

MECKLENBURG – UNION METROPOLITAN
PLANNING ORGANIZATION POPULATION
PROJECTIONS AND EMPLOYMENT
ALLOCATIONS 2000 - 2030

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Introduction

This is the final report on the methodology used for population projections and employment allocations by the UNC Charlotte Center for Applied Geographic Information Science team contracted to perform this task for the Mecklenburg-Union Metropolitan Planning Organization (MUMPO) region. Members of the research team include:

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Mecklenburg County Land Use Survey

The purpose of this work is to do a comprehensive land use survey of Mecklenburg County utilizing a combination of county tax records and windshield surveys. The county tax records were utilized first in an attempt to classify as many parcels as possible into five residential categories and eight employment categories.

The classification from the tax files utilized the land use code descriptions and building code descriptions found in the file. All parcels classified as residential were identified in the tax file and a density was calculated based on the parcels acreage and number of units listed in the tax file. Each residential parcel was classified into the appropriate residential category based on the calculated density.

In order to classify the non-residential parcels the land use codes found in the tax files were assigned the appropriate corresponding category from our inventory and for further clarification or identification the building codes found in the tax files were assigned the appropriate corresponding category from our inventory. The non-residential parcels were then assigned to the correct category based on the land use and building code descriptions that were referenced to our non-residential categories. The parcels remaining are to be classified by use of a windshield survey, which totaled 9,143 parcels.

In order to complete the land use survey it was decided to concentrate our survey on major thoroughfares and the area surrounding them. The windshield survey in Mecklenburg County classified 6,440 of the remaining parcels. The remaining 2,703 parcels not yet classified were completed by calculating the percentage of each land uses acreage already classified for each TAZ and assigning that percentage of land use acreage for the unclassified parcels for each TAZ. To complete the land use survey the acreages for each land use was compiled and completed in the base year inventory for each TAZ.

Union County Land Use Survey

The purpose of this work is to do a comprehensive land use survey of the MUMPO portion of Union County utilizing a combination of county tax records and windshield surveys. The county tax records were utilized first in an attempt to classify as many parcels as possible into our five residential categories and our eight employment categories.

The classification from the tax files utilized the land use code found in the file. All parcels classified as residential were identified in the tax file and a density was

calculated based on the parcels acreage and number of units listed in the tax file. Each residential parcel was classified into the appropriate residential category based on the calculated density.

In order to classify the non-residential parcels the land use codes found in the tax files were assigned the appropriate corresponding category from our inventory. The non-residential parcels were then assigned to the correct category based on the land use code descriptions that were referenced to our non-residential categories. The parcels remaining are to be classified by use of a windshield survey, which totaled 8,258 parcels.

In order to complete the land use survey accurately the windshield survey for Union County involved all remaining parcels not yet classified. To complete the land use survey the acreages for each land use was compiled and completed in the base year inventory for each TAZ.

Base Year Employment Data Collection

The initial step in the process for collecting employment data was to review the sources available to us providing number of employees and employer locations, which included Info-USA and Dunn & Bradstreet. After reviewing both data sources it was decided that neither one of them was accurate enough to provide a thorough and comprehensive review of employment in Mecklenburg and Union County. [See attached report on employment data review.]

Due to the deficiencies found in the available sources an alternative source of employment data was found. The UNC-Charlotte Urban Institute conducted a comprehensive survey of all businesses over 50 employees in Mecklenburg and Union

County. The Urban Institute provided us with the data they had collected and we proceeded to utilize a GIS to address match the records.

In order to complete the survey business with less than 50 employees were pulled from the Info-USA data source, which had been found to be the most complete set of employers with less than 50 employees. The two data sources, Urban Institute over 50 employees and Info-USA less than 50 employees, were merged together to complete the employment collection process. The list was then reviewed for duplicate records and amended accordingly to create our final list of all employers and a count of total employees. The employee information was then assigned to our eight employment categories based on SIC code designations provided by the Urban Institute survey and the Info-USA data thus completing our survey of employment in Mecklenburg and Union County.

Commercial Vehicle Data Collection

The purpose of this work is to collect data referring to the number of and type of commercial vehicles operated by businesses in Mecklenburg and Union County. The commercial vehicle data collection was completed by the UNC-Charlotte Urban Institute in conjunction with the employment survey completed for this project. The commercial vehicle information was provided by the employers through the survey process and compiled by the Urban Institute. The final aggregation to TAZ level was completed based on employer location.

School Enrollment Data Collection

The purpose of this study is to determine the location and enrollment of school in Charlotte-Mecklenburg and Union county.

1. Data Collection Procedures

The number of students was based on the latest data available on the Web site in August 2003. Three different files were created: 1) Kindergarten to middle, 2) High school, and 3) College, in Charlotte-Mecklenburg and Union County. To identify the type of school, a public school was coded as 1 and a private school was coded as 2.

The following sources were used to make the list of student enrollment in Charlotte-Mecklenburg and Union county.

1. Charlotte-Mecklenburg Schools (www.cms.k12.nc.us)
2. Union County Public Schools (www.ucps.k12.nc.us/schools/schools.htm)
3. North Carolina Directory of Non-Public Schools: Conventional Schools Edition, Department of Administration, NC Division of Non-Public Education (www.ncdnpe.org)
4. National Center for Education Statistics (www.nces.edu.gov/globallocator.htm)
5. MSN Yellow Pages (www.msn.com)
6. Charlotte.com (www.charlotte.com)

The following criteria were used to determine the location and enrollment of the school.

1. Learning centers and daycare were excluded from the list.
2. Bible schools and church schools were included on the list.
3. The public school lists were created on the basis of Charlotte-Mecklenburg Schools and Union County Public Schools Web site. However, they only provide the aggregated number of students in the county. Therefore, the National Center for Education Statistics was used to determine the number of students for each school and then the total number was compared with the Charlotte-Mecklenburg and Union County Schools' data.

4. For the private school data, the North Carolina Directory of Non-Public Schools was used. In addition, the MSN Yellow Pages and Charlotte.com were used as a supplement.
5. If the number of enrollment was not listed or had a great discrepancy among the lists, we called each school to determine the accurate numbers.

2. Mapping Procedures

Geocoding address matching in the function of the ArcGIS was used to identify the location of the school. The following shape files were used for reference.

1. Master address in Mecklenburg County
2. GIS street layer in Mecklenburg County
3. Union County street files

If the school address did not match the street address at all, we manually located the point on the map. Mapquest (www.mapquest.com) and the school Web site were used to identify the proper location. If the results from the Geocoding showed several possible options for the location, we chose the one that was closest to the actual address.

3. Verification

After finishing placing all schools, we checked if each school was located in the proper place. The focus was on the cases in which the address matching score were not 100 percent. The employment data in Mecklenburg County was used for reference. If the location of the school was misplaced, we modified the point to the proper location. Finally, we aggregated the numbers based on TAZ.

The purpose of this work is to allocate employment based on the distribution of population, hence Population Chasing Employment. The given totals of population chasing employment per category per horizon year were allocated in the same proportions as the population of the county. Due to the fact that some TAZ's contained population but had no available land for development, their population was assigned to the closest TAZ that had land available for development. Once the population figures were allocated, the assignment of employment per TAZ based on population was performed in the following steps:

1. Identified TAZ's that contained > 5 acres of land available for development (vacant developable and re-developable), to be used as the TAZ's that are capable of receiving employment. In Mecklenburg County 545 TAZ's out of 946 were identified as having >5 acres of available land. In the MUMPO portion of Union County 163 TAZ's out of 256 were identified as having >5 acres of available land.
2. Created a point layer that contained the centroids of all TAZ polygons and a point layer that contained the centroids of the TAZ polygons that were identified in Step 1 as being available for employment.
3. Utilized the spatial join function in a GIS with the two centroid layers (joining points to points) which joined each centroid of a TAZ that is not available for employment to a centroid of a TAZ that is available for employment based on spatial distance between centroids. The centroids not available for employment were assigned to the centroid available for development that it is closest to. This joining procedure summed the population figures of the TAZ's so that the TAZ's

that are available for employment received the population of the TAZ's that are not available for employment.

4. The new population figure was then transferred to a TAZ boundary file and a population ratio was calculated (pop. per TAZ / total pop. = pop. ratio).
5. The population chasing employment totals for each category per horizon year were multiplied by the population ratio to obtain the number of employees per TAZ. Due to rounding errors, the TAZ's with the highest number of employees were adjusted (no adjustments larger than one employee per TAZ) to match the totals.

Non-Population Chasing Employment

The purpose of this work is to allocate employment that is not directly influenced by population distributions, hence Non-Population Chasing Employment. The given totals of non-population chasing employment per category per horizon year were allocated based on a series of panel meetings in which the panel members identified locations or areas for the allocation of employment. In some instances, current employment trends were used to distribute the employment after possible location suggestions were exhausted or difficult to assess. Panel members openly discussed location decisions and amount of employment to be allocated.

Mecklenburg County

Panel Members: Joe McLelland, Jonathan Wells, Jonathan Robinson, Steve Patterson, Anna Brigman, and Tom Drake.

A total of three meetings were convened to allocate projected employment per category, per horizon year.

Union County

Panel Members: Brian Matthews, Lee Bailey, and Dick Black.

One meeting was convened to allocate projected employment per category, per horizon year.

After completing the allocation of employment per category, per horizon year the Charlotte-Mecklenburg Planning Commission reviewed the projections and allocations. After reviewing the allocations the Planning Commission recommended changes to 26 TAZ's based on their knowledge and planning goals for the areas. The 26 TAZ's were then adjusted to match the Planning Commission's recommended employment figures. These 26 TAZ employment figures recommended by the Planning Commission have remained constant throughout each round of the allocation process. Each round of employment allocations held the non-population chasing employment constant and only adjusted the population chasing employment component based on the new population projection figures recalculated for each round of projections. For each new round of employment allocations a new series of employment projections for the population chasing component were provided by the RLUTA team and allocated based on the new population ratios calculated from the updated population projections.

Population Projections

Methodology Overview

The population projection methodology employed for Mecklenburg county and the MUMPO portion of Union county closely follows that prescribed by the RLUTA team. It is a bottom-up approach that identifies Land Development Factors (LDF) that influence the location of residential development. LDFs were chosen with the assistance of panels of experts from Mecklenburg and Union counties separately and then data were collected and used to generate GIS layers representing the LDFs. The expert panels were also asked to rank each of the LDFs in order of importance. These rankings formed the basis of a weighting system used to calculate a composite score from the LDFs. Composite LDF scores were averaged for each Transportation Analysis Zone (TAZ) and then converted into residential acres consumed per TAZ. Development densities (households per acre) for each TAZ were used to derive the number of new households in a TAZ and then historical household size was used to calculate population. For each projection year the acres consumed were subtracted from the total to be carried forward into the next projection period.

One difference between the MUMPO and RLUTA methodologies is in the use of Development Potential Areas (DPA). DPAs were not used by the MUMPO team due to anticipated difficulties in asking expert panels to predict values for acres consumed, households per acre and persons per household for three sets of DPAs (one set per horizon year). In a region with over 1200 TAZs, DPAs would likely number in the hundreds. It is unreasonable to ask a panel of experts to make judgments for hundreds of

areas for three different time periods. Instead a more automated method was employed whereby the experts provided guidance on important factors and relative weights and computer software derived values for acres consumed, households per acre and persons per household at a TAZ level instead of DPAs.

Each round of population projections was presented to the staff of planning departments and other government agencies and feedback was solicited. Feedback was used to adjust factor weights and other key modeling values and in some cases new or modified factor layers were supplied by local agencies.

Expert Panels

Expert panels for both Mecklenburg and Union counties were used to provide input on the predicted location of residential development and the selection of location development factors. Base maps showing the transportation network, recent population growth, water and sewer availability and employment were presented to the panels and they were asked to draw areas of high expected growth on the maps. Both county's panels drew areas for 2010 and 2020 but declined to speculate on 2030 growth patterns. In addition, the panels were given a list of possible LDFs and asked to indicate their relative importance and to add any factors they felt should be considered. The factors presented were:

Positive Factors

- Existing water service
- Planned water service

- Existing sewer
- Planned sewer
- Available land
- Population growth 1990 – 2000
- Residential building permit activity 2000 – present
- Transit stations, station areas
- Employment Centers (>5,000 employees with 0.5 miles)
- Travel time to core employment areas
- Waterfront within 0.5 miles
- Planned transportation improvements

Negative Factors

- Undesirable landuses (industrial)
- Congestion
- Sewer treatment facilities

Absolute Avoidance

- Protected open space
- Floodways
- SWIM buffers
- Airport

The final factors chosen and their weights are listed in the attached individual reports for Mecklenburg and Union counties.

Location Development Factor Definitions

The following factors were used as input to the population projection model.

Developable Residential Land is land that is currently zoned residential and has no building on it.

Redevelopable Residential Land is land that is currently zoned residential, has building square footage reported in the tax record and has a building value that is less than 40% of the parcel's total assessed value.

Population Change is calculated from the actual or projected population change in the previous ten year period (e.g. 1990 – 2000 for the 2010 horizon year).

Travel Time to Employment Concentrations was estimated from CDOT's travel time estimates for the transportation network from the year closest to the beginning of the projection period. Employment concentrations were defined as any area with 5000 jobs within ½ mile. For the 2010 horizon year, 2003 base year employment (points) were used. For later years the first round employment projections by TAZ were used.

Water Availability

Mecklenburg: CMUD's map of areas without water lines was used for the 2010 projections. For 2020 this was combined with a buffered map of CMUD's projected 10 year needs. For 2030 water service was assumed to exist everywhere in Mecklenburg County.

Union: Water service area maps were obtained from Union County GIS.

Sewer Availability

Mecklenburg: CMUD's map of areas without sewer lines was used for the 2010 projections. For 2020 this was combined with a buffered map of CMUD's projected 10 year needs. For 2030 sewer service was assumed to exist everywhere in Mecklenburg County.

Union: Sewer service area maps were obtained from Union County GIS. In addition, input from planning staff concerning current and future service was incorporated.

Proximity to Waterfront extends ½ mile in from the shoreline of Lake Norman, Mountain Island Lake and Lake Wylie.

Proximity to Transit Stations (Mecklenburg only) was calculated from the transit station locations anticipated to be in service for each horizon year. A factor score of 1.0 was used within ¼ mile of the station and the score then declined in a linear fashion to zero at a distance of ½ mile.

Expert Panel (Union County only). Digitized areas of predicted high growth for 2010 and 2020 were input.

Growth Policy Factor (Union County only). A municipal growth policy factor (high, medium, low) was collected with assistance from local experts.

Limiting Factors

Available land serves both as a LDF and as a limiting factor. The model does not allow more land to be consumed per TAZ than is available. Residential densities also serve as a limiting factor. For most of the modeling region densities were calculated directly from year 2002 tax parcel records. In environmentally sensitive or constrained areas of Union county (heel splitter and pig toe habitats) observed densities were replaced with policy derived values. In the Charlotte sphere of influence development densities were provided by the Charlotte Mecklenburg Planning Commission staff.

Modeling Framework

A grid cell (raster) modeling approach was used to weight and combine LDFs. In Union county a 500 by 500 foot grid cell size was used. In Mecklenburg a finer 250 by 250 foot cell size was employed. This finer cell structure was necessitated by the desire to more accurately model variations around transit centers where quarter and half mile circles were used in one of the layers.

All LDFs except population growth were standardized to range from 0 to 1.0. Population growth ranged from -1.0 to +1.0 due to the fact that some TAZs had negative growth during the 1990 to 2000 period.

Attractiveness scores for each grid cell were calculated by an equation of the form,

$$\text{Score} = \sum (W_i * \text{LDF}_i),$$

where W_i = the weight of factor i , and

LDF_i = the normalized value of factor i in this grid cell

Once scores were calculated for each grid cell, a zonal average was calculated using TAZs as the zone layer. These averaged scores were then used to derive the percentage of available acreage to be consumed per TAZ during this time period. The development densities recorded for each TAZ were multiplied by the acres consumed to arrive at the number of households added during each time period. Historical household sizes (where available) translate households into numbers of people. Where no households existed in the year 2000 a county wide average was used.

After each horizon year is completed the acres consumed are subtracted from the total and the new figure is carried over to start the next iteration. Since developable and redevelopable acres are LDFs these factor values have to be calculated anew for each iteration along with population growth. All other LDFs are not influenced by running the model and may be constructed beforehand and held until needed.

Model Review

To date, two rounds of population projections for Union county and four rounds for Mecklenburg have been completed. After each round reports were distributed or

presented to representatives of county and municipal agencies for their review and comment. This resulted in several changes to input layers, factor weights, development densities and available acreages. For instance the towns of Huntersville and Davidson provided additional data on zoning categories that corrected early round errors in acres available. Charlotte-Mecklenburg Planning Commission staff supplied revised figures for residential density and acres available. Union county and Monroe provided additional data on densities, water and sewer plans and growth policies. These changes resulted in a series of model runs that have progressively improved. Total population figures have not varied dramatically but the locational pattern of growth has shifted significantly due to model refinements.

Model Results – Mecklenburg County

Factor Weights

The following weights were used in the Mecklenburg County model runs.

Factor	Weight		
	2010	2020	2030
Developable Land	3	3	2
Travel Time to Emp	2	2	2
Water	2	2	*
Sewer	2	2	*
Redevelopable	2	3	3
Population Change	2	1	1
Waterfront	1	1	1
Transit	1	2	2
Planner's Judgement	2	2	2
Theoretical Maximum	17	18	11

Summary Population Projection Tables – Mecklenburg County**Household Projections by Sphere of Influence, 2000 – 2030**

SPHERE	HH2000	HH2010	HH2020	HH2030
Charlotte	235,500	283,680	337,602	384,357
Cornelius	6,249	9,116	12,395	15,213
Davidson	2,082	3,425	5,379	7,066
Huntersville	10,223	17,988	27,692	35,913
Matthews	7,663	9,392	11,112	12,521
Mint Hill	8,449	12,461	17,952	23,152
Pineville	3,250	4,084	4,957	5,657
Totals	273,416	340,146	417,089	483,879

Population Projections by Sphere of Influence, 2000 – 2030

SPHERE	POP2000	POP2010	POP2020	POP2030
Charlotte	593,849	712,086	842,381	954,947
Cornelius	14,439	21,234	28,995	35,653
Davidson	7,424	11,034	16,269	20,780
Huntersville	27,801	48,412	74,009	95,689
Matthews	21,143	25,902	30,622	34,498
Mint Hill	22,865	33,736	48,665	62,864
Pineville	7,933	10,155	12,497	14,378
Totals	695,454	862,559	1,053,438	1,218,809

Projected Population Change (percent), 2000 – 2030

SPHERE	PCTCHG2010	PCTCHG2020	PCTCHG2030
Charlotte	19.9	18.3	13.4
Cornelius	47.1	36.5	23.0
Davidson	48.6	47.4	27.7
Huntersville	74.1	52.9	29.3
Matthews	22.5	18.2	12.7
Mint Hill	47.5	44.3	29.2
Pineville	28.0	23.1	15.1
Totals	24.0	22.1	15.7

Developable and Redevelopable Land Available, 2000 - 2030

	Acres Available 2000	Acres Available 2010	Acres Available 2020	Acres Available 2030
<u>SPHERE</u>				
Charlotte	49,703	42,975	35,207	28,729
Cornelius	3,885	3,374	2,751	2,217
Davidson	4,871	4,363	3,561	2,870
Huntersville	21,186	18,601	14,981	11,922
Matthews	2,509	2,145	1,756	1,443
Mint Hill	11,420	10,203	8,524	7,008
Pineville	1,185	1,022	830	677
Totals	94,759	82,683	67,610	54,866

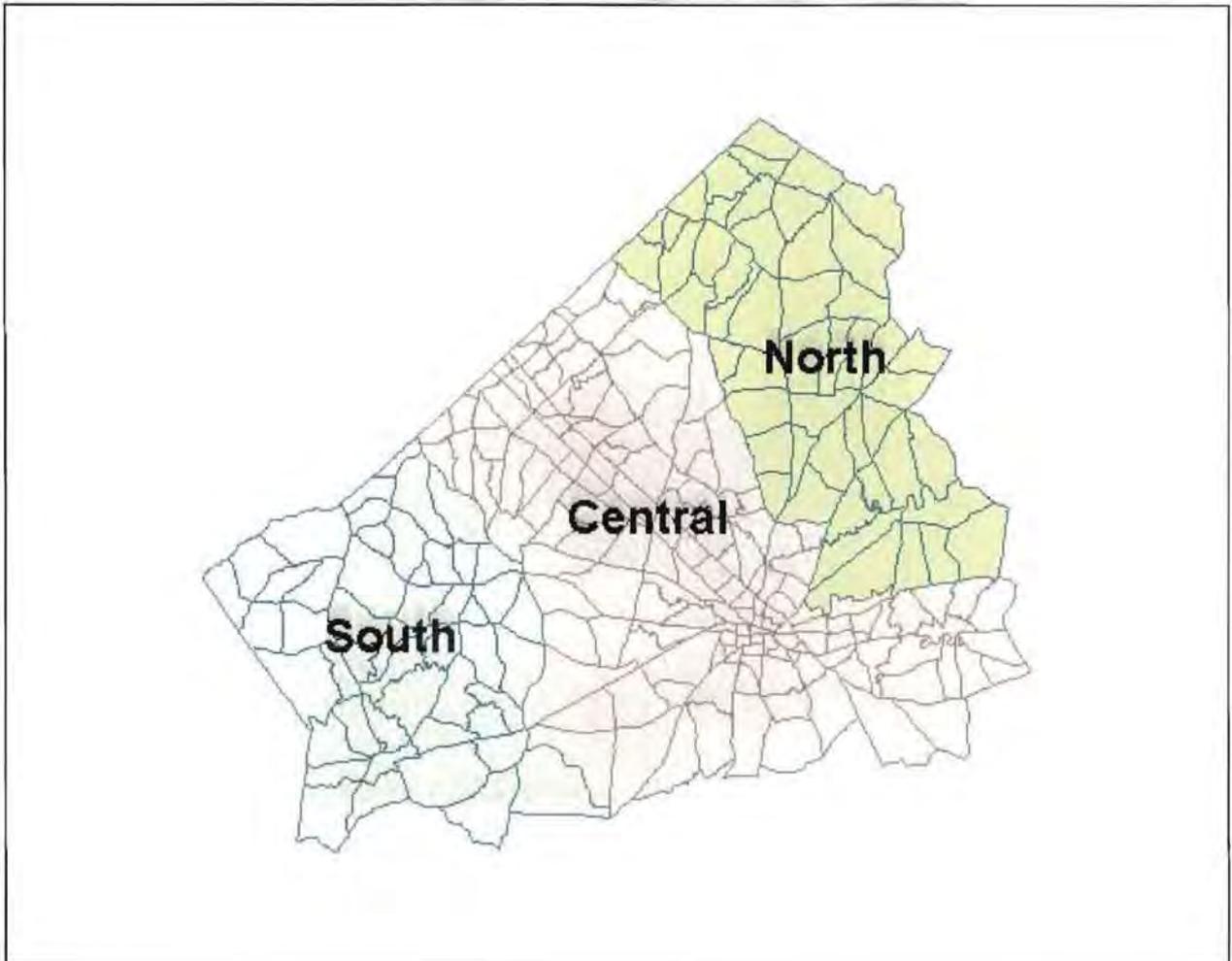
Model Results – Union County

Factor Weights

The following factor weights were used in the Union County model runs.

Factor	Weight		
	2010	2020	2030
Developable Land	3	3	3
Travel Time to Emp	3	3	3
Water	2	2	2
Sewer	2	2	2
Redevelopable	2	3	3
Population Change	3	1	Not used
Expert Panel	2	2	2
Growth Policy	1	1	1

Summary Population Projection Tables – Union County



Household Projections by District, 2000 – 2030

<u>District</u>	<u>HH2000</u>	<u>HH2010</u>	<u>HH2020</u>	<u>HH2030</u>
Central	23,883	34,510	45,300	55,273
North	4,317	7,437	13,327	25,120
South	6,229	9,822	14,012	20,905
Total	34,429	51,769	72,639	101,298

Population Projections by District, 2000 – 2030

<u>District</u>	<u>Pop2000</u>	<u>Pop2010</u>	<u>Pop2020</u>	<u>Pop2030</u>
Central	67,907	96,895	126,198	153,424
North	12,180	21,002	37,447	70,093
South	18,978	29,569	41,645	61,393
Total	99,065	147,466	205,290	284,910

Projected Population Change (percent), 2000 – 2030

<u>District</u>	<u>PctChg2010</u>	<u>PctChg2020</u>	<u>PctChg2030</u>
Central	42.7	30.2	21.6
North	72.4	78.3	87.2
South	55.8	40.8	47.4
Total	48.9	39.2	38.8

Developable and Redevelopable Land Available, 2000 - 2030

<u>District</u>	Acres Available 2000	Acres Available 2010	Acres Available 2020	Acres Available 2030
Central	35,105	20,192	6,509	0
North	26,354	18,096	7,859	0
South	24,851	12,398	4,599	0
Total	86,310	50,686	18,967	0

