



A Fire Station Location Analysis for San Marcos, Texas



Introduction

The City of San Marcos is proactively developing a plan integrate GIS to help the San Marcos Fire Department prepare for and assess future development in and around the city. During the Spring semester of 2013, CenTex360° was asked to analyze data associated with 16 of the city's predetermined grid cells. (Fig. 1) For this study we examined the 16 grid cells that overlay the city of San Marcos, and compared their values to the 5 grid cells with existing fire stations. The purpose of this study is to help locate, plan, and acquire potential areas that need a fire station early on in advance and will help justify the costs of a new fire station to City Council.

Scope

The geographic extend of our analysis is The City of San Marcos, Texas. This area is approximately 30 square miles with a total population of 46,685 and contains about 1500 people per square mile (United States Census Bureau).

Overview of Methodology

To complete this analysis we preformed a series of computational steps on each of the 16 grid cells. We considered the following factors in this study: (1)Parcel Area, (2)Parcel Value, (3)Day & Nighttime Populations, (4) Square Footage of Buildings, (5) Value of Improvements, (6) Wildlife/urban interfaces, and (7) Conflagration Index (see below).

Methodology of Conflagration Index

The conflagration index was created to determine the potential spread of fire between building structures. This index is a weighted sum model that is partially subjective and based on our literature review. We used the following three factors:

Factors(Weighted Sums)

- I. Length of Wildlife-Urban Interface(.2)
- II. Conflagration Area(.4)
- III. Number of Buildings in Close Proximity(.4)

Figure 1

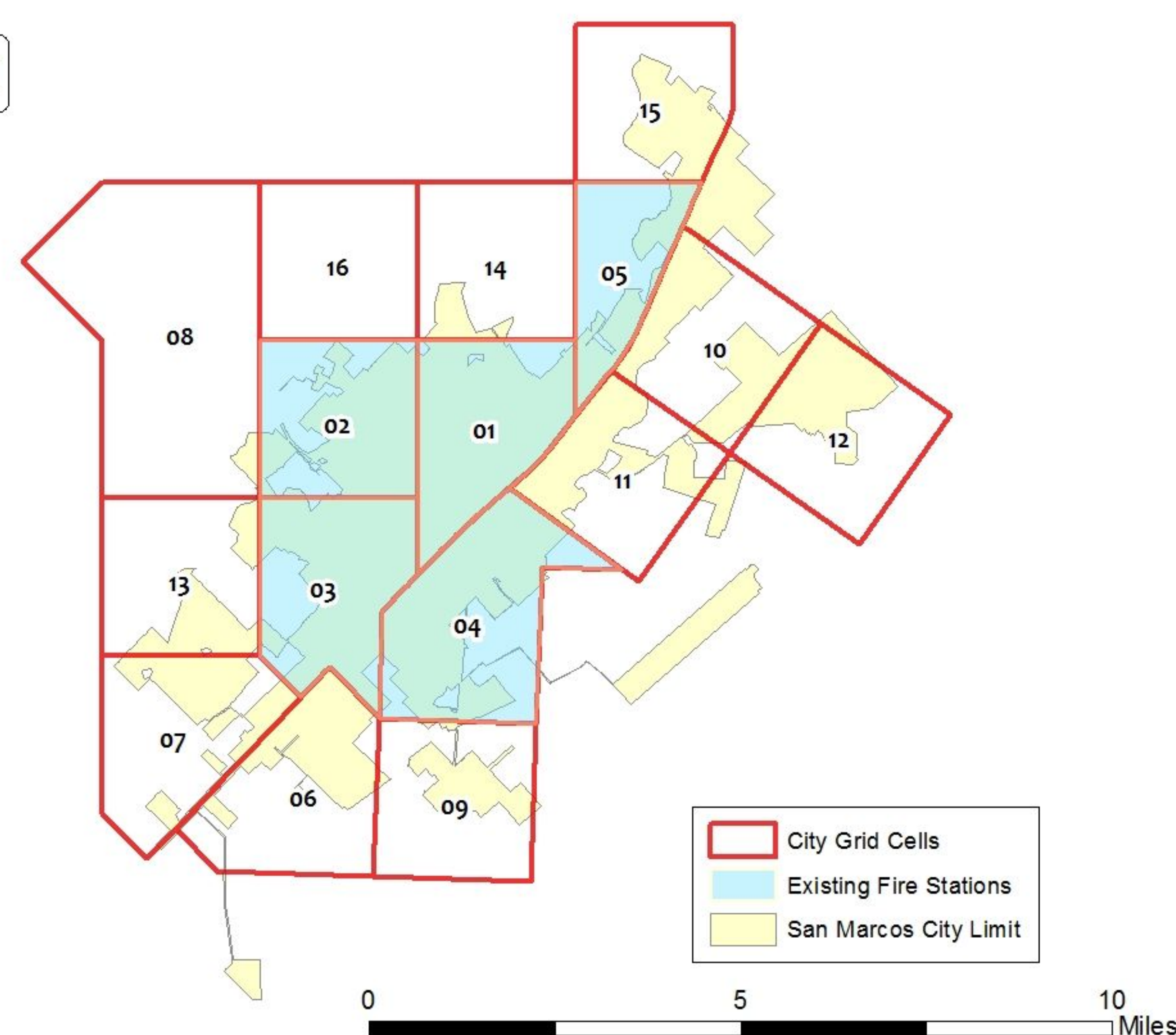


Figure 2: Grid 11

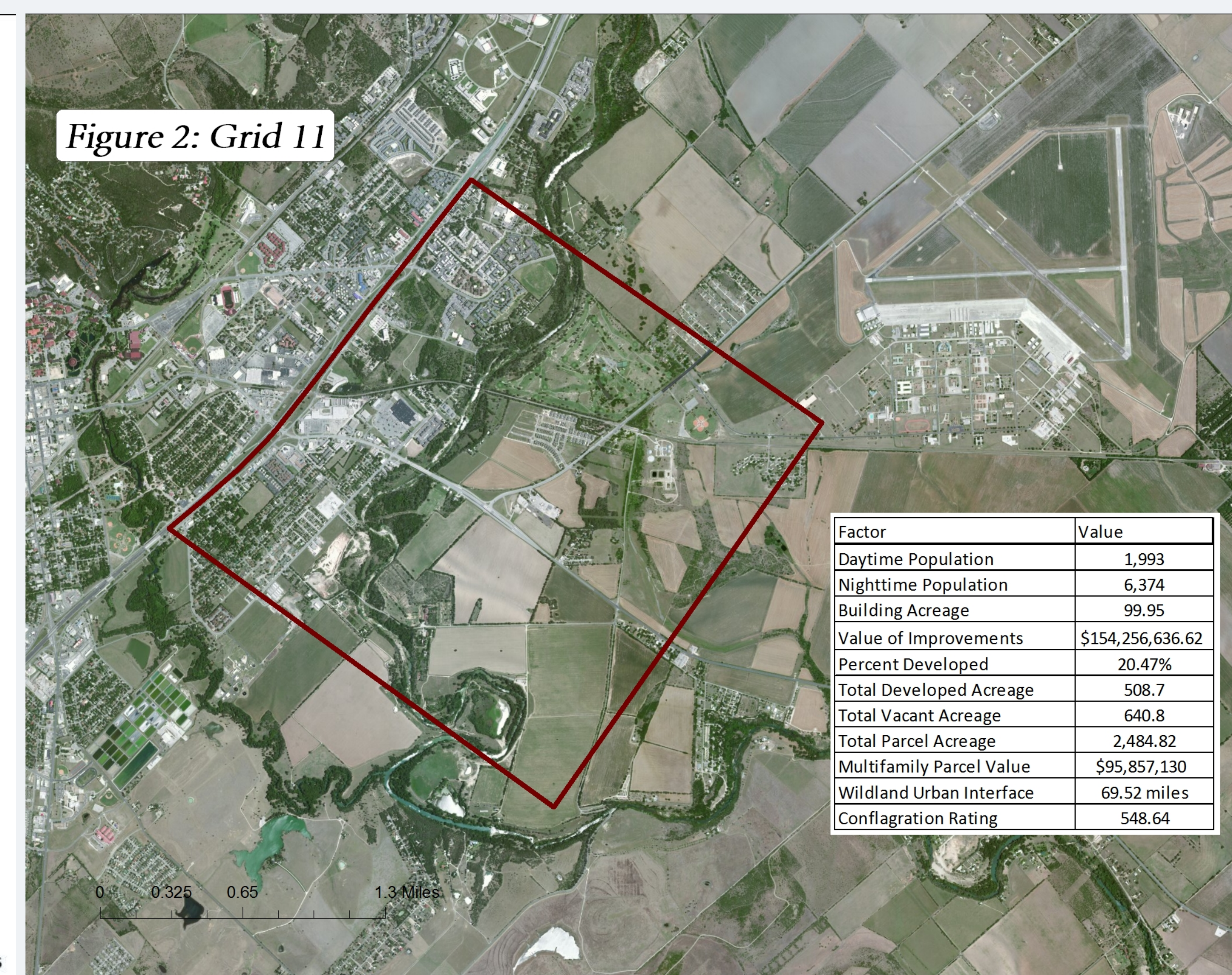


Figure 3

Grid ID	Total Parcel Value	Total Acreage	Value of Improvements	Daytime Population	Nighttime Population	Conflagration Sum
1	\$ 472, 038, 426	2, 364.91	\$ 428, 378, 641	33,179	14,946	1257.01
2	\$ 376,786, 256	2, 543.82	\$ 321, 128, 455	670	7,098	1836.81
3	\$ 310, 272, 823	2, 683.71	\$ 230, 747, 911	3,873	2,165	4689.49
4	\$ 360, 094, 581	3, 317.10	\$ 291, 052, 957	1,675	4,435	643.73
5	\$ 132, 538, 415	1, 720.19	\$ 101, 062, 738	1,071	516	197.17
6	\$ 111, 221, 446	2, 945.31	\$ 90, 698, 877	3,123	242	20.63
7	\$ 62, 090, 345	2, 819.02	\$ 38, 818, 940	501	236	69.15
8	\$ 14, 550, 298	6, 406.84	\$ 11, 935, 321	512	-	32.87
9	\$ 35, 361, 148	2, 787.86	\$ 27, 370, 678	250	68	85.74
10	\$ 49, 188, 923	2, 917.39	\$ 33, 072, 498	617	1,532	216.67
11	\$ 192, 613, 618	2, 484.82	\$ 154, 256, 636	1,993	6,374	548.64
12	\$ 2, 544, 160	2, 810.87	\$ 1, 427, 660	607	2,032	90.44
13	\$ 87, 600, 898	2, 796.07	\$ 70, 053, 132	-	239	35.75
14	\$ 32, 774, 840	2, 828.68	\$ 23, 754, 490	-	24	88.00
15	\$ 49, 007, 712	2, 046.36	\$ 35, 590, 130	90	564	71.4
16	\$ 22, 823, 752	2, 843.46	\$ 17, 386, 315	-	83	38.81

I. Length of Wildland-Urban Interface

Wildland-urban interface was identified as a significant factor in the spread of fire. We defined the wildland-urban interface as the presence of undeveloped land adjacent to developed land. To calculate this, individual parcels were coded as either 0 (vacant/undeveloped) or 1 (developed). We then used the search by location tool to determine the total length of parcel boundaries that fit this criteria. The longer the boundary between developed and undeveloped, the literature suggests, the more likely a fire is to advance.

II. Conflagration Area

This factor was based on the assumption that a fire will more likely travel to a closer structure than one farther away. In order to measure this, we created a 20' buffer around all buildings, and then intersected the output. This determined how much area is shared between buildings and gave us a numeric value to determine the relative proximity of buildings in a given grid.

III. Number of Buildings Affected

This factor took into account the number of buildings that were affected by our conflagration area calculation. The more buildings within close proximity, the more likely a fire is to spread between structures.

Results

Results indicate that grid cell 11 (Fig. 2) is the most suitable area for a new fire station. Grid cell 11 ranks 5th overall in total parcel value, and contains a high daytime population (i.e. commercial & industrial population) and nighttime population, (i.e. residential population). Grid cell 11 also shows a high conflagration acreage with 68.85 sq. acres of buildings 20 ft or less in proximity to each other. Considering the high number of commercial/industrial buildings in grid cell 11 as well as the high concentration of population and the possibility of potential conflagration, we consider grid cell 11 to meet the needs for fire station services.

Conclusion

We have successfully highlighted the city grid cells that indicate a need for future firefighting services. Our team has also created a map book for our client that provides a visual reference to our research, and a master spreadsheet (Fig. 3) that summarizes our calculations.



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 Acknowledgements: Thanks to Dr. Alberto Giordano, Ryan Schuermann and City of San Marcos
 Spring 2013 GIS Design and Implementation 4427
<http://geosites.evans.txstate.edu/>