To: Dr. David Maidment, GIS in Water Resources
From: Tom Hilde
Date: 29 September, 2011
RE: Term Project Proposal

I. Objective

My goal is to measure the impact of development on the quality and/or availability of water in Austin. More specifically, how does non-point pollution and impermeable surfaces associated with development change the quality and/or availability of surface water and/or groundwater? Ideally, I would like to confront the issue of drought conditions and present a solution for adapting our development to mitigate impacts on groundwater availability. However, the availability problem may have more to do with how much is being pumped out of the ground by users rather than development impacts.

II. Plan to Execute

The City of Austin's Environmental Integrity Index offers a valuable data source for monitoring municipal watersheds in the urban, peripheral urban, and suburban context. Data associated with these reports include percentage of impermeable cover in each watershed, presence of baseflow or stormflow conditions at each monitoring site, and water quality scores at each monitoring site. Monitoring takes place every three years, and most sites have had several phases of monitoring. This allows for the identification of trends.

It seems like a good idea to study the program's findings over the years and identify locations or watersheds that have seen a decrease in baseflow and/or water quality conditions. Supplemental data sources may be available with more frequent observations for watersheds of interest. Precipitation data could be compared to flow conditions over time to see if infiltration rates or runoff levels have seen significant change. It would be interesting to compare urban versus suburban watersheds in terms of overall environmental integrity and changes in these values over time, especially suburban watersheds in the process of annexation or development. After identifying interest areas, land use and development patterns could be analyzed to investigate whether there is a correlation with water quality/quantity.

The City of Austin has 2008 land use GIS data available as well as a Jurisdiction History GIS layer. I am currently under the impression that impermeable surface percentages have previously been estimated for land use type, which would allow me to do a spatial analysis of current impermeable surface percentages in certain watersheds. Land use data is available for previous years, which would allow calculations of change over time. The Jurisdiction History feature class is interesting because it documents Austin's annexation history including the date of annexation per event, which could help identify suburban or fringe watersheds that have seen recent development.

As a planning student, a larger question I have is how development can mitigate impacts on water quality/availability. It would be fun to model a few scenarios that could reduce impervious coverage in certain areas and see how this would impact infiltration levels. For example, I've been involved with an alley greening pilot project; what if the City were to replace the impermeable alleys in an urban area with permeable paving? What impacts would this have on infiltration and water quality?

III. Data Sources

City of Austin GIS: Land Use, Annexation History, Impermeable Surface % by Land Use(?), Street and sidewalk network
USGS: Watershed & Subwatershed boundaries
NHDPlus (if needed for analysis): Slope, elevation, mean annual flow, drainage area
National Elevation Dataset: DEM
National Land Cover Dataset: Would this help identify urban cover?
National Water Information System: Groundwater levels
Water.weather.gov/ahps: Precipitation

IV. Challenges/Questions Moving Forward

Because I haven't done much work in water resources to date, I am very excited to explore and learn in this area. However, please forgive me if anything I have mentioned in this proposal is off the mark in terms of feasibility.

I realize this proposal is broad in scope. A good portion of these ideas I've thought of for my upcoming professional report. If it would be helpful in terms of feasibility, I would narrow down both what element of water I analyze (quality, flow, etc.), and the study area of analysis (maybe the most interesting watershed in Austin, or a site elsewhere that has gone through notable recent development). I would appreciate any knowledge or advice you can lend on this matter.

I should also note that I am in a GIS for Planners course as well, with a term project component. If the scope described here seems too broad, this may be an opportunity for me to sync both projects to increase feasibility. For example, I could complete the land use and impermeable cover analysis for that project while doing the water analysis for this project.

Because of the urban nature of the environment I want to focus on, I am not sure how this will impact water analysis. Is it feasible to estimate the quality of infiltration and flow in an urban environment?

V. Alternative Option

In the event that this plan is not feasible to execute, I have an alternative topic I'd like to study. Water levels of Minnesota lakes have risen a substantial amount over the past 20 years, to the point where beaches have disappeared and property is at risk. These lakes are the site of arguably irresponsible development, due to the statewide passion of spending the weekend at the cabin on one of Minnesota's 10,000 lakes. It may be interesting to study this progression and analyze why this is happening? If you think this topic would be more interesting or feasible, I can write up another proposal.