

Creating a Wireless City

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Introduction

In 2006, Austin hosted the World Congress on Information Technology, which prompted the development of a citywide wireless infrastructure, the wireless mesh, built throughout downtown Austin to provide free wireless internet access. At the time, the network covered an area from Town Lake on the south to 7th Street on the north, and from Lamar Boulevard on the west to I-35 on the east. The goal was to expand the network into East Austin and Zilker Park, but seven years later, the wireless mesh no longer exists (Seldon, 2006). The question is, why? Although central Austin is filled with restaurants, bars, libraries, and other businesses that provide free Wi-Fi access to patrons, there continues to be areas where Wi-Fi is nonexistent, especially in pockets where it would be greatly beneficial to the community (such as bus stops and parks). In addition, these Wi-Fi hotspots often require customers to purchase products at the business in order to access their network. North of Austin, the City of Pflugerville sees the community value in Wi-Fi connectivity with plans to provide Wi-Fi in five city parks. The investment of at least \$40,000 is considered a worthy endeavor for the city (Pantazes, n.d.). City spokesperson Terri Waggoner states, "We're investing in connectivity for the city and at the same time it's going to provide a service for our employees to be able to use the Wi-Fi system and we're just offering that out to our residents" (Pantazes, n.d., para. 4).

As the adoption rate increases for smart phones and mobile devices provided by commercial services, some believe public hotspot Wi-Fi services are no longer needed. However, if you have ever tried using your cell phone as a hotspot or browsed for a long period of time on your phone, you know that the speed and usability are nowhere on par with having your device connected to high speed Wi-Fi. Fortunately, many cities continue to promote public Wi-Fi. Wikipedia's page on municipal wireless network (defined as "the concept of turning an entire city into a Wireless Access Zone, with the ultimate goal of making wireless access to the Internet a universal service") lists 56 cities that are offering this wireless access. Austin is a high-tech city with a variety of residents, cultures, businesses, technology, and creativity ("Wireless Access Zone"). For a city that is often seen as cutting edge, it is alarming that the city has not become a fully wired city.

Problem Statement

Current Wi-Fi hotspots in Austin are present at a variety of business locations. In addition, Time Warner Cable has begun putting Wi-Fi hotspots outdoors which customers can use for free, or others can use for a small fee. There are, however, geographic gaps where public Wi-Fi hotspots are missing, or

in other words, where access is limited. The question then is, if the City of Austin or another entity determined they wanted to add hotspots in Central Austin, where should they be placed to ensure public access to wireless Internet is more universal?

Data

The data used for this research comes from the City of Austin's GIS datasets, the Census Bureau, Capital Metro, and various additional references to gather existing hotspot locations. City data, Census Bureau data, and Capital Metro data should be considered extremely accurate. The data offers the background needed to determine where there are no existing hotspots. By concentrating on the current Austin downtown area, where businesses are located and where citizens might congregate and want to connect, I should be able to find the most beneficial spots to put additional hotspots. The data on existing hotspots is vital to this project. This data was populated by researching lists of Wi-Fi hotspots in Austin as well as looking at Time Warner Cable and AT&T's Wi-Fi hotspot map. This data is fairly accurate, but because many of the lists found were created by citizens with no date listed, some of the hotspots may no longer be available and new ones may now exist. In general though, this data will provide adequate information to make an informed determination on ideal locations for future Wi-Fi hotspots. Because this data was populated with addresses, it had to be turned into a dataset using geocoding to specify points based on longitude and latitude according to the physical addresses.

Datasets used with corresponding maps to the right of each description:

- Edges (United States Census Bureau Geography)
 - Line shape file
 - Data retrieved from Census Bureau datasets
 - This data shows streets within the City of Austin and was used for geocoding current Wi-Fi hotspots and as the basis for the map



Figure 1

- City of Austin Parks (City of Austin GIS Data Sets)
 - Polygon shape file
 - Data retrieved from City of Austin datasets
 - This GIS feature class includes PARD Parkland boundaries within the City of Austin and surrounding areas.
 - The parks dataset is being used primarily to show location and landmarks on the map and will be used in analysis section.

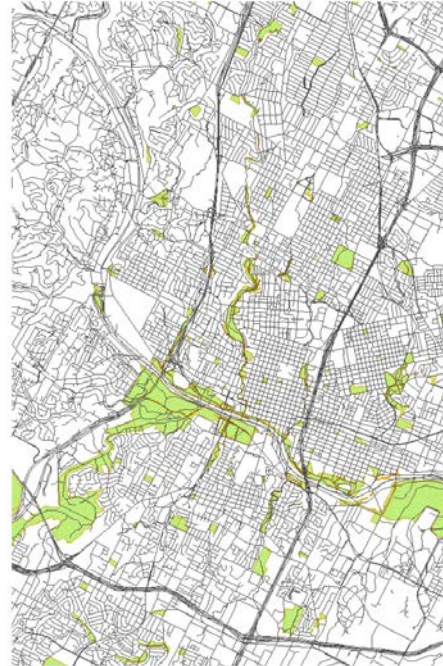


Figure 2

- Lakes (City of Austin GIS Data Sets)
 - Polygon shape file
 - Data retrieved from City of Austin datasets (ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html)
 - Show City of Austin Lakes

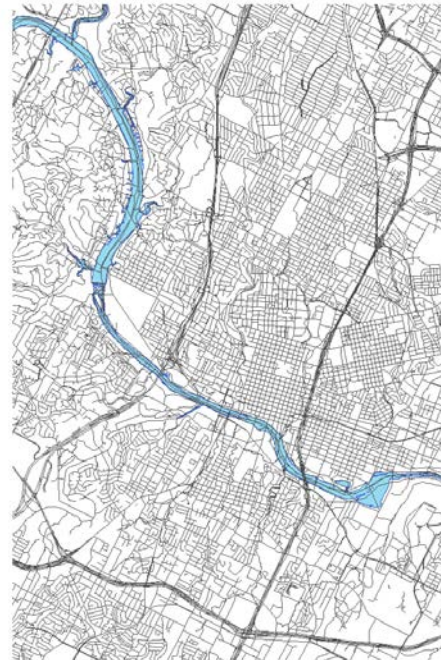


Figure 3

- Zoning (City of Austin GIS Data Sets)
 - Polygon shape file
 - Data retrieved from City of Austin datasets
 - This feature class represents the zoning classification boundaries in the City of Austin and surrounding counties, including residential, commercial, industrial, and special purposes. Specifically for this dataset, I created a new layer specifically showing commercial zoning (as shown in orange on the map).



Figure 4

- Current Wi-Fi Hotspots (AT&T wi-fi hotspot locations; City of Austin GIS Data Sets; Free wi-fi hotspots in austin, tx; Hotspot directory; The wi-fi free spot directory; TWC wi-fi coverage map)
 - Dataset created from Excel spreadsheet with addresses using Census Bureau Edges

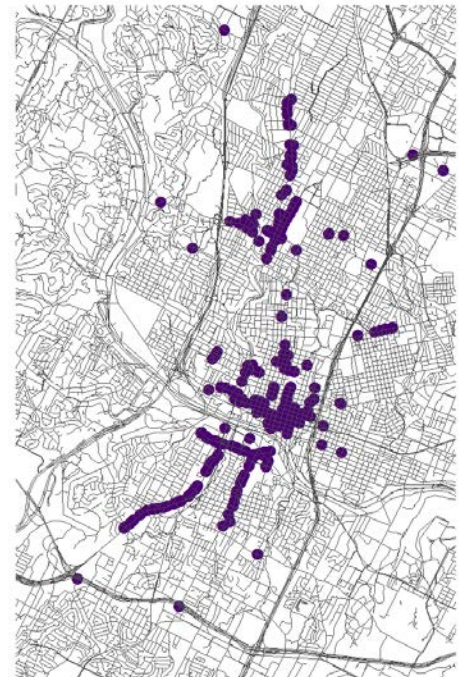


Figure 5

- Bus Stops (Capital Metro Geospatial Data)
 - Point shape file
 - Data retrieved from Capital Metro datasets
 - This feature class represents active Capital Metro transit stops (shown with black dots)
 - This data will be used in the analysis section



Figure 6

Methodology

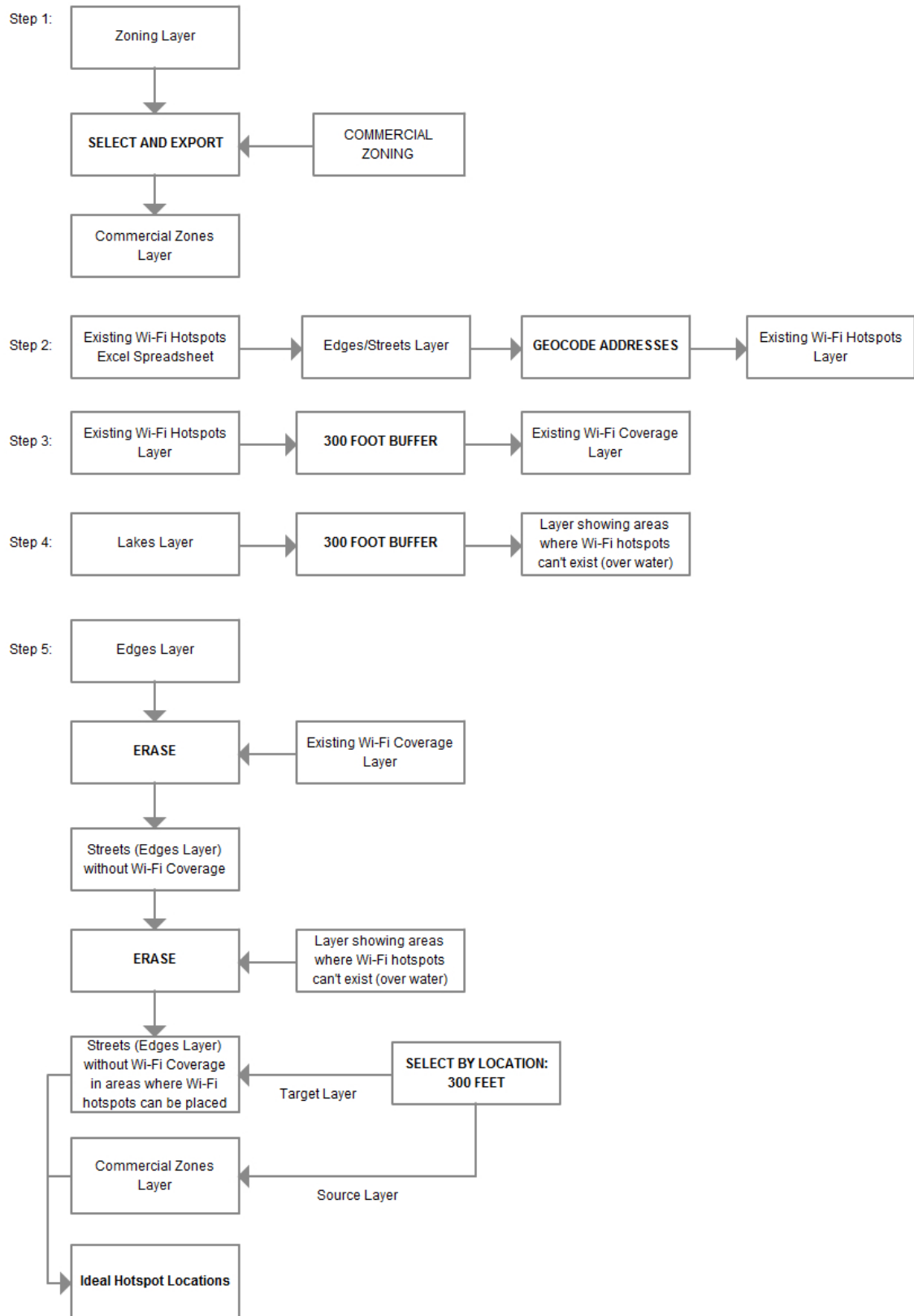
For this project, the main goal was to create a new, main layer that removes areas where Wi-Fi hotspots already have coverage (creating a buffer around current Wi-Fi hotspots), removes areas where Wi-Fi hotspots cannot be added (creating a buffer around lakes), and adds areas of commercial zoning (where citizens congregate and are most likely to use Wi-Fi). The Edges dataset was used as the main background layer, but was also necessary to locate the locations of current Wi-Fi hotspots using geocoding. The additional Parks and Capital Metro Bus Stops layers were included for analysis because these two locations are potential valuable areas to have Wi-Fi access.

The first step was to create the one dataset I lacked, Wi-Fi hotspots (See Figure 5). This was accomplished by obtaining lists of Wi-Fi hotspots located in Austin (AT&T wi-fi hotspot locations; City of Austin GIS Data Sets; Free wi-fi hotspots in austin, tx; Hotspot directory; The wi-fi free spot directory; TWC wi-fi coverage map). Then using both the Edges dataset from the Census Bureau and the Excel spreadsheet with addresses of Wi-Fi hotspots, I geocoded the current hotspots and matched the addresses to the addresses built into the Edges (Austin street map) database. The range of Wi-Fi hotspots is typically 300 feet, so this number, along with looking at the area contained within Austin South of 71, North of Research, East of Mopac and a few blocks east of IH-35, was used to narrow down the location of future Wi-Fi hotspots (Wi-fi, n.d.).

The goal of the project was to determine where Wi-Fi hotspots do not exist, and more importantly to discover locations that would be the most useful to Austin citizens in public areas. So the first step was to select and export a new layer from the zoning layer, keeping only commercial zoning areas (based on zoning definitions as defined by City of Austin) (Zoning districts, n.d.). Hotspots cannot be over lakes, so once the new layer was created with commercial zoning, the next step was creating a 300 foot buffer around the lake (so that a hotspot could potentially be placed 300 feet from the lake and allow citizens to be up on the lakefront and still get Wi-Fi access). Next I took the layer containing current Wi-Fi Hotspots and created a 300 foot buffer around existing hotspots. With the two buffers and base commercial layer created, the next step was to create the base layer for future hotspots with the two buffer layers (where hotspot coverage either already occurs or is not possible) erased. I used the Arc Toolbox Analysis tools using the Erase feature twice, first to erase the Wi-Fi buffer layer from the Edges layer, then to erase the Lake buffer layer from this newly created layer. The final layer is the basis for ideal locations for Wi-Fi hotspots where there are currently no existing hotspots.

The final step was to Select by Location, with the new Edges layer (with Wi-Fi and Lake buffers erased) as the target layer and Commercial Layer as the source layer with 300 feet as the location. This revealed locations within 300 feet of commercial zoning that do not currently have Wi-Fi coverage, and thus would be the ideal locations to begin with as they would provide ideal public Wi-Fi hotspots.

Methodology chart:



Analysis Results

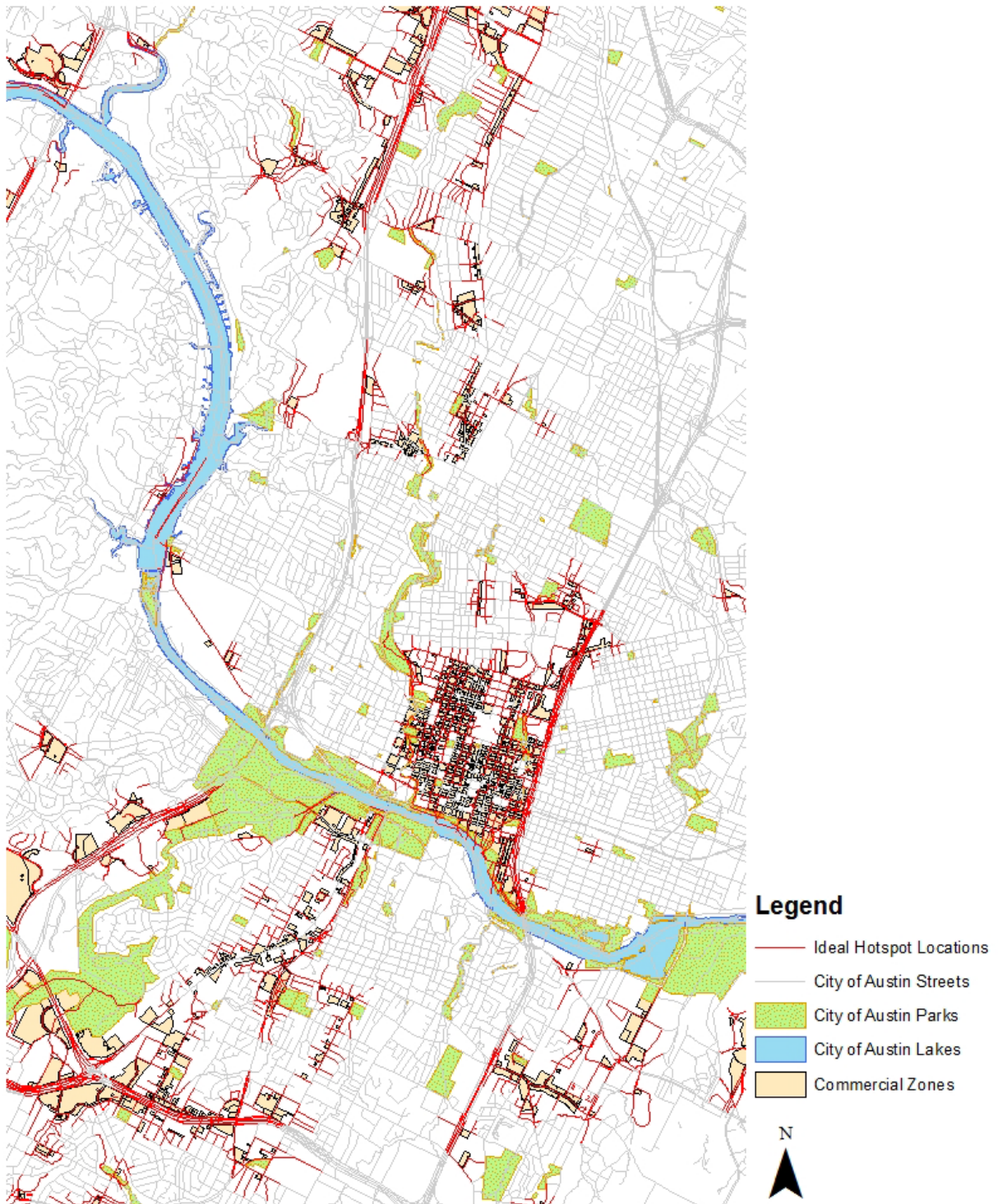


Figure 7

While the final map (Figure 7) does not show specifically where each individual hotspot should occur, it is an ideal starting point to start figuring out what areas of central Austin, near commercial zoning areas where citizens are more likely to congregate and use Wi-Fi, Wi-Fi hotspots should be located.

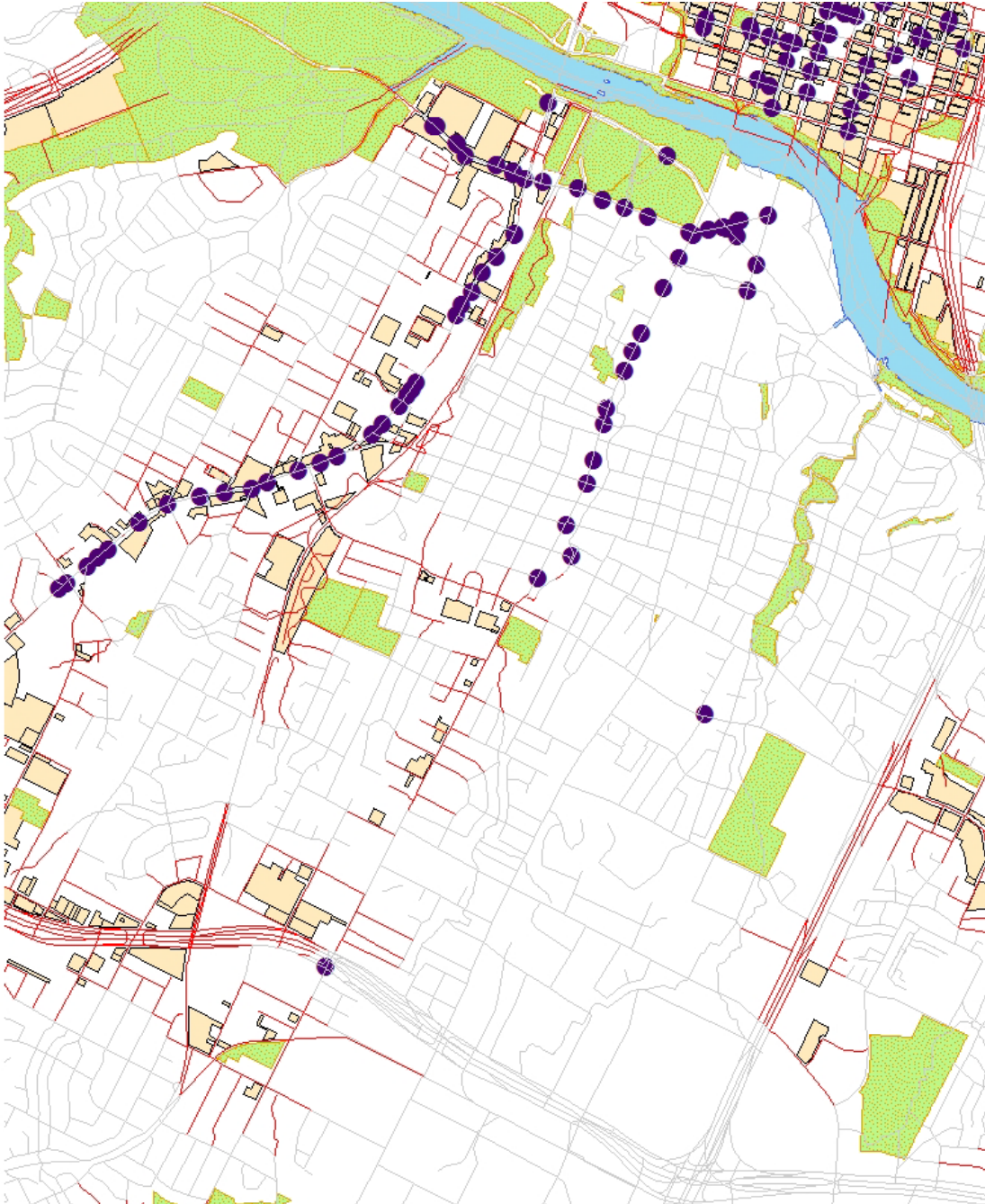


Figure 8

Figure 8 shows a close-up of South Austin. As you can see, the Wi-Fi hotspots (shown as purple circles) are generally along main streets, where they are most likely either inside of restaurants or bars, or close by enough that patrons can use them. The future ideal locations of Wi-Fi Hotspots show up by commercial areas where no hotspots are currently located, or on side streets close to commercial areas where hotspot access could provide additional value.

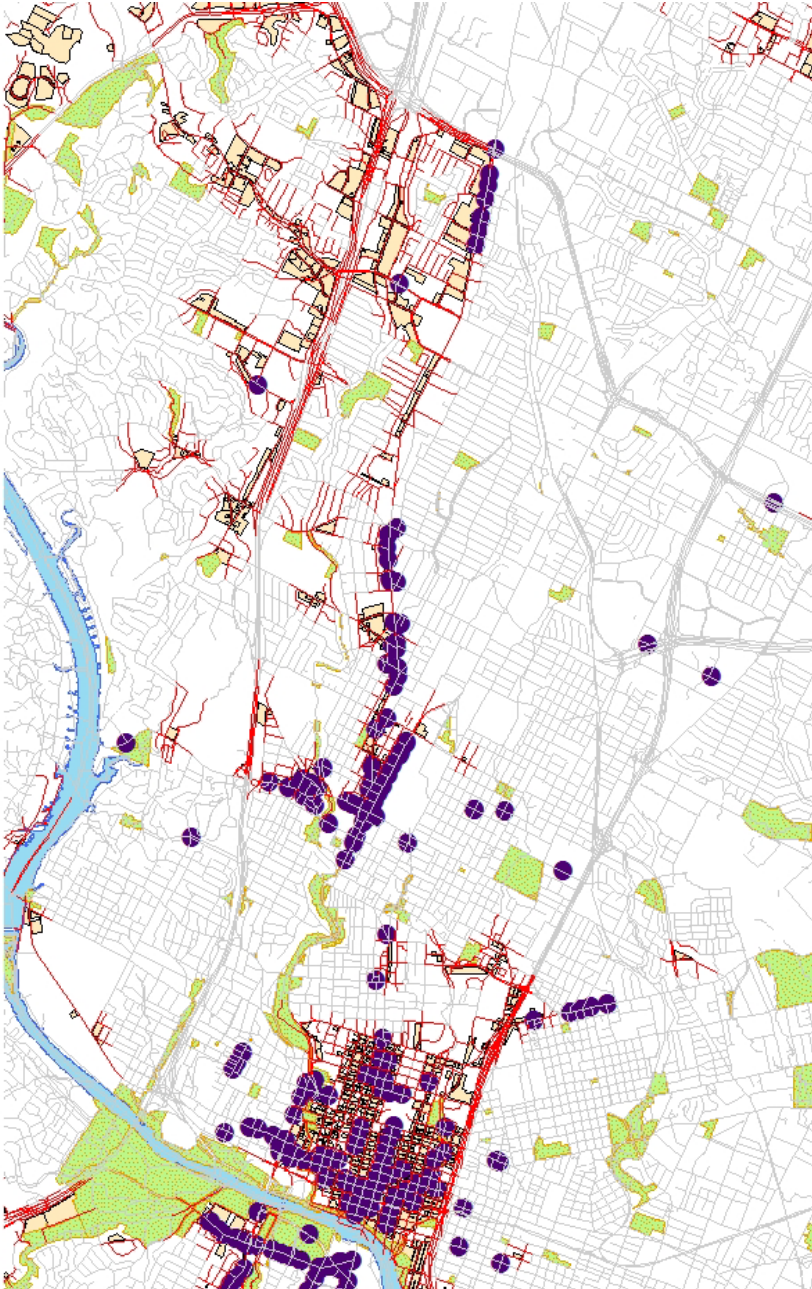


Figure 9

Figure 9 of North Austin shows great hotspot density in downtown Austin and just slightly North of Downtown around Burnet Road area where quite a few restaurants, bars, and coffee shops are located, but further North by Anderson Lane where development is growing with restaurants, bars, and coffee shops, there are many open areas where no coverage is located and could be ideal spots to add new hotspots.

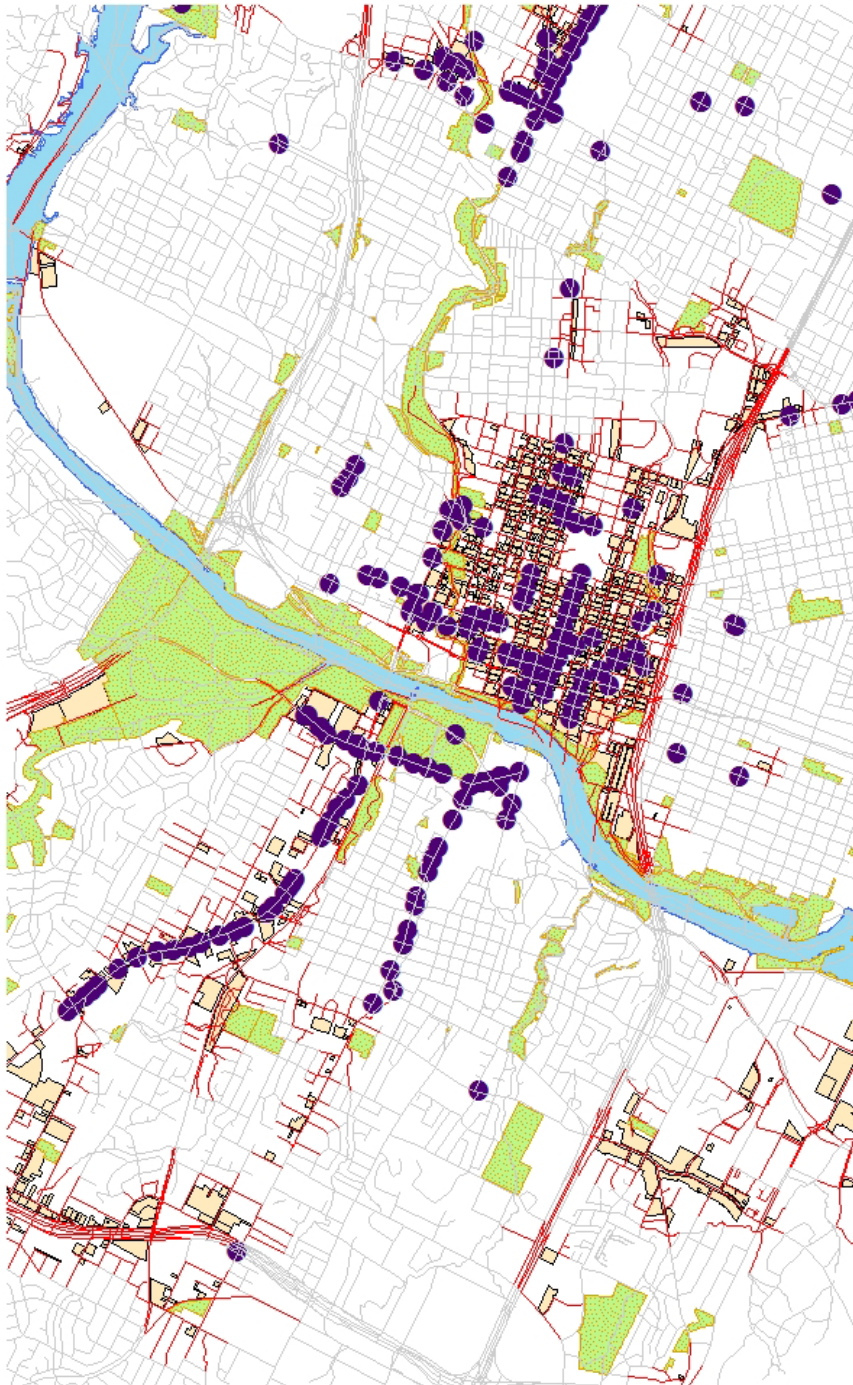


Figure 103

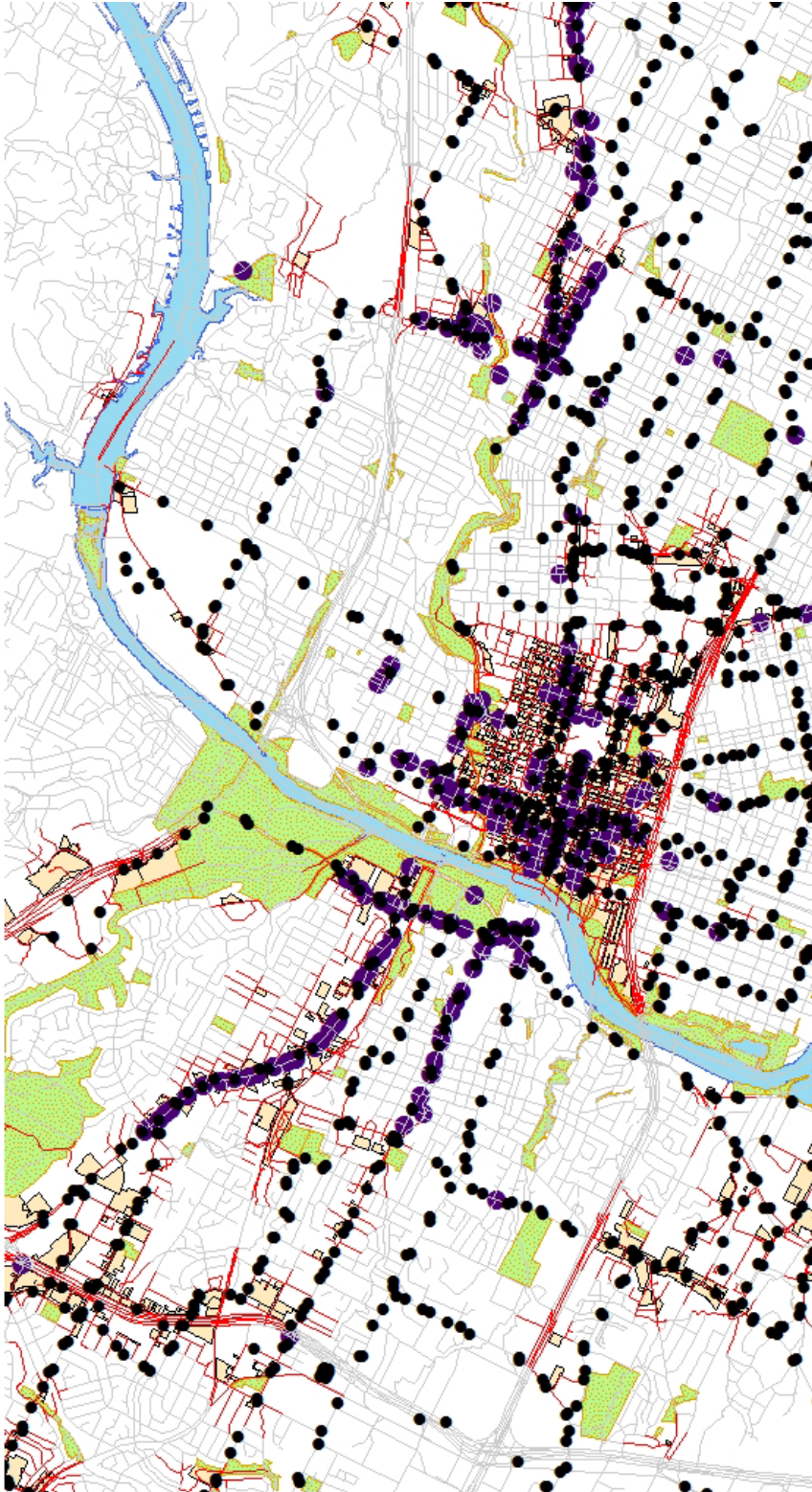


Figure 11

In addition, many bus stops and parks are located around the commercial areas and main streets. In Figure 10 showing downtown Austin, you can see quite a few streets around Zilker Park where hotspots could be added, thus increasing coverage for citizens who use the park (and are likely to want to connect while there). And in Figure 11, you can see that many of the suggested locations would bring hotspot coverage to bus stops (shown with black circles), a place where many would find connections as a valuable way to surf the Internet while waiting for the bus on their way to work, school, or activities.

Conclusion

While this mapping project illustrates that there are certainly many areas where adding Wi-Fi hotspots could increase public access to Wi-Fi, the locations that the mapping has selected provide only a starting point that would eventually need deeper analysis to determine whether any business or public entity should adopt the selected areas to install Wi-Fi hotspots. This is because the list used in this analysis is not all-inclusive, nor does it take into consideration future technology developments that may enhance Wi-Fi access. In addition, Wi-Fi service inside a building often has a shorter range while there are various hotspots that can have a greater range and the 300 foot range utilized in this study is an average. A deeper analysis would involve additional research on every Wi-Fi hotspot in the selected area of Austin including the specific range for each hotspot, as well as looking forward to enhanced developments of Wi-Fi access that might extend the range of wireless access.

Although this analysis focused on all public Wi-Fi services throughout Austin, there is a significant difference between free and paid public hotspots. To truly create a wireless city, expanding *free* Wi-Fi throughout the city is required to allow all citizens, no matter their income, access to the Internet and its wealth of information.

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