

Review of the City of South Bend Fire Service using GIS.

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Background

- ▶ Fire Services are a crucial part of city infrastructure.
- ▶ Have not had a review recently.
- ▶ Geospatial analysis of current Fire Response Areas.
- ▶ Do they meet the needs of the population?
 - ▶ Response Times.
 - ▶ Alarm Call volume.



Background

- ▶ Population of 103,353 (Census Bureau, 2021)
- ▶ City covers 42+ square miles.
- ▶ Is the SBFDD over-extended?
- ▶ Alarm Call volume from 2022.
 - ▶ First and Second-Order Variations.
 - ▶ Gaps in coverage?
- ▶ Need for a new station?
- ▶ If yes, where?



Photo courtesy Capt. David Schackow

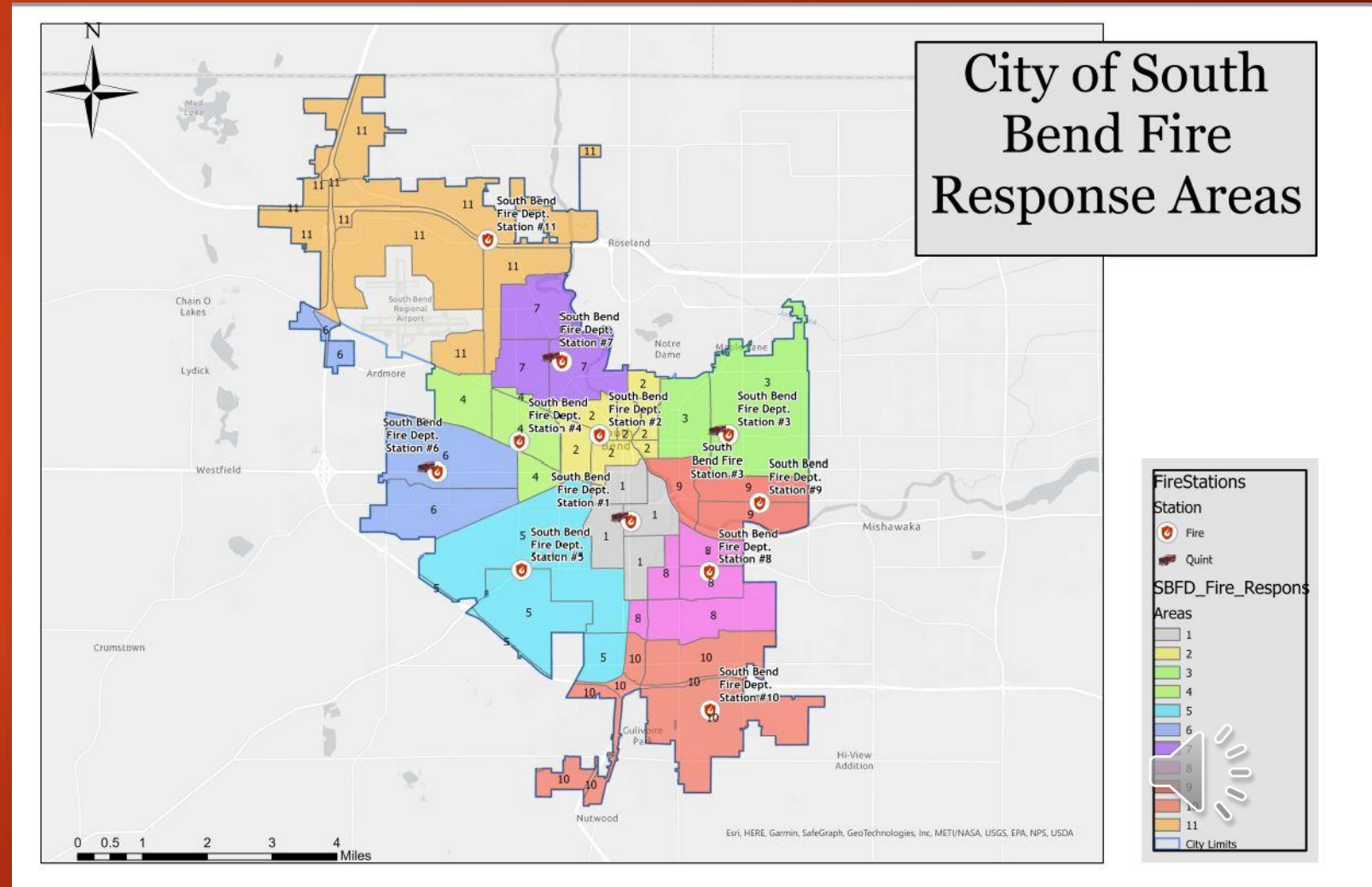
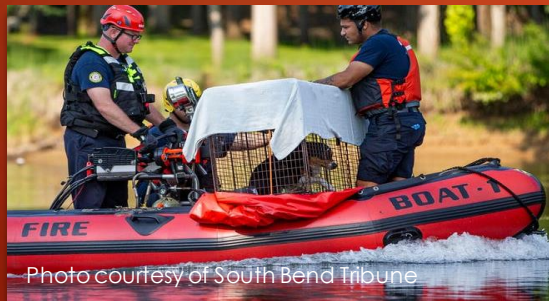


Background

- ▶ Stations and Fire Response Areas

- ▶ Stations (11)

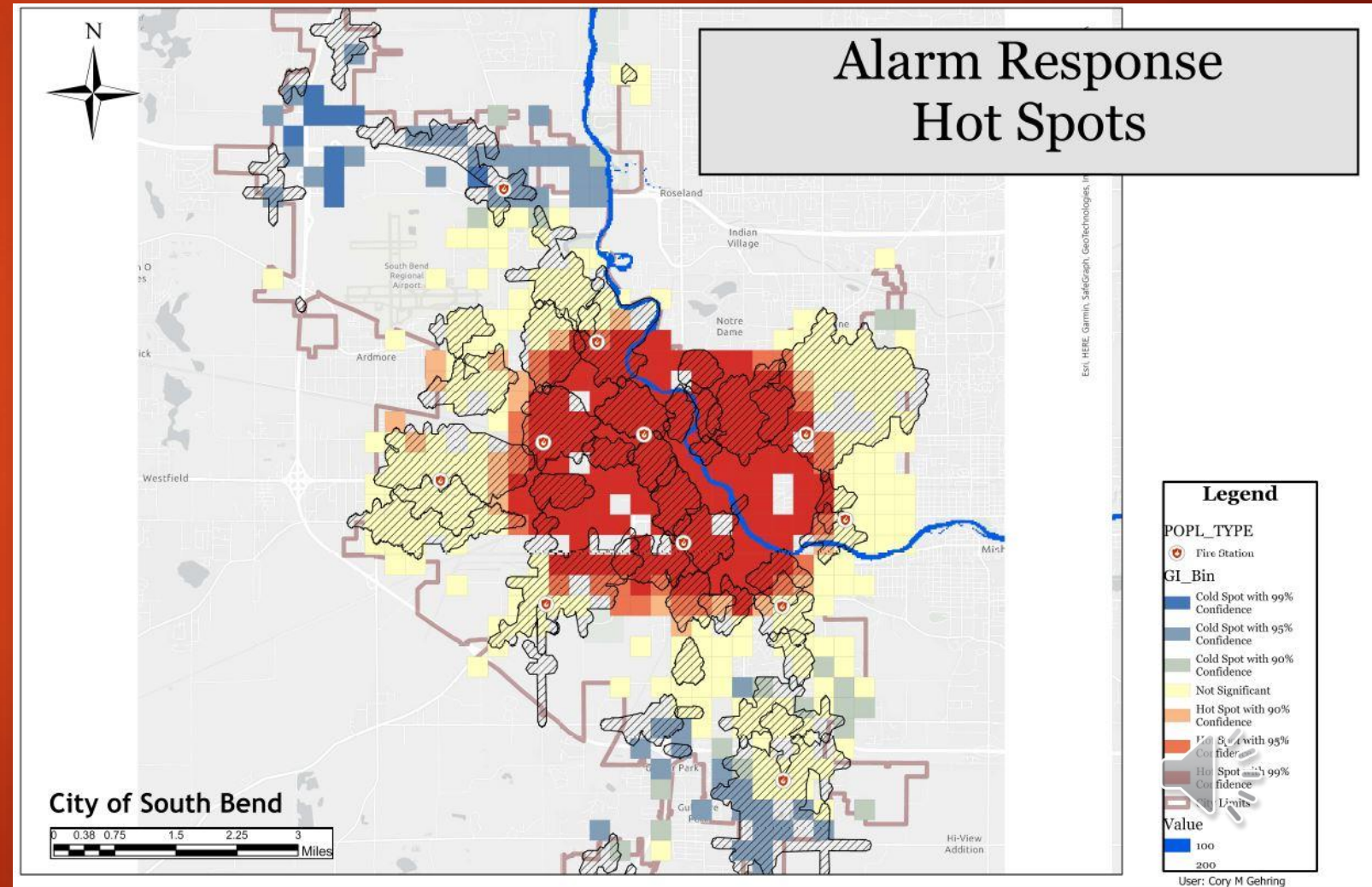
- ▶ Need a 12th ?



Description of the Problem

Things considered:

- ▶ 24,078* Alarm calls January 1, 2022-December 31, 2022.
 - ▶ 560 fire calls.
 - ▶ 17,712 EMS calls answered.
- ▶ Are there gaps?
- ▶ Simple Random Sample of 10%.



*(Indiana Department of Homeland Security, 2022).

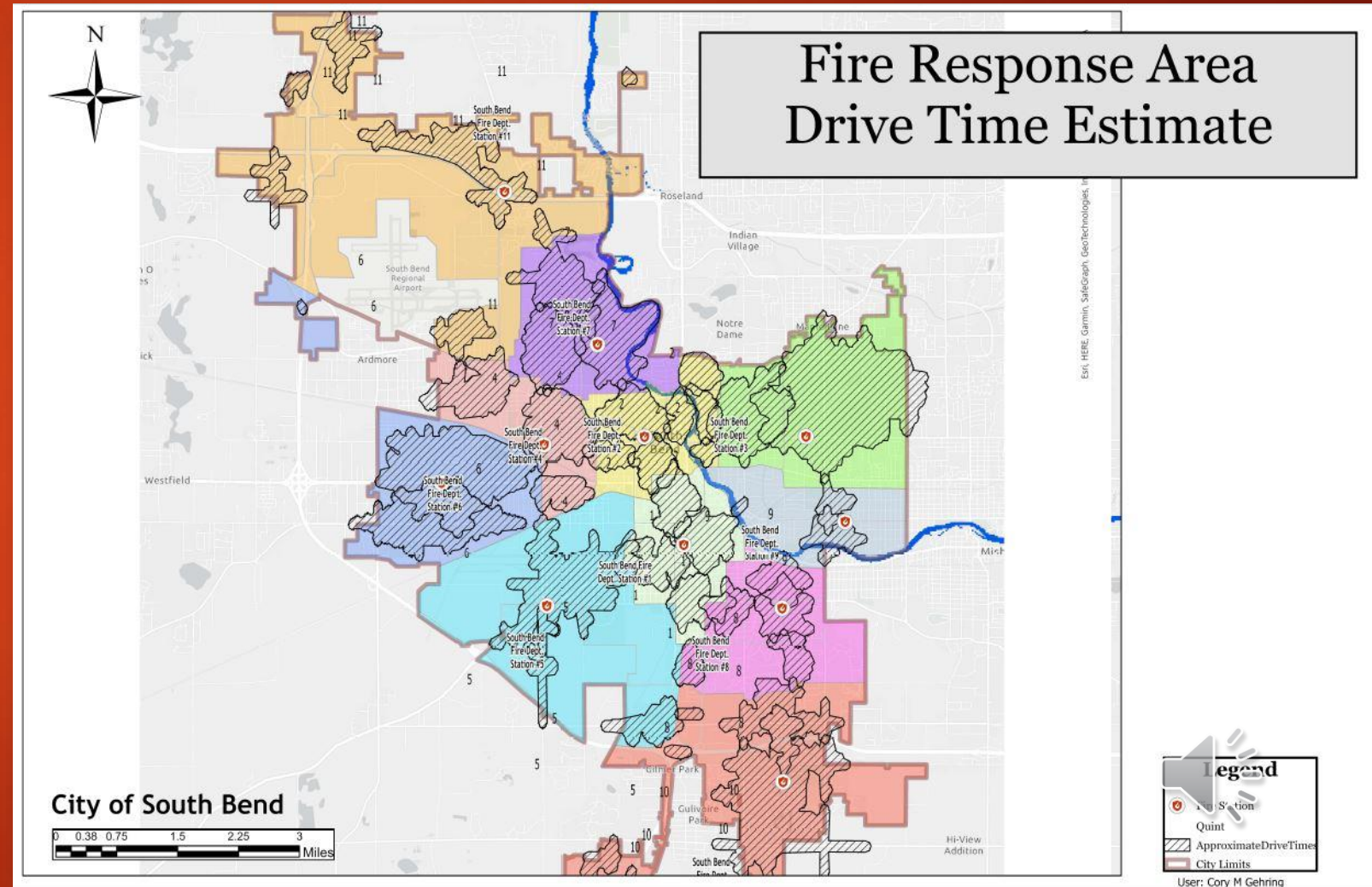
Goals & Objectives

- ▶ Goal- Geospatial review of the Sbfd.
 - ▶ Is there an area of the city showing the Sbfd being over-extended?
 - ▶ If so, is there a need for a new fire station to be built?
 - ▶ If yes, what is the optimal location for the new fire station?



Methodology

- ▶ Qualitative information per the National Fire Protection Association Standard 1710*.
 - ▶ Alarm Answering Time: 15 seconds for 95% of calls; 40 seconds for 99% of calls.
 - ▶ Alarm Processing Time: 64 seconds for 90% of calls; 106 seconds for 95% of calls.
 - ▶ Turnout Time: 60 seconds for EMS responses; 80 seconds for fire responses.
 - ▶ First Engine Arrive on Scene Time: 240 sec (4 minutes) for 90% of responses with a minimum staffing of 4 personnel.
- ▶ Max drive time calculated: 6.31 minutes.



Methodology

- ▶ Estimated call volume and response times per station.
- ▶ Approximate Drive Time Tool max travel time does not exceed 6.31 minutes.

Max Approximate Drive times per Fire Response Area	
Area	Drive Time
Fire Response Area 1	1.53 minutes
Fire Response Area 2	1.75 minutes
Fire Response Area 3	3.19 minutes
Fire Response Area 4	2.06 minutes
Fire Response Area 5	3.07 minutes
Fire Response Area 6	2.80 minutes
Fire Response Area 7	4.85 minutes
Fire Response Area 8	1.97 minutes
Fire Response Area 9	1.10 minutes
Fire Response Area 10	4.23 minutes
Fire Response Area 11	4.66 minutes
Average Reported Response Time in 2022	5.5 minutes*

*Note: The calculated statistical mean (average) is 2.87 minutes for the Approximate Drive Time Tool.

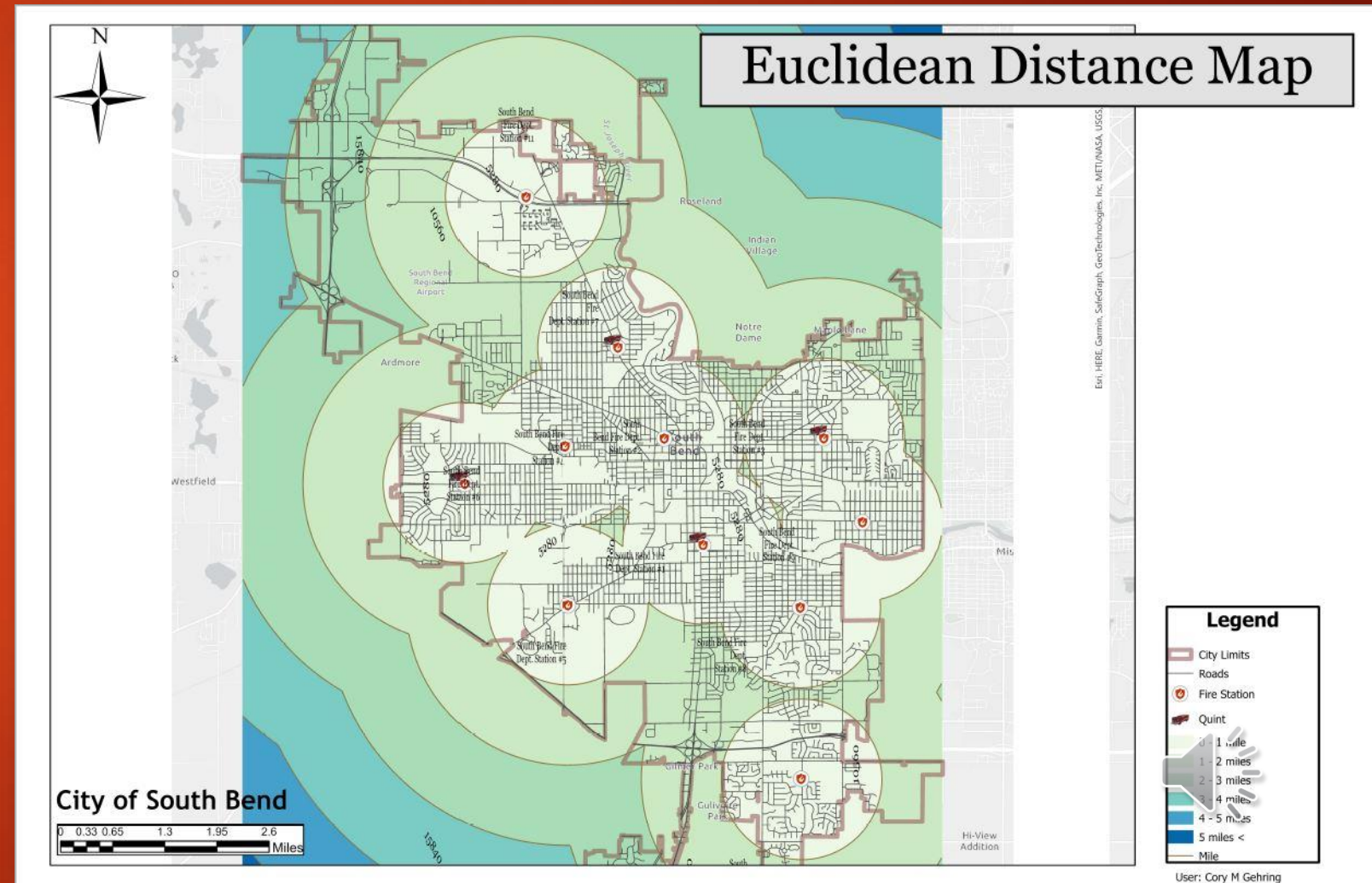
Methodology

- ▶ Data Cleaning
 - ▶ Determining the sample
- ▶ Preparing the layers
 - ▶ Converting to raster
 - ▶ Reclassifying
 - ▶ Combining



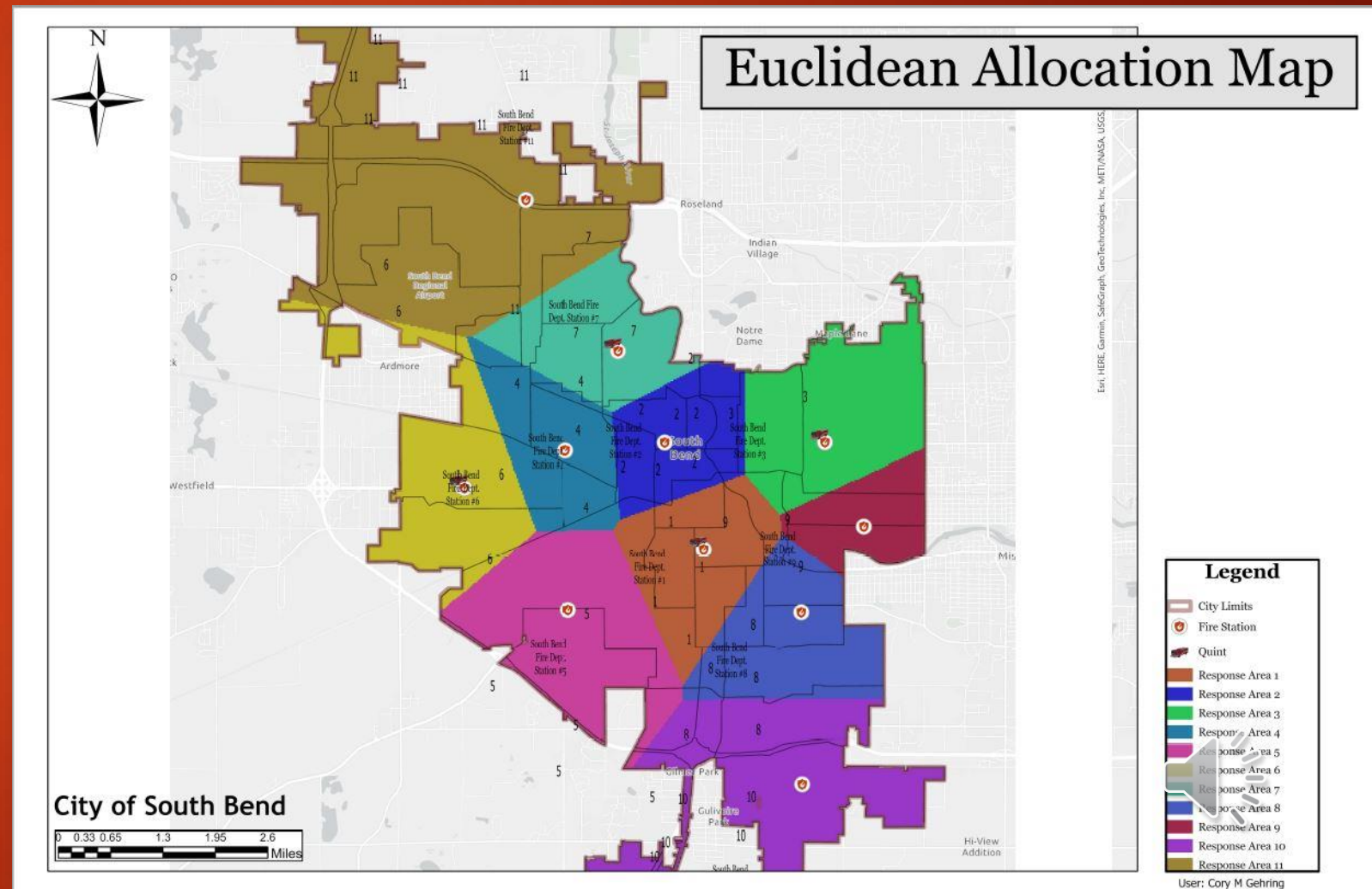
Analysis Conducted

- ▶ Euclidean Distance Tool
 - ▶ Linear Distance
 - ▶ 1-mile rings
 - ▶ Gap in areas 6, 9, and 11.



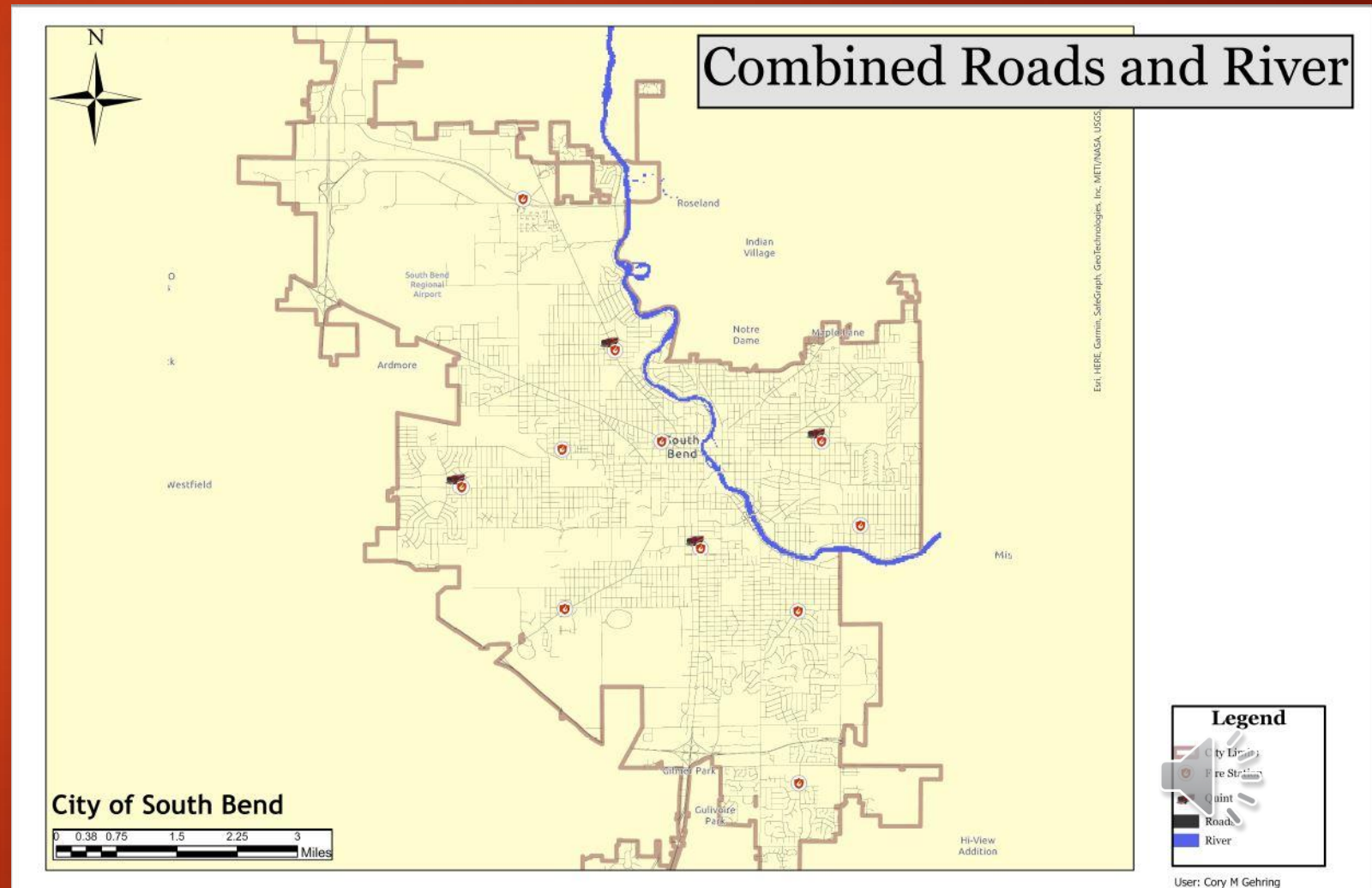
Analysis Conducted

- ▶ Euclidean Allocation Tool
 - ▶ Distance Closest Proximity.
 - ▶ Determined the effect of the Fire Stations on the other cells in the Fire Response Areas on a cell-by-cell basis.
- ▶ Very similar to the current Fire Response Areas.



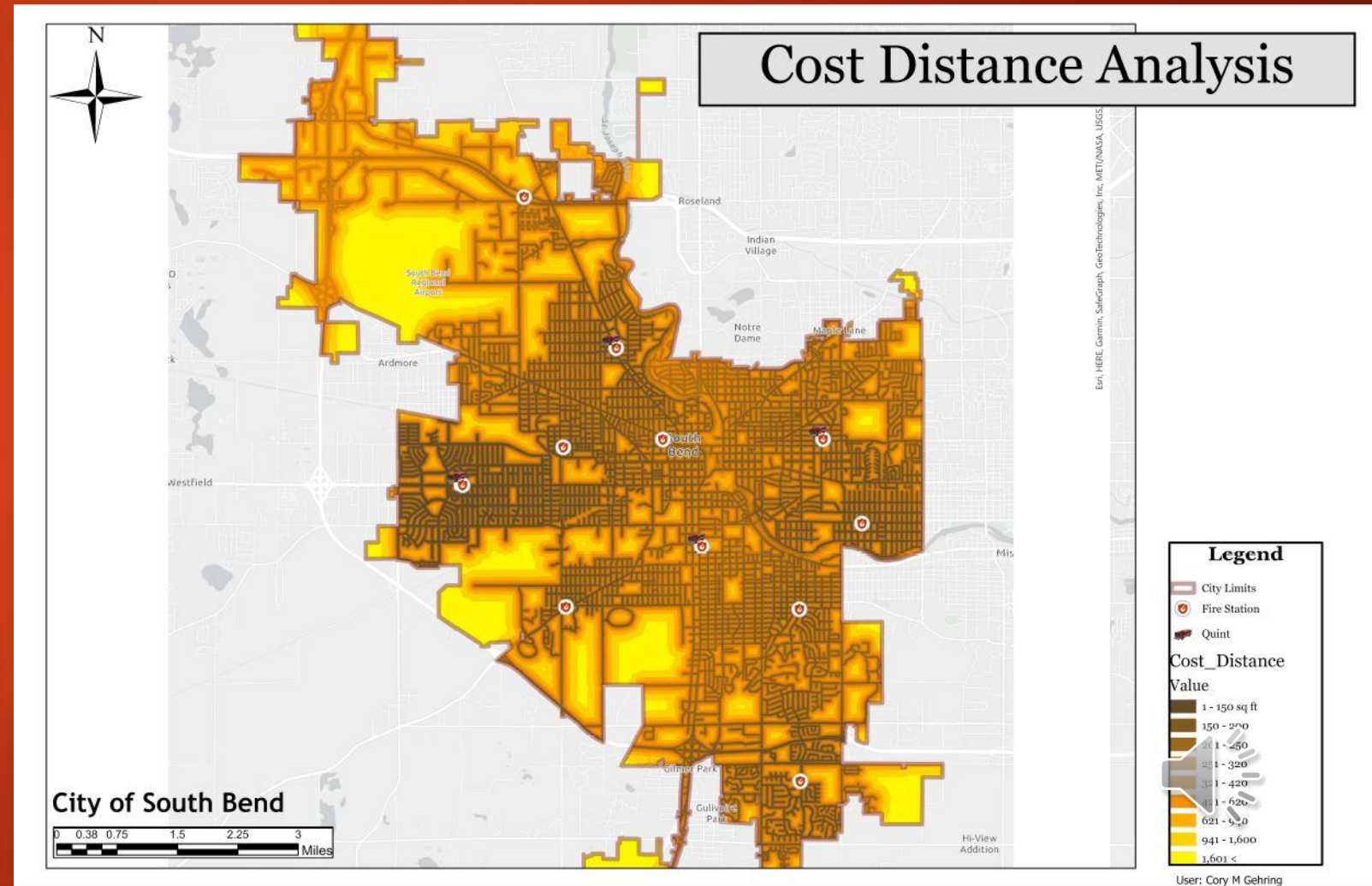
Analysis Conducted

- ▶ Roads and river as obstacles.



Results

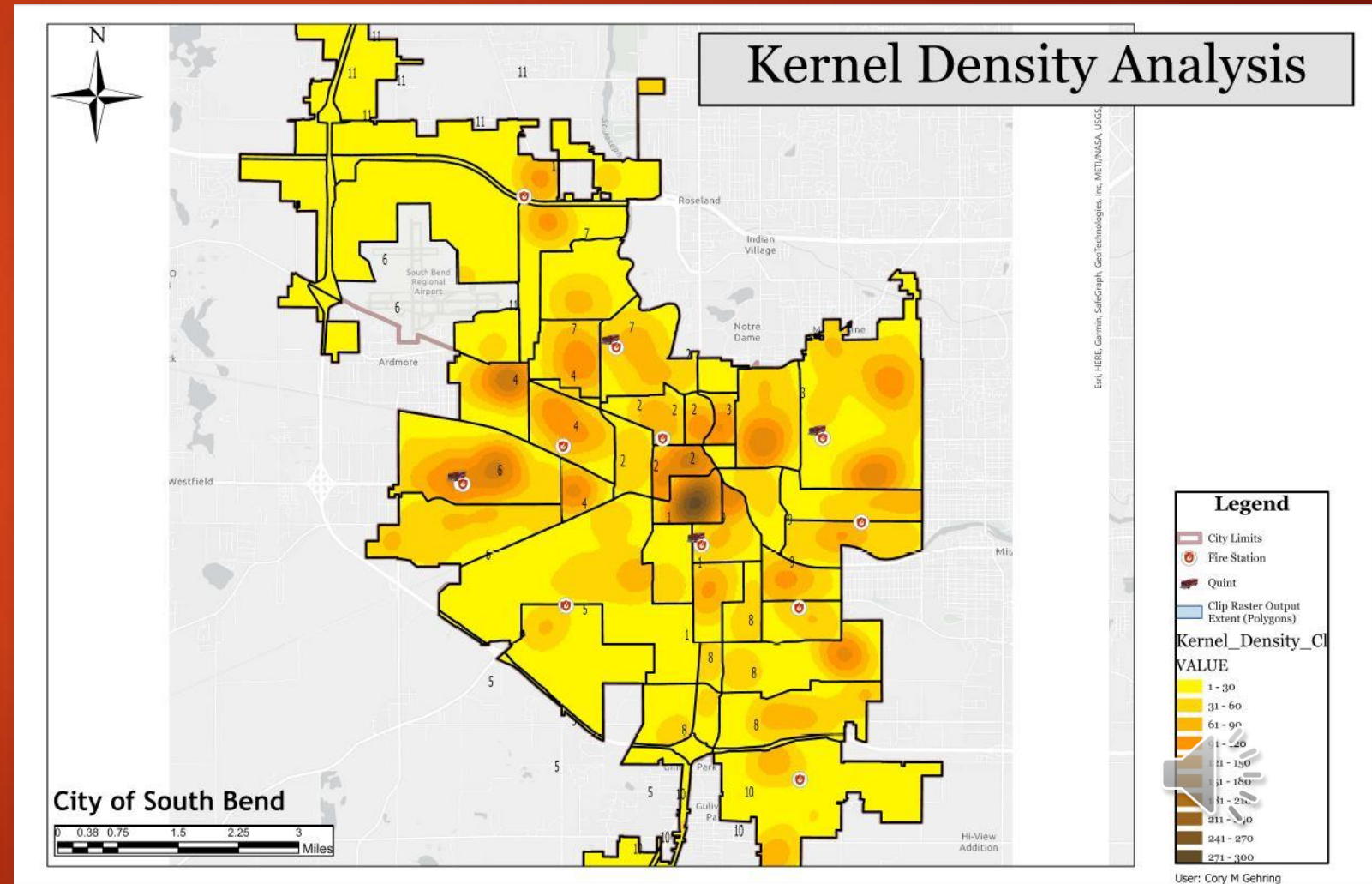
- ▶ Cost Distance Tool
 - ▶ Roads and the river are “obstacles”
 - ▶ Determined the effect of the cost distance incorporating the roads.
- ▶ High travel cost in Fire Service Areas 5, 6, 10, and 11 indicated by the bright yellow.



Results

Kernel Density Analysis.

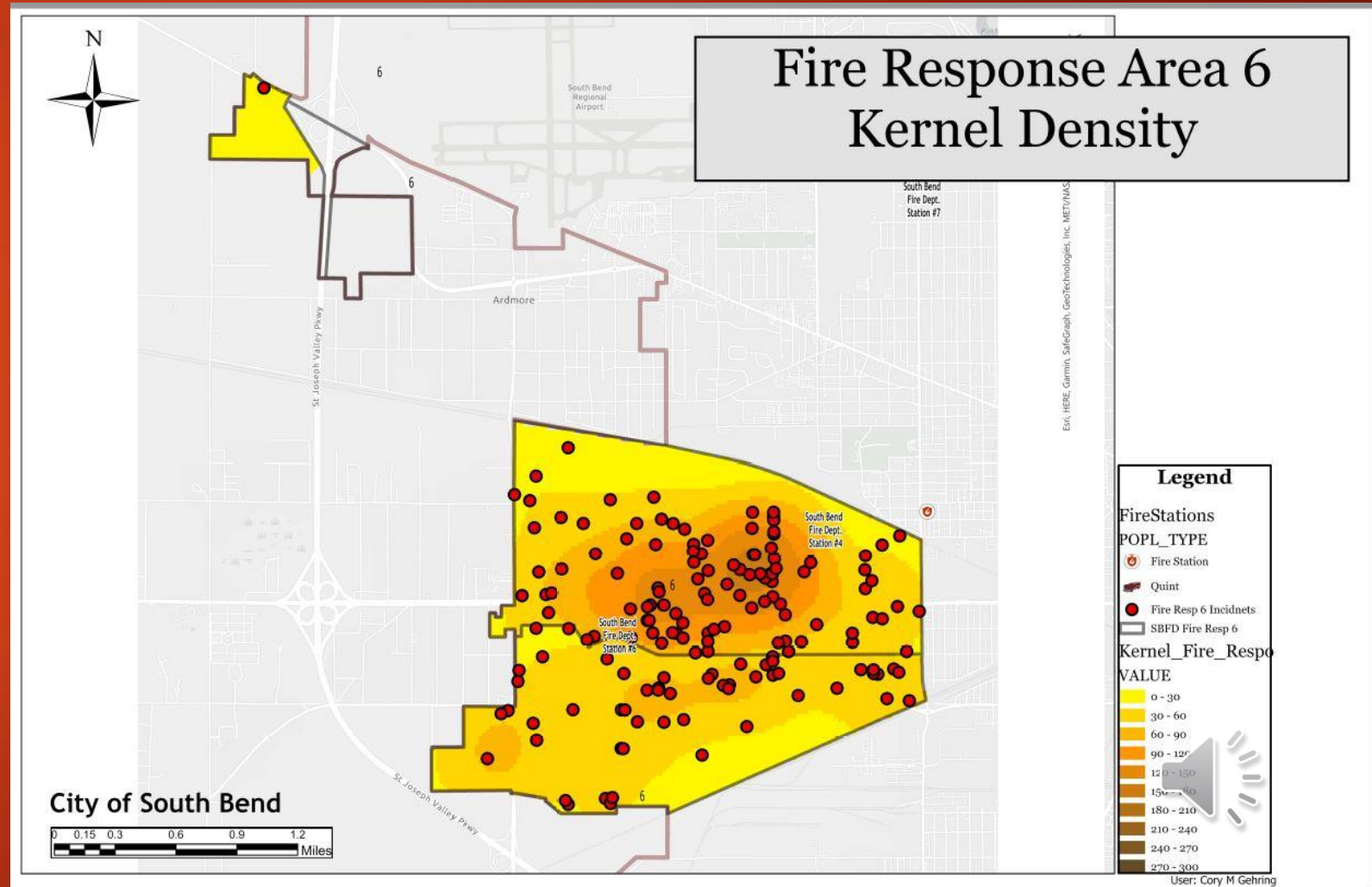
- ▶ Magnitude of alarm calls.
 - ▶ Darker the color, the more volume of calls.
- ▶ Out of the areas identified as possible gaps, Fire Response Area 6 appears to have a need.



Results

Putting it all Together.

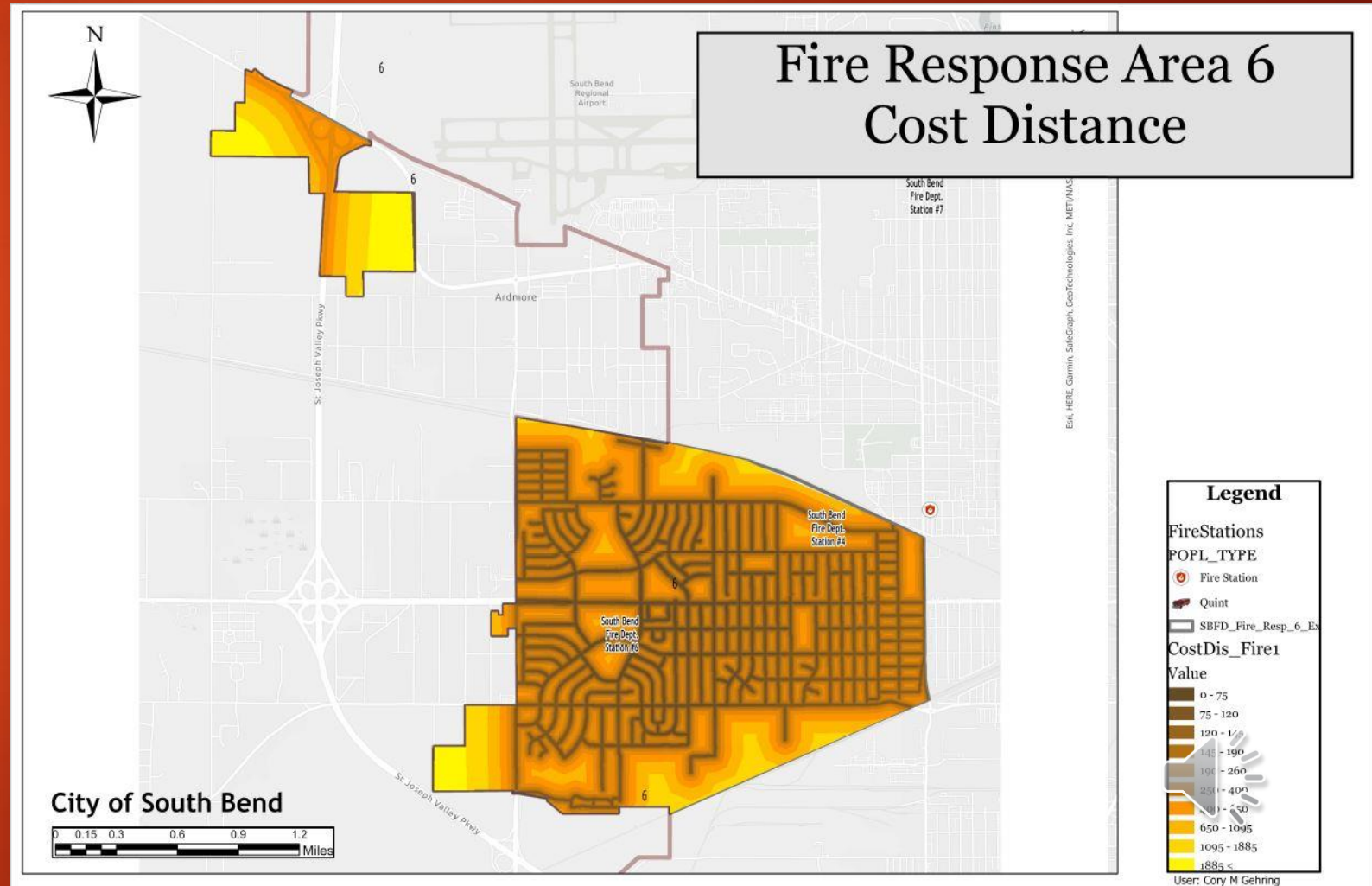
- ▶ Fire Response Area 6.
 - ▶ Appears to have a high alarm call volume.



Results

Putting it all Together.

- ▶ Fire Response Area 6.
 - ▶ Appears to have high-cost distance.
 - ▶ Bright yellow in the northwest, southwest, and southeast.



Discussion

The results were unexpected.



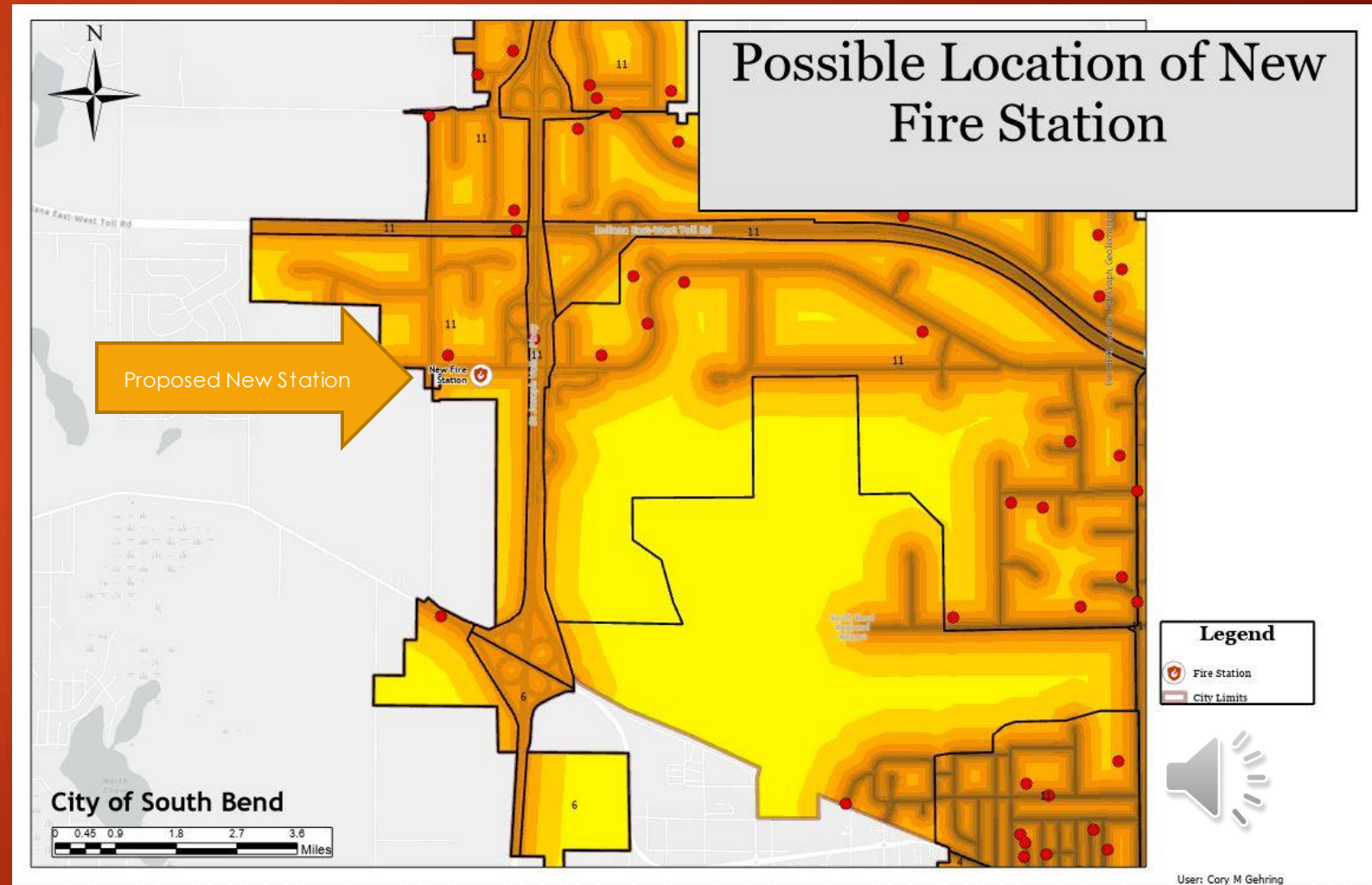
Discussion

If there was a need...



Conclusion

- ▶ Is there an area of the city showing the Sbfd being over-extended?
 - ▶ No.
- ▶ If so, is there a need for a new fire station to be built?
 - ▶ Not currently.
- ▶ If yes, what is the optimal location for the new fire station?
 - ▶ Should one be needed, it should be located between Fire Response Areas 6 and 11.



*Note: Sbfd provided the lot location where the next station is intended. This is ideal as the data of this study suggest.

References

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QUESTIONS?

