

# **Analysis of Existing Fire Station Coverage Within the City Limits of Fort Worth, Texas**

Spring 2003 Semester Project  
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## **ABSTRACT:**

This project will identify areas that are not within a five-minute response time of existing fire stations within the city limits of the City of Fort Worth, Texas. This project makes assumptions and establishes parameters based on research and the scope of the project realizing that more criteria must be examined before the actual results should be used. After the initial analysis is made and areas in need of service have been identified, those areas will be overlaid with the City's surplus property feature class. This overlay will identify if the City owns property that might be used to build new fire stations and save taxpayers money.

## **INTRODUCTION:**

Today, with urban sprawl increasing, development is occurring at a rapid pace outside central city limits. Large commercial and business districts (often with more office and retail space than the downtown area) quickly establish themselves in suburbia. The City of Fort Worth has not escaped this expansion. With current development activity expanding at the edge of existing city limits and large developments planned in the extraterritorial jurisdiction, the need for adequate fire and EMS services increases. Currently, the City of Fort Worth has 39 fire stations that serve a population of 540,391 residents across 313 square miles. Historically, this work was done by sending out a fire or police vehicle that would drive certain routes and record its travel time through the street network (Johnson, 2001), or by creating circular, equi-distant buffer zones around emergency service stations. Today, using GIS and its network analysis abilities, we are able to establish a network that determines driving time vs. distance. (Denike, 2001). This project proposes to locate areas that are an unsafe distances from emergency service nodes (fire

stations). This will help City of Fort Worth Fire Department planners decide where to locate new public safety services locations in the future. Along with identifying any areas that might need quicker emergency response, those areas will be filtered to see if the cost of placing a new station might be reduced by using the City of Fort Worth's existing surplus property instead of purchasing new property outright.

## **Methodology:**

**Study Area:** The City Limits of Fort Worth, Texas and ETJ for future development.

**Data Sources:** 1) City of Fort Worth GIS Department:

- a. City Limits
  - b. City and Tarrant County Streets
  - c. ETJ
  - d. Surplus Property Coverage
- 2) City of Fort Worth Fire Department
- a. Existing Fire Stations
  - b. EMS response codes for use with incident report
- 3) City of Fort Worth Information Systems Department
- a. Incident report gathered from Computer Aided Dispatch (CAD) system.  
(November, 2002 to April 22, 2003).

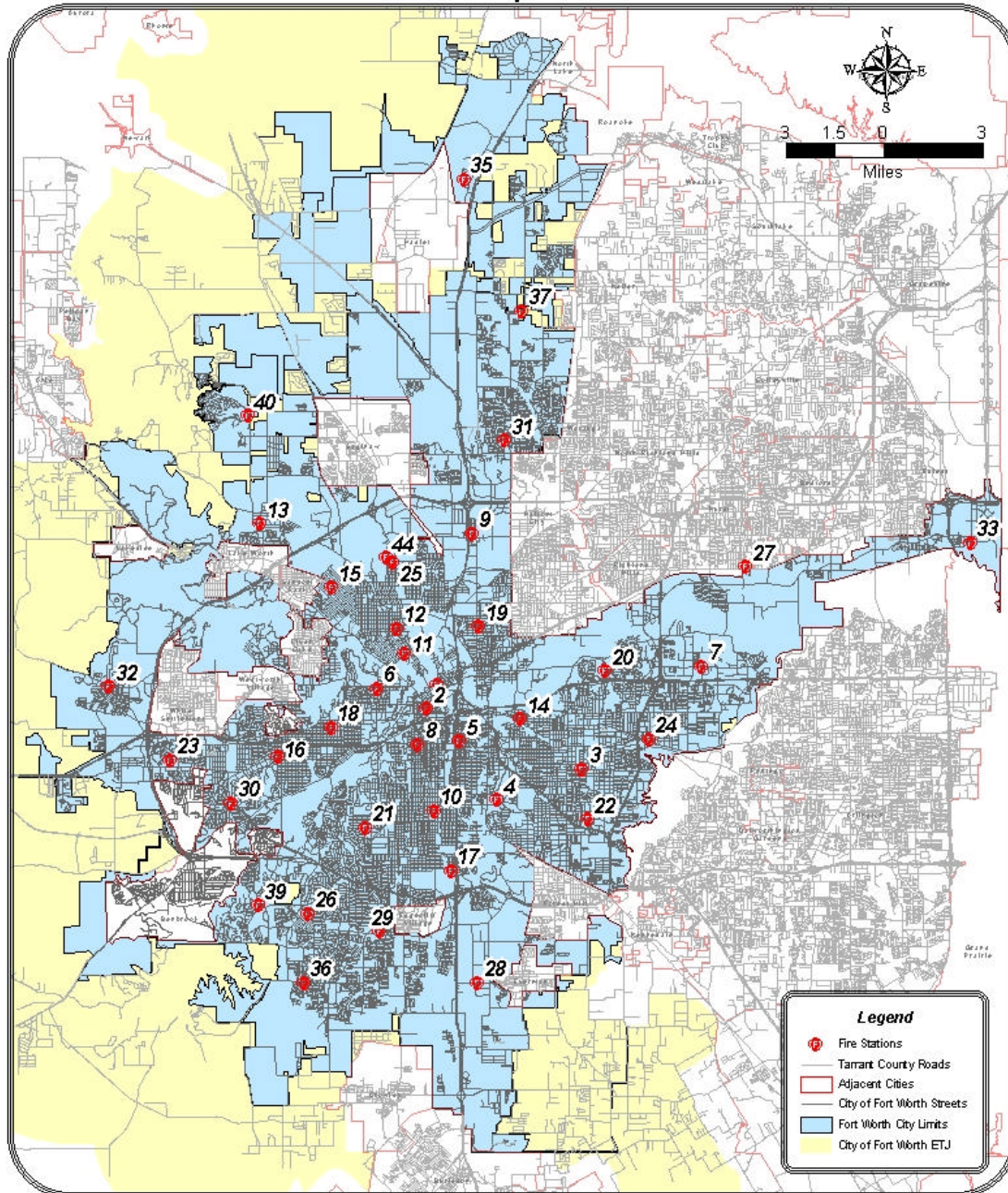
## **Process:**

All data sets were derived and assembled in ArcMap, Spatial Analyst, and ArcInfo Workstation Network. The incidents database was obtained from the City's CAD system that has been on line since November 2002. This data included case number, emergency code, and response time. For the last three years, the City of Fort Worth Fire Department responded to an average of just over 93,000 emergency calls. In addition, Fort Worth partially serves adjoining cities such as

Benbrook. However, for the purpose of this study only the area inside the city limits will be studied. See Map 1 next page.

## Existing Fire Stations in the City of Fort Worth

Map 1



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A response time of five-minutes was used for this study. After talking with members of the Fire Department and using data from the research. (Stewart, April 2001)

### **Establishing 5 minute response network and areas using Network Analysis.**

Using Arc Network, a road network coverage was generated around the existing fire stations to reflect the five minute response time. The road network was used to generate a polygon shapefile specifying which areas met the five-minute response time as shown in Map 2. This coverage shows areas that are outside the five-minute response window especially in the northern and southern reaches of the City. There is a significant increase in population and development activities in the northern and southern areas and it is projected to increase over the next 10 years. The City has just completed annexing and extending its City limits in these areas and along with increasing the City limits goes providing City services as well. Map 2 identifies some potential areas in need of additional emergency service.

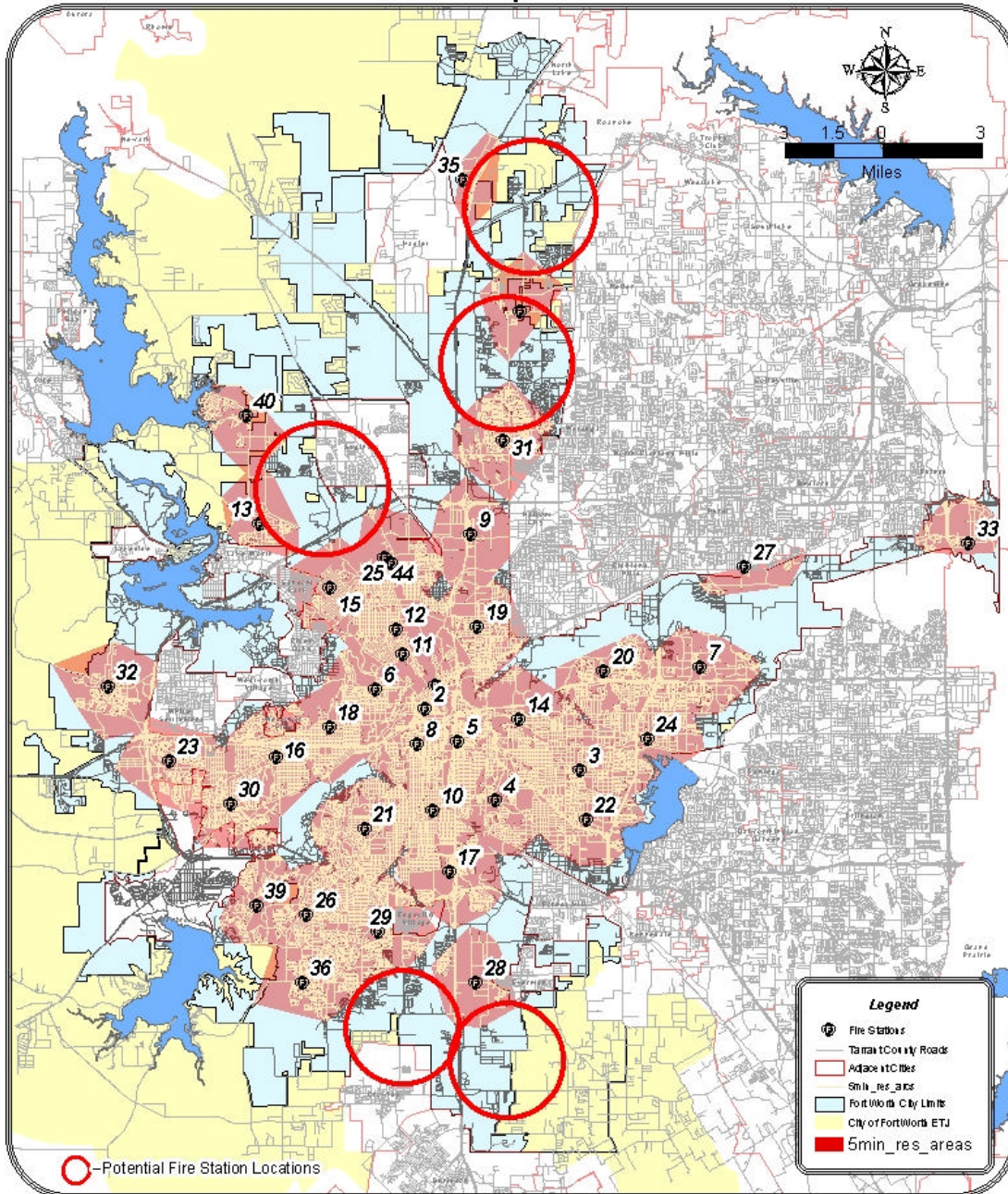
### **Geocoding Fire Response Calls from the CAD incident database.**

The CAD incident database includes all Fire response calls from November 2002 to April 2003 and contained almost 40,000 records. Those records were geocoded and the table was modified to reflect total response time. The database was analyzed for records that might distort the analysis such as non-emergency calls, errors in time reporting, and records with null or missing response codes. To see what percentage of calls were outside the five-minute response areas, the calls were clipped with the response areas and it was determined that 22% of the calls were located outside the project response areas. Using this data an area in the far west section of the City was added to make a total of six possible areas of needed emergency facilities. This area is



a strong candidate because there are a number of large developments planned for the western area of the City of Fort Worth's ETJ including Walsh Ranch, and Haywire Ranch (City of Fort Worth Development Department). Map 3 shows the result of this step in the project.

## 5 Minute Response Time Areas Map 2

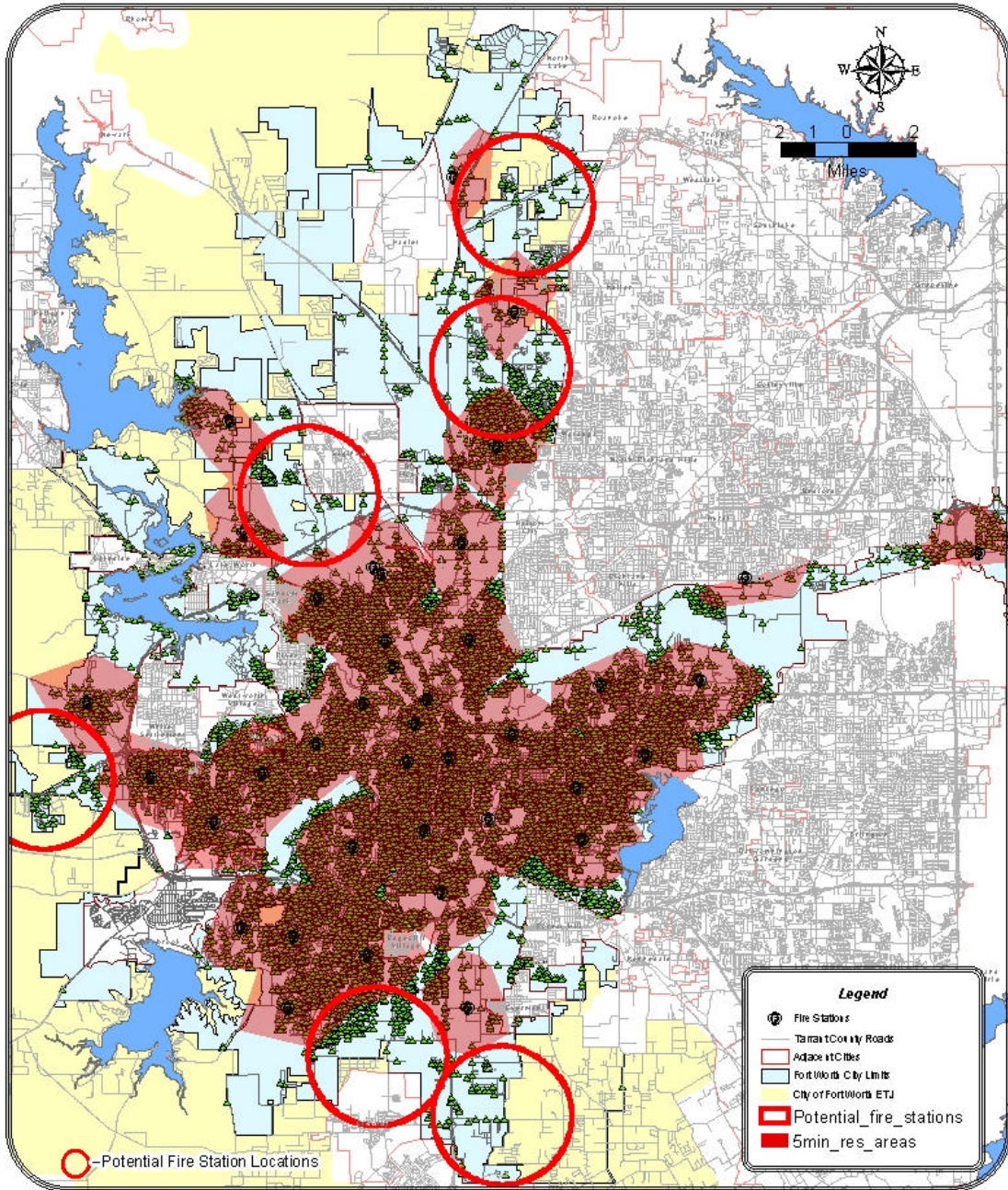


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# November, 2002 to April, 2003 Fire Calls

Map 3



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### **Spatial Analysis of Fire Calls:**

Spatial Analyst was used to create a raster model from the actual response times contained in the CAD call data. This model would be used to test the validity of the five-minute response time polygons created using Network Analysis. Using the fire incident database, columns were created to show the response time in seconds for ease of analysis. The Inverse Distance Weighting function of Spatial Analyst was used and the resulting raster was re-classified to show responses under five-minutes and responses over five-minutes. The resulting raster supported the network analysis results. (See Map 4).

### **Identifying City of Fort Worth Surplus Property within Proposed Locations:**

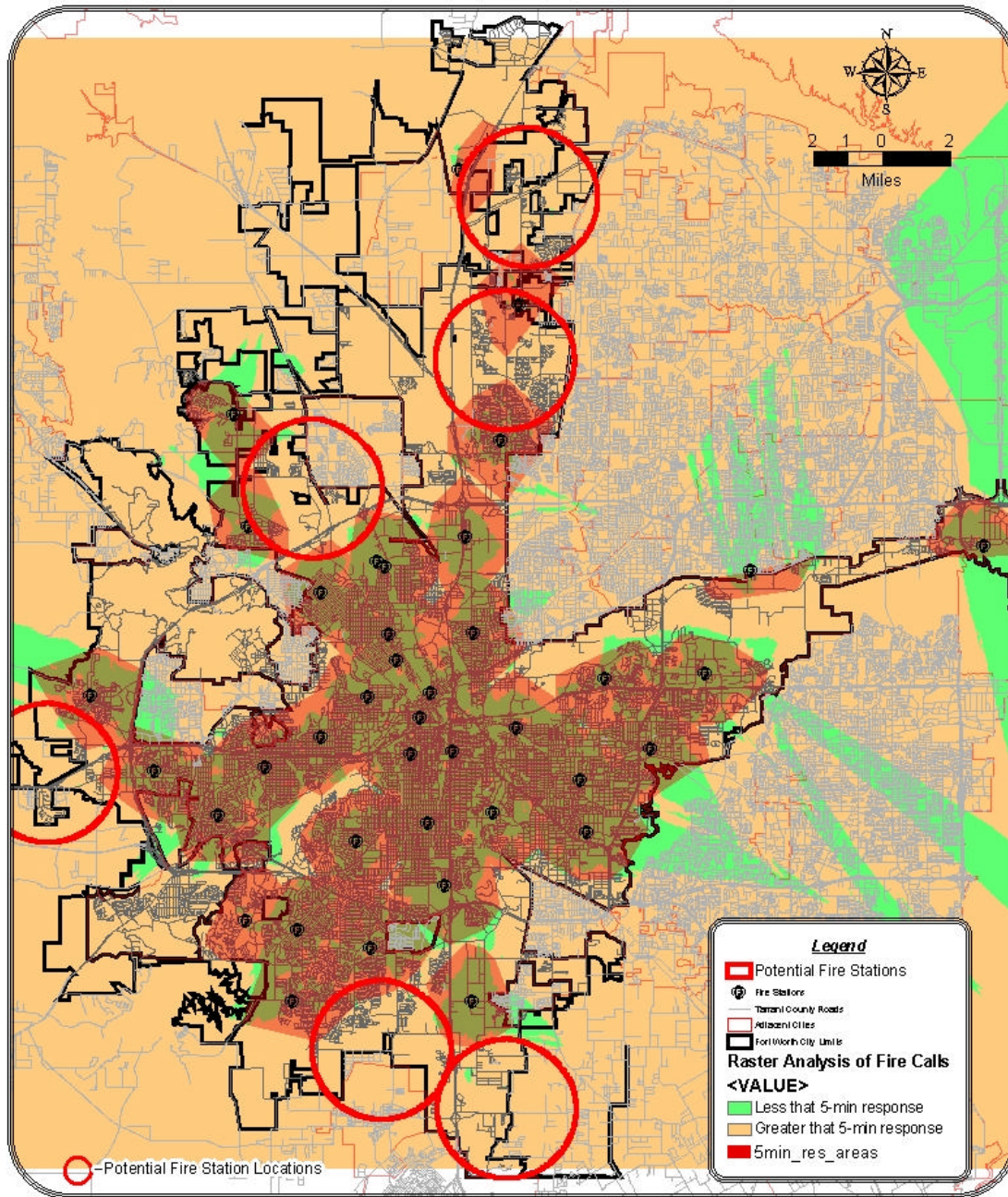
The last step in this project was to see if the City of Fort Worth has surplus property within any of the proposed fire station locations. A shape file of the City of Fort Worth surplus property was obtained from the Real Property division of the Engineering Department. Using the minimum area requirement from the Fire Department, the surplus property shapefile was queried for property over one acre. The select by location function in Arc Map was used to see if there were any surplus property locations that fell within one of the six potential fire station areas. Only the two far south areas contained surplus property which were over one acre.

Within these two areas, three possible sites were identified, Eastview Street, McCart Avenue, and South Freeway. Eastview Street and South Freeway were the strongest of the three choices, because of their proximity to a major highway IH-35W. See Map 5.



# Spatial Analysis of Fire Response Calls

Map 4

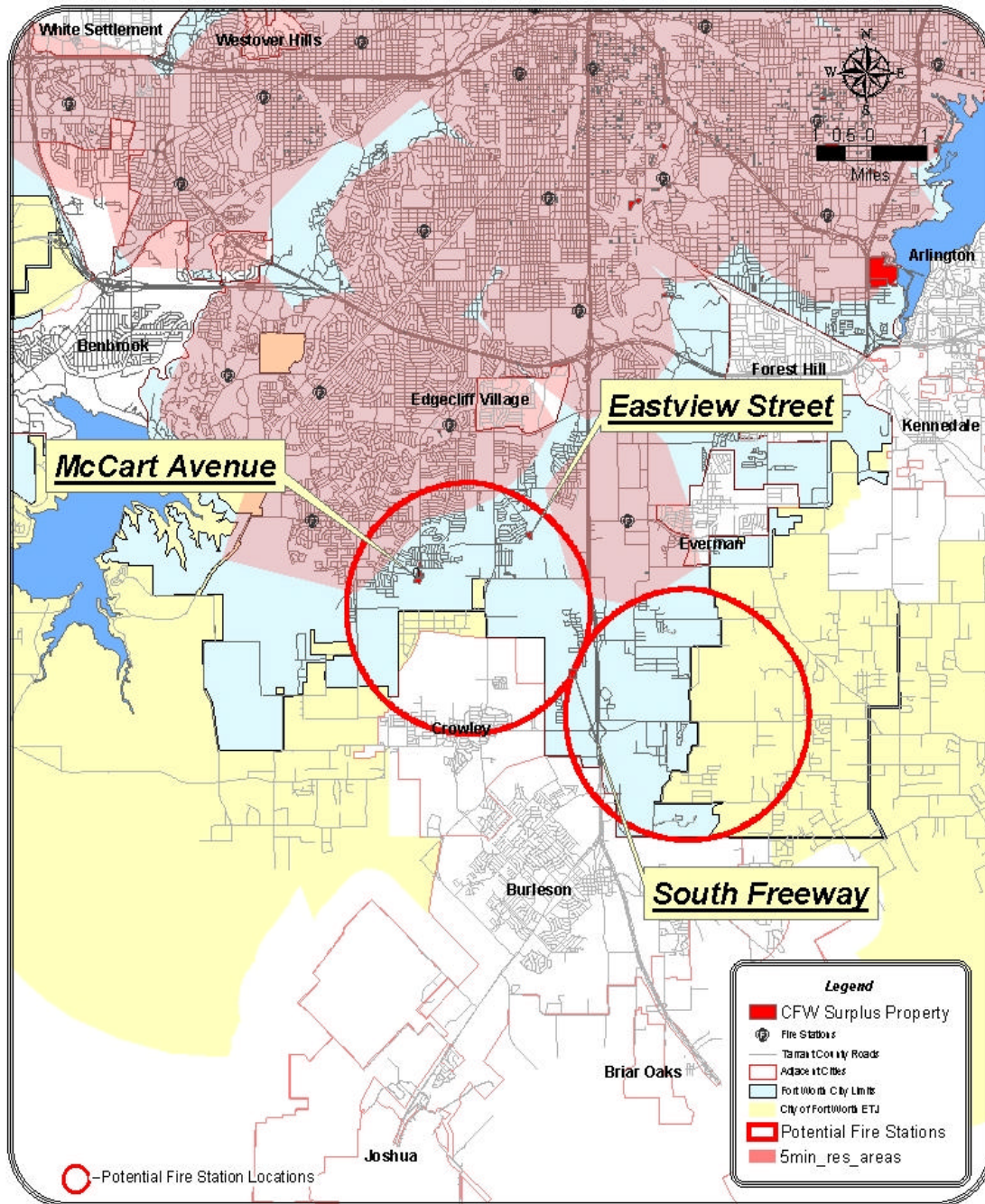


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# City of Fort Worth Surplus Property

## Map 5



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## **Conclusion:**

In conclusion, this project identified areas that might not have emergency services within a five-minute response time by existing fire stations within the city limits of the City of Fort Worth, Texas. This project made assumptions and set analysis parameters based on research and the scope of the project realizing that more criteria must be examined before the actual results should be used. If the potential properties are to be considered for use, they should be carefully looked at to see if they are buildable sites considering development standards. Fort Worth is a rapidly growing part of the DFW metroplex and with future growth goes the need for city services and emergency services to grow along with it.

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