is generally considered one of the most reliable indicators of site quality. Conducting activities in a manner that decreases a site's potential capability to produce timber will be reflected in reduced post harvest site index.

Soil productivity is one of the main factors impacting site productivity. Site index will be negatively affected if soil productivity were significantly reduced due to harvesting activities. A relative comparison of a plantation's average site index when well growing compared to the pre-harvest site index is therefore an appropriate method for evaluating if the resiliency and productive capacity of forest stands and forest soils has been maintained.

Implementation and Monitoring Procedure:

The vast majority of the forests in the DFA are even aged, thrifty to mature stands, which make them amenable to collecting accurate pre-harvest site indices during operational cruising activities, utilizing existing site index compilation programs. In some instances where cruising information is not available pre-harvest, site index estimates will be derived from forest inventory maps, or alternatively from SIBEC information, although this source is considered less reliable at present.

The site index information will be compiled for each SU in each well growing block surveyed. Silviculture staff will compare the prorated averages of pre-harvest SI in each block to the recorded post harvest SI and report this information in Annual Reports. Future Annual Reports should report any declared blocks harvested under the *FSJPPR* (November 15th, 2001, or later start dates) the preharvest and post harvest SI.

Participants will ensure that cruising project tenders include SI requirements within the contract documents. SLPs will identify the pre-harvest site index for each SU from the cruising information, or where not available, from the forest cover inventory information. Well growing surveys will collect and report site index by SU.

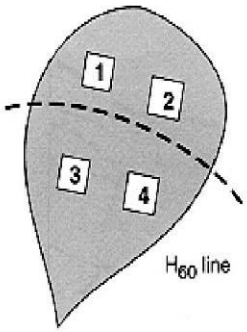
5.35 PEAK FLOW INDEX

Indicator Statement	Target Statement
Number of watersheds caused to exceed their threshold PFI value by the Participants' forestry activities	The Participants' forestry activities will not cause any watershed in the DFA to exceed their Peak Flow Index threshold
SFM Objective: Protection and Maintenance of Water Resources	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Riparian Management Landscape Level Strategy.	

Acceptable Variance:

PFI thresholds may be exceeded if forest management measures, including harvesting, are required to prevent the spread of significant forest damaging agents (e.g. insect infestation).

What is this indicator and why is it important?



Block no.	Area (ha)	Stand height (m)	ECA (ha)	Weight factor	Weighted ECA
1	20	4	15.0	1.5	22.5
2	30	6	15.0	1.5	22.5
3	20	1	20.0	1.0	20.0
4	30	8	7.5	1.0	7.5

Weighted Total ECA = **72.5**

Peak Flow Index = $\frac{72.5}{1000}$ = **0.0725**

Figure 11. Peak Flow Index - Example Calculation

Most changes to stream channel stability and fish habitat occur during large runoff events, or peak flows (Beaudry and Gottesfeld 2001). In the interior of British Columbia most peak flows occur during spring snowmelt. Large disturbances in a forested watershed, such as extensive forest harvesting or wildfires, can have a negative impact on peak flows by increasing the flows above stability thresholds. This can accelerate streambed and stream bank erosion, damage fish habitat and result in an unstable fluvial system. After forest harvesting or wildfires have disturbed an area, both winter snow accumulation and spring snow melt rates increase (Winkler 2001). However, the impact of disturbances on peak flows is not equal throughout a watershed. Disturbances that

are located at higher elevations in a watershed have a greater impact on peak flows than do those located at lower elevations (Gluns 2001). Consequently, it is important that a water quantity indicator take this fact into consideration. The Peak Flow Index (PFI) considers this by providing a greater weight factor to the disturbances that occur at higher elevations. The "higher elevation" is defined as the upper 60% of the watershed. This "upper watershed area" is defined individually for each watershed or sub-basin by using the concept of the "H60 line". Openings above the H60 line in a watershed are assumed to have a greater proportional influence on the peak flow levels than those below the H60 line. A factor of 1.5 is applied to the area of openings above the H60 line to determine Equivalent Cut Area (ECA).

The Peak Flow Index (PFI) approach also considers that the forest will re-grow over time within a disturbed area. As re-growth occurs, the negative impact of increased snow accumulation and rapid melt is reduced and consequently so are the impacts to increased peak flows. The PFI considers stand height as the indicator of re-growth. The PFI value decreases as the stand height increases. The PFI method provides an objective way of to forecasting and evaluating the potential effects of past disturbances and future plans. By providing conservative target values, it ensures that rates of forest harvesting do not contribute to the degradation of the water resource. Figure 11 provides an example of how PFI is calculated, using a 1000 ha watershed.

The Peak Flow Index is not intended to be a detailed quantitative modeling of increased volumes of flows, but rather as a "coarse filter" to identify where more detailed reviews may be required when new harvesting is planned. If the PFI for a watershed is below the baseline threshold when new harvest area is proposed, then no further review is required. However, if the current PFI is above the baseline threshold then a more detailed review of the watershed is warranted.

Current Status:

There are 105 watersheds delineated for monitoring Peak Flow Indices in the DFA. The watersheds and baseline target PFIs were developed by Pierre Beaudry, MSc, RPF, Professional Hydrologist (P. Beaudry & Associates Ltd. Watershed Management Services). The watersheds are based on the BC Provincial Watershed Atlas and existing watershed groups. The following principles were applied when delineating watersheds:

- The watershed boundaries are based on the concept of hydrologic watersheds (water draining through a single point) as opposed to political watersheds. Modifying the true hydrological watershed to fit within the political (administrative) landscape was avoided wherever possible. Also, small watersheds, known as "residual areas," were not "lumped" or aggregated into a single unit. The PFI concept is most relevant if it monitors a single hydrologic watershed.
- The size of subbasins in this plan ranges from approximately 60 to 2,900 square kilometers. Very small watersheds and very large watersheds are not included because the PFI concept is most applicable at the sub basin level.
- Watersheds were delineated where the DFA covered at least 50% of the watershed area. Therefore, one watershed extends beyond the DFA. Alternatively, the DFA is not completely covered by watersheds. Despite these physical limitations the majority of the planning area is covered by watersheds.

Watersheds were named according to the local name of the water body, where applicable. A basin name was also added to provide a geographic reference.

Once all watersheds were delineated, a baseline target was determined for each of the watersheds. The targets suggested when the indicator was first introduced in SFMP #1 were considered to be conservative. Although the physical and biological impacts from increased peak flows are not known, there can be temporary increased flows facilitated by the removal of a large percentage of the forest canopy. Consequently, a maximum target is set with the overall goal of maintaining the sustainability of the soil and aquatic resources. The targets must consider the type of watershed and type and stability of the fluvial system. The idea behind setting a baseline target is not to prevent changes in peak flows to occur, but to maintain flows within levels that will not unduly accelerate rates of streambed and stream bank erosion and degrade fish habitat. The suggested target PFI values were based on a combination of professional opinion, scientific literature and 20 years of personal involvement in research projects investigating peak flows by Pierre Beaudry.

As part of this plan's development an analysis was conducted to assess the impacts of disturbance (mainly wildfire) since the last FOS amendment analysis. The results are presented in Table 27 below. The analysis considered the area disturbed by wildfire through 2024, and shows significant impacts to several watersheds relative to the last time an analysis was completed for this indicator. Not surprisingly, many of the watersheds impacted by the recent fires were heavily impacted. Of the 105 watersheds analyzed, 20 were above their threshold Peak Flow Index. Therefore 81% of watersheds monitored by this indicator are below threshold.

Table 27: PFI Baseline Targets and Current Condition (watersheds above threshold in red text)

Watershed Group	Watershed Name	Area (km²)	H60 elevation (m asl)	Baseline Threshold PFI	Equivalent Cut Area (km²)	PFI 2025
Fontas	Bedji Creek	231.6	508	50	59.6	25.7
Fontas	Chasm Creek	167.2	599	50	15.3	9.1
Fontas	Dazo Creek	258.6	460	50	4.1	1.6
Fontas	Ekwan Creek	770.8	420	50	442.9	57.5
Fontas	Etthithun River	1191.3	535	50	171.5	14.4
Fontas	Fontas River	319.9	660	50	9.7	3
Fontas	Fontas River LB	713.9	580	50	120.5	16.9
Fontas	Font Unnamed 1	97.9	461	50	1.1	1.2
Fontas	Kataleen Creek	153.4	413	50	58.5	38.1
Fontas	Teklo Creek	212.2	426	50	136.8	64.4
Fontas	Upper Etthithun River	406.2	680	50	27.8	6.8
Kahntah	Cautley Creek	868.6	680	62	80.5	9.3

Watershed Group	Watershed Name	Area (km²)	H60 elevation (m asl)	Baseline Threshold PFI	Equivalent Cut Area (km²)	PFI 2025
Kahntah	Cautley Creek	479.7	740	62	57.0	11.9
Kahntah	Dahl Creek	415.0	700	50	259.8	62.6
Kahntah	Helicopter Creek	148.1	613	62	50.6	34.2
Kahntah	Kahntah Creek	1102.7	700	50	482.7	43.8
Kahntah	Kahn Unnamed 4	228.2	720	50	78.7	34.5
Kahntah	Kahn Unnamed 5	126.7	624	62	1.9	1.5
Lower Beatton	Aitken Creek	830.6	815	43	221.5	26.7
Lower Beatton	Charlie Lake	292.9	773	62	46.2	15.8
Lower Beatton	Doig River	985.6	731	43	68.3	6.9
Lower Beatton	Osborn River	736.7	745	43	88.1	12
Lower Beatton	Umbach Creek	431.3	741	43	67.4	15.6
Lower Beatton	Upper Blueberry	859.5	820	50	260.8	30.3
Lower Halfway	Aikman Creek	118.9	815	43	19.9	16.8
Lower Halfway	Blair Creek	235.2	902	43	48.3	20.6
Lower Halfway	Cameron Creek	497.8	944	43	62.0	12.4
Lower Halfway	Cameron River	2042.2	837	37	469.8	23
Lower Halfway	Colt Creek	158.1	913	43	25.5	16.1
Lower Halfway	Deadhorse Creek	208.4	820	43	63.0	30.3
Lower Halfway	Graham River	2326.0	1279	43	120.4	5.2
Lower Halfway	Ground Birch Creek	344.5	735	43	78.1	22.7
Lower Halfway	Horn Creek	430.0	1474	37	7.4	1.7
Lower Halfway	Kobes Creek	280.9	828	50	47.7	17
Lower Halfway	LHAF Unnamed 1	213.7	860	43	49.9	23.3
Lower Halfway	Needham Creek	333.1	1430	43	4.7	1.4
Lower Halfway	Poutang Creek	176.3	1453	43	1.6	0.9
Lower Halfway	Townsend Creek	299.4	880	43	84.9	28.4
Lower Sikanni	Bull Creek	353.5	752	50	296.7	83.9
Lower Sikanni	Dechacho Creek	164.7	516	50	67.0	40.7
Lower Sikanni	Gutah Creek	1458.7	645	50	637.3	43.7
Lower Sikanni	Gutah Creek	810.8	728	62	505.1	62.3
Lower Sikanni	Katah Creek	597.9	660	50	301.5	50.4
Lower Sikanni	Kenai Creek	79.3	1000	50	6.3	7.9
Lower Sikanni	LSIK Unnamed 2	163.3	720	43	79.0	48.4
Lower Sikanni	LSIK Unnamed 4	59.6	641	50	1.2	2.1
Lower Sikanni	Niteal Creek	519.2	475	50	11.5	2.2

Watershed Group	Watershed Name	Area (km²)	H60 elevation (m asl)	Baseline Threshold PFI	Equivalent Cut Area (km²)	PFI 2025
Lower Sikanni	West Conroy Creek	1103.0	720	50	570.3	51.7
Lower Sikanni	West Conroy Creek	249.9	782	50	104.2	41.7
Milligan	Dede Creek	129.6	720	62	5.7	4.4
Milligan	Flick Creek	204.3	780	62	9.0	4.4
Milligan	Little Beaverdam Creek	336.1	732	62	12.1	3.6
Milligan	Milligan	434.8	780	50	89.7	20.6
Milligan	Milligan Creek	1848.0	758	50	157.2	8.5
Milligan	MILL Unnamed 3	326.9	880	62	65.9	20.2
Milligan	Upper Milligan Creek	384.7	832	50	20.3	5.3
Upper Beatton	Arrow Creek	510.6	783	50	132.9	26
Upper Beatton	Beatton River	1078.1	984	43	183.5	17
Upper Beatton	Black Creek	670.1	807	50	484.5	72.3
Upper Beatton	Grewatsch Creek	272.0	927	50	207.2	76.2
Upper Beatton	Holman Creek	151.5	896	50	165.2	109.1
Upper Beatton	Jedney Creek	129.8	952	43	133.6	102.9
Upper Beatton	Laprise Creek	341.0	860	50	326.0	95.6
Upper Beatton	Martin Creek	121.2	830	50	109.4	90.3
Upper Beatton	McMillan Creek	103.9	736	43	3.1	3
Upper Beatton	Nig Creek	479.8	782	50	194.8	40.6
Upper Beatton	UBTN Unnamed 9	157.1	757	50	22.3	14.2
Upper Beatton	Upper Beatton Lrg	2361.6	924	50	1,279.4	54.2
Upper Halfway	Blue Grave Creek	159.4	960	37	23.0	14.4
Upper Halfway	Chowade River	993.8	1200	43	53.7	5.4
Upper Halfway	Cypress Creek	623.5	1241	37	29.4	4.7
Upper Halfway	Halfway River	1101.5	1475	37	43.4	3.9
Upper Halfway	Horseshoe	198.4	1060	37	8.1	4.1
Upper Halfway	Two Bit Creek	161.1	1235	37	7.9	4.9
Upper Halfway	UHAF Unnamed 3	128.5	1221	37	1.7	1.3
Upper Halfway	UHAF Unnamed 6	212.4	976	37	20.3	9.5
Upper Halfway	Upper Chowade	428.9	1395	37	21.9	5.1
Upper Halfway	Upper Cypress	336.6	1493	37	6.9	2
Upper Halfway	Upper Halfway River	632.0	1235	37	9.0	1.4

Watershed Group	Watershed Name	Area (km²)	H60 elevation (m asl)	Baseline Threshold PFI	Equivalent Cut Area (km²)	PFI 2025
Upper Peace	Coplin Creek	350.3	773	43	73.2	20.9
Upper Peace	Farrel Creek	512.3	713	43	160.9	31.4
Upper Peace	North Cache Creek	188.0	759	43	28.2	15
Upper Peace	Red Creek	240.0	753	43	67.8	28.2
Upper Prophet	Besa Creek	518.5	1568	43	5.5	1.1
Upper Prophet	Minaker River	556.6	1070	43	57.5	10.3
Upper Prophet	Minaker River	171.5	1060	43	39.3	22.9
Upper Prophet	Nevis Creek	183.3	1422	37	6.8	3.7
Upper Prophet	Pocketknife Creek	236.4	1110	43	16.0	6.8
Upper Prophet	Upper Prophet River	1190.7	1569	37	29.6	2.5
Upper Prophet	Upper Prophet River	269.0	1683	37	3.6	1.3
Upper Sikanni	Boat Creek	392.4	719	50	11.0	2.8
Upper Sikanni	Buckinghorse River	1245.6	1029	43	270.7	21.7
Upper Sikanni	Buckinghorse River	391.2	1119	43	16.6	4.2
Upper Sikanni	Coal Creek	216.1	900	43	195.3	90.4
Upper Sikanni	Daniels Creek	224.5	1041	43	59.8	26.6
Upper Sikanni	Donnie Creek	122.8	822	50	98.1	79.9
Upper Sikanni	Loranger Creek	132.8	1390	43	7.1	5.4
Upper Sikanni	Medana Creek	139.4	1000	43	116.7	83.7
Upper Sikanni	Middle Fork Creek	209.0	1060	43	23.9	11.4
Upper Sikanni	Sidenius Creek	462.9	1489	43	4.8	1
Upper Sikanni	Sikanni Chief	472.6	1488	43	4.4	0.9
Upper Sikanni	Sikanni Chief River	2917.8	1143	43	320.0	11
Upper Sikanni	Temple Creek	217.5	760	43	139.0	63.9
Upper Sikanni	Trimble Creek	161.1	1439	43	2.5	1.6
Upper Sikanni	Trutch Creek	859.5	781	43	415.0	48.3

Implementation and Monitoring Procedure:

There are two levels of implementation for this indicator: PFI calculation (coarse filter), and watershed review (fine filter).

The first level, determining the current or projected PFI for each watershed, is required to provide the number of watersheds with PFIs that may exist above their baseline PFI, and to identify areas that may require a more detailed watershed review. Watersheds showing as under the PFI thresholds should be able to support some amount of non-salvage harvesting disturbance without experiencing the potential risks resulting from excess PFI values, and will not require a watershed review. The potential impact of forest harvesting will be forecasted when a FOS is developed or amended significantly, by modelling proposed blocks as harvested, and 'growing' any managed stands in the watershed for the duration of the FOS. Watersheds projected to have PFI in excess of threshold, will require a detailed watershed review before non-salvage harvesting may proceed. Alternatively block plans can be changed to lessen the impact and ensure PFI stays under threshold. Spatial data information will be updated to reflect recent stand replacing natural disturbances, past and future harvesting, and stand growth to identify the projected impacts on PFI target achievement for the term of the FOS. Data sources include forest cover inventory (VRI), watershed boundaries, and Participant block data. Salvage harvesting of recently burned areas will not be considered as contributing to increasing Equivalent Cut Area (and thereby PFI), since the burned areas will already have been discounted as completely disturbed as part of the forecasting. Provided soil disturbance levels are carefully monitored and kept below allowable limits, salvage harvest may indeed be, overall, beneficial for watersheds impacted by wildfire, considering prompt silviculture actions that will occur may help revegetate conifer sites to a 'treed' condition at a faster rate than natural regen.

The second level, watershed review, is required where new harvesting is planned within watersheds that exceed the baseline PFI, or for watersheds where PFI thresholds have not been determined (i.e. not in a defined Watershed Group for the DFA). The scope of the watershed review process will be on Peak Flow levels and associated risks.

Watershed reviews will be performed by a professional hydrologist and may include specific recommendations regarding further development and forest management practices in subject watersheds, with the goal to minimize impacts from potential peak flow events. Recommendations may focus on specific design of blocks or roads, seasonal timing conditions, limits on area disturbance, road deactivation requirements, revision of vegetative cover assumptions, etc. These recommendations will inform the development and implementation of operational plans, including deferring non-salvage harvesting in subject watersheds until conditions allow for operations that will not cause PFI to increase above threshold (i.e. sufficient regrowth of young stands has occurred). Reviews conducted for watersheds that have not had PFI thresholds set will include recommended Peak Flow Indices.

Watershed reviews for areas with previously established PFI thresholds may include a review of the PFI, and recommendations for amending the threshold values. The participants will follow the recommendations set out in watershed reviews, and make the reviews available to interested parties.

5.36 WATER QUALITY EFFECTIVENESS EVALUATION

Indicator Statement	Target Statement
The percentage of surveyed stream crossings annually identified with a high WQEE (formerly WQCR) rating on forestry roads within the DFA for which Participants have stewardship WQCR – Water Quality Concern Rating WQEE – Water Quality Effectiveness Evaluation	On an annual basis fewer than 30% of the total number of surveyed stream crossings on roads for which the Participants have stewardship will have high WQEE
SFM Objective: Protection and Maintenance of Water Resources; Forest Health and Productivity	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

Maximum allowable 'high' WQEE will be 35%.

What is this indicator and why is it important?

Sediment from forestry practices is generated mainly from the following three sources: roads, landslides and stream bank instability. Significant increases in sediment concentration in streams over natural levels can have a negative effect on fish and fish habitat (Slaney et al. 1977; Government of BC 1995; Hall et al. 1987; Hartman and Scrivener 1990; Phillips 1971; Scrivener and Tripp 1998.). Sediment can also reduce the value of water for domestic and agricultural use (Government of BC 1995). In areas where rainfall precipitation is dominant and harvesting occurs on steep slopes, landslide processes can be a major contributor of sediment to streams. In areas such as the Fort St. John DFA, where the landscape is dominated primarily by rolling hills and low precipitation, landslides are a less significant landscape process than in many other areas of the province.

Sediment yields from logging roads can show a 2-to-50-fold increase over historical levels (Reid 1993). The main point of road sediment delivery to streams is at crossings such as culverts and bridges (Brownlee et al. 1988; Government of BC 1995). While it is recognized that roads are not the only source of sediment related to forestry practices, they are the most significant causes of increased sedimentation (Beschta 1978; Brownlee et al. 1988; Government of BC 1995; Reid and

Dunne 1984). Through the proper layout, construction, deactivation and use of erosion and sediment control (ESC) measures, the impact that roads have on water quality can be significantly reduced (Beaudry 1998; Government of BC 1995). To assess the impact that stream crossings are having on the water quality within the Fort St. John DFA, a field-based assessment, known as the Stream Crossing Quality Index (SCQI) was developed.

The SCQI method is a subjective type of assessment, yet it is systematic in its approach. There are no detailed quantitative measures that must be made (e.g., length and depth of erosion rills). The SCQI method was designed with the assumption that it is better to assess a much larger number of crossings in a qualitative way than it is to assess only a few crossings in a very detailed, quantitative way. A balance between effectiveness and efficiency has been developed when performing the SCQI field assessments. The SCQI method was designed to be conducted relatively quickly (10 to 15 minutes per crossing) so that a maximum number of crossings can be assessed within an area of interest. This method was implemented in the DFA in 2002.

The result of conducting the SCQI field surveys is an individual score for each crossing surveyed. This is calculated based on the erosion and sediment delivery potential of the crossing and results in a numerical score. The individual crossing score is used to assign a Water Quality Concern Rating (WQCR) of None, Low, Medium, or High to each individual crossing. The WQCR can then be used to identify individual or groups of crossings that may be having a negative impact on local water quality.

In the winter of 2006/07, there was a new standard developed for use throughout the province for evaluating the effectiveness of measures to protect water quality. It is called the Water Quality Effectiveness Evaluation (WQEE). The developer of the SCQI system, Pierre Beaudry, was also involved in some aspects of the WQEE development. Mr. Beaudry developed translation tables that allow field values collected using the WQEE method to be used to derive WQCR for the purposes of tracking this indicator. One notable change relative to the previous SCQI method is that the WQCR determination is impacted by stream class, fish-bearing status, and community watershed status. This was done to better account for the concept of stream size, sediment dilution, and potential downstream impacts (Beaudry, 2007). In general, the WQCR goes up (none to high) as the size of the stream goes down. Streams with a 'fish-bearing' status generally have one class higher WQCR than non-fish-bearing streams, size and WQEE score being equal. Streams in a designated community watershed generally will receive a much higher WQCR than non-fish-bearing streams, size and WQEE score being equal, up to three classes higher.

Starting in the 2021 reporting season, the Participants switched to using the FREP's (Forest and Range Evaluation Program) methodology of calculating the WQEE directly which provides the same final qualitative rating.

It is anticipated that implementation of the indicator strategy will result in construction and maintenance of stream crossings that minimize the sedimentation of streams, thereby protecting water quality and fish habitat.

Implementation and Monitoring Procedure:

Crossings surveyed shall be restricted to those on roads under the control of the Participants. The number of crossings surveyed in a year depends on spatial distribution of the selected samples, and other logistical constraints (e.g., weather, access, staff availability, etc.).

Selection of survey locations is guided in part by the following criteria:

- Areas that have not received previous sampling,
- Areas that provide a representative sample of practices among Participants,
- Areas where concentrations of recent road construction and deactivation projects (< 5 years) have occurred,
- Areas where terrain features and soil type pose a relatively high potential for sediment delivery into streams.
- Areas where previous surveys, or remediation work, require follow up assessments, and
- Limitations based on access and safety.

Crossing assessments are typically done between May and November annually. Assessments will be guided by the procedures outlined in the Water Quality Effectiveness Evaluation Protocol (Maloney et al, 2018) published by FOR's FREP program and follow the following general steps:

1. Determining the sampling area.
2. Sample areas are determined as per 'Selection of Location' section, above.
3. All reasonably accessible stream crossings in the sample population are to be visited and assessed. No range assessments are required.
4. For all sites in the selected sample areas, a site field card is completed. Only the data required to obtain an estimate of Surface Erosion Contribution is required (erosion potential and delivery potential). No estimates of Turbidity or Mass Wasting Contribution are required.
5. Evaluate management practices associated with stream crossings in relation to soil erosion and sediment delivery potential.
6. Compile all results from field data forms and summarize including a calculation of the percentage of crossings ranked high. Include summary information in Annual Reports.

If assessment and evaluation of survey data identifies levels of "High" WQEE more than targets, recommendations will be developed for changes to management practices related to road construction, maintenance, and deactivation.

5.37 SMALL STREAMS AND NCD MANAGEMENT

Indicator Statement	Target Statement
The number of annual non-conformances to SLP measures related to Riparian Management Area (RMA) retention for small streams and areas adjacent to non-classified drainages (NCD)	No non-conformances to SLP measures related to RMA retention for small streams and areas adjacent to NCDs from harvesting or silviculture activities
SFM Objective: Protection and Maintenance of Water Resources; Forest Health and Productivity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Riparian Management Landscape Level Strategy, and the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance*:*

Variances to address a forest health concern will be permitted and reviewed by applicable First Nations.

What is this indicator and why is it important?

Protecting small streams and NCDs and related aquatic ecosystems through careful forestry practices assists in maintaining water quality in the downstream watersheds and helps sustain fish and wildlife species which rely on streamside vegetation, or the maintenance of water quality.

This indicator measures if Participants' harvesting and silviculture activities are being conducted in accordance with measures outlined in SLPs related to RMA retention for small streams (i.e., S4, S5, and S6 classifications) and for areas adjacent to connected NCDs. Connected NCDs are those that connect directly to a classified riparian feature (S1-S6, W1, W3, W5, L1, L3). If they are not connected, they are referred to as NCDs. The majority of riparian classifications completed by Participants within or adjacent to their operations will be on S4, S5 or S6 streams, so management measures on these small streams can have a meaningful impact on riparian and water resources. Protecting the streambanks and stream channels reduces the risk of sedimentation entering the watercourse and contributes to the maintenance of water quality.

(a) The following management practices outline the minimum retention that will be prescribed in an SLP within the RMA for small streams and areas adjacent to NCDs: within 30m of an S4 stream, retain a minimum of 20% of the area, basal area or merchantable stems.

(b) within 30m of an S5 stream, W3 wetlands, or L3 lake, retain a minimum of 10% of the area, basal area or merchantable stems.

(c) within 20m of an S6 stream or connected NCD, retain a minimum of

5% of the area, basal area or merchantable stems.

within 5m of S4, S5, S6 streams, and connected NCDs, retain over the length of the feature naturally occurring ground vegetation, shrubs, advanced regeneration, non-merchantable conifers, and non-merchantable stems, to the extent practicable considering partial cutting activities being conducted.

This indicator was updated in October 2024 as part of the SFMP #4 re-write to address gaps in current management practices on small streams and NCDs.

Implementation and Monitoring Procedure:

Management practices will be included in SLPs to protect small stream RMAs and areas adjacent to NCDs through prescribed retention to maintain water quality, aquatic habitats and riparian values on streams and NCDs without mandatory riparian reserve zones.

All streams, wetlands, and lakes in or immediately adjacent to a planned harvest area will be classified prior to the commencement of operations.

Management strategies for the protection of these values on streams and NCDs without mandatory riparian reserve zones, as well as for the protection of other non-fish bearing waterbodies, are based on site-specific assessments during fieldwork. Foresters consider factors such as riparian classification, topography and slopes, edaphic characteristics, season of harvest, snow loads, vegetation and habitat characteristics. Measures that may be implemented are designation of Wildlife Tree Patch or other reserve area, restricting harvesting operations to frozen ground conditions, compressible snowpack criteria, establishment of machine free or machine sensitive zones, use of low ground pressure equipment, and prescribing retention of non-merchantable stems within riparian areas.

The location of these streams, NCDs and waterbodies, and SLP protection measures are reviewed with workers prior to the commencement of harvesting and silviculture activities.

Inspections will be completed on harvesting and silviculture activities by Participants' field staff. Non-conformances to SLP measures related to this indicator will be noted and tracked by the Participants.

Incident records will be reviewed during the preparation of the Annual Report, and the number of non-conformance issues to SLP measures to protect small streams and NCDs from harvesting and silviculture activities will be reported for each managing Participant.

The location, classification and management practices for small streams and NCDs will be included in SLPs and/or operational maps used for timber harvesting or silviculture activities.

5.38 SPILLS ENTERING WATERBODIES

Indicator Statement	Target Statement
Number of spills of a reportable substance (i.e., antifreeze, diesel fuel, gasoline, greases, hydraulic oil, lubricating oil, methyl hydrate, paints and paint thinners, solvents, pesticides, and explosives) entering water bodies	Zero spills entering water bodies
SFM Objective: Protection and Maintenance of Water Resources	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

Preventing spills from entering waterbodies is crucial in protecting aquatic ecosystems and human health. Spills of hazardous substances can contaminate water sources, harm or kill aquatic plants and animals, and disrupt ecological balance. By preventing spills, the Participants support the maintenance of water quality and avoid environmental damage.

Any volumes of spills of the substances included in the indicator statement are reportable.

Implementation and Monitoring Procedure:

Applicable operational controls are within the Participants' Environmental Management Systems including Work Instructions, Emergency Preparedness and Response Plan, and spill response training. Preworks are conducted prior to commencement of operations which identify the location of classified waterbodies.

Any reportable spills will be investigated, and recommendations will be made to minimize the risk of future occurrences.

Regular audits and inspections of activities will be conducted. All reportable spills will be tracked and reported to the appropriate agency.

Annual reviews of incidences will be completed, and conformance performance for this indicator will be reported in Annual Reports.

5.39 COORDINATED DEVELOPMENTS AND ACCESS MANAGEMENT

Indicator Statement	Target Statement
Number of coordinated developments and access management plans	Report annually the number of proposed coordinated developments and access management plans that occurred
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Road Access Management Landscape Level Strategy.	

Acceptable Variance:

No variance is necessary as the target is to report coordinated activities and access management planning that occurs between the industries.

What is this indicator and why is it important?

The opportunities for coordinated development and access management plans will fluctuate annually based on the overall activity and proximity of other industrial operations, and interest from First Nations and stakeholders on access management planning. This indicator is a measure of the level of coordinated inter-industry developments that occurs annually. Access management planning is necessary to incorporate First Nations and stakeholders' interests. Coordination of access between forestry and other industries helps minimize the creation of new roads and leads to reduced impacts on the land base. In addition to known opportunities for coordination, the referral of proposed activities between industries can help identify new opportunities to share access roads.

The Discussion Paper for the most recent timber supply review by the Office of the Chief Forester (2016) identified that the area of the CFMLB occupied by "current roads" at 117,483 ha, and after accounting for overlaps with other exclusions resulted in a net reduction of 63,045 ha. In the 2018 'Rationale for Allowable Annual Cut (AAC) Determination', it was observed that the forestry industry regularly uses existing "oil and gas features" when planning roads. The Chief Forester did not project reductions to the CFMLB due to future road construction. Coordinating access development can reduce the impacts on the THLB, as well as other non-timber resources.

Implementation and Monitoring Procedure:

Existing and planned forest industry roads are made available by the Participants to the BC Energy Regulator for referral purposes, to oil and gas companies, and upon request to other industries. Current status is included in Annual Reports.

All existing, and the next six years or more of proposed cutblocks and roads are shared at a minimum annually between Participants and displayed on operational maps included on the consolidated FOS.

Where deactivation is planned, the Participants will engage with First Nations and stakeholders on access management planning for new and existing access roads greater than 5 km in length. In addition, any other roads that First Nations or stakeholders identify as requiring access management plans will be discussed and considered.

The Participants will respond to industry referrals in a timely manner. The Participants will determine the potential impacts on those roads and blocks impacted by the proposed development where they bear some legal liability. Where opportunities are identified to reasonably minimize disturbances to the THLB (e.g., using an existing road instead of building a new one), or otherwise minimize impacts to the forest operations or resources (e.g., avoiding effectively isolating patches of merchantable timber by the location of pipelines etc.), the Participants will note these opportunities in their responses to the referrals, for the proponents' consideration. The Participants will also advise the company if road use agreements may be required.

The FOS and SLPs or operational harvesting or silviculture maps will be reviewed at the time industry referrals are received to identify potential issues or possible synergies. FOS access routes and SLPs or harvest plans may be changed as the result of new oil and gas developments being constructed in or adjacent to planned forestry developments.

The Participants have identified the following minimum critical road construction standards that will permit the forest industry to utilize industry road locations:

Minimum width: 5 metres with inter-visible turnouts; or 7 metres with no turnouts

Maximum grade: 8% adverse and 12% favourable for sustained; 10% adverse and 12% favourable for short pitches <100m; 5% on switchbacks

Minimum bridge requirements: L60T (i.e., legal highway loading)

The Participants will endeavor to work closely with other industrial sectors through the referral and planning process in proposed development areas where other sectors operate, and to identify opportunities to locate and coordinate access in the most optimal location which will meet the needs of both industries.

The following information will be tracked, and reported for each Annual Reporting period (i.e., April 1st – March 31st annually):

- Licensees will track **new road use agreements** signed with other industries, and **annually report the number of new agreements**, and the **length of the roads covered under one or more agreements** (e.g., agreements on the same road with different companies will count as more than 1 agreement, but the road length would not be double counted).
- The Participants will track **the number of referrals** from the oil and gas industry that indicate coordinated activities is occurring by the proponent **proposing to use existing**

forestry roads or construct a new road in the same general location as a future proposed FOS road.

- The number of access management planning engagement opportunities presented to applicable First Nations and stakeholders and the outcome.

5.40 RANGE ACTION PLANS

Indicator Statement	Target Statement
Percent consistency with mutually agreed upon action plans for range	Operations will be 100% consistent with resultant range action plans
SFM Objective: Community Involvement and Landowner Outreach; Public Land Management Responsibilities	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

Variances are permissible only on reaching mutual agreement between the affected range tenure holder and Participant.

What is this indicator and why is it important?

The forest and range industries are active on the same crown land base in much of the Fort St. John DFA. This extensive overlap of tenures frequently results in one industry's operations impacting the other's activities. For example, forestry activities may cause the removal of or rendering ineffective the natural range barriers. Natural range barriers may be rivers, rock faces, dense timber stands or other naturally occurring features that stop or significantly impede livestock movement. These known or identified natural range barriers are particularly important for range tenure holders to manage livestock according to tenure boundaries, as well as preventing livestock wandering on roads with high traffic and consequently pose safety risks to the public. The Participants may choose to adjust forestry activities or seek FOR approval for installation of cattle guards or fences to mitigate the effect of removing or rendering ineffective the known or identified natural range barriers. Participants may help range tenure holders with installation of these range developments.

Some other resulting issues from forestry activities may include loss of grazing opportunities through seed choice, timing of operations and herbicide use. Addressing these overlapping tenure issues successfully requires open communication of interests and expectations, a proactive process to address issues, and commitment to implement mutually agreed upon actions. This indicator is important in that it demonstrates the Participants' commitment to track and follow through to completion mutually agreed actions, which may have target completion dates months or years after the action is initiated.

Implementation and Monitoring Procedure:

Prior to 2013, Timber Range Action Plans (TRAPs) were the main documentation template for developing strategies to mitigate range and forestry activities' impacts on one another. However, over time, the formality and process of TRAP that originated from the Timber and Range Impact Mitigation Committee (TRIM C) project has become less formal. Since 2018, other formats of documents have been started to be used to record mutually agreed upon action plans.

At the FOS stage, forestry staff will invite range tenure holders to engage in discussions to formulate a mutually agreed action plan to address issues impacting range values and developments arising from the proposed forestry activities on their tenure area. To formulate such plans, forestry and range tenure holders should start by examining the timber harvesting proposal and its anticipated impact on features such as natural range barriers, existing range developments and existing fence lines. Mitigation strategies will be identified to alleviate the impacts of the proposed forestry activities. Cattle guard construction and fencing are commonly used tools to minimize the impacts of natural range barrier removal. District Manager approval will be sought where the Participants propose damaging or modification of existing range developments, or construction of new range developments. Participants may help the range tenure holder to implement the approved modifications to existing range developments or construction of new range developments. Where natural range barriers will be removed by timber harvesting, acceptable strategies may include retention of patches of forest left intact in the field as buffers or reserves, construction of debris fences, installation of cattleguards and/or traditional post and wire fences.

Additionally, if range tenure holders identify an issue related to their tenure at other times such as field operations or block layout stage, a range tenure holder engagement meeting may be held to address the concern.

These action plans and dates will be documented and entered as range issues into the Participant's tracking systems, responsibilities will be identified and communicated to affected staff, and progress will be tracked through to the completion of the action. In the event circumstances require that changes be made to the action plan the forestry supervisor making the change will note in the action plan what change was made, indicate in the plan that he has discussed and got agreement from the range tenure holder for the change, and notify any responsible parties of the changes made.

Participants will inform FOR range staff of the range discussions, and providing the range tenure holder agrees, invite FOR to participate in discussions to develop range action plans. FOR attendance and participation is encouraged by the Participants as the FOR are the owners of all range developments on crown land and must authorize the destruction, modification or construction of existing or new range developments.

An annual review of the Participant's tracking systems will identify the number of Timber and Range Action Plans (TRAPs) planned and the number of other mutually agreed upon action plans.

The FOS, Pesticide Management Plans, and other operational plans which require public review and comment will be referred to range tenure holders, and actions agreed to will be identified in the final submission of these plans.

SLPs, harvesting and silviculture plans will be consistent with any relevant mutually agreed range tenure action plans.

5.41 DAMAGE TO RANGE IMPROVEMENTS OR NATURAL RANGE BARRIERS

Indicator Statement	Target Statement
Time to repair range improvements or mitigate impacts of natural range barriers being rendered ineffective by Participants' activities	Range improvements damaged, or natural range barriers rendered ineffective by Participants' activities will be repaired, and/or have mitigation measures applied, within 2 years of damage, or impact to natural range barrier
SFM Objective: Community Involvement and Landowner Outreach; Public Land Management Responsibilities	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Range and Forage Management Landscape Level Strategy.	

Acceptable Variance:

The indicator target would not apply if a Participant can implement alternative mitigation strategies to the satisfaction of the range tenure holder and if required, approval from the appropriate government agency. If a natural range barrier is not made known or identified prior to harvesting, but is rendered ineffective, the Participant must develop and implement measures to mitigate the impact in less than two years from the time the impact was caused and made known to the Participant.

Temporary removal or alteration of a range development to enable short-term forestry activities to proceed is permissible. However, repairs to or replacement of improvements must be completed in less than two years from the time of damage or removal.

What is this indicator and why is it important?

The overlapping nature of forest and range tenures may result in natural range barriers and range developments being present in cutblocks planned for harvest by the forest industry. A natural range barrier can be a river, rock face, dense timber or any other naturally occurring feature that stops or significantly impedes livestock movement to and from an adjacent area. Range developments include fences, cattle guards, dugouts, or trails constructed by range-tenure holders for specific range management purposes. Range developments are considered the property of the provincial government. Natural range barriers and range developments may intentionally be lost or rendered ineffective to conduct forestry activities. In cases where natural range barriers or range developments are not made known to the forest tenure holder, they may be inadvertently damaged by the forest industry.

Alteration or removal of natural range barriers and range developments may occur, on the understanding that the developments or range barrier will be reconstructed or replaced in a timely manner, preferably prior to the next scheduled turnout of cattle for summer grazing, to the standard specified in the FOR Peace Natural Resource District range structure guidelines. District Manager approval is required to build, modify, or damage a range development, and also to vary from the range development standards (e.g. use of non-treated posts, smooth wire, virtual fencing, debris corridors). The Participants support the use of '**wildlife-friendly'** fencing for fencing repairs, rebuilds, or new construction (e.g. to mitigate impacts to a natural range barrier).

This indicator demonstrates the Participants' commitment to address direct impacts to natural range barriers and range tenure developments resulting from forestry activities, and to minimize disruption to range tenure holders.

For the purposes of this indicator, the terms "range improvement" and "range development" have the same meaning.

Implementation and Monitoring Procedure

All concerns raised by the range tenure holders will be dealt with by the Participants in a timely manner. The two-year period identified in the target statement is meant to accommodate situations where concerns were raised regarding damage to natural range barriers or developments long after completion of the timber harvest activities. This allows the Participants time for discussion with the range tenure holder and the appropriate government agency to develop mitigation plans and seek authorization for those plans. It also considers time required to address logistical concerns such as the availability of fence materials and seasonal weather and access conditions.

Information on the location and pre-harvest condition of natural range barriers and range developments are provided by range tenure holders through responses to referral requests on the FOS, and other operational plans, or range-related mutually agreed action plans. In addition, natural range barriers and range developments may be identified and mapped during SLP field data collection. Where natural range barriers are identified prior to harvest or road construction, mitigation measures will be considered, including avoidance, and discussed and/or developed with the applicable range tenure holders, as outlined below. With the acknowledgement of range tenure holders, Participants may contact the government for guidance and administrative support during discussions with range tenure holders, and while developing mitigation strategies. Participants will seek District Manager approval for plans to construct, modify, remove, damage or destroy a range development.

Actions that the Participants may implement when planning harvesting activities which may negatively impact natural range barriers and/or range developments are:

- Proactively contact range tenure holders and affected First Nations in situations where proposed block or roads may overlap or impact natural range barriers or range developments, to determine if mitigation plans are necessary.

- Confirm with the government Range Officer and range tenure holder whether harvesting and road construction will remove or render ineffective a natural range barrier or range improvement.
- Where it is confirmed that timber harvesting or road construction will damage a range improvement, develop mitigation plans and seek authorization from FOR if the mitigation plan requires the Participant to construct, modify, remove, damage or destroy a range development on crown range.
- Adjust road and/or cut block locations to reduce or eliminate impact to the natural range barrier or range development.

When developing strategies to restrict cattle movement in situations where it is anticipated that timber harvesting will remove or render ineffective natural range barriers, the Participants will consider implementing the following strategies:

- Retain a reserve of trees wide enough to significantly impede the movement of cattle. Consult with the range tenure holder and the government Range Officer to identify the appropriate reserve size, configuration, and tie-in points.
- Facilitate the construction of range developments such as wildlife-friendly post and wire fence lines, debris fences, and/or cattle guards upon receipt of appropriate approvals.
- Adjust road and/or cut block locations to reduce or eliminate impact to the natural range barrier.

The Participants will review the preferred mitigation proposals with applicable First Nations. Proposed actions related to mitigating damage to range developments are tracked by the Participants.

The location of natural range barriers and range developments are shown on operational maps, and pre-works with the Participants staff and contractors to identify what measures are needed, if any, to avoid, modify, temporarily remove and/or repair such structures.

Damage to natural range barriers and range developments is recorded by Participant staff through field inspections. Staff develop action plans to ensure mitigation, repair, or restoration measures are authorized by FOR and conducted in a timely manner.

The Participants' tracking systems identify all action plans and target dates, including those derived from range-related mutually agreed action plans. An annual review of the tracking system will identify all range damage issues and note whether the target and completion dates are consistent with this indicator.

Range-related actions and target deadlines arising out of operational plan referrals of the FOS and PMPs etc. will be tracked.

Provided the features are known and their locations shared with the Participants, SLPs will identify natural range barrier and range development locations, if their location causes them to be at risk of damage from the Participants' operations, and what measures are necessary to

protect or otherwise mitigate negative impact to natural range barriers and range developments resulting from timber harvesting and road construction operations.

It is anticipated that implementation of the indicator strategy will minimize the potential negative impacts that forestry operations may have on some aspects of range management.

5.42 RECREATION SITES

Indicator Statement	Target Statement
The number of recreation sites maintained by Participants	Participants will maintain a minimum of one recreation site within the DFA
SFM Objective: Management of Visual Quality and Recreational Benefits; Public Land Management Responsibilities	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

The DFA has several campsites operated by the government or commercial interests, however most are concentrated in the high traffic corridors near the Alaska Highway and charge fees to users. Providing maintained campsites in more remote but locally popular locations helps meets local demand for recreational pursuits in a natural setting.

Implementation and Monitoring Schedule:

The Participants currently maintain the Crying Girl Recreation Site on the Graham River at 101 km on the Halfway Graham Forest Service Road. The area features hunting, fishing, boating, and hiking opportunities. The campsite was originally constructed by Canfor in 1991 on a 58 ha government recreational reserve. Additional campsites and a 2.5 km hiking trail were added in 1996 with FRBC funding. In July of 1999 Canfor assumed sole responsibility for the campsite and its maintenance. The site currently provides a total of 15 campsites for free public use.

In 2009, following discussions with government agencies, responsibility for the campsite has been transferred back to the government, however the Participants continue to maintain the campsite on behalf of the government.

Annual maintenance contracts are locally awarded to complete garbage disposal, site cleanup, outhouse cleaning, firewood cutting and distribution, and general cleanup from June 1st to October 31st of each year.

An existing visual inventory utilized this campsite as a viewpoint. SLPs for harvesting within the Graham operating area will address any visual impacts from the Crying Girl campsite viewpoint.

Maintenance of the recreational values present at the campsite will be considered in proposing any future development proposals in the FOS.

5.43 VISUAL QUALITY OBJECTIVES

Indicator Statement	Target Statement
Consistency with Visual Quality Objectives (VQOs)	Pilot Participants' forest operations will be consistent with the established VQOs
SFM Objective: Management of Visual Quality and Recreational Benefits	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Visual Quality Management Landscape Level Strategy.	

Acceptable Variance:

A variance to the requirement for consistency with established VQOs, where approved by the District Manager, is permitted on a site-specific basis, where required to address risks to resource values or safety issues (e.g. fire salvage, sanitation harvesting for forest pest control), as identified in an SLP. A rationale will be prepared by a qualified professional and must specify the reasons for the variance and the measures that will be implemented to address the resource value at risk and mitigate impacts on the visual resource.

What is this indicator and why is it important?

This indicator is a results-based measure of how successful the Participants are in meeting post-harvest visual quality objectives. It applies to cutblocks that occur in known scenic areas established by government. Guidelines are also provided below for cutblock design and apply to all blocks.

Visual quality objectives are the extent to which the visual or scenic resources of a landscape may be altered compared to the pre-existing or natural condition. VQOs are resource management objectives established by government that reflect the desired level of visual quality based on the physical characteristics and social concern for the area. The five VQOs are defined below:

(a) *Preservation*: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is

(i) very small in scale, and

(ii) not easily distinguishable from the pre-harvest landscape.

(b) *Retention*: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is

(i) difficult to see,

(ii) small in scale, and

(iii) natural in appearance.

(c) *Partial retention*: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is

(i) easy to see,

(ii) small to medium in scale, and

(iii) natural and not rectilinear or geometric in shape.

(d) *Modification*: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint,

(i) is very easy to see, and

(ii) is

(A) large in scale and natural in its appearance, or

(B) small to medium in scale but with some angular characteristics.

(e) *Maximum Modification*: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint,

(i) is very easy to see, and

(ii) is

(A) very large in scale,

(B) rectilinear and geometric in shape, or

(C) both.

Visual Quality Objectives for the DFA have been set by the government, and are mostly concentrated along the Alaska Highway, and several of the local river valleys (Figure 12).

Implementation and Monitoring Procedure:

The visual landscape inventory contains known scenic areas and associated Visual Quality Objectives and is located on the BC Government's Land and Resource Data Warehouse. The inventory current at the time of submission of this SFMP for approval, will be referred to during the development of the FOS and amendments, and blocks that may impact the achievement of VQOs will be noted in the FOS, and tracked by the Participants.

The FOS will identify where proposed blocks occur in visually sensitive polygons, and SLPs and harvest plans will be consistent with the VQOs or variances.

Block design and layout for all cut blocks (including those without existing VQOs) shall be conducted with the principle of avoiding straight lines (>100m) and regular geometric shapes, with the intent of creating harvest boundaries that are 'natural' in appearance.

If deemed necessary by the Participants, pre-harvest visual impact assessments and landscape design processes may be done to assist in block design to achieve VQOs. Where variances are required to allow harvesting to meet other resource management objectives (e.g., forest health), the Participants will document and retain a rationale for the variance, the measures that will be implemented to address the resource value at risk, and the measures to be used to mitigate impacts on the visual resource to the extent practicable. The Participants will seek approval from the District Manager for these site-specific variances to be consistent with VQO. The Participants will notify FOR regarding proposed variances at the time of harvest authorization request.

Post-harvest reviews of harvested areas that fall within visually sensitive landscapes will be completed no later than the end of the following year after harvesting is completed (e.g., if logging is finished in November of 2025, the post-harvest assessment would be done by December 31, 2026).

Participants will maintain records of the results of post-harvest reviews, variances to VQOs and rationales and will report annually on the relative conformance to the target in the Annual Report.

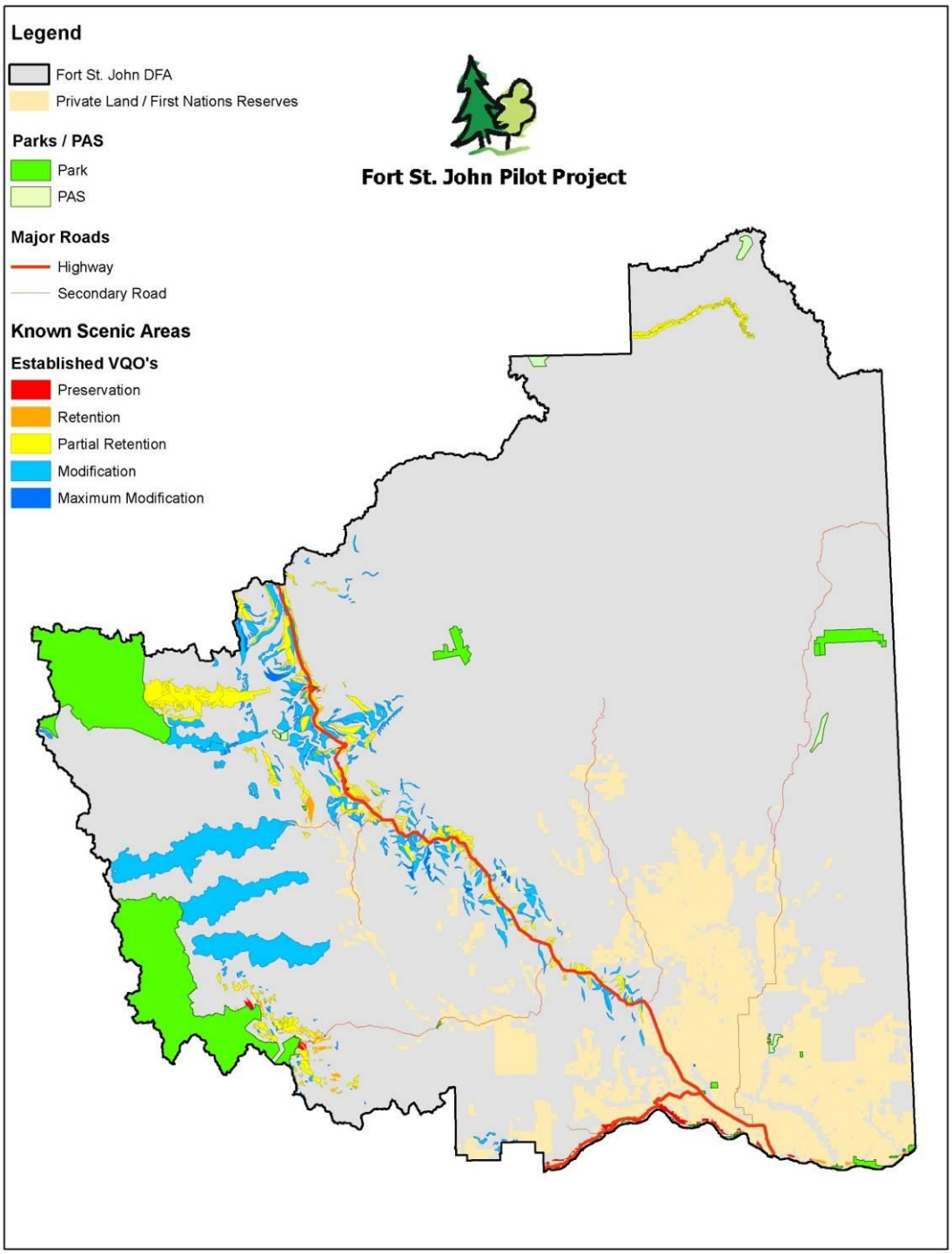


Figure 12. Fort St. John TSA visual quality polygons.

5.44 VISUAL SCREENING

Indicator Statement	Target Statement
The percentage of SLPs prepared annually for cutblocks adjacent to existing roads and other linear features that prescribe retention of screening	100% of SLPs prepared annually for blocks adjacent to existing roads and other linear features will have retention of screening prescribed
SFM Objective: Conservation of Biological Diversity; Management of Visual Quality and Recreational Benefits	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target and acceptable variance will be one of the indicators used to determine if forest practices are consistent with the Biodiversity and Wildlife Habitat Management Strategy.	

Acceptable Variance:

Roads needed for decking timber, roads or other linear features where no natural visual screening exists pre-harvest (such as dead pine stands with little understory) or roads where the windthrow hazard is high and roadside retention creates a safety risk to road users, areas that will not be accessible with a motorized vehicle post-harvest due to deactivation, rehabilitation or restoration and new roads proposed for harvesting blocks will be exempt from this indicator. Other variances will be allowed if supported by applicable First Nations.

What is this indicator and why is it important?

This indicator was created in SFMP#4 to address concerns from First Nations regarding increased hunting pressure linked to harvesting operations increasing the area that is visible from a motorized vehicle on roads post-harvest. Prescribing visual screening along roads in SLPs and LPs will result in a decrease in the visibility of recently harvested areas from roadsides and help address this concern. This is a particular concern along mainline and secondary roads that are well travelled during the first few years post-harvest before 'green-up' of harvested areas.

Screening may include shrub species, non-merchantable regeneration or merchantable windfirm trees. Other linear features are included in this indicator as they could also help provide screening to blocks where they exist.

Implementation and Monitoring Procedure:

Field staff and contractors will collect notes for blocks adjacent to existing roads and linear features that describe the type of vegetation structure present and note what screening potential exists. The forester creating the SLP will determine where retention of screening is required, and where the variance may need to be applied. Where required, retention of screening will be prescribed in the SLP and may need to be confirmed with a field visit with applicable First Nations. Prescriptions will be site specific and vary in width depending on the site parameters (e.g. density of existing vegetation, relative accessibility of site, windthrow risk). The objective is to provide as much screening of the block post-harvest as is practicable. Where an existing adjacent road is required for decking, attempts will be made to retain some existing vegetation as screening to

the extent that operations allow. Some examples of existing adjacent roads required for decking are situations where slopes in the block adjacent to the road are too steep to build another road, or where building another road would create an unreasonable amount of permanent access structure area (PAS). Windthrow assessments should be completed where mature trees are being considered for screening and if the windthrow hazard is high, consideration of safety to road users should be given priority above screening. In cases like these, it may be appropriate to have visual screening as internal WTPs further away from the road, at a close windfirm area, but still limiting line of sight from roads.

Annually, a report will be compiled for blocks with SLPs completed (April 1st - March 31st), which shows (by Managing Participant) how many SLPs should have prescribed screening and how many had screening applied. Each Participant will track performance internally and results will be presented in the Annual Reports.

5.45 RECREATION OPPORTUNITY SPECTRUM

Indicator Statement	Target Statement
The amount of area in primitive and semi-primitive non-motorized classifications of the Recreation Opportunity Spectrum (ROS) for the Graham, Sikanni, and Crying Girl LUs	A minimum of 69,227 ha in primitive ROS area (100% of 1996 primitive ROS area) and 174,769 ha in semi primitive non-motorized ROS area (50% of the 1996 total semi primitive non-motorized ROS area) in the combined Graham, Crying Girl and Sikanni LUs (excluding the Graham Laurier and Redfern-Keily PA's)
SFM Objective: Management of Visual Quality and Recreational Benefits	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Road Access Management Landscape Level Strategy.	

Acceptable Variance:

The Primitive ROS percentage may fluctuate over time as roads are constructed and permanently deactivated to retain the percentage at 1996 levels. At any given time, the Primitive ROS percentage may decrease down to 10% on a temporary basis until such time as the constructed forest roads are permanently deactivated, and the Primitive classification is restored.

There is no allowable variance for the Semi-Primitive non-motorized target.

What is this indicator and why is it important?

The Fort St. John LRMP identified the importance of the availability of a wide range of public and commercial outdoor recreational opportunities. The three LUs identified as having a low management intensity can offer a wilderness recreation experience due to the relatively low level of human activity and industrial development present. A wilderness recreation experience can

be described as having a moderate to high probability of experiencing solitude, closeness to nature, high degree of self reliance, interacting with a natural appearing environment, low interaction with people, and little to no on-the-ground evidence of other people.

This indicator is a measure of the amount of Primitive and Semi-Primitive forest land that has been classified under the Ministry of Forests Recreation Opportunity Spectrum within the Landscape Units that are available to provide a range of wilderness recreational opportunities for the general public. Appendix 16 includes definitions of the ROS classes.

Access management such as deactivation and road rehabilitation can be used to achieve the desired ROS classification on a landscape.

Current Status:

During development of FOS #2, the proposed block and road footprint was projected to assess the potential impact on the ROS, and was determined to be consistent with the SFMP targets. The following Table 28 identifies the condition of the recreation opportunity spectrum expected upon the completion of all harvest operations in FOS# 2. During major amendment #411 of FOS #3, new blocks were proposed in the Graham Operating area and the analysis was updated for current and future state. The results were consistent with this indicator and are displayed in the Table 28 below. It is important to note that since 1996 there has been a change to the overall spatial data for the LU areas - a decrease of 8,453 ha that could not be reconciled with the currently available spatial data. The overall LU area of the Crying Girl, Graham and Sikanni LUs is currently 537,483 ha, and in 1996 was 545,936 ha. The participants made considerable efforts to determine the source of the discrepancy, and discussed the issue with the government, but the difference could not be reconciled. Therefore the target statement was updated to match the currently available spatial data that will now be the baseline for the purposes of this indicator and its targets. The ROS categories were re-calculated using the current LU spatial data and the primitive area was increased from 65,839 ha to 69,227 ha, and the semi-primitive non-motorized decreased from 361,451 ha to 349,537 ha, 50% of which is 174,769 ha and was updated in the target statement.

Table 28: Projection of Changes to ROS Class from 1996 to 2016

Crying Girl Graham & Sikanni LUs	Primitive (ha)	Semi-primitive non-motorized (ha)	Semi-primitive motorized (ha)	Roaded (ha)	Urban / Agriculture (ha)	Total
1996 levels	69,227	349,537	118,101	269	349	537,483
FOS Projected	67,053	323,721	140,588	269	349	531,980
SFMP Target minimum	**69,227**	**174,769**				

Implementation and Monitoring Procedure:

It is anticipated that forest operations will respect and reflect the interests of non-timber forest resource users, local public and First Nations, resulting in the maintenance of wilderness recreation experience opportunities and existing recreation opportunities offered by the established recreational sites and trails in the Fort St John DFA.

Forest management activities within each of the specified Landscape Units will be evaluated as part of the development of FOSs. The potential impact of the proposed developments will be evaluated by recalculating the ROS classification for these LUs and presented in the FOS to demonstrate consistency. Amendments to proposed forest operations may be necessary to mitigate impacts, or other deactivation measures may be implemented following harvest operations to ensure conformance to ROS target levels.

Forest operations will be planned so that they do not cause the Primitive classification to dip below 10% and so that appropriate deactivation measures will be implemented as soon as practicable following harvesting and primary silviculture activities to restore the Primitive classification to the original level. These evaluations will be undertaken by the Participants upon the preparation of each FOS.

Access will be managed to be consistent with the access related LRMP objectives and other SFMP indicators. Management options available to assist in meeting these objectives include access controls, road deactivation or rehabilitation, accelerated harvesting or alternative silviculture techniques. Access control and or deactivation may be completed for existing roads adjacent to or within the LU areas to remove areas from the “roaded” classification and move to the Semi-Primitive. These are subject to agency approvals and do not include energy sector or mining activities. All deactivation and other mitigating measures will be implemented as soon as practicable following harvesting and primary silviculture activities.

New road construction will be open for the duration of the season in which the forest management activity occurs (e.g., road construction, harvesting, and primary silviculture). Seasonal deactivation and access restrictions are normally be completed by the end of the active season.

The Graham River Integrated Resource Management Plan incorporated access restriction provisions to limit public access. These provisions were intended to protect wildlife and wilderness values and are consistent with LRMP objectives. The construction of a remote-control gate on the bridge crossing the Graham River addressed the LRMP strategic direction to restrict access for non-industrial users (as defined in the LRMP) south of the Graham River. Canfor holds the road and bridge tenure, and manages access permissions. . Once industrial activities are completed in the clusters accessed by the bridge, the bridge deck may be removed to further restrict access.

The Participants may use roads developed and maintained by other non-forest industry industrial users (e.g., energy, mining). If a Participant assumes responsibility for a road due to no other industrial user having long term interests in it, then the area occupied by the road will be as attributable to forest management activities.

New non-forestry related roads, and forest industry roads taken over by other industries (e.g., not deactivated due to other industries' needs) will not be considered in the ROS analysis.

5.46 ACTIONS ADDRESSING GUIDES, TRAPPERS AND OTHER INTERESTS

Indicator Statement	Target Statement
Percentage of operations consistent with mutually agreed upon action plans for guides, trappers and other known non-timber commercial interests	100% of operations will be consistent with action plans for guides, trappers and other non-timber commercial interests
SFM Objective: Recognize and Respect Indigenous Peoples' Rights	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

Variances are permissible only on reaching mutual agreement between the affected tenure holders and Participant.

What is this indicator and why is it important?

Diversity in commercial resource activities within a limited land base is important to the sustainability of communities. Extensive overlap of forest tenures with guide, trapping, and other non-timber commercial interests may necessitate mutually agreed upon action plans to address site-specific issues. This indicator measures the Participants' implementation success in addressing these actions.

Implementation and Monitoring Procedure:

The Participants currently notify trappers, guides and others that may be affected by proposed activities during the preparation of the FOS, as part of the regulatory public review and comment period. Prior to the commencement of approved forest activities, further notification is provided to those stakeholders that will be affected by the activity. In the event site specific comments are received, Participants attempt to come to agreement with the stakeholder on reasonable actions that may mitigate the impacts.

The Participants track comments, responses, and actions arising from this information sharing with stakeholders.

During the referral period for each SFMP, FOS, PMP, and/or SLP (if available) the Participants will provide opportunities to meet with affected guide, trapper and known non-timber commercial interest stakeholders to:

- Provide a review of the current SFMP, FOS, PMP, and/or SLPs (if available) as applicable,
- Seek site specific information from tenure holders and known non-timber commercial interests regarding tenure improvements, tenure use timing, and other issues pertinent

to the overlap of forest and guide, trapping tenures and non-timber commercial interest activities, and

- Where possible, develop, review and implement a mutually agreed action plan to address site-specific issues.

Outside of the review and comment periods, if concerns regarding forestry operations are raised by guides, trappers or other commercial interests, the Participants will endeavor to reach an amicable agreement to address the concerns by developing and implementing mutually agreed actions plans.

When an action plan is developed, the issue needs to be clearly identified to facilitate reporting. The Participants will enter the action plan in a database for tracking purposes identifying the action, that the issue deals with a guide, trapper or other commercial interest's concerns, what the due date to complete the action is, and the Participant's staff member responsible for completing or following up on the action.

The FOS, SLPs and all other short-term operational plans will be consistent with any agreements between Participants and guides, trappers and other known non-timber commercial interests.

An annual review of action plans will be completed, and a summary of conformance to action plans will be prepared and reported in annual reports.

5.47 TIMBER PROCESSING

Indicator Statement	Target Statement
Processing location of volume harvested in the DFA	Report the processing location for volume that was harvested within the DFA
SFM Objective: No applicable SFI objective.	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator is a report of where the volume of timber harvested within the DFA is being processed. The volumes harvested in the DFA include all quota, BCTS purchase, private, and woodlot volumes. The volumes exclude oil and gas salvage wood, as FOR reporting does not provide a clear distinction to delineate by TSA the source of this wood. The reporting provides an overview of how much volume is staying in the DFA for processing compared to the amount leaving the DFA. The intention is to provide transparency and insight into local economic performance.

This indicator was changed in 2024 from a target to a reporting requirement due to the closure of the Canfor Fort St John division, leaving the DFA without a mill to process conifer volume. This will likely result in volume harvested on their tenure to be processed outside of the DFA. Additionally, Louisiana-Pacific shares volume between the Peace Valley and Dawson Creek mills due to their proximity and regional management strategy.

Implementation and Monitoring Procedure:

Forest organizations that harvest in relation to their allocation of the allowable annual cut provide employment and taxation revenue to local communities. Forest organizations that process timber within the DFA will provide the most employment to the local communities in the DFA, however significant local employment is still generated from volume harvested in the DFA and processed elsewhere.

All timber to be harvested within the DFA is assigned a unique timber mark identifier and requires that a scale site designation (SSD) be approved by FOR. Each truckload of timber is then marked appropriately and delivered to the approved scale site designation and recorded into FOR's scaling information system. A query of the scale information system based on the population of tenures originating within the DFA will identify specifically where the timber was hauled to, how many cubic metres of timber was hauled and subsequently milled.

The SSD will be queried, and results will be summarized in the Annual Report using Table 29. All timber harvested from the DFA can be determined from records, except for oil and gas salvage which will be excluded from the calculation.

It is desired that most of the timber harvested by the major licensee Participants will be processed in their local facilities, however, economic challenges do not always make that possible as outlined above. In addition, timber that is sold through auction by BCTS can be delivered to any approved milling facility as there is no requirement that it be processed locally. This also applies to timber originating from private lands, woodlots, and oil and gas salvage activities. For the purposes of monitoring this indicator all timber harvested within the DFA and delivered to a processing facility within Canada will be included except for timber originating from oil and gas salvage.

Table 29: Proportion of Total Volume Locally Processed[7]

	Total Scaled Volume of Timber Delivered to Local Processing Plants (m^3)	(a) Total Scaled Volume of Timber Originating Within the DFA (m^3)	(b) Total Volume of Timber Originating Within the DFA Processed within the DFA (m^3)	(c) Total volume of Timber Originating within the DFA Processed outside of the DFA
Conifer				
Deciduous				
All				

[7] The volumes in the table include quota, BCTS, woodlot and private wood but do not include oil and gas salvage since there is no practical way to determine from which TSA the salvage wood originated

5.48 FOREST HEALTH FOS PLANNING

Indicator Statement	Target Statement
The percentage of significant detected forest health damaging agents outside areas with silviculture obligations which have treatment plans prepared and implemented	100% of significant detected forest health damaging agents outside areas with silviculture obligations will have treatment plans prepared and implemented within 1 year of initial detection
SFM Objective: Forest Health and Productivity	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Forest Health Management Landscape Level Strategy.	

Acceptable Variance:

Areas with significant detected forest health damaging agents where Participants are unable to obtain harvest authorizations due to Land Use decisions or agreements will be exempt from this indicator. A period of 1 year is permissible to provide for data collection and engagement with forest health specialists, First Nations, stakeholders, and the public. Any variances will be reviewed with applicable First Nations.

What is this indicator and why is it important?

This indicator describes the effectiveness of the forest health management strategy in addressing identified forest health issues. The current process of detection has to date been successful in identifying significant forest health issues, as broad-based pest incidence surveys have not identified any substantial catastrophic losses to damaging agents which have gone undetected. This indicator will identify that treatment plans are developed and implemented in a timely manner to address significant forest health issues that are detected.

Significant detected forest health damaging events are defined as those identified as:

- forest health events identified as significant by government agencies
- forest health events identified as significant by the Participants, or
- damage which threatens the survival of 10% or more of the trees in a merchantable stand greater than 50 hectares in size
- Field verified damage ranked as moderate or severe and greater than 50 ha in the annual AOS data

In addition to significant forest health damaging events, the Participants will engage in First Nation's led fuel management initiatives around communities and culturally significant areas.

Implementation and Monitoring Procedure:

Participants and FOR have conducted detection programs across most of the Fort St John DFA, focusing primarily on existing or proposed development areas. Some overview flights in other parts of the DFA have been undertaken where forest health issues in adjacent TSAs posed a potential threat to stands within the DFA. Fire and windthrow damage have been routinely identified from field information and overview flights, and salvage programs developed as required. Other forest health issues in the DFA have been sporadic and localized since significant forest utilization commenced, as most of the forest stands are relatively young.

FOR has on one occasion, requested a pest inventory assessment for a spruce beetle outbreak near Wonowon. Surveys showed the pest was limited in extent, and salvage logging was conducted to address the concern. Of late, forest health management focused on the mountain pine beetle outbreak which began locally in the later part of the term of SFMP# 2. The mountain pine beetle infestation has significantly declined to the point where it is no longer of sufficient significance to be considered the primary forest health agent requiring management in the Fort St John DFA. In 2023 massive wildfires occurred in the Fort St. John TSA impacting over 800,000ha, the largest being the Donnie Creek wildfire, which was greater than 600,000ha in gross size alone. Due to this, fire salvage has most recently been the primary focus related to forest health in the DFA

Harvesting is currently the most applied treatment and control for protecting mature timber inventories for fire, wind damage, and spruce beetle.

Participants utilize the forest health management expertise in the Canadian Forestry Service and FOR as needed. The Canadian Forestry Service holds extensive historical information (old Forest Insect and Disease Survey), and it also houses expert diagnostic services, and conducts research relevant to forest health management. FOR also has leading experts in diagnostics, management, and training.

AOS data from 2023 from Table 30 below reiterates the above comments, that fire is the main forest health damaging agent currently and other forest health damaging agents are currently insignificant in size and do not qualify as significant detected forest health damaging agents. (Although there is a couple Aspen Leaf Miner moderate severity polygons identified that were greater than 50ha, they are in areas currently not available for harvest under the Blueberry River First Nation's Implementation Agreement.) It should be noted that 2023 AOS did not have complete coverage due to smoke from the widespread forest fires.

1. The participants will review yearly the FOR AOS data spatially to determine if there are any significant detected forest health damaging agents in addition to those otherwise identified by FOR or the Participants. An example of the summarized AOS data from 2023 for the DFA is shown below in Table 30.
2. The participants will maintain and refine a detection and monitoring program for damaging agents over the land base by:

a) reviewing FOR Aerial Overview Surveys yearly and work with FOR to identify areas for further detailed helicopter and ground surveys

b) conducting aerial and ground surveys, as needed in areas where significant identified forest health damaging agents are found, and the cost benefit analysis is reasonable.

c) conducting aerial surveys in other parts of the DFA if there is reason to suspect potential forest health issues may exist in these areas.

d) collecting remote sensing data to detect forest health issues across the DFA as budgets allow to supplement AOS, aerial and ground surveys

e) providing training to appropriate forest workers, consultants and industry staff at identifying specific forest health concerns within the Fort St John DFA.

3. Active Participants will address fire management in their emergency response plans that outline objectives, duties and responsibilities related to minimizing fire risk and responding to fire occurrence.
4. The Participants will develop treatment plans for significant detected forest health damaging agents. Treatment plans will identify the location of the significant concern, and an implementation schedule for the proposed treatments. Treatment plans will be developed using forest health specialists as needed. Plans will consider the risk presented by the damaging agent, and the cost benefits of a range of available options. Some of the more common options which may be employed are:
   - relocating harvesting activities to meet forest health management requirements
   - pheromone baiting and lethal trap programs (trap trees in forested conditions, and lethal traps in mill yard conditions)
   - incorporating forest health requirements into cutblock designs or SLPs, where necessary to prevent the spread of forest health problems
   - no action, if warranted by the level of risk and cost: benefit analysis.

Table 30: Summary of FOR AOS data from 2023 showing current incidence and severity of forest health damaging agents across the FSJ DFA.

TSA	FHF	Geometry	Severity	Spot Area (ha)	Polygonal Area (ha)	Total Area (ha)
Fort St. John TSA	IBB	Polygonal	Trace		127	127
			Light		80	80
		Spot	Severe	18		18
			IBB Total	**18**	**207**	**225**
	IBS	Spot	Severe	17		**17**
			IBS Total	**17**		**17**
	ID6	Polygonal	Light		7	**7**
			Moderate		98	**98**
			ID6 Total		**106**	**106**
	NB	Polygonal	Severe		777,429	**777,429**
			NB Total		**777,429**	**777,429**
	NBP	Polygonal	Moderate		3	**3**
			Severe		4	**4**
			NBP Total		**7**	**7**
	NF	Polygonal	Severe		3	**3**
		Spot	Severe	0		**0**
			NF Total	**0**	**3**	**4**
	NW	Polygonal	Moderate		39	**39**
			Severe		16	**16**
			NW Total		**54**	**54**
Fort St. John TSA Total				**36**	**78,398**	**780,433**

IBB = Western Balsam Bark Beetle
IBS = Spruce Beetle
ID6 = Aspen Leaf Miner
NB = Fire
NBP = Post-Burn Mortality
NF = Flooding
NW = Windthrow

The Participants will report in the annual report on the results of all aspects of the monitoring plan and all treatment plans initiated and the time frame from detection as outlined above under the Implementation and Monitoring procedure. Forest health information on areas or damage agents of broad concern affecting or potentially affecting more than one participant (e.g., mountain pine beetle, spruce bark beetle) will be forwarded to FOR. Participants will notify FOR following treatment action on high-risk damage agents. A summary of significant pest conditions and treatment plans will be presented in each annual report.

5.49 PARTICIPANTS' COORDINATION

Indicator Statement	Target Statement
Percentages of SFMPs and FOSs jointly prepared by the Participants	100% of all SFMPs and FOSs will be jointly prepared by the Participants
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: Linkage to FSJPPR: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy	

Acceptable Variance:

May exclude new Participants that join the Pilot Project and can be assigned blocks from an existing plan, or Participants that are not required to complete a plan (e.g., TSL holders).

What is this indicator and why is it important?

The coniferous and deciduous timber resources are highly intermingled yet widely dispersed within the TSA. Most Participants' tenure interests lie primarily in either deciduous or coniferous stands, depending on what the needs are of their primary manufacturing customer. Independent development of adjacent and intermixed resources would result in serious overlapping tenure conflicts, an inability to meet broader landscape level objectives, and economic inefficiencies in planning effort and access development. Coordinated planning allows comprehensive analysis of all harvesting plans concurrently to determine forecasted impacts on landscape level strategies and SFMP indicators and provides a clearer document for First Nations and members of the public to understand potential cumulative impacts of all forestry operations.

Fully coordinated SFM and FOS Plans provide opportunities for cost efficiencies in planning, harvesting and road construction, and can ensure fair and equitable distribution of harvesting opportunities. Increased cost efficiencies promote the viability timber processing facilities.

"Jointly prepared" refers to a plan that applies to all effected Participants, and that the Participants, or their designated representatives, are aware of the plan, and agree with its content. The actual workload may vary between Participants, depending on the content of the plan, the relevance to their operations, and their administrative capacity.

Implementation and Monitoring Procedure:

Opportunities to streamline the information included in the FOS, and the FOS development and consultation process, including changes to schedule requirements, are outlined in Section 6.2 Revised FOS Requirements. SFM Pilot Project annual reports will list all SFMPs or FOSs that were prepared during the reporting period and if they were jointly prepared.

5.50A AAC PARTITION – DECIDUOUS PLANNING

Indicator Statement	Target Statement
The volume of deciduous species that has been identified in planned cutblocks in the FOS within the Core partition area	The Core area will have a maximum of 56% of the total planned deciduous harvest volume identified in the Fort St John TSA area
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy	

5.50B AAC PARTITION – DECIDUOUS HARVEST PERFORMANCE

Indicator Statement	Target Statement
The volume of deciduous harvest volume (measured using planning stage block volume data), that has been harvested by the Participants within the Core partition area since May 10, 2018	On a 3-year rolling basis, deciduous harvest volume in the Core area will not exceed an average of 512,000 m^3 annually
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy	

Acceptable Variance:

Acceptable variance to the annual partition target is 20% in any reporting year, with an acceptable variance of 10% to the 3-year rolling target. Variances account for: reduction in block volume from WTPs, revisions to Old Seral Retention, other retention, VRI inaccuracies, harvest deferrals necessary to address public, First Nation or stakeholder concerns. This variance provides Participants with the flexibility to meet the target with planned blocks considering the uncertainties inherent in the VRI and harvest scheduling. For this indicator:

- If the FSJ sawmill is down for greater than six months, conifer blocks contributing deciduous volume will not be tallied. Incidental deciduous volume within planned conifer blocks will not be tallied because the conifer blocks will not be harvested.
- If the harvest planning indicator is not achieved, the Participants have one year to amend the FOS to get it back into compliance.

What is this indicator and why is it important

This indicator is intended to track the Participants conformance with the AAC partition identified in the most recent (2018) AAC determination.

The Fort St John TSA TSR #3 AAC Determination, dated May 10, 2018, established the AAC for the Fort St John TSA at 2,115,000 m^3. The AAC determination also identified a non legal partition to the AAC as follows:

1. Coniferous species: a maximum of 1,200,000 m^3 for coniferous species of which no more than 672,000 m^3 may be harvested from the 'core area'. Within the core area spruce should comprise no more than 50% of the conifer volume; and
2. Deciduous species: a maximum of 915,000 m^3 for deciduous species of which no more than 512,000 m^3 may be harvested from the 'core' area.

The core area consists of the Blueberry, Kobes, Halfway, Lower Beatton and the southern portion of the Tommy Lakes landscape units. This AAC determination will remain in effect until a new AAC is determined. The partition is intended to result in a more balanced distribution of timber harvesting throughout the Fort St John TSA. Harvesting similar timber profiles to those assumed in the TSR process can help support the maintenance of sustainable long-term timber supplies. There have been several significant and substantial changes to land use planning since last Timber Supply Review for Fort St. John TSA., and more in process. There has also been significant impact caused by wildfire since the last AAC determination. It seems very unlikely that the partitions and species proportions that this indicator is based on reflect the reality of the actual current available fibre. A new Timber Supply Review is required that considers the significant impacts to available timber supply that have occurred since the last determination.

Current Status

Table 31 summarizes the Participants' planned harvest opportunities by geographic area. As of the date of preparation of this amendment, the total deciduous AAC managed by the Participants is 336,000 m^3. The planned volume is based on FOS#3 but with the significant changes to the land base, this no longer an accurate reflection of the Participants' harvest plans. A new FOS will be developed upon completion of SFMP#4, considering the targets outlined in these indicators.

Table 31. Participants' Planned Deciduous Harvest by Geographic Area

Geographic Area	Total Deciduous Volume (m^3)	Mgmt. Unit Proportion of Total TSA Deciduous Volume	AAC Partition Total Harvest Proportion Target
Core	2,441,084	40%	<56.1%
Periphery	3,765,052	60%	>43.9%
FSJ TSA	**6,206,136**	**100%**	

Table 32 summarizes the deciduous volume harvested during 3 reporting years. Newly harvested volume will be summarized in the Annual Report.

Table 32. Participants' Deciduous Volume Harvested During 3 Reporting Years

	Reporting Period					
	2022-2023		2023-2024		2024-2025	
Managing Participant	Periphery Total Deciduous Harvest Volume (m^3)	Core Deciduous Harvest Volume (m^3) & Proportion of Total TSA Deciduous Harvest (%)	Periphery Total Deciduous Harvest Volume (m^3)	Core Deciduous Harvest Volume (m^3) & Proportion of Total TSA Deciduous Harvest (%)	Periphery Total Deciduous Harvest Volume (m^3)	Core Deciduous Harvest Volume (m^3) & Proportion of Total TSA Deciduous Harvest (%)
BCTS	0	18,898 (100%)	0	1000 (100%)	0	0
Canfor	15,726	60,622 (79%)	111,551	60,228 (35%)	104,971	22,141 (17%)
LP	0	0	0	14,213 (100%)	0	116,972 (100%)
TOTAL	**15,726**	**79,520 (83.5%)**	**111,551**	**75,441 (40%)**	**104,971**	**139,113 (57%)**

*3-year rolling performance is at 55.8%

Implementation and Monitoring Procedure:

Harvest scheduling is typically planned 1-3 years in advance of the desired harvest date. Because of the lead time required to develop cutblock harvest plans and acquire necessary cutting and road permits, the Participants will require up to 3 years to revise their harvest plans to bring their harvest performance into conformance with the AAC partition. FOS amendments will be

generated by the Participants, adding blocks where geographically necessary, to bring the FOS harvest opportunities in line with the deciduous AAC partition.

The AAC determination rationale does not specify how performance to the partition is to be measured (units) or monitored (periodicity). The reporting proposed by the Participant's will include annual performance and average performance over the 3-year rolling period. The 3-year rolling period for harvest performance monitoring provides flexibility to ramp up revision of harvest scheduling plans over a few years to conform with the non-legal partition. It also provides flexibility to overcut in an individual year, followed by undercutting to ensure that over the reporting period, the intent of the partition is achieved – this is similar flexibility to that provided by cut control requirements which are monitored over a 5-year period.

Conformance to this indicator is summarized in annual reports. The Participants will annually report the amount of:

- The proportion of total TSA deciduous harvest within the Core area. Both indicators will use the block volume data generated at the FOS planning stage. Cruise and or scale volume data may be used where available for reporting harvest performance.

FOS and harvest performance will be analyzed to ensure they are consistent with the TSA AAC partition. Proposed development will be adjusted, if necessary, to ensure consistency with targets identified in the SFMP which are designed to generate conformance with the AAC partition.

5.51A AAC PARTITION - CONIFER PLANNING

Indicator Statement	Target Statement
The volume of conifer species that has been identified in planned cutblocks in the FOS within the Core partition area	A) In the Core area non spruce conifer species will comprise a minimum of 50% of the total planned conifer harvest volume. B) The Core area will have a maximum of 56% of the total planned conifer harvest volume identified in the Fort St John TSA area
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy	

5.51B AAC PARTITION - CONIFER HARVEST PERFORMANCE

Indicator Statement	Target Statement
The volume of conifer species (measured using planning stage block volume data), that has been harvested by the Participants within the Core partition area since May 10, 2018	On a three-year rolling average: A) Conifer harvest volume in the Core area will not exceed an average of 672,000 m^3 annually. B) In the Core area non spruce conifer species will comprise a minimum of 50% of the total conifer volume harvested by the Participants
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: For the purposes of Section 42 of the FSJPPR this indicator statement, target statement and acceptable variance will be used to determine if forest practices are consistent with the Timber Harvesting Landscape Level Strategy	

Acceptable Variance:

The acceptable variance to the annual partition target is 20% in any reporting year, with an acceptable variance of 10% to the 3-year rolling target. Variances account for: reduction in block volume from WTPs, revisions to Old Seral Retention, other retention, VRI inaccuracies, harvest deferrals necessary to address public, First Nation or stakeholder concerns. This variance gives us flexibility to meet the target with planned blocks in light of the uncertainties inherent in the VRI and harvest scheduling. For this indicator:

- If PVOSB mill is down for greater than six months, deciduous blocks contributing conifer volume will not be tallied. (Incidental coniferous volume within planned deciduous blocks will not be tallied because the deciduous blocks will not be harvested.)
- If the harvest planning indicator is not met, the Participants have one year to amend the FOS to get it back into compliance.
- BCTS monitoring, volume is considered harvested once the volume has been sold.
- This indicator is to be reviewed after the next Timber Supply Review (TSR) to ensure continued relevance to the new TSR.

What is this indicator and why is it important

This indicator is intended to track the Participants' conformance with the AAC partition identified in the most recent (2018) AAC determination.

The Fort St John TSA TSR #3 AAC Determination, dated May 10, 2018, established the AAC for the Fort St John TSA at 2,115,000 m^3. The AAC determination also identified a non legal partition to the AAC as follows:

1. Coniferous species: a maximum of 1,200,000 m^3 for coniferous species of which no more than 672,000 m^3 may be harvested from the 'core area'. Within the core area spruce should comprise no more than 50% of the conifer volume; and

2. Deciduous species: a maximum of 915,000 m^3 for deciduous species of which, no more than 512,000 m^3 may be harvested from the 'core' area.

The 'core' area consists of the Blueberry, Kobes, Halfway, Lower Beatton and the southern portion of the Tommy Lakes landscape units. This AAC determination will remain in effect until a new AAC is determined. The partition is intended to effect a balanced distribution of timber harvesting throughout the Fort St John TSA. Harvesting similar timber profiles to those assumed in the TSR process can help support the maintenance of sustainable long-term timber supplies. Harvest performance in smaller diameter pine stands was identified as a priority in TSR 2, but due to the damage inflicted on the pine resource from the mountain pine beetle, was no longer considered a priority in the most recent AAC determination. There have been several significant and substantial changes to land use planning since last Timber Supply Review for Fort St. John TSA, and more in process. There has also been significant impact caused by wildfire since the last AAC determination. It seems very unlikely that the partitions and species proportions that this indicator is based on reflect the reality of the actual current available fibre. A new Timber Supply Review is required that considers the significant impacts to available timber supply that have occurred since the last determination.

Current State

Table 33 summarizes the Participants' planned harvest opportunities by geographic area. As of the date of preparation of this amendment, the total conifer AAC managed by the Participants is 767,011 m^3 annually. The planned volume is based on FOS#3 but with the significant changes to the land base, this is no longer an accurate reflection of the Participants' harvest plans. A new FOS will be developed upon completion of SFMP#4, considering the targets outlined in these indicators.

Table 33. Participants' Planned Harvest by Geographic Area

Geographic Area	Spruce Volume (m^3)	Non-spruce Conifer Volume (m^3)	Total Conifer Volume (m^3)	Target Spruce Proportion for the Core area (%)	Spruce Proportion of Geographic area Conifer Volume (%)	TSA Total Harvest Target Proportion	Partition Area Proportion of Total TSA Conifer Volume (%)
Core	1,583,947	842,248	2,426,195	<50.1	65	<56.1	34
Periphery	3,094,975	1,548,094	4,643,069	N/A	67	>43.9	66
FSJ TSA	**4,678,922**	**2,390,342**	**7,069,264**		**66%**		**100%**

Table 34 summarizes the conifer volume harvested during 3 reporting years. Newly harvested volume will be summarized in the Annual Report.

Table 34. Conifer Volume Harvested During 3 Reporting Years

	Reporting Period					
	2022-2023		2023-2024		2024-2025	
Managing Participant	Core Total Conifer Harvest Volume (m^3)	Core Spruce Harvest Volume (m^3) & Proportion of Total Core Conifer Harvest (%)	Core Total Conifer Harvest Volume (m^3)	Core Spruce Harvest Volume (m^3) & Proportion of Total Core Conifer Harvest (%)	Core Total Conifer Harvest Volume (m^3)	Core Spruce Harvest Volume (m^3) & Proportion of Total Core Conifer Harvest (%)
BCTS	15,437	41,737 (73%)	4,392	0	0	0
Canfor	140,633	42,007 (23%)	133,653	71,967 (35%)	65,808	80,432 (55%)
LP	0	0	14,818	2,020 (12%)	49,296	3,710 (7%)
TOTAL	**156,070**	**83,744 (35%)**	**152,863**	**73,987 (32.6%)**	**115,114**	**84,142 (42%)**

*3-year rolling performance is 36%

Implementation and Monitoring Procedure:

Harvest scheduling is typically planned 1-3 years in advance of the desired harvest date. Because of the lead time required to develop cutblock harvest plans and acquire necessary cutting and road permits, the Participants will require up to 3 years to revise their harvest plans in order to bring their harvest performance into conformance with the AAC partition. FOS amendments will be generated by the Participants, adding blocks where geographically necessary, to bring the FOS harvest opportunities in line with the coniferous AAC partition.

The AAC determination rationale does not specify how performance to the partition is to be measured (units) or monitored (periodicity). The reporting proposed by the Participants will include annual performance and average performance over the 3-year rolling period. The 3-year rolling period for harvest performance monitoring provides flexibility to ramp up revision of harvest scheduling plans over a few years to conform with the non legal partition. It also provides flexibility to overcut in an individual year, followed by undercutting to ensure that over the reporting period, the intent of the partition is achieved – this is similar flexibility to that provided by cut control requirements which are monitored over a 5-year period.

Conformance to this indicator is summarized in annual reports. The Participants will annually report the amount of:

- The proportion of spruce conifer harvest in the Core area, and
- The proportion of total TSA conifer harvest within the Core area.

Both indicators will use the block volume data generated at the FOS planning stage. Cruise and or scale volume data may be used where available for reporting harvest performance.

FOSs and harvest performance will be analyzed to ensure they are consistent with the TSA AAC partition. Proposed development will be adjusted, if necessary, to ensure consistency with targets identified in the SFMP which are designed to generate conformance with the AAC partition.

5.52 CUT CONTROL

Indicator Statement	Target Statement
Percentage of total Allowable Annual Cut (AAC) charged to licensee tenure holder or BCTS Participants during the cut control term of each license	Industry Participants: Not to exceed 110% of the combined cumulative coniferous AAC for the cut control period Not to exceed 110% of the combined cumulative deciduous AAC for the cut control period BCTS Participant: Not to exceed 110% of the combined cumulative coniferous commitment offered for sale for the cut control period Not to exceed 110% of the combined cumulative deciduous commitment offered for sale for the cut control period
SFM Objective: Forest Management Planning	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None, however, the actual volume permissible to be harvested may be adjusted through time if additional licenses are awarded to Participants to address past undercuts, or changes made by the Chief Forester to the approved AAC for the TSA.

What is this indicator and why is it important?

Harvesting at levels that do not significantly exceed the cumulative coniferous and deciduous volumes allocated under various licenses, agreements and apportionments provides assurances that the industry and BCTS are harvesting at levels consistent with the established AAC for the Fort St. John TSA. The targets may need to be revised in the event of catastrophic natural disturbances, or related regulatory changes.

Implementation and Monitoring Procedure:

The Participant's strategy is to develop harvest or timber sale plans consistent with allocated coniferous and deciduous harvest levels over the term of each license.

The FOS uses the approved allowable harvest levels for all Participants' tenures to assign cutblocks to their license or apportionment.

BCTS uses FOS volumes to develop timber-selling programs consistent with coniferous and deciduous apportionments. Plans are modified, as needed once more accurate volumes are determined from operational timber cruises. BCTS' conformance to cut apportionment levels is determined from coniferous and deciduous cruise data from individual advertised timber sales, whether the volume is sold or not.

Industry Participants' cut control positions are based on actual scaled deliveries plus bush waste assessment volumes. Cuts attributable to the coniferous and deciduous licenses will be assigned to the two targets consistent with the TSA AAC methodology. On deciduous licenses, all deciduous and coniferous volumes charged to cut control will apply to the deciduous component of this indicator. On coniferous licenses, all coniferous and deciduous volumes charged to cut control will apply to the coniferous component of this indicator.

The industry Participants' will periodically compare planned estimated harvest volumes to actual cut control volumes and modify future harvest plans as needed to compensate for over or underestimates of actual versus estimated volumes.

The final assessment of achievement of the target for this indicator will be provided in the Annual Report that follows the end of the cut control period for each license. Interim monitoring will be presented in each year's annual report to demonstrate whether the Participants are trending towards achievement of this target for each license.

Industry Participants: The annual cut control levels will be monitored using the FOR's harvest billing system, which provides the cut control volumes for each tenure. Coniferous licenses and deciduous licenses volumes will be summed, and the total coniferous and deciduous industry annual and cumulative to date cut control volume will be reported in each Annual Report.

BCTS Participant: The annual commitment for volume offered will be determined separately for coniferous and deciduous volumes based on timber sales offered for sale during the government fiscal year (April 1st – March 31st). The annual and cumulative BCTS coniferous and deciduous volumes offered for sale will be reported in each Annual Report. The following Table 35 will be used to report results in Annual Reports:

Table 35: Volume Harvested by Cut Control Year per License

License	AAC (m^3)	Cumulative Cut Control Volume (m^3)	Volume Harvested (m^3) by Cut Control Year					Total Volume Harvested (m^3)
			1	2	3	4	5	
A18154	394,952							
BCTS Conifer Allotment	372,059							
BCTS Deciduous Allotment	180,000							
A98271	100,000							
TOTAL								
Maximum Total Cumulative AAC (m^3)								
Maximum Total Cumulative AAC (m^3) = 110% of cumulative AAC								

5.53 DOLLARS SPENT LOCALLY ON EACH WOODLANDS PHASE

Indicator Statement	Target Statement
Percentage of dollars spent locally on each woodlands phase in proportion to total expenditures	Woodlands phases to be monitored: • Logging/hauling: minimum of 80% • Road construction and maintenance: minimum of 80% • Silviculture: minimum of 5% • Planning and administration: minimum of 50%
SFM Objective: No applicable SFI objective.	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

A 10% variance to the minimum target (e.g., logging/hauling 10% lower than 80%= 72% of costs) is required for each identified woodlands phase, as the dollars to be spent fluctuate annually, depending on the amount of harvesting completed that year.

What is this indicator and why is it important?

Forest products organizations that harvest in relation to their allocation of the allowable annual cut provide employment and taxation revenue to local communities. Hiring local contractors and suppliers results in a more stable and resilient local economy. Participants' woodlands operations purchase a wide variety of products and services to produce timber and to manage their forestry activities. This indicator is a measure of total amount of dollars attributed to forestry activities (woodlands phase*) that are spent locally, which is an indication of the diversity of the local forest employment opportunities associated with forest industry activities. For the purposes of this objective, "local" has been defined as those residences or businesses which have mailing addresses or known established businesses located in the Peace Natural Resource District. The indicator includes staff costs as local administrative costs and refers to the total expenditures of all Participants.

Implementation and Monitoring Procedure:

Costs for all woodlands phases will be tracked annually, and a query will be done identifying the amount of these dollars that are expended in contracts to local contractors, (as determined by the contractor mailing address, or otherwise known to have local operations) and dollars paid to employees, all of whom are considered local. The data includes the total values of all Participants' woodlands costs.

The following activities have been combined to define a woodlands phase.

- Logging and hauling,
- Road construction and road maintenance, including deactivation,
- Reforestation, including external costs for seedlings, site preparation, planting, brushing and all silviculture surveys,
- Planning and administration, including all wages, all office overhead, all forest development and layout, taxes, leases and rentals.

Stumpage and forest rent costs are excluded from the cost basis, as these are paid to the provincial government.

Each Participant will be responsible for ensuring that all costs are tracked by each phase as identified above and further tracked by the invoice addresses to determine whether this is local or not. A summary will be provided in the annual report.

5.54 NUMBER OF KNOWN VALUES AND USES ADDRESSED IN OPERATIONAL PLANNING

Indicator Statement	Target Statement
Percentage of known traditional site-specific First Nation values and uses identified that are addressed in operational plans	100% of known traditional site-specific First Nation values and uses identified will be addressed in operational plans
SFM Objective: Protection of Special Sites; Recognize and Respect Indigenous People's Rights	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

The indicator is a measure of the Participants' recognition and response to the traditional First Nation's values and uses that are made known in a timely manner during referral processes. The requirement for site-specificity enables both the Participant and First Nations to best qualify and/or quantify the effects of forest development and the strategies required to manage for the development.

This indicator contributes to respecting the social, cultural, heritage and spiritual needs of First Nation people who traditionally and currently use the DFA for the maintenance of traditional aspects of their lifestyle. Working with First Nations to identify, define and develop management approaches that recognize and respect traditional values and uses is an important component of the forest industry's sustainable forest management framework.

This indicator applies to any block or road where a Participant has agreed to implement special measures in an operational plan to address site specific concerns identified by a First Nation. This indicator also applies to archeological sites or areas of potential (AOP) identified during an Archaeological Overview Assessment (AOA) and/or Archaeological Impact Assessment (AIA) and the applicable recommendations from the Archaeologist.

Implementation and Monitoring Procedure:

Participants will continue with ongoing relationship building processes with First Nations, to encourage meaningful engagement and input during the development of the SFMP, the FOS, and PMPs.

The Participants will provide opportunities for First Nations to provide site-specific information about traditional values and uses (subject to confidentiality agreements) at the SFMP, FOS, block development and PMP stages.

Detailed operational planning will occur following the review and comment periods. Measures will be identified in operational plans to address all site-specific known values and uses included in the scope of this indicator.

Information provided after the formal referral review and comment periods will be considered and addressed to the extent Participants are able to do so without unduly disrupting ongoing operations. Ongoing communication with First Nations will also occur through regular or ad hoc meetings that may be arranged, or field trips, that provide additional opportunities for dialogue with First Nations.

The Participants field staff are trained in the recognition of wildlife habitat and cultural heritage resources features. Standard Work Procedures provide guidance to field staff regarding the requirement to identify and protect various resource features encountered during fieldwork activities. This guidance provides for management of resource features not specifically identified by First Nations via discussion of the Participants plans.

Participants will track the number of opportunities for communication, meetings and input provided during review and comment opportunities for operational plans. Where site-specific information on traditional uses and values is provided, the Participants will record the information, track the issue and any resulting action plans and/or strategies to address the values, and identify staff responsibilities to complete or close off the action. Information from AIAs will likewise be tracked through Participants' information management systems.

A review of the information management systems will be completed for the April 1st to March 31st period each year, and the results for this indicator will be reported in Annual Reports.

5.55 TERMS OF REFERENCE (TOR) FOR PUBLIC PARTICIPATION PROCESSES

Indicator Statement	Target Statement
Maintaining the current Terms of Reference (TOR) for the FSJPPR public participation process	The TOR for the FSJPPR public participation process (PAG) will be maintained with a formal biennial review
SFM Objective: Community Involvement and Landowner Outreach; Public Land Management Responsibilities	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

The TOR will be reviewed at some point every second year (in even years). Due to the timing of meetings, the TOR review may not be in the same month each year.

What is this indicator and why is it important?

The Participants are committed to provide ongoing opportunity for the public to be involved in the Fort St. John Pilot Project planning and monitoring activities. A key element in the public oversight component is the establishment of a Public Advisory Group (PAG) and TOR for the PAG. This indicator states that every second year a review of the TOR will be completed by the PAG to ensure the TOR remain relevant through time. This is a demonstration that the public participation process is designed and functioning to the satisfaction of the PAG.

Implementation and Monitoring Procedure:

It is anticipated that implementation of the indicator strategy will result in the generation of a TOR that is reflective of the needs of the Participants and interests represented on the PAG.

The Participants will review the TOR timing requirements included in Section J of the TOR when preparing the draft agenda prior to each PAG meeting, and if two years have passed since the last TOR approval, they will add it as a topic to be addressed in the agenda. The status of the Terms of Reference review will be reported in annual reports.

5.56 PUBLIC INQUIRIES

Indicator Statement	Target Statement
The percentage of timely responses to public inquiries	Respond to 100% of public inquiries regarding Participants' forestry practices within one month of receipt
SFM Objective: Community Involvement and Landowner Outreach; Public Land Management Responsibilities	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

Responses will be provided to all inquiries, provided contact information is provided so that the Participants can reach the person making the inquiry.

What is this indicator and why is it important?

This indicator measures the percentage of timely responses provided to public inquiries or concerns regarding our woodlands activities that effect the environment or other forest resource users. The indicator includes responses to public comments on operational plans (e.g., SFMP's, FOSs, PMPs) as well as unsolicited public comments on operational activities. Relevant information used in decision making is made available to the PAG, general public and affected parties upon request.

Providing timelines for responses that provide information on the Participants' operational practices, or indicate how a particular issue will be addressed, encourages the Participants to

actively consider and address public input. The responses also provide an indication that comments are being considered within the planning and communication processes.

Implementation and Monitoring Procedure:

The Participants currently solicit feedback from interested stakeholders and the public when preparing public plans. As well, ongoing feedback is often received regarding the practices and management of the forest from interested parties.

It is anticipated that implementation of the indicator strategy will result in the generation of opportunities for the public, First Nations and others to gain a better understanding of the Participants planned activities.

All staff who receive inquiries will be responsible for forwarding them to the appropriate person within the organization in a timely manner that will allow for a response within one month.

Supervisors responsible for applicable plans or operational activities will ensure that responses are provided to public inquiries concerning the environment, or inquiries from other forest resource users. They will also ensure records are kept of the inquiries and responses.

Public inquiries regarding forestry operations or plans will be tracked as such in the Participants databases (e.g., LRM), with information clearly identifying it as a public inquiry, what the issue is, who is responsible to respond to the inquiry, and by when (i.e. within one month of original receipt of the inquiry). Once the response is provided, the response and date provided will be noted in the database, and the action plan closed.

A review of the database will be completed for each annual reporting period (April 1st-March 31st) to identify and report all the public inquiries received, and to determine if the one-month time frame was achieved. The information will then be summarized and reported in the Annual Report.

5.57 EDUCATIONAL OUTREACH

Indicator Statement	Target Statement
Number of people to whom information, presentations, or field trips provided annually	Minimum of 40 people provided information, presentations, or field trips
SFM Objective: Community Involvement and Landowner Outreach	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator measures the access to relevant information related to forestry operations and sustainable forest management topics that is provided to the PAG and the general public. Providing pertinent information, presentations or field trips assists in increasing the level of understanding of the issues and opportunities in sustainable forest management.

The participants are committed to working with directly affected stakeholders and members of the public on forest management issues and have a well-established history of participation in community meetings, including local planning processes. The sharing of knowledge contributes to informed, balanced decisions and plans acceptable to the majority of the public. When informed and engaged, members of the public can provide local knowledge and support that contributes to socially and environmentally responsible forest management.

Implementation and Monitoring Procedure:

It is anticipated that implementation of the indicator strategy will result in the generation of opportunities for the public, First Nations and others to gain a better understanding of the Participants' planned activities and of forest management concepts resulting in an educated and informed public with a broad understanding of forestry that can provide local input and support on matters pertaining to forest planning and operations.

The Participants currently engage in public outreach by various means including hosting PAG meetings that are open to the public, posting of annual reports and audit summaries to the internet and to the Fort St. John Public Library, participating in local trade shows, meeting with school groups and in hosting a community picnic. These events provide opportunities to share information with interested members of the public.

During scheduled PAG meetings, members are polled on what types of information presentations or field trip topics they would find useful at or prior to the next meeting. The Participants or advisors may also suggest presentation or field trip topics that the PAG may find helpful in future meeting deliberations. Participants maintain their involvement in educational outreach initiatives (e.g., maintaining an open and active public advisory group, hosting field tours and open houses, providing notification/referrals with educational content to stakeholders, conducting school classroom presentations, participation in trade fairs, publication of informative articles and responding to public inquiries). The Participants will record attendance level at each meeting or tour (public and stakeholders), estimate readership for articles published/posted to the web, count the number of public enquiries responded to, count the number of stakeholders provided information and count the number of students provided information.

The Participants will annually track and report the number of people that participated in educational opportunities. During the preparation of the Annual Report a review of minutes from PAG meetings will identify the number of people (PAG members, advisors and the public) in attendance at presentations or field trips. Internal data tracking systems such as ITS & COPI will be used to record:

- the number of public enquiries responded to,

- the number of people reached by notification/referrals including educational content sent to stakeholders,
- the number of people reached by school visits,
- the number of people responding to articles published in local newspapers or posted to the web, and
- the number of people requesting information in response to the Participants' involvement in trade fairs, open houses or similar public events during the annual reporting period (April 1st-March 31st).

5.58 HERBICIDE USE

Indicator Statement	Target Statement
The amount of area treated by herbicide application where prior consent was received from First Nations	The participants will obtain consent from First Nations on 100% of the area treated with herbicide annually
SFM Objective: Conservation of Biological Diversity; Recognize and Respect Indigenous Peoples' Rights	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator is a measure of the participants' efforts to reduce herbicide use as a vegetation management tool, in response to input received from First Nations and the public regarding the impact of herbicide use on specific non timber resources. In response to the Blueberry Implementation Agreement and the Treaty 8 Consensus Agreements, the Participants agree to eliminate aerial herbicide usage across the DFA, as well as to obtain applicable First Nation consent for herbicide ground applications.

This indicator reflects the Participants' recognition and response to the traditional aboriginal values and uses that are made known in a timely manner during referral processes. The requirement for site-specificity enables both the Participant and First Nations to best qualify and/or quantify the effects of vegetation management and the strategies required to manage for the treatment.

Implementation and Monitoring Procedure:

It is anticipated that implementation of the indicator strategy will result in the generation of opportunities for the public, First Nations and others to gain a better understanding of the

Participants vegetation management activities resulting in an educated and informed public with a broad understanding of forestry that can provide local input and support on matters pertaining to forest planning and operations.

Participants will continue with ongoing relationship building processes with First Nations, to encourage meaningful engagement and input during the development of the PMPs and the Notification of Intent to Treat (NIT) process. The Participants will encourage First Nations to provide site-specific information about traditional values and uses (subject to confidentiality agreements) at the SFMP, FOS, PMP and NIT stages.

Detailed operational planning will occur following the review and comment periods. Strategies will be implemented in operational plans to address all site-specific known values and uses included in the scope of this indicator. Information provided after the formal referral review and comment periods will be considered and addressed to the extent Participants are able to do so without unduly disrupting ongoing operations. Ongoing communication with First Nations will also occur through regular or ad hoc meetings that may be arranged, or field trips, that provide additional opportunities for dialogue with First Nations to identify site-specific information.

Participants will annually track the area originally proposed for vegetation management using herbicide application as the treatment method. Participants will also annually track the area removed from each year's herbicide management program. The Participants will also record information provided by First Nations and the public regarding requests to alter or revise annual herbicide treatment plans. This information will be recorded in the Participants' tracking systems, and any resulting action plans and/or strategies to address the values and identify staff responsibilities to complete or close off the action will be tracked. A review of the information management systems will be completed for the April 1st to March 31st period each year, and the results for this indicator will be reported in Annual Reports.

Operational plans will be consistent with jointly agreed upon strategies between Participants and First Nations.

5.59 PAG SATISFACTION SURVEYS

Indicator Statement	Target Statement
Level of satisfaction with the public participation process as measured by PAG surveys	A minimum satisfaction level of 80% as measured by PAG surveys
SFM Objective: Community Involvement and Landowner Outreach; Public Land Management Responsibilities	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

10%. An average satisfaction level of less than 80% will result in follow-up discussions with the PAG to identify opportunities for improving the level of satisfaction with the public participation process.

What is this indicator and why is it important?

The SFM Public Advisory Group (PAG) was established to assist the Pilot Project participants in developing SFM Plans in part by identifying local values, objectives, indicators and targets. The SFM Plan is an evolving document that will be reviewed for effectiveness and revised as needed, with the assistance of the Public Advisory Group, to address changes in forest condition and local community values.

Maintaining the interest and participation of this group is an integral part of a dynamic and responsive SFM Plan. The ability of people to share information, discuss and solve problems, and set and meet objectives is key to achieving and maintaining meaningful participation. A vigorous public participation process helps to ensure issues are identified, discussed, and where possible, resolved.

This indicator was established in 2011 and utilized a set of survey questions focusing on satisfaction with the public participation process. Prior surveys, conducted in the 2009 and 2010 monitoring years focused on the process of individual PAG meetings assessing satisfaction with meeting process, facilitation, support and logistics.

PAG members are given the opportunity to complete an anonymous online or hard copy Public Participation Process Satisfaction survey. The satisfaction survey continues to provide insight into areas for future improvement of the public participation process.

Implementation and Monitoring Procedure:

It is anticipated that implementation of the indicator strategy will result in the generation of a public participation process that is responsive to the needs of the public and will promote an educated and informed public with a broad understanding of forestry that can provide local input and support on matters pertaining to forest planning and operations. This indicator will also foster the continuation of an active and engaged PAG and contribute to continuous improvement of the PAG function.

Participants will provide all PAG members and interested public who have shown notable interest (PAG meeting attendance) during the reporting period, a feedback form (survey) to assess their satisfaction with the process. The survey will be sent only to those public advisory group members and advisors that submitted written comments regarding the SFMP or attended one of the meetings in the subject reporting period. Public observers who have attended a minimum of 2 PAG meetings in the reporting period will also be offered the opportunity to complete the survey. Therefore, the survey population will consist of PAG members, PAG advisors, and public observers who have attended 2 or more meetings in the subject reporting period.

A PAG meeting survey, intended to assess the efficacy of individual PAG meetings, will be administered separately as per the PAG TOR and is considered an additional tool to be used by the Participants to improve the public participation process. However, the results of the PAG

meeting surveys are not considered when reporting the average level of satisfaction with the public participation process for this indicator.

The satisfaction survey will be sent out annually, on or about the time of the annual spring meeting and is intended to reflect upon the PAG's satisfaction with the public participation process over the reporting year that is about to or has drawn to a close. For example, the spring meeting is usually held in February or March and the reporting year runs from April 1 to March 31 annually. Accordingly, the subject time frame for the satisfaction survey will be the current reporting year that is about to conclude on March 31.

The survey content and process will follow the direction described in the Public Advisory Group's Terms of Reference. All survey questions will have a 1-5 scoring assessment (*1 – very dissatisfied, 2 – somewhat dissatisfied, 3 – neutral, 4 – somewhat satisfied, 5 – very satisfied*). A sample of the types of questions to be included in the evaluation form is noted below. The actual evaluation form and questions to be used will be a stand-alone document from this SFMP. Revisions to the evaluation form will not warrant amendment of the SFMP document.

The results of individual surveys returned to the participants will be compiled to generate an average score from all surveys for each question. The average score for each question will then be tallied to determine an overall average score which will be the basis for assessment of the indicator. The overall average score will be converted to a percentage basis and will represent the satisfaction level with the public participation process. The indicator target of a satisfaction level of at least 80% is equivalent to an average survey score of at least 4 out of 5. The overall average satisfaction level will be noted in the annual report.

Fort St. John Pilot Project Sustainable Forest Management (SFM) Plan
PUBLIC PARTICIPATION PROCESS EVALUATION FORM

The purpose of this form is to provide an opportunity for PAG members, advisors and the public to evaluate the effectiveness of the public participation process. Results of the evaluation will be used to effect continual improvement. Thank you for taking the time to complete the form. Only rate the statements that pertain to your experience. Please rate your level of satisfaction or agreement with the following aspects of the public participation process by circling the response which most closely reflects your opinion.

1. I have a good understanding of the purpose of the advisory group and my role as part of that group.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

2. My concerns related to SFM values and objectives are being adequately listened to at the Advisory Group Meetings.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

3. Efforts have been made to incorporate my concerns related to SFM values and objectives into the SFM Plan.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

4. My concerns related to SFM indicators and targets are being adequately listened to at the Advisory Group Meetings.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

5. Efforts have been made to incorporate my concerns related to SFM indicators and targets into the SFM Plan.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

6. Information provided in advance of meetings is adequate and organized to allow for me to effectively contribute.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

7. Advisory Group Meetings are run efficiently and effectively.

1	2	3	4	5	
Very	Somewhat	Neutral	Somewhat	Very Satisfied	Not applicable



Dissatisfied	Dissatisfied		Satisfied		

8. The meeting agenda allows for discussion of any related sustainable forestry issues of concern to advisory group members.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

9. The meeting minutes capture important aspects of the meeting.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

10. Additional information I ask for is provided to me.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

11. The participants encouraged open communication.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

12. The outputs generated through discussion with the public advisory group (SFM Plan and annual monitoring reports) are clear and concise.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

13. The participants strived for consensus-based decision making.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

14. A broad cross-section of interests is represented at Public Advisory Group Meetings.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

15. The participants have tried to recruit new members as needed.

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

16. The Participants are proactive about sharing new information to the PAG members regarding topical issues related to environment, sustainability, forestry, etc.?

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

17. PLEASE Rate your overall level of satisfaction with the public participation process

1	2	3	4	5	
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Not applicable

Questions 1-16 are intended to identify level of satisfaction with individual aspects of the public participation process.
Question 17 is intended to assess the overall satisfaction with the combined aspects of the public participation process.

4. The Fort St John Pilot Project Managing Participants would like your input! To keep PAG meetings more engaging and tailored towards the group's interests, we would like your feedback on which guest speakers or topics relating to sustainable forest management in the Fort St. John TSA you would like to see explored in upcoming PAG meetings. Some examples could be traditional ecological knowledge, wildlife, hydrology, soils, forest inventory and analysis, etc. Please let us know your suggestions below!

Note that for the purposes of annual reporting of the participants' performance with regard to SFMP indicator # XX, question 17 and 18 are not included in the computation of the average score for indicator.

For any scores less than 3, please provide any comments or suggestions that will explain the reason for the score and how you feel the process can be improved. Scores of less than 3 with no explanatory comment will be excluded from the analysis.

Thank you again for your time in completing the survey – your feedback is very much appreciated!

Please return completed survey to:
Sarah Curtis RPF
Louisiana Pacific Canada Ltd.
8220 259 Road
Fort St. John BC V1J 8J9
sarah.curtis@lpcorp.com

5.60 AVAILABILITY OF INFORMATION ON SFM

Indicator Statement	Target Statement
An annual report and audit results made available to the public	Annual reports and audit results will be made available to the public
SFM Objective: Communications and Public Reporting	
Linkage to *FSJPPR*: FSJPPR 57(3)(d), (e): A participant must ensure that the following information is reasonably available for review by the public during business hours at one or more of the business premises of the participant in the pilot project area: *(a) a copy of any audit report submitted under section 50 during the previous 5 years.* *(b) a copy of any annual report submitted under section 51 during the previous 5 years.*	

Acceptable Variance:

None.

What is this indicator and why is it important?

This indicator was established in 2011. This target recognizes the importance of keeping members of the public informed on forestry strategies being developed and planning occurring in the FSJPP area. Issues of concern brought forward by the public are part of the discussions occurring at public advisory group meetings and often work their way into a reporting requirement of the SFM Plan such as Indicator 5.56 Public Inquiries. Annual reporting of the Plan's performance measures to the public advisory group and to the broader public provides an open and transparent means of demonstrating how issues of concern are being managed and provides opportunity for the public to respond. This provides members of the public opportunity to share local knowledge that contributes to socially and environmentally responsible forest management.

It is anticipated that implementation of the indicator strategy will result in the generation of opportunities for the public, First Nations and others to gain a better understanding of the Participants' Forest management activities. This will educate and inform the public and provide a broader understanding of forestry, which can translate to more local input and support on matters pertaining to forest planning and operations.

Implementation and Monitoring Procedure:

The Participants make annual report and audit reports available to the public by posting the reports to the Fort St John Pilot Project, Canfor and BCTS websites, providing a copy to the FOR and the Fort St. John Public Library. The Participants also discuss the annual report and audit results with the public advisory group.

The Participants maintain a website that makes the annual report publicly available (*www.fsjpilotproject.com*). The monitoring report is provided to government and is also posted to the managing participants' external websites. A copy of the annual report will be provided to the Fort St. John Library.

Expected results of the implementation of this indicator are increased public awareness and understanding of the SFM Plan and annual performance against the Plan's targets, and a continuously improving SFM Plan that has openly informed, included and responded to the public.

The Participants will report a yes/no answer as to whether the annual monitoring report was made publicly available by way of:

- an external website,
- submission to government agencies,
- submission to the PAG and
- submission to Fort St. John Public library.

5.61 REPRESENTATIVE EXAMPLES OF ECOSYSTEMS

Indicator Statement	Target Statement
The percentage of area of forest stands in a non-managed condition, by leading species, by NDU	100% of baseline targets for forested stands in a non-managed condition, by leading species, by NDU will be met
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

10 ha or 10% of area, whichever is greater for Leading Species by NDU that have an uncommon distribution (as noted in Table 37) if required for access purposes.

No acceptable variance for Leading Species by NDU that are not identified as uncommon in Table 37.

What is this indicator and why is it important?

The following is adapted from Bunnell 2002 and Wells et.al. 2003 a, b.

Habitat structures and patterns that are monitored by the indicators for forest type, seral stage, patch size, dispersed retention, coarse woody debris (volume and structure), riparian, shrubs, and wildlife tree patches are considered as medium filters. These indicators are designed to ensure that the habitat requirements of many species are met in managed stands. There are,

however, species about which we know little, but that may be restricted to particular ecosystem types or geographic localities. Most species, but especially those for which knowledge is sparse or absent, are best sustained by ensuring that some portion of each distinct ecosystem type is represented in a relatively non-managed state.

Stands that are not subject to active forest management also play an important role as a precautionary buffer against errors in efforts intended to sustain species in the managed forest. While we can develop management practices intended to keep many forest-dwelling species in managed forests, we also recognize that we have insufficient knowledge to ensure that proposed practices will meet all species' requirements in those stands. That is particularly true of the many poorly known, or completely unknown, organisms. Non-managed stands are an ecological safeguard against the inevitable errors or unintended consequences that occur during management.

Poorly understood functions also will be sustained in non-managed areas. For example, natural disturbances can occur that would otherwise be suppressed or reduced. While some aspects of natural disturbance can be mimicked in managed stands, other aspects cannot be (e.g. large patches of burned snags, or large areas attacked by spruce or balsam bark beetles). Some species benefit from or rely on these features of natural disturbance, so may not be productive in managed landscapes.

The final function of non-managed areas in the landscape is to provide an ecological baseline against which the effects of human activities can be compared (Arcese and Sinclair 1997). This role as a benchmark is especially critical in the long-term monitoring required to assess effectiveness of forest practices.

It is preferable to conduct this type of representative management based on site series or clusters of site series or plant associations. Until such time as this type of information is available leading tree species shall be the coarse filter for representativeness. A non-managed condition for the purposes of this indicator is considered as areas not contributing to the long-term harvest level within the DFA, or non-THLB (NHLB).

Setting aside a large percentage of the THLB as non-managed forest to ensure that biological richness is sustained may not always be compatible with economic and social objectives for managed forests. Forest districts in BC typically have 20% to 50% or more of the forest in a non-managed state. This non-managed area is of two types: 1. areas that are not harvested or are harvested only lightly because of concerns other than conserving biological diversity (e.g., operability, visual quality, watershed protection, favoured-species management[8]); and 2. areas intentionally set aside to protect biological diversity (e.g. UWR, wildlife tree patches, riparian buffers, etc.). Based on the latest Timber Supply Review, the 2016 Fort St. John TSA Discussion Paper lists several classifications of potentially forested land that is removed from the CFMLB in the net-down to THLB. Table 36 below shows the net-down area from CFMLB to derive THLB. Cells with yellow-highlights and bolded figures in the "Unique Area excluded" are potential

[8] Even though favoured species, such as caribou, are a component of biological richness, such species-specific approaches can work against sustaining all of biological diversity. It is important to assess how areas set aside for a single species contribute to the broader goals of representation.

forested areas that could be considered non-managed and represent ~58% of the CFMLB. Please see Table 19 for a complete reproduction of the 2016 Discussion Paper table.

This non-managed proportion of the land base exceeds the objective for protected areas of most jurisdictions (typically 12%, following the Brundtland commission), and exceeds many recommendations derived from principles of conservation biology (e.g., 33 to 50%; Noss 1993; Sætersdal and Birks 1993; Stokland 1997; Soulé and Sanjayen 1998) (Bunnell 2002).

Table 36: Net-downs from CFMLB (from 2016 FSJ TSA Discussion Paper)

CFMLB = 2,757,161 ha Areas excluded below:	**Total Area (ha)**	**Unique Area Excluded (ha)**	**Percent Area Excluded**
Oil and gas imprint	102,016	50,801	1.8
Current roads	117,483	63,045	2.3
Stream management area	164,864	**74,148**	2.7
Lake management area	2,934	**837**	0.03
River management area	41,602	**22,530**	0.8
Low productivity sites	1,966,293	**1,009,275**	36.6
Steep ground	552,232	**92,668**	3.4
Unstable ground	199,252	**35,208**	1.3
Economically inoperable	54,330	**1,323**	0.05
Problem forest types	1,683,748	**207,156**	7.5
Does not meet min harvest age (MHA) criteria on VDYP curves	2,681,354	**75,568**	2.7
Wildlife and range burns	59,170	8,085	0.3
Wildlife habitat areas	321,456	**16,599**	0.6
Ungulate winter range	293,099	**14,717**	0.5
Recreation sites	2,297	571	0.02
Archaeology sites	1,513	181	0.01
Permanent sample plots for growth and yield	175	147	0.01
Wildlife Tree retention	35,865	**35,865**	1.3
THLB	**1,020,817**	**1,708,724**	**62.0**

Current Status:

The latest assessment of the future condition of this indicator was completed to confirm consistency of amendment 411 to the FOS. The targets specified for proportion of area in forest stands by leading species in an unmanaged condition in SFMP# 3 will remain for this plan. The table below (Table 37) and indicates the best available projection for future status of forest stands by leading species and NDU for the Non-THLB (NHLB). This reflects the stand types that will exist in a non-managed state. FOS blocks have been identified within the portion of the land base that is considered as the THLB.

An assessment of those NDU/species combinations considered unique (highlighted in yellow in the following table) to ensure that targets are not compromised. The above would likely not be necessary for the Boreal Plains NDU due to the amount of area already in the NHLB.

Data collection for TSR IV was not started during the development of this plan. Analysis of the future condition of this indicator will be completed to assess the consistency of the FOS with this SFMP, when the next Timber Supply Review data package is available .

Table 37: Current (2022) Proportion of Leading Species by NDU Unmanaged (from FOS amendment #411)

NDU	Leading Species	Total Forested Area (ha)	NHLB (ha)	Projected Harvest area to 2036 (ha)	SFMP Target Baseline (%)	NHLB (%)
Boreal Plains	Ac	26,343	26,028	421	12	99
Boreal Plains	At	596,069	180,359	41,095	12	30
Boreal Plains	Bl	2,479	1,821	13	12	73
Boreal Plains	Ep	67,149	64,795	1,200	12	96
Boreal Plains	Lt	42,113	42,091	0	12	100
Boreal Plains	Pl	457,485	194,738	15,247	12	43
Boreal Plains	Sb	1,328,078	1,299,703	8,356	12	98
Boreal Plains	Sw	287,505	131,463	23,356	12	46
Boreal Plains	Sx	156,139	49,853	11,946	12	32
Boreal Plains - Total		3,001,939	1,128,887	101,634		
Boreal Foothills - Valley	Ac	224	219		80	98
Boreal Foothills - Valley	At	3,165	2,062	134	12	65
Boreal Foothills - Valley	Bl	2,295	2,259	2	80	98
Boreal Foothills - Valley	Ep	32	32	0	100	100
Boreal Foothills - Valley	Pl	12,789	6,496	1,228	12	51
Boreal Foothills - Valley	Sb	1,782	1,604	35	12	90
Boreal Foothills - Valley	Sw	45,763	35,739	1,722	12	78
Boreal Foothills - Valley	Sx	196	102	0	12	52
Boreal Foothills - Valley Total		66,247	48,512	3,119		73
Boreal Foothills - Mountain	Ac	46	46	0	100	100
Boreal Foothills - Mountain	At	2,827	2,425	4	12	86
Boreal Foothills - Mountain	Bl	11,997	11,716	47	12	98
Boreal Foothills - Mountain	Pl	19,262	14,424	842	12	75
Boreal Foothills - Mountain	Sb	921	859	0	12	93
Boreal Foothills - Mountain	Sw	85,261	72,748	2,297	12	85
Boreal Foothills - Mountain	Sx	98	93	0	12	94

Boreal Foothills - Mountain - Total				3,190		
Northern Boreal Mountains	Ac	203	198	0	70	98
Northern Boreal Mountains	At	6,893	6,097	0	12	88
Northern Boreal Mountains	Bl	11,888	11,694	0	12	98
Northern Boreal Mountains	Pl	20,005	17,002	0	12	85
Northern Boreal Mountains	Sb	2,914	2,897	0	12	99
Northern Boreal Mountains	Sw	18,669	16,370	0	12	88
Northern Boreal Mountains	Sx	121,094	116,782	0	12	96
Northern Boreal Mountains - Total				0		
Omineca - Valley	Ac	14	14	0	100	100
Omineca - Valley	At	414	326	0	50	79
Omineca - Valley	Bl	18	18	0	100	100
Omineca - Valley	Pl	2,146	1,278	0	12	60
Omineca - Valley	Sb	240	236	0	100	60
Omineca - Valley	Sw	5,333	3,883	0	12	73
Omineca - Valley	Sx	86	86	0	NO TARGET	
Omineca - Valley Total				0		
Omineca - Mountains	Ac	20	20	0	100	100
Omineca - Mountains	At	732	671	0	50	92
Omineca - Mountains	Bl	17,901	17,890	0	12	100
Omineca - Mountains	Pl	5,792	4,655	0	12	80
Omineca - Mountains	Sw	63,387	60,444	0	12	95
Omineca - Mountains	Sb	382	377	0	100	99
Omineca - Mountains - Total				0		

Implementation and Monitoring Procedure:

This indicator is forecasted at each TSR. Forested areas and types undergo an review to see whether they contribute to potential timber supply. The current status table was derived from the base case analysis definition of the THLB conducted in support of TSR 3. New inventory information and assumptions on which forest types contribute to timber supply will require a new forecast following completion of TSR 4.

Setting aside a large percentage of the THLB as non-managed forest to ensure that biological richness is sustained may not always be compatible with economic and social objectives for managed forests. Forest districts in BC typically have 20% to 50% or more of the forest in a non-managed state. This non-managed area is of two types: 1. areas that are not harvested or are harvested only lightly because of concerns other than conserving biological diversity (e.g., operability, visual quality, watershed protection, favoured-species management[9]); and 2. areas intentionally set aside to protect biological diversity (e.g., UWR, wildlife tree patches, riparian buffers). Based on the latest Timber Supply Review, the 2016 Fort St. John TSA Discussion Paper lists several classifications of potentially forested land that is removed from the CFMLB in the net-down to THLB (Table 19).

This non-managed proportion of the land base exceeds the objective for protected areas of most jurisdictions (typically 12%, following the Brundtland commission), and is comparable to many recommendations derived from principles of conservation biology (e.g., 33 to 50%; Noss 1993; Sætersdal and Birks 1993; Stokland 1997; Soulé and Sanjayen 1998) (Bunnell 2002).

Forested stands by leading species are used as a surrogate for ecosystem groupings in this broad, landscape-level assessment. Data sources for this include forest cover (VRI), Participants' block management data, Natural Disturbance Unit boundaries, and DFA boundaries. Changes in leading species types due to disturbances such as fires generally take many years post-disturbance to appear and be reflected in forest inventory, and are updated less frequently than changes due to industrial development or forest management. Revised leading species information following the recent wildfire disturbances is not available. As new inventory information is collected and incorporated into timber supply analyses, this indicator will be reviewed and confirmed that it is still being met.

During each TSR process this indicator will be analyzed to ensure that the required representation of forest types by leading species is met.

Each FOS will have the leading species NDU combinations highlighted in Table 37 reviewed, and plans adjusted if necessary to ensure that the targets for these species are achieved. The FOS rationale will identify if any of these stands are proposed for harvest and confirm that the target is still being achieved.

[9] Even though favoured species, such as caribou, are a component of biological richness, such species-specific approaches can work against sustaining all of biological diversity. It is important to assess how areas set aside for a single species contribute to the broader goals of representation.

5.62 RARE ECOSYSTEMS

Indicator Statement	Target Statement
Percentage of the area of rare ecosystem groups reserved from harvest	100% of the area of rare ecosystem groups will be reserved from harvest
SFM Objective: Conservation of Biological Diversity	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

10% of the total rare ecosystem group forest area may be harvested, where required to construct safe access or in situations where less overall environmental disturbance is created by building access through the rare ecosystem group versus building access to avoid the rare ecosystem group. Based on assessments completed by professionals, those sites deemed poor representations of the rare ecosystem group may be harvested.

What is this indicator and why is it important?

Maintaining representation of a full range of ecosystem types is a widely accepted strategy to conserve biodiversity. Ecosystem conservation represents a coarse-filter approach to biodiversity conservation. It assumes that by maintaining the structure and diversity of ecosystems, the habitat needs of various species will be provided. For many species, if the habitat is suitable, populations will be maintained. Please see also Section 5.61 Representative Examples of Ecosystems for the importance of maintaining some forest in a non-managed condition.

For the purposes of this SFMP rare forest ecosystem groups are defined as those forest ecosystem groups that make up less than 0.1% (2,166 ha) of the forested portion of the crown forest land base (2,166,838 ha).

Current Status:

Rare ecosystems are frequently identified as focal points for conservation concern. Provincially, ecosystems are listed based largely on frequency of occurrence or rarity. There are at least three broad reasons for creating local lists, including:

- to help assess the status of an ecosystem throughout a planning area,
- to focus attention and tracking on ecosystems that merit conservation concern; and
- to help rank allocation of resources to conservation efforts, such as parks, Wildlife Habitat Areas, Old Growth Management Areas (OGMA's) or Wildlife Tree Patches (WTPs).

An analysis of ecosystem representation across all Canfor licensee operations was conducted in 2011. This analysis predicted the abundance and representation of ecosystem groups within four

distinct regions and 13 management units across Canfor and BCTS operations in BC. The following steps were carried out for this analysis:

- Identifying the non-harvesting land base,
- Classifying the forested land base into ecosystem groups, and
- Evaluating the amount and how the ecosystem groups are distributed in the harvesting and non-harvesting land base.

Classification of the landscape into units that represent the diversity of ecosystems is fundamental to representation analysis. Representation studies worldwide have used various classification systems based on landform-vegetation classes (Awimbo, Norton, and Overmars 1996), climate-physiography-soil-vegetation interactions (Lapin and Barnes 1995), breeding bird communities (Saetersdal and Birks 1993), and physiography alone (Wessels, Freitag, and van Jaarsveld 1999). The Biogeoclimatic Ecosystem Classification (BEC) (Pojar, Klinka, and Meidinger 1987) integrates climate, soils, and vegetation into a hierarchal scheme that lends itself well to representation analysis for forest ecosystems of British Columbia.

Definition of ecosystem types requires classification at an ecologically appropriate scale (Pregitzer, Goebel, and Wigley 2001). Existing Provincial BEC mapping is commonly used for coarse filter management using the variant level. This information is often too general since variants describe climate and may contain a wide range of ecosystems that may respond differently to forest management. Conversely, representation at the BEC site series level is not appropriate for a coarse filter approach for practical reasons (too many groups) and because there is limited evidence that organisms are linked to this level of detail (Huggard 2000; Bunnell et al. 2003).

The goal for the ecosystem classification was to identify a level of site series aggregation that recognizes the uniqueness of individual sites while providing logical ecosystem units for coarse filter management. Ralph Wells created groups of site series (eco-groups) for this analysis using statistical methods (described in more detail in Appendix C: Site Series Cluster Analysis of the Ecosystem Representation Analysis Report). Expert review of the eco-groups was provided by Bruce Rogers and Michael Ryan (Research Ecologists, FOR).

The Fort St John TSA is approximately 4.86 million hectares in north-eastern BC. It is mostly in the North-East Plains region, with the western portion of the TSA in the North-East Mountains region. The THLB makes up 37% of the Crown Forest Management Land base (refer to Table 19 for a full area breakdown of the TSA).

There are six forested BEC variants in the Fort St John MU, and the highest BEC responsibility is for variant BWBSwk2 at 89%. The eco-groups that occur within this variant in Fort St. John are:

BWBSwk2 – North-East Plains 3, 6, 11, 12, 14, 19, 20, 26, 27, 28, and 31

Ecosystem Representation Analysis examines the proportion of each ecosystem unit that is expected to remain unharvested. A level of representation of eco-groups in the non harvesting land base (NHLB) provides an ecological safeguard to ensure that some portion of each distinct ecosystem type is represented on the land base in a relatively unmanaged state. See Table 38 for the analysis of eco-group representation within the NHLB.

There are a total of 36 eco-groups in Fort St John, 11 in the North-East Mountains region and 25 in the North-East Plains. The North-East Mountains groups have very high NHLB representation (all greater than 50%), and the North-East Plains groups range from a low of 25% for group 24 to 91% representation for group 22. Overall, there is 47% representation of eco-groups in the NHLB.

Table 38: Fort St John DFA representation of eco-groups in the NHLB

Region	Eco Group Number	Eco Group Name	Forest Area (ha)	Percent NHLB
NE Mtns	69	hygric SWBmk	2,303	53.2%
	68	subhygric-hygric SWBmk	26,063	58.0%
	25	submesic-mesic SWBmk	95,221	58.5%
	46	submesic-subhygric SWBmk	2,656	63.0%
	9	subxeric ESSFmv4	180	68.5%
	30	subxeric-mesic ESSF	107,640	69.7%
	21	subxeric-hygric ESSF	4,915	70.7%
	43	hygric ESSFmv4	219	70.7%
	48	mesic-hygric ESSF/SBS	29,184	71.6%
	5	subxeric SWBmk	2,538	74.9%
	3	xeric SWBmk	891	76.0%
NE Plains	24	submesic-subhygric BWBSmw	227,678	24.8%
	21	submesic-hygric BWBSmw$	208,483	30.5%
	20	mesic-subhygic BWBSwk2$	679	40.4%
	26	submesic-mesic BWBSwk	148,886	40.5%
	19	submesic-mesic BWBSwk2$	36,681	43.2%
	16	submesic-subhygric BWBSmk$	103,220	44.1%
	31	mesic-hygric BWBSwk$	2,965	44.4%
	11	submesic BWBSwk2$	4,255	45.5%
	8	submesic BWBSmk$	21,459	46.2%
	33	hygric BWBSwk3	207	46.8%
	12	submesic-mesic BWBS	535,897	47.7%
	27	subhygric-hygric BWBSwk2	30,492	49.6%
	9	submesic-subhygric BWBS$	8,135	51.5%
	25	mesic-hygric BWBS (horsetail)	294,252	52.9%
	6	xeric-subxeric BWBSwk2	410	53.6%
	28	mesic-subhygic BWBSwk2	8,466	54.1%
	4	xeric-subxeric BWBS	2,674	59.0%
	1	xeric-subxeric BWBSmk$	1,840	68.3%
	34	subhygric-hygric BWBSmk	9,048	69.0%
	15	submesic-subhygric BWBS	48,486	69.6%
	23	mesic-subhygic BWBSmw$	4	69.8%
	14	subxeric-hygric BWBS	200,299	74.2%
	3	xeric-subxeric BWBSwk$	36	77.5%
	2	xeric-subxeric BWBSmw$	10	86.0%

Region	Eco Group Number	Eco Group Name	Forest Area (ha)	Percent NHLB
	22	submesic BWBS$	467	91.1%
			2,166,838	48.8%

Most of the eco-groups have low abundance, the most common is North-East Plains group 12, at 25% of the CFLB (Table 39). The rarest is North-East Plains group 23, with only 4 ha total. There are 11 eco-groups that are rare, with an abundance of less than 0.1% (Table 39).

Table 39: Eco-group abundance in the Fort St. John MU

Region	Eco Group Number	Eco Group Name	Forest Area (ha)	Abundance (% of CFLB)	Status
NE Mtns	9	subxeric ESSFmv4	180	0.0%	Rare
	43	hygric ESSFmv4	219	0.0%	Rare
	3	xeric SWBmk	891	0.0%	Rare
	69	hygric SWBmk	2,303	0.1%	
	5	subxeric SWBmk	2,538	0.1%	
	46	submesic-subhygric SWBmk	2,656	0.1%	
	21	subxeric-hygric ESSF	4,915	0.2%	
	68	subhygric-hygric SWBmk	26,063	1.2%	
	48	mesic-hygric ESSF/SBS	29,184	1.3%	
	25	submesic-mesic SWBmk	95,221	4.4%	
	30	subxeric-mesic ESSF	107,640	5.0%	
NE Plains	23	mesic-subhygic BWBSmw$	4	0.0%	Rare
	2	xeric-subxeric BWBSmw$	10	0.0%	Rare
	3	xeric-subxeric BWBSwk$	36	0.0%	Rare
	33	hygric BWBSwk3	207	0.0%	Rare
	6	xeric-subxeric BWBSwk	410	0.0%	Rare
	22	submesic BWBS$	467	0.0%	Rare
	20	mesic-subhygic BWBSwk2$	679	0.0%	Rare
	1	xeric-subxeric BWBSmk$	1,840	0.1%	Rare
	4	xeric-subxeric BWBS	2,674	0.1%	
	31	mesic-hygric BWBSwk$	2,965	0.1%	
	11	submesic BWBSwk2$	4,255	0.2%	
	9	submesic-subhygric BWBS$	8,135	0.4%	
	28	mesic-subhygic BWBSwk2	8,466	0.4%	
	34	subhygric-hygric BWBSmk	9,048	0.4%	
	8	submesic BWBSmk$	21,459	1.0%	
	27	subhygric-hygric BWBSwk2	30,492	1.4%	

Region	Eco Group Number	Eco Group Name	Forest Area (ha)	Abundance (% of CFLB)	Status
	19	submesic-mesic BWBSwk2$	36,681	1.7%	
	15	submesic-subhygric BWBS	48,486	2.2%	
	16	submesic-subhygric BWBSmk$	103,220	4.8%	
	26	submesic-mesic BWBSwk	148,886	6.9%	
	14	subxeric-hygric BWBS	200,299	9.2%	
	21	submesic-hygric BWBSmw$	208,483	9.6%	
	24	submesic-subhygric BWBWmw	227,678	10.5%	
	25	mesic-hygric BWBS (horsetail)	294,252	13.6%	
	12	submesic-mesic BWBS	535,897	24.7%	
			2,166,838	100.0%	

Table 40: Rare Eco-groups BEC site series and association

Region	Eco Group #	Eco Group Name	BEC Site Series	Moisture-Nutrient regime	Site Association
NE Mtns	3	xeric SWBmk	SWB mk-02	Very xeric-subxeric; very poor-poor	Sw - Scrub birch - Cladina
	9	subxeric ESSFmv4	ESSF mv4-02	Subxeric-submesic; poor	BlPl - Crowberry - Cladina
	43	hygric ESSFmv4	ESSF mv4-05	hygric; poor-rich	Bl - Alder - Horsetail
NE Plains	1	xeric-subxeric BWBSmk$	BWBSmk-102$	xeric-subxeric; poor-rich	At - Soopolallie - Kinnikinnick
	2	xeric-subxeric BWBSmw$	BWBSmw102$	xeric-subxeric; poor-rich	At - Soopolallie - Kinnikinnick
	3	xeric-subxeric BWBSwk$	BWBSwk1-102$	xeric-subxeric; poor-rich	At - Kinnikinnick - Fuzzy-spiked wildrye
			BWBSwk2-102$	xeric-subxeric; poor-rich	At - Kinnikinnick - Fuzzy-spiked wildrye
	6	xeric-subxeric BWBSwk	BWBSwk2-102	xeric-subxeric; very poor-medium	Pl - Lingonberry - Reindeer lichen
	20	mesic-subhygic BWBSwk2$	BWBSwk2-110$	mesic-subhygric; medium-rich	At - Highbush cranberry - Bluebells
	22	submesic BWBS$	BWBSwk1-103$	submesic; medium-rich	At - Rose - Fuzzy-spiked wildrye
	23	mesic-subhygic BWBSmw$	BWBSmw-110$	mesic-subhygric; rich	AT - Highbush-cranberry -Oak fern

	33	hygric BWBSwk3	BWBSwk3-111	hygric; very poor-poor	Sb - Horsetail - Stepmoss

Implementation and Monitoring Procedure:

Area identified as rare ecosystems within the Fort St. John MU represents 4,943 ha or 0.18% of the crown forested land base.

It is anticipated that rare ecosystems, as defined by the current ecosystem representation analysis, will be maintained into the future. It is anticipated that a diversity of ecosystems exhibiting “rare” attributes will be maintained, thereby enabling a diversity and abundance of naturally occurring plants, animals and their habitats to be maintained into the future.

Ecological site identification consists of collecting accurate site, soil, and vegetation information, and then using the various tools and descriptive material presented in the publications “A Field Guide For Ecosystem Identification for the Boreal White and Black Spruce Zone of British Columbia” and “A Field Guide for Site Identification and Interpretation for the Northern Rockies Portion of the Prince George Forest Region” to identify the site unit that best fits the information collected. The development of an appropriate management prescription depends on accurate site description and other site-specific data (e.g., slope gradient, soil texture), as well as correct site unit identification. Combining site identification with the collection of site, soil, and vegetation data provides the most complete ecological description of a site. The intent is to reserve the area of representative rare ecosystems encountered in the field during harvest block layout activities.

There is much natural variability in ecosystems, and it is important to approach ecosystem classification with that understanding. Not every ecosystem can be easily “pigeonholed” into a classification unit. To be reserved from harvest, a candidate “rare” ecosystem must be a good representation of the eco-group considered to be rare by the ecosystem representation analysis. Based on assessments completed by forest professionals, those ecosystems that exhibit significant variability that prevents definitive identification and are therefore deemed poor representation of the rare eco-group, may not be reserved from harvest.

All cut block layout completed after June 2014 will incorporate an assessment of ecological site classification to identify rare ecosystems at the fieldwork stage of development. When a mappable unit (typically >= 1. 0 ha that are not part of complexes) of the ecosystems noted as rare in Table 40, are identified in the field, they will be reserved from harvest. In situations where the rare eco-group is part of a site series complex, the rare eco-group will be reserved from harvest if the site series complex is >= 2 ha in size and the rare eco-group comprises greater than 60% of the total area of the site series complex.

Periodically, revision of the list of rare ecosystems may occur by way of ecosystem representation analyses conducted in conjunction with Timber Supply Review processes or by stand alone ecosystem representation analyses, which may be triggered by forest inventory or predictive ecosystem mapping updates for the DFA.

Participants will annually report any incidents of harvesting that occurred in ecosystem groups defined as rare. During development of SLPs blocks are compared against the predictive rare ecosystem data and retention activities identified where the presence of the rare ecosystem is

confirmed in the field. The results of the ground confirmation will be reported annually in the annual report.

In order to ensure that 100% of the rare ecosystem groups are reserved from harvesting, the following actions will be undertaken.

- Prior to layout being conducted a map identifying the predicted locations of rare ecosystems is compared to proposed road and block locations.
- The requirement to reserve rare ecosystems from harvest is reviewed with layout staff and contractors during the pre-work stage. This will enable the layout crews to identify any of the rare ecosystem sites during their fieldwork.
- Where representative rare ecosystem groups are identified in the field, the areas will be reserved from harvest or road construction by either removing the area from the harvest block or incorporating the area in WTPs or other reserves.

In the situations noted above where a rare eco-group is not reserved from harvest, a rational describing the reasons for harvesting the eco-group will be prepared by the prescribing professional.

5.63 EFFECTIVE COMMUNICATION – NON-TIMBER RESOURCES

Indicator Statement	Target Statement
Evidence of communication and consideration of non-timber resources into forest management planning	100% of non-timber resource values, identified through communication, have been responded to and considered and may be accommodated in forest management plans
SFM Objective: Community Involvement and Landowner Outreach	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

Variances are permissible only on reaching mutual agreement between the affected stakeholder and Participant.

What is this indicator and why is it important?

The intent of the indicator is to plan forest management activities with consideration given to concerns brought forward by stakeholders. This indicator measures the Participants' implementation success in addressing these actions.

This indicator was designed to assess the Participant's performance relative to providing tenured and non-tenured stakeholders effective opportunities to be proactively involved in forest management planning activities and provide input on proposed development activities. This will ensure that when forestry activities are planned, information is exchanged in an effective and

timely manner, to resolve potential land use conflicts before they occur. This process will help to identify interests and non-timber values that require consideration within the planning framework. Resulting stakeholder input could include the identification of interest areas, detail as to the nature of the interest on the land base and site level detail regarding potential impacts resulting from proposed development activities. Addressing issues successfully requires open communication of interests and expectations, a proactive process to address issues, and commitment to implement mutually agreed upon actions at some future time.

When significant disagreement occurs, efforts towards conflict resolution are documented. For the purposes of this indicator, 'significant disagreement' requires the complaint to be submitted to the respective participant in writing. This indicator and target demonstrate the Participants' commitment to track and follow actions through to completion.

Implementation and Monitoring Procedure:

Forestry planning staff will provide the opportunity for tenured and non-tenured stakeholders to meet or otherwise provide comments on forestry activities proposed for their area of interest in the FOS, PMP or other operational plans that are made available for review and comment. Where issues are identified during the referral of these plans, potential actions to resolve the issues will be discussed with the applicable stakeholder, and any subsequent forest management plan accommodations will be noted in action plans with completion dates and responsibilities identified.

These action plans and dates will be documented and entered as issues into incident tracking systems, responsibilities will be identified and communicated to affected staff, and progress will be tracked through to completion of the action. In the event circumstances require that changes be made to the action plan the forestry supervisor making the change will note in the action plan what change was made, indicate in the plan that he has discussed and got agreement from the applicable stakeholder for the change, and notify any responsible parties of the changes made.

Outside of the review and comment periods, if concerns regarding forestry operations are raised by tenured and non-tenured stakeholders, the Participants will endeavour to reach an amicable agreement to address the concerns by developing and implementing mutually agreed actions plans.

In the event of a significant disagreement, the Participants shall document all efforts towards conflict resolution. The participants will provide a response within 30-days of receipt and document steps to move towards resolution.

The number and type of opportunities provided by the Participants to interested and directly affected stakeholders to be pro-actively involved in forest management planning activities and provide input regarding proposed development will be tracked by planning staff. The Participants will be required to review and summarize this information annually for reporting purposes.

Reporting will include, but is not limited to, the number of accommodations completed, and the number of accommodations not completed as scheduled, to determine the percentage of consistency with management plans. An annual review of action plans will be completed, and a summary of conformance to action plans will be prepared and reported in annual reports. Note: annual reporting will not disclose the proportion of suggestions accommodated.

FOSs, PMPs, and other operational plans which require public review and comment will be referred to known stakeholders, and actions agreed to will be identified in the final submission of these plans. SLPs, harvesting and silviculture plans will be consistent with any relevant accommodations to the management Plans (SFMP, FOS, PMP) and associated action plans.

5.64 EFFECTIVE COMMUNICATION – FIRST NATION COMMUNITIES

Indicator Statement	Target Statement
Evidence of ongoing communication with First Nation communities and consideration of information gained	100% of information on First Nation titles and rights, identified through on-going communication with First Nation communities, has been responded to and considered and may be accommodated in forest management planning
SFM Objective: Protection of Special Sites; Recognize and Respect Indigenous Peoples' Rights	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

The intent of the indicator is to plan forest management activities with consideration given to concerns brought forward by First Nation communities respecting titles and rights. This indicator measures the Participants' implementation success in addressing these actions.

When significant disagreement occurs, efforts towards conflict resolution are documented. For the purposes of this indicator, 'significant disagreement' requires the complaint to be submitted to the respective participant in writing. This indicator and target demonstrate the Participants' commitment to track and follow actions through to completion.

Implementation and Monitoring Procedure:

Implementation of this indicator is expected to result in continued effective communication between the Participants and First Nation Communities. It is anticipated that forest operations will respect and reflect the interests made known from First Nation communities, resulting in the maintenance of First Nation values and opportunities to practice treaty rights.

Where issues are identified during the referral of management plans, potential actions to resolve the issues will be discussed with the applicable First Nations, and any subsequent forest management plan accommodations will be noted in action plans with completion dates and responsibilities identified. In the event of a significant agreement, the Participants shall

document all efforts towards conflict resolution. The participants will provide a response within 30-days of receipt and document steps to move towards resolution.

The number and type of opportunities provided by the Participants to First Nation communities to be pro-actively involved in forest management planning activities and provide input regarding proposed development will be tracked by planning staff. The Participant's will be required to review and summarize this information annually for collating and reporting purposes.

Contact types will include referrals, general inquiries, educational, etc. Reporting will include, but is not limited to, the number of attempts to contact, actual number of contacts and number of responses with information, the number of accommodations actually completed, and the number of accommodations not completed as scheduled, to determine the percentage of consistency with management plans. An annual review of action plans will be completed, and a summary of conformance to action plans will be prepared and reported in annual reports

FOSs, PMPs, and other operational plans which require public review and comment will be referred to First Nation communities, and actions agreed to will be identified in the final submission of these plans. SLPs, harvesting and silviculture plans will be consistent with any relevant mutually agreed upon action plans

5.65 Residual Fibre Utilization

Indicator Statement	Target Statement
The volume of residual fibre that is being utilized for products other than lumber and oriented strand board production	Report annually the volume of residual fibre utilized by facilities in the production of commodities other than lumber and oriented strand board
SFM Objective: Efficient Use of Fiber Resources	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

None.

What is this indicator and why is it important?

With the concern for the efficient utilization of a shrinking timber supply, this indicator reports how much residual fibre is being utilized for products other than lumber and/or OSB production. This fibre may come directly from timber harvesting, secondary harvesting, or residuals from sawmill production. It is important to note that utilization of this fibre is very sensitive to economic factors. The report will also indicate what the annual harvest (conifer and deciduous) was for the reporting year. The list of products utilizing residual fibre may change from year to year as the demand for certain products changes. Some of the reporting items will include:

- Harvest residuals:
    - Pulp log harvest volume delivered to pulp mills,
    - Residual fibre from logging debris
- Residual fibre from milling for:
    - Pellet production
    - Chips for Pulp Mill
    - Hog fuel for power production
    - Other

Implementation and Monitoring Procedure

There is currently no pulp mill in the region, and no conifer sawmill operating within the DFA. The Participants will continue to seek out economically viable uses for the residual fibre generated by our harvesting operations.

The Participants will annually report the amount of:

- residual fibre utilized resulting from lumber and OSB production, and
- on block residual fibre utilized to generate products other than lumber and OSB.

5.66 INCORPORATION OF NEW LAND USE PLANS

Indicator Statement	Target Statement
The number of finalized applicable Land Use Plans incorporated into the SFMP	All applicable Land Use Plans will be incorporated into the SFMP where necessary, through an amendment submitted to the government for approval within one year of each Land Use Plan being finalized
SFM Objective: Public Land Management Responsibilities	
Linkage to *FSJPPR*: None.	

Acceptable Variance:

Timing of the SFMP major amendment submission may be delayed if mutually agreed upon by Government, the applicable First Nation and the Participants. Depending on the complexity of the LUP (Land Use plan) and the degree to which the SFMP is impacted by the LUP, one year may not be enough to submit a major amendment. The Participants are not involved in these processes, and it is not known if a year is reasonable or not for each individual LUP and therefore it is expected that the parties involved will work together to come to a reasonable, mutually

agreed upon timeline. In addition, if multiple LUPs are finalized in a short period of time, additional time may also be required to incorporate them into the SFMP.

What is this indicator and why is it important?

The Participants and SFMP#4 Planning Team acknowledge multiple Government-to-Government Land Use Planning processes are ongoing and will not be completed by the time a draft SFMP#4 needs to be submitted to Government for approval to ensure no lapse in an approved SFMP. This indicator is a commitment to incorporate these LUPs into the SFMP once finalized, through a major SFMP amendment within one year. These LUPs are expected to significantly change many sections of the SFMP and better align the SFMP with First Nation's values and strengthen the protection of Treaty Rights.

Currently, the following processes are known to be in progress and likely to create a need for an SFMP major amendment once finalized:

- Blueberry River First Nation WMB (Watershed Management Basin) Planning
- Doig River First Nation Land Use Plan
- Halfway River First Nation Adaptive Management Program and Plan (AMPP)
- Prophet River First Nation – Future LUP
- Fort Nelson First Nation – Future LUP

In addition to those listed above, there is potential for new LUPs to begin, and once finalized this indicator will apply to them as well. Currently, none of the above LUPs have been finalized.

Implementation and Monitoring Procedure

Following the formal approval by government and the applicable First Nation of a LUP and it being made available to the Participants, the Participants will review the LUP and adjust SFMP indicators and strategies as required to incorporate the LUP. It is expected that this would be a collaborative process involving the applicable First Nations.

The Participants will report out annually on the number of newly finalized LUPs and the status of the associated SFMP major amendment.

Once a major SFMP amendment has been approved by government to incorporate a new LUP, changes from the updated SFMP may impact the FOS and SLPs.

6.0 CHANGES IN REQUIREMENTS

The Sustainable Forest Management Plan must include any applicable performance standards that are to be used for the purposes of Part 3 Division 5 and the associated Schedules of the *Fort St. John Pilot Project regulation*.

6.1 REVISED FIELD PERFORMANCE REQUIREMENTS

6.1.1 Wildlife Tree Patch Retention Levels

In order to facilitate landscape level management on a common platform, SFMP#1 included a proposal that retention levels of WTP be assessed for all Participants collectively. In order to set appropriate targets, an assessment was conducted of all identified WTPs in each landscape unit, in all blocks harvested cumulatively since the *FSJPPR* came into effect. The basis for the establishment of targets was the process outlined in Table 20 (a) and (b) of the Biodiversity Guidebook, with modifications upwards in some landscape units to address lower expected forest management intensities, or minimum natural retention ranges outlined by Delong (2002)(see Appendix 17).

Pursuant to section 35(5) of the *FSJPPR*, the approval of SMFP # 1, effective April 1, 2004 replaced the applicable performance standard relating to wildlife trees and Wildlife Tree Patches in section 29(1), with the applicable performance standard as specified by the indicator, target, and acceptable variance statements in section 5.9 (Wildlife Tree Patches) of the plan. As part of the development of SFMP#3 in 2017, the Participants reviewed the WTP targets and went through a structured process to review and revise them as applicable. Of the eleven LU targets, three were left unchanged, four were lowered, and four were raised. The revised targets were included in the draft plan, and put into effect with the approval of the plan. This plan will continue the use the WTP targets outlined in Section 5.9 Wildlife Tree Patches as the applicable performance standard, with no changes proposed. The minimum targets continue as follows:

Landscape Unit	WTP %
Blueberry	9%
Halfway	7%
Kahntah	5%
Kobes	8%
Lower Beatton	3%
Milligan	4%
Tommy Lakes	8%
Trutch	5%
Sikanni	4%
Graham	7%
Crying Girl	7%

The WTP % applies to the cumulative area of all blocks logged under the *FSJPPR* in each landscape unit (irrespective of individual Participant performance), and will be summarized in Annual Reports.

Equivalent Protection

This revised applicable performance standard provides equivalent or better protection than the default *FSJPPR* applicable performance standard and Field Performance Requirements for the following reasons:

- The average minimum WTP retention level is higher than the average WTP levels in the applicable performance standard,
- Higher WTP retention levels are being proposed for the Kahntah and Trutch LUs, because table 20(b) of the Biodiversity Guidebook was used to provide for less risk to biodiversity in these moderate and low forest management intensity zones.
- Higher WTP levels than were calculated using Table 20(a) of the Biodiversity Guidebook were also proposed for the Halfway and Tommy Lakes LUs in SFMP#1, and then increased substantially in SFMP#3, to increase the retention levels above the minimum 3%, consistent with the lower end of retention noted by Delong (2002).
- Managing to one level for all Participants eliminates potential confusion for reviewers or interested parties, and allows for easier coordination and planning between participants (e.g. blocks immediately adjacent to each other but managed by separate participants).

Consistency with the Preamble to the Code

The continued implementation of an SFMP, maintaining SFI SFM certification, the ongoing participation of the Public Advisory Group, and active representation of local First Nations in the development of this plan, provides assurance that the Participants are managing the forests based on sustainable use for all British Columbians. Information presented in annual reports since the start of SFMP# 1 shows that the participants have met or exceeded landscape level targets for WTP retention for LUs in the DFA.

Adequate Management and Conservation of Forest Resources

The calculation of WTP retention levels is based on procedures outlined in the biodiversity guidebook, as well as discussion with First Nations, and reflections of past and likely current performance. The only changes to the levels of retention relative to the biodiversity guidebook levels is increasing the minimum retention levels. Consequently, the Participants believe this change to field performance requirements contributes to adequately managing and conserving forest resources.

6.1.2 Permanent Access Structures

In order to provide flexibility to increase road densities where needed due to site conditions, to encourage decreased densities where practical, and to reduce Participant and government administrative process arising from frequent section 25 variance requests, the Participants believed it desirable to assess the amount of Permanent Access Structures (PAS) in cutblocks at a larger scale than block-by-block. SFMP # 1 revised the applicable performance standard to:

"*A maximum of 5% of the total area in Managing Participants cutblocks occupied by permanent access structures in which harvesting was completed, as determined on a 3-year rolling average*."

Pursuant to Section 35(5) of the *FSJPPR*, the approval of SMFP # 1, effective April 1, 2004 replaced the applicable performance standard relating to permanent access structures described in Section 30(1)(b) of the *FSJPPR*, with the applicable performance standard as specified by the indicator, target, and acceptable variance statements in **Section 5.26 Permanent Access Structures** of that SFMP. This plan includes a minor revision of the wording to the statements, but with no change to the landscape level impacts. The revised applicable performance standard is:
"*A maximum of 5% of the total area in cutblocks occupied by permanent access structures in which harvesting was completed, as determined on a 3-year rolling average*"

Assessment Population

For the purposes of reporting performance under Indicator 26 Permanent Access Structures, a 3-year rolling average is defined as a list of cutblocks that have completed harvesting by the Fort St. John Pilot Project Participants, in the 3 reporting years previous to the submission date of the annual report. The reporting periods run for the 12 months starting from April 1 to March 31 annually.

Equivalent Protection

This revised Field Performance Requirement provides equivalent or better protection than the applicable performance standard included in the *FSJPPR* Field Performance Requirements for the following reasons:

- The proposed maximum level of 5% for compliance purposes is less than the *FSJPPR* standard of 7%.
- The proposed maximum level of permanent access structures that will be constructed on the land base and reported annually will provide equivalent protection to the current standard. The measurement process has been modified to be more reflective of the cumulative impact of multi-block (quasi landscape level) than the previous individual block (stand level) measurements of permanent access structures.

Consistency with the Preamble to the Code

The continued implementation of an SFMP, maintaining SFI SFM certification, the ongoing participation of the Public Advisory Group, and active representation of local First Nations in the development of this plan, provides assurance that the Participants are managing the forests based on sustainable use for all British Columbians. The participants remain in compliance with the limits put in place by the revised applicable performance standard.

Adequate Management and Conservation of Forest Resources

The calculation of permanent access structure levels has been modified to be more reflective of a multi-block approach versus a single block approach and the allowable percentages have been reduced, relative to the default minimums set out in regulation. The standard set out in this plan removes the need to request District Manager variances and requires that the Participants

adhere to the new allowable percentage. The Participants believe this change to field performance requirements contributes to adequately managing and conserving forest resources.

6.1.3 Reforestation

Pursuant to Section 35(5) of the *FSJPPR* the Reforestation Strategy and related indicators in this SFMP proposes to revise the Field Performance Standards and related Schedules relating to reforestation requirements as outlined in the following sections.

6.1.3.1 Landscape Level Assessment of Coniferous and Deciduous Areas

Pursuant to Section 35(5) of the *FSJPPR*, the approval of the Reforestation Strategy in SFMP #1 effectively revised the Field Performance Requirements relating to reforestation of coniferous areas outlined in Section 32 and Schedule 'F' of the *FSJPPR*.

SFMP #3 extended this approach to deciduous reforestation areas, after the completion of a deciduous volume compiler, used to assess performance relative to the Reforestation Assessment indicator .

Pursuant to Section 35(5) of the *FSJPPR*, the approval of SFMP # 2, effective November 1, 2010, replaced the performance standard specified in *FSJPPR* sections 32(4), (5), (6), (8), and Sections 98 and 99 with the applicable performance standards as specified by the indicator, target, and acceptable variance statements applied to the Landscape Level Reforestation Strategy of that SFMP. Under this plan use of the Landscape Level Reforestation Strategy and related legal indicators as the applicable performance standard will continue.

The SFMP # 4 Reforestation Strategy will apply to all coniferous and deciduous areas logged after November 15th, 2001. This will also apply to coniferous and deciduous areas with commencement dates before November 15th, 2001 if the Participant currently carries reforestation liability, and has submitted a statement to the District Manager that the cutblock(s) will be subject to the SFMP under Section 42 of the *FSJPPR*.

Appendix 9 includes details on crop tree requirements and stocking standards for coniferous, deciduous and mixedwoods areas. The changes to regulatory requirements regarding stocking and well-growing requirements are summarized below.

6.1.3.2 Deciduous Stocking Requirements for Areas Outside of the Landscape Level Deciduous Assessment Population

Table 41 below, provides the applicable performance standard for stocking requirements to be used to assess the establishment of a well growing stand of crop trees on deciduous areas within cutblocks that are outside of the landscape level assessment population.

Table 41. Performance Standards for Well Growing Deciduous Areas

Type of Area	Site	Min. # of Trees/ha (MSS) *	Minimum Height	Countable species BWBS/ESSF
Deciduous	Xeric-Submesic	4000	1.4 m	At (Pli max 15%)
Deciduous	Mesic-Subhydric	4000	1.4 m	At, Ac, (Ep, Pli, Sx to max 15%)

-Minimum strata size is 2 ha contiguous, or 20% of the area in blocks less than 10 ha[10]

-Well growing block assessments can be completed at anytime from 5 years to 15 years after harvest commencement[11]

-No TSS for deciduous

-Ac is only acceptable if not sprouting from a cut stump

The minimum inter tree distance for deciduous areas is 0.5 metres

These standards replace the requirements of Sections 32(4), (5), (6), and 98(1), (2) and (3) of the *FSJPPR* as they apply to deciduous areas outside of the landscape level assessment population. (see Section 6.29)[12].

6.1.3.3 Reforestation Landscape Level Strategy- Seed Use

The use of seed will be consistent with the indicator, target and acceptable variance of Indicator #13, found in **Section 5.14 Seed Use**, which relies on the Chief Forester's Standards for Seed Use. For the purposes of Section 35(5) of the *FSJPPR* indicator, target, and acceptable variance statements in Section **5.14 Seed Use** will be used to guide seed use, and will replace the requirements of Section 99 (Use of Seed) in Schedule 'F' of the *FSJPPR*.

6.1.3.4 Mixedwood Reforestation Stocking Guidelines

Mixedwood reforestation is a component of the Landscape Level Reforestation Strategy. The landscape level assessment of reforestation, however, as presented in Section 5.32 Reforestation Assessment does not apply to intimate mixedwood areas at this time. The Participants' Stocking Standards and Crop Tree Requirements andMixedwood Management Guidelines are presented in Appendix 9 and Appendix 13. The relative area of stands managed as intimate mixtures is small, and the multi-block approach used for the majority of the participants' managed stands is not well suited for small sample sizes. The research paper by Farnden (2009) was used to support the participants' stocking standards and survey methodology for mixedwoods.

For the purposes of Section 32 (5) (a) (i) the applicable performance standard that will apply to all areas declared as intimate mixedwoods is presented in Appendix 9, Section 1.4.3 "Stocking

[10] Consistent with the strata size definition in the FSJPPR

[11] Changed from FSJPP Regulation standard of 9 years minimum

[12] Disapplied Sections of the FSJPPR are fewer than in SFMP#1, as changes to Regulation deleted some sections.

Guidelines for Mixedwoods in the BWBS". These replace the requirements of Section 32(4), (5), (6) and Section 98(1), (2), and (3) of the *FSJPPR,* as those sections applied to mixedwood areas. Mixedwood harvested areas that are not to be managed as intimate mixtures will be stratified into discrete conifer and deciduous areas, and will continue to be managed according to the conifer and deciduous standards outlined in this SFMP.

6.1.3.5 Appendix 9 Supplemental Reforestation Requirements

For the purposes of Section 35(5) of the *FSJPPR*, the following sections of Appendix 9 will be used to replace effected portions of Section 32 of the *FSJPPR*:

Appendix 9 Section 1.2 Crop Tree Requirements and Vegetative Competition replaces the requirements in 32(6)(a),(b),(d), and 98(1) Table A.

Appendix 9 Section 1.3 Minimum Inter tree distance replaces the minimum inter-tree distance requirements in Section 32(6)(d).

Equivalent Protection

This revised Field Performance Requirement and landscape level strategy provides equivalent or better protection than the default Field Performance Requirements outlined in the FSJPPR for the following reasons:

- The reforestation strategy allows for management flexibility at the stand level to address a wide range of values, including biodiversity, species at risk, mitigation of First Nations concerns, and other non-timber values, while still ensuring sustainability of the timber resource at the DFA level.
- The reforestation strategy provides a landscape level measure of success that exceeds previous practice since landscape level summaries were not in place.

Consistency with the Preamble to the Code

The continued implementation of an SFMP, maintaining SFI SFM certification, the ongoing participation of the Public Advisory Group, and active representation of local First Nations in the development of this plan, provides assurance that the Participants are managing the forests based on sustainable use for all British Columbians. The participants remain in compliance with the limits put in place by the revised applicable performance standards.

Adequate Management and Conservation of Forest Resources

Under the term of SFMP#3 the participants consistently reported reforestation assessment results exceeding target levels. The assessment of reforestation success at the landscape level reflects appropriately the inherent variability present on the DFA, and provides flexibility to address a wide array of forest resources and values.

6.1.4 Coarse Woody Debris

Similar to the changes proposed for WTP targets and assessment, SFMP#1 included a proposal that retention levels of CWD be assessed for all Participants collectively, across the landscapes of the DFA, rather than the default block-specific level specified in the regulation. This approach

reflects the natural range of variability of CWD volumes on the landscape, and acknowledges the wide range of stand types managed by the participants. Having a minimum target for CWD retention of 46 m^3/ha (50% of the average pre-harvest volume from plot data collected in similar stands), allows for site variations above and below the target, and is in keeping with ranges of natural variability reported in research.

Pursuant to section 35(5) of the *FSJPPR*, the approval of SMFP # 1, effective April 1, 2004 replaced the applicable performance standard relating to Coarse Woody Debris in section 29(1), with the applicable performance standard as specified by the indicator, target, and acceptable variance statements in Section 5.6 Coarse Woody Debris Volume of the plan.

Equivalent Protection

This Field Performance Requirement provides equivalent or better protection than the applicable performance standard default set out in the *FSJPPR* for the following reasons:

- The target for CWD retention is based on the average pre-harvest level of 92 m^3/ha is based on the best available information of pre-harvest CWD in the Fort St. John TSA.
- There is a systematic sampling process in place, using a provincial data collection protocol, to measure actual post-harvest CWD retention levels, which will allow DFA comparisons of average post harvest CWD levels.

Consistency with the Preamble to the Code

The continued implementation of an SFMP, maintaining SFI SFM certification, the ongoing participation of the Public Advisory Group, and active representation of local First Nations in the development of this plan, provides assurance that the Participants are managing the forests based on sustainable use for all British Columbians. Plot data collected since the start of SFMP#1 shows that the participants have met or exceeded landscape level targets for CWD volume in the DFA.

Adequate Management and Conservation of Forest Resources

The basic premise of retaining at least 50% of CWD is unchanged, as the primary objective of the change is to provide specific measurable targets that can be efficiently measured during other monitoring activities. Allowing for block-by-block variation is consistent with the natural variation in CWD between stands that was noted in data collected through the NIVMA program in the Fort St. John TSA, as well as in other CWD research projects.

Consequently, the Participants believe this change to field performance requirements contributes to adequately managing and conserving forest resources.

6.1.5 Riparian Reserve Strategy

The Riparian Reserve strategy, and the related indicator (Section 5.24 Riparian Reserves) is consistent with the requirements of the *FSJPPR*. The variance to this indicator allows a qualified registered professional to prescribe harvest in riparian reserves, subject to the conditions outlined in a variance request acceptable to the District Manager.

For the purposes of Section 35(5), Section 28(1) (b) (i) (A) of the *FSJPPR* may be affected by the application of this Riparian Management Strategy, specifically the acceptable variance to this indicator.

Equivalent Protection

This strategy provides equivalent protection to the *FSJPPR* applicable performance standard and Field Performance Requirements for the following reason:

- Adherence to riparian reserve zone requirements will in most cases (other than below) be as prescribed in the regulation
- The conditions which would allow the Participants to propose harvesting in riparian reserves are restricted to extraordinary situations where other resource values may be at risk and those identified in the Forest Planning and Practices Regulation section 51, and would require a rationale by a qualified registered professional to identify why harvesting is proposed in the riparian reserve, and how the riparian values are to be protected to the extent practicable.

Consistency with the Preamble to the Code

The continued implementation of an SFMP, maintaining SFI SFM certification, the ongoing participation of the Public Advisory Group, and active representation of local First Nations in the development of this plan, provides assurance that the Participants are managing the forests based on sustainable use for all British Columbians.

Adequate Management and Conservation of Forest Resources

The basic premise is to maintain riparian reserves as no-harvest zones, except in rare cases harvesting some or part of riparian reserve area may be an effective measure to protect other highly valued resources that may be at risk. Measures will be identified to minimize the impacts on the riparian values in those instances. Allowing some flexibility to address serious issues such as forest health damaging agents through some limited harvesting may actually reduce natural mortality in reserve areas. It therefore may have a net benefit to the broader riparian resource values. Consequently, the Participants believe this change to these requirements contributes to adequately managing and conserving forest resources.

6.1.6 Visual Quality Strategy

The Visual Quality Strategy and the related indicator # 43 (**Section 5.43 Visual Quality Objectives**) is consistent with the requirements of the *FSJPPR*, and does allow participants the option, in exceptional circumstances, to vary from established VQO where approved by the District Manager. Participants will submit a rationale outlining the specific risks to forest values other than visual quality, or public safety, and the expected outcomes of proposed activities. If acceptable to the District Manager, they will waive the requirement to be consistent with visual quality objectives. The Participants will notify the Ministry of Forests regarding proposed variances at the time of harvest authorization request.

For the purposes of Section 35(5), Section 28(1) (c) of the *FSJPPR* may therefore be affected by the application of this Visual Quality Strategy, specifically the acceptable variance for this indicator.

Equivalent Protection

This strategy provides equivalent protection to the *FSJPPR* Field Performance Requirements and applicable performance standard for the following reasons:

- In most cases, the participants are required to be consistent with established VQOs.
- The variance, which may allow a qualified professional to prescribe harvesting that may not be consistent with a visual quality objective, is restricted to extraordinary situations where other resource values may be at risk, and still requires a rationale by a professional to identify why some harvesting is proposed, and how the visual impacts are to be mitigated to the extent practicable.

Consistency with the Preamble to the Code

The continued implementation of an SFMP, maintaining SFI SFM certification, the ongoing participation of the Public Advisory Group, and active representation of local First Nations in the development of this plan, provides assurance that the Participants are managing the forests based on sustainable use for all British Columbians. The participants have maintained consistency with established VQOs.

Adequate Management and Conservation of Forest Resources

The basic premise is to be consistent with the visual quality objectives except in the rare instance when other highly valued resources may be at risk if active forest management does not occur. In those instances, measures will also be identified to mitigate visual impacts due to prescribed activities. Allowing some flexibility to address serious issues such as forest health through some focused operations may reduce natural mortality in the visual quality polygon or adjacent visually sensitive areas overall. It may therefore have a net long-term benefit to the visual resources in the specific polygon, and on visual resources in adjacent areas by reducing long-term mortality due to forest health agents. Consequently, the Participants believe this change to these requirements contributes to adequately managing and conserving forest resources.

6.2 REVISED FOS REQUIREMENTS

To encourage coordinated forestry operations, and efficiencies in forest planning and consultation this plan includes a requirement for the completion of a joint FOS (Section 5.49 Participants' Coordination). As per section 79 of the *FSJPPR*, changes can be made to Schedule C of the regulation, which outlines the FOS requirements, if the SFMP provides that the information requirement should no longer apply.

The changes to *FSJPPR* Schedule C requirements for FOS content (highlighted in red text) outlined below, are carried forward from the previous plan, and will continue to provide efficiencies in the preparation, administration, and implementation of Forest Operations Schedules:

Map and Information Requirements Sections

The following parts of *FSJPPR* sec. 81 (map and information requirements) are proposed to be deleted from the requirements of the FOS:

FSJPPR sec. 81 (1) (a) forest cover (delete). Seral stage theming will continue to be shown on the maps, but forest cover polygons and labels will not be required. This will provide an overall landscape indication of conifer and deciduous seral stage distribution outside of the cutblocks, and reduce map 'clutter'. The FOS will also have analysis information on the plan's seral stage distribution impacts (Section 5.2 Seral Stages)

FSJPPR sec. 81 (1)(c) (xii) and (xiii) Fish streams, riparian class of streams, wetlands and lakes (delete),

Riparian classifications are not completed until field layout is done, at which time changes to blocks or roads may be made to conform to existing regulatory and SFMP requirements. Stream, wetland, and lake locations will still be shown as required in FSJPPR sec. 81(1)(b).

FSJPPR sec. 81 (1)(e) (i): delete the requirement to show the approximate location of roads and bridges. Section (81) (e) (i) would read "*proposed construction of a road*".

FSJPPR sec. 81 (1)(e) (ii) (iii) (iv) - delete the requirement to show proposed replacement or construction of bridges and major culverts. This is a continuation of a change implemented in SFMP #1. Waterbodies will be depicted on maps, and legal requirements regarding crossings will still apply. This provides the flexibility to determine crossing type at the time of field layout, rather than during the FOS development, and will reduce the number of amendments required.

FSJPPR sec. 81 (1)(g) - delete this subsection entirely (i, ii, iii, iv). This will delete the requirement to show current and future temporary or semi permanent deactivation. This is a continuation of a change implemented in SFMP #1. With multiple industries operating on the same land base, road deactivation status changes continually in an unpredictable manner, so attempting to map road deactivation status has little value.

It is proposed that the following requirement be added to Schedule C:

FSJPPR sec. 81 (1)(e) (v): The Participants may choose to declare in a FOS that all existing non-status roads within the Fort St. John TSA are considered to be identified in the FOS as roads for the purposes of Section 23(2), even though they may not be individually referenced or delineated in the text or on maps in the FOS.

Many roads exist or are built that do not have an identified owner, and may not be constructed, or known to the Participants at the time of the FOS. Section 23(2) requires roads to be identified in a FOS for a Participant to get an authorization to build or use road. This section originally envisioned all roads either being constructed by the Participants and therefore being shown in the FOS, or having a third-party owner that would allow the Participants to legally use the road through road use agreements. The provision resulted in administrative costs and delays for both the government and the Participants in amending FOSs to show existing non-status roads in order to authorize the Participants to use of the road.

Declaring all non-status roads as being 'identified' in the FOS, even though they may not be specifically shown, will reduce administrative burdens for all parties. As the roads already exist, and legal requirements that come with road use will still apply, environmental and other resource values will be maintained. Existing roads may proposed FOS roads that would no longer be needed, thereby potentially reducing environmental impacts.

FSJPPR sec. 81 (1)(e) (vi): Provided the Participants have, during the review and comment period, specifically requested review and comment from First Nations, stakeholders, and the public for a specifically identified area immediately adjacent to proposed cutblocks in any FOS or previous Forest Development Plan, any existing or proposed roads within that specified area will be considered to be identified in the FOS as roads for the purposes of Section 23(2), even though they may not be individually referenced or delineated in the text or on maps in the FOS.

6.3 RECOMMENDATION TO REVISE SELECT SECTIONS OF THE FSJPPR

In order to provide for future administrative efficiencies, the Participants recommend that Government consider revising the requirements of the following sections of the *FSJPPR.*

Clarification of FOS General Content Section

Section 80(3) of the *FSJPPR* currently states that *"A forest operation schedule must be signed and sealed by a professional forester"*. Numerous amendments are made to the FOS that, under Sections 83(3) and 83(4), do not require notice, as they are considered of a minor nature and do not significantly change the objectives or results.

The Participants recommend that the Government consider revising (red text inserted) the requirements of Section 80(3) of the *FSJPPR* to the following:

"A FOS and an amendment to a FOS subject to Sections 83(1) and 83(2) must be signed and sealed by a registered professional forester. Amendments subject to Section 83(3) and (4) not requiring notice may be prepared by a qualified registered professional other than a registered professional forester."

Section 80(4) requires Participants to sign the FOS. Some Participants, through Memoranda of Agreement or similar legal agreements, have effectively delegated that responsibility to other Participants. Furthermore, minor amendments not requiring notice may be submitted by one Participant after consulting with another, and the Participants have no need to each sign these minor amendments. For greater clarity, we are proposing the following change to this section;

80(4): "*A FOS or amendment that requires notice subject to Section 83(1) submitted to government must be signed by the Participant or a party acting on behalf and with the consent of the Participant (e.g., 'Managing Participant')*".

Notice Requirement Revisions

It is desirable to minimize the requirement to provide notifications of FOS amendments that are very unlikely to impact individuals or stakeholders, or compromise the achievement of the strategic objectives of the SFMP, or government agencies. Provided that the aforementioned review and comment of the FOS has requested comments on areas adjacent to or in proposed cutblocks, and no site-specific comments from the public, First Nations, or government agencies were received concerning an area, the following change to the notice requirements of Section 83(4)(c) is proposed:

a) Delete the requirement of 83(4)(c)(i) to provide notice of amendments for block changes within the riparian management zone of streams that have a classification of S1, S2, S3, or S4.

Streams are already well protected through the implementation of the Riparian Management Landscape Level Strategy. The FOS review and comment will have previously identified any specific concerns adjacent to cutblocks that must be addressed by the Participants if a block boundary is extended slightly. Minor changes to boundaries often occur, and these changes may easily encompass an additional portion of a riparian management zone, simply because a stream exits the cutblock perpendicular to a boundary. Requiring notice of these types of amendments,

even though the areas adjacent to blocks have already been through a review and comment process, is administratively burdensome to both government staff and the Participants.

b) Amend the requirement of 83(4)(c) (iii), from *"(iii) a wildlife tree patch"*, to read *"a wildlife tree patch, other than one that a qualified registered forest professional determines represents a forest health risk (e.g., due to mountain pine beetle or spruce beetle infestation)."*

Blocks have already received a public review and comment process, so the Participants are aware of any concerns, including wildlife issues, in an area. A failure to address previously unforeseen forest health issues in some areas can pose a serious threat to surrounding forests. Overall wildlife tree patch levels are managed at the landscape level, and provided a forester has duly considered the implications to the WTP indicator, and any site-specific concerns that were raised in a block which might override forest health concerns, the requirement for additional notice is onerous, and may result in forest health issues not being addressed in a timely manner.

Requirement for the SFMP to be Consistent with the LRMP

Section 35(1)(b) requires that the SFMP "…*is consistent with Schedule A and any higher level in effect in the pilot project area on the date the sustainable forest management plan is submitted for approval."* Schedule A is a reproduction of the Management Zones and Their Objectives, from the 1997 Fort St. John Land and Resource Management Plan (LRMP). While much good work went into building the LRMP, the absence of First Nations participation is notable and significant. Having a regulatory requirement to be consistent with objectives that were not arrived at including First Nations collaboration and oversight, and may be contrary to some First Nations values, is out of step with the current zeitgeist in BC and Canada. The Participants suggest an amendment to delete "…*is consistent with Schedule A and*…"from this section.

Information Required Before Requesting and Authorization (Reforestation Declaration)

Since the advent of RESULTS submissions, the submission of written declarations to FOR is redundant. We suggest that the process of submitting reforestation declarations should be made flexible to allow submission of the declarations by way of the reforestation information submitted through RESULTS. Consequently, this would eliminate the formal written submission of reforestation declarations to the District Manager.

The requirement to identify the reforestation standards that will apply to areas within blocks is recommended to be completed through the formal submission of this information in RESULTS, taking the place of formal (written) declarations. The submission of reforestation standard information into RESULTS would constitute the declaration.

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APPENDICES

Appendix 1: Sustainable Forest Management Policies

SUSTAINABLE FOREST MANAGEMENT POLICIES

BC Timber Sales

On April 1, 2003 BC Timber Sales replaced the Small Business Forest Enterprise Program (SBFEP) with a mandate to provide the cost and price benchmarks for timber harvested from public land in British Columbia. Through 12 Business Areas and an operational presence in 33 locations, BCTS manages some 20 percent of the provincial Crown allowable annual cut.

Sustainable forest management is a high priority for British Columbians and central to the BCTS mandate. BCTS is the largest tree planter in British Columbia, with over a billion trees planted to date. The commitment to forest management excellence includes achieving and maintaining certification of an Environmental Management System in all Business Areas under the International Organization for Standardization (ISO 14001) and achieving Sustainable Forest Management (SFM) certification over its operating areas. The foundation of the ISO 14001 certification is the Environmental Management System (EMS). BCTS developed and implemented an EMS for the Peace-Liard Business Area in 2004 and achieved ISO certification in 2005.

In the spring of 2019, the Managing Participants (Canfor and BCTS) transitioned from CSA certification of their forest management activities in the Pilot Project Area to Sustainable Forestry Initiative certification.

Under the SFI Forest Management standard, sustainable forest management is verified by independent third-party audit. Local values, goals and indicators included in the Sustainable Forest Management Plan have been developed in consultation with a Public Advisory Group.

In July 1999 the Fort St. John small business program formally announced its commitment to participate in a pilot project within the Fort St. John TSA along with several other major licensees to develop a more streamlined forest management approach. This commitment included its full participation as an equal partner in the development and management of a Sustainable Forest Management Plan to the Canadian Standards Association Z809-02 Sustainable Forest Management (SFM) standard, (as of 2019, the SFI 2022 standard). BCTS participation in the Fort St. John Pilot Project continued through the term of the first SFMP and will continue throughout this plan. BCTS is committed to achieving the expectations of our EMS, this SFMP, and the attached Sustainable Forest Management Policy.

BCTS will ensure that our actions and decisions contribute to an equitable, safe, healthy and satisfying work environment and that our operations are conducted in a manner that will not jeopardize human health and safety and commit to maintaining an excellent safety record.

Sustainable Forest Management Policy

BC Timber Sales (BCTS) is committed to managing and administering high-quality forest and environmental management activities and practices on our operations through effective measures that ensure *sustainable forest management (SFM).*

It is the policy of BC Timber Sales to:

- Strive for excellence in forest management by continually improving the performance of resource management activities and practices.
- Conduct our forest management activities to comply with applicable legislation, regulations, policies, and other requirements to which we subscribe, including our commitment to social laws.
- Provide public participation opportunities.
- Respect and recognize Aboriginal title and rights, and treaty rights.
- Maintain a program to increase engagement and partnerships with Indigenous peoples in the management of natural resources within B.C. including incorporation of Indigenous knowledge.
- Improve staff and client's cultural awareness and understanding of Indigenous peoples' history and knowledge.
- Maintain an organizational culture where all staff proactively participate in providing conditions and safeguards for the health and safety of staff, clients, and the public.
- Honour all international agreements and conventions to which Canada is a signatory.
- Improve knowledge of the forest and SFM, monitor advances in science and technology, and incorporate these advances where applicable.
- Promote awareness of SFM to our clients and the public.

Len Stratton
Director Sustainability and
Forestry, BC Timber Sales

Date Sept 19, 2022

Canfor

In July of 1999 Canfor formally announced its commitment to seek sustainable forest management certification of the company's forestry operations under the Canadian Standards Association Sustainable Forest Management (SFM) standard. The Sustainable Forest Management Plan presented here, and its implementation is intended to fulfill that commitment for Canfor's Fort St John operation.

As a preparatory step to sustainable forest management certification, Canfor developed an environmental management system (EMS) for the company's woodlands operations. In December 1999 this environmental management system was certified to the ISO 14001 standard developed by the International Organization for Standardization. The Company EMS provides a platform on which to build the sustainable forest management elements required to meet the CSA SFM standard.

The management of Canfor has set out a number of commitments which define the mission, vision, policies and guiding principles for the company. These include the Canfor Mission, Environment Policy and Forestry Principles. These commitments have been used to enable and guide the development of this Sustainable Forest Management Plan, and also commit us to the continual improvement of our performance in implementing the plan under the principle of adaptive management.

Canfor's Environment Policy includes a commitment to "create opportunities for interested parties to have input to our forest planning activities". The CSA SFM standard requires that sustainable forest management planning be carried out in consultation with those directly affected by or interested in forest management on the defined forest area (DFA). Our Environment Policy commitment has been interpreted and extended to include the involvement of the public in the setting of local values, objectives, indicators and targets for the purpose of developing a plan to achieve and maintain sustainable forest management on the DFA. The Environment Policy and Canfor’s Forestry Principles also include the opportunity for participation by First Nation peoples with respect to their rights and interests in SFM on the DFA. The Fort St John Results Based Pilot Project Public Advisory Group is the body that has provided this input.

Additionally, Canfor, acting on behalf of Cameron River Logging, Tembec, and as the woodlands manager of the joint venture licence with Dunne-za LP (West Moberly First Nation) and with Louisiana-Pacific Canada, will manage the respective Fort St John licences and Pulpwood Agreements in accordance with Canfor’s SFM commitments.

Environment Policy.

We are committed to responsible stewardship of the environment throughout our operations.

We will:

- Comply with or exceed legal requirements.
- Comply with other environmental requirements to which the company is committed.
- Achieve and maintain sustainable forest management.
- Set and review objectives and targets to prevent pollution and to continually improve our sustainable forest management and environmental performance.
- Provide opportunities for interested parties to have input into our sustainable forest management planning activities.
- Promote environmental awareness throughout our operations.
- Conduct regular audits of our forest and environmental management systems.
- Communicate our sustainable forest management and environmental performance to our Board of Directors, shareholders, employees, customers and other interested parties.

Susan Yurkovich
President & CEO

January 2025

Canadian Forest Products Ltd. & affiliated companies.

Objectives for Sustainable Forestry on LP Forests

- LP will strive to broaden the practice of sustainable forestry by employing an array of scientifically, environmentally, and economically sound practices in the growth, harvest, and use of forests.
    - Develop policies, programs and plans to implement and achieve the sustainable forestry standard principles and objectives.
    - Individually, through cooperative efforts, or through American Forest & Paper Association (AF&PA), provide funding for forest research to improve the health, productivity, and management of all forests, as well as to better understand the role of managed forests in sequestering carbon.
    - Provide public recreational and educational opportunities where consistent with forest-management objectives.
    - Ensure that long-term harvest levels are sustainable and consistent with appropriate growth and yield models and written plans.
- LP will strive to ensure long-term forest productivity and conservation of forest resources through prompt reforestation, soil conservation, afforestation and other measures.
    - After final harvest, reforest by planting or by direct seeding within two years, or by planned, natural-regeneration methods within five years.
    - Promote state-level reporting of the overall success rates of reforestation and afforestation.
    - Use forest chemicals prudently, following all applicable label requirements Best Management Practices (BMP's). Meet or exceed the laws and regulations concerning the use of fertilizers, herbicides and other forest chemicals to improve forest health and productivity, while protecting employees, neighbors, the public and the forest.
    - Implement management practices to protect and maintain forest and soil productivity.
    - Protect forests from damaging agents such as wildfire, pests, and diseases in order to maintain and improve long-term forest health and productivity.
    - When utilizing genetically improved seedlings, including those derived through biotechnology, the company will use sound scientific methods and follow all appropriate federal and state regulations and other internationally applicable protocols.
- LP will strive to protect the water quality in streams, lakes, and other bodies of water by implementing riparian protection measures based on soil type, terrain, vegetation, and other applicable factors.

  - Use Best Management Practices (BMP) developed under the Environmental Protection Agency (EPA)-approved state water-quality programs. Meet or exceed all applicable state water-quality laws and regulations, as well as the requirements of the federal Clean Water Act.
  - Develop (where they do not currently exist), implement, and document riparian protection measures for all perennial streams and lakes. Involve experts at the state level to help identify goals and objectives for riparian protection.
  - Individually, through cooperative efforts or through the AF&PA, provide funding for water quality research.
  - Require BMP employee training in woodland management and wood procurement operations. Encourage training for forest management and harvesting contractors.

- LP will strive to manage the quality and distribution of wildlife habitats and contribute to the conservation of biological diversity by developing and implementing stand- and landscape-level measures that promote habitat diversity and conservation of forest plants and animals.
  - Enact policies and programs promoting habitat diversity at stand and landscape levels.
  - Individually, through cooperative efforts or through the AF&PA provide funding for research to improve the science and understanding of wildlife management at stand or landscape levels, ecosystem functions, and the conservation of biological diversity.
  - Apply knowledge gained through research, science, technology and field experience to manage wildlife habitat and contribute to the conservation of biological diversity.
- LP will strive to manage the visual impact of harvesting and other forest operations.
  - Enact policies and programs to manage the impact of harvesting on visual quality.
  - Develop and adopt appropriate policies for managing the size, shape, and placement of clear-cut harvests. The average size of clear-cut harvest areas shall not exceed 120 acres, except when necessary to respond to forest health emergencies or other natural catastrophes.
  - Adopt a "green up" requirement, under which past clear-cut harvest areas must have trees at least 3 years old or 5 feet high at the desired level of stocking before adjacent areas may be clear-cut; or adopt other, more comprehensive methods that provide age, habitat, and aesthetic diversity.
  - Use harvest methods, age classes and judicious placement of harvest units to promote diversity across the forest landscape.
- LP will strive to manage the visual impact of harvesting and other forest operations.

  - Identify special sites and manage them in a manner appropriate to their unique features. We will cooperate with organizations that have expertise in protecting special sites for advice on how these lands can best be managed to maintain their unique character.

- LP will strive to promote the efficient use of forest resources.
  - Use appropriate forest harvesting technology and practices to minimize waste and ensure efficient utilization of trees harvested while being consistent with other SFI objectives.

Objectives for Public Reporting and Involvement in the Practice of Sustainable Forestry

- Publicly report our progress in fulfilling our commitment to sustainable forestry.
- By providing information on the environmental and economic advantages of our practices, encourage landowners to reforest following harvest and to use Best Management Practices.
- Provide opportunities for the public and the forestry community to participate in the commitment to sustainable forestry.
- Support and promote, at the state or other appropriate levels, mechanisms for public outreach, education and involvement related to forest management, such as, 800 numbers, environmental education, and/or private and public sector technical assistance programs.
- Support and promote, at the state or other appropriate levels, procedures to address concerns raised by loggers, consulting foresters, employees, the public or Program Participants regarding practices that appear to be inconsistent with the sustainable forestry standard principles and objectives.

Objectives for Continual Improvement in the Practice of Sustainable Forestry

- Promote continual improvement in the practice of sustainable forestry and monitor, measure and report performance in achieving the commitment to sustainable forestry.
- Establish a management review system that examines findings and progress in implementing the SFI program and policies and make appropriate improvements in policies and plans, and inform their employees of changes.

Policy on Environmental Stewardship

Louisiana-Pacific Corporation strives to:

- Meet or surpass the requirements of environmental laws and regulations.
- Manage natural resources in a responsible and sustainable manner.
- Participate in research and partnerships that further our understanding of natural systems and promote conservation values.
- Meet, as verified by third-party audits, the principles recommended to foster multiple-use and the sustainability of world forest resources.
- Conserve non-renewable resources through efficient use and careful planning.
- Properly manage and minimize waste through pollution prevention programs.
- Fully account for environmental considerations in corporate planning, policies and decision-making.
- Continuously improve environmental programs and employee awareness.

Brad Southern, CEO
September 8, 2017

Appendix 2. LRMP RMZS Within Each Landscape Unit

Table 42. LRMP RMZs within each Landscape Unit

Landscape Unit	LRMP RMZ Name	Area (ha) Total Area (ha)
Blueberry	Agriculture Settlement Area	183,259
	Aikman Deadhorse	166,164
	Alaska Highway Corridor	14,296
	Charlie Lake Community Watershed	596
	Grazing Reserve 1	17,210
	Jedney	183,290
	Major River Corridor	53,460
	Upper Cameron	113,159
Blueberry Total		731,433
Crying Girl	Crying Girl	27,882
	Graham-Laurier Protected Area	222
	Graham-South RMZ	30,707
	Major River Corridor	8,532
Crying Girl Total		67,343
Graham	Besa Halfway Chowade	202,824
	Graham-Laurier Protected Area	99,778
	Graham-North RMZ 1	27,041
	Graham-North RMZ 2	3,474
	Graham-South RMZ	117
	Major River Corridor	1,975
Graham Total		335,209
Halfway	Alaska Highway Corridor	1,361
	Bluegrave Horseshoe	80,258
	Crying Girl	15,298
	Grassy-Minaker	0
	Pink Mountain Protected Area A	98
	Major River Corridor	34,789
	Sikanni Falls Protected Area A	163
	Sikanni Falls Protected Area B	132
	Two-Bit	74,339
Halfway Total		206,438
Kahntah	Chinchaga	680,257
	Conroy	49,255
	Ekwan Lake Protected Area	1,741
	Milligan Hills Protected Area	7,227

Landscape Unit	LRMP RMZ Name	Area (ha) Total Area (ha)
	Sikanni Old-Growth Protected A	585
	Sikanni-Fontas Valley	10,181
Kahntah Total		**749,247**
Kobes	Farrell Creek	50,207
	Kobes	91,961
	Peace Corridor	4,670
	Peace River / Bodreau	128
	Major River Corridor	12,840
Kobes Total		**159,807**
Lower Beatton	Agriculture Settlement Area	374,203
	Alaska Highway Corridor	4,207
	Beatton Doig AOI	948
	Beatton Park	309
	Beatton River Site	186
	Boundary Lake Wetlands	348
Lower Beatton	Cecil Lake ER	121
	Cecil Lake Wetlands	1,156
	Charlie Lake Park	85
	Charlie Lake Community Watershed	25,036
	Clayhurst Ecological Reserve	284
	Grazing Reserve 3	7,809
	Grazing Reserve 4	14,481
	Grazing Reserve 5	6,223
	Peace Corridor	23,414
	Peace Corridor / River Sites	1,676
	Peace River / Boudreau	716
	Major River Corridor	36,997
Lower Beatton Total		**498,200**
Milligan	Chinchaga	227,754
	Chinchaga Lakes Protected Area	1,475
	Grazing Reserve 2	9,180
	Osborne	225,404
	Major River Corridor	10,154
Milligan Total		**473,968**
Sikanni	Besa Halfway Chowade	229,431
	Redfern-Keily Protected Area	80,779

Landscape Unit	LRMP RMZ Name	Area (ha) Total Area (ha)
	Sikanni Chief River ER	2,075
Sikanni Total		312,285
Tommy Lakes	Alaska Highway Corridor	1,157
	Conroy	342,362
	Jedney	321,857
	Major River Corridor	21,014
	Sikanni Canyon Protected Area	1,412
	Sikanni-Fontas Valley	17,875
Tommy Lakes Total		705,677
Trutch	Alaska Highway Corridor	6,291
	Buckinghorse River Way Park	36
	Grassy-Minaker	72,846
	Jedney	37,084
	Major River Corridor	21,064
	Sikanni Canyon Protected Area	3,297
	Sikanni Falls Protected Area A	302
	Sikanni Falls Protected Area B	186
	Sikanni Old-Growth Protected A	890
	Sikanni-Fontas Valley	14,324
	Trutch	280,404
Trutch Total		436,724
Grand Total		4,676,330

Appendix 3: LRMP Objectives by LU

Table 43: LRMP Objectives by Landscape Unit

Sig. Forestry Influence	Resource Objective	LRMP Objectives	LANDSCAPE UNIT APPLICABILITY										
			Blueberry	Crying Girl	Graham	Halfway	Kahntah	Kobes	Lower Beatton	Milligan	Tommy Lakes	Trutch	Sikanni
Y	Access1	Coordinate access and linear development to minimize negative effects on other resource values.	X	X	X	X	X	X	X	X	X	X	X
Y	Access2	Maintain existing access, coordinate industrial access development including linear development to minimize negative effects on other resource values.							X				
Y	Access3	Manage access to protect alpine areas (e.g., Pink Mountain).				X							
Y	Access4	Manage access to protect significant fish and wildlife habitats, alpine areas, and recreation values.		X	X			X					
N	Access5	Ensure future infrastructure requirements are considered when exploring for oil and gas. (intent- for Agriculture or Settlement needs)							X				
Y	Agric1	Control the spread of noxious weeds.	X					X	X				
Y	Agric2	Maintain livestock grazing opportunities on existing tenures.	X			X			X				
Y	Agric3	Maintain or enhance opportunities for livestock grazing.	X			X		X	X	X	X	X	

Sig. Forestry Influence	Resource Objective	LRMP Objectives	LANDSCAPE UNIT APPLICABILITY										
			Blueberry	Crying Girl	Graham	Halfway	Kahntah	Kobes	Lower Beatton	Milligan	Tommy Lakes	Trutch	Sikanni
N	Agric4	Maintain or increase land supply for agriculture including access to Crown land.	X			X		X	X	X			
N	Agric5	Minimize or mitigate wildlife impact on agricultural enterprises.	X			X	X	X	X	X			
N	Agric6	Provide opportunities for the growth and expansion of the agriculture and food production industries.	X			X		X	X	X	X		
N	Agric7	Recognize the high agricultural values within the Peace River corridor.						X	X				
Y	Consult	**Ensure that all land and resource management planning activities within the planning area provide for consultation with local municipal governments.**		X	X			X	X				
N	Ecology1	Maintain and enhance ecological integrity in areas subject to resource impacts from recreational use.				X						X	X
Y	Ecology2	**Maintain functioning and healthy ecosystems.**	X	X	X	X	X	X	X	X	X	X	X
Y	Ecology3	Restore and rehabilitate negatively affected ecosystems.	X	X	X	X		X					

Sig. Forestry Influence	Resource Objective	LRMP Objectives	LANDSCAPE UNIT APPLICABILITY										
			Blueberry	Crying Girl	Graham	Halfway	Kahntah	Kobes	Lower Beatton	Milligan	Tommy Lakes	Trutch	Sikanni
N	Energy1	Maintain opportunities and access for oil & gas exploration, development, and transportation.	X	X	X	X	X	X	X	X	X	X	X
Y	Fish1	**Maintain fish habitat and water quality for priority fish species.**	X	X	X	X	X	X	X	X	X	X	X
Y	Fish2	**Maintain high quality fisheries in natural settings.**											X
Y	Guide1	Maintain guide outfitting opportunities.		X	X	X		X				X	X
Y	Habitat1	Maintain caribou habitat.		X		X	X	X				X	X
Y	Habitat2	Maintain habitat for priority furbearing species.	X	X	X		X	X	X	X	X	X	
Y	Habitat3	Maintain high capability ungulate winter habitat.	X	X	X	X	X	X	X	X	X	X	X
Y	Habitat4	Maintain site specific habitats.	X			X			X	X		X	
Y	Habitat5	Manage critical wetland habitats for waterfowl and other wildlife species.						X	X	X			
Y	Habitat6	Minimize wildlife habitat fragmentation and maintain existing large mammalian predator/prey system.		X	X	X		X				X	X
Y	Habitat7	Protect or enhance habitats for red and blue listed species.					X		X	X	X		
N	Recreation1	Integrate recreational activities with grazing and resource extraction.							X				

Sig. Forestry Influence	Resource Objective	LRMP Objectives	LANDSCAPE UNIT APPLICABILITY										
			Blueberry	Crying Girl	Graham	Halfway	Kahntah	Kobes	Lower Beatton	Milligan	Tommy Lakes	Trutch	Sikanni
Y	Recreation2	Manage backcountry recreation and tourism opportunities in a natural or natural appearing condition.											X
N	Recreation3	Manage wildlife populations to provide opportunities for non-commercial hunting.											X
Y	Recreation4	Provide a full range of recreation opportunities.				X	X	X	X	X	X	X	
Y	Recreation5	Provide a full range of wilderness recreation opportunities identified in the ROS as primitive, semi-primitive non-motorized and semi-primitive motorized.		X	X								X
Y	Recreation6	Provide quality public and commercial recreational opportunities and values.	X	X	X	X		X	X		X		X
N	Recreation7	Provide tourism opportunities in Peace R corridor.						X	X				
Y	Timber1	Enhance timber harvesting and a sustainable long-term timber supply.	X	X	X	X		X		X	X		
Y	Timber2	Maintain timber harvesting and forest management opportunities.		X	X	X	X		X			X	X
Y	Timber3	**Manage for forest health.**							X				
Y	Timber4	Minimize losses to the THLB.	X			X		X	X			X	

Sig. Forestry Influence	Resource Objective	LRMP Objectives	LANDSCAPE UNIT APPLICABILITY										
			Blueberry	Crying Girl	Graham	Halfway	Kahntah	Kobes	Lower Beatton	Milligan	Tommy Lakes	Trutch	Sikanni
Y	Timber 5	Ensure timber harvesting in the Graham recognizes the watershed's other important resource values e.g., trapping, guide outfitting, wilderness.			X								
Y	Timber 6	Forest Management Intensity Levels Strategies (Intensive, Moderate, Low)	Int.	Mod.	Low	Int.	Mod.	Mod.	Mod.	Mod.	Int.	Mod.	Low
Y	Visual1	Manage visually sensitive areas along existing access corridors/trails and adjacent to protected areas.			X								X
Y	Visual2	Manage visually sensitive areas as scenic areas.	X	X	X	X		X	X	X	X	X	X
Y	Visual3	Manage visually sensitive areas within the Peace River Valley.						X	X				
Y	Visual4	Manage visually sensitive areas within Tommy Lakes area.									X		
Y	Visual5	Manage visually sensitive areas within the Alaska Highway corridor.	X			X			X		X	X	
Y	Water1	Maintain groundwater quality and quantity.	X			X		X	X			X	X
Y	Water2	Maintain the headwaters of major rivers and streams as a source of water for current and future generations.			X								X
Y	Water3	Maintain water quality in the Peace River.											

Sig. Forestry Influence	Resource Objective	LRMP Objectives	LANDSCAPE UNIT APPLICABILITY										
			Blueberry	Crying Girl	Graham	Halfway	Kahntah	Kobes	Lower Beatton	Milligan	Tommy Lakes	Trutch	Sikanni
Y	Water4	Promote water stewardship to manage for other resources.	X	X	X	X		X	X		X	X	X
Y	Water5	Protect water quality and quantity in Charlie Lake watershed.							X				
Y	Water6	Sustain natural stream flow regime.	X	X	X	X		X	X	X	X		

Table 44: LRMP Timber Strategies by Landscape Unit

Proposed Forest Management Intensity Level by LU and LRMP Timber Strategy		LANDSCAPE UNIT APPLICABILITY										
		Blueberry	Crying Girl	Graham	Halfway	Kahntah	Kobes	Lower Beatton	Milligan	Tommy Lakes	Trutch	Sikanni
		INTENSIVE	MOD	LOW	INTENSIVE	MOD	INTENSIVE	MOD	MOD	INTENSIVE	MOD	LOW
all	Quantify THLB and develop policies to reduce permanent losses	X	X	X	X	X	X	X	X	X	X	X
1	Establish forest production target for LUs… consistent with high intensity forest management regimes	X			X		X			X		
2	Establish forest production target for LUs… consistent with moderate intensity forest management regimes		X	X		X		X	X		X	

3	Establish forest production target for LUs… consistent with low intensity forest management regimes							X				X
4	Reforest … all PP Br, NC deciduous, and NSR. while providing for critical wildlife habitat	X			X	X	X	X	X	X		
5	Establish and maintain a permanent road infrastructure	X	X		X	X	X		X	X		
6	Minimize losses from damaging agents through aggressive fire and pest mgmt, including salvage	X	X			X	X	X	X	X	X	X
7	Promptly and aggressively reforest and manage cutovers and burnt areas within the THLB	X	X	X	X	X	X	X	X	X	X	X
8	Encourage utilization of pulp quality stands, unless it can be shown that long term viability and sustainability of wildlife species will be negatively impacted		X	X								X

8B	Encourage utilization of pulp quality stands	X			X	X	X	X	X	X	X	
9	Vary cut block adjacency requirements	X	X				X	X			X	
10	Encourage afforestation of reverted and low capability ag land	X					X	X		X		
11	Develop a long-term plan to manage access and forest management activities, incorporating sequential development		X	X								
12	No harvesting South of Graham R in the North Graham until at least 2006			X								

Appendix 4: Sustainable Forest Management Indicator Matrix

Fort St. John Pilot Project SFM / SFI Matrix

The SFI 2022 Forest Management Standard promotes sustainable forestry based on 13 Principles, 17 Objectives, 41 Performance Measures and 114 Indicators.

The organization, in conformance with the public participation process requirements set out in Section 5, will identify DFA-specific values, objectives, indicators and targets for each of the SFI SFM objectives described in Section 2 of SFI 2022 Standards and Rules, as well as any other values associated with the DFA. References to specific tables correspond to the table number in the SFMP Plan. Legal SFMP Indicators are noted in red text, non-legal SFMP indicators are in black text

SFI Objective	SFMP Indicator		FSJPP Target
1. Forest Management Planning *To ensure forest management plans include long-term sustainable harvest levels and measures to avoid forest conversion or afforestation of ecologically important areas.*	1 - Forest Types	Percent distribution of forest type (deciduous, deciduous mixedwood, conifer mixedwood, conifer) >20 years old by landscape unit	All forest type groups by landscape unit will meet or exceed the minimum area percentage in Table 6
	11 - Guidelines for Species at Risk and Species of Management Concern	The percentage of SLPs prepared annually for 'effected' cutblocks that incorporate stand level management guidelines	100% of SLPs prepared annually for effected cutblocks will incorporate stand level management guidelines
	18 - Deletions to Forest Area	The percentage of the Crown Forest Management Land Base* in the DFA converted to non-forest land use through the forest management activities of the participants during the term of SFMP# 4	Less than 0.14% of the Crown Forest Management Land Base* in the DFA will be converted to non-forest land use through the forest management activities of the participants during the term of SFMP# 4
	20 - Graham Merchantable Area Harvested	Cumulative merchantable area (hectares) within blocks harvested within the Graham River IRM Plan area since 1997	The cumulative merchantable area (hectares) within harvested blocks will not exceed the planned maximum cumulative harvest areas as measured at the end of each time period Period # 4 (ending April 2022): 10,858 ha Period # 5 (ending April 2027): 13,400 ha Period #6 (ending April 2032): 16,033 ha
	22 - MKMA Harvest	The number of long-term harvest plans within the MKMA completed and submitted to government	A minimum of one long-term harvest plan submitted no later than one year following government approval of a landscape unit objective under the MKMA Act, which applies to the Fort St. John TSA portion of the MKMA

	26 - Permanent Access Structures	Percentage of the total area in cutblocks occupied by permanent access structures in which harvesting was completed	A maximum of 5% of the total area in cutblocks occupied by permanent access structures in which harvesting was completed, as determined on a 3-year rolling average
	31 - Species Composition	Relative change in plantation composition versus harvest composition for spruce and pine	The relative proportion of spruce and pine planted annually will equal the proportions harvested annually (excluding fill planting)
	32 - Reforestation Assessment	Predicted Merchantable Volume (PMV) (cubic meters) coniferous and separate deciduous surveyed areas.	PMV will meet or exceed the Target Merchantable Volume (TMV). The TMV is set at 95% of the Maximum Predicted Merchantable Volume attainable on both coniferous and deciduous areas
	39 - Coordinated Developments and Access Management	Number of coordinated developments and access management plans	Report annually the number of proposed coordinated developments and access management plans that occurred
	49 - Participants' Coordination	Percentages of SFMPs and FOSs jointly prepared by the Participants	100% of all SFMP's and FOSs will be jointly prepared by the Participants
	50A - AAC Partition - Deciduous Planning	The volume of deciduous species that has been identified in planned cutblocks in the FOS within the Core partition area	The Core area will have a maximum of 56% of the total planned deciduous harvest volume identified in the Fort St John TSA area
	50B - AAC Partition - Deciduous Harvest Performance	The volume of deciduous species (measured using planning stage block volume data), that has been harvested by the Participants within the Core partition area since May 10, 2018.	On a 3-year rolling basis, deciduous harvest volume in the Core area will not exceed an average of 512,000 m^3 annually.
	51A - AAC Partition - Conifer Planning	The volume of conifer species that has been identified in planned cutblocks in the FOS within the Core partition area	A) In the Core area non spruce conifer species will comprise a minimum of 50% of the total planned conifer harvest volume. B) The Core area will have a maximum of 56% of the total planned conifer harvest volume identified in the Fort St John TSA area.

	51B - AAC Partition - Conifer Harvest Performance	The volume of conifer species (measured using planning stage block volume data), that has been harvested by the Participants within the Core partition area since May 10, 2018.	On a three-year rolling average: A) Conifer harvest volume in the Core area will not exceed an average of 672,000 m^3 annually. B) In the Core area non spruce conifer species will comprise, a minimum of 50% of the total conifer volume harvested by the Participants.
	52 - Cut Control	Percentage of total Allowable Annual Cut (AAC) charged to licensee tenure holder or BCTS Participants during the cut control term of each license	<u>Industry Participants:</u> Not to exceed 110% of the combined cumulative coniferous AAC for the cut control period Not to exceed 110% of the combined cumulative deciduous AAC for the cut control period <u>BCTS Participant:</u> Not to exceed 110% of the combined cumulative coniferous commitment offered for sale for the cut control period Not to exceed 110% of the combined cumulative deciduous commitment offered for sale for the cut control period
2. Forest Health and Productivity *To ensure long-term forest productivity, forest health and conservation of forest resources through prompt reforestation, afforestation, deploying integrated pest management strategies, minimized chemical use, soil conservation, and protecting forests from damaging agents*	2 - Seral Stages	The minimum proportion (%) of late seral stage forest retention by NDU by LU	All Periods: The minimum proportion (%) of late seral stage forest retention by NDU by LU as identified in Table 7 will be met
	3 - Patch Size	Percent area by Patch Size Class (0-50, 51-100, and >100 ha) by NDU	A minimum of 9 of 18 of the baseline targets for early patches will be achieved during the term of this SFMP (table 10)
	4 - Soil Disturbance	Number of blocks with non-conformances to soil disturbance limits, by Managing Participant	Zero blocks will have non-conformances to soil disturbance limits
	6 - Coarse Woody Debris Volume	Average retention level of Coarse Woody Debris volume (m3/ha) on blocks logged in the DFA between June 15, 2025, and December 31, 2032	Average retention level over the DFA will be a minimum of 46 m3/ha on harvested blocks assessed between June 15, 2025, and December 31, 2032
	14 - Seed Use	The percentage of seedlings & vegetative material used and planted in accordance with the Chief Forester's Standards for Seed Use (April 2022), as amended from time to time	100% of seedlings and vegetative material will be used and planted in accordance with the Chief Forester's Standards for Seed Use (April 2022), as amended from time to time

	24 - Riparian Reserves	The number of non-compliances to riparian reserve zone standards	No non-compliances to riparian reserve zone standards
	26 - Permanent Access Structures	*see indicator 26*	*see indicator 26*
	27 - Forest Health in Silviculture Obligation Areas	Percentage of silviculture obligation areas with significant detected forest health damaging agents which have treatment plans developed for them	100% of silviculture obligation areas with significant detected forest health damaging agents will have treatment plans developed for them and initiated within 1 year of detection
	30 - Preventing the Spread of Invasive Plants	The percentage of SLPs prepared annually for 'effected' cutblocks that incorporate one or more best practices for preventing the spread of invasive plants during forest management activities	100% of SLPs prepared annually for 'effected' cutblocks will incorporate one or more best practices for preventing the spread of invasive plants during forest management activities
	32 - Reforestation Assessment	*see indicator 32*	*see indicator 32*
	33 - Establishment Delay	Establishment Delay (years)	The area weighted average establishment delay for coniferous regeneration will not exceed two years. The area weighted average establishment delay for deciduous regeneration will not exceed three years. The area weighted average establishment delay for mixedwood stands regeneration will not exceed three years
	34 - Site Index	Site index	Average post-harvest site index will not be less than average pre-harvest site index on blocks harvested under the Pilot Project Regulation
	36 - Water Quality Effectiveness Evaluation	The percentage of surveyed stream crossings annually identified with a high WQEE (formerly WQCR) rating on forestry roads within the DFA for which Participants have stewardship WQCR – Water Quality Concern Rating WQEE – Water Quality Effectiveness Evaluation	On an annual basis fewer than 30% of the total number of surveyed stream crossings on roads for which the Participants have stewardship will have high WQEE

	37 - Small Streams and NCD Management	The number of annual non-conformances to SLP measures related to Riparian Management Area (RMA) retention for small streams and areas adjacent to non-classified drainages (NCD)	No non-conformances to SLP measures related to RMA retention for small streams and areas adjacent to NCDs from harvesting or silviculture activities
	48 - Forest Health FOS Planning	The percentage of significant detected forest health damaging agents outside areas with silviculture obligations which have treatment plans prepared and implemented	100% of significant detected forest health damaging agents outside areas with silviculture obligations will have treatment plans prepared and implemented within 1 year of initial detection
3. Protection and Maintenance of Water Resources *To protect the water quality and water quantity of rivers, streams, lakes, wetlands, and other water bodies.*	24 - Riparian Reserves	*see indicator 24*	*see indicator 24*
	35 - Peak Flow Index	Number of watersheds caused to exceed their threshold PFI value by the Participants' forestry activities	The Participants' forestry activities will not cause any watershed in the DFA to exceed their Peak Flow Index threshold
	36 - Water Quality Effectiveness Evaluation	*see indicator 36*	*see indicator 36*
	37 - Small Streams and NCD Management	*see indicator 37*	*see indicator 37*
	38 - Spills Entering Water Bodies	Number of spills of a reportable substance (i.e., antifreeze, diesel fuel, gasoline, greases, hydraulic oil, lubricating oil, methyl hydrate, paints and paint thinners, solvents, pesticides, and explosives) entering water bodies	Zero spills entering water bodies
4. Conservation of Biological Diversity *To maintain or advance the conservation of biological diversity at the stand- and landscape-level and across a diversity of forest and vegetation cover types and*	1 - Forest Types	*see indicator 1*	*see indicator 1*
	2 - Seral Stages	*see indicator 2*	*see indicator 2*
	3 - Patch Size	*see indicator 3*	*see indicator 3*
	5 - Dispersed Retention	Level of dispersed retention (stems/ha) on harvested areas	Retain at least 8-20 snags or live trees per hectare on harvested areas, of which 6 must be >23 cm dbh
	6 - Coarse Woody Debris Volume	*see indicator 6*	*see indicator 6*

successional stages including the conservation of forest plants and animals, aquatic species, threatened and endangered species, Forests with Exceptional Conservation Value, old-growth forests, and ecologically important sites	7 - Coarse Woody Debris Structure	Number of Coarse Woody Debris 'pile equivalent' structures* retained for wildlife habitat structure, in harvested areas	A minimum of one Coarse Woody Debris 'pile equivalent' structures* retained for wildlife habitat structure per 5 hectares, in harvested areas
	8 - Shrubs	The proportion of shrub habitat (%) by Landscape Unit	Each landscape unit will meet or exceed the baseline target (%) proportion of shrub habitat
	9 - Wildlife Tree Patches	Cumulative Wildlife Tree Patch percentage in blocks harvested under the FSJPPR in each Landscape Unit	Cumulative Wildlife Tree Patch % will meet or exceed the minimum target in each LU (Blueberry 9%, Halfway 6%, Kahntah 5%, Kobes 8%, Lower Beatton 3%, Milligan 4%, Tommy Lakes 8%, Trutch 5%, Sikanni 4%, Graham 4%, Crying Girl 3%)
	10 - Protection of Sites of Biological Significance	The percentage of identified "Sites of Biological Significance" * that have protection measures prescribed in operational plans	100% of identified "Sites of Biological Significance" * will have protection measures prescribed in operational plans
	11 - Guidelines for Species at Risk and Species of Management Concern	*see indicator 11*	*see indicator 11*
	12 - Migratory Birds Risk Reduction	Application of Participants' Migratory Birds Standard Work Procedures and beneficial management practices to reduce risk of incidental take during the nesting season	Participants will maintain and implement Standard Work Procedures and beneficial management practices for reduction of the risk of incidental take of migratory birds during the nesting season
	15 - Deciduous Regeneration	% natural regeneration of deciduous	100% natural regeneration for deciduous
	16 - Class A Parks and Protected Areas	Amount of forestry-related harvesting or road construction within Class A parks and protected areas	No forestry-related harvesting or road construction within Class A parks or protected areas
	17 - Ungulate Winter Ranges, Wildlife Habitat Areas and MKMA	Proportion of Pilot Participant activities consistent with objectives of the Muskwa-Kechika Management Area (MKMA) and general wildlife measures for Ungulate Winter Ranges (UWR) and Wildlife Habitat Areas (WHA)	All Pilot Participant activities will be consistent with the objectives of the MKMA and the general wildlife measures for UWR and WHA

	19 - Graham Harvest Timing	The number of clusters in the Graham IRM Plan area where active operational harvesting is concurrently occurring	Operational harvesting within the Graham IRM Plan area will be constrained to no more than one 'cluster' of cutblocks at any one time
	20 - Graham Merchantable Area Harvested	*see indicator 20*	*see indicator 20*
	21 - Graham Connectivity	Area harvested in cutblocks in the Graham River IRMP area, within the permanent alluvial and non-productive/non-commercial components of the connectivity corridors	No area harvested within cutblocks in the permanent alluvial and non-productive/non-commercial components of the Graham River IRMP connectivity corridors
	22 - MKMA Harvest	*see indicator 22*	*see indicator 22*
	23 - River Corridors	Percentage of harvested area in cutblocks that create openings greater than 1 hectare within 100 meters of RRZs in identified major river corridors	No more than 10% of the harvested area in cutblocks will create openings greater than 1 hectare within 100 meters of RRZs in identified major river corridors
	24 - Riparian Reserves	*see indicator 24*	*see indicator 24*
	29 - Noxious Weed and Invasive Plant Content	The percentage of noxious weeds and known invasive plant species of concern in the seed mix analyses	Seed lots utilized by the Participants will meet standards established by the Canadian Seed Growers Association regarding allowable content of seeds of noxious weeds and invasive plants as identified in the most current Provincial and Federal Regulations, and Regional District guideline
	28 - Salvage and Sanitation Harvest	The percentage of AAC/volume allocation requested for harvest authorization between April 1st and March 31st that focuses on salvage and sanitation harvest	Report annually the percentage of AAC/Volume allocation requested for harvest authorization between April 1st and March 31st that focuses on salvage and sanitation harvest
	30 - Preventing the Spread of Invasive Plants	*see indicator 30*	*see indicator 30*
	31 - Species Composition	*see indicator 31*	*see indicator 31*
	44 - Visual Screening	The percentage of SLPs prepared annually for cutblocks adjacent to existing roads and other linear	100% of SLPs prepared annually for blocks adjacent to existing roads and other linear features

		features that prescribe retention of screening	will have retention of screening prescribed
	61 - Representative Examples of Ecosystems	The percentage of area of forest stands in a non-managed condition, by leading species, by NDU	100% of baseline targets for forested stands in a non-managed condition, by leading species, by NDU will be met
	62 - Rare Ecosystems	Percentage of the area of rare ecosystem groups reserved from harvest	100% of the area of rare ecosystem groups will be reserved from harvest
5. Management of Visual Quality and Recreational Benefits *To manage the visual impact of forest operations and provide recreational opportunities for the public.*	3 - Patch Size	*see indicator 3*	*see indicator 3*
	42 - Recreation Sites	The number of recreation sites maintained by Participants	Participants will maintain a minimum of one recreational site within the DFA
	43 - Visual Quality Objectives	Consistency with Visual Quality Objectives (VQOs)	Pilot Participants' forest operations will be consistent with the established VQOs
	44 - Visual Screening	*see indicator 44*	*see indicator 44*
	45 - Recreation Opportunity Spectrum	Area in primitive and semi-primitive non-motorized classifications of the Recreation Opportunity Spectrum (ROS) for the Graham, Sikanni, and Crying Girl Lus	A minimum of 69,227 ha in primitive ROS area (100% of 1996 primitive ROS area) and 174,769 ha in semi primitive non-motorized ROS area (50% of the 1996 total semi primitive non - motorized ROS area) in the combined Graham, Crying Girl and Sikanni LUs (excluding the Graham Laurier and Redfern-Keily PA's)
6. Protection of Special Sites *To manage lands that are geologically or culturally important in a manner that considers their unique qualities.*	54 - Number of Known Values and Uses Addressed in Operational Planning	Percentage of known traditional site-specific First Nation values and uses identified that are addressed in operational plans	100% of known traditional site-specific First Nation values and uses identified will be addressed in operational plans
	64 - Effective Communication - First Nation Communities	Evidence of ongoing communication with First Nation communities and consideration of information gained	100% of information on First Nation titles and rights, identified through on-going communication with First Nation communities, has been responded to and considered and may be accommodated in forest management planning
7. Efficient Use of Fiber Resources	6 - Coarse Woody Debris Volume	*see indicator 6*	*see indicator 6*

To minimize waste and ensure the efficient use of fiber resources.	65 - Residual Fibre Utilization	The volume of residual fibre that is being utilized for products other than lumber and oriented strand board production	Report annually the volume of residual fibre utilized by facilities in the production of commodities other than lumber and oriented strand board
8. Recognize and Respect Indigenous Peoples' Rights *To recognize and respect Indigenous Peoples' rights and traditional knowledge.*	25 - Value and Total Number of Contracts Awarded to First Nations	Value and total number of Contracts awarded annually to First Nations.	Report the annual total value and number of contracts awarded to companies or groups owned or operated by First Nations
	46 - Actions Addressing Guides, Trappers and Other Interests	Percentage of operations consistent with mutually agreed upon action plans for guides, trappers and other known non-timber commercial interests	100% of operations will be consistent with action plans for guides, trappers and other non-timber commercial interests
	54 - Number of Known Values and Uses Addressed in Operational Planning	*See Indicator 54*	*See Indicator 54*
	58 - Herbicide Use	The amount of area treated by herbicide application where prior consent was received from First Nations	The participants will obtain consent from First Nations on 100% of the area treated with herbicide annually
	64 - Effective Communication - First Nation Communities	*see indicator 64*	*see indicator 64*
9. Climate Smart Forestry *To ensure forest management activities address climate change adaptation and mitigation measures.*	14 - Seed Use	*see indicator 14*	*see indicator 14*
	32 - Reforestation Assessment	*see indicator 32*	*see indicator 32*
10. Fire Resilience and Awareness *To limit susceptibility of forests to undesirable impacts of wildfire and to raise community awareness of fire benefits, risks, and minimization measures.*	32 - Reforestation Assessment	*see indicator 32*	*see indicator 32*

11. Legal and Regulatory Compliance *To comply with all applicable laws and regulations including, international, federal, provincial, state, and local.*	12 - Migratory Birds Risk Reduction	*see indicator 12*	*see indicator 12*
	16 - Class A Parks and Protected Areas	*see indicator 16*	*see indicator 16*
	17 - Ungulate Winter Ranges, Wildlife Habitat Areas and MKMA	*see indicator 17*	*see indicator 17*
12. Forestry Research, Science and Technology *To invest in research, science and technology, upon which sustainable forest management decisions are based.*	32 - Reforestation Assessment	*see indicator 32*	*see indicator 32*
13. Training and Education *To improve the implementation of sustainable forestry through appropriate training and education programs.*	13 - Forest Workers Safety	Implementation and maintenance of certified safety program	Each managing Participant will implement and maintain a certified safety program
14. Community Involvement and Landowner Outreach *To broaden the practice of sustainable forestry through public outreach, education, and involvement, and to support the efforts of SFI Implementation Committees*	40 - Range Action Plan	Percent consistency with mutually agreed upon action plans for range	Operations will be 100% consistent with resultant range action plans
	41 - Damage to Range Improvements or Natural Range Barriers	Time to repair range improvements or mitigate impacts of natural range barriers being rendered ineffective by Participants' activities	Range improvements damaged, or natural range barriers rendered ineffective by Participants' activities will be repaired, and/or have mitigation measures applied, within 2 years of damage, or impact to natural range barrier
	55 - Terms of Reference (TOR) for Public Participation Process	Maintaining the current Terms of Reference (TOR) for the FSJPPR public participation process	The TOR for the FSJPPR public participation process (PAG) will be maintained with a formal biennial review
	56 - Public Inquiries	The percentage of timely responses to public inquiries	Respond to 100% of public inquiries regarding Participants' forestry practices within one month of receipt
	57 - Educational Outreach	Number of people to whom information, presentations, or field trips provided annually	Minimum of 40 people provided information, presentations, or field trips

	59 - PAG Satisfaction Surveys	Level of satisfaction with the public participation process as measured by PAG surveys	A minimum satisfaction level of 80% as measured by PAG surveys
	63 - Effective Communication - Non-Timber Resources	Evidence of communication and consideration of non-timber resources into forest management planning	100% of non-timber resource values, identified through communication, have been responded to and considered and may be accommodated in forest management plans
15. Public Land Management Responsibilities *To participate and implement sustainable forest management on public lands.*	40 - Range Action Plan	*see indicator 40*	*see indicator 40*
	41 - Damage to Range Improvements or Natural Range Barriers	*see indicator 41*	*see indicator 41*
	42 - Recreation Sites	*see indicator 42*	*see indicator 42*
	55 - Terms of Reference (TOR) for Public Participation Process	*see indicator 55*	*see indicator 55*
	56 - Public Inquiries	*see indicator 56*	*see indicator 56*
	59 - PAG Satisfaction Surveys	*see indicator 59*	*see indicator 59*
	66 - Incorporation of New Land Use Plans	The number of finalized applicable Land Use Plans incorporated into the SFMP	All applicable Land Use Plans will be incorporated into the SFMP where necessary, through an amendment submitted to the government for approval within one year of each Land Use Plan being finalized
16. Communications and Public Reporting *To increase transparency and to annually report progress on conformance with the SFI Forest Management Standard.*	60 - Availability of Information on SFM	An annual report and audit results made available to the public	Annual reports and audit results will be made available to the public

17. Management Review and Continual Improvement *To promote continual improvement in the practice of sustainable forestry by conducting a management review and monitoring performance.*	*No applicable SFMP indicator. The objective is addressed by the Participants' individual periodic management reviews.*		
No applicable SFI Objective	47 - Timber Processing	Processing location of volume harvested in the DFA	Report the processing location for volume that was harvested within the DFA
	53 - Dollars Spent Locally on Each Woodlands Phase	Percentage of dollars spent locally on each woodlands phase in proportion to total expenditures	Woodlands Phases to be monitored: - Logging/hauling: minimum D14:F107of 80% - Road construction and maintenance: minimum of 80% - Silviculture: minimum of 5% - Planning and administration: minimum of 50%

Appendix 5: Growth & Yield Monitoring Plan

Growth & Yield Monitoring Plan
for the Fort St. John Timber Supply Area

Version 2.0

Prepared for

Don Rosen
Canadian Forest Products Ltd.
Chetwynd, BC

Project: CFC-005

March 31, 2003

Table of Contents

1. INTRODUCTION 1
1.1 BACKGROUND 1
1.2 PROJECT GOAL & OBJECTIVES 1
1.3 TERMS OF REFERENCE 1
2. BUSINESS NEEDS & OBJECTIVES FOR G&Y MONITORING 2
2.1 BACKGROUND 2
2.2 THE PROCESS 2
2.3 PRIMARY BUSINESS NEEDS 2
2.4 SECONDARY BUSINESS NEEDS 2
2.5 G&Y MONITORING OBJECTIVES 2
3. SAMPLE DESIGN 4
3.1 OVERVIEW 4
3.2 PURPOSE 4
3.3 TARGET POPULATION 4
3.4 SAMPLE LOCATION 4
3.5 PLOT NUMBERING 5
3.6 SAMPLE SIZE 5
3.7 PLOT DESIGN 7
3.8 RE-MEASUREMENT PERIOD 7
3.9 PLOT MEASUREMENTS 7
3.10 DATA MANAGEMENT 8
3.11 DATA ANALYSIS & INTERPRETATION 8
3.12 FUTURE MODIFICATIONS 9
4. LINK TO SILVICULTURE SURVEYS 10
4.1 OVERVIEW 10
4.2 FULL-MEASURE SILVICULTURE SURVEY PLOTS 10
4.3 INFORMATION PROVIDED 11
5. RECOMMENDATIONS 12
APPENDIX I – GENERAL INFORMATION ON MONITORING 13
APPENDIX II – DETAILED PROJECTIONS OF FUTURE PLOT DISTRIBUTIONS 16
APPENDIX III – PROVIDING DATA ON SFM INDICATORS 19
APPENDIX IV – FIELD SAMPLING METHODS 21

List of Tables

Table 1. Distribution of 3 km grid points in managed stands by major species. 5
Table 2. Forecasted harvest levels for the Fort St. John TSA. 5
Table 3. Major species distribution within deciduous and coniferous leading stands. 5
Table 4. Estimated distribution of plots by general species composition, grid size and year. 6
Table 5. Estimated average annual cost for plot establishment and re-measurement by decade and grid size. 6
Table 6. Estimated distribution of plots by detailed species composition, grid size and year 16
Table 7. Estimated number of plots to establish and re-measure by year on a 3 km grid. 17
Table 8. Estimated numbers of plots with yield data (one measurement) or growth data over time. 18
Table 9. Data for SFM indicators developed for the TSA provided by G&Y monitoring plots. 19
Table 10. Data for SFM indicators provided by silviculture survey plots. 20

List of Figures

Figure 1. Monitoring plot design for tree measurements. 7
Figure 2. Full-measure plot design. 10

1. INTRODUCTION

1.1 BACKGROUND

The Fort St. John Timber Supply Area (TSA) licencees are developing a sustainable forest management (SFM) plan that links TSA forest management activities to Canadian Standards Association (CSA) standards. Most activities supporting the SFM plan include setting forest management goals and objectives (through public consultation), developing targets for these objectives, and developing indicators to measure progress toward meeting the targets. One component of this SFM plan is to ensure that the productive capability of the landbase is maintained; this can be done by tracking growth & yield (G&Y) through a G&Y monitoring[1] program.

1.2 PROJECT GOAL & OBJECTIVES

The primary goal of this project is to develop a G&Y monitoring program for the Fort St. John TSA. This program will be designed to monitor the critical G&Y indicators and as many other indicators as possible to track progress towards meeting the SFM plan targets.

The specific objectives of this project are to:

1) Identify the business needs for a G&Y monitoring program in the TSA.
2) Define specific objectives for the G&Y monitoring program.
3) Identify where the G&Y monitoring program can provide data on other SFM indicators.
4) Develop a sampling design to meet the business needs and objectives.

1.3 TERMS OF REFERENCE

This project was completed by J.S. Thrower & Associates Ltd. (JST) for Don Rosen of Canadian Forest Products Ltd. (Canfor) of Fort St. John, BC. The JST project team was Eleanor McWilliams, *MSc RPF* (project manager), Jim Thrower, *PhD RPF* (technical support), Ron Zayac, *B.Comm* (GIS manager) and Wendy Creighton, *Dipl. Tech. GIS* (GIS technician).

Additional contributors to the G&Y monitoring options were Greg Taylor, *RPF* (Canfor), Jeff Beale, *RPF* (Slocan- Louisiana Pacific OSB Corp), Roger St. Jean, *RPF* (BC Timber Sales), Dave Menzies *RPF* (Canfor), Rod Brooks *RPF* (Louisiana Pacific Ltd.), Doug Russel (Louisiana Pacific Ltd.), Winn Hays-Byl, *RPF* (Ministry of Sustainable Resource Management [MSRM]), and Rod Kronlachner (Ministry of Forests [MOF]).

[1] General information on monitoring is provided in Appendix I.

2. BUSINESS NEEDS & OBJECTIVES FOR G&Y MONITORING

2.1 BACKGROUND

Clearly defined business needs and program objectives are critical components of a well-designed monitoring program. Business needs should focus on information requirements to support forest management decisions and processes (e.g., SFM planning, allowable annual cut determinations). One example of a business need is to periodically measure the actual G&Y of post-harvest and regenerated (PHR) stands to check against the corresponding projections used in timber supply analysis.

Business needs should be defined with a clear understanding of the importance of how different information impacts forest management decisions. Understanding the risk of using incorrect information in decision-making processes is important in determining the key variables (indicators) to be monitored. For example, large errors in some estimates may have very little impact on management decisions, but small errors in others may have large consequences. A sensitivity analysis of managed stand volumes done for the Fort St. John timber supply analysis[2] showed that if managed stands yields were increased by 10%, the initial conifer harvest would increase by 4.1%. Conversely, if these yields are reduced by 10%, the initial conifer harvest is reduced by 9.5%.

2.2 THE PROCESS

The Fort St. John TSA G&Y monitoring business needs were identified through discussions with licencee, MOF, and MSRM staff. Different monitoring needs for the TSA were considered including monitoring all stands, only PHR stands, and subsets of PHR stands (e.g., mixedwood, conifer and deciduous). The need to monitor timber and non-timber forest attributes was also discussed. Many potential uses and needs for information derived from a monitoring program were evaluated and included analysis of their costs, benefits, uncertainty in management processes, and potential future changes.

2.3 PRIMARY BUSINESS NEEDS

The primary business needs identified for G&Y monitoring on the Fort St. John TSA are to:

1) Periodically measure actual G&Y of managed stands to check projections used in timber supply analysis.
2) Provide data on indicators to support SFM requirements.
3) Provide data for inventory and G&Y model development.

2.4 SECONDARY BUSINESS NEEDS

The secondary business need is to monitor G&Y and stand dynamics in mature stands (particularly mixedwood stands) to check corresponding projections used in timber supply analysis. Monitoring mixedwood stands could become a key component of a mixedwood strategy that tests assumptions of how mixedwood stands change over time.

2.5 G&Y MONITORING OBJECTIVES

Based on these business needs, the specific objectives of the G&Y monitoring program for the Fort St. John TSA are to:

[2] Ministry of Forests. 2002. Timber supply review, Fort St. John Timber Supply Area analysis report. June 2002. 142p.

1) Monitor change in volume, species composition, top height, and site index in managed stands beginning 15 years post-harvest. This data will be compared with predicted values of the same attributes used in timber supply analysis to provide a level-of-comfort that the projections used in timber supply analysis are accurate and precise. This data can also be used to track SFM indicators should the harvest level change in future.
2) Provide data on snags, coarse woody debris, and shrubs to address SFM objectives.
3) Provide data on stand growth that can be used as a subset of the data required to develop new G&Y models.
4) Develop a sample design that can be modified in future to incorporate plot establishment in mature stands and link with Vegetation Resources Inventory (VRI) Phase II ground sampling.[3]
5) Link the G&Y monitoring plots with silviculture surveys designed to monitor the first 15 years post-harvest.

[3] If all or a randomly chosen subset of the G&Y monitoring plots are re-measured at the same time as the temporary sample plots are established for VRI ground sampling, then the two data sources can be combined to give a better estimate of current yield.

3. SAMPLE DESIGN

3.1 OVERVIEW

The key features of the proposed sample design are:

1) Potential sample points are located on a systematic grid across the TSA.
2) Samples are 400 m^2 circular plots centered at these grid points.
3) Plots are installed in managed stands established 15 years post-harvest.
4) All sample plots will be installed over more than one year.
5) Sample plots will be re-measured every 10 years (funding permitting).

3.2 PURPOSE

The purpose of this sample design is to provide tree-level and non-timber data from a representative sample of managed stands on the TSA. This design is intended to provide data to address the program objectives (Section 2.5), be compatible with the MOF Change Monitoring Inventory (CMI) protocol[4], and to provide this information in a cost-effective manner.

G&Y monitoring is *the process of comparing the actual G&Y of a forest or stand to the predicted or expected G&Y for that forest or stand.* This program is intended to check existing G&Y predictions for managed stands and not to estimate stand response from silviculture treatments.

3.3 TARGET POPULATION

The target population is all managed stands at least 15 years post-harvest in the timber harvesting land base (THLB) of the TSA.[5] The target population will expand as stands are harvested and regenerated. This definition may change in future if natural stands are included in the G&Y monitoring program.

Pre-stratifying the target population is not recommended because it is extremely difficult to maintain the stratification over time. The system should be designed to be simple and flexible in order to ensure its longevity. Changes in species composition and silviculture treatments can affect stratification schemes when stands "jump" between strata.

3.4 SAMPLE LOCATION

We recommend locating monitoring plots in managed stands on a systematic grid across the TSA. Plots can be randomly or systematically located without compromising the statistical validity of the design. Plots located systematically on a grid will cover as many conditions as random plots, and have added convenience since plot locations are known once the grid size is defined.

The intent is that these plots provide a statistically valid sample of the target population. Thus, all stand types should be sampled, plot locations are not moved to "representative conditions of the stand", nor are plots protected or buffered. If plots are buffered or treated differently than the rest of the target population, they cease to be a valid sample.

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[4] Ministry of Sustainable Resource Management. 2002. Change monitoring inventory ground sampling procedures for the provincial change monitoring inventory program, *version 1.2*. http://srmwww.gov.bc.ca/tib/publications.htm.

[5] The THLB is approximately 23% of the total TSA area according to the Fort St. John timber supply area analysis report.

3.5 PLOT NUMBERING

We recommend using a plot numbering system based on Universal Transverse Mercator (UTM) coordinates. These numbers can be used to uniquely identify plots and their locations and limit the possibility for numbering errors as plots are added over time.

3.6 SAMPLE SIZE

Several grid sizes (1, 2, 3, 4, and 5 km) were superimposed on the TSA inventory and all points in the THLB were identified. Preliminary analyses, which balanced sample size and cost, suggests a grid size between 3 and 4 km to sample the managed stand population. A 3 km grid provides one plot every 900 ha, while a 4 km grid provides one plot every 1,600 ha.

Table 1. Distribution of 3 km grid points in managed stands by major species.

	Post-harvest (yrs)		
Species Group	0-14	15 +	Total
Sw > 80%	21	10	31
Mixedwood SxAt	3	16	19
Mixedwood AtSx	5	13	18
At > 80%		10	10
Sw leading conifer	2	8	10
Pl > 80%	6	2	8
Pl leading conifer	1	4	5
Mixedwood AtPl	2	2	4
Mixedwood PlAt	2		2
Total	*42*	*65*	*107*

Prior to further analyses, the inventory data for the 3 km grid points was checked to ensure that it was correct. This included ensuring harvest updates were complete and reconciling stand ages and harvest history data. This information was used to produce a summary of the distribution of 3 km grid points in managed stands by major species (Table 1).[6]

Table 2. Forecasted harvest levels for the Fort St. John TSA.

	Harvest (ha/year)	
Year	Conifer	Deciduous
2003	3,000	200
2004	3,000	200
2005	3,600	1,500
2006	3,600	3,000
2007	3,800	3,500
2008	3,800	4,200
⋮	⋮	⋮
2052	3,800	4,200

The 3 km grid data was used to proportionately estimate the distribution of grid points (by major species and years since harvest) in managed stands on 3.2, 3.4, 3.6, 3.8, and 4 km grids. Inventory records were used to estimate the number of plots to be established in the next 14 years. Forecasted harvest levels (Table 2) provided by Canfor were used to estimate the number of plots to be established 15 years and later. The distribution of these future plots was projected by major species group and assumed that current species distribution will be maintained as coniferous- or deciduous-leading. This distribution was obtained from the Fort St. John TSA analysis report (June 2002) (Table 3) and was applied to the projected number of G&Y monitoring plots to be established on areas not yet harvested.

Table 3. Species distribution within deciduous and coniferous leading stands.[7]

Species Group	%
Deciduous	65
Mixedwood At-Pl	16
Mixedwood At-Sx	19
Deciduous Total	*100*
Mixedwood Sx-At	11
Mixedwood Pl-At	11
Pl > 80%	24
Pl-leading conifer	19
Sw > 80%	19
Sw-leading conifer	16
Conifer Total	*100*

3.6.1 Post-stratification

The choice of grid sizes is partly a function of the ability to post-stratify the plots into large enough[8] groups to check the G&Y projections for those groups (Section 3.11). Species groups are usually categorized by conifer, deciduous, conifer mixedwood, and deciduous mixedwood. However,

[6] Lodgepole pine (Pl), white spruce (Sw), and trembling aspen (At).

[7] Data is compiled from the June 2002 Fort St. John TSA analysis report (Tables A3 and A16).

[8] A minimum sample size of 30 plots is recommended for G&Y estimates. Estimates of growth have less variability than estimates of yield and therefore require smaller sample sizes to obtain the same precision.

since the objective of checking G&Y projections, mixedwoods should be divided into Pl-At[9] mixtures and Sw-At mixtures.

G&Y models for Pl-At and Sw-At mixtures will be different because Pl and Sw have different shade tolerances; thus, the models will be developed separately. Further, Pl-At mixtures are easier to model and new models will likely be developed for this mixture before models are developed for a Sw-At mixture. Thus, given the objective of checking G&Y projections, we recommend splitting the mixedwood stands by conifer species.

The projected plot distribution by species groups over time (Table 5) shows that by 2005 a 3 km grid would contain enough plots to check conifer and mixedwood Sw-At stands as individual groups (30 and 31 plots, respectively), but insufficient plots to check either deciduous or mixedwood Pl-At stands separately. The latter would be checked as part of the overall average of managed stand performance. By 2015, the 3 km grid would produce enough plots to extract pure Sw stands from the conifer group and analyze them separately (Table 6, Appendix II). In contrast, a 4 km grid would not provide enough plots to analyze conifer stands as a group unit 2015 and mixedwood Sw-At stands until approximately 2030 (Table 5). The estimated difference in average annual costs between a 3 and 4 km is $11,500 per year over the first three decades (Table 4).

Table 5. Estimated distribution of plots by general species composition, grid size and year.

	Grid Size (km)					
Species Group	3.0	3.2	3.4	3.6	3.8	4.0
			2005			
Deciduous	10	9	8	7	6	6
Mixedwood (Pl-At)	2	2	2	2	1	1
Mixedwood (Sw-At)	31	27	24	22	19	17
Conifer	30	26	23	21	19	17
Total	*73*	*64*	*57*	*51*	*45*	*41*
			2015			
Deciduous	10	9	8	7	6	6
Mixedwood (Pl-At)	6	5	5	4	4	3
Mixedwood (Sw-At)	36	32	28	25	22	20
Conifer	51	45	40	35	32	29
Total	*103*	*91*	*80*	*72*	*64*	*58*
			2025			
Deciduous	25	22	20	17	16	14
Mixedwood (Pl-At)	13	12	10	9	8	7
Mixedwood (Sw-At)	45	39	35	31	28	25
Conifer	79	69	61	55	49	44
Total	*162*	*142*	*126*	*112*	*101*	*91*
			2035			
Deciduous	56	49	43	39	35	31
Mixedwood (Pl-At)	25	22	20	18	16	14
Mixedwood (Sw-At)	58	51	45	41	36	33
Conifer	112	98	87	77	70	63
Total	*251*	*220*	*195*	*174*	*156*	*141*
			2045			
Deciduous	86	75	67	60	53	48
Mixedwood (Pl-At)	37	33	29	26	23	21
Mixedwood (Sw-At)	72	63	56	50	45	40
Conifer	144	127	112	100	90	81
Total	*340*	*299*	*264*	*236*	*212*	*191*

Table 4. Estimated average annual cost for plot establishment and re-measurement by decade and grid size. Assuming $2,500 per plot for establishment and $1,000 per plot for re-measurement.

	Grid size (km)					
Decade	3.0	3.2	3.4	3.6	3.8	4.0
2003-2012	$23,300	$20,400	$18,100	$16,100	$14,500	$13,100
2013-2022	$19,900	$17,500	$15,500	$13,800	$12,400	$11,200
2023-2032	$35,700	$31,400	$27,800	$24,800	$22,300	$20,100
2033-2042	$44,600	$39,200	$34,700	$31,000	$27,800	$25,100
2043-2052	$53,500	$47,000	$41,700	$37,200	$33,400	$30,100

The ability to post-stratify the data to provide information on coarse woody debris, snags and shrubs, and range species to meet SFM information requirements has not yet been fully considered. It is not clear how potential strata would be defined besides using the major species groups. A summary of the data available to meet SFM requirements is provided in Appendix III.

[9] Pl-At mixtures include the full range of mixtures from 21 – 79% of either species, with Pl being the leading conifer. In contrast the symbols Pl-Aand At-l are used to refer to Pl leading and At leading stands respectively.

The choice of grid size is a function of available funding. It is important to recognize that establishing a monitoring program is an ongoing commitment that will require annual funding. Details of estimated costs and the quantity of G&Y data supplied by the different grid sizes are provided in Appendix II (Table 7, Table 8)

3.7 PLOT DESIGN

We recommend using a slightly modified version of the standard MSRM CMI plot (Figure 1). Tree measurements taken from the Main plot and Small-tree plot would be consistent with CMI standards. The Main Plot is 400 m^2 (11.28 m radius) where all trees greater than 9 cm diameter at breast-height (DBH) are measured and tagged. Trees between 4 and 9 cm are measured and tagged in the Small-tree plot (100 m^2, 5.64 m radius). The proposed modification is to the increase the radius of the Regeneration plot from 2.5 m to 3.99 m.[10] In this plot, all trees taller than 30 cm but less than 4 cm DBH are measured and tagged (50 m^2, 3.99 m radius). This will make the Regeneration plot the same size as the proposed full-measure silviculture survey plots (Section 4) that have previously been established at the same plot center and re-measured over the first 15 years post-harvest.

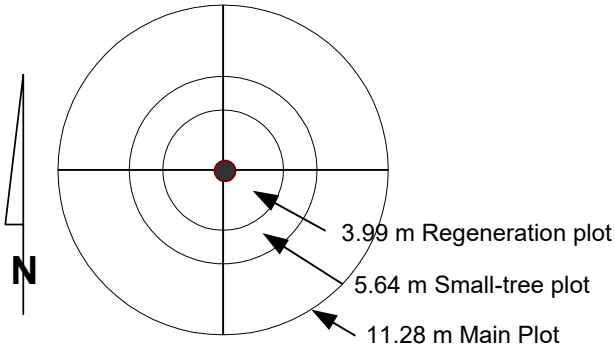


Figure 1. Monitoring plot design for tree measurements.

Coarse woody debris, ecological, vegetation and range data will be collected to CMI standards.

~~3.7~~3.8 RE-MEASUREMENT PERIOD

We recommend a ten-year re-measurement period to coincide with every second five-year Management Plan cycle. In other management units, five-year re-measurement schedules have been recommended but the growth rates in the Fort St. John TSA do not warrant re-measurement every five years.

3.9 PLOT MEASUREMENTS

3.9.1 Overview

We propose that most MSRM CMI standard field procedures be used; however, stem-map information should not be collected and a modified selection of site trees is proposed. A summary of procedures is provided in Appendix IV.

~~*3.8.3*~~*3.9.2 Tree Tags*

Brown tree tags should be affixed at breast-height rather than at stump height as recommended in the CMI protocol. This simplifies the work without making the plot unduly visible.

~~*3.8.6*~~*3.9.3 Top Height & Site Trees*

Top height trees should be selected as per CMI guidelines from the Small-tree plot. We recommend that leading and second species not be determined prior to site trees selection.

[10] If required, a 2.5 m radius could be used and trees within this plot recorded to maintain consistency with other CMI projects.

The age of the largest diameter, dominant or co-dominant tree of each species in each quadrant should be measured. This ensures that the age of the leading and second species are recorded. If the largest diameter tree of a given species (coded as "S" tree) is not suitable for height and age measurement, the next largest diameter tree suitable for height and age will be selected (and coded as "O" tree). If site trees between 4 and 9 cm DBH are outside the Small-tree plot (but inside the Main plot) they should not be tagged during plot establishment. In this case, site trees should be tagged and the height and age recorded in the site tree section on Card 10.

3.10 DATA MANAGEMENT

Data will be entered into the most recent version of the VRI Data Entry (VIDE) software, suitable for both VRI and CMI data. JST can compile the data using the MSRM CMI data compiler.

3.11 DATA ANALYSIS & INTERPRETATION

Data from the first measurement provides yield estimates only. These can be used to audit the projected yield of managed stands in timber supply analysis. Change is estimated when two or more measurements are available and then is it possible to determine differences between measured and predicted G&Y for the main attributes of interest. Graphical analysis includes plotting actual versus predicted values and plotting differences (actual-predicted) versus stand age or any other chosen variable to examine trends. The statistical analysis includes the average differences and associated confidence intervals.[11]

When the sample is large enough, it is possible to post-stratify the data to examine issues on subsets of managed stands. A minimum sample size in a stratum is approximately 30 plots.

The graphical and statistical analysis is intended to examine overall trends of over- or under-prediction in the data. If the analyses suggest over- or under-prediction, then possible sources of the differences should be identified. For example, when considering volume estimates, potential factors to consider as sources of error are the differences between the inventory inputs into the model and the actual stand attributes. Potential inventory attributes to examine include stocking, site index, treatment, species composition, stand structure, and pest or disease incidence.

The monitoring plot data could be used to adjust yields, but we recommend the data not be used to adjust growth projections (yield curves) based on observed growth. Both activities address the symptom of a problem rather its actual cause. Adjusting current yields for the sampled population is acceptable if data are representative of current yields. Adjusting yield curves to reflect observed growth in one time period is risky because this trend may not continue over time. The more prudent approach is to determine why differences occur. Often they result from incorrect inputs to the models.

The main objective of the monitoring program is to detect differences in growth. This program is limited in its ability to determine the causes of the differences. Consequently, additional samples or studies may be needed to identify possible sources of differences, should they occur.

[11] J.S. Thrower & Associates Ltd. 2000. Graphical and statistical analysis for monitoring estimates of change at the management-unit level. Version 2.0. Contract report to B.C. Ministry of Forests, Resources Inventory Branch, Victoria, B.C. Project MFI-055.

3.12 FUTURE MODIFICATIONS

Future modifications to the G&Y monitoring program could include:

1) **Decreasing sample intensity –** Sampling intensity can be decreased in future as more plots are located in managed stands. The number of plots will increase as natural stands are harvested, regenerated, and brought to the minimum 15 years from disturbance. If the program becomes too costly, randomly selected plots can be dropped from older managed stands where the comfort of predicting stand yield is higher. As well, costs can be reduced by increasing the re-measurement period of some plots.

2) **Expanding the monitoring program to natural stands –** The G&Y monitoring program could be expanded to include natural stands. This would form a separate target population and a separate analysis would be needed to determine potential sample sizes. One possibility is using a grid size that is a multiple of that chosen for the managed stands so that once plots in the natural stand grid are harvested, the same plot centers could be used for silviculture surveys and PHR monitoring program. Initial analyses suggest that a 7.2 km grid size (twice 3.6 km) would provide approximately 50 plots in natural mixedwood stands. Expanding the grid into natural stands should be coordinated with VRI ground sampling to minimize sampling costs.

3) **Re-measure the G&Y monitoring plots as part of the VRI ground sample –** If all or a randomly chosen subset of the G&Y monitoring plots are re-measured with the VRI Phase II ground sampling, then the two data sources can be combined to give a better estimate of current yield.

4. LINK TO SILVICULTURE SURVEYS

4.1 OVERVIEW

The proposed monitoring plots will track the G&Y of managed stands beginning at 15 years post-harvest. "Full-measure" silviculture survey plots will be established at permanent points on a 200 m grid at the time of the first survey and re-measured in subsequent surveys over the next 15 years. A subset of these 200 m grid points will form part of the G&Y monitoring plot sample.[12]

4.2 FULL-MEASURE SILVICULTURE SURVEY PLOTS

Each full-measure plot includes a 50 m^2 (3.99 m radius) plot (Main plot) divided into quadrants along cardinal directions to measure tree attributes, and a 100 m^2 (5.64 m radius) plot (Site Index plot) to collect height and age data from site trees (located at the same plot center) (Figure 2). Suitable site trees have three or more years height growth above breast-height. Site tree data should be collected from one tree of each species located in the Site Index Plot with a suitable site tree.

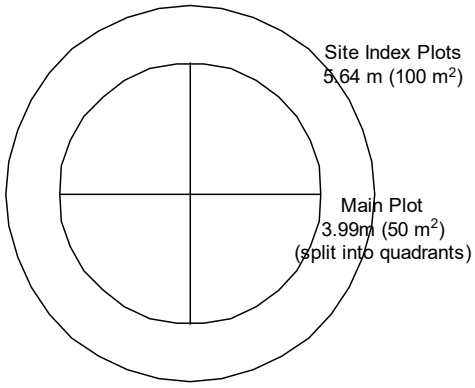


Figure 2. Full-measure plot design.

4.2.1 Plot Location

Full-measure plots are established on the 200 m grid. Plot centers should be permanently marked with a steel pin[13] and global positioning system (GPS) coordinates recorded. Plot locations should be geo-referenced in the geographic information system (GIS). These sample points should not be visible in order to avoid treating the plot area differently than other portions of the stand (which may bias the information from the sample point at subsequent measurements). The same center point will be used for the subset of full-measure plot locations chosen for the G&Y monitoring program.

4.2.2 Main Plot – 50 m^2

Quadrant Information – Each quadrant is recorded as stocked if it contains at least one healthy tree of an acceptable species that is free of brush competition (according to current free growing regulations). If a non-stocked quadrant could support tree growth, comment on why there are no trees (e.g., type of non-productive (NP) ground, missed plantable spots, brush competition, or health problems).

Tree Information – Data for each tree in the plot includes:

i) Quadrant number (1-4).
ii) Tree species.
iii) Height (measure some for reference and visually estimate others).
iv) Forest health codes (use the same codes used in other silviculture surveys).

Brush Information – Record percent cover and average height of brush by species in each quadrant.

NP Area Information – Record the type of NP area (e.g., rock, water) and percent cover in each quadrant.

[12] All proposed grid sizes for the G&Y monitoring plots are multiples of 200 m.

[13] Any pin type could be used as long as it does not degrade and can be detected with a metal detector.

4.2.3 Site Index Plots – 100 m²

Record site index information for one site tree of each species from the Site Index Plot located at each plot center. Site trees are:

i) The tallest tree in the 100 m² plot for that species.[14]
ii) Undamaged (stem damage resulting in less than 5% reduction in height growth).
iii) Not overtopped by other trees or competing vegetation where height growth may be affected.

The second tallest tree can be measured for site index if the tallest is not suitable. This must be noted on the field card. Information collected for each tree should include:

i) Total height.
ii) Age at breast-height.
iii) Total age.
iv) Rank in height relative to other trees in the plot of that species (e.g., tallest, 2nd tallest, etc.).

4.3 INFORMATION PROVIDED

If full-measure plots are repeatedly revisited as part of regular surveys during the first fifteen years post-harvest, they will provide a large observational database that can be linked to silviculture history and ecological data to determine trends in stand development. The same plot size (3.99 m radius) must be used and the same measurements (species, quadrant, estimated heights, damage codes, percent brush cover, and brush height[15]) must be taken during each survey. The data collected will provide information on:

1) **Early height growth** – This data can be used to check assumed years to breast-height and years to green-up. Other data can be used to check juvenile height growth curves or the juvenile height assumed with site index curves.
2) **Ingress patterns** – This data can be used to assess planting requirements and expected species composition.
3) **Growth following different silviculture treatments** – This data will not provide information on treatment response[16], but will provide feedback and demonstrate growth trends following various treatments.
4) **Stand-level details required to assign yield curves for timber supply** – The full-measure plots can be post-stratified and summarized by analysis units to provide statistically-defensible information to generate yield curves for timber supply analysis.
5) **Data on SFM indicators** – This includes data to check site productivity (early height growth), presence of snags and shrubs. A summary of the data provided on SFM indicators is presented in Appendix III.

[14] Where site trees are less than 1.3 m in height they must be selected by height as opposed to DBH. Generally, it is more efficient to select site trees in young stands based on height and in older stands based on DBH. The VRI procedure is to choose trees based on DBH (Section 3.9.3). Site trees could be tagged on all or a subset of plots and the tagged trees could be re-measured in subsequent surveys to examine how site trees changes over time and how this influences site index estimates.

[15] If brush is a significant management issue, then surveys should be done at the same time of the year to ensure consistent % cover estimates.

[16] Treatment response is defined as the incremental gain (or loss) due to the treatment. It is the growth in the treated stands minus the growth that would have occurred if the stand had not been treated.

5. RECOMMENDATIONS

As a result of this analysis and discussions with the licensees and MOF and MSRM stakeholders, we recommend:

1) A 3 to 4 km monitoring grid size be used. The final choice of grid size will depend on funding and the level of detailed data needed. If possible, we recommend choosing a 3.6 km (or smaller) grid size to allow for sufficient plots for post-stratification into major species groups.
2) If the G&Y monitoring program is expanded into mature stands, it should be coordinated with VRI Phase II ground sampling.
3) Early stand establishment and stand dynamics be monitored with full-measure silviculture survey plots. This will provide a large database that can link silviculture history and ecological data to examine trends in stand development. This can be complimented with well-designed trials to determine cause and effect relationships.
4) G&Y monitoring plots provide some of the data necessary to calibrate G&Y models. However, calibrating the models requires a collaborative effort needed to develop a mixedwood growth model. One of the first strategic decisions the licensees need to consider is whether the work already completed to calibrate TASS should be used or whether a new model should be developed. It is also important to determine the appropriate scope for collaborative work to ensure that local issues are adequately addressed. The proposed G&Y monitoring plots could provide a portion of the data required for model calibration. Additional data from designed experiments (i.e., WESBOGY trials) and natural stands will be required.

APPENDIX I – GENERAL INFORMATION ON MONITORING

WHAT IS MONITORING?

The term "monitoring" is widely used and is very ambiguous. The term "monitoring" is generally used to describe the process of checking or regulating some defined activity. It is also used interchangeably with the word "measuring". The literature is filled with numerous kinds of "monitoring", for example: adaptive monitoring, biodiversity monitoring, change monitoring inventory, compliance monitoring, ecosystem monitoring, effectiveness monitoring, environmental monitoring, fertilizer application monitoring, fertilizer response monitoring, forest health monitoring, forest monitoring, growth and yield monitoring, habitat monitoring, herbicide application monitoring, implementation monitoring, silviculture monitoring, trend monitoring, validation monitoring, etc. So the bottom line is, don't worry what a monitoring program is called, focus on what is being done and why. What are the objectives? Where can the results be applied? How can the results be used?

Under the principles of SFM, monitoring is defined as the periodic measurement and assessment of change of an indicator, where an indicator is a variable used to report progress towards achieving a goal. Goals are broad, general statements that describe a desired state or condition related to one or more forest values.[17] In this context, two broad categories of monitoring can be recognized. The first, which may be referred to as "administrative monitoring", checks that planned SFM activities are implemented (i.e., did we do what we said we were going to do?). An example is monitoring to ensure conformance with established visual quality objectives. Most administrative monitoring can be carried out internally by individual licensees.

The second category of monitoring may be referred to as monitoring the state of the forest, which includes activities that measure timber and non-timber variables over time. **G&Y monitoring**, which is the process of checking G&Y estimates for a defined population, is in this broad category. Monitoring the state of the forest requires a long-term commitment to establishing and re-measuring plots over time. To be cost-effective, it is best addressed as a joint venture among licensees.

Some of the variables a program designed to monitor the state of the forest could track include volume, wood quality, species composition, site productivity, and coarse woody debris.

Monitoring is a key process in adaptive management. It is the feedback loop that provides information for continuous improvement. The level of success in achieving objectives can be evaluated, and planning and management activities can be improved accordingly.

LINKS BETWEEN G&Y MONITORING AND OTHER DATA COLLECTION PROGRAMS

Monitoring the state of the forest requires permanent sample plots (PSPs) and associated establishment and re-measurement costs. Field costs[18] for plot establishment on other G&Y monitoring projects have ranged between $1,500 - $2,000/plot. Plot establishment costs are a function of access and the number of variables to be measured. Costs increase significantly if a single plot cannot be established in one

[17] These are the Canadian Standards Association CAN/CSA-Z808/809-96 definitions.

[18] Field costs include planning (hiring crews, arranging transportation, equipment, etc.), crew time, helicopter time where necessary, training and quality assurance, and data entry.

day. In addition to field costs, there are costs for sample plan development, data analysis, and reporting. Given the expense of plot establishment, it is prudent that the data collection is closely linked to the business needs, and that the data collected be used for as many purposes as possible. The following outlines potential linkages between a monitoring program and other data collection programs.

VRI Phase II Ground Plots

PSPs established for G&Y monitoring purposes could be used as a portion of the plots established for VRI Phase II ground sampling. Data from fixed area PSPs and variable radius temporary sample plots (TSPs) currently established for VRI Phase II can be combined. Single fixed area PSPs are less efficient[19] for estimating current volume than the VRI Phase II prism plot cluster, but if the plots are already established, they could be used to reduce the number of Phase II plots needed to be established. Theoretically, inventory and G&Y monitoring plots should be kept separate so that the G&Y monitoring plots provide an independent check of the inventory and inventory projections. Practically, the implications of using plots for both inventory and G&Y monitoring should be minimal if the monitoring plots make up a small portion of the inventory plots and the cost savings offsets these minimal implications.

For the Fort St. John TSA, the G&Y monitoring plots will make up all of the VRI Phase II ground plots in managed stands. This means the G&Y monitoring data can be used to check growth projections, but cannot be used to conduct an independent check of future yields. There will be a small chance that the G&Y monitoring plots will give an estimate of yield significantly removed from the true value for the area, and this situation will persist over time. For example, if the G&Y monitoring plots happen to under-estimate the true yield at time 1, they will likely under-estimate the true yield at time 2 while the observed growth rates will likely be representative of the area. An independent check of yields can be carried out at any time in the future with a set of temporary plots randomly or systematically established to represent the population of interest.

Developing Growth Models

BC has a long history of establishing and re-measuring PSPs[20] to develop and maintain G&Y models. Most of these PSPs were subjectively[21] located in natural and treated stands, or established as part of designed experiments. G&Y monitoring plots could be used to augment the data sets used for model development. There is risk to doing this as it could result in incorrect conclusions from monitoring. This risk is a function of the degree to which the monitoring data have influenced the model. For example, the risk would be highest where most of the same data used to develop a model (e.g., VDYP) were also used to the check the estimates from the model. Ideally, completely independent PSPs would be used to develop and check models, however, the costs of maintaining two independent sets of plots is likely prohibitively expensive and unnecessary.

[19] Empirical evidence from TFL 37 suggests that the single CMI plot is approximately 30% less efficient for estimating current volume than the VRI Phase II prism plot cluster. That is, sampling for net volume using the single CMI plot would require 30% more plots than would the five-point VRI cluster, to attain the same target sampling error.

[20] For example, the Growth Natural Program.

[21] Plots purposely established in fully stocked portions of stands. Monitoring plots will be randomly or systematically located.

In the Fort St. John TSA, models need to be developed for mixedwood stands. Most provincial G&Y models (e.g., TASS, VDYP7, and PrognosisBC) are developed using data from a range of areas and stand conditions. Consequently, the risk of a model projection being largely influenced by the data from any given management unit is low. It should be noted that other types of modeling data (e.g., experimental plots to determine treatment responses) are still needed in addition to plots established for monitoring and model development.

Site Index Adjustment (SIA)

Many TFLs and most Innovative Forestry Practices Agreement (IFPA) areas in the province have chosen a statistical approach to provide unbiased estimates of potential site index (PSI) for yield projection in PHR stands in timber supply analysis. The data are collected from randomly selected plots across the management unit and used to adjust preliminary estimates attached to each polygon for the entire management unit. This approach has been widely used by industry (on more than 20 land bases) and is accepted for generating managed stand yield tables for application in timber supply projections.

A G&Y monitoring program does not provide enough samples in suitable stand types to complete an SIA project. However, data from G&Y monitoring plots can be used for this purpose. Using data from the monitoring plots to develop the SIA theoretically compromises the independence to monitor the site index estimates over time. However, this potential problem is probably not of practical significance if the proportion of G&Y monitoring plots in the overall sample used for SIA is low.

Site Index-Biogeoclimatic Ecosystem Classification (SIBEC).

Data from all suitable PSPs should be used to contribute to the provincial SIBEC database. Data from G&Y monitoring PSPs are probably more suitable for the SIBEC database as they will be from randomly or systematically located plots as opposed to the current policy of subjectively locating SIBEC plots.

Predictive Ecosystem Mapping (PEM)

G&Y monitoring plots could be used to provide point estimates of site series to check PEM estimates of site series. However, the observations from this program should be supplemented with many more samples to achieve the objective.

APPENDIX II – DETAILED PROJECTIONS OF FUTURE PLOT DISTRIBUTIONS

Table 6. Estimated distribution of plots by detailed species composition, grid size and year

	Grid Size (km)					
	3	3.2	3.4	3.6	3.8	4
			2005			
Deciduous	10	9	8	7	6	6
Mixedwood AtPl	2	2	2	1	1	1
Mixedwood PlAt	0	0	0	0	0	0
Mixedwood AtSx	15	13	12	10	9	8
Mixedwood SxAt	16	14	12	11	10	9
Pl > 80%	3	3	2	2	2	2
Pl leading conifer	4	4	3	3	2	2
Sw > 80%	15	13	12	10	9	8
Sw leading conifer	8	7	6	6	5	5
Total	*73*	*64*	*57*	*51*	*45*	*41*
			2015			
Deciduous	10	9	8	7	6	6
Mixedwood AtPl	4	4	3	3	2	2
Mixedwood PlAt	2	2	2	1	1	1
Mixedwood AtSx	18	16	14	13	11	10
Mixedwood SxAt	18	16	14	13	11	10
Pl > 80%	8	7	6	6	5	5
Pl leading conifer	4	4	3	3	2	2
Sw > 80%	29	25	23	20	18	16
Sw leading conifer	10	9	8	7	6	6
Total	*103*	*91*	*80*	*72*	*64*	*58*
			2025			
Deciduous	25	22	20	17	16	14
Mixedwood AtPl	8	7	6	5	5	4
Mixedwood PlAt	5	5	4	4	3	3
Mixedwood AtSx	22	20	17	16	14	13
Mixedwood SxAt	22	20	17	16	14	13
Pl > 80%	16	14	12	11	10	9
Pl leading conifer	11	10	9	8	7	6
Sw > 80%	37	33	29	26	23	21
Sw leading conifer	15	13	12	10	9	8
Total	*162*	*142*	*126*	*112*	*101*	*91*
			2035			
Deciduous	56	49	43	39	35	31
Mixedwood AtPl	15	13	12	11	9	9
Mixedwood PlAt	10	9	8	7	6	6
Mixedwood AtSx	31	28	24	22	20	18
Mixedwood SxAt	27	24	21	19	17	15
Pl > 80%	26	23	20	18	16	14
Pl leading conifer	19	17	15	13	12	11
Sw > 80%	45	40	35	31	28	25
Sw leading conifer	22	19	17	15	14	12
Total	*251*	*220*	*195*	*174*	*156*	*141*
			2045			
Deciduous	86	75	67	60	53	48
Mixedwood AtPl	23	20	18	16	14	13
Mixedwood PlAt	15	13	11	10	9	8
Mixedwood AtSx	40	35	31	28	25	23
Mixedwood SxAt	32	28	25	22	20	18
Pl > 80%	36	32	28	25	22	20
Pl leading conifer	27	24	21	19	17	15
Sw > 80%	53	47	41	37	33	30
Sw leading conifer	29	25	22	20	18	16
Total	*340*	*299*	*264*	*236*	*212*	*191*

Table 7. Estimated number of plots to establish and re-measure by year on a 3 km grid. Total cost is based on $2,500 for establishment and $1,000 for re-measurement.

Year	Establish	Re-measurement 1st	2nd	3rd	4th	Total Cost
2003	25					$62,500
2004	24					$60,000
2005	24					$60,000
2006	2					$5,000
2007	1					$2,500
2008	3					$7,500
2009	0					$0
2010	2					$5,000
2011	8					$20,000
2012	4					$10,000
2013	2	25				$30,000
2014	8	24				$44,000
2015	0	24				$24,000
2016	0	2				$2,000
2017	4	1				$11,000
2018	4	3				$13,000
2019	4					$10,000
2020	6	2				$17,000
2021	7	8				$25,500
2022	8	4				$24,000
2023	9	2	25			$49,500
2024	9	8	24			$54,500
2025	9		24			$46,500
2026	9		2			$24,500
2027	9	4	1			$27,500
2028	9	4	3			$29,500
2029	9	4				$26,500
2030	9	6	2			$30,500
2031	9	7	8			$37,500
2032	9	8	4			$34,500
2033	9	9	2	25		$58,500
2034	9	9	8	24		$63,500
2035	9	9		24		$55,500
2036	9	9		2		$33,500
2037	9	9	4	1		$36,500
2038	9	9	4	3		$38,500
2039	9	9	4			$35,500
2040	9	9	6	2		$39,500
2041	9	9	7	8		$46,500
2042	9	9	8	4		$43,500
2043	9	9	9	2	25	$67,500
2044	9	9	9	8	24	$72,500
2045	9	9	9		24	$64,500
2046	9	9	9		2	$42,500
2047	9	9	9	4	1	$45,500
2048	9	9	9	4	3	$47,500
2049	9	9	9	4		$44,500
2050	9	9	9	6	2	$48,500
2051	9	9	9	7	8	$55,500
2052	9	9	9	8	4	$52,500

Table 8. Estimated numbers of plots with yield data (one measurement) or growth data (multiple measurements) over time.

Grid Size (km)	Plots with data to compare: Yield	Growth for: 10 yrs	20 yrs	30 yrs	40 yrs
			2005		
3.0	73				
3.2	64				
3.4	57				
3.6	51				
3.8	45				
4.0	41				
			2015		
3.0	103	73			
3.2	91	64			
3.4	80	57			
3.6	72	51			
3.8	64	45			
4.0	58	41			
			2025		
3.0	162	103	73		
3.2	142	91	64		
3.4	126	80	57		
3.6	112	72	51		
3.8	101	64	45		
4.0	91	58	41		
			2035		
3.0	251	162	103	73	
3.2	220	142	91	64	
3.4	195	126	80	57	
3.6	174	112	72	51	
3.8	156	101	64	45	
4.0	141	91	58	41	
			2045		
3.0	340	251	162	103	73
3.2	299	220	142	91	64
3.4	264	195	126	80	57
3.6	236	174	112	72	51
3.8	212	156	101	64	45
4.0	191	141	91	58	41

APPENDIX III – PROVIDING DATA ON SFM INDICATORS

Table 9. Data for SFM indicators developed for the Fort St. John TSA provided by a network of systematically established G&Y monitoring plots.

Indicator	Target	Data Provided	VRI/CMI Cards
4. Snags/Cavity Sites	4.1 Establish a minimum of 6 snags and/or merchantable live trees (i.e., potential cavity sites) per hectare, as averaged over the total are harvested annually.	Number of snags and merchantable live trees per hectare. The issue here is the high variability resulting in low precision (wide confidence interval). Most of the plots will have 0 snags and a few will have 1 or 2.	Tree Details (TD)
5. Coarse Woody Debris Volume (relative %)	5.1 Maintain 50%+ of pre-harvest levels as measured in representative monitoring plots.	Gross volume of coarse woody debris by decay class. The issue will be whether there are sufficient plots to post-stratify into the strata developed for CWD target retention ranges. If the sample size is insufficient, the plots could still be used as part of the total sample required.	Coarse Woody Debris (EW) Coarse Woody Debris (EC)
7. Shrubs	7.1 Evaluate and determine baseline shrub levels (species diversity, distribution, and abundance) across seral stages and forest types.	Biogeoclimatic site series, successional stage, % cover and heights for trees, shrubs, herbs and mosses. Re-measurements will provide data on the changes over time. The issue will be whether the sample size is sufficient to allow for the required post-stratification.	Ecological Description 1 (EP) Ecological Description 2 (ED) Tree and Shrub Layer (ET) Herb and Moss Layer (EH) Succession Interpretations (EO)
15. Long term harvest level measured in m^3/yr	15.1 Harvest at a rate that does not adversely affect the long-term harvest level.	Growth & yield data for managed stands that can be used to check the accuracy of yield curves used to project managed stands in timber supply.	Tree Details (TD) Tree Loss Indicators (TL) Small Tree, Stump, and Site Tree Data (TS)
16. Site index	16.1 Post-harvest site index will not be less than pre-harvest.	Estimates of site index from monitoring plots can be used to check current inventory site indices and compare to pre-harvest site indices. The sample size should be sufficient to determine across the population of regenerated stands if the site indices are the same, lower or higher than pre-harvest site indices. Data on site tree height growth can be compared to height growth curves (site index curves) to check that the site index curves accurately reflect site tree height growth.	Small Tree, Stump, and Site Tree Data (TS)
21. Mean annual increment	21.1 Maintain or increase MAI for the TSA over time.	Growth & yield data for managed stands that can be used to provide a representative sample of the MAI in managed stands (15 years post-harvest) over time.	Tree Details (TD) Tree Loss Indicators (TL) Small Tree, Stump, and Site Tree Data (TS)
22. Total growing stock	22.1 Analyze and determine target range for growing stock (THLB and NHLB)	Growth & yield data for managed stands that can be used to check the accuracy of yield curves used to project growing stock in managed stands in the THLB.	Tree Details (TD) Tree Loss Indicators (TL) Small Tree, Stump, and Site Tree Data (TS)

Table 10. Data for SFM indicators provided by a network of systematically established and re-measured silviculture survey plots.

Indicator	Target	Data Provided
4. Snags/Cavity Sites	4.1 Establish a minimum of 6 snags and/or merchantable live trees (i.e., potential cavity sites) per hectare, as averaged over the total are harvested annually.	Number of snags and merchantable live trees per hectare could be determined if snags and merchantable live trees were recorded on the plots. The issue here is the high variability resulting in low precision (wide confidence interval). Most of the plots will have 0 snags and a few will have 1 or 2.
7. Shrubs	7.1 Evaluate and determine baseline shrub levels (species diversity, distribution, and abundance) across seral stages and forest types.	Percent cover of shrub species could be recorded and summarized by forest type.
16. Site index	16.1 Post-harvest site index will not be less than pre-harvest.	The plots will provide a large observational database on early height growth that can be compared to juvenile height growth curves or assumed early height growth patterns from site index curves used in timber supply.
15. Long term harvest level measured in m^3/yr	15.1 Harvest at a rate that does not adversely affect the long-term harvest level.	Plot data can be post-stratified by analysis units and used to assign appropriate yield curves for timber supply analysis.

APPENDIX IV – FIELD SAMPLING METHODS

OVERVIEW

For the most part, Ministry of Sustainable Resource Management Monitoring procedures should be followed to establish the plots. This appendix outlines proposed changes to these procedures (by VRI/CMI card number) for review and consideration for use in the Fort St. John TSA. It should be noted that any changes require modification of the standard compilation procedures.

1 Header Card (CH)

Plot number – There are four spaces to enter a plot number on this card. It is recommended that plot numbers incorporate the UTM coordinates of the plot to ensure unique plot numbers over time. This also allows for easy location of the plot. A plot number based on UTM coordinates could be recorded in the notes section. A sequential plot number (for plots established in any given year) could be entered in the plot sample # field. This information along with the date of establishment will be stored in the database, allowing plot XXXX-XXXX to be cross-referenced as the Yth plot established in year Z.

2 Compass Card (CP)

Complete following CMI procedures.

3 Cluster Layout (CL) (Version 99/3)

Complete following CMI procedures.

4 Range Sampling (RS) Shrub Transect #1

Complete following CMI procedures.

5 Range Sampling (RS) Shrub Transect #2

Complete following CMI procedures.

6 Coarse Woody Debris (EW) Transect #1

Complete following CMI procedures.

7 Coarse Woody Debris (EW) Transect #2

Complete following CMI procedures.

8 Tree Details (TD)

Regeneration plot radius – The regeneration plot radius is changed from 2.5 m to 3.99 m to be compatible with full-measure silviculture survey plots previously established at the same center point.
Height to live crown

CMI procedures specify recording height to live crown to the nearest m. For this project, since we are measuring small trees, record to the nearest decimeter. For example, 0.4 m is entered as 04 in columns 21 and 22.

Call Grading is not completed.

9 Tree Loss Indicators (TL)

Complete and enter following CMI procedures with the exception of stem mapping.

10 Small Tree, Stump and Site Tree Data (TS)

Top height tree (T) – Measured as per CMI standards.

Leading (L) and second (S) species – Do not determine prior to selecting site trees. The age of the largest diameter, dominant or co-dominant, tree of each species in each quadrant is measured. If the largest diameter tree of a given species (coded as "S" tree) is not suitable for height and age, the next largest diameter tree suitable for height and age will be selected (and coded as "O" tree). If a site tree is between 4 and 9 cm DBH, outside the Small-tree plot but inside the Main plot, this site tree will be tagged and the height will be recorded in the site tree section on Card 10.

11 Auxiliary Plot Card (TA)

Not used.

12 Ecological Description 1 (EP)

Complete following CMI procedures.

13 Ecological Description 2 (ED)

Complete following CMI procedures.

14 Tree and Shrub Layers (ET)

Complete following CMI procedures except use the 11.28 m radius plot was instead of a 10.0 m radius plot.

15 Herb and Moss Layers (EH)

Complete following CMI procedures.

16 Succession Interpretations (EO)

Complete following CMI procedures.

Appendix 6: Reforestation Strategy: Stocking Estimators and Future Volume

Silviculture Note
Stocking estimators and future volume

Pat Martin

September 4, 2002

Introduction

Tree stocking, the degree to which growing space is occupied, is an important forestry concept. In a young stand, stocking is a main determinant of future stand volume/ha and the distribution of tree sizes at harvest (Clutter et al. 1983). **A variety of estimators have been developed to quantify the stocking in regenerated stands (Stein 1978; Shreuder, Gregoire and Woods 1993, pg. 291). Typically, these estimators are designed to take on greater values as density and uniformity of tree distribution increase, and many are capped at some maximum value. When stocking estimators are evaluated, the focus has been on ease of use, cost, and the extent to which they exhibit desired behaviour over a range of tree density and uniformity (Stein 1978). Historically, the ability of a stocking estimator to predict future volume has not been an important evaluation criterion.**

Recently in B.C. interest has grown in the relationship between stocking estimators and future volume. Bergerud (2001) demonstrated the relationship between the stocking estimator "total well-spaced trees/ha" and TASS predicted merchantable volume/ha at age 67 years for lodgepole pine on site index 18 m. J.S. Thrower and Associates (2002) developed a new stocking estimator "MSQ" and demonstrated its relationship to TASS predicted merchantable volume/ha at age 80 years for lodgepole pine on site index 20 m.

Martin, Browne-Clayton, and McWilliams (2002) described a new system for managing reforestation that is based on the future volume predicted, in part, from the stocking observed in young stands. Though this new system uses the stocking estimator "MSQ," it could be re-formulated to use other stocking estimators. In future implementations of this new system, it is desirable to ensure that the stocking estimator used has high predictive power. In this paper, I report the results of a cursory assessment of the ability of four stocking estimators to predict merchantable volume/ha at age 80 years for lodgepole pine on site index 18 m.

Methods

The spatially explicit, individual tree growth model TASS (Mitchell 1975, Mitchell and Cameron 1985) was used to generate a variety of tree spatial patterns in a 100 m x 100 m plot. From bare **ground the stand represented by each plot was grown to the silviculture survey date at which time surveys were simulated in the stand. The survey parameters were computed and the stand was grown for 100 years. Volumes at ages 60, 80, and 100 years (site heights of 18.8, 21.9, and 24.0 m, respectively) were extracted from the TASS output, though only the volume at age 80 is reported here. Regression analysis was used to assess the strength of the relationship between the four stocking estimators and merchantable volume/ha at age 80.**

Stocking estimators

Though a total of seven stocking estimators were evaluated, in this paper I report only the results for four (Table 1):

Table 1. Description of the four stocking estimators that were assessed.

Code	Name	Plot procedure	Compilation
TTPH	Total trees per hectare	In a 3.99 m radius plot, the surveyor counts all live trees.	Plot counts are averaged and expanded to a per hectare basis.
WSTPH	Well-spaced trees per hectare	In a 3.99 m radius plot, the surveyor maximizes the count of well-spaced trees. No "M" cap. 2.0 m MITD.	Plot counts are averaged and expanded to a per hectare basis.
MSQ	Mean stocked quadrants	In a 3.99 m plot divided into quarters along cardinal directions, the surveyor counts the number of quarters containing at least one live tree.	Plot counts are averaged.
PERSP	Percent stocked 1.4 m radius plots	The surveyor counts a 1.4 m plot as stocked if it contains at least one live tree.	Percent of all plots that were tallied as stocked is computed.

TASS simulations

Fifty different tree spatial distributions were taken from the many stem maps used to produce Land Management Handbook 50 (Bergerud 2002). From those distributions classified as clumped, maps with the following initial trees/ha were used: 300, 425, 550, 650, 750, 900, 950, 1020, 1150, 1240, 1400, 1500, 1750, 2000, 2250, 2500, 2750, 2900, 3100, 3265, 3906, 4500, 5200, 5917, 6944, 8000, 10000, and 20000. From those distributions classified as natural (random spatial pattern), maps with the following initial trees/ha were used: 300, 550, 750, 950, 1150, 1400, 1750, 2250, 2750, 3100, 3906, 5200, 6944, and 10000. From those distributions classified as planted (grid spatial pattern), maps with the following initial trees/ha were used: 425, 650, 950, 1240, 1750, 2500, 4500, and 8000.

The following run specifications were used for each TASS simulation:

TASS version:	v2.07.14WS
Species:	interior lodgepole pine
Site index:	18 m
Site index curve code:	Pl_THROWNIGH
Merchantable volume	
Minimum dbh:	12.5 cm
Top dib:	10 cm
Stump height:	0.3 m

OAFs:	No OAFs applied
Plot size:	100 m X 100 m
The TASS runs and the survey simulations were conducted by RamSOFT Systems Ltd.	

Survey simulation

Each stem map was grown to a site height of 5 m, which **occurred 16 years from run initialization. Surveys were simulated at this time. Ten plots were randomly located on the stem map, plot values taken, and the sample mean computed. This was repeated 1000 times. Last, the 1000 sample means were averaged. Thus, each survey value is a mean from 10,000 plots. In counting trees, no minimum height criteria were applied. To reduce costs by re-using data previously compiled, one set of plot centers was used for WSTPH and MSQ and a different set for the other estimators.**

Data analysis

A single equation form was identified that could provide a good fit to each of the four volume-stocking estimator relationships. A function in the Weibull family was fit with nonlinear least squares using the SYSTAT statistical software (SPSS Inc. 1998):

$$V = b_0\left(1 - \exp\left(b_1\left(X/\phi\right)^{b_2}\right)\right)$$

Where V is merchantable volume/ha at age 80,

b_0, b_1, and b_2 are parameters, and

X is the stocking estimator (TPH, WSTPH, MSQ, and PERSP). ϕ is a constant assigned before fitting equal to the largest X value in the data set: $\phi = 16712$ for TPH, $\phi = 2182$ for WSTPH, $\phi = 4$ for MSQ, and $\phi = 100$ for PERSP.

The fit statistics and a visual examination of residuals indicated that excellent fits were obtained. Two fit statistics, the mean square error and the squared correlation between observed and predicted values, were taken to indicate the ability of a stocking estimator to predict future volume/ha (Table 2).

The complete data set is provided in Appendix 7.

Results

The relationship between each stocking estimator and TASS-predicted volume at age 80, with the fitted curve, is displayed in Figures 1-4.

Though volume/ha at 80 years is approximately linearly related to MSQ, the relationship is curvilinear with TTPH, WSTPH, and PERSP. A visual assessment suggests that the stocking estimators TPH, WSTPH and PERSP produce values that are spread more widely, while many of the 50 stem maps assessed returned MSQ values very close to 4. However, an increased spread is not associated with an improved ability to predict future volume (Table 2).

MSQ predicts future volume/ha slightly better than WSTPH and PERSP do and much better than TTPH does (Table 2). The relationships between future volume and WSTPH, PERSQ, and MSQ are so strong that little improvement can be expected from adding additional explanatory variables or stratifying the data.

Table 2. Fit statistics from regressions relating stocking estimators to future volume.

Stocking estimator	Mean square error	R^2: Correlation of observed and predicted values (squared)
TTPH	703	0.84
WSTPH	142	0.97
MSQ	44	0.99
PERSP	152	0.97

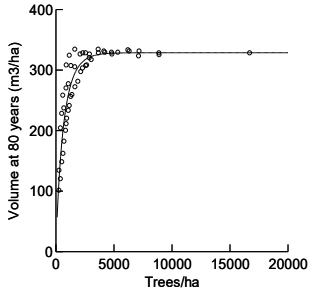


Figure 1. Relationship between merchantable volume/ha at age 80 and total trees/ha at survey. Solid line is fitted regression.

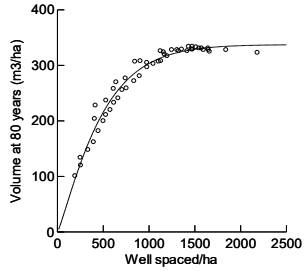


Figure 2. Relationship between merchantable volume/ha at age 80 and total well spaced trees/ha at survey. Solid line is fitted regression.

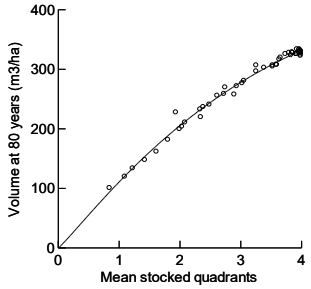


Figure 3. Relationship between merchantable volume/ha at age 80 and mean stocked quadrants at survey. Solid line is fitted regression.

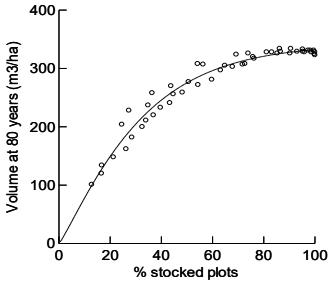


Figure 4. Relationship between merchantable volume/ha at age 80 and percent stocked plots at survey. Solid line is fitted regression.

Discussion

In terms of its ability to predict future volume, the stocking estimator MSQ is superior to the three others examined (TTPH, WSTPH, and PERSP). However, WSTPH and PERSP are almost as good so when other factors are considered, such as cost, ease of use, or familiarity of procedure – the use of MSQ, WSTPH, or PERSP could easily be justified. As expected, TTPH is a poor estimator of future volume and, for this purpose, its use is not recommended.

Bergerud (2001) found that the relationship between TASS-predicted future volume and well-spaced trees/ha varied with tree spatial pattern. Though this issue was not specifically examined in this analysis, the excellent fits suggest that little could be gained by stratifying by tree distribution type (random, clumped, or grid). Additional replicates of the planted and natural spatial pattern stem maps and subsequent analysis is recommended to further examine this issue.

The volumes used in this study are TASS-predicted volumes, not actual volumes observed in real stands that originated with the specified tree spatial patterns. Thus, the fit statistics grossly over-state the accuracy with which these stocking estimators will predict real stand future volumes. Moreover, if there is some systematic bias in TASS predictions, for example, if volumes are consistently over-estimated at low stockings, then the shape of the volume-stocking relationships displayed in Figure 1-4 will be incorrect.

These results indicate the correlation between future volume and a stocking estimator when sample size is enormous. Each data point is the mean of 10,000 sample plots. The correlation under operationally realistic sample sizes should be investigated. Furthermore, it would certainly cost less to take a single PERSP plot than to take a single WSTPH plot. In dense stands, TPH is also time consuming to tally. However, cost has not been considered in this analysis. Subsequent study should attempt to identify the stocking estimator that provides the most accurate prediction of future volume at a realistic fixed cost.

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Appendix 7: Complete data set

Stem map #	TASS initialization density (#/ha)	Tree spatial distribution type	Trees per hectare at survey (#/ha)	Well-spaced trees per hectare (#/ha)	Mean stocked quadrants with unrotated 3.99 m plots	Percent stocked 1.4 m radius plots (percent)	Merch. volume at age 80 (m^3/ha)
1	300	clumped	278	192	0.84	12.81	101
2	425	clumped	402	254	1.09	16.64	120
3	550	clumped	524	334	1.42	21.28	148
4	650	clumped	628	394	1.61	26.23	162
5	750	clumped	716	446	1.80	28.50	182
6	900	clumped	852	500	1.99	32.54	200
7	950	clumped	898	528	2.08	33.99	211
8	1020	clumped	948	576	2.34	36.91	220
9	1150	clumped	1086	616	2.33	39.68	233
10	1240	clumped	1170	662	2.48	43.32	241
11	1400	clumped	1290	706	2.61	44.67	256
12	1500	clumped	1400	752	2.72	48.21	259
13	1750	clumped	1658	836	2.93	54.34	272
14	2000	clumped	1908	896	3.05	59.73	281
15	2250	clumped	2156	978	3.25	63.15	297
16	2500	clumped	2314	1046	3.38	67.82	303
17	2750	clumped	2582	1104	3.52	71.72	307
18	2900	clumped	2670	1128	3.58	72.64	308
19	3100	clumped	2894	1168	3.65	75.81	320
20	3265	clumped	3064	1196	3.63	76.23	317
21	3906	clumped	3676	1306	3.79	83.15	328
22	4500	clumped	4234	1356	3.84	86.54	329
23	5200	clumped	4842	1416	3.92	90.25	326
24	5917	clumped	5350	1468	3.95	93.00	329
25	6944	clumped	6218	1512	3.96	95.21	333
26	8000	clumped	7184	1572	3.98	97.32	331
27	10000	clumped	8892	1648	3.98	98.58	328
28	20000	clumped	16712	1840	3.98	99.95	328
29	300	random	286	250	1.22	16.76	134
30	550	random	518	414	1.93	27.34	228
31	750	random	702	530	2.38	34.83	237
32	950	random	890	640	2.74	43.77	270

Stem map #	TASS initialization density (#/ha)	Tree spatial distribution type	Trees per hectare at survey (#/ha)	Well-spaced trees per hectare (#/ha)	Mean stocked quadrants with unrotated 3.99 m plots	Percent stocked 1.4 m radius plots (percent)	Merch. volume at age 80 (m^3/ha)
33	1150	random	1086	742	3.02	50.62	277
34	1400	random	1310	846	3.25	56.31	307
35	1750	random	1642	976	3.52	64.82	305
36	2250	random	2102	1124	3.73	73.93	326
37	2750	random	2578	1248	3.85	81.13	328
38	3100	random	2910	1322	3.90	85.30	326
39	3906	random	3662	1432	3.96	90.55	334
40	5200	random	4810	1474	3.97	95.25	329
41	6944	random	6332	1546	3.98	98.17	331
42	10000	random	8906	1660	3.98	99.79	325
43	425	planted	406	406	2.03	24.58	204
44	650	planted	612	612	2.89	36.40	258
45	950	planted	906	904	3.59	54.18	308
46	1240	planted	1170	1158	3.82	69.25	324
47	1750	planted	1646	1472	3.92	86.22	334
48	2500	planted	2336	1594	3.98	95.90	328
49	4500	planted	4150	1644	3.98	99.55	331
50	8000	planted	7138	2182	3.98	100.00	323

Appendix 8: Reforestation Strategy: Survey Design and Field Procedure

Survey Design and Field Procedures

I) Conifer Survey Design and Field Procedures

Scope of this document

This document describes only the survey methods to be employed to meet the requirements of yield assessment and inventory labels. It is limited, at this time, to data collection for conifer plantations.

Prior to collecting plot data in the field the following information should be reviewed and used to develop strata within each cutblock. Minimum strata size is 2 ha.

1. Pre-harvest prescription or plan

Ensure survey map reflects original prescription or plan map and any subsequent revisions. Place SU boundaries with different species or stocking standards on the survey map. Review the prescription or plan for any other requirements or conditions that would affect stocking levels and set boundaries as required.

2. Establish plot locations

Locate 100m grid locations on the survey map following NAD 83 datum. If the survey map has not been accurately geo-referenced then this step will not be practical and plots will need to be established in the field and added to the map. Plots that fall outside the NAR will be null plots.

3. Block assessment in the field

A block walkthrough prior to plot establishment is required to complete the following:

- Review blocks in the field and update the map. This may require identification of unmapped features, traversing of boundaries, etc.
- Map inventory polygons utilizing current procedures by reviewing species composition, site productivity and stocking. Separate those areas below minimum stocking levels.
- Identify and map areas that may require further treatment to reach well growing status

Data Collection

Count Plot

A count plot is located where the last three digits of either or both of the UTM easting and northing are 100, 300, 500, 700, or 900. Area for the plot is 50m² (3.99m radius). Quadrants are established along cardinal directions. At a count plot, the following is done:

a) Record the Strata

Based on the strata mapping as above.

b) Count stocked quadrants

Record the number of quadrants that contain at least one acceptable tree. An acceptable tree is:

i) Preferred or acceptable species (as listed in the SP for the SU)

ii) Healthy (Meets forest health standards)

iii) Acceptable advance regeneration (meets adv. regen. standards)

iv) Well Growing

c) Count potential stocked quadrants after brushing

Record the number of quadrants that would contain at least one acceptable tree following a brushing treatment.

d) Record UTM coordinates

Record the UTM coordinates of the plot.

Data Collection at Full Measure Plot

A Full Measure Plot is one where the last three digits of both the UTM easting and northing are 000, 200, 400, 600, or 800. At an enhanced plot, collect all of the data required at a Count Plot plus the following:

a) Record BEC

Assess site series in an area approximately 5.64 m around plot center. Based on a rough ocular estimate, assign the area to the dominant site series. Record BEC zone/subzone/variant/site series.

b) Record species class.

Assess species composition in an area approximately 5.64 m around plot center. Based on a rough ocular estimate, assign the area to 1 of 3 species groups: >= 80% Pl, >= 80% Sx, or mix based on 20% divisions.

b) Height Measure tree

In a 5.64 m radius plot, make a rough ocular estimate of whether Pl or Sx is more common. Locate the tallest tree of this species that is live and not a residual. Measure and record total height and species code. If this tree is also a suitable growth intercept sample tree (healthy, undamaged and unsuppressed), record breast height age by counting whorls.

c) Additional Data

In a 3.99 m plot, collect total tree count, and total conifer count and average height by species.

Map areas of low stocking

If during the survey, a mappable patch (2 ha or larger) of low stocking was found, transfer its boundaries onto the survey map. Map patches that a rough ocular estimate suggests have < MSS preferred and acceptable species, free from brush and healthy. And provide a description of the area and recommendations for treatment.

Map treatment units

If during the survey a mappable area (2 ha or larger) that would benefit from further treatment i.e. fill planting, vegetation control, etc. is found then transfer the boundaries to the map and provide a description of the area and recommended treatment.

Map areas of high density stocking

If during the survey, a mappable patch (2 ha or larger) of stocking >20,000 stems per hectare was found, transfer its boundaries onto the survey map and provide a description of the area and recommendations for treatment.

Data Format

In an ASCII or excel format file provide the following:

For each plot:

- Cutblock identity (e.g., CP838 Block 1A)
- Plot identity (e.g., plot # 1)
- UTM coordinates of the plot (e.g., 307200; 5639200)
- Stratum identity (e.g., species class, density class, target stocking class)
- Stocked quadrant tally (e.g., 0, 1, 2, 3, or 4)
- Potential stocked quadrant tally following a brushing treatment (e.g., 0, 1, 2, 3, or 4)
- Plot type (S=count plot, E=full measure plot)

In addition to the above, for each enhanced plot:

- Height sample tree species (e.g., Pl or Sx)
- Sample tree height (e.g., 2.5 m)
- If height sample tree is suitable GI tree, record breast height age (e.g., 4 years)
- BEC classification (zone/subzone/variant/site series) (e.g., MSdm² 01)
- Average height by species
- Total tree count (e.g., 25)
- Total conifer count (e.g., 21)

Supporting Data

Stratum Description - Brief description of stratum and criteria used to establish the stratum.

Inventory Label - Requires a label for each stratum

II) – Deciduous Survey Design and Field Procedures

Scope of this document

The intention is to utilize the Mean Stocked Quadrant (MSQ) procedure as the desired assessment method throughout the establishment to well growing period. While many of the processes of the assessment are comparable, this document describes only the survey methods to be employed to meet the requirements of yield assessment and inventory label creation.

Prior to collecting plot data in the field the following information should be reviewed and used to develop strata within each cutblock. Minimum strata size is 2 ha.

1. Pre-harvest prescription or plan

Ensure survey map reflects original prescription or plan map and any subsequent revisions. Place SU boundaries with different species or stocking standards on the survey map. Review the prescription or plan for any other requirements or conditions that would affect stocking levels and set boundaries as required.

2. Establish plot locations

Locate 100m grid locations on the survey map following NAD 83 datum. If the survey map has not been accurately geo-referenced then this step will not be practical and plots will need to be established in the field and added to the map. Plots that fall outside the NAR will be null plots.

3. Block assessment in the field

A block walkthrough prior to plot establishment is required to complete the following:

4. Review blocks in the field and update the map.

This may require identification of unmapped features, traversing of boundaries, etc.

Map inventory polygons utilizing current procedures by reviewing species composition, site productivity and stocking. Separate those areas below minimum stocking levels.

Data Collection

Count Plot

A count plot is located where the last three digits of either or both of the UTM easting and northing are 100, 300, 500, 700, or 900. Area for the plot is 50m² (3.99m radius). Quadrants are established along cardinal directions. At a count plot, the following is done:

a) Record the Strata

Based on the strata mapping as above.

b) Count stocked quadrants

Record the number of quadrants that contain at least one acceptable tree. An acceptable tree is:

i) Preferred or acceptable species (as listed in the SLP for the SU)

ii) Healthy (Meets forest health standards)

iii) Well Growing

d) Tally total tree count

e) Tally countable deciduous stems

f) Assess forest health factors

g) Record UTM coordinates

Data Collection at Full Measure Plot

A Full Measure Plot is one where the last three digits of both the UTM easting and northing are 000, 200, 400, 600, or 800. At an enhanced plot, collect all of the data required at a Count Plot plus the following:

a) Record BEC

Assess site series in an area approximately 5.64 m around plot center. Based on a rough ocular estimate, assign the area to the dominant site series. Record BEC zone/subzone/variant/site series. This will assist in determining the associated BEC site index grouping the stratum will be placed in.

b) Height Measure tree

In a 5.64 m radius plot, locate the largest diameter tree of the leading species that is live and not a residual. Measure and record total height and species code.

c) Additional Data

Inventory label data collection

Map areas of low stocking

If during the survey, a mappable patch (2 ha or larger) of low stocking was found, transfer its boundaries onto the survey map. Map patches that a rough ocular estimate suggests have < MSS preferred and acceptable species, free from brush and healthy. And provide a description of the area and recommendations for treatment.

Data Format

In an ASCII or excel format file provide the following:

For each plot:

- Cutblock identity (e.g., CP838 Block 1A)
- Plot identity (e.g., plot # 1)
- UTM coordinates of the plot (e.g., 307200; 5639200)
- Stratum identity (e.g., WG versus NSR)
- Stocked quadrant tally (e.g., 0, 1, 2, 3, or 4)
- Plot type (S=count plot, E=full measure plot)

In addition to the above, for each enhanced plot:

- Sample tree species
- Sample tree height (e.g., 2.5 m)
- BEC classification (zone/subzone/variant/site series) (e.g., BWBS mw 01)
- Average height by species
- Total tree count (e.g., 25)

Supporting Data

Stratum Description - Brief description of stratum and criteria used to establish the stratum.

Inventory Label - Requires a label for each stratum. Those stratums that did not have a plot established within it must still have an inventory label ocularly assessed.

Appendix 9: Reforestation Strategy Stocking Standards and Crop Tree Requirements

Reforestation Strategy Stocking Standards and Crop Tree Requirements

1 .1 INTRODUCTION

The Landscape Level Reforestation Strategy proposes alternate "applicable performance standards" for *FSJPP Regulation* Sections 32 (4),(5),(6),(8), and (from Schedule F), Section 98 and Section 99 for coniferous and deciduous areas logged after November 15, 2001. The strategy also applies to coniferous and deciduous areas with commencement dates before November 15, 2001 if a Participant currently carries reforestation liability and submits a statement to the District Manager that the cutblock(s) will be subject to the SFMP under Section 42 of the *FSJPPR*.

This Appendix is intended to summarize the key stocking standards and crop tree requirements for deciduous, coniferous and mixedwood areas for the term of the SFMP. The following changes to requirements apply to coniferous and deciduous areas:

1.2 CROP TREE REQUIREMENTS AND VEGETATIVE COMPETITION

For the purposes of Section 42 of the *FSJPPR* for coniferous areas in which the Reforestation landscape level strategy applies, the following will be used to determine if a crop tree is well growing at the reforestation assessment as discussed in Section 5.32 Reforestation Assessment. Note for the purposes of this process, balsam poplar and cottonwood are used interchangeably due to the potential species overlap and difficulty in differentiating them.

A) A crop tree that is at least 100% of the height of all herbaceous competition (e.g. grass), and 150% of the height of shrub and deciduous tree competition within a one metre radius cylinder is well growing.

If the crop tree does not meet the criteria in (A) above, it must meet the following criteria:

B) A crop tree is well growing if it is taller than vegetation excluding aspen and balsam poplar (but including birch and shrub species), in three of four quadrants in the one metre radius cylinder, and.

C) It is taller than countable aspen and/or balsam poplar (cottonwood) in at least three of four quadrants of the one metre radius cylinder and the number of countable aspen or balsam poplar (cottonwood) in the plot does not exceed two. Quadrants may be aligned to minimize the number of quadrants with vegetation taller than the crop tree. A 'countable' aspen or poplar is considered to be a tree that is greater than the median height of all potentially well growing trees within the 3.99 metre radius plot and

D) It is at least 100% of the height of all herbaceous competition. [13]

Any vegetation assessment for final reforestation assessments cannot be completed until at least one growing season following chemical brushing, and three growing seasons following manual brushing.

[13] **Replaces S 32(6)(c)**

For the purposes of Section 42 of the *FSJPPR* for deciduous areas the following standard will be used to determine if a crop tree is well growing at the reforestation assessment:

> A) A well growing deciduous crop tree is defined as one that meets the minimum height criteria in Table C, and is at least 100% of the height of all herbaceous competition (e.g. grass) within a one metre radius cylinder.

Both conifer and deciduous crop trees must be healthy enough that they can reasonably be expected to reach maturity. Qualified registered professionals will be responsible for establishing and updating crop tree health criteria to use for reforestation assessments. The criteria will be developed using the best information available, (e.g. the "Free- Growing Damage Criteria" found in the "Establishment to Free Growing Guidebook") and in consultation with forest health professionals and /or the FOR.

1.3 MINIMUM INTER-TREE DISTANCE

Coniferous Areas: The minimum inter tree spacing (MITD) at establishment will be 1.5 metres for coniferous areas. Reductions to a 1.0 metre minimum will be allowed where conditions warrant (e.g. plantable spots are limited), as noted in a forester's rationale, which will be documented and retained by the Participant.[14]. MITD does not apply at the final reforestation assessment survey under the landscape level strategy.

Deciduous Areas: The minimum inter tree spacing (MITD) at establishment, and for areas assessed prior to full implementation of the LLS, will be 0.5 metres[15]for standard well-spaced surveys. MITD will not apply for MSQ surveys at either the establishment phase or at the final reforestation assessment survey under the landscape level strategy.

Mixedwood Areas: Mixedwoods will be assessed using MSQ surveys using the standards specified in Section 1.4.3 of this Appendix, consequently there will be no specific MITD for mixedwoods.

1.4 STOCKING REQUIREMENTS

For the purposes of Section 42 of the *FSJPPR* for areas to which the Reforestation landscape level reforestation assessment process applies, the Stocking Standards in Section 1.4.1 will apply as follows:

1. The target stocking standard (TSS) as set out in Table A is required for the SLP and for a landscape level calculation of Maximum Predicted Merchantable Volume (MPMV) at the time of the reforestation assessment (Section 5.32 Reforestation Assessment). It is otherwise not used in the final legal assessment of coniferous reforestation success under the Reforestation LLS, as the assessment is based on the cumulative results for all blocks.

[14] **Replaces requirements of S 32(6)(d)**

[15] **This is unchanged from the FSJPPR**

2. The minimum stocking standard (MSS) as set out in Table A is required for the SLP and determination of Establishment Delay (Section 5.33 Establishment Delay). It is otherwise not used in the final legal assessment of reforestation success under the Reforestation LLS, as the assessment is based on the cumulative results for all blocks.

1.4.1 Stocking Standards for Coniferous Areas:

Table A below provides a standard for SLPs and determining Establishment Delay (Section 5.33 Establishment Delay). The Participants may, at their discretion, choose to use an MSQ survey, utilizing the equivalent MSQ numbers included in Table B, to determine establishment delay.

Table A- Coniferous Stocking Standards for Establishment Delay and Max PMV determination

Type of Area	Site	Minimum # of Trees/ha (MSS) *	Target # Trees/ha (TSS)*	Countable species BWBS/ESSF/SWB
Coniferous	Xeric-Subxeric	500	1000	Sw, Pl, Bl
Coniferous	Submesic-mesic	700	1200	Sw, Pl, Bl, Sb
Coniferous	Subhygric	500	1000	Sw, Pl, Bl, Sb, Lt
Coniferous	Hygric-Subhydric	400	800	Sw ,Pl, Bl, Sb, Lt

*well spaced trees/ha(see Table B for equivalent MSQ values)

No Specific Minimum heights- adequate height determined in " Crop Tree Requirements and Vegetative Competition"

Minimum strata size is 2 ha contiguous, or 20% of the area in blocks less than 10 ha

Reforestation Assessment completed 15 growing seasons after harvest commencement

Table B - MSQ/Well Spaced Conversions

MSQ Value	# Well Spaced /ha Equivalent
0	0
0.3	100
0.7	200
1.2	300
1.7	**400**
2.1	**500**

2.5	**600**
2.8	**700**
3.1	**800**
3.3	**900**
3.5	**1000**
3.6	**1100**
3.7	**1200**
3.8	**1300**
3.9	**1400**
3.9	**1500**
3.9	**1600**
3.9	**1700**
4	**1800**

For the purposes of Section 42 of the *FSJPPR* for areas to which the Reforestation landscape level reforestation assessment process applies, the Stocking Standards in Section 1.4.2 will apply as follows:

1. The target stocking standard (TSS) as set out in Table A is required for the SLP and for a landscape level calculation of Maximum Predicted Merchantable Volume (MPMV) at the time of the reforestation assessment (Section 5.32 Reforestation Assessment). It is otherwise not used in the final legal assessment of coniferous reforestation success under the Reforestation LLS, as the assessment is based on the cumulative results for all blocks.

2. The minimum stocking standard (MSS) as set out in Table A is required for the SLP and determination of Establishment Delay (Section 5.33 Establishment Delay). It is otherwise not used in the final legal assessment of reforestation success under the Reforestation LLS, as the assessment is based on the cumulative results for all blocks

1.4.2 Stocking Standards for Deciduous Areas

Well Growing and Forest Health Acceptability Criteria for Deciduous Crop Trees

- tree pith must not be laterally displaced more than 30 cm from the root crown pith location
- tree must not originate from a cut stump
- tree must have at least one live leader
- tree stem must not have a wound that is greater than 10% of the stem circumference, or is greater than 10% of the total length of the stem
- tree stem must not have any fungal infections or insect infestations affecting tissues below the bark surface, visible without destructive sampling

- tree must not be browsed to such a significant degree so as to limit its ability to become a crop tree

Table C below provides a standard for SLPs and determining Establishment Delay (Section 5.33 Establishment Delay). The Participants will choose to use an MSQ survey, utilizing the equivalent MSQ numbers included in Table D, to determine establishment delay.

Table C- Deciduous Stocking Standards for Establishment Delay and Max PMV determination[4]

Type of Area	Site	Min. # of Trees/ha (MSS) *	Target # of Trees/ha (TSS) *	Minimum Height (m)	Countable Species
Deciduous	Xeric-Submesic	1200	4000	1.4	At, Ac, Ep
Deciduous	Mesic-Subhydric	1200	4000	1.4	At, Ac, Ep

*well spaced trees/ha (see Table D for equivalent MSQ values)

- Minimum strata size is 2 ha contiguous, or 20% of the area in blocks less than 10 ha
- Reforestation Assessment completed 10 growing seasons after harvest commencement
- Well growing block assessments can be completed at any time from five growing seasons to fifteen growing seasons after harvest commencement[16] - **disallowed**
- Specific establishment delay requirements only – A quadrant is considered stocked if there are 3 acceptable deciduous trees over 1m in height. The stratum is considered stocked if there are a minimum of 2000 countable stems.
- Specific year 6 or 7 survey requirements. A quadrant is considered stocked if there are 3 acceptable deciduous trees over 1.4 metres in height, The stratum is considered stocked if there are a minimum of 2000 countable stems.
- Countable trees are considered as those trees suitable for selection as crop trees, and are within a minimum of 20% of the height of tallest crop trees selected in the plot.

[16] **New Applicable performance standard to replace 9 yr minimum in S 32 (4) and (S 32(6)(e)(ii) – disallowed)**

Table D - MSQ/Well Spaced Conversions Deciduous

MSQ	Well Spaced Equivalent	MSQ	Well Spaced Equivalent	MSQ	Well Spaced Equivalent	MSQ	Well Spaced Equivalent
		1	146	2	430	3	1149
0.1	10	1.1	167	2.1	473	3.1	1288
0.2	21	1.2	188	2.2	519	3.2	1453
0.3	34	1.3	211	2.3	571	3.3	1653
0.4	48	1.4	236	2.4	627	3.4	1902
0.5	62	1.5	263	2.5	690	3.5	2224
0.6	77	1.6	291	2.6	760	3.6	2658
0.7	93	1.7	322	2.7	839	3.7	3289
0.8	109	1.8	355	2.8	929	3.8	4324
0.9	127	1.9	391	2.9	1031	3.9	6535

Table E provides the applicable performance standard for stocking requirements to assess the establishment during the reforestation period of a well growing stand of crop trees on deciduous areas that are outside of the landscape strategy population as a result of being 11 growing seasons or more from harvest commencement.

Table E. Stocking Standards for Deciduous Areas Outside of the Landscape Level Population

Type of Area	Site	Min. # of Trees/ha (MSS) *	Minimum Height	Countable species BWBS/ESSF
Deciduous	Xeric-Submesic	4000	1.4 m	At (Pl max 15%)
Deciduous	Mesic-Subhydric	4000	1.4 m	At, Ac, (Birch, Sx, Pl max 15%)

These standards replace the requirements of Section 32(4), (5), (6), and Section 98(1), (2) and (3) as they applied to deciduous areas.

1.4.3 Stocking Guidelines for Mixedwoods in the BWBS

Mixedwood harvested areas that are stratified into discrete conifer and deciduous strata will be managed according to Sections 1.4.1 and 1.4.2 respectively.

The following stocking guidelines utilized the Peace District Manager's standards as a guide for intimate mixtures.

Establishment Delay Guidelines

Species	Target MSQ	Minimum MSQ	Regen /Est. Delay
At, Ac, Ep, Sw, Pl	3.7	2.8	3

- "Healthy trees" and "competition from plants, shrubs or other trees" as current standards.
- At Establishment delay only, a quadrant should only be considered as stocked with At or Ac if it has at least 3 acceptable At or Ac over 1 m in height.
- There are no minimum inter-tree distance requirements for MSQ based establishment delay surveys.
- Regeneration/Establishment delay assessments should include an inventory label so that potential land classification trajectories can be determined.

Well Growing Guidelines

Species	Target MSQ	Minimum MSQ	Early Well Growing (Yrs.)	Late Well Growing (Yrs.)
Sw, Pl, At, Ac, Ep	3.7	2.8	15	20

- "Healthy trees" and "competition from plants, shrubs or other trees" as current standards
- For this assessment At & Ac requirements are 1 or more per quadrant
- These standards replace the requirements of Section 32(4), (5), (6), and Section 98(1),(2) and (3) as they applied to mixedwood areas.

Well Growing Criteria

A crop tree is Well Growing if it meets the following criteria:

- Deciduous tree top height must be at least 66% of the tallest tree within the plot and meet the Well Growing and Forest Health Acceptability Criteria for Deciduous Crop Trees specified in section 1.4.2 above.
- Crop trees of all species must be at least 100% of the height of all herbaceous competition with a 1m radius
- Sw height must be at least 1.5m and,
- Sw leader height over the past three complete growing seasons must be 20cm or greater.
- Pl is well growing if it is taller than competing vegetation (including deciduous trees) in three of the four quadrants in the one metre radius cylinder, and meets the Sw requirements above.

Land Status Classification

The target Well Growing mixedwood land status classification will be based upon the classification that characterizes the stand at the time of harvest. The process for classifying areas and tracking forest types over time is included in Appendix 13 “Mixedwood Management Guidelines”.

Survey Guidelines

- Stocking guidelines are to be evaluated on a plot basis and reported for the block area declared as a mixedwood.
- Strata must be clearly mapped.
- One (1) plot per hectare (approximately) will be established.
- Consistent with the *FSJPPR*, the minimum strata size is two ha, and must be classed as either C, CD, DC, or D.

1.4.4 Modifying Stocking Standard Requirements

The qualified registered professional may modify target and minimum stocking requirements, however, decreases in TSS and MSS require a documented rationale specifying the field conditions that would justify a lower or higher target stocking. Site conditions such as a poor site with a low preharvest stocking, a wet site with limited suitable microsites, are examples of conditions that would justify reduced TSS. These modified target and minimum stocking requirements would require the approval of the District Manager.

If the qualified registered professional who prepared the SLP for the area is of the opinion that the area in the cutblock in which reforestation is required is a complex of different types of sites interspersed, then the minimum and target stocking requirements for the complex are the number of trees per hectare determined by the following procedure:

(i) Estimate the amount of area in each type of site.

(ii) For each type of site, multiply the amount of area of that type by the stocking requirement for that type of site, in accordance with Table A.

(iii) Add the total number of well spaced trees required for all types of sites as determined in (ii).

(iv) Divide the total number of trees required for the complex by the total area of the cutblock.

Appendix 10: Stand Survey & Growth Modeling for the Fort St. John TSA

Development of Models to Predict PMV from MSQ Statistics for Deciduous Stands

Contractor Report For Canadian Forest Products Ltd. Fort St. John, BC

Original: January, 2013

Amended: Nov 2013

Prepared by Craig Farnden PhD RPF Dept. of Forest Resources and Management University of British Columbia

1.0 Introduction

This report describes the creation and application of set of models intended to support development of Mean Stocked Quadrant (MSQ) surveys and related stocking standards for deciduous stands in the Peace River region of northeastern British Columbia. It should be considered as an addendum to Stand Survey & Growth Modeling for the Fort St. John TSA (J.S. Thrower and Assoc. 2003), and it is assumed here that readers are familiar with the contents of that document. The basic theory and field methods described in the antecedent report continue largely unchanged, with the exception of a few minor alterations as noted in section 2.0

2.0 Deciduous versus Conifer MSQ Assessments

There are two primary differences between conifer and deciduous MSQ surveys and proposed stocking standards:

1. Where conifer stands are assessed at year 15, deciduous stands are assessed at year 10.

2. For conifer stands, management---induced acceleration in growth of newly planted trees is reflected in a reduced number of years to breast height and is recognized through application of the effective age concept. Uncertainties in age determination for trembling aspen make this impractical. Corresponding changes have been necessitated in the deciduous compilation procedure, where impacts of effective age have been eliminated.

A further addition for deciduous stands is the option for 3 different plot sizes: 30 m² (3.09m radius), 40 m² (3.57 m radius) and 50 m² (3.99 m radius). However, as of Feb 28, 2013, no decisions have been made with regard to administrative acceptability of plot sizes other than 50 m².

3.0 Model Fitting

Models to predict yield from MSQ statistics were generated in a 4-step process:

1. A set of 80 stem maps was generated using routines developed by Farnden (2009). Density[17] levels of root suckers varied in 10 steps from 100 to 51,200 trees/ha, with each density level replicated in 4 spatial patterns (Figures 1 and 2) and 2 temporal patterns of suckering.

2. Stand growth originating from each of the stem maps was simulated using the Tree and Stand Simulator (TASS v. 2) model. Growth of each stand was replicated at 5 levels of site index ranging from 15 to 27 m, with generation of final models expanded to 1 m increments through interpolation.

3. Stem maps at age 10 were extracted from the TASS output, and simulations were run to generate a sample of 5000 MSQ plots from each stand, using three variations on plot

[17] Stand densities in the modeling environment represent only those trees that would be considered as "acceptable" or "countable" in a field survey --- see Section 5.0 for a further discussion.

size (30, 40 and 50 m²). The mean of the 5000 plots was assumed to be the true mean for the population for each plot size.

4. The mean MSQ for each stand was used in a modeling exercise to predict merchantable yield at a reference age of 80 years

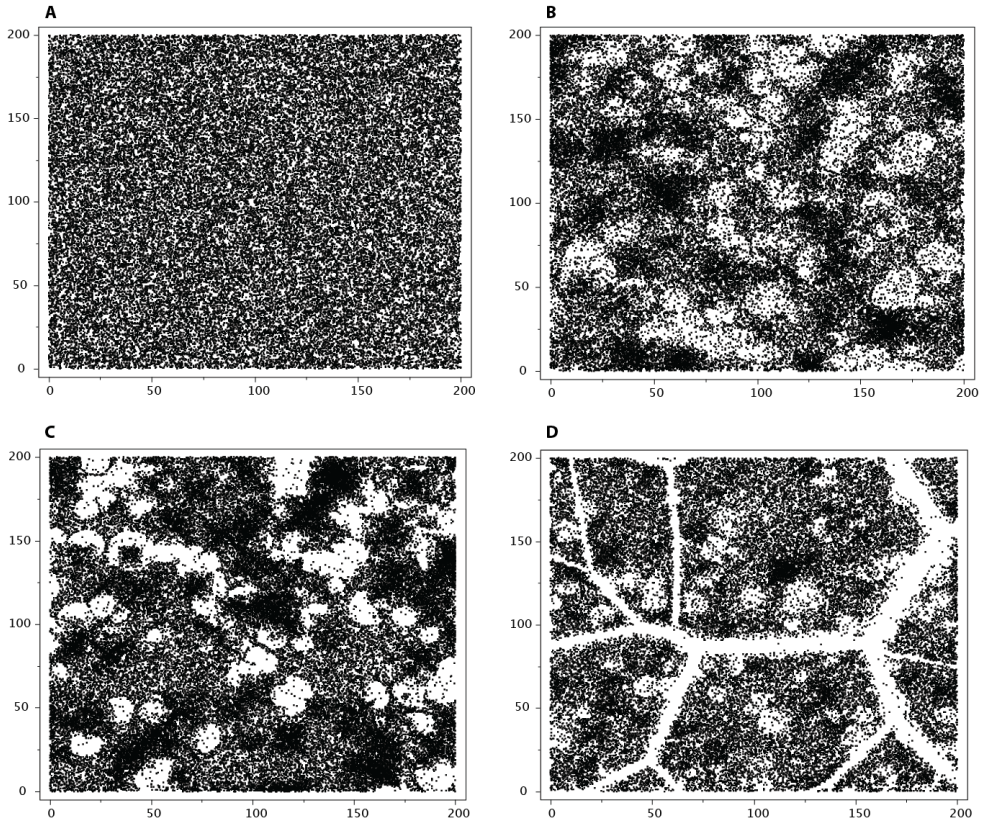


Figure 1. Stem maps illustrating the 4 simulated spatial patterns used to gene rate deciduous MSQ models, in this case for stands with 12,800 suckers per hectare. The scale is in metres, and each dot represents a tree location. The pattern in (A) represents a completely random distribution, (B) and (C) represent increasing levels of clumping, and (D) builds upon (B) with the addition of linear features such as wet draws and harvest trails that could impact on stocking levels.

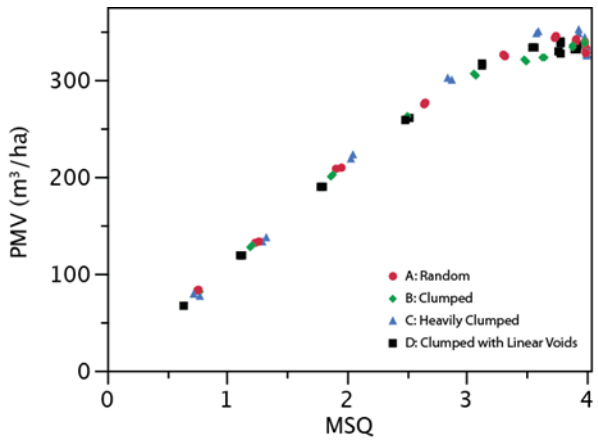


Figure 2. Impact of spatial pattern on relationship between MSQ and PMV for SI_{50} = 21. The four spatial patterns correspond to those illustrated in Figure 1, with various points representing variations in establishment density.

A variety of model forms was investigated, with an imposed requirement to "run through zero". The selected model takes the form:

$$PMV = b_0\left(1 - e^{-b_1 \times MSQ^{b_2}}\right)^{b_3}$$

where b_0 is a horizontal asymptote representing the maximum achievable yield (FMV) under full stocking, and where the remaining parameters control a set of sigmoidal curve shapes. Note that for all models, PMV ⇒ FMV as MSQ ⇒ 4. Parameters and fit statistics for the resulting models are provided for SI_{50} = 21 in Table 1, with parameter estimates for the remaining models provided in Appendix 1. A table of PMV values by MSQ, SI and plot size is provided in Appendix 2.

Table 1. Parameter estimates and fit statistics for models predicting yield at age 80 for site index = 21m using MSQ values as predictors.

Plot Size	b_0	b_1	b_2	b_3	RMSE	Pseudo R^2
30 m²	**334.7**	**0.0267**	**4.119**	**0.2165**	**7.05**	**0.994**
40 m²	**335**	**0.0027**	**5.681**	**0.1662**	**6.53**	**0.995**
50 m²	**335.4**	**0.0002**	**7.463**	**0.1345**	**6.04**	**0.996**

In the process of developing the deciduous MSQ models, it became apparent that the relations hips between PMV and MSQ were strongly polymorphic by site index (see Figure 3). This finding contrasts with the situation for conifer stands where the relationships are assumed to be anamorphic, and PMV could be scaled by site index from a single curve shape. If the conifer

approach were to be followed for deciduous stands, the result would be biased outcomes for some site indices, as no one curve would be an appropriate surrogate for all sites.

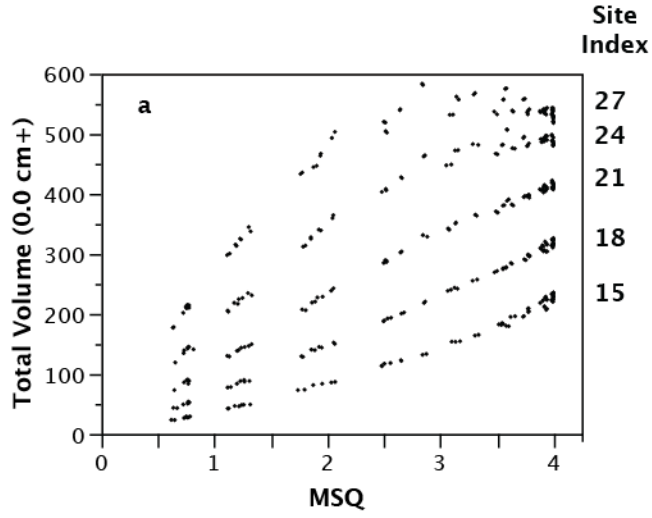


Figure 3a. Impact of growth rates on PMV curve shape, based on total volume. At very high site indices (eg. SI = 27m), it takes fewer trees than at lower site indices to maximize use of available growing space. For SI = 21 and lower, total yield continues to increase right up to MSQ = 4_1 but yield plateaus at lower MSQ's for the higher SI's.

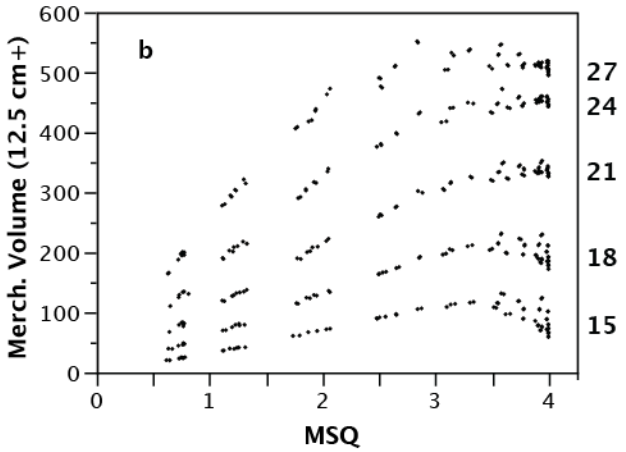


Figure 3b. Impact of merchantability limits on PMV curve shape. For the lowest site indices, PMV value (merchantable as opposed to total volume) start to decline at the highest MSQ values. This effect results from a significant proportion of trees falling below the merchantable dbh limit. This trend is exacerbated for stands with the highest stand densities, which correspondingly experience the highest risk of merchantable yield declines. This effect is largely absent for site indices 24 and 27.

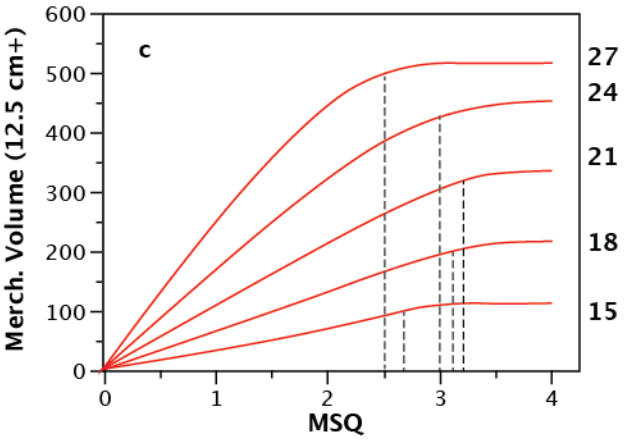


Figure 3c. Impact of site index and merchantability limits on TMV thresholds. PMV curves have been fit to the data points from 3b. Any stands established at densities above 10,000 trees/ha for SI's 15 and 18 have been ignored to avoid the merch volume dropoff associated with high MSQ values shown in Figure 3b above. Relative to relationships for SI = 21, SI's 24 and 27 experienced lower TMV values as a result of improve growing space occupancy by fewer trees, while SI's 15 and 18 experience lower TMV's as a result of the merchantable yield

reductions associated with high establishment densities (which are strongly correlated to high MSQ's).

The net outcome is that there is no single reference site index that can adequately represent the full range of site indices that might be experienced under operational conditions. For example, the selection of a circum-median SI = 21m as the reference SI would result in a stocking standard that is higher than necessary for better and poorer sites (Fig 3c), based on the concept of potential yield performance. Such an outcome would place an overly restrictive restocking requirement on licensees working under this system. There for, despite the difficulty in estimating aspen site index, it is recommended that SI be included in this system as an input parameter.

In order to utilize site index within the PMV/MSQ assessment procedure, a reasonably reliable estimate of age is required. There are at least two options for achieving this including:

1. assuming that total age is equal to years since harvest (10 years) and that SI is then Simply a function of height, and
2. counting age using bud scale scars on a branch whose origin on the stem is immediately below breast height, or

The first of these options is the most likely to be easily applied in the field and is recommended. Based on values derived from the computer program Site Tools, a function to derive site index from total height assuming a total age of 10 years was developed as:

$$SI = 2.54 + 4.15 \times HT - 0.0845 \times HT^2$$

where HT is the stand top height (in metres) based on a sample of the fattest tree in each of a set of 0.01 ha plots. The validity of this model is restricted to a SI_{50} range from 14 to 28m. Given that total age is fixed in this method at 10 years, care will be needed to avoid sampling trees that were already established prior to harvest. Such trees will typically be recognized as emergents, or trees that are obviously taller than the main canopy. In some cases, it may be possible to confirm that a tree is too old by counting bud scale scars on branches.

Some concern has been expressed that SI values determined for aspen at young ages using the currently recommended height/age curves will be biased on the high side, based on experience with long term monitoring plots starting from sucker regeneration (pers. comm. Richard Kabzems). For application of the PMV/MSQ models described in this paper, any such bias will have a minimal impact on decisions regarding acceptability of stocking levels. Of greater concern is the entry of these SI values into the Results database and ultimately into the forest inventory,

where they will impact future timber supply calculations. A review of this issue with recommendations for operational application and research needs is recommended.

4. Well Spaced; Conversion to MSQ

In order to explore the relationships between MSQ and WS stocking, an additional set of survey simulations was run on each simulated stand. For each of 4 variations on minimum inter-tree distance, 500 plots were assessed at random locations with the mean for each survey/stand combination assumed to be the true mean for the population. The current stocking standard for deciduous stands, specified in the Fort St. John Pilot Project SFMP, is based on well spaced stocking using a minimum inter- tree distance (mitd) of 0.5 m and an M value of 50. The TSS is implied to be 10,000 WS trees/h a, with the minimum specified as 4,000 WS trees/ha.

In moving to a stocking standard based on MSQ values, a conversion function is desirable to facilitate the transition. Such a function was derived based on simulated survey outcomes using both systems as illustrated in Figure 4. The resulting equation is a modified Gompertz f unction where the curve is fixed to "go through zero" and an extra parameter is added as an exponent to the "x" value to allow greater flexibility. The resulting equation is:

$$MSQ = 4.00 * e^{-e^{2-1.85\left(\frac{WS}{200}\right)^{0.322}}}$$

With fit statistics of RMSE = 0.73 and pseudo R^2 = 0.99

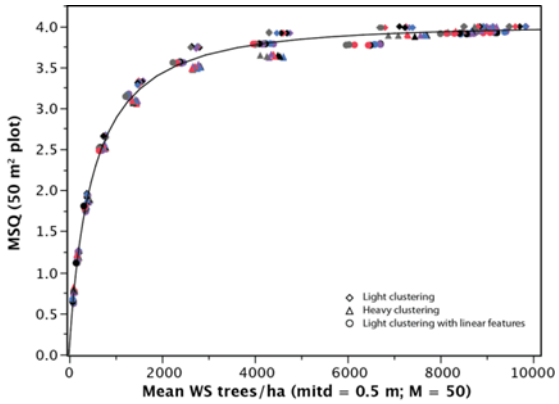


Figure 4. Comparison of simulated WS and MSQ survey outcomes. Spatial patterns correspond to those illustrated in Figures 1b to 1d. Stands with a random spatial pattern were not included.

The reciprocal function is:

$$WS = 200\left(\frac{2 - ln\left(-ln\left(\frac{MSQ}{4}\right)\right)}{1.85}\right)^{3.11}$$

Both of these functions were found to be insensitive to site index, but somewhat sensitive to spatial pattern. The function predicting MSQ from WS trees will slightly overestimate MSQ for relatively uniform stands, and underestimate MSQ for heavily clustered stands (spatial pattern c in Fig. 1

In exploring the relationships between the current WS stocking standards and the proposed MSQ standards, it became apparent that the current deciduous WS standards are poorly suited to evaluating reforestation success using future yield as a criteria for success. The rationale for this conclusion is illustrated in Fig. 6, where TASS-predicted future yields are plotted against simulated survey outcomes. It is apparent that yields are maximized for WS values well below the minimum threshold (MSS) of 4000 WS/ha (mitd=0 .5; M = 50). The implication suggested here is that, using a yield-based reforestation objective, many stands with WS values below 4000 will be rejected as NSR when they are actually capable of producing perfectly acceptable timber crops. It is also apparent that the use of an mitd as low as 0.5 m results in counting of a large number of redundant WS trees that have no impact on yield.

A yield function based on an mitd of 2.0 m and an M value of 6 is provided in Fig. 6 for comparison. From a yield- based perspective, this option provides equivalent or better precision, while providing a much simpler and cost-effective means of assessing stocking.

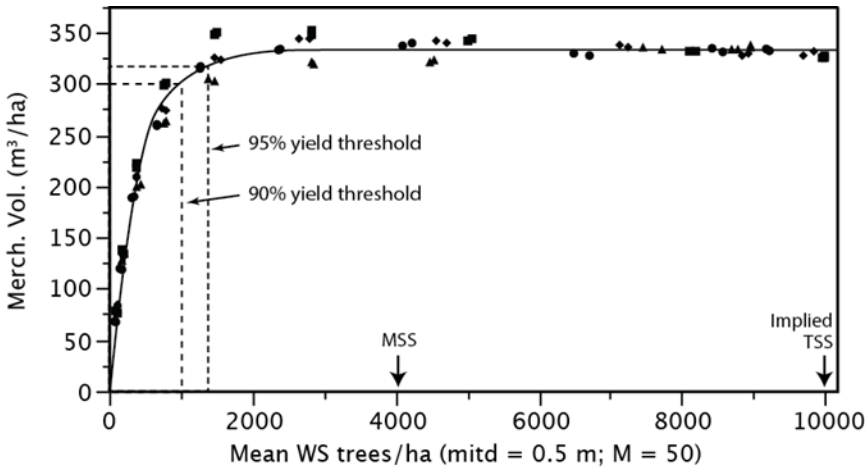


Figure 5. Predicted yield by WS stocking for current stocking standards (MSS = minimum WS). Based on this relationship, it appears that a 0.95 volume threshold would be achieved at approximately 1400 WS trees/ha. This is roughly equivalent to 2000 to 3000 countable/acceptable trees/ha depending on tree spatial pattern.

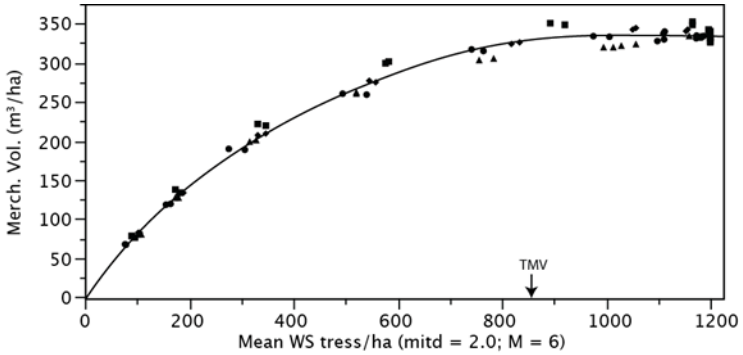


Figure 6. Predicted yield by WS stocking assuming mitd = 2.0m and M = 6. Based on this relationship, it appears that a 0.96 volume threshold would be achieved at approximately 850 WS trees/ha, or 2000 to 3000 countable/acceptable trees/ha depending on tree spatial pattern.

5.0 Acceptable and Countable Trees

In predicting tree and stand growth using an individual tree model, there are a certain number of poor quality trees whose presence and growth are not well represented in simulations. These trees include those that are genetically inferior or seriously maladapted to the site, or are seriously damaged by agents such as disease, browsing ungulates or hail. For the current project such trees were assumed to have no impact on long term stand dynamics and were eliminated from simulations at the outset. To be compatible, field surveys must follow a similar strategy, and such trees must be ignored in all plot tallies. This is commonly achieved using the concepts of “acceptable" and “countable" trees. In order to be tallied, a tree must meet certain criteria:

1. it must be free of unacceptable damage, and

2. it must be of sufficient vigour and relative size (i.e. > some percentage of top height) that it could form part of the main tree canopy in the future; for trembling aspen this is particularly important because (a) the species is shade intolerant and (b) the species rarely suckers more than 2 years after disturbance, such that trees well behind in height at year 10 are highly likely to have poor long term growth characteristics.

Defining acceptability criteria for aspen is beyond the scope of the current project –if not already available they should be developed by agreement between the Fort St. John Pilot Project licensees and the BC Ministry of Forests, Lands and Natural Resource Operations.

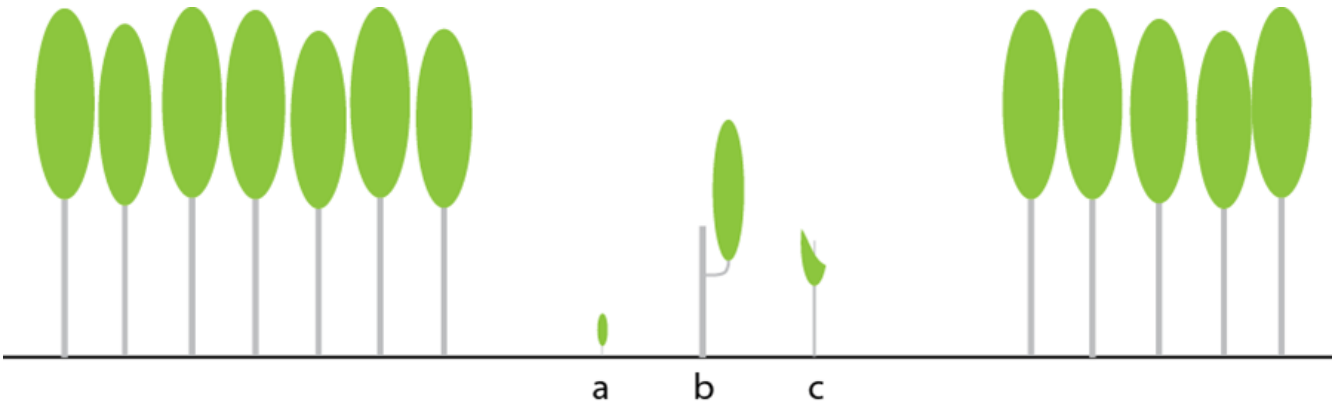


Figure 7. Examples of poor-quality trees that should be ineligible for contributing to the stocking of an otherwise unstocked gap. Tree a is of similar age as the rest of the trees but has a very low vigour, tree b has sustained serious stem damage and tree c is being continuously browsed by ungulates.

6.0 Impacts of Uncertainty in the TASS Model

The modeling exercise used to develop the MSQ equations in this report depends heavily on the TASS growth model developed by the BC Ministry of Forests, Lands and Natural Resource Operations. It is important to recognize that in building this model, there was no data available for stands at densities less than approximately 2500 trees/ha, and very little data for young stands in general. As a result, some of the model behaviour at low densities and young ages is based on theory and experience with other species rather than on strong empirical evidence. As illustrated in Figure 8, the density ranges over which critical stocking decisions are being made falls within the range of densities for which there was no calibration data. Is this a critical problem? Probably not, for the following reasons:

1. A strength off models such as TASS is that they allow us utilize well known principles of forest stand dynamics that apply to all species as a general framework, with adjustments made for individual species. This generality of model construction greatly facilitates interpolation and extrapolation to scenarios where empirical data is weak or missing.

2. At the threshold density for which there is empirical data (2500 trees/ha), the model is predicting yields that are only slightly below the maximum achieved with full stocking.

3. We know from experience with a wide range of species that there is no threshold below which yield drops suddenly with small decreases in establishment density; the dropoff starts slowly and approaches a near-linear pattern as one approaches closer and closer to zero.

Such models are the outcomes of extensive work by highly skilled individuals and generally represent the best information available.

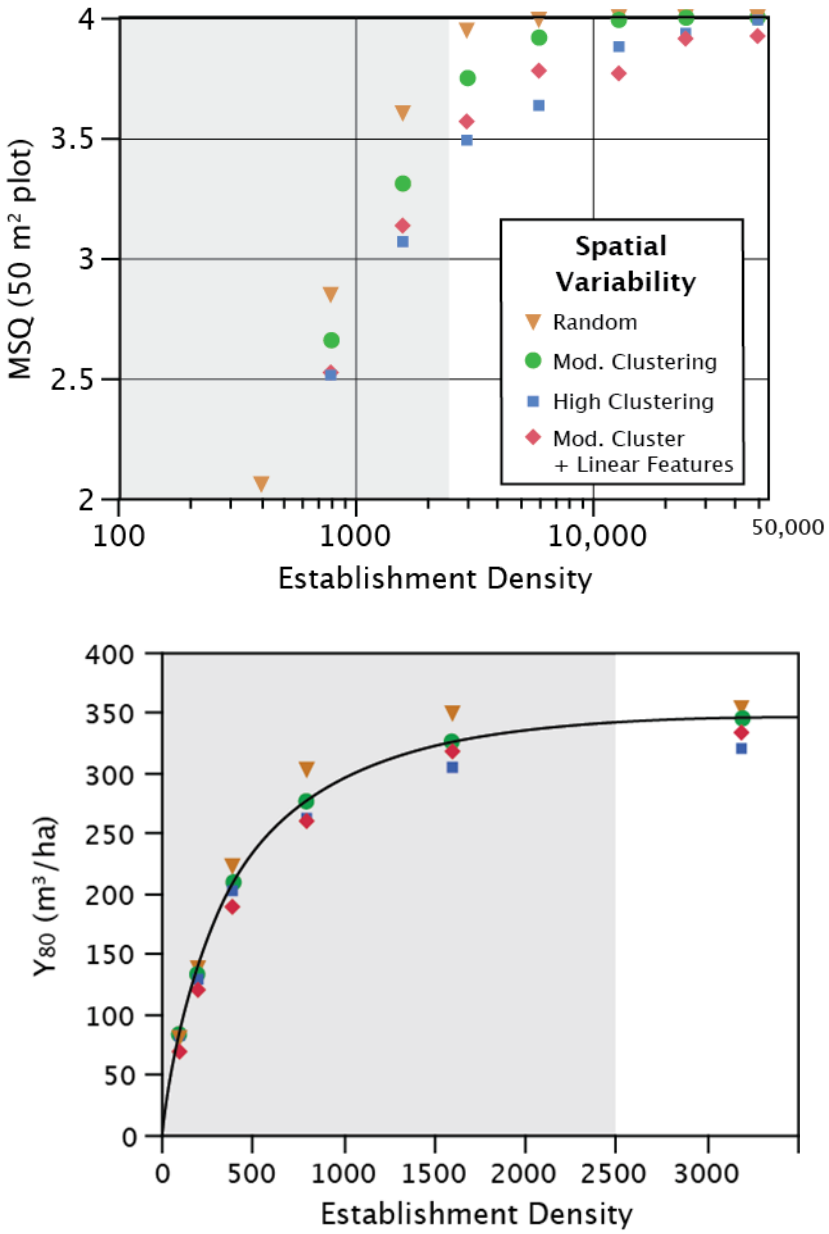


Figure 8. Comparison of total stand densities as modeled in TASS with MSQ values (top) and merchantable yield for SI50 = 21 (bottom). The relationships between these measures vary with

spatial pattern, represented here using the four patterns from Figure 1. The grey zones represent stand densities for which there was no calibration data available for TASS. Note that critical MDQ threshold values for stocking acceptability range from 2.5 to 3.25, depending on SI (from Figure 3c). Note also the equivalent total stand densities in the field will be higher when the presence of trees with unacceptable levels of vigour and damage are included in the tally.

7.0 Transfer of Risk

The concept of free growing in the administration of forest regeneration in British Columbia is a milestone by which the Crown accepts that a harvested unit is acceptably regenerated, and there is minimal risk of future reductions in stocking. In assessing future regeneration performance, the stocking survey is designed to account for the yield impacts of unstocked gaps present at the time of assessment. This includes features such as those characterized by MacIsaac et al. (2006) as persistent preharvest natural gaps, postharvest wet areas, harvest disturbance gaps such as in- block roads, landings and burn piles, and postharvest regeneration voids.

The stocking survey cannot account for stocking issues that may become apparent after the free growing declaration. After this point, the Crown implicitly accepts the risks and consequences for any further damage. To this end, desired conditions at the time of transfer must be defined such that a majority of stands will have a minimal risk of declining to an unacceptable condition. It is important to recognize here that the long term minimally acceptable condition is not the same as that of the free growing threshold, but that the free growing threshold already has an implied safety buffer built in. It must also be recognized, however, that the post-free growing risks and the magnitude of the safety buffer have never been explicitly recognized or quantified in BC. Recent experience with the realization of extensive post-free growing damage to lodgepole pine has brought this issue to the forefront. The degree to which we understand that further stocking losses (as opposed to ongoing and expected self-thinning) might occur needs to be further discussed, and monitoring plots such as those being deployed in the nascent Stand Development Monitoring program will play an important role.

8.0 Summary and Conclusions

It appears from the results of analyses presented in this report that an MSQ-based stocking standard for deciduous (primarily aspen) stands is a viable approach to the administration of reforestation performance by licensees. In comparison to the similar system for conifer stands, there are a few changes necessitated by uncertainty in age determination and the polymorphic nature of the PMV/MSQ relationships by site index. There may also be some work still required to define acceptable/countable stem criteria. Despite an appearance of increased uncertainty for the deciduous MSQ assessment procedure over that for conifer stands, the proposed MSQ standards are a superior approach to the current implementation of WS-based standards.

References

J.S. Thrower and Assoc 2003. Stand survey & growth modeling for the Fort St. John TSA. Contract report to Canadian Forest Products ltd., Chetwynd BC.

MacIsaac DA; Comeau PG; Macdonald SE 2006. Dynamics of regeneration gaps following harvest of aspen stands. Canadian Journal of Forest Research 36:1818-1833

Appendix 1. PMV Parameters by Plot Size and Site Index

Data for PMV models were generated using TASS and survey simulations for site indices 15, 18, 21, 24, and 27 and an initial set of models were produced. Using these, PMV values were generated for each 0.1 increment of MSQ, and PMV values for the remaining SI's were interpolated (or extrapolated for SI's 14 and 28) at each 0.1 increment of MSQ. The derived values were then used to generate PMV models for the remaining SI's.

Table 2.1. PMV equation parameters by SI for 50m² plots

SI	b0	b1	b2	b3
14	79	1.665×10^{-17}	34.07	0.03534
15	112	1.018×10^{-11}	22.92	0.04937
16	146.2	3.377×10^{-6}	11.19	0.0991
17	181	3.726×10^{-5}	8.914	0.1225
18	216.6	7.281×10^{-5}	8.215	0.1312
19	255.7	1.085×10^{-4}	7.897	0.1318
20	295.3	1.483×10^{-4}	7.653	0.1329
21	335.4	1.903×10^{-4}	7.463	0.1345
22	374	0.001333	5.99	0.1625
23	412.6	0.004093	5.179	0.1858
24	451.2	0.007873	4.741	0.2018
25	471.7	0.02754	3.918	0.2438
26	492.1	0.03591	3.974	0.2371
27	515	0.01824	4.994	0.1789
28	538.5	0.004895	6.844	0.1237

Table 2.2. PMV equation parameters for SI for 40m² plots

SI	b0	b1	b2	b3
14	78.7	8.798×10^{-17}	38.64	0.02882
15	112	1.887×10^{-17}	15.46	0.06871
16	146.3	1.348×10^{-4}	8.693	0.1207
17	181.1	4.867×10^{-4}	7.286	0.142
18	215.6	5.937×10^{-4}	6.959	0.1462
19	255.7	0.001137	6.402	0.1535
20	295.3	0.001838	5.992	0.1601
21	335	0.002654	5.681	0.1662
22	373.8	0.006564	5.009	0.181
23	412.4	0.01209	4.583	0.1931
24	450.4	0.01804	4.331	0.2012
25	472	0.0685	3.404	0.2609

26	492.6	0.1076	3.228	0.2808
27	515	0.07431	3.971	0.2172
28	537.5	0.02552	5.685	0.1403

Table 2.3. PMV equation parameters by SI for 30m² plots

SI	b0	b1	b2	b3
14	77.86	2.209×10^{-7}	17.86	0.0572
15	112.1	2.556×10^{-4}	8.79	0.1119
16	146.5	0.004269	6.197	0.1562
17	181.2	0.008118	5.386	0.1765
18	215	0.009751	5.098	0.1833
19	255.7	0.0152	4.691	0.1955
20	295.3	0.02095	4.399	0.2065
21	334.7	0.02673	4.119	0.2165
22	373.7	0.05679	3.565	0.2487
23	412.4	0.1012	3.111	0.2868
24	450.3	0.1566	2.788	0.3273
25	471.9	0.3297	2.295	0.4272
26	492.5	0.4166	2.327	0.4321
27	514.7	0.2149	3.459	0.2421
28	537.7	0.05459	6.023	0.1167

Appendix 2. PMV Values by Site Index and MSQ

Table 3.1. PMV by MSQ and Site Index for 50m² plot size.

	Site index														
MSQ	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
1.0	0	32	42	52	62	77	91	106	128	148	170	196	223	251	279
1.1	23	36	47	58	69	85	101	117	140	163	186	214	243	273	302
1.2	25	39	51	63	76	93	110	127	152	177	202	232	263	295	325
1.3	28	43	56	69	82	101	119	138	165	191	218	250	283	316	348
1.4	30	47	61	75	89	109	129	149	177	205	233	268	302	337	370
1.5	33	51	66	81	96	117	138	159	189	219	249	285	321	357	391
1.6	36	55	71	87	103	125	148	170	201	232	264	301	339	377	412
1.7	38	59	76	93	110	133	157	180	213	246	279	318	356	395	432
1.8	41	62	80	99	117	141	166	191	225	259	294	333	373	413	451
1.9	44	66	85	105	124	150	176	202	237	273	309	348	388	429	469
2.0	46	70	90	111	131	158	185	212	249	286	323	363	403	445	485
2.1	49	74	95	116	138	166	194	222	260	298	336	376	417	459	499
2.2	52	78	100	122	145	174	203	233	271	310	349	389	429	471	512
2.3	55	82	105	128	152	182	212	243	282	322	362	401	440	482	521
2.4	58	86	110	134	158	190	221	253	293	333	374	412	450	491	528
2.5	61	91	115	140	165	197	230	263	303	344	385	422	459	498	533
2.6	64	95	120	146	172	205	238	272	313	354	395	431	466	504	536
2.7	67	99	125	151	178	212	246	281	322	363	405	438	473	508	538
2.8	70	102	129	156	184	219	254	290	331	372	413	445	478	511	538
2.9	73	106	133	161	190	225	262	298	339	380	421	451	482	513	538
3.0	75	109	137	166	195	232	268	306	346	386	427	456	485	514	538
3.1	78	111	140	170	200	237	274	312	352	392	433	460	487	514	538
3.2	79	112	143	173	204	242	280	318	357	397	438	463	489	515	538
3.3	79	112	144	176	208	246	284	323	362	401	441	466	490	515	538
3.4	79	112	145	178	211	249	288	327	366	405	444	468	491	515	538
3.5	79	112	146	179	213	252	291	330	368	407	447	469	491	515	538
3.6	79	112	146	180	215	253	293	332	370	409	448	470	492	515	538
3.7	79	112	146	181	216	254	294	334	372	410	449	471	492	515	539
3.8	79	112	146	181	216	255	295	335	373	411	450	471	492	515	539
3.9	79	112	146	181	216	255	295	335	373	412	451	471	492	515	539
4.0	79	112	146	181	217	256	295	335	374	412	451	471	492	515	539

Table 3.2 PMV by MSQ and Site Index for 40m² plot size.

	Site index														
MSQ	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
1.0	27	39	50	61	73	90	108	125	150	176	200	232	259	290	321
1.1	30	43	55	68	80	99	118	137	164	191	218	252	281	314	346
1.2	33	47	60	74	88	108	128	148	177	206	234	271	303	337	370
1.3	36	51	66	80	95	117	138	160	190	221	251	290	323	359	393
1.4	39	55	71	87	102	126	149	171	204	236	267	308	342	380	415
1.5	43	59	76	93	110	134	159	183	216	250	283	325	360	399	436
1.6	46	64	82	100	117	143	169	194	229	264	298	341	378	418	456
1.7	49	68	87	106	125	152	179	205	241	278	313	356	393	435	474
1.8	52	72	92	112	132	160	188	216	254	291	328	371	408	450	490
1.9	55	76	98	119	139	169	198	227	265	304	341	385	422	463	503
2.0	59	81	103	125	147	177	208	238	277	316	355	397	434	475	514
2.1	62	85	108	131	154	185	217	248	288	328	367	409	444	485	523
2.2	65	89	113	137	161	193	226	258	299	339	379	419	454	493	529
2.3	69	93	118	143	167	201	234	268	309	349	390	428	462	499	533
2.4	72	97	123	149	174	209	243	277	318	359	399	436	469	505	536
2.5	75	101	128	154	180	216	251	286	327	368	408	444	474	508	537
2.6	78	105	132	159	186	222	258	294	335	376	416	450	479	511	537
2.7	79	108	136	164	192	229	265	301	342	383	423	455	483	513	537
2.8	79	110	139	168	197	234	271	308	349	389	430	459	485	514	537
2.9	79	111	141	171	201	239	276	314	354	395	435	462	488	514	537
3.0	79	112	143	174	205	243	281	319	359	399	439	465	489	515	537
3.1	79	112	145	177	208	247	285	323	363	403	442	467	490	515	537
3.2	79	112	146	178	211	250	288	327	366	406	445	469	491	515	537
3.3	79	112	146	180	213	252	291	329	369	408	447	470	492	515	537
3.4	79	112	146	180	214	253	292	331	370	409	448	471	492	515	537
3.5	79	112	146	181	215	254	294	333	372	411	449	471	492	515	537
3.6	79	112	146	181	215	255	294	334	373	411	450	471	492	515	538
3.7	79	112	146	181	215	255	295	334	373	412	450	472	493	515	538
3.8	79	112	146	181	216	256	295	335	373	412	450	472	493	515	538
3.9	79	112	146	181	216	256	295	335	374	412	450	472	493	515	538
4.0	79	112	146	181	216	256	295	335	374	412	450	472	493	515	538

Table 3.3 PMV by MSQ and Site Index for 30m² plot size.

	Site index														
MSQ	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
1.0	32	44	62	77	92	113	133	152	182	211	239	274	309	346	382
1.1	36	49	68	85	100	123	144	166	197	228	259	296	333	371	407
1.2	39	53	74	92	109	133	156	179	212	245	278	317	356	394	431
1.3	42	57	80	99	117	143	168	191	227	262	296	336	376	415	454
1.4	46	62	86	106	125	152	179	204	241	277	313	354	394	435	474
1.5	49	66	92	113	133	162	190	216	255	292	329	370	411	452	492
1.6	52	70	98	120	141	171	200	228	268	306	344	385	425	466	507
1.7	56	75	103	127	149	180	211	239	280	319	358	398	438	479	519
1.8	59	79	109	133	157	189	220	250	292	332	371	410	448	489	527
1.9	62	83	114	139	164	197	230	260	303	343	383	420	458	496	533
2.0	66	87	119	145	171	205	239	270	313	353	393	429	465	503	536
2.1	69	91	124	151	177	213	247	279	322	363	403	437	471	507	537
2.2	72	95	128	156	183	220	255	288	331	371	411	444	477	510	538
2.3	75	99	132	161	189	226	262	295	338	378	418	450	481	512	538
2.4	77	102	136	165	194	232	268	302	345	385	424	454	484	513	538
2.5	78	105	139	169	199	237	274	309	351	390	430	458	486	514	538
2.6	78	107	141	172	202	241	279	314	356	395	434	461	488	514	538
2.7	78	109	143	175	206	245	283	319	360	399	438	464	489	515	538
2.8	78	111	145	177	208	248	286	323	363	402	441	466	490	515	538
2.9	78	111	145	179	211	250	289	326	366	405	443	467	491	515	538
3.0	78	112	146	180	212	252	291	328	368	407	445	469	492	515	538
3.1	78	112	146	180	213	253	292	330	370	408	447	469	492	515	538
3.2	78	112	146	181	214	254	293	332	371	410	448	470	492	515	538
3.3	78	112	146	181	214	255	294	333	372	411	448	471	492	515	538
3.4	78	112	146	181	215	255	295	334	373	411	449	471	492	515	538
3.5	78	112	146	181	215	255	295	334	373	412	449	471	492	515	538
3.6	78	112	146	181	215	256	295	334	373	412	450	472	492	515	538
3.7	78	112	146	181	215	256	295	334	373	412	450	472	492	515	538
3.8	78	112	146	181	215	256	295	335	374	412	450	472	492	515	538
3.9	78	112	146	181	215	256	295	335	374	412	450	472	492	515	538
4.0	78	112	146	181	215	256	295	335	374	412	450	472	492	515	538

Appendix 11: Listing of Invasive Plants

B.C. Invasive Plant Candidates for Eradication (EDRR Candidates)

The following invasive plant species are not present in BC or are present but extremely limited in extent, and pose a significant threat to BC's environment, economy and/or human health. These species have been identified as a result of an extensive review that considered their regulation and status in BC and bordering jurisdictions, presence elsewhere in similar environments to those that occur in BC, and listing under federal regulations. These species are proposed candidates for eradication province wide (EDRR candidates) under the B.C. Invasive Species Early Detection Rapid Response (EDRR) Program.

Common Name	Scientific Name	Type
African-rue	*Peganum harmala* L.	Terrestrial
Black Henbane	*Hyoscyamus niger* L.	Terrestrial
Brazilian Elodea/ Waterweed	*Egeria densa Planch.*	Aquatic - submerged, rooted
Broom, French	*Genista monspessulana* (L.) L.A.S. Johnson	Terrestrial
Camel Thorn	*Alhagi maurorum* Medik.	Terrestrial
Common Crupina	*Crupina vulgaris* Cass.	Terrestrial
Common Reed, European	*Phragmites australis* (Cav.) Trin. ex Steud. *subsp. australis*	Semi aquatic - emergent
Cordgrass, Dense-flower	*Spartina densiflora* Brongn.	Semi-aquatic - tidal
Cordgrass, Salt Meadow	*Spartina patens* (Aiton) Muhl.	Semi-aquatic - tidal
Cordgrass, Smooth	*Spartina alterniflora* Loisel.	Semi-aquatic - tidal
Cordgrass, English	*Spartina anglica* C.E. Hubbard	Semi-aquatic - tidal
Dyer's Woad	*Isatis tinctoria* L.	Terrestrial
Eggleaf Spurge	*Euphorbia oblongata* Griseb.	Terrestrial
False-brome, Slender	*Brachypodium sylvaticum* (Huds.) P. Beauv.	Terrestrial
Flowering Rush	*Butomus umbellatus* L.	Aquatic – submerged and emergent, rooted
Foxtail, Slender/Meadow	*Alopecurus myosuroides* Huds.	Terrestrial
Goat's Rue	*Galega officinalis* L.	Terrestrial
Halogeton/Saltlover	*Halogeton glomeratus* (M. Bieb.) C.A. Mey.	Terrestrial
Hawkweed, Mouse-ear	*Hieracium pilosella* L.	Terrestrial
Hyacinth, Water	*Eichhornia crassipes* (Mart.) Solms	Aquatic - semi- emergent
Hydrilla	*Hydrilla verticillata* (L. f.) Royle	Aquatic – submerged, rooted
Johnsongrass	*Sorghum halepense* L.	Terrestrial
Jointed Goatgrass	*Aegilops cylindrica* Host	Terrestrial

B.C. Invasive Plant Candidates for Eradication (EDRR Candidates)

Common Name	Scientific Name	Type
Knapweed, Squarrose	*Centaurea virgata* Lam. ssp. squarrosa (Boissier) Gugler	Terrestrial
Kudzu	*Pueraria montana* (Lour.) Merr. var. lobata (Willd.) Maesen & S. Almeida	Terrestrial
Medusahead	*Taeniatherum caput-medusae* (L.) Nevski	Terrestrial
Nightshade, Silverleaf	*Solanum elaeagnifolium* Cav.	Terrestrial
Nutsedge, Purple	*Cyperus rotundus* L.	Terrestrial
Paterson's Curse	*Echium plantagineum* L.	Terrestrial
Pepperweed, Perennial	*Lepidium latifolium* L.	Terrestrial
Red Bartsia	*Odontites serotina* Dum.	Terrestrial
Reed, Giant	*Arundo donax* L.	Terrestrial
Sage, Mediterranean	*Salvia aethiopis* L.	Terrestrial
Spring Millet Grass	*Milium vernale M. Bieb.*	Terrestrial
Spurge Flax	*Thymelaea passerina* (L.) Coss. & Germ.	Terrestrial
Starthistle, Iberian	*Centaurea iberica* Trev. ex Sprengel	Terrestrial
Starthistle, Purple	*Centaurea calcitrapa* L.	Terrestrial
Starthistle, Yellow	*Centaurea solstitialis* L.	Terrestrial
Syrian Bean-Caper	*Zygophyllum fabago* L.	Terrestrial
Texas Blueweed	*Helianthus ciliaris* DC.	Terrestrial
Thistle, Italian	*Carduus pycnocephalus* L.	Terrestrial
Thistle, Slenderflower	*Carduus tenuiflorus* W. Curtis	Terrestrial
Water Lettuce	*Pistia stratiotes* L.	Aquatic – emergent, free-floating
Water Soldier	*Stratiotes aloides* L.	Aquatic – submerged/emergent, rooted
Yellow Floating Heart	*Nymphoides peltata* [(Gmel.) Kuntze]	Aquatic - emergent

What Can You Do?

- Learn to identify provincial eradication candidate species: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species/priority-species/priority-plants
- If you find a new plant species in BC: collect a pressed sample, take pictures, record site location and description.

PRRD Regional Early Detection Rapid Response (REDRR)		
Regional EDRR species are a significant threat and is new to the area under consideration. The achievable management objective is eradication. This list includes brand new incursions and high risk invasive plant species that are extremely limited in extent (i.e. have less than 10 very small sites) in the area under consideration. Some of these species may not be present within the PRRD but are found in adjacent areas and are at risk of being introduced.		
Common Name	**Latin Name**	**Occurrences/Threat**
Baby's breath	*Gypsophila paniculata*	Not present at this time

Big Head knapweed	*Centaurea macrocephala*	One infestation of 6 plants discovered in 2013, is a provincial EDRR species
Blueweed	*Echium vulgare*	Not present at this time
Bohemian knotweed	*Fallopia x bohemica*	Not present at this time
Brown knapweed	*Centaurea jacea*	Exists in the NWIPC along Highway 16.
Cheat grass	*Bromus tectorum*	Not present at this time
Chicory	*Cichorium intybus*	*1 site found in 2013. Numerous sites found in southern BC.*
Creeping bell flower	*Campunaula rapunculiodes*	One small infestation discovered in 2013
Cypress spurge	*Euphorbia cyparissias*	The New Invaders Program notes cypress spurge to be a problem in the Hudson's Hope area. This invasive plant is highly aggressive and toxic.
Field Scabious /Blue button	*Knautia arvensis*	One site between Arras and Groundbirch, may still be sold in nurseries
Giant knotweed	*Polygonum sachalinense*	Not present at this time
Himalayan balsam/Policeman's Helmet	*Impatiens glandulifera*	Horticulture plant in a few gardens in Dawson Creek. 1 new site discovered in 2014.
Himalayan knotweed	*Polygonum polystachyum*	Not present at this time
Hoary alyssum	*Bereroa incana*	Sites present in the Prince George area.
Hoary cress	*Cardaria draba*	None present at this time
Hound's tongue	*Cynoglossum officinale*	Two sites previously mis-identified, plant is under effective bio-control in southern portions of BC since 2007.
Japanese knotweed	*Fallopia japonica*	Not present at this time
Leafy spurge	*Euphorbia esula*	Present in Grande Prairie AB
Marsh plume thistle	*Cirsium palustre*	Less than 10 sites documented with 3 sites under control.
Mountain bluet	*Centaurea Montana*	Noted in horticulture settings in 2011 historically at Telegraph Creek BC
Nodding thistle	*Carduss nutans*	Not present at this time, exists in the NWIPC along Highway 16.

Plumeless thistle	*Carduus acanthoides*	Found in Trail, BC and has biocontrol agents.
Purple loosestrife	*Lythrum spp.*	Present in Grande Prairie AB
Rush skeletonweed	*Chondrilla juncea*	No sites in the PRRD to date
St. John's Wort or goatweed	*Hypericum perforatum*	No sites reported
Sulphur cinquefoil	*Potentilla recta*	Not present at this time
Tansy ragwort	*Senecio jacobeae*	No sites reported
Tartary buckwheat	*Fagopyrum tataricum*	No known sites in the region
Wild parsnip	*Pastinaca sativa*	One small infestation discovered in 2013.

PRRD Category a High Priority for Eradication and Containment		
These invasive plants are highly competitive, have the ability to spread rapidly, and pose as significant threat.		
Common Name	**Latin Name**	**Occurrences/Threat**
Burdock	*Arctium spp.*	Historic sites in Taylor along the rail line, Lynx Creek subdivision at Hudson's Hope, Clayhurst area and areas along the Peace, Jackfish Lake area, and Groundbirch community pastures and East Pine, 46 sites in 2012
Comfrey	*Symphytum spp.*	Two sites in Chetwynd, one in Fort St. John identified in 2012.
Common tansy	*Tanacetum vulgar*	Likely present since homesteader times, medicinal plant used to keep insects away and induce miscarriage.
Dalmatian toadflax	*Linaria dalmatica*	Present in small patches since 1987 south of Charlie Lake. Currently there are 45 sites, largest site at the Peace Lookout 7 ha., occupying private and crown land, initial site was small, but present since 1991.
Diffuse knapweed	*Centaurea diffusa*	One historical site within BC HYDRO's Site C. Plant may have spread outwards, need better education around identification and reporting

Green foxtail	*Sertaria viridis*	Plant is difficult to see as it heads out later in the summer, few sporadic sites in Cecil Lake, Hudson's Hope highway, historically in Dawson Creek, Fort St. John, Chetwynd, and Taylor, and the 103 road.
Meadow goat's-beard or Salsifly	*Tragopogon pratensis*	Sporadic distribution.
Orange hawkweed	*Heiracium aurantiacum*	62 sites, noted since 1994, sporadic infestations in the region, see notes under yellow hawkweed
Russian thistle	*Salsola kali*	Present in the Stewart Lake Gravel Pit, East Pine, historically in Taylor
Spotted knapweed	*Centaurea biebersteinii*	Historically, there were 12 spotted knapweed sites in 1999, 14 in 2000 and 15 in 2001, 2002 and 2003. New IAPP records indicate a total of 24 sites infesting approximately 10 ha in 2011, there were 26 sites spread throughout the area
Invasive yellow hawkweeds	*Pilosella spp.*	Inventory began in 2005. There were 199 sites in 2008, currently there are 108 sites located in the region located at Mile 137 Alaska Highway, Monkman, Tumbler Ridge, Johnson Creek and the Hudson's Hope area. Treatments have occurred since 2007.
Wild caraway	*Carum carvi*	Prevalent north of Pink Mountain, historical infestation at Site C.

PRRD Category B – Medium Priority for Eradication and Containment		
Primary invasive plants have the ability to spread rapidly but are not as aggressive as Category A plants, or have become naturalized, are still considered a threat to the fine seed industry.		
Common Name	**Latin Name**	**Occurrences/Threat**

Annual bluegrass	*Poa Annua*	Present on local golf courses and worldwide on lawns.
Common toadflax	*Linaria vulgaris*	Under biological control since the 1950's, larger patches are surveyed and treated if threatening farm land.
Creeping (Canada) thistle	*Cirsium arvense*	Wide spread, are surveyed and treated if threatening farm land.
Kochia	*Kochia scoparia*	Historically in commercial lots, landfill sites and gas plant at Taylor, minor amounts on private land, Beatton Hills on Cecil Lake Road
Night-flowering catchfly	*Silene noctiflora*	Seeds introduced with alfalfa. Important to review seed analysis prior to purchasing seed.
Oxeye daisy	*Chrysanthemum leucanthemum*	Prevalent in Southern BC, Pine Pass and Hudson's Hope several sporadic infestations showing up throughout the region
Scentless chamomile	*Matricaria perforata*	Widespread in the area, rare in southern BC.
Tall/Meadow buttercup	*Ranunculus acris*	First occurrence noted in 2011, species was confirmed in 2013 as *Ranuculus acris.* More infestation discovered in 2013

*Other invasive plants may be added to this list as made know by the District Manager.

Appendix 12: Soil Disturbance Information

Soil Disturbance Classification

Soil Disturbance Described under the Forest Practices Code

Excavated or Bladed Trail ("R")

A constructed trail that has:

- a mineral soil cutbank height greater than 30 cm, and
- an excavated width greater than 1.5 meters.

Measure disturbance depending on whether fill slopes are considered unfavorable in the Silviculture Prescription:

- If fill slopes are unfavorable: include the width of the trail in horizontal distance from the top of the cut to the point where the sidecast fill is continuously 20 cm deep. Do not count accumulations of slash that are "clean woody debris" as part of the sidecast. Clean woody debris contains less than 30% mineral soil.
- If fill slopes are favorable: include the width in of the trail in horizontal distance from the top of the cut to the outside edge of the compacted running surface. If the running surface is not compacted (e.g. a winter trail), then measure the excavated width only.

Corduoroyed Trail ("Y")

A trail constructed using logs and woody debris placed side by side to form a surface greater than 2 meters in length capable of supporting equipment traffic.

This disturbance is counted on all sites.

Compacted Area ("A")

An area of soil greater than 100 m^2, having a minimum width of 5 m that:

- has been compacted by equipment travelling over the area, and
- has the same characteristics as Repeated Machine Traffic and/or Wheel/Track Ruts

This disturbance is counted on all sites.

Dispersed Trails: Wheel / Track Ruts ("T") on All Sites

The depth criteria for this category vary depending on the compaction hazard, as defined in the FPC hazard assessment guidebook [1] . On High and Very High Compaction Hazard sites both depth criteria apply. **No evidence of compaction is required to assess ruts.**

Definition Criteria

Impressions or ruts in the soil that are at least 30 cm wide and 2 meters long with depth measured as follows:

1. **On all sites: a minimum of 15 cm** at the deepest point in the perpendicular cross section, when measured from the top of the undisturbed forest floor to the top of the intact forest floor in the rut, or the mineral soil surface if forest floor is not present in the rut. The rut must be 15 cm deep over the entire length of 2 meters. Ignore any accumulations of slash, needles or other organic debris that accumulated in the rut or on the adjacent undisturbed forest floor during harvesting operations when making this assessment.
2. **On sites with a High or Very High Compaction Hazard:** a minimum of 5 cm at the deepest point in the perpendicular cross section, when measured from the undisturbed mineral soil to the mineral soil surface in the rut. The rut must be 5 cm deep over the entire length of 2 meters.

Dispersed Trails: Repeated Machine Traffic ("E")

General Description

This category describes disturbance where there is evidence of repeated, heavy machine traffic, but where ruts are not visible.

This type of disturbance typically occurs where there has been heavy machine traffic on repeatedly used skid trails which are obvious linear features. "Repeated use" generally means 3 or more passes over the same location on the ground. This disturbance may also occur on heavy traffic areas in roadside landings and around piles constructed by windrowing or round piling slash.

On Moderate to Very High Compaction Hazard sites logged under moist conditions, compaction may occassionally result from fewer than 3 passes of heavy equipment. This disturbance rarely occurs on Moderate or Low Compaction Hazard soils logged under dry conditions, where random skidding operations have limited the the use of trails to 1 or 2 passes.

Repeated Machine Traffic is counted on all sites.

Definition Criteria

1. **The survey point shows evidence of compaction (see "Assessing Compaction" below).**

[1] Hazard Assessment Keys for Evaluating Site Sensitivity to Soil Degrading Processes Guidebook (June 1995).

2. **In addition,** there is either evidence of compaction in 100% of a 1 x 2 meter rectangle, **or** there must be a combination of the following attributes covering 100% of a 1 x 2 meter rectangle:

   - exposed mineral soil
   - forest floor, fine slash or woody debris crushed into the mineral soil
   - forest floor crushed or scraped to 1/2 of its original depth, with evidence of repeated machine traffic
   - evidence of large roots, vegetation or stumps which have been scraped by repeated machine traffic.
   - bedrock, coarse fragments or large roots exposed by repeated machine traffic

   These attributes are taken as an indication the compaction at the point also exists in the entire 1 x 2 meter rectangle. When present it is not necessary to dig in the circle.

   If you do dig and find that the rectangle is not 100% compacted, then do not call the disturbance Repeated Machine Traffic.

3. Include as Repeated Machine Traffic, survey points which fall on rocks or stumps that are **surrounded** by disturbance that would be classified in this category.

Assessing Compaction

Any one of the 3 conditions listed below is considered to be compacted soil (compacted mineral soil, puddled mineral soil, compacted deposits of slash and organic debris).

1. **Mineral soil compaction is assessed relative to conditions in the adjacent undisturbed soil** (e.g. soil texture may change within the survey area). The specific criteria to use in assessing compaction will depend on the difference in moisture content in the undisturbed and disturbed soils. Any one of the following attributes defines a compacted condition:

   a) Coarse platy structure. The excavated soil breaks apart in consolidated plates that are typically 1 cm or greater in thickness. This structure is not evident in the adjacent undisturbed soil.

   b) Massive soil showing a loss of the normal structure evident in the undisturbed soil.

   c) A noticeable change in density. If the disturbed and undisturbed soils have the same moisture content, the changes in density may be recognized by any one of the following characteristics:

      - a difference in resistance to shovel penetration
      - a difference in resistance to crushing between the thumb and index finger, blocks of soil that are 2.5 cm thick

2. **Puddling** is characterized by the presence of any one of the following conditions:

   a) a loss of the normal structure evident in the undisturbed soil.

   b) the deposition of fine mineral particles on the soil surface

   c) organic material ground into the mineral soil

3. **Compacted deposits of forest floor, fine slash and woody debris** overlying the mineral soil that cannot be readily excavated with a shovel (e.g. deposits of compacted cribbed-in slash on winter skid trails that are deeper than 20 cm, and are not plantable)

Deep Gouge ("G")

Mineral soil gouged deeper than 30 cm, or to bedrock at the survey point.

Measure from the undisturbed mineral soil surface to the mineral soil surface evident at the time of the survey. In other words, do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 30 cm. A "mineral soil deposit" must have at least 70% mineral soil, and not contain large air pockets created by buried slash.

This disturbance is counted on all sites.

Long Gouge ("L")

Mineral soil gouged deeper than 5 cm, or to bedrock at the survey point, and on over 100% of a 1.0 x 3.0 metre rectangle.

Measure to the depth of the mineral soil surface evident at the time of the survey using the same procedure described for Deep Gouges (i.e. do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 5 cm).

This disturbance is counted on all sites.

Wide Gouge ("W")

Mineral soil gouged deeper than 5 cm, or to bedrock at the survey point, and on over 80% of a 1.8 x 1.8 metre square.

Note: 80% of a 1.8 x 1.8 m square is equivalent to 100% of areas that are 1.44 x 1.8 m, or 1.61 x 1.61 m.

Measure to the depth of the mineral soil surface evident at the time of the survey using the same procedure described for Deep Gouges (i.e. do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 5 cm).

This disturbance is counted on all sites.

Very Wide Scalp ("V")

Forest floor removed at the survey point, and on over 80% of a 3.0 x 3.0 metre square.

Note: 80% of a 3.0 x 3.0 m square is equivalent to 100% of areas that are 2.40 x 3.0 m, or 2.68 x 2.68 m.

Forest floor is considered removed when there is:

- exposed mineral soil
- exposed mineral soil covered by fine woody slash, undecomposed needles or dislodged rotten wood
- exposed mineral soil covered by dislodged forest floor that is less than 50% of the adjacent undisturbed forest floor depth

Forest floor is **not removed** when it is:

- intact forest floor of any depth (see "intact forest floor" below)
- mixed forest floor and mineral soil (see "mixed forest floor" below)
- exposed mineral soil covered by dislodged forest floor that is $\geq$ 50% of the adjacent undisturbed forest floor depth.

Intact forest floor typically shows the presence of roots growing into the mineral soil.

Mixed forest floor is a non-compact layer at least 5 cm thick at the surface with at least 50% incorporated forest floor.

Dislodged forest floor must be of similar character to the adjacent undisturbed forest floor to be acceptable.

This disturbance is counted on all sites.

Wide Scalp ("S")

Forest floor removed at the survey point, and on over 80% of a 1.8 x 1.8 metre square.

Note: 80% of a 1.8 x 1.8 m square is equivalent to 100% of areas that are 1.44 x 1.8 m, or 1.61 x 1.61 m.

Use the same definition of forest floor removal described for the Very Wide Scalp category.

This disturbance is counted when there is:

- High or Very High Mass Wasting Hazard
- High or Very High Forest Floor Displacement Hazard
- Very High Soil Displacement Hazard
- Very High Compaction Hazard
- Very High Surface Erosion Hazard

Continuous Scalp ("C")

Mineral soil exposed at the survey point, and continuously exposed for a length of 5 meters.

This disturbance is counted when there is:

- High or Very High Mass Wasting Hazard
- High or Very High Surface Erosion Hazard
- Very High Soil Displacement Hazard

Table 4 Summary of Changes in Soil Disturbance Classification under the Forest Practices Code

Corresponding Categories		Description of Differences under the FPC
1994 Silviculture Regulation	**Forest Practices Code**	
Skidroad ("R")	Excavated/ Bladed/Trail ("R")	1. The cutbank height must be at least 30 cm. 2. The excavated width must be at least 1.5 meters. 3. Include the fill slope to where it is continuously 20 cm deep if it is an "unfavorable growing medium" as defined on the Silviculture Prescription, otherwise include only the compacted running surface.
Extensive Uniform Compaction ("E")	Repeated Machine Traffic ("E")	1. The dimensions assessed have changed: compaction or visual indicators must be evident over 100% of a 1 x 2 meter rectangle. Previously the area assessed was 75% of a 2 meter diameter circle. 2. Under the FPC this category is now assessed on all sites. Previously it was not assessed on Low Compaction Hazards. **Note:** field procedures for assessing Extensive Uniform Compaction have also been amended from the 1994 field season (see Appendix 1).
Wheel/Track Ruts ("T")	same	1. No evidence of compaction is required. 2. The depth criteria are changed (length and width criteria are the same): • **On all sites:** a minimum of 15 cm deep, measured from the top of the forest floor; • **On sites with a High or Very High Compaction Hazard:** a minimum of 5 cm, measured from the top of the undisturbed mineral soil
Wide Gouge ("W")	same	The depth criteria is now gouged deeper than 5 cm, instead of greater than or equal to 5 cm. Mineral soil deposits in gouges are also treated differently. The new procedure is to measure from the undisturbed mineral soil surface to the mineral soil surface evident at the time of the survey. In other words, do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 5 cm. A "mineral soil deposit" must have at least 70% mineral soil, and not contain large air pockets created by buried slash.

Table 3 Forest Practices Code Allowable Soil Disturbance and Forest Floor Displacement

Leading Soil Disturbance Hazard	Soil sensitivity rating	Categories Counted in Allowable Soil Disturbance[1,2]	Allowable Soil Disturbance (% NAR)[2]		Allowable Forest Floor Displacement (% NAR)
			Coast & Interior		Coast & Interior
Mass wasting	VH	Always + S + C	5		5
Surface soil erosion	VH	Always + S + C	5		15
Soil displacement	VH	Always + S + C	5		15
Mass wasting	H	Always + S + C	5		25
Soil compaction	VH	Always + S	5		25
			Coast	Interior	Coast & Interior
Surface soil erosion	H	Always + C	5	10	25
Mass wasting	M, L	Always	5	10	30
Surface soil erosion	M, L	Always	5	10	30
Soil displacement	H, M, L	Always	5	10	30
Soil compaction	H, M, L	Always	5	10	30
Forest floor displacement	VH, H	Always + S	5	10	30
Forest floor displacement	M, L	Always	5	10	30

[1] "Always" includes soil disturbance that is always counted, namely: excavated/bladed trails, compacted areas, corduroyed trail, repeated machine traffic, ruts, deep gouges, long gouges, wide gouges, and very wide scalps (see Appendix 1 for definitions).

"S": Wide Scalps, "C": Continuous Scalps (see Appendix 1 for definitions).

[2] Combine the categories measured for different hazard ratings if that will result in more categories being counted, or a lower allowable disturbance limit. For example, on a site with a Very High Compaction Hazard, and a High Surface Erosion Hazard the categories counted would be "Always + S + C", and the counted disturbance limit would be 5%.

Notes:

Table 4 Summary of Changes in Soil Disturbance Classification under the Forest Practices Code (continued)

New Categories in the FPC		Notes
Deep Gouge ("G")	new	The depth criteria is now gouged deeper than 30 cm, instead of greater than or equal to 30 cm. Measure mineral soil deposits in the gouge as described under "Wide Gouges" on the preceeding page.
Long Gouge ("L")	new	The depth criteria is now gouged deeper than 5 cm, instead of greater than or equal to 5 cm. Measure mineral soil deposits in the gouge as described under "Wide Gouges" on the preceeding page.
Very Wide Scalp ("V")	new	Dimensions are the same. A scalp is where there is forest floor removal. The definition of "forest floor removal" has changed slightly. Forest floor is considered removed when there is: • exposed mineral soil • exposed mineral soil covered by fine woody slash, undecomposed needles or dislodged rotten wood • exposed mineral soil covered by dislodged forest floor that is less than 50% of the adjacent undisturbed forest floor depth Refer to Section 2 or Appendix 1 for a complete definition.
Wide Scalp ("S")	new	Dimensions are the same. See the new definition of "forest floor removal" described for Very Wide Scalps. Refer to Section 2 or Appendix 1 for a complete definition.
Continuous Scalp ("C")	new	See Section 2 or Appendix 1 for a complete definition.
Corduroyed Trail ("Y")	new	See Section 2 or Appendix 1 for a complete definition..
Compacted Area ("A")	new	See Section 2 or Appendix 1 for a complete definition.

Reconnaissance Survey - Field Layout

Transect Location

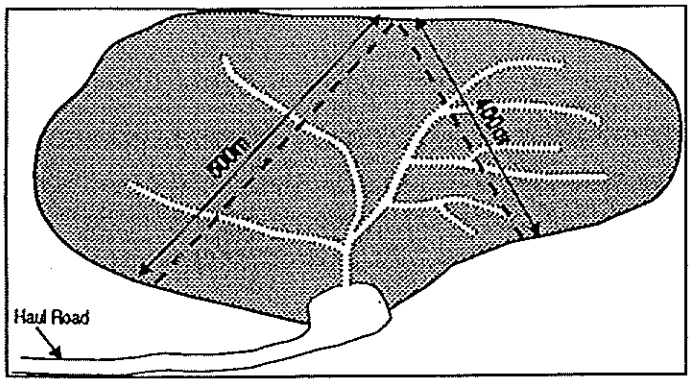
Transect layout is flexible, and can be adapted to the size and shape of the area and disturbance distribution. The configuration of transects can be any of the following:

Transect Layout	Application
2 long transects that are not parallel	most common method: suitable for most SU's
Sawtooth pattern	narrow (< 200 m) areas
Triangle pattern	use only where soil disturbance is randomly oriented
A single diagonal line	monitoring operations in progress
A series of parallel lines	suitable in all SU's where more detailed assessments are required

Notes:

Reconnaissance Survey - Pacing Method

Planning the Survey



Survey points are assessed at equal spacing along the transect.

Calculate your point spacing as follows.

1. Use a target of at least 300 - 400 survey points. Use more points or transects if you require more accurate results.

$$\text{e.g. } \frac{\text{900 m transect}}{\text{300 points}} = \text{3.0 meters}$$

2. Calibrate the point spacing to your pace:

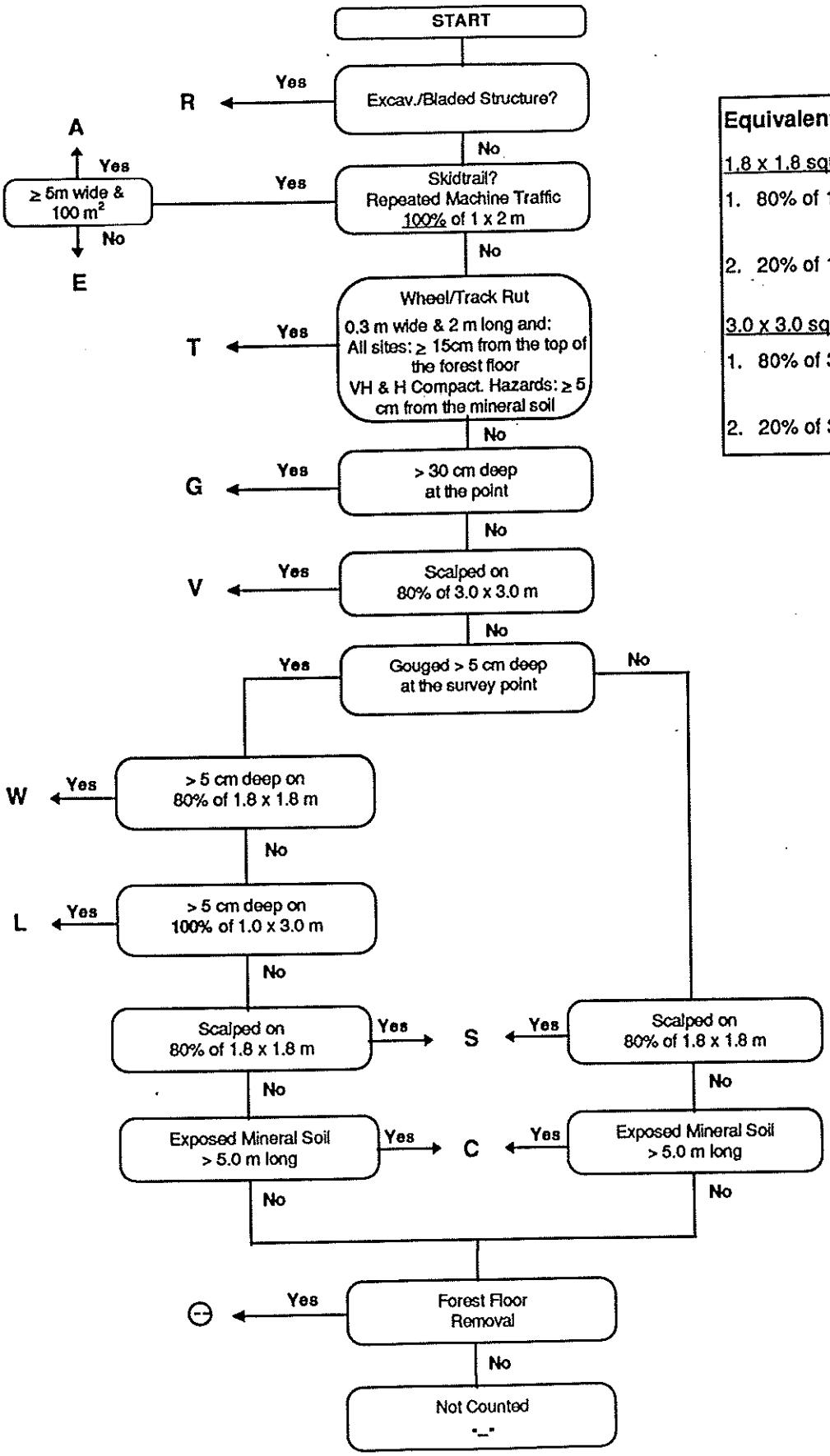
   3.0 m x 1.23 paces / m = 3.69 ⟶ 3 paces between points

   KEY: Always round down. If you round up, you will obtain fewer than your target number of sample points.

3. Record field data as shown on the example.

Notes:

Appendix 3 Soil Disturbance Classification Flow Chart



Equivalent Dimensions:

1.8 x 1.8 squares

1. 80% of 1.8 x 1.8 m = 100% of 1.61 x 1.61 m
   = 100% of 1.44 x 1.8 m
2. 20% of 1.8 x 1.8 m = 0.8 x 0.8 m

3.0 x 3.0 squares

1. 80% of 3.0 x 3.0 m = 100% of 2.68 x 2.68 m
   = 100% of 2.40 x 3.0 m
2. 20% of 3.0 x 3.0 m = 1.34 x 1.34 m

Summary of Soil Disturbance Categories

Disturbance Surveyed After Harvesting

Code	Category
R	Skid Roads
E	Extensive Uniform Compaction (Unbladed Skid Trails)
W	Wide Gouges (Skid Trails)
T	Wheel / Track Ruts

Disturbance Surveyed After MSP

Code	Category	
G	Deep Gouges	Always Counted
W	Wide Gouges	
L	Long Gouges	
V	Very Wide Scalps	
S	Wide Scalps	Sometimes counted
C	Continuous Scalps	
O	Other Scalps and Gouges	Counted in Total Displacement

Not Counted or Not Surveyed

-	Not Counted (Undisturbed, etc.)
X	Not Surveyed

Soil Disturbance Definition Document

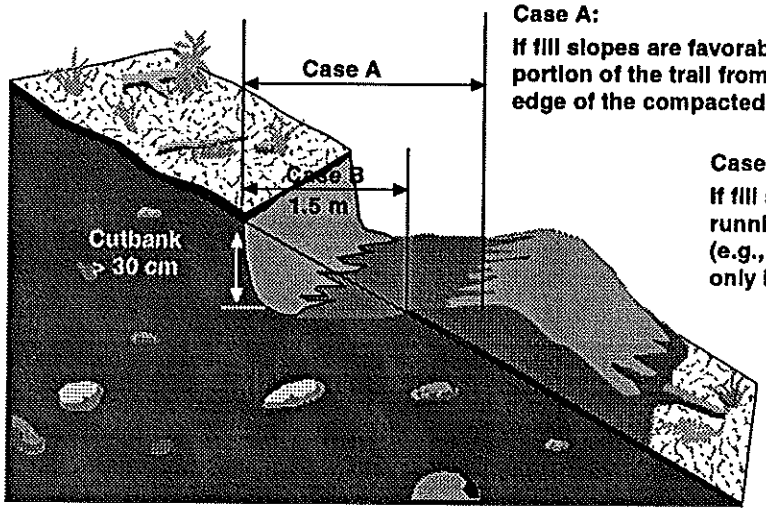
Under the Forest Practices Code disturbance to the soil must meet minimum size criteria before it is counted as a category of detrimental soil disturbance. In this agreement each specific category of soil disturbance will be defined and illustrated so the contractor can avoid creating categories of disturbance that will be counted.

Excavated or Bladed Trails of a Temporary Nature

Excavated or bladed trails are constructed trails with an excavated width greater than 1.5 m and a depth of excavation into mineral soil exceeding 30 cm. The construction of excavated or bladed trails requires prior approval in a logging plan or silviculture prescription. If the rehabilitation of temporary excavated or bladed trails is not carried out, these structures contribute towards counted soil disturbance. If trails are constructed (for fire guards, planter access, etc.) so the depth of excavation into mineral soil is less than 30 cm, they will not meet the legal definition of excavated or bladed trails.

Soil disturbance in association with excavated or bladed trails will be assessed in different ways depending on whether the fill slope material is favorable or unfavorable for growing trees. The following diagrams illustrate these points.

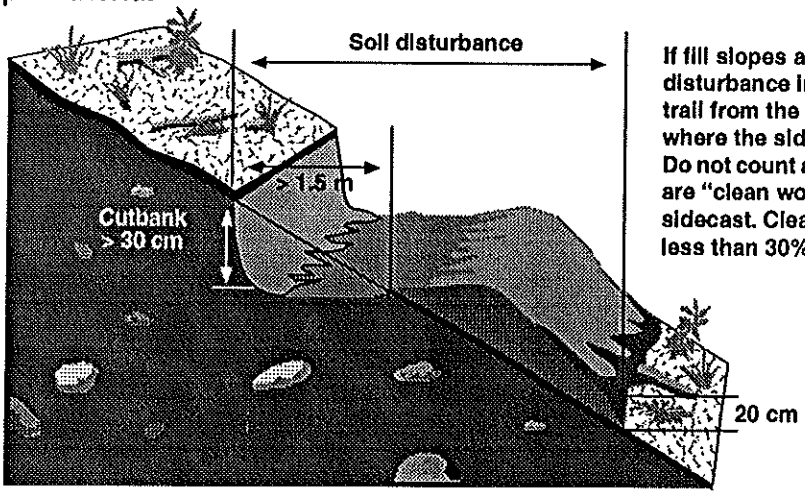
Favorable Fill Slope Material



Case A:
If fill slopes are favorable – soil disturbance includes any portion of the trail from the top of the cut to the outside edge of the compacted running surface.

Case B:
If fill slopes are favorable and the running surface is not compacted (e.g., a winter trail), soil disturbance only includes the excavated area.

Unfavorable Fill Slope Material



If fill slopes are unfavorable – soil disturbance includes any portion of the trail from the top of the cut to the point where the sidecast fill is >20 cm deep. Do not count accumulations of slash that are "clean woody debris" as part of the sidecast. Clean woody debris contains less than 30% mineral soil.

Initials (Contractor)	Initials (Province)

Corduroyed Trails

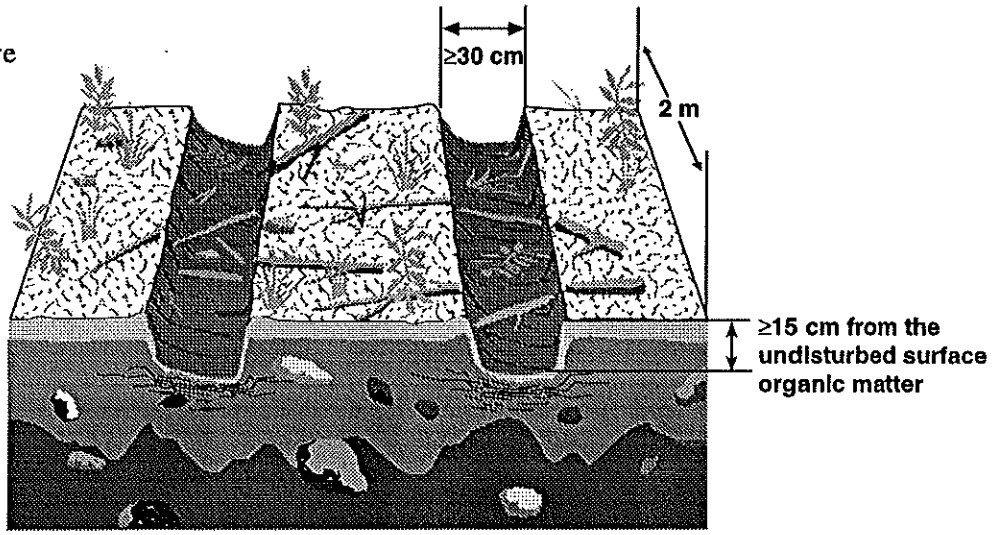
Corduroyed trails are trails where logs and woody debris placed side by side form a surface greater than 2 m in length, capable of supporting equipment traffic. Tree tops and limbs placed in front of equipment to distribute machine load and reduce soil compaction should not be considered a corduroyed trail unless they prevent the establishment of regeneration at close to target stocking. Corduroyed trails require rehabilitation in accordance with the *Forest Practices Code Act* and regulations.

Wheel/Track Ruts

Wheel/track ruts are impressions in the soil caused by machine traffic. There are two different categories of wheel/track rut disturbance.

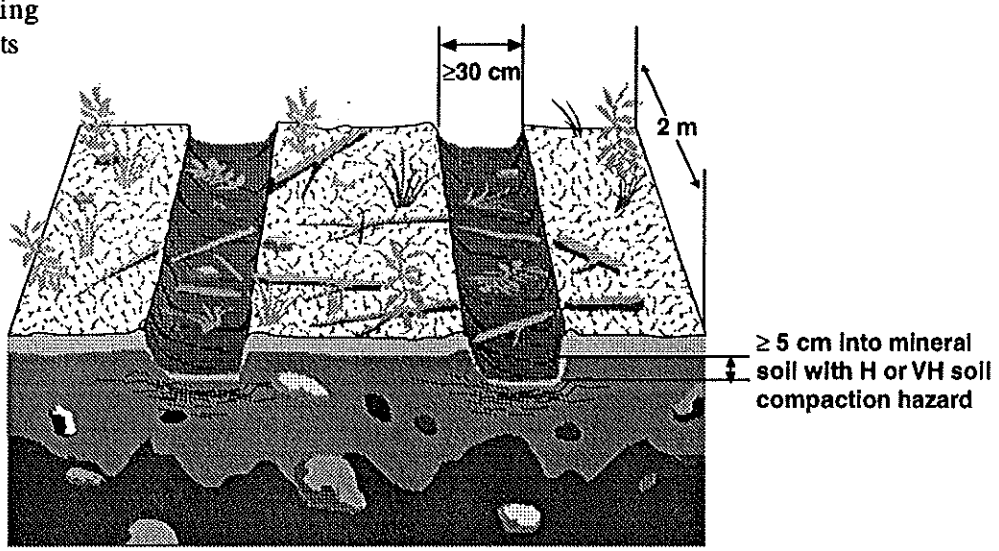
15 cm Deep Wheel/Track Ruts

Fifteen cm deep wheel/track ruts are impressions in the soil that are at least 30 cm wide, 2 m long and have a depth of at least 15 cm at the deepest point in the cross section of the rut over the entire length of 2 m. Depth is measured from the undisturbed surface organic matter to whatever soil material (mineral or organic) is present in the bottom of the rut. The 15 cm deep wheel/track ruts count as soil disturbance on all sites.



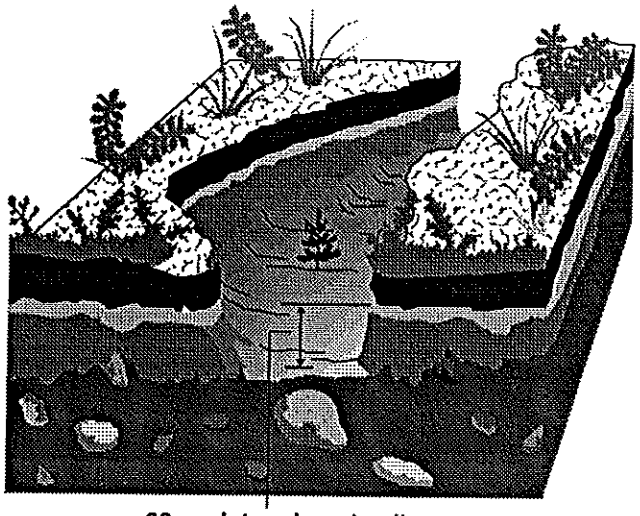
5 cm Deep Wheel/Track Ruts

Five cm deep wheel/track ruts are impressions in the mineral soil that are at least 30 cm wide, 2 m long and have a depth of at least 5 cm at the deepest point in the cross section of the rut over the entire length of 2 m. Depth is measured from the undisturbed mineral soil surface to the mineral soil surface in the bottom of the rut. If forest floor is present in the bottom of the rut, gently brush it aside to expose the underlying mineral soil. The 5 cm deep wheel/track ruts count on sites with a high or very high soil compaction hazard or where the soil compaction hazard has not been assessed in accordance with section 39(3)(a)(ii) of the *Operational Planning Regulation*.



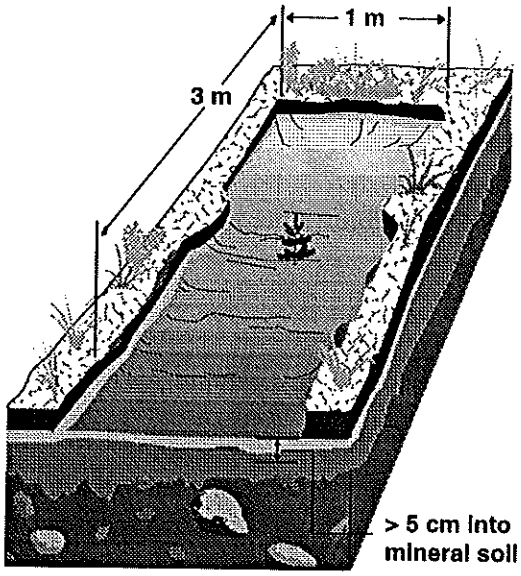
Deep Gouge

A deep gouge is an excavation into mineral soil that is deeper than 30 cm (measured from the undisturbed mineral soil surface), or to the depth of underlying bedrock. This disturbance counts on all sites.



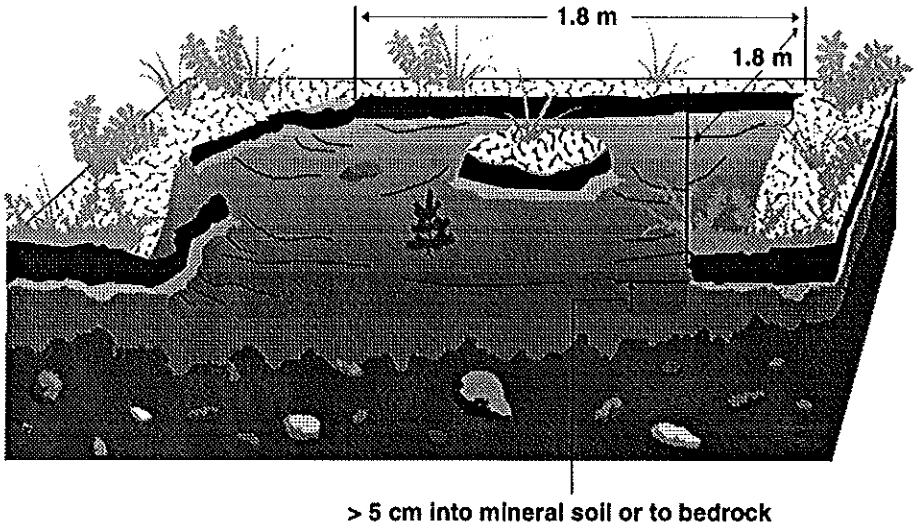
Long Gouge

A long gouge is an excavation into mineral soil that is deeper than 5 cm (measured from the undisturbed mineral soil surface), or to bedrock on 100% of a 1.0 × 3.0 m rectangle. This disturbance counts on all sites.



Wide Gouge

A wide gouge is an excavation into mineral soil that is deeper than 5 cm (measured from the undisturbed mineral soil surface) or to bedrock on at least 80% of a 1.8 × 1.8 m area. This disturbance counts on all sites.



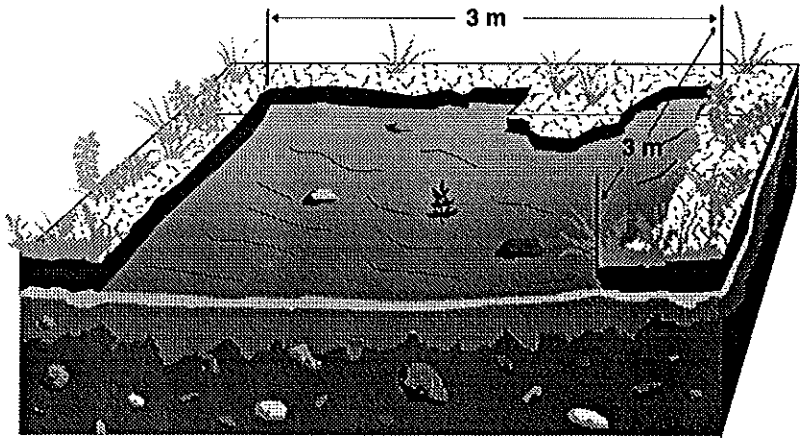
Very Wide Scalp

A very wide scalp has forest floor removed on over 80% of a 3.0 × 3.0 m area. This disturbance counts on all sites.
Forest floor **is** removed when there is:

- exposure of underlying mineral soil due to the complete removal of the forest floor
- exposed mineral soil covered by fine woody slash, undecomposed needles or dislodged rotten wood
- exposed mineral soil covered by dislodged forest floor that is less than half the thickness of the adjacent undisturbed forest floor.

Forest floor **is not** removed when there is:

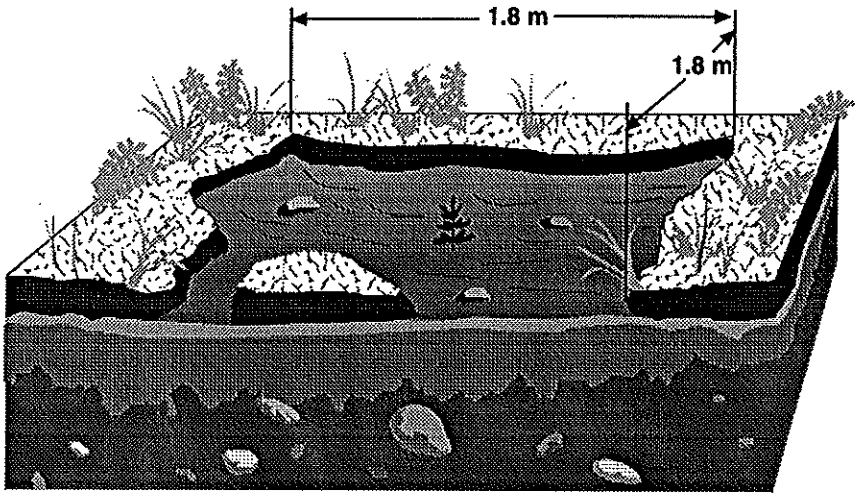
- intact forest floor of any depth typically showing the presence of roots growing into the mineral soil
- mixed forest floor and mineral soil as a result of site preparation mixing treatment
- exposed mineral soil covered by dislodged forest floor that is greater than half the thickness of the adjacent undisturbed forest floor. Dislodged forest floor must be of similar character to the adjacent undisturbed forest floor to be acceptable.



Wide Scalp

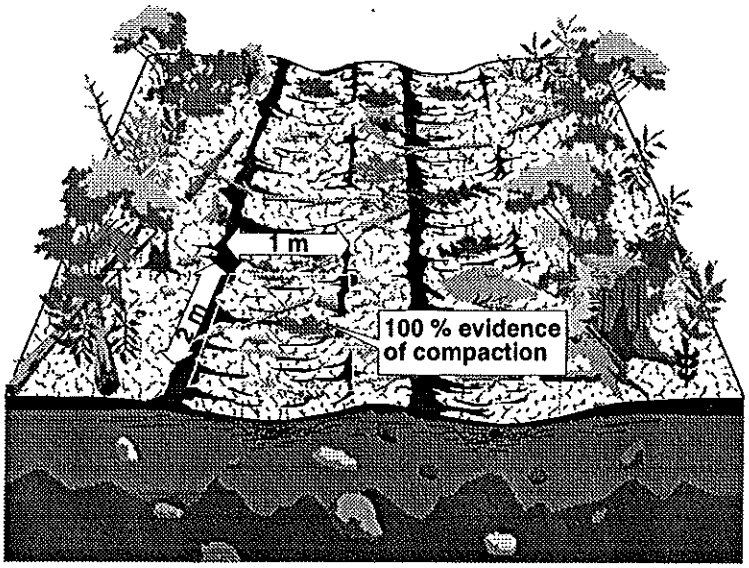
A wide scalp has forest floor removed on over 80% of 1.8 × 1.8 m area. This disturbance is counted where there is:

- very high soil displacement hazard
- very high compaction hazard
- very high soil erosion hazard
- moderate or high likelihood of landslides
- or where soil hazards have not been assessed in accordance with section 39(3)(a)(ii) of the *Operational Planning Regulation.*



Repeated Machine Traffic

Repeated machine traffic consists of evidence of soil compaction or repeated heavy machine traffic on 100% of a 1.0 × 2.0 m rectangle. This disturbance counts on all sites except where a low compaction hazard has been assessed.



Evidence of Compaction

Any of the conditions listed below is considered to be evidence of compaction (compacted mineral soil, puddled mineral soil, compacted deposits of slash and organic debris).

1. Mineral soil compaction is assessed relative to conditions in the adjacent undisturbed soil. Any one of the following attributes defines a compacted condition:
   - *Coarse platy structure.* The excavated soil breaks apart in consolidated plates that are typically 1 cm or greater in thickness. This structure is not evident in the adjacent undisturbed soil.
   - *Loss of the normal structure evident in the undisturbed soil.*
   - *A noticeable change in density.* If the disturbed and undisturbed soils have the same moisture content, the changes in density may be recognized by any one of the following characteristics:
     - a difference in resistance to shovel penetration
     - a difference in resistance to crushing between the thumb and index fingers of blocks of soil that are 2.5 cm thick.
2. Compacted deposits of forest floor, fine slash and woody debris overlying the mineral soil that cannot be readily excavated with a shovel (e.g., deposits of compacted and cribbed-in slash on winter skid trails that are deeper than 20 cm).

Compacted Areas

A compacted area is an area of soil >100 m^2 and >5 m wide that has been compacted by equipment travelling over the area. It has the same characteristics and is counted as soil disturbance on the same sites as repeated machine traffic areas. Compacted areas require rehabilitation in accordance with the *Forest Practices Code Act* and regulations.

Sometimes Counted Categories of Soil Disturbance

The following categories of soil disturbance only count on more sensitive sites or where soil hazards have not been assessed. They are referred to as *sometimes counted* categories of soil disturbance.

1. 5 cm Deep Wheel/Track Ruts
2. Repeated Machine Traffic
3. Wide Scalp
4. Compacted Area

The Work Plan Maps should indicate if any of these *sometimes counted* categories of soil disturbance count on specific treatment units. If the Work Plan Maps do not contain this information, the contractor must avoid the creation of any of the *sometimes counted* categories of soil disturbance.

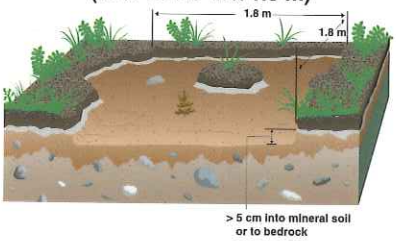
Always Counted

Deep Gouge



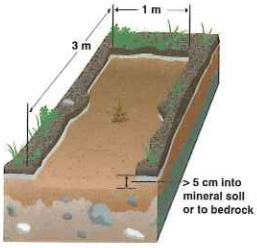
> 30 cm into mineral soil or to bedrock

Wide Gouge
(80% of 1.8 m x 1.8 m)



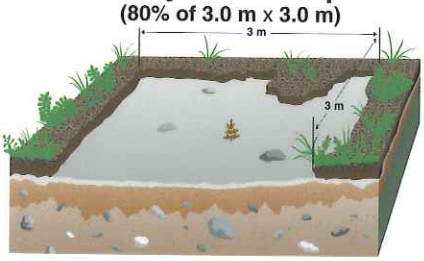
> 5 cm into mineral soil or to bedrock

Long Gouge
(100% of 1.0 m x 3.0 m)



> 5 cm into mineral soil or to bedrock

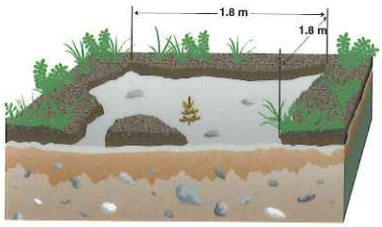
Very Wide Scalp♦
(80% of 3.0 m x 3.0 m)



♦ Scalp means the forest floor has been removed.

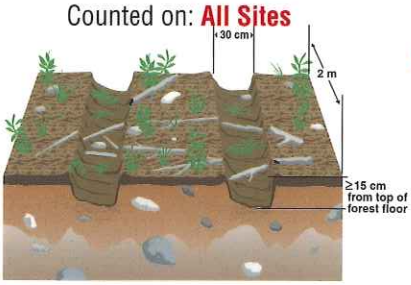
Wide Scalp♦
(80% of 1.8 m x 1.8 m)

Counted when: VH soil displacement, compaction or erosion; **or** moderate or high likelihood of landslides; **or** the soil hazards have not been documented in an operational plan.

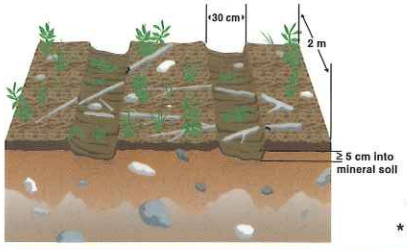


Forest Practices Branch
B.C. Ministry of Forests
Soil Disturbance Card Feb/99

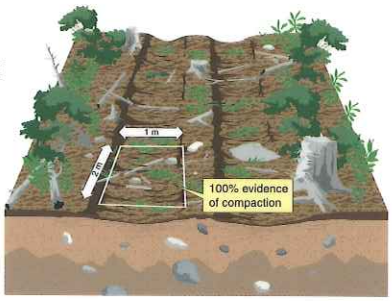
Wheel/Track Rut
Counted on: **All Sites**



Wheel/Track Rut
Counted on: **Very High and High Compaction Hazard Sites**
or where soil hazards have not been documented in an operational plan.



Repeated Machine Traffic
Counted on: **Very High, High and Moderate Compaction Hazard Sites**
or where soil hazards have not been documented in an operational plan.



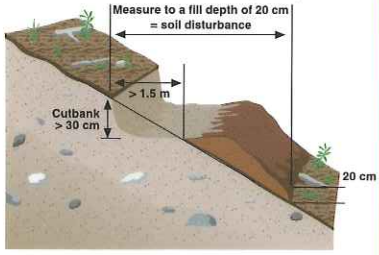
Compacted Areas*: counted on same sites as "repeated machine traffic," illustrated above, but compacted areas are larger (i.e., must be >100 m² and > 5 m wide).

Corduroyed Trail*: logs and woody debris placed side-by-side to form a surface > 2 m long capable of supporting machine traffic.

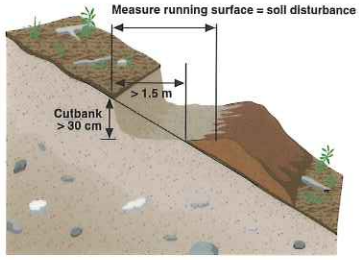
*Must be rehabilitated unless exempted by district manager.
**Must be preapproved and may require rehabilitation.

Temporary Excavated/BladedTrails**

Unfavorable Fill Slope Material
(won't support tree growth)



Favorable Fill Slope Material



C.P. _____ Contractor:_____
Block _____ Spacing: _____

Date

	Line	1	2	3	4	5	6	7	8	9	10	Total

SUMMARY: % Dist.=(# Plots Dis. / Plots) x 100

	Running Total (# Plots & Plots Dis.) Plot Survey
Date: _____ #Plots ____ #Plots Dis. _____ %Dis. _____	#Plots _____ #Plots Dis. ____ %Dis._____
Date: _____ #Plots ____ #Plots Dis. _____ %Dis. _____	#Plots _____ #Plots Dis. ____ %Dis._____
Date: _____ #Plots ____ #Plots Dis. _____ %Dis. _____	#Plots _____ #Plots Dis. ____ %Dis._____
Date: _____ #Plots ____ #Plots Dis. _____ %Dis. _____	#Plots _____ #Plots Dis. ____ %Dis._____
Date: _____ #Plots ____ #Plots Dis. _____ %Dis. _____	#Plots _____ #Plots Dis. ____ %Dis._____
Date: _____ #Plots ____ #Plots Dis. _____ %Dis. _____	#Plots _____ #Plots Dis. ____ %Dis._____

Additional Comments:

Instructions: In order to carry out boot surveys the following should be followed:

1) Choose a bearing which will best cover the area to be surveyed.
2) Prior to starting, decide on an appropriate spacing for your plot centers (ie.every 5 steps).
3) Remain consistent and unbiased when performing the survey.
4) At each plot center, determine if there is disturbance (as described on Site Deg. Cards).
5) Record findings on this form and keep records available in the field.

Appendix 13: Mixedwood Management Guidelines

Fort St. John Pilot Project

Mixedwood Management Guidelines

May 7, 2010



MIXEDWOOD MANAGEMENT GUIDELINES UNDER THE FORT ST. JOHN PILOT PROJECT SFMP

Guideline Objectives

The guidelines are designed to provide foresters with the direction for choosing and managing reforestation pathways that will produce successful mixedwood stands at the landscape level and meet the commitments made in the Sustainable Forest Management Plan (SFMP). It will also be an evolving document that can incorporate new ideas, science and methodologies, as they become better known.

The objective of this mixedwood management strategy is:

- To describe the method for classifying and tracking forest types for forest management purposes.
- To describe some possible methods that will be implemented to achieve the desired future forest conditions and forest types described in the SFMP.

Background

In the SFMP Section 4.7 Reforestation Strategy, states that the participants must declare to reforest an area within a cutblock as a coniferous area, a deciduous area or a mixed wood area. The prescribing and implementing foresters are responsible to ensure stocking on the site is managed to provide forest establishment sufficient to meet the landscape level targets. This section also says that the short-term mixedwood management strategy will be achieved primarily through reforestation strategies that maintain **separate deciduous and coniferous strata**. The reforestation guideline will involve approaches that stratify the area to be reforested into discrete deciduous and coniferous strata.

Boreal mixedwood forests will be sustained by managing forest type distribution as per Section 5.1 Forest Types indicates the percent distribution of forest type (deciduous, deciduous mixedwood, conifer mixedwood, conifer) >20 years old by landscape unit.

Classifying and Tracking Forest Types

In accordance with the Fort St. John Pilot Project Regulation (FSJPPR) and SFMP, the participants will declare to reforest the cutblock as a coniferous area, a deciduous area, or a mixedwood area in the Site Level Plan by incorporating the appropriate stocking standards. The mixedwood forest type area will be further defined into deciduous leading or coniferous leading mixedwoods.

Initial Cutblock Classification

The following process will be used to categorize a cutblock into a forest type class:

Prescribing foresters will review the gross volume for a grouping of blocks such as in a Timber Sales Licence or Timber mark grouping. This grouping of blocks may be larger if more blocks are ready to be submitted for declaration and are in close vicinity (for example, blocks managed by the same participant but being harvested under different licenses). The source of the volume statistics shall be the timber cruise block-method compilation summary. Forest Types shall be classified according to the percentage of gross volume by species type. The species types are **coniferous** and **deciduous**. The tree species included in each species group, and the corresponding cruising codes, are listed in the following table.

SPECIES TYPE	TREE SPECIES	CRUISE COMPILATION CODE
Coniferous	White spruce (*Picea glauca*)	S
	Black spruce (*Picea mariana*)	S
	Lodgepole pine (*Pinus contorta*)	PL
	Subalpine fir (*Abies lasiocarpa*)	B
	Tamarack (*Larix laricina*)	L
Deciduous	Trembling aspen (*Populus tremuloides*)	AT
	Balsam poplar (*Populus balsamifera*)	AC
	Paper birch (*Betula papyrifera*)	E

If the leading species type in the block contains greater than 75% of the gross volume, it shall be considered 'pure' Forest type – either 'pure' deciduous or 'pure' coniferous. If the species types are between 25% and 75% of the gross volume, the block shall be classified as a 'mixedwood' Forest type – either deciduous-leading or conifer-leading mixedwood.

Defining Initial Area targets

The process for defining area targets is designed to give prescribing foresters a method for assigning the original declarations on a Standard Unit (SU). The areas determined in this original forest type declaration will form the baseline proportions in each ledger population described in section C below for future balancing. This process for defining the area targets is described below:

- If the block is considered pure coniferous (>75% conifer), then 100% of the NAR will be tallied toward coniferous stand management.

- If the block is considered pure deciduous (>75% deciduous), then 100% of the NAR will be tallied toward deciduous stand management.
- If the block is considered a conifer leading mixedwood site (50 to 75% coniferous), then minimum of 51% of the NAR is tallied toward coniferous stand management and a maximum of 74% of the NAR is tallied toward coniferous stand management.
- If the block is considered a deciduous leading mixedwood site (50 to 75% deciduous), then minimum of 51% of the NAR is tallied toward deciduous stand management and a maximum of 74% of the NAR is tallied toward deciduous stand management.
- Once the areas have all been accounted within the grouping of blocks, the prescribing foresters will stratify standard units (SU), assign the appropriate SU forest types, assign stocking standards and develop silviculture regimes for each cutblock designed to achieve the required area targets determined above.

Ledger System for Balancing Forest Types Over Time

In accordance with the Fort St. John pilot project SFMP landscape level reforestation strategy, the process for tracking the declaration of the forest type areas determined above needs to be flexible enough to allow Professional Foresters to exercise their professional judgment at the cutblock level to vary regimes and/or make corrective actions as required to achieve the landscape level targets.

This concept will require participants to maintain a ledger or tracking system to ensure forest type groups are maintained on the landscape within the scope of the participants' management. The ledger or tracking system should maintain a history of the original declarations as determined above. The original declarations will form the baseline proportions for balancing future area exchanges of conifer and deciduous strata. The ledger or tracking system must also track future reclassifications to ensure the original baseline proportions, as determined at the Standard Unit level (original forest type declaration), are being maintained. Progress will be tracked internally and on an annual basis.

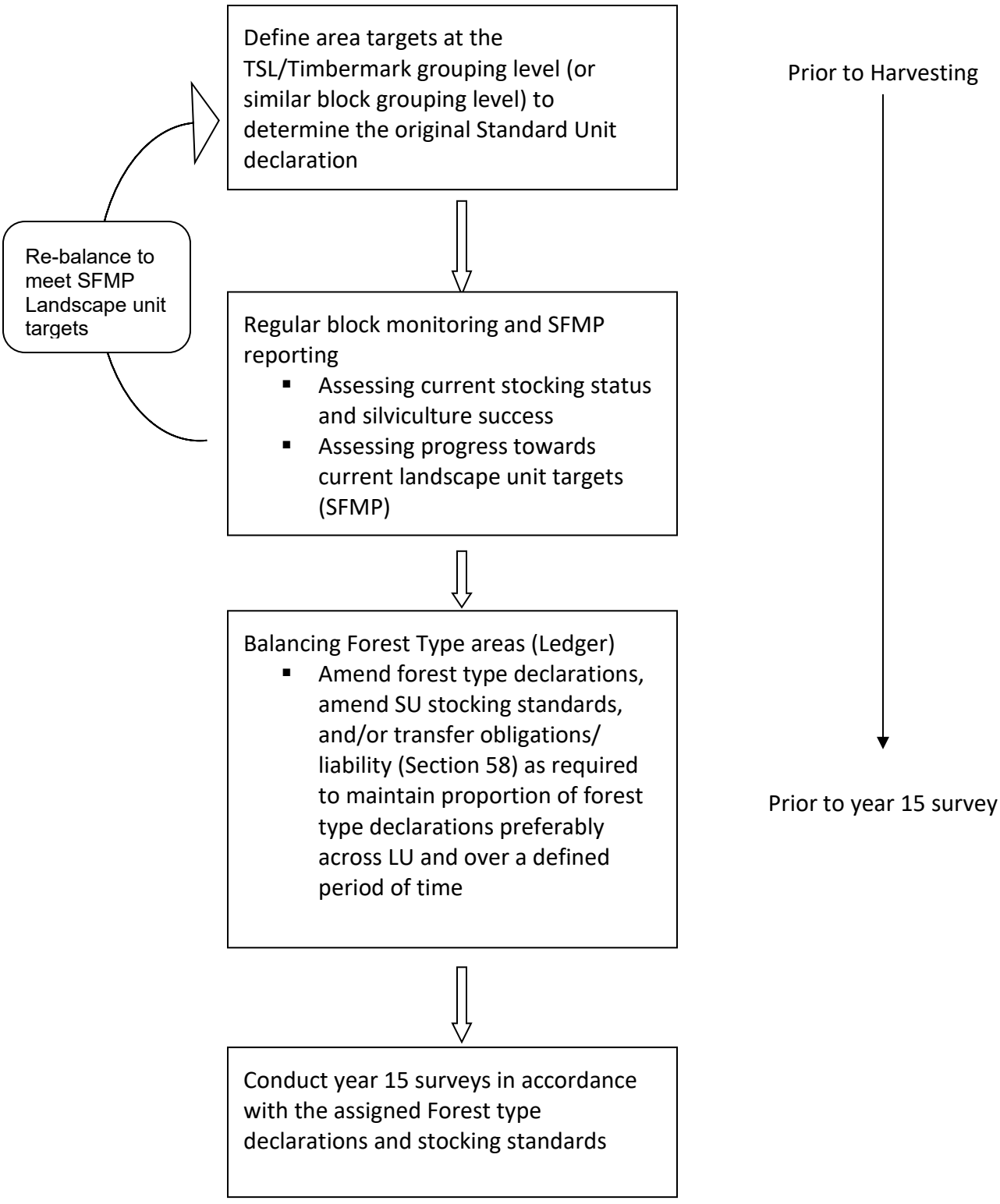
The population of standard units to be balanced should be within a defined period of time, using the harvesting commencement dates, and preferably within the same landscape unit. However, if there are not suitable areas within the landscape unit to exchange, the balancing of forest types may occur within adjacent landscape units or across the TSA provided the exchanges will not result in a landscape unit exceeding the target ranges described in the SFMP. The following general principles will be used to evaluate suitable areas for conducting a reforestation declaration exchange:

- Areas considered for exchange should have a similar site index.
- Areas considered for exchange should be verified in the field to ensure they are ecologically suitable for species changes.
- Exchanges between blocks in as close proximity as operationally feasible should be considered first prior to balancing areas across the TSA.

- Areas to be exchanged should consider the operational logistics and economics associated with establishing a different crop tree species on site.
- Area exchanges must occur between areas of similar ages as described below.
- Once standard units are declared well growing, they will not be eligible for exchange, but will remain in the population for intimate mixedwood percentage calculations.

The population of blocks will include all blocks harvested since November 15, 2001 (start of the FSJPPR), and the population of blocks upon which the intimate mixture proportion is based will not contain those with a harvest start date greater than 15 years in the past (applies beyond 2016). It is preferable that the balance be maintained across each managing participant's population of blocks and areas of liability. If managing participants would like to exchange blocks and liability for the purpose of balancing forest type areas, this exchange must be done in writing in accordance with Section 58 (Assignability) of the Fort St. John Pilot Regulation. The reclassification of forest type areas, whether done through balancing individual participant's blocks or through exchange of blocks, must be completed prior to the year-15 MSQ survey for those blocks. See figure 1 below for a summary of the overall process.

Figure 1: **Forest Type Declaration and Balancing Process**



Proposed Methods of Reforestation

The commitment for the term of the current SFMP regarding intimate mixtures of conifer and deciduous is to manage intimate mixtures on ten percent of the harvested boreal mixedwood land base as operational trials. To put this in context, during the term of SFMP #1 the Participants collectively harvested over 16,000 ha of forested lands. Of this area, over 5000 ha was from stands classified by the percentage of net merchantable volume by species as being either conifer leading or deciduous leading mixtures. This equated to over 500 ha of harvested area with commitments to manage towards intimate mixtures. It is difficult to forecast whether similar amounts of area will be managed for intimate mixtures over the term of SFMP#2 given the adjustment to gross volumes rather than net merchantable volumes as a determining factor. As well, the population of blocks considered within the management regime timeframe is expanding which will have an impact on selection decisions.

Managing for intimate mixtures as operational trials will take on a slightly different focus during the term of this SFMP and beyond. The question is not as uncertain what should be attempted operationally in the field or what might be the expected future result. There is a significant amount of research and literature that has provided a better understanding of those issues, much of which has been collected across the boreal mixedwood forests of Canada, and more specifically in northern BC and Alberta. The issue that needs to be operationally tested more fully is the regeneration standards themselves. It appears that there continues to be an overemphasis toward addressing an issue at a stand level that would be better addressed at the landscape level.

The Participants' are attempting to scope out how mixedwoods might be assessed on a landscape level during this SFMP. In the interim, the current reforestation standards will be utilized and tested. However, there should be enough flexibility to adjust stand-level plans in response to variation in early stand development (e.g., poor survival of plantations, poor establishment of aspen, etc.) (Comeau *et al*. 2005). For the purpose of the final reforestation assessment, discrete stratums of conifer would fall in the applicable 15-year population for the conifer MSQ surveys. Preferably, discrete deciduous areas would be surveyed at the same 15-year period. Assessment procedures for discrete deciduous strata will be conducted using the current free growing survey procedures until an MSQ type assessment for deciduous areas is available. Growth model trial runs are currently being completed on deciduous species so a MSQ type assessment for deciduous should be available in the near future.

Silviculture is used to direct a stand from its current condition to a desired future stand condition (Ontario Ministry of Natural Resources, 2003). To ensure a stand develops along a desired pathway, action may need to be taken before, during, and after harvest. Boreal mixedwood management often involves silviculture intervention, and in some cases repeated intervention (Ontario Ministry of Natural Resources, 2003).

The issue of boreal mixedwood management is made more complex when the desire is to prescribe site specific treatments that attempt to emulate natural disturbances and processes. Emulating natural change in species composition and stand structure is driven somewhat through understanding stand development stages. The classic natural successional pathway on boreal mixedwood sites is a change from shade-intolerant hardwood species to more shade-tolerant

conifer species (Ontario Ministry of Natural Resources, 2003). However, that is but one of many stand composition types found on these sites along the successional pathway continuum.

There are a number of literature papers that have described this pathway continuum for boreal mixedwood sites (Lieffers et *al.* 1996, Ontario Ministry of Natural Resources, 2003, Comeau *et al*. 2005.)

The key message in Table 1 is that Current State equates to current condition and based on the silviculture treatments prescribed may produce the Outcome or desired future forest condition.

Table 1: From Hawkins, C. 2003. Innovative Mixedwood Strategies for the Dawson Creek TSA. [Modified from Figure 2 in (Lieffers et al.,1996)]

Current State	First Treatment	Secondary Treatment	Outcome
1. Deciduous or Deciduous Coniferous (vigorous)	A) Clearcut (suckering) B) Late understory plant C) Early understory plant with wind protection	Understory protection	Deciduous or Deciduous-Coniferous Stands are horizontal mixes of coniferous patches and these are of different age. Stands are horizontal mixes of coniferous patches and deciduous patches and these are of different age.
2. Deciduous or Deciduous Coniferous (breaking up)	A) Clearcut (suckering) B) Understory site preparation and plant C) Clearcut, site preparation, plant	Understory protection Vegetation management	Deciduous Stands are horizontal mixes of coniferous patches and deciduous patches and these are of different age. Coniferous or Coniferous-Deciduous (Mixture)

Current State	First Treatment	Secondary Treatment	Outcome
3. Coniferous or Coniferous-Deciduous	A) Clearcut (suckering) B) Clearcut, site preparation, plant C) Clearcut, site preparation, plant D) Shelterwood E) Leave seed clusters ▪ leave for natural ▪ site preparation F) Group selection	Vegetation management Removal cut	Deciduous or Deciduous/Coniferous Deciduous/Coniferous (Mixture) Coniferous or Coniferous-Deciduous Coniferous or Coniferous-Deciduous Deciduous-Coniferous (Mixture) Deciduous-Coniferous (Mixture) Stands are small patches of intermixed deciduous and coniferous but the patches are of different ages.
4. Overstory Deciduous or Deciduous Coniferous Understory Coniferous (short even-aged)	A) Understory protection		Stands are horizontal mixes of coniferous patches and deciduous patches and these are of different age.
5. Overstory Deciduous or Deciduous Coniferous Understory Coniferous (tall even-aged)	A) Understory protection with wind protection		Stands are horizontal mixes of coniferous patches and deciduous patches and these are of different age.
6. Overstory Deciduous or Coniferous Understory Coniferous (uneven-aged)	A) Understory protection with wind protection ▪ Tall understory cut		Stands are horizontal areas of young deciduous between patches of all-aged coniferous, leading to selection system. Stands are horizontal mixes of coniferous patches and deciduous patches and these are of different age.

Current State	First Treatment	Secondary Treatment	Outcome
7. Overstory Coniferous Deciduous or Coniferous Understory (uneven-aged)	A) Understory protection with wind protection ▪ Tall understory cut B) Single tree selection		Stands are horizontal areas of young deciduous between patches of all-aged coniferous. Stands are horizontal mixes of coniferous patches and deciduous patches and these are of different age. Coniferous (all-aged)
8. Overstory Coniferous Deciduous or Coniferous (partly uneven-aged) Understory Coniferous (scattered pockets of advance growth)	A) Irregular shelterwood removal cuts		Coniferous or Coniferous Deciduous

Strategies for managing mixedwoods have been described under three general headings, depending on whether the desired stand condition is 1) a mosaic of single species groupings, 2) an intimate mixture (i.e. a mixture with a more-or-less horizontally distribution of spruce and aspen) that develops into two stories that are suitable for two stage harvesting, or 3) an intimate mixture that develops into a single story of co-dominants that is suitable for one-stage harvesting (Comeau *et al*. 2005).

To produce the desired future forest condition requires silviculture as mentioned previously. Further to the point however is that it is a silviculture suite of treatments that potentially is required, which could include the silvicultural system employed, the stand tending treatments and the regeneration standards being targeted towards.

The participants of the Fort St. John Pilot Project have employed a number of different tactics to produce desired future stand conditions over the period of the first SFMP. It is expected over the period of SFMP #2, the Participants will continue to exercise these tactics with the opportunity to introduce other approaches.

These tactics have been employed with the objective of producing a mosaic of **single species groupings:**

"Large scale" un-mix the mix (each block will be managed for pure conifer or pure deciduous),

- Utilization of a conventional clearcut silvicultural system applied on a stand to be managed as pure deciduous regenerated back naturally to deciduous with the expectation of a final harvest age at rotation of 60-70 years (Comeau, 2007).
- Utilization of a conventional clearcut silvicultural system applied on a stand to be managed as pure coniferous; regenerated by artificial means primarily planting of primarily spruce and/or lodgepole pine at 1200-1600 stems per hectare, site preparation is optional, vegetation management through herbicide application or manual brushing, with the expectation of a final harvest age at rotation of 100-110 years (Comeau, 2007).

"Small scale" un-mix the mix (divide blocks into discrete strata of pure conifer and pure deciduous),

- Conventional clearcut silvicultural system applied on a stand considered a deciduous leading mixedwood site to be managed to produce a mosaic of single species groupings. Consider for this example a 60% deciduous, 40% coniferous segregation. The deciduous stand will be regenerated naturally to deciduous. The conifer stand will be regenerated by artificial means, primarily planting of primarily spruce and/or lodgepole pine at 1200-1600 stems per hectare, site preparation is option, vegetation management through herbicide application or manual brushing. Both stands will be managed with the expectation of a final harvest age at rotation of 100-110 years (Comeau, 2007).
- Conventional clearcut silvicultural system applied on a stand considered a coniferous leading mixedwood site to be managed to produce a mosaic of single species groupings. Consider for this example a 60% coniferous, 40% deciduous segregation. The deciduous stand will be regenerated naturally to deciduous. The conifer stand will be regenerated by artificial means primarily planting of primarily spruce and/or lodgepole pine at 1200-1600 stems per hectare, vegetation management through herbicide application or manual brushing. Both stands will be managed with the expectation of a final harvest age at rotation of 100-110 years (Comeau, 2007).

These tactics have been employed with the objective of producing **two-story intimate mixtures** (Comeau *et al*. 2005)

Strip Clearcutting (Comeau *et al*. 2005)

- Applicable to primarily a stand considered as pure deciduous or deciduous leading mixedwood site. The primary consideration is that there are sufficient numbers of healthy, vigorous spruce understory 2-7m tall. The harvest method is clearcut with a single-pass system. Unharvested wind buffers are retained every 50m or less within the stand, with the strips oriented perpendicular to the predominant wind direction. Skid trails are laid out a certain distance apart. Along the skid trails, the feller buncher is expected to harvest the aspen for an expected width on either side of the skid trail. There is a certain percentage of aspen that is not harvested as a result because it is unreachable (Lieffers and Grover 2004). The skid trails may be allowed to regenerate naturally to deciduous or regenerated by artificial means primarily planting of primarily spruce and/or lodgepole pine at 1200-1600 stems per hectare, vegetation management, if required is

through spot herbicide application or manual brushing. The resulting stand will be managed with the expectation of a final harvest age at rotation of 100-110 years.

The "Do-Nothing" approach (Comeau *et al*. 2005)

- This tactic is applicable to almost every current existing stand condition. A conventional clearcut harvest system is employed. Site preparation is optional, but is a consideration for early seedling survival. Stand is typically regenerated by artificial means, primarily planting spruce at 1200-1600 stems per hectare. After planting, no further treatments are considered. Due to the delayed growth of the conifer under the anticipated deciduous canopy, the rotation age is extended. The resulting stand is managed with the expectation of a final harvest age at rotation of 130-140 years.

Tending strips or large circles of spruce (Comeau *et al*. 2005)

- This tactic is applicable to almost every current existing stand condition. A conventional clearcut harvest system is employed. Site preparation is optional, but is a consideration for early seedling survival. Alternating strips of spruce and deciduous are created by artificially planting spruce at spacing densities that equate to 1200-1600 stems per hectare in linear strips and leaving unplanted strips between them. There is a consequence of scale between what might be considered discrete species grouping and an intended intimate mixture. Current practice has considered 25m or less in terms of strip width to be included within intimate mixtures. The width of the strips will determine the relative proportions of spruce and deciduous in the mixture. Brushing the strips to maintain the deciduous free area is important. This may be achieved by chemical or manual brushing treatments. Harvest rotations are divided into two passes. The first pass is a conventional clearcut of the deciduous strips at 60-70 years. These strips are then allowed to naturally regenerate to deciduous. The second harvesting pass is to remove both the deciduous and coniferous strips at a final harvest rotation age of 130-140 years (Comeau, 2007).

  With regard to managing large circles of spruce, a conventional clearcut harvest system is employed. Site preparation is optional, but is a consideration for early seedling survival. Stand is typically regenerated by artificial means, primarily planting spruce at 1200-1600 stems per hectare. When the regenerating stand is approximately five years old, a chemical brushing treatment by aerial application in a process called "pulse spraying" is undertaken. The on/off nature of the treatment creates a typical deciduous-free circle 12-15 feet in diameter. The distribution and density of the circles will determine the relative proportions of the spruce and deciduous in the mixture (Comeau *et al*. 2005).

These tactics have been employed with the objective of producing **one story intimate mixtures** (Comeau *et al*. 2005)

Tending Individual Spruce (Comeau *et al*. 2005)

- This tactic is applicable to almost every current existing stand condition. A conventional clearcut harvest system is employed. Stand is typically regenerated by artificial means, planting at low densities of 400-600 stems per hectare. The principle focus is to remove

aspen within a specified radii of each planted crop tree by manual cutting or selective herbicide treatments. The resulting stand will be managed with the expectation of a final harvest age at rotation of 90-100 years (Comeau, 2007).

References:

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Appendix 14: Procedure for Selecting Sample Trees in Operational Cruising for Use in Site Index Calculations

Procedure for Selecting Sample Trees in Operational Cruising

for Use in Site Index Calculations

The cruiser must first determine the leading species in the plot based on live basal area. In variable radius (prism) plots this can easily be done by determining the species with the highest live stem count as each tree represents equal basal area. In fixed area plots leading species can be approximated by a live stem count in the field as well (has been shown to be accurate 90% of the time).

Once leading species has been determined, select the largest diameter, live, leading species tree within a 0.01 ha area (5.64m radius plot). This tree must be suitable to use as a height and age sample. If the selected tree is not suitable, use the 2nd largest diameter, live, leading species tree within the 0.01 ha area.

Examples of trees that are not suitable for height samples include:

- broken top
- significant dead top
- fork or crook that significantly affects height growth
- abnormally high amount of scarring or other damage that may have affected height growth (small to moderate scarring is still suitable to use as a sample)

Examples of trees that are not suitable for age samples include:

- rotten cores
- residual trees (Mature veterans in an immature stand - please note these trees should still be recorded as TC 5's on the cruise card)

In situations where there is a secondary coniferous species that contributes greater than or equal to 20% of the basal area in an individual plot, the above procedures should be repeated for the secondary coniferous species as well.

All sample tree information (both leading and secondary species information) must be keypunched into the Card Type 3 in the compilation program.

If there are no trees within the 5.64m radius plot, select the most suitable tree (following the standards listed above) within the cruise plot as the sample tree to determine the Maturity Class for the plot for use in the appraisal cruise. Sample trees taken from outside the 5.64 m radius must not be keypunched in the Card Type 3 in the compilation program.

Appendix 15: Stream Crossings, Wetland Crossings, and Seasonal Bridge Installation and Removal Procedures

GUIDELINES FOR STREAM CROSSINGS, WETLAND CROSSINGS, AND SEASONAL BRIDGE INSTALLATION AND REMOVAL: North Peace

Revised July 2025

Purpose:

The intent of this document is to provide best management practices for various options pertaining to stream crossings, culvert and temporary bridge installation, and roads crossing wetlands.

It is the participant's responsibility to ensure that riparian classification is completed and communicated to everyone involved in the planning and construction of the crossing. Qualified professionals will make the decisions on appropriate crossing methods based on site-specific conditions and timing, while keeping the main objectives in mind.

Objectives:

- Minimize impact to stream bank integrity by utilizing the least impact crossing structure, when feasible, and to implement bank stabilization countermeasures where necessary. This would include riprap, straw matting, grass seeding, etc.
- Maintain surface and subsurface water flow
- Minimize impact to the structure and function of riparian vegetation, and riparian soils
- Maintain fish passage.
- Minimize the risk of damage to fish and fish habitat.
- Maintain water quality by preventing the introduction of sediment and other deleterious material.
- Prevent pollutants from entering riparian areas
- Conserve the ecological integrity of riparian environments

STREAM CROSSING PLANNING AND METHODOLOGY:

- Notification of the proposed location and construction of a bridge or major culvert will be in the Forest Operations Schedule, cutting permit application, site level plan, road permit application, and/or specific notifications to government.
- Participants will plan and construct stream crossings using the *Summer and Winter Stream Crossing Planning Matrices* (attached) as a guide. Stream crossings

qualified by a "maybe" will be applied where site conditions permit and where the stated objectives can be met. Alternate measures are allowed as long as the objectives stated above, and legal requirements can be met.

- Minimum culvert (CMP or steel pipe) diameters for winter seasonal installations that will be removed prior to spring freshet shall be 500 mm, and for summer installations shall be 600 mm.
- Where other appropriate alternatives exist (e.g. as per the *Summer and Winter Stream Crossing Planning Matrices*), culverts will not be installed in streams classed S1 through S3, inclusive.
- Instream work required to install bridges or culverts on S1 through S4 streams will be restricted to the *Least Risk Instream Work Windows* for resident fish species in streams (as identified by government) as outlined in the *Riparian Management Area Guidebook*. Alternate measures are allowed as long as the objectives stated above, and legal requirements can be met.
- Aspen and cottonwood will not be used in the construction of any fills in or adjacent to streams that will be in place during non-frozen conditions. These species contain a leachate that may be toxic to aquatic life.
- Snow fills shall be constructed of clean snow only, and must have some form of drainage structure included in the fill matrix to allow potential water flow and avoid ice damming. Placements of clean logs or temporary steel pipes to facilitate movement of water under snow fills will be considered appropriate (refer to *the Winter Stream Crossing Planning Matrix*). Where a large number of logs are required in the construction of the crossing it is recommended that the logs be banded to facilitate removal. Snow fills and associated drainage structures will be removed with an excavator during road deactivation, placed above the high water mark of the stream and protected from erosion.
- Ice bridges may be constructed (see *Winter Stream Crossing Approval Matrix*) on major rivers and streams with appropriate depth and winter flows. Ice bridges will not interfere with or impede winter flows in any stream or river. Ice bridges will be maintained and monitored throughout their use.
- Clean, limbed and topped coniferous logs with the root boles removed may be used to reinforce ice bridges.
- Ice bridges will be located such that approach grades are minimized. Where possible, bridge approaches shall be constructed of clean snow and ice to a sufficient thickness to adequately protect riverbanks.

SUMMER STREAM CROSSING PLANNING MATRIX

Stream Class	S1	S2	S3	S4	S5 no fish	S6 no fish
Width	**> 20 m**	**> 5-20 m**	**1.5 – 5 m**	**≥ 1.5 m**	**> 3 m**	**≥ 3 m**
Temporary bridge (no instream work)	Yes	Yes	Yes	Yes	Yes	Yes
Temporary bridge (with instream work)	Yes (*1*)	Yes (*2*)	Yes (*2*)	Yes (*2*)	Yes (*3*)	Yes
Seasonal (*4*) bridge (no instream work)	No	Maybe (*1)	Yes	Yes	Yes	Yes
Seasonal (*4*) bridge (with instream work)	No	Maybe (*2*)	Yes (*2)	Yes (*2*)	Yes (*3*)	Yes (*3*)
Engineering culvert with earth fill	n/a	No	Maybe (*2)	Maybe (*2*)	Yes (*3*)	Yes (*3*)
Culverts less than 2,000 mm	n/a	n/a	n/a	Yes (*3*)	Yes	Yes
Ford	No	No	Yes (*5)	Yes (*6*)	Yes (*6*)	Yes (*6*)

I Site specific approval required from the appropriate authority.

2 Site specific approval required from the appropriate authority. Instream work may be restricted to specific time period. (Refer to timing windows identified in this document.)

3 Instream work may be restricted to specific time period. (Refer to Timing Windows identified in this document).

4 Clear span, no approaches within the stream channel, monitored/removed at high flows.

5 Light (LGP, pickup or less) traffic only; site specific notification required.

6 Refer to MLWAP authorization letters for details. Note: Instream work does not include fords.

WINTER STREAM CROSSING PLANNING MATRIX

Stream Class	S1	S2	S3	S4	S5 – no fish	S6 – no fish
Width	**> 20 m**	**> 5-20 m**	**1.5 – 5 m**	**≤ 1.5 m**	**> 3 m**	**≤ 3 m**
Temporary or seasonal clear span bridge (no instream work)	Yes	Yes	Yes	Yes	Yes	Yes
Seasonal bridge (with instream work)	Yes (*4*)	Yes (*4*)	Yes (*4*)	n/a	Yes (*4*)	n/a
Seasonal bridge (with instream work, and snow fill or ice approaches)	Yes (*4*)	Yes	Yes	Yes	Yes	Yes
Ice bridge – heavy loads	Yes	Yes (*1*)	No	No	n/a	n/a
Ice bridge – light loads (*2*)	Yes	Yes	Maybe (*4*)	n/a	Yes	n/a
Snow fill – artificial or natural, with pipe or log bundles (*3*)	n/a	No	Yes	Yes	Yes	Yes
Snow fill – artificial or natural (no flow, dry or frozen solid)	n/a	No	Yes	Yes	Yes	Yes
Temporary pipe/culvert with earth fill	n/a	No	No	Yes	Yes (*4*)	Yes

1 If depth ≥ 1 metre, width ≥ 15 metre and winter mean daily flows ≥ 0.5 m^3/sec

2 Weight restriction. (1 ton or less). For heavier loads, special approval is required from the participants engineering supervisor.

3 If stream flow.

4 Not first option.

Note: Instream work does not include fording for construction purposes.

Timing Windows:

Instream work can result in harmful effects to fish and fish habitat, including the harmful alteration or destruction of spawning habitat, introduction of sediment and the destruction of fish eggs and juveniles prior to emergence from gravel. Therefore, such work must be undertaken during times or periods when such harmful effects will be minimized. Timing windows may be better referred to as windows of least risk regarding fish and fish habitat. Instream timing windows (windows of least risk) for the Fort St. John TSA are as follows:

Fish Affected	Approved In-Stream Time Window
Both spring and fall spawners	July 15 - August 15
Fall spawners (bull trout, kokanee and mountain whitefish)	June 15 - August 15
Spring spawners (rainbow trout, arctic grayling)	July 15 - March 31
Anadromous salmon	DFO has site-specific time windows if needed

- If fish species information for a particular stream is not available, the instream timing window for both spring and fall spawners will be used.
- Stream inventory data for fish presence/absence are critical to establishing the widest possible timing windows.
- These timing windows must be applied to all construction in fish streams, as well as tributaries that have a high risk of depositing sediment into fish streams.

Variances to Timing Windows:

- Where a proponent wishes to conduct in-stream work outside the approved timing window, a variance must be requested from the MOE in writing. Requests will be evaluated on a case by case basis.
- Notwithstanding the above, if any one of the following conditions is met, then the timing window extends from January 1 through December 31 of any given year.
    1. On fish streams, the stream channel is dry and the construction, modification or deactivation activity will not result in the introduction of sediment into fish habitat.
    2. Winter crossings of fish streams located on cutblocks where appropriate winter crossings methods are identified in a plan (i.e. SLP, FDP,FOS, SFMP).
    3. On fish streams, the structure does not encroach below the high water mark,

no work is proposed within the stream channel and the risk of sediment delivery to the stream is low.

- Any request for variance must be submitted, in writing, to the appropriate government agency.
- Any approval for a variance from the timing windows and measures outlined in this document must be kept on site.

Temporary Bridge Installation and Removal:

- Seasonal bridge construction and removal will be accomplished in a manner that does not cause stream bank erosion or contribute silt or dirt to the stream

Seasonal Bridge Installation (Single span, steel stringer):

- Seasonal winter bridges will clearly span the stream channel, or as otherwise approved by the appropriate authority.
- Seasonal summer bridges will clearly span the stream channel with provisions for somewhat higher than normal flows and debris.
- Bridge approaches will not enter the stream channel of the stream without approval from the appropriate authority. Monitoring of weather conditions and associated stream flows will be ongoing with provisions in place for timely removal of the bridge span, abutments (sills) and approach fills prior to high water stream flow events.
- Any rock used as riprap will be clean (free of fines and dirt), durable, angular in shape and suitably graded and sized to resist movement by stream flows. Riprap placement will not adversely impact fish, fish habitat, or fish passage.
- An area may be leveled off above the stream bank to accommodate bridge sills. Log cribbing may also be used to supplement abutments where leveling is required.
- Abutment walls will be erected to prevent approach fills from sloughing into streams. Minimum size for logs used in abutments is 300 mm and the minimum size of timbers used in abutments is 200 mm x 200 mm. Where appropriate abutment walls will be lined with geotextile fabric.
- Access to the stream will protect stream bank integrity and not initiate or cause erosion. An excavator may be used to construct access trails through riparian areas provided equipment is operated from the banks.
- Seasonal winter bridges may be installed any time after freeze-up, generally no earlier than October 15th in any year.
- All seasonal summer bridges may be installed after spring freshet. Fording streams by heavy equipment to facilitate bridge construction will be minimized (generally,

no more than two crossings) and will be restricted to the timing window identified in this document for all streams S1 through S4 (inclusive) without prior approval by government. **Fording of these streams outside the window will require government notification.**

Bridge Removal:

- The fording of the stream by heavy equipment to facilitate bridge removal will be minimized (generally, no more than two crossings).
- Deactivation of approaches will involve re-contouring stream banks to their pre-construction condition (as appropriate) to prevent erosion and seeding with appropriate vegetation (any disturbed areas).
- All excavated material and debris from the site will be placed in a stable area above the normal high water mark and protected from erosion**.**
- Seasonal winter bridges will be removed by the first day of spring freshet, usually no later than March 15th in any year. Extensions to this date may be approved by the government upon application.
- Seasonal summer bridges will be removed as soon as possible. Fording of the stream by heavy equipment to facilitate bridge removal will be restricted to the timing window identified in this document for all streams S1 through S4 (inclusive) without prior approval by government. If not threatened by higher flows, and if still required, seasonal bridges may stay in place for the winter. They will be removed by the first day of spring freshet, usually no later than March 15th in any year without consulting the government. Extensions to this date may occur but will be dependent on site-specific conditions that may vary year to year.

Installation & Removal Guidelines for In-Block Equipment Crossings on Streams

General:

- Equipment crossing locations must be approved by a participants supervisor before construction.
- During summer activities or unfrozen ground conditions, measures must be taken to protect the approaches to the crossing. Coniferous logs can be used as a mat to protect the ground adjacent to the crossing.
- Where possible, clean, non-merchantable wood should be used for constructing crossings and approaches (dry trees or undersize). Deciduous trees can be used under frozen conditions only.

- Where possible rub trees (stubbed) should be created on each side of the approach to the crossing. This will help minimize the amount of debris carried to the crossing and help minimize the width of the crossing.
- Care must be taken during installation and removal to maintain the natural stream banks and vegetation.
- Where snow fills are used as a temporary crossing structure, they must be installed at least one day prior to skidding across them to allow the snow sufficient time to set up.
- Crossing structures must be monitored by the logging contractor during use to ensure the objectives are being met (i.e. stream banks are not being damaged, sediment and other deleterious material is not being introduced to the creek).

Suggested methods of construction:

- Temporary Bridge – Spans streams bank to bank. Construction materials can include coniferous logs/timbers/steel.
- Culvert with Log Fill – Permits free flow of water, as the logs fill and/or bridge the channel (depending on log orientation) to protect stream bank stability, and provide an overflow drainage option in the event of culvert freeze-up. Deciduous logs may be used during frozen conditions only.
- Log Fill – Permits water flow, logs fill and/or bridge the channel (depending on log orientation) to protect stream bank stability. Where a large number of logs are required in construction of the crossing it is recommended that the logs be banded to facilitate removal. Deciduous logs may be used during frozen conditions only.
- Clean snow/ice fill – Snow and/or ice fill channel protecting stream bank stability.

Removal Guidelines:

- Prior to spring freshet materials used for the crossing structure and approaches must be removed in a manner that protects the stream channel and banks. Crossing materials will be removed from site, skidded to slash piles or left as coarse woody debris, if appropriate.
- Any logging debris (including limbs) must be removed from the channel and crossing site, and placed a minimum of 5 metres from the channel or 5 metres above the high water mark whichever distance is greater. Care must be taken to minimize disturbance to the natural stream channel.

IN-BLOCK EQUIPMENT CROSSING PLANNING MATRIX

Stream Class	S3	S4	S5 – no fish	S6 – no fish
Width	1.5 – 5 m	? 1.5 m	> 3 m	? 3 m
Temporary bridge (without instream work)	Yes	Yes	Yes	Yes
Culvert with log fill	No	Maybe (*1*)	Yes	Yes
Snow fill, artificial or natural/log fill	Yes	Yes	Yes	Yes
Clean artificial or natural snow/ice fill	Yes	Yes	Yes	Yes
I Specific approval required. *2* Frozen conditions only				

WETLAND CROSSING GUIDANCE

The high density of wetlands in the boreal forest often results in the inability to completely avoid crossing wetlands when constructing new roads. Incorporating guidance regarding wetlands into road design, construction and maintenance plans can maximize the quality, lifespan, and life cycle cost of a road while minimizing the effect to wetlands.

The following guidance was developed using:

Wetland Best Management Practices for Forest Management Planning and Operations.

Forest Management and

Wetland Stewardship Initiative (FMWSI). 2018.

Ducks Unlimited Canada. Edmonton, Alberta. Pp. 71.

Soil Moisture Conditions

Prioritize operations during frozen conditions. Compact snow to promote frost penetration and minimize damage to wetland soils, roots, and vegetation.

If operating during non-frozen conditions, the following equipment and/or materials must be considered:

- Low ground pressure tracked equipment
- Amphibious vehicles/high flotation equipment
- Smaller and lighter equipment
- Log corduroy and/or access mats

Erosion and Sedimentation

To the extent possible, leave ground vegetation intact to minimize soil disturbance and erosion potential. Install and maintain erosion control measures to prevent sediment from being transported into the wetland. This may include:

- Erosion control measures along the edges of the road or applying mulch or fibre mats on exposed soils.
- Installing silt fence at edges of landing or other active areas to prevent sediment from moving off site.

- If appropriate, use slash or logs to prevent sediment from moving off site.

Fuel Management

Designate areas for storing petroleum products and for equipment maintenance that are a minimum of 100 metres from wetlands and waterbodies. Keep spill containment and clean up materials on site. Properly dispose of containers, used oil, and other refuse.

Wetland Road Crossing Construction

Build non-seasonal roads far enough in advance of use to allow natural settlement. When clearing the road right-of-way, minimize vegetation disturbance. Consider:

- Removing vegetation during frozen conditions.
- Leaving surface vegetation, including root mats, intact.

Ensure proper placement of conduit (culvers or corduroy) to maintain water flow based on wetland type. Engineer road surfaces to direct surface run-off into drainage structures and away from wetlands and waterbodies.

Winter Road Construction

Winter snow and ice crossings are recommended for crossing inundated or flooded wetland types. Bridges are recommended for crossing moving water wetlands, if winter crossings are required. Remove or compact surface snow cover to promote greater frost penetration.

- Maintain surface vegetation when removing snow cover.

During construction, minimize disturbance to soils underlying the road to help maintain hydrologic connectivity when the crossing thaws. Use clean snow to construct wetland crossings; winter road crossings will melt in the spring and sediment or other material in the snow will enter the wetland. If clean snow is not available, remove contaminated snow prior to spring break-up.

Avoid using materials with the potential to contaminate the wetland (e.g. shavings or sawdust). Ensure the road surface is clean and free or debris prior to road decommissioning or thaw.

Access Mat Use

Minimize the number and length of access mats used while ensuring that wetlands are adequately covered or that alternate practices are applied to minimize disturbance. Use clean mats to avoid contamination or the introduction of invasive species.

Ensure that access mats do not impede surface or sub-surface water movement.

- Access mats are designed to specific strength ratings, use mats according to these specifications to reduce the risk of mats sinking into the soil.
- Do not layer mats if mats start to sink into the soil and are no longer passable. Layering mats can compact soil and impede sub-surface water movement.

Remove access mats when work is complete. Remove them by backing out of the site, removing one mat at a time, and taking care not to move equipment and vehicles across wetland areas.

Monitor Road Performance

Conduct regularly scheduled inspections considering drainage and ground disturbance. Look for signs of culverts not functioning as they should, visible changes to wetland hydrology, and changes to vegetation communities on either side of the road.

Maintain road surfaces to direct surface run-off into drainage structures away from the wetland. Clean roads and drainage structures following forestry activities to maintain adequate drainage.

Where it makes sense, manage road access to minimize unnecessary traffic.

Appendix 16: ROS Polygon Delineation Standards

ROS Polygon Delineation Standards

ROS Class	Factors					
	Remoteness		Naturalness		Social Experience	
	Dist. from road (km)	Size (ha)	Motorized Use	Evidence of Humans	Solitude/Self-reliance	Social Encounters
Primitive (P)	>8	>5000 ha	occasional air access, otherwise no motorized access or use in the area	very high degree of naturalness structures are extremely rare generally no site modification little on-the-ground evidence of other people evidence of primitive trails	very high opportunity to experience solitude, closeness to nature; self-reliance and challenge	very low interaction with other people very small party sizes expected
Semi-Primitive Non-Motorized (SPNM)	> 1	> 1000 ha	generally very low or no motorized access or use may include primitive roads and trails if usually closed to motorized use	very high degree of naturalness structures are rare and isolated except where required for safety or sanitation minimal or no site modification little on-the-ground evidence of other people	high opportunity to experience solitude, closeness to nature, self-reliance and challenge	low interaction with other people very small party sizes expected
Semi-Primitive Motorized (SPM)	> 1	> 1000 ha	a low degree of motorized access or use	high degree of naturalness in the surrounding area as viewed from access route structures are rare and isolated minimal site modification some on-the-ground evidence of other people evidence of motorized use	high opportunity to experience solitude, closeness to nature, self-reliance and challenge	low interaction with other people small party sizes expected
Roaded Natural (RN)	< 1	N/A	moderate amount of motorized use within the area may have high volume of traffic through the main travel corridor	moderate degree of naturalness in surrounding area structures may be present and more highly developed moderate site modification some on-the-ground evidence of other people some on-site controls	moderate to high opportunity to experience solitude, closeness to nature, self-reliance and challenge	moderate interaction with other people small to large party sizes expected

ROS Class	Factors					
	Remoteness		Naturalness		Social Experience	
	Dist. from road (km)	Size (ha)	Motorized Use	Evidence of Humans	Solitude/Self-reliance	Social Encounters
				typically represent main travel corridors and recreation areas that have natural-appearing surroundings		
Roaded Modified (RM)	< 1	N/A	moderate to high degree of motorized use for both access and recreation	low degree of naturalness moderate number of more highly developed structures highly modified in areas; generally dominated by resource extraction activities on-the-ground evidence of other people and on-site controls	low to moderate opportunity to experience solitude, closeness to nature, self-reliance and challenge	moderate to high interaction with other people moderate to large party sizes expected
Rural (R)	< 1	N/A	high degree of motorized use for both access and recreation	very low degree of naturalness complex and numerous structures, high concentrations of human development and settlements associated with agricultural land obvious on-the-ground evidence of other people and on-site controls	low opportunity to experience solitude, closeness to nature, self-reliance and challenge	high interaction with other people large party sizes expected
Urban (U)	< 1	N/A	very high degree of motorized use for both access and recreation	very low degree of naturalness highly developed and numerous structures associated with urban development very high site modification obvious on-the-ground evidence of other people and on-site control	very low opportunity to experience solitude, closeness to nature, self-reliance and challenge	very high interactions with other people very large party sizes expected

Appendix 17: WTP Retention Target Calculation

Landscape Unit	Forested Area		% Available for Harvest	Harvested with no WTR		Harvested with WTR		WTR	WTR %	Target	Target	SFMP targets	Comments
	Total	THLB		Area	%	Area	%			with LU Objectives	No LU Objectives		
Blueberry	484,522	319,555	66%	57,107	17.90%	1,681	1%	163	10%	6%	9%	**6%**	High intensity zone, accept higher risk to biodiversity
Halfway	155,063	71,299	46%	9,574	12.90%	704	1%	98	14%	3%	6%	**3%**	High intensity zone, increase to 3% (from 2%) to fall within Delong range of 3-15% in fire
Kahntah	233,653	120,656	52%	6,763	5.60%	272	0%	60	22%	3%	7%	**7%**	Medium intensity-use rating consistent with greater protection of biodiversity
Kobes	115,901	74,271	64%	14,433	19.20%	307	0%	26	8%	5%	8%	**5%**	High intensity zone, accept higher risk to biodiversity
Lower Beatton	94,349	51,167	54%	15,050	29.40%	0	0%	0	0%	5%	8%	**8%**	Medium intensity-use rating consistent with greater protection of biodiversity
Milligan	157,627	74,271	47%	3,145	4.20%	0	0%	0	0%	3%	6%	**6%**	Medium intensity-use rating consistent with greater protection of biodiversity

Tommy Lakes	401,001	107,677	42%	13,207	7.70%	2,802	2%	304	11%	2%	5%	**3%**	High intensity zone, increase to 3% (from 1%) to fall within Delong range of 3-15% in fire
Trutch	258,178	107,677	42%	2,288	2.10%	90	0%	40	44%	2%	5%	**5%**	Medium intensity- use rating consistent with greater protection of biodiversity
Sikanni	98,455	30,853	31%	0	0.00%	0	0%	0	0%	1%	4%	**4%**	Low intensity- use rating consistent with greater protection of biodiversity
Graham	219,455	54,687	25%	96	0.20%	0	0%	0	0%	1%	4%	**4%**	Low intensity- use rating consistent with greater protection of biodiversity
Crying Girl	62,085	29,931	48%	969	3.20%	1,788	6%	210	12%	3%	6%	**6%**	Medium intensity- use rating consistent with greater protection of biodiversity
Total All LUs	**2,280,291**	**1,106,746**	**49%**	**122,631**	**11.00%**	**7,644**	**1%**	**901**	**12%**	**3%**	**6%**		

Appendix 18: Fort St. John TSA Timber Supply Analysis Report

Fort St John Timber Supply Area

Timber Supply Analysis Report
In support of the
Fort St. John Forest Practices Code Pilot Project

October 2003

Completed by:

Robert Schuetz, RPF
INDUSTRIAL FORESTRY SERVICE LTD.



Table of Contents

page

1.0 Introduction *2*

2.0 Information Preparation for the Timber Supply Analysis *2*

2.1 Land Base Determination 2

2.1.1 Coniferous Land Base 5
2.1.2 Deciduous Land Base 5
2.1.3 THLB Age Distribution 5

2.2 Growth and Yield 6

2.2.1 Unmanaged Coniferous 7
2.2.2 Managed Coniferous 7
2.2.3 Deciduous 7
2.2.4 Mixed-wood 8

2.3 Analysis Model 8

2.4 Management Practices 9

2.4.1 Defined Management Areas 10

3.0 Results *16*

3.1 Harvest flow 16

3.1.1 Scenario 1 – TSR2 Mimic 16
3.1.2 Scenario 2 NDU Analysis and an Enhanced Deciduous THLB 18
3.1.3 Scenario 3 – Watersheds 19
3.1.4 Scenario 4 – Biodiversity Emphasis Options 19
3.1.5 Scenario 5 – Graham River Integrated Resource Management Plan 20
3.1.6 Scenario 5 - Additional Sensitivity Analysis 21
3.1.7 Harvest flow summary information 24

3.2 Growing Stock 24

3.3 Changing Age Class Distributions 26

3.4 Carbon Cycling 28

4.0 Summary and conclusions *29*

Appendix I

Data Package in Support of the Timber Supply Analysis

Table of Figures

Figure 1 Map of the Fort St. John TSA 3
Figure 2 Fort St. John THLB Age Distribution 6
Figure 3 Average Yield Curves by Leading Species – Fort St. John TSA 7
Figure 4 Species Distribution - Fort St. John TSA 8
Figure 5 Defined Forest Management Areas 11
Figure 6 Visually Sensitive Areas 11
Figure 7 Caribou Habitat 12
Figure 8 Forest Area by BEC, NDT - Fort St. John TSA 13
Figure 9 Forest Area by Natural Disturbance Unit – Fort St. John TSA 13
Figure 10 General Watershed Areas 14
Figure 11 Graham River IRMP 15
Figure 12 Scenario 1 harvest flow - TSR2 base case 17
Figure 13 Scenario 2 harvest flow – Minimum NDUs 19
Figure 14 Scenario 4 harvest flow - Biodiversity Emphasis Options 20
Figure 15 Scenario 5 harvest flow - Graham River IRMP 21
Figure 16 Scenario 5(a) harvest flow - Black Spruce Excluded from NCLB 22
Figure 17 Scenario 5(b) harvest flow - Random Harvest Rule 23
Figure 18 Change in growing stocks - Scenario 5 Fort St. John TSA 25
Figure 19 Total growing stock - Fort St. John TSA 26
Figure 20 Age class distribution of the THLB over time 27
Figure 21 Age class distribution of the entire forested land base over time 27
Figure 22 Total ecosystem carbon over time – Fort St. John TSA 28
Figure 23 Rate of carbon sequestration – Fort St. John TSA 29

Tables

Table 1 Land Base Net Down 4
Table 2 Harvest flow results summary 24
Table A3 Inventory Coverage's 32
Table A4 Land Ownership 33
Table A5 Range Classifications 34
Table A6 Reductions for Inaccessible Areas 36
Table A7 Operability 37
Table A8 Coniferous Problem Forest Types 37
Table A9 Deciduous Problem Forest Types 37
Table A10 Recreation Reductions 38
Table A11 Environmental Sensitive Area Reductions 38
Table A12 WTP reductions by Landscape Unit 39
Table A13 THLB1 – TSR2 Assessment 40
Table A14 Deciduous Area Add-Back 40
Table A15 THLB2 - Deciduous Enhanced 41
Table A16 Graham IRMP Area Adjustment 41
Table A17 TSR2 THLB adjusted for Graham IRMP 42
Table A18 TSR2 THLB Adjusted for Enhanced Deciduous and the Graham IRMP 42
Table A19 Definition of Analysis Units 44
Table A20 Analysis Unit Area 46
Table A21 NDU Forest Cover Constraints 47
Table A22 Landscape Unit BEOs 48
Table A23 Minimum Harvest Ages 48
Table A24 Calculating ECA Targets (example) 49
Table A25 Watershed code 50
Table A26 Forested Area by Watershed 50
Table A27 Years to Greenup by Watershed Group 51
Table A28 Rate of Hydrologic Recovery by ECA 51
Table A29 Graham River Clusters 52
Table A30 NDU Area in NCLB cycled annually 53
Table A31 Enhanced deciduous land base yield tables 54
Table A32 Carbon table ID versus AU# associations 55
Table A33 Ecosystem Carbon and Sequestration Rate by Carbon ID 56

Timber Supply Analysis Report

In Support of the

Fort St. John Sustainable Forest Management Plan

1.0 Introduction

In support of the *Forest Practices Code Act, Fort St. John Pilot Project Regulation* (December 2001), a Sustainable Forest Management Plan (SFMP) for the Fort St. John Timber Supply Area (TSA) was undertaken by four licensees and Fort St. John British Columbia Timber Sales (BCTS). The purpose of the SFMP is to test alternative methods of meeting the objectives of the Forest Practices Code while improving the regulatory framework. Improvements are initiated through a shift from prescriptive management to results-based management.

The purpose of this report is to evaluate and quantify the potential impact of some of the management initiatives being forwarded by the proponents of the Ft St. John SFMP. To assist in the evaluation of these initiatives, Industrial Forestry Service Ltd. was contracted to undertake a timber supply analysis of the Fort St. John TSA. The analysis is supported by the proponents of the SFMP which include Canadian Forest Products Ltd., Louisiana Pacific Canada Ltd., Slocan Forest Products Ltd. and the BCTS.

2.0 Information Preparation for the Timber Supply Analysis

This analysis was completed over a 2 month period. This was possible only through close familiarity with the Ministry of Forests' (MOF's) recently completed timber supply review (June 2002) and an acceptance by the contract proponents that, as a starting point, the timber harvesting land base (THLB) determination, yield assumptions and management assumptions followed the analysis developed by the MOF through the Timber Supply Review process. The Ministry of Forests Timber Supply Review (TSR) Base Case was the starting point. Following a re-determination of the Fort St. John TSR Base Case, the Code Pilot proponents have included, deleted, and modified analysis assumptions in recognition of the varied management initiatives that are being tabled under the SFMP.

Timber supply analyses generally require three principle sources of information that are integrated into one cohesive forest estate model. This information involves an identification of the land base inventory, timber growth and yield data, and management practices. These three factors, along with a brief description of the model, are described in the sections that follow.

The information contained in this analysis was prepared for the purpose of addressing five specific scenarios. As some of the scenarios utilized management data that was considerably different from the TSR2 Base Case, considerable preparatory processing was required prior to the start of the analysis.

The management scenarios that were modeled in this analysis are:

- **Scenario 1** is a remake of the MOF's TSR2 Base Case scenario. This scenario provides the benefit of both calibrating the model to match the original TSR2 Base Case, and evaluating the impact of moving away from some "traditional" management assumptions.
- **Scenario 2** is an NDU Enhanced Scenario. In this scenario several changes are made in a move away from managing according to the Base Case:

a. The deciduous land base is expanded to include some stands that were previously considered problem forest types,

b. The non-contributing land base was cycled for natural disturbances at a rate of 1,105 ha/year (versus 5,000 ha/year used in Scenario 1),

c. Deciduous stands are cycled when they reach their maximum ecological age. (This was not done in Scenario 1 where deciduous stands were assumed to age indefinitely if they were not harvested),

d. Forest cover constraints that were based upon the Forest Practices Code (FPC) Biodiversity Guidebook were dropped in favour of Natural Disturbance Units (NDU),

e. Approximately 15 percent of deciduous-leading stands were assigned a 4-year regeneration delay,

f. Minimum deciduous harvest ages are modified to better reflect the ability to harvest deciduous stands at 120 m^3/ha.

- **Scenario 3** builds on Scenario 2 through the inclusion of equivalent clear cut area (ECA) constraints on large and small spatially defined watersheds in the TSA,
- **Scenarios 4** builds on Scenario 3 but modifies the forest cover constraints that were applied to NDUs. This was done by increasing the old-growth targets from a minimum percent area over 140 years of age, to include mean and maximum targets based upon the biodiversity emphasis option (BEO) recommended for Fort St. John landscape units.
- **Scenario 5** builds on scenario 4 but modifies the harvest schedule and the THLB in recognition of the Graham River Integrated Resource Management Plan (IRMP).

2.1 Land Base Determination

The Fort St. John TSA is defined by a series of inventory coverages that spatially describe many industrial, political, legal, economic and ecological management concerns across the entire land base. Map inventories representing many of these concerns are merged with the forest inventory to provide a spatially explicit graphical and tabular data-base. An Arc-Info Geographic Information System (GIS) was used to link these spatial coverages to the forest inventory. The resource inventories were largely identical to the inventories used in the TSR Base Case. However, several key inventories have been modified as a result of the progressive nature of forest management across B.C. Revised inventories that include woodlot areas, newly legislated protected areas, range leases, and inaccessible areas are only a few of the many layers that have been merged with the Fort St. John land base inventory files. A listing of the old and new inventories is provided in Table A3 in Appendix I.

Industrial Forestry Service Ltd. updated the inventory files for this analysis in August 2003. The current dataset includes many revisions to the data base completed by the Ministry of Forests approximately 1½ years earlier. The predominant changes to the Fort St John TSA data base involve the inclusion of a vegetative resource inventory (VRI) for approximately 12 percent of the TSAs area. Furthermore, landscape units have been expanded in size and

reduced in number, and two new administrative inventories have been included into the analysis (i.e., NDUs and watersheds).

Figure 1 depicts the location of the Fort St. John TSA within the province of British Columbia. Table 1 describes the net-down process for the Fort St. John TSA through which the THLB and the non-contributing land base (NCLB) are defined. Three different THLBs have been identified for the Fort St. John TSA in this timber supply analysis.

- THLB 1 describes a THLB utilizing as closely as possible the net-down assumptions developed by the MOF and described in the Fort St. John Timber Supply Analysis Report. This THLB was used in Scenario 1 and is representative of the MOFs TSR2 base case.

- THLB 2 describes an enhanced THLB that maintains the same net coniferous area but greatly expands the deciduous THLB area by including the Slocan-LP OSB Corp merchantable deciduous forest types. This THLB was used in Scenarios 2, 3 and 4.

- THLB 4 includes the enhanced deciduous THLB described above, but excludes area in the Graham River Valley that is outside the cut-block clusters and riparian reserves that have been spatially identified in the Graham IRMP. This THLB was used in scenario 5.

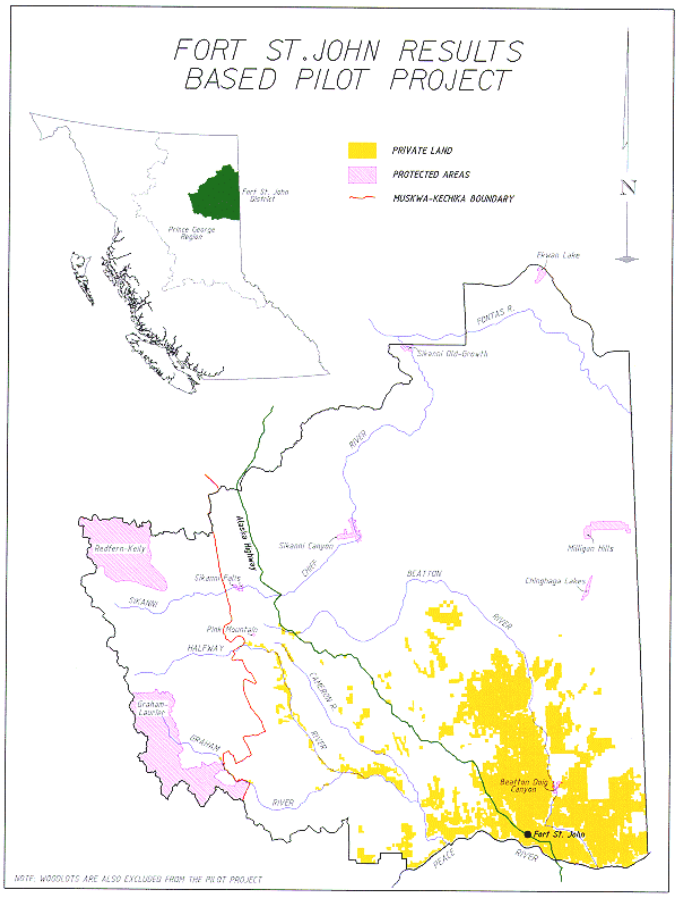


Figure 1 Map of the Fort St. John TSA

Table 1 Land Base Net Down

Classification	Gross Area (ha)	Net Area (ha)
Total TSA Area	**4,676,639**	
Non-forest	*2,018,108*	
Woodlots	*18,409*	*17,767*
Not Managed by BC For. Service	*555,181*	*215,596*
Non-commercial Cover	*173,065*	*148,977*
Area contributing to Forest Biodiversity		**2,276,190**
Range Leases	*13,388*	*9,370*
Parks and Reserves	*94,384*	*94,384*
Productive Forest Land Base		**2,172,436**
Reductions to Productive Forest		
Range and Wildlife Burn Areas	*30,795*	*30,623*
Inaccessible Areas	*24,297*	*15,691*
Inoperable	*20,356*	*18,347*
NonMerch Conifer	*344,063*	*339,100*
NonMerch Deciduous	*88,551*	*83,211*
Low Productivity Conifer	*554,305*	*328,261*
Low Productivity Deciduous	*171,228*	*149,174*
Recreation	*54,059*	*29,740*
ESA	*37,351*	*12,176*
WTP's	*95,586*	*52,921*
Reduction for NSR	*36,323*	*8,674*
Unclassified Roads,Trails and Landings	*14,348*	*9,351*
Lakes and Wetlands Riparian Areas	*15,087*	*7,181*
Streams Riparian Areas	*66,438*	*34,918*
Seismic Lines	*26,269*	*14,712*
Total Reductions		1,134,080
Timber Harvesting Land Base 1 **Coniferous - 733,206 hectares** **Deciduous - 305,150 hectares**		**1,038,356**
Deciduous Add-back		*124,289*
Timber Harvesting Land Base 2 **Coniferous - 733,206 hectares** **Deciduous - 429,439 hectares**		**1,162,645**
Reduction for Graham IRM Plan		*13,234*
Timber Harvesting Land Base 3 **Coniferous - 720,276 hectares** **Deciduous - 429,135 hectares**		**1,149,411**

2.1.1 Coniferous Land Base

Table 1 reveals that this net-down of the Fort St. John timber harvesting land base has resulted in a coniferous THLB that is almost the same size as the area determined by the MOF in TSR2. This coniferous THLB is utilized in all of the management scenarios but one. A small decline in the coniferous THLB occurs through the removal of merchantable areas inside the Graham River IRM Planning area.

Although only a very small difference in total coniferous area was determined through the net-down, the amount of area that was allocated to "small pine" versus the "traditional coniferous land base" has changed considerably. Approximately 18 percent of the area previously attributed to small pine has been redefined as traditional conifer. Approximately 6 percent of the coniferous land base now exists in the small pine THLB. Further detail in this regard is provided in Appendix I.

2.1.2 Deciduous Land Base

This analysis determined three deciduous THLBs. The first duplicates the net-down logic used in TSR2; the second defines an enhanced deciduous base; and the third marginally reduces the enhanced land base for the Graham IRMP. In this analysis, the first deciduous THLB is approximately 6 percent smaller than the land base derived in the MOF's analysis. An in-depth study into this discrepancy has not been carried out.

The second deciduous THLB is approximately 32 percent larger than the MOFs deciduous THLB. Slocan-LP OSB Corp has undertaken analysis that supports the inclusion of additional deciduous forest stands in an "enhanced deciduous THLB. This deciduous THLB adjustment is also partially supported by the MOF's own Phase II VRI analysis. The results of this analysis showed that deciduous volumes existing on the inventory files are believed to be underestimated in the Fort St. John TSA generally. Justification of this belief is not part of this analysis report.

The third and final deciduous THLB is reduced very slightly for deciduous stands within the Graham IRMP. This THLB was only used in Scenario 5.

The seral succession of deciduous-leading mixed-wood stands to coniferous-leading mixed-wood stands is not modeled in this analysis.

2.1.3 THLB Age Distribution

Figure 2 shows the current age class distribution of forested stands in the timber harvesting land base. Approximately 63 percent of the THLB is coniferous-leading stands. The remaining 37 percent are leading deciduous stands comprised of 'TSR2 defined' deciduous (26 percent) and stands previously defined as problem forest types (11 percent). The area in the Graham IRMP is mostly coniferous and makes up only 1 percent of the THLB area.

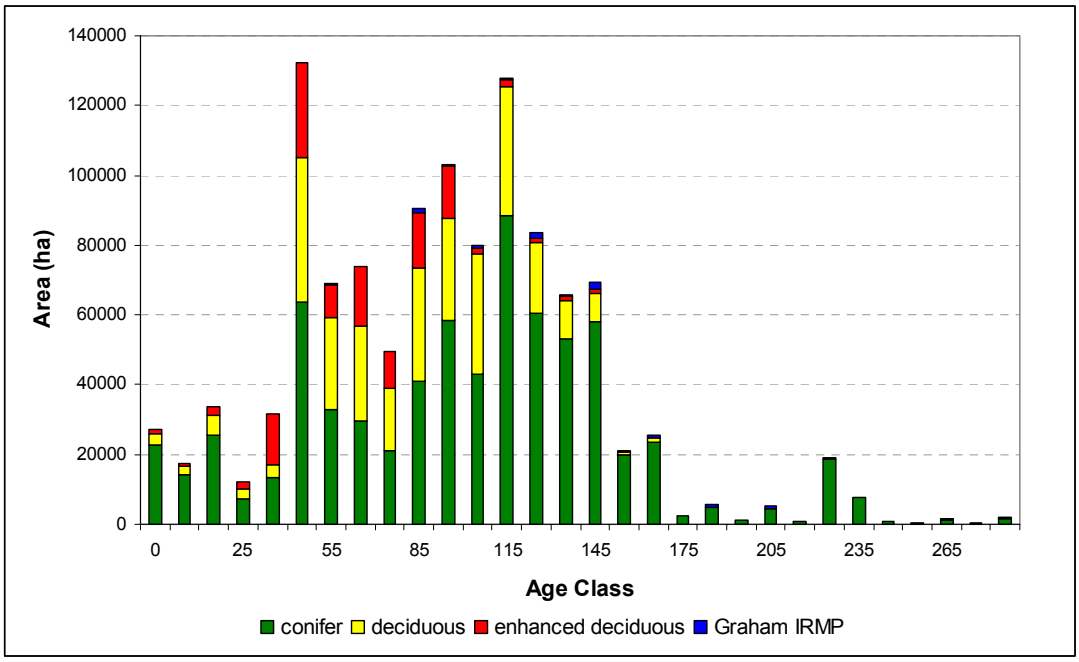


Figure 2 Fort St. John THLB Age Distribution

2.2 Growth and Yield

In this analysis, growth and yield relate to the rate at which stands increase in volume over time. Although the forest inventory for portions of the Fort St John timber harvesting land base was updated with the completion of a VRI, the analysis units and the yield tables representing each analysis unit remain largely unchanged from those developed and used by the MOF in the TSR2 analysis. The exception to this rule was the development of five additional analysis units and yield tables to represent the area and the growth and yield of the enhanced deciduous land base. Details on the amount of area in each analysis unit are provided in Appendix I, Table A19 .

The growth and yield of stands were determined by the MOF using two stand level models. Unmanaged stands were predicted using the VDYP model. Managed stands were predicted using the TIPSY model. It was assumed that deciduous-leading stands reverted back to an unmanaged state.

Figure 5 depicts the area-weighted average growth curve for deciduous stands and for unmanaged and managed coniferous stands.

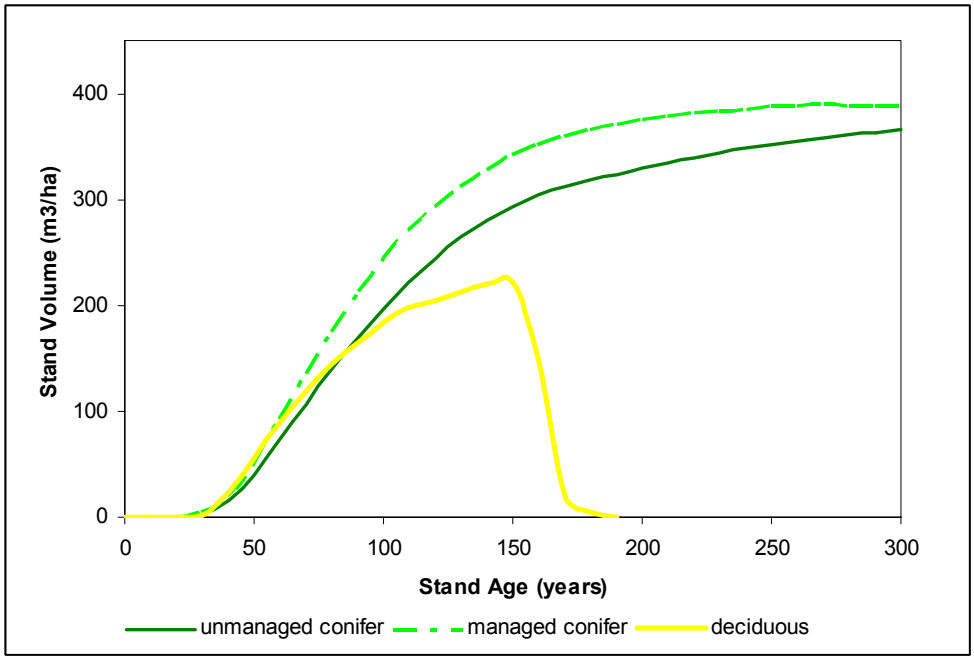


Figure 3 Average Yield Curves by Leading Species – Fort St. John TSA

2.2.1 Unmanaged Coniferous

Unmanaged conifer yield tables were unchanged from the yield tables used in TSR2. These unmanaged yield tables were produced using the MOF's Variable Density Yield Prediction model (VDYP). After harvesting, unmanaged coniferous stands convert to managed coniferous stands.

2.2.2 Managed Coniferous

Managed coniferous stands generally yield more volume per hectare than unmanaged stands. This is as a result of active forest management with respect to site preparation, seedling spacing, competition management, seedling quality and stand thinning. The managed stand coniferous yield tables used in this analysis remained unchanged from TSR2. Figure 5 shows that managed stands yield approximately 20 percent more volume than unmanaged stands after 100 years.

2.2.3 Deciduous

Deciduous yield tables remain largely unchanged from TSR2. However, two items are of note: 1) five new yield tables were added to the analysis to represent deciduous stands that were considered problem forest types. These stands were added back to an 'enhanced' deciduous land base. The analysis units representing these stands were only used in the scenarios (i.e., Scenarios 2-5) where an enhanced deciduous land base was modeled; 2) the yield tables of deciduous-leading stands were adjusted in Scenarios 2-5 such that after a certain age the merchantable volume fell to zero. The time at which this merchantable volume fall down occurs depended upon the leading species (i.e., 155 years for cottonwood and aspen, 115 years for birch). This was done to model the mortality and limited commercial and ecological life span of deciduous

species. As a result of deciduous mortality, the average merchantable volume per hectare predicted for deciduous stands greater than 150 years age declines rapidly (see Figure 5). To minimize the loss of deciduous stands to mortality, a 'relative oldest-first' harvesting rule was applied in the model.

2.2.4 Mixed-wood

Mixed-wood stands were treated as per TSR2. The seral succession of deciduous-leading mixed-wood stands to coniferous-leading mixed-wood stands was not modeled. This omission occurred because growth and yield information on mixed-wood succession dynamics is lacking. Mixed-wood assumptions modeled in this analysis, presume that the total amount of mixed-wood area will remain relatively static. Figure 4 shows the amount of THLB by species composition. Roughly 27 percent of the THLB is comprised of mixed-wood stands.

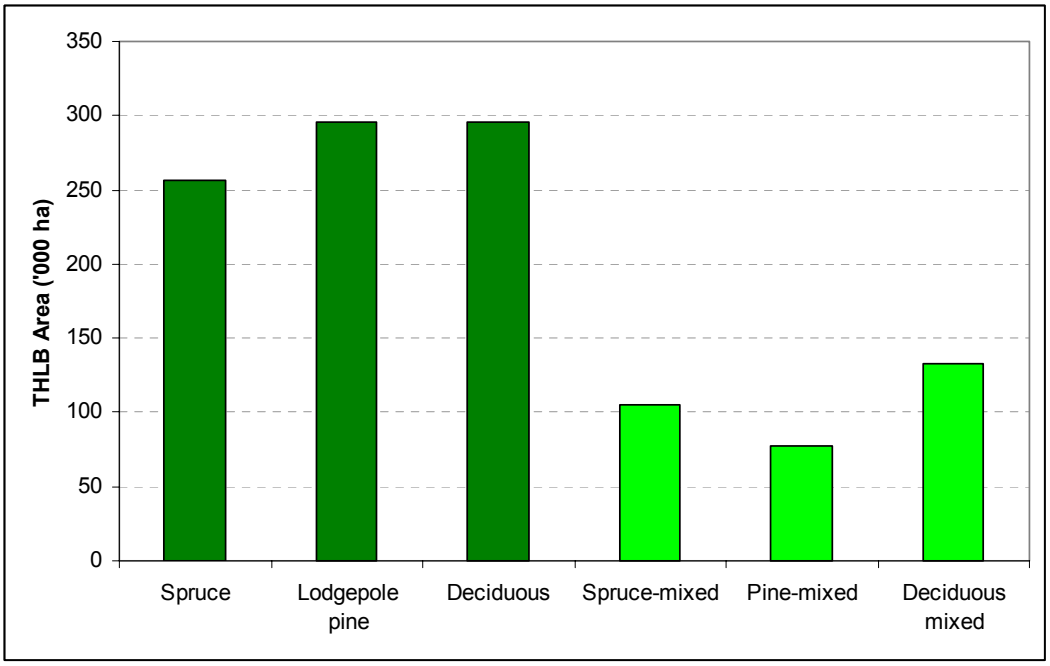


Figure 4 Species Distribution - Fort St. John TSA

2.3 Analysis Model

The forest estate model used in this analysis is the B.C. Ministry of Forest's forest estate model "FSSIM version 3.0". This is an aspatial model that harvests stands according to their availability and age, subject to varied resource management constraints. For the most part, stands are not selected for harvesting as a consequence of their location in the landscape.

In Scenario 5 (Graham IRMP), a degree of spatial integrity is maintained by spatially and temporally harvesting cut-block clusters. The area and timing of harvest was in reference to the design and harvest schedule proposed in the Graham River Integrated Resource Management Plan.

2.4 Management Practices

Management practices in the Fort St John TSA are largely guided by the Forest Practices Code of BC Act and associated regulations. The practices identified in this Act and Regulations that most directly influence short and long-term timber management is provided in Appendix I.

The scenarios examined in this analysis evaluate the change in some key management practices. A brief description of some of these key management assumptions follow:

- In all scenarios, three independent harvest forecast are modeled. One forecast for each of the traditional conifer land base, the deciduous land base and the small diameter pine land base.

- Silviculture management remains unchanged in all scenarios. Based upon TSR2 modeling assumptions, the treatment of stands pre and post-harvesting follows a system of clear-cutting with reserves, followed by stand re-establishment by either planting or natural regeneration.

- Forest health and unsalvaged losses remain the same in all scenarios. Losses are based upon the TSR2 expected average annual loss of 37,500 m^3/year of merchantable volume. This loss is applied only to the traditional coniferous land base and all harvest flows graphed in this report are net of non recoverable losses.

- Timber utilization remains unchanged in all scenarios and is based upon TSR2 assumptions regarding the size of trees and logs removed during harvest.

- Maintenance of scenic values occurs through an established visual landscape inventory and forest cover targets on this inventory. Visual quality objectives applicable to scenic areas remain unchanged in all scenarios.

- Cut-block adjacency was modeled in Scenario 1, by ensuring that the area within the IRM zone that does not meet green-up does not exceed a maximum of 40%. All other scenarios involved modeling according to natural disturbance units and have cut-block adjacency constraints removed.

- Caribou habitat values are maintained in all scenarios through forest cover targets (i.e., Kobes Creek, Graham and Hackney Hills) and through adjacency constraints (ie, Milligan Hills).

- Minimum harvest ages define the time it takes a stand to reach a merchantable condition with respect to volume/hectare. The minimum volume targets vary for coniferous based upon operability (e.g., licensees require 140 m^3/ha for operations on conventional ground and 250m^3/ha for operations on cable ground). Volume targets for deciduous are 120 m^3/ha. The minimum harvest ages used in this analysis remain unchanged between scenarios. The targets follow the values applied by the MOF in TSR2.

- Stand level biodiversity is maintained in all scenarios through a merchantable area reduction for wildlife tree patches (WTPs). WTP area reductions were

applied based upon landscape unit name. This analysis utilizes far fewer landscape units then was used in TSR2. Hence the target values have been adjusted accordingly.

- Landscape level biodiversity is maintained through forest cover targets. This analysis diverges from the traditional FPC Act biodiversity guidebook's natural disturbance types (NDTs), and replaces those guidelines with recommended natural disturbance unit seral stage targets developed for the Prince George Forest Region. Only scenario 1 in this analysis utilizes NDTs. All other scenarios test the impact of managing for NDU landscape level old growth targets.

- The maintenance of water quality is managed by the establishment of a peak flow index applicable to defined watersheds. Each watershed has equivalent clear-cut area (ECA) forest cover targets. These watersheds and their associated targets are applied in Scenarios 3-5.

- Some forest lands are kept in an early seral stage through regular controlled burns for range and wildlife management. These areas do not contribute to timber supply, but can affect the amount of area outside burns required for old growth biodiversity.

- The Graham River Integrated Resource Plan was incorporated in Scenario 5. This IRMP spatially identified and scheduled cut-block clusters for harvesting over a very long planning horizon. THLB area adjacent to, but outside these clusters and associated riparian management zones, were excluded from any future harvesting opportunities.

2.4.1 Defined Management Areas

Management practices associated with several of the preceding bullets are summarized in the figures that follow. Additional information pertaining to the forest cover constraints applicable to each of these areas is provided in Appendix I. Figure 5 shows the area within management zones relative to the total productive forest. Note that defined management areas are not mutually exclusive of one another. Overlap between zones can exist.

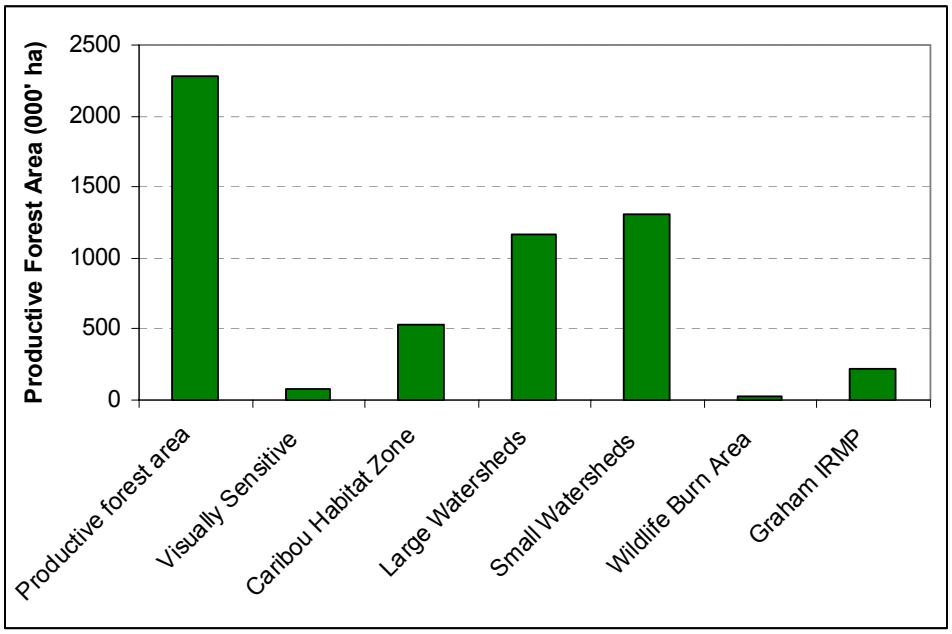


Figure 5 Defined Forest Management Areas

Visually Sensitive Areas

Visually sensitive areas cover only a very small portion (3.5 percent) of the TSA. These areas are classifications by their visual quality objectives (VQO), to which forest cover targets are applied. Figure 6 shows the relative distribution of VQO classifications across visually sensitive inventory area. Both the THLB and the non-contributing land base (NCLB) contribute to achieving visually quality objectives. Forest cover targets were applied at the VQO/landscape unit level.

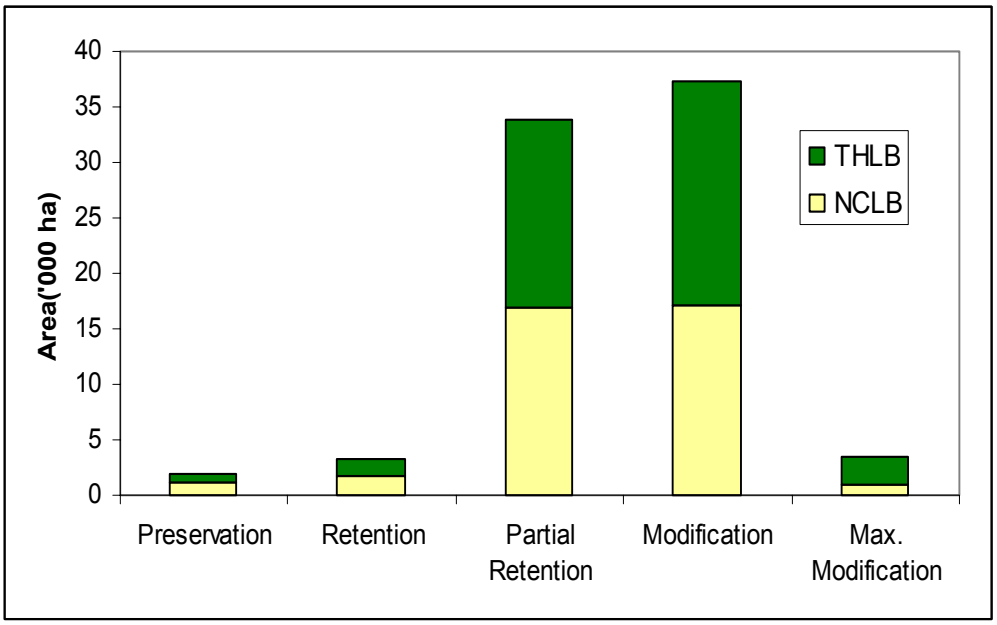


Figure 6 Visually Sensitive Areas

Caribou Habitat

Four caribou habitat zones have been spatially defined in this analysis. These zones cover approximately 24 percent of the TSA. Figure 7 describes these zones relative to one another. The Graham, Hackney Hills and Kobes Creek habitat areas are managed for old growth. The Milligan Hills area is managed for cut -block adjacency.

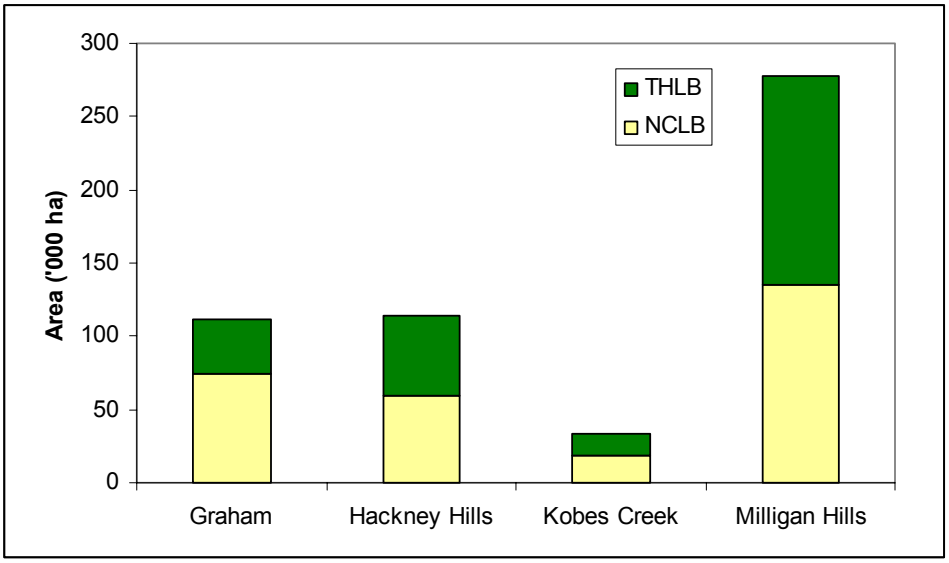


Figure 7 Caribou Habitat

BEC variants versus NDUs

A major change in management for biological diversity involves the incorporation of natural disturbance units as a planning tool across the Prince George Forest Region. NDUs are a relatively recent development in British Columbia's evolutionary progress to utilize best available information in the formulation of management planning guidelines. The Forest Practices Code biodiversity guidebook incorporated natural disturbance types utilizing biogeoclimatic ecosystem classifications for which old growth forest cover targets where determined. NDUs reflect a move towards the utilization of technically supportable guidelines utilizing spatially defined geographic areas and considerable research into natural disturbance patterns. This work was completed by the MOF at the Prince George Regional Office. The distribution of forested areas within NDTs and NDUs is shown in Figures 8 and 9.

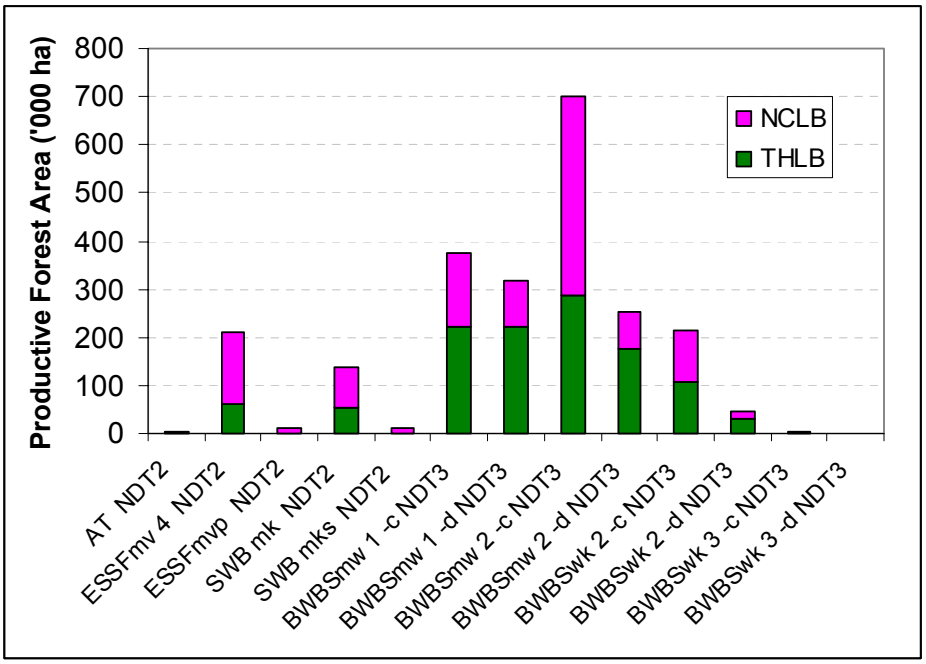


Figure 8 Forest Area by BEC, NDT - Fort St. John TSA

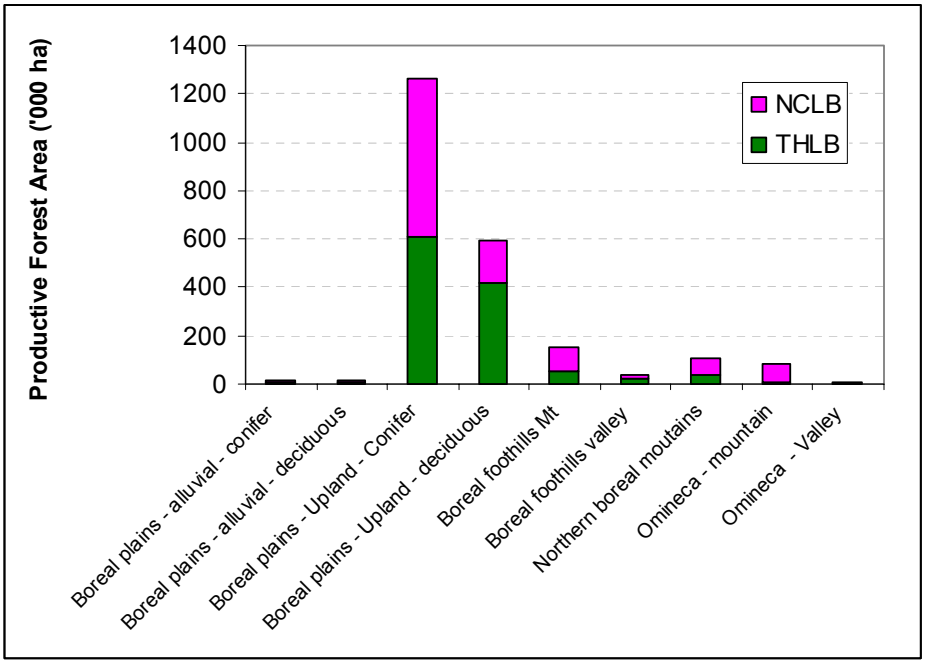


Figure 9 Forest Area by Natural Disturbance Unit – Fort St. John TSA

Watersheds and Equivalent Clear Cut Area (ECA)

As part of the Fort St. John SFMP project, watersheds have been delineated across most of the TSA. The watersheds vary in size from 900 hectares to over 170,000 hectares with many smaller watersheds existing within larger ones. Forest cover equivalent clear-cut area targets have been recommended for all of these watersheds. Figure 10 shows the broad extent to which watershed areas have been defined across the TSA.

Equivalent clear-cut area or "ECA" is used to estimate the average height required by plantations to achieve hydrologic recovery within a watershed. Most hydrologic impacts occur during periods of peak stream flow – usually during the springtime. After an area is harvested, both winter snow accumulation and spring melt rates' increase. As harvested areas are replanted and these plantations grow, the amount of snow accumulation and rate of snow melt are reduced. This reduction occurs as a result of the extent that the snow pack is exposed to solar radiation. The process is referred to as 'hydrologic recovery'. This analysis placed cumulative forest cover constraints on a watershed, thereby controlling the amount of forest land existing under a specified height. This should ensure that excessive timber harvesting in a watershed does not result in significant watershed damage.

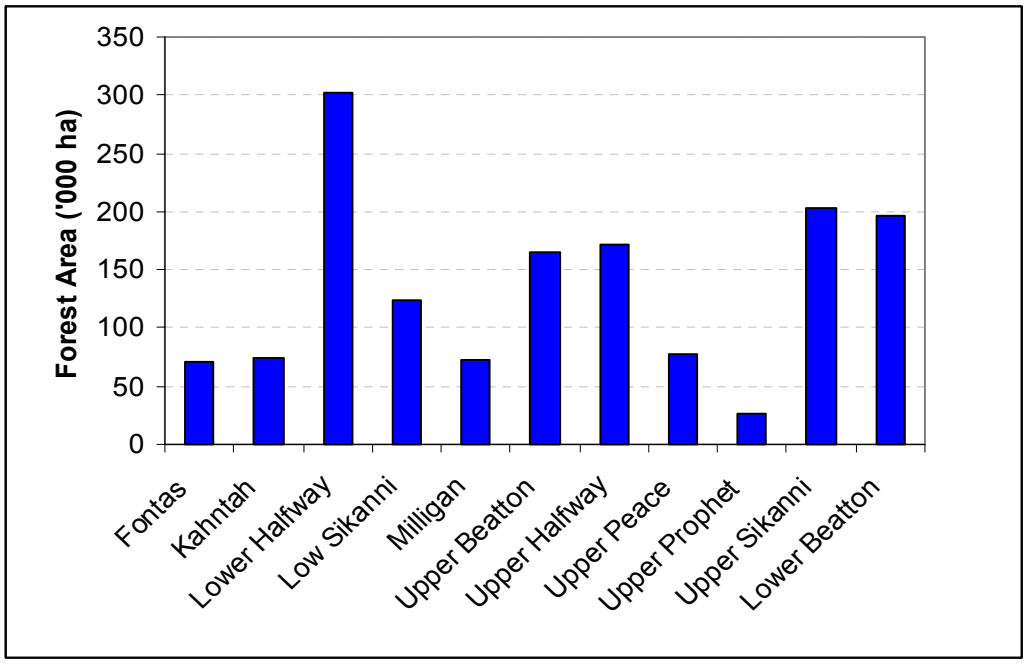


Figure 10 General Watershed Areas

Graham River Integrated Resource Plan

Forest management within the Graham River Valley has been refined for short and long-term management through a comprehensive integrated resource management plan. The acceptance of this plan by Graham River resource users led to the spatially explicit delineation of cut blocks and riparian corridors. A harvest schedule was proposed for these cut-blocks. Scenario 5 in this analysis incorporates this plan within the timber supply analysis. THLB area outside cut-blocks and riparian reserves were added to the non-contributing land base. The IRMP covers approximately 157,000 hectares in the TSA. From this area 24,022 hectares are identified in cut-block clusters or riparian areas as contributing to the THLB. The remaining area outside of clusters will not be harvested under this plan. Figure 11 defines this area and the associated harvest schedule.

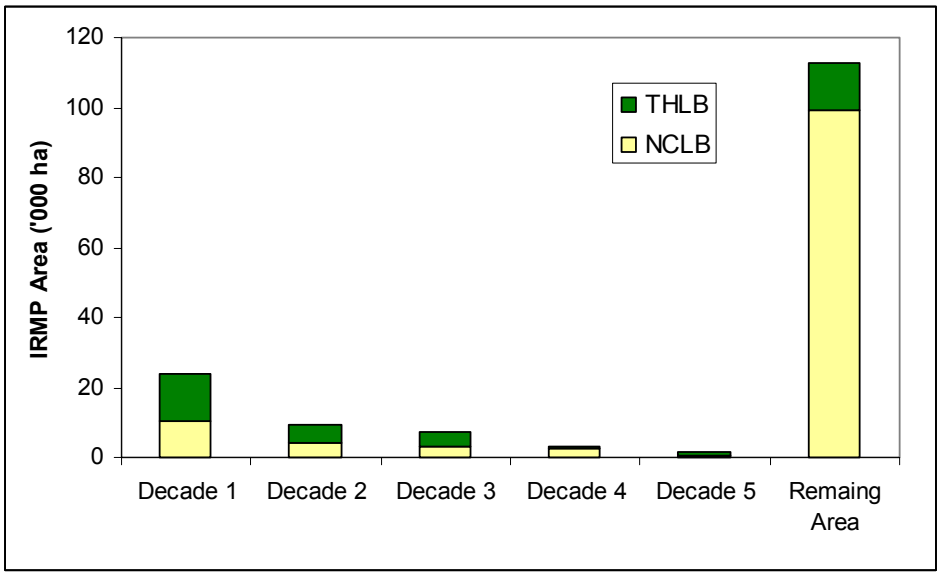


Figure 11 Graham River IRMP

3.0 Results

Five scenarios are examined in this analysis report. None of the scenarios are identified as a standard "Base Case", since the intent of this analysis was not to identify a sustainable harvest based upon current management practices, but to evaluate different management alternatives in support of a Sustainable Forest Management Plan.

3.1 Harvest flow

Harvest flow describes the sustainable harvest level for the TSA for the short, mid and long-term. The harvest flows shown in this report are net of non-recoverable losses and are supportable for a 400-year period. In each scenario, three harvest flows were determined. These are:

- A flat line non-declining traditional coniferous harvest level;
- A small-diameter lodgepole pine harvest level; and
- A deciduous harvest level that begins above the long-term sustainable harvest flow, and is followed by a maximum 10% per decade step down to the non-declining harvest level.

In each case an area-based disturbance target was directed at stands outside the THLB. This was done to cycle a certain level of mortality in the forested non-contributing land base

3.1.1 Scenario 1 – TSR2 Mimic

Forest estate modeling assumptions incorporated in this scenario follow very closely the land base and related assumptions developed by the Ministry of Forests for the Fort St. John Timber Supply Review (June 2002) Base Case Scenario. The harvest flow in Figure 12 shows a total initial harvest level of 2,750,000m^3/year. This harvest level is only 31,000 m^3 or 1.1 percent greater than the MOF's TSR2 Base forecast. The closeness of the result provides sufficient comfort to conclude that the forest estate model re-constructed for this analysis is capable of replicating TSR2 results, in light of changes to some inventories and various management assumptions.

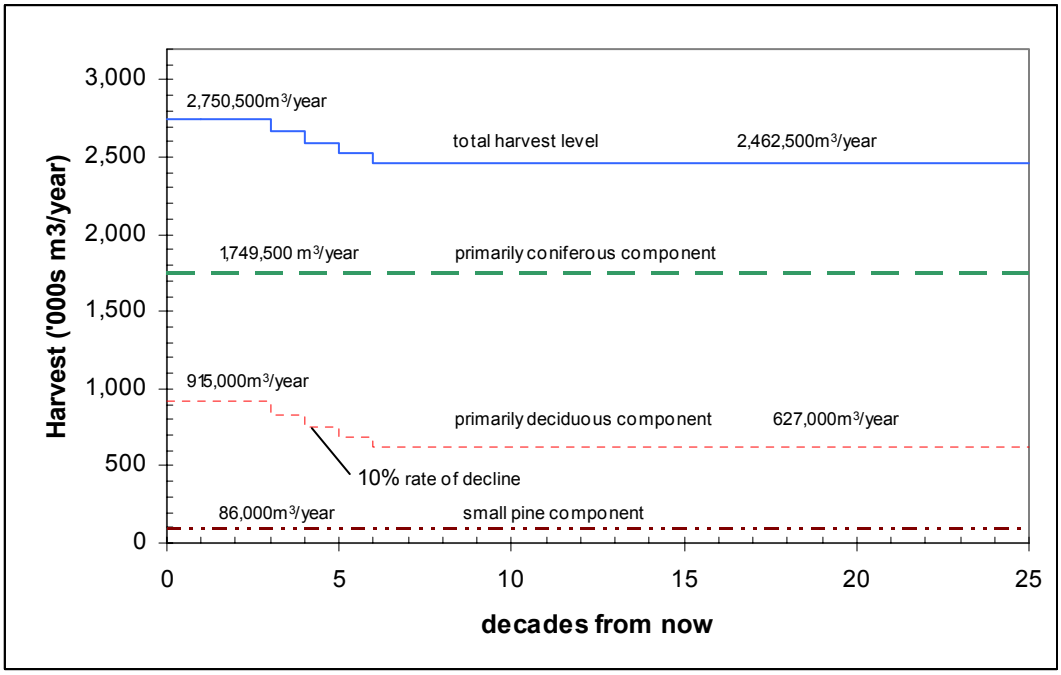


Figure 12 Scenario 1 harvest flow - TSR2 base case

Figure 12 also shows that the total TSA harvest has been apportioned to three defined land bases. The traditional coniferous land base can support a non-declining net harvest level of 1,749,500m^3/year. Although this is 3.3 percent greater than the harvest determined in TSR2, the difference can be generally explained by:

a) An increase in the traditional coniferous THLB by 1.5 percent (i.e., area has shifted from small pine to the traditional conifer THLB).

b) Grouping landscape units into larger contiguous management areas.

c) Small shifts in the amount of THLB associated with each analysis unit.

d) Use of a "relative oldest first" harvest rule in this analysis versus "random harvesting" in TSR2 (relative oldest first was used to better quantify the change in harvesting as a result of changes in management assumptions).

The small-pine harvest level has dropped significantly relative to the TSR2 results. A long-term harvest level of 86,000m^3/year is 22 percent less than the 110,000m^3/year reported in the TSR2 Report. A relatively significant portion of the area previously considered small-pine has shifted to the traditional conifer land base. The reason for the shift is a combination of the updated VRI forest inventory and slight variations in analysis unit programming logic.

The deciduous land base can continue to support an initial accelerated harvest of 915,000m^3/year for the next 30 years. This harvest then falls 10 percent per decade to the long-term harvest level of 627,000m^3/year (5,000m^3/year less than the TSR2 results). The difference in long-term harvest level is relatively small, in light of the 6

percent decrease in the deciduous THLB. Additional analysis, in regards to deciduous land base availability and yield and successional assumptions, needs to be undertaken; hence the results were deemed to be a reasonable representation of the sustainable deciduous harvest flow.

3.1.2 Scenario 2 NDU Analysis and an Enhanced Deciduous THLB

The participants of the Fort St. John results-based code pilot project have proposed a SFM plan that would manage forests according to a more natural range of variation then is currently advocated by the FPC biodiversity guidebook. The proposed plan would emulate patterns of natural disturbance at a landscape level, as opposed to management strategies directed at individual stands or cut-blocks. This scenario evaluates the move towards adopting natural disturbance indicators developed by the MOF's ecologist for the Prince George Region[1]. Several other changes to Scenario 1 were also incorporated in this scenario. To summarize these changes:

a) The deciduous land base was increased to include deciduous leading stands previously excluded from the THLB due to their being considered problem forest types. The inclusion of these stands increased the deciduous THLB by 41 percent (i.e., 124,290 ha) to 429,012.

b) Growth and yield from deciduous-leading stands was limited to a defined maximum age (155 years). Stands exceeding this age (if not harvested) reverted back to an immature unmanaged stand.

c) The non-contributing land base in both Scenario 1 and this scenario is cycled to reflect stand mortality from disturbance. Scenario 1 cycled the NCLB at a rate of 5,000 ha per year. Scenario 2 cycled stands based upon stand replacement disturbance cycles by NDU. Scenario 2 cycled the NCLB at a rate of approximately 1,105 ha per year.

d) The estimated loss to the THLB through the construction of future roads, trails and landings was increased from 0.6 percent in Scenario 1 to 6.4 percent.

Figure 13 shows the harvest flows that result from these changes. The initial TSA harvest level of 2,816,500m^3/year is 2.4 percent greater than in Scenario 1. Specifically, the traditional coniferous harvest has decreased from 1,749,500 to 1,693,500m^3/year; the small pine harvest has decreased from 86,000 to 83,000m^3/year; the deciduous allotment has increased from 915,000 to 1,040,000 m^3/year, and remains at this level for an additional 30 years before sinking to a long-term sustainable level.

Too many changes where made in the transition from Scenario 1 to Scenario 2 to fully analyze the incremental effect of each change. The increase in the deciduous THLB undoubtedly had a positive effect on the total deciduous harvest level. Increasing the estimated losses to future roads will have a negative effect on the long-term harvest level. The effect of managing for NDUs was unknown. Further analysis was undertaken. The stepwise change from NDT management to NDU management (i.e., whereby minimum NDU targets were applied to Scenario 1 in

[1] Natural Disturbance Units of the Prince George Forest Region: Guidance for Sustainable Forest Management, 2002. DeLong, Unpublished 2002

replace of NDT targets) revealed that this change had a very minor (e.g., <1%) positive impact on sustainable harvest levels.

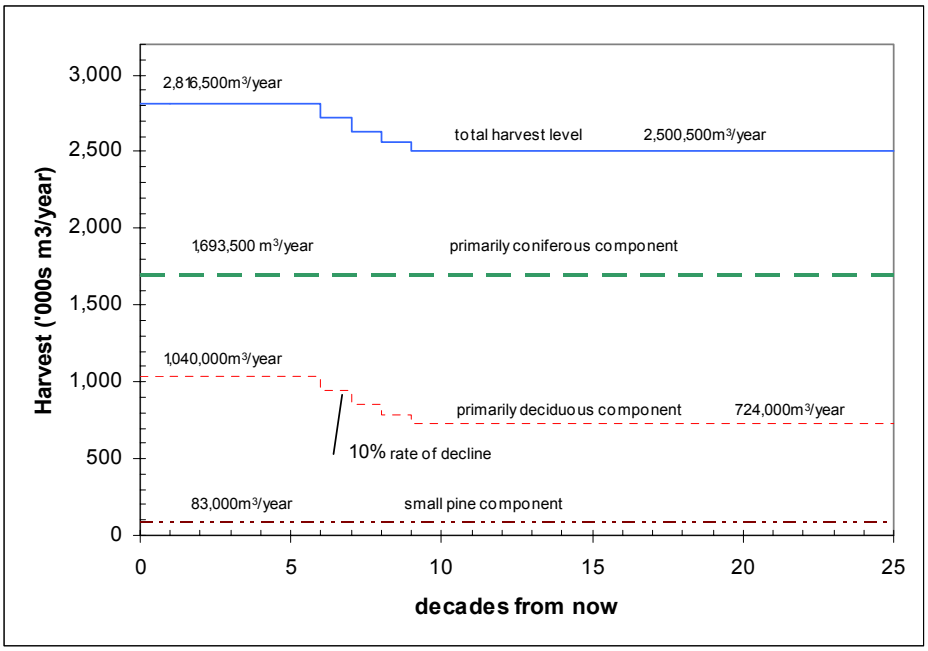


Figure 13 Scenario 2 harvest flow – Minimum NDUs

3.1.3 Scenario 3 – Watersheds

Incorporating watersheds into the harvest simulation was done incrementally by building on Scenario 2. Over 80 defined watersheds covering 1,564,164 hectares of forest land were modeled using equivalent clear cut area constraints. Greenup targets of 3, 5, 7 and 9 metres were applied to each watershed. Many of the watersheds were relatively small and overlapped with larger watersheds, thus more than one ECA target may have been applied to a forest stand. Further detailed information is provided in Appendix I, Section 2. The short and long-term timber supply impact of managing for watersheds using ECA is nil. The harvest flow described in Figure 13 is fully supportable, with the inclusion of watershed ECA targets in the timber supply model.

3.1.4 Scenario 4 – Biodiversity Emphasis Options

Previous to this point in the analysis, the constraints applied to the NDU/landscape unit areas were the minimum old growth targets (e.g., old growth is defined as stands ≥140 years) suggested in the Prince George Region natural disturbance unit document. The exception was deciduous leading stands in the Omineca NDU where the minimum NDU constraint was defined as the maintenance of 10% forest area above 120 years of age. This old growth target was determined through consultation with Craig Delong, the MOF's regional ecologist.

Biodiversity emphasis options (BEOs) have been proposed for landscape units within the TSA. The effect of these proposed BEOs was tested by applying the range

of variability applicable to NDU old growth targets according to the biodiversity emphasis assigned to each landscape unit. High BEO landscape units were assigned the maximum old growth targets applicable for the NDU. Intermediate BEO landscape units were assigned mean old growth targets, and low BEO landscape units were assigned minimum NDU old growth targets.

The effect of this BEO assignment on the harvest flow is shown in Figure 14. BEOs have a very small effect on the TSA harvest levels. In the short-term the harvest flow falls only 0.2 percent. In the long-term the fall-down is slightly greater than 1 percent.

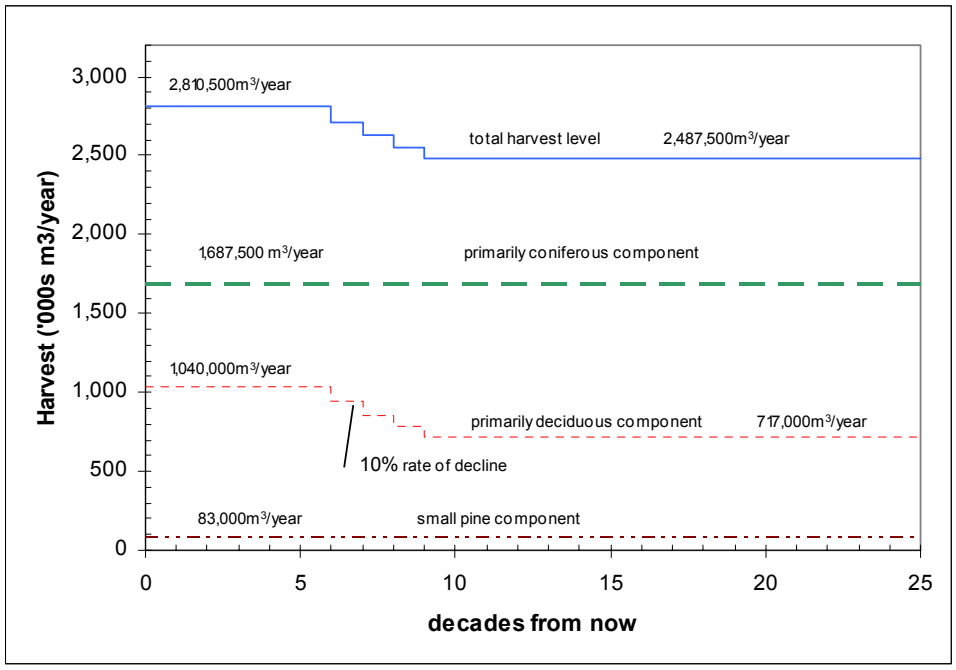


Figure 14 Scenario 4 harvest flow - Biodiversity Emphasis Options

3.1.5 Scenario 5 – Graham River Integrated Resource Management Plan

An integrated resource management plan (IRMP) was developed by Canfor for the Graham River Valley. A harvest plan was constructed with consideration given to scenic values, wildlife, recreation, hunting/fishing, and timber production. The geographic area is defined as the Crying Girl landscape unit and the Graham River landscape unit where it exists within the Omineca NDU. Within this area, clusters of cut-blocks were spatially delineated and a harvest schedule was prescribed. Riparian zones, inside and adjacent to clusters, were also defined. A maximum 10 percent of the area within riparian zones is considered available for harvest. All other area outside clusters and outside riparian zones was excluded from future harvesting.

The Graham IRM plan has a significant impact on the THLB for the entire TSA. The THLB was reduced by 13,234 ha (1.1%) for operable area adjacent to, but outside riparian areas and clusters.

The resultant harvest flow is provided in Figure 15. The initial net harvest level in for Scenario 15 is 2,769,500m^3/year for the TSA. This is sustainable for 60-years before beginning four declines of 10 percent per decade. In 90 years the long-term sustainable harvest level of 2,445,500m^3/year is achieved.

In Scenario 5, the coniferous and small pine harvest levels drop 2.2 and 5.1 percent respectively. This occurs primarily as a result of lost timber production opportunities in areas outside the IRMP harvest plan. The deciduous harvest level is not affected in the short or mid-term. A very small deciduous harvest reduction is forecast for the long-term. Very little of the Graham Valley has merchantable deciduous stands.

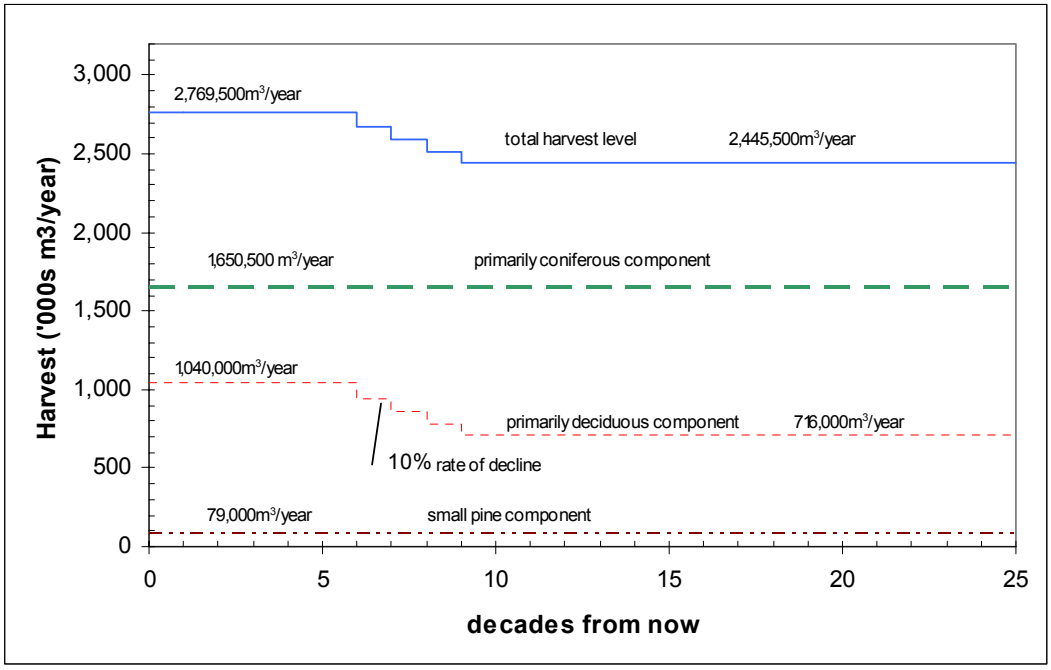


Figure 15 Scenario 5 harvest flow - Graham River IRMP

3.1.6 Scenario 5 - Additional Sensitivity Analysis

Additional sensitivity analysis was completed on Scenario 5. The sensitivity centered around 2 management assumptions:

a) All scenarios to this point included black spruce as contributing to biodiversity. Within the Fort St. John TSA, extensive areas of black spruce exist. These areas significantly mitigate the impact of forest cover constraints on the THLB. The timber supply impact of removing these expanses of black spruce from contributing to forest cover old growth targets was assessed.

b) All scenarios utilized a relative oldest first harvest rule. This was contrary to the TSR, which utilized a random harvest rule. The relative oldest first rule was chosen because it removed the possibility of a change in the analysis results, simply due to a change in the order of the input files.

The results for scenario 5(a) and scenario 5(b) are provided in Figures 20 and 21 respectively. Excluding black spruce (and range/wildlife burn areas) from contributing to biodiversity reduces the NCLB by 355,000 hectares or 32 percent. This has a significant impact on the timber that would otherwise contribute to biodiversity.

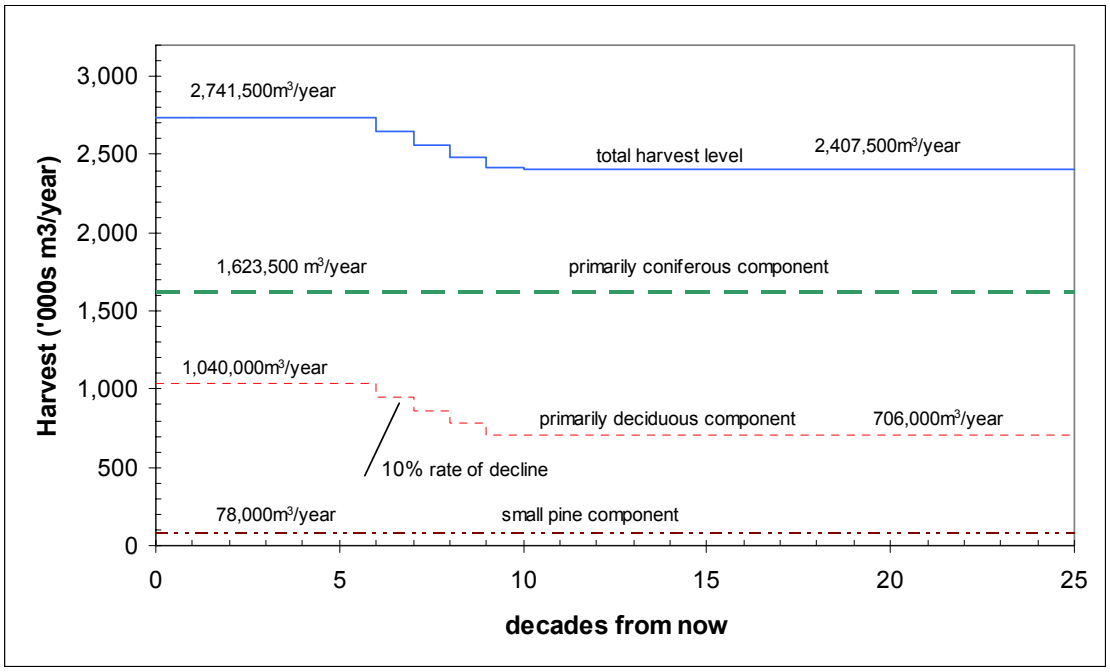


Figure 16 Scenario 5(a) harvest flow - Black Spruce Excluded from NCLB

A random harvest rule results in a very significant change to the sustainable harvest level for the TSA. Using this harvest rule, the total short-term harvest is sustainable for only 30 years, at a level of 2.38 million m^3/year. This is a 14 percent reduction from the original Scenario 5 which used a relative oldest first rule. After 7 decades, a long term harvest flow of 1.99 million m^3/year is reached..

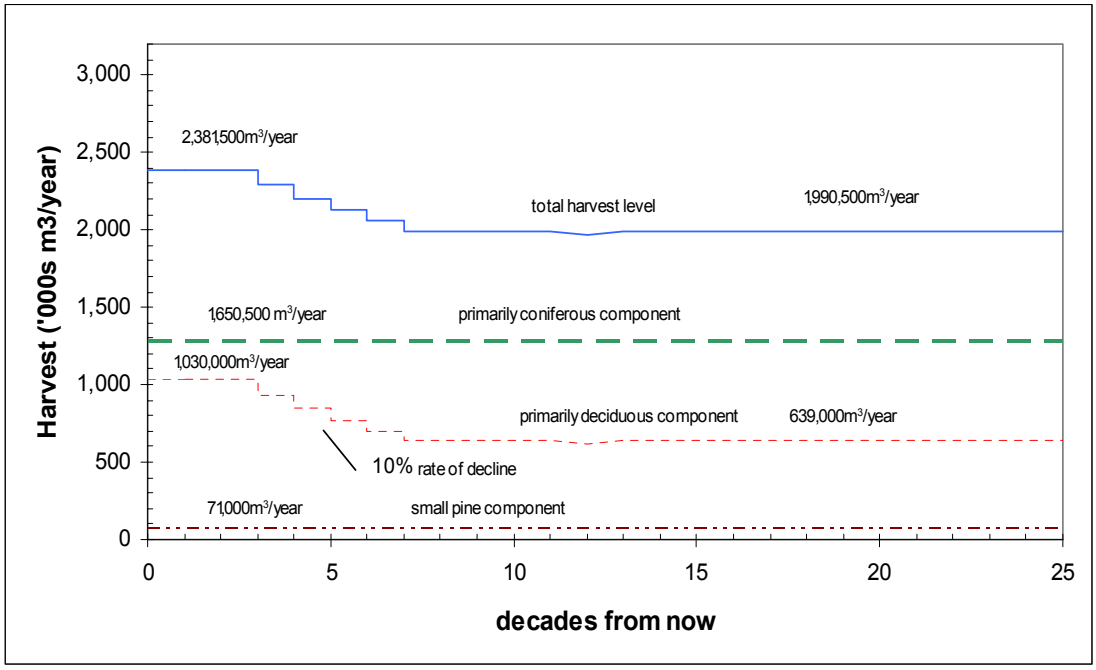


Figure 17 Scenario 5(b) harvest flow - Random Harvest Rule

3.1.7 Harvest flow summary information

Table 2 provides a tabular comparative summary of the harvest flow results for the preceding scenarios.

Table 2 Harvest flow results summary

Scenario	Description	THLB Area (ha)		Annual Harvest Levels (m3/year)					Percent change from S1
				Leading Conifer	Leading Deciduous		Total		
		Conifer	Deciduous		Short Term	Long term	Short term	Long-term	(short term)
n/a	MOF TSR2	733,221	325,318	1,804,000	915,000	632,000	2,719,000	2,425,000	-1.15
S1	TSR2 mimic	733,206	305,150	1,835,500	915,000	627,000	2,750,500	2,462,500	0.00
S2	NDU	733,206	429,440	1,776,500	1,040,000	724,000	2,816,500	2,500,500	2.40
S3	Watersheds	733,206	429,440	1,776,500	1,040,000	724,000	2,816,500	2,500,500	2.40
S4	BEO	733,206	429,440	1,770,500	1,040,000	717,000	2,810,500	2,487,500	2.18
S5	Graham IRMP	720,267	429,144	1,729,500	1,040,000	716,000	2,769,500	2,445,500	-0.69
S5a	Graham – No Sb	720,267	429,144	1,701,500	1,040,000	706,000	2,741,500	2,407,500	-0.30
S5b	Graham - Random	720,267	429,144	1,721,500	1,030,000	639,000	2,751,500	2,360,500	0.00

The harvest flow results shown in Table 2 reveal that the Fort St. John TSA is very resilient to changes in management direction. This is a directed function of 2 overriding features: 1) the existing age class distribution indicates that approximately 73 percent of the THLB is merchantable and a large portion of this area can support both harvesting and old growth biodiversity; 2) the THLB includes only about 50% of the forested land base. Even with disturbance cycling, the non-contributing land base can support most of the short and long-term forest cover requirements that would otherwise constrain a harvest flow.

The sections following provide additional information about the consequences of harvest activities on the growing stock, and age class distributions across the TSA. For the sake of brevity, only the results for Scenario 5 are provided. Analysis of these results indicates that in most cases, only minor changes occur between the scenarios.

3.2 Growing Stock

For Scenario 5, Figure 18 shows the change in the THLB growing stock over time. Incorporating the expanded deciduous land base, the total THLB growing stock begins at about 180 million cubic metres and then declines rapidly over the next 10 decades. The THLB total growing stock stabilizes at about 95 million cubic metres. Most of this volume is

coniferous. Figure 18 also shows the total growing stock for coniferous leading and deciduous leading stands. The TSA will eventually support a coniferous inventory of 73 million cubic metres and a deciduous inventory of 22 million cubic metres.

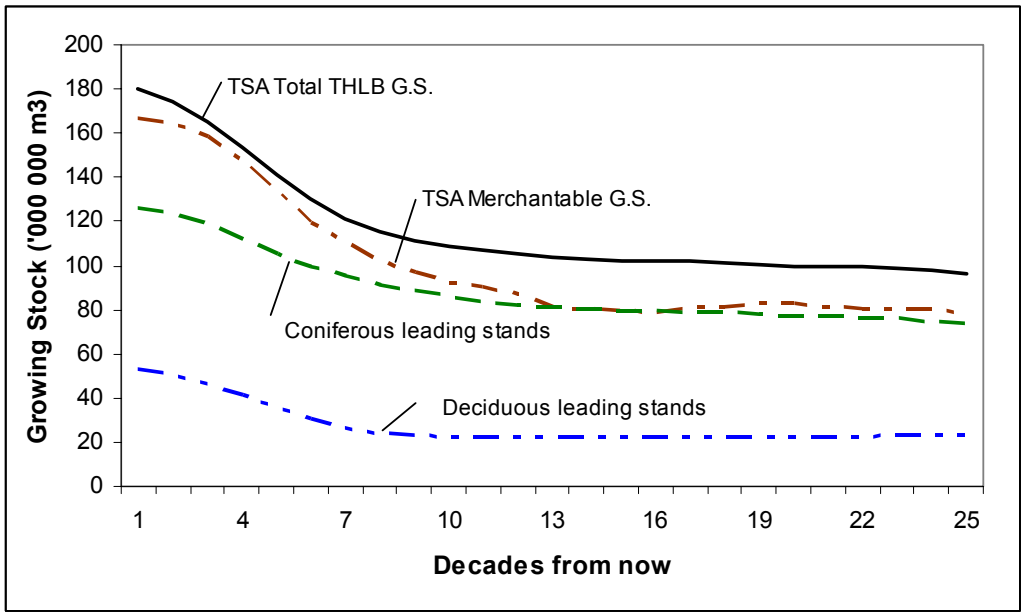


Figure 18 Change in growing stocks - Scenario 5 Fort St. John TSA

Yield tables for the non-contributing land base were not created in this analysis. However, when an area-weighted unmanaged stand yield table representing the THLB was applied to the NCLB, the result shown in Figure 19 is representative of the total expected change in the inventory for all productive forest stands in the TSA as-a-whole. Approximately 50 percent more growing stock exists across the TSA then is currently represented by the THLB. Although many of these stands are cycled (i.e., die through mortality and/or disturbance) the overall growing stock rises over time to about 500 million cubic metres. It is important to note that large catastrophic events are not modeled. Mortality equivalent to 1100 ha per year and periodic range and wildlife burns are modeled.

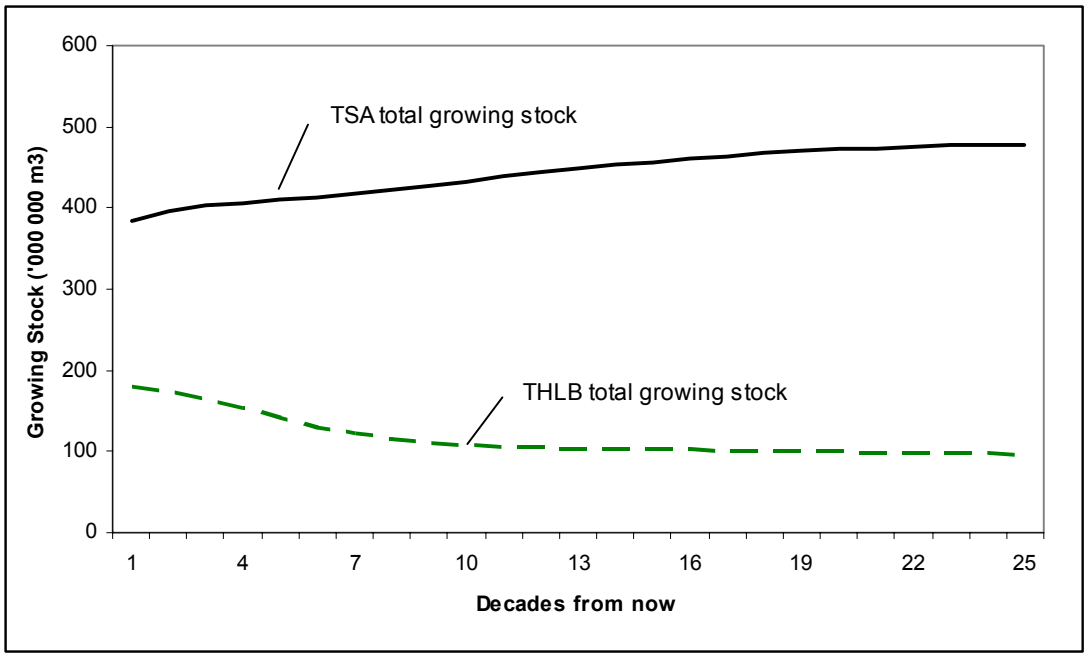


Figure 19 Total growing stock - Fort St. John TSA

3.3 Changing Age Class Distributions

Figure 20 plots the age class distribution of the timber harvesting land base over time. The graph reveals that harvesting transforms the THLB into a mostly normalized forest, with the majority of stands less than 120 years of age. The small amount of area in older age classes are representative of small, highly constrained areas (i.e., visually sensitive areas with a preservation or retention VQO) that hold area in reserve for other resource concerns.

Figure 21 also plots age class distribution over time, but is representative of the entire forested land base. Here, considerably more area is forecast to eventually exist in older age classes. Most of this area is representative of forests that do not contribute to the sustainable harvest levels.

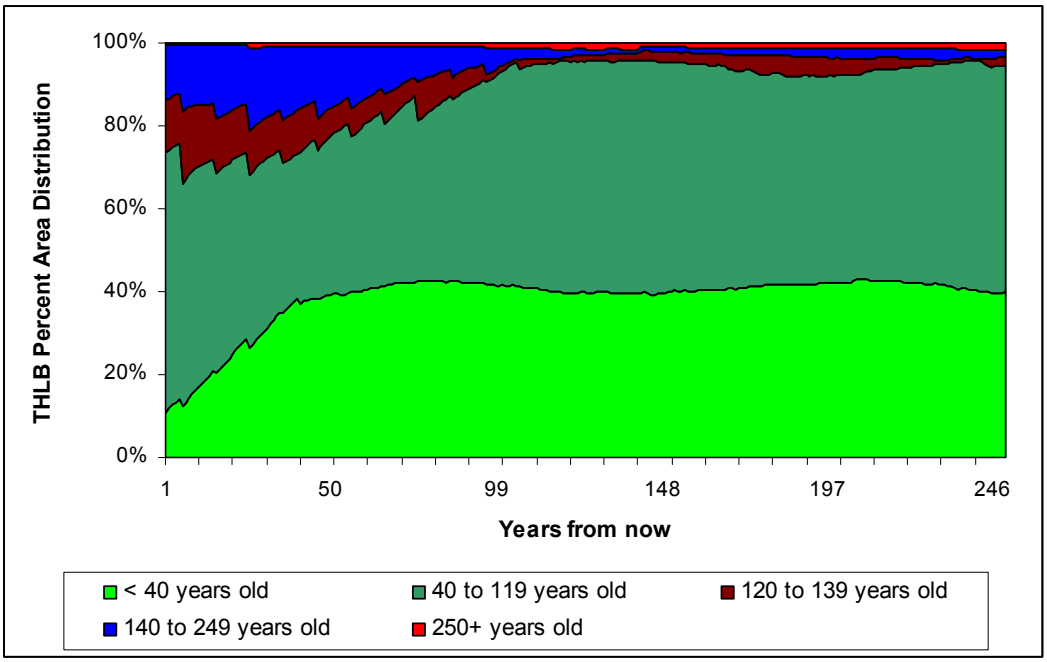


Figure 20 Age class distribution of the THLB over time

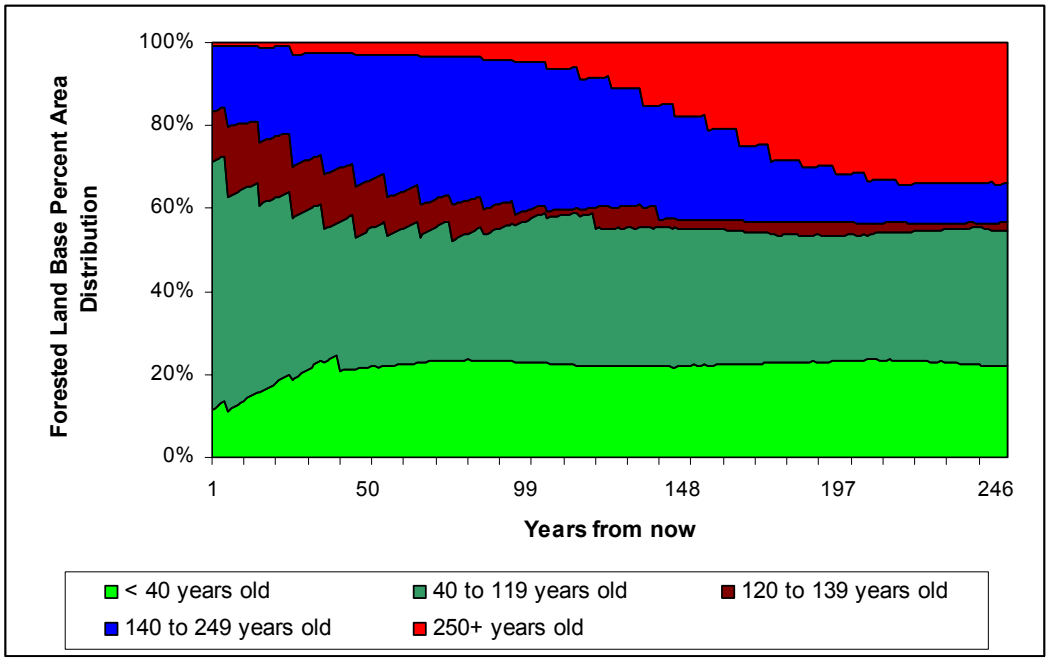


Figure 21 Age class distribution of the entire forested land base over time

3.4 Carbon Cycling

The timber supply model was not originally constructed to model the amount of carbon sequestration over time, for the forest stands within the TSA. Near the completion of this analysis, the desire to show the impact of forest management on carbon cycling became apparent. Carbon tables were created by Dr. Brad Seely (Forest Ecosystem Management Simulation Group, UBC) that described the amount of carbon in forest stands existing and forecast to exist in the Fort St. John TSA. These carbon tables were linked to the existing forest cover analysis units used in this project. The age class distributions of all analysis units, over a 400-year simulation period, were multiplied by the amount of carbon within each stand to describe the trend in carbon sequestration over time. Figures 22 and 23 show the total amount of ecosystem carbon over time and the rate of carbon sequestration.

- Line 1 is representative of the amount of carbon under the Scenario 5 harvest flow.
- Line 2 is representative of carbon under Scenario 5b, using a random harvest selection and the current apportioned allowable annual cut.
- Line 3 is representative of carbon sequestration if no harvesting occurred and the forest land base cycled naturally at a rate of approximately 20,000 hectares per year (based upon NDU disturbance rates).

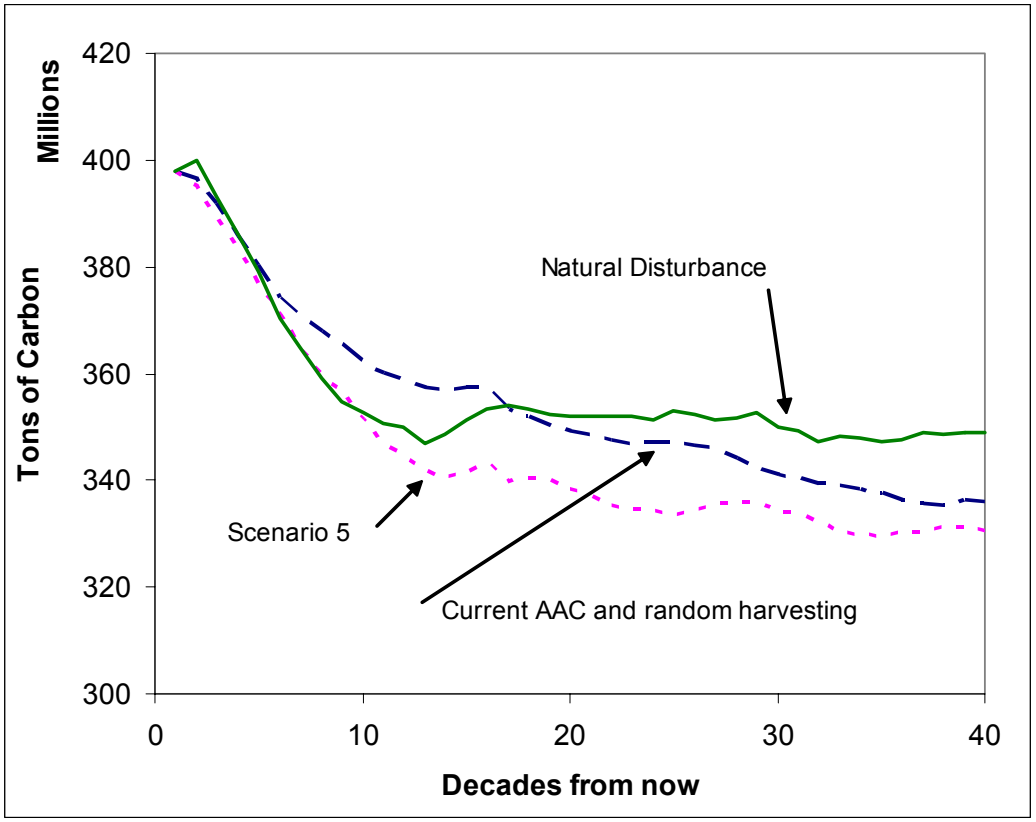


Figure 22 Total ecosystem carbon over time – Fort St. John TSA

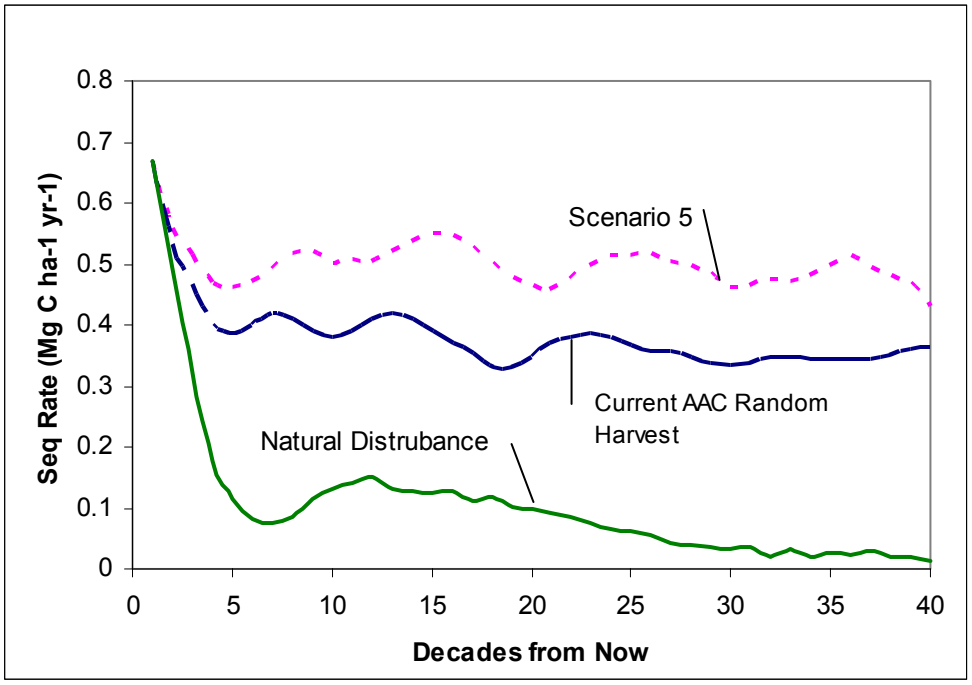


Figure 23 Rate of carbon sequestration – Fort St. John TSA

4.0 Summary and conclusions

A timber supply analysis was assessed for small pine, traditional conifer and deciduous leading stands in the Fort St. John TSA. The analysis began with the resurrection of the MOF's Base Case timber supply analysis scenario, but incorporated new inventories, revised landscape units and some small modifications to management assumptions. The results determined in a new base case (Scenario 1) were sufficiently close to the MOF's results to conclude that the forest estate model used for this report provided a reasonable representation of the TSR2 Base Case.

In support of the results-based code pilot project, for which a sustainable forest management plan has been created, additional analysis was conducted. Several changes to Base Case management assumptions were incrementally applied to quantify the impact of various management initiatives.

Considerable opportunity exists to increase deciduous harvest levels through the inclusion of stands that the Base Case considered deciduous-leading problem forest types. This opportunity is supported by the TSR2 report, which also suggested that deciduous-leading stand volumes may be underestimated by 27 percent. A 41 percent area increase in the deciduous-leading THLB can produce an immediate 14 percent increase in the deciduous harvest level, and keep this level sustainable for an additional 30 years.

The adoption of natural disturbance units in place of FPC natural disturbance types, utilizing minimum old growth targets, does not improve or constrain timber availability appreciably.

Watersheds have been defined for most of the TSA. For each watershed a peak flow index was used to establish equivalent clear-cut area (ECA) targets. The TSA contains sufficient forest area in the non-contributing land base to mitigate timber supply harvest reductions as a result of watershed management.

Biodiversity emphasis options have been proposed for landscape units within the TSA. Once again, the amount of forest area in the NCLB alleviates any significant impacts of harvest constraints in landscape units designated a high or intermediate BEO. A small (i.e., 0.5%) decrease in the TSA harvest was the simulation result.

The Graham River IRMP has spatially defined a THLB and a harvest schedule for a small resource sensitive portion of the TSA. Incorporation of this spatial plan into the analysis results in a small (1.7 %) decrease in the harvest forecast. This reduction is partly in response to the decrease in the THLB and partially in response to a harvest schedule that does not schedule according a harvest plan that better maximizes mean annual increment.

Appendix I

Data Package
in support of the
Fort St. John Result Base Code Pilot
Timber Supply Analysis

Data Package in Support of the Fort St John Code Pilot Project

The following data package was created in support of the Fort St. John Code Pilot timber supply analysis report. The information and logic using in the creation of this Data Package followed, to a great extent, the logic, yield assumptions, management assumptions and land base assumptions created for and used by the B.C. Ministry of Forests (MOF) in the timber supply review (TSR2) for the Fort St. John TSA completed in June 2002. The reader should be aware that several items have changed since the completion of the Ministries TSR Analysis. These changes include an updated land base inventory, watershed coverage, revised landscape units, and proposed natural disturbance unit (NDU) boundaries. The scenarios that investigated alternative management strategies incorporate most if not all these changes. This data package is divided into 3 sections.

1. Land base inventory
2. Management Assumptions
3. Growth and Yield

These three general topics form the basis under which a timber supply forest estate model can be constructed.

Section 1. Land Base Inventory

Table A3 describes the inventory coverage's used in the creation of an Arc-Info GIS semi-spatially explicit resultant data base. The resultant data base was used to formulate the inventor for the forest estate model.

Table A3 Inventory Coverage's

Inventory Coverage	Date	Scale
Forest Cover	1964-1989 Updated to 2003	1:20,000
Vegetation Resource Inventory	2000 updated to 2003	1:20,000
Landscape Units	2003	1:20,000
Biogeoclimatic ecosystem classification		
Range burns	1998	1:250,000
Wildlife burns	1999	1:50,000
Visual quality objectives	1997	1:50,000
Recreation	1998	1:20,000
Natural Disturbance Units	2003	
Graham IRMP cut-blocks and riparian	1998	1:20,000
Pulpwood Areas	1996	1:20,000
Protected Areas	2003	1:20,000
Caribou Management Zones	1989	1:50,000

Fort St. Kohn LRMP Resource	1996	1:20,000
Region / Compartment boundaries	1989	1:50,000
Watersheds		1:20,000

As closely as possible, the net down logic used to identify the timber harvesting land base (THLB) was conducted as per the TSR2 net down. To this end, the MOF's timber supply analyst was greatly supportive in assisting with programming logic. The following sections describe the net down used in the creation of the revised THLB in support of the Fort St. John SFMP analysis.

TSA Area

The Fort St. John TSA area was spatially identified. All area outside the perimeter of the TSA was excluded from the analysis. The total area of the Fort St. John TSA covers 4,676,639 ha.

Reduction for Non-Forest

Non-forest areas were excluded from the productive forest land base using the Type ID indicator codes on the forest inventory files. Type ID 6, 7, and 8 were removed from the productive forest land base.

Reductions for woodlots

Woodlots were removed from the inventory file, using a new inventory coverage that was not available for the TSR2 analysis. As a result considerably more area was removed in this analysis for woodlots. Forest area in woodlots is not used in support of biodiversity or other forest cover requirements.

Reductions for Ownership

Ownership refers to the forested and non-forested parts of the TSA for which the MOF has management jurisdiction. The MOF does not have jurisdiction over private lands, federal lands, Indian reserves and municipal areas that exist within the TSA. These areas are removed from the productive forest land base. The areas are identified on the inventory files by an ownership code. All ownership codes 1N, 40N, 52N, 61C, 61N were removed from this analysis. The remaining ownership codes (i.e., 60N, 62C, 63N, 67N, 69C, 69N, 72B, 76N, 77N) were not removed in this analysis. The total area in each ownership code is provided in Table A4.

Table A4 Land Ownership

Ownership	Schedule	Total Area
0		1.0
1	N	90.7
40	N	505,576.1
52	N	6,705.2
60	N	2,603.9

61	C	41,753.2
61	N	1,055.0
62	C	3,996,735.9
63	N	440.2
67	N	68.8
69	C	113,239.6
69	N	663.4
76	N	76.7
77	N	7,629.2
	Total	**4,676,639.0**

Reductions for Range Lease

Range lease areas were identified in the analysis using a non-standard inventory file. All areas identified as a "LEASE" were removed from the analysis area. These areas were deemed to have an agricultural value that precluded long-term timber supply planning.

Table A5 Range Classifications

Range type	Area (ha)
N/A	4,354,587.9
LEASE	13,388.2
PERMIT	308,662.9
Total	**4,676,639.0**

Reductions for Parks

Parks are identified as provincial parks, new parks, ecological reserves and recreation areas. These areas have been excluded from the timber harvesting land base, but the forests within these parks can contribute towards achieving old growth and biodiversity targets. The areas in parks are identified by ownership codes and by the non-standard inventory coverage associated with the Fort St. John Land and Resource Management Plan (LRMP). The logic used to defined parks is as follows:

1) if the ownership coded was 69N
2) if the resource management zone designation was "park" or "ecological reserve".

Wherever these conditions were met the area was classified as a park.

Reductions for Non-commercial cover

Non-commercial brush species are identified on the standard inventory files as Type ID #5. These areas are excluded from BOTH the timber harvesting land base and from contributing to the productive forest land base. A total of 192,035 ha are classified as Type ID #5 in the Fort St. John TSA.

Reductions for Unclassified roads trails and landings

In the MOF's process of completing the analysis for TSR2, existing unclassified roads and landings were spatially identified using a GIS. This spatial classification resulted in an incredibly large data-set due to the countless sliver polygons created by road buffers (as well as stream, wetland and lakeshore buffers). To simplify the analysis, the original data-set was used to determine the percent area in each polygon that should have area removed for roads (as well as in streams, wetlands and lake buffers). This percentage was then used in place of the GIS spatial reduction. These reduction values were obtained from the MOF and applied to the FIP portion of the inventory files. This information was not available for the newer VRI portion of the inventory files. To address unclassified roads in the VRI database, a TSA average reduction of 0.15156 percent was calculated using the TSR2 net-down summary table.

Reductions for Riparian Areas around Lakes and Wetlands

As with the reduction for unclassified roads and landings, a percent reduction was applied for riparian areas around lakes and wetlands. For the FIP portion of the inventory files, the reduction was polygon specific and matched the percent reduction used by the MOF. The VRI portion of the inventory file used a reduction factor of 0.34387 percent, as determined again from the TSR2 net-down table.

Reductions for Riparian Areas around Streams

Once again, in the reduction for unclassified roads and landings, a percent reduction was applied for riparian areas around single and double line streams. For the FIP portion of the inventory files, the percent reduction was polygon specific and matched the percent reduction used by the MOF. The VRI portion of the inventory file used a reduction factor of 1.66 percent as determined using the TSR2 net-down table.

Reductions for Seismic Lines

Finally, a percent reduction was applied for the corridors created by the construction of seismic lines, gas lines and hydro lines. For the FIP portion of the inventory files, the reduction was matched the percent reduction used by the MOF. The VRI portion of the inventory file used a reduction factor of 0.67004 percent as determined using the TSR2 net-down table.

Reductions for Range and Wildlife Burn Areas

Range and wildlife burn areas are managed for range and/or wildlife use. Prescribed burning is used to keep these areas in an early seral stage, and as such they do not contribute to the THLB, but are part of the productive forest. Range and wildlife burn areas were identified using a non-standard inventory file. There were 3,886 ha removed for wildlife burn areas and 27,563 ha removed for range burn areas for a total reduction of 31,449 ha.

Reductions for Inaccessible Areas

Inaccessible areas were identified in the TSR as region compartment numbers located too far from a timber processing facility to justify the hauling cost at the present time and in the foreseeable future. This analysis expands on this reduction to also include areas that would otherwise fall into the THLB, but existed in an area having a biogeoclimatic ecosystem classification of AT or ESSFmvp. There were 2,063.5 ha of AT and 12,491.0 ha of ESSF mvp for a total reduction of 14,554.5 ha.

The reductions for inaccessible areas are presented in Table A6.

Table A6 Reductions for Inaccessible Areas

Region	Compartment	Productive Forest Area (ha)
78	104	2,764
78	105	1,421
79	178	1,134
79	182	1,425
79	183	3,080
	Sub-Total	**9,824**
Biogeoclimatic Ecosystem Classification		**Productive Forest Area (ha)**
Alpine Forest (AT)		2,063.5
ESSF mvp (Alpine parkland)		12,491.0
	Sub-Total	**14,554.5**

Reductions for Inoperable Areas

Inoperable areas are sites that are deemed to be isolated, or areas with impassable physical barriers (e.g. steep slopes). Classified by air-photo interpretation, these areas are delineated in the FIP file by the operability code "I" for inoperable. There were 20,408.4 ha removed from the THLB for inoperability. The remaining operable areas, have been categorized into one of three other operability codes ("A" for conventional, "C" for cable or "H" for cable/aerial) based upon their slope, soil/parent material and harvest system. Table A7 lists the operability codes and their associated area classifications.

Table A7 Operability

Operability	Productive Forest	Timber Harvesting
(A) Conventional	2,169,650.1	1,026,392.5
(C) Cable	86,005.8	11,954.1
(H) Aerial (heli)	109.8	9.0
(I) Inoperable	20,408.4	0
Total	**2,276,174.1**	**1,038,355.6**

Reductions for Non-merchantable Coniferous Leading Species

Non-merchantable coniferous leading types are physically operable stands that exceed minimum site criteria, are not currently utilized or have marginal merchantability. The areas removed for black spruce, hemlock and cedar leading stands are presented in Table A8.

Table A8 Coniferous Problem Forest Types

Type Group	Description	Percent	Area (ha)
21 to 26	Remove all SB leading stands	100	342,664.4
10, 16	Remove all Hw and Cw	100	35.9
Total			**342,700.3**

Reductions for Non-merchantable Deciduous Leading Species

Non-merchantable deciduous leading types are physically operable stands that exceed minimum site criteria, and are not currently utilized or have marginal merchantability. The area removed for deciduous-leading stands is presented in Table A9.

Table A9 Deciduous Problem Forest Types

Type Group(s)	Description	Percent	Forest
33, 34	Remove all larch (Lx) leading stands	100	3,213.6
35 to 38	Remove all stands with Ac > 49% (not	100	20,896.3
35, 37, 41	Remove all stands with > 30% SB	100	0
40	Remove all stands with E or Ep leading	100	39,226.4
>=35 and <=42	Remove all stands with cmc_pct < 50	100	38,089.4
>=35 and <=42	Remove all stands with operability of C or	100	24,623.1
		Total	126,048.8

Reductions for Low Productivity Species

Stands that are considered to have low productivity do meet the minimum requirements for economic merchantability. Reasons such as poor nutrient availability, exposure, excessive moisture, and so forth may cause this lower yield. There are different criteria for identifying sites with low timber growing potential. The logic used to identify mature and immature low productivity sites is identical to the logic used in the TSR2 Report for the Fort St. John TSA Tables A-10 and A-11.

Reduction for Recreation Areas

Area reductions for recreation were carried out as per the logic identified in Table A-12 in the Fort St. John TSR2 Report.

Table A10 Recreation Reductions

Feature Significance	Management Class					
	Very Sensitive		Sensitive		Not Sensitive	
	% Red	Prod. For	%	Prod. For	% Red	Prod. For
Very High	100	492.1	50	0.0	0	0.0
High	100	1,889.7	50	77,923.5	0	0.0
Moderate	100	0.0	20	66,652.7	0	47,468.5
Low	0	0.0	0	781,844.1	0	282,311.5

Reduction for ESAs

Environmentally sensitive area reduction factors remained largely unchanged from TSR2. However, the VRI portion of the inventory no longer carries an ESA classification. The reduction factors were therefore only applied to the original FIP portion of the inventory. Table A11 describes these reductions and the forested area within each ESA classification.

Table A11 Environmental Sensitive Area Reductions

ESA	Reduction	Productive Forest
Es1	90.0	38,717.1
Es2	50.0	1,094.3
Ep1 Ep2	90.0	2,436.4
Ea	90.0	0.0
Ew1	90.0	814.5
Ew2	30.0	7,165.1

Total	50,227.4

Reduction for Wildlife Tree Patches

The Fort St. John TSR2 applied wildlife tree patch reductions based upon BEC, leading species and landscape unit. The landscape units have been changed (updated) in this analysis; hence the reduction for WTPs has been changed.

Table A12 WTP reductions by Landscape Unit

Landscape Unit	% reduction for WTPs
Lower Beatton	8.0
Milligan	4.0
Kahntah	4.0
Trutch	4.0
Tommy Lakes	3.0
Blueberry	5.0
Kobes	5.0
Crying Girl	6.0
Halfway	3.0
Graham	4.0
Sikanni	4.0

Reductions for non-productive burns areas

Reductions for non-productive burn areas no longer apply to the VRI portion of the inventory, as this information should be captured in the new inventory. However, this information remains a problem in the FIP portion of the inventory. To address the fact that large areas of the TSA have had wildfires that have been classified as NSR, the TSR2 Analysis reduced the amount of NSR that could be included in the THLB by 44.6 percent. This reduction was also applied to the FIP portion of this analysis.

Resultant net land base determination

The foregoing land base reductions resulted in the productive forest land base (i.e., 2,276,290 ha) being reduced to an initial timber harvesting land base of 1,038,355 hectares (THLB1). This THLB1 area was derived as a relative comparison to the THLB reported in the MOF's TSR2. It was used to benchmark the timber supply model to evaluate the relative change in modeling assumptions. The total area of 1,038,355 ha is divided into traditional conifer, small pine, and deciduous area as indicated in Table A13.

Table A13 THLB1 – TSR2 Assessment

Timber Harvesting Land Base 1	MOF's TSR2 Net Area	Net Area (ha)
Traditional conifer	676,523	686,656
Small Pine	56,698	46,977
Deciduous	325,318	304,722
Total		**1,038,355**

Revisions to the Timber Harvesting Land Base

This analysis included an evaluation of the effect of alternative management assumptions. These assumptions lead to the creation of 3 additional THLB's for which analysis was completed. These THLBs are:

THLB1 - As defined by the TSR2 logic

1. THLB2 – Adjust the TSR2 deciduous land base to include stands previously considered problem forest types (i.e., enhanced deciduous THLB)
2. THLB3 – As per THLB1 but remove areas outside the Graham River IRMP clusters and riparian areas from contributing to the timber harvesting land base. This THLB was not utilized in the analysis for the Fort St. John SFMP.
3. THLB4 – As per THLB3 but include the enhanced deciduous THLB

The assumptions leading to the creation of these additional timber harvesting land bases are described in the sections that follow.

Enhanced Deciduous Land Base

The enhanced deciduous land base involved an assessment of deciduous stands which in the TSR2 net-down were considered problem forest types or low productivity sites. This area was added back to the deciduous THLB after reductions for ESAs, riparian reserves, unclassified roads, etc. Table A14 shows the logic used to identify these stands.

Table A14 Deciduous Area Add-Back

AU# / Leading Species	Inventory type group	Stand characteristic where operability is conventional	Productive Forest Area (ha)	Net Area added to the Enhanced Deciduous THLB (ha)
602 - Birch	40	SI >= 14.0 & age <= 70	12,995.3	4550.3
603 - Birch	40	Age >70 & volume >120		6962.5
604 - Cottonwood	35, 36	Age <101 & SI>=9.6 & Ac% >= 49	11,377.2	12,493.1
		Age >=101 Ht>=17.5 vol >=120 Ac%>=49	14,175.9	
605 - Aspen with Conifer [1]	41	Age <101 and SI >=10.5 and <13.0	33,958.7	27,792.8
606 - Aspen with Deciduous	42	Age <101 and SI >=10.5 and <14.7	91917.1	72,491.1

AU# / Leading Species	Inventory type group	Stand characteristic where operability is conventional	Productive Forest Area (ha)	Net Area added to the Enhanced Deciduous THLB (ha)
			Total	**124,289.8**

The adjustment to the deciduous low site and problem forest type definition led to the creation of THLB2. This expanded the Deciduous THLB by 124,290 hectares (a 40% increase). The coniferous land base remained unchanged. The resultant enhanced timber harvesting land base for the TSA increased 12 percent to 1,162,645 ha.

Table A15 THLB2 - Deciduous Enhanced

Timber Harvesting Land Base 2	Net Area (ha)
Traditional conifer	686,656
Small Pine	46,977
Deciduous	429,012
Total	**1,162,645**

Graham River IRMP Adjustment

The SFMP is cognizant of the effort expended by Canfor on the development of the Graham River Integrated Resource Management Plan (IRMP). Through consultation with all stakeholders, a spatial long-term harvest plan was constructed and scheduled in a manner that met the concerns of other resource users. Cut-blocks were developed and "clustered" based upon the natural disturbance guidelines of the time. Riparian areas between the cut blocks were incorporated into the "clusters" and minimum extractions rules were applied. All areas outside the clusters, though merchantable under normal TSR net-down rules, were excluded from future harvest consideration. To incorporate this IRMP into the THLB for this analysis, the area outside defined riparian zones and clusters were identified and removed from the THLB. This was done first as an adjustment to THLB1 and created THLB3. It was then also applied to the enhanced deciduous land base and created a final THLB4. Table A16 describes the adjustment to the net-down logic and the area affected by the adjustment.

Table A16 Graham IRMP Area Adjustment

IRMP Area	Location	Reduction	THLB1	THLB2 Area
Inside Clusters	Graham LU and Omineca NDU or Crying Girl LU	0%	3505.4	3446.5
Defined Riparian Area outside clusters		0%	869.5	889.2
Outside clusters and riparian		100%	8514.5	8627.6
		Total	**12889.4**	**12963.3**

As a result of these adjustments, the THLB1 area was reduced by 8514.5 hectares to create THLB3 (IRMP adjusted), and the THLB2 (enhanced deciduous) land base was reduced by 8627.6 ha to create THLB4 (enhanced deciduous, IRMP adjusted).

The changes to the THLB as a result of the Graham River IRMP led to the definition of two additional THLB determinations. The area for each land base is described in Tables A17 and A18.

Table A17 TSR2 THLB adjusted for Graham IRMP

Timber Harvesting Land Base 3	**Net Area (ha)**
Traditional conifer	674,025.9
Small Pine	46,668.4
Deciduous	304,564.3
Total	**1,025,258.6**

Table A18 TSR2 THLB Adjusted for Enhanced Deciduous and the Graham IRMP

Timber Harvesting Land Base 4	**Net Area (ha)**
Traditional conifer	674,025.9
Small Pine	46,668.4
Deciduous	428,716.8
Total	**1,149,411.1**

These four timber harvesting land bases set the stage upon which several management alternatives were assessed.

Future Roads Trails and landings

A loss to future roads trails and landings of 0.6 percent was applied to all unmanaged stands in Scenario 1. This assumption matched the reduction used in the TSR2 Base Case. In scenarios 2 -5 the percent reduction was changed to 6.39 percent of all unmanaged stands greater than 30 years age.

Section 2 Management Assumptions

Management assumptions are used to tell the computer when it is allowed to first consider an area eligible for harvesting and then to harvest an area. The assumptions also explicitly define what happens to an area after it is harvested.

Analysis Units

The analysis units used in this report are the same as was used in TSR2. However, because of the inclusion of a new inventory on over 12 percent of the land base, and slight differences in the programming logic used to define the analysis units, the area within each analysis unit differs from the areas reported in TSR2.

Five new analysis units were also developed. These analysis units were devised to represent the area added-back to the deciduous THLB and described the enhanced deciduous land base. The definition for these 5 analysis units was provided in Table A14. The definition for the remaining analysis units is provided in Table A19. The area in each analysis unit (applicable to THLB4) is shown in Table A20.

The conversion of unmanaged stand analysis units to managed stand analysis units is the same in all scenarios. The conversion matches the TSR2 Report.

Table A19 Definition of Analysis Units

AU#	Name	ITG	1st	1st	2nd	site	Age	height	harvest	logging
11	Sw g old	18-21	n/a	n/a	n/a	>14	>140	n/a	A	none
12	Sw m old	18-21	n/a	n/a	n/a	>9.7 &	>140	n/a	A	none
13	Sw p old	18-21	n/a	n/a	n/a	<= 9.7	>140	n/a	A	none
14	Sw g y/t	18-21	n/a	n/a	n/a	>15.5	<=140	n/a	A	none
15	Sw m y/t	18-21	n/a	n/a	n/a	>9.7 &	<=140	n/a	A	none
16	Sw p y/t	18-21	n/a	n/a	n/a	<= 9.7	<=140	n/a	A	none
21	Pl all old	28	n/a	n/a	n/a	n/a	>140	>=19.4	A	none
24	Pl g thrifty	28	n/a	n/a	n/a	>18.5	>30	>=19.4	A	none
25	Pl m thrifty	28	n/a	n/a	n/a	>15.5 &	>30	>=19.4	A	none
26	Pl p thrifty	28	n/a	n/a	n/a	<=15.5	>30	>=19.4	A	none
28	Pl gm young	28	n/a	n/a	n/a	>14	<=30	n/a	A	none
29	Pl p young	28	n/a	n/a	n/a	<=14	<=30	n/a	A	none
31	Small Pl All old	28	n/a	n/a	n/a	n/a	>140	>=17.7	A	none
34	Small Pl good	28	n/a	n/a	n/a	>12.5	> 80 and	>=17.7	A	none
35	Small Pl	28	n/a	n/a	n/a	<=12.5	> 80 and	>=17.7	A	none
51	Aspen g all	42,41	n/a	> 80	n/a	>21	n/a	n/a	A	none
52	Aspen m all	42,41	n/a	> 80	n/a	>15.5 &	n/a	n/a	A	none
53	Aspen p all	42,41	n/a	> 80	n/a	<=15.5	n/a	n/a	A	none
61	Sw/At g old	22-26	n/a	n/a	AT	>14.5	>140	n/a	A	none
62	Sw/At m old	22-26	n/a	n/a	AT	<=14.5	>140	n/a	A	none
64	Sw/At g yt	22-26	n/a	n/a	AT	>18	<=140	n/a	A	none
65	Sw/At m yt	22-26	n/a	n/a	AT	>14.5 &	<=140	n/a	A	none
66	Sw/At p yt	22-26	n/a	n/a	AT	<=14.5	<=140	n/a	A	none
71	Sw/other g old	22-26	n/a	n/a	not= AT	>14	>140	n/a	A	none
72	Sw/other m old	22-26	n/a	n/a	not= AT	>9.9	>140	n/a	A	none
73	Sw/other p old	22-26	n/a	n/a	not= AT	<=9.9	>140	n/a	A	none
74	Sw/other g yt	22-26	n/a	n/a	not= AT	>18	<=140	n/a	A	none
75	Sw/other m yt	22-26	n/a	n/a	not= AT	>14.5 &	<=140	n/a	A	none
76	Sw/other p yt	22-26	n/a	n/a	Not= AT	<=14.5	<=140	n/a	A	none
81	Pl/At all old	29-31	n/a	n/a	AT		>140	n/a	A	none
84	Pl/At g yt	29-31	n/a	n/a	AT	>20	<=140	n/a	A	none
85	Pl/At medium	29-31	n/a	n/a	AT	>16 &	<=140	n/a	A	none
86	Pl/At p yt	29-31	n/a	n/a	AT	<=16	<=140	n/a	A	none
91	Pl/other gm old	29-31	n/a	n/a	not= AT	>13.8	>140	n/a	A	None
93	Pl/other p old	29-31	n/a	n/a	not= AT	<=13.8	>140	n/a	A	none
94	Pl/other good	29-31	n/a	n/a	not= AT	>17	>30	n/a	A	none
				1st	2nd	site			harvest	logging

AU#	Name	ITG	1st	1st	2nd	site	Age	height	harvest	logging
95	Pl/other	29-31	n/a	n/a	not= AT	>13.8 &	>30	n/a	A	none
96	Pl/other poor	29-31	n/a	n/a	not= AT	<=13.8	>30	n/a	A	none
97	Pl/other all y	29-31	n/a	n/a	not= AT		<=30	n/a	A	none
101	At/Sw good all	41	n/a	<= 80	S	>19	n/a	n/a	A	none
102	At/Sw medium	41	n/a	<= 80	S	>15 &	n/a	n/a	A	none
103	At/Sw poor all	41	n/a	<= 80	S	<=15	n/a	n/a	A	none
111	At/Pl good all	41	n/a	<= 80	PL	>19.5	n/a	n/a	A	none
112	At/Pl medium	41	n/a	<= 80	PL	>15 &	n/a	n/a	A	none
113	At/Pl poor all	41	n/a	<= 80	PL	<=15	n/a	n/a	A	none
121	At/Mix good all	35, 36	n/a	n/a	n/a	>19.5	n/a	n/a	A	n/a
		41, 42	n/a	<= 80	not= PL	>19.5	n/a	n/a	A	n/a
122	At/Mix medium all	35, 36	n/a	n/a	n/a	>15 &	n/a	n/a	A	n/a
		41, 42	n/a	<= 80	not= PL	>15 &	n/a	n/a	A	n/a
123	At/Mix poor all	35, 36	n/a	n/a	n/a	<=15	n/a	n/a	A	n/a
		41, 42	n/a	<= 80	not= PL	<=15	n/a	n/a	A	n/a
511	Sw all old	18-21	n/a	n/a	n/a	n/a	>140	n/a	C /H	none
514	Sw all thrifty/y	18-21	n/a	n/a	n/a	n/a	<=140	n/a	C /H	none
521	Pl/Mix all all	28,29,	n/a	n/a	n/a	n/a	n/a	n/a	C /H	none
561	Sw/Mix all all	22-26	n/a	n/a	n/a	n/a	n/a	n/a	C /H	none
1001	Managed Sw	18-21	n/a	n/a	n/a	n/a	n/a	n/a	A	L
1002	Managed Pl	28	n/a	n/a	n/a	n/a	n/a	n/a	A	L
1006	Managed Sw/At	22-26	n/a	n/a	AT	n/a	n/a	n/a	A	L
1007	Mngd Sw/other	22-26	n/a	n/a	not= AT	n/a	n/a	n/a	A	L
1008	Managed Pl/At	29-31	n/a	n/a	AT	n/a	n/a	n/a	A	L
1009	Mngd Pl/other	29-31	n/a	n/a	not= AT	n/a	n/a	n/a	A	L
1551	M unconv Sw	18-21	n/a	n/a	n/a	n/a	n/a	n/a	C / H	L
1552	M unconv	28-31	n/a	n/a		n/a	n/a	n/a	C / H	L
1556	M unconv	22-26	n/a	n/a		n/a	n/a	n/a	C / H	L

Table A20 Analysis Unit Area

AU#	Species	THLB4 Area (ha)	AU#	Species	THLB4 Area (ha)
11	Sw g old	16,287	91	Pl/other gm old	4,801
12	Sw m old	17,902	93	Pl/other p old	8,465
13	Sw p old	34,957	94	Pl/other good thrifty	12,583
14	Sw g y/t	35,656	95	Pl/other medium thrifty	43,346
15	Sw m y/t	36,270	96	Pl/other poor thrifty	56,398
16	Sw p y/t	4,938	97	Pl/other all y	670
21	Pl all old	4,374	101	At/Sw good all	15,314
24	Pl g thrifty	22,420	102	At/Sw medium all	32,981
25	Pl m thrifty	43,032	103	At/Sw poor all	9,639
26	Pl p thrifty	25,713	111	At/Pl good all	12,702
28	Pl gm young	11,533	112	At/Pl medium all	24,942
29	Pl p young	400	113	At/Pl poor all	5,866
31	Small Pl All old	1,805	121	At/Mix good all	7,210
34	Small Pl good thrifty	25,181	122	At/Mix medium all	18,689
35	Small Pl medium poor thrifty	19,682	123	At/Mix poor all	3,676
51	Aspen g all	20,323	511	Sw all old	2,728
52	Aspen m all	131,037	514	Sw all thrifty/y	2,463
53	Aspen p all	22,185	521	Pl/Mix all all	1,380
61	Sw/At g old	8,878	561	Sw/Mix all all	4,226
62	Sw/At m old	6,742	602	Birch medium	4,550
64	Sw/At g yt	12,763	603	Birch good	6,962
65	Sw/At m yt	25,086	604	Cottonwood	12,493
66	Sw/At p yt	13,820	605	Aspen-conifer PFT	27,712
71	Sw/other g old	6,573	606	Aspen - PFT	72,435
72	Sw/other m old	8,585	1001	Managed Sw	18,135
73	Sw/other p old	14,807	1002	Managed Pl	8,940
74	Sw/other g yt	8,580	1006	Managed Sw/At	9,067
75	Sw/other m yt	16,683	1007	Mngd Sw/other	13,531
76	Sw/other p yt	32,230	1008	Managed Pl/At	2,656
81	Pl/At all old	4,633	1009	Mngd Pl/other	2,892
84	Pl/At g yt	8,348	1551	M unconv Sw	75
85	Pl/At medium young/thrifty	32,816	1552	M unconv Pl/mix	22
86	Pl/At p yt	27,500	1556	M unconv Sw/mix	121
				Total Area All Analysis Units in THLB4	**1,149,411**

Notes:
Quality: g = good, m = medium, p = poor
Age: y or yt = young,
PFT = previously defined as a problem forest type

Forest Cover Constraints

Forest cover constraints are used in the timber supply analysis to constrain harvesting within certain spatially defined geographic areas. Constraints are used when consideration is being given to other resource values. Generally there are two types of forest cover constraints.

- Group 1 constraints restrict harvesting when a specified percent of the area is less than a prescribed green up age or height. Harvesting is not allowed to take place when a Group 1 constraint is broken in an area.

- Group 2 constraints are used to ensure that a specified minimum amount of area is greater than a target age. These are typically old growth constraints used for thermal cover or biodiversity. Harvesting can take place in a specified zone if this constraint is not currently met. An appropriate amount of the oldest stands closest to the target age is reserved from harvesting in order to eventually meet this management objective. If sufficient merchantable area exists above the minimum harvest age and is not required for the old growth objective, then this area is available to harvest.

The forest cover constraints for the Base Case and for all scenarios with respect to visually sensitive areas and caribou habitat remain unchanged from TSR2. These constraints are described in Tables A-22, A-23 and A-25 of the TSR2 Fort St. John TSA Analysis Report June 2002.

This analysis utilizes new forest cover requirements with regard to natural disturbance units and watersheds. When modeling according to NDU guidelines, the adjacency constraint for the IRM zone is removed for the analysis. Table A21 shows the forest cover constraints by NDU.

Scenario 1 in this analysis used FPC Biodiversity NDT targets as per the TSR2 Report. Scenarios 2 and 3 used NDU constraints and a low BEO. Scenarios 4 and 5 used NDU constraints and a BEO as per Table A21 and A22.

Table A21 NDU Forest Cover Constraints

NDU Classification	Minimum % Area ≥ 140 years		
	Low BEO	Inter BEO	High BEO
Boreal foothills Mt	33	41	49
Boreal foothills valley	23	32	40
Boreal plains - alluvial - conifer	44	51	57
Boreal plains - Upland - Conifer	17	25	33
Northern boreal mountains	37	49	60
Omineca - mountain	58	64	69
Omineca - Valley	23	32	40
Boreal plains - alluvial - deciduous	10	15	20
Boreal plains - Upland - deciduous	10	15	20

Table A22 Landscape Unit BEOs

Landscape Unit Name	Recommended Biodiversity Emphasis Option	Landscape Unit Name	Recommended Biodiversity Emphasis Option
Graham	High	Milligan	Intermediate
Halfway	Low	Trutch	Intermediate
Sikanni	High	Blueberry	Low
Crying Girl	Intermediate	Lower Beatton	Intermediate
Kahntah	Intermediate	Tommy Lakes	Low
Kobes	Low		

Minimum Harvest Ages

Table A23 provides the minimum harvest ages used for all scenarios in this analysis. The logic used to determine these minimum harvest ages follows the information provided in the TSR2 Report.

Table A23 Minimum Harvest Ages

AU	MHA	AU	MHA	AU	MHA	AU	MHA
11	72	75	79	1005	114	2076	98
12	97	76	102	1006	81	2081	73
13	169	81	83	1007	81	2084	51
14	67	84	53	1008	78	2085	59
15	93	85	67	1009	78	2081	73
16	127	86	83	1051	58	2093	98
21	74	91	67	1052	78	2097	88
24	51	93	109	1053	114	2101	51
25	64	94	55	1056	71	2102	64
26	74	95	71	1551	90	2103	85
28	66	96	103	1552	136	2511	108
29	104	97	69	1556	94	2514	76
31	120	101	55	2011	61	2521	78
34	88	102	68	2012	85	2561	69
35	105	103	83	2013	151	602	71
51	53	111	54	2014	56	603	61
52	69	112	67	2021	69	604	56
53	114	113	93	2024	51	605	100
61	81	121	56	2025	51	606	90
62	108	122	70	2026	62	888	61
64	66	123	90	2029	103	887	61
65	79	511	147	2031	118	886	61
66	102	514	98	2034	75	2602	71
71	79	521	98	2035	96	2603	61
72	100	561	110	2061	69	2604	56
73	153	1001	71	2064	53	2605	100
74	63	1002	68	2073	148	2606	90

Watersheds

ECA constraints on a watershed are typically applied incrementally with varying targets applied to varying tree heights. As a plantation grows the hydrologic recovery of the watershed increases as a consequent. If an ECA target is placed on a watershed, then the maximum area that can be in a denuded state is that target number. However, as portions of the harvested area regenerate into plantations of varying height, the amount of total area with less than 100% hydrologic recovery increases. It is estimated in the Code Interior Watershed Assessment Procedure Guidebook that with each 3-metre increase in plantation height, hydrologic recovery improves by 25 percent. This then can be translated into a 25% increase in the Group 1 constraint in the Forest Estate Model FSSIM.

The following table shows the guidelines used in the application of ECA constraints in the Fort St. John TSA. When reference is made in this document to an ECA constraint, the maximum amount of forest area below three metres is the target number referred to. Additional constraints increasing by 25 percent increments every three metres to a regenerated stand height of nine metres is inferred, and was applied in all of the applicable harvest scenarios examined.

Table A24 Calculating ECA Targets (example)

Average Height (m)	"Trigger Height"	Average Age to Achieve Height (years)	Hydrologic Recovery (IWAP) (%)	Maximum ECA Constraint		
				30%	20%	10%
0 - < 3 m	0	0	0%	n/a	n/a	n/a
3 - < 5m	3	16	25%	30% < 16 yrs	20% < 16 yrs	10% < 16 yrs
5 - < 7 m	5	24	50%	37.5% < 24 yrs	25% < 24 yrs	12.5% < 24 yrs
7 - < 9 m	7	30	75%	45% < 30 yrs	30% < 30 yrs	15% < 30 yrs
9 m +	9	35	90%	52.5% < 35 yrs	35% < 35 yrs	17.5% < 35 yrs

In this analysis watersheds were identified using a three string code. The first character denotes the ECA target. The second character, the watershed region and the third character denoted the watershed number or drainage. Table A25 describes the code logic. Table A26 describes the area in each watershed.

Table A25 Watershed code

ECA	Watershed Group	Watershed number
25 = 2	FONT = F	L1 = Z
30 = 3	KAHN = K	L2 = Y
35 = 8	LHAF = L	L3 = X
40 = 4	LSIK = S	S1 = 1
50 = 5	MILL = M	S2 = 2
	UBTN = B	S3=3
	UHAF = H	S4=4
	UPRO = P	S5=5
	USIK = U	S6=6
	UPCE = E	S7=7
	None =N	S8=8
		S9=9
		S10=A
		S11=B
		S12=C
		S13=D
		S0=0

Table A26 Forested Area by Watershed

Watershed	Forest Area (ha)	Watershed	Forest Area (ha)	Watershed	Forest Area (ha)
3H1	14,529	4FY	5,434	5S6	25,644
3H2	17,443	4FZ	13,984	8B1	10,595
3H3	11,635	4K2	12,628	8BA	2,678
3H5	21,072	4K4	12,182	8EO	31,338
3H6	17,131	4KY	16,962	8HX	31,097
3H8	5,916	4L8	23,900	8L1	16,396
3HY	25,518	4M2	16,290	8L2	23,308
3HZ	26,593	4M4	13,940	8L3	19,440
3L7	28,955	4MZ	15,241	8L4	35,255
3LY	48,806	4N0	66,400	8L5	9,979
3P2	3,262	4NZ	80,739	8L9	14,272
3P5	4,726	4S1	16,032	8LA	30,360
3PY	5,726	4S4	2,259	8LB	9,413
4B2	22,526	4S5	18,748	8LC	16,556
4B4	25,233	4S7	3,925	8LZ	26,050
4B5	13,001	4S8	2,582	8N0	172,111
4B6	32,115	4S9	6,370	8P3	7,549
4B7	9,297	4SX	16,104	8PZ	5,428
4B8	27,399	4SY	21,688	8S2	10,389
4B9	5,055	4UA	9,207	8U1	16,533
4BB	16,520	4UD	25,399	8U2	6,712
4F1	1,638	5K5	3,092	8U4	4,173
4F2	4,043	5KI	5,298	8U5	17,242
4F3	5,395	5KZ	24,829	8U6	12,056

Watershed	Forest Area (ha)	Watershed	Forest Area (ha)	Watershed	Forest Area (ha)
4F4	6,461	5M1	926	8U8	11,283
4F5	4,309	5M3	15,125	8U9	15,882
4F7	4,228	5M5	4,044	8UB	14,594
4F8	11,461	5M6	6,555	8UC	51,572
4FX	13,949	5N0	3,391	8UZ	19,046

Forest cover constraints were determined for each watershed area. The area-weighted site index in each watershed group was used to calculate the average years to green-up for all species at green-up heights of 3, 5, 7, and 9 metres. These green-up ages are provided in Table A27. The rate of hydrologic recovery is shown in Table A28.

Table A27 Years to Greenup by Watershed Group

# of Years to Green up				
H2O Group	**3m**	**5m**	**7m**	**9m**
Upper Beatton	16	24	32	41
Upper Peace	13	19	25	31
Fontas	16	22	29	36
Halfway	23	32	41	50
Kahntah	12	18	23	29
Lower Halfway	15	21	28	34
Milligan	12	16	24	30
Lower Peace	13	18	23	29
Upper Prophet	23	33	43	53
Lower Sikanni	12	18	23	29
Upper Sikanni	19	27	36	46

Table A28 Rate of Hydrologic Recovery by ECA

	Average Ht (m)	3	5	7	9
ECA %	**Hydrologic recovery %**	**0%**	**25%**	**50%**	**75%**
25		25	31	37	44
30		30	38	45	52
35		35	44	53	61
40		40	50	60	70
50		50	62	75	88

Graham River IRMP

Cut block clusters in the Graham IRMP were scheduled for harvest according to the timing shown in Table A29. Defined riparian areas within the IRMP were given a forest cover adjacency constraint such that during any harvest period there as a maximum of 10 percent of the forest area less than 40 years age.

Table A29 Graham River Clusters

Cluster #	Harvest decade	Forest Area (ha)	THLB (ha)
1	1	1,891.3	1,183.8
2	1	2,137.5	824.7
3	1	2,333.7	590.7
4	1	3,793.6	1,263.4
5	1	2,206.1	1,338.8
17	1	622.9	216.2
6a	1	2,420.9	1,017.4
6b	1	812.5	594.7
6c	1	691.5	367.8
sub-total		16,910.2	7,397.5
7	2	1,840.1	638.2
9	2	914.9	577.7
10	2	821.7	486.9
11	2	1,737.9	810.9
8a	2	1,769.1	974.3
8b	2	2,031.4	1,267.0
sub-total		9,115.1	4,755.1
12	3	3,299.5	2,261.6
13	3	2,340.7	1,375.3
14	3	2,640.4	1,919.2
15	3	3,012.3	1,850.0
sub-total		11,293.0	7,406.1
16	4	1,970.7	1,083.5
18	4	1,241.0	703.1
19	4	2,923.2	1,825.4
sub-total		6,134.8	3,611.9
20	5	1,301.4	852.6
	Total	**44,754.4**	**24,023.2**

Cycling the NCLB

In Scenario 1, the NCLB was cycled according to the TSR2 analysis, which cycled 5,000 ha per year. In all other scenarios the NCLB was cycled according to the rates show in Table A30. These vales were derived using the report: Natural Disturbance Units of the Prince George Forest Region: Guidance for Sustainable Forest Management, 2002. DeLong, Unpublished 2002.

Table A30 NDU Area in NCLB cycled annually

NDU	Area cycled per year (ha)
Omineca - Valley	72
Omineca - mountain	23
Northern boreal moutains	55
Boreal foothills valley	16
Boreal foothills Mt	99
Boreal plains - Upland - deciduous	177
Boreal plains - Upland - Conifer	657
Boreal plains - alluvial - deciduous	3
Boreal plains - alluvial - conifer	3
Total	**1105**

Wildlife and Range Burn Areas

Range and wildlife burn areas have been spatially identified on the inventory file. During the running of all simulations, the stand ages in these areas were re-assigned to age 20 over the first 30-year period. Thereafter, every stand that reached the age of 60 was reassigned an age of 20

There are 31,449 hectares of forest land that does not contribute to the THLB and is cycled on a 60-year rotation for wildlife and range burns.

Section 3 Growth and Yield

Yield tables for most analysis units are identical to the tables used in Tables A-27 and A-28 in the Fort St. John TSR2 Analysis Report. Only the yield tables for previously excluded deciduous stands were created using VDYP. These yield tables are provided in Table A31 following.

Deciduous Yield Tables

Scenarios 2-5 in the analysis changed the longevity of deciduous leading stands. As Table A31 shows, birch stands (AU#s 602 and 603) were assumed to yield merchantable volume until 110 years of age. All other deciduous stands were assumed to yield merchantable volume until 150 years of age. The logic for this is in current age class distributions for deciduous stands, wherein almost no area exists in deciduous stands greater than 140 years of age. Deciduous stands that reached an age of 150 years without being harvested were transferred to immature deciduous stands having a reversion age of 5 years.

Table A31 Enhanced deciduous land base yield tables

Age	602	603	604	605	606
0	0	0	0	0	0
10	0	0	0	0	0
20	0	0	0	0	0
30	0	0	1	0	0
40	27	35.1	25	0	14
50	61	79.3	89	11	39
60	91	118.3	141	37	64
70	118	153.4	186	62	85
80	141	183.3	224	84	103
90	163	211.9	257	104	119
100	182	236.6	285	121	132
110	199	258.7	310	137	142
120	0	0	331	151	149
130	0	0	350	162	156
140	0	0	365	171	162
150	0	0	379	178	164
160	0	0	0	0	0

Carbon Cycling

Volume tables that reflect carbon cycling were created using the FORECAST model by Brad Seely. These tables were used to predict the total amount of carbon in the TSA over time and the rate of carbon sequestration. Carbon volume tables were created for the TSA and matched to existing analysis units. The age class distribution for each analysis unit in each period was then multiplied by the corresponding carbon volume in the appropriate carbon table and age class.

The relationship between analysis units and carbon table identifiers is shown in Table A32. Carbon for the NCLB was apportioned according to the proportions identified in the last column of Table A32.

Table A33 shows the total amount of ecosystem carbon (Mg C ha-1) and the carbon sequestration rate (Mg C ha-1 yr-1) for each carbon identified table.

Table A32 Carbon table ID versus AU# associations

Carbon Table	Analysis unit	Carbon Table	Analysis unit	Carbon Table	NCLB Analysis unit	Proportion
1	13,16,511	25	101	15	886 & 888	0.0402911
2	12,15	26	113, 913	30	886 & 888	0.2411666
3	11,14,514	27	112,914	11	886 & 888	0.0335798
4	21, 26, 29, 31, 34, 35	28	111	10	886 & 888	0.0190432
5	25,28	29	915	18	886 & 888	0.0485414
6	24	30	902, 887	31	886 & 888	0.2278847
7	53, 123, 602, 605, 606, 909, 910	31	906	21	886 & 888	0.0365591
8	52, 122,604	32	2013, 2511, 2073	20	886 & 888	0.0241764
9	51, 121,603	33	2012	7	886 & 888	0.0550105
10	62, 66,904	34	2011, 2014, 2514, 1001, 2551, 1551	8	886 & 888	0.1495651
11	61,65, 903	35	2021, 2026, 2029, 2031, 2034, 2035	23	886 & 888	0.0114413
12	64	36	2025, 1002	24	886 & 888	0.0283407
13	73	37	2024	26	886 & 888	0.013997
14	72, 561	38	2076	27	886 & 888	0.0194131
15	71, 901	39	2061, 1056, 1006, 1007, 1556, 2521	29	886 & 888	0.0509898
16	74	40	2064			
17	76,93,96	41	2561, 2093,2081			
18	75, 91, 95, 97, 905	42	1008, 1009, 2097			
19	94	43	2084, 2085, 1552, 2552			
20	81,86,908	44	1053			
21	521,907	45	1052			
22	84,85	46	1051			
23	103, 911	47	2103			
24	102, 912	48	2102			
		49	2101			

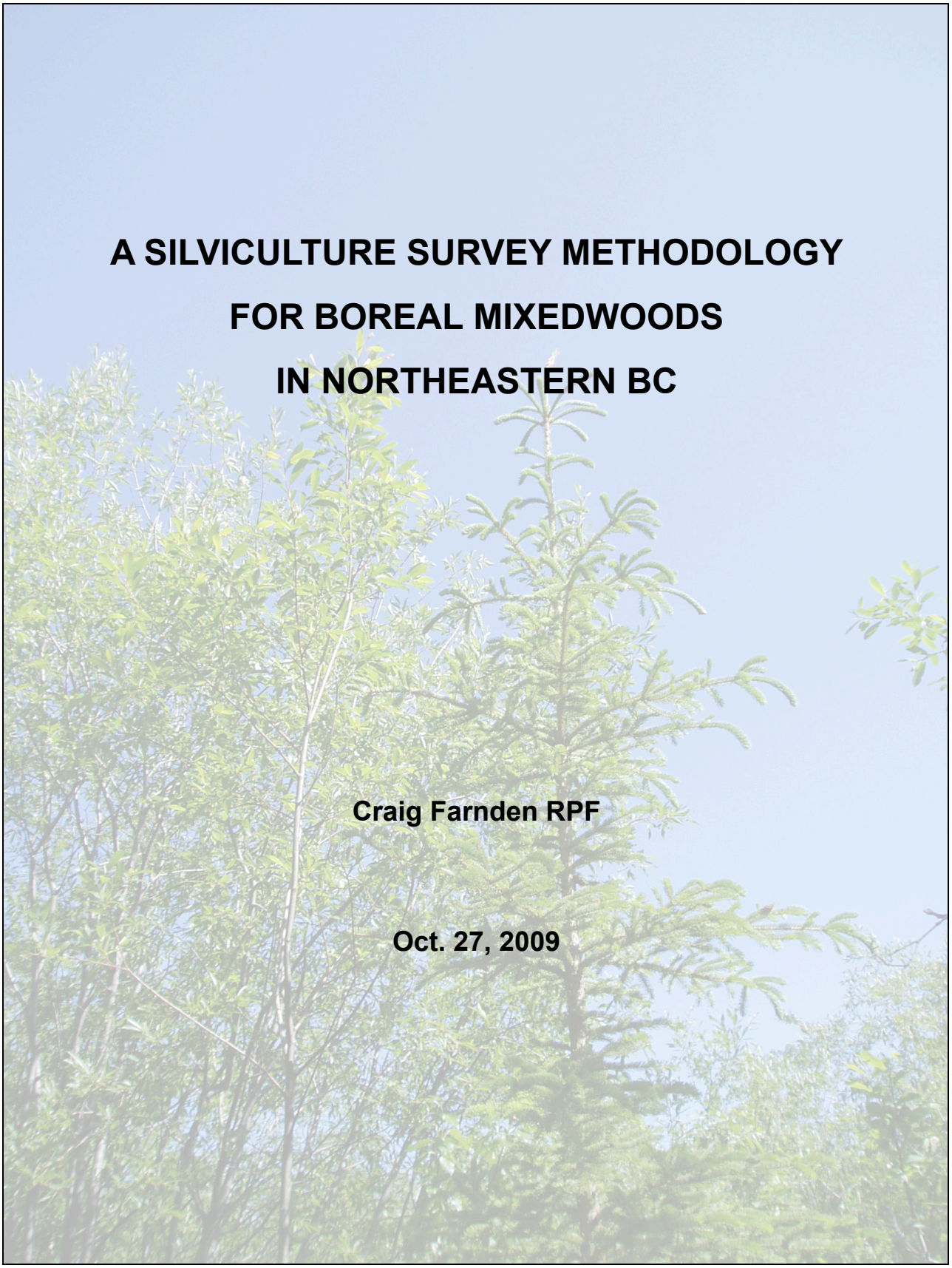
Table A33 Ecosystem Carbon and Sequestration Rate by Carbon ID

Year	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10
1	117.0	0.0	170.1	0.0	199.9	0.0	151.3	0.0	234.2	0.0	225.5	0.0	151.0	0.0	234.2	0.0	225.7	0.0	151.1	0.0
10	98.2	-1.9	145.0	-2.5	174.5	-2.5	125.5	-2.6	200.5	-3.4	203.1	-2.2	124.6	-2.6	201.8	-3.2	206.5	-1.9	123.3	-2.8
20	85.2	-1.3	127.2	-1.8	156.8	-1.8	113.0	-1.2	184.9	-1.6	205.1	0.2	111.9	-1.3	189.2	-1.3	213.9	0.7	104.8	-1.8
30	75.6	-1.0	114.4	-1.3	142.8	-1.4	112.5	-0.1	179.3	-0.6	225.1	2.0	110.9	-0.1	182.8	-0.6	226.8	1.3	98.6	-0.6
40	69.3	-0.6	105.5	-0.9	132.6	-1.0	117.9	0.5	184.6	0.5	244.5	1.9	117.1	0.6	186.7	0.4	240.5	1.4	100.2	0.2
50	67.1	-0.2	101.6	-0.4	127.8	-0.5	129.8	1.2	198.8	1.4	267.2	2.3	130.2	1.3	200.7	1.4	255.0	1.5	109.2	0.9
60	70.0	0.3	104.0	0.2	130.9	0.3	145.8	1.6	219.8	2.1	289.3	2.2	146.5	1.6	216.6	1.6	269.0	1.4	123.3	1.4
70	77.5	0.7	112.6	0.9	141.6	1.1	161.5	1.6	240.3	2.0	308.4	1.9	160.9	1.4	231.7	1.5	280.1	1.1	139.2	1.6
80	87.6	1.0	125.8	1.3	158.0	1.6	174.1	1.3	255.1	1.5	320.1	1.2	171.3	1.0	244.2	1.3	287.0	0.7	153.7	1.5
90	97.9	1.0	139.7	1.4	175.7	1.8	185.0	1.1	266.1	1.1	327.8	0.8	178.4	0.7	253.0	0.9	291.8	0.5	166.5	1.3
100	107.6	1.0	152.8	1.3	192.3	1.7	195.9	1.1	276.2	1.0	335.4	0.8	182.2	0.4	256.1	0.3	292.9	0.1	176.4	1.0
110	116.7	0.9	164.7	1.2	207.2	1.5	205.8	1.0	285.2	0.9	342.6	0.7	184.1	0.2	255.0	-0.1	290.9	-0.2	184.5	0.8
120	125.4	0.9	175.9	1.1	220.8	1.4	212.2	0.6	291.5	0.6	347.0	0.4	186.9	0.3	255.9	0.1	290.5	0.0	192.2	0.8
130	133.5	0.8	185.9	1.0	233.0	1.2	211.8	0.0	290.2	-0.1	343.3	-0.4	189.5	0.3	258.1	0.2	290.6	0.0	199.3	0.7
140	141.1	0.8	195.1	0.9	244.0	1.1	207.6	-0.4	285.4	-0.5	335.7	-0.8	192.4	0.3	261.4	0.3	292.1	0.2	206.0	0.7
150	148.3	0.7	203.6	0.8	253.9	1.0	202.2	-0.5	279.5	-0.6	327.2	-0.9	194.9	0.2	265.6	0.4	294.7	0.3	212.3	0.6
160	154.6	0.6	210.8	0.7	262.0	0.8	196.2	-0.6	272.5	-0.7	317.7	-0.9							217.9	0.6
170	158.9	0.4	215.9	0.5	267.3	0.5	189.2	-0.7	264.6	-0.8	307.4	-1.0							221.8	0.4
180	162.3	0.3	219.7	0.4	271.0	0.4	181.6	-0.8	256.0	-0.9	296.5	-1.1							224.9	0.3
190	165.6	0.3	223.3	0.4	274.7	0.4	173.5	-0.8	247.3	-0.9	285.3	-1.1							228.0	0.3
200	168.8	0.3	226.7	0.3	278.4	0.4	167.6	-0.6	242.6	-0.5	278.2	-0.7							231.0	0.3
Year	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20
1	234.0	0.0	224.9	0.0	116.9	0.0	151.1	0.0	233.9	0.0	225.0	0.0	151.2	0.0	234.0	0.0	225.3	0.0	151.2	0.0
10	196.0	-3.8	196.6	-2.8	98.2	-1.9	122.1	-2.9	194.4	-3.9	194.7	-3.0	123.6	-2.8	197.1	-3.7	199.9	-2.5	125.2	-2.6
20	170.2	-2.6	186.9	-1.0	85.2	-1.3	100.4	-2.2	164.5	-3.0	177.4	-1.7	105.9	-1.8	173.4	-2.4	194.6	-0.5	112.7	-1.3
30	156.9	-1.3	195.7	0.9	76.0	-0.9	88.4	-1.2	146.2	-1.8	171.6	-0.6	100.3	-0.6	162.4	-1.1	206.1	1.2	112.1	-0.1
40	154.4	-0.3	210.6	1.5	70.4	-0.6	83.3	-0.5	138.3	-0.8	175.3	0.4	101.6	0.1	162.3	0.0	224.7	1.9	117.9	0.6
50	163.2	0.9	224.0	1.3	68.9	-0.2	85.0	0.2	142.6	0.4	190.0	1.5	110.1	0.8	172.8	1.0	243.8	1.9	130.6	1.3
60	178.5	1.5	234.1	1.0	72.9	0.4	92.3	0.7	153.6	1.1	199.4	0.9	123.9	1.4	190.6	1.8	261.6	1.8	147.4	1.7
70	199.6	2.1	241.4	0.7	81.0	0.8	102.4	1.0	170.3	1.7	213.1	1.4	138.5	1.5	211.7	2.1	275.0	1.3	163.9	1.7
80	221.0	2.1	243.3	0.2	91.3	1.0	113.2	1.1	190.9	2.1	228.7	1.6	151.2	1.3	230.8	1.9	285.9	1.1	177.3	1.3
90	239.9	1.9	246.7	0.3	101.5	1.0	124.2	1.1	213.9	2.3	243.8	1.5	163.1	1.2	247.9	1.7	298.0	1.2	188.1	1.1
100	255.2	1.5	258.7	1.2	111.5	1.0	135.0	1.1	234.4	2.0	261.1	1.7	174.7	1.2	263.5	1.6	308.7	1.1	196.6	0.8
110	267.7	1.3	271.4	1.3	120.9	0.9	145.1	1.0	251.9	1.8	276.3	1.5	185.6	1.1	277.0	1.3	317.1	0.8	202.2	0.6
120	279.3	1.2	284.9	1.3	129.7	0.9	154.4	0.9	267.7	1.6	289.3	1.3	195.1	0.9	288.7	1.2	324.8	0.8	207.2	0.5
130	289.6	1.0	297.3	1.2	137.3	0.8	162.1	0.8	281.2	1.4	300.9	1.2	200.5	0.5	295.8	0.7	331.5	0.7	209.6	0.2
140	297.9	0.8	309.7	1.2	144.2	0.7	168.7	0.7	292.8	1.2	313.4	1.3	203.7	0.3	300.5	0.5	332.5	0.1	210.4	0.1
150	304.5	0.7	315.1	0.5	150.6	0.6	174.7	0.6	302.5	1.0	316.8	0.3	206.1	0.2	304.9	0.4	329.9	-0.3	210.4	0.0
160	309.7	0.5	317.1	0.2	155.8	0.5	179.5	0.5	309.4	0.7	317.6	0.1	207.4	0.1	308.9	0.4	325.6	-0.4	209.7	-0.1
170	294.7	-1.5	316.3	-0.1	159.2	0.3	182.4	0.3	312.0	0.3	315.9	-0.2	207.7	0.0	309.0	0.0	319.6	-0.6	208.9	-0.1
180	291.2	-0.4	314.6	-0.2	161.5	0.2	184.3	0.2	312.6	0.1	313.6	-0.2	207.4	0.0	304.0	-0.5	313.1	-0.6	207.7	-0.1
190	286.5	-0.5	314.1	-0.1	163.9	0.2	186.2	0.2	313.5	0.1	312.3	-0.1	207.2	0.0	298.0	-0.6	307.3	-0.6	205.0	-0.3
200	283.1	-0.3	314.5	0.0	166.7	0.3	188.2	0.2	309.4	-0.4	311.9	0.0	206.9	0.0	291.3	-0.7	301.9	-0.5	202.4	-0.3

Year	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	29	29	30
1	151.2	0.0	225.4	0.0	151.1	0.0	234.0	0.0	225.2	0.0	151.1	0.0	234.1	0.0	225.5	0.0	46.1	0.0	116.9
10	125.2	-2.6	202.5	-2.3	124.5	-2.7	198.4	-3.6	199.6	-2.6	125.6	-2.6	200.8	-3.3	203.0	-2.2	38.8	-0.7	98.2
20	112.7	-1.3	205.4	0.3	110.8	-1.4	180.0	-1.8	198.6	-0.1	114.8	-1.1	186.7	-1.4	208.0	0.5	36.6	-0.2	85.2
30	112.1	-0.1	223.7	1.8	109.2	-0.2	171.2	-0.9	212.6	1.4	114.3	0.0	180.6	-0.6	223.3	1.5	37.2	0.1	76.0
40	117.9	0.6	243.3	2.0	114.5	0.5	173.6	0.2	226.9	1.4	120.5	0.6	185.3	0.5	239.8	1.7	39.3	0.2	70.4
50	130.6	1.3	265.2	2.2	127.0	1.2	187.9	1.4	243.1	1.6	133.3	1.3	201.0	1.6	258.0	1.8	42.6	0.3	68.9
60	147.4	1.7	286.7	2.2	143.1	1.6	208.5	2.1	259.6	1.6	149.6	1.6	222.2	2.1	276.2	1.8	48.7	0.6	72.9
70	163.9	1.7	304.1	1.7	158.6	1.6	229.1	2.1	275.1	1.6	164.9	1.5	241.4	1.9	290.7	1.5	55.9	0.7	81.0
80	177.3	1.3	313.8	1.0	170.3	1.2	244.4	1.5	287.3	1.2	175.9	1.1	255.0	1.4	299.0	0.8	62.8	0.7	91.3
90	188.1	1.1	319.2	0.5	178.5	0.8	255.0	1.1	297.4	1.0	183.5	0.8	263.6	0.9	303.3	0.4	69.1	0.6	101.5
100	196.6	0.8	323.6	0.4	182.5	0.4	261.5	0.6	302.2	0.5	187.0	0.3	266.5	0.3	303.6	0.0	74.9	0.6	111.5
110	202.2	0.6	326.6	0.3	184.3	0.2	266.8	0.5	302.1	0.0	188.2	0.1	265.9	-0.1	301.5	-0.2	79.7	0.5	120.9
120	207.2	0.5	326.9	0.0	188.1	0.4	270.8	0.4	302.1	0.0	191.0	0.3	266.2	0.0	301.0	-0.1	83.9	0.4	129.7
130	209.6	0.2	319.8	-0.7	192.3	0.4	270.2	-0.1	299.2	-0.3	193.6	0.3	265.1	-0.1	298.8	-0.2	87.6	0.4	137.3
140	210.4	0.1	309.9	-1.0	196.3	0.4	264.4	-0.6	292.7	-0.7	195.8	0.2	264.0	-0.1	296.4	-0.2	91.0	0.3	144.2
150	210.4	0.0	300.2	-1.0	200.0	0.4	255.6	-0.9	284.1	-0.9	197.0	0.1	263.8	0.0	294.8	-0.2	94.2	0.3	150.6
160	209.7	-0.1	290.8	-0.9	203.3	0.3	246.3	-0.9	275.9	-0.8	197.3	0.0	264.7	0.1	294.3	0.0	96.9	0.3	155.8
170	208.9	-0.1	281.8	-0.9	206.1	0.3	237.5	-0.9	269.4	-0.7	197.0	0.0	266.7	0.2	295.1	0.1	98.6	0.2	159.2
180	207.7	-0.1	273.3	-0.9	207.8	0.2	230.1	-0.7	264.8	-0.5	195.3	-0.2	269.6	0.3	297.0	0.2	99.6	0.1	161.5
190	205.0	-0.3	265.6	-0.8	209.2	0.1	224.5	-0.6	262.1	-0.3	193.1	-0.2	273.1	0.3	299.6	0.3	101.0	0.1	163.9
200	202.4	-0.3	263.2	-0.2	210.2	0.1	219.9	-0.5	260.4	-0.2	192.5	-0.1	278.2	0.5	304.2	0.5	102.5	0.2	166.7
Year	31	31	32	32	33	33	34	34	35	35	36	36	37	37	38	38	39	39	40
1	117.0	0.0	75.8	0.0	99.5	0.0	120.2	0.0	105.0	0.0	143.6	0.0	173.8	0.0	97.5	0.0	134.5	0.0	158.8
10	98.7	-1.8	61.5	-1.4	81.8	-1.8	99.9	-2.0	83.6	-2.1	117.4	-2.6	139.7	-3.4	76.1	-2.1	106.9	-2.8	125.6
20	87.1	-1.2	56.7	-0.5	74.8	-0.7	92.7	-0.7	78.5	-0.5	111.0	-0.6	132.8	-0.7	70.6	-0.6	101.9	-0.5	120.1
30	79.5	-0.8	59.2	0.3	75.8	0.1	94.8	0.2	85.6	0.7	120.5	0.9	147.1	1.4	77.0	0.6	116.4	1.4	139.7
40	75.5	-0.4	66.9	0.8	82.2	0.6	103.6	0.9	97.1	1.1	141.2	2.1	176.3	2.9	88.6	1.2	135.3	1.9	164.6
50	75.2	0.0	75.7	0.9	92.5	1.0	115.5	1.2	109.9	1.3	165.0	2.4	207.4	3.1	103.6	1.5	157.8	2.3	191.5
60	81.7	0.7	85.5	1.0	104.4	1.2	129.5	1.4	124.3	1.4	191.3	2.6	239.4	3.2	120.6	1.7	176.4	1.9	215.1
70	92.9	1.1	96.0	1.1	117.7	1.3	145.4	1.6	137.9	1.4	214.8	2.4	267.0	2.8	137.2	1.7	192.1	1.6	233.9
80	104.1	1.1	106.4	1.0	131.0	1.3	161.7	1.6	149.8	1.2	233.7	1.9	288.7	2.2	152.2	1.5	203.4	1.1	241.9
90	115.0	1.1	116.9	1.0	144.1	1.3	178.2	1.6	161.0	1.1	250.1	1.6	306.4	1.8	165.0	1.3	212.7	0.9	241.8
100	126.1	1.1	126.7	1.0	156.1	1.2	193.1	1.5	171.8	1.1	265.3	1.5	321.9	1.6	175.5	1.0	221.3	0.9	239.8
110	136.3	1.0	135.9	0.9	167.1	1.1	206.8	1.4	182.0	1.0	278.9	1.4	335.1	1.3	183.0	0.7	229.9	0.9	246.6
120	144.5	0.8	144.3	0.8	177.4	1.0	219.3	1.2	190.6	0.9	289.5	1.1	344.5	0.9	189.1	0.6	238.7	0.9	257.9
130	149.2	0.5	151.7	0.7	186.6	0.9	230.1	1.1	196.0	0.5	294.4	0.5	346.3	0.2	194.8	0.6	247.1	0.8	269.3
140	152.1	0.3	158.6	0.7	195.2	0.9	240.0	1.0	199.6	0.4	295.1	0.1	344.2	-0.2	200.4	0.6	254.8	0.8	278.6
150	154.3	0.2	165.0	0.6	203.2	0.8	249.1	0.9	202.5	0.3	293.7	-0.1	340.6	-0.4	205.4	0.5	261.3	0.7	283.2
160	155.6	0.1	170.2	0.5	210.0	0.7	256.4	0.7	204.4	0.2	290.5	-0.3	335.3	-0.5	209.7	0.4	265.3	0.4	284.3
170	155.9	0.0	173.8	0.4	214.8	0.5	260.7	0.4	204.5	0.0	286.0	-0.5	328.6	-0.7	213.0	0.3	268.6	0.3	282.8
180	155.7	0.0	176.7	0.3	218.9	0.4	263.6	0.3	203.9	-0.1	280.8	-0.5	321.0	-0.8	216.0	0.3	267.8	-0.1	281.3
190	156.0	0.0	179.7	0.3	222.9	0.4	266.4	0.3	203.3	-0.1	275.5	-0.5	313.3	-0.8	219.0	0.3	267.2	-0.1	280.5
200	158.7	0.3	182.9	0.3	226.8	0.4	269.2	0.3	202.8	-0.1	272.1	-0.3	308.1	-0.5	222.0	0.3	265.8	-0.1	280.3

40	41	41	42	42	43	43	44	44	45	45	46	46	47	47	48	48	49	49
0.0	101.9	0.0	140.4	0.0	167.9	0.0	99.2	0.0	131.8	0.0	156.0	0.0	97.8	0.0	134.0	0.0	156.4	0.0
-3.3	81.5	-2.0	114.5	-2.6	135.6	-3.2	81.6	-1.8	115.8	-1.6	138.1	-1.8	81.9	-1.6	117.8	-1.6	136.6	-2.0
-0.5	78.8	-0.3	110.2	-0.4	129.0	-0.7	81.2	0.0	126.5	1.1	151.1	1.3	84.0	0.2	127.8	1.0	147.1	1.1
2.0	88.6	1.0	125.4	1.5	148.4	1.9	94.3	1.3	149.8	2.3	176.5	2.5	98.1	1.4	150.7	2.3	174.3	2.7
2.5	101.0	1.2	147.9	2.3	181.2	3.3	111.3	1.7	177.1	2.7	204.8	2.8	115.6	1.7	175.9	2.5	202.4	2.8
2.7	116.4	1.5	174.3	2.6	214.7	3.4	133.0	2.2	206.0	2.9	234.1	2.9	136.0	2.0	202.8	2.7	231.5	2.9
2.4	134.3	1.8	201.8	2.8	247.6	3.3	154.0	2.1	232.3	2.6	259.4	2.5	155.8	2.0	226.7	2.4	257.6	2.6
1.9	151.6	1.7	226.2	2.4	275.2	2.8	173.0	1.9	253.2	2.1	279.6	2.0	173.9	1.8	245.1	1.8	278.4	2.1
0.8	166.5	1.5	245.5	1.9	294.6	1.9	187.8	1.5	267.0	1.4	293.2	1.4	188.5	1.5	256.9	1.2	293.3	1.5
0.0	178.9	1.2	260.4	1.5	307.5	1.3	198.2	1.0	275.5	0.8	300.7	0.8	200.2	1.2	262.9	0.6	303.5	1.0
-0.2	189.7	1.1	272.8	1.2	317.2	1.0	202.2	0.4	276.9	0.1	300.7	0.0	207.3	0.7	259.8	-0.3	303.2	0.0
0.7	197.5	0.8	281.2	0.8	323.1	0.6	201.2	-0.1	273.2	-0.4	295.3	-0.5	211.3	0.4	254.6	-0.5	293.0	-1.0
1.1	203.2	0.6	286.4	0.5	325.1	0.2	201.7	0.0	272.6	-0.1	293.2	-0.2	215.9	0.5	251.0	-0.4	280.2	-1.3
1.1	207.5	0.4	287.0	0.1	320.6	-0.5	202.6	0.1	274.0	0.1	293.4	0.0	220.3	0.4	246.6	-0.4	267.6	-1.3
0.9	211.0	0.3	284.2	-0.3	313.6	-0.7	203.3	0.1	276.1	0.2	294.3	0.1	224.5	0.4	240.7	-0.6	257.1	-1.0
0.5	213.9	0.3	278.5	-0.6	306.5	-0.7	202.5	-0.1	278.2	0.2	295.2	0.1	228.3	0.4	233.5	-0.7	248.7	-0.8
0.1	216.0	0.2	270.9	-0.8	299.1	-0.7							231.7	0.3	225.9	-0.8	241.9	-0.7
-0.1	217.6	0.2	263.3	-0.8	291.8	-0.7							234.6	0.3	218.6	-0.7	236.4	-0.6
-0.2	219.2	0.2	257.5	-0.6	284.3	-0.7							237.3	0.3	212.6	-0.6	232.5	-0.4
-0.1	220.5	0.1	253.8	-0.4	277.2	-0.7							239.1	0.2	208.0	-0.5	229.8	-0.3
0.0	221.6	0.1	253.4	0.0	273.1	-0.4							239.9	0.1	204.4	-0.4	228.0	-0.2

Appendix 19: Silviculture Survey Methodology for Boreal Mixedwoods (Farnden Report)



A SILVICULTURE SURVEY METHODOLOGY FOR BOREAL MIXEDWOODS IN NORTHEASTERN BC

Craig Farnden RPF

Oct. 27, 2009

ACKNOWLEDGEMENTS

This document has been prepared under contract to Canadian Forest Products Ltd. as part of a PhD project by the author in the Faculty of Forestry at the University of British Columbia. Gratefully acknowledged are the patience, guidance and advice of Dr. Bruce Larson, Dr. Peter Marshall and Dr. John Nelson, staff at the BC Ministry of Forests and Range - Forest Practices Branch, and staff of Canadian Forest Products Ltd, BC Timber Sales and the BC Ministry of Forests in the Peace River region of British Columbia.

Reviews of this document have been provided by Patrick Smook (Canfor), Maureen Schulting (Pathocon Consulting) and Dave Weaver (MoF, Forest Practices Branch). Their contributions have greatly improved the outcome. However, any remaining errors or inconsistencies are solely the responsibility of the author.

The layout of this document follows closely that of an earlier document produced by J.S. Thrower and Assoc. Ltd. that describes a similar survey procedure. Some portions of the surveys are identical, and in such cases text describing field procedures has been copied verbatim. Even where text has not been copied, it should be recognized that the current survey procedure builds upon the work of these and other authors. Their precedents are appreciated.

TABLE OF CONTENTS

1.0 Introduction 1
2.0 Mixedwood Survey 1
2.1 Mixedwood Survey Objectives 1
2.2 Mixedwood Survey Overview 1
2.3 Target Population 2
2.4 Office Procedures 2
2.4.1 Map & Previous Data 2
2.4.2 Office Stratification 2
2.4.3 Plot Locations 3
2.5 Field Sampling 4
2.5.1 Quadrats versus Quadrants 4
2.5.2 Stratification 4
2.5.3 Quadrats 5
2.5.4 Enhanced Plots 7
3.0 Survey Outcomes – Yield and Stand type 7
3.1 Overview 7
3.2 Objectives 8
3.3 Model Development 8
3.3.1 MGM Simulations 9
3.3.2 Simulated Surveys 9
3.3.4 Spruce Site Index 9
3.3.5 Brush Impacts 11
3.3.6 Non-Productive Quadrats 11
3.3.7 TMV's 11
4.0 Survey Outcomes – Inentory Labels 12
5.0 References 12

1.0 INTRODUCTION

The purpose of this document is to outline a survey and compilation procedure for the assessment of post-harvest spruce-aspen mixedwood stands where the spruce component consists primarily of planted trees. The procedure is based on extensive modeling of mixedwood stand development, and uses survey outcomes to predict future yields and the partitioning of that yield into conifer and broadleaved components. The procedure is initially targeted at satisfying the management criteria for intimate mixtures of spruce and aspen as identified in the Sustainable Forest Management Plan for the Fort St. John Pilot Project. However, it should be generally applicable to any post-harvest juvenile, even-aged mixture of white spruce and trembling aspen across the boreal forest of BC and nearby regions of other jurisdictions.

2.0 MIXEDWOOD SURVEY

2.1 Mixedwood Survey Objectives

The goals of the survey are to:

1. Describe stand characteristics in sufficient detail to estimate the Predicted Mean Volume (PMV) at age 80 along with the volume breakdown (composition) by species group (conifer versus broadleaved).
2. Contrast PMV to a threshold percentage of the theoretical maximum achievable volume – the target mean volume (TMV) for a stand of the same species composition.
3. Produce inventory labels
4. Identify areas that would potentially benefit from silvicultural treatments.

2.2 Mixedwood Survey Overview

The key components of the mixedwood survey are:

1. The survey in its current form can be applied to even-aged mixtures of white spruce and trembling aspen, with aspen also being an analogue for cottonwood. Minor components of other species such as lodgepole pine and paper birch can be tolerated.
2. Stands are surveyed approximately 15 years after harvest to estimate the predicted mean volume (PMV) at age 80, and the percentage of that volume produced by conifer species (mainly spruce).
3. Sample plots for stocking (quadrats) are located at 25 m intervals on strip lines spaced 100 m apart, based on UTM coordinates (NAD 83). Quadrats are 10 m^2 in area (1.78 m radius).
4. Quadrat plots are classified based on the presence or absence of trees by species class and (for conifers) free growing status *relative to non-tree competing vegetation*:
    a) Null - plot is outside the net area to be reforested (NAR)

b) NP
c) Unstocked, stockable
d) Conifer, well growing
e) Conifer, impeded
f) Broadleaved tree
g) Both conifer and broadleaved; conifer well growing
h) Both conifer and broadleaved; conifer impeded

5. Enhanced plots are located on a 200 m grid (every eighth sample point on alternating strip lines). Enhanced plots are 100 m^2 (5.64 m radius) in size and are sampled in addition to the quadrat on the same point.
6. Measurements in enhanced plots include:
    a) Site Series
    b) % Cover of the tree layer and composition of the understorey
    c) Height and age of the dominant and co-dominant trees
    d) Site index

2.3 Target Population

The target population to sample in a given year is the NAR created from harvesting 15 years previously, where the intention was to reforest with intimate or micro-scale mixtures of spruce and aspen. While the intent is to always survey stands at age 15, the predictive models are not significantly affected by assessment ages that deviate by at least up to 5 years.

2.4 Office Procedures

2.4.1 Map & Previous Data

A Silviculture Prescription (SP) map (or equivalent) should be used to develop the plot locations of the stand survey and should be updated following each survey. This map should show block boundaries, NP areas, non-commercial cover (NCC), wildlife tree patches (WTP's), riparian management areas (RMA's), permanent access structures and temporary roads. The surveyor should be familiar with the block history.

2.4.2 Office Stratification

Prior to field sampling, the following information should be transferred to the survey map:

1. NAR boundary
2. Standards unit boundaries from the SP (or equivalent) map

Standards units can be combined if they have the same site index and the same preferred and acceptable (p+a) species.

2.4.3 Plot Locations

Strip lines are located at 100 m intervals. Under most conditions, strip lines can be positioned on a UTM grid (NAD 83) at even 100 m intervals (last two digits of either the northing or easting are 00, depending on whether the strips are oriented E-W or N-S respectively). Quadrats are spaced at 25 m intervals on the strip lines, with enhanced plots at 200 m intervals on alternating strips (Fig 1). In keeping with conventions for other surveys, enhanced plots should be placed where both the northing and easting coordinates are even multiples of 200 m (000, 200, 400, 600 or 800). For both quadrat and full measure plots, allowance should be made at the office stage for the possibility of grid points that appear to be outside the NAR according to mapped boundaries, but are found to be within the NAR in the field.

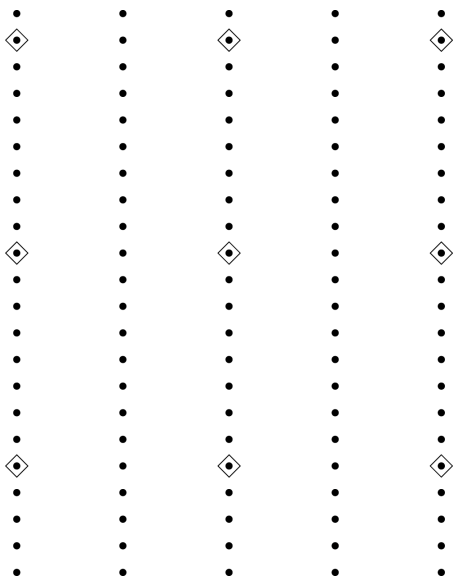


Figure 1. Strips and Plots.

Quadrat plots are located at 25 m intervals on strips lines spaced 100 m apart. Full measure plots are located at 200 m x 200 m grid points, corresponding to every eighth quadrat on alternating strip lines.

In some cases, it will be inappropriate to run strip lines on a N-S or E-W bearing. The classic case is where linear features affecting stocking have been created through management actions. Such cases can lead to significant bias in survey outcomes, as the probability of any one plot falling within a particular stocking condition are affected by the pattern. There are two options in such cases, depending on the nature of the pattern:

1. If the striped pattern has irregular stripe widths or the stripes do not follow straight lines, strip lines can be run in either the N-S or E-W direction, depending which is closest to being perpendicular to the stripes. Plots are placed at the standard intervals.

2. If the striped pattern has regular stripe widths and stripes follow straight lines, strip lines can be run as in option 1 above, but plots must be spaced at irregular intervals. This can be achieved either by

    a. plotting each successive quadrat interval as a random distance between 4 and 46 m (a range from 0 to 50 would allow for overlapping plots which is less than desirable), or

    b. starting with a regular 25 m interval, and adding a random distance along the strip line ranging from –23 to +23 m.

    In both of these cases, enhanced plots should be placed not on regular grid points but at every eighth quadrat on alternating strips.

2.5 Field Sampling

2.5.1 Quadrats versus Quadrants

An unfortunate source of potential confusion in this field procedure arises from the similar spelling and sound of two technical terms used in this versus other similar survey methods (e.g. Mean Stocked Quadrant or MSQ surveys):

> **Quadrat**: a fixed area plot, typically quite small, used as a measure of habitat in which individuals in a population are tallied to assess local distribution. The word quadrat originally referred to a rigid square frame used to define the limits of the plot, which in turn is derived from the squarish shape of the quadrate bone in the skulls of birds or reptiles. In practice quadrats may be any shape but are most commonly square or circular (Oxford University Press 2005).
>
> **Quadrant**: one fourth of a circular plot that is subdivided by two diameters passing through the plot center and oriented to each other at right angles. In practice, each quadrant of a circular plot is considered as roughly equivalent to a quadrat (as in MSQ surveys). One important difference is that quadrant data is usually summarized at the plot level first before calculating stand level statistics. In such cases, the number of samples, *n*, is based on the number of plots rather than the number of quadrants. If quadrant level statistics are treated as discrete samples, problems are encountered with hypothesis tests because the quadrants are spatially correlated and are not independent (independence is a key assumption of many statistical tests).

2.5.2 Stratification

Prior to the survey, a walkthrough is required to complete the following:

1. Review block in the field and update the map. This may require identification and GPS location of unmapped natural features or new developments such as well sites and seismic lines.
2. Preliminary identification or confirmation of strata. Strata are areas greater than 2 ha with the same forest cover, site type, stocking class and treatment opportunity.

By the completion of the survey, the cutblock must be divided into confirmed strata (polygons), based on common local and Provincial criteria and subject to the following requirements:

1. Inventory labels for the polygon must accurately specify species composition and site index, as per section 4.7.1 of the *Surveys Manual*[1]
2. Areas with different TMV (if any) due to differences in moisture regime or other rationale must be delineated.
3. Areas with different stocking classes (NSR, SR and WG) must be delineated.
4. Areas with different mixedwood stand type classes (D, DC, CD and C) must be delineated
5. Areas with treatment opportunities must be delineated. If, during the survey, the surveyor identifies and stratifies an area 2 ha or larger that would benefit from further treatment (i.e. fill planting, control of non-crop vegetation), then the boundaries of the area must be transferred to the map. A description and rationale for the treatment must be provided.

Note: post-stratification based on grouping like plots on a map is not an acceptable practice and will not be tolerated under any circumstances.

2.5.3 Quadrats

Quadrats are milhectare (10 m^2 or 1.78 m radius) plots that are classified based on the presence of certain combinations of trees, productive capability and competitive environment. The classes are:

Null

Plot is outside the NAR; plot is not included in any subsequent summaries

Unstockable

No acceptable trees are present; plot is non-productive ground

Unstocked, stockable

No acceptable trees are present but plot is potentially stockable. Comments are required regarding potential reasons for no acceptable trees being present and feasibility of adding trees.

Conifer, well growing

The only acceptable trees present are conifers. At least one conifer is of an acceptable species, an acceptable size and condition, and is free from overtopping non-crop vegetation (see well growing definition below).

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[1] The Surveys Manual is available at: http://www.for.gov.bc.ca/hfp/publications/00099/Surveys/Silviculture%20Survey%20Procedures%20Manual-April%201%202009.pdf

Conifer, impeded

The only acceptable trees present are conifers. At least one conifer is of an acceptable species and is of acceptable size and condition, but all such trees are impeded by competition from non-crop vegetation (see well growing definition below).

Broadleaved tree

The only acceptable trees present are broadleaved.

Mixed; conifer well growing

Both acceptable conifers and acceptable broadleaved trees are present, and at least one conifer is free from overtopping tall shrubs (see free growing definition below).

Mixed; conifer impeded

Both acceptable conifers and acceptable broadleaved trees are present; all acceptable conifers are impeded by tall shrubs (see free growing definition below).

In addition to classifying the plot, record:

1. pest codes for any pests present, along with the number of live and dead trees affected.
2. an *ocular estimate* of the total number of trees by species (Sx, Pl, Bl, Sb, Lt, At, Ac and Ep).

Conifer Tree Acceptability – trees must be at least 30 cm tall to be tallied (unless otherwise defined in an SP or equivalent document), and must be free of insect or disease conditions that will prevent them from becoming merchantable-sized trees (minor growth limiting pests and deformities do not limit acceptability) - see FS 660.

Broadleaved Tree Acceptability – trees must be at least 150 cm tall and

a) the tree pith must not be laterally displaced more than 30 cm from the root crown pith, and
b) the tree must not originated from a cut stump (aspen and cottonwood), and
c) the tree must have at east one live leader, and
d) the tree must not have a wound that is greater than 10% of the stem circumference or greater than 10% of the stem length, and
e) the tree must not have any fungal or insect infection affecting tissues below the bark surface (visible without destructive sampling), and
f) the tree must not be browsed so as to limit its ability to become a crop tree.

Damage to trees where the tree is likely to overcome the damage and continue growing as a dominant or co-dominant tree should not limit the tree from being tallied.

Conifer well growing assessments –conifer trees are well growing if:

a) they meet the acceptability criteria above, and
b) they are at least 100% of the height of all herbaceous and grass competition within a 1 m radius cylinder, and
c) they are taller than shrub competition in three of four quadrants of a 1 m radius cylinder

It is important to recognize that broadleaved crop trees (aspen, cottonwood and birch) are ignored in well growing assessments for conifers – the competitive effects of these species are accounted for in a different fashion.

2.5.4 Enhanced Plots

In addition to the quadrat, enhanced sample points include a 100 m^2 (5.64 m radius) plot to collect BEC , site index and additional inventory label data:

- assess and record site series, complete with zone, subzone and variant
- estimate percent cover of the tree layer
- record percent cover and average height of non-crop vegetation by species; include any species that might compete with crop trees
- record mean height and age of dominant and co-dominant crop trees by species
- for each of the dominant conifer and broadleaved crop tree species in the stratum *for which growth intercept equations are available*, locate the fattest tree in the plot for potential use as a growth intercept sample tree. If a selected tree meets the acceptability criteria listed below, record the height and breast height age. If the fattest tree does not meet the acceptability criteria, use the second fattest tree. If the second fattest tree is also unsuitable, attempt to find a suitable site tree in a 100 m^2 plot centered on each successive quadrat until a suitable replacement is found.

To be suitable for growth intercept evaluations of site index, a tree must:

- have three or more years height growth above breast height, and
- have an undamaged stem with vigorous, relatively uniform height growth above breast height, and
- have vigorous and uniform ring width at breast height, and
- must not be directly overtopped by other trees or brush, and
- must be in a dominant or co-dominant position

3.0 SURVEY OUTCOMES – YIELD AND STAND TYPE

3.1 Overview

This free growing assessment procedure for intimate and micro-scale boreal mixedwoods is based on an analysis framework described by Farnden (2009a). This framework uses a combination of simulated surveys and projections of yield from

existing growth models to build new simplified models using input parameters derived from silviculture survey data. Model outcomes include Predicted Mean Volume (PMV), Target Mean Volume (TMV) and Species Composition (Conifer Percentage of PMV). PMV is the predicted total yield at age 80, and TMV is a threshold percentage of the maximum potential yield for a stand of similar species composition.

3.2 Objectives

There are two primary objectives for predicting yields for mixedwood stands using silviculture survey data as predictive parameters:

1. Assessing compliance with statutory or contractual reforestation obligations
2. Assessing stand level contributions to landscape level management objectives

If the TMV exceeds the PMV for a stand or an area weighted collection of stands, the reforestation obligations are deemed to have been met. Compliance with landscape level species composition objectives are tracked by classifying each stand into a Mixedwood Stand Type class[2], and tracking the area reforested into each class in a ledger system (see Martin et al. 2002).

3.3 Model Development

Details on the generation and functioning of the models for calculating TMV and projected species composition are provided here for reference. While an understanding of the system is useful, in most cases field staff will rely on spreadsheets or custom programs to compile survey results and calculate the required outcomes.

Separate prediction models were developed for each 1 m increment of white spruce site index, covering a productivity range from SI_{50} = 13 to SI_{50} = 27. For each model, a set of 113 mixedwood stands (9 ha each) was generated using the following criteria:

- 9 levels of area coverage by aspen clones from 10 to 90% in 10% increments, where the aspen density varied randomly fro 10,000 to 16,000 trees/ha
- 4 levels of aspen density between clonal patches at 0, 50, 200 and 800 trees/ha
- spruce planted at 1400 trees/ha and three levels of survival: 30, 60 and 90%
- aspen site index was calculated from the spruce site index using a conversion equation provided by Nigh(2002):

$$SI_{At} = -4.768 + 1.253 \times SI_{Sw}$$

For each stand, yields were predicted using the Mixedwood Growth Model[3] (MGM), and surveys were simulated using the Silviculture Survey Simulator developed as part of the PhD work Farnden (2009b,c) at the University of BC.

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[2] Stand Type Classes: D = 0 to 20% conifer volume, DC = 20 to 50% conifer volume, CD = 50 to 80% conifer volume and C = 80 to 100% conifer volume.

[3] Mixedwood Growth Model (MGM): an individual tree, distance independent growth model developed at the University of Alberta for use in boreal mixedwoods. Information on the model can be accessed at http://www.ales2.ualberta.ca/rr/mgm/mgm.htm (as accessed April 2, 2009).

3.3.1 MGM Simulations

For each simulated 9 ha stand, a set of 36 sampled treelists was generated using randomly located 100 m^2 plots and used to generate a discrete yield curve. The 36 yield curves were then combined to generate a composite yield curve for the stand. Each sample treelist was assumed to represent local growing conditions, such that variation in competitive conditions throughout the stand would be appropriately represented in the predicted yields.

Stands were grown from the initial age of 12 years to a projected age of 80 years using BC site curves and merchantability limits set at a 12.5 cm dbh limit, 30 cm stump height and 10 cm minimum top diameter. No yield deductions were made for waste or decay.

3.3.2 Simulated Surveys

Surveys were simulated using survey algorithms built into the Silviculture Survey Simulator. For each stand, survey statistics were compiled from a set of 144 randomly located 10 m^2 quadrats, each of which was classified as:

1. Unstocked: no trees present
2. Aspen: at least 1 broadleaved tree present; no conifers
3. Spruce: at least one conifer tree present; no broadleaves
4. Mixed: at least one broadleaved tree and at least one conifer present

Survey summary statistics are simply the percentages of plots in each class (C_0, C_1, C_2 and C_3 respectively).

3.3.3 Model Fitting

Models for PMV and species composition (% spruce) are based on either on multiple linear regression using ordinary least squares (OLS), a complex variant of a Weibull function or a complex variant of a logarithmic function (Farnden 2009c):

$$\text{PMV} = b_0 + b_1C_0 + b_2C_1 + b_3C_2 \qquad \text{for SI = 13 to 21}$$

$$= b_6 * \left(1 - e^{-b_4 (b_0 + b_1C_0 + b_2C_1 + b_3C_2)^{b_5}}\right) \qquad \text{for SI = 22 to 27}$$

$$\text{\% Spruce} = 1 - e^{-b_4 (b_0 + b_1C_0 + b_2C_1 + b_3C_2)^{b_5}} \qquad \text{for SI = 13 to 18}$$

$$= b_4 + b_5 \log\left(b_0 + b_1C_0 + b_2C_1 + b_3C_2\right) \qquad \text{for SI = 19 to 22}$$

$$= b_0 + b_1C_0 + b_2C_1 + b_3C_2 \qquad \text{for SI = 23 to 27}$$

Where b_0 through b_6 are separate sets of coefficients for each model. C_3 is not utilized as it is redundant information. All models were fit using JMP version 8.0.1. Model parameters and fit statistics are provided in Tables 1 and 2.

Table 1. Coefficients and fit statistics for the models used to calculate PMV assuming discrete site index values. Separate models have been generated for different levels of site productivity based on 1 m increments of white spruce site index.

Sw SI_{50}	Y_{80}								
	b_0	b_1	b_2	b_3	b_4	b_5	b_6	R^2/I^2	RMSE
13	89.38	-74.63	-68.79	9.52				0.961	3.80
14	109.47	-90.22	-72.35	12.52				0.957	4.45
15	135.28	-110.34	-77.09	12.77				0.953	5.28
16	168.83	-136.33	-84.62	8.94*				0.946	6.49
17	212.86	-170.26	-94.54	-0.48*				0.9348	8.31
18	270.41	-214.11	-113.56	-17.50				0.928	10.51
19	338.82	-265.93	-136.47	-40.43				0.925	13.04
20	415.78	-323.60	-161.10	-68.23				0.9224	15.85
21	496.45	-382.77	-178.63	-97.47				0.9187	18.84
22	36.53	-15.413	-9.318	-7.419	1.772e-7	4.734	533.84	0.913	21.77
23	26.61	-10.244	-5.861	-5.0277	1.076e-7	5.372	589.8	0.909	23.58
24	8.544	-0.1417	-0.07340	-0.07096	1.336e-151	162.8	647.5	0.905	28.43
25	5.750	-1.0310	-0.4970	-0.5597	1.357e-10	14.08	702.6	0.892	27.24
26	2.829	-0.3355	-0.1802	-0.1834	2.516e-11	25.74	742.4	0.877	29.5
27	1.518	-0.001953	-0.001184	-0.001104	1.1953e-106	1741.7	787.56	0.875	30.47

Table 2. Coefficients and fit statistics for the models used to calculate yield-based species composition (% Spruce) assuming discrete site index values. Separate models have been generated for different levels of site productivity based on 1 m increments of white spruce site index.

Sw SI_{50}	Y_C							
	b_0	b_1	b_2	b_3	b_4	b_5	R^2/I^2	RMSE
13	1.1240	-0.6415	-1.1225	-0.2422	8.868	1.814	0.955	0.0349
14	0.8877	-0.5186	-0.9103	0.0938	6.024	1.360	0.945	0.0421
15	0.9351	-0.4746	-0.9621	0.4181	3.567	1.194	0.931	0.0498
16	1.1150	-0.4773	-1.1511	0.8132	2.059	1.087	0.914	0.0568
17	0.6057	-0.1881	-0.6284	0.6201	2.829	1.027	0.898	0.0628
18	0.5691	-0.0594	-0.5955	0.7979	2.101	1.040	0.888	0.0650
19	0.6052	0.0906	-0.4225	0.4346	0.9468	0.6249	0.888	0.0647
20	0.5753	0.1180	-0.3072	0.3447	1.020	0.8275	0.887	0.0650
21	0.5567	0.0724	-0.1515	0.1588	1.514	1.702	0.887	0.0645
22	0.7754	0.0124	-0.0264	0.0241	4.207	14.57	0.898	0.0618
23	0.5011	0.2052	-0.5115	0.4461			0.908	0.0580
24	0.5147	0.1647	-0.5400	0.4301			0.9181	0.0550
25	0.5399	0.1074	-0.5778	0.4021			0.9271	0.0520
26	0.5757	0.0587	-0.6158	0.3618			0.9324	0.0500
27	0.6273*	0.0268	-0.6551	0.3016			0.9320	0.0496

3.3.4 Spruce Site Index

Spruce site index is required for model selection. Several sources of site index are available, listed in order of preference:

1. growth intercept estimate for spruce using data from surveyed block
2. 2nd or later generation SIBEC estimate[4]
3. growth intercept estimate for spruce using data from nearby block on same site series and soil type
4. 1st generation SIBEC estimate
5. Pre-harvest inventory estimate

3.3.5 Brush Impacts

The growth model used to predict yields (MGM) is unable to explicitly model the effects of non-tree brush competition. The effects of these competitors must therefore be added in after the generation of the fitted models. Adjustments are based on the assumption that tall shrubs overtopping spruce will have a temporary effect on spruce growth, thus reducing spruce yields. This is handled within the survey system by:

a) Subdividing the classes of plots where conifers are present (C_2 and C_3) into those where at least one conifer is free of impeding competition from tall shrubs (mainly alder and willow) versus those where all conifers are impeded

b) Assuming that the impeding vegetation will, on average, result in a *10*% reduction of yield for the affected trees

For the impeded spruce plots, 10% are then transferred to the unstocked (C_0) category, and the remainder to the unimpeded spruce (C_2) category For the impeded mixed plots, *10*% are transferred to the aspen (C_1) category, and the remainder to the mixed (C_3) category.

3.3.6 Non-Productive Quadrats

Non-productive (NP) and null (plot center is outside of NAR) quadrats are treated as exclusive to the sampled population and are not included in the calculation of the percentage of plots in each stocking category.

3.3.7 TMV's

TMV is not fit as a model on its own, but is calculated using the PMV model. For TMV, the number of unstocked plots in excess of 5% are redistributed proportionately to the stocked classes (where 95% stocked plots is a theoretical upper ceiling) to determine a theoretical maximum yield. The threshold volume for acceptable regeneration performance is then set as some proportion of the theoretical maximum yield. For

[4] Second generation and later estimates are recognized in the SIBEC tables by the inclusion of a standard error value.

example, the value set in the 2003 Sustainable Forest Management Plan for the Fort St. John Pilot Project is 0.95.

Example:

A stand has survey outcomes with C_0=8.1%, C_1=21.4%, C_2=15.4% and C_3=55.1%. In this case, there is 3.1% excess in the unstocked (C_0) class that must be redistributed to the other classes:

$C_{0(new)} = 0.05$

$C_{1(new)} = C_1 + C_1*0.031 \div (1-0.081) = 0.221$

$C_{2(new)} = C_2 + C_2*0.031 \div (1-0.081) = 0.159$

$C_{3(new)} = C_3 + C_3*0.031 \div (1-0.081) = 0.570$

To determine TMV using the 0.95 threshold from the Fort St. John SFMP, the calculation becomes

0.95 x PMV(0.05, 0.221, 0.159)

4.0 SURVEY OUTCOMES – INENTORY LABELS

Elements of the inventory label for reporting to the BC Ministry of Forests' Results database are determined as follows:

Species Composition: based on the total tally of trees by species in all quadrats:

$$Species\%_i = \frac{\sum Species_i}{\sum All\ \ Trees}$$

Height and Age: based on the estimates of the mean height and age of the dominant and co-dominant trees of the 1st and 2nd leading species from the enhanced plots.

Site Index: based on growth intercept estimates of the dominant species where available, otherwise using the best available alternate method.

Crown Closure: based on mean crown closure as estimated for each of the enhanced plots

Total Trees: based on the tally of trees within the quadrats

5.0 REFERENCES

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Mixedwood Field Sampling Outcomes

	Unstocked NP	Unstocked	At	Sw Well Growing	Sw Impeded	Mixed Well Growing	Mixed Sw Impeded
No.Plots:	0	10	56	30	0	34	0
Percent:	0.0%	7.7%	43.1%	23.1%	0.0%	26.2%	0.0%

Total Plots: 130

Effective Sampling Outcomes for Modeling

Unstocked	At	Sw	Both
7.7%	43.1%	23.1%	26.2%

Yields

Sw SI	PMV	TMV	% Sw
18	201	205	63%

PMV / TMV: 0.979

Instructions

1. Determine the number of plots from the survey that fall into each stocking category. Enter the number into the first line of white cells. Make sure that the total number of plots in the survey matches the automated total on the form - if the total is not correct then at least one of the numbers for the individual classes is incorrect.

2. Select the stand site index from the drop down list under "Sw SI".

3. Read and manually copy the PMV, TMV and % Sw values to the document or report where they are needed.

Appendix 20: Migratory Birds BMP Compendium

Compendium Description of Beneficial Management Practices for Forest Harvesting in the BC Interior to Avoid or Limit Incidental Take of Migratory Birds

April 25, 2016



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1. BC Timber Sales, 2. West Fraser Mills Ltd. 3. STRIX Ecological Consulting, 4. Interfor Corporation

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Compendium Description of Beneficial Management Practices for Forest Harvesting in the BC Interior to Avoid or Limit Incidental Take of Migratory Birds

Introduction

Adverse impacts to migratory birds due to forest harvesting activities, including the incidental take of nesting birds, may be avoided or limited through the application of beneficial management practices. This document is intended to provide a brief description of a range of practices that may be considered by forest managers to avoid or mitigate impacts to birds and their active nests. This compendium does not describe the full range of practices that may be considered nor does it provide detailed or prescriptive measures. It should be used by forest managers in conjunction with additional information towards integrating beneficial management practices for migratory birds as a component of an effective management program that considers all forest based values.

Forest managers should become familiar with the compliance requirements of the Migratory Birds Convention Act, 1994 and should also familiarize themselves with the recommendations put forth by Environment Canada. This should include becoming familiar with the key sensitive nesting periods for birds in the geographic area of the intended forest harvest activities. To promote compliance, Environment Canada has provided detailed Avoidance Guidelines on their website. This compendium is designed to complement the Environment Canada recommendations on avoidance by describing beneficial management practices that are specific to forest harvesting operations in the interior of British Columbia.

A summary list of the practices that are described below is provided in Appendix 1 of this compendium. The summary list includes a relative efficacy rating for each beneficial management practice that relates to the avoidance of nesting birds. The relative efficacy for each practice has considered the likelihood of avoidance resulting from use of the practice, as well as the relative degree of protection that may be afforded to nesting birds. The rating is a guide and must be considered in the context of regional, local and site level information as related to the circumstance for which the practice may be considered for use. A more detailed description of the listed practices follows this introduction. A preliminary list of additional information sources that are relevant to migratory birds and beneficial management practices is provided in Appendix 3.

Specific to addressing the conservation needs of migratory birds, Environment Canada provides the following recommendations that provide important context for this document:

1. *Know your legal obligations;*
2. *Avoid engaging in potentially destructive or disruptive activities in key sensitive periods and locations, in order to reduce the risk of affecting birds, their nests or eggs;*
3. *Develop and implement appropriate preventive and mitigation measures to minimize the risk of incidental take and to help maintain sustainable populations of migratory birds.*

Note that appropriate measures need to be decided on a case-by-case basis. It is the responsibility of the individual or company undertaking the activities to determine these measures.

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Beneficial Management Practices – Descriptions

Strategic Operations

SO1 Block Scheduling

Adverse impacts to nesting birds during forest harvesting operations, including incidental take, can be reduced through the application of timing restrictions on operations in areas of high risk. Timing windows may be applied in key locations and /or during key sensitive nesting periods for birds. Appropriate timing windows will vary by species, by region, and with consideration to local factors such as elevation, climate, latitude, or habitat type.

Environment Canada and Climate Change Canada publish technical information on general nesting periods within established regional nesting zones across Canada. This information supports the planning and scheduling of activities to reduce the risk of adverse impacts to migratory birds, their nests and their young. For the B.C. interior, 2 nesting zones (A and B) are described, each with multiple nesting regions (e.g. A4 – Quesnel/Prince George) that have specific nesting windows published. See Appendix 2 - Figure 1 for a map of the regional nesting zones and regions of Canada. Appendix 2 - Table 1 presents general nesting periods for these zones. When a subject site is near the boundary of a zone, it is advisable to also consider the nesting period in adjacent zone(s), since differences between zones occur as a gradient.

The nesting periods do not take into account the nest building period (up to 2 weeks) preceding egg-laying and precautionary measures are recommended at the beginning of the general nesting period. The accuracy of the nesting period estimates could vary within a period by up to 10 days or more due to natural variability and site specific conditions. These nesting periods also may not include the complete nesting period for species under provincial jurisdiction (such as jays, owls, hawks, blackbirds, grouse, cormorants or pelicans). In addition, the general nesting period may not be accurate for species that may breed opportunistically, or for species that may nest earlier or later, or for mountainous landscapes.

In addition to the regional nesting period tables, Environment Canada also presents information in a set of calendars that show the variation in nesting intensity by habitat type and nesting zone. Nesting intensity is defined as the proportion of species that are estimated to be actively nesting in a given date range. Nesting intensity does not reflect the estimated proportion of individuals in the date range, therefore periods with fewer nesting species may still have a higher number of individuals (within those species) that are nesting during that time period. Nesting calendar has been summarized in Appendix 2 - Table 2 for forested habitats within each nesting region in the interior of B.C.

The information in Appendix 2 is current to April 6, 2016 and is subject to change at any time. It is strongly recommended that the Environment Canada website be relied on by forest managers for current information specific to nesting periods and for atypical information that may not be reflected in Appendix 2. In some cases, more specific information may be available and should be considered. In the case of one or more species or sites of interest, an on-line tool is available from Bird Studies Canada in the Project Nestwatch section of their website (see Appendix 3). Qualified persons may also be relied on to provide site specific recommendations of suitable timing windows that will consider the particular circumstances that are relevant to the site and planned operations.

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SO2 Spring Decking

Where all-season roads and in-woods log storage space are available, consider decking logs to avoid harvest operations during the nesting period. For example, logs could be skidded / yarded and decked during the winter season and hauled during the nesting season. Depending on regulatory requirements, this may require incremental activities, such as the field scale of logs and segregation of scaled and unscaled logs. Contractual provisions may entail advance payments to contractors or increased contract rates related to operating season and / or workforce capacity reductions and additional log handling costs. It is possible there would be degradation of log quality due to the time lag between processing and hauling.



As an alternative to in-woods decking, mill facilities that have sufficient capacity may be able to carry a greater inventory of logs at the mill storage location into the spring break-up period, enabling a delay in start-up of harvest operations until after the peak nesting period. This will increase costs associated with log inventories and would also increase the risk of deteriorating log quality due to the longer storage period before processing.

SO3 Block Stratification

There may be circumstances where a planned harvest block has a variety of stand types which represent nesting habitat for multiple species of migratory birds. In these instances, the block may be stratified in relation to the planned timing or sequencing of operations on the basis of the relative likelihood and / or the timing of use by nesting birds. The management intent would be to reduce the potential risk of adverse effects to migratory bird populations through active scheduling of operations within a block to avoid or limit operations on those portions of the block that have the highest risk for migratory birds. For example, if one portion of a cut block is of a site type that is considered of high value to nesting birds (e.g. riparian management zones, deciduous pockets) then harvest operations within or in close proximity to this type would be scheduled to occur outside of the nesting period.

Planning

PL1 Partial Cut or High Retention Silviculture Systems

This silviculture practice is limited to ecosystems and stand types that are relatively wind firm and suited to multi-story or multi-entry regeneration strategies (e.g. dry-belt Interior Douglas Fir). The post-harvest stand condition may result in the retention of trees species in a size, condition and distribution that is suitable habitat for bird species likely to be occurring within the stand in question. Forest Stewardship Plans must include applicable stocking standards.

Consider referencing species specific BMP documents or Species Accounts for guidance on stand type and desired habitat characteristics when preparing harvesting prescriptions. Where practicable, identify existing and potential recruitment nest trees. Consider marking these trees for retention. In proximity to existing and potential nest trees, prescribed retention should also address the foraging needs for the variety of bird species likely occurring. These needs may vary on a microsite basis e.g. upland areas vs riparian.

PL2 Planned Retention

Planned retention can serve as a beneficial management practice for migratory birds while also contributing to other forest management targets. Planned retention may target merchantable or non-merchantable site types. Non-forest and non-merchantable patches within a merchantable stand may be high value areas for migratory birds. These areas typically have higher structural complexity than the neighboring area and as such provide unique living spaces (or niches) for forest-dwelling bird species. These microsites may have above average coarse woody debris, standing dead trees, a thick understory, an open canopy, a grassy meadow, a mineral lick or wet area, and/or other features. The presence of such features makes these areas biodiversity islands for wildlife species providing unique ecological features that aid in survival and reproduction of individuals. As an example, an area damaged by beetle-kill can create openings that expose the understory to sunlight resulting in denser and richer understory patches. Some bird species may choose these locations to nest because the thick brush offers added food and nest concealment. These sites generally offer little in the way of merchantable timber so planning retention around these patches can be done at little or no cost.

More generally, the spatial design and pattern of any such retention contributes to habitat heterogeneity and connectivity over the landscape. The creation of forested corridors and refuges will aid in Incidental Take avoidance during future harvest events in adjacent areas. Consider retention around non-merchantable areas at the landscape or forest -level as well as at the block or site-level and apply appropriate buffers to protect the features or values present.



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Planned retention recommendations:

- Deciduous patches in conifer stands
- Deciduous patches with obvious heart rot or disease
- Conifer patches in deciduous stands
- Non-merchantable areas, including understory or immature timber
- Wet areas
- Open areas
- Disturbed areas (e.g. fire or beetle kill)
- Unique features (e.g. mineral licks, raptor stick nests, multiple trees with multiple cavities, snags or stubs)
- Anchored on (or buffering) other features or sites that are reserved to meet related objectives e.g. wildlife habitat area (WHAs)

PL3 Staff and Contractor Training

All forest workers should receive training that is relevant to their role and responsibilities. Training should be delivered by qualified persons, recognizing forest workers will have a range of knowledge and abilities related to identifying migratory birds and their habitats. Outcomes should be monitored to ensure that objectives are being met and to identify opportunities for improvement. Forest planners and field layout personnel will generally require the greatest degree of training. They are the individuals primarily being relied on to identify and implement Incidental Take avoidance or reduction strategies, which may include determining the presence of species of special management concern and to develop appropriate management measures or practices that are to be incorporated into operational plans.

Forest workers should be aware of specie of management concern relevant to their activities. These will be determined based on federal, provincial, regional and local management needs and priorities.

Audience	Recommended Training Components	Training Outcomes
Forest Planners and Layout Personnel	○ Knowledge of legal requirements and conservation objectives that relate to migratory birds, their nests and eggs. ○ Awareness of the species of management concern relevant to the site. General knowledge of their habitats, range of occurrence and nesting season. ○ Identification of high value features of importance to birds (e.g. large stick nests, wildlife trees, snags, stubs). ○ Knowledge of applicable management objectives and appropriate measures and practices. ○ Awareness of scope of practice and circumstances that warrant the use of qualified persons. ○ Reporting requirements (e.g. occurrences of species at risk reported	○ Awareness and understanding of the legal requirements and conservation objectives that relate to migratory birds, their nests and eggs. ○ General knowledge of the species of management concern relevant to the site. ○ Be observant for and able to identify high value features of importance to birds (e.g. large stick nests, wildlife trees, snags, stubs). ○ Understand the applicable conservation

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Audience	Recommended Training Components	Training Outcomes
	to provincial authorities to support conservation status assessments). Tools: ○ Summaries of legal and other requirements. ○ Field identification guides. ○ Species lists. ○ Detailed management guides including beneficial management practices. ○ Standard operating procedures. ○ Listings of qualified persons for specialized services that may be required..	objectives and appropriate measures and practices that may be applied. ○ Rely on qualified persons when appropriate. ○ Apply and prescribe appropriate measures and practices. Ensure site level plans are clear.
Operations Supervisors	○ Knowledge of legal requirements and conservation objectives that relate to migratory birds, their nests and eggs. ○ Awareness of the species of management concern relevant to the site. ○ Knowledge of applicable management objectives and appropriate measures and practices. ○ Knowledge of procedures to be followed in the event the operational plan is not clear or does not address the circumstance (e.g. the occupied nest of a species of concern is newly identified during operations and appropriate measures or practices may not be in place). Tools: ○ Field identification guides. ○ Operational plans. ○ Standard operating procedures	○ Awareness and understanding of the legal requirements and conservation objectives that relate to migratory birds, their nests and eggs. ○ General knowledge of the species of management concern relevant to the site. ○ Be observant for and able to identify high value features of importance to birds (e.g. large stick nests, wildlife trees, snags, stubs). ○ Understand and communicate the plan. Monitor that the site level plan is being followed. ○ Provide direction when required (e.g. stop work, engage a qualified person, and implement appropriate measures prior to resuming work).
Harvesting Crews Road Building Crews	○ Knowledge of legal requirements and conservation objectives that relate to migratory birds, their nests and eggs. ○ Awareness of the species of management concern relevant to the activity. ○ Knowledge of the measures and practices that have been prescribed in operational plans.	○ Awareness and understanding of the legal requirements and conservation objectives that relate to migratory birds, their nests and eggs. ○ General knowledge of the species of

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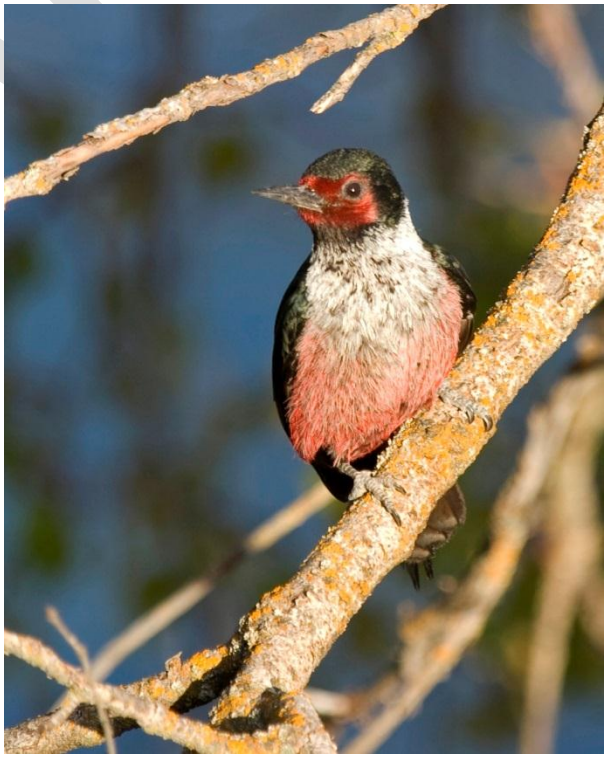
Audience	Recommended Training Components	Training Outcomes
Silviculture Crews	○ Knowledge of procedures to be followed in the event the operational plan is not clear or does not address the circumstance (e.g. the occupied nest of a species of concern is newly identified during operations and appropriate measures or practices may not be in place). <u>Tools:</u> ○ Field identification guides. ○ Operational plans. ○ Standard operating procedures.	management concern relevant to the site. ○ Be observant for and able to identify high value features of importance to birds (e.g. large stick nests, wildlife trees, snags, stubs). ○ Understand and follow the Plan. ○ Know when to stop work and seek direction.

PL5 Species-specific Strategies

A given species may have specific requirements or may warrant special management measures or practices to meet conservation objectives for example, a species designated under the federal Species at Risk Act, or a species identified at provincial, regional, or local levels as being of management concern. In these circumstances, species specific strategies may be developed to avoid or limit adverse impacts to the subject species, typically with the involvement of qualified persons.

In British Columbia, species of management concern may include, but are not limited to, species identified under:

- the federal Species at Risk Act,
- the BC Wildlife Act,
- the BC Identified Wildlife Management Strategy,
- regional or local Higher Level Plans, Land Use Plans, etc.



Environment Canada has published Bird Conservation Strategies for each of Canada's Bird Conservation Regions and these may serve as a basis for developing bird conservation strategies, guidelines and beneficial management practices for the forest industry. These strategies identify priority species and describe relevant considerations such as; population size, distribution, population trend, conservation status and threats, and may be used in conjunction with additional information to develop species specific strategies.

Information sources to support the development of species specific strategies may include the BC Conservation Data Center, Environment Canada (e.g. recovery strategies and recovery plans) and B.C. Environment (e.g. BC Identified Wildlife Management Strategy) - see Appendix 3.

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PL6 Block Design to Avoid Nesting Birds



Adverse impacts to nesting birds, including incidental, take during harvesting operations, can be reduced through pro-active measures applied during the block design phase. Nest site locations for birds that reuse their nests or provide secondary nests for other species that are known from prior surveys or reports should be actively avoided This information is particularly important for avoiding known colony nesting locations, known stick or cavity nest locations, migration staging areas and areas that serve as primary food reserves (typically large bodies of water and riparian areas). Known nest sites and important attributes associated with these sites may be tracked in geodatabases that are available to, or maintained by, forest managers. Collaboration between government agencies and forest managers to maintain geodatabases of known nest sites can promote the effective use of this information. Such databases can be used to pre-plan harvest locations during the breeding window wherein known locations are avoided during the breeding season.

Block boundary design may also limit or reduce adverse impacts to nesting birds by considering and avoiding high value habitats and habitat features used or relied on by nesting birds. High value habitats and habitat features such as riparian areas, lowland wet areas, brush patches, complex site types, snags, cliff ledges, high cut banks, etc. may be avoided in block design (size, shape, and boundary placement) and through the application of suitable planned retention areas or buffers from these important bird habitats/habitat features.

Layout

LO1 Enduring Nest Identification



Enduring nests persist on the landscape for multiple years and possibly multiple rotations, typically supporting many years of nesting by one or more bird species or other wildlife species (e.g. furbearers). Enduring nests may or may not differ from wildlife trees and snags (BMP LO4) as these are often the structures used for nest building. Cavity nests, for example, are often found in wildlife trees or snags because the internal rot makes for easy excavation; however, young healthy wood offers more protection from the physical environment and predators and therefore, some birds may choose to excavate cavities in healthy young trees. Large, old broadleaf trees are particularly valuable nest trees.

Stick nests created by raptor species are also enduring nests. They may remain in the host tree for multiple years and are often built by one species but subsequently used by another species (e.g. Northern Goshawk or Red-tailed Hawk

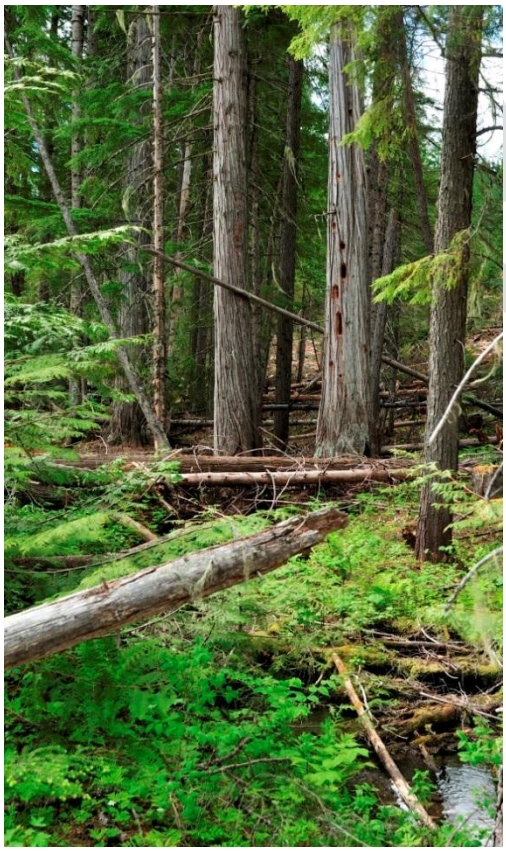
nest used by Great Gray Owl or Great Horned Owl). Stick nests of most species will require a buffer for adequate protection. Additional buffering or corridor creation may be required if there is fish-bearing water nearby or if it is a known Northern Goshawk (*Accipiter gentilis*) nest. Refer to local regulations, applicable measures for Wildlife Habitat Areas (WHAs), and the references provided in Appendix 3 to determine an appropriate buffer size.

It is recommended that all encountered enduring nests be recorded (GPS) and/or excluded from the block during harvest (i.e. retention). A waypoint can be taken during layout and the nest can be checked for activity prior to harvest should harvest occur in the nesting season. If the nest is active at the time of harvest then a buffer should be used. Regardless of nest activity, it is recommended that the enduring nest tree remain intact and not felled except where such trees are not wind firm or protected by a buffer. In some case, snags or stubs may be a safety risk for forest workers and related Work Safe B.C. regulations will apply.

Further guidance for specific species habitat preferences can be found in the Beneficial Management Practices Guidebook for Raptors in British Columbia (refer to Appendix 3).

LO2 Riparian Protection

Riparian areas are high value habitats and attract breeding and/or migrating birds. The site richness provides an excellent variety of nesting locations and the water and plant communities provide abundant food sources for nesting birds and their young.



Protection measures could include:

- Prescribing retention of suitable understory vegetation, including deciduous species, to support a variety of bird species
- Providing training and instruction for layout and timber cruising personnel related to nest identification and avoidance (occupied and / or secondary nests).
- Providing for retention of nests and nest features (e.g. cavities, snags, stubs) as wildlife trees and patches, or within Riparian Management Zones
- Ensuring there are functional systems for reporting and tracking of persistent or long-term nests and nest sites (e.g. large stick nests, secondary nests).

Additional measures to exclude the riparian management zone from harvesting activities during the breeding season should be used as these areas will likely have the highest densities of nesting birds. Riparian management zones are often readily identifiable spatially (from imagery or other data sources) during initial block design planning and these tools can be used to stratify or design blocks around riparian areas. It is also recommended that the layout/cruising personnel identify the natural break in flora between the upland merchantable timber and the riparian plant community to ensure these areas are identifiable within site level plans.

LO3 Unplanned/Unmarked Retention

Unplanned and/or unmarked retention refers to retention that is not flagged and netted out of the block at the layout stage (i.e. planned retention). The areas to be retained are left to the operator's discretion and may include any of the following:

- Specific tree species retention (e.g. deciduous clusters or clones in conifer stands)
- Dominate or co-dominate retention
- Understory retention (e.g. young or non-merchantable understory)
- Shrub layer retention
- Dispersed retention
- Group retention
- Shelterwood retention
- Group selection
- Mixed retention (two or more of the above)
- Unique features (e.g. raptor stick nests, multiple trees with multiple cavities, snags or stubs)

The type of unplanned retention used should be dependent on the species of concern or avian guild of concern (e.g. cavity nesters, warblers, etc.) as determined by local management considerations and the knowledge and expertise of the operator.

LO4 Wildlife Tree, Snag and Stub Retention

A wildlife tree is any standing dead or live tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife. A snag refers to a standing, dead or dying tree (often missing its top), and a stub refers to a snag or live tree that has snapped off on the main trunk (usually 3-5 meters). High value snags have substantial internal decay and cavities. Stubs are used a perches or as nest sites in the bowl at the top. Identification of wildlife trees, snags, and stubs requires knowledge and training from qualified personnel. More detailed Information on bird use of snags and stubs is available (refer to Appendix 3). The following characteristics and habitat attributes should be used to identify wildlife trees.



- Internal decay or rot
- Broken top / "chimney cavity" present
- Presence of natural/excavated cavities
- Crevices present (loose bark or cracks suitable for bats)
- Large brooms present
- Active or recent wildlife use (feathers, white wash from raptors)
- Current/active insect infestation

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- Tree structure suitable for wildlife use (e.g. large nest, hunting perch, bear den, etc.)
- Largest tree in the area by height and/or diameter and/or veterans
- Locally important wildlife tree species

The attributes of these trees create prime habitat for cavity-nesting birds. “Primary cavity nesters" include species like Northern flicker, red-breasted sapsucker, and various species of woodpeckers. The excavated holes created by the primary cavity nesters may also be used by "secondary cavity nesters" such as owls, chickadees, nuthatches, buffleheads, goldeneyes, Wood Duck, and Tree Swallows.

Retention of individual trees and snags may be planned or unplanned (operator discretion). Such trees may or may not contain an active nest at the time of harvest but the likelihood that an active nest is present is higher within and around these trees relative to the adjacent forest. It is recommended that the regional guidelines for Wildlife Tree Retention be followed (refer to Appendix 3). This BMP can be applied to all blocks at all times of year, even outside of the nesting season of migratory birds, to maintain habitat at the population level.

It is important at all times when planning and implementing activities related to wildlife tree retention to meet WorkSafe BC Regulations. Non-wind firm snags that are not felled must be buffered to prevent safety hazards during reforestation and any subsequent activities on the site. Refer to the local snag/wildlife tree regulations/policies applicable to your operating area and the associated WorkSafe BC regulations.

Harvest Operations

HO1	Species-specific Surveys

Species specific surveys may be of some use in forest planning. These techniques can be used to confirm the presence of a species of concern in a particular block or stand, but cannot be used to confirm the absence of a species of concern. Such information can be used to assist in block scheduling. For example, one might be able to identify the arrival of a species-at risk. Foresters are encouraged to consult professional biologists before considering any of these techniques, their caveats and utility in forest planning, however, a short summary of the techniques available is provided to inform decision-making.

Species-specific techniques can include point counts, transects, or callback surveys. The first two techniques are considered non-intrusive; however the call playback survey may be disruptive to breeding or nesting birds (depending on the species) if not done correctly. A skilled and qualified bird expert should be used as these techniques require the ability to identify species by sight and sound. Such a person will be able to identify which species a call playback survey might be useful for. A brief description of each technique is described below:

Point Counts*. The simplest method of identifying birds (also counting them) is called a "point count". A trained observer records all the bird species seen or heard from a point count station in a particular habitat type, for a set period of time (5 or 10 minutes depending on the protocol goals). Often multiple stations are set up in a fixed area or along transects that are spaced 200 to 250 m apart. Point counts are recommended for most forest songbirds. Bird behavior (e.g. breeding call, observed, flyover, foraging, etc.) is usually recorded for each bird detected.*

***Transects**. Point count stations or continuous listening along a transect will yield presence/absence information wherein only the presence information obtained from a location is confirmable. This technique is perhaps better than a single point count if your species of concern is territorial and may help identify the extent of a breeding pairs' territory*.

***Call playbacks**. Many species of birds (i.e. Woodpeckers, owls, and nighthawks in particular) will respond to the song or call of a conspecific early in the breeding season. "Call playback" is a technique that can be used to effectively confirm the presence of a given species if that species is known to respond to the playback techniques. If used, however, call playback surveys should be completed by a skilled and certified biologist or expert birder. Consult with an expert well before the breeding season if you are considering using this method because call playbacks become less effective once birds are on nests. There is a published standardized protocol in place for owls available (http://www.strixecological.ca/docs/Guidelines%20Nocturnal%20Owl%20NA.pdf).*

Cost and suitability factors related to detection surveys are circumstance-specific and will be reflective of the efficiency and success of the method applied and the currency of the results Depending on site specific circumstances, it may take one crew about two days to survey an 80 ha stand twice. The results may only be partially indicative of presence and not absolute related to species absence, for the point of time surveyed. The results may only be relevant for a brief period (e.g. 7 days), following which a re-survey may be required, depending on the objectives of the survey.

If a species of concern is detected by the survey then some BMP options include:

- Timing deferrals relative to the nesting window of the species.
- Retention designed around preferred nesting habitat (e.g. alders, deciduous pockets).
- Set-backs around locations of confirmed presence (particularly of paired birds)
- Identify availability of habitat in the adjacent areas
- Determine where the bird was heard calling to search for potential nest sites

HO2 Nest Sweeps

Nest sweeps can be an intrusive form of survey, if not done carefully. Environment Canada generally does not recommend this technique and has published this cautionary statement on their website:

> "*In most cases nest search techniques are not recommended because, in most habitats, the ability to detect nests remains very low while the risk of disturbing active nests is high. Flushing nesting birds increases the risk of predation of the eggs or young, or may cause the adults to abandon the nest or the eggs. Therefore, except when the nests searched are known to be easy to locate without disturbing them, active nest searches are generally not recommended; they have a low probability of locating all nests, and are likely to cause disturbance to nesting birds. In many circumstances, incidental take is likely to still occur during industrial or other activities even when active nest searches are conducted prior to these activities*."

However, if further investigation is required to determine the presence of breeding birds, particularly for species of concern, consider using skilled and expert birders and non-intrusive

search methods. This may include high or very high risk blocks where there are no other alternative locations for harvest.

Such searches may be of more use if they are confined to small areas or if they target areas where specific nest types might occur. Some examples:

- gravel pits;
- new road layout;
- a previously cleared area where there is a lag between clearing and harvest
- structures such as a bridges or buildings,
- blocks adjacent to fields, clearings, or clearcuts
- conspicuous nest structures (within the nesting period or outside the nesting period; see enduring nests);
- cavity nesters inside trees or snags (such as woodpeckers, goldeneyes, nuthatches, owls);
- common ground nesters, or
- colonial-breeding species that can often be located from a distance



Cost and suitability factors related to detection need to be analyzed. Many of the species of concern can benefit from direct nest searches for the protection of their nests. Caution needs to be used for species that easily abandon their nests to perceived threats. For these species, the nest tree itself should not be flagged in favor of field marking the surrounding buffer only, or other unobtrusive methods. A crew of two people can usually complete about 10 ha of nest sweeps per day. The results may only be relevant for a brief period (e.g. 7 days), following which a re-survey may be required, depending on the objectives of the survey.

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Appendix 1

Migratory Bird Incidental Take Avoidance - Listing of Beneficial Management Practices

Management Practice Category	Reference No.	Application Phase	BMP Category	BMP Name	BMP Brief Description	Likelihood of Avoidance (LoA)	LoA Rank minimal = 1, partial = 2, true = 3	Degree of Protection (DoP)	DoP Rank low = 1, mod. = 2, high = 3	Relative Efficacy Rating (LoA Rank * DoP Rank)
Avoid	HO1	Harvest Operations	Operations	Species-specific Surveys	Includes call playbacks for species presence/absence	Partial avoidance	2	Low	2	4
Avoid	HO2	Harvest Operations	Operations	Nest Sweeps	Pre-harvest nest sweep	Minimal avoidance	1	Low	1	1
Avoid	LO1	Layout	Retention	Enduring Nest Identification	Identification and management of conspicuous & enduring nests	Partial avoidance	2	Moderate	2	4
Avoid	LO2	Layout	Retention	Riparian Protection	Increasing riparian retention where possible i.e. to match ecosite where riparian-centric species may nest or feed	Partial avoidance	2	Moderate	2	4
Avoid	LO3	Layout	Retention	Unplanned/Unmarked Retention	Refers to directions given to operators for unmarked retention (e.g. single species retention)	Partial avoidance	2	Moderate	2	4
Avoid	LO4	Layout	Retention	Wildlife Tree, Snag and Stub Retention	Retention of individual trees or snags suitable for cavity nesting bird species	Minimal, Partial avoidance	1, 2	Low, Moderate	1, 2	1 to 4
Avoid	PL1	Planning	Landscape	Partial Cut or High Retention Silviculture System	Partial cut or high retention silviculture system applied (low risk silviculture system)	Partial avoidance	2	Moderate	2	4
Avoid	PL2	Planning	Retention	Planned Retention: Biodiversity Anchors	Patch/edge retention designed around "biodiversity anchors"	Minimal avoidance	1	Moderate	2	2
Avoid	PL3	Planning	Training	Staff and Contractor Training	Training of forest planners, layout personnel, and forest workers	Partial avoidance	2	Low	1	2
Avoid	PL4	Planning	Operations	Species-specific strategies	Refers to altered operational plans relative to a species of concern; variable	Variable	1, 2, 3	Variable	1, 2, 3	1 to 9
Avoid	PL5	Planning	Landscape	Block Design	Avoid high value features and habitats during block design phase	Minimal, Partial avoidance	1, 2	Low, Moderate	1, 2	1 to 4
Avoid	SO1	Strategic Operations	Timing	Block Scheduling	Scheduling high risk blocks outside the nesting period	True avoidance	3	High	3	9
Avoid	SO2	Strategic Operations	Timing	Spring Decking	Decking of logs for hauling in to or after the nesting season, to maintain log flows without reliance on active harvest operations	True avoidance	3	High	3	9
Avoid	SO3	Strategic Operations	Timing	Block Stratification	Delineating blocks into segments with differing harvest plans or schedules relative to MBCA risk status	True avoidance	3	Moderate	2	6

Beneficial Mitigation Practices

Management Practice Category	Reference No.	Application Phase	BMP Category	BMP	BMP Brief Description
Mitigate	i	Planning	Training	Awareness	Refers to efforts to generate a broader awareness
Mitigate	ii	Planning	Habitat Enhancement	Nest Supplementing	Refers to the use of artificial nests (nest boxes and raptor platforms)
Mitigate	iii	Harvest Operations	Habitat Enhancement	Stubbing	Refers to the use of stubbing to encourage the development of snags and wildlife trees
Mitigate	iv	Strategic Operations	Landscape	Habitat Supply Modeling	Refers to the modeling of specific habitat types for species of concern for the landbase

Matrix of Efficacy Rating

Likelihood of Avoidance	Degree of Protection: Low (1)	Mod. (2)	High (3)
Minimal (1)	1	2	3
Partial (2)	2	4	6
True (3)	3	6	9

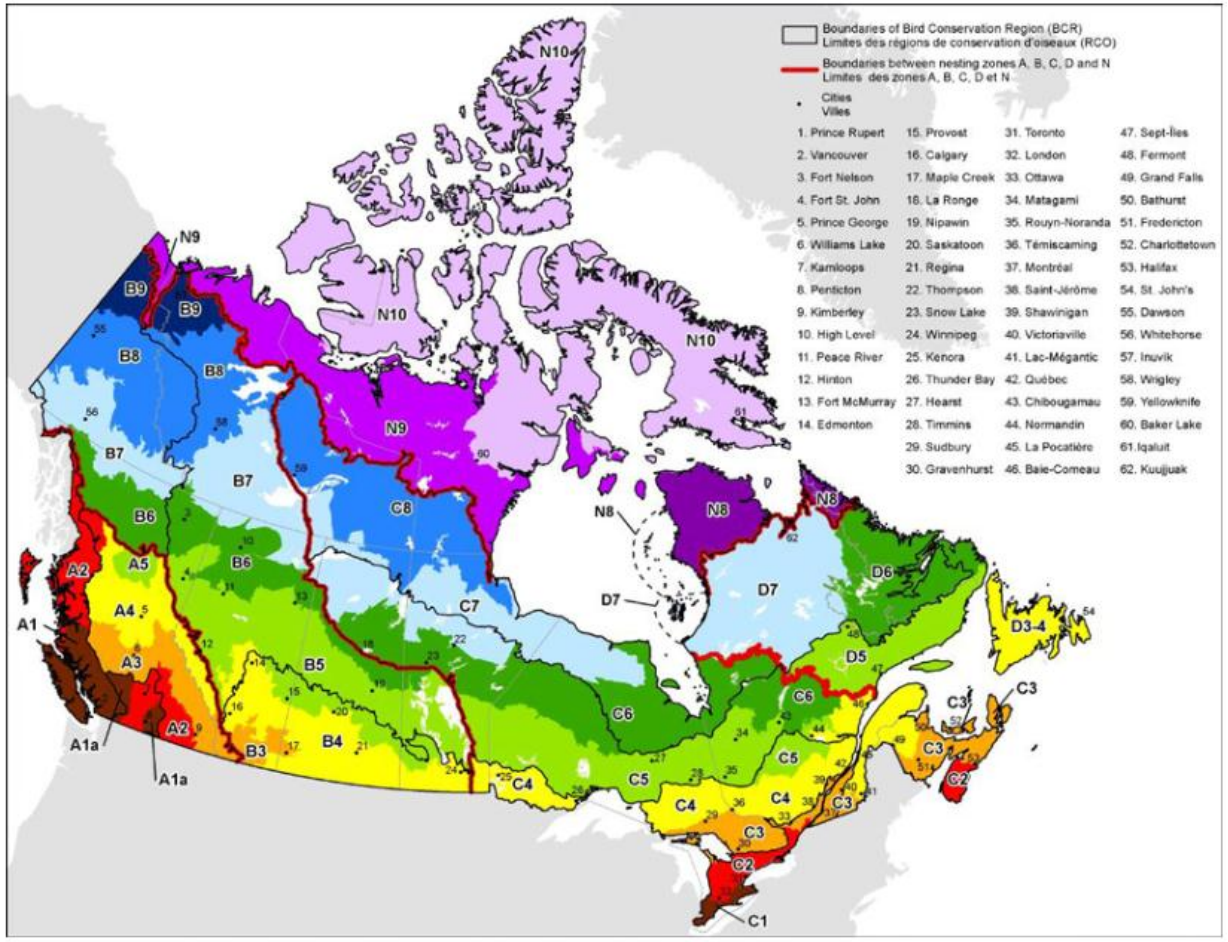
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Appendix 2

Source: Environment Canada (April 6, 2016)

Figure 1*

Map of the nesting zones in Canada



* A1a is now the same as A1 as of April 2016. **Appendix 2**

Source: Environment Canada (April 6, 2016)

Table 1. Regional nesting period table in Canada, technical information for planning purposes

Nesting zone A: **Northern Pacific Rainforest (BCR5), Great Basin (BCR9) and Northern Rockies (BCR10)** **(Map of Nesting zone A) (Nesting calendars of zone A)**	**Regional nesting period**
A1	Late March - Mid-August
A2	Early April - Mid-August
A3	Mid-April - Mid-August
A4 and A5	Late April - Mid-August
Nesting zone B: **Prairie Potholes (BCR11), Boreal Taiga Plains (BCR6) and Northwestern Interior Forest (BCR4)** **(Map of Nesting zone B) (Nesting calendars of zone B)**	**Regional nesting period**
B3 and B4	Mid April - Late August
B5	Late April - Late August
B6	Late April - Mid-August
B7 and B8	Early May - Late August
B9	Mid-May - Mid-August

Appendix 2

Table 2 - BC Interior Nesting Calendars: Forested Habitats
Percentage Species Nesting in Early through Late Date Range

Important Notes:

The information in Appendix 2 is current to April 6, 2016 and is subject to change at any time. It is strongly recommended that the Environment Canada website be relied on by forest managers for current information specific to nesting periods and for atypical information that may not be reflected below.

1. *The nesting periods do not take into account the nest building period (up to 2 weeks) preceding egg-laying and precautionary measures are recommended at the beginning of the general nesting period.*

2. *The accuracy of the nesting period estimates could vary within a period by up to 10 days or more due to natural variability and site specific conditions.*

3. *These nesting periods may not include the complete nesting period for species under provincial jurisdiction (such as jays, owls, hawks, blackbirds, grouse, cormorants or pelicans).*

4. *The nesting periods may not be accurate for species that may breed opportunistically, or for species that may nest earlier or later, or for mountainous landscapes.*

5. *Table 2 reports nesting intensity - the proportion of species that are estimated to be actively nesting in a given date range. Nesting intensity does not reflect the estimated proportion of individuals in the date range, therefore periods with fewer nesting species may still have a higher number of individuals (within those species) that are nesting during that time period.*

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To illustrate the use of the Table below, for Nesting Zone A1 it is estimated that 61-100 % of the considered bird species may be actively nesting between May 6 and July 19. Less than 5 % may be nesting between March 26 and 30, or August 8 and 9.

Nesting Zone A1 (BCR 9 Great Basin - Okanagan) - March 26 - August 9

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	March 26 - 30	August 8 - 9
6 - 10 %	March 31-April 1	August 5 - 7
11 - 20 %	April 2 - 13	August 1 - 4
21 - 40 %	April 14 - 24	July 28 - 31
41 - 60 %	April 25 - May 5	July 20 - 27
61 - 100 %	May 6 to July 19	

Nesting Zone A2 (BCR 9 Great Basin - Kamloops/west Kimberley) - April 4 to August 11

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	April 4 - 8	August 10 - 11
6 - 10 %	April 9 - 13	August 6 - 9
11 - 20 %	April 14 - 22	August 2 - 5
21 - 40 %	April 23 - May 4	July 28 - August 1
41 - 60 %	May 5 - 14	July 21 - 27
61 - 100 %	May 15 to July 20	

DRAFT

Nesting Zone A3 (BCR 10 Northern Rockies - 100 Mile House) - April 14 to August 12

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	April 14 - 17	August 10 - 12
6 - 10 %	April 18 - 21	August 7 - 9
11 - 20 %	April 22 - May 2	August 3 - 6
21 - 40 %	May 3 - 10	July 28 - August 2
41 - 60 %	May 11 - 19	July 22 - 27
61 - 100 %	May 20 to July 21	

Nesting Zone A4 (BCR 10 Northern Rockies -Quesnel/Prince George) - April 21 - August 13

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	April 21 - 24	August 10 - 13
6 - 10 %	April 25 - 28	August 8 - 9
11 - 20 %	April 29 - May 8	August 3 - 7
21 - 40 %	May 8 - 13	July 29 - August 2
41 - 60 %	May 14 - 22	July 23 - 28
61 - 100 %	May 23 to July 22	

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Nesting Zone A5 (BCR 10 Northern Rockies - West Williston Lake) - April 26 to August 11

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	April 26 - 30	August 10 - 11
6 - 10 %	May 1 - 3	August 8 - 9
11 - 20 %	May 4 - 12	August 4 - 7
21 - 40 %	May 13 - 16	July 30 - August 3
41 - 60 %	May 17 - 25	July 24 - 29
61 - 100 %	May 26 to July 23	

Nesting Zone B5 (BCR 6 Boreal Taiga Plains - Fort St. John) - April 22 to August 24

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	April 22 - 27	August 18 - 24
6 - 10 %	April 28 - May 2	August 11 - 17
11 - 20 %	May 3 - 12	August 4 - 10
21 - 40 %	May 13 - 19	July 30 - August 3
41 - 60 %	May 20 - 27	July 24 - 29
61 - 100 %	May 25 to July 23	

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Nesting Zone B6 (BCR6 Boreal Taiga Plains - Fort Nelson & BCR4 NW Int.) - April 30 to August 12

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	April 30 - May 5	August 11 - 12
6 - 10 %	May 6	August 9 - 10
11 - 20 %	May 7 - 14	August 5 - 8
21 - 40 %	May 15 - 20	July 31 - August 4
41 - 60 %	May 21 - 28	July 24 - 30
61 - 100 %	May 29 to July 23	

Nesting Zone B7 (BCR 4 Northwest Interior) - May 3 to August 14

Percentage of Species	Early Nesting	Late Nesting
0 - 5 %	May 3 - 9	August 13 - 14
6 - 10 %	May 10 - 11	August 11 - 12
11 - 20 %	May 12 - 18	August 6 - 10
21 - 40 %	May 19 - 22	August 1 - 5
41 - 60 %	May 23 - 30	July 25 - 31
61 - 100 %	May 27 to July 22	

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Appendix 3

Migratory Birds - Information Sources

(Sites last accessed February 26, 2016)

A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (Interim guidance, November 19, 2014):
http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=12121

A Scientific Basis for Managing Northern Goshawk Breeding Areas in the Interior of British Columbia: Best Management Practices. Stuart-Smith, K., W.L. Harrower, T. Mahon, E.L. McClaren, and F. I. Doyle. (2012). FORREX Forum for Research and Extension in Natural Resources, Kamloops, B.C. FORREX Series 29 : http://www.forrex.org/sites/default/files/forrex_series/176-goshawk-final.pdf

Atlas of the Breeding Birds of British Columbia:
http://www.birdatlas.bc.ca/

BAM Guidance for Conducting Avian Point Count Surveys (The Boreal Avian Modelling Project 2015):
http://www.borealbirds.ca/index.php/data_collection_guidance

BC Species and Ecosystems Explorer:
http://a100.gov.bc.ca/pub/eswp/

BC Environment Guidelines and Best Management Practices:
http://www.env.gov.bc.ca/wld/BMP/bmpintro.html

Best Management Practices Guidebook for Raptors in British Columbia:
http://www.env.gov.bc.ca/esd/distdata/Peace_Region_Wildlife_Values/Industrial_Sectors/Best_Management_Practices/Raptor%20BMPs%20for%20British%20Columbia.pdf

Bird Studies Canada:
http://www.birdscanada.org/

Bird Studies Canada – Nesting Calendar Query Tool:
http://www.birdscanada.org/volunteer/pnw/rnest/warning.jsp?lang=en

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Conservation Framework (BC Environment):
http://www.env.gov.bc.ca/conservationframework/index.html

Develop with Care 2012: Environmental Guidelines for Urban and Rural Land Development in British Columbia. Cullington, J. and D. Polster. (2012):
http://www.env.gov.bc.ca/wld/documents/bmp/devwithcare/

eBird. Cornell Lab of Ornithology and National Audubon Society:
http://ebird.org/content/ebird/about/

Environment Canada - Bird Conservation Regions and Conservation Strategies:
http://www.ec.gc.ca/mbc-com/default.asp?lang=En&n=1D15657A-1

Environment Canada – Migratory Birds Convention Act and Regulations:
https://www.ec.gc.ca/Nature/default.asp?lang=En&n=7CEBB77D-1

Environment Canada – Nature (Migratory Birds, Species at Risk, Wildlife Habitat, etc.):
http://www.ec.gc.ca/Nature/

Environment Canada – General Nesting Periods of Migratory Birds in Canada:
http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1

Environmental Mitigation Policy for B.C.:
http://www.env.gov.bc.ca/emop/

Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (Province of Ontario, 2010):
https://www.ontario.ca/document/forest-management-conserving-biodiversity-stand-and-site-scales

Guidelines for Nocturnal Owl Monitoring in North America (Takats et al. 2001):
http://www.strixecological.ca/docs/Guidelines%20Nocturnal%20Owl%20NA.pdf

Guidelines for Raptor Conservation During Urban and Rural Land Development in British Columbia. Bently, M. D. and M. W. Demarchi. (2013):
http://www.env.gov.bc.ca/wld/documents/bmp/raptor_conservation_guidelines_2013.pdf

Guidelines for the Selection of Valued Components and Assessment of Potential Effects:
www.eao.gov.bc.ca/pdf/EAO_Valued_Components_Guideline_2013_09_09.pdf

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Identified Wildlife Management Strategy (2004):
http://www.env.gov.bc.ca/wld/frpa/iwms/iwms.html

NCASI Migratory Bird Handbook (available to members from this site):
http://www.ncasi.org/News/NCASI-Canada-Bulletin/11-02/NCASI/FPAC-migratory-birds-practices-handbook.aspx

Observations on the Use of Stubs by Wild Birds. BC Journal of Ecosystems and Management 1(1): 1-5. Harris, B. 2001.
http://jem.forrex.org/index.php/jem/article/viewFile/212/131

Provincial Wildlife Tree Policy and Management Recommendations (BC Forest Practices Branch, February 2000):
https://www.for.gov.bc.ca/hfp/publications/00034/wltpolicyfinalmay15-00.pdf

Strategic Land and Resource Planning (BC Crown Lands):
https://www.for.gov.bc.ca/tasb/SLRP/

The Birds of North America Online. Cornell Lab of Ornithology and the American Ornithologists Union:
http://bna.birds.cornell.edu/bna

Wildlife Habitat Areas:
http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html

Wildlife Habitat Features:
http://www.env.gov.bc.ca/wld/frpa/habitatfeatures.html

Wildlife Habitat Features – Summary of Management Guidelines Northern Interior Forest Region (Draft, 2004):
http://www.env.gov.bc.ca/esd/distdata/Peace_Region_Wildlife_Values/Fish_and_Wildlife/FRPA/Wildlife_Habitat_Features/DRAFT.WHF.NorthInterior.revise.July30.pdf

Wildlife Management Areas of B.C.:
http://www.env.gov.bc.ca/fw/habitat/conservation-lands/wma/

WorkSafe B.C. – Occupational Health and Safety Regulation, Part 26: Forestry Operations and Similar Activities:
http://www2.worksafebc.com/publications/OHSRegulation/Part26.asp
26.11 Dangerous trees:
http://www2.worksafebc.com/publications/OHSRegulation/Part26.asp#SectionNumber:26.11

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Appendix 21: Stick Nest Identification and Management Guide

Canadian Forest Products Ltd.

Western Canada Operations

Guide to Stick Nests and their Management



Prepared by :

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April 2017

Table of Contents

Introduction 3

General Management Guidance for Stick Nests 4

Species Accounts 8

- Bald Eagle 8
- Osprey 10
- Northern Goshawk 12
- Cooper's Hawk/ Sharp-shinned Hawk 14
- Great Blue Heron 16
- Red-tailed Hawk 18
- Merlin 20
- Broad-winged Hawk 22
- Corvids and Gulls 24
- Other Species that may use stick nests 26

Photo credits 28

INTRODUCTION

This guide is designed to assist with the identification and management of stick nests commonly occurring within Canadian Forest Products Ltd. (Canfor) British Columbia and Alberta operating areas.

Stick nests are the platforms that birds, predominantly raptors, construct to lay their eggs and raise their young in. These structures are often re-used over many years by the same individuals, and often by generations of the same species. Further, nests built by one species (e.g., goshawks) may subsequently be used by other species (e.g., great grey owls). As such, stick nests serve important ecological functions beyond their utility for a single individual of a given species, even if they are inactive in any given year.

In British Columbia, all stick nests are protected when occupied by a bird or its egg under Section 34 of the *Wildlife Act*, and some stick nests even when unoccupied. Section 34 reads:

> A person commits an offence if the person, except as provided by regulation, possesses, takes, injures, molests or destroys
>
> (a) a bird or its egg,
>
> (b) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl, or
>
> (c) the nest of a bird not referred to in paragraph (b) when the nest is occupied by a bird or its egg.

British Columbia also has upcoming legislation to protect nests of Bald Eagles, Ospreys, and Great Blue Herons (as well as some other cavity nesting birds and birds not present on Canfor's operating areas) as Wildlife Habitat Features (WHF). This legislation requires that authorized persons carrying out primary forest or range activities "must not damage or render ineffective a WHF".

Alberta protects stick nests through the Operating Ground Rules for individual forestry companies (see mgmt. section).

Federally, most forest birds that build stick nests, with the exception of Great Blue Herons, are *not* protected under the Migratory Bird Convention Act (1994); this includes hawks, owls, falcons, osprey, eagles, jays, crows, and ravens. However, any Endangered or Threatened species has its 'residence' protected under Canada's Species at Risk Act (SARA), which would include the stick nest for stick-nesting species. As of April 2017, none of the species in this guide were on the SARA registry. For up-to-date status information on stick-nesting species, refer to Canfor's Species Database or the Environment Canada Public Registry.

Finally, note that some species may use stick nests occasionally, or may not commonly nest within Canfor's operating areas. These species include:

- Great Gray Owl
- Great Horned Owl
- Barred Owl
- Swainson's Hawk
- Northern Hawk Owl

Pictures and brief descriptions of these species are included at the end of this guide (Pg. 26)

GENERAL MANAGEMENT GUIDANCE FOR STICK NESTS

The following guidance broadly applies to the management of all stick nests found during layout activities. The overall objective is to maintain the integrity of the breeding area, so that it can continue to be used successfully in subsequent years. This may not always be possible given the extent of harvest/ wildfire/pest outbreaks surrounding the nest and in the surrounding landscape, but should be the goal in the majority of cases. Specific management prescriptions will vary among species and be dependent on specific site conditions. For example, although buffers are referred to in terms of a radius of a circle, in most cases circular areas are not the best reserve design. Forest type changes, terrain, waterbodies, roads, existing blocks, and other factors will influence the final boundaries of any reserve. When in doubt, consult the Canfor Senior Forest Scientist or another qualified professional for advice.

Management actions for stick nests are focused on three main objectives:

1. Protect the tree with the active (occupied) nest,

2. Protect some amount of habitat surrounding the active nest and alternate nests, ideally in one large patch, rather than separate small patches around each nest tree,

3. Protect the breeding area from disturbance during the breeding season.

Definitions for the purposes of this document:

Active Nest: the nest that is being used to lay eggs in during the breeding season in question.
Alternate Nest: nest(s) in the breeding area that are not being used to lay eggs in during the breeding season in question (but may be used for feeding or roosting platforms in that season).

Steps to take once a stick nest is found during field layout:

1. Record the UTM , species, and diameter of the nest tree and ribbon the tree (e.g. triple ribboned with Wildlife Tree Patch ribbon) and give the data to WIM to be entered as a Wildlife Feature in Canfor's GIS system. The "Wildlife Feature and High Value Snag Tracking" card should be used for this purpose. It is also helpful to take a few pictures of the nest and nest tree, as this can aid identification. If it is a Bald Eagle, Osprey, or Great Blue Heron nest, make sure you note this is a Wildlife Habitat Feature on the form.

2. Search the surrounding area for other nests.

   Nests are often located within 300 m of each other, and within the same habitat type. Goshawks generally have multiple nests (up to 8) in their breeding areas; other raptors usually have only one or two nests. Nests within the same breeding area are usually found in the same species of tree and position in the tree as each other. So, take a good look at the first nest you found and search for others like it. Binoculars are very helpful here. Each nest that is found should be ribboned and information collected and given to WIM as per the first nest.

3. Identify the species using the nest and the active nest, if possible.

The bird species using a stick nest cannot be confirmed without seeing or hearing the bird. Binoculars are often necessary. Field guides can augment this guide with more detailed information, including information on regional variation in plumage. Smartphone Apps such as the iBird Canada Guide to Birds, or The Sibley eGuide to the Birds of North America are very useful as they have good pictures and example songs and calls for most bird species. With these on your phone or tablet with you in the field, you can immediately confirm the species.

The active nest is the one that is being used that breeding season, and may change from one year to the next, especially in goshawks. It can only be identified when it is being used, e.g. from April through July. Thus, if you find a stick nest in winter, you must return in spring to determine if it is active. Signs of use include:

- Fresh green branches placed on the outside of the nest (decoration)
- Whitewash streaks (droppings), remains of prey, or raptor feathers under or near the nest
- White down feathers on the outside of the nest
- A bird in the nest, adult or chick (should be obvious, but is not always, if the nest cup is deep)

To help find the active nest, call-plays backs are useful. This requires having a 'horn' which projects the breeding 'song' of the species you suspect may be nesting in the area (an iphone does not project far enough by itself – it must be hooked up to a horn that projects at least 200 m). If present, the bird will often (but not always) call back. For example, with goshawk, the female will often call from the nest in late April or early May. Taking a bearing on this call and following it will enable you to find the active nest. This is easier said than done however, since the bird will not always call from the nest. An experienced person may be required to assist. A good rule of thumb for goshawks is that a nest area cannot be said to be inactive unless three visits on non-consecutive days have been made to the nest area and it has been thoroughly searched with call playbacks each time.

4. Establish a reserve for the breeding area using the information in this guide.

Key factors to consider in reserve design include:

- Incorporate all nests (active and alternate) into a windfirm reserve whenever possible.
- Connect the reserve to other reserves (e.g., RRZ) or forest at the block edge where practicable
- Retain large trees, in clumps if singles are not windfirm, and snags (within WorkSafe BC Reserves as required) within the block to provide perches and future nest sites (for some species).

Suggested minimum radii for reserves vary among species and are listed on the pages for each species. Bear in mind that specific prescriptions will always be dependent on specific site conditions; forest type changes, terrain, waterbodies, roads, existing blocks, and other factors will influence the final boundaries of any reserve.

In the Grande Prairie Division, management for raptor stick nests is found in "Canfor Grande Prairie's Operating Ground Rules":

"Unoccupied nests (year-round) require a 30m radius buffer. Occupied raptor nests will be given a 100m buffer unless otherwise approved by Alberta, and consultation with Alberta Area Biologist in the event of a listed at-risk species. Activity timing restrictions may also be necessary during active nesting period for sites containing identified at-risk raptors. Nest buffers will also be incorporated into variable-retention patches and watercourse buffers wherever possible."

5. Prescribe Timing Restrictions.

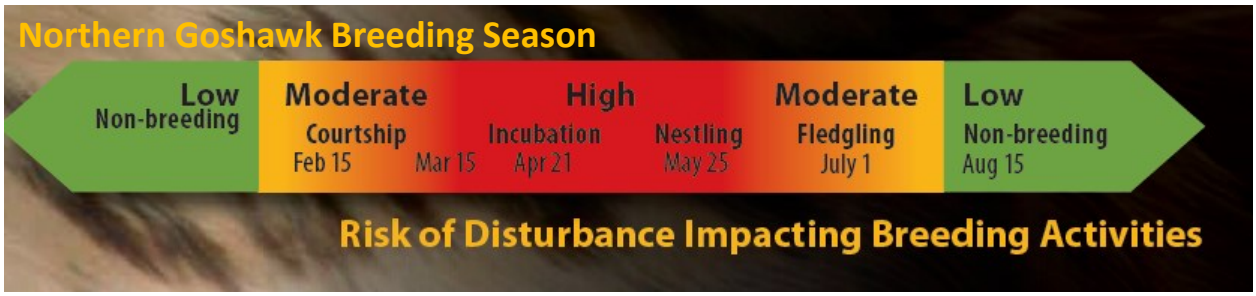
Breeding raptors can be very sensitive to noise disturbance, especially during the courtship and egg laying period (e.g., before June). Too much disturbance can cause a pair to abandon their nest and lose their eggs for that year. Different forest management activities have different levels of noise disturbance; the table below groups forest management activities into three categories: High, Medium, and Low disturbance. The distance from the nest at which these activities should be avoided varies by species and is found in the Management Actions table in the Species Accounts.

Disturbance Level	Forest Management Activity	
High	• Harvesting and Skidding • Processing • Road Construction	• Loading and hauling • Aerial herbicide application
Medium	• Brushing/thinning with power equipment	• Ground herbicide application • Mechanical Site Preparation
Low	• Layout and cruising (without dogs) • Routine road maintenance	• Tree Planting (without dogs)

Many stick-nesting species are widely distributed across the province, and their breeding seasons varies with the latitude and elevation of the breeding site. The dates in the management action summary table for each species are based on the BC Breeding Bird Atlas species breeding dates (for interior locations), which includes the courtship and nest initiation period (except for Northern Goshawks, which lists the breeding dates found in the Best Management Practices document).

In some cases, the start of the breeding season given in the Species Accounts is earlier than the actual breeding season starts at Canfor Operations. In this case, the start of the breeding season may be verified by the return of the birds to the nest site or area. In addition, the Risk of Disturbance Impacting Breeding Activities scale from the Best Management Practices for Northern Goshawks in the Interior of BC can be used to determine the key periods to avoid.

Prescribed timing restrictions should correspond to the breeding season for the species inhabiting the nest. Under certain circumstances (e.g. forest health issues), this may not be possible; in cases such as this, a minimum timing restriction is listed for each species. Timing restrictions may be lifted or adjusted following consultation with a qualified professional (e.g. RPBio).



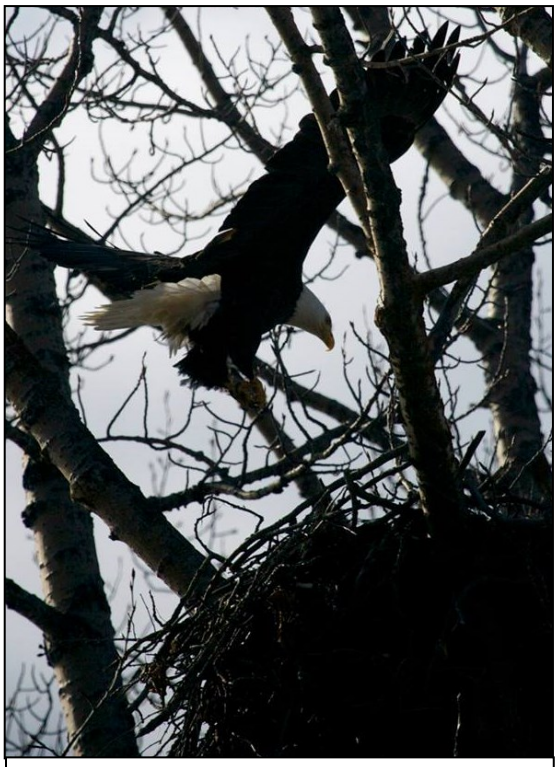
Additional Information

1. Canfor species database: \\canfor.ca\woods\FMG\WORKING\Biodiversity_and_Wildlife\Canfor_Species_Databases
2. Identified Wildlife Management Strategy (IWMS) – BC document providing management guidelines for selected species: http://www.env.gov.bc.ca/wld/frpa/iwms/
3. BC Breeding Bird Atlas – recent survey information for breeding birds within BC: http://www.birdatlas.bc.ca/
4. E-fauna Electronic Wildlife Atlas of BC – general distribution information for wildlife in BC: http://ibis.geog.ubc.ca/biodiversity/efauna/
5. Northern Goshawk BMP Brochure: \\can-for.ca\woods\FMG\WORKING\Biodiversity_and_Wildlife\Species_of_Management_Concern_Info\Northern Goshawk\Goshawk Brochure March 2011.pdf

Additional information, specific to Canfor's Grande Prairie FMA are found here:

1. Canfor Grande Prairie's Forest Management Plan: http://www.agric.gov.ab.ca/app21/forestrypage?cat1=Forest%20Management&cat2=Forest%20Management%20Plans&cat3=Canadian%20Forest%20Products%20Ltd
2. Canfor Grande Prairie's Operating Ground Rules: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/formain15749/$FILE/canfor-ogr-final-post-june-16.pdf
3. Canfor Grande Prairie's 2015 Sustainable Forest Management Plan http://www.canfor.com/docs/default-source/responsibility/sfm-plan-grande-prairie---aug-2012-revised_nov_2015-compressed.pdf?sfvrsn=2

Bald Eagle (*Haliaeetus leucocephalus*)



Adult bald eagle approaching nest platform

Identification: Large, stocky bird (wingspan 168 cm-244 cm), somewhat light yellow eye, yellow feet and heavy yellow bill.

- Adults – black body with pure white head and tail.
- Juveniles – all brown body with white mottling on underside of chest and wings.

Soars with wings held flat. Call is distinctive series of high pitched stuttering whistles.

Similar species: Adult golden eagles have a dark eye, smaller head and golden nape; juvenile golden eagles with small white patches on underside of wings.

Distribution: Across British Columbia.

Food Habits: Prefer fish (caught live, stolen from other fishing species such as osprey, or found dead) but eat a variety of items such as birds, mammals or carrion.

Breeding Habitat: Primarily coniferous forests close to water, but deciduous and mixedwood forests also used. Require large, sturdy trees to support their nests.



Juvenile bald eagle. Note white head and tail of adult and white mottling on breast and belly.



Adult bald eagle in flight—note white head and tail, dark brown body, yellow bill.



Juvenile bald eagle in flight – note white mottling under body and wings.



Bald eagle in nest

Nest Characteristics

- Site – usually < 2km from water
- Tree – select large trees, either in the open or extending above main canopy for ease of access. Often coniferous, but can be deciduous like cottonwood where structure is suitable
- Position – usually in top ¾ of tree on branches suitable for supporting the weight, near trunk or in fork of branches near trunk
- Size – very large; varies from newly constructed nests (~1.5m diameter) to nests in use for generations (up to ~2.5m diameter).
- Nests are typically used year after year by the same pair or their offspring, but one to four nests may be in a single breeding territory.

Tolerance to New Disturbance: Unless near urban/ rural interfaces, have low-moderate thresholds for new disturbance.

NOTE—Bald Eagle nests are protected throughout the year under the Wildlife Act. They are also Wildlife Habitat Features.

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	100	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	100
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and veteran trees singly or in windfirm clumps to provide perches and roosts. Avoid locating roads here.	100	As per active nest	
Remainder of Block	Ensure riparian reserves around lakes and marshes include large trees for perches and are wide enough to be windfirm (min. 30 m).			
Timing Restriction: No activities during breeding season (20 February - 15 August) when practicable. Minimum Timing Restriction 15 March—15 August				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 500 m; or within 300 m horizontal distance where there is sufficient visual screening provided by continuous forest cover (of at least mid forest age) or topography.			
Medium	Within 200 m.			
Low	Within 50 m.			

Osprey (*Pandion haliaetus*)



Adult osprey

Identification: Large raptor (150cm-180cm wingspan) but slimmer and smaller than eagles.

Adults and juveniles have distinctive brown wings and back with a white breast and head, and a distinctive brown line through the eye. In flight, a distinctive 'crook' is evident in the wing. Females are on average 20% larger than males.

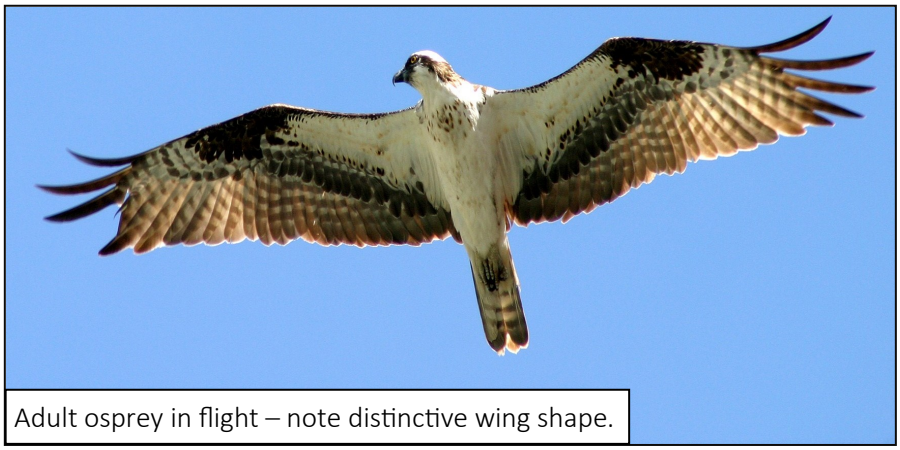
Call is a series of short, shrill whistles.

Similar species: None.

Distribution: Widely distributed in BC, locally abundant wherever suitable habitat (shallow lakes, ponds, and rivers) is available.

Food Habits: Fish specialists, eat live fish almost exclusively. Fish caught by diving up to 3 feet into the water to grab a fish and then transport it back to a perch or the nest to consume.

Breeding Habitat: Due to food habitats, breeding habitat is primarily dictated by access to shallow, fish-bearing water such as lakes, reservoirs, streams, ponds, or wetlands.



Adult osprey in flight – note distinctive wing shape.

Nest Characteristics

- Site – often adjacent or close to water, but can be up to 4 km away. May be out in the open, or in forests, at the top of tall snags, to provide easy access to nest. Often close to human activity.
- Tree – use a broad array of natural and man-made structures, including live trees, snags, power poles, and artificial nest platforms.
- Position – usually at top of structure, or in case of live trees with healthy crowns, as near the top as possible.
- Size – varies from smaller, newly constructed nests (0.7m in diameter) to nests in use for generations (up to ~2.0m diameter).



Adult osprey in flight with fish.

Tolerance to New Disturbance: High; readily nests on human-made structures, and tolerant of human activity.



Osprey nests. Top left: Nest in fir tree, Vavenby Region; top right: artificial nest platform adjacent to power pole, Houston Region; bottom left: on top of a High Value Snag, Kootenay Region; bottom right: adjacent to a reservoir.

Note— Osprey nests are protected year round under the Wildlife Act of BC. They are also Wildlife Habitat Features.

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	75	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	75
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and vets for perches and future nest sites. Avoid locating roads here.	75	As per active nest	
Remainder of Block	Retain windfirm veteran trees			
Timing Restriction: No activities during breeding season (15 April - 31 August) when practicable. Minimum Timing Restriction 15 March—15 August				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 500 m; or within 300 m horizontal distance where there is sufficient visual screening provided by continuous forest cover (of at least mid forest age) or topography.			
Medium	Within 100 m.			
Low	Within 50 m.			

Northern Goshawk (*Accipiter gentilis*)



Adult Northern Goshawk—Note slate-grey back, white eyeline and darker eye.

Identification: Stocky forest hawk with rounded wings and long tail.

Adults – brown to grayish back, black cap, and distinctive white eye line. Females (105-115cm wingspan) are larger than males (98-104cm wingspan), with adults develop a red eye in contrast to the yellow eye of juveniles. In flight, the tail is noticeable longer and wings are rounded in contrast to other hawks.

Juveniles – more brownish colouration than adults with brown streaking on a white breast, yellow vs. red eye.

Call near the nest is a repeated *kye kye kye*.

Similar species: Cooper's hawks have similar features and may overlap in size (e.g., a male goshawk and female Cooper's Hawk are of similar size). Goshawks are generally larger with longer wings and a shorter tail. Cooper's hawk has a less distinct eyebrow stripe with a reddish chest and evenly barred tail.

Distribution: Widely distributed in BC forests, particularly middle elevation forests.

Food Habits: A variety of prey from mid-size mammals such as snowshoe hare and squirrel to larger birds such as grouse.

Breeding Habitat: Goshawks use a nest area (usually a closed canopy old or mature stand), contained within a larger breeding area, which often includes some dense younger forest as hiding cover for juveniles.



Adult Northern Goshawk in flight—note tail length relative to overall body length and 'fuzzy' barring on trailing edge of wing and tail.



Juvenile Goshawk—Note the brownish colouration and yellow eye.

Nest Characteristics

- Nest Area– The nest area is typically in a stand of mature or old-growth forest dominated by large trees, a closed canopy, and relatively open understory, often near water and on relatively gentle slopes.
- Tree – Often one of the largest trees in the stand, often conifers, although deciduous species are also used. May have up to eight alternate nests typically within 300 m but sometimes further apart; usually build a new nest each year.
- Position – usually in the lower half of the nest tree, below the forest canopy, and often in the first substantial whorl of branches. Active nests tend to have fresh green material added to the nest platform.
- Size – averages roughly 70-100 cm in diameter.

Tolerance to New Disturbance: Low, requires large tracts of forest for nesting and foraging







MANAGEMENT ACTIONS—Refer to the "Best Management Practices for Northern Goshawk Breeding Areas in the Interior of British Columbia" for complete details. Different breeding area may be managed for different levels of risk.

Breeding Season: 15 Feb - 15 August		
Management	Active and Alternate nest sites	
Reserve	• Include as many alternate nests within the reserve as possible. • Buffer nests from block/forest edges by 200m. • Include as much old and mature closed canopy forest within the reserve as possible; some younger (40-80 yr) forest can be included. • Total area of reserve should be > 75 ha for low to minimal risk of breeding area abandonment; 50-75 ha for moderate risk; 25-50 ha for high risk. • Reserves < 25 ha are ineffective to maintain breeding area use over the long-term. • Minimize edge: area ratio of the reserve: avoid narrow ribbons < 200 m wide	
Remainder of Block	Retain windfirm veteran trees and snags (where safe to do so) for hunting perches, and large CWD for plucking perches.	
Timing Restriction (no activities during breeding season). Does not apply if nest area verified unoccupied.	High Disturbance Activities	>500 m away
	Medium Disturbance Activities	
	Low Disturbance Activities	> 250 m away

Cooper's Hawk (*Accipiter cooperii*) / Sharp-shinned Hawk (*Accipiter striatus*)

Identification: Cooper's and Sharp-shinned hawks can be difficult to distinguish in the field and have an overlapping distribution in the southern half of the province. Both Cooper's and Sharp-shinned hawks are forest hawks and are generally seen sub-canopy.

Adults – Females of both species are significantly larger than males (up to 50% larger). Cooper's hawks have a proportionally larger head which protrudes well past the 'wrists' when see in flight (males: 62cm-80cm wingspan, females: 75cm-90cm wingspan). Sharp-shinned hawks are smaller, have a 'square' end to their tail, and heads which barely protrude past their 'wrists' when seen in flight (males: 53cm-56cm wingspan, females: 58cm-65 cm wingspan).

Juveniles – more brownish colouration than adults with brown streaking on a white breast that ends higher on the belly in Cooper's hawk than sharp-shinned hawk.

Cooper's hawk call is a series of nasally flat *pek pek pek* calls, Sharp-shinned hawk calls are a sharper *kiwkiwkiw.*



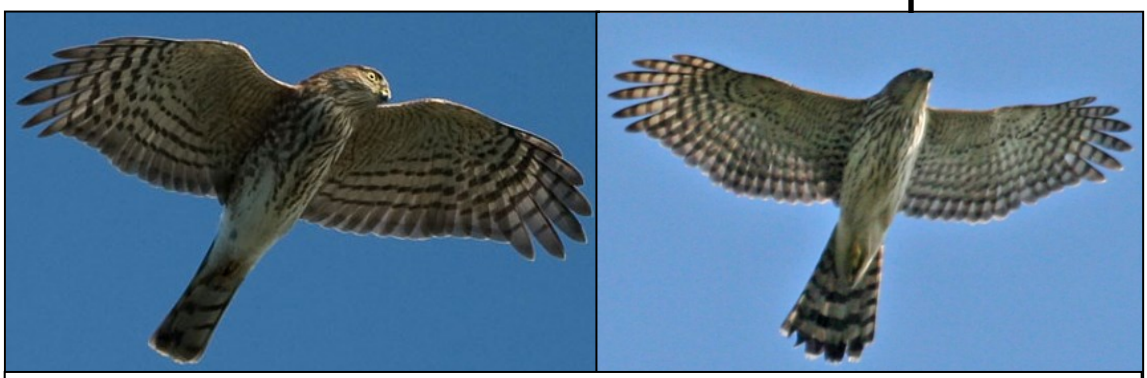
L: Cooper's hawk – note reddish barring on breast and lack of a distinct white eye line. R: Sharp-shinned hawk – note 'square' tail and less contrast between cap and sides of neck.

Similar species: Both species smaller than the more robust looking northern goshawk, and lack the goshawk's bold white eye line. Goshawk and Cooper's hawk have similar features and may overlap in size (e.g., a male goshawk and female Cooper's hawk are of similar size). Goshawk are generally larger with longer wings and a shorter tail. Cooper's hawk has a less distinct eyebrow stripe with a reddish chest and evenly barred tail.

Distribution: Cooper's Hawk occurs in southern two-thirds of the province while Sharp-shinned Hawk widely distributed in BC.

Food Habits: Cooper's hawks diet includes many medium-sized birds as well as small mammals, while sharp-shinned hawks are specialist songbird predators.

Breeding Habitat: Use a wide variety of coniferous, deciduous, and mixed-wood forest types. Cooper's hawks tend to use breeding habitat that has more deciduous species, is older with taller trees, and less dense than sharp-shinned hawks.



L: Cooper's hawk – note reddish barring on breast and lack of a distinct white eye line. R: Sharp-shinned hawk – note 'square' tail and less contrast between cap and sides of neck.



Nest Characteristics

- Site – nest sites tend to be in mature or old-growth forests with large trees, a closed canopy, and relatively open understory. Both species will return to the same breeding sites, but typically do not re-use nests from previous years.
- Tree – nests of either species can be found in either coniferous or deciduous trees.
- Position – below the canopy, almost always in the bottom half of the tree.
- Size – nests of Cooper's hawk larger (64cm-76cm diameter) than sharp-shinned (35cm-60cm diameter), often fresh green branches evident on the active nest structure.

Tolerance to New Disturbance: **Cooper's hawk:** Moderate—High, prefers area with interlocking canopy for rearing young; **Sharp-shinned hawk**: Moderate, requires secure forest cover for nesting; tolerant of human activity.

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	20 Both species	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	20*/ Variable**
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and vets for perches and future nest sites. Maintain CWD for cover for prey. Avoid locating roads here.	100 m for Cooper's; 50 m for Sharp-shinned.	As per active nest	
Remainder of Block	Retain windfirm veteran trees			
Timing Restriction: No activities during breeding season (20 April - 15 September for Cooper's hawk, 20 May—20 August for Sharp-shinned) when practicable. Minimum Timing Restriction 15 March—15 August				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 100 m for Cooper's Hawk; within 50 m for Sharp-shinned.			
Medium	Within 50 m for Cooper's Hawk; within 25 m for Sharp-shinned.			
Low	Within 25 m for Cooper's Hawk; within 10 m for Sharp-shinned.			

**Cooper's hawk, or if nest is >75cm in diameter*

***Sharp-shinned hawk, or if nest is <75cm in diameter, only required to retain the nest tree (however, reserve may be necessary to protect nest from damage, and reserve size will depend on site topography, stand type, etc.).*

Great Blue Heron, *herodias* subspecies (*Ardea herodias herodias)*



Adult Great Blue Heron; note slate-grey colouration and bold, blue eyeline.

Identification: large (standing ~120 cm tall) wading bird.

Adults – easily identifiable due to its large size, slate-grey body colour, and distinctive dark-blue stripe running from above the eye through to the back of the head.

Call a series of guttural croaks.

Similar species: Sandhill Cranes are more uniformly grey, adults have a red crown. In flight, Sandhill Cranes keep their neck outstretched, and travel in flocks.

Distribution: Throughout the southern two-thirds of BC and along coastal areas up to Alaska. Closely tied to major river and lake systems in the interior of the province.

Food Habits: Hunt mainly fish but consume a wide variety of prey items including reptiles, amphibians, insects, and small mammals that they stalk and ambush.

Breeding Habitat: Key habitat feature is shallow water to wade as they hunt so almost always associated with wetlands, slow-moving rivers, lakes, and ponds. Will also use grassy uplands to forage, especially juveniles.

Nest Characteristics

- Site – may nest individually but usually in colonies of up to 100 pairs. Nests are usually located in mature forests (deciduous, coniferous or mixed). Colonies may extend for several tree lengths within a stand. Herons generally tend to avoid human disturbance. Herons may return to the same colony site for many years, although they will change locations, particularly if subjected to predation pressure or human disturbance. Nests are located <10km from suitable foraging areas.
- Tree – broad range of tree species, often deciduous but sometimes conifers or snags.
- Position – usually in top half of tree, exact position selected where branch structure suitable for supporting nest .
- Size – ranges in size from 50 cm to 1.0 m in diameter for older nests.



Adult Great Blue Heron in flight; note 'S' shape of neck while flying.



NOTE—Great Blue heron nests are protected throughout the year under the Wildlife Act. They are also Wildlife Habitat Features.

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	200	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	200
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and vets for perches and future nest sites. Maintain large CWD. Avoid locating roads here.	100	As per active nest	
Remainder of Block	Retain windfirm veteran trees			
Timing Restriction: No activities during breeding season (1 March—15 August) when practicable. Minimum Timing Restriction 15 March—15 August				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 300 m			
Medium	Within 300 m			
Low	Within 75 m			

Red-tailed Hawk (*Buteo jamaicensis*)



Adult Red-tailed Hawk perched; note reddish colour to back of tail.

Identification: large, stocky hawk (114cm-133cm wingspan).

Adults – colouration is highly variable, but they can be readily identified by the reddish wash to the top of tail, light coloured chest, dark bars at leading edge of broad wings and robust body.

Juveniles – similar to adults but top of tail a dull brown with contrasting dark brown bars.

Call is familiar and distinctive *keee-eee-arrr* call.

Similar species: Swainson's hawk chest is darker and wings are longer and narrower with strong contrast between dark trailing edges and light leading edge.

Distribution: Widely distributed in BC.

Food Habits: Majority of prey items are small- and medium-sized mammals, which they ambush from elevated perches.

Breeding Habitat: Habitat generalists, using habitats that range from mature forest patches to open scrub-land. They are most commonly found in open areas with patches of forest creating edge habitat.



Adult Red-tailed hawk in flight. Note wide, stocky wing shape and dark bars at leading edge of wing.

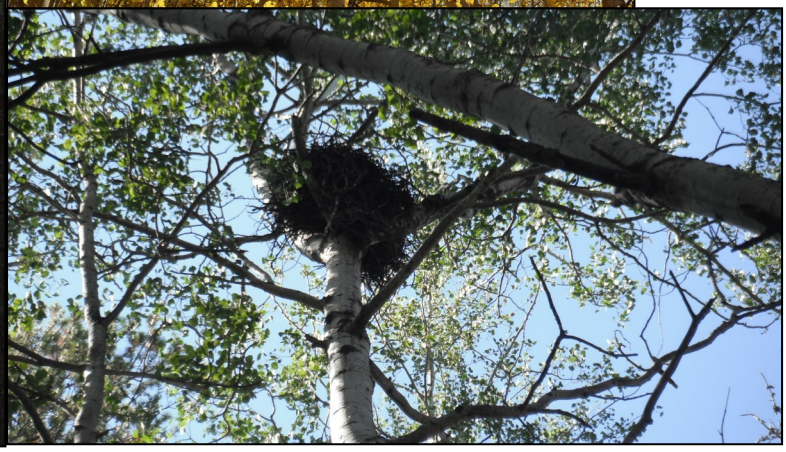


Juvenile Red-tailed Hawk. Note dark, thick streaks across belly, white chest and bare yellow legs.

Tolerance to New Disturbance: High—tolerant of human activity.







Left: Red-tailed Hawk nest in larch tree, note triple ribbon at base, Kootenay Region; top and bottom right: Red-tailed Hawk nests in aspen trees.

Nest Characteristics

- Site – typically the edge of conifer or mixedwood forest with mature trees or veteran trees to provide a nest site. Nest may be reused for several years, then abandoned, and then reused some years later.
- Tree – often in the tallest tree in a patch with good views of surrounding area, usually conifers but can use deciduous species.
- Position – usually built at or near the tops of trees.
- Size – averages 70cm in diameter, can be larger for nests re-used for several years.

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	20	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	20
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and vets for perches and future nest sites. Maintain large CWD. Avoid locating roads here.	100	As per active nest	
Remainder of Block	Retain windfirm veteran trees			
Timing Restriction: No activities during breeding season (20 February—15 August) when practicable. Minimum Timing Restriction 15 March—15 August				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 100 m			
Medium	Within 50 m			
Low	Within 25 m			

Merlin (*Falco columbarius*)



Adult merlin, note slate-grey back and brown bars on breast, white tail bands.

Identification: small falcon (53cm-68cm wingspan), as with all falcons distinguished by their constantly flapping, pointed wings and rapid flight.

Adults – females larger than males, males have greyer backs than the brownish ones of females. Both sexes have heavily barred chests, several white tail bands and dark underside of wing.

Juveniles – have brownish colouration, similar to females.

Call a rapid accelerating series of sharp notes *twi twitwitwittiti-tititi*

Similar species: American kestrels are smaller with reddish colour on back and tail, a more slender build and distinctive 'mustache' stripes; prairie and peregrine falcons are larger with slower wingbeats and occasional gliding flight – both also lack the heavy streaking and tail banding of the merlin; sharp-shinned hawks are similar sized but have a different shape with short, rounded wings and a long tail .

Food Habits: Specialize on preying on smaller birds such as songbirds and shorebirds, which they often take on the wing.

Breeding Habitat: Inhabits open habitats such as patchy woodlands, forest openings, and riparian areas. Often associated with rivers, wetlands, lakes and other natural openings.

Distribution: Across British Columbia.

Nest Characteristics

- Site – do not construct their own nest platforms, rather, they use old nests of hawks and corvids (crows, ravens, magpies). Selected nests tend to be in patches of deciduous or coniferous trees with a good view of the surrounding open habitat.
- Tree – variable.
- Position – varies but prefers nests higher in trees
- Size – averages 40cm in diameter.



Adult merlin in flight, note pointed wings and heavily barred chest.

Tolerance to New Disturbance: Moderate—high, forages and nests in close proximity to human developments, provided songbird prey are available. For nesting, secure tree cover is required.

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	20	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	variable*
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and vets for perches and future nest sites. Maintain large CWD. Avoid locating roads here.	50	As per active nest	
Remainder of Block	Retain windfirm veteran trees			
Timing Restriction: No activities during breeding season (15 April—15 August) when practicable. Minimum Timing Restriction 15 April—15 August				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 50 m			
Medium	Within 25 m			
Low	Within 10 m			

only required to retain the nest tree, however, reserve may be necessary to protect nest from damage, and reserve size will depend on site topography, stand type, etc.)



Broad-winged Hawk (*Buteo platypterus*)



Adult Broad-winged hawk. Note barring on neck and chest and tail bands.



Juvenile broad-winged hawk. Note pale face, lack of chest barring and white eye-line.

Identification: Small (81cm-100cm wingspan), compact forest-dwelling hawk.

Adults – compact body with large head and wings coming to a distinctive point, trailing edge of wing outlined in black to wing tips, heavy reddish barring at throat becoming less dense on chest, thick black and white bars on tail, reddish-brown head.

Juveniles – blotchy brown patches on white chest, distinctive white eyeline on pale head.

Call a distinctive high-pitched whistle: *teeteeeeeeeee.*

Similar species: Red-tailed hawks are much bigger with more rounded wings and pale chests; Cooper's and sharp-shinned hawks have shorter wings and long tails.

Distribution: Extends westward into BC from main range in Alberta; most common in the Peace and regions adjacent to the west slopes of the Rocky Mountains.



Broad-winged hawk in flight. Note black along trailing edge of wing and thick tail bands.

Food Habits: Broad range of food including small mammals, amphibians, and insects. Hunts from a perch in forest interior, usually sub-canopy, although may also hunt along forest edges

Breeding Habitat: Undisturbed lower-elevation deciduous and mixedwood forests with small openings, usually near water. Avoids human disturbance and activity in breeding sites.

Nest Characteristics

- Site – mature deciduous or mixed-wood stands, usually avoiding areas with human activity or disturbance
- Tree – generally uses most abundant species in a stand, either coniferous or deciduous
- Position – sub-canopy in lower third main canopy, in deciduous trees located in first main crotch, in coniferous tree on lower whorl of horizontal branches against trunk
- Size – varies from 35cm – 50cm in diameter



Broad-winged hawk nest with chicks in deciduous tree

Tolerance to New Disturbance: Low—moderate, an inconspicuous and secretive raptor.

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	50	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	Variable*
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and vets for perches and future nest sites. Maintain large CWD. Avoid locating roads here.	100	As per active nest	
Remainder of Block	Retain windfirm veteran trees			
Timing Restriction: No activities during breeding season (15 May—15 August) when practicable. Minimum Timing Restriction 15 May—15 August				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 100 m			
Medium	Within 50 m			
Low	Within 25 m			

only required to retain the nest tree, however, reserve may be necessary to protect nest from damage, and reserve size will depend on site topography, stand type, etc.)

Corvids and Gulls (that build stick nests)

Identification: Diverse group, including Bonaparte's gull (*Chroicocephalus philadelphia*), American crow (*Corvus brachyrhynchos*), common raven (*Corvus corax*), and black-billed magpie (*Pica hudsonia*). All are relatively easily identifiable:

Bonaparte's Gull – small white and grey gull with distinctive black head and partial white eye ring around eye. Franklin's gull is similar but not in BC during the breeding season

American Crow – jet black with less robust bill than common raven, also lacks 'rough' patch of feathers on neck of the common raven

Black-billed magpie – smaller than a crow with long black tail and black back, head and neck, belly is pure white

Common Raven – jet black bird with heavy bill and patch of 'rough' feathers on the throat

Distribution: All are relatively widely distributed across BC

Food Habits: Generalists, eat a wide range of small mammals, birds, eggs, reptiles, amphibians, insects, carrion, and human garbage.

Breeding Habitat: Occupy a wide range of habitats. All species are generalists, both in food and breeding habitat. Species main important in regards to other stick-nesting species is the stick nests they create that are subsequently used by other species (e.g., merlin).

Nest Characteristics

- Site – Bonaparte's gull builds nests on the margins of water such as lakes, wetlands, rivers or on small islands; may nest as solitary pairs or in loose colonies. The three corvids (crow, raven, magpie) nest in a variety of natural and non-natural sites
- Tree – can be either conifer or deciduous for any of the four species
- Position – varies although often in the top half of trees
- Size – averages 30cm in diameter for all species but varies widely – up to 50cm in some cases where nests are reused

MANAGEMENT ACTIONS

Management Unit	Active nest site		Alternate nest sites	
	Comments	Dist. from nest (m)	Comments	Dist. from nest (m)
Reserve patch	No harvest or roads	20	No harvest, connect to reserve around Active Nest where possible; always when nests < 100 m apart	Variable*
Treatment Unit (inside net area surrounding Reserve)	Maintain large snags and vets for perches and future nest sites. Maintain large CWD. Avoid locating roads here.	50	As per active nest	
Remainder of Block	Retain windfirm veteran trees			
Timing Restriction: No activities during breeding season (see table below) when practicable.				
Disturbance Level	No activities (Does not apply if nest area verified unoccupied)			
High	Within 50 m			
Medium	Within 25 m			
Low	Within 10 m			

BREEDING DATES

Species	Breeding season	Minimum timing restriction
Bonaparte's gull	15 May—20 August	15 May—15 August
American crow	10 April—15 September	10 April—15 August
Black-billed magpie	15 April—15 August	15 April—15 August
Common Raven	10 March—15 July	15 March—15 July

Bonaparte's gull (below), and on nest (right).





Common raven (below), and on nest (right).





American crow (below), and nesting (right).





Magpie (below), and on nest (right).





Other species that may use stick nests

Great Gray Owl *Strix nebulosa*



Description: Adults are tall owls, with broad wings and long tail, large heads and facial disks. Silvery grey overall, fine brown, grey, and white streaking. Yellow eyes and bill. No ear tufts.

Similar Species: Barred owls are smaller and more brown overall; have brown vertical bars on chest. Great Horned owls are smaller, less grey, and have ear tufts.

Great Horned Owl *Bubo virginianus*





Description: Adults are thick-bodied, large owls with large ear tufts. Grey-brown overall with reddish faces, though colour varies regionally from pale to sooty.

Similar Species: Great Gray Owls are larger, greyer and lack ear tufts. Barred Owls are slightly smaller and have dark, and lack ear tufts.

Barred Owl *Strix varia*





Description: Large, stocky owl with a rounded head, no ear tufts, and tails that are medium length and rounded. Eyes are almost black; body colouring is mottled brown and white. Underparts are marked with vertical brown bars, upper breast is crossed with horizontal brown bars.

Similar Species: Great Grey owls are considerably larger, with yellow eyes, and have a black and white “bowtie” under their face. Northern hawk owls have yellow eyes, horizontal brown bars, and long tails.

Other Species that may be using Stick Nests

Northern Hawk Owl *Surnia ulula*





Description: Adults are medium sized owls with white spotted brown upperparts and heavy horizontal barring on underparts. Facial disk is grey is partially bordered by a thick brown stripe. Yellow eyes.

Similar Species: does not resemble other owl North American owls due to long tail. Broad head and body help distinguish them from hawks.

Swainson's Hawk *Buteo swainsoni*





Description: Adults are large hawks with broad wings and short tails. Upperparts are dark brown, throat is white, upper breast is rufous (reddish-brown), and pale buff upperparts.

Similar Species: red-tailed hawks have shorter, wider wings, and lack a strong light to dark wing contrast that Swainson's Hawks have.

Photo Credits

Unless indicated below, photos were sourced from Allaboutbirds.org or Google.

Bald Eagle

Adult bald eagle approaching nest platform – Vicki Prigmore
Bald eagle in nest—Nicolas Dory

Osprey

Adult osprey in flight with fish— Caters News Agency
Nests: Top left —Andy Groom; top right— Ryan Gill; bottom left—Kari Stuart-Smith; bottom right— Kevin Skarda

Northern Goshawk

Nests: Left and Right—Kari Stuart-Smith; middle — esagor, Flickr

Cooper's Hawk

Cooper's Hawk in nest—Alek Komarnitsky

Great Blue Heron

Adult Great Blue Heron—Vicki Prigmore
Great blue heron colony—John Cooper

Red-tailed Hawk

Juvenile Red-tailed Hawk— L.M. Smith
Red-tailed hawk nest in aspen tree (Fall leaves) - kyleddsn, Flickr

Merlin

Perched merlin—John Fox, Flickr
Merlin in flight—Brian Rusnica, Flickr

Corvids and Gulls

Bonaparte's gull on nest—Melanie and Kyle Elliott, Flickr
Raven on nest—Joni Sweetman, Flickr
Crow on nest—achatphoenix, Flickr
Magpie walking—Tony Hisgett, Flickr
Magpie on nest—Gillian haygreen, Flickr

Other species that use stick nests

Great gray owl with owlets—articphoto.ulk.co
Great Horned owl on nest—John Fox Flickr
Great Horned owl owlets—Mac Walter, Flickr
Barred owl – Trisha Norton, Flickr
Swainson's hawk in nest—Christian Newton, Flickr
Swainson's hawk in flight – Anne Elliott Flickr
Adult Northern hawk owl— Yan Li, Flickr
Northern Hawk owl owlet—Anne Elliott Flickr

Appendix 22: Glossary

SFMP #4 Glossary of Terms and Acronyms

Allowable Annual Cut (AAC)

The annual rate of timber harvesting specified for an area of land by the Chief Forester of the BC Ministry of Forests. The Chief Forester sets AACs for Timber Supply Areas and Tree Farm Licences in accordance with Section 8 of the *Forest Act*.

Abiotic

Not of biological origin (see biotic), e.g., windthrow, forest fires, flooding.

Access Management

The planning, construction, maintenance, use and deactivation of all roads. May also refer to approved methods of controlling
access to certain areas to protect other values**.**

Access Structure

A structure within a cutblock that

a) is either a permanent access structure or a temporary access structure, and
b) was constructed for facilitating the harvesting of timber within the cutblock.

Accumulations

Term used in reference to waste calculations on harvested areas. The amount of waste in areas that has been piled and accumulated along roads or on landings.

Adaptive Management

A learning approach to management that incorporates the experience gained from the results of previous actions into decisions. It is a continuous process requiring constant monitoring and analysis of the results of past actions that are used to update current plans and strategies.

Aerial Logging

Harvest method where the logs are carried (fully suspended) from the felling area to roadside or other decking area using aircraft.

Anthropogenic

Influenced by the impact of humans on nature.

Applicable performance standard (APS)

The specific level to which a participant or holder of a Timber Sales License must perform a requirement of the *Fort St. John Pilot Project Regulation* determined in decreasing order of priority as follows

a) as specified in a higher-level plan unless the higher-level plan
    i. was in effect less than 4 months before submission for approval of a Sustainable Forest Management Plan or Forest Development Plan for the areas that specifically addressed the standard of performance and
    ii. does not otherwise specify that the higher-level plan is to prevail despite any Sustainable Forest Management Plan or Forest Development Plan
b) as specified in a variance with respect to the standard of performance
c) as specified in a Sustainable Forest Management Plan unless a Forest Development Plan
    i. was approved for the areas before the Sustainable Forest Management Plan was approved for the area, and
    ii. specifically addressed the standard of performance
d) as specified in the Forest Development Plan
e) as specified in an SLP

Archaeological Sites

Locations that contain physical evidence of human activity for which the application of scientific methods of inquiry (i.e. survey, excavation, data analysis) are the primary source of information.

Archaeological Impact Assessment (AIA)

Field studies conducted by an Archaeologist used to confirm the presence or absence of archaeological resources as defined by the Heritage Conservation Act where potential conflicts are suspected between archaeological resources and a proposed development. An AIA locates, records and assesses the significance of an archaeological resource where present and assesses the nature and extent of expected impacts and makes recommendations to manage the expected site impacts from forestry activities.

Audit

A planned independent and documented assessment to determine whether agreed upon requirements are being met.

BC Timber Sales (BCTS)

Formerly known as the Small Business Forest Enterprise Program. BC Timber Sales is an independent organization within the B.C. Ministry of Forests created to develop Crown timber for auction to establish market price and capture the value of the asset for the public.

Bone Dry Unit (BDU)

A unit of measurement that lumber mills use to measure the amount of by-product wood chips they can produce. The by-product chips are used in pulp mills as feedstock.

Biodiversity (or Biological Diversity)

Diversity of plants, animals and other living organisms in all their forms and levels of organization, including genes, species and ecosystems, and the evolutionary and functional processes that link them.

Biogeoclimatic Ecosystem Classification (BEC)

A hierarchical classification scheme having three levels of integration; regional, local and chronological; and combining climatic, vegetation and site factors. The hierarchical classification includes Biogeoclimatic Zone, sub-zone, variant, and site series.

Biogeoclimatic Zone

A geographic area having similar patterns of energy flow, vegetation, and soils as a result of a broadly homogenous macroclimate. British Columbia has 14 Biogeoclimatic zones.

Biogeoclimatic Variant

A subdivision of a Biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.

Biotic

Relating to living beings, or of biological origin (see abiotic), e.g., insect outbreak, disease.

Blue-listed Species

In British Columbia, the designation of an indigenous species, sub-species, or population as being vulnerable or at risk because of low or declining numbers or presence in vulnerable habitats. Included in this classification are populations generally suspected of being vulnerable, but for which information is too limited to allow designation in another category.

Boreal Forest

One of the nine major forest regions of Canada. Typical tree species found in the boreal forest are White and Black Spruce, Lodgepole Pine, Trembling Aspen, and Paper Birch.

Botanical Forest Products

Non-timber-based products gathered from forest and range land. There are seven recognized categories: wild edible mushrooms, floral greenery, medicinal products, fruits and berries, herbs and vegetables, landscaping products, and craft products.

Cable Logging

Harvest method where the logs are pulled with the use of cables (fully suspended or dragging) from the harvest site to the decking area.

Canadian Council of Forest Ministers (CCFM)

A council made up of the Ministers, Deputy Ministers and Assistant Deputy Ministers of the various Canadian federal and provincial government agencies responsible for managing Canada's forests. The CCFM provides leadership on national and international issues and sets direction for the stewardship and sustainable management of Canada's forests.

Category A Block

Blocks reviewed and approved in previous Forest Development Plans.

Category I Block

Blocks included in the plan for public information purposes only, and not for official approval. Generally, comments received on these blocks will be considered prior to submitting the blocks as proposed Category A blocks (i.e. requested for approval as Category A blocks).

Conservation Data Centre (CDC)

The British Columbia Conservation Data Centre (CDC) (see Blue-listed and Red-listed Species). The staff specialists at the CDC, in co-operation with scientists and specialists throughout the province, have identified those vertebrate animals, vascular plants and plant associations in the province, which have become most vulnerable. Each of these rare and endangered species and plant associations has been assigned a global and provincial rarity rank according to an objective set of criteria established by The Nature Conservancy of the United States, and a status on the provincial Red or Blue lists.

Certification

A system of rules or procedures acknowledging conformance to a standard.

Land Resource Manager (LRM)

The forest management database used by the Participants of the Fort St. John Pilot Project to track and store the spatial and tabular information associated with their forest development activities and obligations.

Culturally Modified Tree (CMT)

A culturally modified tree (CMT) is a tree that has been altered by aboriginal people as part of their traditional use of the forest. Non-aboriginal people also have altered trees, and it is sometimes difficult to determine if an alteration (modification) is of native or non-aboriginal origin. There are no reasons why the term "CMT" could not be applied to a tree altered by non-aboriginal people. However, the term is commonly used to refer to trees modified by aboriginal people in the course of traditional tree utilization.

Coarse Woody Debris (CWD)

Dead, woody material on the forest floor, primarily logs, stumps, and large branches, generally greater than 7.5 cm in diameter. It includes fallen trees, sloughing bole wood, and large fallen branches, but generally excludes self-supporting dead trees and branches still attached to standing trees

Community

A group of people living in the same locality and under the same government, a group of people having similar or common interests

Coniferous

Cone bearing trees or shrubs, usually with needle-shaped or scale-like leaves, often evergreen. Conifer trees are often referred to as softwoods (e.g. spruce, pine, and balsam fir).

Coniferous Stands

Those forest stands in which the most predominant trees by volume are coniferous trees. Deciduous trees such as aspen and birch may be present, but are less abundant than the coniferous trees.

An area where coniferous trees, collectively, represent a minimum of 75% of the volume of timber volume on the area.

Conventional Logging

Harvest method where the logs are pulled using skidders or other ground-based machines to a roadside decking area, where trees are processed into logs, which are then loaded onto trucks and transported to mills or sort yards.

Conservation

The controlled use and systematic maintenance, enhancement, restoration and/or protection of natural resources, such as forests, soil, and water systems for present and future generations.

Conserve

To protect from permanent loss or irreparable harm, to use carefully or sparingly.

Consistent

Not in material conflict.

Co-operative

A willingness and ability to work with others.

Coordinated Resource Management Plan

A group of management plans dealing with coordinating range resource developments on range tenure areas with other resource users.

Committee on the Status of Endangered Wildlife In Canada (**COSEWIC)**

The Committee on the Status of Endangered Wildlife In Canada (COSEWIC) determines the national status of wild Canadian species, sub-species, and separate populations suspected of being in danger. It bases its decisions on the best up-to-date scientific information available.

Crop Tree

A healthy tree that is of a species that is:

(a) ecologically suitable for the site, and
(b) commercially valuable.

Cubic Metre (m^3)

A measure of wood volume commonly used in the forest industry, based on solid wood 1 m x 1 m x 1 m. A typical merchantable conifer tree would have approximately 0.45 to 0.5 m^3/tree, although some large trees can exceed 2 m^3/tree.

Cultural Heritage Resources (CHR)

An object, a site or the location of a traditional societal practice that is of historical, cultural or archaeological significance to British Columbia, a community, or indigenous peoples**.**

Cutblock

A specific area of land

a) identified in a forest development plan, FOS, or a site plan for areas where timber harvesting is to be carried out,
b) identified in a site plan for any of the following areas that are to be reforested:
    i. an area where a contravention of section 96 of the Act has occurred;
    ii. an area that has been naturally disturbed;
    iii. a backlog area;
c) identified in a site plan for areas where silviculture treatments on well-growing stands are to be carried out, and
d) referred to in paragraph (a), (b) or (c) that the District Manager has exempted the Participant from the requirement to prepare the forest development plan or site plan as the case may be.

Cut to Length Harvesting (CTL)

A mechanized forestry system where trees are felled, delimbed, and bucked (cut into logs) at the stump, then transported to a road or landing area

Data

Factual information, especially information organized for analysis or used to reason or make decisions; values derived from scientific experiments.

Deactivation

The application of a variety of methods to place a road in a self-maintaining state that will indefinitely protect adjacent resources and values. Includes controlling drainage on road surfaces through the use of water bars or cross-ditches across the road subgrade (roughly perpendicular to the road.

Deciduous

Trees or shrubs commonly broad leafed, that shed their leaves annually. Deciduous trees are commonly referred to as hardwoods.

Deciduous Stand

Those forest stands in which the most predominant trees by volume are deciduous (broad-leafed) trees. Coniferous trees such as spruce and pine be present, but are less abundant than the deciduous trees.

An area where the deciduous trees, collectively, represent a minimum of 75% of the volume of timber on the area.

Defined Forest Area (DFA)

A specific area of land, forest, and water delineated for the purposes of registration of a Sustainable Forest Management system.

Dispersed

Term used in reference to waste calculations on post harvested areas. It refers to the amount of waste not associated with accumulations at roads or landings (i.e. in the cutblock).

Disturbance

A discrete force that causes significant change in structure and/or composition of forests through natural events such as fire, flood, or wind, insect or disease outbreaks, or by human-caused events such as timber harvesting. Disturbances can occur at a wide range of scale.

Equivalent Clearcut Area (ECA)

A measure used in forestry and watershed management to assess the impact of forest disturbances, like logging or wildfire, on hydrological functions. It represents the area of forest that has been disturbed, accounting for the recovery of the forest over time.

Ecosystem

a biological community of interacting organisms and their physical environment.

Ecosystem Management

A system which is a holistic approach to managing natural resources and ecological processes with the goal of sustaining ecosystem health, biodiversity, and the delivery of essential services for present and future generations.

Environmental Management System (EMS)

An Environmental Management System is a set of standards established by the International Organisation for Standardization (ISO 14001). This process includes commitment, public participation, preparation, planning, implementation, measuring and assessing performance, and review and improvement of a management system. The incorporation of feedback loops into the process allows for ongoing enhancement of the integrity and performance of the management system, and is designed to lead to continual improvement.

Even aged

Term given to forested areas where the dominant tree species are approximately the same age (i.e. +/- 20 years).

Forest Development Plan (FDP)

An operational plan guided by the principles of integrated resource management (the consideration of timber and non-timber values), which details the logistics of timber development over a period of usually five years. Methods, schedules, and responsibilities for accessing, harvesting, renewing, and protecting the resource are set out to enable site-specific operations to proceed.

Fisheries-Sensitive Zone

A flooded depression, pond or swamp, that:

a) either perennially or seasonally contains water, and
b) is seasonally occupied by a species of fish listed in the definition of "fish stream" in the Operational Planning Regulation,
c) but does not include a wetland or lake that has a riparian management area established under Part 8 of the Operational Planning Regulation, Schedule C of the Pilot Regulation, or a stream.

FOR

BC Ministry of Forests

Forage

Vegetation that is suitable as food for wildlife or domestic animals - may refer to an area where this vegetation occurs in abundance.

Forest Cover Type

A stand of trees that have very similar characteristics. Most often grouped together according to tree species, age, and size.

Forest Fragmentation

A process whereby large contiguous forest patches are transformed into one or more smaller patches surrounded by disturbed areas. Fragmentation can be caused naturally by fire, disease, wind and insect attack, and also by forest planning and harvesting.

Forest Licence

A volume-based tenure instrument awarded by the BC Provincial Government which sets out an allowable annual cut the holder is allowed to harvest from a specific TSA. It includes commitments the holder must make, such as operating a manufacturing facility, reforesting cutblocks to government approved standards, payments to the government, etc. Failure to harvest the minimum amount of timber can result in loss of all or a portion of the allowable annual cut.

Forest Operations Schedule (FOS)

An operational plan required by the Fort St. John Pilot Project Regulation and described in Part 4 Division 5 of that regulation. Includes maps of proposed cutblocks and roads.

Forest Practice

Timber harvesting, road construction, road maintenance, road use, road deactivation, silviculture treatment, botanical forest product collecting, grazing, hay cutting, fire use and fire control and suppression.

Forest Practices Code (FPC)

The Code is a term commonly used to refer to the Forest Practices Code of BC Act, the regulations made by Cabinet under the act and the standards established by the Chief Forester.

Forest Resources

Resources and values associated with forests and range including timber, water, wildlife, fisheries, recreation, botanical forest products, forage and biological diversity.

Forest and Range Practices Act (FRPA)

An act that governs the activities of forest and range licensees in B.C. The statute sets the requirements for planning, road building, logging, reforestation, and grazing.

Forest Stand

An area of forest that is distinct from the surrounding forest by reason of some combination of topography, species composition, age or other feature.

Fort St. John Land and Resource Management Plan (LRMP)

The Fort St. John Land and Resource Management Plan approved by government on October 8, 1997.

Free Growing (FG)

Young trees that are as high or higher than competing vegetation with one metre of free-growing space surrounding their leaders. As defined by legislation, a free growing crop means a crop of trees, the growth of which is not impeded by competition from plants, shrubs or other trees. Silviculture regulations further define the exact parameters that a crop of trees must meet, such as species, density and size, to be considered free growing.

Government Actions Regulation (GAR)

A regulation under the *Forest and Range Practices Act* that provides the criteria and processes for the creation of localized areas that require special management of certain forest values. These values include wildlife, fish, water quality, visual quality, stream and lake sides and recreation. The regulation also provides for the creation of objectives for managing these areas.

Geographic Information System (GIS)

Computer systems designed to allow users to collect, manage, and analyze large volumes of spatially referenced information and associated attribute data.

Goal (as applied to CCFM Criteria and Critical Elements)

A broad, general statement that describes a desired state or condition related to one or more forest values.

Graham River Integrated Resource Management Plan (GRIRMP)

A long-term strategic plan developed for the Graham River watershed intended to guide resource development within the plan area. Principles of the GRIRMP were brought into the SFMP, and are represented in Sections 5.19-5.21 of the plan.

Green Attack

Term given to trees that have been attacked by insects, often bark beetles, but are not showing signs of mortality. Occurs at the early stage of attack.

Greened-up

A cutblock that supports a stand of trees that has attained the green-up height specified in a higher-level plan for the area, or in the absence of a higher-level plan for the area, has attained a height that is 3 m or greater. Also, if under a silviculture prescription or site level plan, meets the stocking requirements of that prescription or plan, or if not under a silviculture prescription, meets the stocking specifications for that biogeoclimatic ecosystem classification specified by the Regional Executive Director.

Habitat

The natural environment where an organism or a population of organisms lives.

Harvested Area

The area within a cutblock, other than that which is occupied by permanent access structures, where timber harvesting has occurred.

Harvest Authorization (HA)

An authorization given by the Ministry of Forests and Range District Manager for a Participant to harvest timber or construct road under 23.1 of the *Fort St. John Pilot Project Regulation*.

Herbaceous

A plant having little or no woody tissue.

Herbicide

A controlled product used solely to control or manage undesirable plant species.

Higher Level Plan (HLP)

Government approved plans providing strategic context for operational plans that determine the mix of forest resources to be managed in a given area.

Hydrology

The science of the waters of the earth, water properties, circulation, principles and distribution.

Hygric

Term used to describe soils that receive an abundant input of water in the form of soil seepage.

Integrated Land Management Bureau (ILMB)

An organization within the BC provincial government that is tasked with integrated Crown land and resource authorizations, planning dispositions and resource information services

Integrated Resource Management (IRM)

a planning and decision-making process that coordinates resource use so that the long term sustainable benefits are optimized and conflicts among users are minimized

Interior Forest Habitat

Areas generally greater than 600 metres wide which now, or will in the future, have continuous forest stand conditions which are relatively consistent.

Known

When used to describe a feature, objective or other thing referred to in this regulation as known, means a feature, objective or other thing that is:

a) contained in a higher-level plan, or
b) otherwise identified or made available to a Participant by the District Manager or designated environment official at least 4 months before the forest development plan, FOS or site plan for the area was prepared.

Land and Resource Use Planning

The sub-regional integrated resource planning process for British Columbia. LRMP considers all resource values and requires public participation, interagency co-ordination and consensus building in land and resource management decisions.

Land and Resource Management Plan (LRMP)

A plan that provides strategic level direction for managing Crown land resources and identifies ways to achieve community economic, environmental, and social objectives.

Landscape

A large area encompassing a wide diversity of adjacent landforms, land cover, habitats, and ecosystems.

Landscape Level Strategy (LLS)

Those activities that are required to be undertaken in order to achieve forest management objectives identified in a sustainable forest management plan.

Landscape Unit (LU)

A planning area delineated according to topographic or geographic features such as a watershed or series of watersheds and, as designated by a District Manager

Linear Developments

Manmade features which extend in a linear manner, e.g. roads, seismic lines or pipelines.

Long-term

At a minimum, twice the period in years of the average life expectancy of the predominant tree species up to a maximum of 300 years.

Long Term Harvest Level (LTHL)

The level at which harvest can occur given management assumptions and rate of harvest. LTHL considers Non-Recoverable Losses.

MBCA

Canadian federal Migratory Birds Convention Act

Machine Free Zone (MFZ)

Areas within a cut block that the tracks or wheels of equipment may not enter. These are usually associated with streams and wetlands, and are established to guard against soil disturbance and erosion.

Managing Participant

A participant of the Fort St. John Pilot Project that manages tenure within the pilot project area on behalf of themselves and/or another Participant.

Mean Annual Increment (MAI)

The average annual increase in volume of individual trees, or stands, up to the specified point in time. The MAI changes with different growth phases in a tree's life, being highest in the middle years and then slowly decreasing with age. The point at which the MAI peaks is commonly used to identify the biological maturity of the stand and its readiness for harvesting.

Merchantable

At or above minimum specific timber values (i.e. diameter, age, and height).

Mesic

Term used to describe soil moisture. This refers to sites on which the moisture conditions experienced by plants are primarily under the control of the local climate, with no excessive influx of moisture due to slope position or soil conditions.

Mfbm

A measure of lumber produced - a thousand foot board measure. A board foot is 12 inches x 12 inches x 1 inch in thickness. Approximately 240 board feet of lumber can be extracted from $1m^3$ of timber.

Mixedwood Forest

Forests that include deciduous and/or coniferous species at landscape and/or site levels over time. These forests occur in compositions ranging from intimate mixtures of coniferous and deciduous species to irregular groupings of discrete species in a patchwork distribution.

Mixedwood Management

A forest management system that incorporates strategies to maintain a deciduous and coniferous component in the forest over time.

Mixedwood Stand

An area where, at rotation age, the coniferous and deciduous trees
each represents a minimum of 25% of the estimated volume of timber.

Modified Shelterwood

A shelterwood system designed to protect an existing established understorey while removing most or all of the overstorey.

Ministry of Environment and Parks

The BC Ministry of Environment and Parks is responsible for the effective protection, management and conservation of B.C.'s water, land, air and living resources

Ministry of Forests (FOR)

The BC Ministry of Forests is responsible for supporting a sustainable and competitive future for B.C.'s forest sector, while taking action to keep forests healthy and protect communities in the face of climate change and extreme weather events.

Ministry of Water, Land and Resource Stewardship (WLRS)

The BC Ministry of Water, Land and Resource Stewardship is accountable for integrated land and natural resource management, including objective setting for land and marine environments, effectively managing cumulative effects, and advancing reconciliation with Indigenous peoples, environmental sustainability, and economic growth.

Monitoring

The process of checking, observing and measuring outcomes for key variables or specific ecological phenomena against a predefined qualitative objective or standard.

Muskwa-Kechika Management Area (MKMA)

A designated area of special resource management in northeastern British Columbia which is approximately 6.4 million hectares in size and was established in 1998 under the MKMA Act.

Net Area to be Reforested (NAR)

The area under a Silviculture Prescription or Site Level Plan that will be reforested. This excludes areas occupied by permanent roads, areas incapable of growing a stand of trees (rock, wetland etc.), and reserves. This may include areas that did not contain a commercial stand of trees, but because it is capable of growing a stand of trees, will be reforested. See also Harvested Area.

Naturally Disturbed Area

An area where timber has been damaged or destroyed by causes other than harvesting.

Natural Disturbance Types (NDT)

Characterize areas with different natural disturbance regimes. Natural stand initiating disturbances are those processes that largely terminate the existing forest stand and initiate secondary succession in order to produce a new stand. Native species have adapted to the historical extent and distribution of these events, so timber harvesting patterns which approximate the patch sizes and distribution of natural disturbances are desirable. The boreal forest is in the NDT 3, which is characterized primarily by very large fires, often hundreds or thousands of hectares in size.

Natural Disturbance Unit (NDU)

Spatially defined areas within the Ministry of Forests and Range Northeast Region that have had landscape level biodiversity targets established for them for the management of forest resources on the landscape level so that the predominant natural disturbance of the area and its effects can be emulated.

Net Forest Land base

That portion of the land that can potentially produce commercial forests. It includes both mature forests, immature and new forests, and potentially productive land which presently does not have forests established.

Net Area to be Reforested (NAR)

The area on which the licensee is responsible for establishing a free growing (or well growing) crop of trees. This figure is the sum of Standards Unit (SU) area. The NAR does not include any human caused non-productive areas, reserves of immature trees, and natural non-productive areas that are large enough to stratify and map, as well as non-commercial brush areas greater than 4 hectares that are not deemed to be the obligation of a licensee. Non-productive or non-commercial areas that are too small to stratify are included in the SU area.

Northern Interior Vegetation Management Association (NIVMA)

A forest industry co-operative initiated by major forest products companies in northern BC and Alberta, the BC Ministry of Forests and Range, the Canadian Forest Service, the University of British Columbia and the University of Alberta. NIVMA uses a common monitoring protocol to track plantation and managed stand development and performance.

Non-Commercial Brush (NCBR)

Describes a potentially productive forest site that is occupied by shrubs and other deciduous species that are not utilized commercially.

Non-harvestable Land Base (NHLB)

Area not considered part of the THLB. This would include areas excluded from contributing to timber supply during the TSR process, such as parks, riparian areas, inaccessible areas, inoperable areas, non-merchantable forest types, low productivity sites, recreation features, and environmentally sensitive areas.

Non-Productive (NP)

Land that is incapable of growing a merchantable stand within a reasonable length of time.

Non-Recoverable Losses (NRLs)

Losses of timber due to fire, insects or windfall that are either too small or too inaccessible to be retrieved for lumber production.

Not Satisfactorily Restocked (NSR)

Productive forest land that has been denuded and has not been regenerated to the specified stocking standards for the opening.

Notice of Intent to Treat (NIT)

A notice required under the Integrated Pest Management Act that is required to be published annually that describes areas to be treated under an Integrated Pest Management Plan

Objective (as applied to CCFM Criteria and Critical Elements)

A clear, specific statement of expected quantifiable results to be achieved within a defined period of time related to one or more goals. An objective is often stated as a desired level of an indicator.

Note: In the context of the Forest and Range Practices Act, an objective is a statement of management direction applied to forest resources.

Old Growth Management Area (OGMA)

Specific areas of forest designated and managed to maintain or achieve certain structural characteristics of old-growth forests. These areas are legally established during landscape unit planning or operational planning processes.

Old Growth

A climax forest that contains live and dead trees of various sizes, species, composition and age class structure. The age and structure of old growth forests varies significantly by forest type and biogeoclimatic zone**.**

Operational Plan

A plan describing the logistics for forestry development. Methods, schedules and responsibilities for accessing, harvesting, renewing, and protecting the resource are set out to enable site specific operations to proceed. Includes Forest Development Plans, FOSs, Site Level Plans, Access Management Plans, Range Use Plans.

Participant

The BCTS program or a major forest tenure holder who has consented in writing to take part in the pilot project. Currently this includes those listed in Section 2.1 of this SFMP.

Performance Indicator

A measurable variable used to evaluate the effectiveness of sustainable forest management practices.

Permanent Access Structure (PAS)

A road, landing, logging trail, pit, quarry or other similar structure in a cutblock that

a) is constructed by a Participant or holder of a Timber Sale License and is
   i. required to be used for timber harvesting or other forest management activities and whose use will continue long enough to prevent the production of a commercial crop of trees on the area occupied by the structure that will be harvestable concurrently with the crop of adjacent trees, or
   ii. either constructed through material that is not suitable, or contains materials that are not suitable, for use in carrying out the soil rehabilitation treatments necessary to grow a commercial crop of trees, or
b) was constructed by a person other than a Participant or holder of a Timber Sale License.

Pest Management Plan (PMP)

A plan that describes

b) a program, for managing forest pest populations or reducing damage caused by pests, based on integrated pest management, and
c) the methods of handling, preparing, mixing, applying and otherwise using pesticides within the program;

Pilot Project

For the purposes of this SFMP, means the Fort St. John Forest Practices Pilot Project authorized under Section 221.1, Forest Practices Code Act and approved by the Government of British Columbia.

Practicable

Capable of being carried out in practice; with consideration to balancing of all the relevant circumstances to determine whether or not a practice would be feasible.

Preferred and Acceptable Species

Preferred and acceptable tree species are those commercial tree species that are suited to the growing conditions of the site, and are identified in a Site Level Plan.

Proposed Roads

Planned roads that have not been previously approved in a forest development plan, or shown in a Forest Operations Schedule.

Protected Area

An area protected by legislation, regulation, or land-use policy to control the level of human occupancy or activities.

Note: "Categories of protected areas include protected landscapes, national parks, multiple us management areas, and nature (wildlife) reserves" (The State of Canada's Forests 2001/2002), also includes "sites of biological significance" (i.e. critical areas for wildlife habitat, sensitive sites,

and unusual or rare forest conditions, as established according to scientific and traditional criteria).

Public Advisory Group (PAG)

Relative to this plan, the group established under the *Fort St. John Pilot Project Regulation* to provide advice to the Participants regarding the Sustainable Forest Management Plan and to review Pilot Project Annual Reports, and the results of Pilot Project audits.

Qualified Auditor

A person who is competent to assess compliance with this regulation.

Qualified Registered Professional (QRP)

With respect to an activity for which this plan or the *Fort St. John Pilot Project Regulation* requires a qualified registered professional, a person who

a) has the education and experience that is appropriate to carry out the activity, and
b) is a member of, or licensed by, a regulatory body in British Columbia that has the legislated authority to regulate its members or licensees carrying out the activity.

Quantify

To make explicit the logical quantity of; to determine, express or measure the quantity of.

Red-listed Species

In British Columbia, the designation of an indigenous species, sub-species, or population as endangered or threatened because of its low abundance and consequent danger of extirpation or extinction. Endangered species are any indigenous species threatened with imminent extinction or extirpation throughout all or a significant portion of their range in BC. Threatened species are any indigenous species that are likely to become endangered in BC if factors affecting that vulnerability are not reversed.

Reforest

To establish within a harvested area, a naturally disturbed area, or a backlog area, as the case may be, within the reforestation period, a stand of crop trees that meets or exceeds the stocking requirements for the area a well-growing stand in accordance with section 35 of the Pilot Regulations.

Reforestation Period

The period specified in a site plan within which an area must be reforested.

Regeneration Delay

The maximum time allowed in a prescription, between the start of harvesting in the area to which the prescription applies, and the earliest date by which the prescription requires a minimum number of acceptable well-spaced trees per hectare to be growing in that area.

Regional Executive Director (RED)

A regional manager employed in the Ministry of Forests

Regional Manager

A regional manager employed in the Ministry of Water, Land and Resource Stewardship

Registered Seed

Seeds which are tested to standards for germination and quality, from a healthy source and ensures the uses of local seed sources.

Rehabilitation

To restore to a stable condition and to a condition that does not prevent the reforestation requirement from being met.

Resource Agencies

Any government agency, ministry or department having jurisdiction over a resource that may be affected by any activity or operation proposed under a higher-level plan or plan required under this regulation.

Resource Management Zone (RMZ)

A land use designation category under the Forest Practices Code that establishes strategic objectives and special requirements to guide subsequent sub-regional, local and operational planning.

Resource Management Zone Objectives

Statements that apply to specific resource management zones and are derived by the LRMP working group to sustain or enhance identified resource values.

Riparian Area

Interface between land and rivers, streams, lakes, or wetlands.

Riparian Assessments

The evaluation of watercourses or wet areas to determine if it can be classified into one of the Riparian Classes, and if so, whether they are fish bearing or not. Management requirements for reserve zones and management zones depend on the assessed fisheries values and size of the stream.

Riparian Classes

Determined from riparian assessments, streams are classified as follows: S1- fish bearing >20 metres wide; S2 fish bearing 5-20 m wide; S3 fish bearing 1.5 to 5 metres wide; S4 fish bearing < 1.5 metres wide; S5 not fish bearing; >3 metres wide; S6 not fish bearing < 3 metres wide.

Riparian Management Area (RMA)

An area of a width determined in accordance with Schedule C of the *Fort St. John Pilot Project regulation* that is adjacent to a stream or wetland or a lake with a riparian class of L3, and consists of a riparian management zone and, depending on the riparian class of the stream, wetland or lake, a riparian reserve zone.

Riparian Management Zone (RMZ)

An area adjacent to a stream, wetland or lake where constraints to forest practices apply for the purpose of maintaining the integrity of the stream, wetland or lake and associated wildlife habitat.

That portion of the riparian management area that is outside of any riparian reserve zone, or if there is no riparian reserve zone, that area located adjacent to a stream, wetland or lake of a width determined in accordance with Schedule C of the *Fort St. John Pilot Project regulation*.

Riparian Reserve Zone (RRZ)

An area adjacent to a stream, wetland or lake, within the Resource Management Zone, where no logging may occur unless consistent with an approved SFMP.

That portion, if any, of the riparian management area or lakeshore management area located adjacent to a stream, wetland or lake of a width determined in accordance with Schedule C of the *Fort St. John Pilot Project regulation*.

Road Deactivation

The process of modifying an existing road which will not be used for a period of time to minimize access and environmental effects through such measures as water bars, removing bridges and culverts, reseeding with grass or trees, or rollback of slash onto the running surface. The extent of road deactivation is determined by the amount of time the road is not required for use, and the potential risks to the environment posed by the road.

Recreation Opportunity Spectrum (ROS)

A recreation opportunity is the availability of choice for someone to participate in a preferred recreation activity within a preferred setting and enjoy the desired experience.

Rotation

Broadly, the time needed from regeneration of a crop of trees through to harvestable timber. Can be classified under financial, technical, biological or ecological parameters.

SARA

Canada's *Species At Risk Act*

Satisfactorily Restocked (SR)

Productive forest land that has been denuded and subsequently regenerated to the specified stocking standards in the silviculture plan or prescription.

Selection Silviculture System

A silviculture system that removes mature timber either as single scattered individuals or in small groups at relatively short intervals repeated indefinitely, where the continual establishment of regeneration is encouraged and an uneven-aged stand is maintained.

Sequential Clustered Development

The scheduling of operable timber into groups of neighbouring blocks with a single access route, usually within a subdrainage, with each group being developed in sequence over the full harvest cycle. A single-pass, one-entry harvesting approach that concentrates harvesting, thereby minimizing the amount of new access being created, and reducing the amount of forest fragmentation.

Seral Stages

The stages of ecological succession of a plant community over time.

Shelterwood Silviculture System

A silviculture system in which trees are removed in a series of cuts designed to achieve a new even-aged stand under the shelter of remaining trees.

Siltation

The process of introducing soil particles into a body of water (e.g. as a result of eroding stream banks).

Silviculture

The art, science and practice of controlling the establishment, composition, health, quality and growth of vegetation of forest stands.

Silviculture Prescription (SP)

A site-specific operational plan or site plan that prescribes the nature and extent of timber harvesting and silviculture activities that are designed to achieve desired forest management objectives including reforestation of a free growing stand to specified standards.

Site Degradation

Productive forest land significantly degraded or permanently lost to forest production.

Site Index (SI)

An expression of the forest site quality of a stand, at a specified age, based either on the site height, or on the top height (height of the largest diameter tree on a 0.01 ha plot, providing the tree is suitable), which is a more objective measure (FP Code). The measure of the relative productive capacity of a site for a particular tree species, based on height at a given reference or base age (50).

Site Level Plan (SLP)

A plan describing the logistics for forestry development prepared under the Fort St. John Pilot Project regulation, but excluding Forest Development Plans. Includes silviculture prescriptions, stand management prescriptions, road deactivation prescriptions, road layout and design and road deactivation prescriptions.

Site Series

Variation in site conditions encountered within a biogeoclimatic unit is accommodated within the site classification of BEC. The site series describes all land areas capable of supporting specific climax vegetation. This can usually be related to a specified range of soil moisture and nutrient regimes within a subzone or variant, but sometimes other factors, such as aspect or disturbance history, are important determinants as well. A classification of site series for most of the biogeoclimatic units of the province has been developed by the BC Ministry of Forests and is presented in regional field guides.

Special Management Zone (SMZ)

The Fort St John LRMP has Special Management Zones based on major resource values to be given a high priority in land and resource planning and development. Resource development is permitted but must consider and address all significant values identified. SMZ include wildlife habitat and wilderness recreation, major river corridors, and culture and heritage.

Snag

Standing dead tree, either whole or in part (i.e. partially broken off).

Soil Disturbance

The portion of a harvested area where

a) the area has been altered by timber harvesting or related forest practices, and
b) that alteration inhibits reforestation of the area.

Spatial

Pertaining to the physical size, location, pattern and distribution.

Spatial Distribution

The distribution of openings over a landscape, usually in reference to natural disturbance patterns, or to logging. Logging that mimics the natural spatial distribution of natural disturbance patterns is considered to minimize long term effects on wildlife and ecosystems.

Stakeholder

Individual, organization, or other entity concerned with or by management activities on a given forest area.

Stand Level

The level of forest management at which a relatively homogeneous land unit can be managed under a single prescription, or set of treatments, to meet well-defined objectives.

Standards Unit (SU)

An area within a cutblock that is subject to uniform limits for soil disturbance and regeneration dates, stocking standards, free growing dates and free growing heights.

Stocking Requirements

For an area under a site plan, the stocking requirements that are specified in the site plan for that area.

Strategic

Relating to the identification of long-term or overall aims and interests and the means of achieving them

Stubs (Stub trees)

Snags or live trees that are cut off during harvesting at heights of 3 to 5 metres by feller-bunchers, to ensure continuity of some vertical structure and future coarse woody debris in managed stands.

Stumpage

Money charged for the right to harvest timber from publicly owned forest land.

Sustainability

The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time. Applied more broadly, the ability of society to maintain a balance of economic, social and ecological values over time.

Sustainable Forest Management (SFM)

Management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations.

Table Interpolation Projection Program For Stand Yields (TIPSY)

A program that interpolates data from TASS (Tree and Stand Simulator) – a computer model that simulates the growth of individual trees and stands. This program is based on growth trends observed in fully stocked research plots growing in a relatively pest free environment. The yields will be very close to the potential of a specific site, species and management regime.

Temporary Access Structure

An access structure, the area under which will be reforested.

Terrain Stability Map

Terrain mapping is a method to categorize, describe and delineate characteristics and attributes of surficial materials, landforms, and geological processes within the natural landscape. Terrain stability mapping is a method to delineate areas of slope stability with respect to stable, potentially unstable, and unstable terrain within a particular landscape. Terrain stability map polygons indicate areas or zones of initiation of slope failure.

Timber

Timber means trees, whether standing, fallen, living, dead, limbed, bucked or peeled (Forest Act)

Timber Harvesting Land Base (THLB)

The portion of the total area of a management unit considered contributing to, and being available for, long-term timber supply. The harvesting land base is defined by reducing the total land base according to specified management assumptions.

Timber Range Action Plan (TRAP)

A plan completed between Forest Licensees and Range Licensees to mitigate or minimize the impacts of one licensee's activity on the other on overlapping forest and range tenures.

Timber Supply Analysis

An assessment of future timber supplies over long planning horizons (more than 200 years) by using timber supply models for different scenarios identified in the planning process.

Timber Supply Area (TSA)

An administrative boundary determined by the Ministry of Forests in which allowable annual cuts are determined, and from which timber harvesting rights may be awarded.

Timber Sales Office (TSO)

The head office for each BC Timber Sales Business Area.

Timber Sales Manager (TSM)

The senior manager for a BC Timber Sales Business Area

Timber Supply Review (TSR)

A process initiated to regularly assess the timber supply and the allowable annual cut in various timber supply areas. It aims to determine the long-term sustainable harvesting level and analyze projected timber supplies over different time frames, including short-term, medium-term, and long-term projections. This review is essential for making informed decisions regarding forest management and ensuring sustainable practices in timber harvesting.

Topographic

The general configuration of the land surface, including relief and position of natural and man-made features.

Tree and Stand Simulator (TASS)

A three-dimensional growth simulator that generates growth and yield information for even-aged stands of pure coniferous species of commercial importance in coastal and interior forests of British Columbia.

Ungulate

A hoofed mammal (e.g. deer, elk, moose, caribou).

Ungulate Winter Range (UWR)

An area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species. Sections 9 and 12 of the *Government Actions Regulation* of the *Forest and Range Practices Act* outline the regulatory authority for establishing UWR

Value (as applied to CCFM Criteria and Critical Elements)

A principle, standard, or quality considered worthwhile or desirable.

Vegetation Resources Inventory (VRI)

A photo-based, two-phased vegetation inventory program consisting of:

- Phase I: Photo Interpretation
- Phase II: Ground Sampling

Vertical Structure

Those components of a forest which are vertically oriented (e.g. live and dead trees of various heights and species.)

Visual Quality Objective (VQO)

An approved resource management objective that reflects a desired level of visual quality based on the physical and sociological characteristics of the area; refers to the degree of acceptable human alteration to the characteristic landscape.

WLRS

B.C. Ministry of Water, Land, and Resource Stewardship

Watershed

An area drained by a particular stream or river. A large watershed may contain several sub-drainages

Waste

The volume of timber left on the harvested area that could have been removed in accordance with the minimum utilization standards in the cutting authority. It forms part of the allowable annual cut for cut-control purposes.

Waterbody

Any land covered by water.

Wildlife Habitat Area (WHA)

Spatially defined areas that are necessary to meet the habitat requirements of an Identified Wildlife element. WHAs designate critical habitats in which activities are managed to limit their impact on the Identified Wildlife element for which the area was established. The purpose of WHAs is to conserve those habitats considered most limiting to a given Identified Wildlife element.

Windfirm

Trees that are able to withstand the effects of heavy gusts of wind.

Windthrown

A tree or trees uprooted by the wind.

Woodlot Licence

A licence issued by the Ministry of Forests to an individual or group to manage a specific area of Crown timber, plus any private forest land the individual or group owns, and declares part of the Woodlot area.

Wildlife Tree Patch (WTP)

An area specifically identified for the retention and recruitment of suitable wildlife trees. It can contain a single wildlife tree or many. A wildlife tree patch is synonymous with a group reserve.