RESILIENCE

**Resilient Muncie:
A Prepared and
Responsive City**

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Introduction

Muncie Indiana, like many other cities, has seen new and different challenges in the past decades. These changes have placed a strain on Muncie and its residents bringing increasing concerns involving safety, infrastructure, education, economics, and the environment. The Muncie Resilience Plan is aimed at addressing these concerns and to prepare for challenges that may yet be foreseen. Resilience is now seen as an approach to dealing with such uncertainties. Urban Resilience is a city's ability to bounce back or recover after a destabilizing event, such as a stress or shock. A 'shock' differs from a stressor in that it is a sudden event such as an economic recession, a flood, or a tornado. A 'stressor' on the other hand is a long term or chronic issue such as rising sea levels, housing blight, slowing economic growth, food insecurity, drugs, or poverty that has a debilitating impact on the community.

An article by *Inside Indiana Business* for example noted the closure of the Ball jar manufacturing facility in 2018 observing a continued trend of manufacturing decline in the City. The news article noted that, "The company [Ball Corporation] says the manufacturing work will be outsourced to Ball Metal Food Container LLC in Columbus, Ohio and packaging and distribution efforts will move to the Newell Brands Food Division facility in Fishers" (Brown, Inside Indiana Business, 2018).

Muncie also struggles with a high incidence of poverty involving a number of wide ranging effects like childhood malnutrition, housing blight, and financial constraints. The *Muncie Star Press* noted for example that, "At MCS [Muncie Community Schools], about 75 percent of students qualify for free or reduced-price lunch, which is a much greater percentage than any of the other districts in the county, the report showed. The other districts' percentages are closer to the state rate, 45.7 percent" (Fittes, The Star Press, 2017). This data is alarming, because it indicates a high number of lower income households with children that may struggle with food availability and affordability.

The City is also concerned about the impact of development on the environment. A recent proposal to locate a high polluting firm led to neighborhood push-back which derailed the city council decision. As the *Muncie Star Press* noted, "The public had learned the dust was considered a hazardous waste and the proposed facility would have potentially emitted large amounts of lead, mercury and other pollutants into the air. Hundreds of residents flooded city council members with messages telling them to kill the project, which council had earlier backed by an 8-0 vote" (Ohlenkamp, The Star Press, 2019). In response the City of Muncie now looks to create an Environmental Impact Committee to review development proposals for their environmental impact before they are approved.
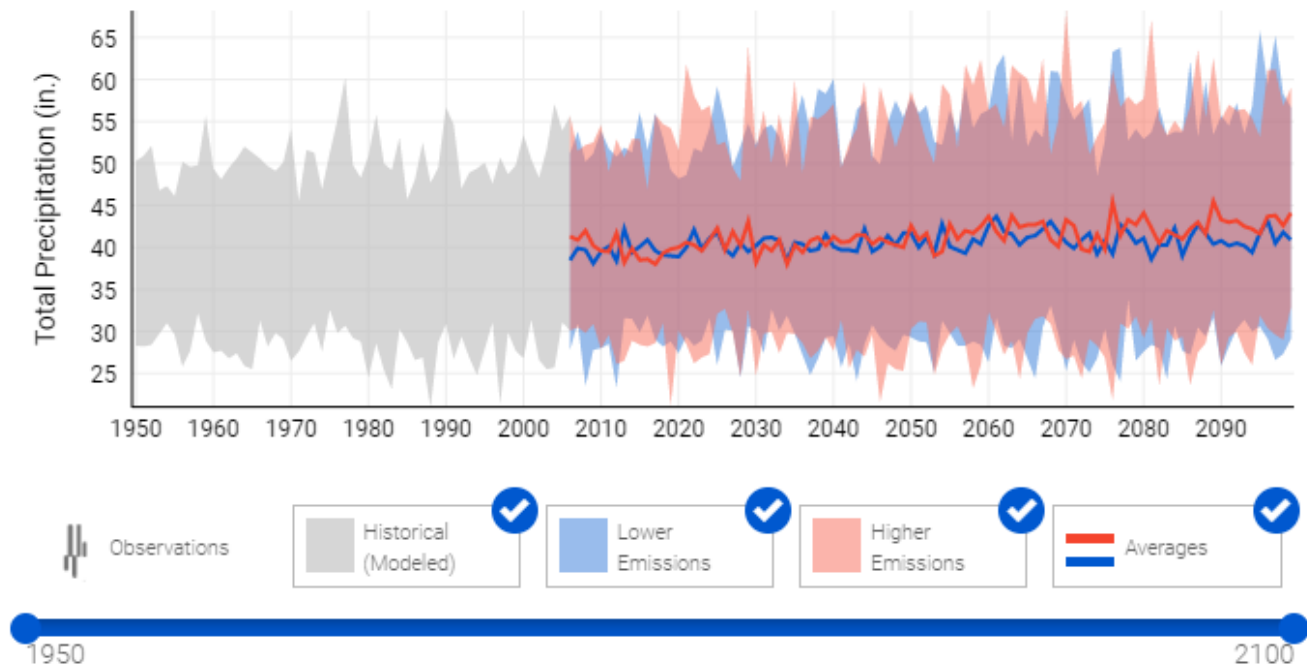
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Figure 1: Precipitation trends in Delaware County, Indiana

The US Climate Resilience Toolkit, a web site developed by the National Oceanic and atmospheric Administration (NOAA) to assist cities in building resilience, shows a general increase in unpredictability of precipitation in Delaware County over the next eight decades as depicted in Figure 1. The increase in unpredictability will place a strain on city infrastructure and the management of flooding.
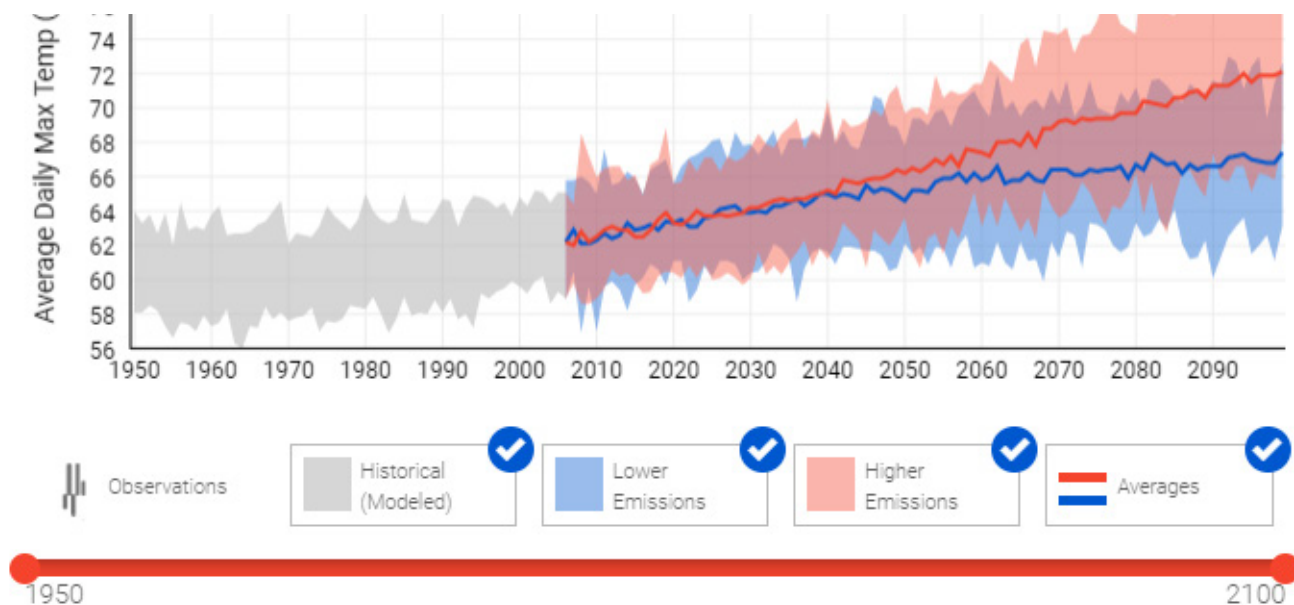
Figure 2: Temperature trends in Delaware County, Indiana.

The US Climate Resilience Toolkit also shows a sharp increase in the average temperatures of Delaware County over the next eight decades as depicted in Figure 2. These findings correspond with global and area trends. This is of concern because a rise in average temperature can affect food production, water availability, and lead to more heat related health hazards, and fire occurrences.

Vision Statement for Muncie

These concerns support the need for a resilience plan and a unifying vision for achieving this goal for the city. Following discussions with civic leaders, a review of documents and a community-wide survey, the following vision statement was crafted to guide the reliance plan:

The Resilience Plan aims to prepare Muncie to adapt to and welcome change.

The Resilience Plan elements and the strategies that have been developed for its implementation all support and reinforce this singular focus of the plan and of the city's future development.

Resilience and Adaptability

Cities of all scales, regions, and climatic conditions face hazards. A hazard is an unpredictable event that destabilizes the functioning of a city or community, damaging property and/or causing harm to city residents. This could involve a severe weather event, such as a major storm or drought, an event directly caused by human activity, such as a toxic chemical spill or pollution. A hazard can consist of any number of immediate shocks or long-term stresses, and poses challenges for community members, policymakers, and local leaders. At their worst, hazards become disasters, with profound and long-term damage.

The risk posed by hazards is projected to increase in the next few decades due to climate change. Climate change is a phenomenon caused by the greenhouse effect, in which gases such as carbon dioxide and methane trap solar radiation in the Earth's atmosphere. Greenhouse gases can be emitted by natural causes such as volcanic eruptions, but a recent surge in these gases and global average temperatures are correlated with human activity--namely air pollution since the Industrial Revolution. This belief is shared by 97% of climate scientists (Cook et al., 2016). Recent effects have been particularly dramatic; 20 out of the last 22 years were the warmest on record (WMO, 2018), and the summer of 2019 involved record-breaking heat waves in Western Europe, India, and the Southern United States. Sea level rise poses flooding risks, particularly as 40% of the world's population lives within 60 miles of ocean coasts (United Nations, 2017), but landlocked areas also face the risks of flash floods from rivers and streams and increased weather abnormalities. Cities are already on the forefront of combating climate change; at 55% of the world's urban population (United Nations, 2018), this rate is projected to rise as climate refugees flee from weather and climate abnormalities. Cities also face unique issues; for instance, impervious surfaces such as asphalt and concrete pose risks such as flooding and trapping heat.

Most hazards faced by Delaware County, particularly those involving abnormal weather events, are predicted to increase in risk in the next few decades. As discussed earlier, according to the U.S. Climate Resilience Toolkit, between 2019 and 2050, average daily high temperatures in Delaware County could rise a full degree. While this may seem minor, it would increase the likelihood of extreme heat and other weather anomalies, such as tornadoes. In recent decades, the world's population has increasingly moved to cities, and in the coming years, the United States is projected to see a surge of climate refugees. Climate refugees will come from both tropical countries already prone to flooding, such as Bangladesh, the Maldives, and Caribbean nations, and from coastal regions within the United States. This could result in a population increase, but factors could decrease population at the same time. Since the US economy has

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shifted its focus from manufacturing to service, post-industrial mid-sized cities including Muncie have witnessed residents move to larger cities. In either case, cities across the globe are preparing their housing stock and infrastructure for these growing irregularities.

As we've seen earlier in this discussion, hazards can come in the form of stresses and shocks. A shock is a singular, fast-burn event most typically associated with the term "disaster." This may include a severe weather event or industrial accident. A stressor, however, is a chronic, "slow-burn" issue that impacts communities over generations. This may include poverty, homelessness, or unemployment. Both types of hazards will pose increasing risks in the coming decades, as climate change impacts not just weather conditions but economies. If a city or community is adaptive and well-prepared to face hazards, they do not always become disasters. A disaster is defined as the combination of a hazard and vulnerability. Resilient cities are able to "bounce back" or recover from these destabilizing events, preventing them from becoming full-scale disasters. One measure of disaster risks for a given community is the Calculated Priority Risk Index (CPRI). Using this method, we calculated Muncie's risks for hazards as follows:

Probability*0.45 + Magnitude/ Severity*0.30 + Warning Time*0.15 + Duration of Event*0.10

The highest priority risks in Muncie, given this analysis, are flooding, tornados, and severe winter storms. The priority levels of the ten highest risks are shown in Table 1.

Risk	CPRI (Max=4)
Flooding	3.1
Tornados	3.1
Severe Winter Storm	3.1
Electricity Failure	2.9
Thunderstorms	2.8
Extreme Heat	2.7
High Winds	2.6
Hazardous Materials	2.6
Water Main Failure	2.5
Drought	2.5

Table 1: Calculated Priority Risk Index (CPRI) for the City of Muncie, Indiana

Process in Development of the Resilience Plan

Several steps were used in the development of the resilience plan. We first reviewed previous plans for the city to get a good understanding of the city's priorities, what has been implemented in the past, and where additional focus may be needed. Next, we assessed the hazard risk index for the city using the Calculated Priority Risk Index (CPRI) to determine the likely hazards that could impact the city. We also conducted a community survey using Qualtrics, an online survey tool that obtained responses from community residents. Several civic leaders were also interviewed to gain insights about the state of resilience of the city and how their organizations are contributing to making Muncie a resilient place. These steps are outlined in Figure 3. Findings from these different approaches were synthesized and used to guide the development of the Resilience Plan. An elaboration of these methods is provided below.
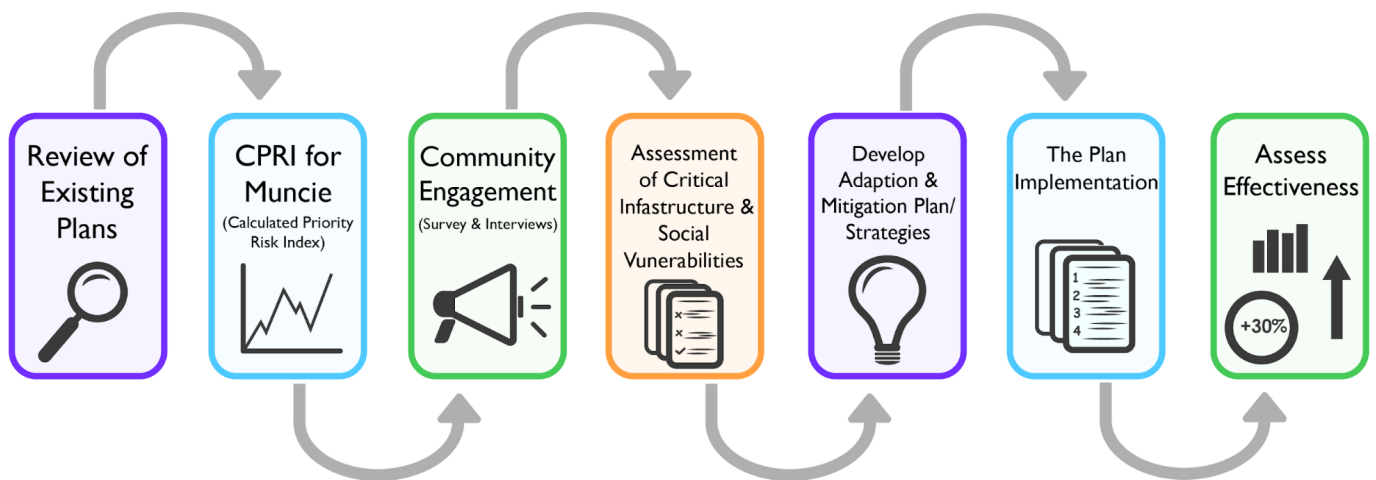

Figure 3: Process in the development of the Resilience Plan

Review of Existing Plans

A review of the existing plans showed that Muncie has been concerned with disaster readiness for over eight decades with the first disaster plan prepared in 1939. We did not return to this issue until recently, 2019. The specific plans that were reviewed are: the Muncie Action Plan 1 (MAP1), Muncie Action Plan 2 (MAP 2), Delaware-Muncie Transportation Plan Update, Disaster Preparedness, East Central Indiana Regional Development Plan, Hazard Mitigation Plan, Muncie-Delaware County Economic Development Alliance VISION 2021, Public Transit Human Services Coordination Plan, and the Comprehensive Plan (Appendix B). A common theme of previous plans include a need to combat sprawl, job training/creation, and promoting economic investment in the city. Overall most of the plans are lacking in specificity about how to achieve these goals, and in some cases advance contradictory strategies. Plans regarding resilience are implied, but not typically directly addressed, some plans were overly optimistic, and did not accommodate uncertainties or effects of climate change. These shortcomings underlines the need for a resilience plan for Muncie.

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Community Engagement

In addition to a review of the existing plans we also interviewed civic leaders. The survey was distributed, and shared throughout various networks (e.g. websites, social media, etc.). In all, 117 people responded to the survey, 56% of whom were Muncie residents. The median income of respondents ranged from $50,000 to $99,999, and the median educational level was of a bachelor's degree. It should be noted that the Chamber of Commerce assisted in the distribution of the survey to its members and thus the survey results may be biased in favor of higher income earners and those with a higher education. Roughly 83% of the survey respondents said that Muncie should be concerned with resilience.

In addition to the survey, interviews were set up with civic leaders (their titles can be found in Appendix C). The civic leaders were asked separate, more in depth questions pertaining to resilience within Muncie and its causes/effects. Figure 4 shows the responses from civic leaders to the question, "Do you think Muncie should be concerned with resilience?" Their response was similar to the findings from the resident survey where roughly 83% said that Muncie should be concerned with building resilience.

What we found in our discussions with civic leaders is that they were most concerned with the everyday stressors that affect the city such as housing blight and building a diverse economy than with shocks. The one shock that was of concern was that of an economic recession. With respect to stressors their primary concerns was with housing blight and affordability as seen in Figures 5 and 6.
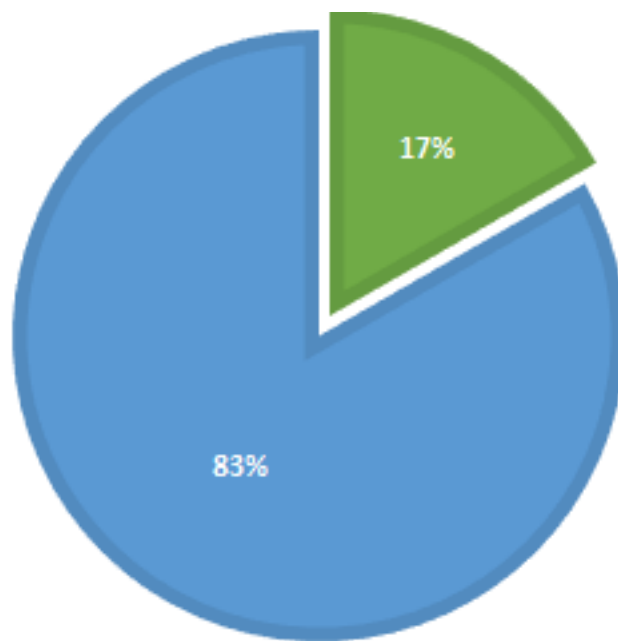

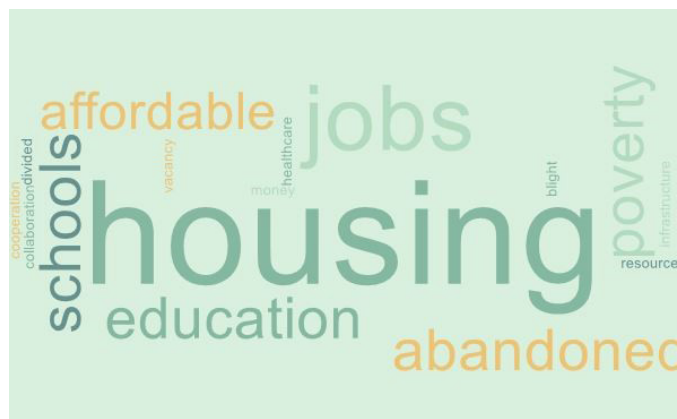Figure 4: Civic leaders views of building resilience in Muncie, Indiana

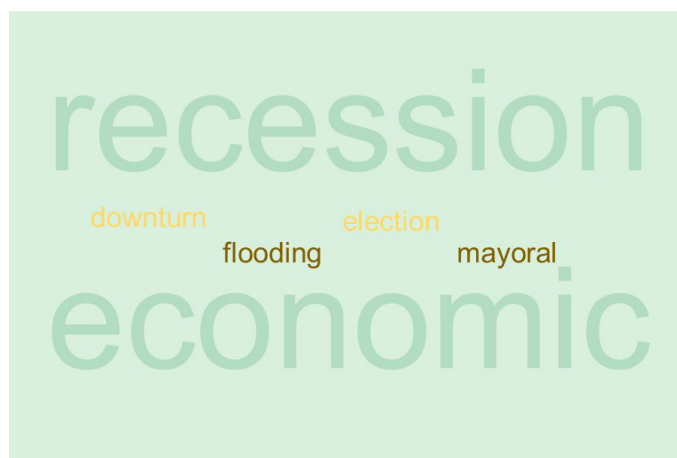Figure 5: Major concerns of civic leaders

Figure 6: Expectations of civic leaders about future shocks

Table 2 further shows a comparison of the findings from both the civic leaders and community residents. Again, in both cases the everyday stressors were more of a concern than potential shocks. Civic leaders were most concerned with poverty, housing blight and deindustrialization, while city residents expressed concern for economic recession, corruption and poverty as their top concerns.

Civic Leaders	Survey
Poverty	Economic Recession
Blight	Corruption
Deindustrialization	Poverty
Education	Blight and Housing Vacancy Rates
Mental Health	Drugs
Drugs	Homelessness
Lack of Trust	Lack of Trust

Table 2: Comparison of concerns of civic leaders and community residents about Muncie's development

In sum, the findings from the community engagement led us to the following conclusions:

- There is an overwhelming support among civic leaders and residents for the city to create a resilience plan.
- Civic leaders and residents are most concerned with the everyday stressors than of potential shocks that will impact the city.
- Priority action areas include fighting housing blight and vacancies, poverty alleviation, and perceived corruption in local government.

Other areas of concern are:

- Improving communication in city government and between the city and county government,
- Providing an attractive environment for economic investment,
- Support for local businesses, especially in times of an economic recession,
- Improving city infrastructure such as roads, bridges, and sidewalks,
- Improving the public school system, and
- Attention to flood risks.

Assessment of Critical Public Infrastructure

We conducted an assessment of critical public infrastructure to determine their adequacy to meet the needs of the city in the case of a hazard. These critical infrastructure included: Libraries, Government Buildings, & Schools, Police, Jails, & Railroads, Assisted Living Facilities, Care Facilities, Medical Facilities, Emergency Operations, & Evacuation Routes, Emergency Shelters, Railroads, Airports, Communication Facilities, Parking Lot Coverage and Greenspace, Roadway Capacity, Water Facilities, Evacuation Routes, Major Intersections, Bridges, and Floodplains. Findings from this assessment are provided next.

Assessment of Transportation and Road Conditions

We identified several roads that are at, near, or over capacity through current AADT (Average Annual Daily Trips) as well as information retrieved from current plans such as the Delaware-Muncie Transportation Plan. The segments of the roads that would need future improvements or expansions are as follows: McGalliard, West Morrison, Tillitson, Wheeling, Bethel, Hoyt, Wyser, and more. By 2030 Bethel, Tillotson to Mcgalliard, and some sections of Burlington and Jackson will be well above capacity. Figure 7 contains graphical representation of future and current at, or above-capacity roads.

Although there are designated evacuation routes for Muncie (see Figure 8), there are no wayfinding signs directing people to the exit points. This will be a major problem in the event of a disaster where people need to leave the city.
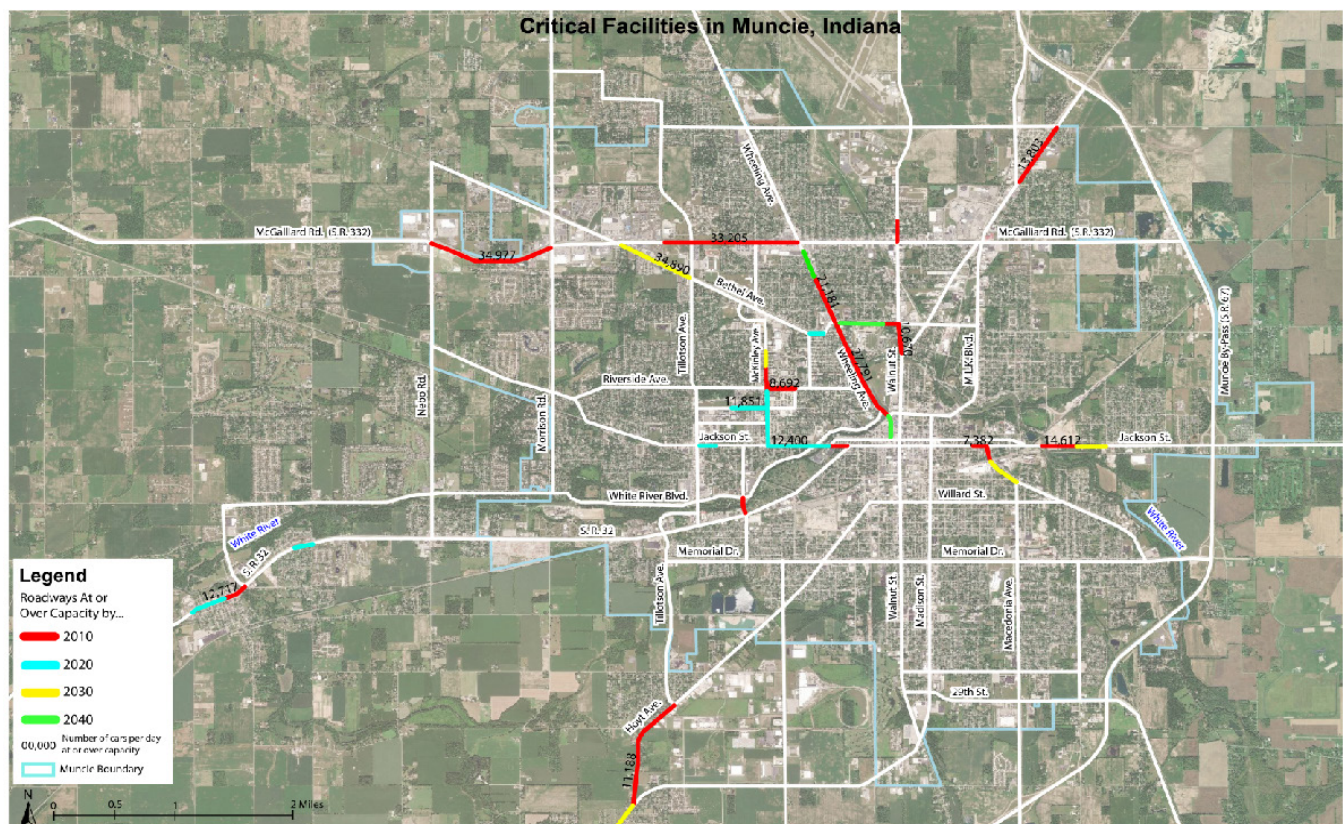
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Figure 7: Roads that at or above capacity based on AADT.

Figure 8: Evacuation routes in Muncie.

Assessment of Utilities (M)

We gathered information on the locations and vulnerabilities regarding certain utilities including, but not limited to: waste water, electrical substations, television towers, cellular towers, sirens, and radio stations. Through the analysis of the data and mapping, we found gaps in siren coverage as well as the location of two main clusters of electric transmission lines and substations, which if destroyed could pose city-scale electrical issues. Represented in Figure 9 are the substations and electrical issues presented within the North and North West corners of Muncie, as well as issues with siren coverage in the case of a city-wide emergency. Figure 10 shows the water treatment facilities in the city. It is important that care is taken to insure that these are not damaged in a disaster.
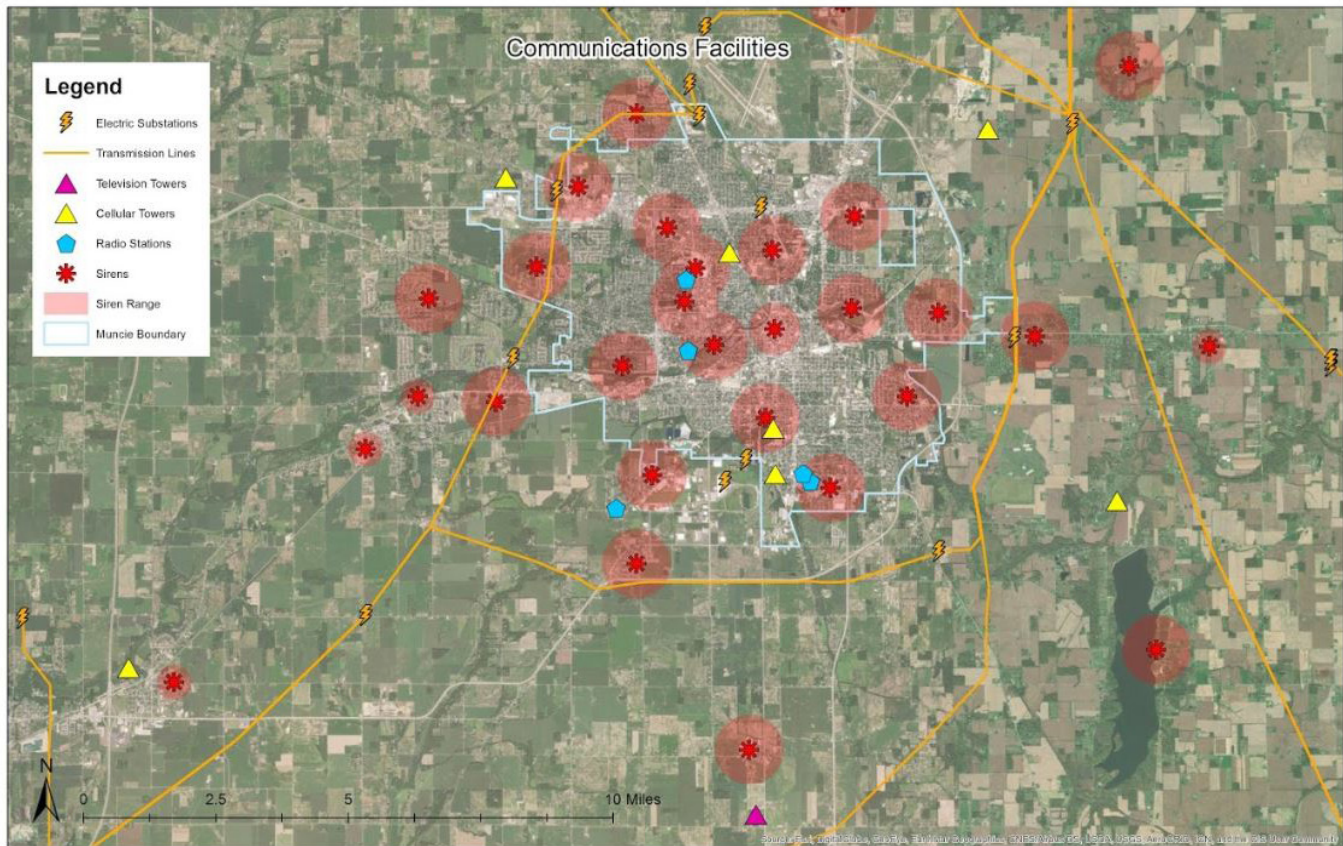
Figure 9: Siren coverage and electrical substations in Muncie.

Figure 10: Water facilities locations

Assessment of Flooding Potential

The City of Muncie is located along the White River and this makes it liable to flooding. The resulting flooding when it occurs will impact a large segment of the city's population, ranging anywhere from a low of 453 people to a high of 1,288 people, and from a low of 20 businesses to a high of 228 businesses and affecting up to 7% of the city's employees (see Figure 11 and Table 3). This is based on 2017 Census data; Muncie population of 68,505, total businesses of 2,720, and Muncie employee count of 37,412. Table 3 shows the impact of flooding on residents, businesses and employees.

Floodplain Class	Population	Businesses	Employees
Floodway	453 (0.66%)	20 (0.74%)	200 (0.53%)
100 Year Flood	1,275 (1.86%)	62 (2.28%)	792 (2.12%)
500 Year Flood	2,429 (3.55%)	99 (3.64%)	1,146 (3.06%)
Flood Risk Reduced by Levee	1,288 (1.88%)	47 (1.73%)	585 (1.56%)
All Floodplain Classes	5,445 (7.95%)	228 (8.39%)	2,723 (7.28%)

Table 3: : Impact of flooding on residents, businesses and employees

Figure 12 shows the amount of land that is taken up by parking as well as green space in the city. Parking contributes to excessive run off because of the impervious surface it creates. By contrast green and vegetative cover decreases runoff and so helps to control flooding. Figures 13 and 14 further shows the number of buildings within the different types of floodplains along with the corresponding land use for each area.
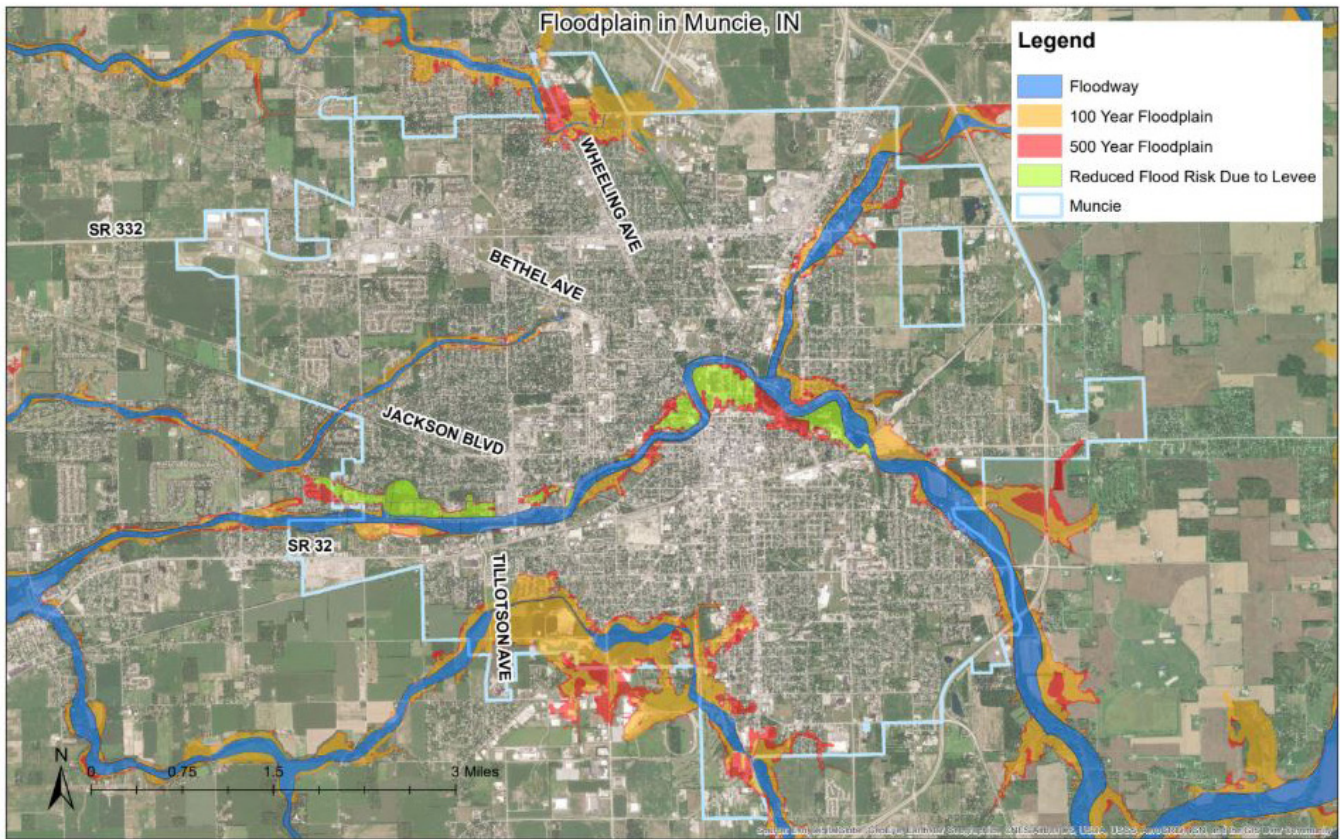
Figure 11: Flood risks in Muncie along the White River.
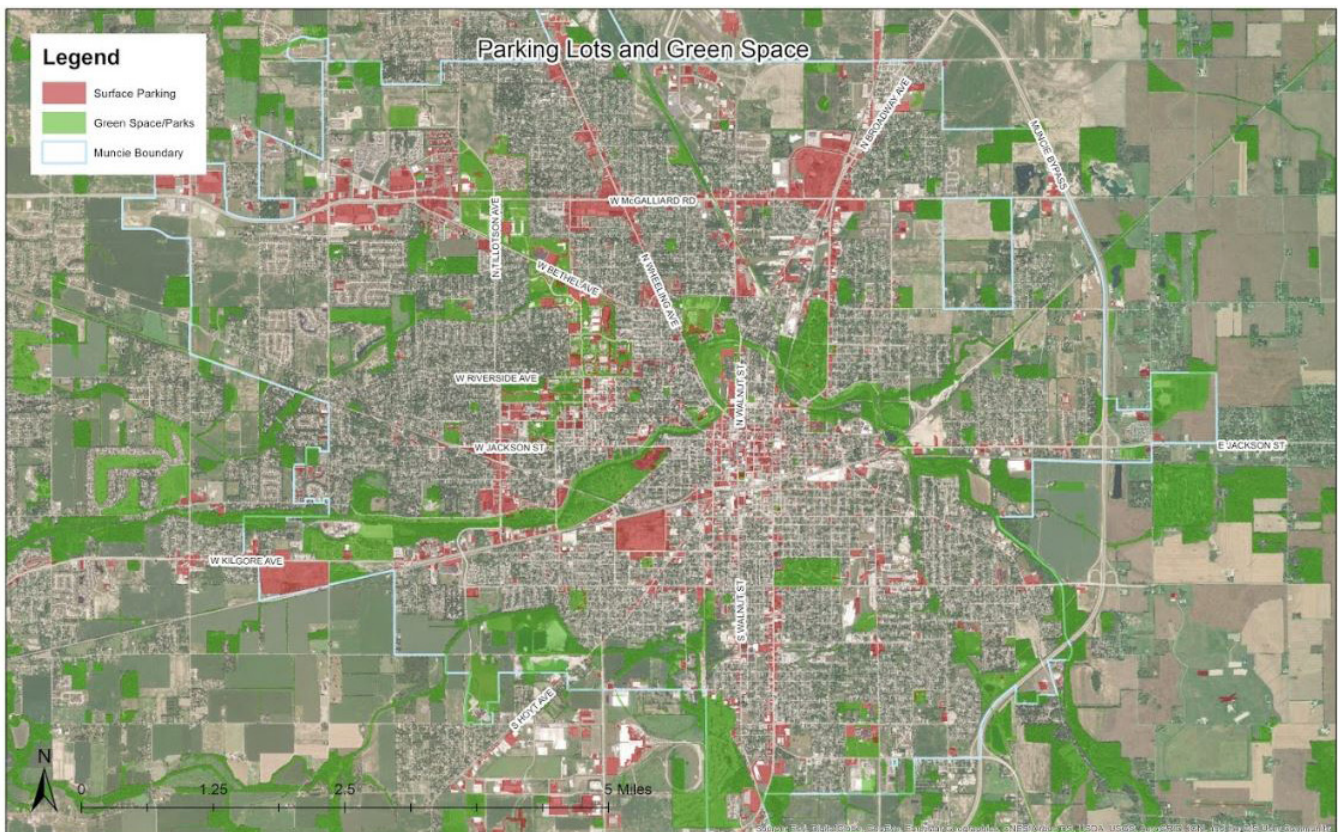
Figure 12: Impervious and green space in Muncie
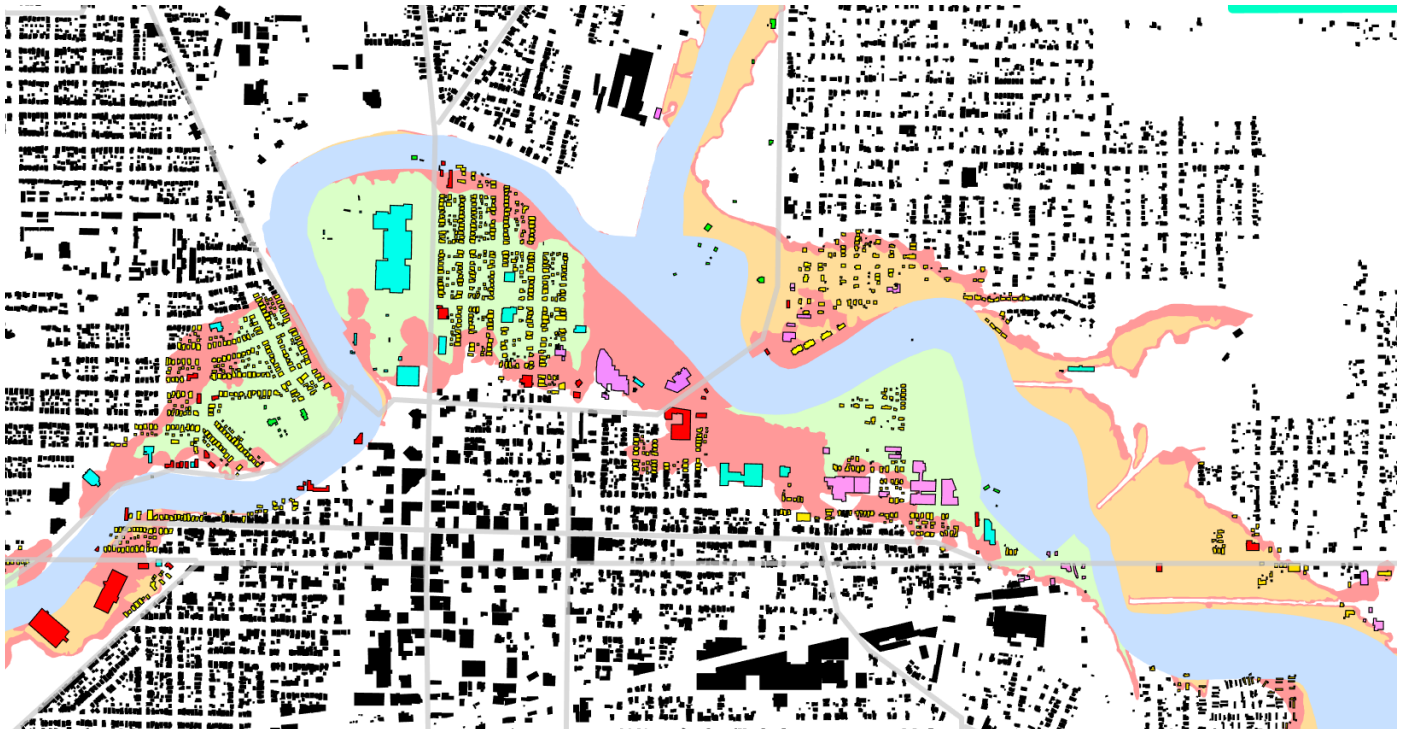
Figure 13: Buildings Affected by Floodplains

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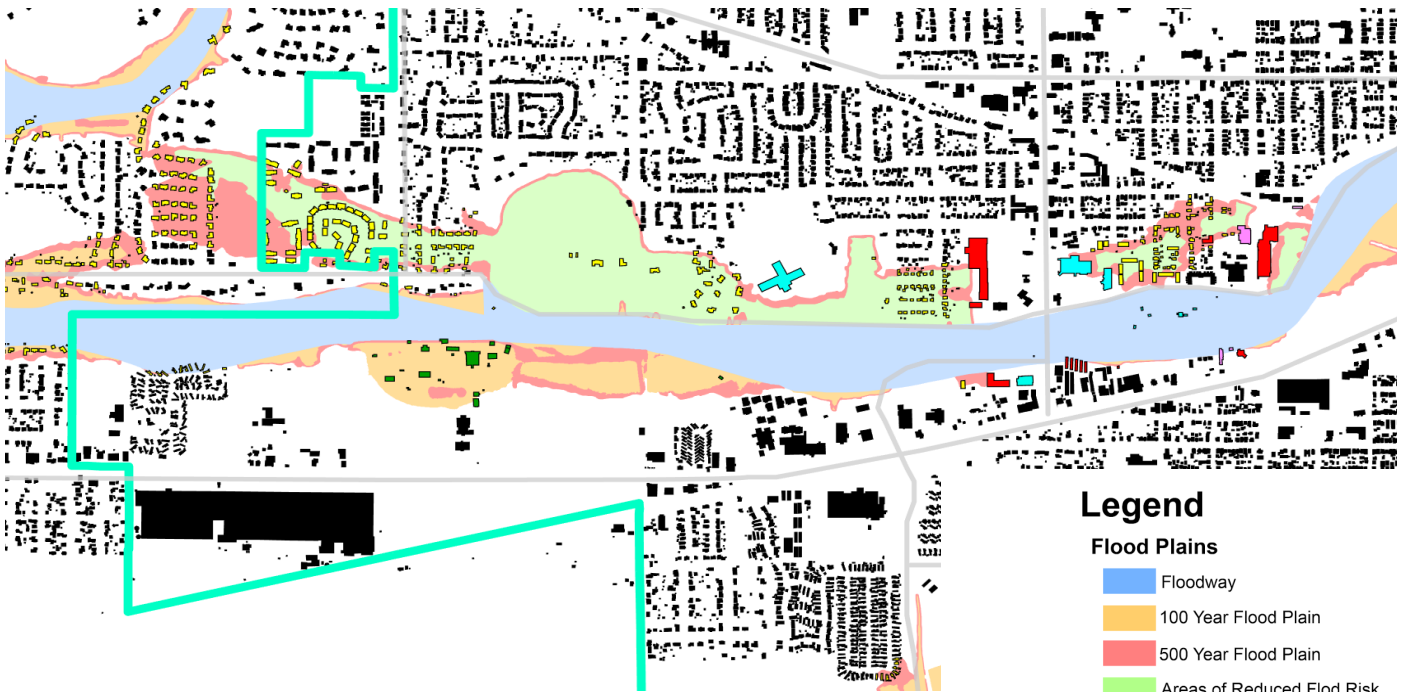
Figure 14: Buildings Affected by Floodplain

Legend

Flood Plains

Floodway

100 Year Flood Plain

500 Year Flood Plain

Areas of Reduced Flod Risk
due to Dams or Levees

Land Uses

Residential

Industrial or Warehousing

Commercial

Instituional or Medical

City Services or Utilities

Muncie Boundary

Major Roads

Assessment of Civic and Cultural Amenities

We mapped several civic and cultural facilities in the city including child care facilities, libraries, and government buildings (see Figure 15). Our analysis revealed that city and county government buildings are all centrally located in downtown. This is convenient for conducting business but may also pose a security problem should these buildings be damaged in a disaster.
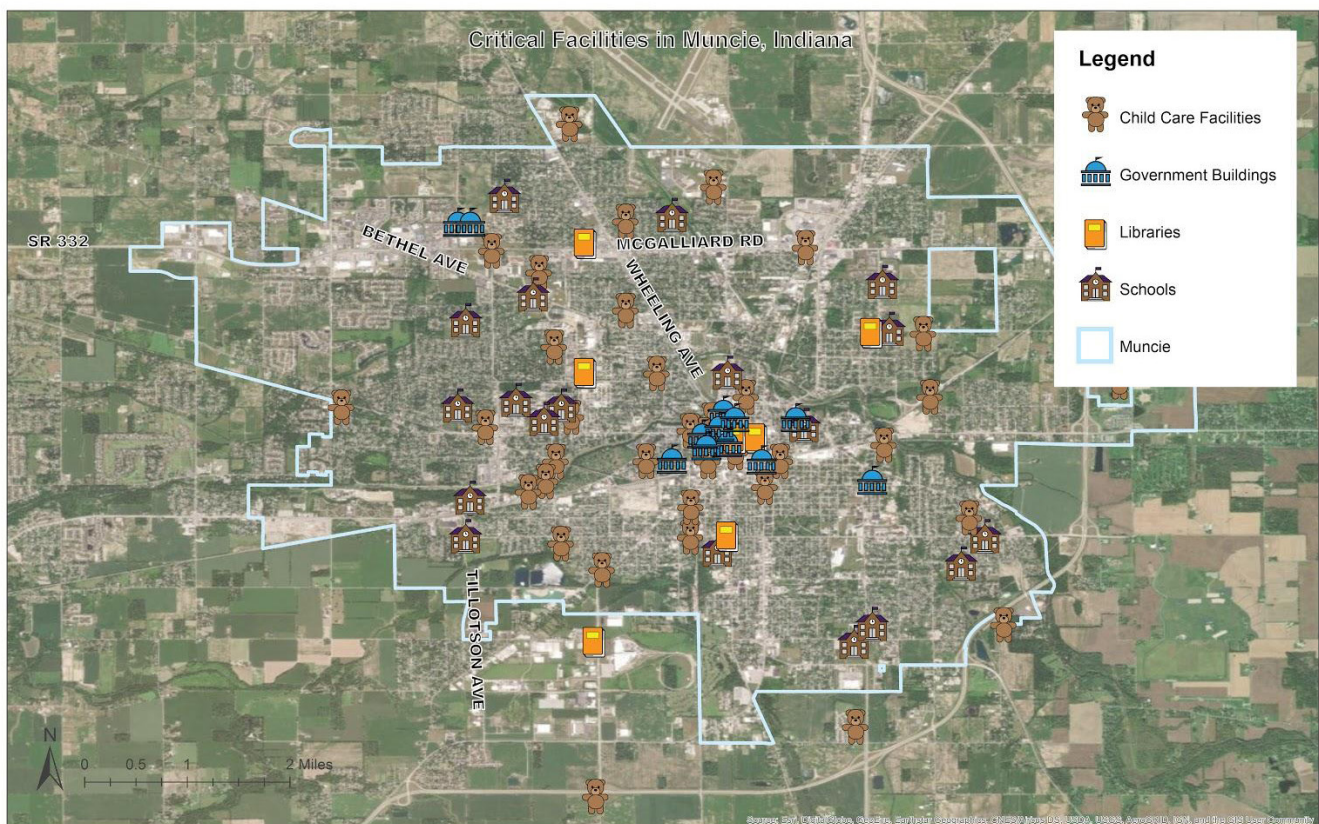
Figure 15: Location of city and county government buildings

Assessment of Health and Medical Facilities

Figure 16 shows that most medical and assisted living facilities are located along major evacuation routes except for Elmcroft of Muncie, Woodlands, Ball Memorial, and Waters of Yorktown. Thus, there is a need to synchronize traffic flow at intersections where nursing facilities are located to ensure smooth evacuation of residents during a disaster.
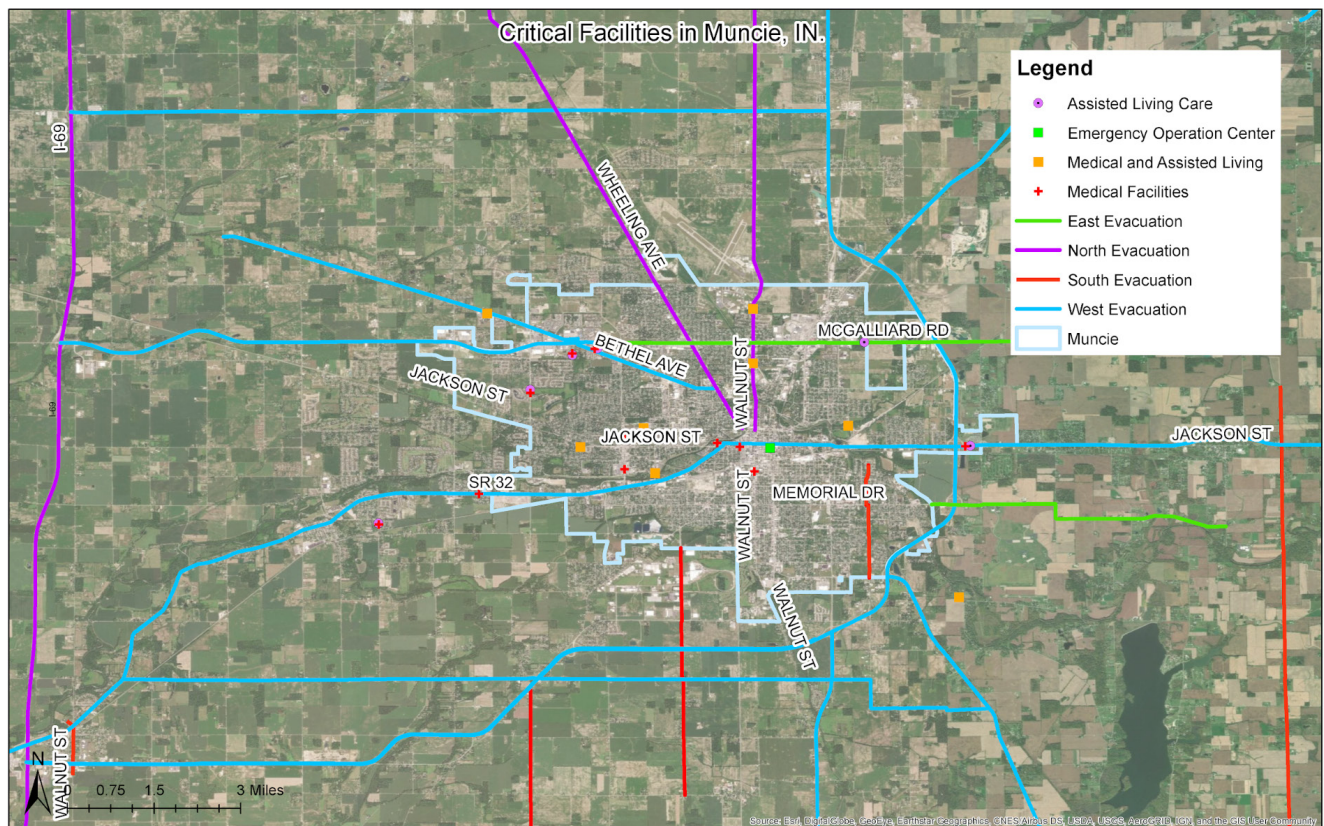
Figure 16: Location of medical and assisted living facilities

Assessment of Emergency Services

Emergency medical facilities will support first responders in an emergency. Thus their location and condition is critical to the resilience of the city. Figure 17 shows the location of emergency shelters. Currently there are no state or local guidelines on how to locate emergency shelters. Thus there is a need to develop guidelines on how to identify and locate emergency shelters, especially schools that can be used as emergency shelters.

Figure 17: Location of emergency shelters

Table 4 summarises the key findings from the assessment of the critical infrastructure and the planning implications from the findings. In the main, the table shows a need to augment services where there are deficits and to strengthen the city's capacity to withstand hazards when they occur.

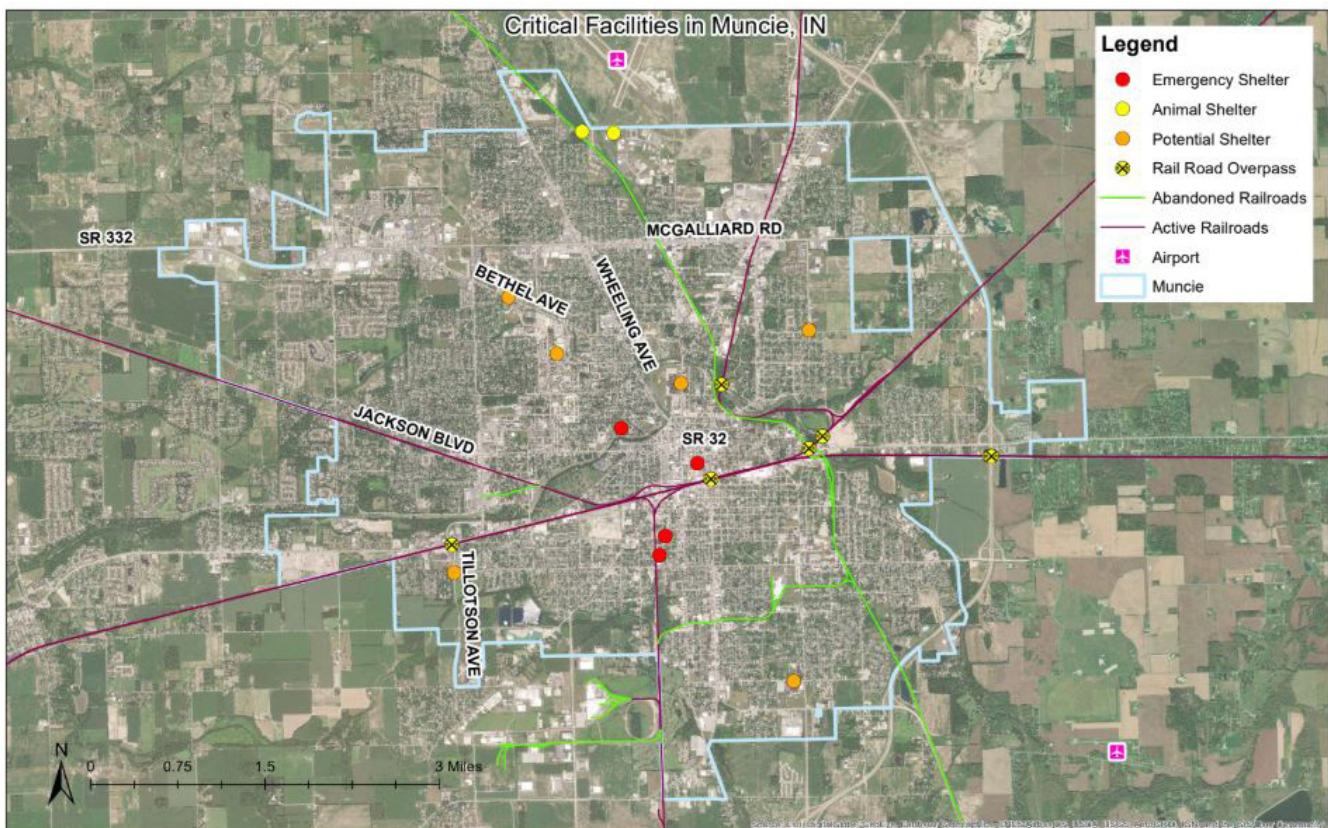| Assessment	Findings	Planning Implications
Libraries, Government Buildings, & Schools	Nucleated location of government buildings can make us vulnerable in events that render the facilities unavailable.	Plan for continuity of services and operations in the event of damage to government buildings.
Police, Jails, & Railroads	Muncie has 4 police stations but none in the south or northwest. It also has 3 cop shops, but none located in the north.	Provide cop shops and more coverage of police services to the northwest where there are no cop shops.
Assisted Living Facilities, Care Facilities, Medical Facilities, Emergency Operations, & Evacuation Routes	Most medical and assisted living facilities are located along major evacuation routes except for Elmcroft of Muncie, Woodlands, Ball Memorial, and Waters of Yorktown.	Synchronize traffic flow at intersections where nursing facilities are located.
Emergency and Fire Facilities 4-8 Minute Response Time	Emergency: 4-minute response time leaves most of the city uncovered. The 8-minute response time leaves parts of northwest, some pockets in the north and east uncovered. Fire: Not all of Muncie is covered in the 4-minute response map particularly east and west	Emergency: Limit northwest growth and/or expand services Fire: Locate at least three more fire stations in northwest, southwest, and east.
Emergency Shelter, Railroads, Airports, and Communication Facilities	Data shows gaps in siren coverage. North of Muncie, there are two main clusters of electric transmission lines and substations. 4 emergency shelters that are all small and located downtown.	Release guidelines on how to identify and locate emergency shelters, including school facilities. Fortify and decentralize electric substations.

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Assessment	Findings	Planning Implications
Parking Lot Coverage and Greenspace	Several census blocks groups (about 10) without any or with very little green space. Overall Muncie has low coverage of green space.	Prioritize areas with little to no green spaces to have more landscaping. Include in subdivision regulations.
Roadway Capacity, Water Facilities, Evacuation Routes, Major Intersections, and Bridges	Several roads are at/ near/ or over capacity, including McGalliard, W Morrison, between Tillotson and Wheeling, Hoyt, and from Wysor to McGalliard.	Prioritize the expansion of roads that are above capacity or near capacity in Muncie Multi-year Capital Improvement Plan
Assisted Living Facilities, Care Facilities, Medical Facilities, Emergency Operations, & Evacuation Routes	Most medical and assisted living facilities are located along major evacuation routes except for Elmcroft of Muncie, Woodlands, Ball Memorial, and Waters of Yorktown.	Synchronize traffic flow at intersections where nursing facilities are located.
Floodplains	The floodplain is large and affects several of Muncie's critical features including: 9.90% of the population and 11.30% of businesses	Use planning regulations to protect residents from poor building standards. Ensure property owners in floodplain have access and can buy into the National Flood Insurance Program. Develop and prepare brochure for those who reside in the floodplain about mitigation and adaptation procedures. Work with the Army Corps of Engineers to protect buildings in the floodplain.

Table 4: Summary and Resilience Planning Implications from Assessment of Critical Public Infrastructure

Assessment of Social Vulnerabilities

In addition to the critical public facilities, we also conducted an assessment of the city's social vulnerabilities. We did so primarily through the resident survey and discussions with civic leaders. We assessed the city's vulnerabilities with respect to housing affordability, housing quality and adequacy, employment, education, poverty, and social inclusion. As shown in Table 5 in comparison to the state of Indiana, Muncie has higher levels of poverty, brownfields per capita, SNAP and food stamp recipients, as well as a higher housing burden, unemployment rate, and a higher rate of housing vacancies, among other social indicators.

Indicator	Muncie	Indiana
Poverty	29.9%	14.6%
Brownfields	52 brownfields **1.8%** of Muncie residents are affected 2.71% of brownfields of Indiana	1,921 brownfields 0.028% of Indiana residents are affected
SNAP/Food Stamps	**14.7%**	11.5
Persons over 18 w/o HS Diploma	9.9%	12.3%
Limited English Households	0.44%	1.73%
Households with No Vehicles	2.10%	6.67%
Disability	**17.1%**	13.8%
Housing Burdened (Rent)	**48.65%**	41.71%
Housing Burdened (Mortgage)	20.93%	22.7%
Unemployment Rate	**3.9%**	3.3%
Median Household Income	**$41,255**	$52,182
Elderly (85+)	**2.14%**	1.91%
Vacant Housing Units	**8.45%**	4.79%

Table 5: Benchmark Comparison with State

Figure 18: Major concerns of residents about resilience in the City of Muncie

A word cloud that was generated from the responses of residents highlights these concerns. Here, we see that the everyday stresses such as poverty, corruption in government, and housing blight, as well as the potential shocks of flooding and tornados were mentioned as important issues (see Figure 18).

Leadership and Communication

We asked residents for their views on leadership and communication and the survey revealed that the areas in which we need to work on to build resilience for Muncie are communication between the city and county government as well as coordination between the different government departments (see Figure 19).
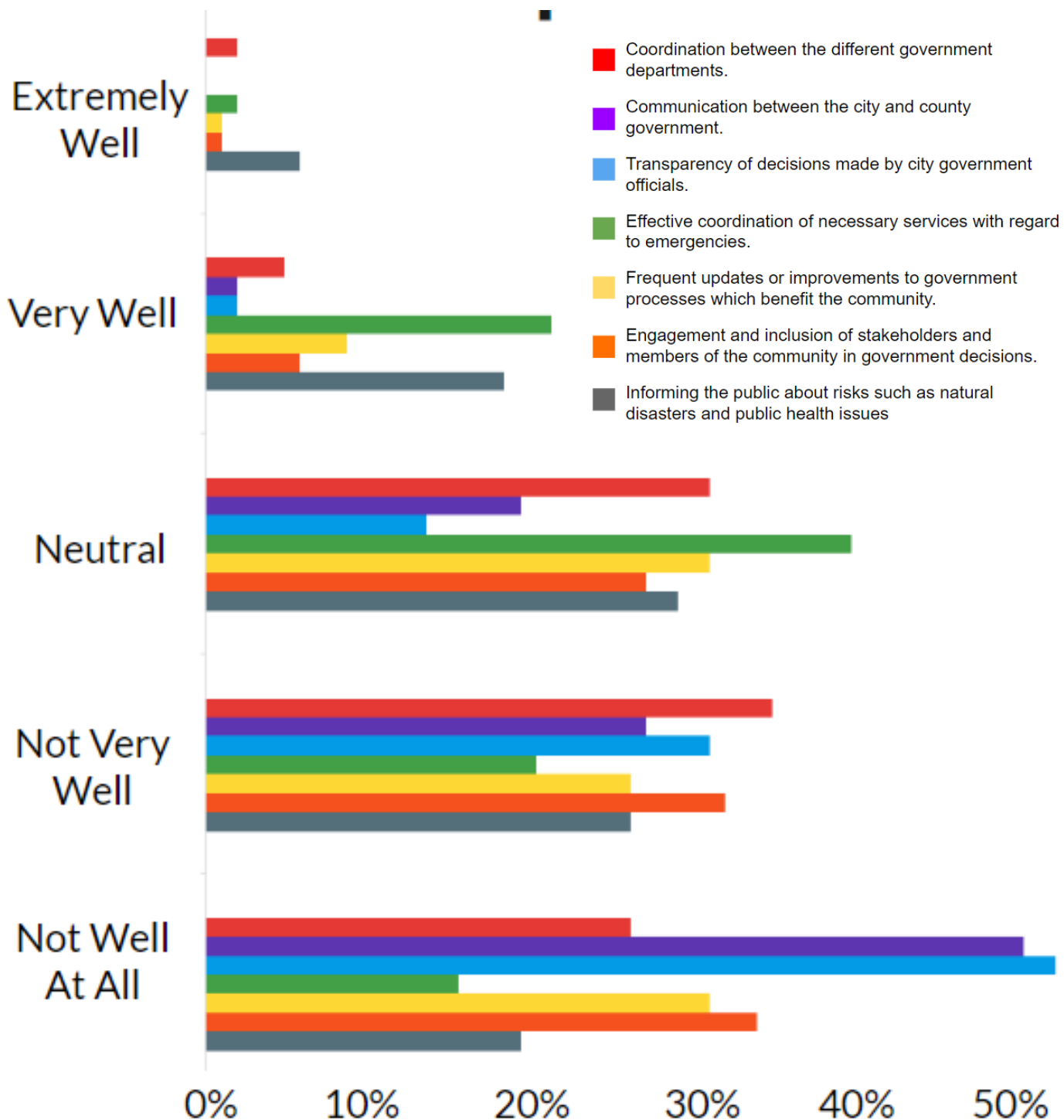
Figure 19: Residents' concerns about leadership and communication

Legend:
- Coordination between the different government departments.
- Communication between the city and county government.
- Transparency of decisions made by city government officials.
- Effective coordination of necessary services with regard to emergencies.
- Frequent updates or improvements to government processes which benefit the community.
- Engagement and inclusion of stakeholders and members of the community in government decisions.
- Informing the public about risks such as natural disasters and public health issues

Management of Disasters and Emergencies

A city is more resilient if natural disasters and emergencies are well managed. City residents in the survey thought the city is doing well with respect to communication infrastructure but not as well in transportation infrastructure and the management of floods (see Figure 20). Participants were asked how well the city manages disasters and emergencies.
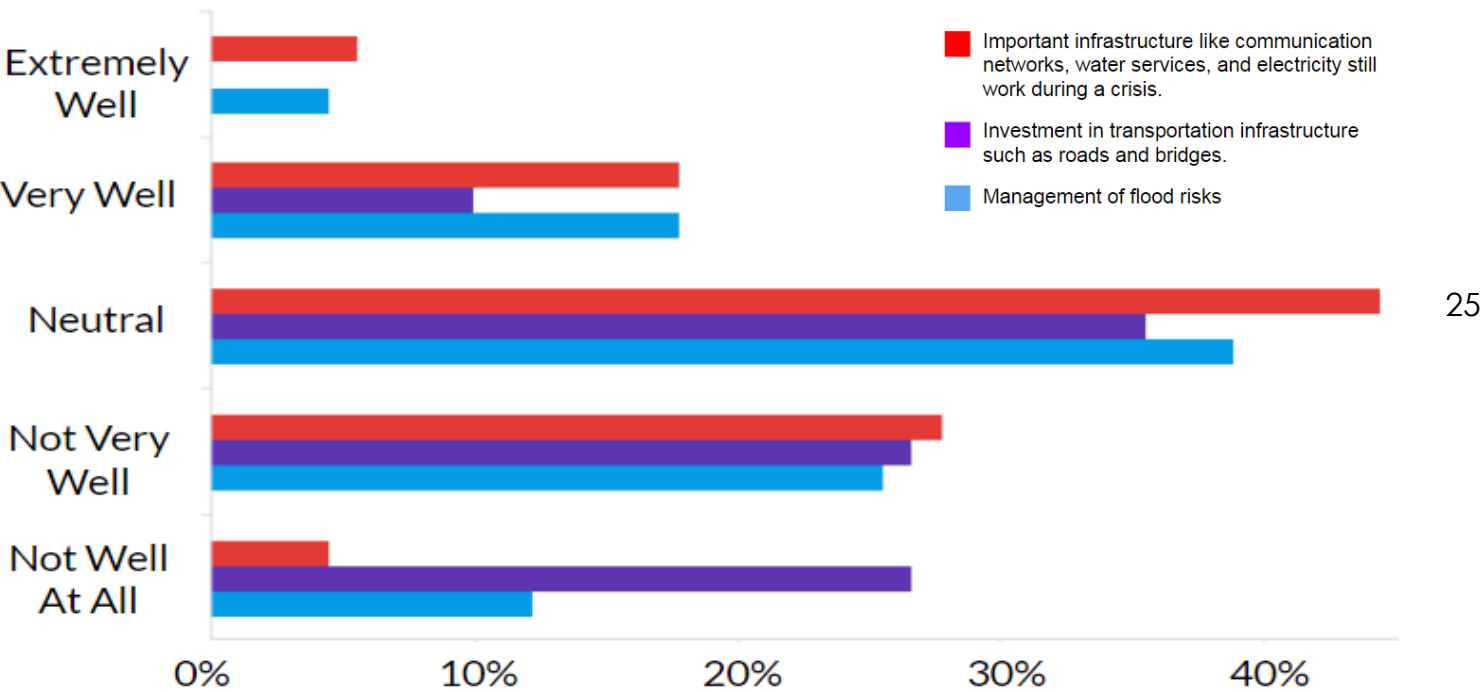
Figure 20: Residents' concerns about the management of disasters and emergencies

Protection of the Human and Natural Environment

A city is more resilient if human-made and natural environments are protected and maintained. Figure 21 shows that residents expressed concern about the quality of streets, sidewalks, bridges and parks but were somewhat satisfied with the preservation of historic buildings and neighborhoods.

Figure 21:Residents' views on the human and built environment

Assessment of Housing Adequacy and Affordability

Housing adequacy and affordability is an issue that has been brought up by both civic leaders and through the survey, establishing its imp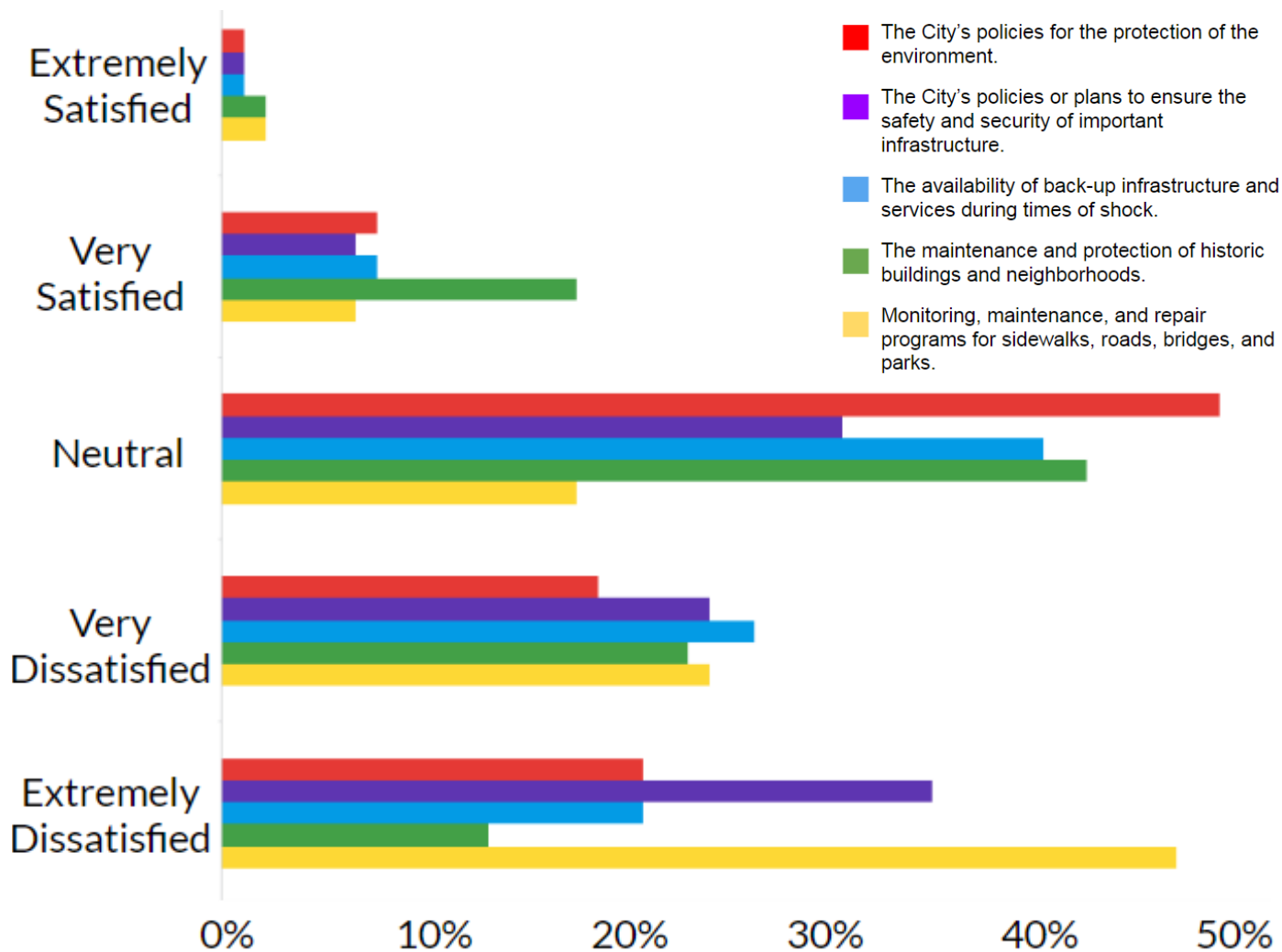ortance in the city. There is a strong correlation between poverty, housing burden (both rental and owner occupied), and vacant structures/land. The combination of these vulnerabilities expresses itself first and foremost, in the large number of vacant lots and structures (Figure 22). When housing burden is accounted for, renting becomes an issue as almost all of Muncie's Census Block Groups contain a population of 33% or higher who are paying a minimum of □ of their income on housing (Figure 23) . Housing burdened homeowners have a much less critical issue, and are at specific locations such as the Old West End Neighborhood, and parts of South Side (Figure 24). When poverty is considered as in Figure 25, it is apparent that there is a larger concentration around downtown as well as in South Side Neighborhood.
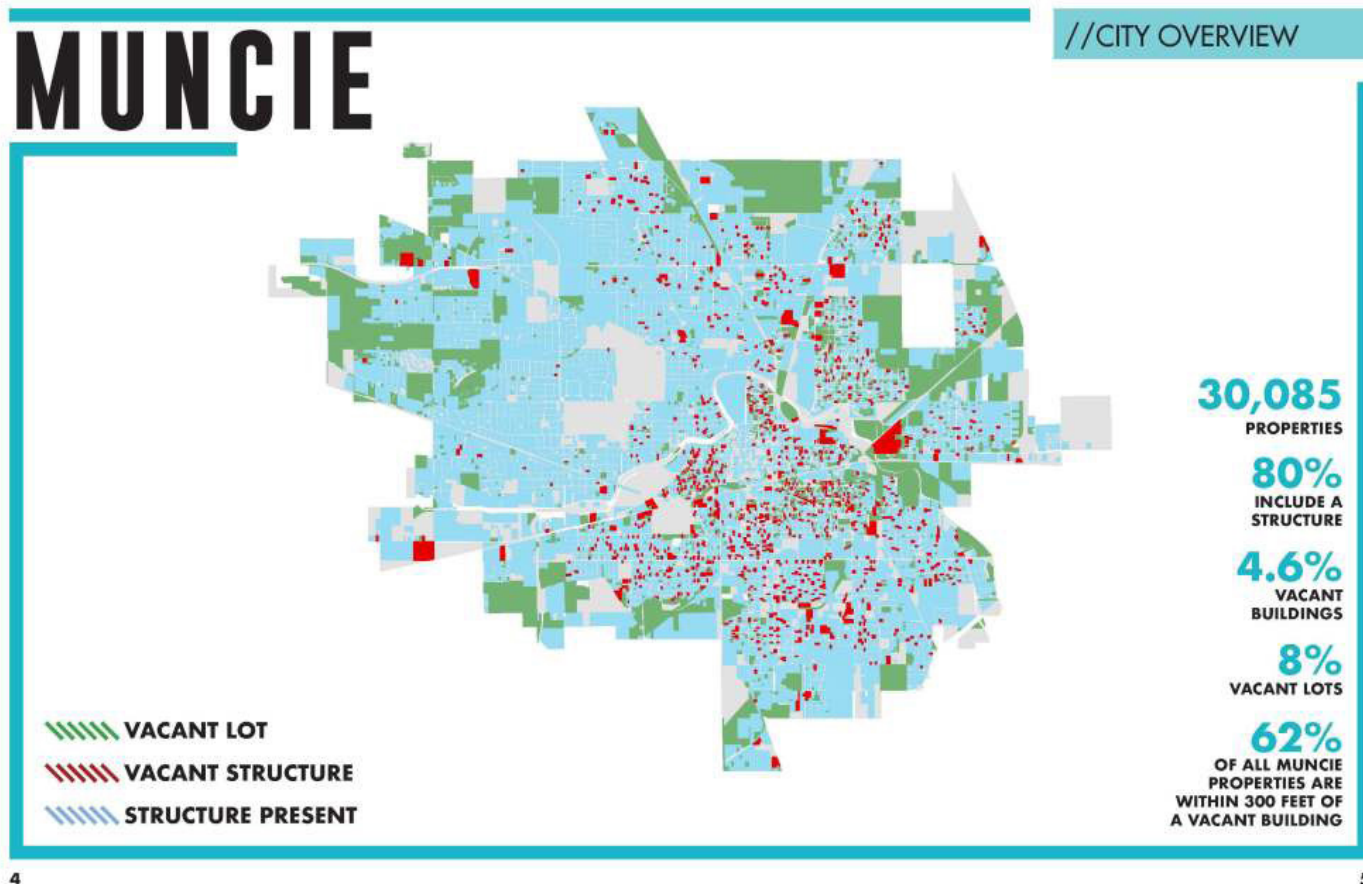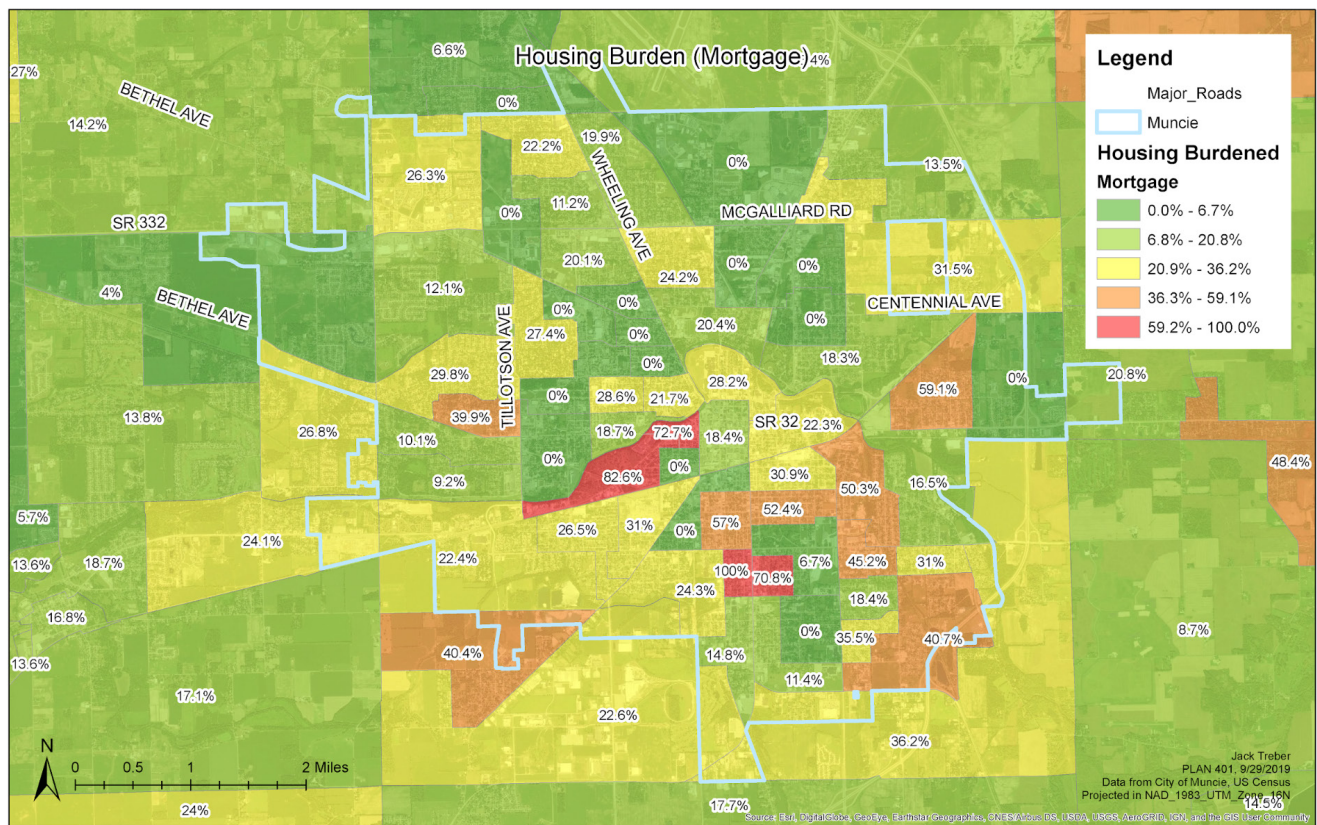
Figure 22: Source: Scout Muncie, https://scoutmuncie.wordpress.com/inventory-map/

Figure 23: Housing burdened home owners.

Figure 24: Housing burdened renters

Poverty by Census Tract in Muncie, IN

Legend
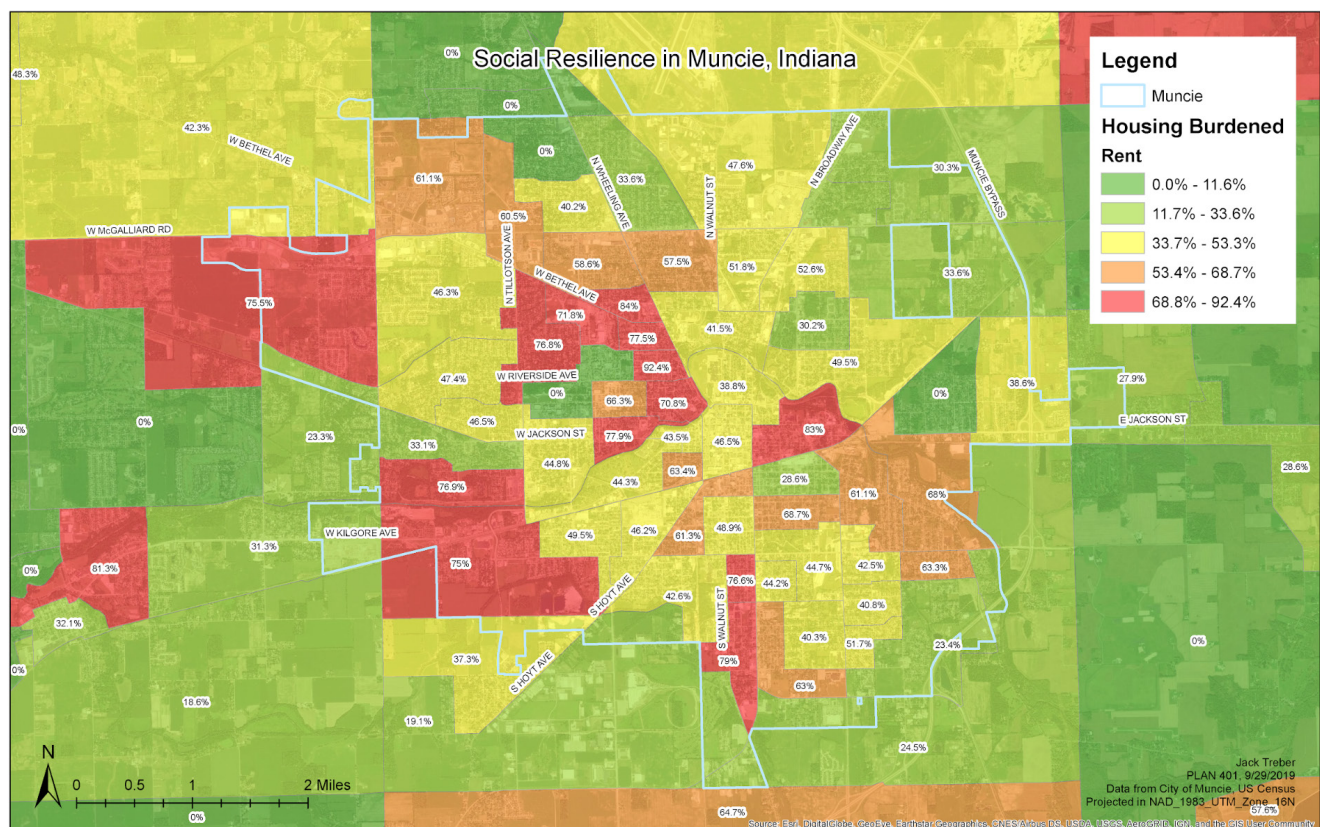- 5.7% - 9.9%
- 9.91% - 18.7%
- 18.7% - 28.9%
- 28.9% - 50.4%
- 50.4% - 77.8%
- Muncie Outline
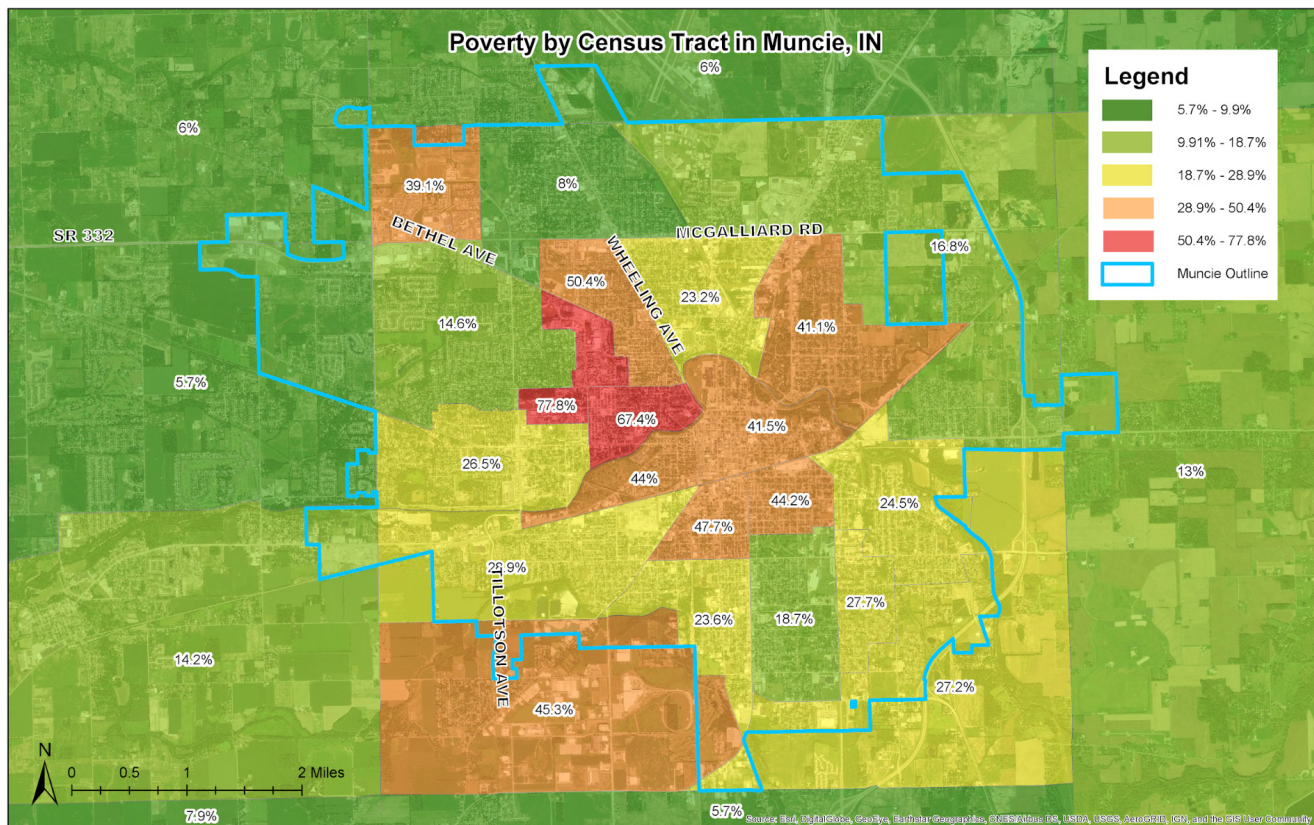
Figure 25: Households living below the poverty level

Assessment of the Local Economy

This topic focuses on how the local economy of Muncie is performing through support for local businesses and employment accessibility. The survey that was conducted included questions relating to support for local businesses and employment accessibility. Figure 26 shows that many residents are dissatisfied with Muncie's economic and social environment. Residents expressed that they are very dissatisfied with the community's ability to attract a skilled workforce. After analysis of the employment accessibility question (see Figure 27), we also found that many residents believe Muncie is not supportive of workers during an economic recession or sudden unemployment and that the city government does not support the local business community to grow and thrive. An employment density map was created (See Figure 28) to show where the majority of employment exists in Muncie. The map showed that the higher areas with employment exist around Ball State University and Downtown Muncie. These concerns not only need to be acknowledged, but addressed by the city government so actions can be initiated to increase the support for the local economy and employees of Muncie.

Support for the Local Economy

A city is more resilient with a strong local economy, and government policies that support local businesses. How satisfied are you with Muncie's level of support for local business?
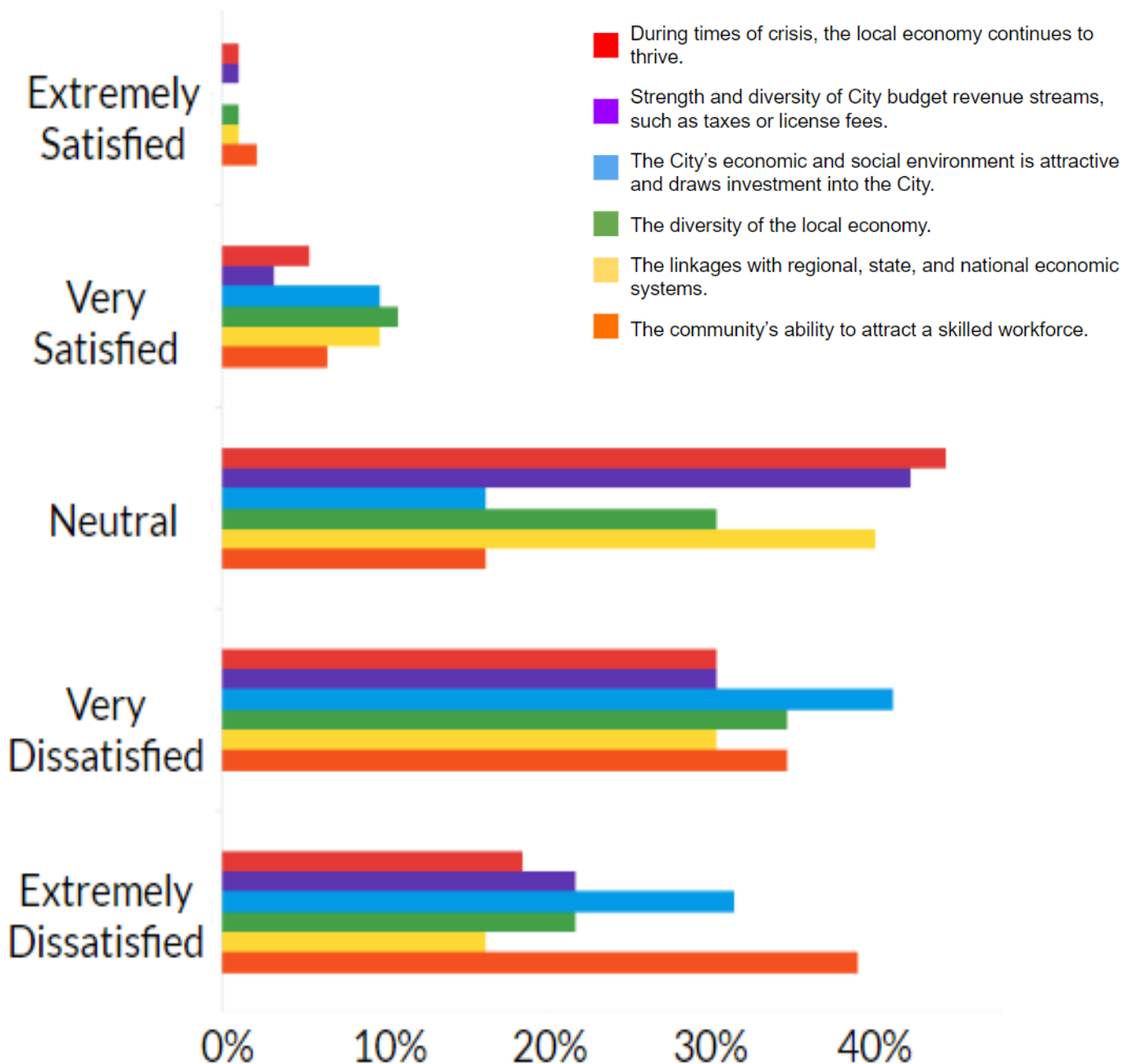
Figure 26: Local government support for local businesses and the economy

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Access to Employment

A city is more resilient when everyone has access to decent employment. How well are these services provided in the City of Muncie?

Legend:
- ■ (red) Supportive policies and programs for the unemployed during a recession.
- ■ (purple) Availability of workplace training programs to improve skills.
- ■ (light blue) Support for workers during an economic recession or due to sudden unemployment or injury.
- ■ (green) City government support to help the local business community grow and thrive.
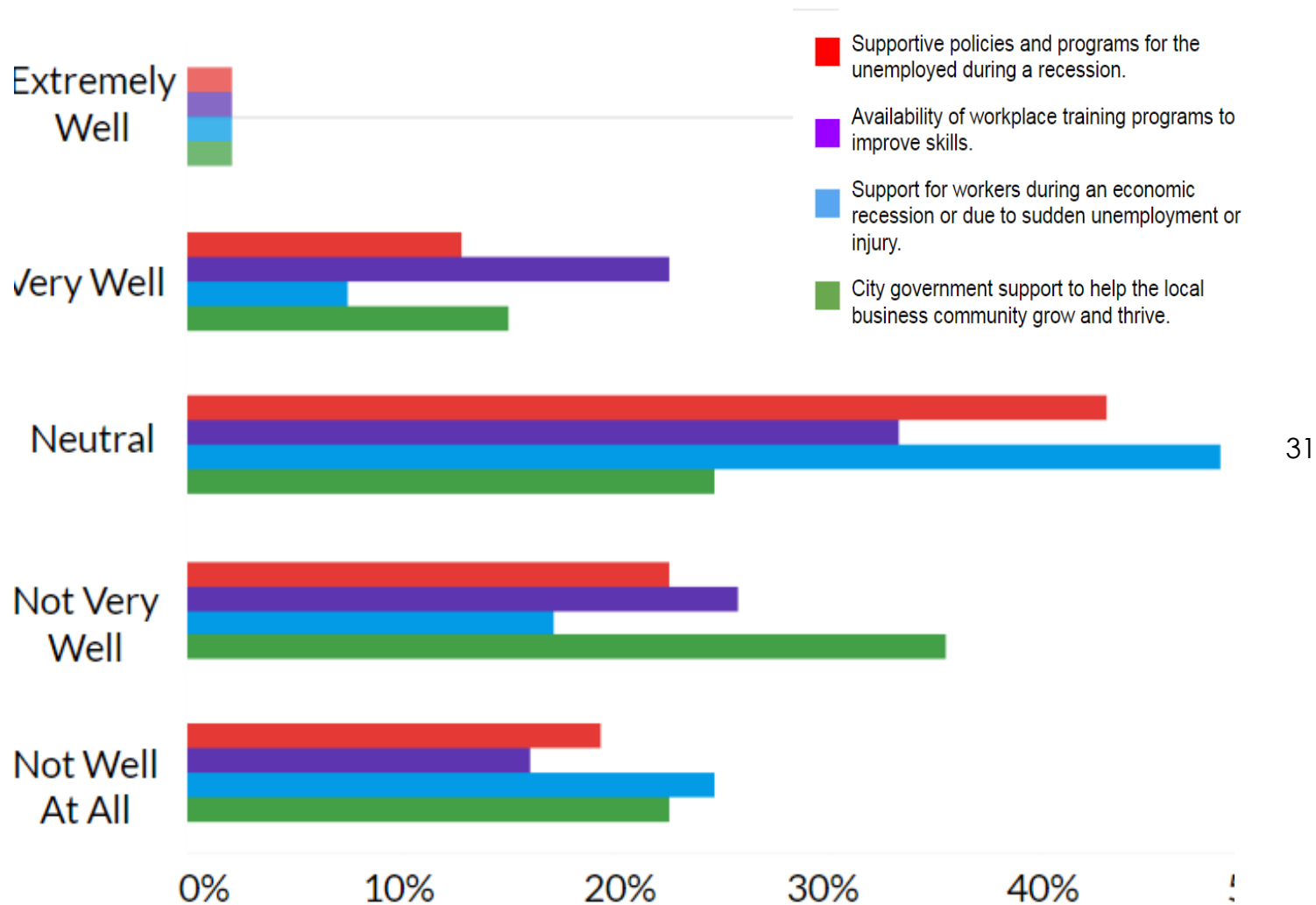
Figure 27: Residents' views on access to employment
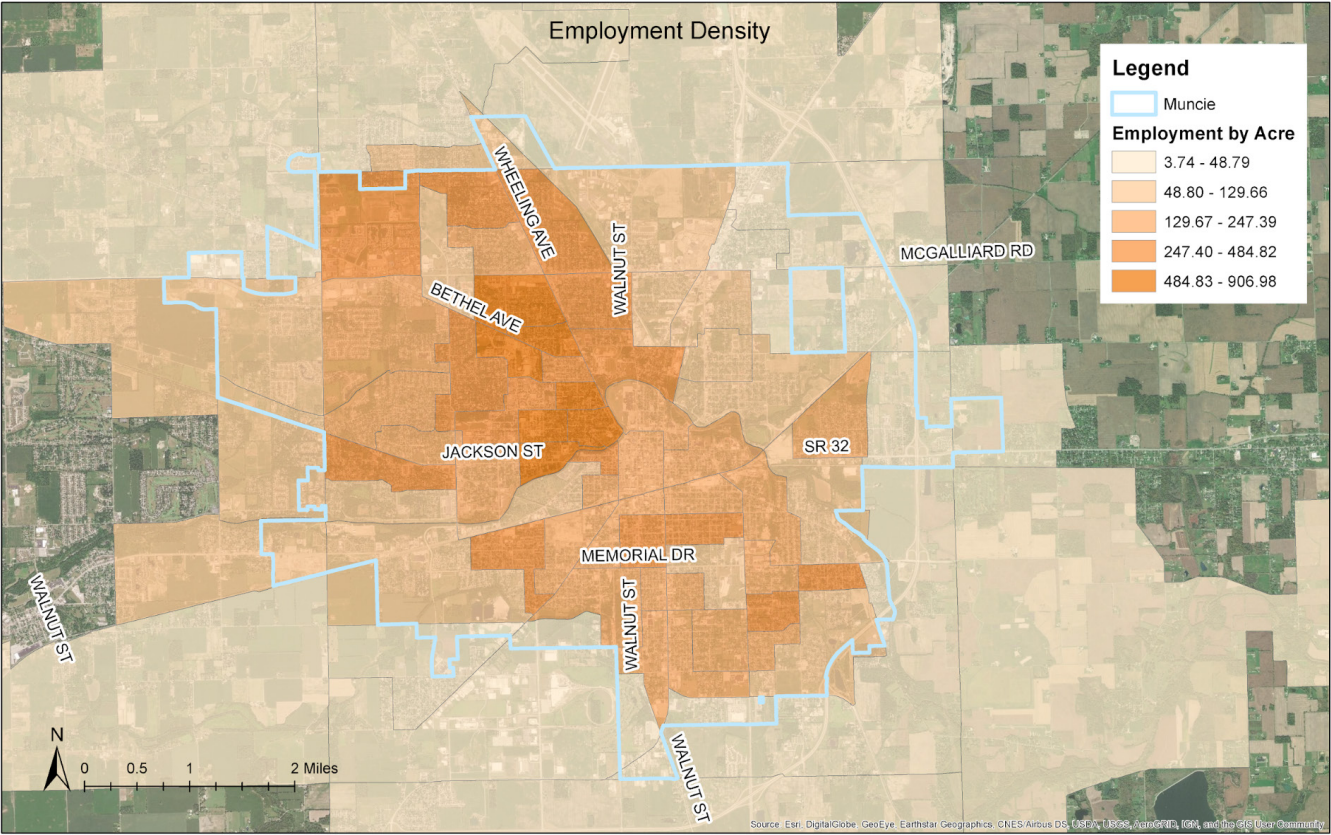
Figure 28: Employment density

Assessment of Education Conditions

Figure 29 shows residents who are 18 and older without a high school diploma. The data show that roughly all of Census Tracts within South Side Neighborhood contain the highest percentages (about 11% to 14%) of people with no high school diploma. This, along with the transition of Muncie Public Schools could play a huge role in education retention, employment retention, as well as increasing future skilled labor.

Figure 29: Educational status

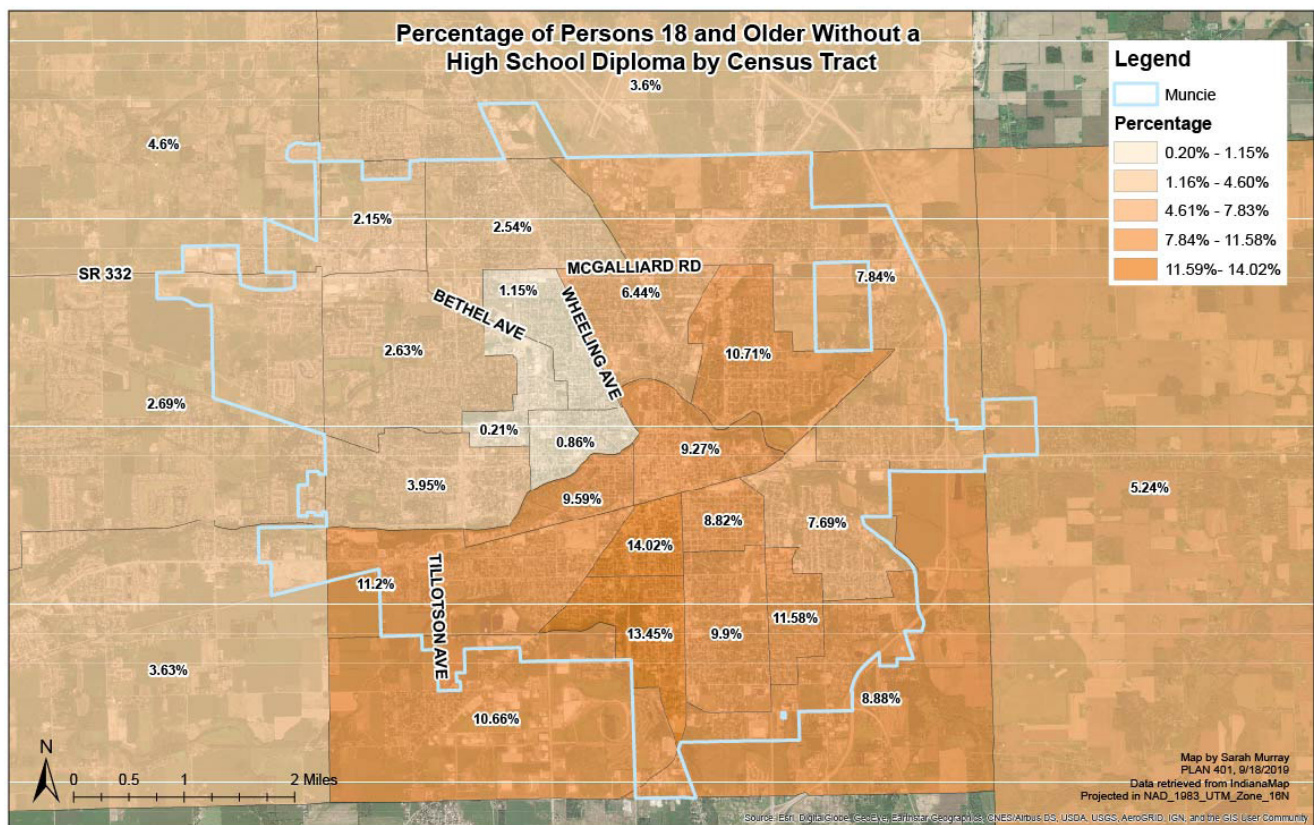| Assesment	Findings	Planning Implications
Population Density	• Density is not necessarily correlated to proximity to downtown. Dense populations are observed in the Northwest.	Contain sprawl, Growth boundary, transfer of development rights, purchase of development rights, diversify land uses, infill, floor area ratios, abolish single family zoning, transit-oriented development, tax speculative land holdings, sprawl spreads thin public resources, cost-ineffective development patterns
Poverty	• At least one fifth of Muncie's population lives in high poverty census tracts (40%+) • BSU Campus is anomaly • Poverty is concentrated around downtown and the University	Social safety net needed for households in poverty, increase median incomes through skills and job training, concentrate resources downtown/in-need areas, improving specific place
Food Stamps/SNAP	• High concentration downtown, McKinley, Old West End, South, Whitley and Southwest	Exploit food deserts, provide programs for struggling residents, lend more SNAP approved businesses, encourage programs to help people overcome benefit use, Food banks needed, urban farms, potential brownfield connection (temporary farms)
No Vehicle Access	• Correlation with poverty, but not directly • Old West End, South/Southwest, and directly Northeast of River Bend	Improved public transit, bike shares, car shares, accessible/affordable options, evacuation issues
Limited English Households	• High concentration on Ball State Campus, Northeast, to an extent downtown	Improve educational access, ESL Programs, explore cultural gap

Table 6: Summary and Resilience Planning Implications from the Analysis of Social Vulnerabilities

Population with Any Disability	• Old West End/Gillespie Tower	Address specific accommodations they require, utilize ADA standards, improve transportation
18 and Older without a High School Diploma	• Highest concentration couth of railroad tracks, slightly west • Demonstrates economic segregation	Enrichment programs, possibly through IVY Tech, particularly in affected areas, housing vouchers used on national level
Single Parents with Kids Under 6 Years Old	• High concentration in Old West End/ Downtown, Large apartment complexes • Full time workers, long-term poverty	Support groups, childcare facilities, child engagement/clubs, athletics, performing arts
Housing Burden by Mortgage/Rent	• Mortgage: High concentration in Old West End, South Side • Rent: High concentrations around BSU Campus, West Bethel and East of Downtown	PHA, Bridge, Habitat, Muncie Mission, Tiny Homes, Brownfield connection
Population of 85+	• High concentration in Northwest, Southeast. • Low concentration in/ around downtown	Consider population growth in respect to availability and location of nursing homes
Employment Density	• Not correlated with centrality • High concentrations around Ball State and Northeast	Improve access, consider population growth as well as demographics and location of populations
Brownfields	• High concentration downtown and long major arterials, railroads • Correlation with poverty and education level	Remediation needed, infill development, decrease sprawl, economic development (focus on post-industrial clean sectors)
Vacancy	• Large density of vacant structures in the southern portion of Muncie	Improve blight programs, consider rehabilitation or historic preservation

Table 6: Summary and Resilience Planning Implications from the Analysis of Social Vulnerabilities

Priority Action Areas

The analysis has determined that the city of Muncie needs to work on several strategies to help move the city towards resilience. In order to ensure that action is taken immediately to jumpstart the process six priority action areas have been identified. These are programs and projects that can be implemented within the first two years because of their relative lower cost of implementation, and because we think they are likely to galvanize public support for their implementation. These priority action areas are as follows:

- City-Government-on-the-Go and City Council meetings in neighborhood

- Designation of emergency shelters and evacuation routes

- Continuity of government operations program

- Expand roads that are at capacity or will be at capacity over the next 20 years

- Increasing safety through community-policing, and restorative justice programs

- Improve city infrastructure and adopt a complete streets policy

Leadership and Engagement

Issue: There is a perception by residents that there is a lack of transparency in decisions made by city government departments.

Goal: Improve communication between residents and the city as well as between the city government and the county government (See Figure 30).

Strategy: Adopt a "City-Government-on-the-Go" (CIGO) program, and schedule city council meetings in each of the Muncie neighborhoods on a rotating basis to involve as many city residents in the decision-making process as possible. The City-Government-on-the-Go program will address

Figure 30: Leadership and transparency in local government

both access to city government as well as make the city government agile and operational during an emergency. With City-on the Go, a vehicle is outfitted with the necessary technology and department staff that would make weekly scheduled visits to high demand locations in the city. This service would also allow citizens with limited time, and those with limited access to transportation to conduct city business by, for example, paying bills, fines and fees during regular hours of city government operation.

Timeframe: Immediate.

Cost: There may be a cost to retrofit a vehicle to serve as a mobile city government.

Partner (s): Mayor and City Council, and Neighborhood Association Boards.

Assessment metrics:

- Before and after survey to gauge the public's views on the transparency of decision making in the City of Muncie.

- Number of locations visited by City-Government-on-the-Go vehicle

- Number of people visiting City-Government-on-the-Go vehicle

- Decrease in outstanding bills

- Increase in utility and other payments

Emergency Shelters

Issue: Currently no formal emergency shelters are designated to house residents in case of a disaster. It is assumed that city buildings, schools (especially Muncie Central High School), and Ball State University buildings will provide a safe refuge in an emergency but these buildings are not stocked with necessities such as food or medical supplies, nor is the public made aware of these shelters and how to access them in the event of an emergency.

Goal: Formally and legally identify emergency shelter locations in all four quadrants of Muncie. This is in an effort to have at least one emergency shelter located within proximity of all residents.

Figure 31: Designated emergency shelter

Figure 32: Wayfinding signs to shelters

Strategy: Analyze existing Muncie Schools, City buildings, and other facilities that meet the FEMA suggested criteria of what can be designated as an emergency shelter. Any additional physical improvement to fortify the buildings should be taken, along with supplying any needed recourse reserves and additional medical supplies and equipment prior to their use. Such shelters could be Ball State Buildings, Elementary, Middle, and High Schools, City Buildings, Fire Departments, Churches, Medical Facilities, and other community buildings. Once emergency shelter locations are identified, wayfinding signs need to be located throughout the city to help direct people to these locations (see Figures 31 and 32).

Timeframe: This is of immediate concern.

Cost: Medium expense. Cost can vary based on building conditions and served population capacity.

Partners(s): The City of Muncie, Muncie School System, Ball State University, and Delaware County Emergency Management Office.

Assessment metrics: Number of buildings identified, fortified, and designated as emergency shelters.

Continuity of Operations Plan

Issue: Muncie Currently has no formalized strategic plan for the continuation of critical government services and operations in case of a disaster and damage to city buildings.

Goal: Formally and legally identify a strategy for the continuation of working government services, continued communications between offices, and locate buildings where city government officials can continue operation if the City Hall building is damaged.
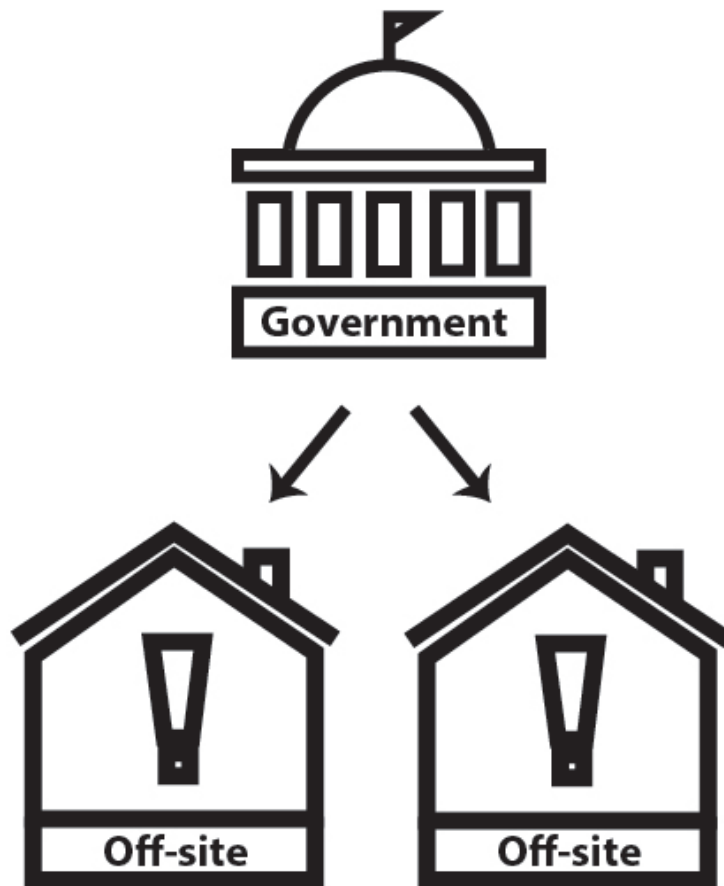
Figure 33: Designated off-site locations for the continuity of local government operations

Strategy: Using Continuity of Operations Plan (COOP), and the National Continuity Policy Implementation Plan (NCPIP), identify building locations that have reliable electricity, water, wifi, and other needs for operation (see Figure 33). Such buildings could be Schools, major local office buildings, churches, as well as an option for city leaders to work from home. Digital and non-digital documents should be safe, fortified, and backed up, and a transportation plan of needed documents relating to continued operations should be made. Lastly Critical equipment, such as computers, storage drives, and other technology should be accessible in multiple off-location sites.

Timeframe: This is of immediate concern.

Cost: Low to medium expense.

Partners(s): The City of Muncie IT department, and City Council and mayor.

Assessment metrics: Adoption of a Continuity of Operations Plan by the City.

Infrastructure Improvement

Issue: Our analysis found several roads that are currently at or above capacity and those that will be at capacity in the next three decades. These included portions of McGalliard, Wheeling, Bethel, Jackson, S.R. 32, etc., (Figure 34 and Table 7).

Goal: Expand roads that are at capacity or will be at capacity over the next 20 years. The provision of a reliable roadway system now and in the future will ensure that in the case of a disaster Muncie residents can evacuate, safely relocate, contact for help, have safe running water, and that Muncie's emergency systems can operate properly.
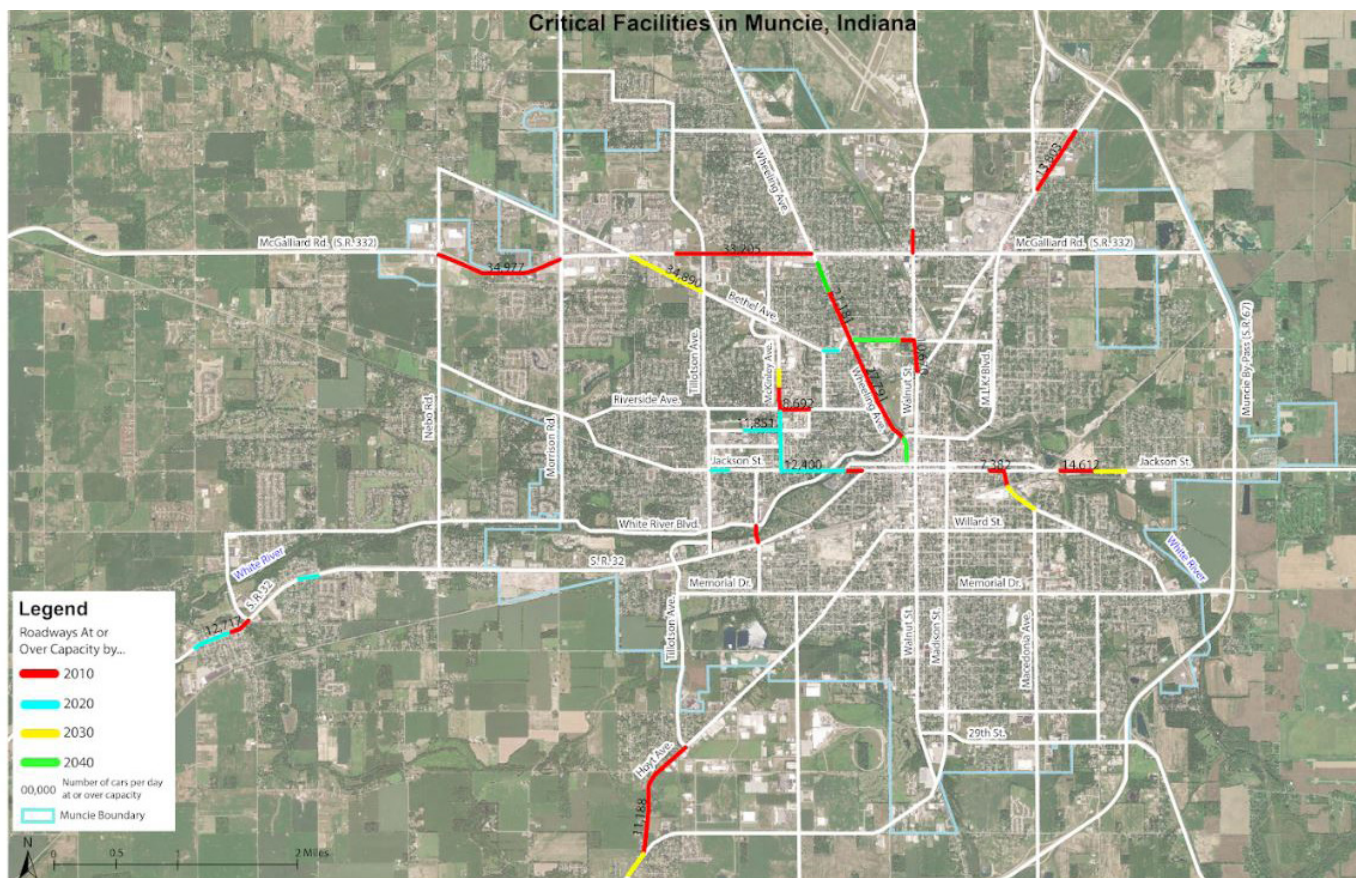
Figure 34: Level of service of Muncie streets

Strategy: The city should adopt a multi-year capital improvement plan that schedules and prioritizes the expansion and construction of the roads and streets that are currently at or above capacity. The sections on McGalliard should be given first priority for reconstruction/expansion as it is the main artery through the city and will be heavily used in the event of an emergency evacuation. This should be followed by roads such as Jackson and Wheeling as they are the main connectors to downtown, cross river access points, and major roadways. Alongside the road improvements, the city should plan to provide sidewalks or repair existing ones and update existing pipelines.

Timeframe: This is of immediate concern and this action should be implemented within the next two years.

Cost: Infrastructure and road improvement is a major cost element of the city's budget and will likely need to be funded through capital improvement bonds, but funding from State and Federal sources should also be explored.

Partners(s): The City of Muncie, Public Works Department

Assessment metrics: LOS standards, and number of accidents on evacuation routes.

Street Name	At capacity 2020	At capacity 2030-40
N Broadway Ave. between 300 N. and E Purdue Rd.	0.60 Miles	
N Walnut St. between Skyway Dr. and McGalliard Rd.	0.32 Miles	
McGalliard Rd.	1.22 Miles	
W McGalliard Rd. between N Nebo Rd. and 300 W.	1.18 Miles	
W Bethel Ave. between W. McGalliard Rd. and Tillotson Ave.		0.70 Miles
Wheeling Ave. between W McGalliard Rd. and W Royale Dr.		0.22 Miles
Wheeling Ave. between W Royale Dr. and W White River Blvd.	1.99 Miles	
W Centennial Ave. between Wheeling Av. and N Walnut St.		0.50 Miles
W Centennial Ave. intersetion to the N Walnut St. and N Granville Ave. intersection	0.38 Miles	
W Bethel Ave.	0.14 Miles	
McKinley Ave through campus		0.12 Miles
McKinley Ave. and W Riverside Ave. intersection	0.29 Miles	
McKinley Ave from W. Riverside Ave. to W Jackson St.	0.62 Miles	
W University from N McKinley to the field	0.32 Miles	
W Jackson St. from N McKinley to the W Jackson St. bridge	0.60 Miles	
W Jackson St.from Tillotson Ave. to Westside	0.14 Miles	
W. Jackson St. from the W. Jackson St. bridge to Old West End	0.20 Miles	
Wheeling Ave. from the north side of the river to Downtown		0.20 Miles
E Jackson St. and E Adams St. intersection	0.18 Miles	
Ohio Ave. from W Kilgore Ave. to S Burlington Dr.		0.30 Miles

Table 7: Level of service of Muncie streets

E. Jackson St. from the west side of the rive to the east side at Bunch Blvd.	0.44 Miles	
E. Jackson St. from Bunch Blvd. to N Bellaire Ave.		0.44 Miles
S. Hoyt Ave. from W Fuson Rd. to 200 W	1.03 Miles	
S Old State Rd. 67 from S. Hoyt ave to S Muncie Bypass		0.55 Miles
SR 32 from S Lindell Dr. to S.Andrews Rd.	0.24 Miles	
SR 32 from S Broadway St. to S Tiger Dr.	0.20 Miles	
SR 32 from S Broadway St. to the Marsh Ave. intersection	0.39 Miles	
Total	**10.48 Miles**	**3.03 Miles**

Table 7: Level of service of Muncie streets

Health and Safety

Issue: Our analysis found that there are 30,085 properties in the city. Of these 4.6% have vacant buildings and 8% have vacant lots. Additionally, 62% of all Muncie properties are within 300 ft. of a vacant building. This contributes to vandalism, structural risks, breeds rodents and pests, illegal activities.

Goal: Support the Muncie Land Bank and increase safety through police engagement and services with community residents, which could build trust in the police, and contribute to decreasing crime and vandalism.

Figure 35: Improve community-police relations

Strategy: Hold police-community events such as "dunk-a-cop" on a rotating basis in each of the Muncie neighborhoods, and increase officer patrols throughout the neighborhoods to promote community safety. Additionally, the city should explore the use of restorative justice programs to address community-police relations. Restorative justice is a system of criminal justice that focuses on the rehabilitation of offenders through reconciliation with victims and the community at large. The City of Muncie should adopt this method of criminal justice for juvenile offenders in the community. This process focuses on healing rather than punishment and gives victims and the community a voice in the process.

Timeframe: Immediate to a year.

Cost: Cost can vary based on whether new police officers need to be hired.

Partner(s): Muncie Police Department, City of Muncie, and the Reconciliation Achieved Through Community Engagement (RACE) program, Delaware County Justice Center, Division of Youth Services, Indiana Department of Correction

Assessment Metrics: Number of police events held at neighborhoods and police patrols to at risk neighborhoods, recidivism and incarceration rates.

Social and Economic Inclusion

Issue: Muncie communities still have gaps in the coverage of multi-modal transportation networks beyond personal vehicles. These modes include public transportation, such as the MITS bus service, and active transportation, such as walking and cycling. Gaps in these connections pose challenges for low-income, disabled, and elderly residents.

Goal: Adapt Muncie's public transportation facilities to accommodate a wider range of users and modes of transportation, with priority given to vulnerable residents. The City would more thoroughly meet the mobility needs of its residents by making its bus services a safe, convenient, and accessible option and by creating and connecting trails and sidewalks.
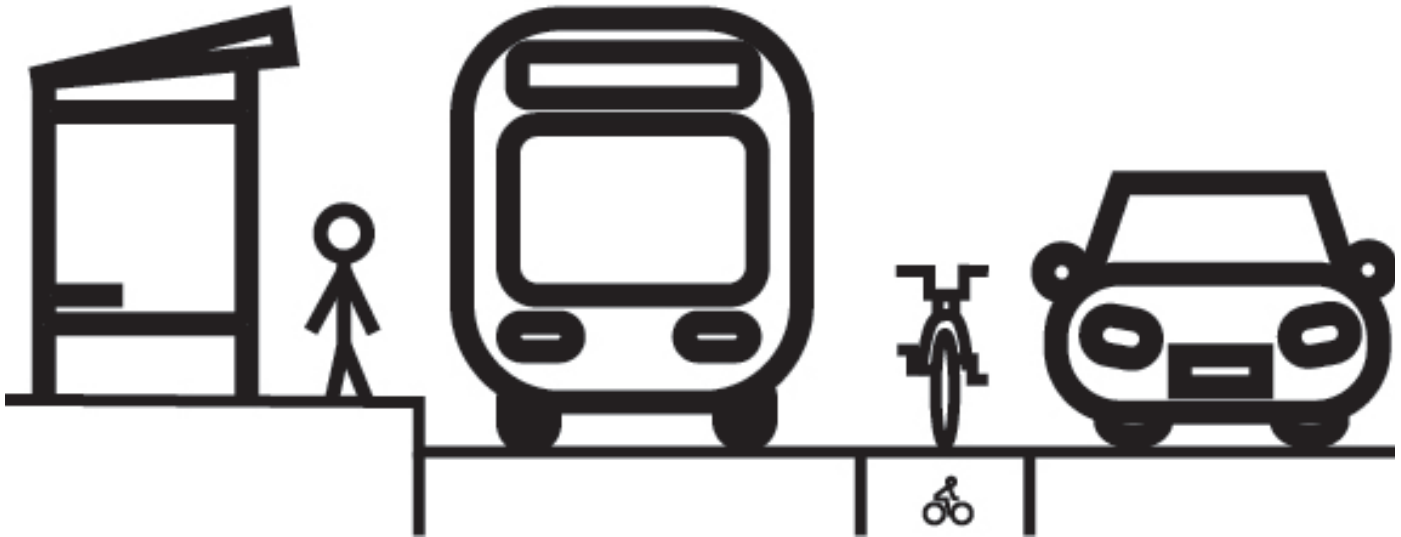
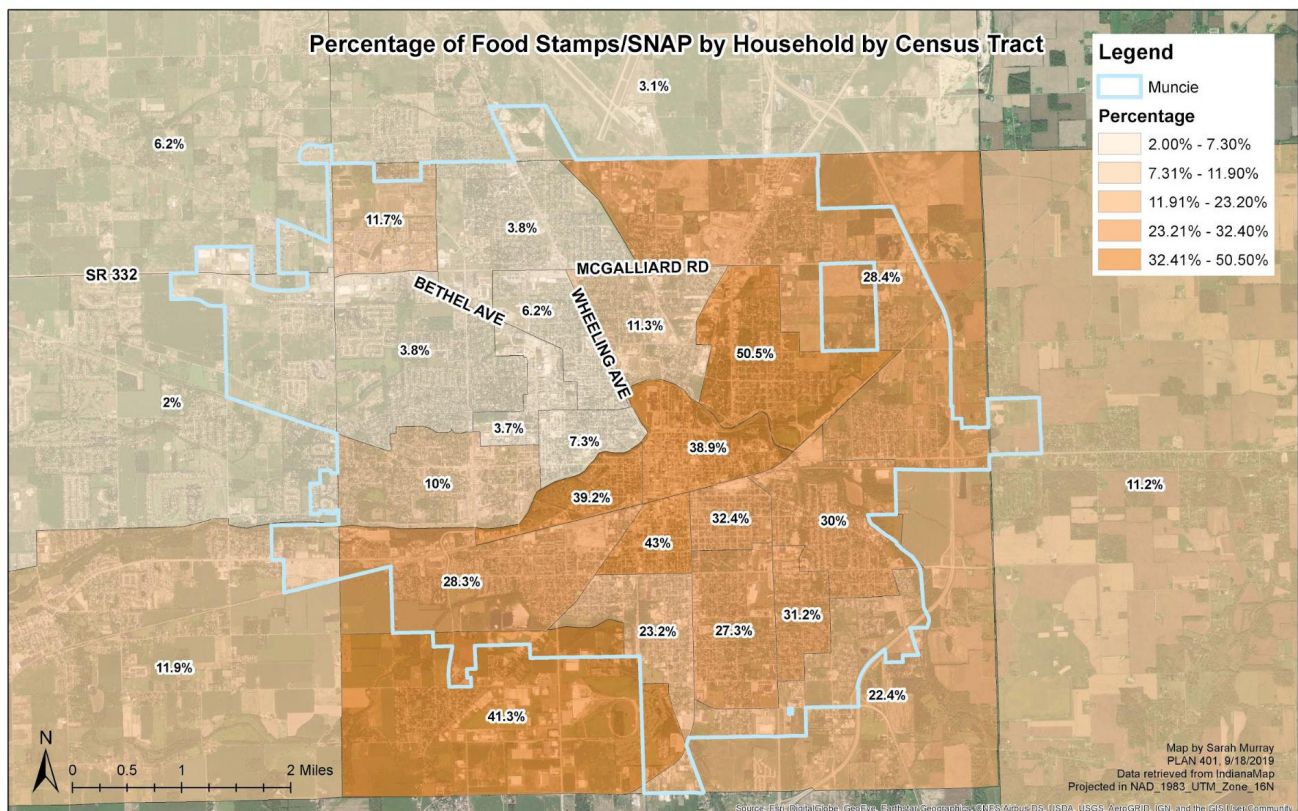Figure 36: Adopt a complete streets program for key collector streets where appropriate

Figure 37: Distribution and location of households needing SNAP and food stamps

Strategy: The city should construct additional bus shelters to make its public transportation safer and more accessible. With benches and roofs, commuters can be seated in safety from harsh weather conditions. People with physical disabilities may have particular difficulty standing for long periods of time to wait for a bus. Standardized materials in every shelter with bus routes, schedules, and links to online resources would also make the system more understandable and accessible. High-priority areas for new bus stations have been identified based on the rate of households needing SNAP and food stamps, those without a personal vehicle, rate of persons with disabilities, population and employment density, and lack of existing facilities (see Figures 36 and 37). The following locations should be given priority action:

- Route 1: Ball State University
- W University Ave, by Ball Memorial Hospital
- Route 9: Industry Willard
- S Macedonia Avenue, between 12th and 26th Streets.
- S Mock Avenue, between 12th and 26th Streets.
- Route 10: Heekin Park
- E 22nd and S Hackley
- Route 11: Southway Centre
- S Walnut St and 18th St
- S Madison St and 20th St
- S Madison and 26th St
- S Walnut and 7th St
- Route 12: Ivy Tech
- W Memorial Dr and S Batavia Ave
- Route 16: Wal-Mart North/University
- W University Ave and N Martin St

Timeframe: Immediate to a year.

Cost: Medium as most of these improvements can be made from the city's general revenue and incorporated into the annual budget.

Partner(s): Mayor, City Council, and MITS.

Assessment Metrics: Number of streets, bicycle lanes, and trails added to the existing network, and number of bus shelters built.

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Elements of the Resilience Plan

1. Civic Leadership and Community Engagement

Issue: The survey found that there is a perceived lack of communication between the city and the county government.

Goal 1.1. Improve communication between city government and the county government.

Strategy 1.1.1. Form an Intergovernmental Commission comprised of selected staff of the City of Muncie and Delaware County government to deliberate on matters affecting both the city and county.

Timeframe: Immediate

Cost: No cost.

Partner(s): City of Muncie Mayor and Delaware County Commissioners

Assessment Metrics: Formation of an Intergovernmental Commission.

Issue: Public's prevention of corruption in city government.

Goal 1.2. Decrease corruption in the local government.

Strategy 1.2.1. Conduct an annual independent audit of city government functions with an eye to identifying anomalies in city government operations and making modifications. The audit can be conducted by the Indiana Department of Administration (IDOA) or a private consulting firm.

Timeframe: Immediate to two years.

Cost: Medium. Potential costs if hiring a private consultant.

Partner(s): City of Muncie Mayor, Muncie City Council, Muncie City Staff, Indiana Department of Administration, and potential private consultant if necessary.

Assessment Metrics: Conduct a before and after survey with Muncie residents to gauge their perception of corruption in the local government.

Goal 1.3 Make information readily accessible to residents

Strategy 1.3.1: To improve communication between the government and the community it is critical that residents have access to online data about their community. This access can be created with a web portal. Once a portal is created, the City needs to train someone to manage and run presentations to educate residents on how to access, use, and analyze the data.

Timeframe: Immediate.

Cost: Medium as someone may need to be hired to be in charge of this program

Partner (s): The city of Muncie

Assessment metrics: Creation of a data portal and the hiring of a responsible staff person.

2. Disaster Readiness

Issue: The analysis identified that about 8% of Muncie's population and 8% of businesses currently reside in the floodway, 100 year and 500 year floodplains. This puts residents at risk of injury, death and/or damage to their property in the event of a flood.

Goal 2.1. Decrease vulnerability of flood risks to residents and properties within the floodplains.

Strategy 2.1.1. The City of Muncie is a member of the National Flood Insurance Program (NFIP). This program helps decrease the cost of insurance to property owners in member cities. Property owners in the floodplain who do not have flood insurance are required to gain proper insurance through the NFIP.

Timeframe: Immediate to a year. Information regarding NFIP should be sent out to homeowners through flyers and online city announcements within three months of the Muncie Resilient Plan's adoption.

Cost: Low. The city will bear some cost for printing flyers. Private homeowners will bear the cost of flood insurance.

Partner(s): The City of Muncie, Delaware County, Delaware County Emergency Management Office, Muncie Neighborhood Associations, and FEMA.

Assessment Metrics: Measuring the number of homeowners with flood insurance, the number of flyers distributed to residents in the floodplain, and a before and after survey of residents to determine how many were able to receive flood insurance and if they knew about NFIP.

Issue: Delaware County's Comprehensive Zoning Ordinance currently does not have landscaping requirements for the floodplain. As a result, residents in the floodplain have no required minimum landscaping standards and this places them at higher risk for flooding.

Goal 2.2. Use Delaware County's land use

regulations to help decrease flooding.

Strategy 2.2.1. Revise the Comprehensive Zoning Ordinance to require minimum landscaping of 10% in new development areas across Muncie. Also require a minimum of 50% permeable surface coverage in new developed or redeveloped sites located in all flood plains.

Timeframe: Immediate to a year.

Cost: There is no cost to revising the Comprehensive Zoning Ordinance.

Partner(s): Delaware County Planning Commission

Issue: The Comprehensive Zoning Ordinance gets revised.

Strategy 2.2.2. Require street trees in city right of ways in the Census Tracts that currently have little or no landscaping or tree cover. This decreases the risk of flash flooding when there is heavy rainfall. A new minimum of 5% street tree coverage in all census tracts should be enacted.

Timeframe: Immediate to a year.

Cost: Low to medium. There may be additional costs with the purchase of trees to plant and potential employment for planting the trees.

Partner(s): Delaware County Planning Commission, Muncie Department of Public Works, and Muncie City Council.

Assessment Metrics: The percentage of tree cover in Muncie Census Tracts and in the flood plains.

Issue: Traffic flow along evacuation routes, critical medical facilities, and at risk populations currently limits efficient evacuation during times of disaster.

Goal 2.3. Synchronize traffic lights to allow a continuous flow of cars to evacuate the city

along designated routes, as well as prioritize efficient flow to and from nursing homes and medical facilities. This will ensure a safe and efficient evacuation, vulnerable populations will not be at a higher risk, and medical facilities will be more accessible.

Strategy 2.3.1. Muncie should look at data, simulation technology, and facility locations to reach the optimized safety and traffic strategy to be used. Traffic light flow technology should be adapted to change when a disaster occurs. Responsibility of operations during times of disaster are held by the City of Muncie's Public Works Department.

Timeframe: Long term. Muncie should implement the suggested strategies once the appropriate technology is acquired and run simulations for the streets involved.

Cost: Medium to high depending on the cost of technology and existing resources.

Partner(s): The City of Muncie, Muncie Public Works Department, Delaware County Plan Commission, Muncie City Council, and Muncie Indiana Transit System.

Assessment Metrics: Determined through traffic flow simulations.

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3. Climate Adaptation

Issue: Several roads were identified to be at or above capacity. These included some portions of McGalliard, Wheeling, Bethel, Jackson, etc. There are many issues regarding infrastructure improvements due to flooding mitigation, over capacity and longevity. According to Indiana Forest Alliance, between 40% and 60% of tree coverage is considered good for a city. Muncie falls significantly short of that standard. There are a lot of impervious pavements (i.e. roads, parking lots, etc.) and much less green space, green infrastructure, and tree coverage in the city (refer to Figure 12).

Goal 3.1. Separate rainwater and waste disposal systems

Strategy 3.1.2. Adapt and improve the combined sewer systems into separate waste and rainwater through the Muncie Sanitary District Long Term Control Plan. The improvement is planned to be done over the next 12 years, making it a fairly slower process compared to others as well as it's currently behind schedule. Utilize capital improvement bonds and using revenue bonds to augment funding. Time orientation is important to the future in respects to increased flooding and storms, soil pollution, street pollution/runoff, and polluted waterways within Muncie. This also will limit capacity at which Muncie can operate in respects to storm/sewer water until those infrastructure needs are met.

Timeframe: Immediate, this will be a progressive, long-term implementation as it will be continued on until about 2031.

Cost: Dependent on bond type, property owner's will have to pay the principal as well as interest on the debt.

Partner(s): City of Muncie, Muncie Sanitary District, Delaware County, and the Muncie Neighborhood Associations.

Assessment Metrics: Number of miles of sewer and stormwater facilities that are separated over time.

Strategy 3.1.3. Create development standards in the Comprehensive Zoning Ordinance to introduce permeable pavements, bioswales (which are vegetative streetside open drainage basins; added along Madison in Downtown, see Figure 38), and increase vegetation along the affected areas, and incorporate green infrastructure throughout the city/streetscape as well as existing infrastructure. This will allow for quick remediation and mitigation in cases of flash flooding, CSO overflow, extreme rainstorms, urban heat islands, and even allow groundwater regeneration/filtration.

Timeframe: Medium term as some engineering work may be needed to implement.

Cost: Low to High. The cost depends on what type of changes, material, and amount of changes that will be needed.

Partner(s): City of Muncie, IDEM, Muncie Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, and Delaware County, and Muncie Delaware Clean and Beautiful.

Assessment Metrics: Adoption of the Comprehensive Zoning Ordinance.

Issue: Urban sprawl at the edge of Muncie that increases the need for more roads, sewer, water, etc. capacities ultimately costing the city more financing. There is also a high concentration of brownfields in downtown, along major arterials, and railroads.

Goal 3.3. Contain sprawl to decrease the cost of extending municipal infrastructure and services.

Strategy 3.3.1. Consider the use of transfer of development rights, purchase of development rights, diversifying of land uses, infill development as well as utilizing other strategies such as: floor area ratios, transit-oriented development, taxing of speculative land holdings, and cost-ineffective development patterns.

Timeframe: Long term as it requires the modification of the county's land use regulations

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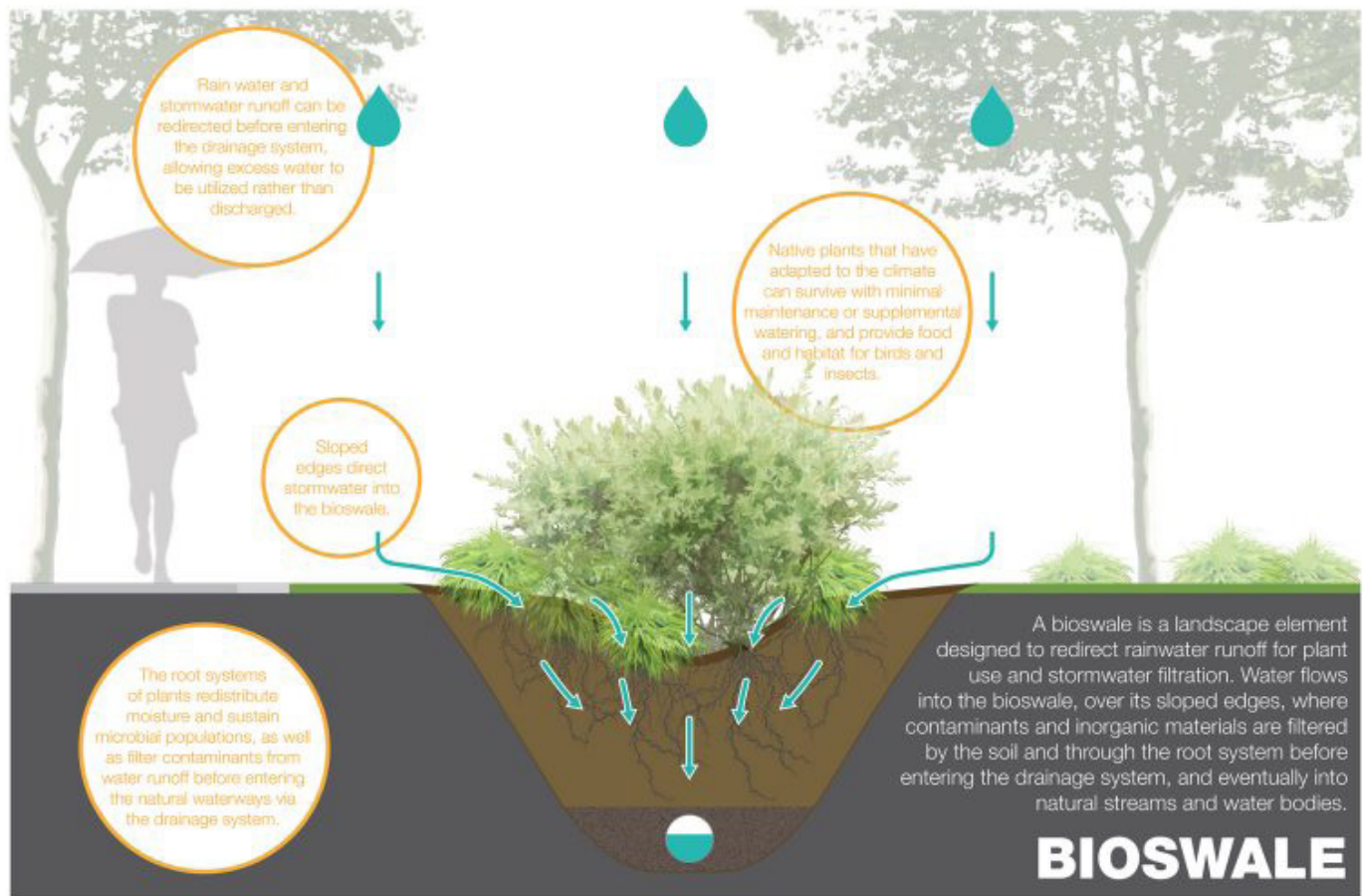
Figure 38: Example of a bioswale (Source: Margaret Robinson, found on Asakura Robinson, http://www.asakurarobinson.net/anon-blog-author/designing-lid/)

and their adoption by the Muncie Delaware County Plan Commission.

Cost: Low.

Partner(s): City of Muncie, Muncie Neighborhood Associations, Muncie Delaware County Plan Commission, Muncie Board of Zoning Appeals, and Delaware County.

Assessment Metrics: Population density in new suburban development, and adoption of a land use plan that incorporates innovative approaches to development.

Strategy 3.3.2. Consider utilizing brownfields sites for future development to mitigate the expansion of new services as well as dilute the impact of urban sprawl. Consider creating a brownfield redevelopment plan to address locations, economic/social potential, cleanup progress, and funding (state/federal) for development of these sites.

Timeframe: Medium to long term.

Cost: High as cost of cleanup may be expensive.

Partner(s): City of Muncie, Muncie Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, and Delaware County.

Assessment Metrics: Identification of sites that need clean up, and number of sites that have been redeveloped into productive economic uses.

Strategy 3.3.3. Modify the Comprehensive Zoning Ordinance to eliminate minimum parking requirements in some land uses, consider eliminating single family zoning, incorporate mixed use zoning (or equivalent) and include density bonus for property owners that use sustainable infrastructure such as bioswales, tree cover, and solar panels.

Timeframe: Medium to long term.

Cost: Low.

Partner(s): City of Muncie, Muncie Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, and Delaware County.

Assessment Metrics: Tracking locations of existing lots to compare to past development, create a list of property owners that utilize sustainable infrastructure.

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4. Economic Security

Issue: Muncie Indiana, like many other American cities, has a municipal boundary that covers a wide expanse of land and population. Much of Muncie's city services such as Police Stations, EMS Services, and Fire Stations are located farther than 4-8 minutes (a federally suggested number) away from residential homes and businesses. This makes city services and roadway infrastructure continually strained and needs constant updating or consideration due to Muncie's growing boundaries, specifically in the North West quadrant of the City.

Goal 4.1. Decrease urban sprawl by incentivizing compact development.

Strategy 4.1.2. Create an expedited permitting process for compact development such as infill development and redevelopment in Muncie's historic neighborhoods.

Timeframe: This is of intermediate concern as it helps to decrease the cost of providing municipal infrastructure to low density or fringe locations.

Cost: Low

Partner(s): The City of Muncie, Muncie Economic Coalition, Delaware County Planning Commission.

Assessment Metrics: Number of expedited permits issued over time (Sprawl Index; land use versus population growth).

Goal 4.2. Retain and capture local expenditure.

Strategy 4.2.1. Encourage people who work in Muncie/Delaware County, to live in Muncie/Delaware County by working with large employers (Ball State and IU Ball Memorial Hospital) and realtors to incentivize residents in Delaware County and the city.

Timeframe: Long term.

Cost: Low

Partner(s): City of Muncie and Delaware County, Realtors

Assessment Metrics: Tracking the number of people who live/work within the county and city limits.

Strategy 4.2.2. Improve quality of life through job creation, and improving city amenities.

Timeframe: Immediate, as this is a long term strategy and will be a continued process throughout the next few years.

Cost: Low to high, depending on which specific strategies are used (e.g. a new streetscape will be more costly than a community activity).

Partner(s): NEXT Muncie, the City of Muncie, Delaware County Planning Commission, Indiana Economic Development Alliance, and the Muncie Neighborhood Associations.

Assessment Metrics: Tracking population and job retention, analyzing the wants/needs of residents and their goal fulfillments, tracking diversification no the economy.

Strategy 4.2.3. Create a reserve fund that can be used in an economic recession.

Timeframe: Immediate, this is a long term strategy since it would take time to have a reserve found that could support the city.

Cost: Low to High, as it is at the discretion of the city and county to decide how much is allocated.

Partner(s): City of Muncie and Delaware County

Assessment Metrics: Implementation of the fund, utilization and continuation of the fund when a disaster happens.

Issue: The highest concentration of residents who are 18 years or older without a high school diploma reside largely in the Southside neighborhood as well as slightly west of the city, which demonstrates economic/educational segregation.

Goal 4.3. Form a public-private partnership between the city of Muncie, BSU, IVY tech, Muncie-Delaware County, and Indiana Economic Development Alliance to address the spatial disparity.

Strategy 4.3.1. Decrease the unemployment rate and provide a business-friendly environment through start-up business incubator and venture capital and business mentorship programs.

Timeframe: Immediate

Cost: City can allocate some funds from the Economic Development Option Tax (EDIT) to fund the program.

Partner(s): Redevelopment Commission, City Council, and County Council.

Assessment Metrics: Number of start-up businesses that have been formed or assisted with funding.

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5. Social and Economic Inclusion

Issue: According to the 2017 Census, 4.9% of Muncie residents have hearing difficulty, 2.9% have vision difficulty, and 1.1% speak English less than "very well." This poses a concern for resilience, as information regarding emergency preparedness may not be equally available for all.

Goal 5.2. Make economic opportunities and information regarding resilience available to Muncie residents with limited English speaking, and visual or hearing ability.

Strategy 5.2.1. The city should make Spanish translations and audible files for all text-based public materials and captions for all visual or audio public materials regarding resilience. These include but are not limited to information on emergency preparedness, healthcare, and educational opportunities.

Timeframe: Less than a year.

Cost: Less than $5,000 in labor fees for translators and audio recorders.

Partner(s): The City of Muncie, ADA, and contracted translators and audio transcribers.

Assessment Metrics: A before and after survey of Muncie residents with limited English speaking, visual, or hearing ability on accessibility to public materials.

6. Health and Safety

Issue: Our analysis found that 30,085 properties in the city, and 4.6% have vacant buildings and 8% have vacant lots. Additionally 62% of all Muncie properties are within 300 of a vacant building. This contributes to vandalism, structural risks, breeds rodents and pests, and illegal activities.

Goal 6.1. Decrease housing blight and vacancies.

Strategy 6.1.1. Demolish blighted homes and structures in areas that are beyond saving or fixing. MAP3 identified 1,289 blighted properties within the city, many of which fit this criteria.

Timeframe: Immediate to a year.

Cost: This requires using eminent domain to acquire these properties in order to demolish them.

Partner(s): Department of Community Development, Muncie-Delaware County Indiana Economic Development Alliance, The City of Muncie Historic Preservation & Rehabilitation Commission, City of Muncie Redevelopment Commission and Muncie Building Commissioner.

Assessment Metrics: The extent of blight reduction as evidenced by properties listed in the category.

Strategy 6.1.2. Adopt a vacant property registration ordinance that requires property owners to register their property within the city if it is vacant for more than a given period of time. The City of Wilmington, Delaware has a vacant property registration ordinance that could be a guide for creating one for Muncie.

Timeframe: Immediate to a year.

Cost: None

Partner(s): The City of Muncie Department of Community Development, Delaware-Muncie Metropolitan Plan Commission, Department of Public Works, Muncie City Council, Mayor of Muncie, and Muncie Building Commissioner.

Assessment Metrics: The adoption of a vacant

property registration ordinance.

Strategy 6.1.3. Adopt a nuisance ordinance that will hold tenants/property owners responsible for nuisance generated at their properties and fines them for such violations.

Timeframe: Immediate to a year.

Cost: None

Partner(s): The City of Muncie Department of Community Development, Delaware-Muncie Metropolitan Plan Commission, Department of Public Works, Muncie City Council, Mayor of Muncie, and Muncie Building Commissioner.

Assessment Metrics: The adoption of a nuisance ordinance.

Goal 6.2. Increase safety through police engagement and services with the community which could lead to a decrease in crime and vandalism.

Strategy 6.2.1. Encourage residents to use the Nextdoor phone application so neighbors are updated and encouraged to go to events happening in their neighborhood.

Timeframe: Immediate to a year.

Cost: None

Partner(s): Muncie Police Department and the Muncie Neighborhood Associations.

Assessment Metrics: The number of app users within each neighborhood.

Issue: Our analysis found that many community members do not have access to resources when an emergency occurs. This can lead to individuals not being notified or prepared properly during an emergency and leaving individuals without shelter or a place to go.

Goal 6.3. Make fire alarms accessible and affordable in the community.

Strategy 6.3.1. Utilize the Indiana State Fire Marshal "Get Alarmed" Smoke Alarm Program. The current program ends in 2020, but the State Fire Marshal is looking to extend the program for more years.

Timeframe: Immediate to a year.

Cost: None

Partner(s): American Red Cross, Indiana State Fire Marshal, Indiana Department of Homeland Security and the Muncie Fire Department.

Assessment Metrics: The number of fire alarms installed by the Muncie Fire Department and American Red Cross.

Strategy 6.3.2. Have the Muncie Fire Department visit with the Muncie Neighborhoods to discuss fire safety.

Timeframe: Immediate to a year.

Cost: None

Partner(s): American Red Cross and the Muncie Fire Department.

Assessment Metrics: The number of neighborhood events held by the Muncie Fire Department.

Summary of Resilience Strategies

Table 8 provides a summary of the resilient challenges identified in the study, and provides goals and strategies for redressing the issues identified. The table begins with a discussion of the priority action projects, those that need to be implemented right away to get the plan started, and then follows with a discussion of other strategies categorized under leadership and community engagement, disaster readiness, climate adaptation, economic security, social and economic inclusion, and health and safety.

Priority Action Areas

Resilience Challenge	Goal	Strategy	Partners	Time Frame
Perceived lack of transparancy	Improve communication between the city and county government	Launch City-Government-on-the-Go	City of Muncie Mayor, City Council, Neighborhood Association Boards	Immediate
No officially designated emergency shelters	Identify emergency shelter locations in all four quadrants of Muncie	Analyze existing Muncie facilities that meet the FEMA suggested criteria for an emergency shelter	City of Muncie, Muncie School Systems, Ball State University, Delaware County Emergency Management Office	Immediate
Lack of strategic plan for continuation of critical government services in case of a disaster	Identify and implement a strategy for the continuation of government services	Adopt Continuity of Operations Plan (COOP), taking suggestions from National Continuity Policy Implementation Plan (NCPIP)	City of Muncie IT Department, City Council, City Mayor	Immediate
Several roads are currently at or above capacity or will exceed capacity in the next three decades	Expand and improve city roads that are at or above level of service capacity to withstand catastrophic damage and meet LOS standards	Adopt a multi-year capital improvement plan to fund road projects	City of Muncie, Public Works Department	Immediate
A high number of vacant buildings in the city	Increase safety through community police relations	Hold police-community events in Muncie neighborhoods. Adopt a restorative justice program to decrease recidivism and incarceration rates	Muncie Police Department, County Police Department, City of Muncie	Immediate
Gaps in the coverage of multi-modal transportation networks beyond personal vehicles	Identify emergency shelter locations in all four quadrants of Muncie	Analyze existing Muncie facilities that meet the FEMA suggested criteria for an emergency shelter	City of Muncie, Muncie School Systems, Ball State University, Delaware County Emergency Management Office	Immediate

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

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Civic Leadership and Community Engagement

Resilience Challenge	Goal	Strategy	Partners	Time Frame
Lack of communication between city and county government	Improve communication between the city and county government	Form an inter-governmental commission comprised of both city and county staff to deliberate on matters impacting the two governments	City of Muncie Mayor, Delaware County Commissioner	Immediate
Perceived corruption in city government	Decrease corruption in city government	Conduct annual independent audit of city government functions	City of Muncie Mayor, Muncie City Council, Muncie City Staff, Indiana Department of Administration, Private consultants	Immediate
Lack of plan for continuity of government services after disasters	Plan for continuity of operations in the event of damage to government buildings	Use continuity of Operations Plan (COOP) and the National continuity Policy Implementation Plan (NCPIP)	City of Muncie Mayor, Muncie City Council, Muncie City Staff, Federal Emergency Management Agency (FEMA)	Mid-Term to Long-Term

Disaster Readiness

Resilience Challenge	Goal	Strategy	Partners	Time Frame
A significant number of Muncie's population and businesses are in the 100- and 500-year floodplains	Decrease vulnerability of flood risks to residents and properties within the floodplains	Encourage property owners in the floodplain who do not have flood insurance to gain proper insurance through the NFIP	City of Muncie, Delaware County Emergency Management Office, Muncie Neighborhood Associations, FEMA	Mid-Term
Lack of landscaping requirements in the floodplain	Use Delaware county's land use regulations to help decrease flood impacts	Revise the Comprehensive Zoning Ordinance to require minimum landscaping and permeable surface coverage in floodplains	Delaware County Planning Commission	Immediate to one year
Lack of minimum landscaping requirements in city's ordinance contributing to increased run-off	Use Delaware County's land use regulations to help increase tree cover in the city, especially in Census Tracts with little tree cover	Require street trees in city right of ways in the Census Tracts that currently have little or no landscaping or tree cover.	Delaware County Planning Commission, Muncie Department of Public Works, Muncie City Council	Immediate to one year

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

Resilience Challenge	Goal	Strategy	Partners	Time Frame
Problems with access to evacuation routes from some nursing homes and critical medical facilities	Synchronize traffic lights as well as prioritize efficient traffic flow at critical locations where medical facilities and nursing homes are located	Use data and simulation technology at facility locations to reach optimized safety and traffic flow	City of Muncie, Muncie Public Works Department, Delaware county Plan Commission, Muncie city Council, Muncie Indiana Transit System	Long-Term

Climate Adaptation

Resilience Challenge	Goal	Strategy	Partners	Time Frame
Several roads are identified as at or above capacity	Improve city infrastructure, including roads, bridges, and sidewalks	Adopt a multi-year capital improvement plan that helps prioritize the expansion and construction of roads and sidewalks	City of Muncie, Neighborhood Associations, Indiana Department of Environmental Management (IDEM), Delaware County	Immediate
		Adapt and improve the combined sewer systems into separate waste and rainwater through the Muncie Sanitary District	City of Muncie, Sanitary District, Delaware County, Muncie Neighborhood Associations	Long-Term
		Create development standards in the Comprehensive Zoning Ordinance to introduce permeable pavements, bioswales, and increase vegetation in high deficit Census Tract areas	City of Muncie, IDEM, Muncie Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, Delaware County	Mid-Term
High concentration of brownfields in downtown, and along major arterials, and railroads	Contain sprawl to decrease the cost of extending municipal infrastructure and services	Utilize strategies such as floor area ratios, transit-oriented development, tax of speculative land holdings, and cost-ineffective development patterns	City of Muncie, Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, Delaware County	Long-Term
		Consider utilizing brownfields sites for future development to mitigate the expansion of new services as well and decrease the impact of urban sprawl	City of Muncie, Muncie Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, Delaware County	Long-Term

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

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Economic Security

Resilience Challenge	Goal	Strategy	Partners	Time Frame
Low density development at the edge of the city	Incentivize high density development and regulate low density development	Initiate restrictions on new development occurring on the outer edges of Muncie.	City of Muncie, Indiana Economic Development Alliance, Muncie Planning Department	Immediate
		Create an expedited permitting process for infill development and redevelopment in Muncie's historic neighborhoods	City of Muncie, Delaware County	Intermediate
	Retain and capture local expenditure	Encourage people who work in Muncie/ Delaware County, to live in Muncie/ Delaware County.	City of Muncie, Delaware County	Within the next three years
		Improve quality of amenities such as schools, streets, trails, public transportation, museums, and other facilities that will help attract and retain workers in Muncie etc.	City of Muncie, Delaware county Planning Commission, Indiana Economic Development Alliance, Muncie Neighborhood Associations	Long-Term
		Create a reserve fund that can be used in an economic recession.	City of Muncie, Delaware County	Immediate
Economic/ education segregation with lower income residents predominantly living south and East of the city	Form a public-private partnership between the city of Muncie, BSU, IVY tech, Muncie-Delaware County, and Indiana Economic Development Alliance	Decrease the unemployment rate and provide a business-friendly environment to help create jobs for the unemployed	Redevelopment Commission, City Council, County Council	Long-Term

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

Economic and Social Inclusion

Resilience Challenge	Goal	Strategy	Partners	Time Frame
Gap in active transportation coverage in low-income areas	Bridge gaps in existing bicycle, pedestrian and transportation facilities coverage	Connect gaps in existing bicycle and pedestrian coverage to ensure smooth and safe connections and enhance the quality and usage of existing public facilities	City of Muncie Public Works Department, State of Indiana (Public Mass Transportation Fund), Federal Government (TIGER Grants)	Mid-Term
Lack of parity in emergency preparedness for residents with hearing, vision and English understanding difficulties	Make economic opportunities and information regarding resilience available to Muncie residents with limited English speaking, visual or hearing ability	The city should make Spanish translations and audible files for all text-based public materials and captions for all visual or audio public materials regarding resilience	City of Muncie, ADA, Contracted translators and audio transcribers	Less than one year

Health and Safety

Resilience Challenge	Goal	Strategy	Partners	Time Frame
High vacancy rates in neighborhoods leads to vandalism, creates structural risks, breeds rodents and pests, and illegal activities	Decrease housing blight and vacancies	Demolish blighted homes and structures in areas that are beyond saving or fixing	Department of Community Development, Muncie-Delaware county Indiana Economic Development Alliance, City of Muncie Historic Preservation and Rehabilitation commission, City of Muncie Redevelopment Commission, Muncie Building Commissioner	Immediate
		Adopt a vacant property registration ordinance that requires property owners to register their property within the city if it is vacant for more than a given period of time	City of Muncie Department of Community Development, Delaware-Muncie Metropolitan Plan commission, Department of Public Works, Muncie city Council, Muncie Building Commissioner	Mid-Term

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

Resilience Challenge	Goal	Strategy	Partners	Time Frame
		Adopt a nuisance ordinance that will hold tenants/property owners accountable for incidents that occur in their properties and fine them for such occurrences	City of Muncie Department of Community Development, Delaware-Muncie Metropolitan Plan Commission, Department of Public Works, Muncie City council, City of Muncie Mayor, Muncie Building Commissioner	Mid-Term
		Encourage residents to use the Next-door phone application	Muncie Police Department, Muncie Neighborhood Associations	Immediate to a year
	Encourage engagement between police and residents	Have a monthly police/community event in each of the Muncie neighborhoods	Muncie Police Department, Muncie Neighborhood Associations	Immediate to a year
	Make fire alarms accessible and affordable in the community	Utilize the Indiana State Fire Marshal "Get Alarmed" Smoke Alarm Program.	American Red Cross, Indiana State Fire Marshal, Indiana Department of Homeland Security, Muncie Fire Department	Immediate to a year
		Have the Muncie Fire Department visit with the Muncie Neighborhoods to discuss fire safety.	American Red Cross, Muncie Fire Department	Immediate to a year

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

Climate Adaptation

Resilience Challenge	Goal	Strategy	Partners	Time Frame
Several roads are identified as at or above capacity	Improve city infrastructure, including roads, bridges, and sidewalks	Adopt a multi-year capital improvement plan that helps prioritize the expansion and construction of roads and sidewalks	City of Muncie, Neighborhood Associations, Indiana Department of Environmental Management (IDEM), Delaware County	Immediate
		Adapt and improve the combined sewer systems into separate waste and rainwater through the Muncie Sanitary District	City of Muncie, Sanitary District, Delaware County, Muncie Neighborhood Associations	Long-Term
		Create development standards in the Comprehensive Zoning Ordinance to introduce permeable pavements, bioswales, and increase vegetation in high deficit Census Tract areas	City of Muncie, IDEM, Muncie Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, Delaware County	Mid-Term

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

Resilience Challenge	Goal	Strategy	Partners	Time Frame
High concentration of brownfields in downtown, and along major arterials, and railroads	Contain sprawl to decrease the cost of extending municipal infrastructure and services	Utilize strategies such as floor area ratios, transit-oriented development, tax of speculative land holdings, and cost-ineffective development patterns	City of Muncie, Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, Delaware County	Long-Term
		Consider utilizing brownfields sites for future development to mitigate the expansion of new services as well and decrease the impact of urban sprawl	City of Muncie, Muncie Neighborhood Associations, Muncie Plan Commission, Muncie Board of Zoning Appeals, Delaware County	Long-Term

Table 8: Summary Table of Resilient Challenges, Goals, and Strategies for Implementation

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APPENDICES

APPENDIX A
Referenced Documents and Sources

Muncie Disaster Preparedness Plan (1939)

Muncie Delaware County Comprehensive Plan (2000)

Public Transit Human Services Coordination Plan (2007)

Delaware-Muncie Transportation Plan Update (2009)

Muncie Action Plan (2010)

Muncie Action Plan 2 (2013)

East Central Indiana Regional Development Plan (2015)

Muncie-Delaware County Economic Development Alliance VISION 2021 (2016)

Hazard Mitigation Plan (2019)

2013-2040 Delaware-Muncie Transportation Plan Update (2013)

2018-2045 Delaware-Muncie Transportation Plan Update (2018)

Be Ready Delaware County Document (2010's)

Indiana Department of Transportation [INDOT] Data (2019)

United States Climate Resilience Online Toolkit (2019)

State of Indiana Standard Multi-Hazard Mitigation Plan (2019)

Muncie Sanitary District CSO Long Term Control Plan Update (2011)

FEMA Design Guidance for Shelters and Safe Rooms Document (2006)

BC Housing Shelter Design Guidelines Document (2017)

State of Florida Statewide Emergency Shelter Plan (2018)

Thrive Indianapolis [Resilience and Sustainability Plan] (2019)

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Plan	Resilience Factors	Strengths	Weaknesses
MAP	**Economic Resilience** An action within the MAP that focuses on economic resilience is, Initiative 1: Linking Learning, Health and Prosperity, Action 2: Create and implement an economic development plan to expand the number of competitive-wage jobs. This focuses on economic resilience by access to the current job situation and addressing the needs and opportunities for the economy within Muncie. • Creating a plan on how to adjust to shrinking population within Muncie **Environmental Resilience** An action within the MAP that focuses on environmental resilience is Initiative 4: Creating Attractive and Desirable Places, Action 5: Create a brownfield redevelopment program. This action focuses on environmental resilience through seeking funding for structure removal and increasing the clean-up of designated brownfields sites which would help remove any harmful substances to our environment from the site. • Researching and implementing sustainable practices to conserve as much natural habitats and resources **Institutional Resilience** An action within the MAP that focuses on institutional resilience is Initiative 1: Linking Learning, Health and Prosperity, Action 5: Develop and implement a plan to coordinate with and capitalize of Ivy Tech to Downtown. This focuses on institutional resilience by creating opportunities for Ivy Tech and downtown businesses to interact and learn from each other. **Physical Resilience** An action within the MAP that focuses on physical resilience is Initiative 4: Creating Attractive and Desirable Places, Action 3: Continue and expand the blight removal program. This focuses on physical resilience because when there are blighted structures, the community is able to react through converted those structures into pocket parks, public gardens, etc. **Social Resilience** An action within the MAP that focuses on social resilience is Initiative 5: Managing Community Resources, Action 9: Institute a Bike-Friendly Community Program. This is social resilience because it gives the opportunity for the community to interact through a bike-friendly community which can increase the social aspect of the bike community. • Creating opportunities for mentorship and extra-curricular for students and community members	They have developed an economical program and council to help involve more people within Muncie. Acknowledge all aspects of economical, environmental, etc. Diverse actions that acknowledge how they can prevent things from advancing (etc. brownfields, blight, etc.)	There's more goals and objective oriented rather than preparing for the future. Lacking in institutional resilience the most.

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Plan	Resilience Factors	Strengths	Weaknesses
MAP 2	**Economic Resilience** • Promotes healthy and more prosperous future • Fostering collaboration • Promotes infill • Promotes a diverse economy • Supports and promotes local events and businesses with new outdoor advertising regulations for signs, including billboard reductions • Suggests ways to be more resourceful and equitable with resources • Coordinate with Ivy Tech, Ball State, and Muncie Community Schools • Create strategic neighborhood plans and work with neighborhoods to identify and secure funding to implement plans • Improve appearance of Gateways **Environmental Resilience** • Develop and implement a sidewalk and recreational paths plan • Institute bike-friendly community program • Implement City of Muncie's 5-year Parks and Recreation Master Plan • Create a Muncie Energy Office and advisory committee • Create a Brownfields Redevelopment Program • Institute bike-friendly community programs **Institutional Resilience** • Coordinate with Ivy Tech, Ball State, and Muncie Community Schools • Create an awareness-building coalition to promote the importance of education • Create a campaign to promote the importance of early childhood learning • Develop a plan to coordinate with and capitalize on the relocation of Ivy Tech to downtown • Work with Building Better Communities at Ball State University to expand the Neighborhood Presidents Council's role in developing neighborhoods, securing grants and educating residents about issues of concern • Encourage partnerships with educational institutions that will expand their influence and involvement in the community • Continue and expand the blight removal program with the use of BSU students **Physical Resilience** • Develop and implement a sidewalk and recreational paths plan • Institute bike-friendly community programs • Implement Downtown Master Plan • Continue and expand the blight removal program • Way-finding signage • Promotional signage • Implement City of Muncie's 5-year Parks and Recreation Master PlanPromotes infil • Improve appearance of Gateways • Adopt and enforce updated corridor development standards	Focuses on environmental and social resilient actions to achieve initiatives throughout plan. Initiatives 4 and 5 focus on economic resilience. Highlights some vulnerabilities as well as current status of resilient actions with the report card section	The use of the word "develop" and "encourage" without going into any further detail of who, how, and when. The concepts promotes resilience but fails to deliver. Initiatives 4 and 5 focus on "identifying and securing funding" with no real plan. This is not resilient because it does not highlight who or where these funds would come from. No real economic resilience is implemented with this plan Only highlights some vulnerabilities Does not indicate what Muncie plans to do in response to specific shocks

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Plan	Resilience Factors	Strengths	Weaknesses
MAP 2	• Promote and expand community-based neighborhood enhancement programs • Create a design manual for public infrastructure for use by public entities, developers and homeowner **Social Resilience** • Develop a community-based mentoring program • Work with Building Better Communities at Ball State University to expand the Neighborhood Presidents Council's role in developing neighborhoods, securing grants and educating residents about issues of concern • Support and promote the community-wide poverty awareness campaign • Develop materials and expertise to help neighborhoods organize, identify and train emerging leaders and connect them with resources in the larger community • Create a centralized community events calendar to increase event awareness in the community • Utilize social media more effectively to promote community pride and event awareness • Promotes healthy and more prosperous future • Fostering collaboration • Create strategic neighborhood plans and work with neighborhoods to identify and secure funding to implement plans • Promote and expand community-based neighborhood enhancement program		
Delaware Muncie Transportation Plan Update	**Economic Resilience** • Acknowledging more vulnerable areas that should be addressed through economic studies. • Supporting the economic vitality of the metropolitan area, by enabling competitiveness, productivity and efficiency **Environmental Resilience** • Different transportation options allow for the opportunity to reduce traffic congestion, reduce energy consumption, and reduce air pollution. **Institutional Resilience** • Adjusting transportation options to increase accessibility to public infrastructure **Physical Resilience** • Acknowledging what roads and street systems need to be adjusted to account for high volume traffic and being able to fix any streets that may need fixed. • Focuses on how to protect the natural environment for the future with their current actions **Social Resilience** • Creating the bike-ped plan to increase the use of the Cardinal Greenway and create a way for people to travel without needing a vehicle. • How to improve the quality of life through different actions and plan improvements.	The amount of data collected to back up the reasoning for the suggested actions There are goals to improve and prevent future need for resiliency actions Focusing on how to alleviate and prevent problems created by urban sprawl	Overall the plan doesn't address any how they would handle/what they would do if something that they haven't observed or planned for would happen. Essentially there is no back-up plan, which makes the plan less resilient.

Plan	Resilience Factors	Strengths	Weaknesses
Disaster Preparedness	**Economic Resilience** • Lends responsibilities of subcommittees in terms of supplies/sources of supplies for fundraising and public info **Environmental Resilience** • The plan is made for natural or accidental disasters (not warfare) **Institutional Resilience** • Shows the separation of duties/responsibilities that Red Cross has versus Federal assistance • It contains three stages of a disaster that express how needs should be dealt 1) on a mass basis immediately following the emergency 2) on a temporary individual basis following the restoration of normal community facilities 3) on a long-time basis through indemnity of other benefits **Physical Resilience** • HQ 1 is City Hall; Alt HQ 2 is Central High School, well known in Muncie; Alt HQ2 is Masonic Temple; lends good alternatives just in case • Requires a damage assessment **Social Resilience** • Utilizes multiple subcommittees (central purchase/supply, fundraising/public info, survey, rescue, medical aid, shelter, food, clothing, transportation/communication, registration/information/intake)	Is very general in resilience, but specific in social processes of duties and responsibilities Connects and relies on integrated federal and Red Cross resources Prepares well for environmental disasters Reliant on local resources	Does not address "social" in terms of the community, is only focused on subcommittees Does not address wartime disasters Relies on subcommittees for all aspects of resilience Does not address economic strongly (only references fundraising)
East Central IN Regional Development Plan	**Economic Resilience** • Contains specific economic information of the region, used to show vulnerability • Capitalizes throughout the document the disadvantages and also benefits of the areas economic sources **Environmental Resilience** • None **Institutional Resilience** • Addresses talent, real estate, educational, and demographic vulnerabilities; gives solutions **Physical Resilience** • Lends development examples to further vision and inclusion **Social Resilience** • Contains specific demographic information of the region, used as a tool for future development • Addresses community engagement and inclusion for the future • Includes quality of place for its vulnerable areas • Addresses talent, real estate, and demographic vulnerabilities; gives solutions	Addresses strengths/ weaknesses of the region Gives specific issues and opportunities the region faces (on multiple resilience levels Gives past efforts, and reviews them in today's terms Establishes a vision of goals, some include resilience	Although it provides examples, it does not address many resilience issues It only addresses the "now" issues, not potentially future ones Does not address resilience directly, or specifically

Plan	Resilience Factors	Strengths	Weaknesses
Hazard Mitigation Plan	**Economic Resilience** • The plan does not address the economic loss or stress after a disaster, though other plans in the resources and other links section, address this topic. **Environmental Resilience** • This document explains in detail the procedures that need to be taken in case of natural disasters. **Institutional Resilience** • They mention a couple of places that can be considered safe buildings, for example, a house, workplace, schools, hospitals, police stations, community shelter points, and other ways to assess nearby buildings suitable for shelter. **Physical Resilience** • The plan recommends that each household understands and analyses their threats in terms of location, housing type, pollution, roadways, and other factors to their own safety. **Social Resilience** • This section, the plan gives residents the names of corporations that offer volunteering programs.	The document lists a wide range of hazards that can occur Gives the readers further resources using hyperlinks, institutions, and other plans to look at	The document does not focus on the city of Muncie in general. Lacks context of importance on certain issues (commonality, data, etc.) Fails to address much of what the city will do in response to the citizen action.
Muncie Delaware County Economic Development Alliance VISION 2021	**Economic Resilience** • Identify and promote apprenticeship programs and make more business connections • Promote an Entrepreneurial Ecosystem with community businesses • Provide leadership on economic and policy issues Attractions and Assets in East Central Indiana • Create clear and easy regulations and initiatives to promote stakeholder and investor attractions **Environmental Resilience** • Promote community revitalization though added funds, initiative programs, and Public art programs • Expand standards for commercial corridors, like downtown, commercial centers, trails, and residential corridors. • Support wellness activities for healthy living and Identify / support public safety programs **Institutional Resilience** • Support efforts to increase business investment and job growth • Promote alternative energy and Identify partners to benefit from alternative energies • Market Muncie-Delaware County as a regional economic center • Maintain High School and Post-Secondary Attainment **Physical Resilience** • Collaborate to encourage retail growth and Partner to promote downtown activities in the Downtown • Promote wellness activities and build awareness of wellness program providers • Stay current and up to date on Transit Options • Collaborate to make the city more bicycle and pedestrian friendly	Focuses on a wide variety of topics Lists current assets to Delaware County Sets clear guiding principles	Does not put these focuses into context of Muncie's current conditions Lacks the contextual reasoning for the document or what it can be used for Leaves out many potential suggestions in how to incorporate or use the listed assets Focuses heavily on Muncie, and lacks information specific to Yorktown or Daleville

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Plan	Resilience Factors	Strengths	Weaknesses
Muncie Delaware County Economic Development Alliance VISION 2021	• Encourage wide housing options, types, and prices • Consult with builders and financiers on new construction • Encourage improvements to existing homes • Partner to develop standards for residential developments **Social Resilience** • Encourage population growth and diversity; through working with employers to recruit workers to the area and convincing commuters to relocate to Delaware County • Expand High-Quality Internet Access, broadband access, and work to implement citywide wi-fi • Alignment of Vision 2021 with Other Plans		
Public Transit Human Services Coordination Plan	**Economic Resilience** • Identifies funding sources apart from tax revenue and fares • Meaningful service to low-income population in the event of a recession • Collaboration with private transit services makes for needed redundancy and modularity in coverage **Environmental Resilience** • Transit alleviates car emissions **Institutional Resilience** • Increased government coordination through Delaware County Transportation Coordination Committee • Collaboration with local hospitals • and human services agencies **Physical Resilience** • Plans to increase service hours • New vehicles purchased • Can reduce infrastructural strain of personal vehicles **Social Resilience** • Attentive to the needs of low income, elderly, and disabled population • Well-informed on attribute data for the population	Diversifies funding sources Simplified payment system, streamlined communication More reliable service and thorough coverage	Unspecific plans; does not confirm new funding sources Explicitly avoids redundancy Few details with regard to accessibility Does not adequately address land use or density
Comprehensive Plan	**Economic Resilience** • Features job training component • Retention of talent from Ball State alumni • Preservation of agricultural sector • Physical room for industry and commerce to grow **Environmental Resilience** • Plan for greenways • Pedestrian connections to downtown • Sensitive development with regard to wetlands and floodplains **Institutional Resilience** • Increased coordination within governmental organizations • Plans to expand tax revenue	Concisely identifies problems faced by the region Plans development with regard to utilities coverage Greenways plan expands modes of transportation Sensitive development with regard to wetlands and floodplains Identification of alternate funding sources	Limited recognition of social issues Does little to prevent sprawl, and in some cases perpetuates it Works against diversity of land uses Too much focus on fringe areas such as McGalliard Road

Plan	Resilience Factors	Strengths	Weaknesses
Comprehensive Plan	**Physical Resilience** • Future subdivisions planned carefully so as to not strain utilities • Additional public service workers hired • Road widening and right turn lanes • Infill development to address vacancy **Social Resilience** • Downtown plan that centers on recreation and culture • Use of CDBGs for low-income areas		

APPENDIX C

Civic Leaders' Interviews

Positions of Civic Leaders
- Muncie Community Schools Member, Board of Trustees
- Muncie Redevelopment Commission, Residential Administrator
- Muncie/Delaware County Planning Commission, Executive Director
- Ball State University, President
- Ball State President's' Cabinet, Provost and Executive Vice President for Academic Affairs
- Muncie Resists, Vice President/Chair

Questions Asked
1. Do you think Muncie should be concerned about resilience?
2. What was the last significant shock that occurred in Muncie and how did civic leaders respond?
3. What do you anticipate to be the next great shock and how are we prepared to face it?
4. What do you think are the major stresses that Muncie faces and how are we addressing these stresses?
5. In order to develop an inclusive resilience strategy that reflects the needs of the entire city, which partners (i.e. current networks, stakeholders, and collaborators) will Muncie need to engage now and in the future?
6. What attributes of a resilient city is Muncie missing? What actions can we take gain and strengthen these?
7. What industries in Muncie do you think are at risk from global economic shifts?
8. What infrastructure in Muncie do you think is at risk from climate change?
9. What is your organization doing to make Muncie more resilient?
10. What in your view are the challenges to making Muncie a resilient city?

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What attributes of a resilient city is Muncie missing?
- A diverse economy
- Job opportunities
- Large cash reserves
- Civic capacity
- Trust in government

APPENDIX D
Assessment of Critical Public Facilities

Jails and Police Stations

Category	
Basic needs (e.g. food, housing)	
Government Communication	
Civic Participation	
Sense of Community	
Crime	
Culture and Diversity	
Education	
Environmnent/ Sustainability	
Emergency Services	
Healthcare/ Public Health	
Infrastructure Development	
Jobs/ The Economy	
Public Needs/ Shelters	
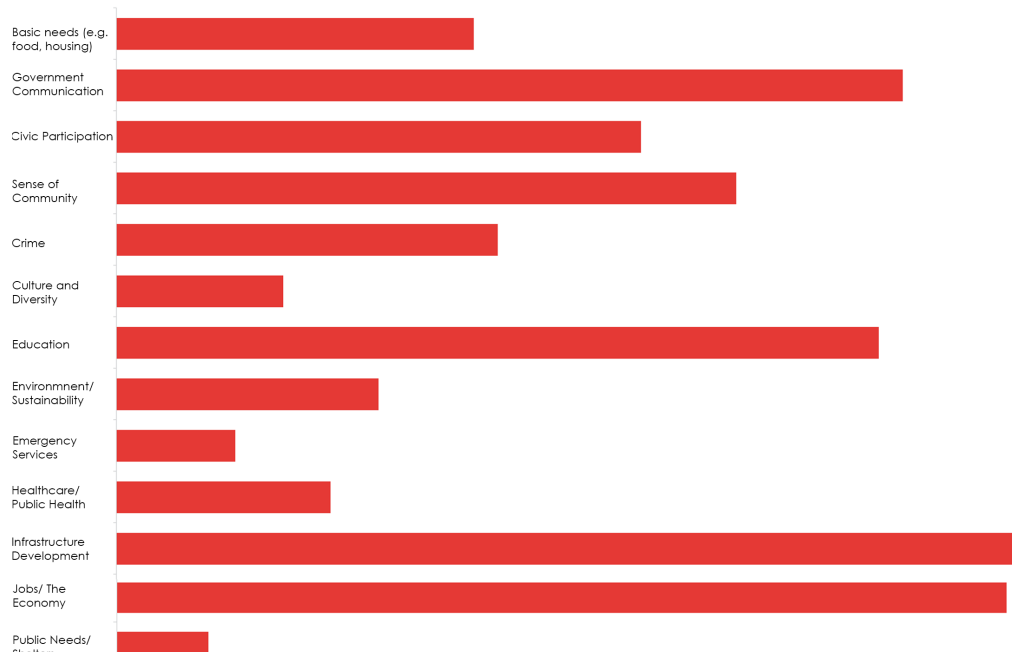
APPENDIX E
Assessment of Social and Economic Conditions

Population Density
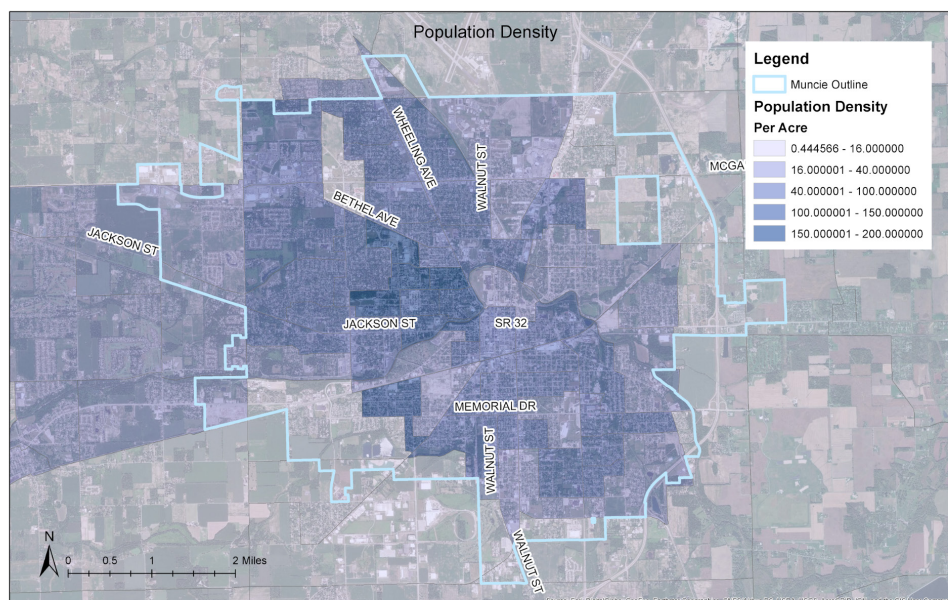
Limited English Household by Census Tract

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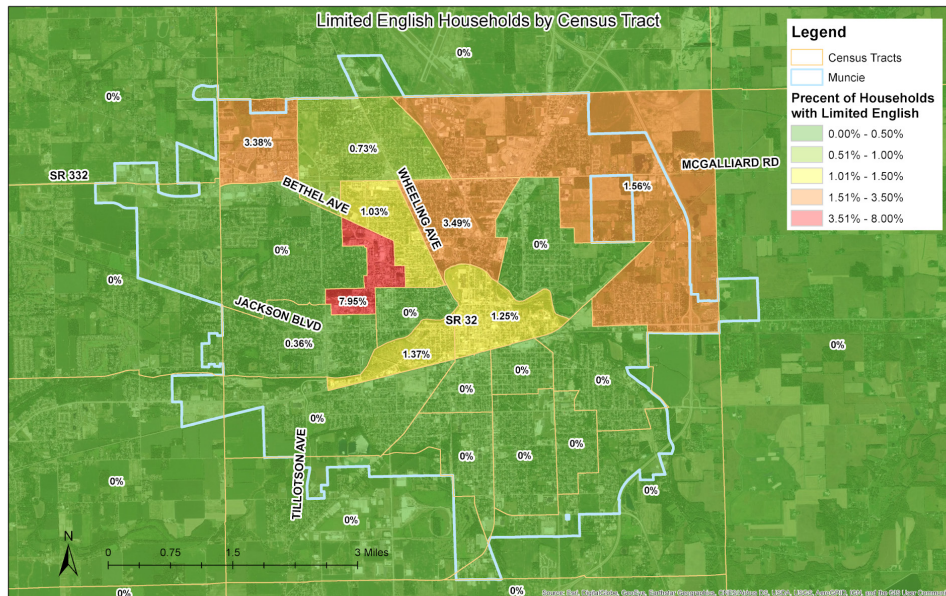
Single Parents with Kids Under 6 by Block Group

Population Aged 85+ in Muncie, Indiana

Population Aged 85+ in Muncie, Indiana

Legend

Number of people per census block group

- 0 - 13
- 14 - 26
- 27 - 49
- 50 - 86
- 87 - 154

Muncie Boundary

Population with any Disability

Population with any Disability

Legend

Muncie

Disabled Population

DisPer

- 4.40% - 9.50%
- 9.51% - 15.30%
- 15.31% - 19.40%
- 19.41% - 25.20%
- 25.21% - 33.40%
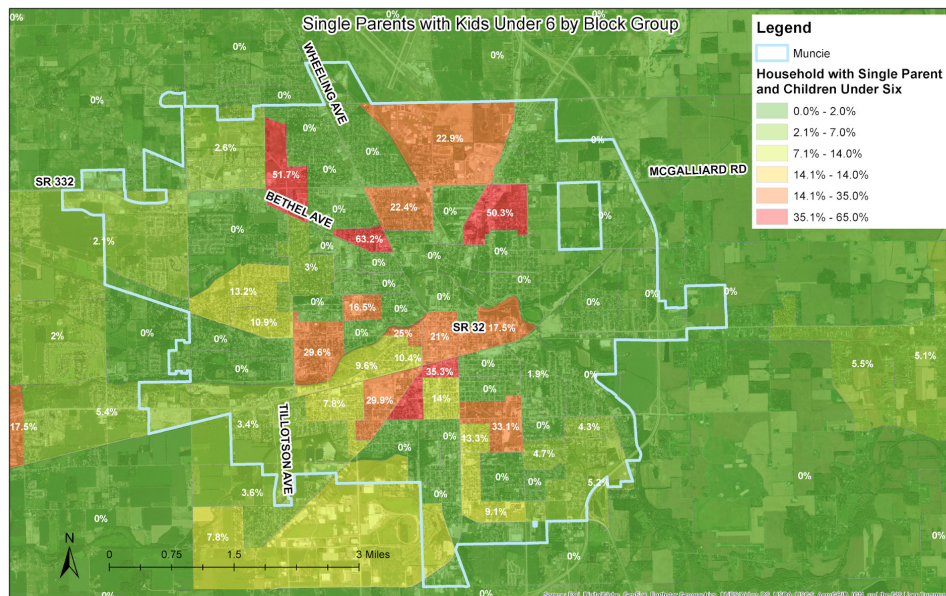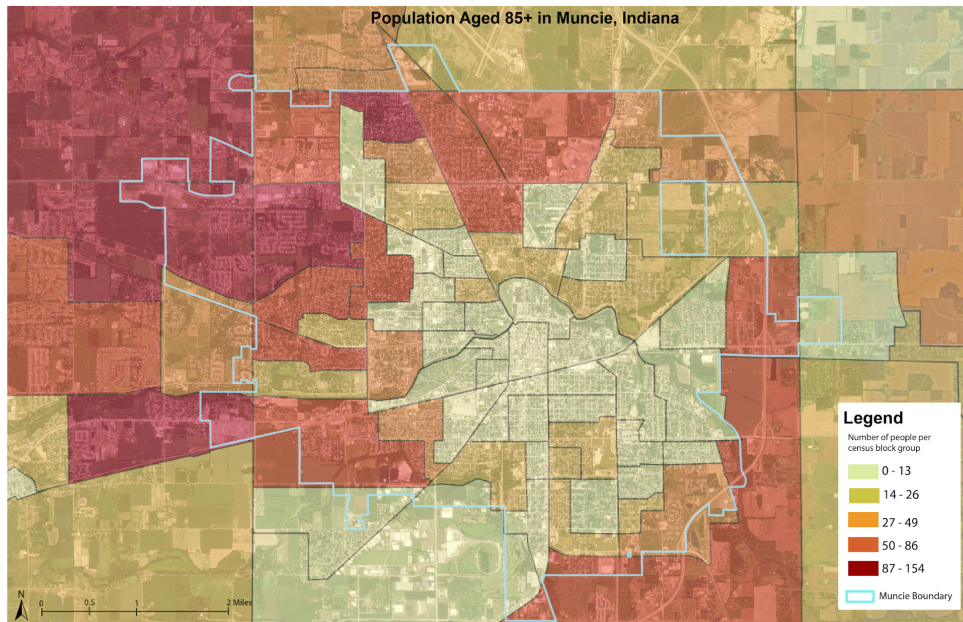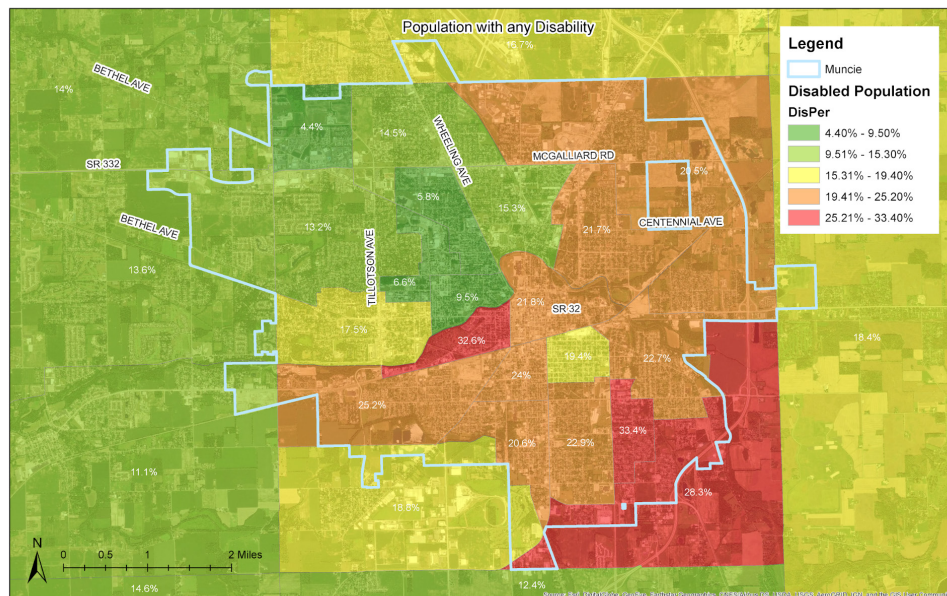
Brownfield Sites in Muncie
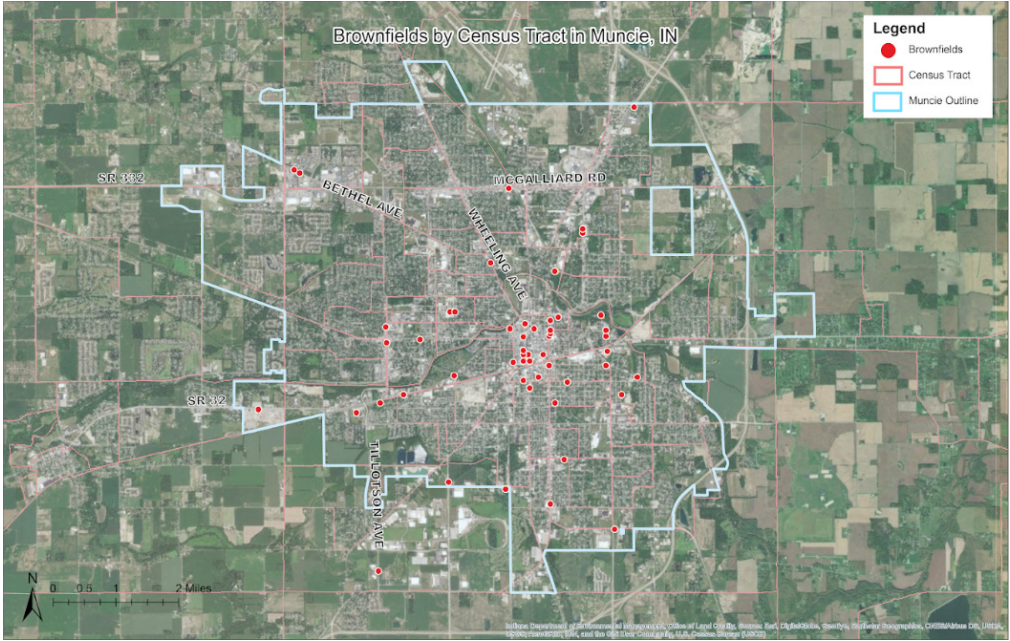
APPENDIX F
Community Survey

Characteristics of Respondents

Total Responses	117 (100%)
Muncie Residents	66 (56%)
Median Income	Between $50,000 and $99,999
Median Education Attainment	Bachelor's Degree

Do you think Muncie should be concerned about resilience?
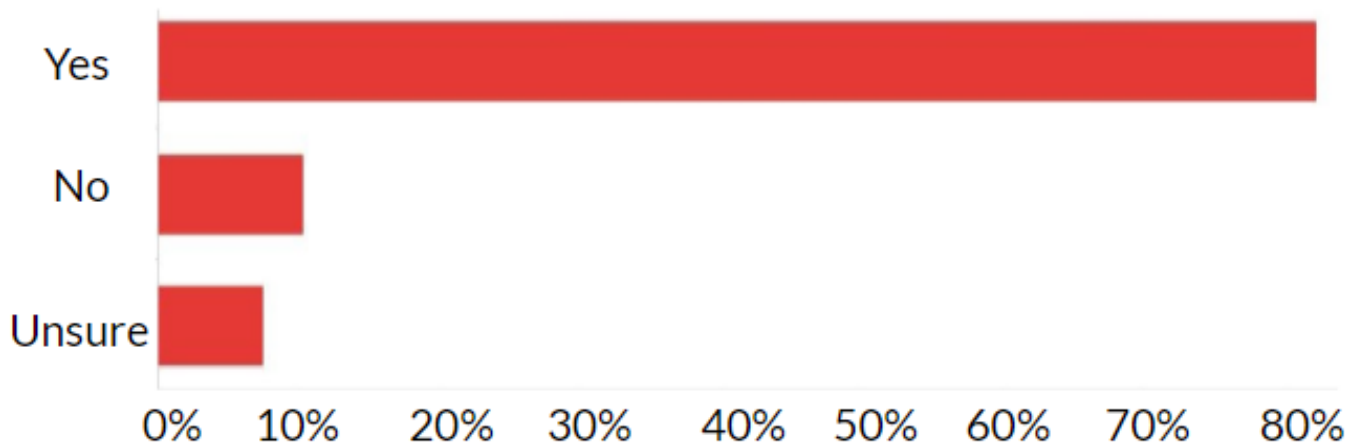
Which three areas do you think need the most focus to increase resilience in the City of Muncie?

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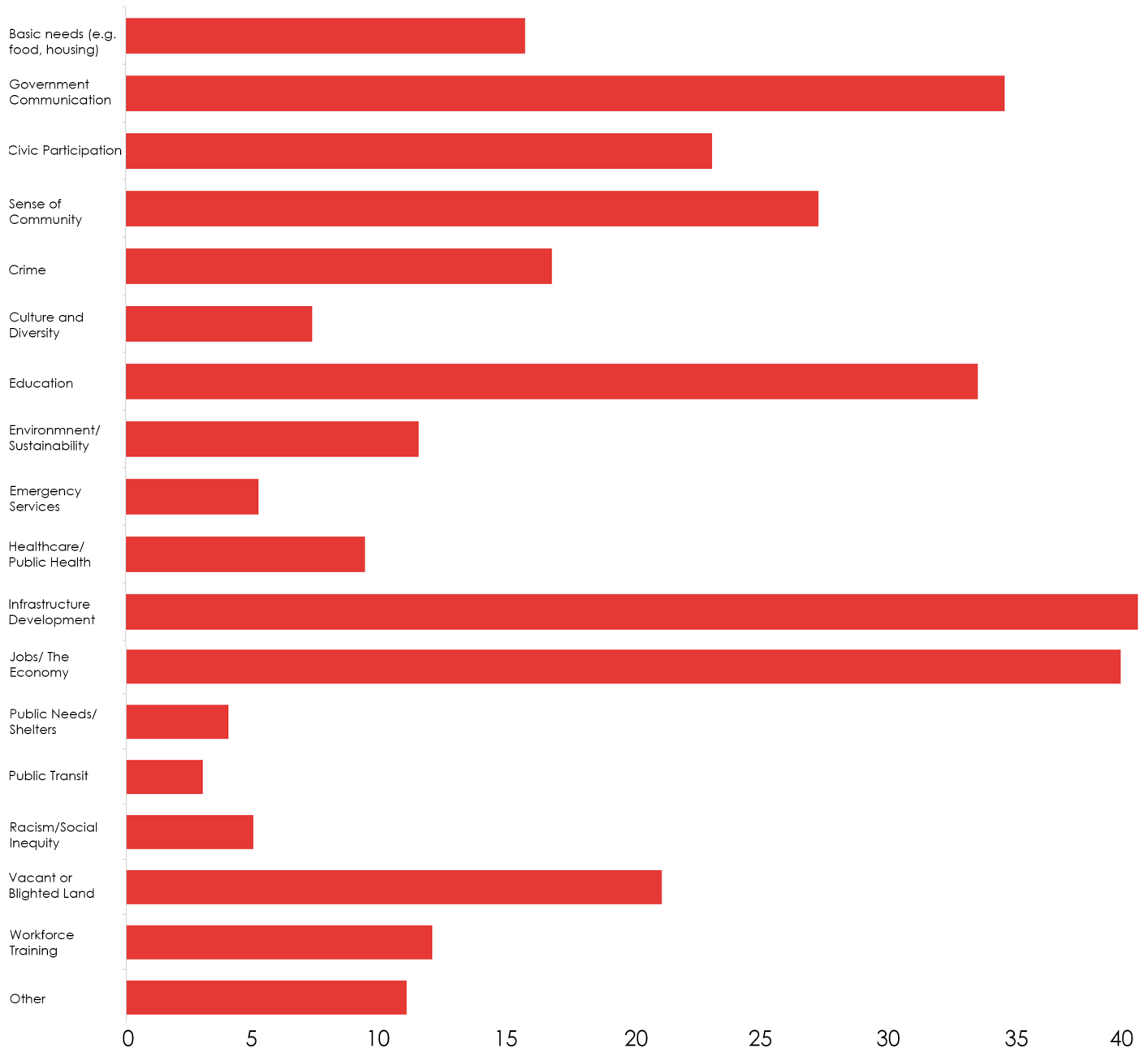
A city is more resilient if its policies are just and members of the community feel safe. How well does the city address this need? Please explain where appropriate.

Legend:
- Overall city plans or strategies that deter crime.
- City policies or practices that prevent corruption and promote trust in the government.
- Police department plans or strategies that ensure safety and security.
- Transparent and equitable enforcement of the law
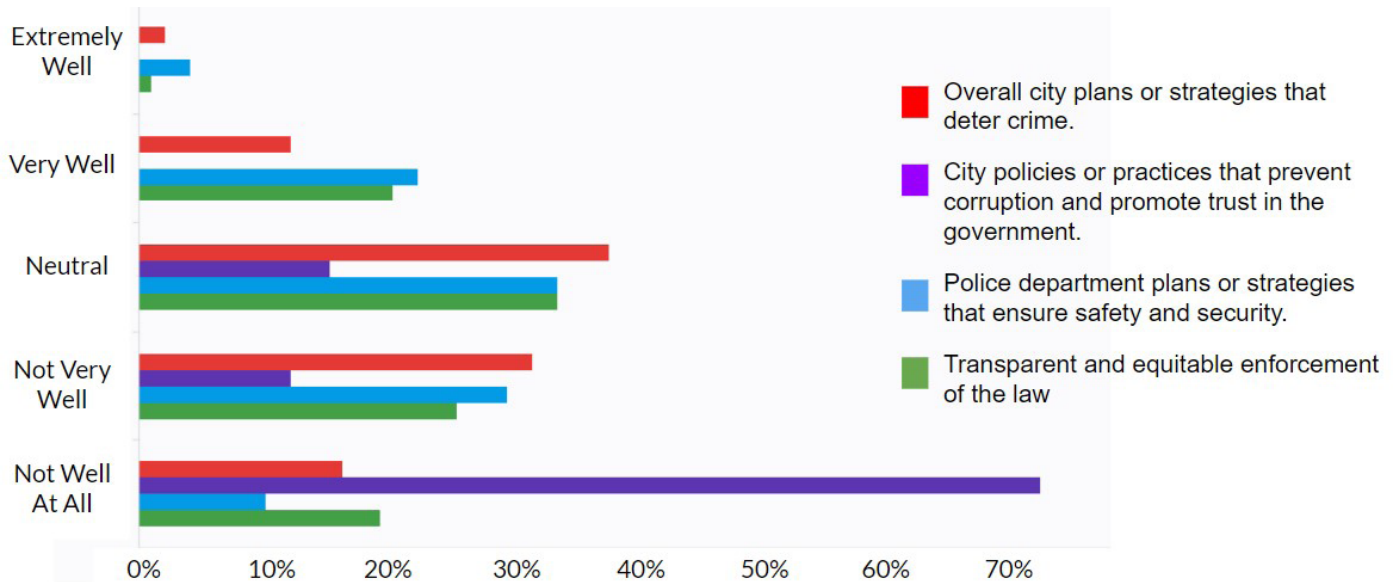
A city is more resilient with a more engaged local community. How satisfied are you with Muncie's level of engagement?

Legend:
- Social connection at the neighborhood level.
- A sense of belonging in the city.
- Community participation in activities like public town halls, neighborhood association meetings, voting, etc.
- Quality public gathering spaces such as parks, recreation centers, and community gardens.

A city is more resilient with a strong local economy, and government policies that support local businesses. How satisfied are you with Muncie's level of support for local business?

Legend:
- **During times of crisis, the local economy continues to thrive.** (red)
- **Strength and diversity of City budget revenue streams, such as taxes or license fees.** (purple)
- **The City's economic and social environment is attractive and draws investment into the City.** (blue)
- **The diversity of the local economy.** (green)
- **The linkages with regional, state, and national economic systems.** (yellow)
- **The community's ability to attract a skilled workforce.** (orange)

Categories: Extremely Satisfied, Very Satisfied, Neutral, Very Dissatisfied, Extremely Dissatisfied

A city is more resilient if people have access to quality, reliable transportation and communication networks. How well does the city manage these networks?

Legend:
- **Access to adequate transportation across the entire city (MITS bus, trails, and bike lanes).** (red)
- **Safety and quality of the public transportation system.** (purple)
- **Access to communication technology (phone, cellular service, internet, etc.).** (blue)

Categories: Extremely Well, Very Well, Neutral, Not Very Well, Not Well At All
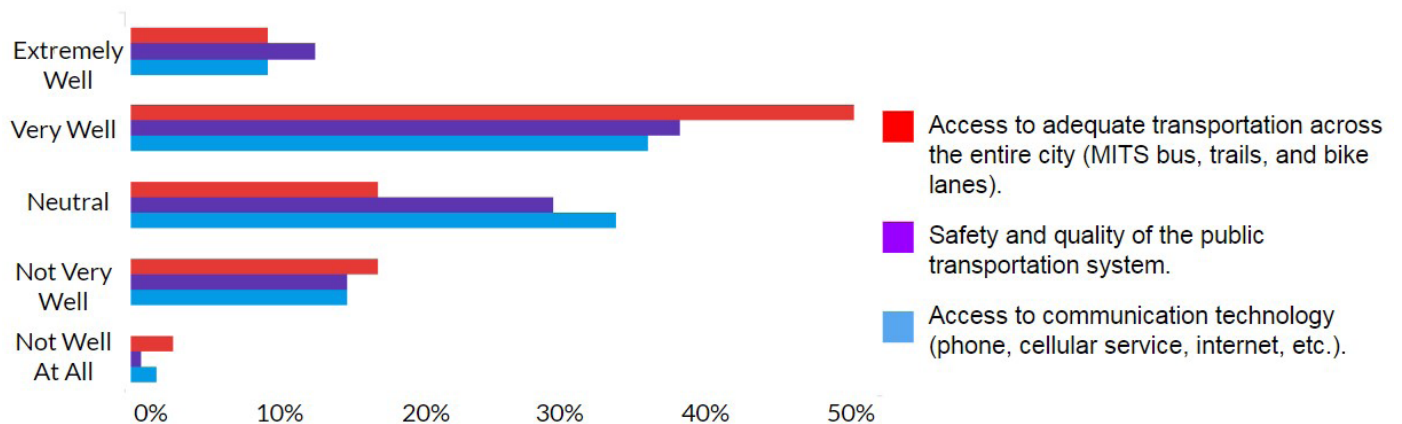
A city is more resilient if education is available for all. How well does the city address education?

Legend:
- Accessible and high quality public schools.
- Safety of public schools.
- Opportunities for educational enrichment beyond formal schooling.

Categories: Extremely Well, Very Well, Neutral, Not Very Well, Not Well At All

Axis: 0%, 10%, 20%, 30%
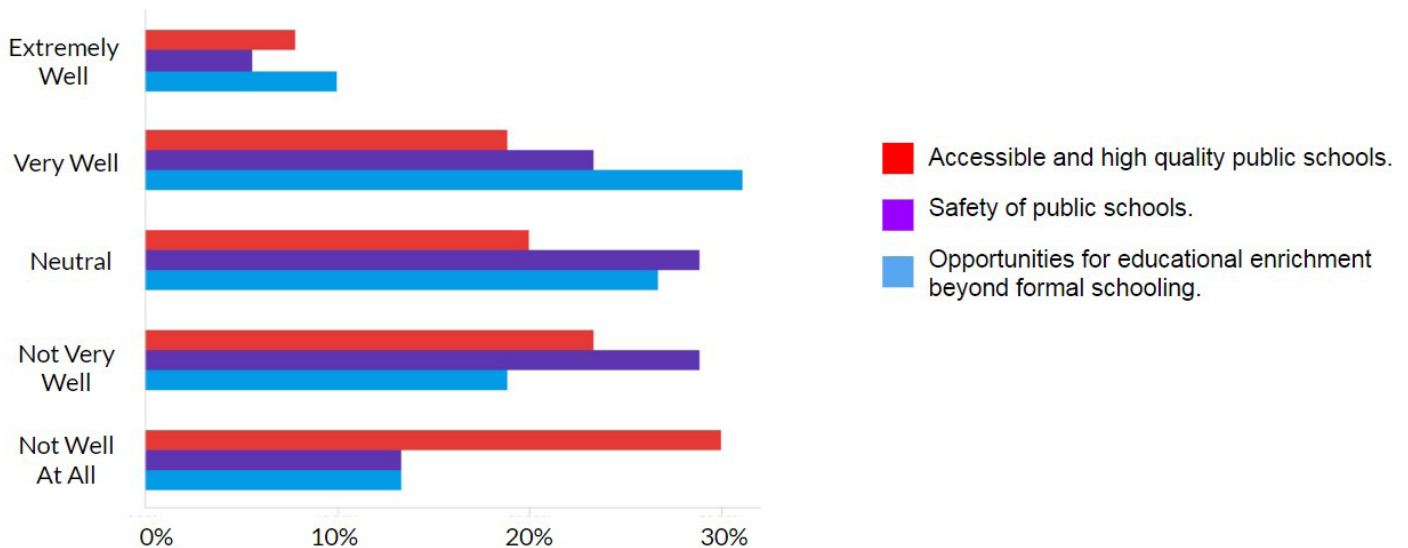
A city is more resilient when the basic needs of its residents are adequately covered. How well are these services provided in the city of Muncie? Please explain where appropriate

Legend:
- Access to decent and affordable housing
- Access to affordable electricity
- Access to affordable household gas
- Access to affordable healthy food
- Access to affordable potable (safe and clean) water
- Access to basic affordable healthcare services
- Access to good quality public education

Categories: Extremely Satisfied, Very Satisfied, Neutral, Very Dissatisfied, Extremely Dissatisfied

Axis: 0%, 10%, 20%, 30%, 40%, 50%
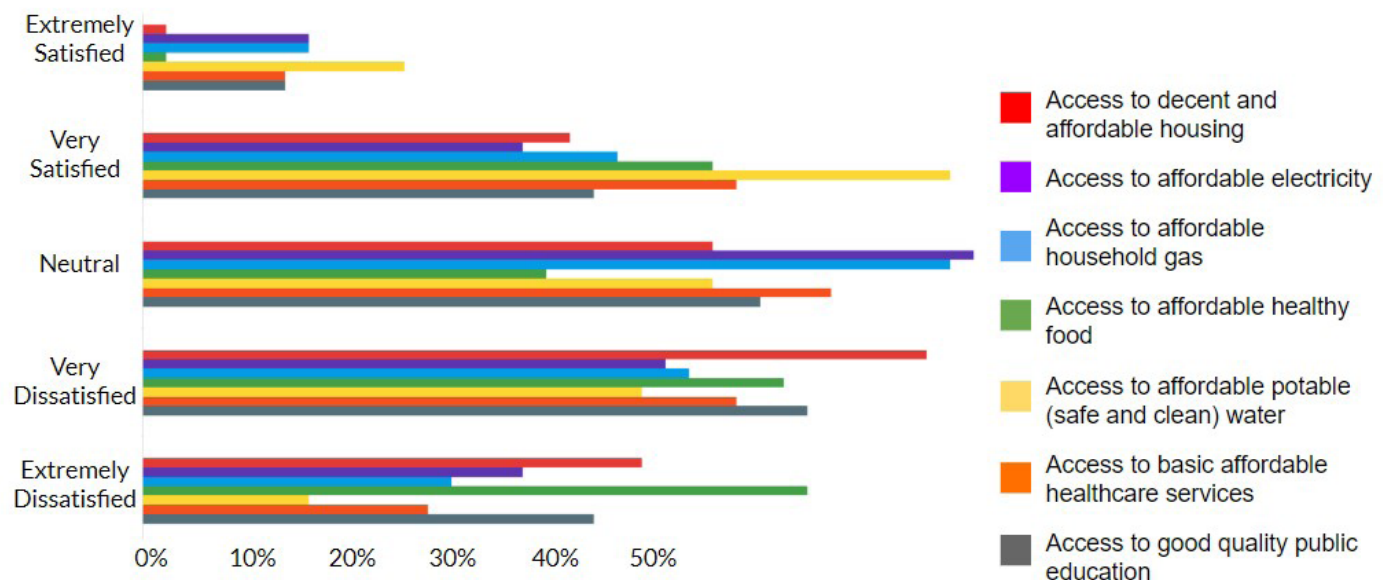
A city is more resilient when everyone has access to affordable medical care. How well is this need addressed in Muncie? Please explain where appropriate.

Legend:
- ■ (Red) Access to medical care (doctors and facilities) during emergencies and disasters
- ■ (Purple) Access to medical care for non-emergencies
- ■ (Blue) City government's capacity to handle public health risks and emergencies, such as disease outbreaks
- ■ (Green) Public education resources regarding public health issues
- ■ (Yellow) Medical resources for preventing disease and other health risks

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