Appendix B: Model Information & Land Use Assumptions

Chittenden County Regional Transportation Model

The Chittenden County Travel Demand Model (the "model") was used to conduct analyses for existing (base year 2015) and future (2035) land use and transportation conditions in the county and WENTS area. The model simulates the interaction between housing, employment and a multi-modal transportation system. System-wide transportation models have been used in Chittenden County since the mid-1980s. The current model was developed in 1994 and updated in 1998 and 2011. The current model uses custom designed computer software and incorporates several advanced features including the ability to estimate bus, commuter rail, walk/bike and shared and single occupancy vehicle trips, and is sensitive to the effect transportation projects have on where trips are made.

The model is able to analyze morning (AM), afternoon (PM) peak hour, as well as all-day conditions. The afternoon peak hour was adopted for analysis of transportation alternatives in the WENTS area because the PM peak represents the most congested conditions and therefore highlights major issues with the highway network.

For the purposes of modeling traffic flows, the Model includes 335 internal Transportation Analysis Zones (TAZs) covering the 18 municipalities in Chittenden County. Traffic entering and exiting the region does so through 17 external zones. Land use is described in terms of dwelling units and employment. Each TAZ includes number of households and different employment categories. These categories such as retail, office, industrial, hotel, and school are placed into various high, low, or medium trip generation categories.

The model follows a five-step process (Figure 1) to estimate trips based on current and future land uses. The steps are defined as follows:

- Trip Generation – estimates the number of person trips produced and attracted to each TAZ.
- Trip Distribution – connects person trips between TAZs.
- Mode Choice – splits person trips into single occupant vehicles, shared vehicle trips, transit trips, or walk/bike trips.
- Assignment – Selects the shortest route for each vehicle and transit trip traveling from one TAZ to another based on distance and travel time.
- Land Use Allocation – The Model begins with a base-year land use and distributes county-wide estimates of housing and employment growth to TAZs based in part on accessibility and the availability of land for development (based on zoning, physical constraints, and existing land use).
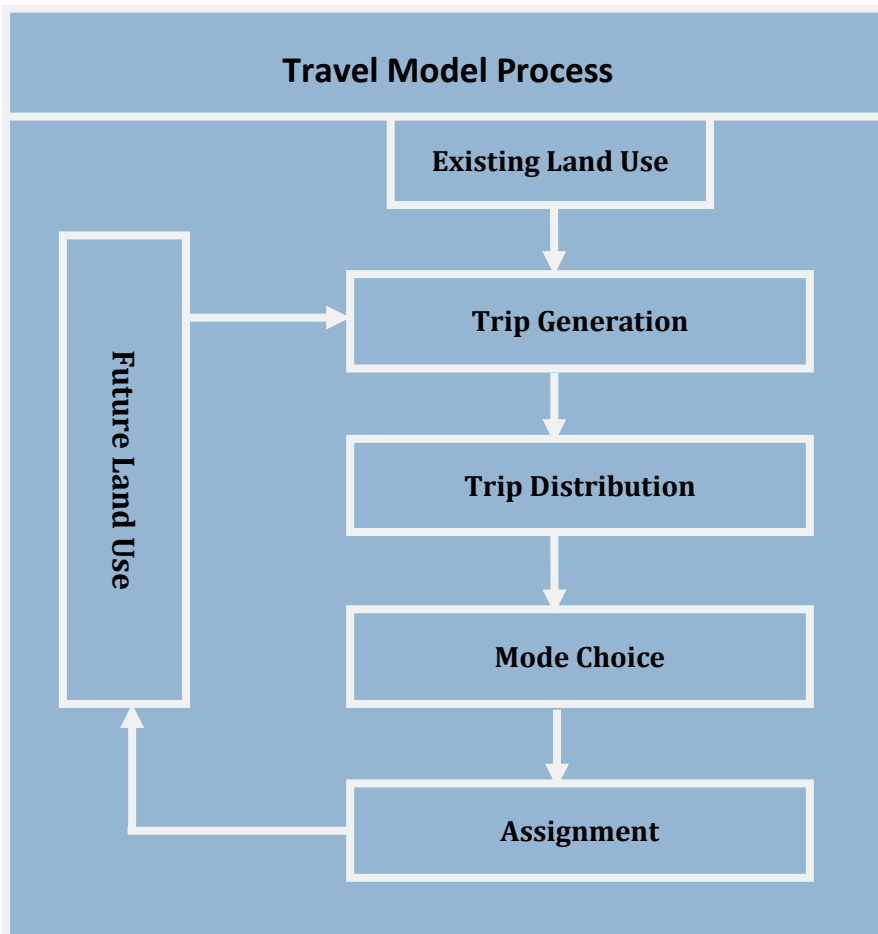
As indicated in Figure 1, the model includes a land use-transportation feedback loop that accounts for:

- The effect of new housing and jobs on the transportation system; and
- The effect of transportation on where housing and jobs are located.

Model outputs include a number of transportation and land use measures. Comparing these outputs across a variety of future scenarios allows analysts to study the interrelationship of transportation and land use decisions, measure the performance of various alternatives and assist in the selection of future transportation projects/alternatives.

Additional information on the model is available on the CCRPC web site at: http://www.ccrpcvt.org/transportation/model/.

Figure 1: Travel Demand Model Process

Travel Model Process

Existing Land Use

Future Land Use

Trip Generation

Trip Distribution

Mode Choice

Assignment

2035 Land Use Scenario

The 2035 land use scenario used for WENTS and the 2013 Metropolitan Transportation Plan (part of the ECOS Plan) was developed to quantify the future potential amount of household and employment for each Traffic Analysis Zone (TAZ) for the purpose of analyzing the interaction of land use and transportation and its associated impacts on travel. Future growth amounts at the county level were determined from the 2011 Woods and Poole demographic forecast (see Table 1). This forecast was purchased by CCRPC for use in long range planning efforts and takes into account interactions between the national economy, the northwest Vermont economic region, and Chittenden County. Forecasts of regional employment are based on the economic activities expected in the future and these estimates are then used in conjunction with existing population and household characteristics to develop the 2035 totals.
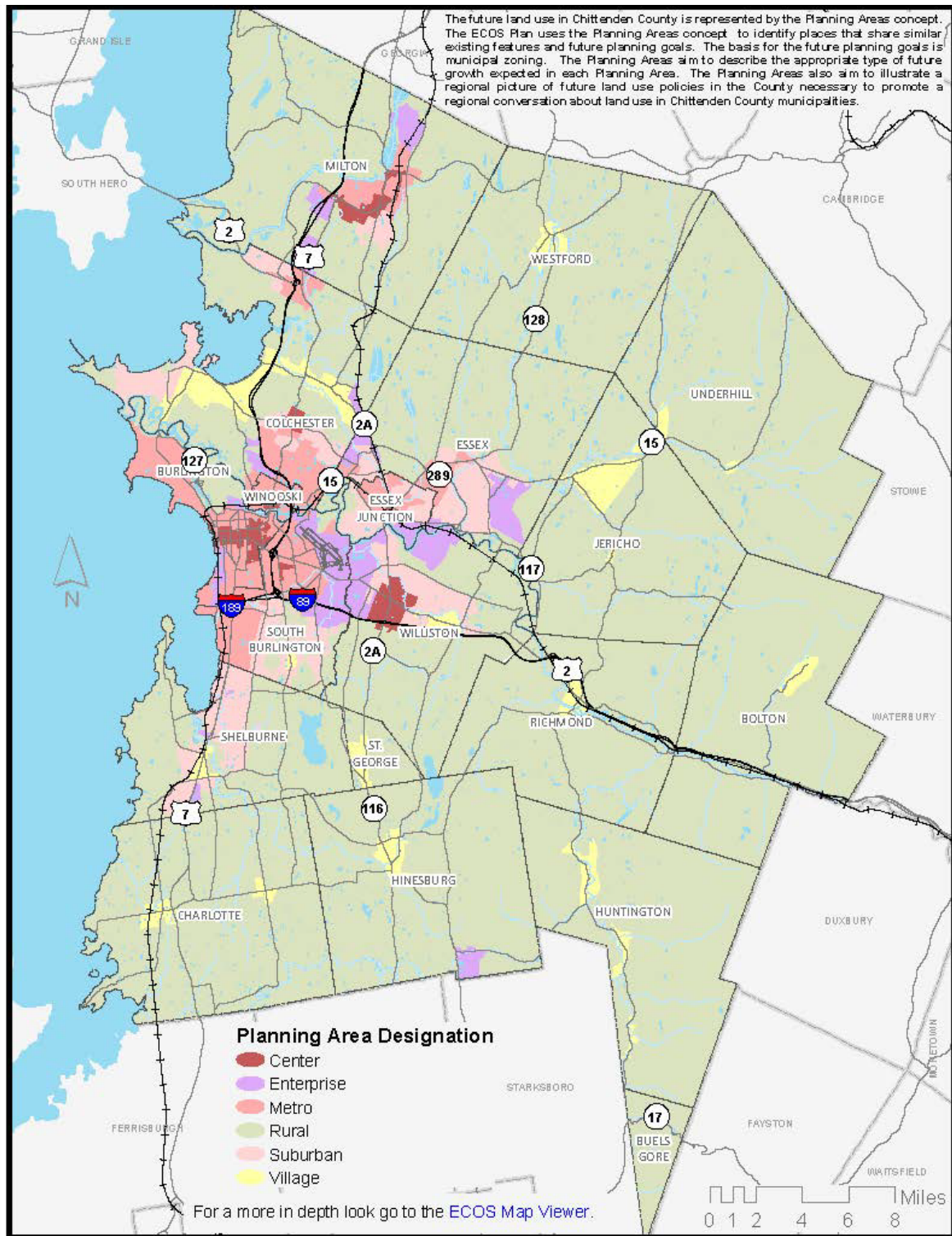
Table 1: 2011 Woods and Poole Forecast for Chittenden County 2005 - 2035

	2005	2010	2010 Census*	2015	2020	2025	2030	2035	*2005-2035*
Population	149,983	154,264	156,545	164,170	174,348	184,694	195,070	205,445	*55,462*
Housing	58,672	60,825	61,827	65,693	70,480	74,987	74,987	83,020	*24,348*
Employment	122,241	123,862	122,458	133,864	142,620	151,854	151,854	171,783	*49,542*

* -2010 Census STF1 County Population and Occupied Housing; 2009 US BEA Total Employment, (Table CA04)

These county level totals for 2035 were then allocated to Planning Areas (see Figure 2) using the proportion of existing housing and employment in these Areas. The Center and Metro planning area future growth proportions also took into consideration additional factors beyond existing housing and employment patterns. The Center planning area boundaries reflect areas where municipalities have received state designation as Growth Centers, New Town Centers, or TIF districts. The growth forecasts for the Center areas took into account existing plus permitted/planned growth documented in local plans and studies. The Metro planning area proportions were then adjusted to balance the regional totals. Table 2 summarizes the outcome of this analysis with the existing 2005 and Planned 2035 proportions of total housing and employment.

Figure 2: Planning Areas in Chittenden County

The future land use in Chittenden County is represented by the Planning Areas concept. The ECOS Plan uses the Planning Areas concept to identify places that share similar existing features and future planning goals. The basis for the future planning goals is municipal zoning. The Planning Areas aim to describe the appropriate type of future growth expected in each Planning Area. The Planning Areas also aim to illustrate a regional picture of future land use policies in the County necessary to promote a regional conversation about land use in Chittenden County municipalities.

Planning Area Designation

- Center
- Enterprise
- Metro
- Rural
- Suburban
- Village

For a more in depth look go to the ECOS Map Viewer.

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Table 2: Proportions of Total Housing and Employment by Planning Area

Planning Area	Households		Employment	
	Existing 2005 Proportion	Proposed 2035 Proportion of Housing	Existing 2005 Proportion	Proposed 2035 Proportion of Employment
Center	14%	21%	30%	27%
Metro	39%	33%	35%	38%
Suburban	18%	18%	4%	4%
Rural	20%	20%	4%	4%
Village	8%	8%	6%	6%
Enterprise	1%	0%	21%	21%
Total	100%	100%	100%	100%

Table 3 below displays 2005 and 2035 land use totals by planning areas as well as how much growth would be allocated between 2005 and 2035 to each planning area type to achieve the proposed 2035 total proportions of housing and employment shown in Table 2 above.

Table 3: 2005 & 2035 Land Use Totals and Growth Increments by Planning Area

	2005 Total		2035 Total		2005-2035 Growth	
	Housing	Employment	Housing	Employment	Housing	Employment
Center	*8,214*	*36,672*	*17,288*	*46,002*	*9,074*	*9,329*
Metro	*22,882*	*42,784*	*27,226*	*65,657*	*4,344*	*22,873*
Center+Metro	31,096	79,457	44,514	111,659	13,418	32,202
Suburban	10,561	4,890	14,838	6,871	4,277	1,982
Rural	11,734	4,890	16,487	6,871	4,752	1,982

Village	4,694	7,334	6,595	10,307	1,901	2,973
Enterprise	587	25,671	587	36,074	-	10,404
Total	58,672	122,241	83,020	171,783	24,348	49,542

The CCRPC endorsed the 2035 Planning Area growth assumptions at their September 2011 meeting and they were used to support the regional transportation model by allocating growth to the Model's 335 Transportation Analysis Zones (TAZs) and the TAZ's development potential relative to others within the same type of planning area. Assumptions were made to assign the planning area growth to the TAZs as their boundaries are not coincident.