Finding New Landfill Sites for Tarrent County, Texas Using GIS and Spatial Analysis

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I. Introduction:

Trash and were to put it has been a major concern for centuries. We as Americans produce about four pounds of trash each per day or 600,000 tons per day or 210 million tons per year (Freudenrich). As our population grows and expands our waste also increases, but where do we put all this waste? Land is a precious commodity and no one wants a landfill near their neighborhood. The good news is that of the 210 million tons of trash generated in the United States about 56 million tons is either recycled or composted. Hopefully this trend will continue so we can have less waste in our landfills.

The purpose of this idea is to find a new suitable landfill for Tarrent County Texas. There are many variables to consider, however this project is just a starting phase of finding some new suitable landfill sites. I plan to look at only certain variables to determine a first round of possible sites for Tarrent County. They are the soil type, which in this case is clay, and location based on the vicinity of the local airports, parks, lakes, wells, and other landfills. With these criteria in mind we will be able to find a place that can apply to all. This is only a starting point we also need to consider that later more restrictions of cost, who owns the land, and if there is enough land in that area to actually build a landfill can be applied. A site can take up to 230 acres (Freudenrich) and other variables may effect the new site location as well. Each state and or county will have its own regulations when it comes to landfills. After the basic safety factors the rest of them basically apply to where people do or do not want a landfill located.

II. Literature Review:

Landfills are not the most common thing to have knowledge about. A Landfill, according to Freudenrich, is considered to be a carefully designed structure built into or on top of the ground in which trash is isolated from the surrounding environment. Many people don't understand the importance of how a landfill is build and where it is built except for the fact that they don't want it anywhere near them. A landfill is made up of four basic elements, the bottom liner, a leachate collection system a cover and a natural hydrological setting.

The natural hydrological setting has to do with the geology of the ground, you want the rocks to be as tight or waterproof as possible but at the same time it needs to be easy to dig in to build the landfill and in case leaking does occur (Environmental Research Foundation).

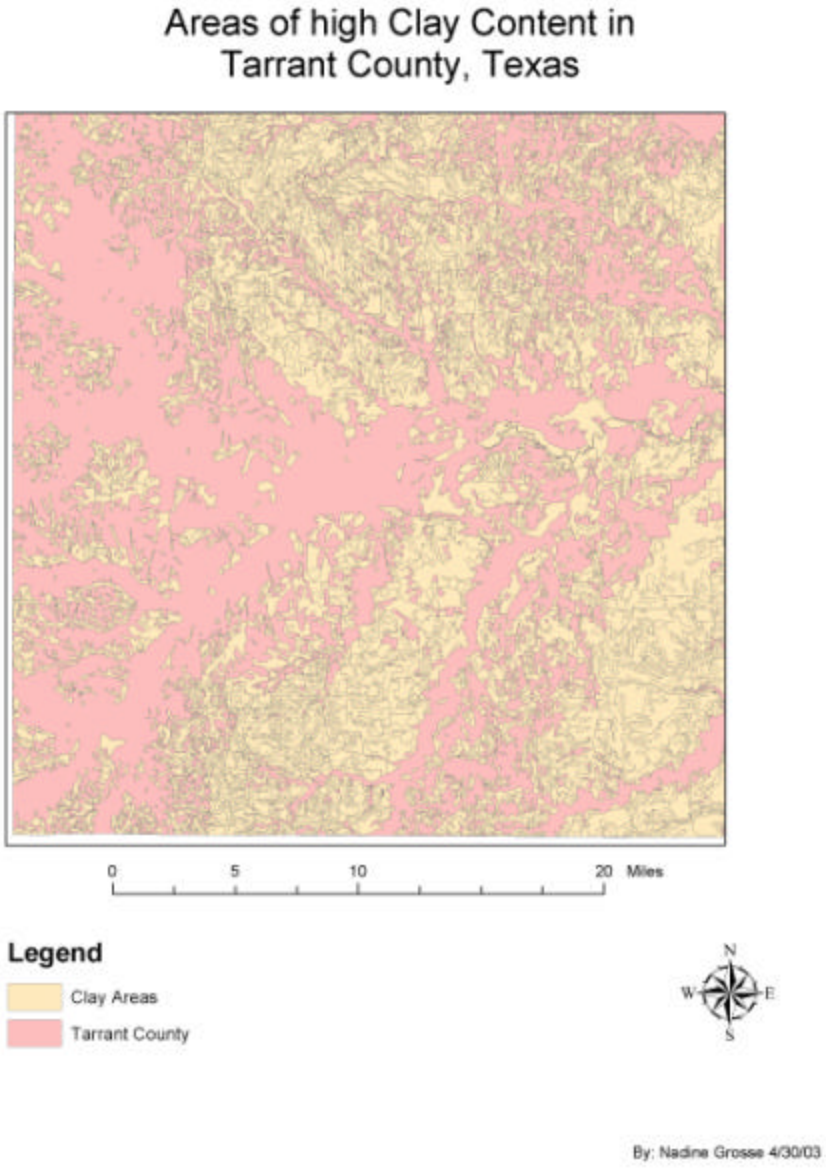
The bottom liner is either one or more layers of clay or synthetic plastics or the combination of the two. State of the art plastic liners are 1/10 of an inch thick. The liner in a sense creates a bathtub in the ground (Environmental Research Foundation). Not all liners work effectively and when water is contaminated by waste it is called leachate water.

A leachate collection system is set up of pipes at the bottom of the liner to capture contaminated water. If this system fails by the pipes clogging up and the leachate is left in the landfill, pressure is created. This is the main cause of leachate coming out the bottom liner and causing them to fail. To help prevent leachate formation a cover is placed over the landfill. This helps prevent rainwater from entering the landfill. It consists of sloped layers of clay, then a layer of sandy soil, overlain by topsoil so vegetation may grow and form roots. It is very important that this cover is maintained, If it is not rain will enter the landfill or bathtub to the point where it overflows its edges and the waste will enter the natural environment (Environmental Research Foundation).

III Methodology and Results:

I plan to look at Tarrent County Texas. One of the major metropolitan areas for the Dallas/Fort Worth Metroplex. Tarrant county has a growth rate of about 3.07%. With its population growing from 860,880 in 1980 to 1,507,500 in 2002. My plan is to look at the county and find some suitable landfill sites based on soil types, and location of the local airports, parks, lakes, wells and landfills.

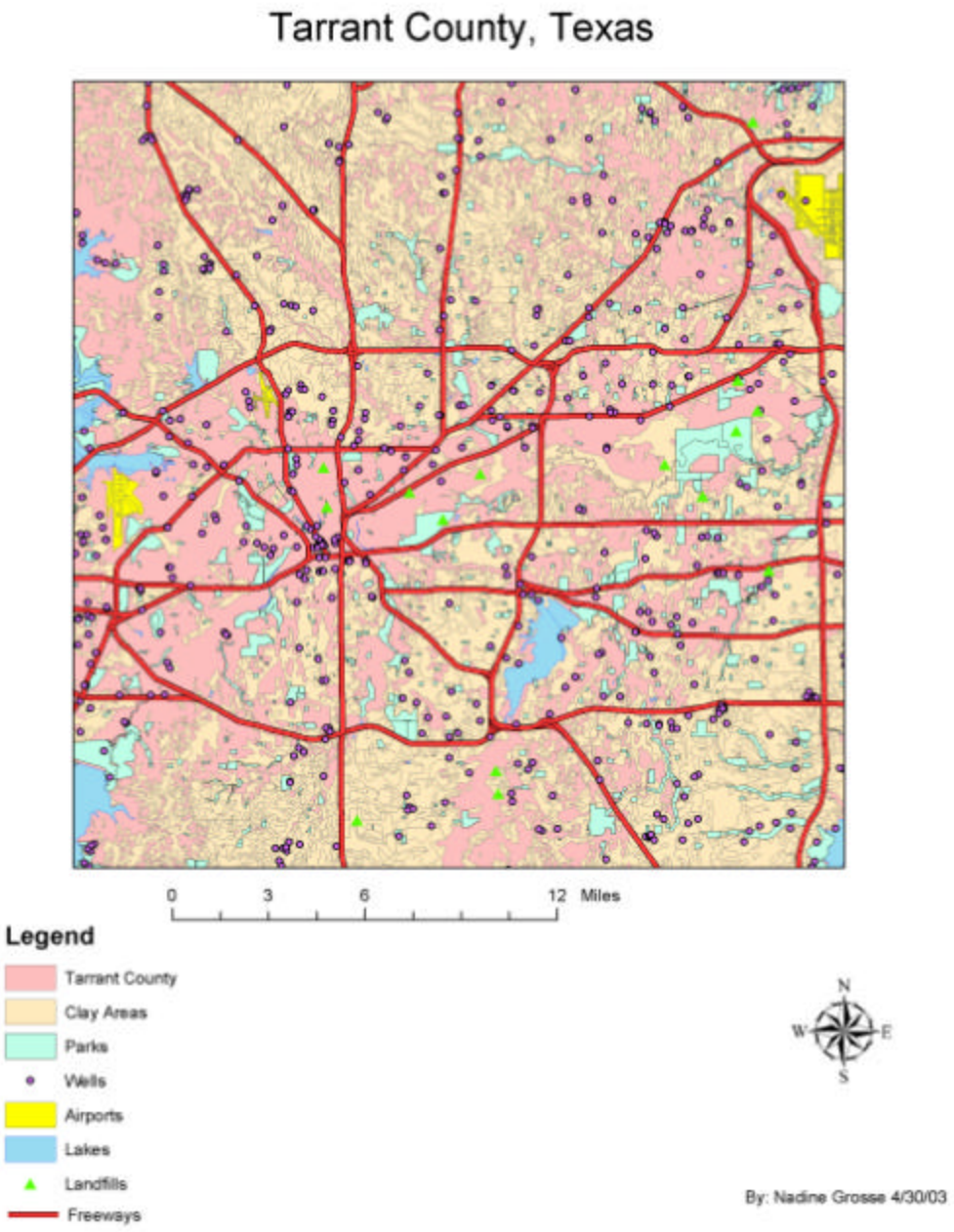
The data that I used came from two main sources. The soils information was from the SURRGO (Soil Survey Geographic Database) site. They have a vast amount of information about the soils in any county that you may be looking for. I took this information and selected only the soils that were fully clay from the database that was provided with this data. Once all the clay soils were selected I created a shapefile showing only the areas in Tarrant County with this soil type that I desired, clay. This was the most difficult part of the project just because the data that you receive is very complex. Unless you understand enough about it you really have no idea what you are dealing with. Thankfully I had some help in being able to determine how my data is understood (See Map 1).



Map 1- showing areas of clay content in Tarrant County, Texas

The rest of my data came from NCTCOG (North Central Texas Council of Governments) from the GIS clearing house section. They have a great amount of data available for download by county or by category. All my data from NCTCOG was already projected. All I had to do for them was to define the projection. I defined it to NAD 83 (North American Datum 1983). Once all my shapefiles were correctly projected and defined I placed them into MapInfo. Before I

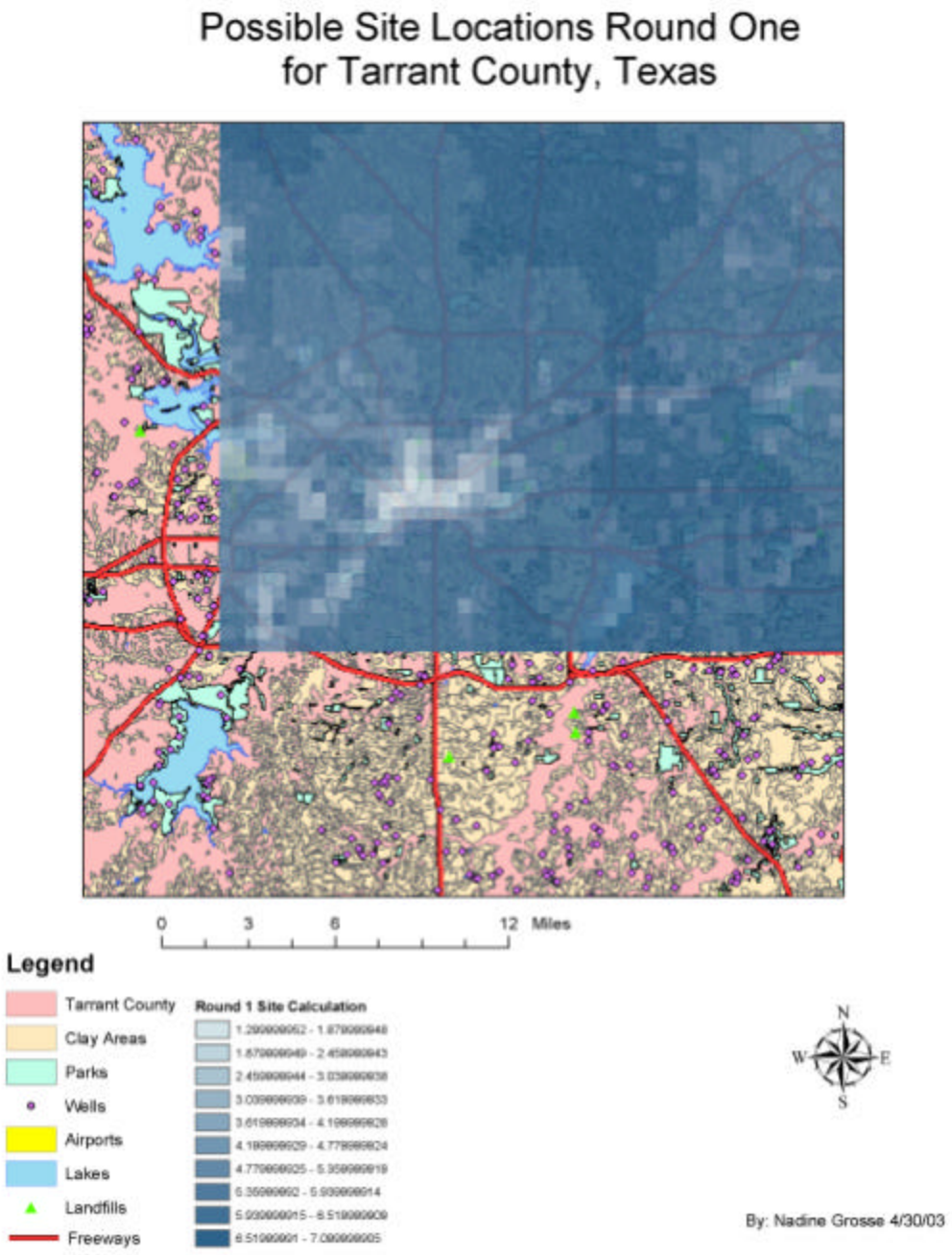
could go any further I had to clip some my information to just Tarrant County. The data that I received covered the Tarrant, Dallas and Denton areas. Once I clipped my data I was ready to continue my search for a site that matched the criteria that I was looking for (see map 2).



Map 2 – Tarrant County Data Collected to begin analysis

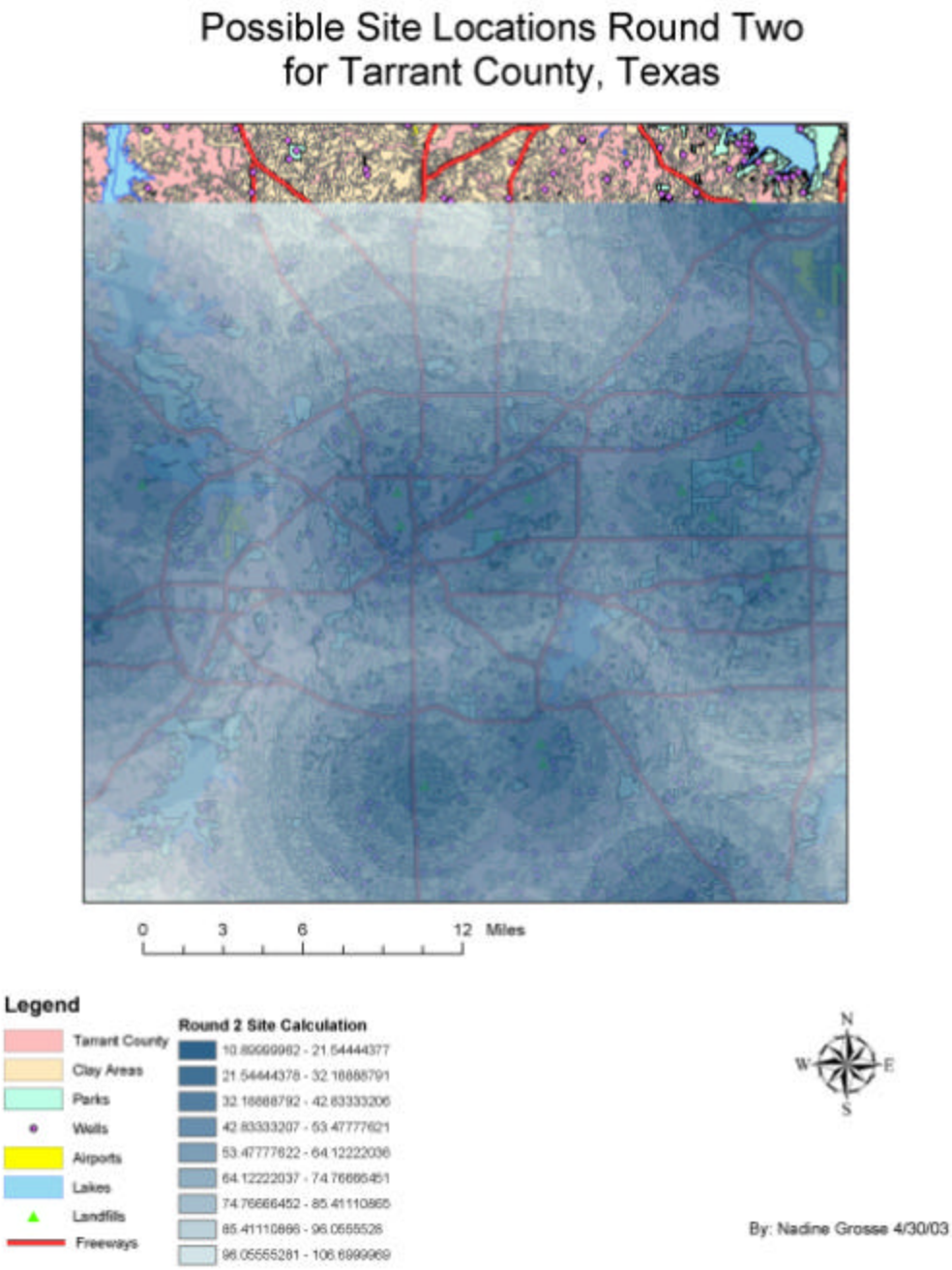
To start I opened up my spatial analyst tool bar and began to do straight line distances for my data sets. I left everything to the default setting and ended up with straight line distances for all my data sets. Once that was done I had to go through and reclassify the straight line distances that I just created. My classification method was equal intervals with 10 classes each. I then had to look at the values and make sure that the locations with higher values were more suitable then those with lower values. The only one I had to actually change away from the default was the clay data. Of course for this one the area needed to be in a clay area and not really anyplace else. For the other however the further away the possible the better.

Now that I had all of my reclassifications I could use the raster calculator to determine some possible sites for a new landfill. I assigned each of my data sets a percentage value according to how important they were in the final scheme of things. I assigned clay a rating of 50%, airport 15%, Lakes 15%, parks 5%. Wells 10% and old landfills 5%. At this point I ran into a slight problem. The data with my airports in it did not cover the entire county. Only the northeastern part had airports in it so the rest of the county had no data. When I did my raster calculation only that section of the entire county was calculated out (see map3).



Map3 – Round one analysis of data, showing problems with the airport data.

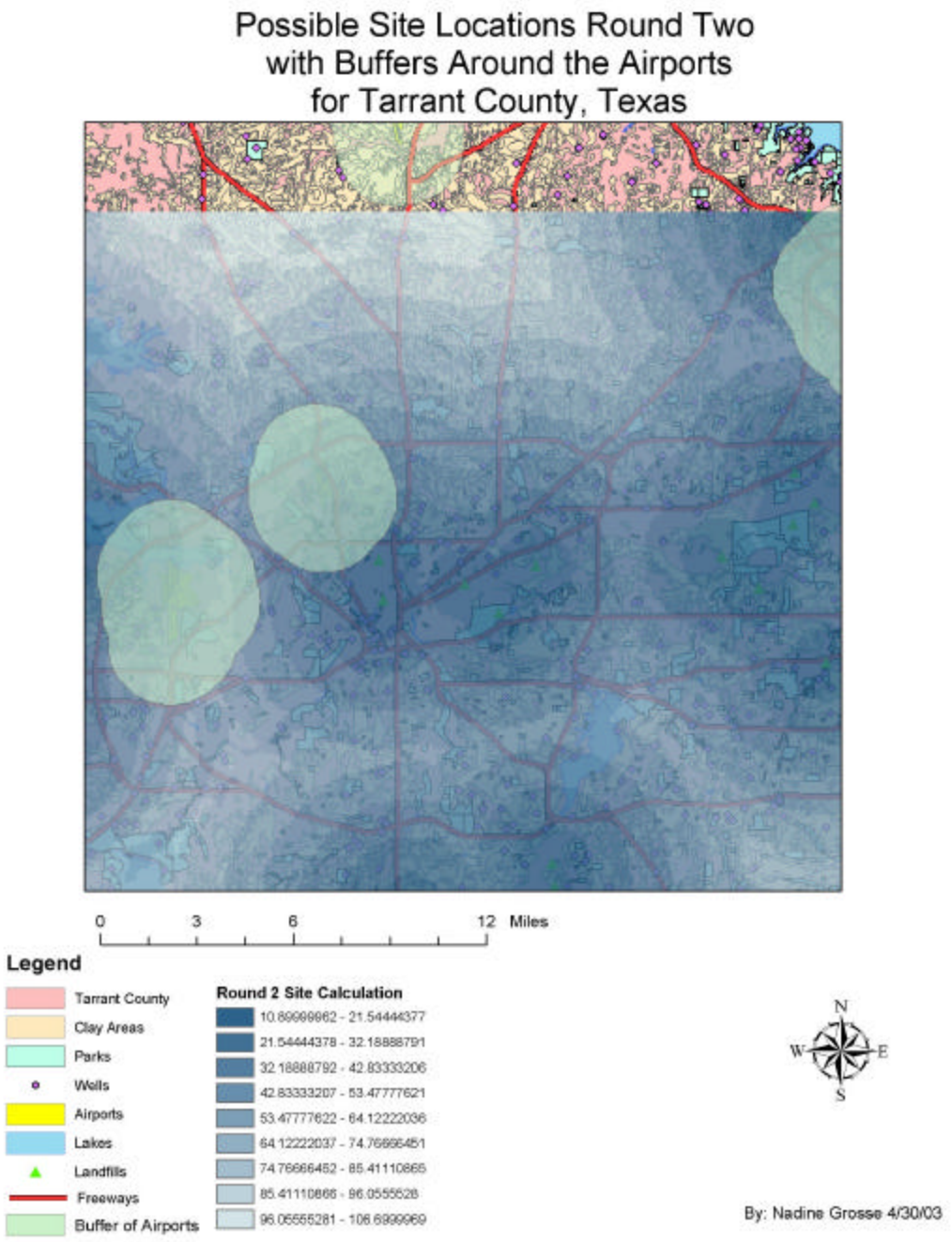
I then decided to just take airports out of the equation and see what my map looks like (see map 4). For my second round of calculations I divided the percentages as follows: clay 40%, Lakes 20%, Parks 10%, Wells 20% and old landfills 10%



Map4- Round two analysis with out airports.

This was a much better result. Apparently I am sill missing certain data since the top portion of Tarrant County was not calculated. However this was better then the first calculation.

To add the airports back in I created a buffer around them of 10,000 feet,



Map 5 – Final map showing desired areas and buffers around the airports.

according to EPA regulations. To show the area that you could not build in just in case a suitable site was found around the airport (see Map5). The results show the areas that are lighter in color are the ones that are more desirable for a landfill location.

IV. Scientific Merits:

The reason for this project is that we have to keep in mind that landfills do fill up and run out of space. Eventually a new one will have to be located. Knowing ahead of time the areas that could be potential sites would be very beneficial.

V. Time Schedule:

For this particular project the time schedule will be relatively short. I am planning on just looking at a few major facts to get an idea of where to locate the next landfill. I am not looking at cost of travel for the dumb trucks or to whom the land actually belongs too. To actually site a landfill with all the factors and requests that would be made by the local government it would take a bit more time.

VI. References:

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