5.0 Foothills Forest Products Monitoring Program

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Overview

Operational strategies have been designed and implemented to create an adaptive, hands-on management approach based on maintaining ecological diversity and sound forest management practices. Foothills Forest Products' strategy to successfully monitor the objectives set out in the E8 Forest Management Plan to meet short term targets and long term objectives, are based on a simple, and more adaptive approach. The monitoring programs implemented eliminate unnecessary complexity and focus on achieving specific goals as set out in the plan.

The monitoring strategies are consistent with the objectives set out in Foothills Forest Products Timber Harvest and Planning Operating Ground Rules, and the Alberta Forest Management Planning Standard.

The objectives as outlined in the VOITS section of the Forest Management Planning Standard, will be monitored and reported by Alberta Sustainable Resource Development. ASRD did the original analysis and set out the initial goals and has the capacity to assess the success in achieving these objectives. FFP will work closely with ASRD to monitor these however will focus on monitoring the operational objectives as outlined below.

5.1 Road Reclamation and Monitoring

Sections of road surface that pose a high risk of environmental concern due to a combination of soil structure, slopes, watercourses, density of crossing structures, aesthetic concerns, etc. may undergo partial or total reclamation. An underlying theme in this management plan is to reduce the amount of access and disturbance created by roads both active and inactive on the landscape. A broad objective of this plan will be to encourage reclamation (both Partial and Total) of roads across the landscape over time.

Partial Reclamation:

Generally, roads are scheduled for partial reclamation when:

- Keeping the basic road bed in place will not pose foreseeable environmental concerns;
- Keeping the basic road bed in place will result in less environmental disturbance than total reclamation and rebuilding the road in the future;
- The road bed can be adequately stabilized for longer periods of time; and
- The road will not be scheduled for use within the next 20 to 30 years.

Sections of road bed that pose a high risk of environmental concern due to a combination of soil structure, slopes, watercourses, density of crossing structures, aesthetic concerns, etc. may undergo total reclamation while the road itself may have been scheduled primarily for Partial Reclamation. Some partial reclamation techniques will include:

a) Prompt removal of watercourse crossings that may pose future risks.
b) Various Erosion Control methods such as waterbars, grass seeding and berms.

Total Reclamation:

Generally, roads are scheduled for total reclamation when:

- Keeping the basic road surface or bed in place will pose foreseeable environmental concerns in which case sections of Temporarily Stabilized or Partially Reclaimed roads may require short term Total Reclamation; or
- The road is not required again for future use; and
- The land area on which the road is located is intended to be placed back into productive forest land base.

Decompaction should be considered for all roads scheduled to be fully reclaimed and/or planted that:

- Were hauled upon during frost-free conditions,
- Are composed of a soil structure prone to compaction,
- Would pose a significant establishment threat to seedling growth if they were not de-compacted.

Decompaction should not occur within 5m of any watercourse and must make use of proper temporary crossing structures where required.

5.2 Reclaimed Block Road Reforestation Success

As per Alberta's 2008 In-Block Road Interpretive Bulletin, FFP will ensure prompt reforestation of all in-block roads (see Silviculture Matrix). By using an aggressive silviculture strategy on in-block roads and decking areas, FFP will opt out of the original automatic 5% reduction in AAC that was previously mandatory as per the planning standard. FFP will however continue to monitor the reforestation success of these areas using an in-house monitoring program for the next 4 years.

This monitoring program measures the reforestation success of the area in each block made up of in-block roads. An extra 5 random plots per block are thrown on the reclaimed road right of way. Foothills Forest Products goal is to have 100% of in block roads regenerate to a passing standard as outlined in the Alberta Regeneration Survey Manual (May, 2007). In order to monitor and achieve success with this program we will conduct random plots (minimum 5 per block) during our establishment and performance surveys. Additional tree planting will follow if required to meet the passing targets. The process for this program will be as follows:

5.3 Surveys

- Plots that fall on a road during the course of the establishment or performance survey will be recorded separately as 'road plot'.
- The data for 'road plots' is compiled in the same manner as other regeneration survey data and must meet the same height, competition and density requirements.
- If the minimum requirement of five plots is not achieved during the regular course of a survey then additional plots will be placed where the survey transect intersects an old road location.
- Placing additional plots where transects cross old road will eliminate bias.
- It was found in the first year of this program that the majority of blocks receive the minimum of five plots without having to place additional plots.
- Most blocks had more than five road plots recorded for each block.
- The regeneration success of in-block roads will be reported on April 30th of each year.

5.4 Permanent Road Monitoring

Inspections of permanent roads are on-going to ensure environmental hazards are identified. Implementation of the appropriate responses based on risk assessment and findings from inspections are done regularly to minimize environmental impacts.

5.5 Temporary Road Monitoring

Inspect temporary roads to ensure environmental hazards are identified and road grades are maintained for the next intended user. Inspect roads after each of the following operational phases:

- Road Construction – inspect after 1st breakup.
- Harvest and Haul – inspect after 1st breakup following the completion of the haul.

- Site Preparation – inspect after 1st breakup after Site Preparation has been completed.

After each phase inspection, repair(s) or maintenance will be completed as appropriate, dependent on nature or work required.

5.6 Erosion Control

Erosion control applies to all road construction, maintenance and reclamation activities for both permanent and temporary road systems. The road monitoring program will allow FFP to minimize soil from roads, ditch lines and bared areas from being transported via surface flows into watercourses. Erosion control measures must be implemented in conjunction with disturbance activities and regularly assessed for their functional value.

The most economical erosion control measure is to retain existing vegetation where possible.

The following methods/implements can be applied to control erosion and minimize sediment movement on all classes of roads, skid ways, or disturbed areas.

Off-Take Ditches:

Off-take ditches are constructed through the use of a diversion berm to divert roadside ditch line flow away from the road and into existing vegetation. They are effective in both moving water flow away from the sub grade, and using vegetation to filter soil out of the flow itself. Install off-take ditches using at a minimum ditch line grades, up to the outlet. Do not disturb the existing vegetation beyond the outlet. Reinforce the initial "turn" in the water flow, if necessary, with non-erodible materials. Target off-take ditches to be at a 45-degree angle to the main road where possible

Sediment Traps:

Dig sediment traps directly in line with anticipated surface flows. These traps should be lined with large rock that may be placed over geotextile to prevent erosion of the trap itself. Functionally, these traps will pool water thereby reducing flow velocity and allowing soil particles to settle out. Soil free water then overflows the trap and continues on. They should be used where topography or proximity to watercourses prevents the use of effective off-take ditches.

Cross-drain culverts:

Cross-drain culverts are a very effective tool used to move water from one side of the ROW to the other. A diversion berm on the discharge end or side of the ROW can then be used to carry water away from sub-grade.

Surface Cross-ditching:

- Surface cross ditches should be constructed at 30-45 degrees to the road and 15 cm in depth, with the excavated fill placed immediately behind the cross ditch itself. Even on well-crowned roads, surface flow can present an erosion hazard. Surface cross ditches can move water from the road

surface into the ditch line and still allow for light vehicle traffic to use the road. They are very effective when used in close proximity to watercourse crossings.

- Target the installation of one surface cross-ditch 5-10 m on either side of crossings on permanent and intermittent creeks on roads that are temporarily stabilized or reclaimed.
- For frequency of cross-ditching use the table below as a guide. Distances within the table outline the recommended spacing between installed surface cross-ditches. Apply site specific judgment to very steep slopes or unstable soils.

Soil Erosion Potential

Road Grade	**High**	**Moderate**	**Low**
<2%	300m	400m	500m
2-6%	100m	200m	300m
7-10%	75m	100m	125m
>11%	25m	50m	75m

*High: fine sands, silts, loams and organics.
Moderate: clays, tills
Low: gravels, coarse sands, sandy gravels

Full Cross-Ditching:

- Construct full cross-ditches from ditch line to ditch line, excavating deep enough to create a smooth transition from one side to the other. Pile excavated material immediately behind the trench to form a berm. Where possible, extend full cross-ditches to run off into adjacent vegetation instead of simply into the other ditch line.
- Enable or restrict ATV and vehicle access through cross-ditches as appropriate for that road.

Rip-rap:

- The placement of coarse rock within or immediately adjacent to water flow can act both as a filter and as a reinforcement of the water flow structure itself. Rip-rap should be installed in a manner that will be stable over time through peak flows, and cannot be by-passed by the water flow. Geotextile is often used in conjunction with rip-rap to protect the underlying material from erosion.

Existing vegetation:

The retention of existing vegetation and diversion of water flow through this vegetation is both economical and effective. Protect existing duff layers and vegetation at all times.

5.7 Actual Road Disturbance

As built block roads will be GPS'd once road construction has been completed. All watercourse and pipeline crossings will be GPS'd. This GPS data will be updated into the company GIS system and be used to track the actual disturbance by block and then by compartment. The actual disturbance by compartment will be reported in the General Development Plan each year.

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Road Inspection Report

Date:_____ **Road/LOC:**_____ **Road Class:**_____

Road Status: _____ **Inspection Type:** **scheduled inspection / major event / follow-up**
(circle one)

Kilometers Inspected:_____ **Usage Potential:**_____

Inspected By:_____

Checklist

Item	OK	Action Required / Comments	Item	OK	Action Required / Comments
Signage			Garbage		
Brushing			Kilometer Markers		
Running Surface			Approaches		
Ditch Seeding			Turn-outs		
Ditch Drainage			Noxious Weeds		
Culvert Tags			Bridge Approaches		
Erosion Potential			Cross-ditches		
Erosion Occurring			Pipeline Crossings		
Road Cut/Fill Slopes					
Flooding					

Additional Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Road Inspection Report Sheet

5.8 Watercourse Crossings

The location of all watercourse crossings will be GPS'd in conjunction with the 'As-Built' road disturbance monitoring. The number of crossings will be tracked by block, by type of crossing and the associated volumes for each within a ledger system (see attached spreadsheet).

This will ensure that all crossings are recorded and eventually reclaimed within the guidelines of the Operating Ground Rules. Summaries of the crossings and volumes will be calculated by compartment will be reported in the GDP each year.

5.8.1 Monitoring and Maintenance

An inventory of all of the existing permanent watercourse crossings will be completed for the operating area to allow for proper monitoring of crossings along our existing road network. All in-block crossings will be tracked using the block status tracker, as stated earlier. Annual inspections will be completed for all permanent and temporary watercourse crossings to help ensure that environmental targets are met. The following information will be tracked for both permanent and in-block crossings:

- - Crossing location (i.e. identification #, marker, road identification, km #)
- - Crossing type (i.e. culverts – plastic, wood, galvanized, portable and permanent bridges)
- - Crossing status (i.e. active, inactive, reclaim, new construction)
- - Watercourse classification
- - Fish bearing status.
- More in-depth information and observations will be tracked and documented using the Road Inspection Report, Culvert Inspection Report, or the Bridge Inspection Report.

5.8.2 Maintenance of cross-drain culverts:

- Culverts should be unobstructed at both ends. Interior of culvert must allow for unobstructed flow and not pool water.
- Culvert ends should be at ground level as to prevent ponding on the intake end and scouring on the discharge end.
- Culverts should be rip-rapped where appropriate to prevent erosion at either end.
- Culverts should have sufficient compacted fill to allow for the next scheduled user to travel over them without inflicting damage.
- Culverts should be free of siltation build-up as to allow the culvert to continue handling peak flows.
- Culverts should be relatively free from ice build up as to allow the culvert to handle the spring run-off.

5.8.3 Maintenance of Watercourse Crossings:

- Watercourse crossing are structurally stable.
- Watercourse crossings are stable in terms of erosion potential on banks and surrounding ditch lines.
- Geotextile and bump logs stop the soils used in dirt caps from entering the watercourse.
- Approaches to crossings are stable and well drained.
- Watercourse crossings must handle peak flows adequately.

The use of gravel on both approaches to bridges is encouraged to minimize the amount of soil that may be carried or dropped into watercourses.

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Culvert Inspection

Date:_____ **Block/LOC:**_____ **Crossing Type:**_____

Road Status: _____ **Inspection Type:** **scheduled inspection / major event / follow-up**
(circle one)

Inspected By:_____

Kilometer Marker	Culvert Size	Stream Class	Stream Name	Comments/Action Required

Additional Comments:

_____

_____

_____

_____

_____

_____

Culvert Inspection Sheet

FOOTHILLS FOREST PRODUCTS

Bridge Inspection Report

Road (name, no., block, permit, etc):_____ **Road Class:**_____

Map Sheet: _____ **Bridge Location:** _____ **LOC #:** _____

Stream Name:_____ **Bridge Size:**_____ **Steam Class:**_____

Bridge Construction

Abudments	☐	**Wood Piles**	☐	**Steel Piles**	☐	**Manuf Wood Crib**	☐	**Roundwood**	☐	
Piers	☐	**Wood Piles**	☐	**Steel Piles**	☐	**Wood Crib**	☐	**Roundwood**	☐	**Concrete**
Deck	☐	**Wood**	☐	**Concrete**	☐	**Steel**	☐			
Stringers	☐	**Wood**	☐	**Concrete**	☐	**Steel**	☐			

Bridge #_____

CHECKLIST

	Item	OK	Action #		Item	OK	Action #
A	Deck Wearing Surface			L	Bridge Rails		
B	Sub-Deck			M	Guardrails		
C	Piles			N	Deck Burner		
D	Pile Caps			O	Signage & Reflectors		
E	Backing			P	Fish Passage		
F	Cribbing			Q	Road Slopes		
G	Wingwalls			R	Aesthetics		
H	Timber Stringers			S	Erosion or Scour		
I	Steel Stringers			T	Flow Alignment		
J	Beams & Bracing			U	Approaches		
K	Precast Units			V			

ACTION

Action #	Description of Action Required	Priority	Date
	(use reverse if necessary)	(H,M,L)	Completed
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

☐ **Follow up Required** **Date:** _____

☐ **Next Annual Inspection** **Date:** _____

Signature _____ **Date:** _____

Bridge Inspection Sheet

5.9 Structure Retention

Foothills Forest Products will identify and track stand retention in the form of both area (in hectares) and estimated merchantable volume per block. This information will be tracked per compartment within the FMU. Estimates will be based on the density of stems per hectare and an ocular assessment of merchantable volume per hectare present in each patch. There may be zero patches of residual structure in any particular harvest area as long as the amount identified in the TSA is met across the landscape over time. Summaries of the proposed retention area and volume will be identified in the FHP and accruals summarized every year in the GDP. Accruals will be reconciled at the end of every 5 year quadrant and merchantable coniferous volume retained will be charged as AAC production.

5.9.1 Targets

Volume targets for structure retention will vary by block with an overall FMU target of 4% merchantable coniferous volume. With the implementation of the Alberta Pine Strategy, compartments with high percentages of pine are likely to have lower retention levels than compartments with higher percentages of black and white spruce. The monitoring system in place will allow for easy cross reference between target and actual values to help meet both short term and long term objectives. Tracking will be done both pre and post harvest as defined below:

- Pre harvest layout will define the obvious patches of structure retention (more will be defined post harvest). .
- Post harvest inspections will identify and define additional areas retained during operations. Ocular estimations of area, density, and volume per hectare will be made for patches less than 2 hectares in size. Patches greater than 2 hectares will be GPS'd.

5.9.2 Retention Composition

Structure retention patches will be defined as a patch of trees with 4 or more representative merchantable trees or meets a minimum of $50m^3$ of volume per hectare.
Retention patches are to be randomly located throughout the blocks. Patches of merchantable wood that are connected to or adjacent to the block boundary or creek buffers qualify as retention as long as they are designated and mapped as retention. They do not need to be ribbonned out in the field. Retention patches must be part of the net landbase. Operational practices for structure retention will be directed to follow the following guidelines.

- *Suggested TREE Species to leave include*: Balsam Fir, Tamarack, Balsam (black) Poplar; wolf trees, trees with forked tops, trees with nests, heavily branched trees; trees in sensitive or wet areas.

- *Suggested PLACES to leave retention include:* wet areas; riparian areas; patches of shrubs; steep slopes; areas with potential operational issues; sensitive sites; around non-merchantable areas; and other natural features of the block.

- *Lesser Vegetation:* Include shrub species such as willow, and alder. Leave as much lesser vegetation as possible; especially along road right-of-ways, watercourses, wet areas, etc.

Retention will not be defined as anything that meets the following criteria:

- Muskeg;
- Swamp;
- or non-productive areas (areas not meeting the minimum avg. of 50 m^3/ha)

Retention patches will be dispersed randomly throughout the block with the focus on wetter areas, steeper slopes, as well as areas with higher densities of advanced regeneration and high amounts of snags valuable for cavity nesters. These patches may also be strategically placed to achieve the habitat management objectives as set out in the Alberta Operating Ground Rules. In areas with pine stands ranked over 30 SSI this may not be achievable as one of the fundamental goals of this plan is to reduce the potential for a MPB infestation. Retention can be located adjacent to the block boundary or riparian buffer to maximize effectiveness.

5.10 Coarse Woody Debris Monitoring

In the absence of wildfire and with the presence of timber harvesting, the amount of coarse woody debris (CWD) on the landscape should gradually increase over time. Historically forest fires were the natural disturbance regime of the forests of the east slopes. Forest fires, depending on intensity and type, typically burned everything including the CWD resulting in an area with very little or no CWD. Timber harvesting practices primarily only remove the live standing trees, leaving dead standing snags, and the coarse woody debris that was present pre-harvest. The following guidelines outline the direction on snag retention, which will improve CWD accumulations:

Snag Retention:

- Maximize the number of snags left in the harvested area (provided safety objectives are met);
- Cut all hazardous snags within 2 tree-lengths of roads, landings, camps and fueling sites;
- Create snags by topping off "leave trees" at 6 meters, where possible.

Using this approach it is likely that the amount of CWD should increase over time on the landscape. The objective is to ensure CWD is maintained across the landscape.

According to the BC Ministry of Forests Coarse woody debris (CWD) is defined as dead woody material, in various stages of decomposition, located above the soil, larger than 7.5 cm in diameter (or equivalent cross-section) at the crossing point, which is not self-supporting. Trees and stumps (intact in ground) are considered self-supporting.

5.10.1 Monitoring and Tracking

Coarse woody debris will be monitored using pre and post harvest surveys. Currently all laid out blocks are given a coarse woody debris ranking of Low, Moderate or High in the Pre-Harvest summary (see attached form). Once the skidding has been completed in the block, another coarse woody debris assessment will be made using the low, moderate or high ranking. Each year the total area of blocks in each category (low, moderate, high) pre- harvest will be compared to the totals in each category post harvest. The objective here will be to maintain CWD levels across the landscape each year. This will be reported annually in the GDP.

Below is the ranking system that will be used to assess CWD in each block.

Low – Stands with less than $50m^3$/ha per ha of CWD.
Moderate – Stands with more than $50m^3$/ha but less than 120m3/ha of CWD.
High – Stands with more than 120m3/ha of CWD.

Although there are dozens of methods for surveying the exact amount of CWD per ha, we will focus on an estimate. Using the ranking system above, ocular estimates of low, moderate and high will be associated to each block pre and post harvest.

5.11 Crossing Volume Tracking System

The merchantable timber volume that is used on watercourse crossings will be reported on an annual basis at the end of the timber year (added onto April AOP reporting). All timber crossings will be mapped and labelled in all the blocks as the year progresses. At the end of the timber year the merchantable volume used in these crossings will be summarized and reported in the AOP.

For the sake of simplicity an average volume has been associated with each type of crossing, so at the end of the year the number of each crossing type can be tallied and a total volume can be calculated.

Crossing Type	**Average Volume Used**
Log Fill	0.4 m^3
Timber Bridge	1.0 m^3

The average volume associated with each crossing type is based on an average for all crossings of each type. For example, whenever possible, incidental aspen or dead trees are used in log fills, so sometimes merchantable timber will not be used. In other cases, aspen is not available and merchantable spruce will be used and the value of 0.6m^3 will be used. Using 0.4m^3 as an average volume for log fills will provide a relatively accurate estimate of volume used in these crossings.

The use of merchantable logs to corduroy roads is very rare in our operations, however should this method be used, it will be mapped/GPS'd. An approximate volume estimate will be recorded and this will be reported in the AOP along with the log fills and timber bridges.

Harvest Design Block Plan

Location:				
Planning Stage:	Prelim:	Layout:	Harvested:	Reforest:
Reforest Strata:	C	CD	DC	D
Primary Species:	PL	SW SB	AW	PB
Harvest Season:	Spring	Summer	Fall	Winter
Hauling Season:	Spring	Summer	Fall	Winter
Season Justification				

Boundary:	Planned: Actual:	
Timber:	Quality:	
	Volume: Deciduous: m3/ha	Conifer: m3/ha
	Piece Size: Deciduous: trees/ha	Conifer: trees/ha
	Variability: L – M – H -	
Water Source:	N/A	Boundary:
		Internal:
Topography:	General Slope:	
	Slope (%):	Aspect (degrees):
Harvesting:	Strata: C – CD – DC – D --	
	Coarse Down Woody Debris: L – M – H --	
	Stand Notes:	
Roads and Crossings:	Notes:	

Harvest Block Plan Sheet

Oil and Gas:	N/A 3	Notes:		
Safety:	N/A 3	Notes:		
Forest Health:	N/A 3	Insect:	Disease:	Weeds:
Aesthetics:	N/A 3	Notes:		
I.R.M(Stakeholder)	Trapper :			
	Rec:			
	Other:			
Ground Rules Deviations:	Yes			
	No			
Silviculture:	Proposed Treatment:			
	Rare Plants:			
Layout :	Date:		Forester:	
GPS:	Date:		Forester:	
Created By:	Date:		Forester:	

5.12Variance Tracking (SHS)

The variance from the spatial harvest sequence will be tracked on a block by block basis using a combination of GPS and GIS. The laid out GPS'd cut block boundary will be overlaid on top of the spatial harvest sequence. Proposed variance will be tracked for all areas larger than 0.5 ha and categorized as either a deletion or an addition to the harvest area that will be tracked as area in hectares. The number of ha that differ between the SHS and the laid out block will be tracked on the block map and annual summaries will be reported in the FHP.

Variance from the SHS will be tracked and reported by compartment. The cumulative total variance for all FHPs will be reported for compartments with more than one FHP and tracked in the GDP. Areas categorized as either additions or deletions will follow the proposed rules as outlined in the 2008 Foothills Forest Products Inc. Timber Harvest Planning and Operating Ground Rules document.

a) Deletions:

- Riparian buffers
- Steep slopes
- Sensitive sites
- Public concerns
- Cultural/Heritage
- Aesthetics
- AVI inaccuracies – productive to non-productive
- Operational – isolated small types

b) Additions:

- Stands from years 11-20 of the SHS.
- Stands from the SHS outside of years 11-20.
- Stands that were not part of the net land base.

5.13 Reporting

All components outlined in the monitoring program will be reported through the various facets of the planning and approvals processes in place by the Government of Alberta. In conjunction with the reporting on the success of operational strategies meeting the allocated targets the methods used will allow for quick adaptations in the event there is any unacceptable variance.

These strategies will accommodate the needs required for effective short term and long term monitoring.