



Economic and Demographic Forecast

*Demographic Forecast Update for
Chittenden County 2000 to 2035*

June 2001

Prepared for Chittenden County Regional Planning Commission and
Metropolitan Planning Organization
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Table of Contents

1.0 Introduction	1
2.0 Methods	1
3.0 Comparison of 2000 Forecast and Census	2
4.0 Revised Chittenden County Forecasts	3
5.0 Conclusion	7

1.0 Introduction

Demographic and economic forecasts for Chittenden County and northwest Vermont were prepared in September 2000 in conjunction with regional plan updates under development by the Chittenden County Regional Planning Commission and the Metropolitan Planning Organization. The forecasts incorporated recent economic development events significant to northwest Vermont and historic data such as individual town population. Subsequent to the release of the September 2000 forecasts, the United States Bureau of the Census released individual town population data taken from the 2000 decennial census. The release of these data, provide additional insight into recent county and town level growth patterns. The new data have been incorporated into these population updates.

As with the previous demographic forecast, these forecast will be employed in the updates to the Chittenden County Regional Plan and the Chittenden County Long-Range Transportation Plan. As with the original forecast, the updates reported here are based on historic patterns of growth, current economic activity, and recent economic events that are expected to alter those historic patterns.

2.0 Methods

The revisions reported here consist of updated population forecasts for Chittenden County, three sub-county planning regions, and the towns of Chittenden County. The updated projections are calculated using the same mathematical procedures as the original forecasts. The population projections are based upon the forecasts for the northwest region of Vermont from the regional input-output model.¹ Once the northwest regional population has been established, two different forecasting methods were employed: a multiple-regression model called SPOP–Small Area Population Projection–and general regression analysis.²

The SPOP model projects population for smaller areas using the percentage shares of the small areas to a larger area. This is accomplished by projecting the total population for the larger area and projecting the percentage share of that total population for each of the smaller areas. The SPOP model considers a set of six regression equations to find the equation that produces the best- fitting line for each of the smaller area's data. The best-fitting equation is then chosen based

¹ For a complete discussion of the methods used in developing the forecasts, please see *Economic & Demographic Forecast: Northwest Vermont and Chittenden County, 2000 to 2035 and Beyond*, Section 5.

² Gabbour, Iskandar. 1993. "SPOP: Small-Area Population Projection." In R. E. Klosterman, R. K. Brail and E. G. Bossard (eds) *Spreadsheet Models for Urban and Regional Analysis*. Center for Urban Policy Research, New Brunswick, New Jersey, pp 69-84.

upon the R^2 s for each equation in each area.³

General regression analysis is a common tool used by economists and statisticians and is the statistical basis for the SPOP model. Regression analysis examines the relationship between a dependent variable and one or more independent, or explanatory variables. The dependent variable is the one being forecast. The independent variables are the one or more which are expected to explain the changes in the dependent variable. In simplistic form, general regression analysis examines the *mathematical* relationship between the dependent and independent variables. The mathematical relationship is represented by an equation which describes a line that best fits the pattern of the data. The mathematical expression of the goodness of fit is termed the R^2 s of the line and indicates how well the equation explains the pattern of data. A thorough discussion of the methods and the statistical concepts is contained in the appendices of the September 2000 forecast.

3.0 Comparison of 2000 Forecast and Census

The original Chittenden County, county sub-regions and town forecasts employed, in part, historic patterns taken from the 1940 through 1990 Census population counts. As the 2000 Census population data had not been released yet, 2000 population was estimated. The subsequent release of the 2000 Census population data enables the elimination of these estimates and the revision of the population projections through 2035. The issuance of the 2000 Census population data also enables the estimation of more dis-aggregated town level projections than were available in the original forecast.

Table 1 displays the 2000 Census counts, the September 2000 estimates for 2000, and the differences for Chittenden County, the sub-county regions and the towns.

Chittenden County's 2000 Census count is lower than the original estimate for the 2000 population. In essence, what the lower counts produce is a small shift in the equation used to estimate the projections. While the mathematical slope of the line equation remains the same, as evidenced by the growth rates (see Table 2), the endpoints differ slightly, with a minor downward shift in the line evident. This circumstance follows throughout the revised projections. With the addition of the 2000 Census counts, the starting points for the revised projections shift, resulting in

³ The R^2 is the coefficient of determination and is calculated thus: $R^2 = TV - UV / TV$; where TV is equal to the total variation for the observed variables, or the total sum of squares; UV is the unexplained variation or the error sum of squares. The other component of the total sum of squares is the explained variation, or the sum of squares due to regression. As the total error is made of error that can be explained by the regression function and error that is purely random, the ratio of the explained variation to the total variation gives a measurement of how well the regression equation is at explaining the relationship between the two (or more) variables.

slight changes in both the endpoint and the slope of the estimated line.

Table 1. Comparison Between Original 2000 Forecast and 2000 Census Counts

	Original Forecast 2000	Census Counts 2000	Difference Census-Forecast
Chittenden County	148.295	146.571	(1.724)
Region 1	61.453	61.264	(0.189)
Burlington	40.295	38.889	(1.406)
South Burlington	14.362	15.814	1.452
Winooski	6.797	6.561	(0.236)
Region 2	42.783	43.262	0.479
Colchester	16.798	16.986	0.188
Essex	18.736	18.626	(0.110)
Williston	7.249	7.650	0.401
Region 3	44.058	42.045	(2.013)
Bolton	na	0.971	--
Charlotte	3.735	3.569	(0.166)
Hinesburg/St. George	5.175	5.038	(0.137)
Huntington/Buell's Gore	na	1.873	--
Jericho	5.171	5.015	(0.156)
Milton	10.339	9.479	(0.860)
Richmond	4.271	4.090	(0.181)
Shelburne	7.091	6.944	(0.147)
Underhill	na	2.980	--
Westford	2.164	2.086	(0.078)
Huntington/Buell's Gore/Bolton/Underhill	6.112	5.824	(0.288)

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The difficulty in producing population projections for numerous small geographic areas is also evident from Table 1. The estimates are very close to the actual count at the county level and in Regions 1 and 2. However, Region 3's 2000 estimates contained the largest gap between counts and projections and the largest number of towns forecast. There are twelve towns all in the region and all are very small. In total, the region accounts for less than one third of the total county population and has experienced rapid growth expressed in percentage terms. The ability to forecast with a great deal of precision is compromised when dealing with this type of a data set. Whereas for Chittenden County and Regions 1 and 2, the original forecast for 2000 was very close to the Census counts, when looking at the town level forecast, there is wider variation in the differences between the 2000 count and the estimates.

4.0 Revised Chittenden County Forecasts

Table 2 shows the revised population projections for Chittenden County, the sub-county regions and the towns. The revised projections for Chittenden County call for 183 more people than previously forecasted over the 2000-2035 time period. The population level forecasted for 2035 is 249,257, approximately 1,541 less than in the previous forecast, yet the compound annual average rate of growth remains the same as for the

previous forecast, 1.4% for 2000-2010 and 1.6% for 2010-2035. While the levels changed, the rates of growth and the absolute change from 2000-2035 remain approximately the same due to the new Census counts being added to the data set used for the projections.

Chittenden County is still expected to see the majority of the population growth for the northwest Vermont region, approximately 52% over the forecast horizon. This is slightly up from the share of population growth exhibited by Chittenden County between 1990 and 2000, approximately 49%.

Of the sub-county Regions, Region 3 shows the largest absolute difference between the original and revised forecast, as well as the largest absolute increase in population from 2000-2035. The original forecast estimated an increase of approximately 51,402 people from 2000 to 2035, while the revised forecast shows an increase of 48,762, a difference of roughly 2,600 people, over the same time frame. This is due in part to the phenomenon mentioned above, in that the equations estimate a line for Region 3 which is shifted due to the inclusion of the 2000 Census data. The average annual rates of growth remain approximately the same, 2.1% 2000-2010, and 2.3% 2010-2035, with the long-term growth rate being +0.1 percentage points above the original forecast's growth rate.

With the addition of the 2000 Census count, more dis-aggregated town level forecasts were achievable. In the original forecast, Bolton, Huntington, Buell's Gore and Underhill were aggregated together in order to develop reasonable statistical validity for the forecast. The revised forecast was able to dis-aggregate Underhill and Bolton from this grouping. Two towns, Charlotte and Westford, are estimated to show a greater increase in population than in the September 2000 forecast over the 2000 through 2035. The rest of the towns are expected to show a slightly lesser increase in population as compared to the original forecast. The aggregated group from the original forecast, Bolton, Huntington, Buell's Gore and Underhill, when added together for comparison, is also expected to show a slightly lesser increase in population over the forecast period.

The forecast for sub-county Region 2 shows the least absolute difference from the September 2000 forecast of a decrease of 773 while demonstrating the second largest absolute increase in population over

Table 2. Updated Population Projections: Crittenden County 2000-2035

	History				Forecast						Absolute Change 00-35	CAA 00-10	CAA 10-35
	1980	1990	2000	2005	2010	2015	2020	2025	2030	2035			
Northwest Vermont	254,189	285,762	316,135	334,937	355,697	379,88	409,673	442,87	478,39	514,897	198,762	1.2%	1.9%
Crittenden County	115,534	131,761	146,571	158,194	168,833	181,134	196,161	212,884	230,798	249,257	102,686	1.4%	1.6%
Region 1	54,709	58,585	61,264	63,176	64,410	65,945	68,058	70,265	72,315	73,949	12,685	0.5%	0.6%
Burlington	37,712	39,127	38,889	39,726	40,086	40,657	41,588	42,583	43,459	44,069	5,180	0.3%	0.4%
South Burlington	10,679	12,809	15,814	16,751	17,488	18,313	19,312	20,344	21,339	22,222	6,408	1.0%	1.0%
Winooski	6,318	6,649	6,561	6,659	6,837	6,974	7,148	7,338	7,517	7,668	1,087	0.4%	0.5%
Region 2	30,864	36,116	43,262	48,170	52,542	57,504	63,424	70,007	77,101	84,501	41,239	2.0%	1.9%
Cotchester	12,629	14,731	16,986	18,344	19,897	21,660	23,770	26,111	28,626	31,236	14,250	1.6%	1.8%
Essex	14,392	16,488	18,626	21,484	23,319	25,402	27,893	30,657	33,626	36,709	18,083	2.3%	1.8%
Williston	3,843	4,887	7,650	8,343	9,326	10,441	11,761	13,239	14,850	16,557	8,907	2.0%	2.3%
Region 3	29,961	37,060	42,045	46,848	51,881	57,686	64,679	72,613	81,381	90,807	48,762	2.1%	2.3%
Bolton	0,715	0,971	0,971	1,042	1,155	1,285	1,443	1,623	1,824	2,041	1,070	1.7%	2.3%
Charlotte	2,561	3,148	3,569	3,864	4,259	4,717	5,272	5,905	6,606	7,362	3,793	1.8%	2.2%
Hinesburg/St. George	3,367	4,487	5,038	5,567	6,168	6,836	7,651	8,572	9,584	10,665	5,627	2.0%	2.2%
Huntington/Buell's Gore	1,170	1,611	1,873	2,157	2,410	2,705	3,060	3,467	3,921	4,413	2,540	2.6%	2.4%
Jericho	3,575	4,302	5,015	5,585	6,137	6,770	7,529	8,382	9,315	10,304	5,289	2.0%	2.1%
Milton	6,829	8,404	9,479	10,975	12,378	14,012	15,991	18,268	20,832	23,647	14,168	2.7%	2.6%
Richmond	3,159	3,729	4,090	4,282	4,647	5,061	5,533	6,066	6,675	7,269	3,179	1.3%	1.8%
Shelburne	5,000	5,871	6,944	7,649	8,411	9,284	10,333	11,513	12,805	14,177	7,233	1.9%	2.1%
Underhill	2,172	2,799	2,980	3,363	3,701	4,088	4,552	5,074	5,644	6,249	3,269	2.2%	2.1%
Westford	1,413	1,740	2,086	2,364	2,625	2,928	3,295	3,713	4,178	4,680	2,594	2.3%	2.3%

Notes:

[1] 1980, 1990 and 2000 population data are Census counts.

[2] CAA = Compound Annual Average Rate of Growth.

[3] The Northwest region contains the counties of Addison, Crittenden, Franklin, Grand Isle, Lamoille and Washington.

the forecast time period of 41,533. Due to the 2000 Census count being higher than the original 2000 forecast, the average annual rate of growth for Region 2 in the near-term, 2000-2010, is +0.1 percentage points higher than the previous forecast at 2.0%. However, the long-term average annual rate of growth is 0.1 percentage points lower, 1.9%, in the revised forecast.

The towns of Region 2, Colchester, Essex and Williston, show changes in their population increases from the September 2000 forecast as well. Colchester shows a lower increase, Essex remains relatively the same and Williston shows a slightly higher increase in population. Colchester is expected to grow an approximate 14,250 people over the forecast period, Essex, by approximately 18,083 people and Williston by approximately 8,907 people. Colchester and Williston are expected to see slightly higher rates of growth in the near-term, 1.6% and 2.0% respectively, versus the rates of growth expected in the long-term horizon, 1.8% and 2.3%, respectively. Essex is expected to show the reverse trend, with a lower rate of growth in the near term, 2.3%, than in the long-term, 1.8%.

Region 1 has the lowest absolute increase of the three sub-county regions with the second largest difference between the September 2000 and revised forecasts, a forecast increase of 12,685 and difference of 1,582 between the September 2000 forecast and these updates. This translates to a 0.1 percentage point increase in the average annual rates of growth in both the near-term and the long-term horizon, 0.5% and 0.6% respectively. This sub-county region contains the highly urbanized towns of Burlington, South Burlington and Winooski. Burlington and Winooski are both expected to see a greater population increase than expected in the previous forecast, while South Burlington is expected to show a lower population increase. Again, this is in part due to the shift in the estimated line caused by the difference between the 2000 Census and the original forecast. Burlington and Winooski's 2000 Census count came in lower than expected while South Burlington's 2000 Census count is approximately 1,500 people higher than the original forecast. Burlington is expected to add approximately 5,180 people, South Burlington 6,408 people and Winooski 1,097 people over the forecast period.

The addition of the 2000 Census population counts to the estimation of the Chittenden County population projections enhances the projections in two ways. First, it allows for more disaggregated town level projections to be made. Second, it allows for a more contemporaneous starting point for the estimation process. This contemporaneous element is especially useful for highlighting the pattern of growth within the county. Between 1990 and 2000, Chittenden County grew by 14,810 people, 66% or 9,825 of this growth was found in the six communities of Regions 1 and 2, namely Burlington, South Burlington, Winooski, Colchester, Essex and Williston. Over the 2000 - 2035 forecast horizon, Chittenden County is

expected to grow by 102,686 people. Fifty-three percent or 53,924 are expected to be in the six communities of Regions 1 and 2. While the majority of the population growth is still expected to be found in the six communities that form the geographic core of Chittenden County, the surrounding communities, the communities of Region 3, begin to see an increase in the share of total population. This follows the historic pattern of growth. As communities increase in density, the population begins to spread out into the surrounding communities.

5.0 Conclusion

The updated projections presented here share two elements with the September 2000 forecast. First, the projections are based upon historic patterns and as such, cannot account for future changes in policy that would alter the historic settlement patterns. Second, while the addition of the 2000 Census allowed for a more dis-aggregated town level projections for the communities of Region 3, the original note of caution regarding the town projections remains relevant. With each step to a smaller geographic area in the population projection process, the margin of error increases due to the volatility and variability exhibited by those areas. Therefore, while the town estimates use the same confidence level in the estimation process that the county and the sub-county region levels do, the precision with which the town level projections can be made is less than that of the larger areas.

The reader is referred to the September 2000 report titled *Economic and Demographic Forecast – Northwest Vermont and Chittenden County 2000 to 2035 and Beyond* for additional important information about the development and use of these forecasts. The September 2000 publication contains important information about the development and use of the forecasts.

