



Delivered Log Cost Analysis for the Kalum Forest District



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Executive Summary

Northwest Timberlands was retained to conduct a Delivered Log Cost Analysis for the Kalum Forest District. This includes the Kalum TSA, TFL 1, TFL 41 and the Nass TSA.

Delivered Log Cost is the total cost to deliver timber from the forest to its final destination. It is comprised of hauling, harvesting, administration, silviculture and road development. For this analysis the assumption has been made that the final destination is Terrace, Kitwanga or Stewart.

For the forest industry in the Northwest to once again be a significant contributor to the regional economy the Northwest needs to attract other forest 'industrial' players (i.e. pellet plant, bioenergy) into the area. The purpose of this Delivered Log Cost Analysis is to provide an estimate of delivered log costs for these new industrial 'players'.

The range of delivered log costs (conventional volume) in the Kalum District is:

Area	Range	Volume (m ³)	Delivery point(s)
Kalum TSA, TFL 1, TFL 41 (on-shore):	\$41.50/m ³ to \$75.90/m ³	41.5 million	Terrace
Nass TSA:	\$53.60/m ³ to \$71.00/m ³	42.1 million	Stewart, Kitwanga, Terrace
TFL 41 (off-shore):	\$92.80/m ³ to \$100.25/m ³	6.2 million	Terrace

The average costs for the most economical portion of the conventional profile are:

	Kalum TSA, TFL 1, TFL 41 (on-shore) (\$/m ³)	Nass TSA (\$/m ³)	TFL 41 (off-shore) (\$/m ³)
Most economical 1,000,000 m ³	52.73	53.68	92.98
Most economical 2,000,000 m ³	53.57	53.89	93.38
Most economical 3,000,000 m ³	53.95	53.99	93.72
Most economical 4,000,000 m ³	54.16	54.04	93.99
Most economical 5,000,000 m ³	54.44	54.07	94.15

The methodology utilized to determine the delivered log costs for the Kalum District has some limitations. However, before conducting additional or more detailed analyses, it is suggested that the results from this delivered log cost analysis be promoted and distributed. If feedback to this report indicates a need for more precise data, additional analyses could be undertaken.

Smaller polygons would reduce the variance in the range of delivered log costs in each polygon. The lower variance would primarily be the result of a more defined cycle time. Furthermore, polygons that are in close proximity to the delivery centers (i.e. Terrace) are particularly relevant as the timber in these polygons will provide for the lowest delivered log cost.

Utilizing the most current inventory information would capture the most recent harvesting and current constraints on the landbase (i.e. Tailed Frog Habitat, Grizzly Bear WHA). This would assist in minimizing the over estimation of the THLB.

This analysis does not consider additional volume that might come from portions of the timber stands that are currently considered to have no economic value. By utilizing more of the timber profile the overall delivered log cost may be lowered when compared with current utilization. This is an important consideration as potential new biofuel or bio-energy players in the Northwest will likely be interested in wood fibre or biomass. Any subsequent delivered log cost analysis should incorporate the effect of biomass/ wood fibre through a sensitivity analysis.

Given the strategic and broad level of this analysis, the delivered log costs to Terrace, Kitwanga and Stewart should be considered a baseline estimate of operating costs in the Kalum. This data can be used to provide an initial indication to a prospective industrial 'player' of the operating costs within the Kalum District.

Key Map

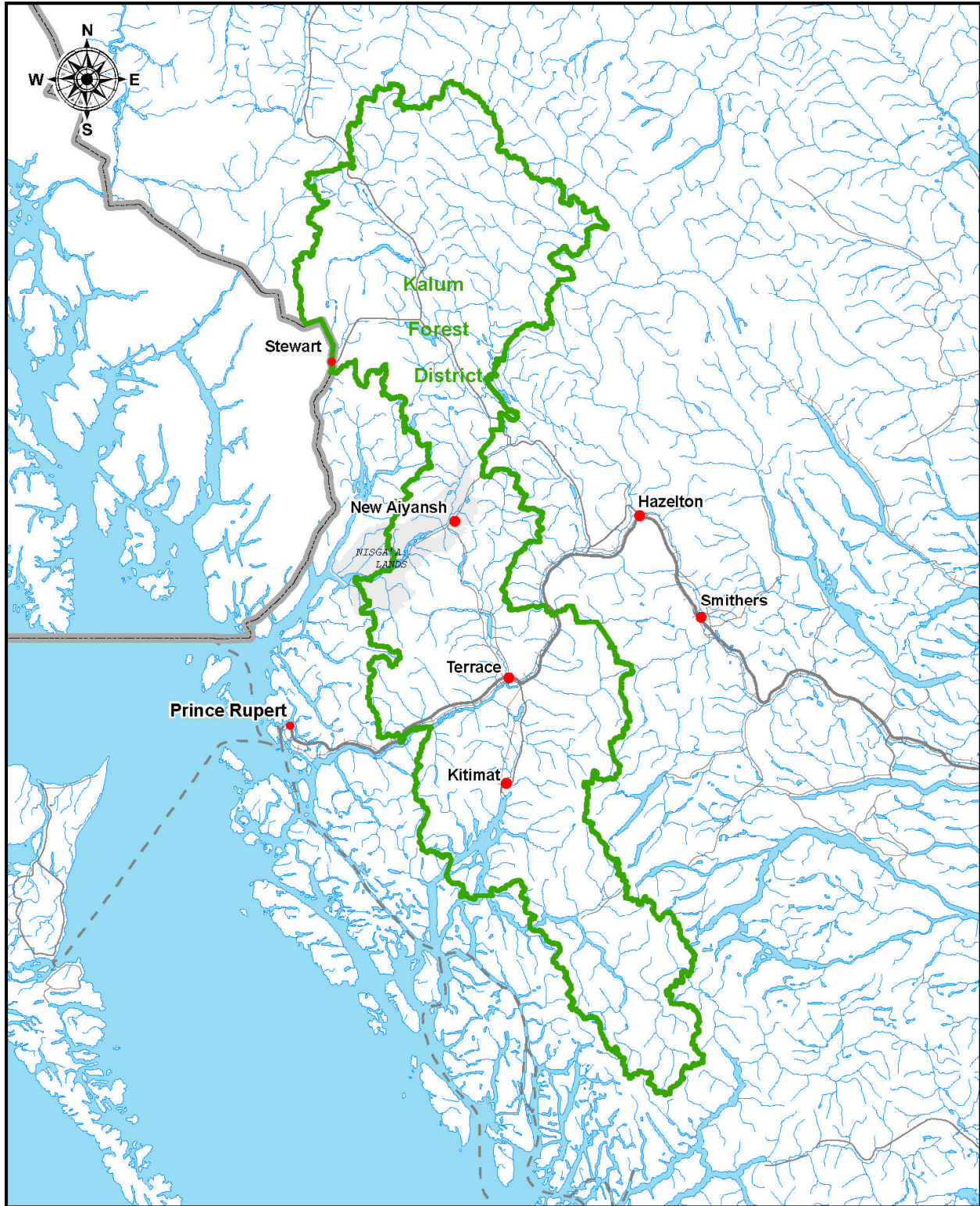


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1 Overview

The forest industry in Northwest BC (Hazelton – Prince Rupert) was once a dominant contributor to the economy. As recently as eight years ago the Northwest had two pulp mills and five sawmills. One of the pulp mills was subject to a permanent closure in 2001, and the other sources its chips primarily from outside the region. Of the five sawmills three no longer exist, one is indefinitely closed, and the other is in receivership.

For the forest industry to once again be a significant component of the regional economy, the Northwest needs to attract other forest industrial ‘players’ (e.g. sawmill, pellet plant, bioenergy) into the area.

A key cost for any industry is the cost and supply of raw material. It is envisioned that some of the new industrial ‘players’ will require raw logs as an input for their final product. The intent of this Delivered Log Cost Analysis is to provide an initial estimate of delivered log costs for these new industrial ‘players’.

BC’s Pacific Northwest includes forests along the Highway 16 corridor between Hazelton and Prince Rupert and the Highway 37 corridor from Kitimat to Terrace and Kitwanga to Stewart. This area includes portions of the Skeena-Stikine Forest District (Kispiox TSA, Cassiar TSA), the Kalum Forest District (Kalum TSA, Nass TSA, TFL 1, TFL 41) and the North Coast Forest District (North Coast TSA). This analysis is currently restricted only to the Kalum Forest District. The analysis should be considered strategic and offers a preliminary estimate for the delivery of logs to Terrace, Kitwanga, and Stewart. If this information is found to be useful, the analysis can be expanded to include the rest of the Northwest.

2 General Methodology

The Kalum Forest District was split into three distinct areas. The Kalum TSA, TFL 1 and the on-shore portion of TFL 41 was considered one area. The other two areas were the Nass TSA and the off-shore portion of TFL 41.

Each distinct area was further divided into smaller polygons (generally following watershed boundaries) from which a delivered log cost to Terrace, Kitwanga or Stewart was calculated from. Each watershed had a Timber Harvest Landbase (THLB) attributed to it so an estimated timber volume could be attached to each polygon.

3 General Parameters

The delivered log cost is comprised of hauling, harvesting, administration, silviculture and road development. Stumpage or BC Timber Sales (BCTS) upset prices were not included in the analysis as they vary in a non-predictable fashion, depending on provincial policy / procedures.

3.1 Hauling

A simple cycle time calculation was performed from the mid-point of each basin / polygon. For most of the areas the calculations were rounded to the nearest \$0.50/m³. Distance calculations were taken from the *Approved Kalum Forest District Appraisal Speeds and Hauling Distances Spread-sheet*. For the majority of the roads Empty / Loaded haul speeds were also taken from the *Appraisal Speeds and Hauling Distances Spread-sheet*. The exception was the Nisga’a Highway from Terrace to the Nass (Junction Y) and from Junction Y to Greenville. An assumption was made that the haul speeds for these road sections in the Appraisal Spreadsheet did not reflect the recent highway improvements.¹ Although the actual cost per tonne-hour will vary depending on whether pulp or sawlog is being hauled an average of \$3.00/tonne-hour was used for the cycle time calculation. One hour was used for the load/unload/delay portion of the cycle time calculation.

¹ Haul speeds were increased to 65 km/hr (loaded) and 75 km/hr (empty) for both sections. Haul speeds in the Appraisal Spreadsheet are 55 km/hr (loaded) and 65 km/hr (empty) for the portion from Terrace to the Nass (Junction Y) and 40 km/hr (loaded) and 60 km/hr (empty) for the portion from Junction Y to Greenville.

For the calculation of the cycle times the final destination for each polygon was Terrace, Stewart or Kitwanga. An assumption was made that timber would go to the location that allowed for the shortest cycle time. So for instance, depending on the location of a polygon in the Nass TSA timber was appraised to Terrace, Stewart or Kitwanga.

Individual cycle times were not calculated for the off-shore portion of TFL 41. As is common practice along the Coast the hauling cost is incorporated into the On Truck Rate.

3.2 Harvest Rate (On Truck Rate)

For the Kalum TSA, TFL 1 and the on-shore portion of TFL 41 local experience² and past harvesting practices were used to determine the appropriate mix of ground based versus cable harvest. Non-conventional harvest methods (i.e. helicopter, long-line skyline) have very high operational costs, and due to the comparatively low value of forested stands in this area, were not considered as a harvesting option due to their high costs.

For the off-shore portion of TFL 41 the mix between conventional (ground based and cable) and non-conventional (helicopter) was determined in conjunction with BCTS (Skeena Business Unit), the primary licensee in the off-shore portion of TFL 41.

In the Nass TSA, Harvest Method Mapping (Ministry of Forests and Range, 2006) and field reconnaissance information provided by BCTS was used to delineate the proportion of ground based and cable harvest.

Although the harvesting rates applied for ground based, cable, conventional and non-conventional in the delivered log cost analysis represents an average rate, the actual on truck rate will vary for each harvest unit depending on the location, terrain and timber quality.

	Ground Based (\$/m ³)	Cable (\$/m ³)	Off-shore conventional (i.e. non-heli) (\$/m ³)	Heli-Ocean (\$/m ³)	Heli-Land (\$/m ³)
Kalum TSA	20	28	-	-	-
TFL1	20	28	-	-	-
TFL 41 (on-shore)	20	28	-	-	-
TFL 41 (off-shore)	-	-	46 to 50	86	108
Nass TSA	22	30	-	-	-

3.3 Administration

Administration costs include forest planning, license fees, road maintenance and overhead. Through discussions with some licensees a cost of \$7.50/m³ was viewed as an appropriate number for the majority of the Kalum Forest District. For the off-shore portion of TFL 41 administration was increased to \$10.00/m³ to recognize that the area is only accessible via water or air transport.

3.4 Silviculture Rate

While actual silviculture costs will vary depending on the stand-level prescription for individual areas, average rates for silviculture were used. These are based on a combination of discussions with licensees and the review of the Interior Appraisal Manual (*effective July 2007*).

	Predominant BEC Zone	Silviculture Rate (\$/m ³)
Kalum TSA	CWH ws1	3.50
TFL 1	CWH ws1	3.50
TFL 41 (on-shore portion)	CWH ws1	3.50
TFL 41 (off-shore portion)	CWH ws1	4.00
Nass TSA	ICH mc1	3.50
Nass TSA	ICH vc	5.00

² Personnel at NWTL Have worked extensively throughout the Kalum District since the 1980s. In the past two years, NWTL personnel have conducted over 1,000,000 m³ of timber reconnaissance in a variety of areas through-out the Kalum District.

3.5 Road Development Cost

For the Kalum TSA, TFL 1 and TFL 41 (on-shore) an average road development cost (\$/m³) for each polygon was calculated by estimating the amount of volume one kilometre of road would develop in that polygon divided by the estimated cost per lineal meter of road construction in that polygon. Generally in drainages that do not have significant prior development the volume of timber developed from one kilometre of road would be higher compared to a drainage that has an extensive harvest history as a substantial amount of road may be required to access small (residual) parcels of timber. Furthermore in constrained areas (i.e. terrain, visual), more road will be required to develop the same amount of timber when compared to an unconstrained area.

For the Nass TSA the above methodology was utilized in conjunction with calculations of development costs from prior BCTS Timber Sales in the Nass TSA.

In TFL 41 (off-shore) road development costs were based on calculations of development costs from prior BCTS Timber Sales in the off-shore portion of TFL 41.

From historical road rates and local knowledge the range of road costs (\$/lineal m) used³ in the above calculations were:

<i>Area</i>	<i>Range</i>
<i>Kalum TSA, TFL 1, TFL 41 (on-shore):</i>	<i>\$45/m to \$95/m</i>
<i>Nass TSA:</i>	<i>\$35/m to \$50/m</i>
<i>TFL 41 (off-shore):</i>	<i>\$120/m</i>

4 Polygon Designation

4.1 Kalum TSA, TFL 1, TFL 41 (on-shore) and Nass TSA

The polygons used to calculate the delivered log costs in the Kalum TSA, TFL 1, TFL 41 (on-shore) and the Nass TSA were from polygons delineated by the Ministry of Forests and Range through the Timber Reallocation Northwest Mountains Pricing Analysis Process in 2003/2004.

The decision was made to use the polygons from the Reallocation Process as each polygon already had a Timber Harvesting Landbase (THLB) attributed to it, eliminating the requirement to create a new data-set for each licence. The calculation of the THLB in the Reallocation Process utilized the same information as was used during Timber Supply Review II (TSR II).

There are two limitations of using polygons from the Reallocation Process. The first limitation is the age of the data (2003 and prior) which will result in an overestimation of the THLB as the data does not reflect recent harvesting activity. Given that harvesting activity within the Kalum TSA, TFL 1 TFL 41 and Nass TSA has been limited since 2003 (no licensee has achieved their AAC) the possible over estimation of the THLB in the individual polygons is not considered a significant issue. The second limitation is that the delineation of the polygons was for a Timber Reallocation Process, not for a Delivered Log Cost Analysis. The areas of some polygons are quite broad, broader than would be preferable to calculate a delivered log cost.

The data provided by the Ministry of Forests and Range contained fields for the age of the timber in a polygon and fields for the quality of timber in a polygon. For the delivered log cost analysis only timber greater than 80 years in age was considered for the volume calculations. For the type of timber in a polygon (i.e. sawlog, marginal sawlog, pulp or other) it was the opinion of Northwest Timberlands Ltd. (NWTL) that the pulp percentage was over estimated for the majority of the polygons so it was decided to use local knowledge to determine the sawlog / pulp log percentage for each polygon. In addition to local knowledge for the Kalum TSA, TFL 1 and TFL 41 BCTS field reconnaissance data was also used to refine sawlog / pulplog percentages.

³ Actual road construction costs for the areas will be higher on a road by road basis. However, the figures presented here are the range of **averages** that were used.

4.2 TFL 41 (off-shore)

The polygons used to calculate the delivered log costs for the off-shore portion of TFL 41 were from polygons delineated by the Ministry of Forests and Range through a Forest Cover Inventory Value Analysis Project completed by the North Coast Field Team of the Skeena Business Unit of BCTS in November 2008.

The polygons from the Value Analysis Project were used as each polygon had a THLB attributed to it, eliminating the requirement to create a new data-set for the off-shore portion of TFL 41.

There is no reference to stand quality for the off-shore portion of TFL 41 as the BCTS Skeena Business Area has requested that the average stand value of individual polygons remains confidential. The timber in the off-shore portion of TFL 41 is too diverse with too many grades within a species to estimate a sawlog or pulp percentage as was done for the other areas in the Kalum District.

5 Results and Discussion – Kalum TSA, TFL 1, TFL 41(on-shore)

Tables 1 and 2 provide the results of the delivered log cost analysis for the Kalum TSA, TFL 1 and the on-shore portion of TFL 41. Figures 1 and 2 summarise this data graphically.

The analysis indicates that there is a range of delivered log costs in the Kalum TSA, TFL 1 and TFL 41 (on-shore) from \$41.50/m³ to \$75.90/m³. It must be stated that there is variation even between the lower and upper limits, as only an average delivered log cost was calculated from the midpoint of each polygon. The true range of delivered log costs in the Kalum TSA, TFL 1 and TFL 41 will vary between \$35.00/m³ and \$85-90/m³. The \$35 to \$45/m³ delivered wood will be from areas in close proximity to Terrace utilizing only or primarily ground based methods. For instance from field reconnaissance work conducted by Northwest Timberlands (NWTL) for various local licensees it is estimated that there is approximately 150,000 to 200,000 m³ of wood available with a delivered log cost of between \$35 to \$45/m³ (assuming \$0.25/m³ stumpage and Terrace is the final destination point for all the timber).

The above example illustrates two points. One is a limitation mentioned previously. Using polygons intended for a Timber Reallocation Process reduces the sensitivity of the calculations (some polygons are too broad). The second limitation is the concept of averages. One has to remember the delivered log cost numbers calculated in Table 1 are averages only and variation exists within each polygon. The minimum variation in each polygon is \$8.00/m³, the difference between an area 100% ground based and an area 100% cable based. Also all things being equal, the variation in a larger polygon is going to be greater when compared to a smaller polygon, due to the difference in hauling costs (cycle time) between the front and back of a drainage. Variation in a polygon will also occur for road development - some areas of the drainage may require capital expenditures such as bridges, whereas in other areas harvesting may be focussed on leave strips. Even silviculture costs can vary as on drier zonal sites natural regeneration maybe a viable alternative, whereas other areas may require planting and additional stand tending. Administration costs will not vary significantly within a polygon as a high proportion of it is comprised of fixed costs.

For the Kalum TSA, TFL 1 and TFL 41 an assumption that was made in the Delivered Log Cost Analysis is there would be no helicopter logging (i.e. no costs were allocated to helicopter logging). As the volumes in Table 2 are derived from the THLB that was used for the Reallocation Process it is likely that some of the THLB incorporates areas that can only be harvested via helicopter. This plus the fact that the THLB does not incorporate the most up to date harvest activity (data from TSR II process as previously mentioned), could result in an inflated volume attributed to each polygon. However, when non statistical net down factors were applied to each polygon (local knowledge was used – a range of 0% to 50% netdown for each polygon) the overall weighted delivered log cost remained essentially the same (variation of <1%), but the available timber declined from 51.8 million cubic meters to 41.5 million cubic meters or a 20% decline. Moreover, it is assumed that this potential decline in available timber will not have a significant effect on administration costs as administration costs are more closely aligned with the allowable annual cut of each licensee.

As was mentioned prior in *Section 3.1* an assumption was made that all wood would be delivered to Terrace, Stewart or Kitwanga. However, if timber from the areas surrounding Kitimat were delivered to

Kitimat instead of Terrace the delivered log costs from these polygons would be \$6.00/m³ less (haul from Kitimat to Terrace).

The polygons this would apply to are:

<i>Polygon</i>	<i>Location</i>	<i>Polygon</i>	<i>Location</i>
ge2721	Kitimat Valley	av3394	Jesse Lake
ge3353	Kitimat	av3330	N.Hirsch
ge3530	Kitimat	av3353	S.Hirsch
av3530	Wathl / Clio Bay	sb3330	N.Hirsch
ge3431	Bish Crk.	av3130	L.Wedeene
ge3394	Jesse Lake	av2789	Wedene
av3431	Bish Crk.		

The same premise as above applies to timber in the Lower Nass. If timber in polygons ge19034 (Ishkheenickh) and ge19033 (Kwiniak) was delivered to the Greenville Dryland Sort instead of Terrace the delivered log cost for the Ishkheenickh would be reduced by \$10.40/m³ (haul premium to Terrace) and \$9.40/m³ for the Kwiniak.

Table 1 – Delivered Log Cost Kalum TSA, TFL 1, TFL 41 (on-shore)

Polygon⁴	Location	Administration (\$/m³)	Road Development Cost (\$/m³)	On Truck Cost⁵ (\$/m³)	Truck Hauling Cost (\$/m³)	Silviculture Cost (\$/m³)	Delivered Log Cost (\$/m³)
sb2091	Sandur	7.50	5.00	20.00	5.50	3.50	41.50
sb19039	Skeena West II	7.50	8.50	24.00	10.00	3.50	53.50
sb19030	Deep Creek	7.50	12.00	24.40	6.50	3.50	53.90
un19039	Newton	7.50	10.00	25.60	8.00	3.50	54.60
ge19031	L.Big Cedar	7.50	9.00	25.20	9.50	3.50	54.70
sb2346	Thunderbird-Johnstone	7.50	12.00	24.40	7.50	3.50	54.90
sb19040	Skeena West I	7.50	9.50	24.00	10.50	3.50	55.00
ge19045	Erlandsen	7.50	9.50	27.20	7.50	3.50	55.20
ge2091	Williams Crk.	7.50	10.00	26.40	8.50	3.50	55.90
ge1258	North Headley	7.50	8.00	21.60	16.50	3.50	57.10
ge1776	Lower Copper	7.50	11.00	27.20	8.00	3.50	57.20
ge19036	L.Cedar	7.50	9.50	27.20	9.50	3.50	57.20
av2631	Chist Crk.	7.50	12.50	26.40	7.50	3.50	57.40
ge19046	Beaver	7.50	9.00	26.40	11.00	3.50	57.40
ge2382	Lower Clore	7.50	9.50	25.60	11.50	3.50	57.60
sb1677	Limonite	7.50	8.50	27.20	11.00	3.50	57.70
ge19042	Nelson	7.50	9.50	27.20	10.00	3.50	57.70
ge19032	Mayo	7.50	9.50	26.40	11.00	3.50	57.90
ge2721	Kitimat Valley	7.50	12.50	24.40	10.50	3.50	58.40
av2986	Bolton/Mackay	7.50	12.50	26.40	9.50	3.50	59.40
sb1435b	Limonite	7.50	9.50	24.40	14.50	3.50	59.40
ge19030	East Kalum	7.50	13.00	27.20	8.50	3.50	59.70
ge1374	Anweiller	7.50	9.50	26.00	13.50	3.50	60.00
ge3353	Kitimat	7.50	12.00	26.40	11.00	3.50	60.40
ge3530	Kitimat	7.50	12.00	26.40	11.00	3.50	60.40
av2721	Upper Kitimat River	7.50	12.50	26.40	10.50	3.50	60.40
un2382	Upper Clore	7.50	9.50	26.40	13.50	3.50	60.40

⁴ Appendix D provides maps showing the location of the polygons.

⁵ Appendix A provides a breakdown of the harvest systems for each polygon.

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Polygon ⁴	Location	Administration (\$/m ³)	Road Development Cost (\$/m ³)	On Truck Cost ⁵ (\$/m ³)	Truck Hauling Cost (\$/m ³)	Silviculture Cost (\$/m ³)	Delivered Log Cost (\$/m ³)
un1966	Hwy 16W-Exstew	7.50	14.50	28.00	7.00	3.50	60.50
ge1677	Kleanza	7.50	13.00	27.20	9.50	3.50	60.70
ge2094	Kitnayakwa	7.50	11.00	25.20	14.00	3.50	61.20
ge1966	Whitebottom/Shames	7.50	14.50	27.20	9.00	3.50	61.70
av3016	Davies Crk.	7.50	12.50	26.40	12.00	3.50	61.90
ge1337	Beaupre / Lava	7.50	11.00	26.40	13.50	3.50	61.90
ge2346	Furlong/Hatchery	7.50	17.50	27.20	6.50	3.50	62.20
un1337	Poupard / May	7.50	11.50	27.20	12.50	3.50	62.20
ge19039	Skeena West / Chimdemash	7.50	16.50	27.20	8.00	3.50	62.70
av3530	Wathl	7.50	14.00	26.40	12.00	3.50	63.40
ge1290	Kiteen	7.50	9.50	25.60	17.50	3.50	63.60
ge1535	Legate	7.50	15.50	27.20	10.00	3.50	63.70
ge1776a	Salmon Run	7.50	15.75	25.60	11.50	3.50	63.85
ge1435	Upper Copper	7.50	10.50	26.40	16.00	3.50	63.90
ge1320	W.Kiteen	7.50	10.00	25.60	17.50	3.50	64.10
ge3431	Bish Crk.	7.50	14.00	26.40	13.00	3.50	64.40
ge19043	Exstew	7.50	18.00	27.20	9.00	3.50	65.20
ge3394	Jesse Lake	7.50	14.00	26.40	14.00	3.50	65.40
av3431	Bish Crk.	7.50	14.00	26.40	14.00	3.50	65.40
ge1334	Stenstrom	7.50	10.50	26.40	17.50	3.50	65.40
ge19044	Zymacord	7.50	18.75	28.00	8.00	3.50	65.75
ge19033	Kwiniak	7.50	11.00	27.20	17.00	3.50	66.20
av3394	Jesse Lake	7.50	14.00	26.40	15.00	3.50	66.40
av3330	N.Hirsch	7.50	15.00	26.40	14.50	3.50	66.90
sb1966	Dasque	7.50	18.50	27.20	10.50	3.50	67.20
av3353	S.Hirsch	7.50	15.00	26.40	15.00	3.50	67.40
ge19040	Fiddler	7.50	18.75	26.40	12.50	3.50	68.65
sb3330	N.Hirsch	7.50	15.00	26.40	17.00	3.50	69.40
ge1255	L.Kiteen	7.50	13.50	27.20	18.50	3.50	70.20
av2346	Coldwater	7.50	23.50	28.00	9.00	3.50	71.50
ge19034	Ishkheenickh	7.50	14.50	26.40	20.40	3.50	72.30
av3130	L.Wedeene	7.50	23.50	26.40	13.50	3.50	74.40
av2789	Wedeene	7.50	23.50	26.40	15.00	3.50	75.90

Table 2 – Delivered Log Cost and Volume - Kalum TSA, TFL 1, TFL 41 (on-shore)

Polygon ⁶	Location	Delivered Log Cost	TSA (ha)	TFL 41 (ha)	TFL 1 (ha)	Sawlog (%)	Pulp (%)	m ³ /ha	Volume (m ³)	Weighted Delivered Log Cost
sb2091	Sandur	41.50	206	0	0	90	10	325	66,950	0.05
sb19039	Skeena West II	53.50	2,142	0	0	50	50	400	856,800	0.88
sb19030	Deep Creek	53.90	780	0	0	65	35	425	331,500	0.34
un19039	Newton	54.60	1,562	0	0	65	35	425	663,850	0.70
ge19031	L.Big Cedar	54.70	0	0	3,876	60	40	425	1,647,300	1.74
sb2346	Thunderbird-Johnstone	54.90	1,405	0	0	65	35	425	597,125	0.63
sb19040	Skeena West I	55.00	270	0	0	50	50	400	108,000	0.11
ge19045	Erlandsen	55.20	0	0	559	55	45	425	237,575	0.25
ge2091	Williams Crk.	55.90	3,767	0	0	55	45	425	1,600,975	1.73
ge1258	North Headley	57.10	0	0	2,105	55	45	350	736,750	0.81
ge1776	Lower Copper	57.20	0	0	3,269	60	40	425	1,389,325	1.53
ge19036	L.Cedar	57.20	0	0	935	55	45	425	397,375	0.44
av2631	Chist Crk.	57.40	0	1,627	0	60	40	475	772,825	0.86
ge19046	Beaver	57.40	0	0	2,014	55	45	450	906,300	1.00
ge2382	Lower Clore	57.60	0	0	2,540	60	40	425	1,079,500	1.20
sb1677	Limonite	57.70	171	0	0	60	40	425	72,675	0.08
ge19042	Nelson	57.70	0	0	565	55	45	425	240,125	0.27
ge19032	Mayo	57.90	0	0	835	60	40	450	375,750	0.42
ge2721	Kitimat Valley	58.40	863	0	0	50	50	475	409,925	0.46
av2986	Bolton/Mackay	59.40	0	1,758	0	60	40	475	835,050	0.96
sb1435b	Limonite	59.40	0	0	3,762	60	40	450	1,692,900	1.94
ge19030	East Kalum	59.70	5,672	0	0	65	35	475	2,694,200	3.10
ge1374	Anweiller	60.00	1,190	0	0	65	35	450	535,500	0.62
ge3353	Kitimat	60.40	415	0	0	55	45	475	197,125	0.23
ge3530	Kitimat	60.40	1,024	0	0	55	45	475	486,400	0.57
av2721	Upper Kitimat River	60.40	0	7,079	0	60	40	475	3,362,525	3.92
un2382	Upper Clore	60.40	0	0	1,693	55	45	425	719,525	0.84
un1966	Hwy 16W-Exstew	60.50	93	0	0	65	35	400	37,200	0.04
ge1677	Kleanza	60.70	3,238	0	0	55	45	425	1,376,150	1.61
ge2094	Kitnayakwa	61.20	0	0	2,394	55	45	400	957,600	1.13
ge1966	Whitebottom/Shames	61.70	0	0	2,740	60	40	475	1,301,500	1.55
av3016	Davies Crk.	61.90	0	1,994	0	60	40	475	947,150	1.13
ge1337	Beaupre / Lava	61.90	0	0	2,322	55	45	425	986,850	1.18
ge2346	Furlong/Hatchery	62.20	1,945	0	0	55	45	425	826,625	0.99
un1337	Poupard / May	62.20	0	0	1,610	60	40	425	684,250	0.82
ge19039	Skeena West / Chimdemash	62.70	6,724	0	0	60	40	425	2,857,700	3.46
av3530	Wathl / Clio Bay	63.40	0	5,697	0	70	30	550	3,133,350	3.83
ge1290	Kiteen	63.60	0	0	4,369	65	35	425	1,856,825	2.28
ge1535	Legate	63.70	814	0	0	50	50	425	345,950	0.42
ge1776a	Salmon Run	63.85	0	0	698	60	40	450	314,100	0.39
ge1435	Upper Copper	63.90	0	0	4,318	40	60	400	1,727,200	2.13

⁶ Appendix D provides maps showing the location of the polygons.

Delivered Log Cost Analysis for the Kalum Forest District

Polygon ⁶	Location	Delivered Log Cost	TSA (ha)	TFL 41 (ha)	TFL 1 (ha)	Sawlog (%)	Pulp (%)	m ³ /ha	Volume (m ³)	Weighted Delivered Log Cost
ge1320	W.Kiteen	64.10	0	0	656	60	40	425	278,800	0.34
ge3431	Bish Crk.	64.40	1,462	0	0	70	30	550	804,100	1.00
ge19043	Exstew	65.20	1,137	0	0	60	40	400	454,800	0.57
ge3394	Jesse Lake	65.40	2,599	0	0	70	30	550	1,429,450	1.80
av3431	Bish Crk.	65.40	0	1,720	0	70	30	550	946,000	1.19
ge1334	Stenstrom	65.40	0	0	930	60	40	425	395,250	0.50
ge19044	Zymacord	65.75	1,186	0	0	55	45	425	504,050	0.64
ge19033	Kwiniak	66.20	0	0	1,543	60	40	450	694,350	0.89
av3394	Jesse Lake	66.40	0	1,491	0	70	30	550	820,050	1.05
av3330	N.Hirsch	66.90	0	216	0	55	45	475	102,600	0.13
sb1966	Dasque	67.20	143	0	0	60	40	475	67,925	0.09
av3353	S.Hirsch	67.40	0	1,572	0	55	45	475	746,700	0.97
ge19040	Fiddler	68.65	970	0	0	55	45	425	412,250	0.55
sb3330	N.Hirsch	69.40	0	1,109	0	55	45	475	526,775	0.70
ge1255	L.Kiteen	70.20	0	0	3,593	40	60	350	1,257,550	1.70
av2346	Coldwater	71.50	0	0	910	60	40	475	432,250	0.60
ge19034	Ishkheenickh	72.30	0	0	1,471	60	40	500	735,500	1.03
av3130	L.Wedeene	74.40	0	532	0	60	40	475	252,700	0.36
av2789	Wedeene	75.90	0	1,331	0	60	40	475	632,225	0.93
	Totals		39,778	26,126	49,707				51,859,625	61.62

Figure 1 - Kalum TSA, TFL 1, TFL 41 (on-shore)

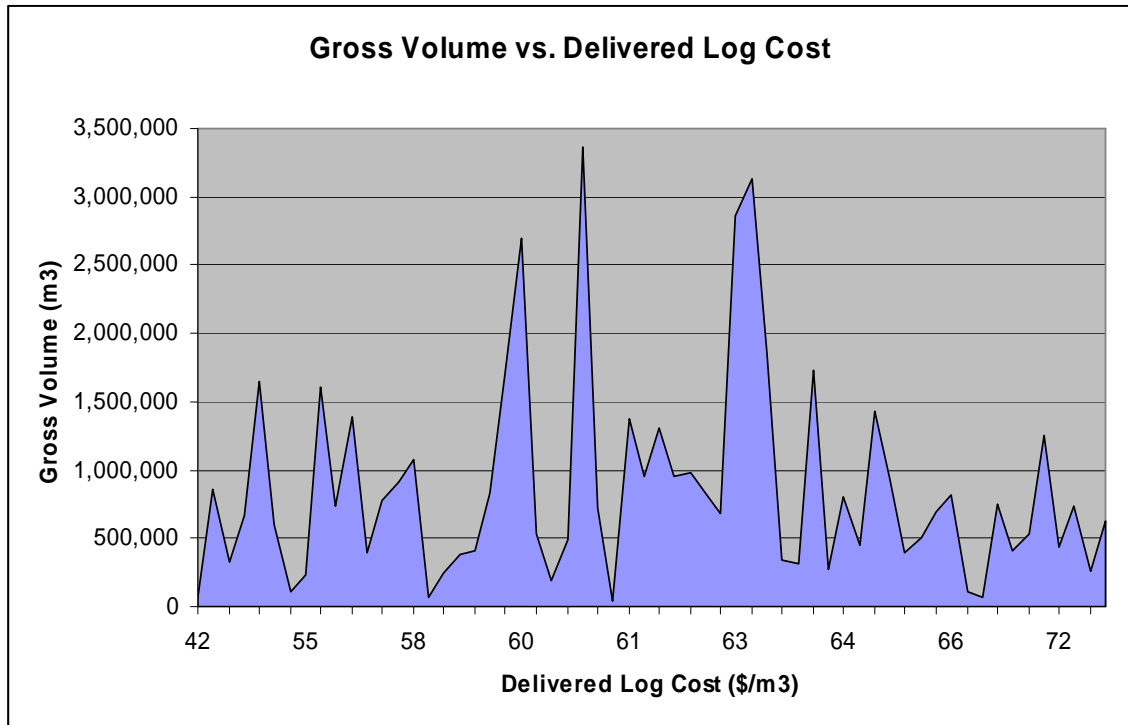
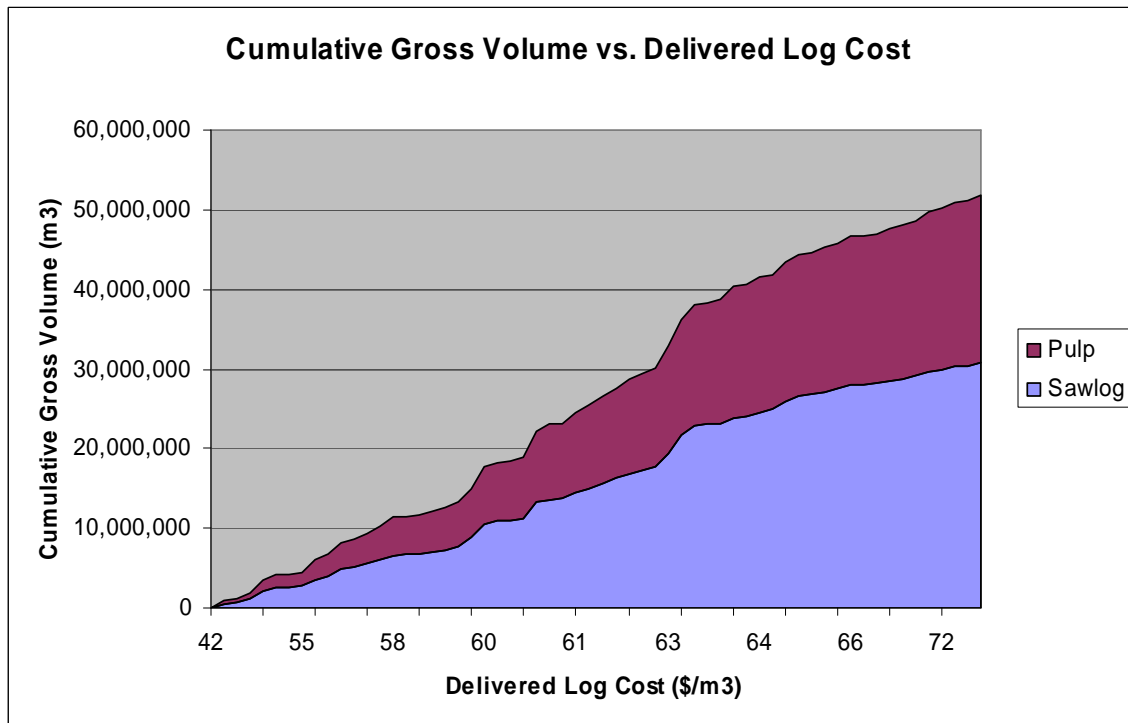


Figure 2 - Kalum TSA, TFL 1, TFL 41 (on-shore)



6 Results and Discussion – Nass TSA

Tables 3 and 4 provide the results of the delivered log cost analysis for the Nass TSA. Figures 3 and 4 summarise this data graphically.

The analysis indicates that there is a range of delivered log costs in the Nass TSA from \$53.60/m³ to \$71.00/m³. As stated prior there is variation even between the lower and upper limits, as only an average delivered log cost was calculated from the midpoint of each polygon. The comments regarding polygon delineation and the concept of averages in *Section 6* are also applicable to the Nass TSA.

There are several options for the delivery of timber located between Meziadin Junction and Cranberry Junction in the Nass TSA. The two main options are Kitwanga and Stewart and to a lesser extent Terrace. From Meziadin Junction to Cranberry Junction the main arterial haul roads are the Vandyke FSR, the Brown Bear FSR, the Arbor FSR, the Orenda FSR and the Meziadin FSR. The junction of the Brown Bear FSR or the Arbor FSR and Highway 37N is the half-way point between Stewart and Kitwanga (i.e. equal haul cost). The following table illustrates the different haul distances from the junction of Highway 37N and the main arterial logging roads.

	<i>Haul Cost</i> <i>Kitwanga</i>	<i>Haul Cost</i> <i>Stewart</i>
Vandyke FSR	\$7.10/m ³	\$7.70/m ³
Brown Bear FSR	\$7.30/m ³	\$7.40/m ³
Arbor FSR	\$7.40/m ³	\$7.30/m ³
Orenda FSR	\$9.60/m ³	\$5.20/m ³
Meziadin FSR	\$9.90/m ³	\$4.90/m ³

For timber located north of Meziadin Junction the most cost effective destination is Stewart.

As was mentioned in *Section 1* an assumption was made that all wood would be delivered to Terrace, Stewart or Kitwanga, however if the timber in the southwest corner of the Nass TSA (i.e. Tchitin, Kwinatahl) were delivered to Greenville instead of Terrace the delivered log costs from these polygons would be \$5.00/m³ less (cost differential between Greenville and Terrace).

The polygons this would apply to are:

<i>Polygon</i>	<i>Location</i>
ge1208	Tchitin
ge1187	Kinskuch
ge1228	Kshadin
un1292	Kwinatahl
un1269	Kwinatahl
ge1269	Kwinatahl

Table 3 – Delivered Log Cost Analysis Nass TSA

Polygon ⁷	Location	Administration (\$/m ³)	Road Development Cost (\$/m ³)	On Truck Cost ⁸ (\$/m ³)	Hauling Cost Terrace (\$/m ³)	Hauling Cost Kitwanga (\$/m ³)	Hauling Cost Stewart (\$/m ³)	Silviculture Cost (\$/m ³)	Delivered Log Cost (\$/m ³)
ge1092	Meziadin Lake	7.50	9.00	23.20	0.00	0.00	10.40	3.50	53.60
sb1048	Orenda	7.50	8.00	23.20	0.00	0.00	11.90	3.50	54.10
ge1048	Wildfire / Upper Kwinageese	7.50	8.00	24.00	0.00	0.00	11.20	3.50	54.20
ge1156	Pas	7.50	7.00	24.40	0.00	12.60	0.00	3.50	55.00
ge1143	L.Pas	7.50	7.00	24.40	0.00	0.00	12.80	3.50	55.20
ge1038	Surveyor Creek	7.50	9.00	22.80	0.00	0.00	11.00	5.00	55.30
ge1112	White River	7.50	8.50	23.60	0.00	0.00	12.40	3.50	55.50
sb1134	Brown Bear	7.50	8.00	23.20	0.00	0.00	13.40	3.50	55.60
sb1156	Harper	7.50	7.00	24.40	0.00	13.60	0.00	3.50	56.00
sb1187	Harper	7.50	7.00	24.40	0.00	14.10	0.00	3.50	56.50
un1187	Harper	7.50	7.00	24.40	0.00	14.10	0.00	3.50	56.50
ge1134	Brown Bear	7.50	8.00	23.20	0.00	0.00	14.40	3.50	56.60
ge951	Irving / Kotcho	7.50	9.00	23.60	0.00	0.00	13.00	5.00	58.10
ge1115	Brown Bear	7.50	8.00	23.20	0.00	0.00	16.40	3.50	58.60
ge845	Owl / Bell II	7.50	9.00	23.20	0.00	0.00	14.50	5.00	59.20
ge1010	Bowser Lake	7.50	10.00	22.80	0.00	0.00	14.00	5.00	59.30
sb1115	Bonnie Lakes	7.50	8.00	23.20	0.00	0.00	17.40	3.50	59.60
sb1089	Bonnie Lakes	7.50	8.00	23.20	0.00	0.00	17.40	3.50	59.60
sb1228	Harper	7.50	7.00	24.40	0.00	18.60	0.00	3.50	61.00
sb1143	Harper	7.50	7.00	24.40	0.00	18.60	0.00	3.50	61.00
ge1089	Bonnie Lakes	7.50	8.00	23.20	0.00	0.00	18.90	3.50	61.10
ge1174	Niska Lakes	7.50	7.00	24.40	0.00	19.60	0.00	3.50	62.00
ge1094	Kwinageese	7.50	8.00	22.80	0.00	0.00	20.40	3.50	62.20
ge1082	Kwinageese	7.50	8.00	22.80	0.00	0.00	22.90	3.50	64.70
ge1208	Tchitin	7.50	8.50	25.20	21.50	0.00	0.00	3.50	66.20
ge1187	Kinskuch	7.50	8.50	26.00	22.90	0.00	0.00	3.50	68.40
ge1228	Kshadin	7.50	10.50	26.00	21.50	0.00	0.00	3.50	69.00
un1292	Kwinatahl	7.50	10.50	26.00	23.50	0.00	0.00	3.50	71.00
un1269	Kwinatahl	7.50	10.50	26.00	23.50	0.00	0.00	3.50	71.00
ge1269	Kwinatahl	7.50	10.50	26.00	23.50	0.00	0.00	3.50	71.00

⁷ Appendix D provides maps showing the location of the polygons.⁸ Appendix B provides a breakdown of the harvest systems for each polygon.

Table 4 – Delivered Log Cost and Volume - Nass TSA

Polygon ⁹	Location	Delivered Log Cost	TSA (ha)	Sawlog (%)	Pulp (%)	m ³ /ha	Volume (m ³)	Weighted Delivered Log Cost
ge1092	Meziadin Lake	53.60	2,447	50	50	340	831,980	1.06
sb1048	Orenda	54.10	3,674	55	45	350	1,285,900	1.65
ge1048	Wildfire / Upper Kwinageese	54.20	16,722	40	60	325	5,434,650	6.99
ge1156	Pas	55.00	5,874	55	45	400	2,349,600	3.07
ge1143	L.Pas	55.20	2,769	55	45	400	1,107,600	1.45
ge1038	Surveyor Creek	55.30	1,454	50	50	340	494,360	0.65
ge1112	White River	55.50	6,360	55	45	350	2,226,000	2.93
sb1134	Brown Bear	55.60	6,618	45	55	350	2,316,300	3.06
sb1156	Harper	56.00	1,538	55	45	425	653,650	0.87
sb1187	Harper	56.50	679	55	45	425	288,575	0.39
un1187	Harper	56.50	1,213	55	45	425	515,525	0.69
ge1134	Brown Bear	56.60	2,783	45	55	350	974,050	1.31
ge951	Irving / Kotcho	58.10	11,782	50	50	340	4,005,880	5.52
ge1115	Brown Bear	58.60	1,129	45	55	350	395,150	0.55
ge845	Owl / Bell II	59.20	4,630	50	50	340	1,574,200	2.21
ge1010	Bowser Lake	59.30	3,345	50	50	340	1,137,300	1.60
sb1115	Bonnie Lakes	59.60	1,568	40	60	325	509,600	0.72
sb1089	Bonnie Lakes	59.60	273	40	60	325	88,725	0.13
sb1228	Harper	61.00	655	50	50	400	262,000	0.38
sb1143	Harper	61.00	15,991	55	45	425	6,796,175	9.84
ge1089	Bonnie Lakes	61.10	8,021	40	60	325	2,606,825	3.78
ge1174	Niska Lakes	62.00	2,543	55	45	400	1,017,200	1.50
ge1094	Kwinageese	62.20	2,018	30	70	300	605,400	0.89
ge1082	Kwinageese	64.70	1,768	30	70	300	530,400	0.81
ge1208	Tchitin	66.20	1,959	50	50	400	783,600	1.23
ge1187	Kinskuch	68.40	6,615	50	50	400	2,646,000	4.29
ge1228	Kshadin	69.00	2,068	55	45	425	878,900	1.44
un1292	Kwinatahl	71.00	397	55	45	425	168,725	0.28
un1269	Kwinatahl	71.00	391	55	45	425	166,175	0.28
ge1269	Kwinatahl	71.00	766	55	45	425	325,550	0.55
	Totals		118,050				42,144,015	59.05

⁹ Appendix D provides maps showing the location of the polygons.

Figure 3 – Nass TSA

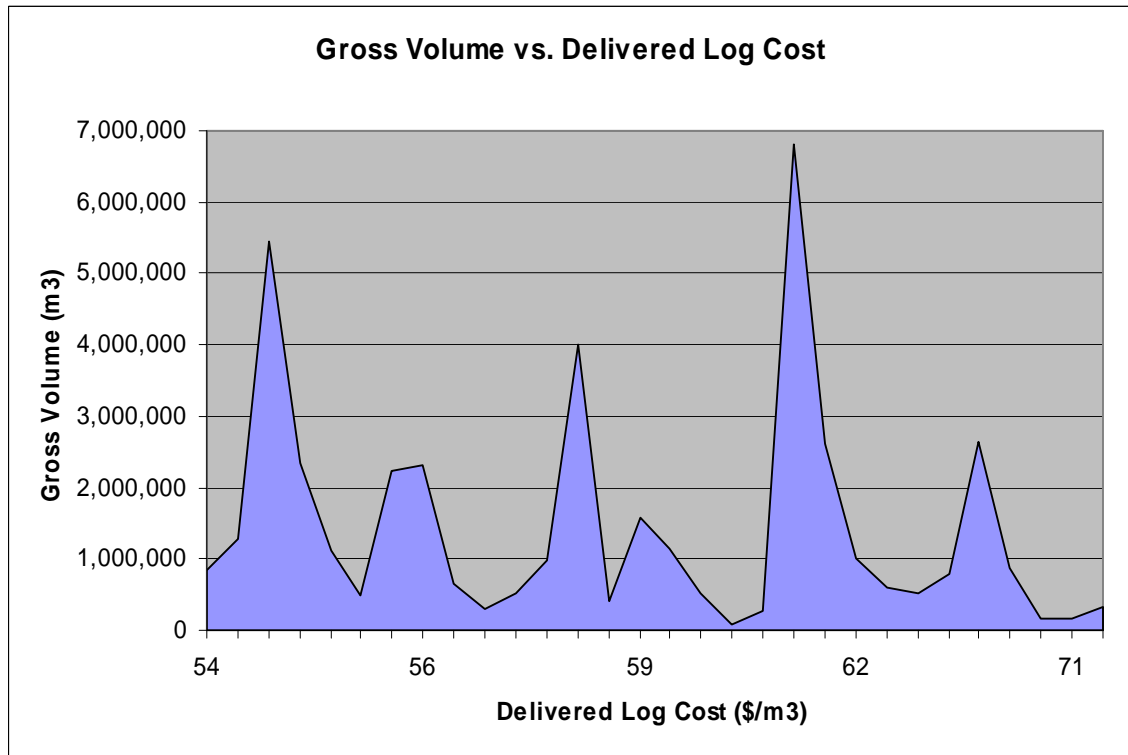
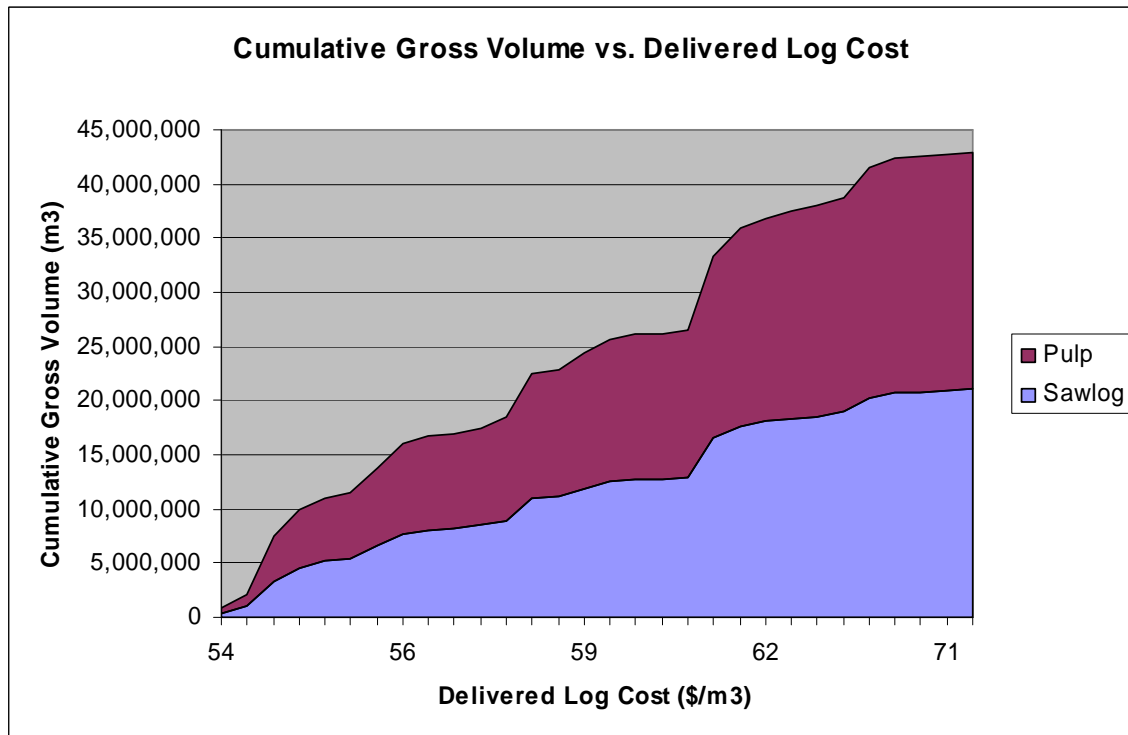


Figure 4 – Nass TSA



7 Results and Discussion – TFL 41 (off-shore)

Tables 5 and 6 provide the results of the delivered log cost analysis for the off-shore portion of TFL 41. Figure 5 summarises this data graphically. Tables 7 and 8 and figure 6 provide a subset of the data related to the conventional (i.e. non-helicopter) portion of TFL 41 off-shore

The delivery of timber from the off-shore portion of TFL 41 to Terrace under current conditions is a theoretical scenario. Traditionally the flow of timber from the off-shore portion of TFL 41 has been to markets on the South Coast or Lower Mainland. For timber to be delivered to Terrace it would have to be towed to Kitimat, dewatered, reloaded and then hauled to Terrace.

The analysis indicates that the range of delivered log costs for conventional timber (ground based and cable) in the off-shore portion of TFL 41 is between \$92.80/m³ to \$100.25/m³. Prior statements' regarding variability within delivered costs and the concept of averages also applies to the off-shore portion of TFL 41.

The cost range of conventional timber is narrower when compared to other portions of the Kalum District as the majority of conventional harvesting in the off-shore portions will be cable and as is common on the off-shore portions of the Coast the on-truck rate includes hauling. To account for the differences in the length of the TFL 41 off-shore drainages (i.e. average haul distance to the dump site at tidewater) the on-truck rate varies from \$46.00/m³ to \$50.00/m³.¹⁰

Unlike the Kalum TSA, TFL 1 and the TFL 41 (on-shore portion) helicopter harvesting costs were included in the delivered log cost analysis (Table 5 / Table 6). The off-shore portion of TFL 41 contains some high value timber that merits the expense of helicopter logging.

BCTS (Skeena Business Area) staff have indicated that the likelihood of harvesting occurring in the Upper Kemano and the Caribou is remote due to a combination of high development costs and decadent timber. This results in a decrease of the available conventional volume from 7.0 million cubic meters to 6.2 million cubic meters.

Table 5 – Delivered Log Cost Analysis TFL 41 (off-shore)

Location ¹¹	Administration (\$/m ³)	Pro-Rated Road Development Cost (\$/m ³)	On Truck Cost ¹² (\$/m ³)	Towing to Kitimat (\$/m ³)	Dewater / Scale Kitimat (\$/m ³)	Kitimat-Terrace Haul (\$/m ³)	Silviculture (\$/m ³)	Delivered Log Cost (\$/m ³)
Heysham	10.00	14.80	55.40	1.40	7.50	6.00	4.00	99.10
Dala-Kildala	10.00	15.73	57.00	0.80	7.50	6.00	4.00	101.03
Eagle	10.00	14.80	58.40	0.80	7.50	6.00	4.00	101.50
Hugh	10.00	14.80	58.40	1.20	7.50	6.00	4.00	101.90
Upper Kemano	10.00	16.92	55.80	2.25	7.50	6.00	4.00	102.47
Barrie	10.00	14.80	58.40	2.25	7.50	6.00	4.00	102.95
Kitsaway	10.00	9.25	69.00	1.40	7.50	6.00	4.00	107.15
Sue Channel	10.00	7.40	71.20	1.20	7.50	6.00	4.00	107.30
Caribou	10.00	18.00	60.00	2.25	7.50	6.00	4.00	107.75
Kildala Arm	10.00	5.55	75.40	0.80	7.50	6.00	4.00	109.25
Kowesas	10.00	11.10	72.00	2.55	7.50	6.00	4.00	113.15
Devastation Channel	10.00	0.00	88.00	0.80	7.50	6.00	4.00	116.30
Maitland and Loretta Islands	10.00	0.00	88.00	1.20	7.50	6.00	4.00	116.70
Crab Lake	10.00	0.00	88.00	1.40	7.50	6.00	4.00	116.90
Gardner Canal	10.00	0.00	88.00	2.25	7.50	6.00	4.00	117.75
Weewanie	10.00	5.55	89.40	1.20	7.50	6.00	4.00	123.65

¹⁰ Assuming a loaded haul speed of 25 km/hr and an empty haul speed of 35 km/hr, 10 km of road equates to a \$2.00/m³ haul cost.

¹¹ Appendix D provides maps showing the location of the polygons.

¹² Appendix C provides a breakdown of the harvest systems for each polygon.

Location ¹¹	Administration (\$/m ³)	Pro-Rated Road Development Cost (\$/m ³)	On Truck Cost ¹² (\$/m ³)	Towing to Kitimat (\$/m ³)	Dewater / Scale Kitimat (\$/m ³)	Kitimat-Terrace Haul (\$/m ³)	Silviculture (\$/m ³)	Delivered Log Cost (\$/m ³)
Falls	10.00	5.55	90.00	0.80	7.50	6.00	4.00	123.85
Horetzky	10.00	3.70	96.00	2.25	7.50	6.00	4.00	129.45
South Seekwyakin Creek	10.00	1.85	102.00	2.25	7.50	6.00	4.00	133.60
Lower Kemano	10.00	0.00	108.00	2.25	7.50	6.00	4.00	137.75
Wachwas Creek	10.00	0.00	108.00	2.25	7.50	6.00	4.00	137.75

Table 6 – Delivered Log Cost and Volume TFL 41 (off-shore)

Location	Delivered Log Cost (\$/m ³)	TFL 41 (ha)	m ³ /ha	Volume (m ³)	Weighted Delivered Log Cost
Heysham	99.10	374	478	179,220	1.37
Dala-Kildala	101.03	7,957	472	3,760,244	29.30
Eagle	101.50	1,074	478	513,222	4.02
Hugh	101.90	1,153	446	515,056	4.05
Upper Kemano	102.47	877	467	410,091	3.24
Barrie	102.95	586	506	296,656	2.36
Caribou	106.15	1,152	467	537,811	4.40
Kitsaway	107.15	1,988	381	756,902	6.25
Sue Channel	107.30	1,346	445	598,861	4.96
Kildala Arm	109.25	1,168	420	490,664	4.13
Kowesas	113.15	1,755	481	843,848	7.29
Devastation Channel	116.30	1,392	362	504,153	4.52
Maitland and Loretta Islands	116.70	482	367	176,860	1.59
Crab Lake	116.90	354	335	118,722	1.07
Gardner Canal	117.75	899	474	426,371	3.87
Weewanie	123.65	951	510	484,970	4.62
Falls	123.85	2,139	503	1,077,017	10.29
Horetzky	129.45	131	500	65,748	0.66
South Seekwyakin Creek	133.60	464	494	229,418	2.36
Lower Kemano	137.75	1,032	478	493,232	5.24
Wachwas Creek	137.75	899	542	487,913	5.18
Totals		28,173		12,966,979	110.77

Figure 5 – TFL 41 (off-shore)

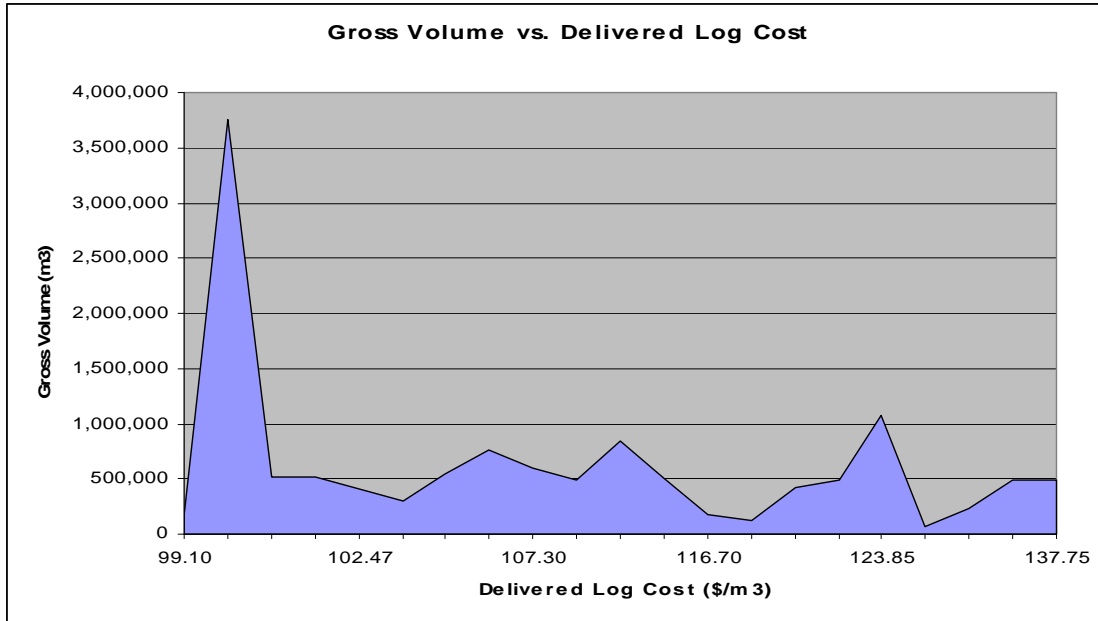


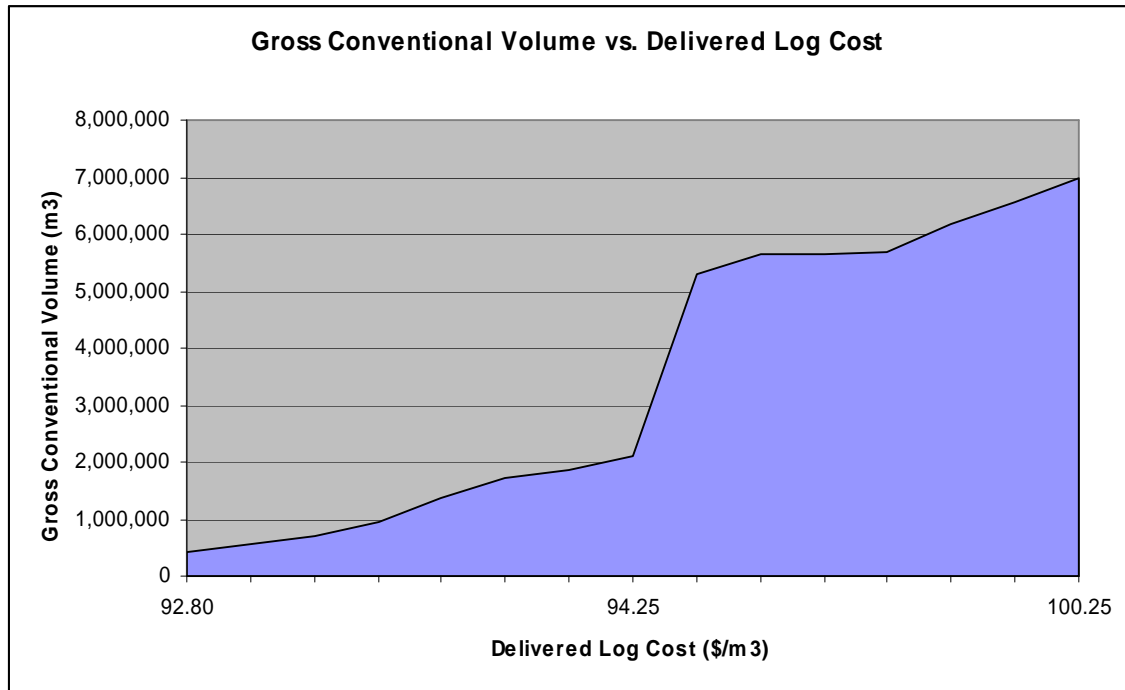
Table 7 – Delivered Log Cost (Conventional) TFL 41 (off-shore)

Location	Administration (\$/m³)	Road Development Cost (\$/m³)	On Truck Cost (\$/m³)	Towing to Kitimat (\$/m³)	Dewater / Scale Kitimat (\$/m³)	Kitimat-Terrace Haul (\$/m³)	Silviculture (\$/m³)	Delivered Log Cost (\$/m³)
Eagle	10.00	18.50	46.00	0.80	7.50	6.00	4.00	92.80
Kildala Arm	10.00	18.50	46.00	0.80	7.50	6.00	4.00	92.80
Weewanie	10.00	18.50	46.00	1.20	7.50	6.00	4.00	93.20
Sue Channel	10.00	18.50	46.00	1.20	7.50	6.00	4.00	93.20
Hugh	10.00	18.50	46.00	1.20	7.50	6.00	4.00	93.20
Kitsaway	10.00	18.50	46.00	1.40	7.50	6.00	4.00	93.40
Heysham	10.00	18.50	46.00	1.40	7.50	6.00	4.00	93.40
Barrie	10.00	18.50	46.00	2.25	7.50	6.00	4.00	94.25
Dala-Kildala	10.00	18.50	48.00	0.80	7.50	6.00	4.00	94.80
Falls	10.00	18.50	48.00	0.80	7.50	6.00	4.00	94.80
South Seekwyakin Creek	10.00	18.50	48.00	2.25	7.50	6.00	4.00	96.25
Horetzky	10.00	18.50	48.00	2.25	7.50	6.00	4.00	96.25
Kowesas	10.00	18.50	48.00	2.55	7.50	6.00	4.00	96.55
Upper Kemano	10.00	18.50	50.00	2.25	7.50	6.00	4.00	98.25
Caribou	10.00	22.50	48.00	2.25	7.50	6.00	4.00	100.25

Table 8 – Delivered Log Cost and Conventional Volume TFL 41 (off-shore)

Location	Delivered Log Cost (\$/m ³)	Volume (m ³)	Weighted Delivered Log Cost
Eagle	92.80	410,578	5.46
Kildala Arm	92.80	147,199	1.96
Weewanie	93.20	145,491	1.94
Sue Channel	93.20	239,544	3.20
Hugh	93.20	412,045	5.51
Kitsaway	93.40	378,451	5.07
Heysham	93.40	143,376	1.92
Barrie	94.25	237,325	3.21
Dala-Kildala	94.80	3,196,207	43.44
Falls	94.80	323,105	4.39
South Seekwyakin Creek	96.25	22,942	0.32
Horetzky	96.25	13,150	0.18
Kowesas	96.55	506,309	7.01
Upper Kemano	98.25	369,082	5.20
Caribou	100.25	430,249	6.18
Totals		6,975,052	94.99

Figure 6 – TFL 41 (off-shore)



8 Recommendations

As previously noted, the methodology utilized to determine the delivered log costs for the Kalum District has its limitations, primarily with the broadness of some of the polygons and age of the data (TSR II).

Smaller polygons would reduce the variance in the range of delivered log costs in each polygon. The lower variance would primarily be the result of a more defined cycle time. Furthermore, polygons that are in close proximity to the delivery centers (i.e. Terrace) are particularly relevant as the timber in these polygons will provide for the lowest delivered log cost. Any new industrial entrant into the region would want to know the volume of the cheapest wood so it is imperative not to dilute the least expensive wood with more expensive timber by making a polygon too large.

Utilizing the most current inventory information would capture the most recent harvesting and current constraints on the landbase (i.e. Tailed Frog Habitat, Grizzly Bear WHA). This would assist in minimizing the over estimation of the THLB.

Additional processing site destinations (e.g. Greenville, Kitimat, Meziadin Junction) would lower overall delivered wood cost.

Sensitivity analyses around items such as silviculture, haul distance, and to a lesser extent harvest system may provide additional value.

The analysis in this report is based on the delivery of logs assuming current and historic utilization. It does not consider the additional volume that might come from portions of the timber stands that are currently considered to have no economic value. As more of the timber in a forest is utilized, the cost to harvest the timber may lessen (less double-handling, decreased unit cost because more volume utilised, less volume put into the cull pile), however the cost to transport the wood on the truck may increase (trucks become fully loaded before they reach the maximum weight they can haul). Nevertheless, by utilizing more of the timber profile the overall delivered log cost may be lowered when compared with current utilization. This is an important consideration given it is anticipated that some of the new industrial players in the Northwest (e.g. biofuel or bio-energy) will likely be interested in wood fibre or biomass. Any subsequent delivered log cost analysis should incorporate the effect of biomass/ wood fibre through a sensitivity analysis to see its impact on delivered log costs.

9 Conclusion

The results of this analysis provide a baseline estimate of operating costs in the Kalum Forest District. This data can be used to provide an initial indication to a prospective industrial 'player' of the operating costs within the Kalum District.

The range of delivered log costs (conventional volume) in the Kalum District is:

<i>Area</i>	<i>Range</i>	<i>Volume (m³)</i>
<i>Kalum TSA, TFL 1, TFL 41 (on-shore):</i>	<i>\$41.50/m³ to \$75.90m³</i>	<i>41.5 million</i>
<i>Nass TSA:</i>	<i>\$53.60/m³ to \$71.00/m³</i>	<i>42.1 million</i>
<i>TFL 41 (off-shore):</i>	<i>\$92.80/ m³ to \$100.25/m³</i>	<i>6.2 million</i>

The average costs for the most economical portion of the conventional profile are:

	<i>Kalum TSA, TFL 1, TFL 41 (on-shore) (\$/m³)</i>	<i>Nass TSA (\$/m³)</i>	<i>TFL 41 (off-shore) (\$/m³)</i>
<i>Most economical 1,000,000 m³</i>	<i>52.73</i>	<i>53.68</i>	<i>92.98</i>
<i>Most economical 2,000,000 m³</i>	<i>53.57</i>	<i>53.89</i>	<i>93.38</i>
<i>Most economical 3,000,000 m³</i>	<i>53.95</i>	<i>53.99</i>	<i>93.72</i>
<i>Most economical 4,000,000 m³</i>	<i>54.16</i>	<i>54.04</i>	<i>93.99</i>
<i>Most economical 5,000,000 m³</i>	<i>54.44</i>	<i>54.07</i>	<i>94.15</i>

It should be noted that the volume from the off-shore portion of TFL 41 should be considered a theoretical scenario at this time as the historical flow of timber from this area is to the South Coast or Lower Mainland. It is more likely that if wood were to be towed to Kitimat it would be for a facility located in Kitimat.

There are limitations to the methodology used in this analysis to derive the delivered log costs for the Kalum, and more precise delivered log cost calculations would be valuable. However, before conducting additional or more detailed analyses, it is suggested that the results from this delivered log cost analysis be promoted and distributed. If feedback to this report indicates a need for more precise data, additional analyses could be undertaken.

Appendix A – Logging Method Breakdown Kalum TSA, TFL 1, TFL 41 (on-shore)

Polygon #	Location	% GBS	% Cable	On Truck Cost (\$/m ³)
sb2091	Sandur	100	0	20.00
sb19039	Skeena West II	50	50	24.00
sb19030	Deep Creek	45	55	24.40
un19039	Newton	30	70	25.60
ge19031	L.Big Cedar	35	65	25.20
sb2346	Thunderbird-Johnstone	45	55	24.40
sb19040	Skeena West I	50	50	24.00
ge19045	Erlandsen	10	90	27.20
ge2091	Williams Crk.	20	80	26.40
ge1258	North Headley	80	20	21.60
ge1776	Lower Copper	10	90	27.20
ge19036	L.Cedar	10	90	27.20
av2631	Chist Crk.	20	80	26.40
ge19046	Beaver	20	80	26.40
sb1677	Limonite	10	90	27.20
ge19042	Nelson	10	90	27.20
ge19032	Mayo	20	80	26.40
ge2721	Kitimat Valley	45	55	24.40
av2986	Bolton/Mackay	20	80	26.40
sb1435b	Limonite	45	55	24.40
ge2382	Clore	30	70	25.60
ge19030	East Kalum	10	90	27.20
ge1374	Anweiller	25	75	26.00
ge3353	Kitimat	20	80	26.40
ge3530	Kitimat	20	80	26.40
av2721	Upper Kitimat River	20	80	26.40
un1966	Hwy 16W-Exstew	0	100	28.00
ge1677	Kleanza	10	90	27.20
ge2094	Kitnayakwa	35	65	25.20
ge1966	Whitebottom/Shames	10	90	27.20
av3016	Davies Crk.	20	80	26.40
ge1337	Beaupre / Lava	20	80	26.40
ge2346	Furlong/Hatchery	10	90	27.20
un1337	Poupard / May	10	90	27.20
ge19039	Skeena West / Chimdemash	10	90	27.20
av3530	Wathl / Clio Bay	20	80	26.40
ge1290	Kiteen	30	70	25.60
ge1535	Legate	10	90	27.20
ge1776a	Salmon Run	30	70	25.60
ge1435	Upper Copper	20	80	26.40
ge1320	W.Kiteen	30	70	25.60

Polygon #	Location	% GBS	% Cable	On Truck Cost (\$/m³)
ge3431	Bish Crk.	20	80	26.40
ge19043	Exstew	10	90	27.20
ge3394	Jesse Lake	20	80	26.40
av3431	Bish Crk.	20	80	26.40
ge1334	Stenstrom	20	80	26.40
ge19044	Zymacord	0	100	28.00
ge19033	Kwiniak	10	90	27.20
av3394	Jesse Lake	20	80	26.40
av3330	N.Hirsch	20	80	26.40
sb1966	Dasque	10	90	27.20
av3353	S.Hirsch	20	80	26.40
ge19040	Fiddler	20	80	26.40
sb3330	N.Hirsch	20	80	26.40
ge1255	L.Kiteen	10	90	27.20
av2346	Coldwater	0	100	28.00
ge19034	Ishkheenickh	20	80	26.40
av3130	L.Wedeene	20	80	26.40
av2789	Wedeene	20	80	26.40

Appendix B – Logging Method Breakdown Nass TSA

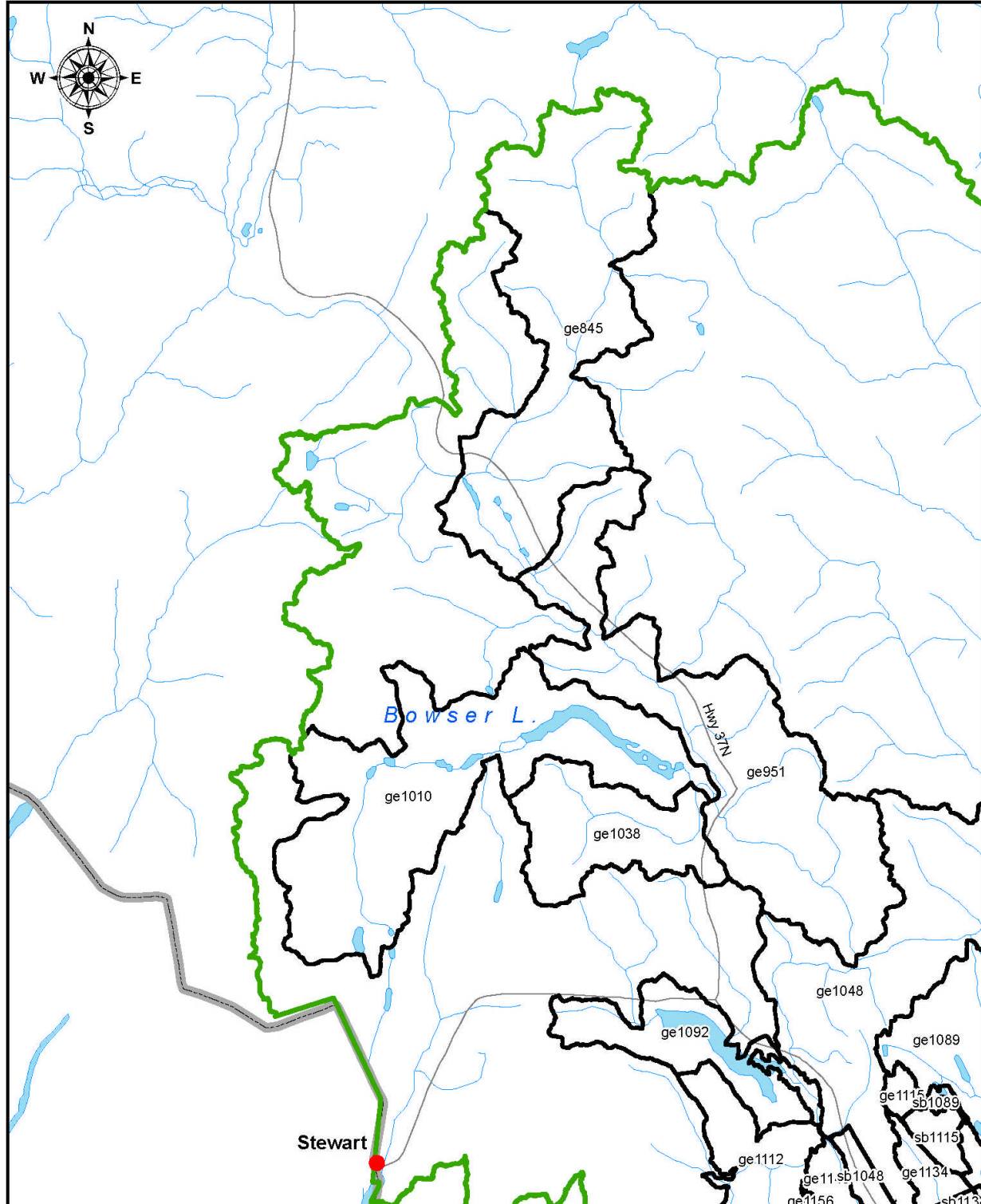
Polygon #	Location	GBS (%)	Cable (%)	On Truck Cost (\$/m³)
ge1092	Meziadin Lake	85	15	23.20
sb1048	Orenda	85	15	23.20
ge1048	Wildfire / Upper Kwinageese	75	25	24.00
ge1156	Pas	70	30	24.40
ge1143	L.Pas	70	30	24.40
ge1038	Surveyor Creek	90	10	22.80
ge1112	White River	80	20	23.60
sb1134	Brown Bear	85	15	23.20
sb1156	Harper	70	30	24.40
sb1187	Harper	70	30	24.40
un1187	Harper	70	30	24.40
ge1134	Brown Bear	85	15	23.20
ge951	Irving / Kotcho	80	20	23.60
ge1115	Brown Bear	85	15	23.20
ge845	Owl / Bell II	85	15	23.20
ge1010	Bowser Lake	90	10	22.80
sb1115	Bonnie Lakes	85	15	23.20
sb1089	Bonnie Lakes	85	15	23.20
sb1228	Harper	70	30	24.40
sb1143	Harper	70	30	24.40
ge1089	Bonnie Lakes	85	15	23.20
ge1174	Niska Lakes	70	30	24.40
ge1094	Kwinageese	90	10	22.80
ge1082	Kwinageese	90	10	22.80
ge1208	Tchitin	60	40	25.20
ge1187	Kinskuch	50	50	26.00
ge1228	Kshadin	50	50	26.00
un1292	Kwinatahl	50	50	26.00
un1269	Kwinatahl	50	50	26.00
ge1269	Kwinatahl	50	50	26.00

Appendix C – Logging Method Breakdown TFL 41 (off-shore)

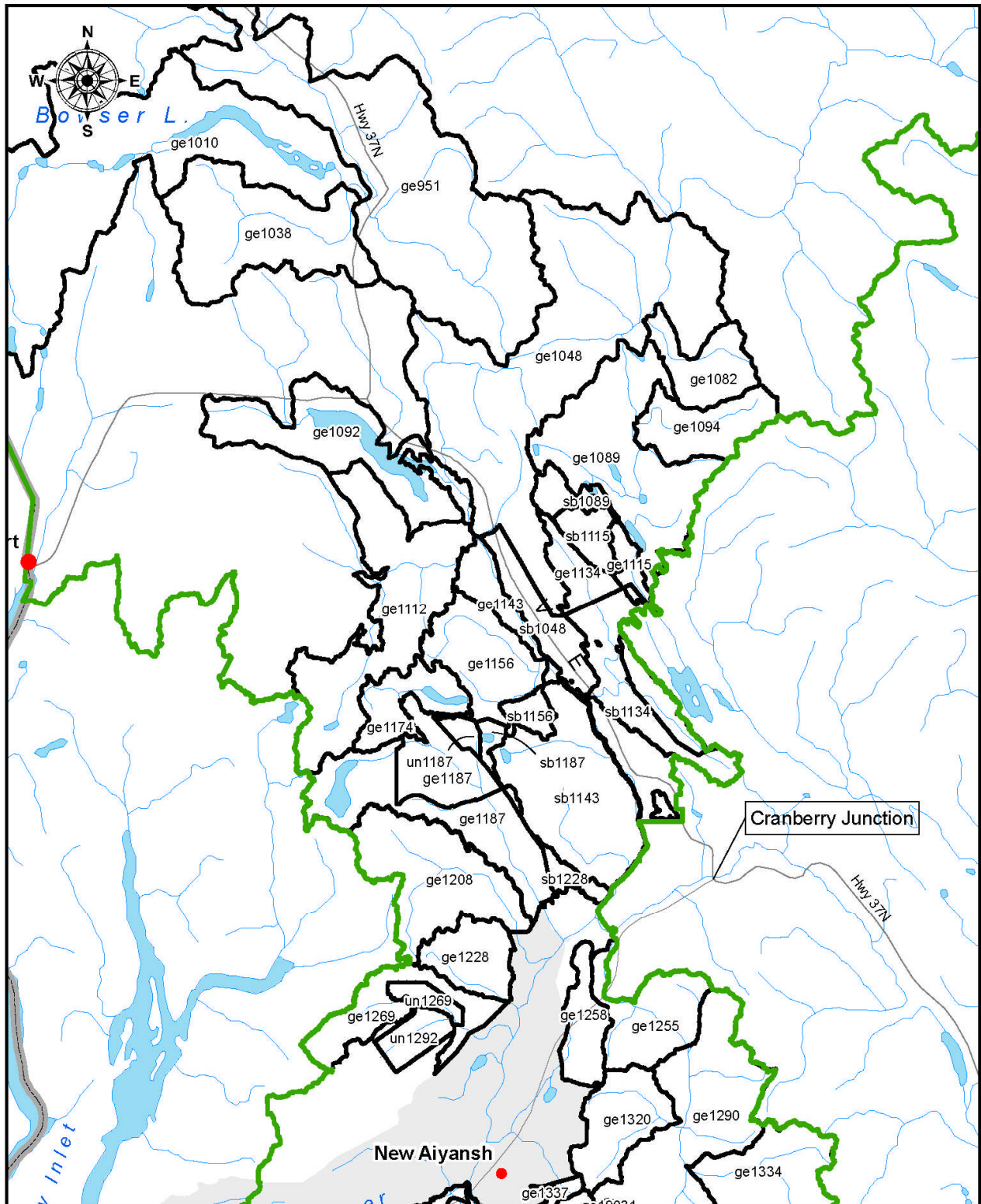
	% Conventional (i.e. non- helicopter)	Heli % Ocean	Heli % Land	On Truck Cost (\$/m ³)
Dala-Kildala	85	0	15	57.00
Gardner Canal	0	100	0	88.00
Weewanie	30	0	70	89.40
Falls	30	0	70	90.00
South Seekwyakin Creek	10	0	90	102.00
Sue Channel	40	60	0	71.20
Maitland and Loretta Islands	0	100	0	88.00
Kitsaway	50	40	10	69.00
Hugh	80	0	20	58.40
Lower Kemano	0	0	100	108.00
Eagle	80	0	20	58.40
Devastation Channel	0	100	0	88.00
Kildala Arm	30	70	0	75.40
Barrie	80	0	20	58.40
Crab Lake	0	100	0	88.00
Heysham	80	15	5	55.40
Wachwas Creek	0	0	100	108.00
Horetzky	20	0	80	96.00
Kowesas	60	0	40	72.00
Caribou	80	0	20	60.00
Upper Kemano	90	0	10	55.80

Appendix D – Polygons

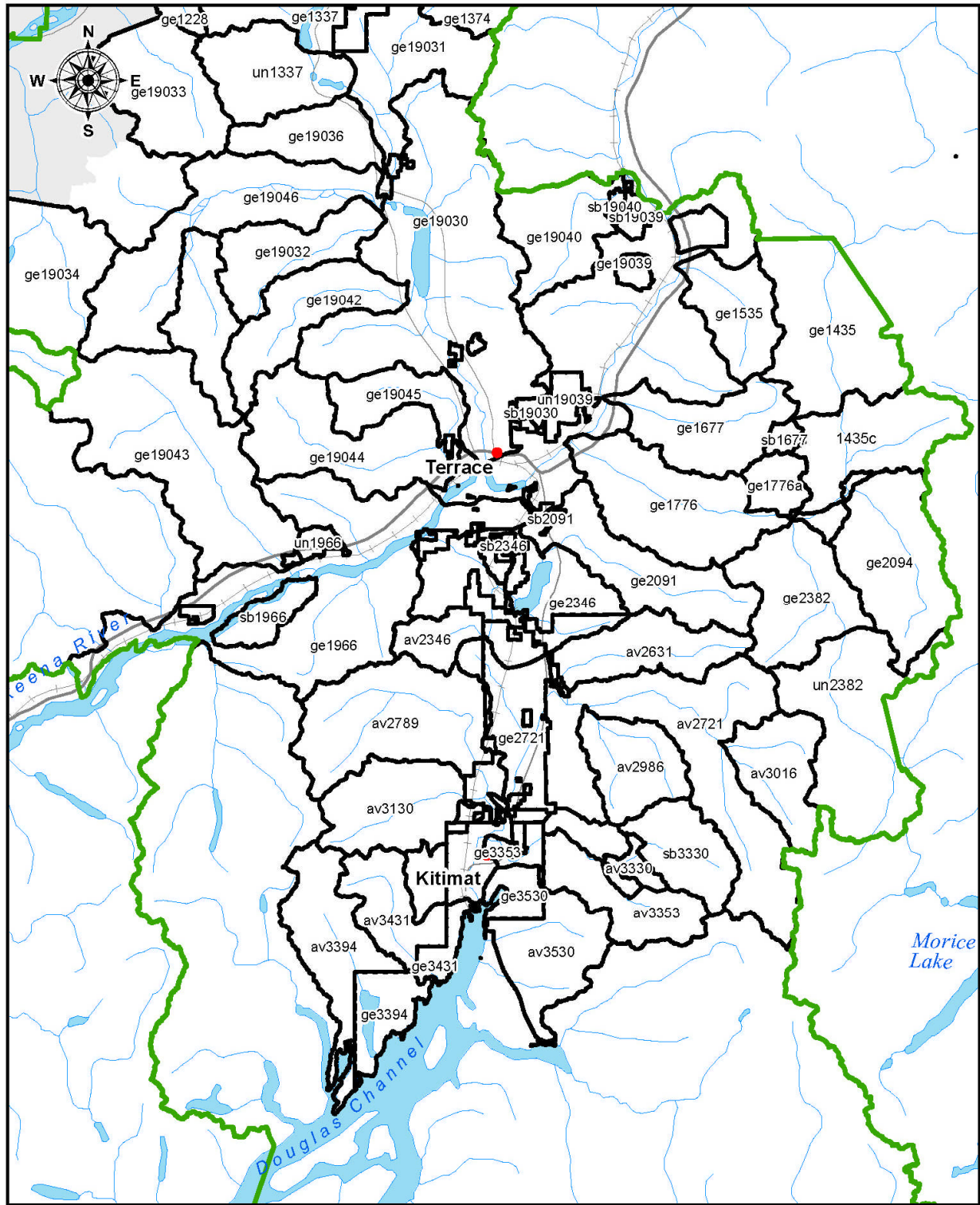
Map 1 of 5: Delivered Log Cost Polygons within the Northern portion of the Kalum Forest District (north half of Nass TSA)



Map 2 of 5: Delivered Log Cost Polygons within the Northern portion of the Kalum Forest District (south half of Nass TSA)



**Map 4 of 5: Delivered Log Cost Polygons within the Mid-portion of the Kalum Forest District
(including Kalum TSA, TFL 1, TFL 41 on-shore)**



Map 5 of 5: Delivered Log Cost Polygons within the Southern portion of the Kalum Forest District (TFL 41 on-shore)

