Redistricting 2010 City Council Districts
Greensboro, NC

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Abstract

The release of the 2010 census population counts (P.L. 94-171) caused Greensboro, NC (population 269,000) to redraw its council district boundaries to re-balance the population within each district. This paper provides an overview of: (a) the legal framework within which redistricting GIS professionals must work; (b) the development of a ArcObjects based application used by staff and legislators to analyze various districting scenarios; (c) Our handling of both the TIGER and population files; and, (d) some general observations of what went well and what we could have done better.

Background on Greensboro, NC

Steve Miller writes in the September 1999 issue of *State Legislatures* magazine "redistricting is a wonderful mix of politics, law, cartography, demography and computer science." I would also add that it is a constantly changing mix where new developments in law, demography and technology presents both opportunities and challenges to governments facing redistricting that are very different from those of previous years.

Let me begin by sharing some background about our city in the hopes that it will assist you in translating our experiences into the context of where you will be working. Greensboro is located in north central North Carolina. Our April 1, 2010 population was 268,897. We operate under the Council-Manager form of government. Since our elections are non-partisan, political party affiliation was not a factor in our redistricting.

Up until 1983, the seven member City Council was elected at-large. Then, in response to a large annexation, the City adopted a modified district system. Today the Mayor and three City Council members are elected at-large. An additional five members are elected from districts.

Greensboro falls under the jurisdiction of Section 5 of the Voting Rights Act. As such, any changes to the system of elections, including redistricting, must include pre-clearance approval by the US Department of Justice (DOJ).

A variety of staff at the City are involved in redistricting. In 2011, staff from the GIS and Legal departments carried out the principal work. From the perspective of GIS, our primary involvement included collection and preparation of the necessary data (both geographic and demographic), creation of a computer application to guide the process, production of the various cartographic outputs and preparation of the DOJ Section 5 submission. As events unfolded, we also worked one-on-one with legislators and senior city staff to develop various redistricting alternatives and to arrive at the final boundaries adopted by City Council.

One factor that might make our 2011 redistricting efforts unusual was the project's very tight timeline. Our schedule was dictated by several outside factors: (a) the necessary demographic data might not be available until as late as April 1, 2011; (b) that the Department of Justice would require 60 days to review our submission; and, (c) that filing dates for the November election open on July 25, 2011. As such, staff had roughly 60 days to finalize data, prepare plans and to secure approval by City Council.

Establishing the Basis for Redistricting

Our first task was to determine the legal context under which the City's redistricting efforts would be guided. What follows does not constitute legal advice. Keep in mind that each jurisdiction will be guided by legal constraints that are unique to your situation. Having said that, what follows is a layman's interpretation of the broad legal environment within which your redistricting is likely to occur. These factors guided Greensboro's efforts.

Equal Population

Foremost among the criteria which will be used at a municipal level is the requirement that districts must be substantially equal in population. Doing so insures that each person's vote counts the same. The legal basis for this is the Equal Protection Clause of the 14th Amendment to the Constitution. However, this does not mean that the population of each district must be exactly the same. For non-Congressional districts, the accepted standard is a maximum population variance of no more than 10 percent. It works like this:

Divide the total number of districts into the total new population. This gives you the population count of the "ideal" district. Then calculate the percentage that your most populous district is above that ideal size. Next calculate the percentage that your least populous district is below the ideal size. Add these two percentages together (ignoring signs) and you have your plan's variance. For example, you have a city of 100,000 people with five districts. Your ideal district should consist of 20,000 people. Your largest district contains 22,000 people, a difference of 10% above the ideal. Your smallest district contains 18,000 people, a difference of 10% below the ideal. Your plan variance is 20%. You failed the test.

This 10% variance rule is not statutory, it is court derived and based on years of case law going back to the US Supreme Court decision of *Reynolds v. Sims* in 1964. Factors may cause plans with greater variances to withstand court challenge and plans with less than 10% variance to fail. However, in Greensboro, we drew all plans with a goal of not exceeding the 10% variance and smaller variances were preferred over larger ones.

"Traditional Districting Principles"

Most of what will guide your redistricting efforts will be found in case law surrounding "Traditional Districting Principals." The Supreme Court first used this term in a 1993 North Carolina case, *Shaw v. Reno*, mentioning "compactness, contiguity and respect for political subdivisions" as examples. In *Miller v. Johnson (1995)*, it added, "respect for … communities defined by actual shared interests." Again in *Bush v Vera (1996)* the Court added, "maintaining… traditional boundaries" to the list. Finally, in 1997 it added "maintaining… district cores" and "protecting incumbents from contests with each other" through *Abrams v. Johnson*. In Greensboro, we applied each of these principles in our redistricting.

1. **Compactness**. Unlike population variance, there is no commonly accepted single measure of compactness that seemed to apply to Greensboro. Those that do exist as based on measures of either dispersion or indentation. Dispersion measures, such as Reock and other convex hull measures, focus on the extent to which a shape's area is spread out from its center. Therefore a circle is compact and a barbell is more dispersed. Indentation measures, such as Polsby-Popper and others, evaluate the indentation of district boundaries. Shapes with shorter perimeters are more compact than those with longer contorted parameters. Most of the compactness measures have been developed for testing Congressional districts, which can be prone to meandering across vast stretches of a state. Given the geographic confines of a municipality, such measures tend to be overly complex.

   One of our goals was to create districts that were more compact than those now present. In Greensboro, we evaluated compactness based on district perimeters (an indentation approach). We took this approach since it is both intuitive and easy to calculate. As plans were developed, we used the ESRI

length field to compare a proposed district boundary to the current district boundary. While we could determine if a plan was more compact than another, we found that mathematical differences in compactness less important in Greensboro than other traditional principals.

2. **Respect for Political Subdivisions**. This criterion translates best to redistricting efforts that hope to preserve the integrity of smaller political units within a larger body. An example of this would be preserving county boundaries when redistricting state legislative seats (a legal requirement in North Carolina).

   At a municipal level we applied this principle to voter precincts. In North Carolina, precincts, referred to by the Census Bureau as Voter Tabulation Districts (VTD), are the smallest geographic unit of voter registration and administration. Typically they will contain 4,000-8,000 people. In developing district boundaries we felt obligated to follow precinct boundaries. In practice this goal supported several other goals: (a) the census population counts would be released by precinct; (b) voter registration statistics are organized by precinct; and, (c) administration of an election organized around something other than precincts would be difficult to administer and very confusing for voters.

3. **Contiguity**. All of the geographic areas of a district should be contiguous. Simply stated, a person should be able to travel from any location in their district to any other location within the district without passing through a different district.

   In principal it's simple, in practice it can get more complicated. The first complication occurs when areas, such as precincts, that make up a district touch only at a single point. This is referred to as point contiguity and individual state laws as well as case law differ on whether or not contiguity can rest on a single point. A second complication surrounds water bodies and whether or not a district can be split by a river or lake and still be considered contiguous.

   In North Carolina, the preponderance of legal precedent leans against point contiguity and Greensboro's water bodies are not a factor in drawing boundaries.

   However, we were presented with the challenge of satellite annexations. Here we have created "islands" that are part of the City, but that are not geographically connected to its core. These were handled in one of two ways. First, it could be a situation where the "island" is part of a voter precinct that is itself connected to the rest of the city. In cases such as these, we required the "island" to follow the balance of its precinct into whatever district the overall precinct was assigned. A second situation would arise where the "island" was part of a precinct and no areas of that precinct were connected to the City's core. In such cases, these islands were assigned to the closest, nearly adjacent, district.

   A final complication surrounds situations where separate portions of the same precinct were contiguous with different districts. In 2001, we used a strict definition of continuity and split precincts where necessary to insure geographically contiguous districts. In 2011, we drew boundaries so that precincts were not divided between two or more districts. While this resulted in a handful of instances where small pockets of population were assigned to a district with which they were not contiguous, we felt it was a reasonable trade-off in order to respect the precinct as a political subdivision and to preserve communities of interest.

4. **Respect for Communities of Interest**. Here the goal is to group people with like interests together so that an elected representative can articulate their views.

   In Greensboro, we looked to neighborhoods as the best indicator of like interests. Over time, the City has defined 255 neighborhoods. To the extent possible, we avoided splitting neighborhoods between districts.

5. **Maintaining District Cores**. To the extent possible, districts should be drawn in such a way as to preserve the core of existing districts.

   Development of redistricting scenarios frequently began by modifying the existing plan in such a way to minimize the number of voter precincts that were shifted from one district to another.

6. **Maintaining Constituent Relationships**. To the extent possible, districts should be drawn in such a way as to avoid situations where incumbents would be in contests with each other.

   Early in the process we identified the precincts where incumbents resided and avoided moving these precincts into a different district.

The Changing Role of Race in Redistricting

There are two relevant parts of the Voting Rights Act that redistricting staff must consider. The first of these, Section 2, applies to the entire country and prohibits states or any of their political subdivisions from taking any action that would deny or abridge the right to vote on account of race or color or because a person is a member of a language minority group.

In the 1986 case of *Thornburg v. Gingles*, the high court identified pre-conditions that plaintiffs must meet to demonstrate a violation of the Act as well as additional factors that might invalidate a minority group's ability to elect representatives. The thrust of Section 2 is to prevent district plans where either too few (fracturing) or too many (packing) members of a minority group are placed into a given district.

The second provision of the Act is Section 5. This section requires that pre-clearance be secured from the Department of Justice, or the courts, before putting electoral changes into place. These provisions only cover selected areas of the Country and include much of the Southeast. Essentially, redistricting plans will not be pre-cleared if the proposed plan exhibits, "retrogression" -- leaving members of a minority group worse off than they were under the current or "benchmark" plan.

Throughout the early 1990's the pre-clearance requirement of Section 5, coupled with the provisions of Section 2, led the Justice Department and many jurisdictions to the conclusion that they must develop plans that created the maximum number of "majority-minority" districts mathematically possible, this to the exclusion of "traditional districting principles." The failure to draw such maximized minority district plans would result in a withholding of the needed pre-clearance. However, the 1990's saw the Court strike down numerous plans that were focused too heavily on race at the expense of compactness and other traditional principles (i.e., *Shaw v. Hunt* 1996, *Johnson v. Miller* 1995 and others). The view that minority-majority districts must be maximized at all costs is no longer valid in 2011.

Finally, redistricting plans must not run afoul of the Equal Protection Clause of the 14th Amendment. The Clause does not require you to ignore race. Rather, as pointed out in *Shaw v. Reno* 1993, race is one of many demographic factors legislatures are aware of and can consider in drawing plans. However, if a plan is drawn so that race is the primary factor, to the exclusion of "traditional districting principles," the plan is subject to strict scrutiny. To this end, beware of bizarre shapes, draw districts that are reasonably compact, avoid making race your dominant motive and follow traditional districting principles. While not a factor in Greensboro's non-partisan system of elections, minority political groups will also seek remedies to gerrymandering via the Equal Protection Clause.

In Greensboro, two of the five districts have always been populated by a majority of African-Americans. No other racial groups comprise more than 4% of the population. Our Hispanic population represents only 7% of residents. In developing our current redistricting plan we insured that there would be no retrogression by maintaining two majority-minority districts and, while aware of race, we did not subordinate traditional districting principles to it.

Preparing the Population Data

All of our population data came from the March 3, 2011 release of the PL 94-171 file for North Carolina. Additionally, we also collected voter registration data for the City.

PL 94-171

This population data is released for each state on a county-by-county basis. It contains the unadjusted population counts from the enumeration on April 1, 2011. PL 94-171 data is compiled by the Bureau expressly for the purpose of redistricting. The data is available in a .zip compressed file format from the Census Bureau's FTP site. Once uncompressed, the data is divided across three files.

The first file is a comma delimited, ASCII text file. It contains two tables. Table 1 (designated "P1") contains total population counts by race. Table 2 (designated "P2") contains counts of population age 18 and over by race.

The second file is also a comma delimited, ASCII text file. It also contains two tables. Table 3 (designated "P3") contains counts of the total non-Hispanic population by race. Table 4 (designated "P4") contains counts of the total non-Hispanic population age 18 and over by race. Typically these two tables are referred to as containing Hispanic population counts. That's not exactly true since you must subtract these counts from their corresponding counts in Tables 1 and 2 if you want the actual Hispanic population totals.

Both of these files have one record for each geographic level of analysis tracked by the Bureau. For example, in Guilford County there are several thousand records with population counts at a block level, about a hundred records report the same information summarized at a tract level and one record summarized at the County level. In addition to the population counts, each record also contains a unique logical record number.

The third file is the geographic header file. This is a fixed length ASCII text file. The file contains information about each geographic entity tracked by the Bureau. For example, in Guilford County there are several thousand records at a block level, about a hundred records at a tract level and one record at the County level. This geographic hierarchy is defined in each record's summary level (SUMLEV) field. Each record also contains a unique logical record number.

The Census Bureau provides an MS-Access database with templates that significantly simplified importing the raw ACSII text files. In addition to the population and geographic header file, you will find an additional table of interest, named "Table," that includes a data dictionary of field names and descriptions for the two population files. If you use their templates, the result will be one table that contains both the P1 and P2 fields and a second table that contains the P3 and P4 fields.

At this point it was necessary to construct a new table that contained population data by race for the entire County at the block level. Block level data is contained in records where the SUMLEV field equals "150" and the records were joined on their LOGECNO field.

The PL94-171 data provides population data by race in great detail. However, for our purposes we extracted data at the single race level. Specifically this included:

Total Population (0001)
White alone (0003)
Black or African-American alone (0004)
American Indian (005)
Asian alone (0006)
Native Hawaiian and Other Pacific Islander alone (0007)

Some other Race alone (0008)
Two or more Races (0009)

This was done for all four population tables (P1 through P4).

Our final step was to join our new population table to the Geoheader table. Again, this was based on the LOGRECNO field present in both tables. This newly created table contained all of the population data plus the associated geographic header record containing block number and summary level field.

The above steps are well documented in a Census publication that can be retrieved from:

http://www.census.gov/rdo/pdf/0HowToUseMicrosoftAccessShells.pdf

This document explains the process and includes a tutorial that constructs a block level file similar to the one described above.

Voter Registration Data

In addition to the population data, we also collected voter registration data by race for each precinct. Not surprisingly, voter registration race categories did not mirror those of the Census. The categories that voters may voluntarily denote are:

White
Black
American Indian
Asian
Multiple Races
Other
Undesignated

Registration data is available only at the precinct (VTD) level and was not available for the exact same day as the Census enumeration. However, the registration data was available for April 14, 2010. Being only a few days after the enumeration, we felt that this date offered good compatibility.

In Greensboro, we found that voter registration figures by race tracked fairly closely with the overall population. As a result, few people paid much attention to this information. Also, as mentioned above, the non-partisan nature of our elections eliminated the need to track voter political party affiliation data.

Preparing the Geographic Data

As discussed above, we went into our redistricting efforts knowing that we would use voter precincts as our basic geographic building block. The geographic underpinning for redistricting is the Census Bureau TIGER file.

For those of you unfamiliar with the TIGER file, it is the underlying geography used by the US Census Bureau. It is available at various levels of geographic detail including census tracts, block groups, blocks, VTD and the like. There are both linear and a polygon versions of TIGER. Redistricting makes use of the polygon versions.

While Greensboro would ultimately draw its district boundaries to follow VTD boundaries, it was not sufficient to use only the VTD version of the TIGER file for three reasons: (a) there are areas along the edges of the City where the City does not encompass the entire VTD so block level population counts would be necessary and in some case

counts would be needed for only portions of a block; (b) The Department of Justice prefers to receive Section 5 submissions via a "block equivalency" file consisting of a block level identifier and its district assignment; and, (c) since the enumeration in April 2010 the City had undergone a series of annexations and de-annexations which further impacted the population counts and which needed to be evaluated on a block-by-block basis.

We secured our version of the TIGER from the Census Bureau website in an ESRI shapefile format. Our subsequent processing involved:

- Re-projection of the TIGER block shapefile to North Carolina State Plane, NAD 1983.
- Using our City limit polygon feature class, we extracted all blocks that intersected the City.
- Realizing that our City limit and the Bureau's TIGER feature classes would not be in perfect spatial alignment, we evaluated each block to determine if it or any portion therefore was legitimately within the City and discarded those that merely intersected or had a shared boundary.
- In cases where a block was bisected by the City limit boundary, the portion that was within the City was preserved as a new "block" feature along with the percentage of its original area that was within the City. The balance of the block that was outside of the City was discarded.

The result was a TIGER block level polygon feature classes that covered just the Greensboro City limits.

Of particular importance within the TIGER file is the GEOID10 field. This contains the index field needed for subsequent joins to population data.

For those of you who have used the TIGER file circa 2000 and before, you should notice a huge improvement in the 2010 file's spatial accuracy. Greensboro participated in a Census Bureau program to adopt local street centerlines as the foundation for TIGER. In our case this was time well spent. Unlike in 2000, we did not have to spatially correct the TIGER file in order to use it in conjunction with our local datasets.

Final Feature Class Preparation

Two feature classes were constructed in these final steps.

The first feature class was created by joining the block level PL94-171 population data to the block level TIGER feature class. The result was a Census block level polygon feature class with population data for the entire City. In situations where only a portion of the block was within the City, our population calculation was based on the percent of the block's area that was within the City.

The second feature class was created by dissolving the block feature class on the block's VTD designation. This dissolve aggregated multiple blocks into a single VTD polygon. The dissolve also calculated a total population count for each field. Next we joined the voter registration data to the VTD feature class. The result was a precinct level (VTD) polygon feature class with population and voter registration data for the entire City.

Application Development

One of the exciting aspects of redistricting today is the extensive array of GIS tools now available. Our first redistricting efforts in the early 1990's used personal computer technology to do some crude mapping and analysis of population data. We didn't realize it at the time but we were using a primitive GIS solution. By 2000 the technology had advanced to where we used ESRI's MapObjects and Visual Basic 6 to develop a true GIS based redistricting application. Today's technology represents significant improvements over what we had in 2000.

Going into the 2011 redistricting project we knew that a new decision support tool would be necessary. The MapObjects based application that we developed in 2000 and used as recently as 2008 utilized technology that was no longer supported and greater functionality would be needed in 2011.

Additionally, a change had occurred in who would be "hands on" in drawing new 2011 district boundaries. Until 2008, redistricting was primarily a staff driven function. It was common for staff to identify a population imbalance (due to annexation, etc.), develop one or two redistricting plans that would rebalance population in the least undisruptive manner possible and Council would simply adopt the change.

However, when a large annexation prompted redistricting in 2008, we found that both elected officials, the local news media and political consultants requested copies of the application so that they could construct their own plans. This was a departure from the previous pattern where the application was used only by staff.

The goal of our application was to provide a "what-if" tool. With such an application users could:

> By interacting with the map, allow the user to assign precincts to districts and see the action's impact on population balance and retrogression;
>
> Perform a series of validation tests to evaluate the plan's adherence to traditional districting principles such as contiguity, maintaining constituent relationships, preservation of existing district cores and preservation of communities of interest (a new feature for the 2011 version);
>
> Generate a series of reports that illustrated the plan and detailed the plan's characteristics; including how the proposed plan varied from the current district boundaries (enhanced for 2011);
>
> Create and save ESRI personal geodatabase feature classes of the plan so that a user could later, modify, share and evaluate multiple plans; and,
>
> Lastly, since we anticipated that the application would be used by the public, it necessitated that the software contain more error checking, improved ease of use and that it could be legally redistributable (all new features for the 2011 version)

We faced several decisions:

1. Would the application be web-based or desktop based?
2. If web-based, would we host the application or utilize a third party – essentially adopt the "Software as a Service" model
3. Would we develop the application in-house or purchase commercial off-the-shelf software?

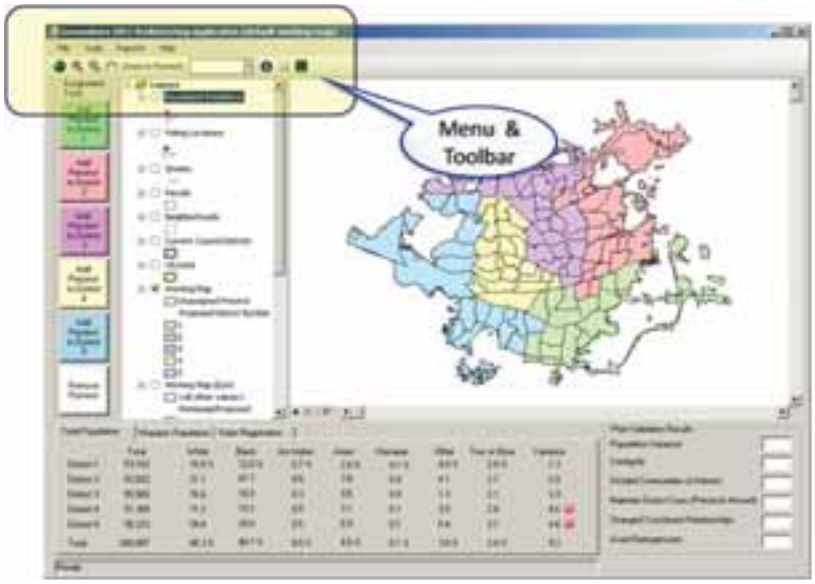
Having evaluated various alternatives we elected to move forward with a desktop based solution. While a number of factors came into play in reaching that decision the most important were: (a) our in-house capability to build, using state-of-the-art technology, an application that reflected the functionality found in our MapObjects based

solution; (b) the likely number of users did not require a web-based deployment; and, (c) there would be no out-of-pocket costs for software or licensing.

The application was developed using a combination of VB.NET, the ESRI ArcReader control and the iTextSharp pdf writer libraries. In the case of VB.NET we elected to use the VB.NET 2008 Express Edition which is a free download. The ArcReader control is also freely distributable as is the open source iTextSharp pdf libraries. The result was a freely distributable application which we bundled with a collection of ESRI personal geodatabase feature classes. The only expense was the ArcPublisher license needed to create the ArcReader project files and this software was among the ESRI products already in use by the City.

Preparing and distributing an application and data offered several advantages over having each interested party acquire different software packages or attempt to draw plans by hand. For example, by using our application everyone developing district plans was using the same data; they were following the same business rules; they were creating plans that could be shared; and, plans could be easily vetted by City staff.

The application was divided into four functional areas. The first of these included the *menus and toolbars*. The toolbar included:



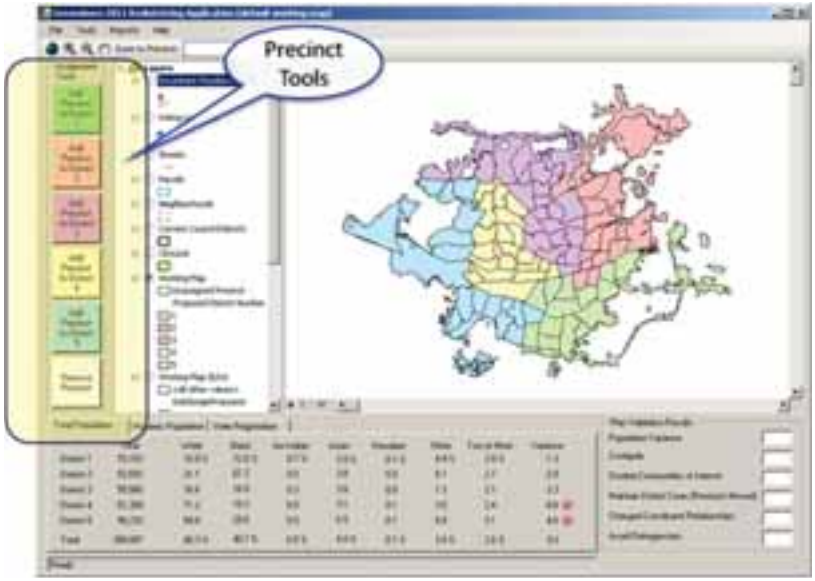
The usual navigation tools of zoom, pan and the like;

Bookmarks for each precinct so that users could quickly zoom to a particular precinct;

The ESRI Identify tool reported precinct statistics; and,

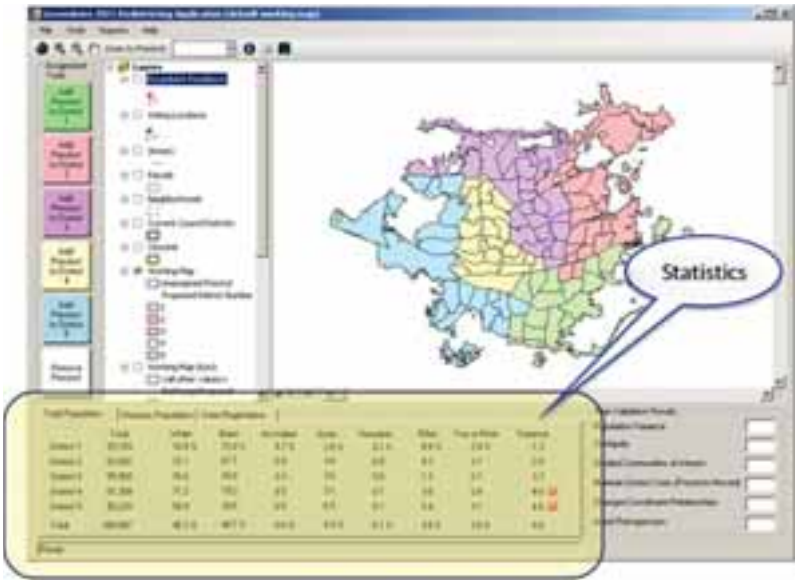
The ESRI Find tool, when bundled with a geocoding locator allowed users to find addresses.

The menus allowed a user to save and retrieve plans. Also include under the "Tools" menu pick was the ability to run a validation routine on a plan to assess contiguity, population variance, divided communities of interest and the like. To a limited degree it allowed users to automatically assign precincts to districts by enforcing contiguity rules.



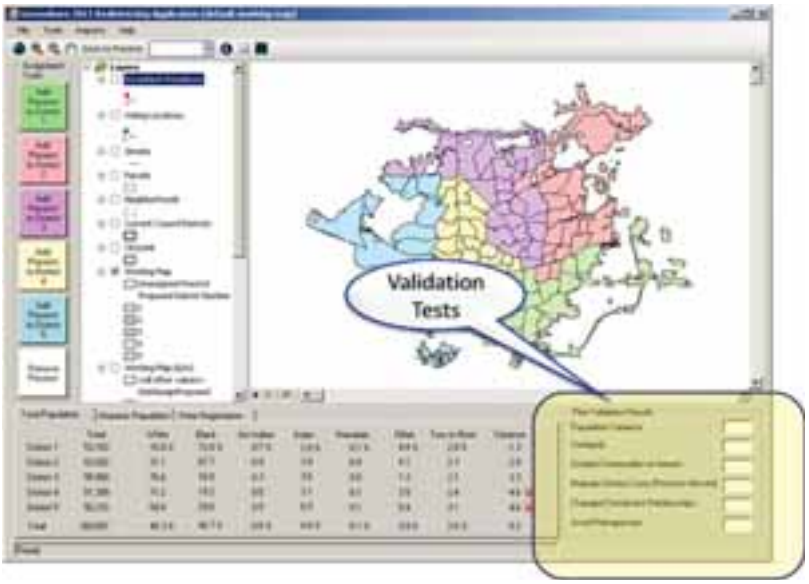
The user utilized a series of *precinct tools* on the left hand of the form to make particular district active and to add/remove precincts to that district. This was accomplished via capturing the X/Y coordinates of the feature being

selected and updating the underlying feature record via the VB.NET connection to the MS-Access database.



Changes to precinct assignments updated the map as well as the *statistics table*. Tabs on the statistics control allowed the user to see the relevant population numbers for the total population, the Hispanic population and voter registration. One problem we encountered with the ArcReader control was a several second delay before an update to the MS-Access database was reflected in a refresh of the map. Our only work around for this problem was to suspend the VB.NET until the map could catch up.

Lastly, the results of a user initiated test returned *validation results* which provided feedback on several redistricting criteria. These included:



A population variance of less than 10%

A test to insure contiguity

A count of community of interest (neighborhood) splits

The maintenance of district cores (count of precincts moved to a new district)

An alert if an incumbent's residence had been placed in a different district; and,

An alert if a majority-minority district fell below 50% non-white. While not a true test of retrogression, it served to warn the user if something had dramatically changed.

We anticipated the need for a number of reports. For example, one page summary of the population statistics and a map, a multi-page listing of precinct moves, a report that showed the validation results and the like. However, we found that we needed more reports that compared the current plan to the proposed plan in various ways, especially as it related to neighborhoods moved to new districts and neighborhoods that were divided between districts.

The application presents the user with a map containing 11 different layers. These include:

Incumbent residence
Voting locations

Streets
Parcels
Neighborhoods
Current council district boundaries (2008)
City limit
Boundaries currently being modeled (both color and black/white)
Population race by precinct
Hispanic population by precinct

Both color and black/white versions of the plan currently being modeled were included to allow for printing both color and black/white copies of the district plan map.

The application lacked functionality in three areas. First, our calculation of compactness, which used a perimeter measurement, could not be done within the application since the ArcReader control would does not support a dissolve method. Second, while several reports were available within the application, the final cartographic output presented to City Council was done via ArcMap. Lastly, preparation of statistical tables (especially those to be used for presentation of data in the ArcMap layouts) was done via Excel working from data contained in the various feature classes.

Application development began in early-2010 and was aided in the fact that the data structures used in 2000 were largely reused by the Census Bureau for 2011. We demonstrated a prototype of the application at the 2010 ESRI conference and came away with some excellent suggestions.

With the base map, population data and application in place the project staff turned their attention to the question of whether or not the 2010 census would necessitate redistricting.

Calculating the Impact of the 2010 Census

Our very first plan modeled in the application was the re-creation of the current district configuration using the 2010 population counts. Doing so determined that population changes were not sufficiently large as to require redistricting. As shown in Table 1, the population variance was 9.2% and just within the 10% maximum allowable range.

Table 1. Census 2010 Population by District

District	Total	White	Black	Am Indian	Asian	Pacific Isle	Other	Multiple	Variance
1	53,103	8,924	38,224	383	1,498	36	2,537	1,501	-3.6%
2	52,692	11,101	35,692	277	2,009	17	2,178	1,418	-2.0
3	55,560	42,576	8,891	182	1,983	22	719	1,187	+3.3
4	51,309	36,531	9,872	250	1,609	32	1,779	1,236	-4.6
5	56,233	30,820	16,637	284	3,661	50	3,064	1,717	+4.6
	268,897	129,952	109,316	1,376	10,760	157	10,277	7,059	9.2%

					Percent			
District	Total	White	Black	Am Indian	Asian	Pacific Isle	Other	Multiple
1	53,103	16.8%	72.0%	0.7%	2.8%	0.1%	4.8%	2.8%
2	52,692	21.1%	67.7%	0.5%	3.8%	0.0%	4.1%	2.7%
3	55,560	76.6%	16.0%	0.3%	3.6%	0.0%	1.3%	2.1%

4	51,309	71.2%	19.2%	0.5%	3.1%	0.1%	3.5%	2.4%
5	56,233	54.8%	29.6%	0.5%	6.5%	0.1%	5.4%	3.1%
	268,897	48.3%	40.7%	0.5%	4.0%	0.1%	3.8%	2.6%

Within a few days of receiving the PL 94-171 data, we also provided each Councilperson with a copy of the redistricting software and data. Subsequently the software and data was also provided to the local news media.

Although there was no legal requirement to redraw district boundaries due to population imbalances, Council embarked on a series of meetings with citizens to review the results and solicit input on the need to redistrict.

Development of New District Boundaries

By early April staff began to get questions surrounding legal aspects of redistricting, especially as it related to contiguity. In the days prior to the April 19th Council meeting, two plans were put forth by Council members. One was drawn by a Councilperson and vetted by staff. A second plan was drawn by staff based on criteria provided by a second Councilperson. That evening the first plan was adopted by Council.

Almost immediately, there was interest in adopting yet a different plan. To that end, staff developed additional plans based on criteria proposed by various members of Council as well a vetting additional plans developed by Council members. At the next Council meeting on May 3rd a different redistricting plan was approved by Council and it was this plan that the City submitted to the DOJ.

Department of Justice Section 5 Preclearance

The submission to the Department of Justice consisted of information provided by our legal staff surrounding the local ordinances and the like. These requirements are thoroughly described in publications from the DOJ.

Obviously a major aspect of the submission surrounded the details of the plan itself. As noted earlier, the DOJ requires that jurisdictions submit their redistricting plans via a "block equivalency file." This is a comma delimited ACSII text file that contains one record per Census block. The record must contain the Census GEOID10 field and the district number assignment. One equivalency file was provided for the current districts and a second equivalency file was submitted for the proposed district boundaries. The DOJ uses these files to retrieve and analyze the PL 94-171 data.

Additional supplemental data was also required. This included:

- Tables comparing the 2011 population data, by race and Hispanic origin, for the proposed plan and current (benchmark) plan;
- Tables comparing voting registration data for the proposed and current plans;
- A description of the methodology employed where population estimates were necessary (blocks split by the City limits and the like);
- Shapefiles for both the current and the proposed district boundaries;
- Printed maps which illustrated the percent of non-white population by VTD; and,
- Printed maps which illustrated the percent of Hispanic population by VTD.

Pre-clearance was secured from the DOJ on June 9th, roughly three months following the release of the PL 94-171 data.

Summary

Things We Did Right

- We determined the legal environment within which we would be working. The data used and the application's functionality were both driven by the legal requirements of redistricting. There is a strong urge to just jump in and start drawing maps – avoid that urge.
- We identified case law and legislation that further defines the legal peculiarities of redistricting in North Carolina. For example, not every state permits point continuity and some states define the 10% population variance calculation more strictly than found nationally.
- By developing the ArcObjects/ArcReader based application in-house we controlled the look and feel of the application and could tailor it to our local requirements. We believe that this made development of alternative plans much easier than possible with off-the-shelf applications that tend to be richer in features but maybe a bit overly complicated.
- By using a combination of freely distributable software components (ArcReader and iTextSharp) there were no licensing costs.
- By freely distributing software and data to develop redistricting plans we insured that everyone was using the same data and business rules. It also made our post-processing and cartographic products easier.
- Redistricting was a team effort. While the GIS staff did most of the hands-on work of the project, the City legal and planning staffs were involved in each step.
- We created ahead of time a non-judgmental naming convention for our plans. We named each plan sequentially with a letter of the alphabet (i.e., "plan-A", "plan-B", etc.). If the plan were subsequently modified, we would affix a number (example: "plan-A1"). Being able to track a plan's lineage proved helpful as the number of plans multiplied.
- We made friends with our Legal staff and our local Board of Elections staff.

Things We (or You Might) Want To Do Differently

- Unless you need the TIGER file at a block level, maybe for some other purpose (such as irregularly shaped jurisdiction boundaries or in meet DOJ review requirements), consider working with the TIGER and PL 94-171 data at the precinct (VTD) level.
- Little attention was paid to voter registration information. You might not need this information if voter demographics mirror the population as a whole (remember that DOJ pre-clearance will require this information)
- Don't spend time developing an application that can model different numbers of districts unless you think someone will want to do that.
- Don't waste time adding error routines and otherwise making your application "idiot-proof" if you are going to be the only user. Conversely, if the application will be used by the public, you can't create enough error checking and validation tests.

- Have the post-processing steps for statistical table and cartographic production well documented. It is very important that you follow the same post processing steps for each plan.

- Avoid scope creep. We found that when developing an application for you own use it's tempting to continue to add functionality which is very interesting, but that you really don't require. Worse still, we found ourselves tinkering with the application code, to add functionality that sounded like it would be nice to have, even while we were drafting plans.

- We should have created additional reports that compared a proposed plan to the current plan, especially impacts on neighborhoods.

- Lastly, have someone not too familiar with the plans double check your work.

Sources for Additional Information:

Some good sources on the legal aspects or redistricting include:

- National Conference of State Legislatures (www.ncsl.org). Of particular interest is their publication "Redistricting Law 2010" which does an excellent job of summarizing the case law on this topic.
- "How To Draw Redistricting Plans That Will Stand Up in Court" by Peter Wattson, Senate Counsel, State of Minnesota (http://www.ncsl.org/documents/legismgt/How_To_Draw_Maps.pdf)
- Brennan Center for Justice (www.brennancenter.org) "A Citizen's Guide to Redistricting" by Justin Levitt provides a good layman's overview.

Data Sources include:

- The Census Bureau's PL 94-171 FTP site (http://www.census.gov/rdo/data/2010_census_redistricting_data_pl_94-171_summary_files.html)
- The Census Bureau's TIGER shapefiles (http://www.census.gov/geo/www/tiger/tgrshp2010/release_schedule.html)
- Census Bureau's MS-Access template database and technical tips (http://www.census.gov/rdo/pdf/0HowToUseMicrosoftAccessShells.pdf) (http://www.census.gov/rdo/tech_tips/)

Department of Justice Section 5 Preclearance requirements

- Guidance Concerning Redistricting Under Section 5 of the Voting Rights Act (http://www.justice.gov/crt/about/vot/sec_5/sec5guidance2011.pdf)
- Revision of Voting Rights Procedures (DOJ) (http://www.justice.gov/crt/about/vot/sec_5/sec5proc_2011.pdf)
- Section 5 Resource Guide (http://www.justice.gov/crt/about/vot/sec_5/guidelines.php)