APPENDIX C: DOCUMENTATION OF THE ANALYSIS OF HOUSEHOLD GROWTH AND RESIDENTIAL DEVELOPMENT PATTERNS

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Current Trends Continued Growth Scenario Household Forecast

To estimate a housing type split to apply to the current trends continued growth scenario household forecast, we used historic (1991 to 1995) Canadian Mortgage and Housing Corporation (CMHC) housing start data. The 1991-1995 historic ratio of ground-oriented housing (single family, duplex, townhouse) on a market sub-area basis is as follows:

Market sub-area	1991 to 1995 Ground Oriented Housing Ratio (based on CMHC starts data)
West	41.76%
Midwest	56.08%
Central	62.41%
East	70.27%

To split the ground oriented housing further into housing types (single family, duplex, townhouse), we assumed again that the historic 1991 to 1995 ratio (based on CMHC housing starts data) would continue:

Market sub-area	Single Family % of Ground Oriented	Duplex % of Ground Oriented	Townhouse % of Ground Oriented
West	71.56%	8.95%	19.50%
Midwest	70.92%	6.16%	22.92%
Central	64.02%	12.9%	23.08%
East	66.62%	5.34%	28.03%

For the split in apartment type we assumed the 1994 CMHC low-rise/high-rise apartment split[1]:

Market sub-area	CMHC 1994 Split between Low-rise/High-rise Apartments (low-rise as a % of total apartment starts)
West	62.88%
Midwest	70.95%
Central	100%
East	100%

Compact Metropolitan Growth Scenario Household Scenario

To estimate a housing type split in this growth scenario we gradually decreased the share of the ground oriented housing assumed in the current trends growth

[1] CMHC started reporting apartment starts data by type (i.e., low-rise versus high-rise) in 1994.

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scenario (based on 1991 to 1995 CMHC housing starts data). That is, we adjusted the 1991 to 1995 CMHC ratios of ground oriented housing to apartment housing downward by 10% at the beginning of each interval (i.e., 1996-2000, 2001-2006, 2007-2021) so that the compact metropolitan scenario would provide for denser development compared to the current trends scenario.

Market sub-area	1996 - 2000 Ratio of Ground Oriented Housing[2]	2001 - 2006 Ratio of Ground Oriented Housing[3]	2007-2021 Ratio of Ground Oriented Housing[4]
West	37.58%	33.83%	30.44%
Midwest	50.47%	45.42%	40.88%
Central	56.17%	50.55%	45.5%
East	63.24%	56.92%	51.23%

To split the ground oriented housing by type (single family, duplex, townhouse) we assumed that the split would be the same as that assumed in the current trends scenario (i.e., based on the CMHC housing starts data 1991 to 1995 actual split) up to 2006, beyond which townhouse development would become the predominant type of ground oriented housing in the west market sub-area, and increasingly predominant in the other market sub-areas (compared to the current trends continued growth scenario). Our assumed ground oriented housing split for the period of 2007 to 2021 is as follows:

Market sub-area	Single Family % of Ground Oriented (2007 to 2021)	Duplex % of Ground Oriented (2007 to 2021)	Townhouse % of Ground Oriented (2007 to 2021)
West	0%	0%	100%
Mid-west	30%	10%	60%
Central	40%	10%	50%
East	40%	10%	50%

As in the case of the current trends continued scenario, we based the split of low-rise versus high-rise apartment for this growth scenario (compact metropolitan) on the 1994 actual apartment split (based on CMHC housing starts data):

Market sub-area	Low-rise Apartment Share of Total Apartment Development
West	62.88%
Midwest	70.00%
Central	100%
East	100%

2 These ratios were derived by adjusting the 1991-1995 actual ratios based on CMHC housing starts data downward by 10%.

3 These ratios were derived by adjusting the 1996-2000 ratios downward by 10%.

4 These ratios are the GVRD's ratios for the period 2007- 2021 as provided in the GVRD's Livable Strategic Plan

Assumptions for Household Forecasts:

Appendix D contains the household forecasts for the two growth scenarios for three time intervals: 1995-2000; 2001-2006; 2007-2021. Also shown in Appendix D are aggregate "usage factors"[5] for units of residential development (e.g., the amount of aggregates required for a single family house, a townhouse, and apartment units). These usage factors were provided by Levelton Associates and include the aggregates required for the construction of the specific type of dwelling unit and the aggregates required for the associated roads and services of each type of dwelling unit.

The aggregate usage factors for housing units and their associated roads and services are:

single family west sub-areas:	423 tonnes per single family unit = (340 tonnes per unit + 83 tonnes per unit for associated roads and services)
single family east sub-areas:	506 tonnes per single family unit = (340 tonnes per unit + 166 tonnes per unit for associated roads and services)
two family dwelling all areas:	263 tonnes per row unit = (200 tonnes per unit + 63 tonnes per unit for associated roads and services)
row/townhouse all areas:	263 tonnes per row unit = (200 tonnes per unit + 63 tonnes per unit for associated roads and services)
apartment low-rise all areas:	101.5 tonnes per low-rise unit = (38.5 tonnes per unit + 63 tonnes per unit for associated roads and services)
apartment high-rise all areas:	122 tonnes per high-rise unit = (59 tonnes per unit + 63 tonnes per unit for associated roads and services)

5 These "usage factors" are estimates by Levelton Associates of the amounts of aggregate required for a given unit measure of a given type of urban construction (e.g., single family house, apartment unit, 1,000 sq.ft. of office floorspace).

Summary of Aggregate Usage due to Residential Development:

The following tables show the difference in aggregate demand due to the expected difference in residential development in the two scenarios:

West Region	Current Trends Continued (tonnes of aggregates)	Compact Metropolitan (tonnes of aggregates)
1995 - 2000	5,511,830	4,745,350
2001-2006	7,310,618	6,223,343
2007-2021	18,817,598	13,192,375
Total (1995-2021)	31,640,046	24,161,068

Mid-west Region	Current Trends Continued (tonnes of aggregates)	Compact Metropolitan (tonnes of aggregates)
1995 - 2000	12,133,541	14,117,022
2001-2006	13,780,847	16,558,167
2007-2021	33,784,877	35,380,361
Total (1995-2021)	59,699,265	66,055,550

Central Fraser Valley Region	Current Trends Continued (tonnes of aggregates)	Compact Metropolitan (tonnes of aggregates)
1995 - 2000	5,940,647	4,226,067
2001-2006	7,704,908	4,495,107
2007-2021	21,753,133	10,199,616
Total (1995-2021)	35,398,688	18,920,790

East Fraser Valley Region	Current Trends Continued (tonnes of aggregates)	Compact Metropolitan (tonnes of aggregates)
1995 - 2000	2,207,062	824,371
2001-2006	3,845,757	979,445
2007-2021	12,232,196	2,117,915
Total (1995-2021)	18,285,015	3,921,731

Total Study Area	Current Trends Continued (tonnes of aggregates)	Compact Metropolitan (tonnes of aggregates)
1995 - 2000	25,793,080	23,912,811
2001-2006	32,642,131	28,256,062
2007-2021	86,587,806	60,890,268
Total (1995-2021)	145,023,017	113,059,141

This analysis suggests that due to higher density residential development, the compact metropolitan growth scenario will require less aggregate for new residential construction over time. Over the entire study period (1995-2021), the total difference between the two growth scenarios is about 32,000,000 tonnes.

Up until 2006, the compact metropolitan growth scenario will result in more aggregate demand in the Mid-west region than the current trends continued growth scenario. This is because this market sub-area will capture a much larger proportion of household growth in the compact growth scenario than it will in the current trends growth scenario.

The difference of about 32,000,000 tonnes is about 4% of the study area's total forecasted demand for aggregates of 775,492,000 tonnes over the study period (1996 to 2021), which implies that the compact metropolitan growth strategy will not significantly impact overall aggregate consumption in the study area.