

# LANDCOR<sup>®</sup>

## DATA CORPORATION



**Report Prepared for:**

Kinder Morgan Canada

**Project:**

Trans Mountain Pipeline Impact Study

Property Values 1998 - 2013



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## Executive Summary

Among the concerns of property owners along potential oil and gas pipeline routes is that the presence of a pipeline easement on or near their property will lower the market value of their property. For property lots with an easement, it is reasonable to expect that the loss of use, resulting from the easement, would lower market values (for properties near a pipeline the expected effect is harder to determine, because unlike overhead transmission lines, a pipeline easement tends to have a more benign physical presence, one not easily observed even at short distance). This study attempts to ascertain whether proximity to the Trans Mountain Pipeline (TMPL) in the Lower Mainland area of British Columbia affects the market value of a residential detached property.

The study uses transactions data from six distinct neighbourhoods, three of which are subjects, which the TMPL transverses, and three of which are controls, more distant from the pipeline, but similar in nature, for the residential market analysis. The analysis estimates the relationship between the distance a property is from the pipeline and its price. We use two methodological approaches for this analysis. The first is a macro or higher-level analysis, that compares property prices, price appreciation and sales rates in a subject neighbourhood with the TMPL and the same for its matching control neighbourhood. The second is a micro/statistical analysis that estimates the direct effect of proximity on transaction prices. To address the variation in property prices that result from differences in lot and structure size and type, this second approach uses a hedonic regression methodology that separates out the different contributions to transaction prices, both house characteristics and neighbourhood, from the effects of proximity to the pipeline.

This research finds no consistent, conclusive evidence to support a relationship between distance to the TMPL and transaction prices. The analysis presented here is conducted separately for each of the three study areas, Coquitlam, Langley, and Chilliwack, where for each there is a subject / comparable neighbourhood pair. The effect of proximity to the TMPL on residential property values is most often statistically not different from a zero effect. Rates of price appreciation are similar in the subject and control neighbourhoods, though in Coquitlam and Langley prices increase marginally more in the control neighbourhoods than the subject areas after 2006, this pattern does not hold for Chilliwack. While this analysis is relatively preliminary, it does reflect the existing literature on pipelines and house values, where there is no consistent, conclusive relationship between pipeline proximity and property value.



# Project Overview

## Introduction

Kinder Morgan Canada is interested in researching the impact of the existing Trans Mountain Pipeline on residential property pricing. This work is in support of the company's pipeline planning with a particular interest in expansion within the Lower Mainland area of British Columbia. Kinder Morgan Canada engaged Landcor Data Corporation (Landcor) and economist Tsur Sommerville, to carry out the data research and to conduct an analysis of residential market data with a focus on the effect on property values based on a property's proximity to the TMPL.

The analysis here uses two different approaches to attempt to identify a consistent relationship between proximity to the TMPL and residential property values. The first, which we refer to as a "macro" approach, relies on comparing aggregated neighbourhood statistics (such as average and median prices, price appreciation, sales volumes) in neighbourhoods proximate to and more distant from the TMPL. The other, the "micro" approach, uses a more defined statistical analysis to try to identify the specific relationship between property value and distance to the TMPL, for properties close to the pipeline.

Landcor identified six distinct neighbourhoods for this study. Three of the areas are subjects (proximate to the TMPL) and three are controls (similar but not on the TMPL) for the residential market analysis. The three subject neighbourhoods have been selected based upon three main criteria:

1. Primarily residential,
2. Intersected by TMPL pipeline infrastructure, and
3. Situated in an either an Urban, Suburban, or Rural jurisdiction.

Landcor provided the raw market data for this set of subject and control neighbourhoods and analyzed market trends for those same neighbourhoods over a 15-year study period (from 1998 to 2013) for the macro analysis element of this report. The micro analysis uses these data in Landcor's standard commercial hedonic regression model, which is the analytical support for Landcor's Automated Valuation Model based products.

This study has two analytical products. The first is a set of graphs comparing the subject and control neighbourhoods. These present a visual comparison between each pair of subject and control neighbourhoods as to whether there are any apparent differences in their respective land, improvement, and total assessed values and property sale prices and sale volumes. The second product is a more refined statistical analysis using hedonic regression techniques to determine the relationship between proximity to the TMPL and house transaction prices. This approach asks whether the variation of house prices in the general vicinity of the TMPL can be explained by the distance from a property to the TMPL, or more generally, what proportion of a property's estimated sales price is attributable to this factor using hedonic valuation.

The subject and control neighbourhoods are very similar in terms of general property characteristics, assessed land values, assessed improvement values, total assessed values, and their respective rates of appreciation over the study period. Likewise, the median sale prices are very similar in terms of appreciation and sale prices over the study period. There is not a consistent pattern as to whether values, prices and sales volumes are higher in the subject or the control. For some jurisdictions these are higher in the subject (the neighbourhood intersected by the TMPL) in others, they are higher in the control.

<sup>1</sup> Landcor Data Corporation is a licensed reseller of the BC Assessment data roll and has extensive experience conducting custom data extraction and regression analyses on property attributes. The BC Assessment roll is a government-maintained dataset of property valuation, which is the basis for the taxation system for the majority of the two million properties in British Columbia. For residential properties, the BC Assessment valuation calculation is determined using a fair market value methodology based on recent and similar sales. This extensive property coverage and market-based valuation process makes the BC Assessment roll the preferred data source for residential property market research.



## Project Overview

The hedonic analysis also yields inconclusive results. Depending on the area under study and specification of the form of the relationship between proximity to the TMPL, estimated house prices are higher, lower, or unrelated to the distance between the property's location and the TMPL. Whether the absence of a clear consistent relationship between house prices and proximity to the TMPL is a finding unique to the chosen study locations, a result of incomplete analysis, or a generalizable result cannot be determined. This fundamental inconsistency in results is an outcome that reflects the variation in the existing research findings in this area.

The small number of studies on the effects of pipelines on property values and variation in results makes it impossible to reach an unequivocal conclusion from the academic literature on the effects of the presence of and proximity to a pipeline on residential property values. The better-executed research finds that, in the absence of a pipeline incident, there is no evidence that the presence of a pipeline, gas or oil, lowers estimated property values.<sup>2</sup> In these studies, transaction prices are uncorrelated with distance to a pipeline, in the event there has been no recent incident. In cases where there has been a recent incident, residential properties more proximate to a pipeline do have lower values. However, this discount dissipates with time.<sup>3</sup> This literature does not separately identify, measure, or estimate the effect on properties with a pipeline easement, so the absence of a proximity effect should not be interpreted as revealing anything about the effect of a pipeline easement on the market value of a residential property.

<sup>2</sup> Among the studies in this area are Diskin, et. al. (2011), Fruit (2008), Kinnard, Dickey, and Geckler (1994), Simons, and Saginor (2006), Wilde, Loos, and Williamson (2012). (See Full References page at the end of this document)

<sup>3</sup> See Somerville and Wetzel (2014), Hansen, Benson, and Hagen (2006), and Simons (1999).



# Project Overview

## Methodology Overview

Landcor used the existing TMPL alignment provided by Kinder Morgan Canada to establish residential property selection sets that represent the two aspects of pipeline influence: properties relatively close to the pipeline and properties relatively far from the pipeline. As there is no accepted value for the absolute distance that divides these two aspects, Landcor chose an arbitrary value based on educated estimate. Landcor then used statistical hedonic regression analysis to determine whether the TMPL influences property values and, if so, to what degree.

One output from this study is a set of subject and control neighbourhood comparisons, mostly in the form of graphs, which highlight the differences in neighbourhood aggregates and averages between those neighbourhoods through which the pipeline passes and a control neighbourhood in the same jurisdiction. These graphs present the values over time in average neighbourhood land, improvement, and total assessed values and property sale prices and the total sale volumes in the subject and control areas over the 15-year study period from 1998 to 2013.

The second output is the statistical report that presents the estimated regression coefficients from a regression that estimates the relationship between a property's transaction price (the dependent variable) and its structural and lot characteristics, neighbourhood, time of sale, and proximity to the pipeline (independent variables). This approach allows an estimate of the proportion of a property's hedonic valuation is attributable to each of these factors and whether they are associated with higher or lower transaction prices; that is, whether it can be demonstrated that proximity to the TMPL has a statistically measurable effect on property sale prices.<sup>4</sup>

For the purpose of this study, these two approaches are referred to herein as the "Neighbourhood Comparison" (or "macro") approach and the "Regression Analysis" (or "micro") approach respectively.

<sup>4</sup> Statistically measurable is defined here: the estimated coefficient is different from zero with 95 percent confidence under the assumption that the error in the regression is normally distributed.



# Project Overview

## Neighbourhood Comparison

The intent of this portion of the study is to provide sampled, reflective, and aggregated valuations and trends within the Lower Mainland and Lower Fraser Valley for specific neighbourhoods based on their relative location to the existing Trans Mountain Pipeline alignment.

Kinder Morgan Canada provided Landcor Data Corporation with the following digital, geographic information system (GIS)-formatted files for use in Landcor's property selection and spatial analyses:

1. The centerline of the existing TMPL alignment, and
2. The easements and right of ways associated with the existing TMPL alignment.

It should be noted that the easement and right of way (RoW) information provided by Kinder Morgan Canada is considered as a reference only and not a precise and definitive delineation of where the easement or RoW actually falls. The TMPL GIS data is intended to show the general location of the Trans Mountain Pipeline. It is specifically not to be used for legal, engineering or surveying purposes, or for doing any work on or around the pipeline, all of which require the specific physical location and marking of the pipeline by qualified personnel and with Kinder Morgan Canada's prior written approval.

The actual number of residential properties with an easement for the TMPL can only be confirmed by way of a property title search through the BC Land Title and Survey Authority (LTSA), which maintains BC's official legal record of private property ownership. Legal information on a land title in British Columbia includes:

- Registered owner(s) names,
- Historical title information (back to the date when information was first computerized),
- Reference codes that identify any encumbrances that are contained on the search, and
- Details of encumbrances, such as mortgages and easements.

## Neighbourhood Selection Process

The neighbourhood selections were informed by using BC Assessment's "Jurisdiction Neighbourhood" coding scheme wherein similar properties in a geographic area are grouped using a numeric code to form a relatively homogeneous group.

Landcor identified key aspects of the pipeline-proximal, subject neighbourhoods around the TMPL and then identified similar control neighbourhoods that share those key aspects. The Housing Price Index (HPI) data for those neighbourhoods was calculated for a period of 15 years, for Assessment Roll Years 1998 to 2013.

The initial conditions for the selection of the subject and control neighbourhoods were that each one of the subject neighbourhoods must be along the existing TMPL alignment in British Columbia and that a similar, comparable control neighbourhood could be identified for each subject neighbourhood that was sufficiently far from the TMPL to be considered beyond the range of influence but similar enough in composition to be used as a control group.

It was also decided that the subject control neighbourhoods should be drawn from different regions of the Lower Mainland and Fraser Valley in order to provide a regional perspective on whether the TMPL affects neighbourhood house values.

# Project Overview

Landcor selected residential properties from three distinct community types:

1. An Urban Neighbourhood in the City of Coquitlam,
2. A Suburban Neighbourhood in the Township of Langley, and
3. A Rural Neighbourhood in the City of Chilliwack.

In examining the potential subject and control neighbourhoods in terms of homogeneity of residential property attributes (lot size, year built, finished area, number of bedrooms, etc.), Landcor presented Kinder Morgan Canada with candidates for inclusion in this study. Kinder Morgan Canada approved the selection of the subject and control neighbourhoods based on Landcor’s analysis and summary of the key property attributes of these residential properties.

The summary of the subject and control neighbourhood property characteristics used in the Neighbourhood Comparison analysis can be found in the following pages. The locations of the neighbourhoods are shown below in Figure 1.

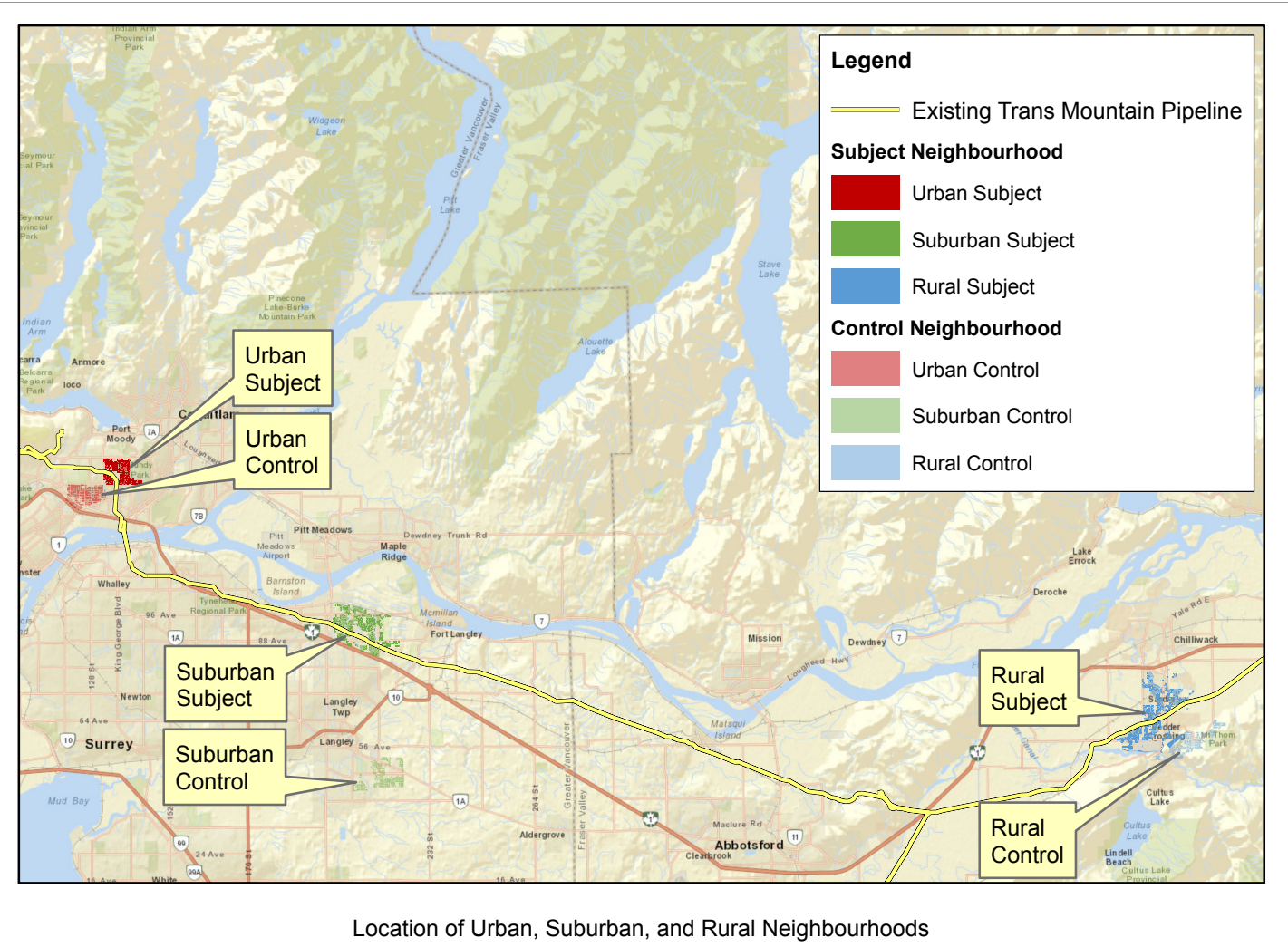


Figure 1 - Location of Urban, Suburban and Rural Neighbourhoods

# Project Overview

## Urban: Coquitlam - Figure 2

Of the approximately 7,500 linear meters of TMPL in the City of Coquitlam, 1,240 meters are within the urban subject neighbourhood, which is roughly 17% of the total length of the TMPL in Coquitlam.

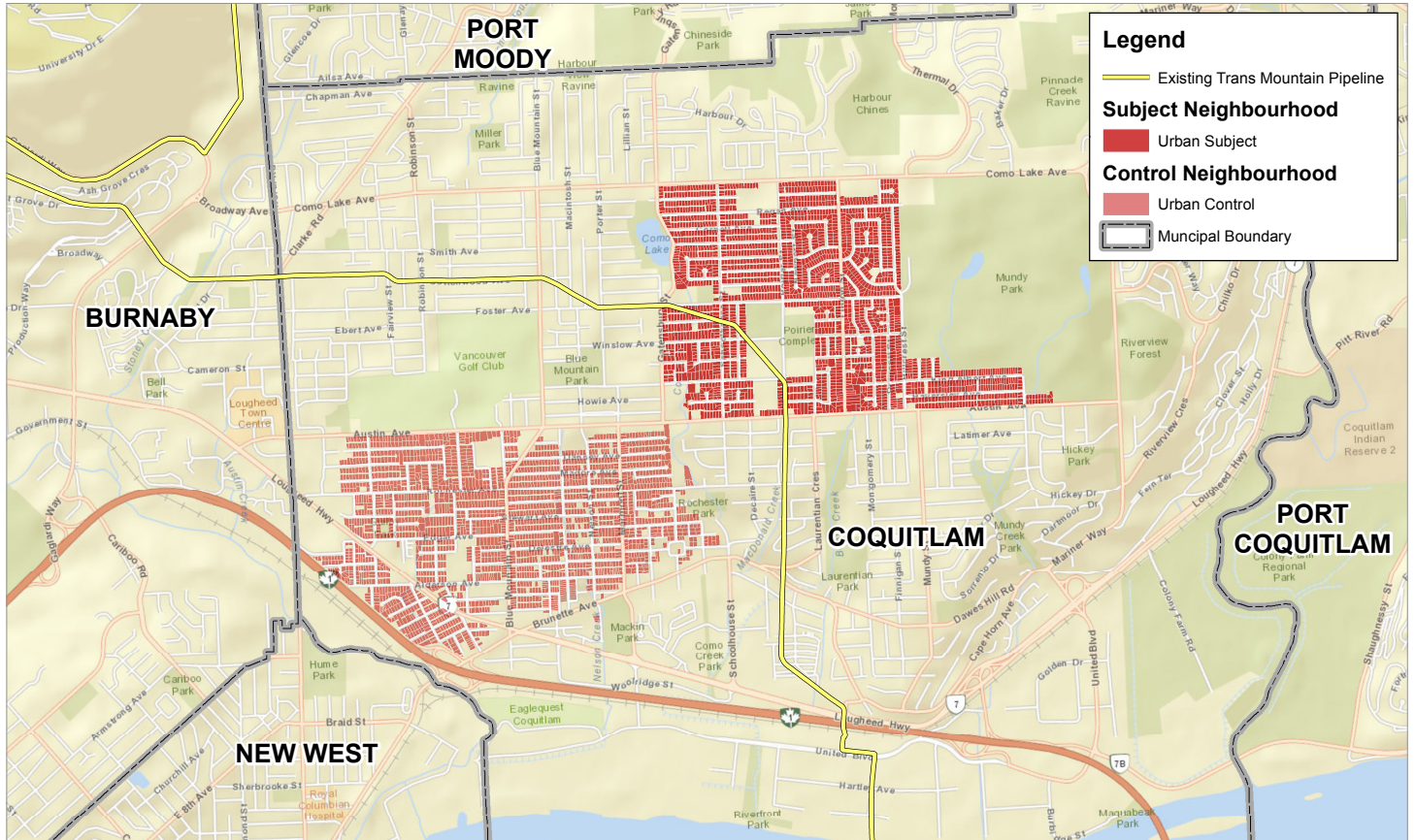


Figure 2 - Subject and Control Neighbourhoods in Coquitlam



# Project Overview

## Suburban: Langley - Figure 3

Of the approximately 17,000 linear meters of TMPL in the Township of Langley, 4,400 meters are within the suburban subject neighbourhood, which is roughly 26% of the total length of the TMPL in the Township of Langley.

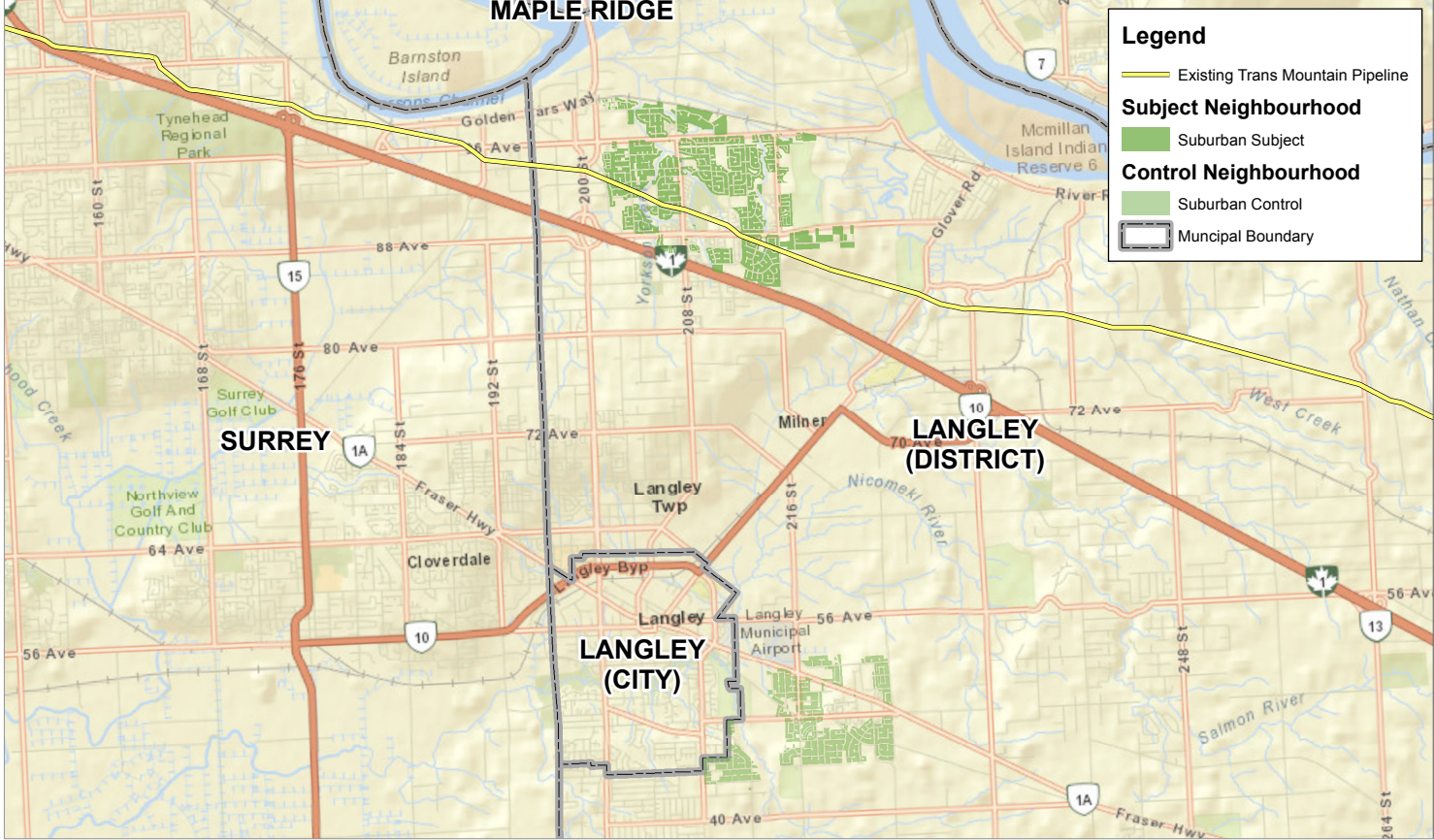


Figure 3 - Subject and Control Neighbourhoods in Langley

# Project Overview

## Rural: Chilliwack - Figure 4

Of the approximately 25,500 linear meters of TMPL in the City of Chilliwack, 1,800 meters are within the rural subject neighbourhood, which is roughly 7% of the total length of the TMPL in Chilliwack.

Much of the TMPL alignment in Chilliwack is through non-residential areas. The rural subject neighbourhood has a relatively lower percentage of the total TMPL length in the subject neighbourhood as compared to the urban and suburban neighbourhoods (7% as compared to 17% and 26%, respectively).

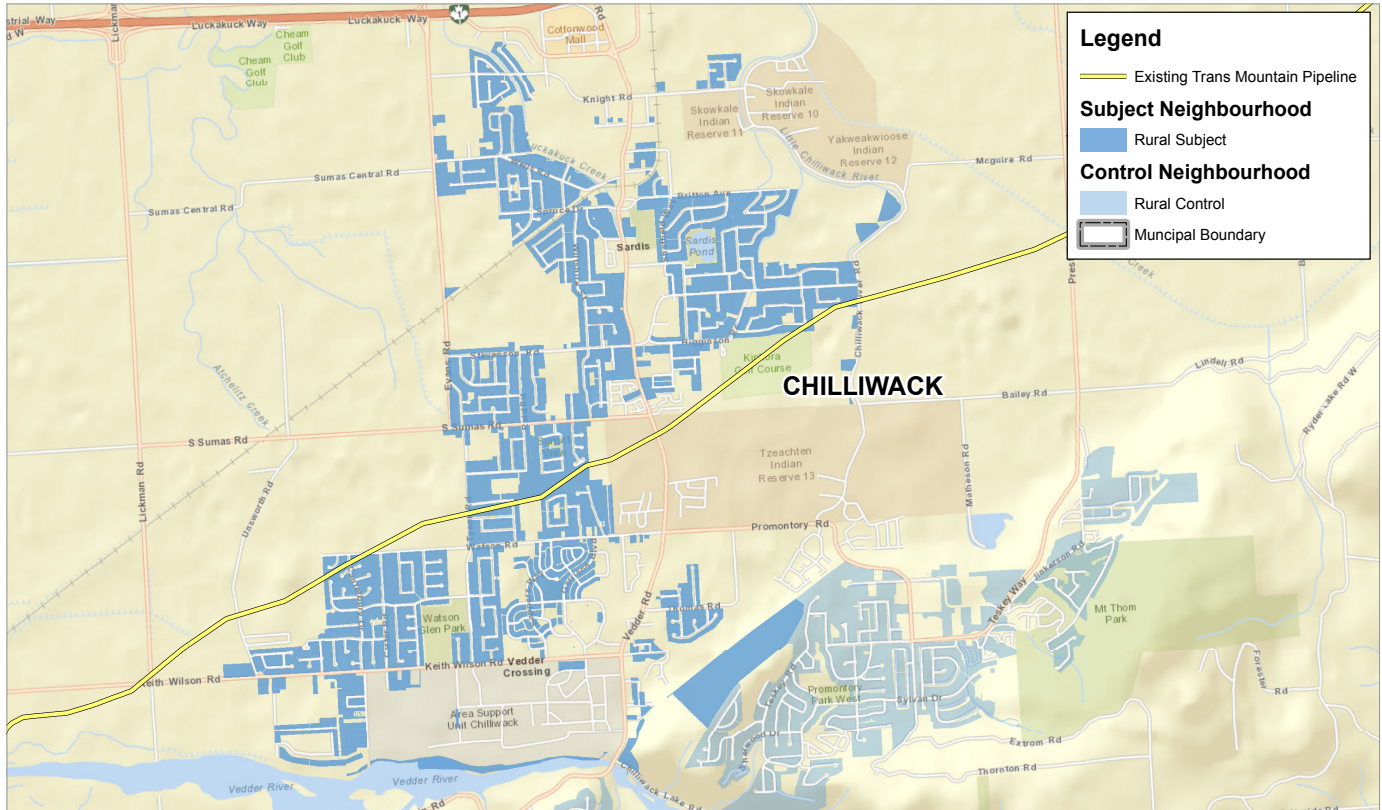


Figure 4 - Subject and Control Neighbourhoods in Chilliwack



# Project Overview

## Exclusion of Farms

Though Landcor's original proposal indicated that farm properties would be included in the analysis, upon further investigation it was deemed that this would not be suitable for the neighbourhood comparison nor the regression analysis. This property type is excluded from the analysis because of the heterogeneous nature of farm properties and because their values depend on soil type and existing operations, variables not available for the analysis. As mentioned, an effort was made to select comparable neighbourhoods (in terms of residential property types, lot size, assessed values, among other property attributes) but farm properties are not as comparable due to the widely varying property attributes. In addition to challenges in explaining the variation in the prices of farm property with available variables, there is also not a sufficiently large sample set of comparable farm properties with transaction prices along the Fraser Valley and Lower Mainland portions of the TMPL route to facilitate an analysis with any degree of statistical accuracy.

## Bill 45 and Assessed Values

During the time period of this study, market increases to July 2008 were not reflected on the 2009 Assessment Roll due to Bill 45, which effectively froze property values at the 2008 roll year value for the 2009 roll year.

*"2009 was a year of continued uncertainty for the global economy. Property values, which were significantly impacted in 2008 by global recession, stabilized in 2009, and BC Assessment successfully managed the potentially difficult transition from the altered roll process back to a regular assessment cycle for production of the 2010 Assessment Roll. The altered roll process occurred in November 2008 when the B.C. government passed Bill 45, the Economic Incentive and Stabilization Statutes Amendment Act (2008). Bill 45 changed the 2009 roll production process to cushion property owners from the rapid changes seen in property values across the province in late 2008".<sup>5</sup>*

<sup>5</sup> Excerpt from BC Assessment Annual Report 2009. Message from the Board Chair to the Minister Responsible  
<http://www.bcasessment.ca/forms/Publications/10-062%20BC%20Assessment%202009%20Annual%20Report%20FINAL.pdf>



# Project Overview

## [Adjustments to the Suburban Control and Rural Control Neighbourhoods](#)

The suburban control neighbourhood in the Township of Langley was dissimilar to the suburban subject neighbourhood in terms of lot size. The suburban control neighbourhood had a greater number of large lots, which would affect some of the comparison analysis. In order to make the two neighbourhoods more similar in composition, 123 properties with a lot size greater than 25,000 square feet were removed from the suburban control neighbourhood.

The rural control neighbourhood in the City of Chilliwack was also dissimilar from the rural subject neighbourhood in terms of lot size; in order to make the two rural neighbourhoods more similar in composition, nine properties with a lot size greater than 500,000 square feet were removed from the rural control neighbourhood. Likewise, sixteen residential strata properties were removed from the rural control neighbourhood as they were considered geographic outliers; these properties were actually located within the rural subject neighbourhood.



# Project Overview

## Residential Property and Actual Use Types

All the residential properties in BC are categorized by BC Assessment using their “Actual Use Code” coding scheme (see Appendix A – Glossary). This code denotes a property’s primary use and each code has a corresponding “Actual Use Description”. The pie chart in Figure 5 summarizes the Actual Use Descriptions for all the subject and control properties included in the analyses for this study.

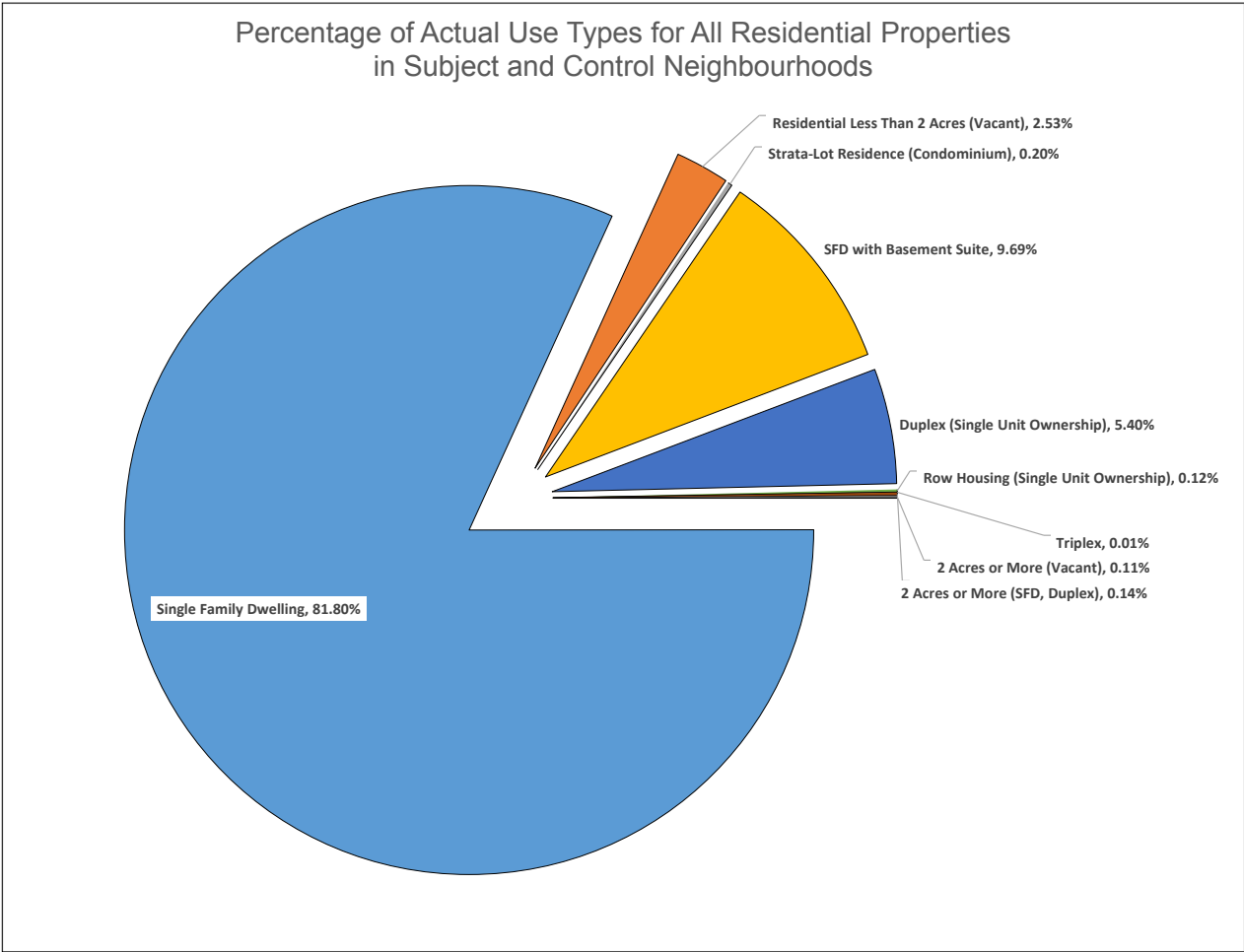


Figure 5 - Allocation of Properties by Actual Use Code

The properties used in the analyses are almost entirely Single Family Dwellings (SFDs), SFDs with Basement Suites, and Duplexes. Together, properties with these three Actual Use Descriptions account for almost 97 percent of the total property types within the subject and control neighbourhoods.<sup>6</sup>

The distribution of property types in each of the subject and control neighbourhoods are similar to the overall Actual Use Code percentages, where SFDs, SFDs with Basement Suites, and Duplexes constitute over 90 percent of the property types. Table 1 presents the break down of properties by Actual Use Code for each of the three communities.

<sup>6</sup> Source: BC Assessment 2014 Assessment Roll Data

# Project Overview

**Table 1 – Allocation of Properties by Actual Use Code by Jurisdiction**

## Urban

Actual Use Type Code	Actual Use Type Description	Urban Subject Count	Urban Subject % Total	Urban Control Count	Urban Control % Total	Overall Average
0	Single Family Dwelling	1,740	81.4%	1,254	52.8%	81.8%
1	Residential Less Than 2 Acres (Vacant)	12	0.6%	52	2.2%	2.5%
30	Strata-Lot Residence (Condominium)	-	-	-	-	0.2%
32	SFD with Basement Suite	346	16.2%	471	19.8%	9.7%
33,34,35,36	Duplex (Single Unit Ownership)	39	1.8%	597	25.1%	5.4%
39	Row Housing (Single Unit Ownership)	-	-	3	0.1%	0.1%
47	Triplex	-	-	-	-	0.01%
60	2 Acres or More (SFD, Duplex)	-	-	-	-	0.1%
61	2 Acres or More (Vacant)	-	-	-	-	0.1%
		<b>2,137</b>	<b>100%</b>	<b>2,377</b>	<b>100%</b>	<b>100%</b>

## Suburban

Actual Use Type Code	Actual Use Type Description	Suburban Subject Count	Suburban Subject % Total	Suburban Control Count	Suburban Control % Total	Overall Average
0	Single Family Dwelling	4,291	90.7%	1,827	88.6%	81.8%
1	Residential Less Than 2 Acres (Vacant)	24	0.5%	21	1.0%	2.5%
30	Strata-Lot Residence (Condominium)	-	-	-	-	0.2%
32	SFD with Basement Suite	386	8.2%	212	10.3%	9.7%
33,34,35,36	Duplex (Single Unit Ownership)	2	0.0%	3	0.1%	5.4%
39	Row Housing (Single Unit Ownership)	15	0.3%	-	-	0.1%
47	Triplex	-	-	-	-	0.01%
60	2 Acres or More (SFD, Duplex)	8	0.2%	-	-	0.1%
61	2 Acres or More (Vacant)	5	0.1%	-	-	0.1%
		<b>4,731</b>	<b>100%</b>	<b>2,063</b>	<b>100%</b>	<b>100%</b>

## Rural

Actual Use Type Code	Actual Use Type Description	Rural Subject Count	Rural Subject % Total	Rural Control Count	Rural Control % Total	Overall Average
0	Single Family Dwelling	4,612	91.3%	1,894	86.1%	81.8%
1	Residential Less Than 2 Acres (Vacant)	92	1.8%	200	9.1%	2.5%
30	Strata-Lot Residence (Condominium)	62	1.2%	-	-	0.2%
32	SFD with Basement Suite	127	2.5%	26	1.2%	9.7%
33,34,35,36	Duplex (Single Unit Ownership)	144	2.8%	53	2.4%	5.4%
39	Row Housing (Single Unit Ownership)	1	0.02%	6	0.3%	0.1%
47	Triplex	2	0.04%	-	-	0.01%
60	2 Acres or More (SFD, Duplex)	4	0.08%	13	0.6%	0.1%
61	2 Acres or More (Vacant)	10	0.2%	8	0.4%	0.1%
		<b>5,054</b>	<b>100%</b>	<b>2,200</b>	<b>100%</b>	<b>100%</b>



## STUDY FINDINGS



# Study Findings

## Report Graphs: Neighbourhood Comparison

The neighbourhood comparison portion of this report is intended to show whether, at the aggregated level of the neighbourhood, there is an appreciable difference between those neighbourhoods that are along the existing TMPL route and those that are not. This “macro scale” comparison of aggregated property assessment and sales values shows that both the control and subject neighbourhoods appreciated at very similar rates over the 15-year study period.

All the graphs use the same conventions in terms of colour and style, in that: Urban neighbourhood data is coloured red, Suburban neighbourhood data is coloured green, and Rural neighbourhood data is coloured blue. The subject neighbourhood data is shown with bold, thick lines whereas the control neighbourhood data is shown as a thinner, lighter shade of the same colour. In each, figure the X-axis represents the roll year. All the graphs use the same 15-year time period along the X-axis, from the 1998 Roll Year to the 2013 Roll Year.

### Average Assessed Values

Figures 6 through 8 present the path of average assessed values for both the subject and control neighbourhoods in each of the three communities. Figure 6 is for the urban neighbourhoods in Coquitlam. Figure 7 is for the suburban communities in Langley. Figure 8 shows values for the rural neighbourhoods in Chilliwack. The average assessed values for land, improvement, and total value are shown separately for each. In these graphs the Y-axis has dollar values for averaged assessed value, either total, for land only, or for improvements only, which have not been inflation adjusted and are measured in nominal dollars.

The value of the improvements is fairly stable, so that increases and decreases over time reflect movements in the value of the land. Generally, total assessed, land, and improvement values for the subject and control neighbourhoods move together in each of the three jurisdictions. One exception is that average land and total assessed values in the control, non-TMPL, neighbourhood in Langley (Figure 7), appreciated faster between 2006 and 2008 than they did in the subject neighbourhood. Because there is not a similar pattern in the Coquitlam and Chilliwack neighbourhoods we cannot link this to the TMPL. In Coquitlam (Figure 6), average total and land values are higher in the subject neighbourhoods, while the reverse is true in Langley. As well the difference between the two is larger in Langley. There is a slight growth in Coquitlam in the difference between average assessed total value, from approximately \$12,800 more for the subject neighbourhood in 1998 to \$25,200 more in 2013. The average assessed value in the comparable neighbourhood in Langley is around \$25,800 more in 1998, a gap that grows substantially to \$106,600 by 2013. In Chilliwack (Figure 8), it is difficult to differentiate, in any way, between the subject and control neighbourhoods.



# Study Findings

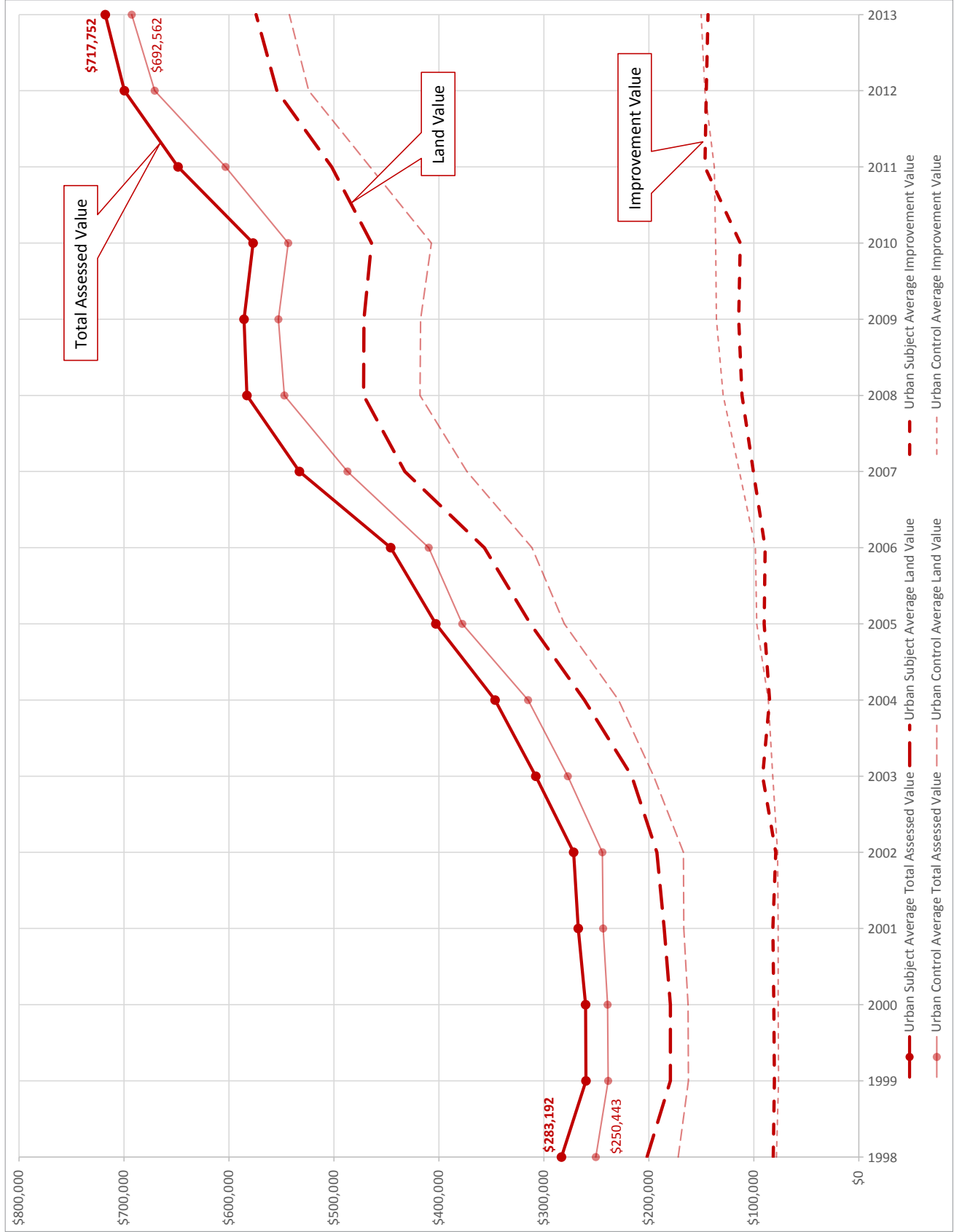


Figure 6 – Average Assessed Value for the Urban Neighbourhoods (Coquitlam) for 1998 to 2013 Roll Years

# Study Findings



Figure 7 – Average Assessed Value for the Suburban Neighbourhoods (Langley) for 1998 to 2013 Roll Years

# Study Findings

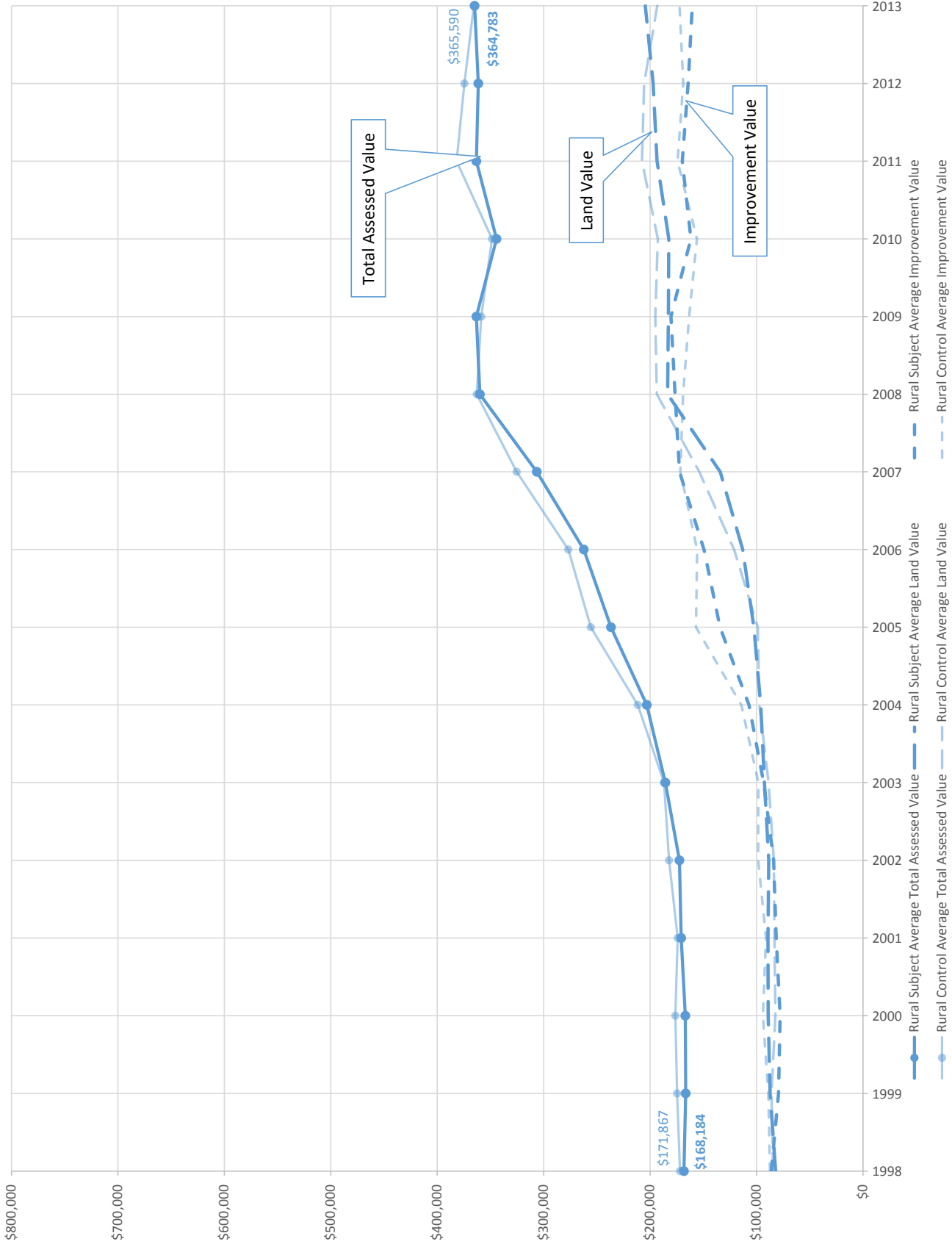


Figure 8 – Average Assessed Value for the Rural Neighbourhoods (Chilliwack) for 1998 to 2013 Roll Years

# Study Findings

## Percentage Change in Average Total Assessed Value

Figures 9 through 11 present the cumulative percentage change in the average assessed value in a neighbourhood from the 1998 base year value. This percentage relative to the base year is shown on the Y-axis, where 100 percent means no change in average assessed value. The pattern of percentage changes between the subject and control neighbourhoods is not consistent across the three different municipalities. In Coquitlam (Figure 9), the average assessed value of properties in the control neighbourhood increased more than those in the subject, 277% vs. 253% of the base year value over the 15 year period, equivalent to a difference of 11.8% vs. 10.2% per year in average annual appreciation. In Langley (Figure 10) average assessed value also increased faster in the control neighbourhood than the in the subject: 246% vs. 228% of the base year, or an average of 6.2% vs. 5.6% per annum. In contrast, in Chilliwack (Figure 11) the total appreciation growth rates are essentially identical 213% vs. 217%, an average of 5.3% vs. 5.2% per annum. For both Coquitlam and Langley the difference in aggregate appreciation between subject and control neighbourhoods begins in 2005 and exceeds a ten percentage point difference by 2008.



# Study Findings

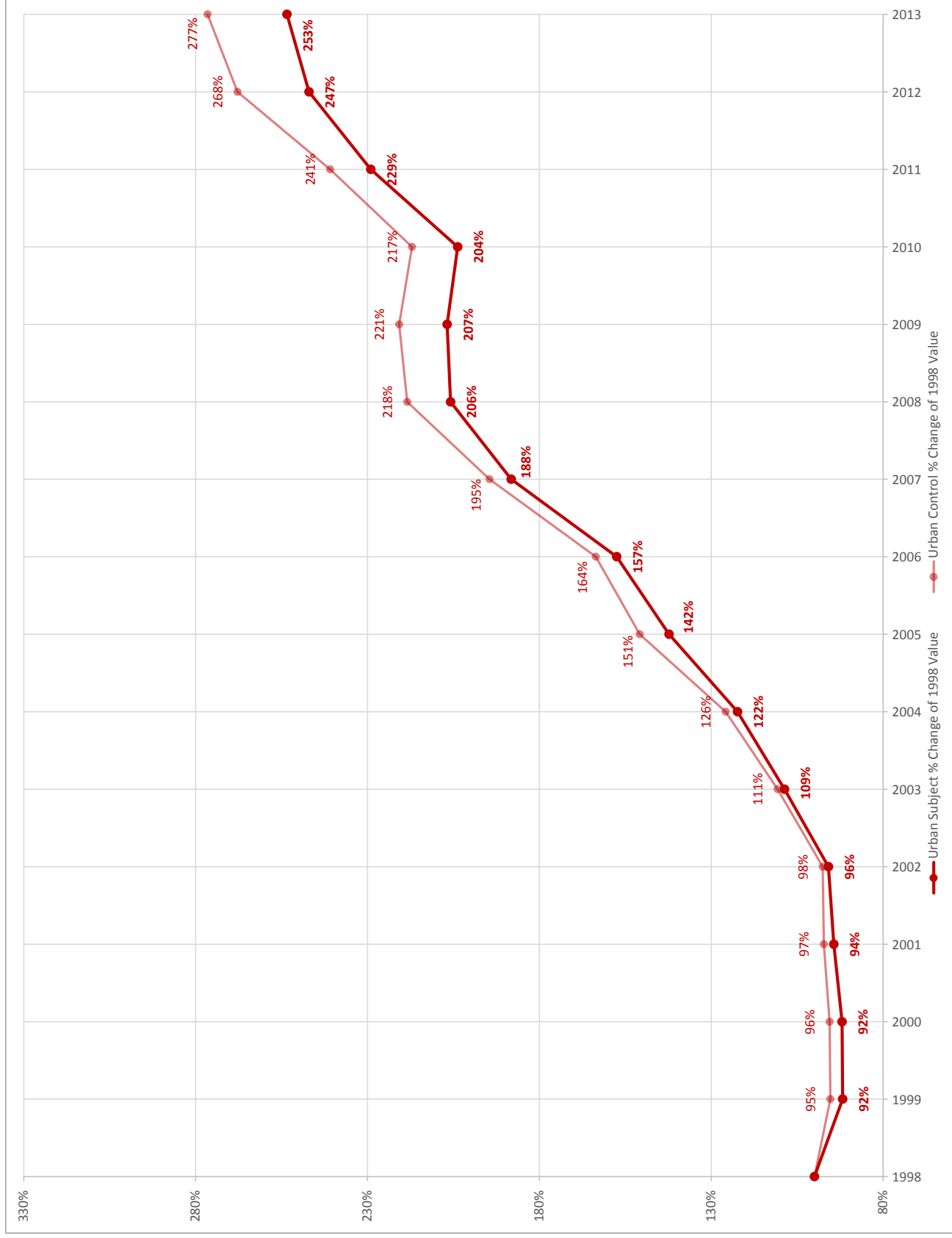


Figure 9 – Average Assessed Value as Percent of 1998 Value for the Urban Neighbourhoods (Coquitlam) for 1998 to 2013 Roll Years

# Study Findings

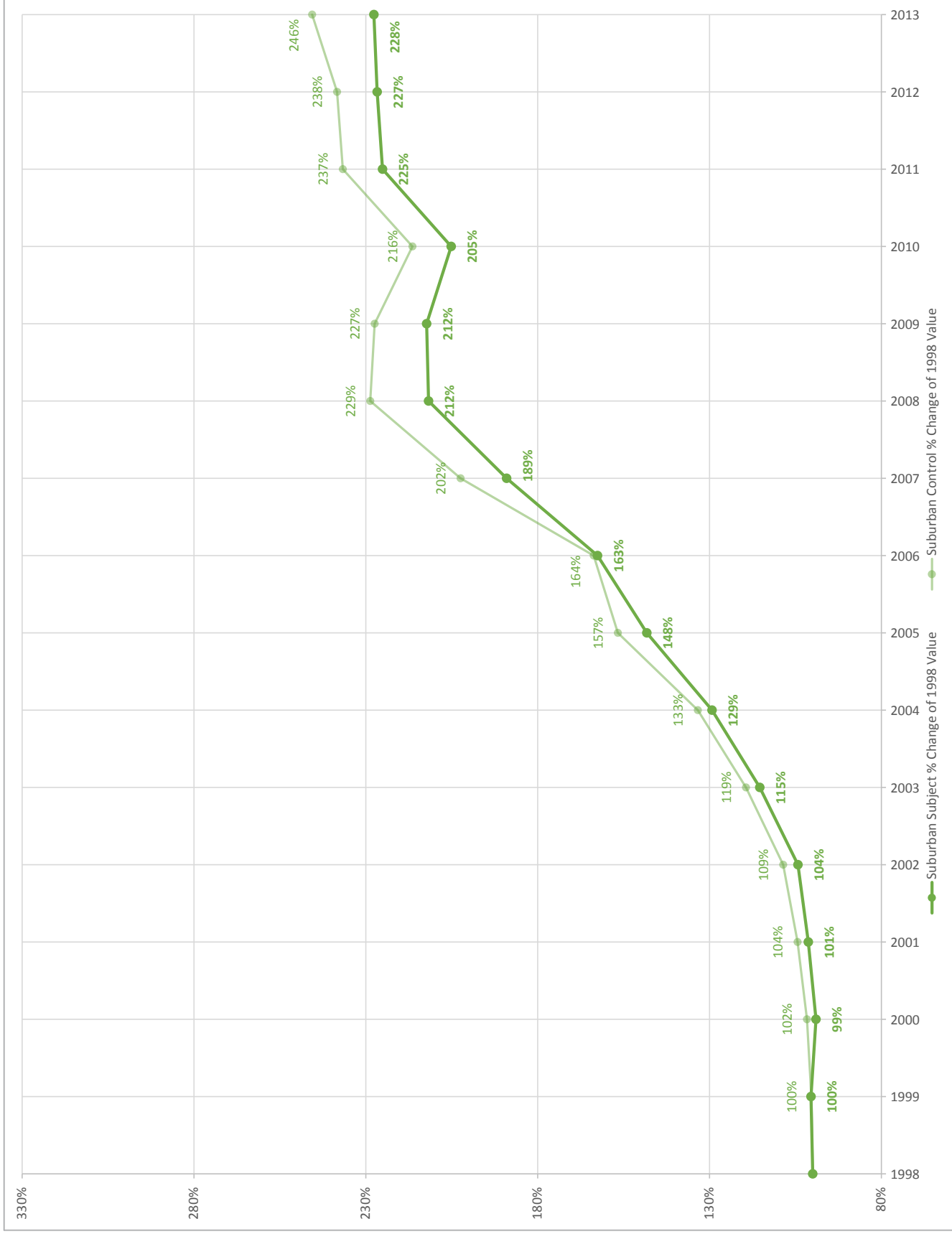


Figure 10 – Average Assessed Value as Percent of 1998 Value for the Suburban Neighbourhoods (Langley) for 1998 to 2013 Roll Years

# Study Findings

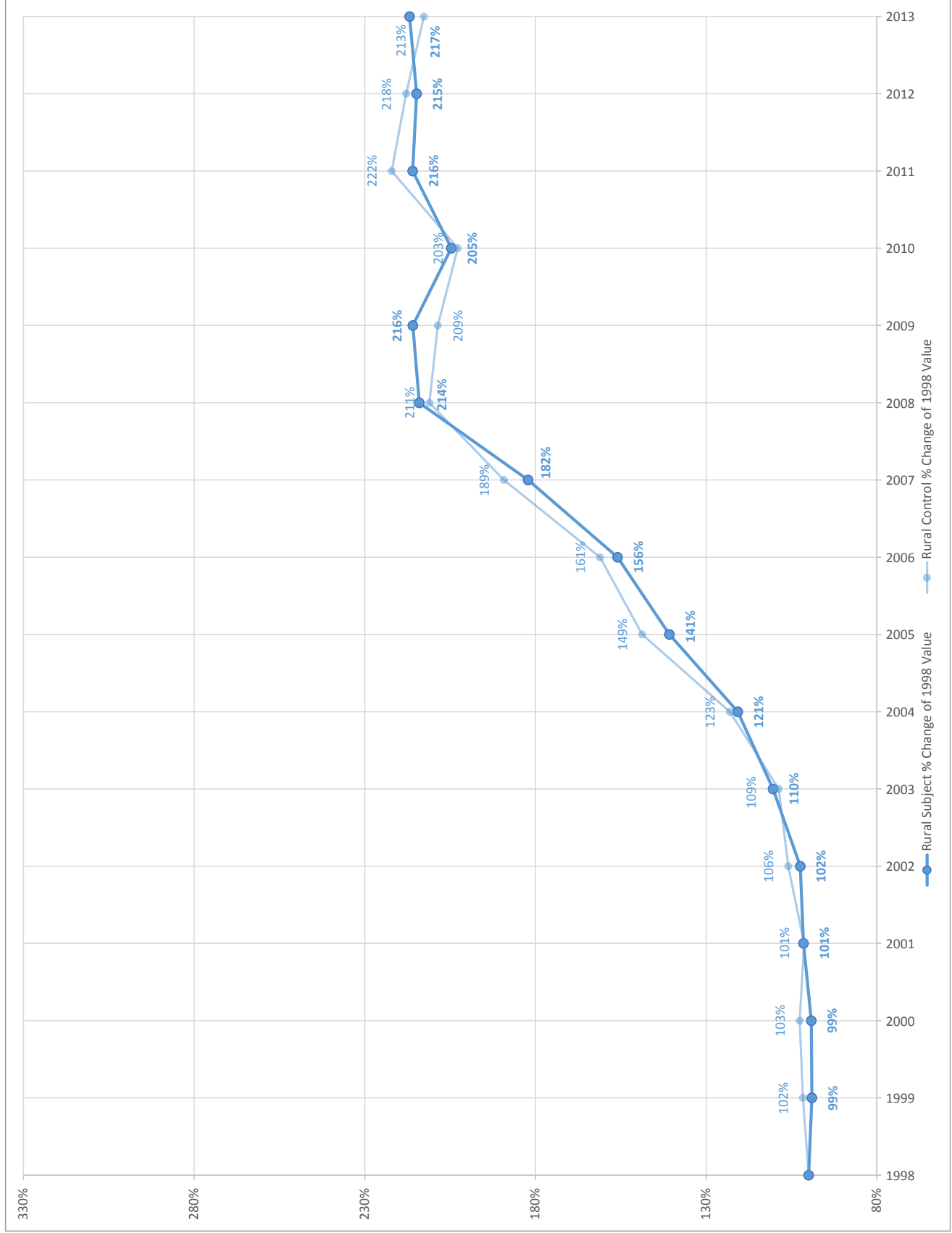


Figure 11 – Average Assessed Value as Percent of 1998 Value for the Rural Neighbourhoods (Chilliwack) for 1998 to 2013 Roll Years

# Study Findings

## Average Sales Values

Average sales values for houses sold in a given year in each neighbourhood by jurisdiction are presented in Figures 12 through 14. Dollar values have not been inflation adjusted and are measured in nominal dollars. The dollar values are measured along the Y-axis of the graphs.

Average sales prices in the subject neighbourhood in Coquitlam (Figure 12) have been higher every year than those in the control neighbourhood, though the difference narrowed between 2008 and 2013 such that average sales prices in 2013 were essentially the same (difference of \$16,000 between the two in 1998, \$71,200 in 2009, and finally \$18,700 in 2013). In contrast, in Langley (Figure 13) average sales prices in the control neighbourhood have been higher every year, and the dollar difference has increased over time. Finally, in Chilliwack (Figure 14), average sales prices for the control neighbourhood started higher, but the averages in the two areas were slightly more than one percent different by 2013.

# Study Findings

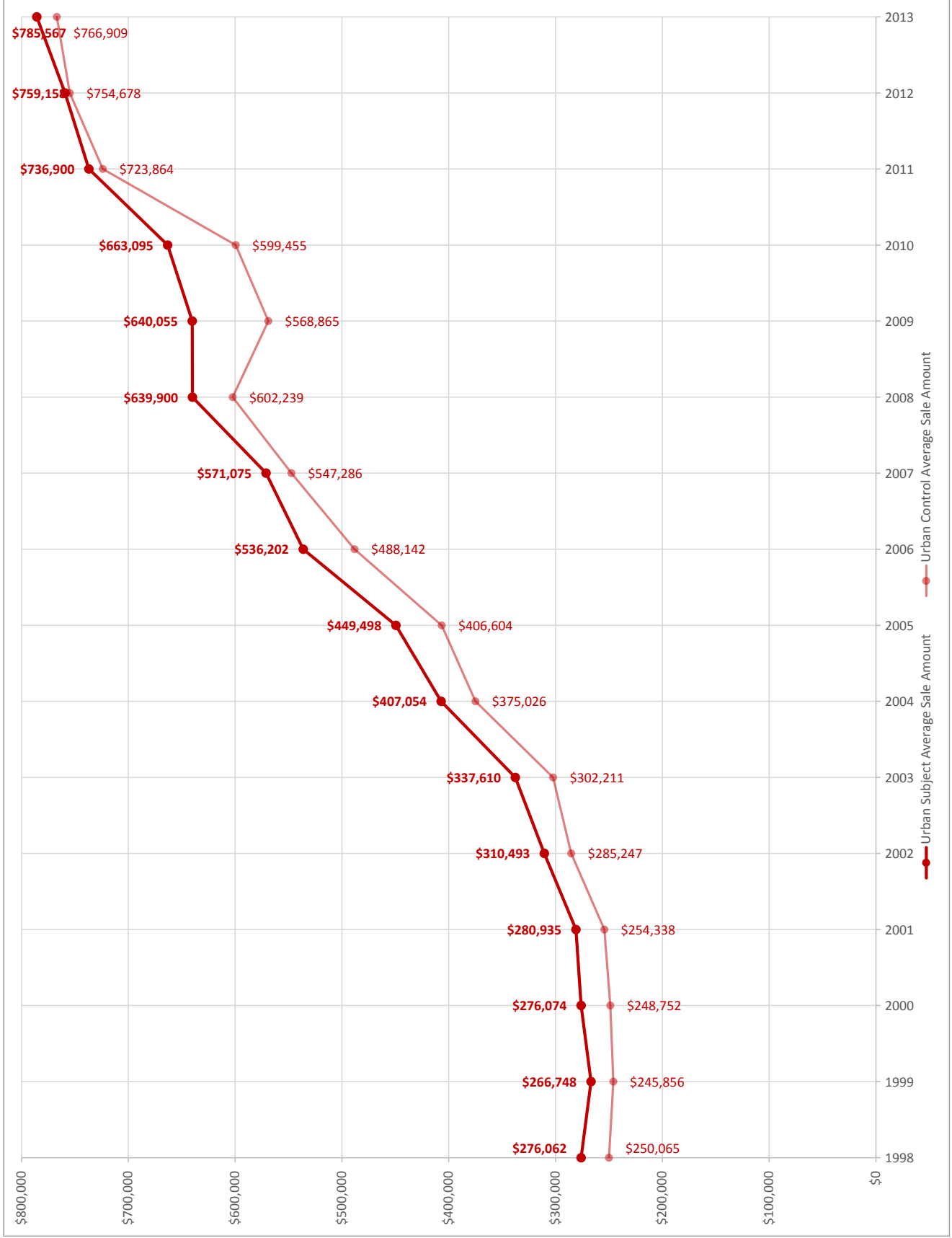


Figure 12 – Average Sales Price for the Urban Neighbourhoods (Coquitlam) for 1998 to 2013 Roll Years



# Study Findings

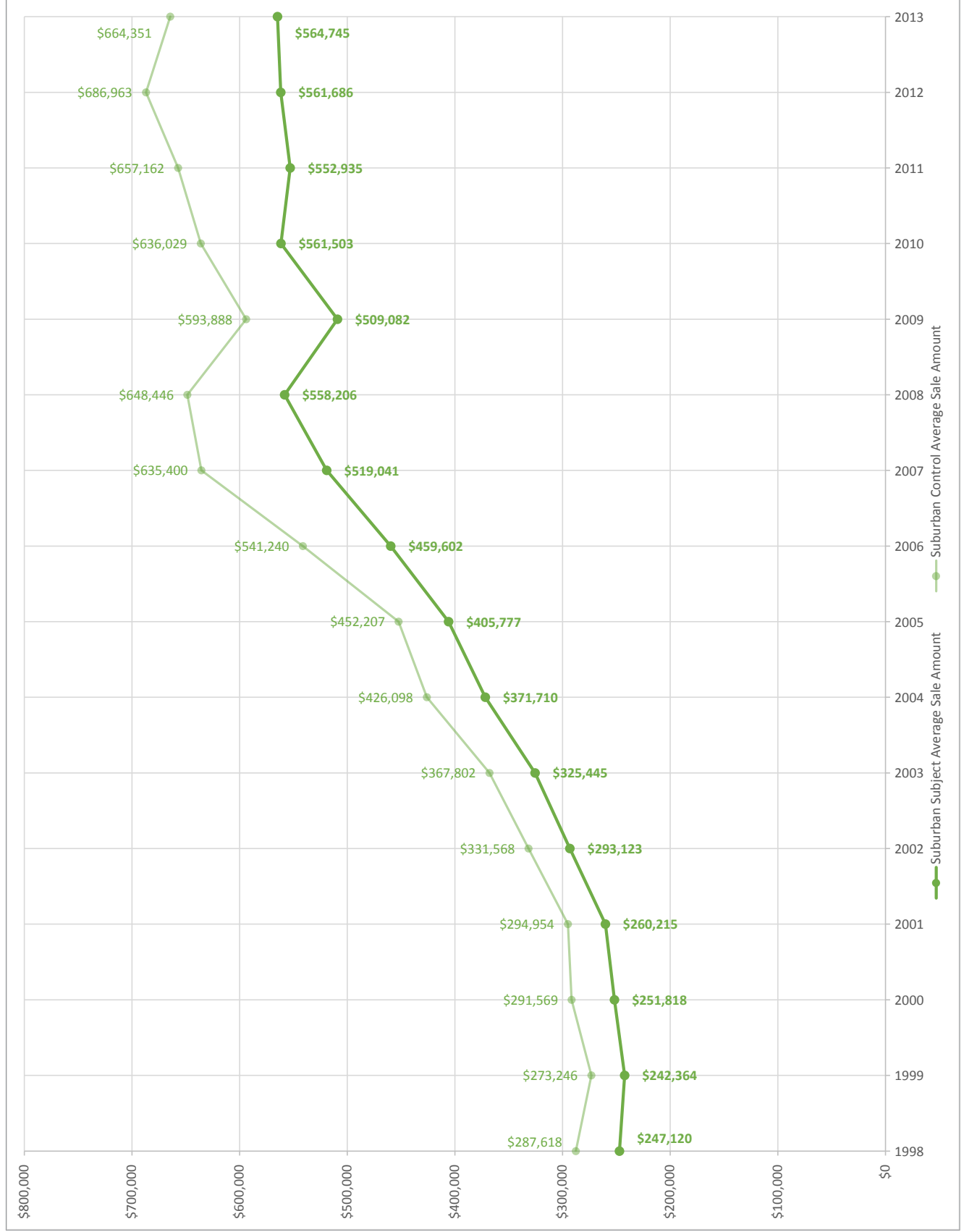


Figure 13 – Average Sales Price for the Suburban Neighbourhoods (Langley) for 1998 to 2013 Roll Years

# Study Findings

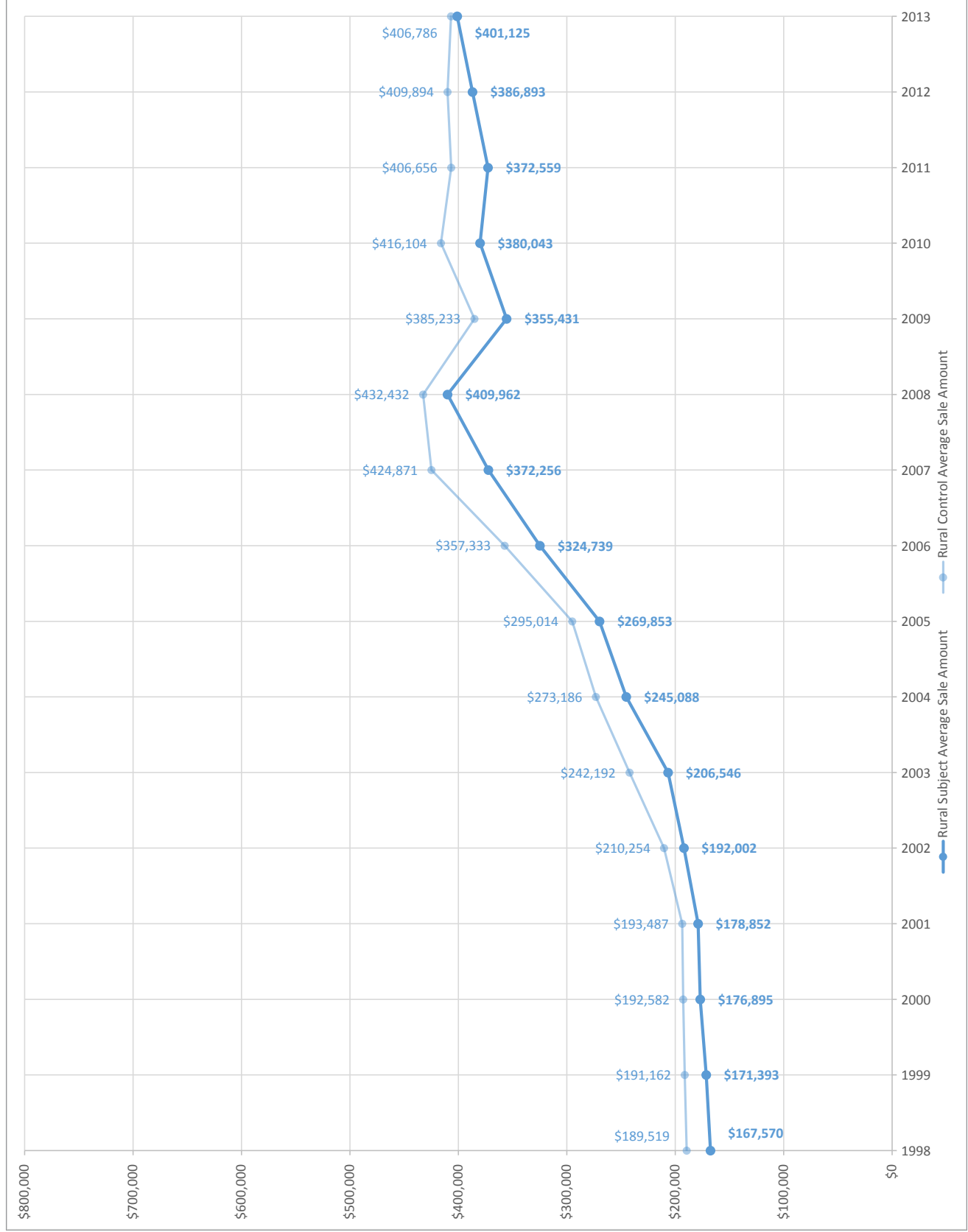


Figure 14 – Average Sales Price for the Rural Neighbourhoods (Chilliwack) for 1998 to 2013 Roll Years

# Study Findings

## Median Sale Prices

Figures 15 to 17 show the year-by-year median sales prices. These values are shown for both the subject and control neighbourhoods, with one figure for each of the urban, suburban, and rural jurisdictions. The X-axis represents the roll years and the Y-axis represents the dollar values for the median sales prices. Dollar values have not been inflation adjusted and are measured in nominal dollars. Median prices tend to have less volatile year-to-year movement than do average prices; median values are less affected by the sales of a small number of unusually expensive or inexpensive houses in a given period than is an average value.

Median sales prices in Coquitlam (Figure 15) are initially \$37,250 higher in the subject neighbourhood than in the control. For most of the study period, they remain higher there, but, by 2013, median sales prices in the control are actually \$16,000 higher than in subject, a difference of approximately 2.3 percent of the median 2013 sales price.

In Langley (Figure 16), the pattern for median prices is quite similar to that of average prices shown in Figure 13. The median prices are always higher in the control neighbourhood than in the subject, a difference of \$51,000 in 1998 (6.3 percent) that grows to \$102,000 in 2013 (19.3 percent higher). As is the case in the previous measures, median prices in Chilliwack (Figure 17) move together for the two neighbourhoods and the difference between the two is quite stable over the study period.

# Study Findings

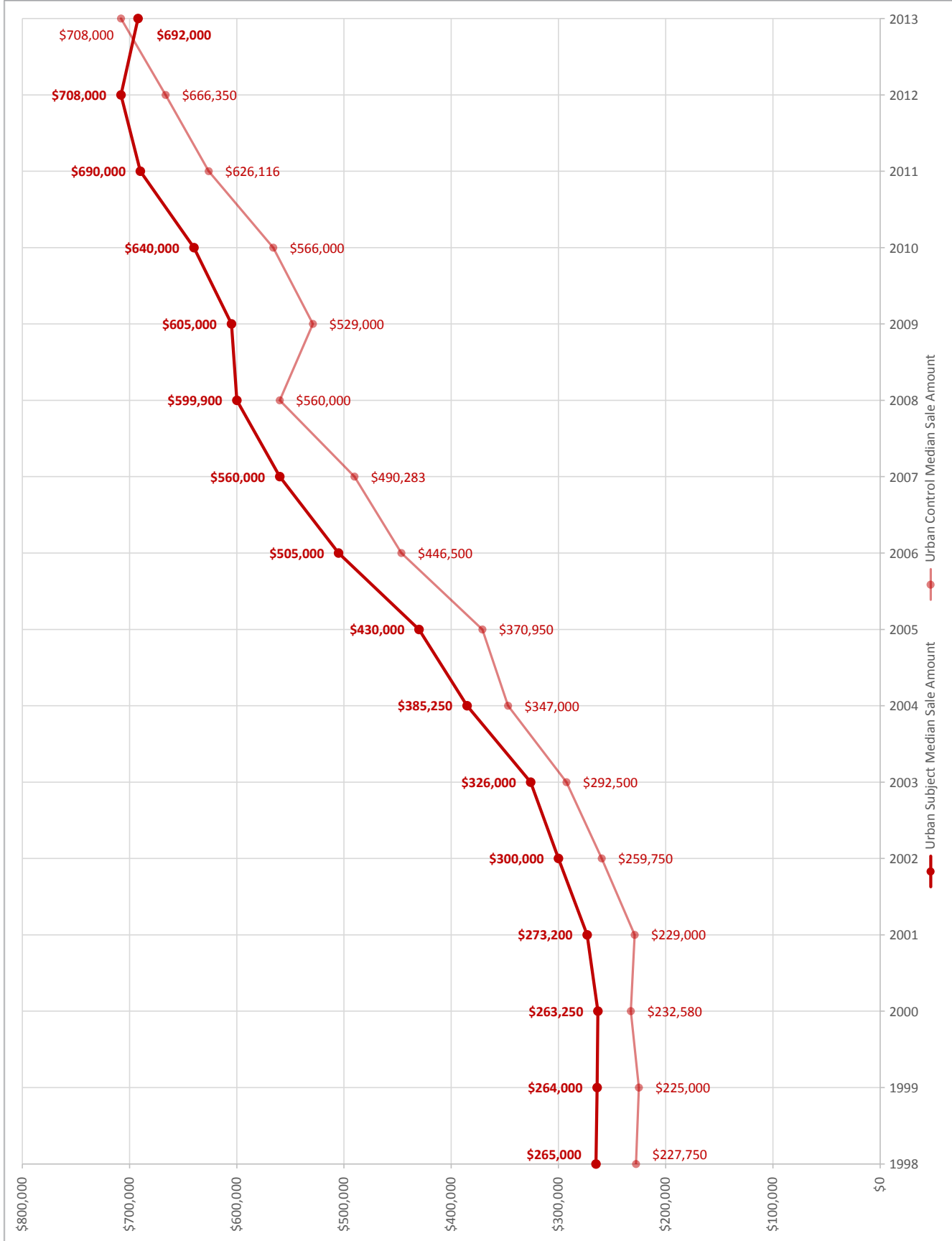


Figure 15 – Median Sales Price for the Urban Neighbourhoods (Coquitlam) for 1998 to 2013 Roll Years

# Study Findings

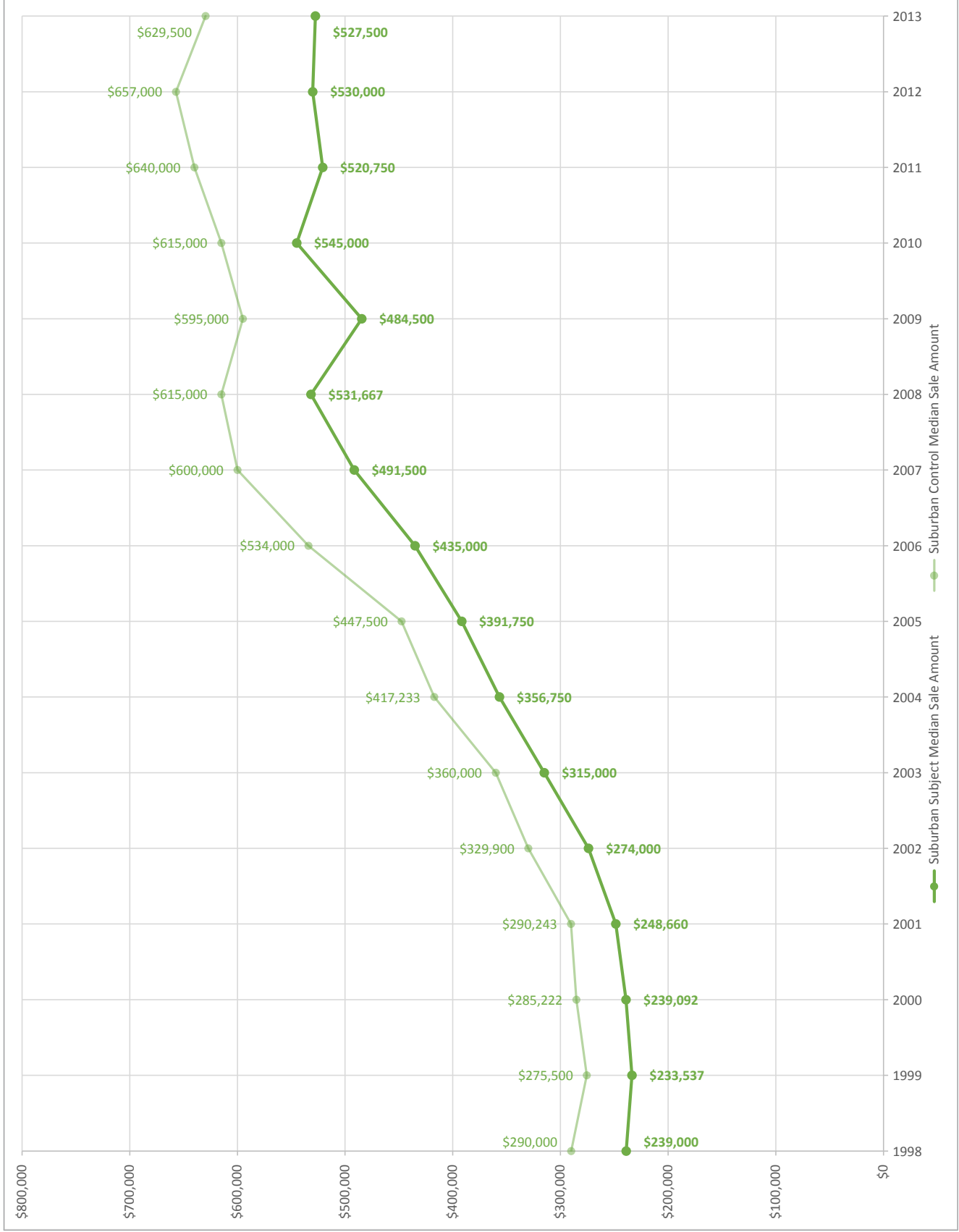


Figure 16 – Median Sales Price for the Suburban Neighbourhoods (Langley) for 1998 to 2013 Roll Years



# Study Findings

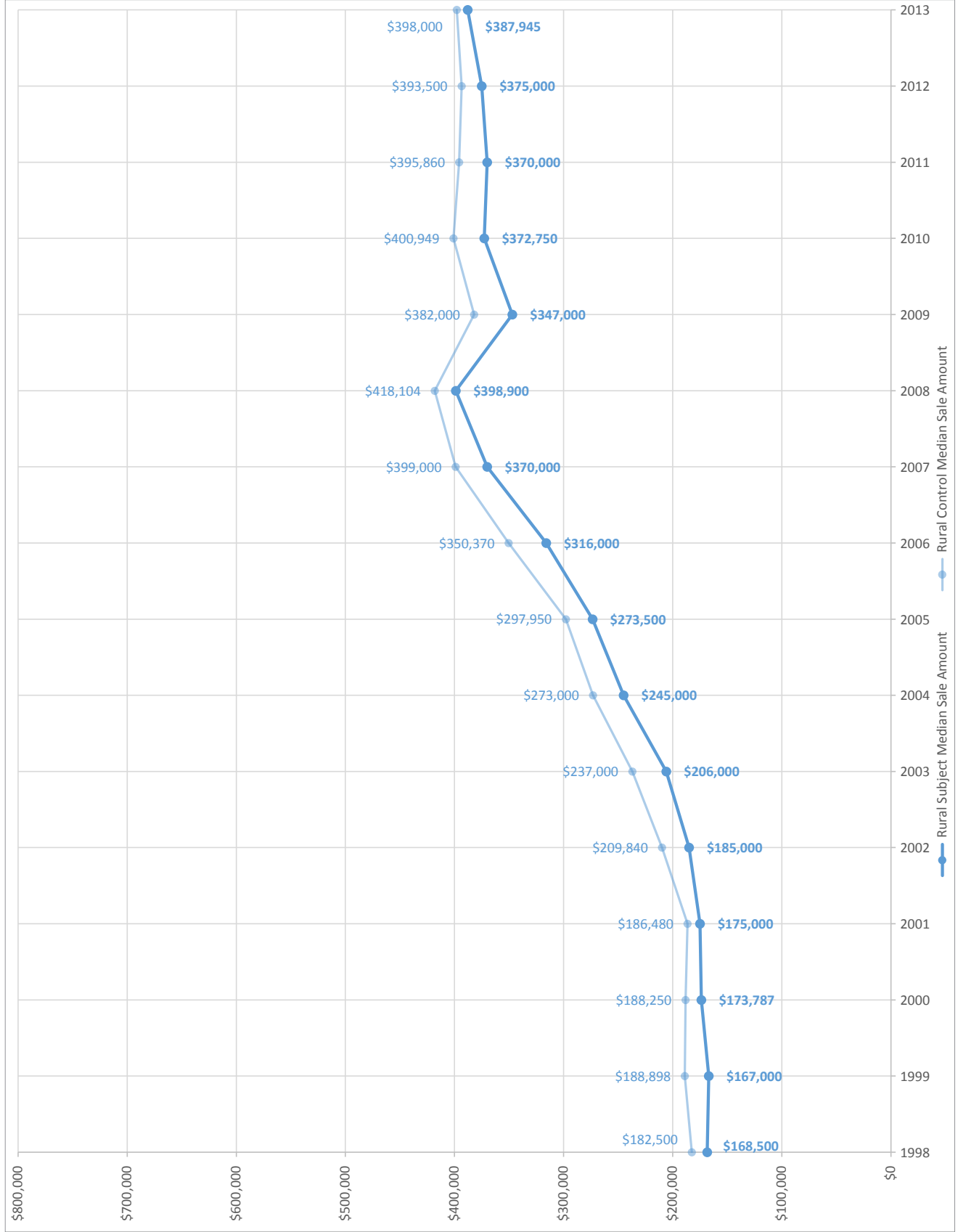


Figure 17 – Median Sales Price for the Rural Neighbourhoods (Chilliwack) for 1998 to 2013 Roll Years

# Study Findings

## Percentage Growth in Median Sales Prices

Figures 18 to 20 show the year-by-year median sales prices as a percentage of the base year (1998) median sales price. These are shown for both the subject and control neighbourhoods, with one figure for each of the urban, suburban, and rural jurisdictions studied here. The graphs compare the percentage change in median sale prices of properties in subject neighbourhoods to that in control neighbourhoods. The percentage change in values is indexed on 1998, with the average assessed values of that year represented at 100 percent. The X-axis represents the roll years and the Y-axis represents the percentage of the median 1998 values. Dollar values have not been inflation adjusted and are measured in nominal dollars.

From 1999 through 2007, median sales prices in Coquitlam for the subject and control neighbourhoods moved together almost in near lock-step (Figure 18). However, median prices in the control neighbourhood rose much more than in the subject for 2008 before dropping back in 2009. After 2010, median sales prices increased more in the control than in the subject neighbourhood, so that by 2013 the median sales price in the control neighbourhood was 311% of its 1998 value, compared with 262% for the subject. This pattern did not occur in either Langley or Chilliwack. Overall, the aggregate growth in median sales prices from 1998 is similar in both the Langley subject and control neighbourhoods (figure 19). Through 2013: the 2013 median price in the control was 217% of its 1998 value and for the subject the same ratio was 221%, annual growth of median sales prices of 5.3% vs 5.4% respectively. Total growth in median sales prices in the two Chilliwack neighbourhoods has been fairly similar, though since 2010 the growth in the subject has been a little higher. In 2006 the values had been 188% and 192% in the subject and control respectively, but by 2013, the median sales price in the subject neighbourhood was 230% of its 1998 value, compared with 218% for the control. Over the 15 year period these amount to an annual increase in the median sales price of 5.7% in the subject neighbourhood and 5.3 % in the control.

# Study Findings

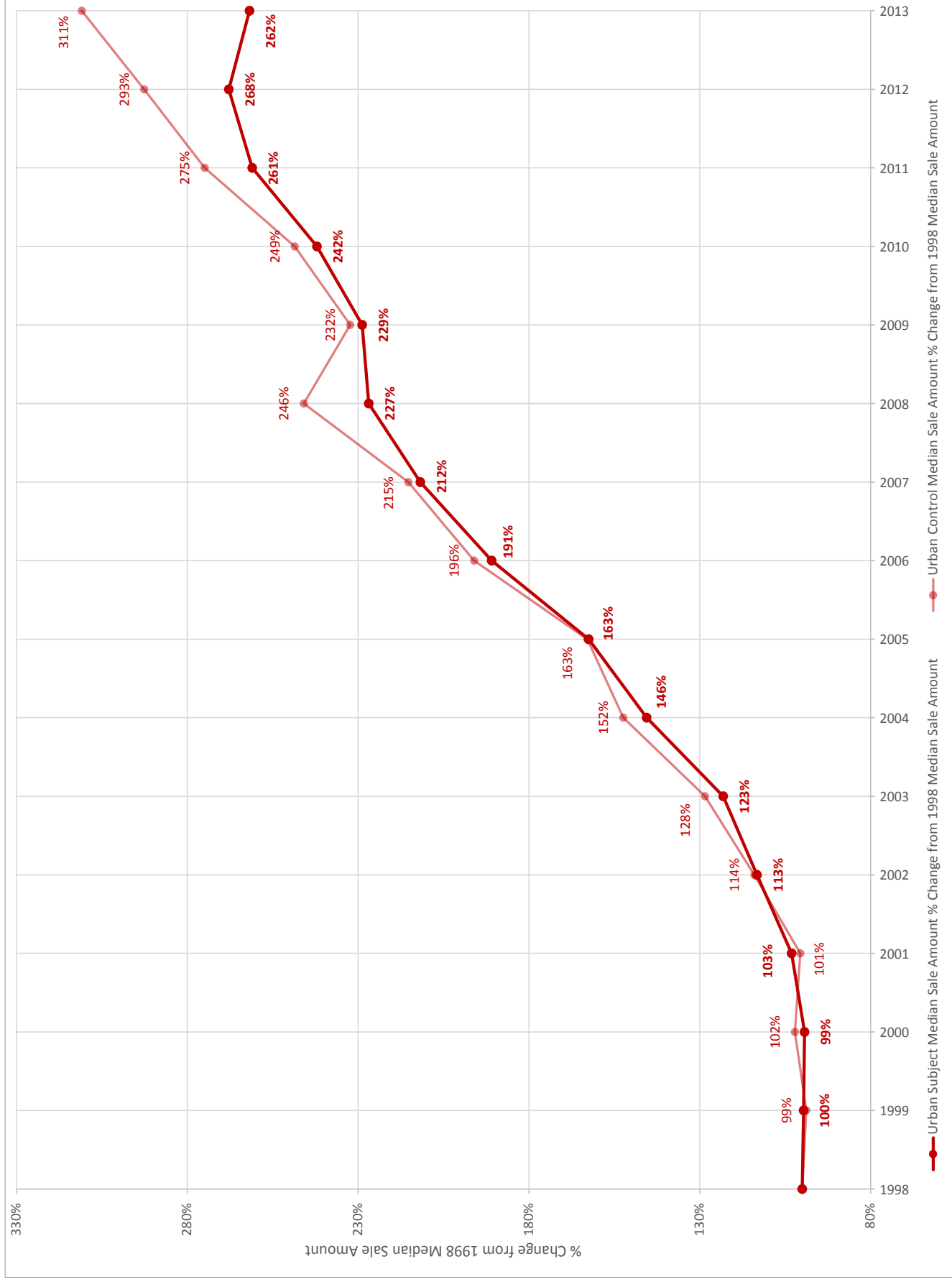


Figure 18 – Median Sales Price as Percent of 1998 Value for the Urban Neighbourhoods (Coquitlam) for 1998 to 2013 Roll Years

# Study Findings

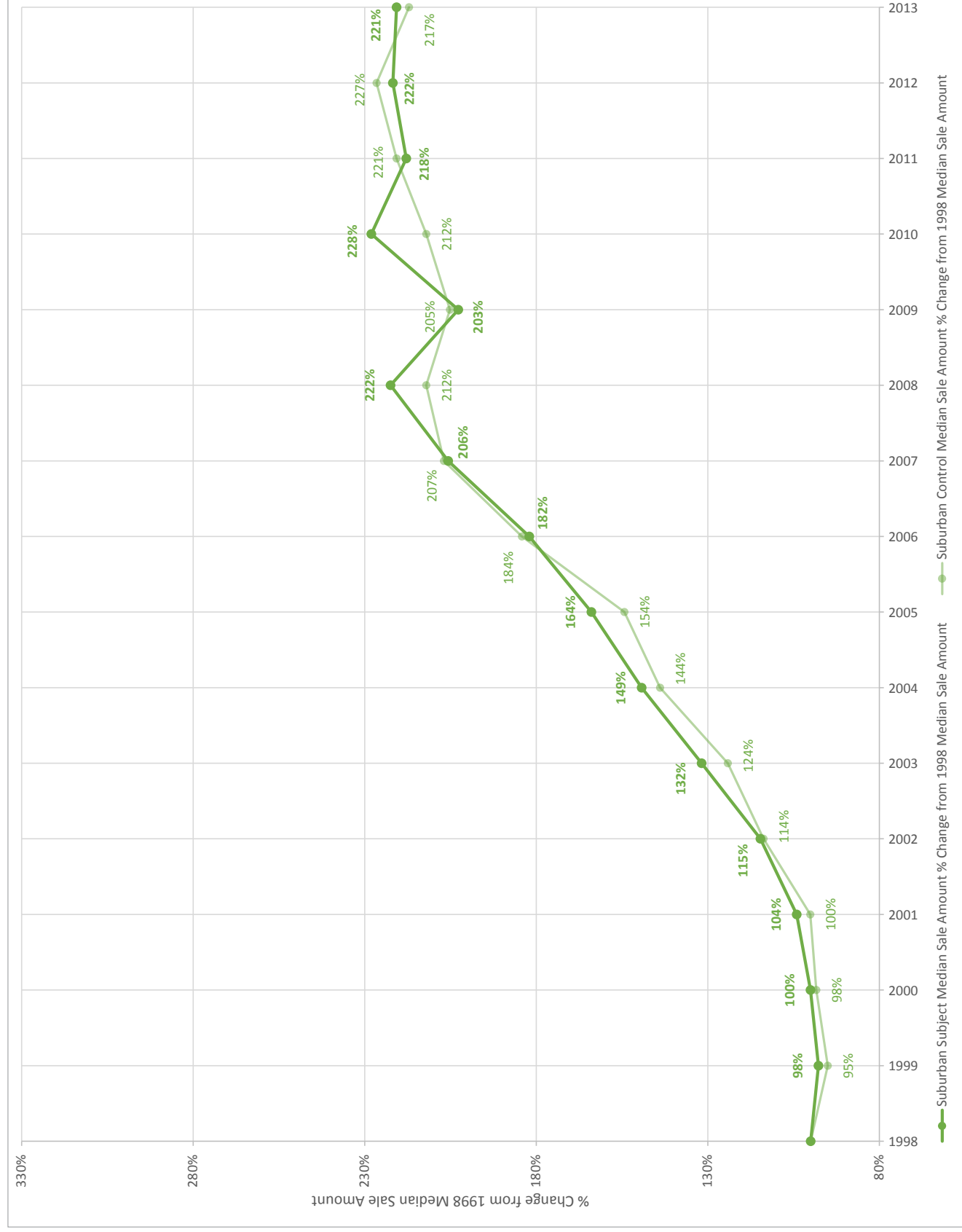


Figure 19 – Median Sales Price as Percent of 1998 Value for the Suburban Neighbourhoods (Langley) for 1998 to 2013 Roll Years

# Study Findings

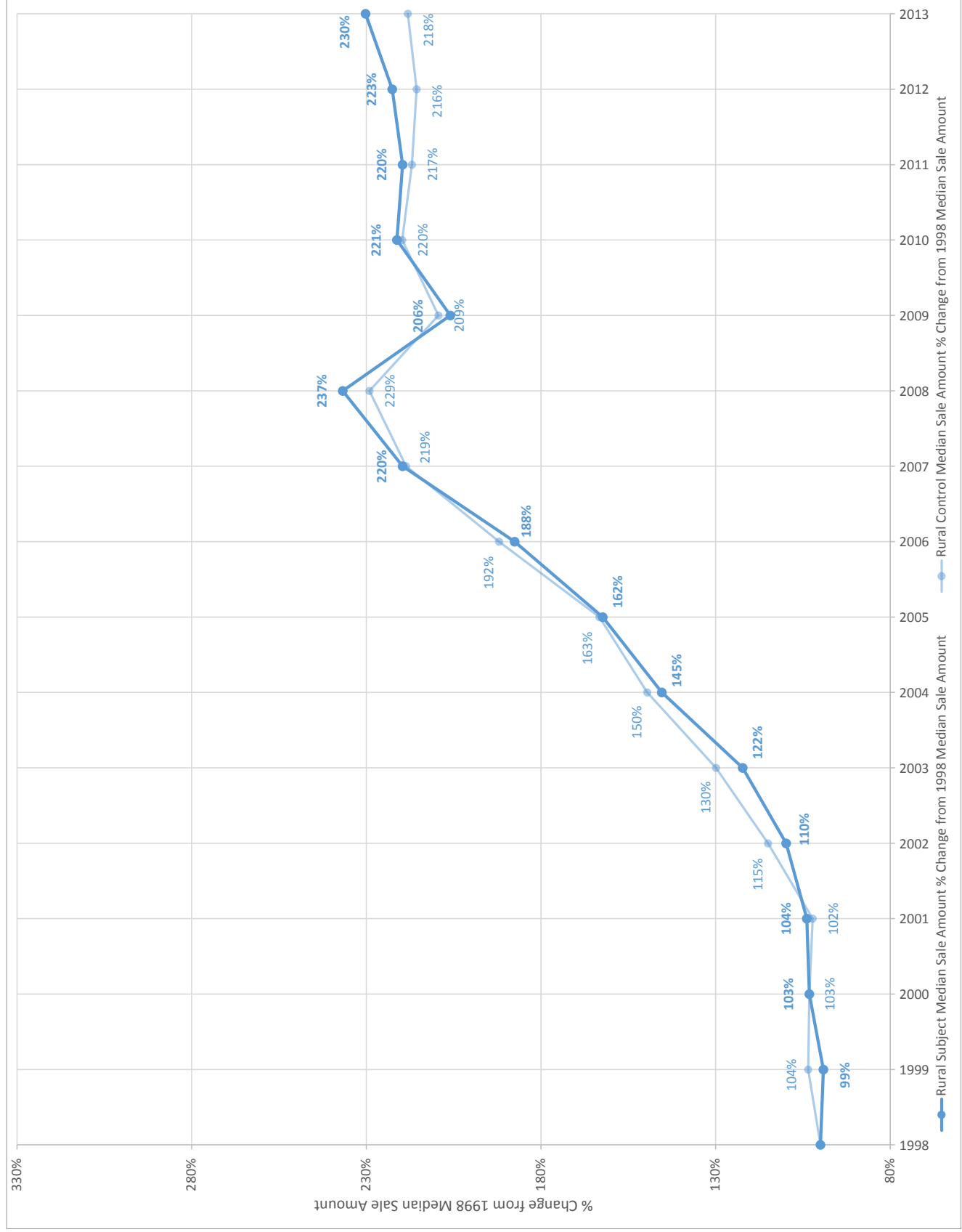


Figure 20 – Median Sales Price as Percent of 1998 Value for the Rural Neighbourhoods (Chilliwack) for 1998 to 2013 Roll Years



# Study Findings

## Property Turnover Rates

Figures 21 to 23 show the annual turnover rate, which is defined as the percentage of houses in a neighbourhood that sell in each year. For context, the figures also include the year by year median sales prices as a percentage of the base year (1998) graphs from Figures 18 through 20. These two values are shown for both the subject and control neighbourhoods, with one figure for each of the urban, suburban, and rural jurisdictions.

The bar graph represents the annual turnover rates. The X-axis represents the roll years and the right Y-axis represents the annual turnover rate as a percentage value. The percentage change in median sale prices of properties in subject neighbourhoods relative to that in control neighbourhoods is indexed on 1998, with the average assessed values of that year represented at 100 percent. The left Y-axis represents the percentage change from median 1998 values. Dollar values have not been inflation adjusted and are measured in nominal dollars.

There is no clear pattern to the turnover figures. Properties in the control neighbourhoods sell more frequently than in the subject in Coquitlam (Figure 21) and Chilliwack (Figure 23) but the reverse is true for Langley (Figure 22). In Chilliwack in some years the turnover rate in the control neighbourhood is double that in the study area, and dramatically higher than the turnover rates in any of the other neighbourhoods. Like overall sales data for the Lower Mainland, turnover rates are higher in the years 2002-2007 than later.

# Study Findings

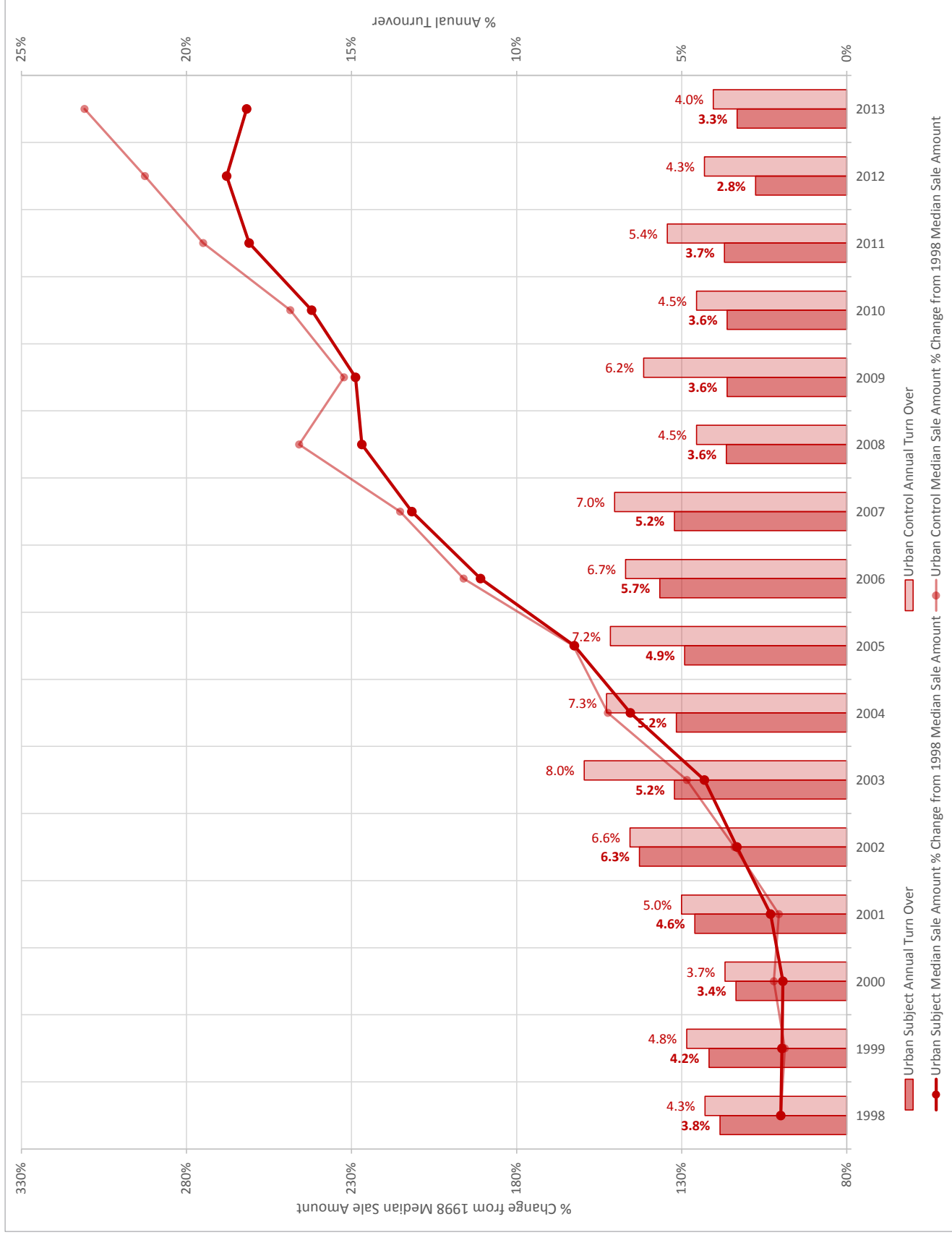


Figure 21 – Annual Turnover Rate for the Urban Neighbourhoods (Coquitlam) for 1998 to 2013 Roll Years

# Study Findings

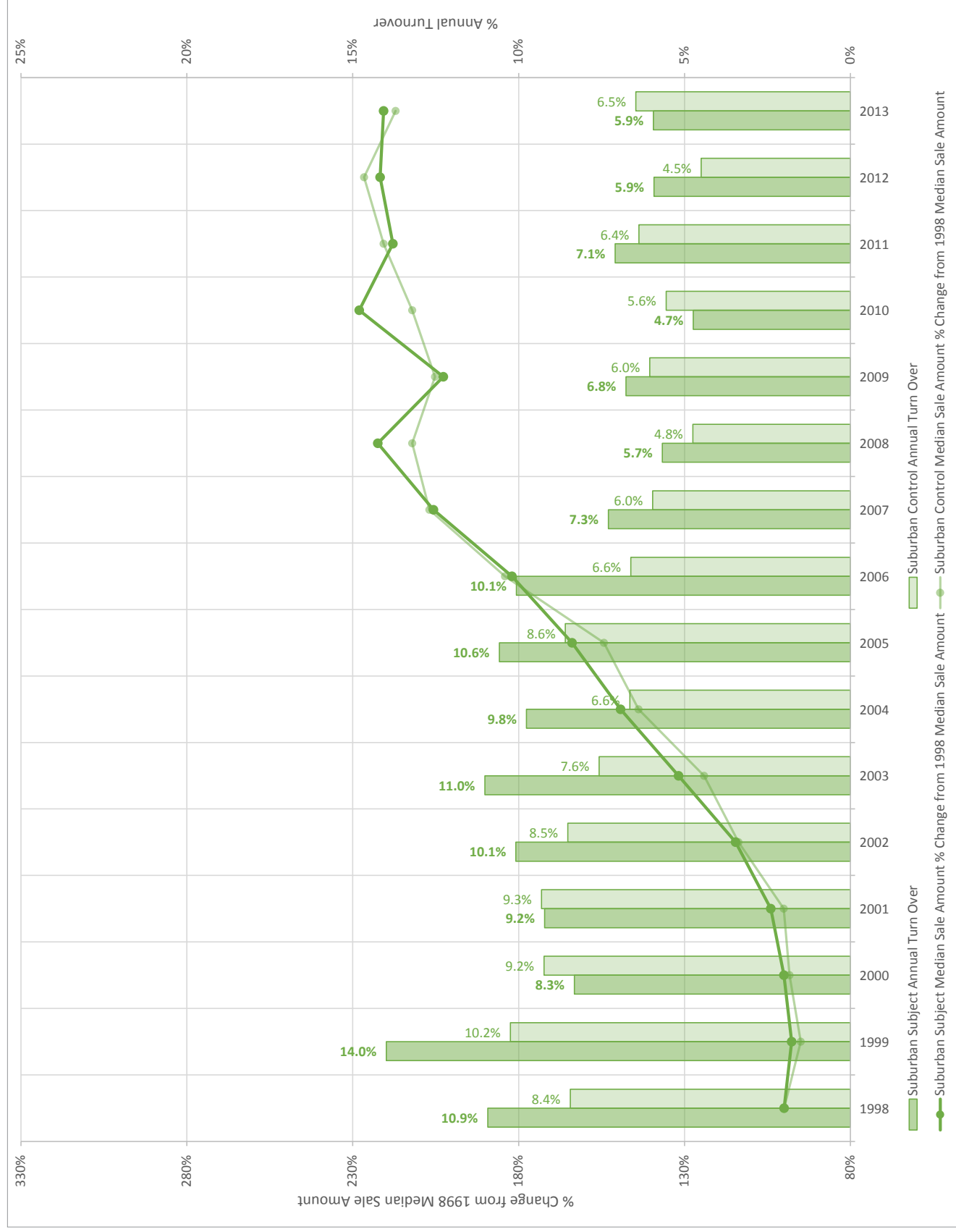


Figure 22 – Annual Turnover Rate for the Suburban Neighbourhoods (Langley) for 1998 to 2013 Roll Years

# Study Findings

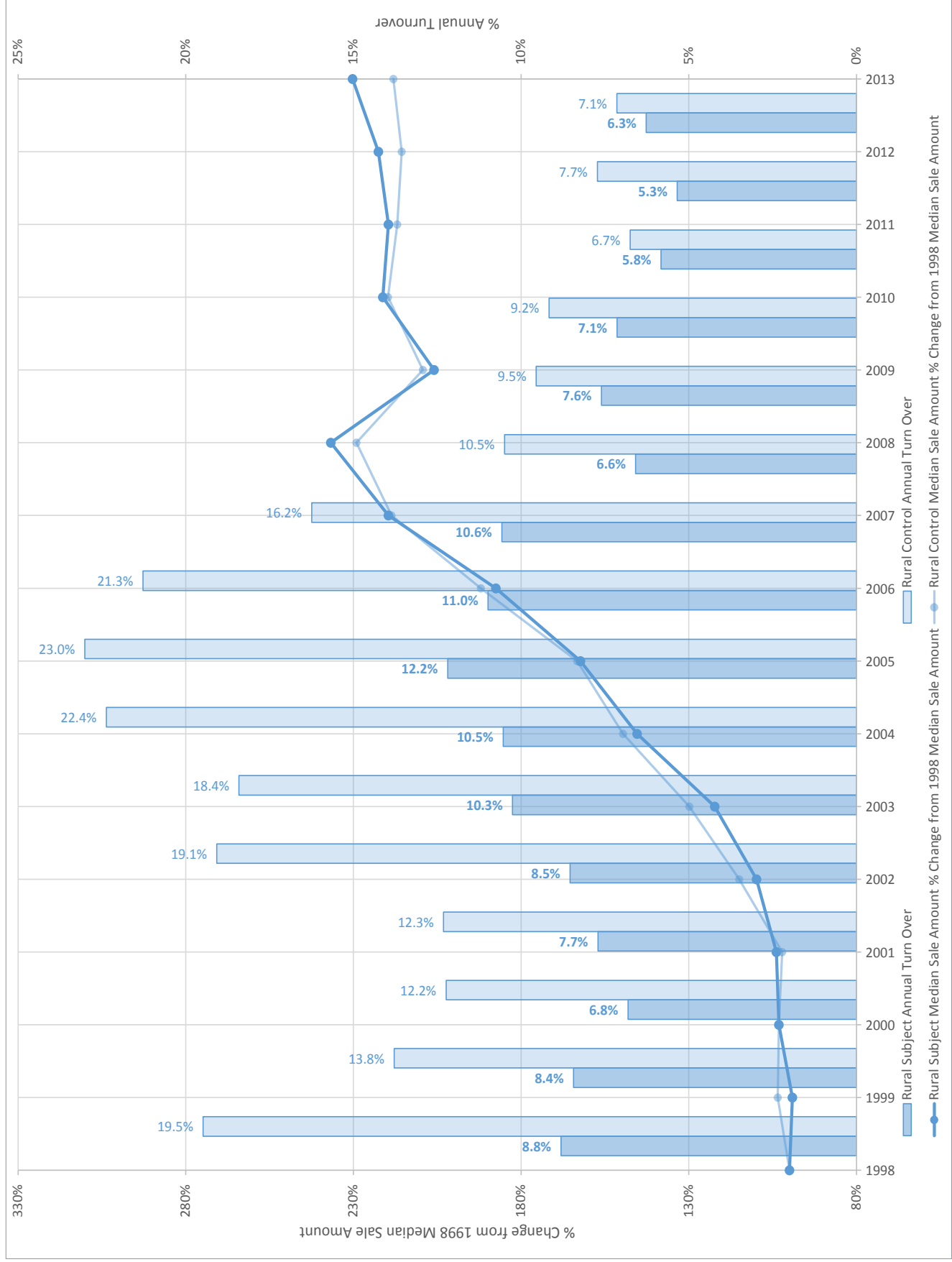


Figure 23 – Annual Turnover Rate for the Rural Neighbourhoods (Chiliwack) for 1998 to 2013 Roll Years



# REGRESSION ANALYSIS





# Regression Analysis

The regression analysis portion of this report is intended to examine the subject neighbourhoods at a “micro” scale, in that each individual property is examined to see if there is a consistent, appreciable effect on a property’s value based on its relative proximity to the existing TMPL alignment. The regression analysis only uses data from the subject neighbourhoods, as the control neighbourhoods are too far from the TMPL for a measure of distance to have any effect explaining the variation in house prices within that neighbourhood. However the control neighbourhoods were used to validate the accuracy of the various regression models by evaluating whether the model’s coefficients could reliably account for the property value.

## Overview

Landcor sought to identify whether properties proximate to large diameter pipeline, in this case the Trans Mountain Pipeline (TMPL), have transaction prices different from similar houses further away (i.e., are house prices affected by proximity to the TMPL). Landcor has an existing hedonic regression model that Landcor uses commercially in the market valuation of BC properties for the purposes of mortgage lending. The model estimates house prices as a function of a set of lot, location, and structural characteristics. The model parameters are validated using data on transaction prices. Internal and market testing of these values have proven the Landcor model to be accurate and reliable with regards to the prediction of real-time market values. Landcor is a licensed reseller of the BC Assessment roll data, which is the source of the lot and structure attribute information for this analysis.

## Methodology

Landcor’s approach was to define a Proximity to Pipeline (P2P ) attribute using both a linear (increasing directly with distance) and a categorized (set at discrete levels) scoring system and then incorporate those attributes separately into their existing model.<sup>7</sup> The following formula describes the general valuation calculation:

$$\ln (P_i) = \alpha + \sum_{j=1}^n \beta_j X_{ji} + \sum_{k=1}^m \gamma_j Y_{ki} + e_i$$

Where:  $\ln (P_i)$  is the natural log sale price of property  $i$ ,  $X$  is a vector of  $j$  property characteristics including the proximity to the TMPL (either as a function of the distance – linear – or a dummy (boolean) variable for being within a particular range of distance),  $Y$  is vector of  $k$  month boolean variables,  $\alpha$  is a constant and  $e$  is error.

<sup>7</sup> In the linear specification, a house’s transaction price is expected to change in a constant fashion with each meter the house is further away from the TMPL. With the categorized approach, all houses in a given range of distance from the TMPL are assumed to have the same percentage change in their house price because of the TMPL when compared with houses either in a different distance range, or those sufficiently far to not be affected in any way by the presence of the TMPL.

# Regression Analysis

The input property characteristics are as follows:

- Time (15 months from Oct 2012 to December 2013). 15 months is the standard sales period examined for Landcor's current market valuation model so it was retained throughout to ensure that baseline accuracy would be maintained. Expanding the time period would allow for the consideration of more sales but could also introduce a considerable number of factors, ranging from macro-economic influences to new property or road development.
- Observations. The analysis considered 481 property sales in the Langley region, 481 property sales in the Chilliwack region and 170 property sales in the Coquitlam region. These were counts after outlier sales were removed. The primary housing type for the areas of study is Single Family Detached (SFD) so Attached and Condo housing types were removed from the analysis.
- Relationship to pipeline. Landcor used GIS information and data supplied by BC Assessment and Kinder Morgan Canada to determine the P2P value based on the minimum distance between the property boundary and the centreline of the TMPL. The variables introduced to determine impact of P2P were:
  - Above Pipeline – the TMPL right of way intersects the subject property boundary
  - Distance to Pipeline – a score indicating the closest distance between the property boundary and the TMPL centreline.
  - Over 1km – a flag indicating that the closest distance between the property boundary and the TMPL centreline is 1km or more.
  - A second analysis was carried out using discrete distance attributes at 100 meter intervals from 100m to 1,000m.

To help understand the contribution of the proximity to the pipeline (P2P) in explaining transaction prices, Table 2 presents the regression summary statistics for the standard commercial hedonic regression model that Landcor uses to support its Automated Valuation Model-based products. These specifications do not include any of the P2P attributes and should be considered the baseline model. The adjusted R-square values for the 3 subject communities range from .780 to .864, meaning that the current set of regression variables and specifications in the basic Landcor valuation model, without the P2P variables, explains 78% to 86% of the variation in transaction prices.

# Regression Analysis

**Table 2 – Regression Statistics**

Current Landcor Model - No P2P Variables

JURISDICTION MAP A	PROPERTY TYPE	Model	R	R Square	Adjusted R Square
Chilliwack	DETACHED	1	.894	.799	.780
Coquitlam	DETACHED	1	.946	.894	.855
Langley	DETACHED	1	.936	.876	.864

Tables 3 to 5 present the same type of regression summary statistics but with different combinations or types of P2P variables. In Table 3, all three P2P variables identified above are added to the baseline Landcor model. Adding the P2P attributes increased the overall model adjusted R-squared values to .803 through .915. The increase is particularly substantial for Coquitlam (0.855 to 0.915) but inconsequential for Langley (0.864 to 0.870). This increase in explanatory power of the regression with the P2P variables indicates that in some cases they contribute to explaining the variation in house prices above what is captured by the lot, neighbourhood, and structure attributes in the baseline Landcor valuation model but this is not a consistent finding.

**Table 3 – Regression Statistics**

Augmented Landcor Model – All 3 P2P Variables

JURISDICTION MAP A	PROPERTY TYPE	Model	R	R Square	Adjusted R Square
Chilliwack	DETACHED	1	.913	.834	.803
Coquitlam	DETACHED	1	.980	.960	.915
Langley	DETACHED	1	.943	.890	.870

In the regressions the variable indicating that a property is more than 1 km from the TMPL did not have a statistically different from zero effect on explaining the variation in transaction prices in the hedonic model so it was excluded from the analysis. Also, sales data supporting the Above Pipeline attribute (a population of seven sales in 15 months across all 3 jurisdictions) was eliminated from Model 2 due to the limited number of sales with this characteristic. Kinder Morgan Canada does have an explicit policy that governs compensation for easements that would address the diminution in value for properties that are bisected by a pipeline. This is described in Appendix B. In Table 4 the regression summary statistics are presented for the regressions where these P2P variables are excluded, so that the linear distance from the property to the TMPL is the sole P2P measure. The results shown in Table 4 are functionally equivalent to those in Table 3, indicating that the excluded P2P variables had little explanatory power.

**Table 4 – Regression Statistics**

Augmented Landcor Model – Distance from TMPL as Only P2P Variable

JURISDICTION MAP A	PROPERTY TYPE	Model	R	R Square	Adjusted R Square
Chilliwack	DETACHED	1	.909	.826	.794
Coquitlam	DETACHED	1	.980	.960	.917
Langley	DETACHED	1	.943	.889	.870

# Regression Analysis

The final specification breaks the distance from the TMPL into discrete categories at 100m intervals instead of using a continuous variable that measures the distance from each property to the TMPL. The regression descriptive statistics for the specification are presented in Table 5. This run exposed the weakness in the attribute as the overall adjusted R Square values dropped from the previous two runs and returned to values very consistent with the baseline run.

**Table 5 – Regression Statistics**

Augmented Landcor Model – Categorized Distance from TMPL as P2P Variables

JURISDICTION MAP A	PROPERTY TYPE	Model	R	R Square	Adjusted R Square
Chilliwack	DETACHED	1	.900	.811	.789
Coquitlam	DETACHED	1	.948	.899	.852
Langley	DETACHED	1	.938	.880	.866

# Regression Analysis

## Estimated Regression Coefficients

A summary of the signs and statistical significance of the regression coefficients is shown below in Table 6. Generally, the individual P2P variables do not have an effect on transaction prices that is statistically different from zero. An examination of the coefficients also indicates that, in some cases, coefficients may be positive, in others negative. The strongest and most consistent finding, that a property that sits on the TMPL has a lower value, is problematic because it is based on only seven sales over the 15 month study period across all three jurisdictions. Consequently, it may reflect idiosyncratic aspects of a particular house rather than a systematic effect.

**Table 6 – Effects of P2P Variables on House Prices**

### Regression Coefficient Summaries

Proximity Measure	Coquitlam	Langley	Chilliwack
Property is bisected by TMPL	Not statistically different from zero	Not statistically different from zero	Negative
Increased distance from TMPL	Positive	Not statistically different from zero	Not statistically different from zero
Proximity Measure	Coquitlam	Langley	Chilliwack
Increased distance from TMPL	Positive	Not statistically different from zero	Positive
Proximity Measure	Coquitlam	Langley	Chilliwack
Property is 100-200m from TMPL	Not statistically different from zero	Not statistically different from zero	Negative
Property is 200-300m from TMPL	Not statistically different from zero	Positive	Not statistically different from zero
Property is 300-400m from TMPL	Not statistically different from zero	Not statistically different from zero	Not statistically different from zero
Property is 400-500m from TMPL	Not statistically different from zero	Not statistically different from zero	Positive
Property is 500-600m from TMPL	Not statistically different from zero	Not statistically different from zero	Not statistically different from zero
Property is 600-700m from TMPL	Not statistically different from zero	Not statistically different from zero	Not statistically different from zero
Property is 700-800m from TMPL	Not statistically different from zero	Not statistically different from zero	Not statistically different from zero

Overall, the lack of a predictable pattern of influence indicates that there may be other factors associated with the P2P attribute that contribute to explaining prices and that it is not uniformly consistent with the P2P attribute. Examples of such factors might be green space, views, commuter access, and traffic or road influences. If the pipeline is typically below a roadway then the influence of transit access or high traffic zones may be the actual factor rather than the pipeline. If the pipeline typically has a clear right of way above it then there may be prevalent green space or improved view lines for nearby properties which affect property values. In all these cases, it is a factor associated with the pipeline that affects values rather than the pipeline itself.



## Summary and Conclusions

This report provides two different approaches to identify the effects of the TMPL on residential property values. The first is an aggregated or macro visual comparison between pairs of subject and control neighbourhoods, the former being intersected by the TMPL and the latter in the same jurisdiction and selected for similarity. The second relies on data on individual properties and is a micro statistical analysis using hedonic regression techniques to specify the relationship between transaction prices for a home and proximity to the TMPL. Neither approach provides an unambiguous answer to the question of interest. The visual comparisons are inconsistent, in some cases, prices and appreciation are higher in the subject neighbourhoods, in other cases, the opposite is true. The estimated effects of proximity to the pipeline on property values in the statistical analysis are more, often than not, not statistically different from zero; one cannot say, with an acceptable degree of confidence, that there is a clear relationship between proximity to the TMPL and residential house values.

The analysis presented here does not provide a consistent answer to the question of what is the effect of proximity to the TransMountain Pipeline and residential property values. The results vary by type of test and community, but for the most part, the effects cannot be identified with the standard degree of statistical confidence. This does suggest the need for a more thorough analysis. Such an effort would require examining properties along the entire urban and suburban length of the pipeline. The analysis would have to pay greater attention to the pipeline's geographic context, as it relates to property values; answering questions about whether proximity to the pipeline is correlated with proximity to other features that affect property values. Does the pipeline alignment border green or open space? Is the easement along a main arterial or close to non-residential areas? Is the easement co-terminus with another utility easement? Even so, the results may be inconclusive, as there is no consensus among the academic research on the relationship between pipeline proximity and house values.



# APPENDICES





# Appendix A

## Glossary<sup>8</sup>

### Assessment Roll

Lists all properties that are subject to assessment. The Assessment Authority Act Regulations (B.C. Reg 497/77) list the information that must be contained in the Assessment Roll. This includes the name and address of the assessed owner, a description of the property's location (legal description and/or property address), and the actual value and classification of land and improvements.

### Actual Use Code

This three digit, internally used, BC Assessment code (abbreviated AUC), denotes a folio's (property's) primary use. Each folio can have only one primary code.

### Completed Roll

<sup>1</sup>Source: BC Assessment Glossary, <http://www.bccassessment.ca/about/Pages/Glossary.aspx>  
Assessment Roll produced by December 31 for the following tax year.

### Effective Year

Effective Year refers to the effective age of an improvement. Effective age is defined in s. 1 of the Depreciation of Industrial Improvements Regulation (BC Reg 379/88) as follows:

"effective age" means the number of years determined by:

- (a) calculating the total cost of the industrial improvement,
- (b) multiplying the chronological age of each part of the industrial improvement by the cost of that part to give the weighted age of that part,
- (c) adding the weighted ages of all of the parts of the industrial improvement, and
- (d) dividing the sum of the weighted ages by the total cost of the industrial improvements and rounding the quotient up to the next whole year to yield the effective

### Folio

A collection of data, identified by a roll number that consists of ownership, actual value and other information required for assessment purposes. The data in a folio usually describes one parcel and any improvements on it. A folio may describe multiple parcels and their improvements, or a portion of a parcel and/or the improvements on such a parcel. Folio is synonymous with (Assessment) Roll Number.

### Homogeneous

A descriptor generally applied to single family residential neighbourhoods where there are several groups of homes that are all relatively or reasonably similar in age, construction, and features. A homogeneous neighbourhood is more commonly encountered in urban and suburban areas. (International Association of Assessing Officers (IAAO) - BC Assessment Modified)

<sup>8</sup>Source: BC Assessment Glossary, <http://www.bccassessment.ca/about/Pages/Glossary.aspx>

# Appendix A

## Improvements

Any building, fixture, or other similar structure attached to land or another improvement. An improvement is defined by Section 1 of the Assessment Act as: "Any building, fixture or structure on or in land (or water over land) or on or in another improvement, but does not normally include any of the following:

- (a) production machinery;
- (b) anything intended to be moved as a complete unit in its day to day use;
- (c) furniture and equipment that is not affixed for any purpose other than its own stability and that is easily moved by hand".

(2) Without limiting the definition of "improvements" in subsection (1), the following things are deemed to be included in that definition unless excluded from it by a regulation under section 22 (1) (a) or 74 (2)

- (d):
- (m) docks, wharves, rafts and floats;
- (n) floating homes and any other floating structures and devices that are used principally for purposes other than transportation

## Land

includes

- (a) land covered by water,
- (b) quarries, and
- (c) sand and gravel,

but does not include coal or other minerals

## Market Turnover

The number of properties sold in a given time period, typically expressed as a percentage of the total number of market properties sold in a given year

## Single Family Dwelling/Residence

A detached residential dwelling unit which has been designed and built to accommodate single family use

## Roll Year

The BC Assessment Authority (BCA) publishes an annual property valuation, as determined by their internal processes, by July 1st, which is then published the following January 1st as that current years' assessed value. The term Roll Year is used in this study to refer to the year in which the value is published, not when it was valued. The year of valuation is one year prior to the Roll Year (i.e. 1998 values are reflected in the 1999 Roll Year).



## Appendix B

For directly affected parcels, where the pipeline is located and an easement is registered on title, there are standard provisions for compensation to land owners. This presumably would offset any potential reduction in property value for those directly affected parcels. In practice, landowners generally receive payment for the easement based on the fee simple value for the lands covered by the easement, and a portion of the fee value for any lands required for construction but released following construction and restoration.

The NEB Act provides direction on the factors that need to be addressed as part of landowner compensation for a new pipeline approved under the Act. Under NEB Section 97(1), the following factors where applicable are considered in assessing compensation:

- (a). market value of the lands taken by the company;
- (b). where annual or periodic payments are being made pursuant to an agreement or an arbitration decision, changes in the market value referred to in paragraph (a) since the agreement or decision or since the last review and adjustment of those payments, as the case may be;
- (c). loss of use to the owner of the lands taken by the company;
- (d). adverse effect of the taking of the lands by the company on the remaining lands of an owner;
- (e). nuisance, inconvenience and noise that may reasonably be expected to be caused by or arise from or in connection with the operations of the company;
- (f). damage to lands in the area of the lands taken by the company that might reasonably be expected to be caused by the operations of the company;
- (g). loss of or damage to livestock or other personal property or movable affected by the operations of the company;
- (h). any special difficulties in relocation of an owner or his property; and
- (i). such other factors as the [Arbitration] Committee considers proper in the circumstances.



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