



**BRITISH  
COLUMBIA**

Ministry of Forests  
and Range

# **INTERIOR MARKET PRICING SYSTEM**



**June 1, 2006**



Revenue  
Branch

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The purpose of this paper is to provide a general overview of the Interior Market Pricing System<sup>1</sup>.

### 1.0 THE MARKET PRICING SYSTEM

On July 1, 2006, stumpage rates for timber harvested under long term tenures<sup>2</sup> in the Interior will be determined using the Market Pricing System (MPS).

The central concept underlying the MPS is that auctions of standing timber establish the market value of the timber, and those market values can then be used to determine the stumpage price for the timber harvested under long term tenures.

Technically, MPS is a “transaction evidence pricing” system. The evidence from transactions (i.e., the results of the auction sales) is used to determine the price of other stands of timber.

Pricing systems like the MPS are common. The U.S. Forest Service and many U.S. states use similar approaches to appraise standing timber. In the market for crude oil, the benchmark price for West Texas intermediate crude oil is established on the New York Mercantile Exchange, and this price is adjusted to value oil with different characteristics (e.g., sulphur content, viscosity, etc.). Finally, each day in the stock market some shares in each firm are bought and sold and the results of those transactions are used to establish the value of all the shares that were not sold.

The Interior MPS determines stumpage rates in two steps.

- First, the average market price for the timber under long term tenures is calculated. Using auction data, this is the market value of the timber adjusted for long term tenure obligations (see Section 2.0).
- Second, a stumpage rate is determined for each cutting authority. The stumpage rate for a specific cutting authority is higher or lower than the average market price, if the timber in that cutting authority is more or less valuable than average (see Section 3.0).

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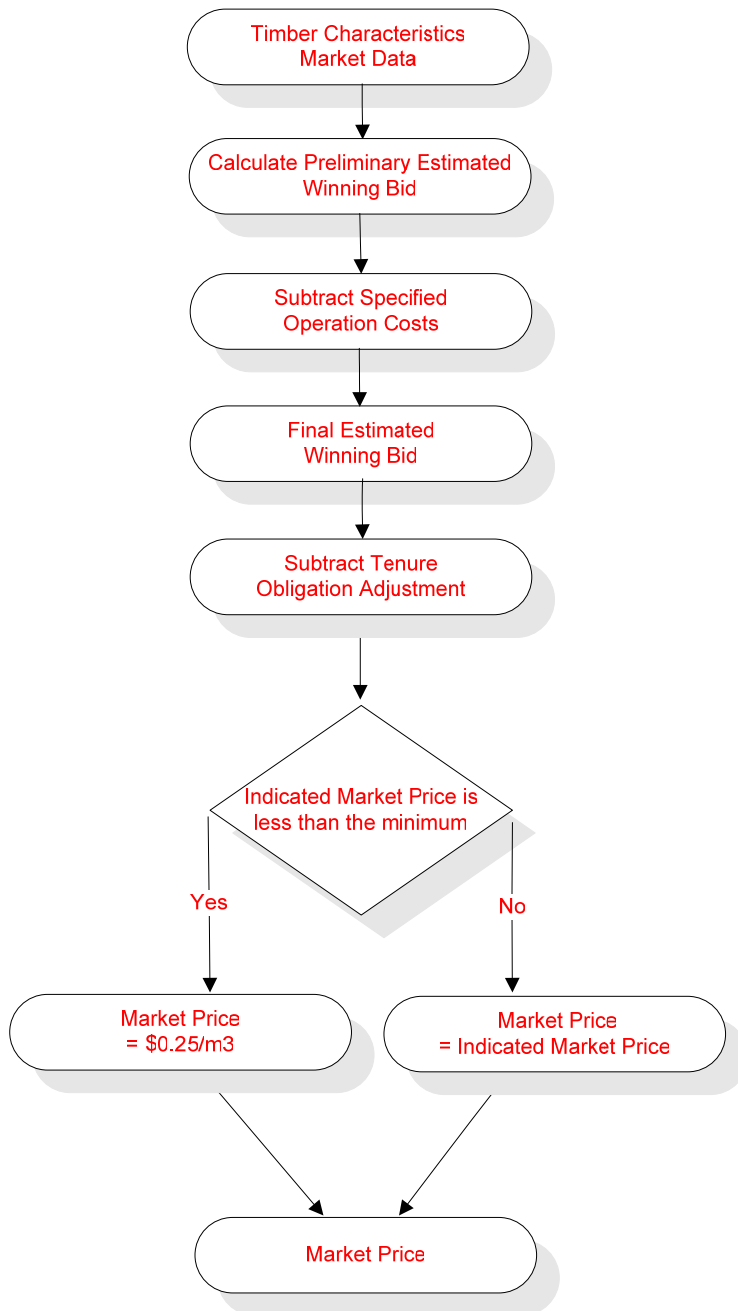
<sup>1</sup> This paper is not intended to provide the basis for calculating stumpage rates nor should it be used as guidance for interpreting the legal policies and procedures for calculating stumpage rates, which will be contained in the *Interior Appraisal Manual*. The *Interior Appraisal Manual* contains the policies and procedures referred to in Section 105 of the *Forest Act*.

<sup>2</sup> Tree farm licences, forest licences, timber licences, woodlot licences, etc.  
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## 2.0 CALCULATING THE AVERAGE MARKET PRICE

With the MPS equations, the average market price is calculated using the procedure in Figure 1, below. This calculation is done for each cutting authority of each tenure and then the average market price is calculated.

Figure 1, MPS Methodology



## Interior Market Pricing System

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In more detail, the main steps in the methodology for calculating the average market price are as follows.

**Step 1:**  
Timber Characteristics  
Market Data

For each cutting authority, the first step is to collect data about the timber. The data includes information on the species of trees, location, lumber prices, harvesting system, slope, etc. All of the information is statistically important in estimating timber value (see Appendix 1 for a List of Variables for which data is required).

**Step 2:**  
Calculate Preliminary  
Estimated Winning Bid

Next, a preliminary estimated winning bid is calculated for the timber (see the statistical equation in Appendix 2 that is used for this calculation<sup>3</sup>) using the data from Step 1. This equation, based on previous auction sales, estimates the market value or expected bid price of the timber, if the timber were sold at auction.

**Step 3:**  
Final Estimated  
Winning Bid

The final estimated winning bid is calculated by subtracting the estimated cost of specified operations (these are unique logging systems or situations that are not represented in the auction data used to derive the MPS equations).

For example, there are no auction sales that have been harvested with skyline logging systems. Therefore, an adjustment is made to account for the extra cost of skyline logging if timber will be harvested with this system.

**Step 4:**  
Market Price

For timber sold under long term tenure, the final estimated winning bid for each cutting authority (Step 3) is reduced by the amount of the tenure obligation adjustment, to give the market price for the timber.

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<sup>3</sup> The equation in Appendix 2 is based on the regressions in Appendices 3 and 4.  
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## Interior Market Pricing System

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Tenure obligation adjustments are necessary for timber sold under long term tenure because, unlike bidders in an auction, the licensee is generally responsible for the cost of planning, main road building and silviculture. For example, a licensee may spend \$20 per cubic metre planning, building road access to, and reforesting a particular cutting authority. If the bidder in an auction had to absorb this cost (which they do not), the expected bid would be \$20 per cubic metre less.

**Step 5:**  
Average Market Price

Finally, the average market stumpage price for the Interior is calculated by volume weighting the market prices for each cutting authority.

### 3.0 DETERMINATION OF THE CUTTING AUTHORITY STUMPAGE RATES

Once the average market price (Section 2.0) has been established, a stumpage rate is calculated for each cutting authority.

The stumpage rate for a specific cutting authority is higher or lower than the average, if the timber in the cutting authority is more or less valuable than the average. This results in a wide range of stumpage rates.

The relative value of the timber in each cutting authority depends upon estimates of both the total selling price of products which could be generated from the timber, and the cost of producing them. The difference between the estimated selling price and the estimated cost of production is termed the “value index”. The value index is considered to be useful in relative terms only, i.e., when comparing one stand’s value index to another, or to the average value index of all stands.

The stumpage rate is calculated, as follows.

$$IR = BR + (VI - MVI)$$

Where	IR	= indicated rate for the appraised timber.
	BR	= base rate for the Interior, as appropriate.
	VI	= cutting authority value index.
	MVI	= mean value index for the Interior, as appropriate.

The indicated rate, base rate, value index and mean value index are all expressed as dollars per cubic metre.

The indicated rate is then compared to the prescribed minimum rate (currently \$0.25 per cubic metre). The stumpage rate is the higher of the two.

#### **Determination of the Base Rate**

Some cutting authorities are charged the prescribed minimum rate (\$0.25 per cubic metre) even though the indicated rate is less. The Interior average market price is adjusted to offset this, as well as to offset the low quality logs priced at \$0.25 per cubic metre. The adjusted average market price is called the base rate.

### **Determination of the Value Index**

The value index is defined as the selling price less the operating cost, both of which are appraisal estimates expected for an average operator in that stand. The formula used is:

$$VI = SP - OC$$

Where

VI	= value index for the cutting authority.
SP	= estimated prorated selling price for the merchantable species and grades appraised on the cutting authority.
OC	= estimated prorated operating cost applicable to the timber being appraised.

The value index, selling price and operating cost are all expressed as dollars per cubic metre.

### **Determination of the Mean Value Index**

The mean value index is the volume weighted average of the value indexes for all cutting authorities on which harvesting has taken place during the recent 12 month period. It is the benchmark against which individual stands of timber are compared.

### **3.1 NEW APPRAISALS**

Site specific data is collected for each stand of timber to be appraised. This data is used in the calculations to estimate the stand selling price, operating costs and value index, and finally the stumpage rate, as explained in Section 3.0.

### **3.2 REAPPRAISALS**

If circumstances change significantly on a cutting permit (for example, helicopter logging is now required instead of conventional logging), the stumpage rate will be redetermined using the same procedure as for new appraisals. Any changes in the data, market prices or policy will be considered in the reappraisal.

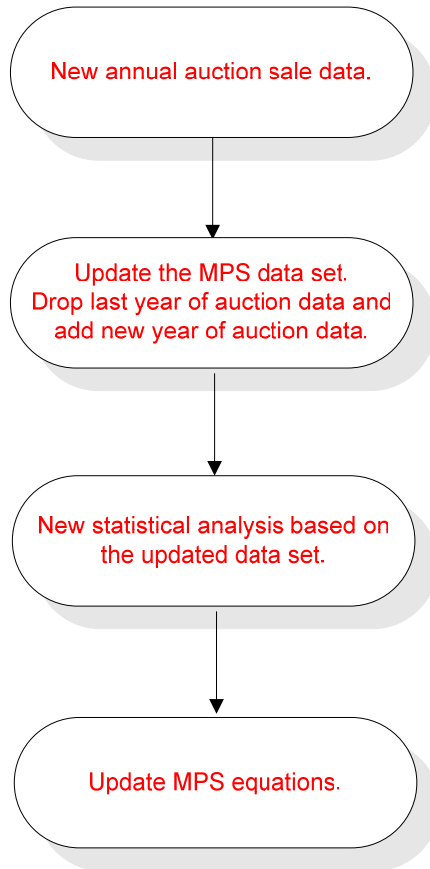
### **3.3 STUMPAGE ADJUSTMENTS**

Every three months (January 1, April 1, July 1 and October 1), the stumpage rate for each cutting permit will be adjusted to account for changes in the selling prices of lumber and chips. At these times, the average market price, base rate and mean value index are all recalculated as well, to adjust to the changes in the market.

#### 4.0 MPS UPDATE METHODOLOGY

The update procedure is illustrated in Figure 2, below. Each year, new data is available from recent auction sales. The data base is updated by adding the new data from recent auction sales and removing the oldest data. Statistical analysis is then employed to update the MPS equations.

Figure 2, MPS Update Methodology



## **5.0 SUMMARY**

The introduction and implementation of the MPS is a significant change in Interior forest policy.

After July 1, 2006, the overall level of stumpage in the Interior will be driven by market forces, using auctions of standing timber.

**APPENDIX 1**

**APPENDIX 1: List of Variables**

Real Stand Average Lumber Value Index	Estimated stand lumber value (\$/m <sup>3</sup> ) in 1997 dollars. Weighted average of (LRF * lumber price by species).
Exchange Rate (\$Cdn/\$US)	Bank of Canada average monthly rate for the month beginning two months prior to the stumpage adjustment date.
Fir Fraction	Fraction of net coniferous cruise volume that is Douglas fir.
HemBal Fraction	Fraction of net coniferous cruise volume that is hemlock and balsam.
Cedar Fraction	Fraction of net coniferous cruise volume that is cedar.
Volume per Hectare/1000	Total net coniferous cruise volume per hectare (cubic metres per hectare)/1000.
LOG (Volume/1000)	Natural logarithm of (net coniferous cruise volume/1000).
1/Volume per Tree * (1-HemBal Fraction)	Volume/Tree = net coniferous cruise volume/number of coniferous stems in the cutting permit.
Deciduous Fraction	Net deciduous cruise volume/(net deciduous cruise volume + net coniferous cruise volume).
Decay Fraction	Weighted average species decay % from cruise/100.
Slope %	Weighted average harvest method side slope from cruise (%).
Partial Cut Fraction	Fraction of net coniferous cruise volume that is appraised as partial cut.
Cable Yard Fraction	Fraction of net coniferous cruise volume that is appraised as overhead cable yarding.
Helicopter Logging Fraction	Fraction of net coniferous cruise volume that is appraised as helicopter yarding.
Horse Logging Fraction	Fraction of net coniferous cruise volume that is appraised as horse yarding.
Fire Damage Fraction	Fraction of net coniferous cruise volume that is fire damaged.
Cycle Time	Hauling round trip cycle time from the landing to the point of appraisal or water dump site and return (hours).
Tow Distance	Lake tow distance (one way km).
Salvage Logging Indicator	1 if greater than one third of net coniferous cruise volume is attacked by mountain pine beetle or other forest pests, 0 otherwise.
Fort Nelson – Peace Zone (AMVZ9)	1 if cutting authority is appraised using Selling Price Zone 9, 0 otherwise.
2005 Auctions	1 for 2006 cutting permits.
District Average Number of Bidders	Average number of bidders by district from the auction dataset.
CPI	Monthly BC consumer price index (Stats Can-P110000).

**APPENDIX 2**

**APPENDIX 2: MPS Interior –Combined Equation**

	Estimated Winning Bid	Equals	( 37.65	
Plus	Real Stand Lumber Price (\$/m <sup>3</sup> )	Times	0.20	
Minus	Exchange Rate (C\$/US\$)	Times	9.91	
Plus	Fir Fraction	Times	8.49	
Minus	HemBal Fraction	Times	12.37	
Plus	Cedar Fraction	Times	36.40	
Plus	Volume per Hectare (m <sup>3</sup> /ha)/1000	Times	10.87	
Plus	Log of (Volume/1000)	Times	3.36	
Minus	1/Volume per tree * (1-HemBal fraction)	Times	2.58	
Minus	Deciduous Fraction	Times	14.13	
Minus	Decay Fraction	Times	33.81	
Minus	Slope (%)	Times	0.03	
Minus	Partial Cut Fraction	Times	2.17	
Minus	Cable Yard Fraction	Times	10.97	
Minus	Helicopter Fraction	Times	35.06	
Minus	Horse Logging Fraction	Times	13.85	
Minus	Fire Damage Fraction	Times	21.72	
Minus	Cycle Time (hrs)	Times	2.46	
Minus	Tow Distance (km)	Times	0.03	
Minus	Salvage (1/0)	Times	3.40	
Minus	Fort Nelson – Peace (1/0)	Times	3.76	
Plus	2005 Auctions (1/0)	Times	0.39	
Plus	District Ave. Number of Bidders	Times	0.60 )	X CPI / 109.3

**APPENDIX 3**

**APPENDIX 3: Interior Winning Bid Equation**

Dependent Variable: Real Winning Bid

Method: Least Squares

Sample: January 2001 to December 2005

Included observations: 1182

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	24.40171	2.702258	9.030120	0.0000
Real stand average lumber value index	0.159428	0.021125	7.546786	0.0000
Fir fraction	6.796802	1.385871	4.904354	0.0000
HemBal fraction	-9.908752	1.881195	-5.267265	0.0000
Cedar fraction	29.15937	4.721543	6.175813	0.0000
Volume per hectare/1000	8.706226	2.849444	3.055413	0.0023
LOG(volume/1000)	2.691565	0.259593	10.36842	0.0000
1/Volume per tree * (1-HemBal fraction)	-2.069715	0.256723	-8.062047	0.0000
Grade 3 fraction	11.31771	1.687208	6.707950	0.0000
Deciduous fraction	-11.32074	2.520243	-4.491924	0.0000
Decay fraction	-27.08290	6.550829	-4.134271	0.0000
Cableyard fraction	-8.789590	1.425948	-6.164032	0.0000
Helicopter logging fraction	-28.08467	2.976973	-9.433969	0.0000
Horse logging fraction	-9.391041	1.088346	-8.628725	0.0000
Fire damaged fraction	-17.39914	1.165400	-14.92976	0.0000
Cycle time	-1.971888	0.143949	-13.69849	0.0000
Tow (Distance)	-0.026901	0.021584	-1.246343	0.2129
LOG(Number of Bidders)	5.341422	0.283647	18.83123	0.0000
Salvage logging indicator	-2.160891	0.546376	-3.954949	0.0001
Fort Nelson – Peace Zone	-3.008954	0.763534	-3.940827	0.0001
2002 auctions	-0.465792	0.651657	-0.714781	0.4749
2003 auctions	-2.056223	0.799835	-2.570809	0.0103
2004 auctions	-3.606570	0.689710	-5.229112	0.0000
2005 auctions	1.022189	0.833623	1.226200	0.2204
R-squared	0.689451	Mean dependent var		36.15659
Adjusted R-squared	0.683282	S.D. dependent var		12.74323
S.E. of regression	7.171592	Akaike info criterion		6.798228
Sum squared resid	59557.95	Schwarz criterion		6.901273
Log likelihood	-3993.753	F-statistic		111.7771
Durbin-Watson stat	1.622383	Prob(F-statistic)		0.000000

**APPENDIX 4**

**APPENDIX 4: Interior Number of Bidders Equation**

Dependent Variable: LOG (Number of Bidders)

Method: Least Squares

Sample: January 2001 to December 2005

Included observations: 1182

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.658527	0.471250	1.397406	0.1626
Forecast real winning bid	0.037255	0.001681	22.16828	0.0000
District average number of bidders	0.090192	0.014414	6.257363	0.0000
Exchange rate (\$Cdn/\$US)	-1.485989	0.736403	-2.017900	0.0438
Partial cut fraction	-0.325923	0.115309	-2.826510	0.0048
Slope %	-0.004579	0.001252	-3.657875	0.0003
Horse logging fraction	-0.318166	0.104049	-3.057847	0.0023
Salvage logging indicator	-0.105875	0.033700	-3.141695	0.0017
Spring auction indicator	0.221511	0.045055	4.916477	0.0000
Winter auction indicator	-0.073479	0.040227	-1.826619	0.0680
2002 auctions	-0.093070	0.052200	-1.782964	0.0749
2003 auctions	0.231395	0.081241	2.848263	0.0045
2004 auctions	0.026096	0.114182	0.228550	0.8193
2005 auctions	-0.132164	0.150419	-0.878641	0.3798
R-squared	0.417061	Mean dependent var		1.184766
Adjusted R-squared	0.410573	S.D. dependent var		0.706209
S.E. of regression	0.542186	Akaike info criterion		1.625360
Sum squared resid	343.3523	Schwarz criterion		1.685469
Log likelihood	-946.5876	F-statistic		64.27996
Durbin-Watson stat	1.806026	Prob(F-statistic)		0.000000