W6 Quota Holders:

Alberta Newsprint Company,

Blue Ridge Lumber (1981) Ltd., and

Millar Western Forest Products Ltd.

Timber Supply and Forest Management Recommendations for FMU W06

Prepared by:

The Forestry Corp.

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Executive Summary

In 1996, Alberta Newsprint Company (ANC) and Blue Ridge Lumber (BRL) were issued conifer allocations in Management Unit W6 as part of the 3% solution. The LFS and the affected companies negotiated the 3% solution to address conifer shortfalls in ANC's Forest Management Agreement area. ANC's and BRL's W6 allocations in the form of timber quotas totaled 115,642 m^3, determined so that their net volume losses were 3%. Shortly after the quotas were issued, Weyerhaeuser was awarded the Edson FMA, which included W6. Reacting to concerns over the W6 conifer timber supply, in 1999 the LFS completed an analysis and lowered the W6 interim conifer harvest level 17%, despite the application of strategies to mitigate the magnitude of the reduction. Other conifer timber supply strategies and sustainability issues were to be addressed in Weyerhaeuser's Management Plan then under development.

Weyerhaeuser's 2001 Management Plan submission proposed another 14% reduction in the conifer harvest level be implemented. The quota holders believed that not enough effort was expended to mitigate the reduction in conifer harvest level and that a higher harvest level was possible through the application of alternative management strategies. In July of 2001, the quota holders retained The Forestry Corp. to assist them with a timber supply assessment using Weyerhaeuser's data and timber supply models to identify alternative strategies that would mitigate reductions in the conifer harvest level without unduly affecting deciduous timber flows.

The assessment demonstrated that higher conifer harvest levels are possible through the application of alternative management strategies. Summaries of the alternative strategies recommended by the quota holders that differ from those present in Weyerhaeuser's Management Plan submission are listed in the bullets below.

- **post harvest conversion to conifer types** – this strategy reflects a conifer regeneration bias by converting deciduous and mixedwood types back to conifer to address the historical forest changes brought about by diameter cutting in the 1930's to the 1950's. The proposed forest is a closer reflection of the natural forest condition than that observed today. The quota holder strategy converts a maximum of 3% (3,400ha) of the total landbase to conifer.
- **retention of 75% of existing Broad Cover Group** – puts limits on the amount of stand conversion possible. A limitation on the post harvest conversion of stand types, required for the sustainability of biodiversity values.
- **10-year reduction of minimum conifer regenerated harvest age** – reflects the impact of planting and spacing on tree growth resulting in stands that can be economically harvested at an earlier age than natural fire origin stands. The quota holders propose a reduction to 70 years from the natural stand minimum of 80 years.
- **increased conifer regenerated yields** – conifer regenerated yields were modeled at 10% above the fully stocked standing yield curves. This is closer to the regeneration potential observed in other lower foothills management units than the standing yields currently present in W6, which has a history of extensive and repeated harvest operations without adequate regeneration. This results in stand level annual increments within the operable age range from 1.7 to 2.2 m^3/ha.
- **20-year surge cut** – planned harvesting at a higher level for 20 years followed by a planned reduction to a long-term sustainable level. The surge cutting analysis demonstrated that higher cuts are possible now and that the long-term levels are only marginally affected. This was one of the LFS mitigation strategies employed in setting the W6 1999 interim cut.
- **carryover volume spread over 20 years** – traditionally carryover volumes are harvested in the next 5-year period. Spreading the carryover out over 20 years has little impact on the sustainable harvest level but reduces the harvest fluctuations.
- **reconfiguration of minimum growing stock requirement** – required to prevent growing stock collapse with the recommended strategies.
- **reductions in incidental volume fluctuations on divided landbase runs** – applied in response to LFS concerns that a reduction in the fluctuations of incidental harvest levels be achieved.

The quota holders presented four preferred forest management strategies to mitigate the planned reduction in conifer harvest levels to the Government and Weyerhaeuser on Oct 10th and 11th. At that time, the LFS identified the large carryover volume as an issue. In response, the quota holders developed 2 new recommended strategies that spread the carryover out over 20 years instead of 5 years and selected the surge cutting option (RUN476 and RUN276).

The historical harvest levels and the quota holder recommended levels are presented in Table 1. The first run is the 1986 Forest Management Plan, which was in place in 1996 when the quotas were issued. The 1999 LFS interim cut adjustment is next, followed by Weyerhaeuser's Detailed Forest Management Plan submission. RUN401 to RUN265 are the quota holder's October draft preferred strategies.

Table 1. Historical and proposed 180-year average annual harvest levels (m^3/yr @ 15/11).

RUN	Date	Landbase	Years 1 to 20 (or 200 if no surge) Conifer	Deciduous	Total	Years 21 to 180 (if different) Conifer	Deciduous	Total
FMP	1986	Divided	224,100	116,660	340,760			
Interim	1999	Divided	186,489	116,660	303,149	172,475	116,660	289,135
DFMP	Jun, 2001	Divided	160,551	121,571	282,122			
RUN401	Oct, 2001	Divided	196,907	133,070	329,977			
RUN465	Oct, 2001	Divided	220,322	173,063	393,385	190,080	130,366	320,446
RUN200	Oct, 2001	Combined	194,958	120,051	315,009			
RUN265	Oct, 2001	Combined	211,643	142,396	354,039	195,181	114,858	310,039
RUN476	**Nov, 2001**	**Divided**	**225,101**	**167,001**	**392,102**	**177,116**	**122,834**	**299,950**
carryover reported			*242,033*	*168,186*	*410,218*	*177,116*	*122,834*	*299,950*
RUN276	**Nov, 2001**	**Combined**	**217,618**	**129,838**	**347,456**	**176,536**	**116,709**	**293,245**
carryover reported			*234,550*	*131,023*	*365,572*	*176,536*	*116,709*	*293,245*

Carryover volumes of 16,932 m^3 conifer and 1,185 m^3 deciduous are reported in pink italics

The quota holder's recommended strategies are RUN476 or RUN276 (in bold). The difference between the two strategies is the landbase assumption. Divided landbase is the current management approach but the quota holders would consider a move to combined landbase, despite the lower harvest level. Analysis has demonstrated that it is possible to achieve the 1996 harvest levels only through surge cutting for 20 years, after which harvest levels will drop down to a level close to the post surge levels recommended by the LFS in 1999. The quota holders favor this approach, as it will provide time to plan for and adjust to a lower harvest level.

The unaudited estimated carryover volume from the DFMP submission was included in all scenarios but was not reported as part of the harvest levels. Carryover volume has been added to RUN476 and RUN276 for comparison. Some of the apparent inconstancy in the results presented is due to differences in the spatial allocation process, which fine-tuning will address once a final management strategy is developed.

Introduction

The W6 quota holders, Alberta Newsprint Company (ANC), Blue Ridge Lumber (BRL) and Millar Western Forest Products (MWFP) retained The Forestry Corp. to assist them in undertaking an assessment of the range of potentially workable scenarios to enhance harvest level projections for FMU W6. This assessment was based on the data sets, models and management assumptions developed by Weyerhaeuser in their DFMP submission. Although the quota holders do not agree with all of Weyerhaeuser's management assumptions, for the purposes of this assessment, changes were restricted to those that enhance the harvest level.

It was not the intent of this assessment to produce an approved W06 allowable cut, but rather to develop an understanding of the timber supply complexity, identify the constraints on conifer AAC, and to investigate a range of technical options and management strategies that could mitigate the conifer harvest level reduction. The assumptions and forest management options investigated in this assessment may not be in line with those in the DFMP submission. Finally, the quota holders recognize that the management strategies presented here would require vetting through a DFMP approval, monitoring and implementation process.

The quota holders presented four workable scenarios and a summary of their analysis in an October 11, 2001 document to both the LFS and to Weyerhaeuser. At that time the option of spreading the carryover harvest over 20 years instead of 5 years was proposed. Six additional runs determined that the AAC impact of this option was small but the harvest level drop downs were reduced. The additional runs including the quota holder recommended strategies (RUN476 and RUN276) are presented in Table 2.

Table 2. Historical and proposed 180-year average AAC for recommended strategies (m^3/yr)[1].

RUN	Surge target (000's m3)	Carryover	Years 1 to 20 (or 200 if no surge) Conifer	Deciduous	Total	Years 21 to 180 (if different) Conifer	Deciduous	Total
Divided Landbase								
FMP	none	none	224,100	116,660	340,760			
Interim	10% drop	none	186,489	116,660	303,149	172,475	116,660	289,135
DFMP	none	5-year	160,551	121,571	282,122			
New management strategies to address carryover								
RUN411	none	20-year	184,127	125,924	310,051			
RUN477	190-200	20-year	204,412	165,718	370,130	178,637	120,943	299,580
RUN476	**200-220**	**20-year**	**225,101**	**167,001**	**392,102**	**177,116**	**122,834**	**299,950**
RUN476 carryover reported			*242,033*	*168,186*	*410,218*	*177,116*	*122,834*	*299,950*
Combined Landbase								
RUN211	none	20-year	186,546	114,843	301,389			
RUN277	190-200	20-year	202,998	122,947	325,945	177,987	119,711	297,698
RUN276	**200-220**	**20-year**	**217,618**	**129,838**	**347,456**	**176,536**	**116,709**	**293,245**
RUN476 carryover reported			*234,550*	*131,023*	*365,572*	*176,536*	*116,709*	*293,245*

Carryover volumes of 16,932 m^3 conifer and 1,185 m^3 deciduous are reported in pink italics

The two recommended strategies differ only in the approach to landbase, either divided or combined. The quota holders are open to either approach but recognize that there are a number

[1] Volumes are spatially allocated 15/11 and include volume reductions for cull and within block retention.

of significant issues associated with the move to combined landbase that must be addressed before this approach can be implemented.

W6 Quota Holder Strategies

The differences in assumptions between the new strategies are summarized below.

RUN411

- divided landbase
- even flow primary species (all runs define even flow as +\-5% from the initial harvested level)
- estimated carryover harvest volume distributed over 20 years. Compare to RUN410 that harvests the carryover over 5 years (less than 0.1% total AAC difference between the 2 runs)
- minimum growing stock level of 10,000,000 m^3 (gross operable volume) at the end of the planning horizon (present in all 6 runs)

RUN477

- divided landbase
- first 20 years surge cutting target of 190,000 to 200,000 m^3
- estimated carryover harvest volume distributed over 20 years
- minimum growing stock level of 10,000,000 m^3

RUN476 – Recommended Strategy

- divided landbase
- first 20 years surge cutting target of 200,000 to 220,000 m^3
- estimated carryover harvest volume distributed over 20 years
- minimum growing stock level of 10,000,000 m^3

RUN211

- single combined landbase
- even flow all species (all runs define even flow as +\-5% from the initial harvest level)
- estimated carryover harvest volume distributed over 20 years. Compare to RUN210 that harvests the carryover over 5 years (0.4% total AAC difference between the 2 runs)
- minimum growing stock level of 10,000,000 m^3

RUN277

- single combined landbase
- first 20 years surge cutting target of 190,000 to 200,000 m^3
- estimated carryover harvest volume distributed over 20 years
- growing stock level of 10,000,000 m^3

RUN276 – Recommended Strategy

- single combined landbase
- first 20 years surge cutting target of 200,000 to 220,000 m^3
- estimated carryover harvest volume distributed over 20 years
- minimum growing stock level of 10,000,000 m^3

To enhance the timber supply, the quota holders altered some of the strategies presented in Weyerhaeuser's DFMP submission. Summaries of the alternative strategies developed by the quota holders that differ from those in the DFMP submission are listed in the bullets below.

- **post harvest conversion to conifer types** – this strategy reflects a conifer regeneration bias by converting deciduous and mixedwood types back to conifer to address the historical forest changes brought about by diameter cutting in the 1930's to the 1950's. The proposed forest is a closer reflection of the natural forest condition than that observed today. The quota holder strategy converts a maximum of 3% (3,400ha) of the total landbase to conifer.
- **retention of 75% of existing Broad Cover Group (BCG)** – puts limits on the amount of stand conversion possible. A limitation on the post harvest conversion of stand types, required for sustainability of biodiversity values.
- **10-year reduction of minimum conifer regenerated harvest age** – reflects the impact of planting and spacing on tree growth resulting in stands that can be economically harvested at an earlier age than natural fire origin stands. The quota holders propose a reduction to 70 years from the natural stand minimum of 80 years.
- **increased conifer regenerated yields** – conifer regenerated yields were modeled at 10% above the fully stocked ("D" density) standing volume yield curves. This is closer to the regeneration potential observed in other lower foothills management units than the standing yields currently present in W6, which has a history of extensive and repeated harvest operations without adequate regeneration. This results in stand level MAIs within the operable age range from 1.7 to 2.2 m^3/ha.
- **20-year surge cut** – planned harvesting at a higher level for 20 years followed by a planned reduction to a long-term sustainable level. The surge cutting analysis demonstrated that higher cuts are possible now and that the long-term levels are only marginally affected. This was one of the LFS mitigation strategies employed in setting the W06 1999 interim cut.
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- **reductions in incidental volume fluctuations on divided landbase runs** – applied in response to LFS concerns that a reduction in the fluctuations of incidental harvest levels be achieved.

A description of non-spatial (Woodstock) model parameters applied in the 2 recommended scenarios are listed in Table 3 while the spatial model parameters (Stanley) are listed in and Table 4.

Table 3. RUN476 and RUN276 non-spatial (Woodstock) model parameters.

Parameter	Setting
Planning Horizon	180 years (36 5-year periods)
Landbase	W6 ecological (combined or divided)
Yield Curves	developed by Weyerhaeuser regenerated yield curves are fully stocked ('D' density for C, CD, DC stands and 'C' density for D stands) regenerated coniferous yields in C, CD, and DC stands are increased by 10%
Regeneration Delay	2 year regen delay for C, CD stands 1 year regen delay for D, DC stands
Conversion	early conversion of D stands (mature D stands converted to pure C after harvest) late conversion of D stands (young D stands are allowed to mature, and then be converted to pure C after harvest) conversion of mixedwood stands to pure C after harvest
Carryover	338, 635 m^3 conifer (16,932 m^3/yr for 20 years) 23,694 m^3 deciduous (1,185 m^3/yr for 20 years)
Growing Stock	minimum 10,000,000 m^3 operable growing stock
A Density Stands	area harvested of A density stands restricted to 20% of total area harvested
Species Flow	evenflow (+-5%) surge cut for coniferous harvest in years 1-20, set conifer surge harvest between 200-220,000 m^3/yr (NET volumes), then post-surge evenflow (+-5%) coniferous harvest level for years 21-180 evenflow (+-5%) deciduous harvest volumes for years 1-180
Seral Stage Indicators	minimum areas required of mature and overmature cover types (as specified in draft DFMP)
Species Distribution	minimum 75% of initial broad cover group area must be retained
Minimum Harvest Ages	80 years for natural origin C, CD stands 70 years for regenerated C, CD stands 60 years for D, DC stands
Minimum Average Harvest Ages	80 years for C, CD, DC stands 70 years for D stands
Maximum Harvest Ages	180 years
Model Objective	maximize total harvest volume

Table 4. RUN476 and RUN276 spatial allocation (Stanley) model parameters.

Parameter	Setting
Stanley Objective	Total harvest volume for RUN276; Total Primary harvest volume for RUN476
Adjacent Distance	100 m
Proximal Distance	30 m
Minimum Block Size	4 ha
Maximum Block Size	None
Target Block Size	40 ha
Greenup Delay	15 years
Maximum Deviation	20 years
Periods To Block	1..12 (first 60 years)
Maximum Flow Fluctuation	5

Stand Conversion

A component of the quota holders' strategy that differed from Weyerhaeuser's DFMP submission was the conversion to conifer types following harvest for some portion of the deciduous leading and mixedwood stands. The recommended divided landbase run converted only mixedwood types compared to the combined landbase run, which converted more deciduous types (Table 5). The explanation for this difference lies in the different model objective functions and even flow constraints. Both runs maximized the same volumes, but the divided landbase required even flow on primary volumes while the combined landbase required even flow on total volume. The overall impact of stand conversions remained slight, only 2% to 3% of the net operable landbase was actually converted in the recommended runs.

Table 5: Area (ha) converted to pure conifer following harvest.

Scenario	Description	Area Converted (ha)				Percent of Operable Landbase
		Mixedwood	Late Deciduous	Early Deciduous	Total	
Divided Landbase						
RUN476	Spatial (reduced deviations) 20 year surge cut for conifer, smoothed out BCG harvest, conifer surge cut between 200-220,000 m³/yr, min. growing stock level set, carryover cut over 20 years	4,152	0	0	4,152	3%
Combined Landbase						
RUN276	Spatial (reduced deviations) 20 year surge cut for conifer, conifer surge cut between 200-220,000 m³/yr, min. growing stock level set, carryover cut over 20 years	13	0	2,613	2,626	2%

Late deciduous conversion was defined as currently younger pure deciduous "D" stands that will be converted to pure conifer following harvest 50 years or so into the planning horizon. None of these stand types were converted. Early deciduous conversion was defined as currently older aged D stands converted to pure conifer following harvest in the first few periods of the planning horizon.

The rules for silviculture treatment response by broad cover types for the quota holder's recommended runs are presented in Figure 1. The deciduous treatment options were clearcut and convert to pure conifer or clearcut and maintain the same stand species proportions at "C" density (Weyerhaeuser's rules). The mixedwood treatment options either maintained the same species percent and tracked along scaled "D" density volumes or were converted to 100% conifer with scaled volumes.

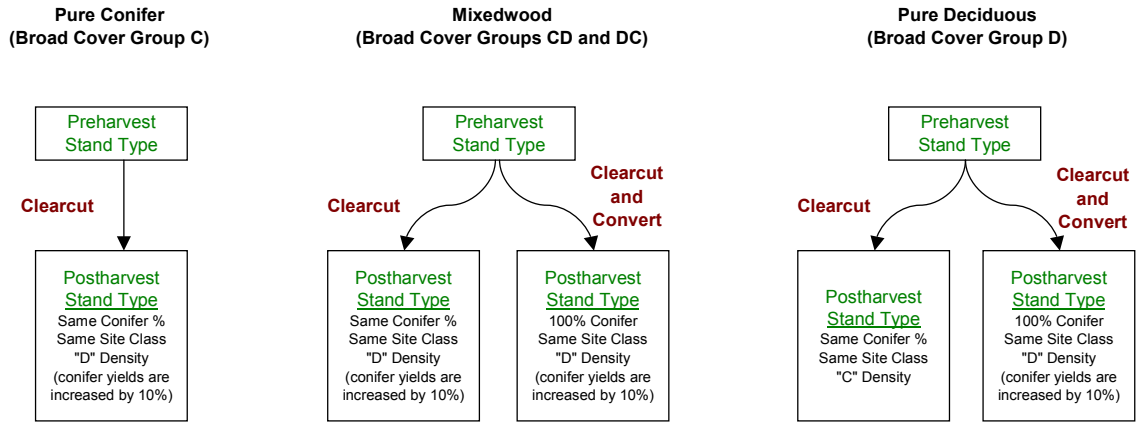

Figure 1: Silviculture treatment response options by broad cover type.

Once conversion was allowed, limitations were required to prevent the removal of most or all of some stand types. The quota holders developed a Broad Cover Group (BCG) constraint that required retention of each the Broad Cover Group types (comprised of D, DC, CD and C types) throughout the planning horizon. In all runs, a minimum of 75% of the initial operable area present in each Broad Cover Group type was required throughout the entire planning horizon. RUN476 reached the maximum conversion limitation only the DC cover group. A graphic representation of the conversion impact on the spatial allocation is presented in Figure 2 along with harvest levels for the first 60 years of the planning horizon.

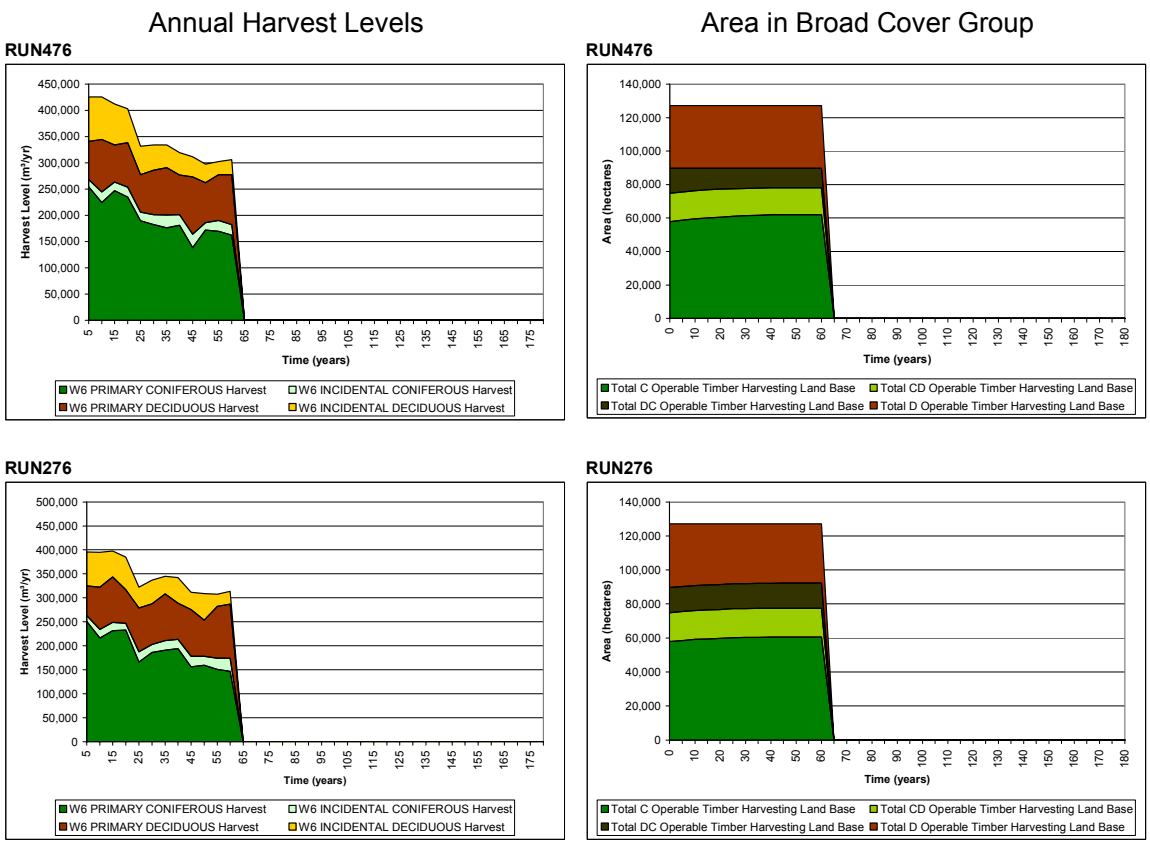

Figure 2: RUN476 and RUN276 60-year harvest levels (m3/yr) and Broad Cover Group (ha) distribution.

The Woodstock model harvested and converted stands in the first few periods since there was no limitation on the rate of conversion other than the harvest rate. However, the spatial allocation process spread the conversion out over a longer period, up to about 50 years as demonstrated in the Area in Broad Cover Group charts and in Table 6 and Table 7.

Table 6: RUN276 periodic silviculture treatment response areas in first 40 years (ha).

Broad Cover Group	Treatment	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25	Years 26-30	Years 31-35	Years 36-40	Total Area
C	Clearcut	5,246	3,564	4,322	4,000	2,959	3,141	3,303	3,134	29,668
CD	Clearcut	1,368	1,157	721	1,111	692	952	655	841	7,497
	CC & Convert	0	0	7	3	0	2	0	0	13
DC	Clearcut	1,244	1,160	662	1,059	831	743	498	728	6,925
	CC & Convert									0
D	Clearcut	1,330	1,870	2,114	1,701	2,320	2,006	2,383	2,092	15,815
	CC & Convert	669	588	264	299	452	111	118	93	2,593
All	Clearcut	9,188	7,750	7,819	7,870	6,802	6,842	6,839	6,795	59,905
	CC & Convert	669	588	270	302	452	113	118	93	2,606
	Total	9,857	8,338	8,089	8,172	7,254	6,955	6,957	6,888	62,510

Table 7: RUN476 periodic silviculture treatment response areas in first 40 years (ha).

Broad Cover Group	Treatment	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25	Years 26-30	Years 31-35	Years 36-40	Total Area
C	Clearcut	5,536	3,994	4,025	3,906	3,209	3,042	2,995	3,046	29,753
CD	Clearcut	1,259	1,013	1,067	992	781	874	589	515	7,090
	CC & Convert	66	99	80	148	182	107	105	87	874
DC	Clearcut	859	675	922	768	596	556	497	401	5,275
	CC & Convert	712	719	478	342	309	207	183	185	3,136
D	Clearcut	2,302	2,703	1,969	2,302	2,082	2,270	2,523	2,216	18,366
	CC & Convert									0
All	Clearcut	9,956	8,385	7,983	7,967	6,667	6,743	6,603	6,178	60,483
	CC & Convert	778	819	558	490	491	314	289	272	4,010
	Total	10,734	9,204	8,541	8,457	7,159	7,057	6,892	6,451	64,493

Silviculture strategies altered the species composition of converted stands. The percent conifer in each stand was tracked Weyerhaeuser's model. After conversion, stands were assigned to the volume present in 100 % conifer stands and thus in conversion scenarios the percent conifer increased through time. The increases in 100% conifer stands were 8% for RUN276 and 13% for RUN 476 (Table 8).

Table 8: Current and future conifer area proportion distribution (ha).

Broad Cover Group	Percent Conifer	RUN276 Area (ha) Year 0	RUN276 Area (ha) Year 60	RUN276 % Diff.	RUN476 Area (ha) Year 0	RUN476 Area (ha) Year 60	RUN476 % Diff.
D	0	15,145	14,533	-4%	15,145	15,145	0%
	10	15,544	14,802	-5%	15,544	15,544	0%
	20	6,870	5,610	-18%	6,870	6,870	0%
DC	30	7,574	7,574	0%	7,574	5,581	-26%
	40	5,674	5,674	0%	5,674	4,518	-20%
	50	1,442	1,675	16%	1,442	1,631	13%
CD	50	1,682	1,442	-14%	1,682	1,442	-14%
	60	3,843	3,840	0%	3,843	3,186	-17%
	70	11,513	11,511	0%	11,513	11,218	-3%
C	80	7,641	7,641	0%	7,641	7,641	0%
	90	19,144	19,144	0%	19,144	19,144	0%
	100	31,091	33,717	8%	31,091	35,243	13%

Increased Regenerated Yield

The quota holders disagreed with the regenerated yield assumptions present in the DFMP submission. Weyerhaeuser assumed that regenerated yield volume would equal the "C" density standing yield volumes. The assumption that regenerated yields equal fully stocked natural yields has been widely applied in Alberta management plans. However, the application of this technique in W6 is problematic because much of the current stand structure in W6 is a result of approximately 50 years of logging where regeneration was not a priority. Only in recent decades were regeneration treatments applied and these stands are too young for use in volume prediction.

The quota holders proposed an increase in conifer regenerated yields to better reflect the results of current conifer regeneration practices. Regenerated conifer yields were assumed to be equal to 110% of the fully stocked "D" density standing yields for pure conifer (C) and mixedwood (CD and DC) stands. Deciduous regenerated yield assumptions were not altered. To demonstrate the validity of this assumption, a comparison was made to standing yields observed in surrounding Lower Foothills management units.

DFMP yield curves developed for timber supply that had distinct Lower Foothills curves were

obtained from surrounding management units. Direct strata by strata comparisons were not available so comparisons were made using an area weighting process. Area weighted pure conifer Lower Foothills curves were compared where possible to the quota holder's "D" density plus 10% W6 regenerated conifer curve. This comparison demonstrated that within the regenerated stand ages that were harvested in the timber supply simulations, the 110% scaled W6 regenerated curve is not extreme. The W6 110% scaled regenerated curve is below the standing volumes present in the other units for most of the harvested age range and all of the critical range from 80 to 100 years (Figure 3). Surge cutting harvested a greater percentage of the regenerated area from younger age classes than RUN 411 did.

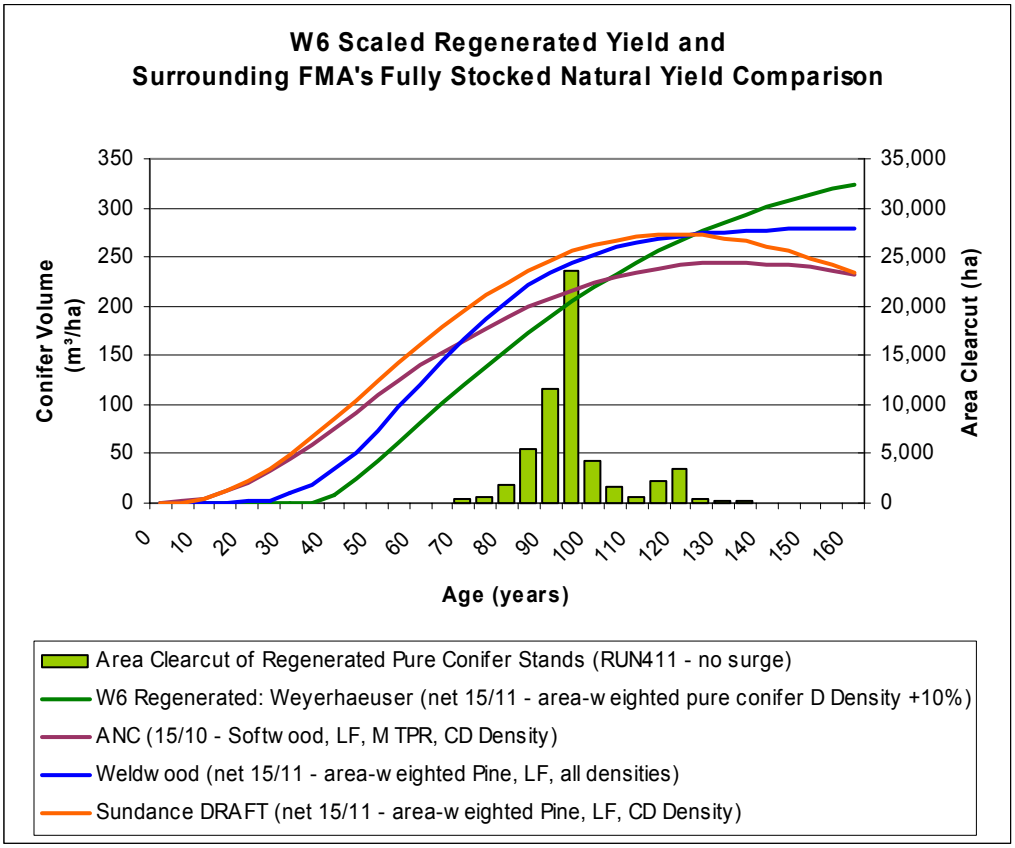

Figure 3: W6 increased regenerated yield compared to other standing volumes.

An explanation for the differences in standing conifer volumes for fully stocked stands is partly due to the lower level of historical stand disturbance in the other units compared with the disturbance levels in W6. As a result, the undisturbed natural yield curves in the other units better represent regenerated growth potential than the W6 curves based in disturbed stands.

GYPSY yield predictions were also compared to the W6 yield curves. An approximation of the average area weighted conifer site index was determined from the DFMP documentation. Average site index values were obtained from the DFMP documentation (Table 9).

Table 9: Average conifer site index values from documented plot information[2].

Species Group	Natural Region	Site Class	Average Site Index
Conifer	LF	G	16.11
Conifer	LF	M	14.15
Conifer	LF	F	11.21
Conifer	UF	G&M	16.90
Conifer	UF	F	15.26
Deciduous	ALL	G	17.06

Average site index values were area weighted to the ecological landbase used in the timber supply (Table 10). The W6 conifer area weighted standing volume conifer site index for W6 is 14.7 metres. This was rounded to a site index of 15 metres for GYPSY comparison.

Table 10: Area weighted site index values for W6 ecological landbase.

Species Group	Site Class	Area of C and CD stands	Proportion of Area	Site Index for Class	Area-weighted Site Index
Conifer	G	30,006	40%	16.11	14.69
	M	38,558	51%	14.15	
	F	6,350	8%	11.21	

Comparison of the W6 110% scaled fully stocked conifer curve was made to GYPSY yield predictions for average site regenerated pine. Average regenerated breast height site index of 16 to 17 metres in the GYPSY documentation was converted to a stand height site index of 15 metres using GYPSY relationships. Finally, a 7-year age adjustment was applied to account for years to reach breast height age. Four initial stand density conditions were plotted in Figure 4 from published GYPSY yield curves; 7,000 tph (average lower foothills value); 2,000 tph; 1,600 tph; and 800 tph (to represent open grown condition not the expected regenerated condition).

[2] Source - page 22 -Table 12 of Natural Stand Yield Curves, Weyerhaeuser Edson FMA, April 4, 2001 prepared by Timberline; in Appendix 6.2 Yield Curve Development of Weyerhaeuser's June 29, 2001 DFMP submission.

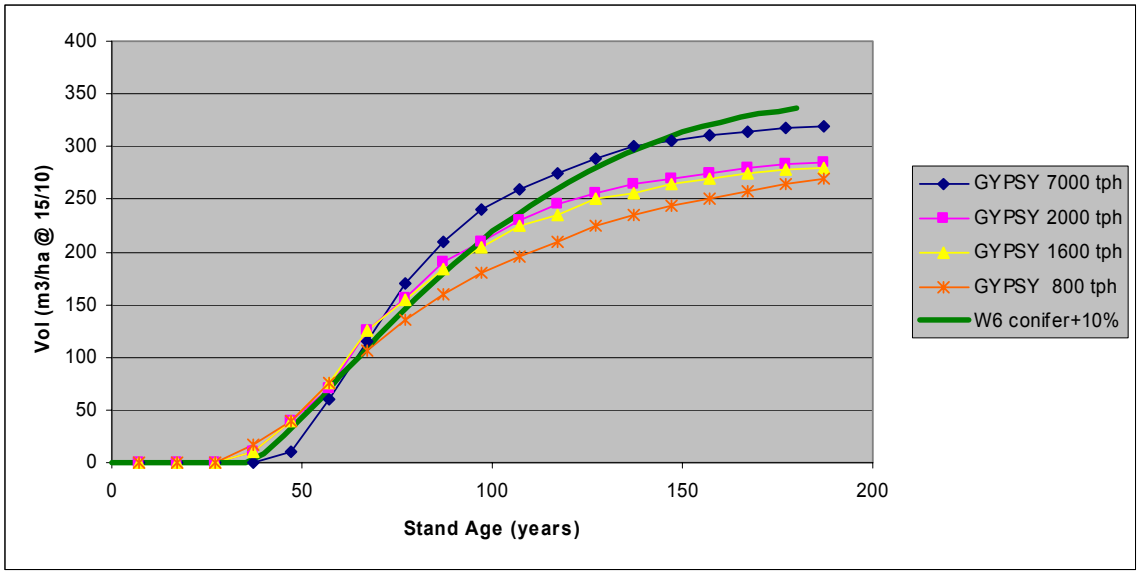

Figure 4. Comparison of W6 fully stocked 110% scaled conifer curve to GYPSY SI = 15 metre regenerated yield predications for four initial densities[3].

The results demonstrate that within the critical regenerated harvest age range of 70 to 100 years for surge cutting scenarios, the W6 110% scaled fully stocked conifer curve is in line with the GYPSY yield predictions. The only GYPSY curve that is below the scaled W6 110% scaled fully stocked curve within the critical range is the open grown 800 stems per hectare curve. However, since regenerated stands were assumed to regenerate to fully stocked condition, this relationship is appropriate.

Regenerated Yield Sensitivity Analysis

The uncertainty surrounding the regenerated yield assumptions required that a drop down sensitivity analysis be undertaken to determine the impact on future allowable cuts if after 20 years the increased regenerated yields predicted by the quota holders were not achieved. The regenerated yield sensitivity analysis was completed using the divided landbase and the most recent even-flow strategy (RUN411). This avoided the problems associated with determining a baseline level under the step down strategies.

The first 20-year harvest sequence from RUN411 was applied in RUN413 where regenerated yields equaled standing volume yields. Stands continued to regenerate to fully stocked status and conversion was permitted. RUN412 was the baseline where no increased regenerated stand volumes were present throughout the entire planning horizon. To account for differences due the +-5% definition of even flow, average harvest levels were reported for the first 20 years and for the last 160 years (Figure 5).

[3] Source: GYPSY – Yield Curves for Seed-origin Natural and Regenerated Lodgepole Pine Stands. August 2001. (Figures A127, A129, A130, A135).

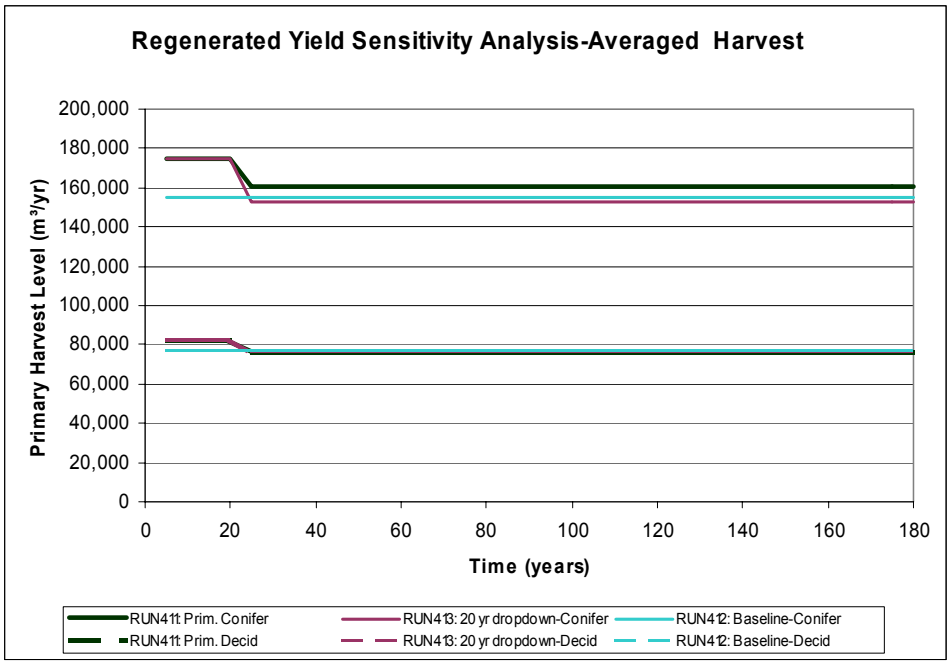

Figure 5: Regenerated drop down yield sensitivity analysis, even flow divided landbase.

The average harvest level after 20 years from drop down scenario (RUN413) was compared to the baseline scenario average level after 20 years (RUN412). The percent difference from the baseline was a 1.7% below the baseline for conifer and 1.2% below the baseline for deciduous. This analysis demonstrated that the risk associated with the application of increased regenerated conifer yields on future cut levels was very small.

Results

The 180-year average AAC results for the spatially allocated divided and combined landbases are presented in Table 11 and Table 12. Estimated carryover volumes were modeled as part of the harvest sequence but are not included in the reported AAC levels in these tables. This is consistent with all other runs.

Detailed non-spatial and spatial model results for the additional runs undertaken are presented in the appendices.

Table 11. 180 year average spatial AAC results for the divided landbase (m^3/yr).

Scenario	Description	Effective Time Period for Harvest Levels	Harvest Levels* (Net 15/11) Coniferous	Deciduous	Total	Proportion of Conifer Harvest to Total Harvest	Harvest Levels** Primary Coniferous	Deciduous	Incidental Coniferous	Deciduous	Harvest Levels by Operator Quota Holders Coniferous	Weyerhaeuser Coniferous	Deciduous	Total	Percent Difference from Baseline Quota Holders Coniferous	Weyerhaeuser Coniferous	Deciduous	Total
Spatial Allocation																		
RUN401	Non-spatial	Years 1-180	193,778	141,386	335,163	58%	175,799	81,924	17,978	59,462	110,244	55,282	123,795	179,077	-22%	0%	25%	16%
RUN401-Stanley1	Spatial (DFMP settings), blocked total primary cut	Years 1-180	196,907	133,070	329,977	60%	181,151	71,798	15,756	61,272	113,600	55,055	115,479	170,534	-19%	0%	17%	10%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	2%	-6%	-2%		3%	-12%	-12%	3%								
RUN401-Stanley2	Spatial (DFMP settings), blocked primary cut by landbase	Years 1-180	192,125	118,010	310,136	62%	179,556	57,278	12,570	60,732	112,599	51,274	100,419	151,693	-20%	-7%	1%	-2%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-1%	-17%	-7%		2%	-30%	-30%	2%								
RUN401-Stanley3	Spatial (DFMP settings), blocked total cut	Years 1-180	195,460	132,488	327,948	60%	179,726	71,698	15,734	60,790	112,706	54,502	114,897	169,399	-20%	-1%	16%	10%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	1%	-6%	-2%		2%	-12%	-12%	2%								
RUN410	Non-spatial	Years 1-180	188,831	134,174	323,005	58%	171,107	81,149	17,724	53,025	107,301	53,278	116,583	169,861	-24%	-4%	18%	10%
RUN410-TOTPCUT	Spatial (reduced deviations), blocked total primary cut	Years 1-180	183,642	125,048	308,691	59%	167,680	73,085	15,963	51,963	105,152	50,239	107,457	157,696	-25%	-9%	8%	2%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-5%	-12%	-8%		-2%	-10%	-10%	-2%								
RUN411	Non-spatial	Years 1-180	188,649	134,644	323,293	58%	170,972	81,204	17,678	53,440	107,216	53,181	117,053	170,234	-24%	-4%	18%	10%
RUN411-Stanley-total p	Spatial (reduced deviations), blocked total primary cut	Years 1-180	184,127	125,924	310,051	59%	168,156	73,365	15,971	52,560	105,451	50,425	108,333	158,758	-25%	-9%	9%	3%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-5%	-11%	-7%		-2%	-10%	-10%	-2%								
RUN465	Non-spatial	Years 1-20	235,454	178,663	414,117	57%	217,291	84,395	18,163	94,268	136,263	70,939	161,072	232,011	-3%	28%	63%	50%
		Years 21-180	185,928	140,336	326,264	57%	168,005	81,596	17,923	58,741								
RUN465_TOTPCUT	Spatial (DFMP settings), blocked total primary cut	Years 1-20	220,322	173,063	393,384	56%	201,930	85,459	18,392	87,604	126,630	65,439	155,472	220,911	-10%	18%	57%	43%
		Years 21-180	190,080	130,366	320,446	59%	174,874	69,223	15,206	61,142								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-6%	-3%	-5%		-7%	1%	1%	-7%								
		Years 21-180	2%	-7%	-2%		4%	-15%	-15%	4%								
RUN475	Non-spatial	Years 1-20	235,557	181,401	416,967	56%	218,136	84,237	17,431	97,164	136,793	70,522	163,810	234,332	-3%	27%	65%	52%
		Years 21-180	181,318	131,294	312,612	58%	163,509	80,898	17,810	50,396								
RUN475-TOTPCUT	Spatial (reduced deviations), blocked total primary cut	Years 1-20	223,824	167,799	391,623	57%	208,301	75,016	15,523	92,783	130,626	64,947	150,208	215,155	-7%	17%	52%	39%
		Years 21-180	182,284	122,209	304,493	60%	166,690	70,833	15,594	51,376								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-5%	-7%	-6%		-5%	-11%	-11%	-5%								
		Years 21-180	1%	-7%	-3%		2%	-12%	-12%	2%								
RUN476	Non-spatial	Years 1-20	233,343	183,974	417,317	56%	215,013	87,477	18,330	96,497	134,835	70,257	166,383	236,639	-4%	27%	68%	53%
		Years 21-180	181,448	131,032	312,480	58%	163,778	80,602	17,669	50,430								
RUN476-TOTPCUT	Spatial (reduced deviations), blocked total primary cut	Years 1-20	225,101	167,001	392,102	57%	209,841	72,826	15,260	94,176	131,591	65,258	149,410	214,668	-6%	18%	51%	39%
		Years 21-180	177,116	122,834	299,950	59%	161,060	73,241	16,055	49,593								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-4%	-9%	-6%		-2%	-17%	-17%	-2%								
		Years 21-180	-2%	-6%	-4%		-2%	-9%	-9%	-2%								
RUN477	Non-spatial	Years 1-20	210,762	179,180	389,942	54%	192,548	87,486	18,213	91,694	120,747	61,763	161,589	223,352	-14%	12%	63%	45%
		Years 21-180	184,737	130,428	315,165	59%	167,057	80,610	17,679	49,818								
RUN477-TOTPCUT	Spatial (reduced deviations), blocked total primary cut	Years 1-20	204,412	165,718	370,130	55%	188,611	75,899	15,801	89,819	118,278	57,882	148,127	206,009	-16%	5%	50%	33%
		Years 21-180	178,637	120,943	299,579	60%	162,756	72,407	15,880	48,536								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-3%	-8%	-5%		-2%	-13%	-13%	-2%								
		Years 21-180	-3%	-7%	-5%		-3%	-10%	-10%	-3%								

* All harvest levels are reduced by within block retention and cull

** Primary and incidental harvest levels are determined by reducing the 180 year average harvest level by the appropriate spatial reduction

Primary conifer is coniferous harvest from C, CD, and DC stands, primary decid is deciduous harvest from D stands

Table 12. 180 year average spatial harvest levels for the combined landbase (m^3/yr).

Scenario	Description	Effective Time Period for Harvest Levels	Harvest Levels* (Net 15/11)			Proportion of Conifer Harvest to Total Harvest	Harvest Levels**				Harvest Levels by Operator				Percent Difference from Baseline			
							Primary		Incidental		Quota Holders	Weyerhaeuser			Quota Holders	Weyerhaeuser		
			Coniferous	Deciduous	Total		Coniferous	Deciduous	Coniferous	Deciduous	Coniferous	Coniferous	Deciduous	Total	Coniferous	Coniferous	Deciduous	Total
Spatial Allocation																		
RUN122	Non-spatial	Years 1-180	213,449	110,195	323,644	66%	196,958	58,846	16,491	51,348								
RUN122-Stanley	Spatial (DFMP settings)	Years 1-180	210,223	115,673	325,896	65%	193,981	61,772	16,242	53,901	121,645	60,326	98,082	158,408	-13%	9%	-1%	3%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-2%	5%	1%		-2%	5%	-2%	5%								
RUN122-Stanley2	Spatial (reduced deviations)	Years 1-180	193,078	104,142	297,220	65%	178,160	55,614	14,917	48,528	111,724	53,101	86,551	139,653	-20%	-4%	-13%	-10%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-10%	-5%	-8%		-10%	-5%	-10%	-5%								
RUN123	Non-spatial	Years 1-180	195,268	135,201	330,469	59%	177,887	80,221	17,380	54,980	111,553	55,462	117,610	173,073	-21%	0%	19%	12%
RUN123-Stanley	Spatial (DFMP settings)	Years 1-180	192,901	119,958	312,859	62%	175,731	71,177	17,170	48,781	110,201	54,448	102,367	156,815	-22%	-2%	3%	2%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-1%	-11%	-5%		-1%	-11%	-1%	-11%								
RUN200	Non-spatial	Years 1-180	195,646	136,291	331,937	59%	178,650	78,456	16,996	57,835	112,031	55,363	118,700	174,063	-20%	0%	20%	13%
RUN200-Stanley	Spatial (DFMP settings)	Years 1-180	194,958	120,051	315,009	62%	178,021	69,107	16,937	50,944	111,637	55,069	102,460	157,528	-21%	0%	3 %	2 %
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	0%	-12%	-5%		0%	-12%	0%	-12%								
RUN210	Non-spatial	Years 1-180	191,670	130,338	322,007	60%	176,279	73,330	15,391	57,007	110,545	52,873	112,747	165,620	-21%	-4%	14%	7%
RUN210-TOTCUT	Spatial (reduced deviations)	Years 1-180	186,728	116,350	303,079	62%	171,734	65,461	14,994	50,889	107,695	50,782	98,759	149,541	-23%	-8%	0%	-3%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-3%	-11%	-6%		-3%	-11%	-3%	-11%								
RUN211	Non-spatial	Years 1-180	192,105	128,783	320,888	60%	176,811	71,671	15,294	57,112	110,878	52,975	111,192	164,167	-21%	-4%	12%	6%
RUN211-Stanley	Spatial (reduced deviations)	Years 1-180	186,546	114,843	301,388	62%	171,694	63,913	14,852	50,930	107,669	50,624	97,252	147,876	-23%	-8%	-2%	-4%
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-180	-3%	-11%	-6%		-3%	-11%	-3%	-11%								
RUN265	Non-spatial	Years 1-20	233,343	145,387	378,730	62%	216,090	72,232	17,253	73,155	135,510	69,581	127,796	197,377	-4%	26%	29%	28%
		Years 21-180	187,782	138,738	326,520	58%	170,051	82,681	17,731	56,057								
RUN265-Stanley	Spatial (DFMP settings)	Years 1-20	211,643	142,396	354,039	60%	195,994	70,746	15,648	71,650	122,908	60,483	124,805	185,288	-13%	9%	26%	20%
		Years 21-180	195,181	114,858	310,039	63%	176,751	68,450	18,430	46,408								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-9%	-2%	-7%		-9%	-2%	-9%	-2%								
		Years 21-180	4%	-17%	-5%		4%	-17%	4%	-17%								
RUN265-TOTCUT_4DEV	Spatial (reduced deviations)	Years 1-20	215,841	128,282	344,123	63%	199,882	63,734	15,959	64,548	125,346	62,243	110,691	172,934	-11%	13%	12%	12%
		Years 21-180	181,552	124,536	306,088	59%	164,409	74,217	17,143	50,319								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-8%	-12%	-9%		-8%	-12%	-8%	-12%								
		Years 21-180	-3%	-10%	-6%		-3%	-10%	-3%	-10%								
RUN275	Non-spatial	Years 1-20	233,343	140,391	373,734	62%	217,132	67,715	16,211	72,676	136,164	68,928	122,800	191,727	-3%	25%	24%	24%
		Years 21-180	182,817	133,542	316,359	58%	166,677	78,179	16,140	55,363								
RUN275-TOTCUT	Spatial (reduced deviations)	Years 1-20	222,366	124,171	346,538	64%	206,918	59,892	15,448	64,280	129,758	64,356	106,580	170,936	-8%	16%	8%	11%
		Years 21-180	178,021	120,477	298,498	60%	162,304	70,530	15,717	49,947								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-5%	-12%	-7%		-5%	-12%	-5%	-12%								
		Years 21-180	-3%	-10%	-6%		-3%	-10%	-3%	-10%								
RUN276	Non-spatial	Years 1-20	233,343	145,545	378,889	62%	216,248	72,994	17,095	72,552	135,609	69,482	127,954	197,436	-4%	26%	29%	28%
		Years 21-180	183,102	132,871	315,973	58%	167,190	77,335	15,912	55,536								
RUN276-TOTCUT	Spatial (reduced deviations)	Years 1-20	217,618	129,838	347,456	63%	201,675	65,116	15,943	64,722	126,471	62,896	112,247	175,143	-10%	14%	13%	13%
		Years 21-180	176,536	116,709	293,246	60%	161,195	67,929	15,342	48,781								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-7%	-11%	-8%		-7%	-11%	-7%	-11%								
		Years 21-180	-4%	-12%	-7%		-4%	-12%	-4%	-12%								
RUN277	Non-spatial	Years 1-20	210,762	142,609	353,371	60%	193,551	73,380	17,211	69,229	121,376	61,134	125,018	186,152	-14%	11%	26%	21%
		Years 21-180	188,462	130,188	318,649	59%	173,088	74,528	15,374	55,659								
RUN277-TOTCUT	Spatial (reduced deviations)	Years 1-20	202,998	122,947	325,945	62%	186,421	63,263	16,577	59,684	116,905	57,841	105,356	163,197	-17%	5%	6%	6%
		Years 21-180	177,987	119,711	297,698	60%	163,468	68,531	14,520	51,180								
	Spatial reduction (or apparent increase for spatial considerations)	Years 1-20	-4%	-14%	-8%		-4%	-14%	-4%	-14%								
		Years 21-180	-6%	-8%	-7%		-6%	-8%	-6%	-8%								

* All harvest levels are reduced by within block retention and cull

** Primary and incidental harvest levels are determined by reducing the 180 year average harvest level by the appropriate spatial reduction

Primary conifer is coniferous harvest from C, CD, and DC stands, primary decid is deciduous harvest from D stands

Conclusions and Next Steps

The timber supply analysis undertaken by the quota holders investigated potential harvest levels under a range of management strategies employing existing silviculture treatments and forest policy options. This analysis demonstrated that increases in conifer harvest levels beyond those proposed in Weyerhaeuser's draft plan submission are possible utilizing existing conifer silviculture treatments and stand conversion. The 1996 conifer harvest level which was in effect when the quotas were issued can only be obtained for a short period of time employing a combination of silviculture, stand conversion and surge cutting with a planned step down in harvest levels. Surge cutting produces only a small reduction in the long-term sustainable harvest levels, demonstrating that the surge cutting principle of capturing stands before volume decay is applicable in W6.

The quota holders developed and presented two recommended forest management strategies as feasible options for forest management in W6. These strategies emerged after over 100 alternatives were investigated during the analysis. The difference between the two recommended strategies is the approach to landbase management, traditional divided landbase or single combined landbase. The quota holders are willing to accept the reduced harvest level associated with the combined landbase approach but many issues such as quota adjustment rules must be clarified first.

This analysis was not designed to set an allowable cut level for W6, nor produce operational sequences, but rather to investigate the range of feasible harvest levels. The scenarios presented here should be used as a guide for selecting appropriate management strategies, the general level of intensity and the approximate associated harvest level. Except as noted, these scenarios are based on the yield curves, landbase and management strategies submitted by Weyerhaeuser. It is the quota holder's understanding that the department's regulatory review has not yet been completed and thus changes could be forthcoming to some of the submitted draft plan assumptions and data sets. Changes could have an impact upon the results developed by the quota holders due to the common shared data sets and therefore, these results should be considered as preliminary and applied appropriately.

Application of the results and strategies presented here could be accomplished by operationalizing the strategies and the associated harvest and silviculture sequences within the DFMP framework. Application within the DFMP framework would involve selecting the appropriate strategies from the assumptions presented here and applying these with an approved landbase and yield curve set. The regenerated yield curves developed by the quota holders would require regulatory review, as would some of the recommended management assumptions.

Once the regulatory phase is completed, the operational component can be dealt with. This would involve clarification and negotiation of the linkages to the lower level plans among all the parties, and an understanding of the rules for on-the-ground implementation. With this understanding, the harvest and silviculture sequences could then be fine tuned for operational efficiencies. The result would be a strategic plan that is both implementable and closely linked to lower level plans.

Appendices

Detailed Result Summaries for 6 additional runs presented

- Divided Landbase
    - Run 411 (even flow)
    - Run 476 (20 year surge)
    - Run 477 (reduced 20 year surge)
- Combined Landbase
    - Run 211 (even flow)
    - Run 276 (20 year surge)
    - Run 277 (reduced 20 year surge)

Updated Total AAC Run Summaries

- Table 1; Divided Landbase Results 60-year average harvest levels
- Table 2; Divided Landbase Spatial Results 60-year average harvest levels
- Table 3; Divided Landbase Results 180-year average harvest levels
- Table 4; Divided Landbase Spatial Results 180-year average harvest levels
- Table 5; Combined Landbase Results 60-year average harvest levels
- Table 6; Combined Landbase Spatial Results 60-year average harvest levels
- Table 7; Combined Landbase Results 180-year average harvest levels
- Table 8; Combined Landbase Spatial Results 180-year average harvest levels