



Sustainability Baseline Assessment and Strategic Goal Recommendations

August 2023
Revised November 2023

Prepared by:

making change personal

paleBLUEdot LLC



Table of Contents

- Section 01 **Introduction**
- Section 02 **Transportation and Land Use**
- Section 03 **Buildings and Energy**
- Section 04 **Waste Management**
- Section 05 **Water and Wastewater**
- Section 06 **Local Food and Agriculture**
- Section 07 **Greenspace and Ecosystems**
- Section 08 **Health and Safety**
- Section 09 **Sustainable Economy**
- Appendix 1 **Reference Map**

Mapping And Demographic Data in This Report

This assessment includes population data or maps at both the Census Tract or Block Group level as well as at the Census “Place” (city boundary) level as appropriate for the specific data set they represent. Census Tract or Block Group boundaries may differ from actual community boundaries. All areas within the official community boundaries are included in the plan this Baseline Document supports, even if not shown on a map. Other assessments might use data at just the Census Tract, Block Group, or Census "Place" (city boundary) level as appropriate or available for the data being assessed in those documents. This may lead to differences in reported population counts due to Census boundary variations. See Appendix 5 Reference Map for census areas which may be referenced in this report.





Introduction

Background

The City of Fitchburg is developing its first Sustainability Plan to support climate resilience and mitigation City-wide. The plan, which will identify Sustainability strategies and actions through 2030, will help those who live and work in the city imagine and achieve a future where the earth and all who live on it thrive. The plan will define goals, strategies, and actions for implementation.

This City of Fitchburg Sustainability Baseline and Strategic Goals document is intended as a tool to support the City of Fitchburg Sustainability Planning team in collaboratively exploring, creating, refining, and finalizing the goals and strategies of the Sustainability Plan. The strategic goal recommendations included in this document should be understood as preliminary only and created solely for the purpose of supporting a fully collaborative planning team process.

Sustainability Plan Framework

Achieving community-wide sustainability advancements requires addressing considerations across a wide range of sectors. This Sustainability Baseline and Strategic Goal Recommendations report is organized around a unifying framework of environmental equity and justice, and includes eight community-wide sectors. Each sector has over-arching Strategic Goals (or “Strategies”) established to be met by 2030 and to organize or provide direction for detailed implementation Actions to be created in collaboration with the Sustainability Planning Team.

Addressing Climate Change

Sector Strategies include considerations for Climate Change Mitigation, Climate Adaptation, or both. Sectors which have GHG reduction potential summarize the estimated GHG reductions possible through successful implementation of the draft recommended strategies. The total potential GHG reduction is summarized on the following pages.

Sustainability Sectors

The City of Fitchburg Sustainability Plan will include the following community-wide sectors:

- Transportation and Land Use
- Buildings and Energy
- Waste Management
- Water and Wastewater
- Local Food and Agriculture
- Greenspace and Ecosystems
- Health and Safety
- Climate Economy

Strategies: are specific statements of direction that expand on the Sustainability vision GHG reduction goals and guide decisions about future public policy, community investment, and actions.

Actions: are detailed items that should be completed in order to carry out the vision and strategies identified in the plan.

Climate Mitigation: addresses the root causes of climate change through the reduction or prevention of greenhouse gas (GHG) emissions.

Climate Adaptation: seeks to lower the risks posed by the impacts of climate change which are now inevitable or likely.

Introduction

Climate Mitigation Goals in Global Context

Considering a plan’s GHG emission reduction goals within a global context can help validate the appropriateness of the goal. An effective approach for evaluating goals within that global context is to consider the most current GHG emission reduction recommendations formulated by the Intergovernmental Panel on Climate Change (IPCC). The scientific consensus of the international IPCC working groups is to reduce global GHG emissions as needed in order to limit global warming to 1.5°C. In addition, the Paris Agreement aims to limit global warming to 1.5 to 2 degrees C above pre-industrial levels, considered to be the threshold for dangerous climate change.

The UNEP Emissions Gap Report published in November 2019 calculates that by 2030, global emissions will need to be 25% lower than 2018 and 80% lower by 2050 to put the world on the least-cost pathway to limiting global warming to below 2°C. To limit global warming to 1.5°C, the same report finds emissions would need to be 55% lower than in 2018 by 2030 and carbon neutral by 2050.

At the state level, in 2019, Governor Evers set a goal for 100% carbon-free electricity in Wisconsin by 2050. Additional statewide goals include:

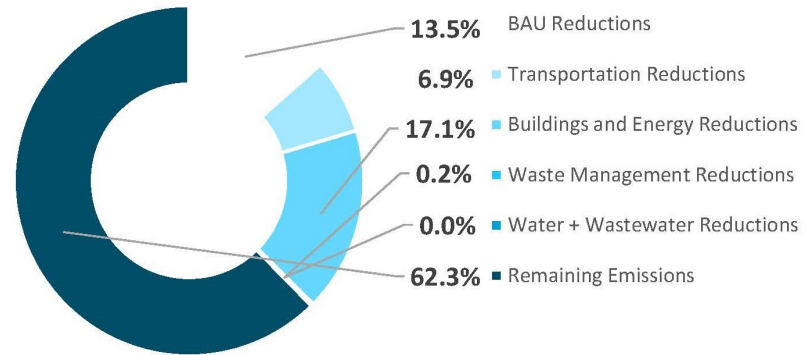
- Ensure the state is fulfilling the carbon reduction goals of the 2015 Paris Climate Accord (26-28% below 2005 by 2025).
- Develop energy efficiency, sustainability and renewable energy standards for all new and existing state facilities, office buildings and complexes.
- Accelerate new and existing policies to reduce carbon pollution and promote clean energy deployment at the state level.

To be in alignment with the State’s commitment to the Paris Agreement and the IPCC recommendations, we recommend a 2030 community-wide GHG emission goal equal to a reduction of 25-55% below 2018 levels.

Projected Emission Reductions Achieved by Draft Strategies


The following sections of this Baseline Assessment document include preliminary strategic goal recommendations for consideration by the planning team. These recommendations are based on the summary research presented in each section and are intended as preliminary statements for the purpose of supporting a collaborative team process which will result in the final strategic goal statements. These preliminary strategical goals generally align with current State of Wisconsin and IPCC recommended emission reduction goals.

Share of Total Projected Potential Emission Reductions by Sector by 2030 from 2022 Baseline (preliminary estimate):



Based on the illustrated potential reductions included in this document, we recommend the following as a preliminary Climate Mitigation goal statement for consideration by the planning team:

Recommended City of Fitchburg GHG Reduction Goal:



“To reduce city-wide GHG emissions by 35% below 2022 levels by 2030, and achieve carbon neutrality by 2050.”*

*2030 goal is equivalent to 40% reduction from a 2018 baseline and within IPCC recommendations





Welcome To

FITCHBURG

Wisconsin's Recycling Leader

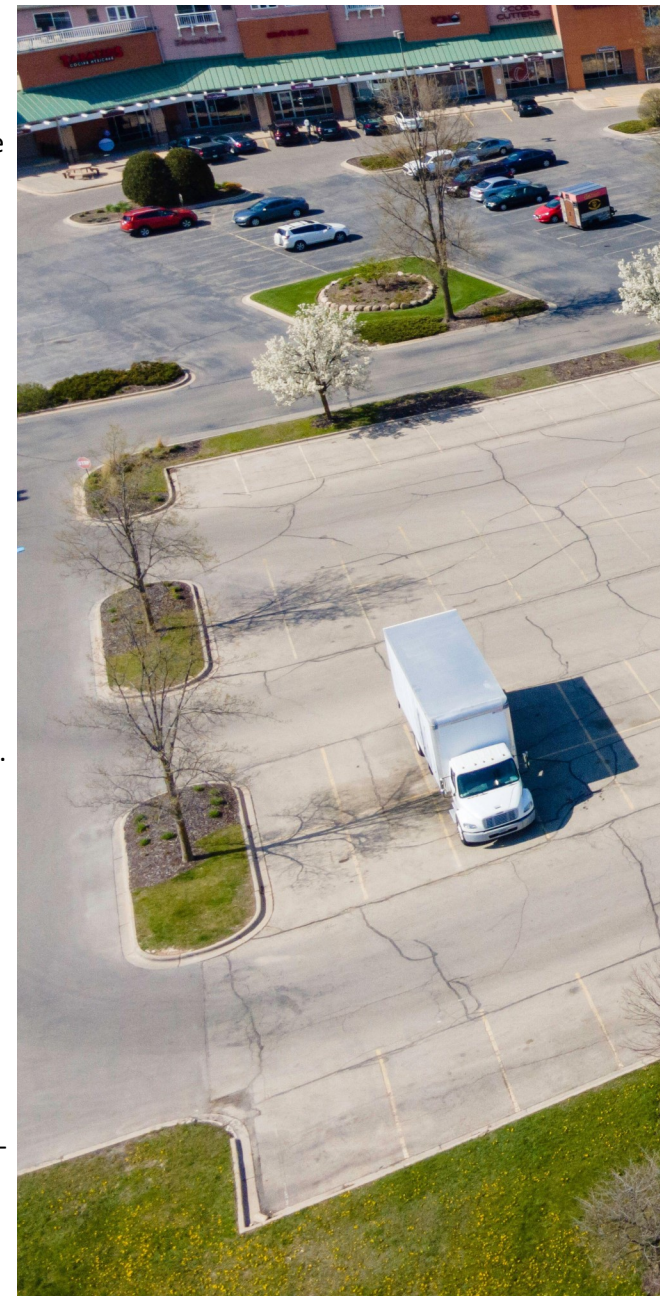
Section 02 Transportation and Land Use

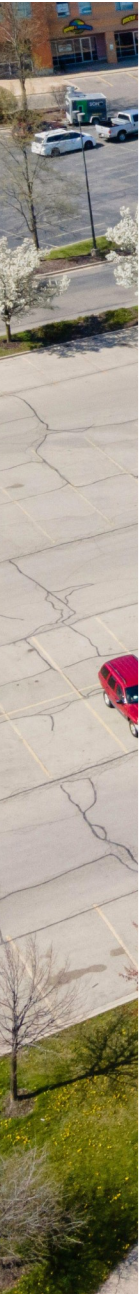
 [Click here to return to TOC](#)

Moving ourselves and our goods and services from place to place is very energy intensive while the vehicles we use for that mobility are very material resource intensive. In addition to transportation vehicles, off-road equipment like construction, recreational and lawn equipment also consume significant amounts of fossil fuels for their operation. Off-road equipment have even higher GHG emission and overall air pollution rates per gallon of fuel consumed than on-road vehicles due to less efficient combustion and lower emission standards than on-road vehicles.

Equipment and transport systems have significant impacts on the environment, accounting globally for 20% to 25% of world energy consumption and carbon dioxide emissions. In the City of Fitchburg, the transportation and land use sector accounts for 33.1% of Citywide GHG emissions. Vehicle Miles Traveled (VMT) are projected to increase; however, transportation emissions may decrease as this sector transitions from fossil fuel to electricity and as the electricity sector moves to more renewable energy sources.

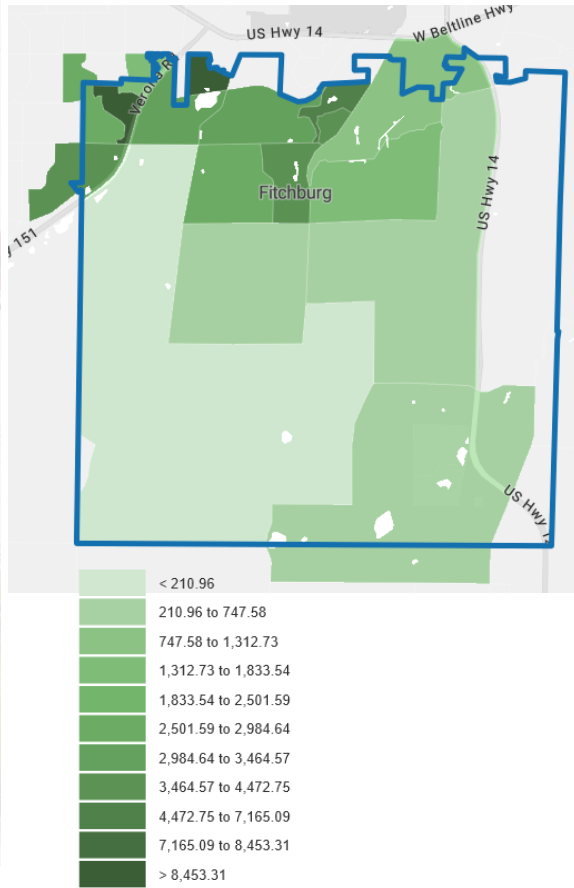
Many options exist for improving the sustainability of our transportation systems while improving quality of life and equity. Increasing shared transportation while decreasing use of single-occupancy vehicles significantly reduces the environmental impacts of transportation. This change also can improve equity in mobility. Alternative transportation modes like bicycles, eBikes, and scooters can also increase opportunities for exercise while reducing air pollution. Lastly, studies indicate that recent advances in electric vehicles, car-sharing technologies and the potential for self-driving vehicles underline a much more sustainable usage of car assets that could remove up to 90% of the vehicles from the streets while enhancing mobility options.





City of Fitchburg Residential Density

The City's developed land is estimated at 6,900 acres—33% of the total area of the City. This land supports a population of 30,834 for an average of 4.5 residents per developed acre. The map below shows the population density per square mile throughout the city. Note: with changes to the city's boundaries and population occurring at the end of 2022 these data are estimates and subject to change.



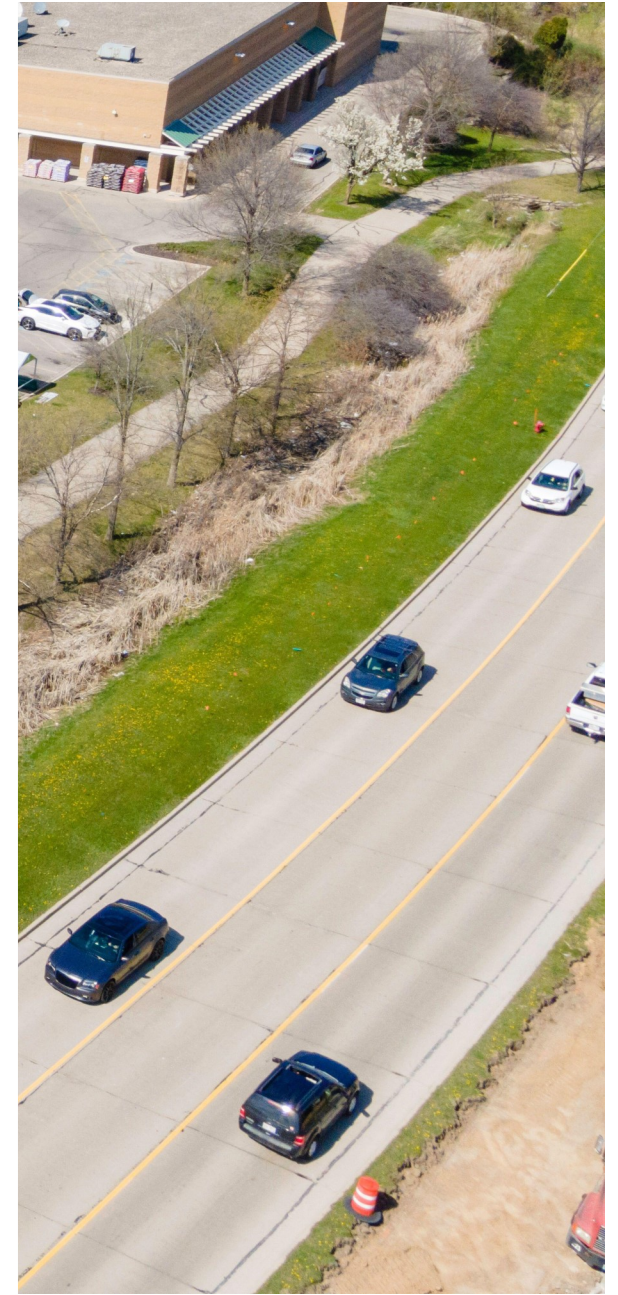
Transportation and Land Use

City of Fitchburg Land Use Density Emissions Reduction Potential

The City of Fitchburg's comprehensive plan predicts a population of over 35,000 by 2030 and 41,000 by 2040. The study "The Influence of Urban Form on GHG Emissions in the U.S. Household Sector" (Lee, S., and Lee, B. 2014) shows that a 1% rise in urban density reduces household travel CO2 emissions by 0.48% and residential energy emissions by 0.35%. Consequently, zoning ordinances and land use policies promoting higher land density can lower community-wide emissions per household.

With policies guiding future population growth towards increased land use density rather than increased developed land area, the potential 11.3% population increase by 2030 could result in an increase of average population per developed acre from 4.5 to 5.1 residents per developed land use acre. Applying the figures established in the Lee study, this could equate to an emissions reduction of up to 5.4% for transportation related emissions compared to the same projected population at the City's current population density levels.

GHG emissions reduction associated with a 6% increased residential land use density by 2030: **(4,056)** Metric Tons.



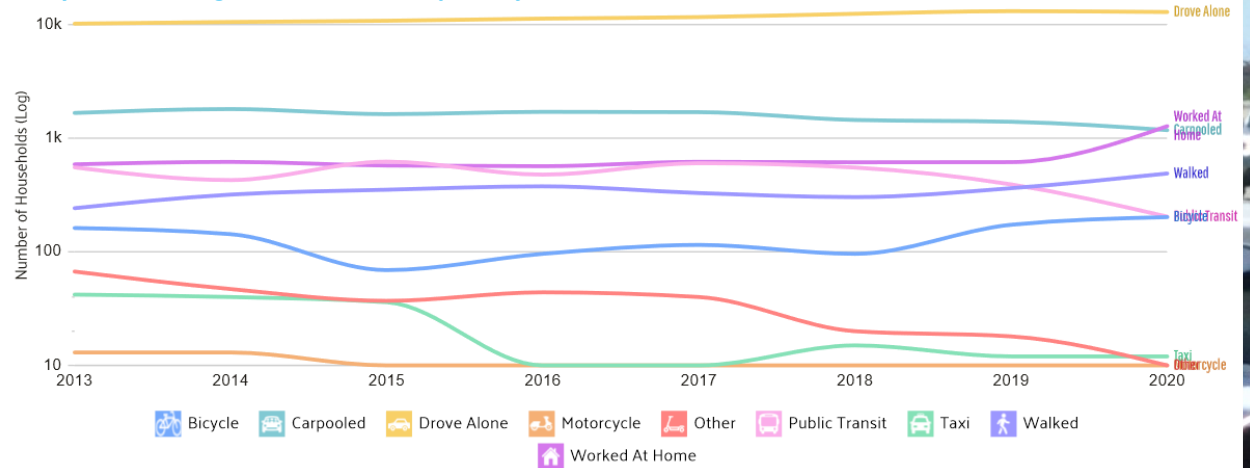


Transportation and Land Use

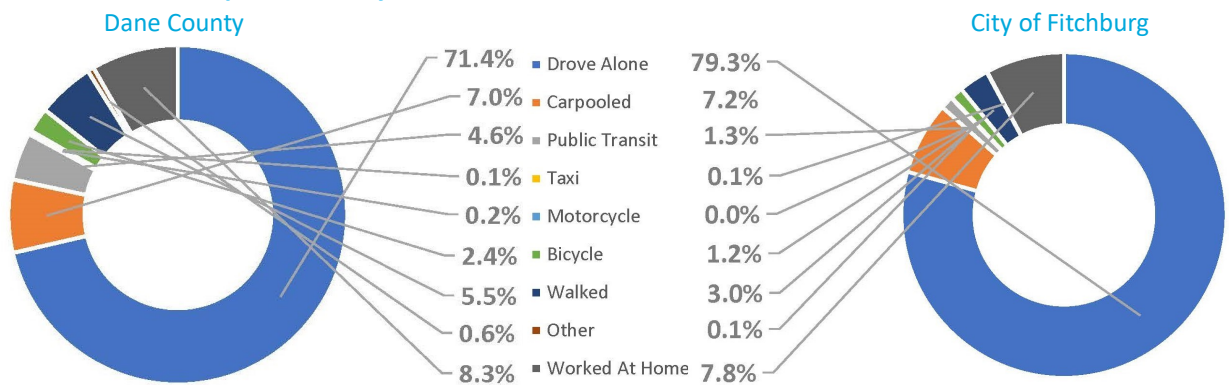
City of Fitchburg Commute

Since 2013, overall average commute time in the City of Fitchburg has remained steady with a slight decrease from 20 to 19.9 minutes. 91% of those employed in the City commute from outside the City while 93% of Fitchburg residents who are employed commute to jobs outside of the City. The City has also seen some change in commuter modes with commuters driving alone increasing 4% (from 75.3% in 2013 to 79.3% 2020), while working from home increased 3.5% and public transit, walking, and biking to work remained somewhat consistent. These trends indicate strategies focusing job development near residential density and encouraging alternative commute modes like public transit, carpooling, walking, and working at home will decrease commuter impacts.

City of Fitchburg Commuter Transport by Mode Since 2013



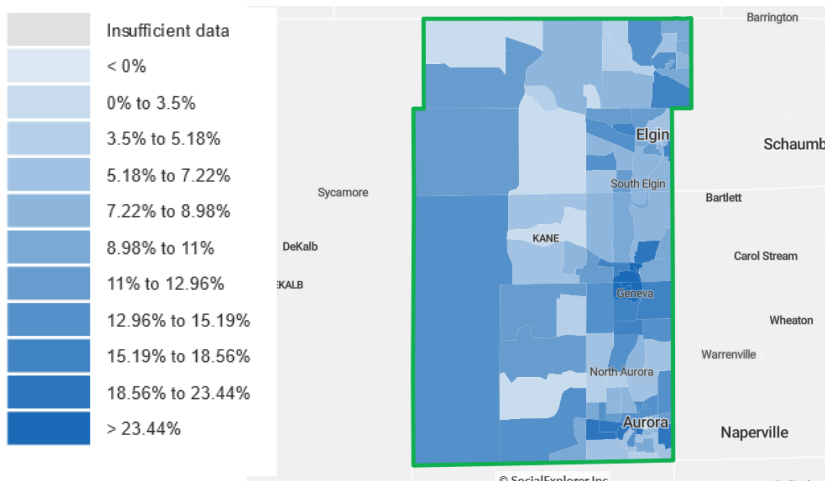
Commuter Transport Share by Mode 2020



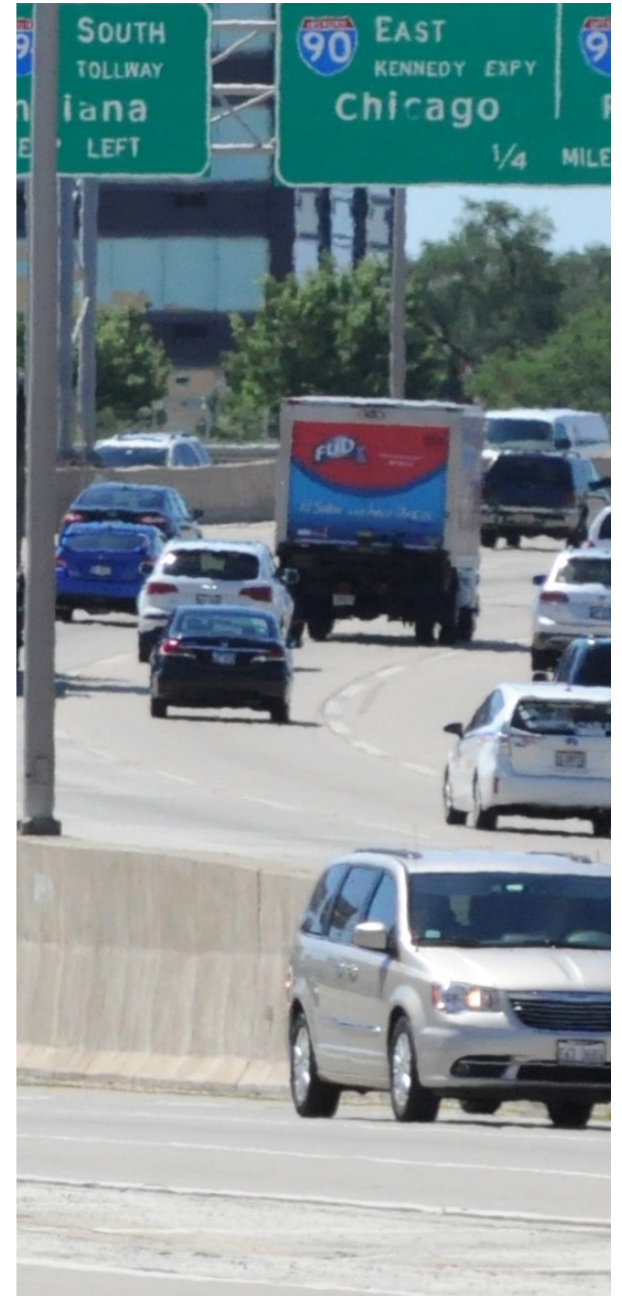
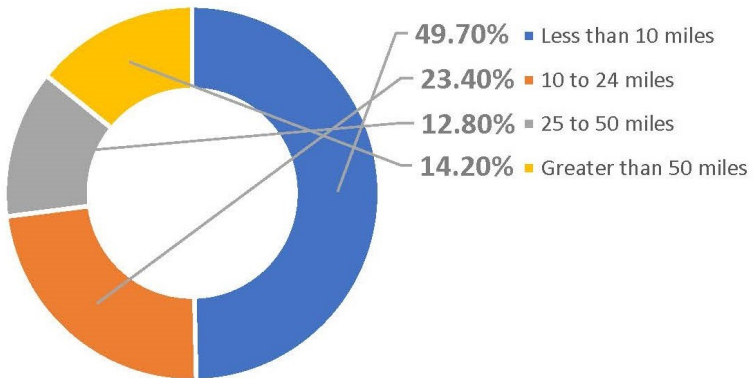
Transportation and Land Use

49.7% of all commuters in the City of Fitchburg, over 6,100 workers, have a commute of less than 10 miles. Due to the shorter commute, the distances traveled by these workers may lend itself well to alternative transportation modes like walking or biking. Reducing the number of people who drive to work alone by 5% and promoting alternatives like carpooling, working from home, and other strategies could lead to a decrease of 5.6 million miles in total driving, saving around \$4,000,000 and reducing greenhouse gas emissions by up to **(2,877)** metric tons each year.

City of Fitchburg Workers with 10 Minute or Less Commute Time



Commuter Share by Commute Distance



Transportation and Land Use

Housing and Transportation Affordability

Land Use density, job locations, and transportation significantly impact living costs, particularly housing and transportation affordability. According to HUD, housing is affordable when the occupant is paying no more than 30 percent of gross income for housing costs, including utilities.¹ According to the US Department of Transportation, the average household spends 15-16% on transportation, setting a total transportation and housing burden of 45% of income.² The map to the right, from Center for Neighborhood Technology, indicates the average Housing and Transportation affordability index for each of the census blocks within the City of Fitchburg. The Citywide average housing and transportation burden (H+T) is 44% (25% on housing and 18% on transportation). As shown on the household count by H+T income share, 5,480 households - approximately 41% of all in the City of Fitchburg - have a combined H+T burden that is *more than* 45% of household income. This trend indicates strategies that continue to focus job development nearest sections of residential density, increased housing affordability, and increased affordable mobility options may support decreasing cost of living, particularly associated with transportation.

Walkability and Bike-ability

The measure of a community's walkability and bike-ability are an important metric of the community's ability to advance sustainable transportation. Bike and walk scores will vary across the City based on location specific parameters. Below are average transit, walk and bike scores for the City of Fitchburg (Source: WalkScore.com). For this location, though the scores can be improved, the existing levels indicate a supportive environment for increasing alternative mobility options such as walking, biking, and public transit. Every 0.5% increase in commuter utilization of biking or walking in the City of Fitchburg may decrease vehicle miles traveled by an estimated 565,000, saving an estimated \$400,000 and eliminating (290) metric tons of GHG emissions.



Car-Dependent

Most errands require a car



Minimal Transit

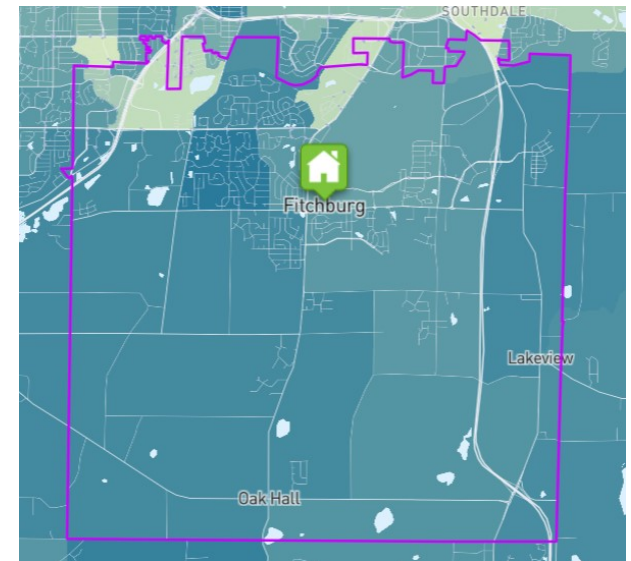
It is possible to get on a bus



Bikeable

Some bike infrastructure

Housing and Transportation Affordability



Combined housing and transportation expenses as share of household income (Source: H+T Index)

	Households
< 24%	0
24 - 36%	3,771
36 - 45%	2,945
45 - 54%	4,367
54 - 66%	1,113
66 - 78%	0
78 - 87%	0
87% +	0

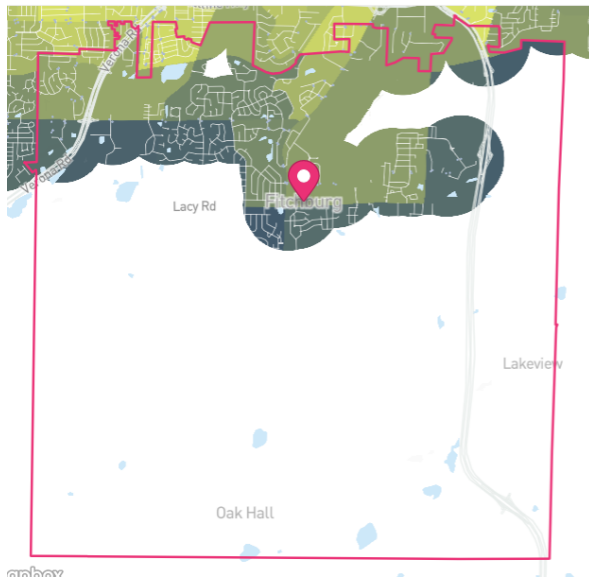
1: HUD Archives: Glossary of Terms to Affordable Housing; <https://archives.hud.gov/local/nv/goodstories/2006-04-06glos.cfm>

2: US DOT, The Household Cost of Transportation: Is it Affordable?; <https://www.bts.dot.gov/data-spotlight/household-cost-transportation-it-affordable>



Transportation and Land Use

Public Transit Performance Map



Overall transit score rating at connectivity, access to jobs, and frequency of service (Source: AllTransit)



Public Transit Indicators

The map to the left illustrates the community area served by transit options and the corresponding “Performance Score”. Areas of lighter color have higher performance scores which represent a mixture of overall trips per week, number of jobs accessible, number of weekly commuters using the transit options, and equity of transit system. (Source: Alltransit)

The average commute in the city is 20.5 minutes, or approximately 10 to 15 miles. Meanwhile, AAA estimates that the cost per mile for operating a vehicle is \$0.72. Consequently, every 1% increase in commuter utilization of public transit in the city may decrease vehicle miles traveled by 1.1 million miles, saving an estimated \$813,000 and eliminating **(575)** metric tons of GHG emissions annually.

AllTransit™ Performance Score

3.7

City: Fitchburg, WI

Low combination of trips per week and number of jobs accessible enabling few people to take transit to work

On Average Households have:

619	Transit Trips per Week within ½ Mile
5	Transit Routes within ½ Mile
94,765	Jobs Accessible in 30-minute trip
4.02%	Commuters Who Use Transit

JOBS

Jobs Near Transit: Percent of jobs that are located within ½ mile of transit.

75.6%

11,310 jobs are near transit

ECONOMY

Transit Access to Customers: Customer households accessible to a business within a 30 minute transit commute.

37,926

Households within a 30 minute transit commute.

HEALTH

Healthy Commuters: Workers who commute by walking or biking and live within ½ mile of transit.

2.21%

Walk

0.95%

Bike

MOBILITY

Transit Routes: Transit routes available within ½ mile of a block group on average.

5

Transit Routes

Transportation and Land Use

Vehicle Ownership in City of Fitchburg

According to the US Census, over 42% of all households in City of Fitchburg own two vehicles, nearly 42% own one, 7.2% own three vehicles, 2.9% own four, and 0.5% own five or more vehicles. Communitywide, 5% are households with no vehicles. According to census data there are an estimated 21,000 vehicles total in the City.

Transitioning this rolling vehicle stock from fossil fuel combustion to low and no emission alternative is critical in meeting significant long-range emissions reductions in this sector. For every 1% of vehicles converted to EV or low/no emission fuel alternatives up to **(1,350)** metric tons of GHG emissions can be eliminated annually.

Existing City of Fitchburg Electric Vehicles and Infrastructure

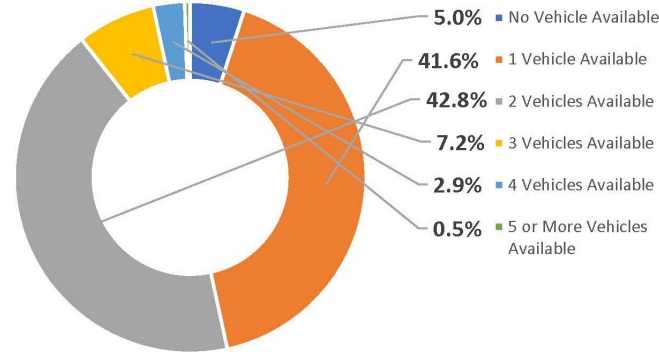
The chart to the right illustrates the total number of electric vehicles and charging infrastructure in the City of Fitchburg compared with the state. As of August 2023, the city had 206 battery electric vehicles (BEV).¹ Comparing the City of Fitchburg's EV rolling stock against state-wide vehicle counts (7,589 BEVs), it is clear that the City's adoption rate is well above the state average. The City's current public charging infrastructure is also ahead of state average for Level II and DC Fast charging ports.

EV Adoption Rates in State

The graph to the right illustrates the new EV purchase adoption rates in the state since 2013. The trends illustrate a clearly increasing EV share of new vehicles purchased from nearly 0% of vehicles sold in 2013 to over 4% in 2023.

1: Based on registration data reported for zip codes 53711 and 53575 by EV Hub <https://www.atlasevhub.com/materials/state-ev-registration-data/>
 2: City of Fitchburg's population is approximately 0.5% of the State population.

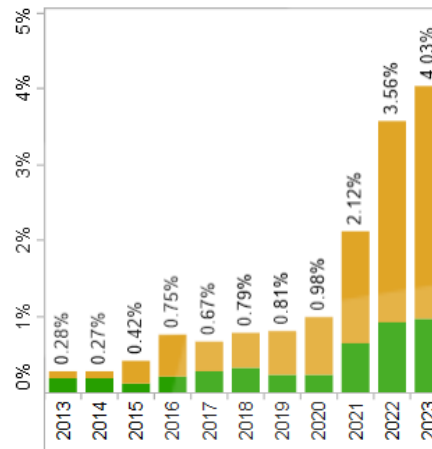
Vehicle Ownership by Household



Existing City of Fitchburg Electric Vehicles and Infrastructure

Type of Electric Vehicle	Vehicles in State	Vehicles in City*	EV % of All Vehicles in City	City Share of State	Share Compared to Population Share ²
BEV	7,589	206	1.0%	2.7%	5.4x population

Electric Vehicle Charging	Chargers in State	Chargers in City	City Share	Share Compared to Population Share ²
DC Fast Ports	309	16	5.2%	10.4x population
Level II Ports	827	12	1.5%	3x population



EV Adoption Rates in State

■ FCEV ■ BEV ■ PHEV
 FCEV = Fuel Cell Electric Vehicle
 BEV = Battery Electric Vehicle
 PHEV = Plug-in Hybrid Electric Vehicle

(Source: Alliance for Automotive Innovation)

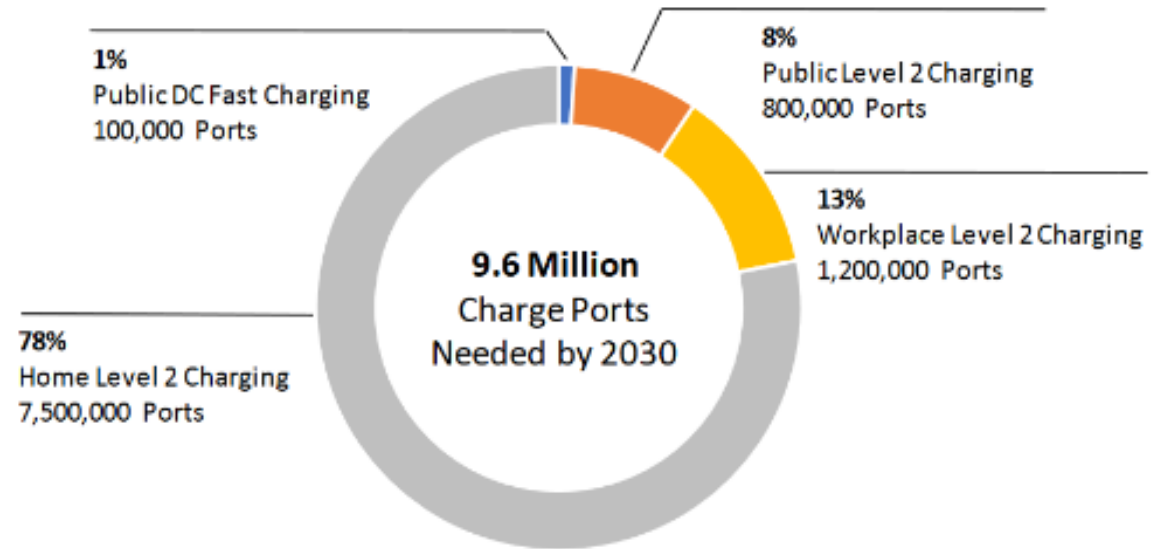




Transportation and Land Use

EV Charging Infrastructure Required in the US by 2030 (serving 18.7 million EV's in use)

According to the Edison Foundation, Electric Vehicle stock in the United States is projected to reach 18.7 million in 2030, up from slightly more than 1 million at the end of 2018. This means EV's will make up at least 7% of the vehicles on the road by that time.



(Sources: US Department of Energy, Alternative Fuels Data Center, US Census, Edison Foundation "Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030" report).

Minimum EV Infrastructure Needed in City of Fitchburg 2030

For the City of Fitchburg, the Edison Foundation's EV charging infrastructure need projections mean anticipating at least 2,000 EV's owned and operated by City of Fitchburg residents by 2030 in addition to the increased EV utilization by visitors to the City and commuters who work in the City but live elsewhere. These EV's will require a minimum of 84 public level II charging ports, 136 workplace level II charging ports, and 10 public CD Fast Charging ports. This will require an increase of a minimum of 208 level 2 charging ports by 2030. For every 1% increase in EV utilization beyond that, an additional 3.12 level 2 charging ports and 0.5 DC Fast charging ports should be planned.

Transportation and Land Use

Potential Climate Change Impacts by Sector

paleBLUEdot compiled a list of climate vulnerabilities for each of the sectors of interest included in this Baseline Assessment. The vulnerabilities were based on existing resources and our experience with other communities as well as regional planning documents and studies. The list of vulnerabilities generated for each sector included both direct impacts of climate change as well as ways that existing stressors in the community might interact with climate changes, either by exacerbating the impacts of climate change or being exacerbated by climate change (see Climate Vulnerability Assessment for more information). The following are the vulnerabilities identified as being of particular concern for this sector:

Vulnerability: Increased Car Use

Reduced interest in walking/biking or using public transportation on hot days, increasing dependence on cars with air conditioning.

Likelihood	Consequence	Capacity	Vulnerability
High	Moderate	High	Moderate

Vulnerability: Flood Damage to Infrastructure

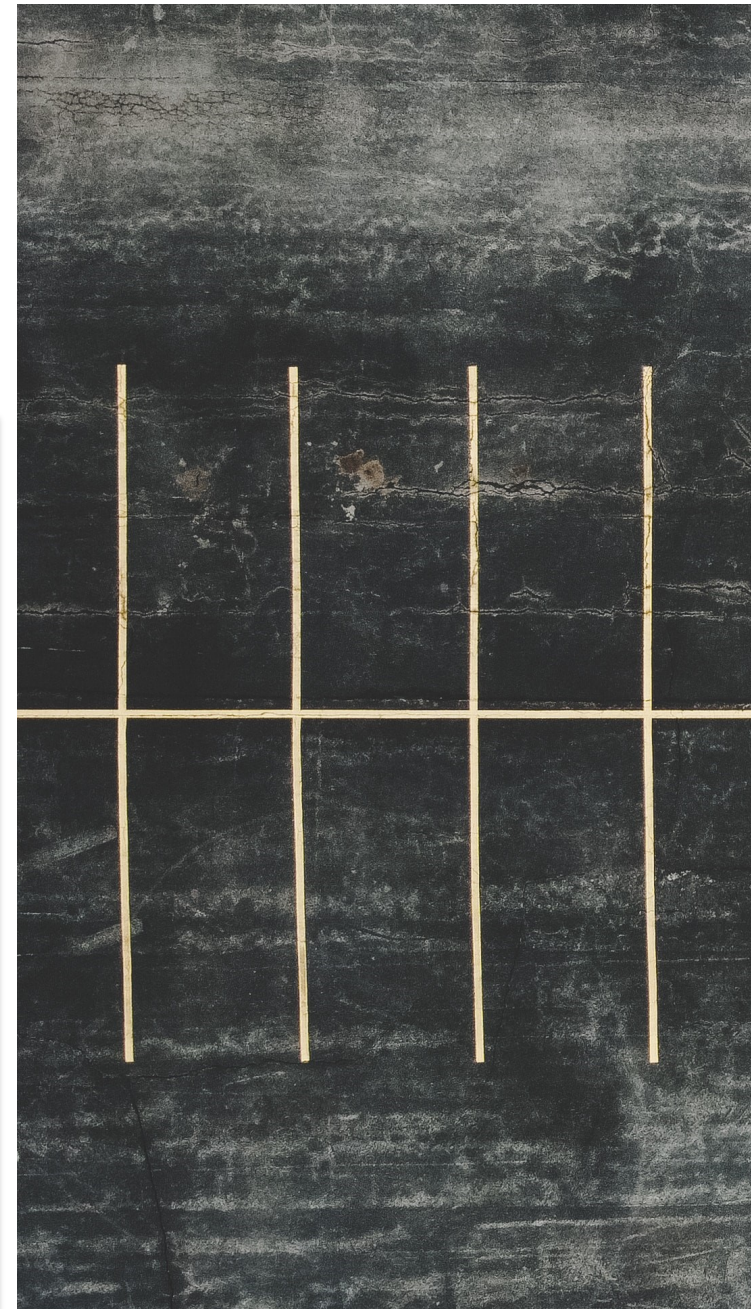
Increased flooding and associated damage to streets, sidewalks/trails, and parking lots during heavy rain events, particularly in low-lying areas or where stormwater infrastructure is inadequate

Likelihood	Consequence	Capacity	Vulnerability
Moderate	Very High	Moderate	High

Vulnerability: Resistance to Change

Historical investment in car-focused and lower density development resulting in reduced walkability, complicating future changes to increase the use of public and alternative mobility.

Likelihood	Consequence	Capacity	Vulnerability
Moderate	High	Moderate	Moderate



Transportation and Land Use

LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

The following are measures included in the LEED for Cities and Communities which relate to this section:

Transportation Performance

Collect and disclose data for one whole calendar year within the last 5 years on modal split

Measure the daily Vehicle Miles Travelled (VMT) per capita for all passenger vehicles within the city

Compact, Mixed Use and Transit Oriented Development

Option: Density, Destinations and Transit

Option: Walk Score and Transit Score

Option: Planning for Future Development

Safe, Multimodal Accessibility

Option: Transit Supportive Design and Policy

Option: Pedestrian and Bicycle Infrastructure

Option: Transportation Safety

Clean Transportation

Option: Electric Transportation Infrastructure

Option: Electric Vehicle Charging Facilities

Option: Alternative Fuel Stations meet or exceed 1.52 per 10,000

Mobility Management

Option: Transportation Demand Management (TDM) Policy

Option: Parking Management

Option: Smart Mobility

Option: Infill and Brownfield Development

Transportation and Land Use

Strategic Goal Recommendations

Community Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Transportation and Land Use Strategic Goals:

TL 1: Decrease community wide Vehicle Miles Traveled (VMT) by 5% by 2030 .

TL 2: Increase public transit commuter ridership from 1.3% to 3.3% by 2030.

TL 3: Increase average population per developed acre by 3% by 2030 (from 4.4 to 4.53 ppl/acre).

TL 4: Increase battery electric vehicle (BEV) use to 15% of vehicles on the road (from approximately 206 vehicles to 3,166 vehicles community-wide).

TL 5: Establish viable renewable fuels in the economy and support infrastructure expansion and fuel adoption. Achieve 20% diesel consumption replacement by 2030. (Renewable fuels include hydrogen, renewable diesel, and bio diesel)

Strategic Goal Recommendations

Municipal Operations

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Transportation and Land Use Strategic Goals

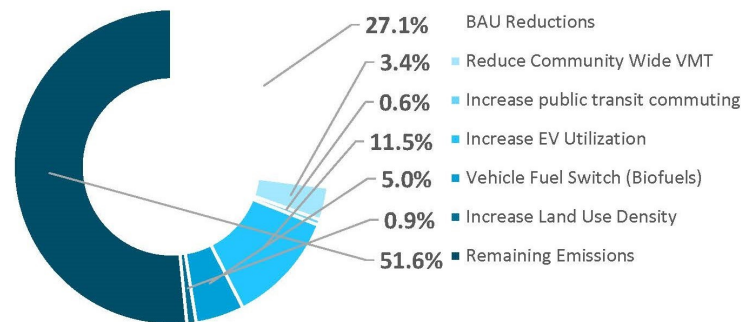
TL 6: Achieve 40% conversion of municipal operations gasoline vehicles and equipment within City and municipal fleets to EV's by 2030. Achieve 100% conversion by 2040 .

TL 7: Convert all municipal operations diesel fuel utilization to renewable diesel and/or biodiesel fuel by 2028.

TL 8: Increase fuel efficiency of remaining combustion engine fleet by 5% by 2030.

Projected Sector Emission Reductions

Achieved by Draft Strategies

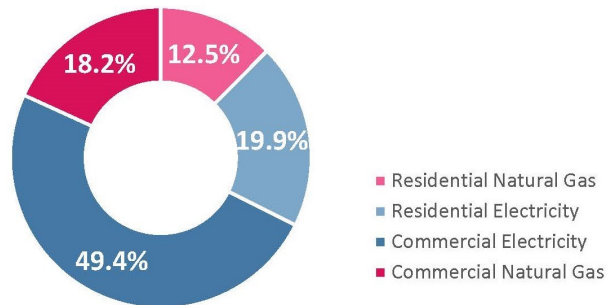




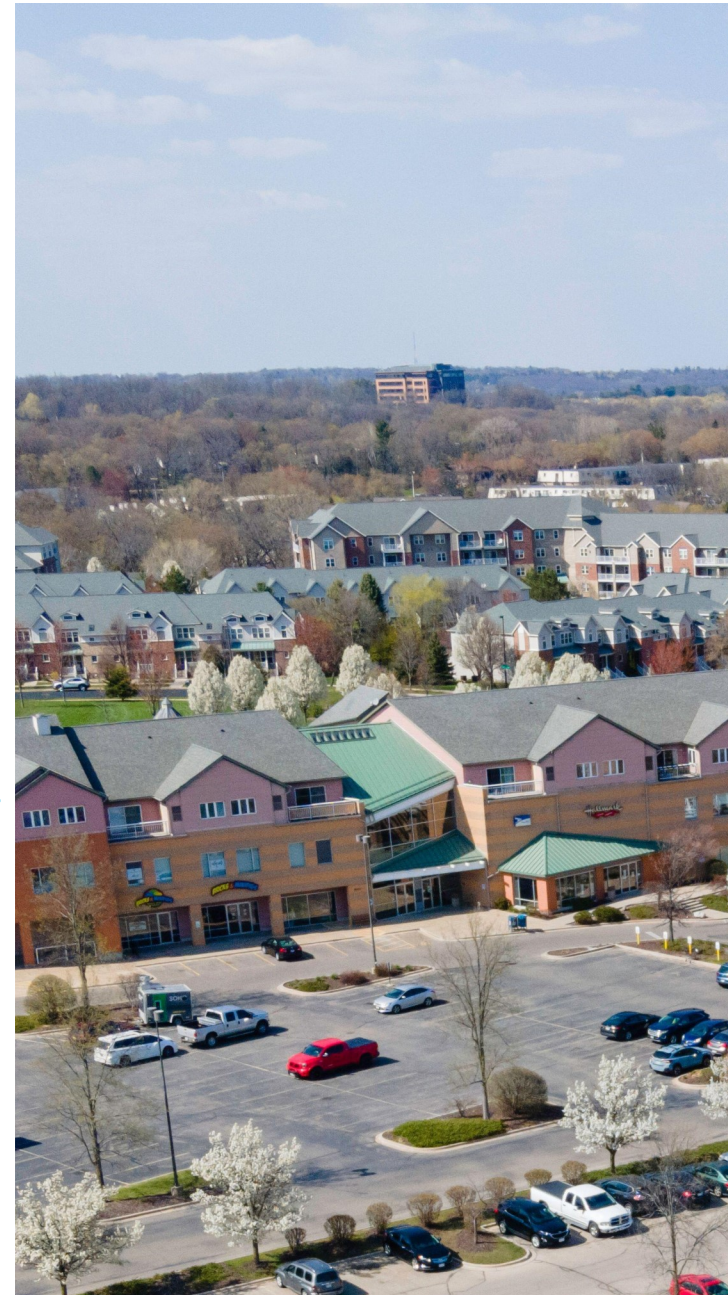
Section 03 Buildings and Energy

Building energy use is a major contributor to greenhouse gas (GHG) emissions. The Building Energy sector includes all residential, commercial, and industrial buildings. Greenhouse gas emissions from this sector come from **direct emissions** – from fossil fuels burned *on-site* for heating or cooking needs – as well as **indirect emissions** – from fossil fuels burned *off-site* in order to supply that building with electricity. Building design plays a large role in determining the future efficiency and comfort of facilities. Increasing energy efficiency can help reduce GHG emissions and result in significant cost savings for both homes and businesses. The City of Fitchburg community can also achieve climate resilience, environmental, social, and economic benefits through enhancements to the built environment.

Buildings and Energy Electricity and Natural Gas Emissions Share of 2022 GHG Emissions by Sub-Sector



[Click here to return to TOC](#)





Buildings and Energy

City of Fitchburg Energy Use Profile—Community Wide

Residential:

According to 2022 community wide data, the residential sector in the City of Fitchburg consumes over 92 million kWh annually. This is equal to 6,585 kWh per household. The sector also consumes over 6.5 million therms of natural gas annually, equal to 467 therms per household. Residential energy GHG emissions total 89,470 million metric tons annually, approximately 32% of Citywide buildings energy sector emissions.

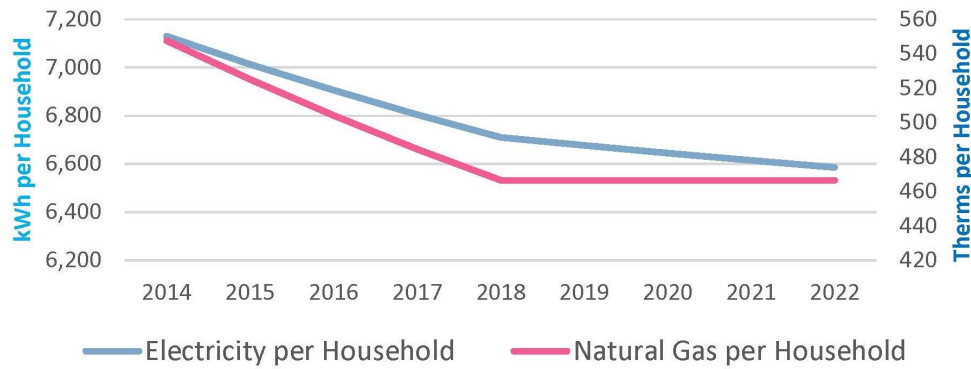
Commercial and Industrial:

The City of Fitchburg commercial and industrial sector in 2022 consumed nearly 236.6 million kWh, equal to 27,553 kWh per job. These sectors also consume over 9.5 million therms of natural gas annually, or approximately 1,111 therms per job. Commercial and industrial energy GHG emissions total 186,545 metric tons annually, approximately 68% of Citywide buildings energy sector emissions.

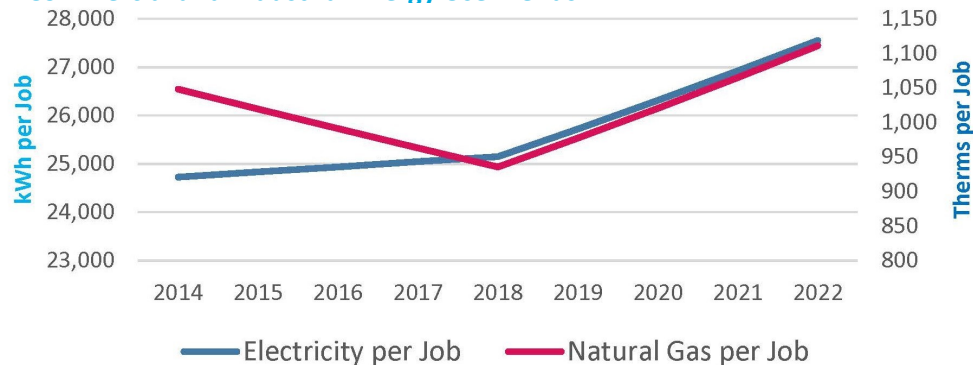
Potential for Change in City of Fitchburg

Based on the City's recent new building permit history (shown to the left), as much as **44%** of the city's housing stock and **13-16%** of the city's commercial building stock may be added, renovated or replaced over a 10 year timeframe. This means that a significant portion of the city's building infrastructure could be positively impacted and influenced through climate action strategies that guide increased energy efficiency and increased renewable energy adoption.

Residential Energy Use Trends



Commercial and Industrial Energy Use Trends



New Building Construction Permits in Fitchburg

New Housing Permits in Last 3 Years:	460
New Housing Units in Last 3 Years:	1,733 (13% of citywide housing stock)
New Commercial Building Permits in Last 3 Years:	19 (2.2% of citywide commercial building stock)
Commercial Renovation Permits in Last 3 Years:	175

Buildings and Energy

City of Fitchburg's Building Stock Efficiency

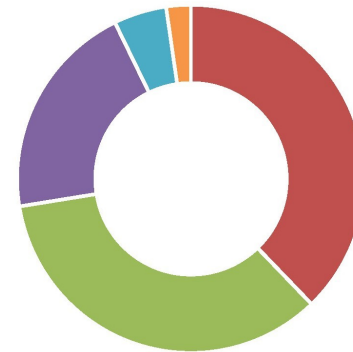
The measure of a community's existing building stock, certified high performance buildings, and housing characteristics provides a basis for determining the current and potential energy efficiency gains for the community. Energy and water efficiency upgrades are one of the simplest and most effective ways to conserve resources, save money, and reduce greenhouse gas emissions.

Residential Energy Efficiency Potential:

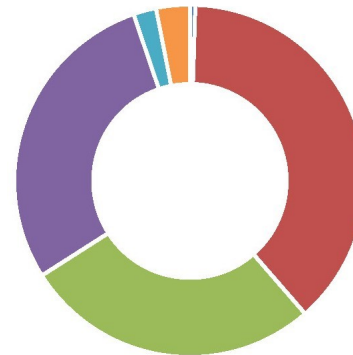
New building technology has increased energy efficiency significantly in recent decades. Although newer U.S. homes are 30 percent larger, they consume a similar amount of total energy as older homes - meaning they are more energy efficient per square foot of space.¹ According to the US Energy Information Administration, homes built between 2000 and 2009 used 15% less energy per square foot than homes built in the 1980s, and 40% less energy than homes built before 1950.

Consequently, this means that retrofitting older homes with some of these technologies provides ample opportunity to improve energy efficiency throughout the community. The charts to the right illustrate the distribution of owner occupied and renter occupied homes based on age throughout the City of Fitchburg.

City of Fitchburg Owner Occupied Homes By Age (all types)



City of Fitchburg Renter Occupied Homes By Age (all types)



1: US Energy Information Administration "Newer U.S. homes are 30% larger but consume about as much energy as older homes" <https://www.eia.gov/todayinenergy/detail.php?id=9951>



Buildings and Energy

The chart below outlines the estimated annual energy savings potential for households within the City. As an illustration, assuming an energy efficiency participation of 2,648 of the City-wide total 13,239 housing units by 2030 (20% participation rate) with an average energy efficiency improvement of 15% each would yield an annual community-wide energy reduction of 2,760 MWh of electricity and 196,000 therms. This reduction would achieve an annual GHG reduction of **(2,684)** metric tons by 2030. Note, this reduction model anticipates a participation focus for residential units built prior to 1980.

Illustration of City of Fitchburg Residential Building Stock Energy Efficiency Potential (based on 2021 US Census Data)

Home Age and Occupancy	Total Estimated Housing Units	Est Electricity Consumption (MWh)	Electric Savings at 15% Improvement (MWh)	Est Thermal Energy Consumption (Thousand Therms)	Potential Thermal Energy Savings at 15% Improvement (Thousand Therms)	Targeted Energy Improvement Participation at 20% (households)	Anticipated Annual Electric Savings (MWh)	Anticipated Annual Thermal Energy Savings (Thousand Therms)	Estimated GHG Reduction (Metric Tons)	
Total	13,239					2,648				
Owner Occupied	6,225	47.0%	43,264	6,490	3,065	460	1,245	1,298	91.94	(1,262)
Built 2020 Or Later:	0	0.0%	0	0	0	0				
Built 2000 To 2019:	2,353	17.8%	16,354	2,453	1,158	174				
Built 1980 To 1999:	2,158	16.3%	14,998	2,250	1,062	159				
Built 1960 To 1979:	1,265	9.6%	8,792	1,319	623	93	886	923	65.42	(898)
Built 1940 To 1959:	306	2.3%	2,127	319	151	23	245	255	18.08	(248)
Built 1939 Or Earlier:	143	1.1%	994	149	70	11	114	119	8.45	(116)
Renter Occupied	7,014	53.0%	48,748	7,312	3,453	518	1,403	1,462	103.60	(1,422)
Built 2020 Or Later:	34	0.3%	236	35	17	3				
Built 2000 To 2019:	2,674	20.2%	18,585	2,788	1,317	197				
Built 1980 To 1999:	1,919	14.5%	13,337	2,001	945	142				
Built 1960 To 1979:	2,022	15.3%	14,053	2,108	995	149	1,111	1,158	82.03	(1,126)
Built 1940 To 1959:	147	1.1%	1,022	153	72	11	118	123	8.68	(119)
Built 1939 Or Earlier:	218	1.6%	1,515	227	107	16	174	182	13	(177)
Total Reduction Potential							2,760	196		(2,684)

Buildings and Energy

Commercial and Industrial Building Energy Efficiency Potential:

Similarly to residential construction, older commercial buildings or newer commercial buildings with under-performing energy efficiency represent a significant potential energy efficiency increase. This means that retrofitting older commercial buildings with some of these technologies provides ample opportunity to improve energy efficiency throughout the community. The chart below outlines the estimated annual energy savings potential for commercial buildings within the City of Fitchburg.

Anticipating an energy efficiency participation of 20% of commercial buildings by 2030 based (approximately 146 of a total estimated 729 commercial buildings) with an average energy efficiency improvement of 15% should yield an annual community-wide energy reduction of 7,099 MWh of electricity and 285,000 therms of thermal energy. This reduction would achieve an annual GHG reduction of **(5,609)** metric tons by 2030.



Illustration of City of Fitchburg Commercial Building Stock Energy Efficiency Potential (based on 2021 US Census Data)

Commercial Building Stock	Total Estimated Commercial Establishments	Est Electricity Consumption (MWh)	Electric Savings at 15% Improvement (MWh)	Est Thermal Energy Consumption (Thousand Therms)	Potential Thermal Energy Savings at 15% Improvement (Thousand Therms)	Targeted Energy Improvement Participation at 20% (establishments)	Anticipated Annual Electric Savings (MWh)	Anticipated Annual Thermal Energy Savings (Thousand Therms)	Estimated GHG Reduction (Metric Tons)
Commercial Establishments	729	236,631	35,495	9,509	1,426	146	7,099	285	(5,609)
Total Reduction Potential	729 100.0%	236,631	35,495	9,509	1,426	146	7,099	285	(5,609)



Buildings and Energy

City of Fitchburg Building Heating Fuel Switch Potential (based on 2021 US Census Data)

Home Age and Occupancy

	Total Estimated Housing Units	Est Electricity Consumption (MWh)	Heating Fuel Emissions Remaining After Energy Efficiency Targets	Targeted Additional Fuel Switching Participation at 0.1 (households)	Estimated Heating Fuel Emissions Reduction From Fuel Switching (Metric Tons)**
Total	13,239				
Owner Occupied	6,225	47.0%	43,264	15,752	622.5 (473)
Built 2020 Or Later:	0	0.0%	0	0	0
Built 2000 To 2019:	2,353	17.8%	16,354	6,138	235.3 (184)
Built 1980 To 1999:	2,158	16.3%	14,998	5,630	215.8 (169)
Built 1960 To 1979:	1,265	9.6%	8,792	2,953	126.5 (89)
Built 1940 To 1959:	306	2.3%	2,127	702	30.6 (21)
Built 1939 Or Earlier:	143	1.1%	994	328	14.3 (10)
Renter Occupied	7,014	53.0%	48,748	17,749	701.4 (532)
Built 2020 Or Later:	34	0.3%	236	89	3.4 (3)
Built 2000 To 2019:	2,674	20.2%	18,585	6,976	267.4 (209)
Built 1980 To 1999:	1,919	14.5%	13,337	5,006	191.9 (150)
Built 1960 To 1979:	2,022	15.3%	14,053	4,840	202.2 (145)
Built 1940 To 1959:	147	1.1%	1,022	337	14.7 (10)
Built 1939 Or Earlier:	218	1.6%	1,515	500	21.8 (15)
Total Reduction Potential				33,501	1,324 (1,005)

Commercial Building Stock

	Total Estimated Commercial Establishments	Est Electricity Consumption (MWh)	Heating Fuel Emissions Remaining After Energy Efficiency Targets	Targeted Additional Fuel Switching Participation at 0.1 (establishments)	Estimated Heating Fuel Emissions Reduction From Fuel Switching (Metric Tons)**
Commercial Establishments	729	100.0%	236,631	48,778	73 (1,463)
Total Reduction Potential					

** Fuel Switching emission reduction Includes estimated emissions associated with increased electrical use. Emissions reductions are calculated based on "Greenhouse gas emission forecasts for electrification of space heating in the US" University of California Davis

Residential and Commercial Building Heating Fuel Switching Potential

As Fitchburg's electric grid nears carbon neutrality, building heating fuel will become an increasingly important target for emission reductions. Reduction, and ultimately the elimination of all fossil fuel heating (oil, propane, natural gas) will be required in order to achieve community wide carbon reductions.

Heating fuel switch options include:

- Conversion to electric heat (e.g. heat pump).
- Conversion to solar thermal systems.
- Switching fuel oil or diesel fuels to biofuels.

The charts on this page outline the potential annual GHG reductions with achieving a heating fuel switch for 10% of Fitchburg households and commercial establishments by 2030. Prior to any energy efficiency strategies, these reductions would achieve a reduction in GHG emissions equal to **(1,508)** metric tons for residential and **(1,463)** metric tons for commercial and industrial.

Buildings and Energy

Residential and Commercial Building Electricity Fuel Switching Potential (on-site renewable) Community Wide

Based on State of Wisconsin goals and commitments by electric utilities in the region, the GHG emissions associated with electricity use can be anticipated to continue to reduce over the years. Generally, however, increasing utilization of on-site renewable energy has multiple benefits for a community beyond GHG emissions reductions. The range of community benefits of increased on-site renewable energy include energy cost savings and increased energy resilience potential. For these reasons, we still recommend inclusion of strategic goals to increase on-site renewable energy.

paleBLUEdot has assessed the rooftop solar PV potential throughout the City of Fitchburg. This assessment has been conducted based on community-wide satellite data (sources: NREL, NOAA, and NASA). Generating capacity was calculated by roof orientation and tilt category. The projected potential for roof characteristics likely to result in economically viable solar arrays were then summarized—see “Total Citywide Optimized Rooftop Solar PV Potential” chart on following page.

City of Fitchburg’s Solar Share Based on 2021 Data:	State	City of Fitchburg	City of Fitchburg's Share
Population	5,892,539	29,606	0.50%
Number of Solar Installations	15,094	225	1.49%
Solar Installations / 1,000 Households	2.56	7.60	296.69%
Estimated Solar Capacity (MW)	1,217	3.01	0.25%
Est Electricity Generated Annually (GWH)	1,359.47	3.36	0.25%
Average Array Size (KW)	80.63	13.38	17%
Solar Industry Businesses	185	2	1.08%



Total City Wide Optimized Rooftop Solar PV Potential

			Flat	Low Tilt	Mid-Low Tilt	Mid-High Tilt	High Tilt
Subtotal Flat							
Suitable Buildings	2,695	33.66%	2,695				
Suitable Roof Planes	4,959	33.66%	4,959				
Square Footage	1,567,697	33.66%	1,567,697				
Capacity (KW dc)	16,490	24.72%	16,490				
Generation (KWH)	21,725,744	28.59%	21,725,744				
Subtotal South Facing							
Suitable Buildings	2,604	32.52%		715	1,558	328	3
Suitable Roof Planes	4,791	32.52%		1,315	2,867	604	5
Square Footage	1,514,723	32.52%		415,750	906,340	191,022	1,610
Capacity (KW dc)	24,621	36.91%		6,758	14,732	3,105	26
Generation (KWH)	26,599,687	35.01%		7,300,891	15,916,022	3,354,497	28,277
West + Southwest							
Suitable Buildings	2,075	25.92%		586	1,488		
Suitable Roof Planes	3,818	25.92%		1,079	2,739		
Square Footage	1,207,104	25.92%		341,170	865,934		
Capacity (KW dc)	19,621	29.41%		5,546	14,075		
Generation (KWH)	21,197,666	27.90%		5,991,204	15,206,462		
East + Southeast							
Suitable Buildings	633	7.90%		633			
Suitable Roof Planes	1,164	7.90%		1,164			
Square Footage	368,021	7.90%		368,021			
Capacity (KW dc)	5,982	8.97%		5,982			
Generation (KWH)	6,462,727	8.51%		6,462,727			
Grand Total			Subtotal: Flat Roof	Subtotal: Low Tilt	Subtotal: Mid-Low Tilt	Subtotal: Mid-High Tilt	Subtotal: High Tilt
Suitable Buildings	8,006		2,695	1,934	3,047	328	3
Suitable Roof Planes	14,732		4,959	3,558	5,606	604	5
Square Footage	4,657,546		1,567,697	1,124,941	1,772,275	191,022	1,610
Capacity (KW dc)	66,715		16,490	18,286	28,808	3,105	26
Generation (KWH)	75,985,824		21,725,744	19,754,822	31,122,484	3,354,497	28,277

Share of Community Electricity Use Met Through Total Potential Technical Generation **23.1%**



Buildings and Energy

Solar PV Rooftop Market Absorption Scenario

paleBLUEdot then explored potential new solar PV market absorption scenarios through 2030 building on the existing installed capacity within the City. The market projection we recommend using for guidance on potential new solar installations within the City of Fitchburg uses the city’s share of State population, adjusted for community average household income compared to state average, and applies that to the statewide new solar PV projections.

The resulting scenario outlined to the right anticipates a 36% initial growth rate. This scenario would result in approximately 6% of current Citywide electrical consumption being met through rooftop solar PV by 2030.

Ground Mounted and Carport Capacity

In addition to roof mounted solar PV potential, the City of Fitchburg has significant solar PV potential associated with ground mounted arrays as well as arrays mounted over parking—known as “Carport” arrays. The 2023 City of Fitchburg Solar Renewable Energy Potentials Study outlined potential scenarios for each of these. The resulting recommended total distributed renewable energy potentials projection for 2030 is outlined to the right.

GHG emissions reduction associated with increased on-site solar projection by 2030: **(18,974)** Metric Tons.

Share of Projected Statewide Annual Increase Based on Population Share

Year	Cumulative Installed (KW)	Annual Generation (KWH)	% of Community Electric Consumption	This is Equivalent to adding (x) Average 9KW Residential Arrays Annually:	Or Equivalent to adding (x) 40KW Commercial Arrays Annually:
2030	19,051	21,281,086	6.48%	297	66.8
2035	43,584	48,685,969	14.81%	545	123
2040	103,179	115,257,395	35.07%	662	149

Total Distributed Renewable Energy Potentials Projection—2030

Source Potential	Cumulative Installed (KW)	Annual Generation (KWH)	Share of Demand
Estimated Existing	3,011	3,429,203	1.04%
New Rooftop	19,051	21,698,345	6.60%
New Carport	2,020	2,661,502	0.81%
New Ground Mounted	7,384	9,727,922	2.96%
Total Potential	31,465	37,516,972	11.42%

To achieve this solar PV Capacity, the Region would need to achieve the following solar PV installation coverage by 2030:

Rooftop Coverage	1,119,806	Square Feet
Parking Lot Coverage	4.4	Acres
Lawn / Bare Ground Coverage	31.8	Acres





Buildings and Energy

Economic Potential for Fitchburg

Based on the City of Fitchburg Renewable Energy Potentials Study, the additional solar PV capacity which could be installed in the City by 2030 (recommended rooftop scenario as well as the estimated ground mounted and carport arrays outlined on the previous page) has an estimated total construction value of \$40 million (2022 dollars). The Fitchburg Economic Development potential of new installed solar PV capacity through 2030 based on Total Distributed Renewable Energy Potentials Projection are:

Jobs:	140
Annual Income Potential:	\$8,921,000

Additional Economic Benefit

In addition to the local re-investment share of the construction and maintenance costs, Fitchburg residents and business owners who invest in solar PV will have direct economic benefit in the form of savings. These savings represent increased economic potential within the City and include:

- 1) All residents and businesses who install solar PV prior to the phase out of the Federal Tax Incentive will be able to save 30% of the cost of installation. In addition, all commercial solar PV owners can harvest additional tax benefits through the federal accelerated depreciation. At the projected additional installation through 2030 outlined in the previous section, this could mean \$21 million in savings and local re-investment potential through 2030.
- 2) Many owners who install solar PV see a decrease in their annual energy costs (including solar PV project finance costs). Though savings vary, a reasonable estimate of the out-of-pocket savings for residents and businesses in Fitchburg is \$350,000 to \$450,000 annually by 2030 (based on a third party ownership structure - not currently allowed in Wisconsin - long-term savings for direct ownership can be significantly higher).

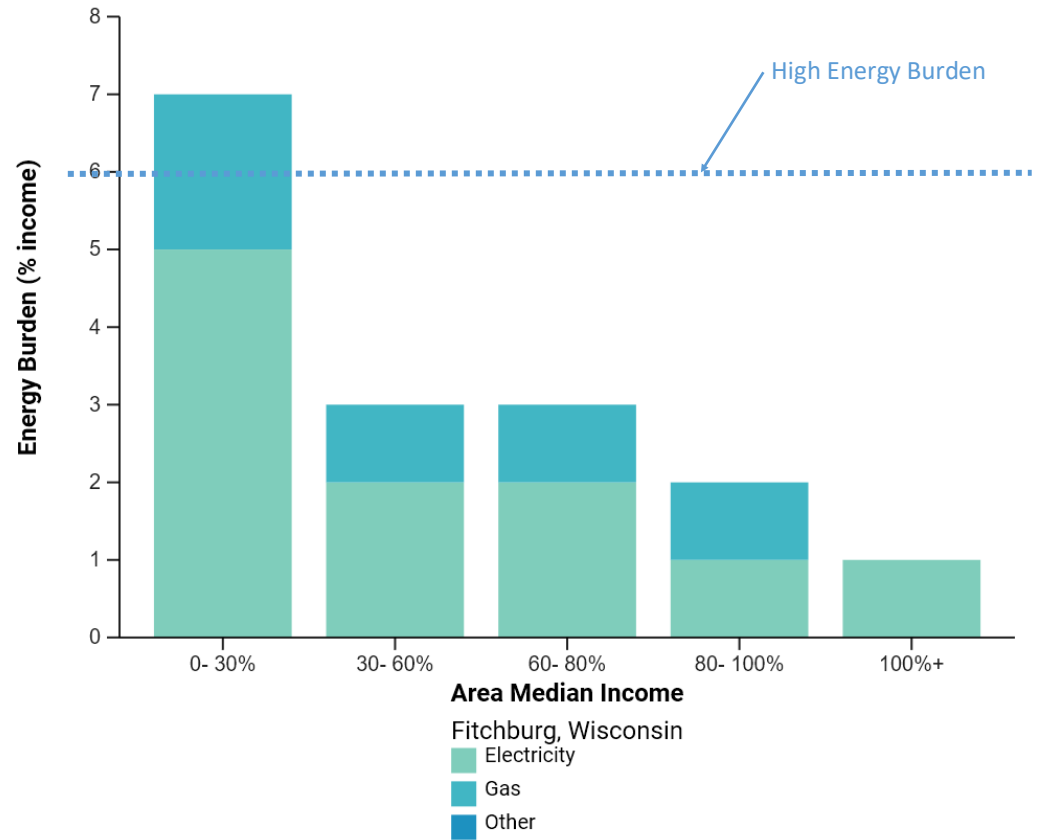
Buildings and Energy

Energy Burden In Fitchburg

A household’s energy burden—the percentage of household income spent on energy bills—provides an indication of energy affordability. Researchers define households with a 6% energy burden or higher to experience a high burden.¹ Factors that may increase energy burdens include the physical condition of a home, a household’s ability to invest in energy-efficient upgrades, and the availability of energy efficiency programs and incentives.

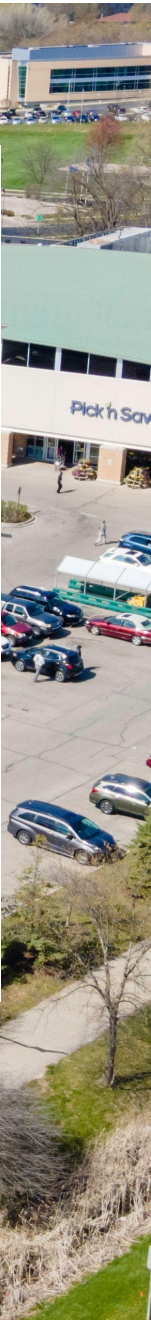
The chart to the right illustrates the average energy burden for Fitchburg households by income. According to this data, there are 1,144 households, or approximately 8% of all households, with 30% or less area median income which have a high energy burden of 7%. These households spend an average of \$1,114 annually. This data can be used to design energy efficiency and renewable energy programs to reduce energy burden while reducing GHG emissions within the community.

Energy Burden For City of Fitchburg



Source: US Department of Energy Low-income Energy Affordability Data Tool

1: ACEEE, “National and Regional Energy Burdens”; <https://www.aceee.org/sites/default/files/pdfs/ACEEE-01%20Energy%20Burden%20-%20National.pdf>





Buildings and Energy

Potential Climate Change Impacts by Sector

paleBLUEdot compiled a list of climate vulnerabilities for each of the sectors of interest included in this Baseline Assessment. The vulnerabilities were based on existing resources and our experience with other communities as well as regional planning documents and studies. The list of vulnerabilities generated for each sector included both direct impacts of climate change as well as ways that existing stressors in the community might interact with climate changes, either by exacerbating the impacts of climate change or being exacerbated by climate change (see Climate Vulnerability Assessment for more information). The following are the vulnerabilities identified as being of particular concern for this sector:

Vulnerability: Energy Cost and Power Outages

High energy demand due to hotter summers and more extreme heat, increasing costs and the risk of power outages (with potentially significant impacts on vulnerable residents such as those who are already under financial stress)

Likelihood	Consequence	Capacity	Vulnerability
Very High	High	Moderate	High

Vulnerability: Flood Damage

Increased damage or loss of buildings due to flooding or related impacts

Likelihood	Consequence	Capacity	Vulnerability
Very High	High	Moderate	High

Vulnerability: Infrastructure Damage

Increased damage or loss of buildings and infrastructure due to extreme weather events or related impacts

Likelihood	Consequence	Capacity	Vulnerability
High	High	Moderate	Moderate

Buildings and Energy

LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

The following are measures included in the LEED for Cities and Communities which relate to this section:

Green Building Policy and Incentives

Option: Buildings Owned and/or Operated by the Local Government

Option: Green Building Policy and Incentives

Housing and Transportation Affordability

Option: Comprehensive Housing Policy

Option: Housing and Transportation Costs

Option: Affordable Housing Production

Option: Affordable Rental Housing Preservation

Power Access, Reliability and Resiliency

Case 1. Electricity Access

Reliability Performance Monitoring

Power Surety and Resiliency

Energy and Greenhouse Gas Emissions Performance

Measure the annual energy consumption and Greenhouse Gas (GHG) emissions for the city

Energy Efficiency

Option: Energy Audit and Energy Conservation

Option: Street Lighting and Public Area Lighting

Option: Water and Wastewater

Option: District Energy System

Option: Energy Efficiency Programs and Policies

Renewable Energy

Option: Renewable Energy in Electricity Supply

Option: Renewable Energy in Total Energy Consumption

Option: Renewable Energy Programs and Policies

Net-Zero Carbon and Climate Action

Option: City-wide Carbon Neutrality Accountability

Option: Climate Action Plan

Option: Reduction in Carbon Intensity



Buildings and Energy

Strategic Goal Recommendations— Community Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following community-wide Buildings and Energy Strategic Goals:

BE 1: Improve total Community wide building energy efficiency (all sectors) by 10% for electricity and natural gas by 2030.

BE 2: Increase adoption of high performance building construction technology, achieving 1% Net Zero households and commercial properties community wide by 2030. (Net Zero buildings are energy efficient buildings that produce as much energy on-site as they consume in a year)

BE 3: Achieve 10% residential and commercial and industrial building "fuel switching" from on-site fossil fuel combustion to electrification by 2030.

BE 4: Increase renewable electricity to 25% (10% on-site and 15% green source purchase / Opt-Out Municipal Aggregation Program) of community-wide residential, commercial, institutional, and industrial building electric use by 2030.

BE 5: Reduce share of population living in high energy poverty from 8% to 4% by 2030.

BE 6: Increase resilience of community-wide buildings to potential impacts of climate change. (impacts include increased flooding risk, increased extreme weather events, and increased extreme temperature events).

Strategic Goal Recommendations Government Operations

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Buildings and Energy Strategic Goals:

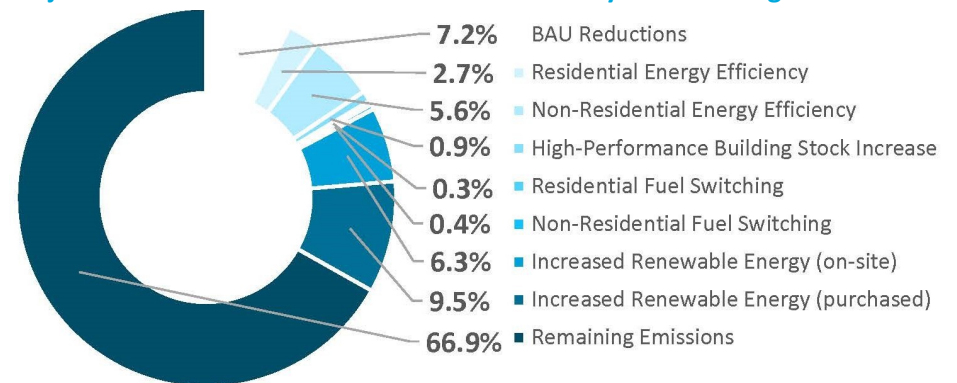
BE 6: Improve total government building energy efficiency by 15% by 2030 (electricity and natural gas, including water and wastewater infrastructure).

BE 7: Achieve 15% government building thermal "fuel switching" from on-site fossil fuel combustion to electrification by 2030.

BE 8: Increase renewable energy to 100% (on-site and green source purchase) of government building electric use by 2030.

BE 9: Increase resilience of government facilities to the impacts of climate change.

Projected Sector Emission Reductions Achieved by Draft Strategies



Section

04

Waste Management

[Click here to return to TOC](#)

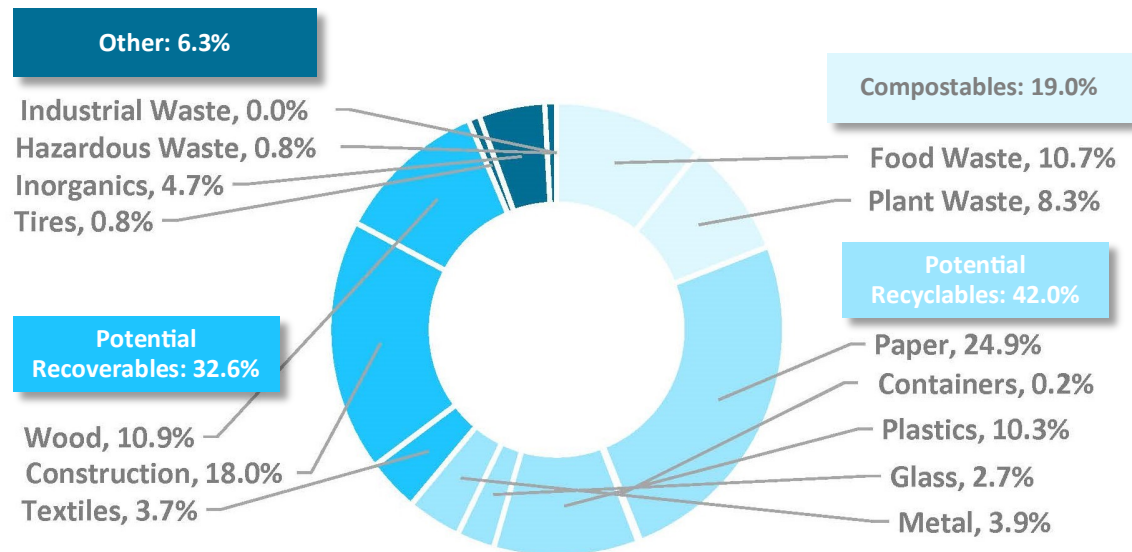
Waste Management

Waste management refers to both municipal solid waste and recycling, and includes consideration of volume, demand and service capacity, and infrastructure associated with collection and disposal.

Citywide municipal solid waste (MSW) handled has been estimated based on the city reporting. In 2022, citywide MSW totaled 6,336 tons. Of the MSW handled an estimated 1,604 tons (25.3% of total) were recycled, 759 tons (12%) were organics collection, and the remaining 3,937 tons (62.7%) were landfilled.

City of Fitchburg Solid Waste Characteristics

In 2021, the State of Wisconsin initiated a comprehensive, quantitative evaluation to understand the make up of the current waste stream (materials not diverted through recycling or organics collection) state-wide. The study assessed solid waste characteristics throughout the State. In the graph below, the findings of the composition of the waste characterization study are shown. This graph groups the classifications of waste defined in the 2021 study into broad categories based on their diversion potential including: Compostables, Potential Recyclables, Potential Recoverables, and Other.

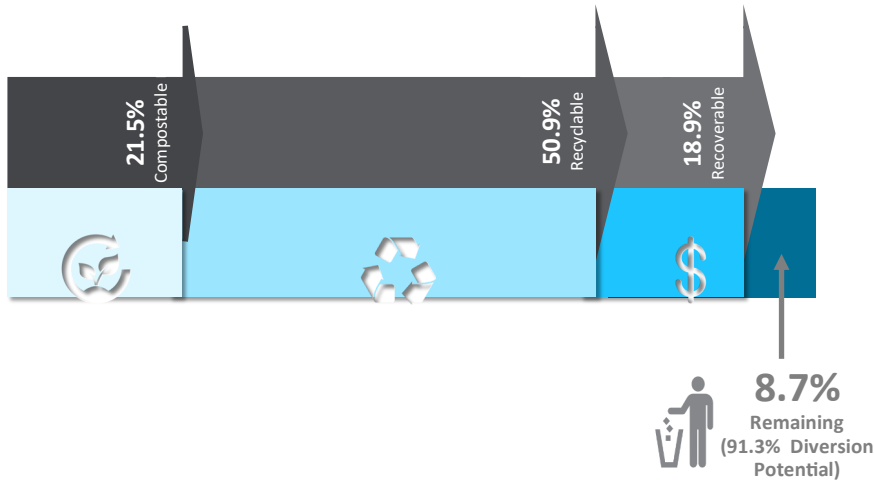


Waste Management

Waste Diversion Potential

Based on the State of Wisconsin Waste Characterization Study, there may be waste diversion potential of up to 78.7% in the current land-filled materials (idealized maximum). Below is the breakdown of the estimated total maximum potential waste diversion (excluding waste reduction):

Compostables	21.5%
Potentially Recyclable Materials	50.9%
Potentially Recoverable Materials	18.9%
Other Materials (remaining landfill waste)	8.7%



Waste Management

Potential Climate Change Impacts by Sector

paleBLUEdot compiled a list of climate vulnerabilities for each of the sectors of interest included in this Baseline Assessment. The vulnerabilities were based on existing resources and our experience with other communities as well as regional planning documents and studies. The list of vulnerabilities generated for each sector included both direct impacts of climate change as well as ways that existing stressors in the community might interact with climate changes, either by exacerbating the impacts of climate change or being exacerbated by climate change (see Climate Vulnerability Assessment for more information). The following are the vulnerabilities identified as being of particular concern for this sector:

Vulnerability: Increased Water Pollution	Likelihood	Consequence	Capacity	Vulnerability
Increased leakage and run-off due to extreme weather events, potentially impacting local water quality.	Moderate	High	High	Moderate
Vulnerability: Increased Waste Generation	Likelihood	Consequence	Capacity	Vulnerability
Increased waste generation due to debris and other damage (including organic debris from vegetation damage), which is likely to be exacerbated by illegal dumping.	Very High	High	Moderate	High
Vulnerability: Resistance to Change	Likelihood	Consequence	Capacity	Vulnerability
Historical precedence for solid waste collection frequency, complexity of encouraging behavior change required to reduce solid waste generated and/or increase effective diversion to recycling and organics composting results in complications in reducing solid waste impacts.	Very High	High	Moderate	High

Waste Management

LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

The following are measures included in the LEED for Cities and Communities which relate to this section:

Solid Waste Management

Demonstrate that all sectors in the city can receive waste

Solid Waste Management

Waste Performance

Measure the total weight of waste (in lbs., kg, or tons) that is generated, and the total weight that is diverted from landfills or incineration

Special Waste Streams Management

Measure and report the total weight of waste generated under hazardous waste and any two special waste streams mentioned below, and the total of such waste diverted from landfill or incineration.

Responsible Procurement

Option: Sustainable Procurement Policy

Option: Embodied Carbon Reduction

Option: Design for Disassembly

Material Recovery

Option: Laws, Regulations and Programs Supporting Material Conservation

Option: Non-recyclable Waste Generation Reporting

Option: Repair/Reuse Awareness and Education

Option: Reuse Centers & Drop Off Facilities

Smart Waste Management Systems

Adopt smart waste management strategies or solutions to handle a minimum of 20% of the waste generated within the city.





Waste Management

Strategic Goal Recommendations

Community Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Waste Management Goals:

WM 1: Decrease total annual municipal solid waste handled per household by 5% by 2030.

WM 2: Increase organics and compostable diversion from 12% to 22.7% of total MSW handled by 2030.

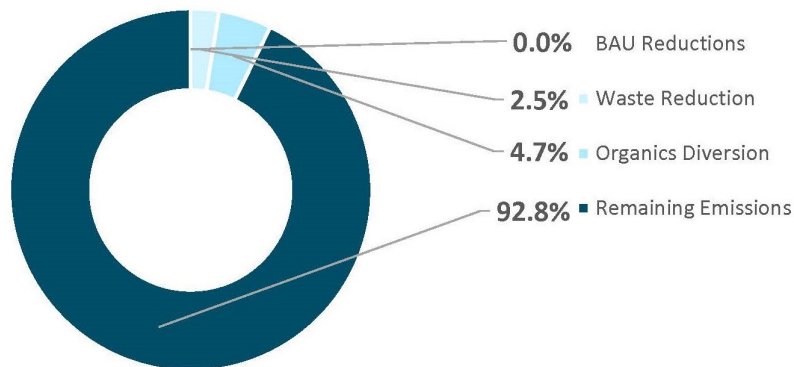
WM 3: Increase recycling diversion from 25% to 50% of total MSW handled by 2030.

WM 4: Increase diversion of potential recoverables from 0% to 3% of total MSW handled by 2030 (from 18.9% to 16% of city landfill waste)

Government Operations

WM 5: Reduce solid waste and procurement impacts of government operations.

Projected Sector Emission Reductions Achieved by Draft Strategies



Section 05 Water and Wastewater

[Click here to return to TOC](#)

Water and Wastewater

Water and Energy Nexus

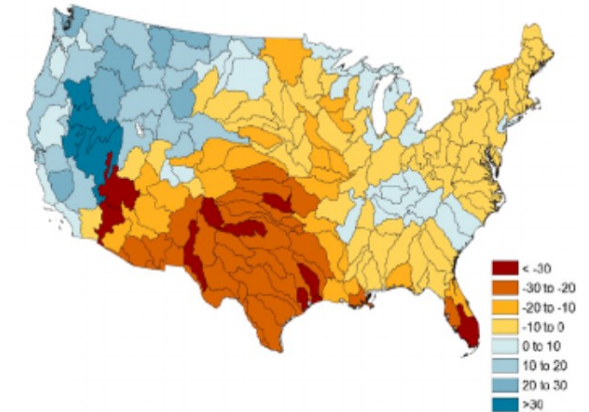
Water and energy are fundamental components of our 21st century life. Production, distribution, consumption, and treatment of water consumes energy. Production of energy - particularly those generated through fossil fuel use - consumes water. The water-energy nexus is the relationship between how much water is used to generate and transmit energy, and how much energy it takes to collect, clean, move, store, and dispose of water. Both fresh water production and waste water treatment are typically the highest energy and carbon emission sources within a community's operations. Reduction of water demand saves energy not only in the production and distribution of fresh water but also in the collection and treatment of wastewater.

Regional Water Stress

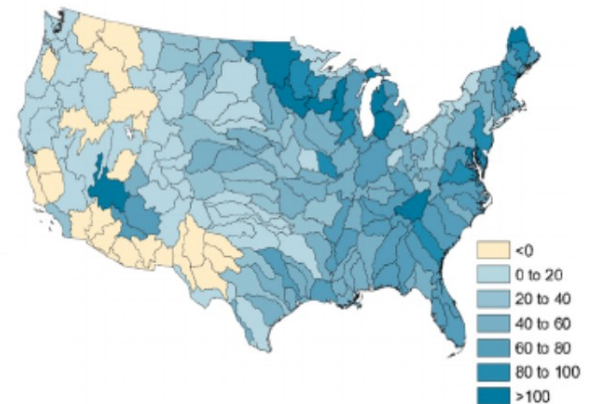
By the year 2025, it is projected that 1.8 billion individuals will reside in regions afflicted by a lack of water, while two-thirds of the global population will inhabit areas facing water stress. The Fitchburg region has experienced a decline in water yield of about 10% since 1985. Looking ahead to 2050, the region should prepare for a surge in water demand that could exceed 20%.

(Maps from "Adaptation to Future Water Shortages in the United States Caused by Population Growth and Climate Change." Additional sources: World Resources Institute, USGS).

Change in Water Yield Since 1985



Projected Change in Water Demand by 2050







Mitigating Flood Impacts

According to the US National Climate Assessment, average annual precipitation in most of the Midwest has increased by 5 to 10% while rainfall during the four wettest days of the year has increased about 35%. By mid-century (average of 2041–2060), annual mean precipitation in Wisconsin is likely to increase by 5–10% compared to 1981–2010, and by late-century (2081–2100) annual precipitation are likely to increase by 10–15%, with expected changes in Fitchburg falling towards the lower end of that range. In addition, the timeframe between rains is expected to continue to increase, (source US National Climate Assessment). Under this scenario, it is likely that certain periods of the year, like spring, may be significantly wetter with storms producing heavier rains. In anticipation of that, it is appropriate to review the areas of the City with flood risk and to review current storm water management capacity against future extreme rainfall event projections.

The map to the right shows the flood risk areas throughout the City as defined by FEMA . Flood risks illustrated relate to water surface elevations for 1% chance annual floods (“100 year flood event”). Areas shown relate to existing bodies of water as well as potential “flash flood” zones in low-lying areas.

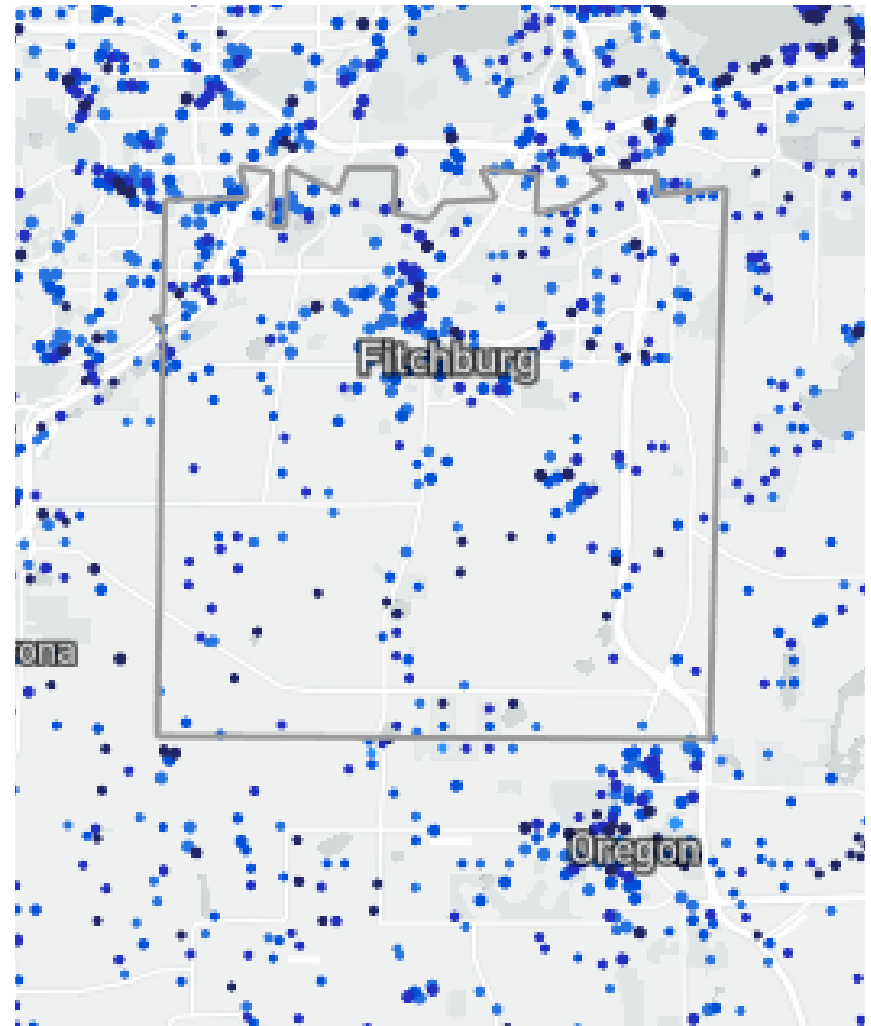
Properties at Risk

According to First Street Foundation, there 552 properties in the City of Fitchburg that have **greater than a 26% chance** of being severely affected by flooding over the next 30 years. This represents **13%** of all properties in the city. Properties at risk in the city:

-  **608** Houses have moderate risk (10.5% of total)
-  **130** Commercial Properties have moderate risk (22.7% of total)
-  **1** Critical Infrastructure has minor risk (5% of total)
-  **2** Social and Gathering Facilities have minor risk (9% of total)

Source: First Street Foundation, FEMA

Properties at Risk Map
(Source: First Street Foundation)



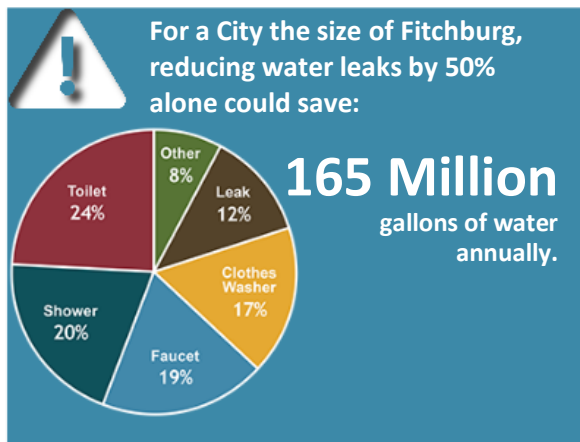
Water and Wastewater

Water Conservation Potential

Community water use rose from 706 million to 800.6 million gallons between 2014 and 2022, a 13.4% hike, against a 13.7% population growth. The marginal per-person usage drop suggests room for conservation. According to “Residential End Uses of Water,” by the Water Research Foundation, on average, 12% of municipal water distribution is lost through leaks in water mains and water pipes on private property.

Cutting water and wastewater use by 1% could lower city GHG emissions by 25-30 metric tons a year. Moreover, conservation aids in sustaining aquifers and bolstering climate change resilience through fluctuating rainfall.

Illustration Water Conservation Potential



Source: Water Research Foundation, Residential End Uses of Water, Version 2, 2016; https://www.circleofblue.org/wp-content/uploads/2016/04/WRF_REU2016.pdf

Potential Climate Change Impacts by Sector

paleBLUEdot compiled a list of climate vulnerabilities for each of the sectors of interest included in this Baseline Assessment. The vulnerabilities were based on existing resources and our experience with other communities as well as regional planning documents and studies. The list of vulnerabilities generated for each sector included both direct impacts of climate change as well as ways that existing stressors in the community might interact with climate changes, either by exacerbating the impacts of climate change or being exacerbated by climate change (see Climate Vulnerability Assessment for more information). The following are the vulnerabilities identified as being of particular concern for this sector:

Vulnerability: Increased Flooding

Increased flooding during periods of heavy rain, particularly where the City’s stormwater infrastructure is inadequate for increased volumes or impermeable surfaces prevent infiltration.

Likelihood	Consequence	Capacity	Vulnerability
Very High	Very High	Moderate	High

Vulnerability: Groundwater Infiltration

Elevated groundwater tables due to frequent large storms, infiltrating the sanitary sewer system and increasing the cost of treatment.

Likelihood	Consequence	Capacity	Vulnerability
Very High	Moderate	High	Moderate

Vulnerability: Resistance to Change

Water consumption behaviors and infrastructure investments (i.e. landscape sprinklers, non-native plantings, etc) as well as perception of a water rich region result in complications in reducing water consumption patterns.

Likelihood	Consequence	Capacity	Vulnerability
Very High	High	Moderate	High





LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

The following are measures included in the LEED for Cities and Communities which relate to this section:

Water Access and Quality

- Case 1. Water and Sanitation Access
- Drinking Water Quality
- Treated Wastewater Quality
- Stormwater Quality

Water Performance

Measure the daily per capita domestic water consumption within the city.

Integrated Water Management

Adopt an integrated water management program

Stormwater Management

- Option: Green Stormwater Infrastructure
- Option: Stormwater Management regulations

Smart Water Systems

- Option: Water Audit
- Option: Water Audit and Automation

Water and Wastewater

Strategic Goal Recommendations

Community Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Water and Wastewater Strategic Goals:

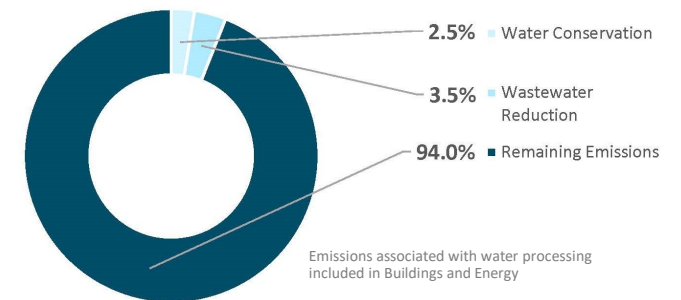
W 1: Promote increased water conservation and wastewater generation City-Wide with a targeted reduction of 6% by 2030.

W 2: Update design standards and implement plans to meet projected climate change storm water and flood mitigation requirements.

W3: Increase groundwater, stream, river and wetland water quality protection and restoration.

W4: Educate, engage, and empower the public on water quality and conservation.

Projected Sector Emission Reductions Achieved



Section

06

Local Food and Agriculture



[Click here to return to TOC](#)

Local Food and Agriculture

Transporting food over great distances involves significant fossil fuel consumption, which in turn releases greenhouse gases into the atmosphere. Extended transport times necessitate more refrigeration, which is also a significant source of carbon emissions. The less we rely on transportation and refrigeration for our food, the more sustainable our food supply becomes.

The US EPA states that in 2018, agriculture was responsible for 9.9% of the U.S. total greenhouse gas emissions. Of this, livestock management was the source of 42% of these emissions, equating to around 259 million metric tons of CO₂ equivalents. The remainder arises from soil management and the energy required to run agricultural machinery and operations. Additionally, tillage methods impact soil health and carbon levels, water quality, and the use of energy and pesticides by farmers.

Economic Potential of Local Food Purchases

Purchasing food from local producers can diminish the carbon footprint of our diets and bolster the local small business economy. According to the 2008 Journal of Hunger and Nutrition article “The Food System as an Economic Driver: Strategies and Applications for Michigan” every \$1 million in revenue produced by farms participating in local markets, about 32 jobs are created, whereas wholesale-focused farms generate merely 10.5 jobs. Additionally, community gardens and neighborhood gardening foster outdoor and social engagement, which enhances social bonds, encourages activities across different ages, promotes gentle forms of exercise, and nurtures habitats for plants, animals, and pollinators.



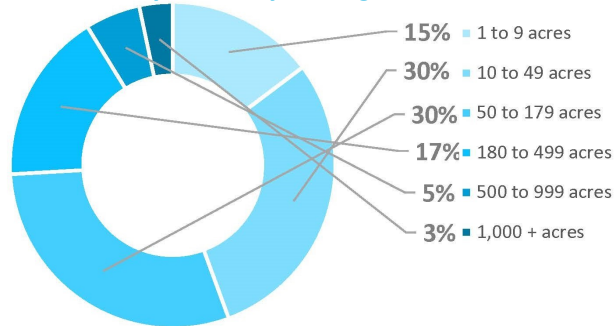


Local Food and Agriculture

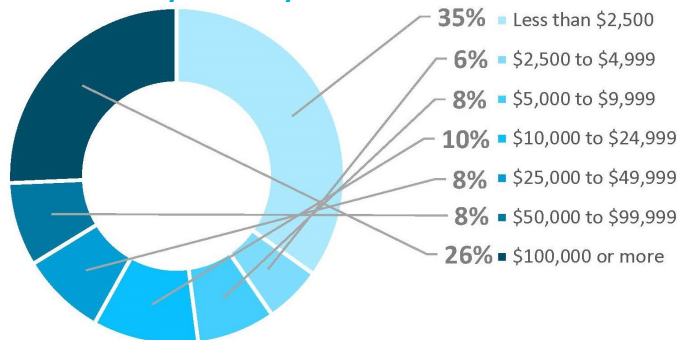
City of Fitchburg Agriculture

Agriculture land uses cover 32.8% of the land in the City of Fitchburg. The county in total, supports over 2,500 farms with an average size of 197 acres producing an average of \$200,000 in annual sales.

Dane County Farms by Acreage



Dane County Farms by Sales

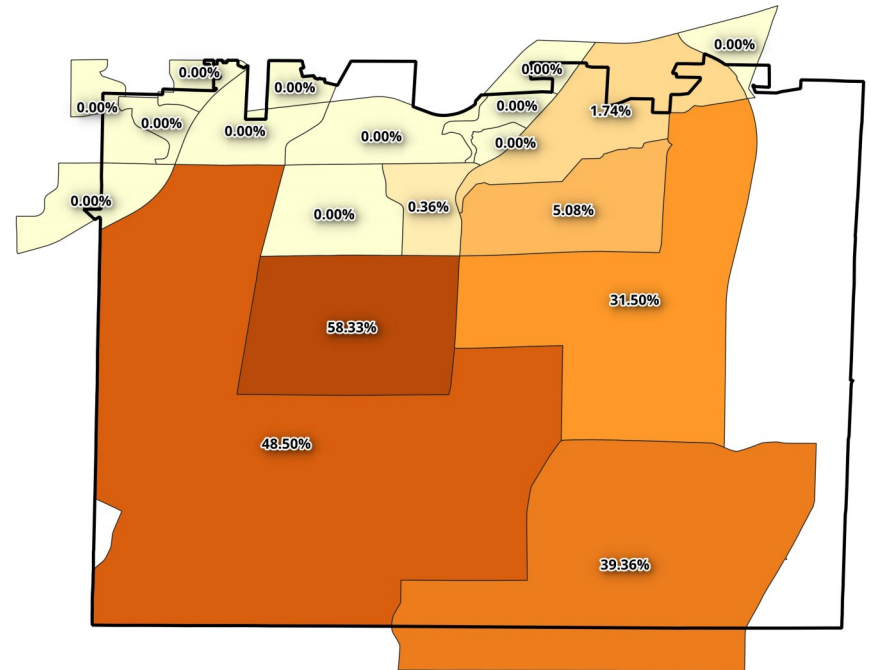


Dane County Farms by Land Use Practices (% of farms)

No till	30
Reduced till	28
Intensive till	20
Cover crop	12

City of Fitchburg Agriculture Land Coverage

Total Acreage: 6,929 Acres Avg. Coverage: **32.8%** City High: **58.3%** Tract 107.01 bg3 City Low: **0.0%** multiple tracts



Dane County Total Land Use in Agriculture: **506,688 acres**

City of Fitchburg Share of County Agriculture Land: **1.37%**

Local Food and Agriculture

Animal Farming and GHG Emissions

Livestock on farms are responsible for a significant release of GHGs from various stages along the production process. Much of these emissions are from the biological processes of the livestock themselves. There are three primary ways in which dairy farms create – and consequently can manage the production of GHG emissions:

- **Direct emissions** from biological processes of the livestock (manure, enteric fermentation)
- **Indirect emissions** related to the support and management of the livestock (reduced carbon sequestration and soil carbon associated with tillage and some soil management practices, emissions associated with soil nitrates from excess and synthetic fertilizer use, energy inputs for fertilizer manufacture, energy inputs for operations)
- **Post-production emissions** (energy inputs for transportation, processing, packaging, and retailing)

Dane County Livestock*



155,725 Cows



3,515 Horses



32,717 Hogs



3,125 Sheep



1,015 Goats



77,037 Chickens

Estimated Fitchburg Livestock**

2,133 Cows

48 Horses

448 Hogs

43 Sheep

14 Goats

1,055 Chickens

*Sources: US Agriculture Census, US EPA State Inventory Tool (SIT)

**Based on City share of County Agriculture Land.

Crop Farming and GHG Emissions

Agricultural soil management techniques can contribute to heightened greenhouse gas emissions. Nitrogen levels in the soil are particularly pivotal, with excess nitrogen leading to the release of nitrous oxide (N₂O). Emission-inducing practices in agriculture include the use of both synthetic and organic fertilizers, cultivation of nitrogen-fixing crops, and the drainage and irrigation of organic soils. These soil management activities represent just over half of the Agriculture sector's greenhouse gas contributions.

Key strategies for curbing emissions in crop production encompass:

- Optimizing fertilizer application to match the nitrogen needs for peak crop yield, as excess nitrogen can exacerbate N₂O emissions without benefiting crop output.
- Encouraging practices that positively influence carbon levels in the soil could enhance carbon sequestration, turning agricultural soils into carbon sinks.





Local Food and Agriculture

Strategies for Reducing Cattle Farm Emissions

Research is ongoing in the United States and Europe to quantify the emissions reduction potential of a number of cattle and dairy practices, though evidence illustrates their intrinsic value in managing and reducing dairy farm emissions. General strategies include:

Feed Efficiency and Mix

Approximately 75% of all the energy contained in feedstuffs that the cow eats is converted into methane (CH₄) emissions. Considering emissions per animal versus emissions per unit of production (gallons of milk) is an important distinction, however, as increasing productivity per animal can result in lower overall GHG emissions.

According to Farm Carbon Toolkit, a community interest company in the UK, there are a range of studies that have shown positive results from increasing the legume content of the forage, replacing maize with grass forage, and increasing the oil content of the feed.

Manure Management

The use of anaerobic digestion delivers a triple benefit for emissions reduction: it mitigates emissions linked to manure storage and application, converts methane into a renewable energy source that can either sustain farm operations or be sold to industrial consumers, and displaces the need for fossil fuels.

Soil and Crop Management

Farmers can adopt soil management practices to increase carbon sequestration and reduce soil carbon losses. These practices focus on increasing the volume of organic matter stored in the soil and include switching from conventional tillage to conservation tillage or no-till, reducing or eliminating fallow as part of planned crop rotations, switching from annual to perennial crops, increasing field residues through irrigation, improved drainage, organic fertilization, planting hay or cover crops, or using additional organic material. Fertilizer use is estimated to account for up to 20% of agricultural emissions, meaning that implementing improved soil and crop management practices with a focus on reduction of fertilizer use can help reduce GHG emissions while improving overall farm gross margins through reduction of input costs.

Renewable Energy and Energy Efficiency

As outlined in the Buildings and Energy section, increased use of on-site renewable energy sources and improved energy efficiency of farm buildings and facilities can result in important emissions reductions. Equally important is the operational cost reductions these strategies can have on overall farm operational costs.

Local Food and Agriculture

Climate Change and Food Security

Our food system is vulnerable to impacts of climate change. These vulnerabilities include physical impacts like extreme precipitation and heat, crop and livestock vulnerabilities like animal heat stress, biological impacts like increasing invasive insect infestations, interruptions to natural annual cycles, and socioeconomic impacts.

Pacific states are particularly sensitive to reduced water supplies, warmer winters, and more variable spring weather. Grain production is vulnerable to more variable weather, warmer winters, heat wave, and hot summer nights and flooding in the Great Plains and the Midwest. Beef, pork, and poultry production is vulnerable to increased frequency and intensity of extreme weather in the Great Plains and the Southeast as well as sensitive to interruptions in feed, water, and power supplies that can occur with extreme weather events and other climate change drivers.

Although all community members may feel any affects of climate change impacts on the food system, individuals who are already experiencing low income or food insecurity will very likely experience these affects more profoundly. Today, food insecurity—disruption of nutrition availability because of lack of money, access, or other resources—is inequitably felt: people experiencing low income are nearly three times more likely to experience food insecurity. We should anticipate that the climate change vulnerabilities of our national food system will exacerbate the inequities of food security in all communities

Increased local food system capacity can help increase resilience, food security, job creation, and community wealth building benefits



Local Food Resources in Fitchburg

Community Gardens Per 100,000 Residents

United States:	5.5
City of Madison:	2.3
City of Milwaukee:	1.2
City of La Crosse:	3.2
City of Fitchburg:	13.5 (4 total)

Farmer's Market Locations

City of Fitchburg: 2

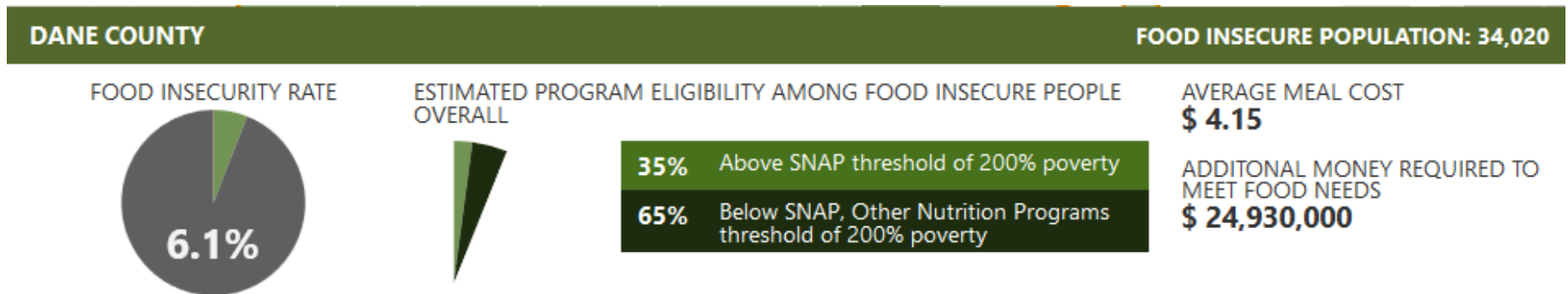
(Sources: American Community Gardening Association, Star Tribune, City of La Crosse, City of Fitchburg)





Potential Food Insecurity in Dane County

According to Feeding America’s Map The Meal Gap tool and USDA data, Dane County has an estimated total food insecure population of 34,020. This represents an estimated average county level food insecure rate of 6.1%.



Vulnerability: Agricultural Production Impacts

Current crops may not be suited for new conditions, increased flooding and climate change impacts on agricultural lands result in crop failures and impact food costs, availability, or security in community.

Likelihood	Consequence	Capacity	Vulnerability
High	Very High	Low	High

Vulnerability: Local Food System Impacts

Extreme weather events such as flooding result in damage or interruption to food distribution and retail operations impacting food costs availability, or security in community.

Likelihood	Consequence	Capacity	Vulnerability
Moderate	Very High	Moderate	Moderate

LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

There are no measures included in the LEED for Cities and Communities which relate to this section.





Local Food and Agriculture

Strategic Goal Recommendations— City Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Local Food and Agriculture Goals:

FA 1: Increase adoption of carbon positive soil, crop, fertilizing, irrigation, and drainage management practices from approximately 25% to 50% by 2030.

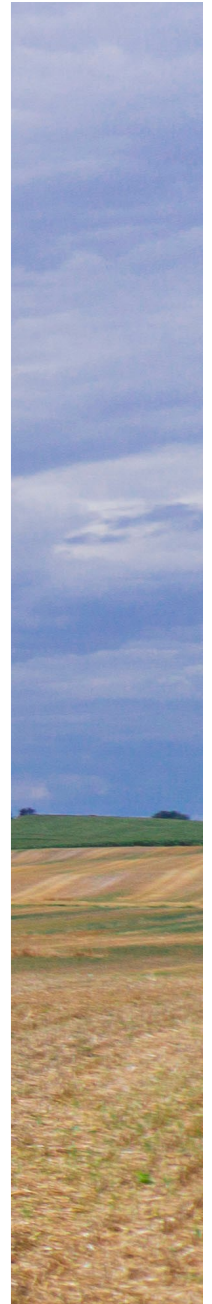
FA 2: Increase share of farms using high feed efficiency practices, achieve 20% adoption rate by 2030.

FA 3: Reduce GHG emissions from manure management, achieve 20% adoption rate by 2030.

FA 4: Increase production of and access to local food, particularly serving low income and food insecure individuals.

FA 5: Reduce food waste and hunger, achieve a 50% reduction in food insecurity City-wide by 2030.

FA 6: Protect and preserve agricultural land while increasing its resilience to climate shocks.



Section

07

Greenspace and Ecosystems



[Click here to return to TOC](#)

Trees and natural ground covering play a central role in supporting community health, improving air and water quality, helping to reduce building energy use, and supporting climate mitigation. Recent studies like “The importance of greenspace for mental health” by Jo Barton and Mike Rogerson have shown that sometimes, going to a park, or even looking a single tree can significantly improve a person’s health and stress levels. Our understanding of the value of trees has been expanded to include mental and physical health benefits. Trees are critical in filtering air, removing harmful pollutants, such as Carbon Monoxide, particulate matter, and Ground-level Ozone - pollutants that can be toxic at high levels and which can cause asthma and other respiratory impacts.

Conversely, higher levels of impervious surfaces (pavement and buildings) within a community will increase the heat island of the community. Heat island refers to the phenomenon of higher atmospheric and surface temperatures occurring in developed areas than those experienced in the surrounding rural areas due to human activities and infrastructure. Increased heat indices during summer months due to heat island effects raise human discomfort and health risk levels in developed areas, especially during heat waves. Based on “Comparison of impervious surface area and normalized difference vegetation index as indicators of surface urban heat island effects in Landsat imagery” by Fi Yuan and Marvin Bauer, the relationship between impervious surface percentage of a City and the corresponding degree of heat island temperature increase can be understood as a ratio. (see “Impervious Surface Reduction Potential” for more).



Community-wide Land Cover Characteristics

Based on the Ground Cover Survey and Carbon Sequestration Study, the City's land cover characteristics are:



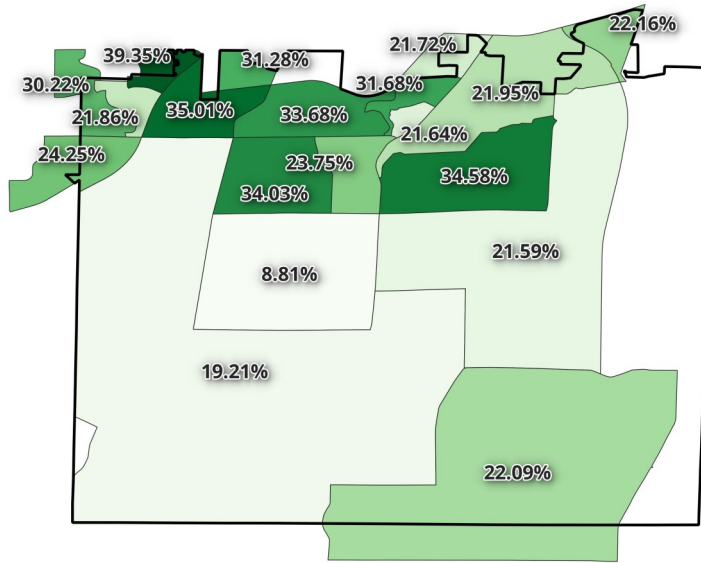
Tree Canopy Coverage

(See Appendix 1 for census area reference map)

City Average: **21.9%**

City High: **39.4%**
Tract 5.01 bg2

City Low: **8.8%**
Tract 107.01 bg3



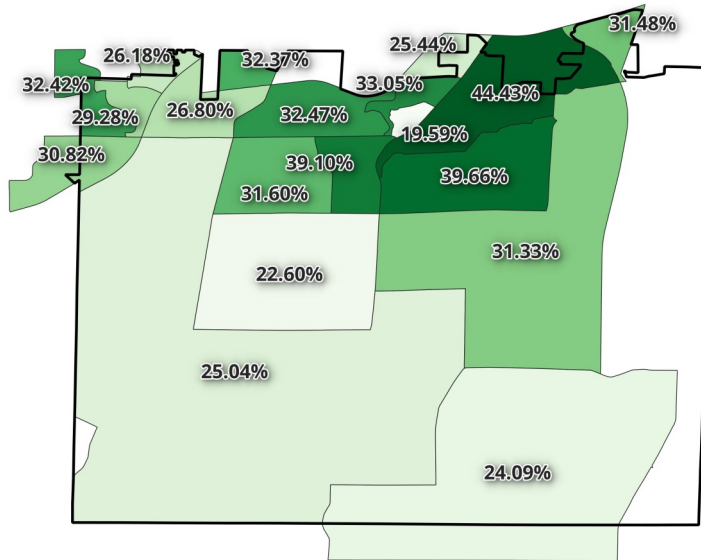
Lawn and Grass Coverage

(See Appendix 1 for census area reference map)

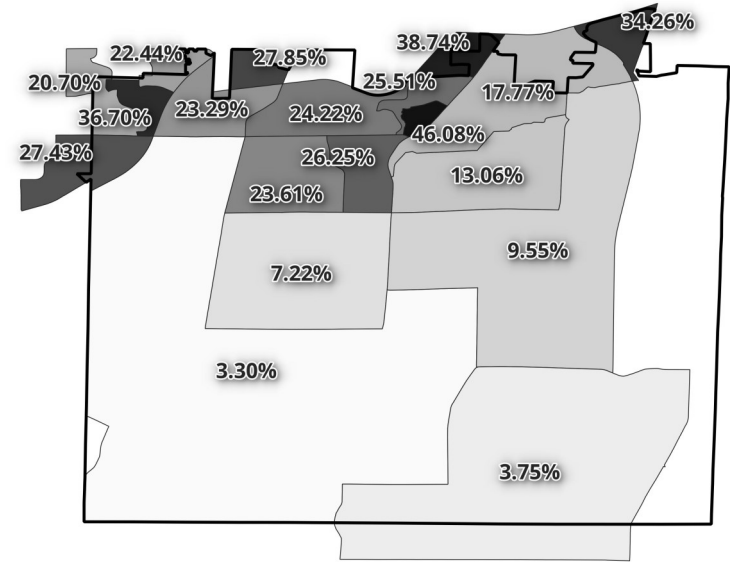
City Average: **30.9%**

City High: **44.4%**
Tract 14.05 bg2

City Low: **19.6%**
Tract 14.04 bg 3



Greenspace and Ecosystems



Dark Impervious Surface Coverage

(buildings+pavement)

(See Appendix 1 for census area reference map)

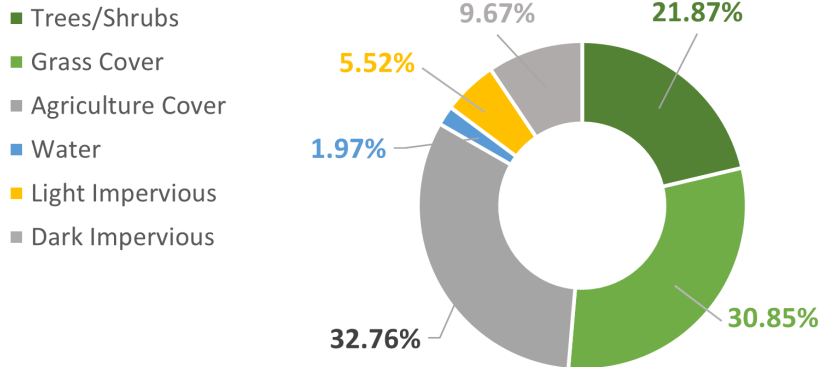
City Average: **9.7%**

City High: **46.1%**
Tract 14.04 bg3

City Low: **3.3%**
Tract 107.02 bg1

Greenspace and Ecosystems

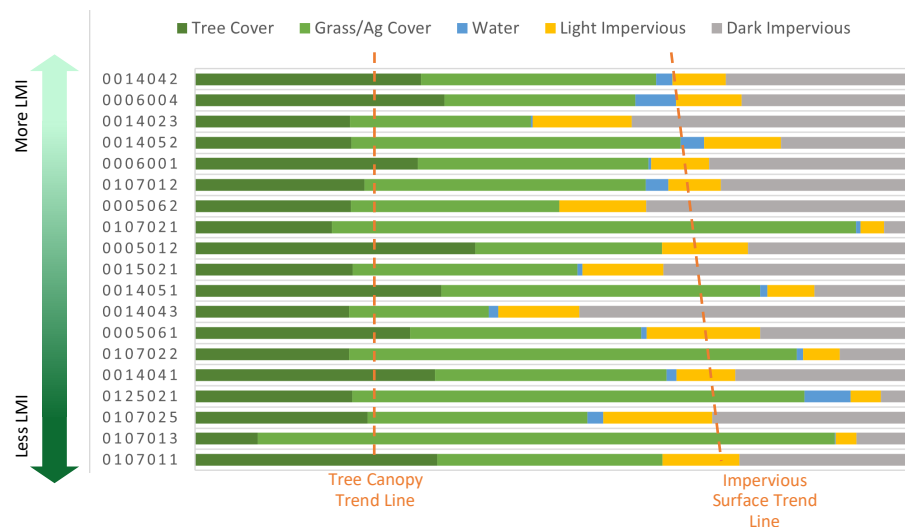
Ground Cover Breakdown by Type



Ground Cover Characteristics by Census Tract

Organized by Share of Low Income Population (LMI)

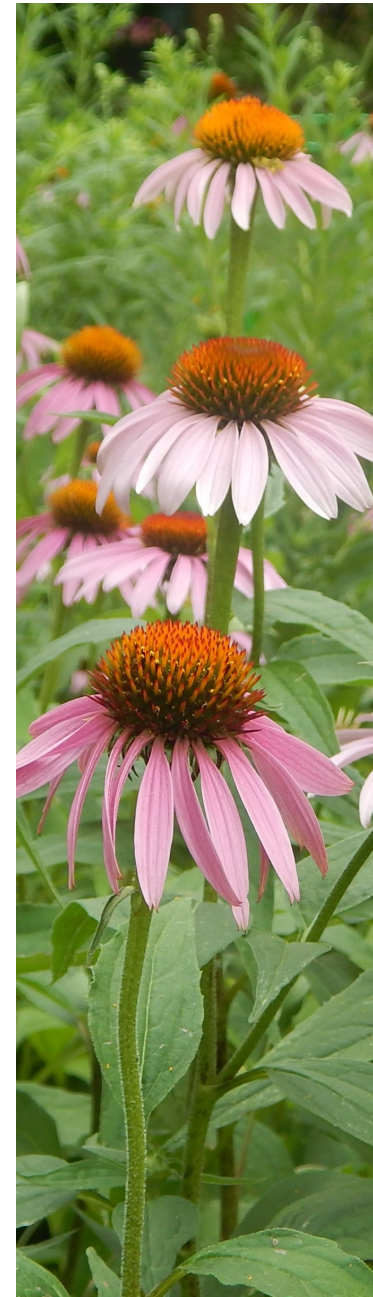
The bar chart below compares land cover data from Section 2 by Census Tract. Tracts with the most low to moderate-income (LMI) households are at the top and those with the least at the bottom. The chart doesn't show a consistent link between LMI populations and tree canopy coverage. There is, however, some indication of a potential link between LMI populations and dark impervious surface.



Review Criteria - Green Infrastructure

Prioritization of locations for increased green infrastructure included in this report is based on an equity approach. The approach reviews a range of land cover and demographic characteristics of each census tract based on a “environmental equity index” (see the Fitchburg Ground Cover Study for more information).

To determine the best locations to plant trees, tree canopy and impervious cover maps were used in conjunction with U.S. Census data to produce an index of priority planting areas by census area. Index values were produced for each census block group with higher index values relating to higher priority of the area for tree planting. This index is a type of “environmental equity” index with areas with higher human population density, higher economic stress, lower existing tree cover, and higher total tree canopy potential receiving the higher index value. The criteria used to make the index are outlined on the following page.





Greenspace and Ecosystems

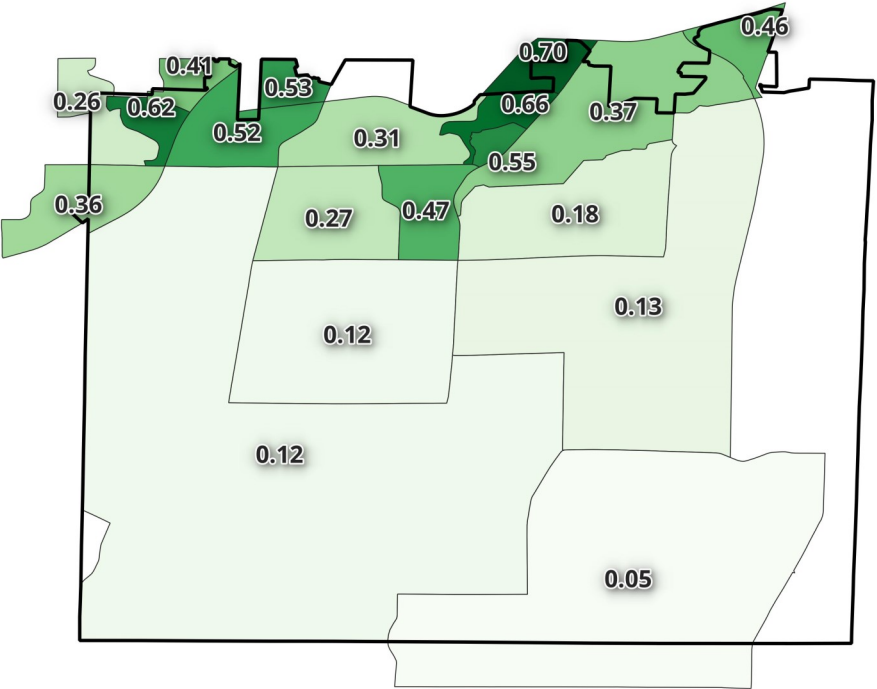
Weighted Priority Tree Canopy Increase

The weighted prioritization for tree canopy increase looks to balance the potential for increased tree canopy with the opportunity to improve tree canopy benefit equity, potential to positively impact as many households as possible, and the need for mitigation of heat island impacts. Higher numbers represent higher prioritization. The priorities above are weighted as follows:

- Potential for New Trees: 15%
- Low Income Density: 30%
- Population Density: 15%
- Heat Island Reduction Need: 40%

Weighted Priority Tree Canopy Increase

To improve environmental equity, the darker green areas of the map below with higher numbers should be prioritized for new tree plantings.



Greenspace and Ecosystems

Calculating Tree Canopy Coverage Goals

City's long-term land cover recommendations center on total tree canopy coverage. To promote environmental equity, we factor in neighborhood-specific metrics like existing tree canopy, population density, economic stress, and heat island mitigation (See the City of Fitchburg Ground Cover Study for more). The City of Fitchburg's Comprehensive Plan established a goal of 30% tree canopy coverage for the Urban Service Area (Policy 1.3.6). This study builds on this goal, illustrating potential ground cover goals covering the entire city.

Our focus here is on 2040 as the maturity goal for planted trees, but we can set interim goals for 2030. Goals prioritize census areas with a progressive percentage increase approach, reflecting varying Tree Stock areas and resulting canopy percentages across census areas. The proposed framework does not include land in use as agriculture in calculations of potential tree canopy increases.

The recommended Tree Stock increase goals are:

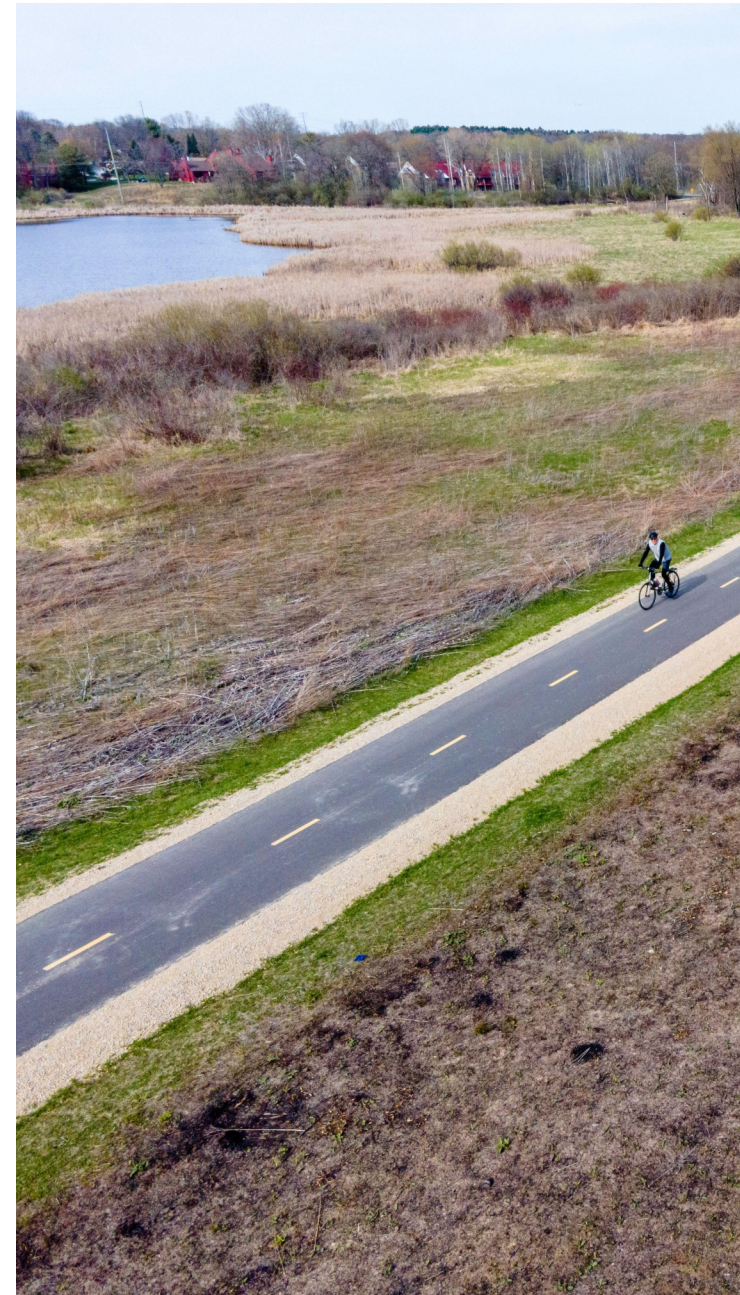
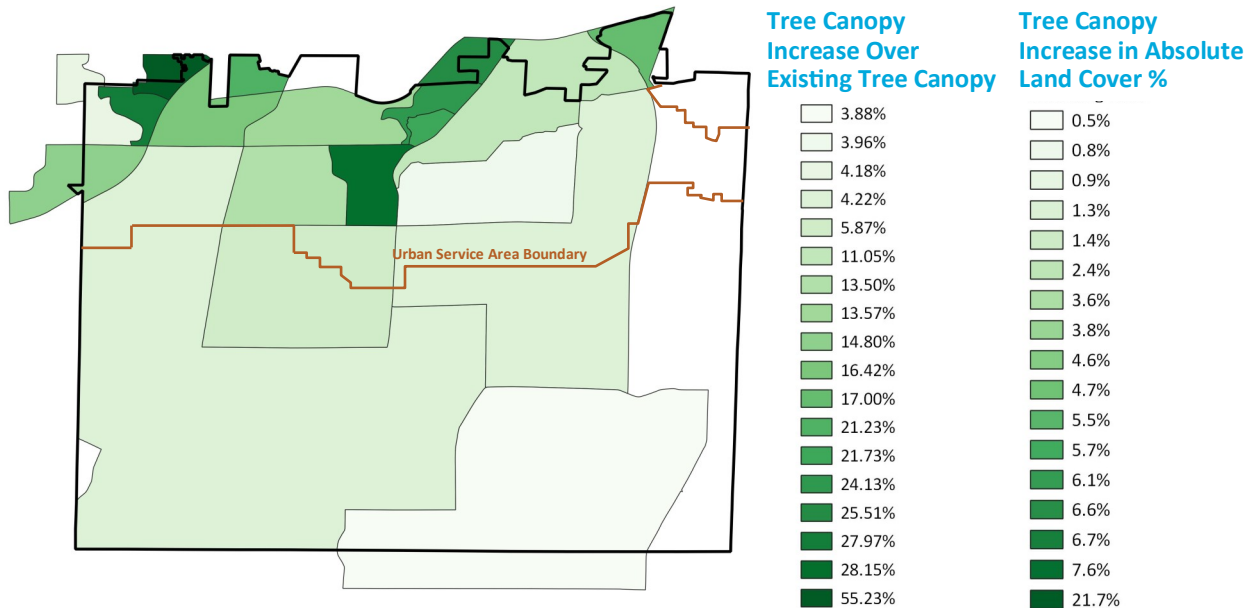
For areas in the top 1/3rd Census area Priority Ranking:

12%

For areas in middle 1/3rd Census area Priority Ranking:

7.25%

For areas in bottom 1/3rd Census area





Greenspace and Ecosystems

New Tree Planting Annual Target to Meet 2040 Tree Canopy Goal

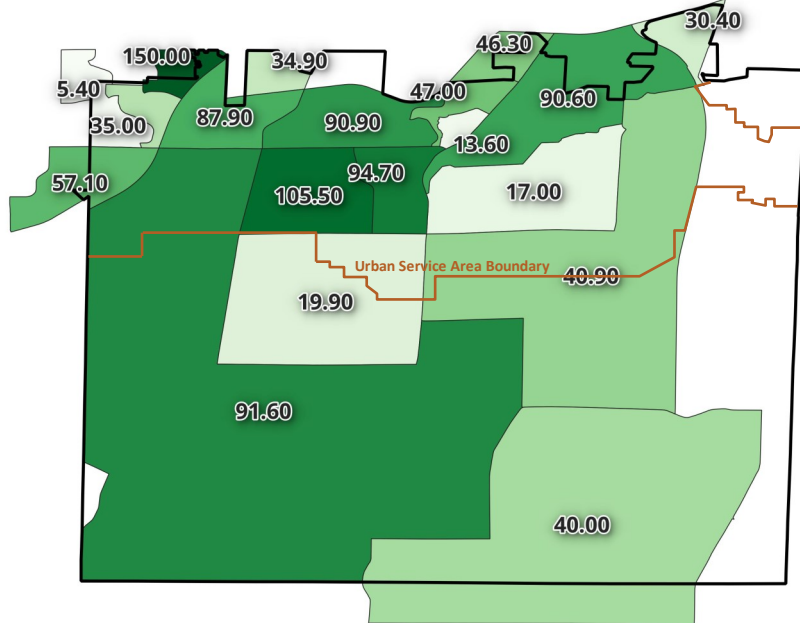
Community-wide total based on an assumed new tree crown radius of 5' planted no more than 22' apart. The proposed framework does not include land in use as agriculture in calculations of potential tree canopy increases.

2,800 New Trees **31** Acres

Resulting Tree Canopy Coverage:	2030	2040
Citywide Average:	22.5%	23.5%
Urban Service Area Average:	30%	32%

Other Ground Cover Goal Potentials

In addition to opportunities to expand and improve the City's tree canopy, the findings of the ground cover study as outlined in the City of Fitchburg Ground Cover, Tree Canopy, and Carbon Sequestration Study may be used to identify additional opportunities for increased heat island mitigation and increased native grass installations.



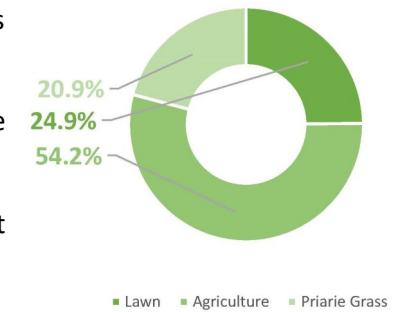
Turf Reduction Potential

As illustrated in the chart below, 54.2% of all grasslands in the City of Fitchburg are agricultural and crop lands. An estimated 20.9% are native prairie and wildflower grasses. The remaining 24.9% are manicured lawns—representing a great opportunity for turf reduction.

Impervious Surface Reduction Potential

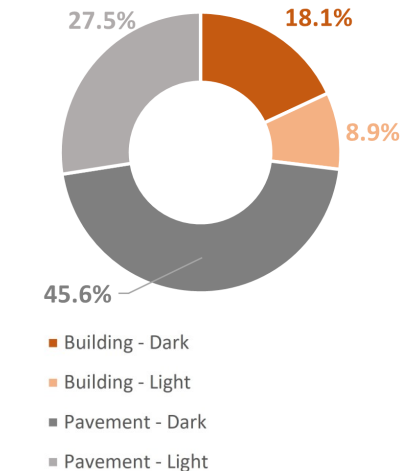
The city's experiences of heat island are directly impacted by the level of impervious surface coverage—particularly dark roofs and pavement. Based on a 2006 study done by Minnesota State University and the University of Minnesota*, the relationship between impervious surface percentage of a City and the corresponding degree of heat island temperature increase can be understood as a ratio.

Existing Grass Coverage in City of Fitchburg by Type



As the diagram to the right illustrates, dark pavements make up 45.6% of City impervious surfaces while dark roof structures make up 18.1%, totaling 63.7% of all impervious surfaces classified as 'dark'. These represent significant opportunities for decreasing heat island impacts in the community through "cool" and "green" roof and pavement strategies. For every 1% decrease in impervious surfaces in a area of the city, that area's likely experience of summer time heat island temperatures may decrease 0.17° F.

Existing Impervious Surface Coverage by Type



*Comparison of impervious surface area and normalized difference vegetation index as indicators of surface urban heat island effects in Landsat imagery. Fi Yuan and Marvin Bauer, February 2007

Greenspace and Ecosystems

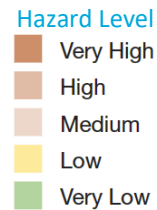
Park Accessibility

Park spaces, and convenient access to them, offer numerous benefits: they enhance physical and mental well-being, drive economic gains by bolstering businesses and rejuvenating neighborhoods, and foster community engagement by creating venues for neighborly interaction and cooperative local improvement efforts. Environmental advantages of park areas include the reduction of air pollution, air cooling to counteract urban heat islands, better water quality, and increased flood resistance.

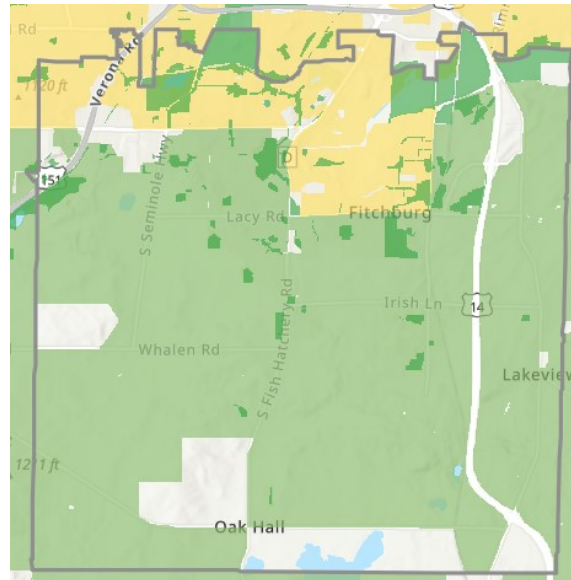
Data from the Trust for Public Land indicates that in Fitchburg, 84% of residents can reach a park within a 10-minute walk.

Data and map sources: Trust for Public Land
<https://www.tpl.org/parkscore>

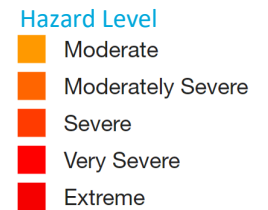
Respiratory Hazard and available park space



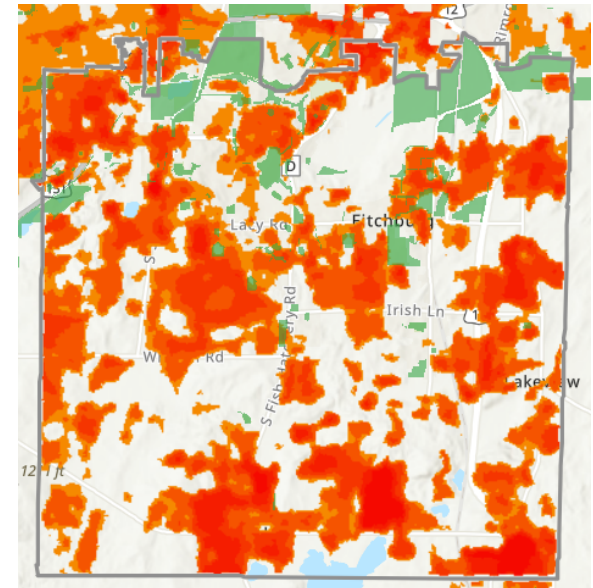
Existing Park Space



Heat Island Hazard and available park space



Existing Park Space








84% of Fitchburg residents live within a 10 minute walk of a park.

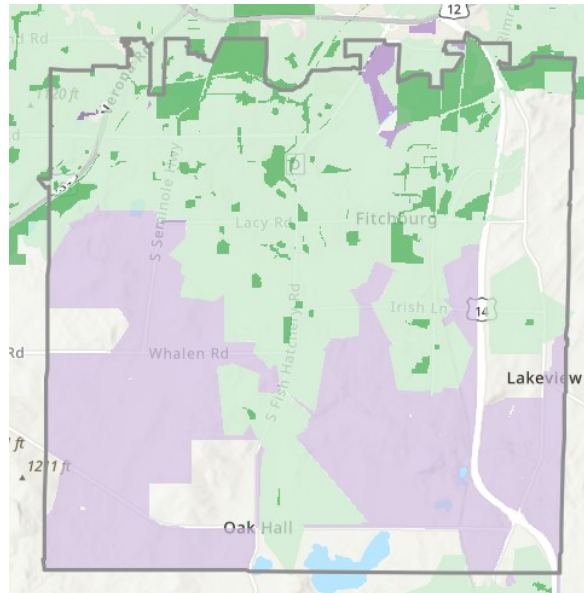
National Average: 55%



Potential Priority Areas for New Parks

Potential priority location for new park / green space to improve accessibility and equity:

- Area within 10 minute walk of park 
- Existing Park Space 
-  Very High
-  High
-  Moderate



Greenspace and Ecosystems

Potential Regions of Community to Prioritize for Public Park / Open Space

The maps to the left indicate potential priority areas for new park or open green space. These areas represent potential locations which could improve overall accessibility and equity of park space distribution serving Fitchburg residents.

The proposed framework does not include land in use as agriculture as recommendation for new public park or open space use.



Greenspace and Ecosystems

Potential Climate Change Impacts by Sector

paleBLUEdot compiled a list of climate vulnerabilities for each of the sectors of interest included in this Baseline Assessment. The vulnerabilities were based on existing resources and our experience with other communities as well as regional planning documents and studies. The list of vulnerabilities generated for each sector included both direct impacts of climate change as well as ways that existing stressors in the community might interact with climate changes, either by exacerbating the impacts of climate change or being exacerbated by climate change (see Climate Vulnerability Assessment for more information). The following are the vulnerabilities identified as being of particular concern for this sector:

Vulnerability: Invasive Species

	Likelihood	Consequence	Capacity	Vulnerability
Expansion of non-native invasive plants and insect pests as temperatures increase (particularly winter temperatures), likely resulting in the introduction of new invasive species into the area.	Very High	Moderate	Moderate	Moderate

Vulnerability: Flooding Impacts

	Likelihood	Consequence	Capacity	Vulnerability
Increased flooding and erosion, impacting native plant communities (e.g., can result in loss of species such as ash) as well as access to and condition of parks and conservation.	Very High	High	Moderate	Moderate

Vulnerability: Tree Canopy Stress

	Likelihood	Consequence	Capacity	Vulnerability
Increased stress and potential loss of tree canopy due to invasive pests (i.e. Emerald Ash Borer), changing temperature and precipitation patterns, extreme weather events, and invasive species impacts.	Very High	Very High	Moderate	High

LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

The following are measures included in the LEED for Cities and Communities which relate to this section:

Ecosystem Assessment

Complete and document an ecosystem

Greenspaces

Option: Greenspace - Percentage of residents having accessible green spaces within 800 meters

Option: Urban Forest Cover - Demonstrate an improvement in the urban forest cover or reduction in the urban heatmap of the city over a period of ten years.

Natural Resources Conservation and Restoration

Option: Natural Resource Acreage - Maintain protected natural resource acreage at 20% or more of total city land area.

Option: Natural Resource Conservation and Restoration Plan

Option: Biodiversity Enhancement - develop and

Light Pollution Reduction

Option: Protect Night Sky Access

Option: Lighting Ordinance - Adopt a lighting





Greenspace and Ecosystems

Strategic Goal Recommendations

Community Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Greenspace and Ecosystems Strategic Goals:

GE 1: Increase tree cover, particularly in the priority neighborhoods, from 21.9% to 23.6% by 2040 with growth coming from non-invasive species and an emphasis on climate adaptive species (an increase of 7% over existing tree canopy coverage).*

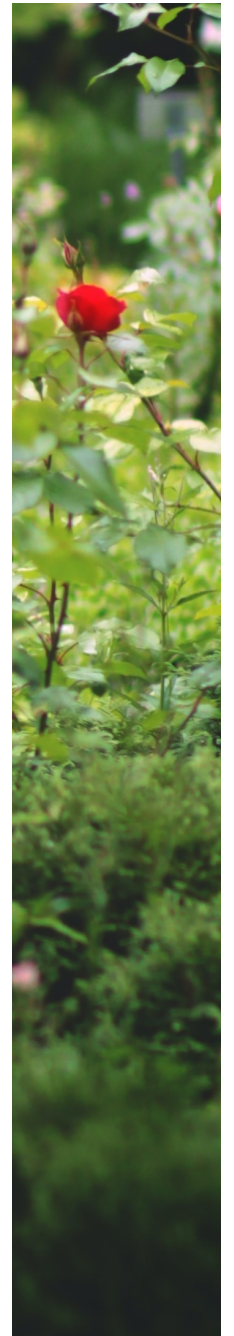
GE 2: Increase pollinator supportiveness of lawns and grasslands in City and achieve a 5% turf replacement with native grasses and wildflowers Community-wide by 2030.

GE 3: Reduce heat island effect through Community-wide “dark” impervious surface coverage reduction, particularly in neighborhoods identified with higher heat island impacts, from 9.2% to 8.7% by 2030 (from 1,900 acres to 1,800 acres).

GE 4: Reduce invasive species and increase climate resilience and biodiversity of City’s tree canopy, parks and greenspaces.

GE 5: Increase connectivity, accessibility and equity of City’s parks and Greenspaces.

* The proposed framework does not include land in use as agriculture in calculations of potential tree canopy increases.



Section

08

Health and Safety


[Click here to return to TOC](#)

Health and Safety

A vital connection exists between human health and the state of the environment. The quality of the air, the purity of our water, and our very existence hinge on the health of Earth's ecosystems. This essential bond informs the urgency of addressing climate change impacts, a key focus of the City's 2023 Climate Vulnerability Assessment. Shifts in climate patterns—like rising temperatures and more severe storms—escalate health risks. Such impacts from climate change threaten our well-being by compromising the air quality, altering weather conditions, and affecting our food, water, and the way we interact with our surroundings. With ongoing climatic shifts, the peril to human health only intensifies.

Just as local authorities and healthcare providers advocate for healthy living through proper diet and exercise, it's crucial for agencies to acknowledge the intertwining of climate initiatives, environmental care, and public health. After all, the condition of our environment directly influences the public's health.

City of Fitchburg Vulnerable Populations Risk Sensitivity Chart

The following identification of the City of Fitchburg population climate vulnerabilities is excerpted from the City of Fitchburg Climate Vulnerability Assessment. Please see that report for additional information: <https://cutt.ly/cwlsb2VK>

Vulnerable Demographic	Population	Primary Risks to The Population										Economic Vulnerabilities					
		Extreme Weather / Temp	Flood	Air Quality	Vector-Borne	Food Insecurity	Water Quality	Waterborne	Power Failure	Wildfir	Crop Yield	Mortality	Energy Costs	Property Crime	Violent Crime		
Children Under 5	1,955	1,955		1,955	1,955	1,955		1,955		1,955			1,955	1,955	1,955		
Seniors Over 65	4,086	4,086	4,086	4,086	4,086	4,086		4,086	4,086			4,086	4,086	4,086	4,086		
Individuals with Disabilities	3,297	3,297	3,297	3,297				3,297	3,297				3,297	3,297	3,297		
Est Total Low Income	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760	6,760
People of Color	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953
Limited English	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425
At-Risk Workers	3,833	3,833	3,833	3,833	3,833			3,833									3,833
Limited Mobility	1,866	1,866				1,866			1,866	1,866			1,866				
Total Instances of Potential Vulnerability by Category*		33,175	31,220	31,309	28,012	29,342	18,138	23,926	29,342	27,387		26,045	9,338	27,476	25,521	21,971	
Percentage of Total Instances of Potential Vulnerability		100%	94%	94%	84%	88%	55%	72%	88%	83%		79%	28%	83%	77%	66%	
Rank by Share of Total Instances of Potential Vulnerability		1	1	1	2	2	5	4	2	3		3	6	3	4	4	

* It is possible, and even likely, for individuals to be members of more than one vulnerable population. Individuals who have more than one instance of potential vulnerability. Please see the City of Fitchburg Climate Vulnerability Assessment for more information.





Highest Sensitivity City of Fitchburg Climate Risk Sensitivity Ranking Summary



Health and Safety

Based on the total estimated population count for each vulnerable population and considering the risks each demographic is most sensitive to, the population vulnerabilities can be considered from highest sensitivity (more vulnerable individuals) to lowest sensitivity (fewer vulnerable individuals). It should be noted that risks which appear to have lower sensitivity levels should not be considered irrelevant for the community.

The Vulnerable Population Risk Sensitivity Chart tabulates the instances of vulnerable population which are particularly sensitive to each of the Climate Risks. The left side of the chart includes all of the primary climate risks while the right side includes the economic climate risks.

Prioritizing Risk and Vulnerabilities

Climate change impacts affect everyone and City policies and actions should consider climate adaptive needs of the entire community. As with all planning efforts, climate adaptation benefits from analysis in order to assist in establishing priorities for initial efforts. Prioritization, however, is necessary to ensure the greatest impact and effectiveness of limited municipal resources.

Based on these reviews, the City's adaptive efforts may be most effective by prioritizing strategies which address the climate risks as follows:

Primary Prioritization:

Extreme Heat and Weather, Air Quality, Flooding, Power/Infrastructure Failure, and Food Insecurity

Secondary Prioritization:

Vector-Borne Disease, Wildfire, Crop Yield, and Energy Costs

Tertiary Prioritization:

All Other Risks

With all adaptation measures, particular attention should be paid to strategies which are most effective for **People of Color, those in Economic Stress, Seniors over 65, and At-Risk Workers.**

Health and Safety

Potential Climate Change Impacts by Sector

paleBLUEdot compiled a list of climate vulnerabilities for each of the sectors of interest included in this Baseline Assessment. The vulnerabilities were based on existing resources and our experience with other communities as well as regional planning documents and studies. The list of vulnerabilities generated for each sector included both direct impacts of climate change as well as ways that existing stressors in the community might interact with climate changes, either by exacerbating the impacts of climate change or being exacerbated by climate change (see Climate Vulnerability Assessment for more information). The following are the vulnerabilities identified as being of particular concern for this sector:

Vulnerability: Extreme Temperature Health Impacts

	Likelihood	Consequence	Capacity	Vulnerability
Increase in heat- or cold-related illness and death, which may be exacerbated by pre-existing medical conditions, age, occupation, and/or socioeconomic variables (e.g., access to a vehicle or regular health care).	Very High	High	High	Moderate

Vulnerability: Emergency Shelter Demand

	Likelihood	Consequence	Capacity	Vulnerability
Increased demand for public shelter, emergency, and medical services.	Very High	High	High	Moderate

Vulnerability: Interruption to Services

	Likelihood	Consequence	Capacity	Vulnerability
Increased flooding and extreme weather events causing associated damage or interruption to health and emergency services.	High	Very High	Moderate	High

LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

The following are measures included in the LEED for Cities and Communities which relate to this section:

Resilience Planning

- Option: Vulnerability and Capacity Assessment
- Option: Resilience Plan
- Option: Improve Resilience

Demographic & Social Equity Assessment

- Conduct a demographic and social equity assessment for the city

Quality of Life Performance

- Measure all of the Quality of Life parameters for one whole calendar year.

Social Services & Infrastructure

- Option: Community Needs Assessment
- Option: Equitable Access to Social Infrastructure
- Option: Community Cohesion

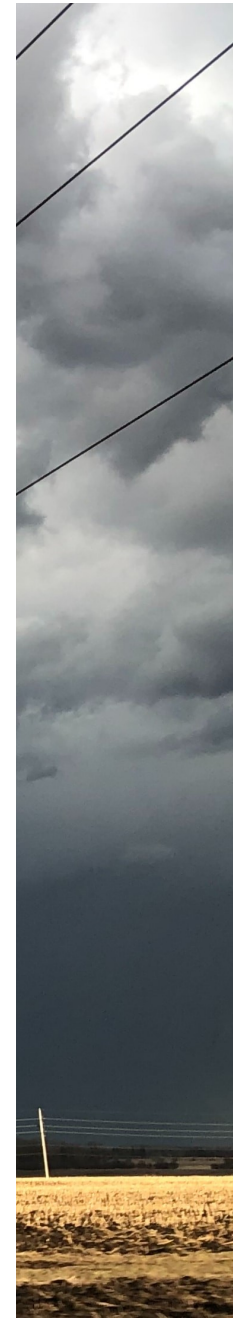
Environmental Justice

- Option: Reducing Environmental Justice (EJ) Risks and Exposure
- Option: Strategies to reduce Environmental Justice (EJ) risk and vulnerability

Public Health

- Option: Public Health Metrics
- Option: Policies for better public health
- Option: Protect Air Quality
- Option: Protect Noise Quality





Health and Safety

Strategic Goal Recommendations— Community Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Health and Safety Strategic Goals:

HS 1 : Assist the City's climate vulnerable population in preparing for and mitigating climate change impacts (prioritized based on elevated risk sensitivities as outlined in the City's [Climate Vulnerability Assessment](#)).

HS 2: Educate, engage, and empower the public on health and safety risks of climate change impacts.

HS 3: Ensure that mission critical, emergency services and health care facilities within the City are prepared for impacts of climate change.

HS 4: Strengthen community response capacity and social support networks.

Section

09

Sustainable Economy



[Click here to
return to TOC](#)

Sustainable Economy

Climate change and the Sustainable Economy are inexorably linked. Left unabated, the impacts of human-made climate change through the end of this century will cost the United States billions of dollars. According to the EPA study “Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment,” the difference in economic impact between the lower-range and higher-range climate models from the IPCC's 2014 climate change report may account for as much as \$224 billion in economic impact annually by 2090. According to a 2019 World Bank report on trends in carbon pricing, a carbon price range of \$50 to \$100 per ton of CO₂ is necessary by 2030 to reach the goals set by the 2015 Paris Agreement, while other studies have placed the full cost of carbon at \$200-\$400 per ton. In 2020, Wisconsin state legislators proposed an initial cost of carbon in Assembly Bill 766 for the State of Wisconsin at \$50. Using that figure, every 1% in community-wide emissions reductions will generate over \$200,000 in social community benefits alone, not including other economic savings or revenue generation.

Sustainability and Economic Development

The Sustainable Economy is closely intertwined with the broader concept of Sustainability. A prevalent concern is the belief that efforts toward sustainability and combating climate change could potentially harm the economy. Yet, proactive sustainability measures may prevent future expenses linked to unchecked environmental degradation and climate-related disruptions. Increasingly, evidence supports the notion that taking decisive action on climate change and reducing fossil fuel emissions can occur without undermining economic stability.

Far from impairing economic growth, sustainable practices and principles can propel economic advancement. Shifting away from fossil fuels, enhancing public transportation systems, and fostering local agricultural sectors are all facets of a move toward indigenous energy and workforce resources. These shifts offer communities the chance to diminish the outflow of local wealth and amplify the retention of community capital through local employment opportunities. Moreover, many jobs within a sustainability-centric economy tend to be more labor-intensive yet less dependent on material resources compared to traditional roles, promoting higher employment rates and reduced resource consumption. In general, economic opportunities include:





Energy Efficiency and Renewable Energy Jobs

Increases in County-wide energy efficiency, fuel switching, and renewable energy installations all require energy retrofits and renovations within existing building stock. This construction effort provides new opportunities for construction laborers, efficiency experts, and testing agents. The specialty niche also provides opportunities for new businesses to be created to address the demand. “How Does Energy Efficiency Create Jobs?” by the American Council for an Energy Efficient Economy (ACEEE) illustrates that a \$15 million investment in energy efficient facilities, when compared against “business-as-usual,” would increase local employment by 45 jobs in year one along with on-going impacts creating up to 20 additional jobs annually for 20 years.

For the City of Fitchburg, a program increasing residential energy efficiency targeting households constructed before 1980 (similar to potential outlined in the Buildings and Energy section of this report) could result in 5-10 jobs or more for every 100 households upgraded annually. Similarly, a program increasing commercial building energy efficiency combined with a program focusing on commercial building retro-commissioning would result in additional jobs.



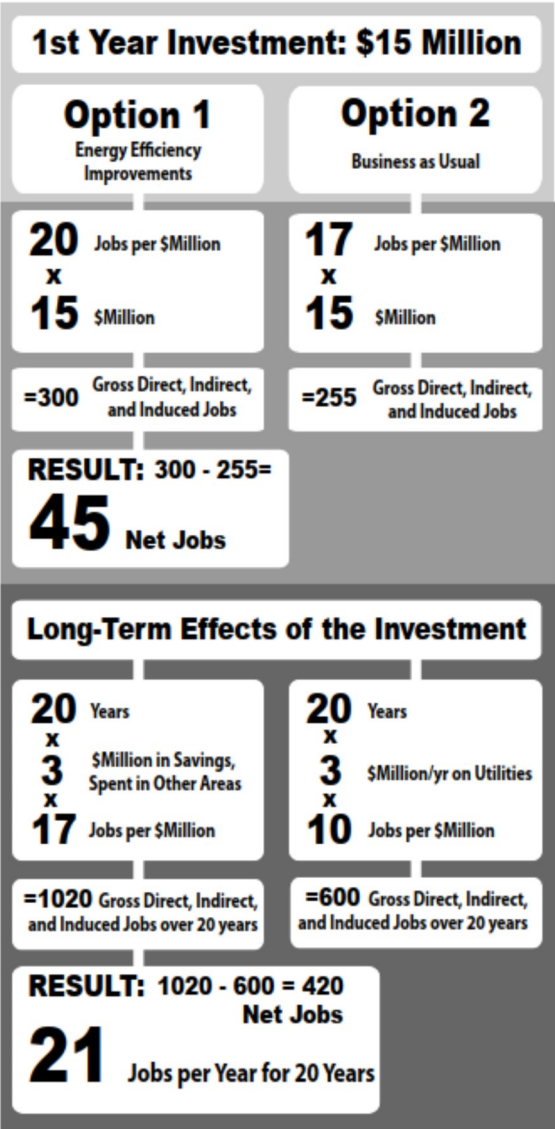
Public Transit Jobs

Transit is key to both creating jobs and increasing access to existing jobs. “What We Learned from the Stimulus” by Smart Growth America found that investments in public transit created almost twice the number of jobs than the same level of spending in auto-centric transportation systems. Cities with better public transportation systems also have lower levels of unemployment, and greater reductions in unemployment among young people according to “Spatial Mismatch and Youth Unemployment in US Cities: Public Transportation as a Labor Market Institution” by Christof Brandtner and Anna Lunn of Stanford University. According to “Economic Impact Of Public Transportation Investment” by the American Public Transit Association, for every \$1 invested in public transportation \$5 in economic returns are generated. Investing in more buses and drivers both creates jobs directly and makes local labor markets function better.



Economic Savings

Investments in energy efficiency, public transportation, renewable energy, and many other sustainability strategies ultimately result in cost savings for community businesses and residents. These savings contribute to an increase in the quality of life for residents and represent a potential for increased spending within the community on goods and services which would provide additional, indirect and induced economic development potential for the community.



Graphic Source: “How Does Energy Efficiency Create Jobs?” ACEEE

Sustainable Economy

Unemployment in City of Fitchburg

According to the US Census, in 2021, community wide unemployment averaged 1%. When viewed at the census block level, portions of the city had unemployment levels as high as 3.7%. (see map on following page) As noted earlier, the potential of local job creation associated with sustainability strategies may provide a meaningful avenue for increasing employment opportunities and quality of life potential among the City of Fitchburg’s most vulnerable.

Wage Inequality—Gini Index

The Gini Index is a summary measure of income inequality. The coefficient ranges from 0, indicating perfect equality (where everyone receives an equal share), to 1, perfect inequality (where only one recipient or group of recipients receives all the income). Below are the Gini Index for the City and State:

City of Fitchburg:

2017: 0.44 2021: **0.45**

State of Wisconsin:

2017: 0.44 2021: **0.44**

Income inequality in Fitchburg increased from 2017 to 2021, which means that wage distribution grew somewhat less even for the city while the state’s inequality remained unchanged. The Gini for both the city and state is lower for 2021 than the national average of 0.478. In other words, wages are distributed more evenly in Fitchburg and in Wisconsin on average in comparison to the national average.

Potential Climate Change Impacts by Sector

paleBLUEdot compiled a list of climate vulnerabilities for each of the sectors of interest included in this Baseline Assessment. The vulnerabilities were based on existing resources and our experience with other communities as well as regional planning documents and studies. The list of vulnerabilities generated for each sector included both direct impacts of climate change as well as ways that existing stressors in the community might interact with climate changes, either by exacerbating the impacts of climate change or being exacerbated by climate change (see Climate Vulnerability Assessment for more information). The following are the vulnerabilities identified as being of particular concern for this sector:

Vulnerability: Utility Interruptions due to Extreme Weather

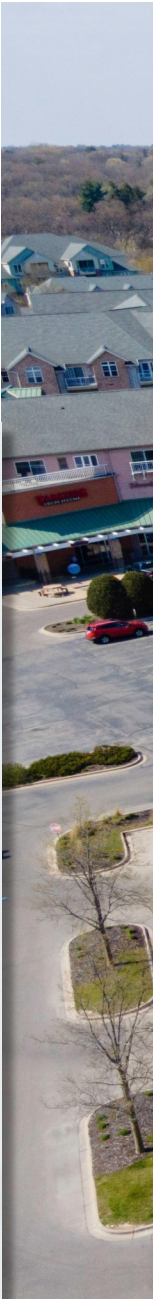
Increased demand and extreme weather impacts on utilities (electric, natural gas) and communications infrastructure which increase costs or potential for service interruption impacting local businesses and industry.	Likelihood	Consequence	Capacity	Vulnerability
	Very High	Moderate	Moderate	Moderate

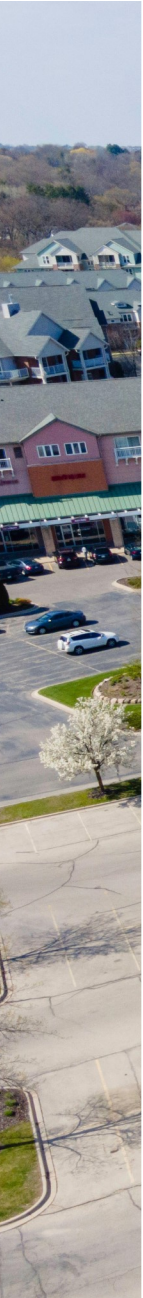
Vulnerability: Local Business Damage due to Extreme Weather

Extreme weather events, flooding, and other climate change impacts result in service interruption or economic damage for local businesses and industry.	Likelihood	Consequence	Capacity	Vulnerability
	High	Very High	High	High

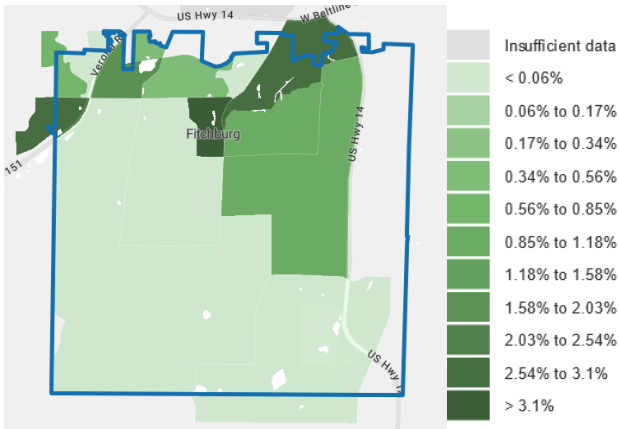
Vulnerability: Impacts on At-Risk Workers

Increased risks for outdoor and other at-risk workers who are more exposed to heat, potentially reducing labor productivity.	Likelihood	Consequence	Capacity	Vulnerability
	Very High	High	Moderate	High





Unemployment in City of Fitchburg



LEED for Cities and Communities Measures

LEED for Cities and Communities is a rating system developed by the US Green Building Council. The rating system is an extension of the Leadership in Energy and Environmental Design (LEED) green building certification program. LEED for Cities measures related to this section have been included in the consideration of the development of the Strategic Goal Recommendations outlined at the end of this section.

The following are measures included in the LEED for Cities and Communities which relate to this section:

Economic Growth & Opportunity

- Option: Income Distribution
- Option: Workforce Readiness
- Option: Equitable Employment
- Option: Strategies to strengthen economic prosperity

Educational Opportunity & Attainment

- Option: Reading Proficiency
- Option: Graduation Rate
- Option: Assistance and support programs

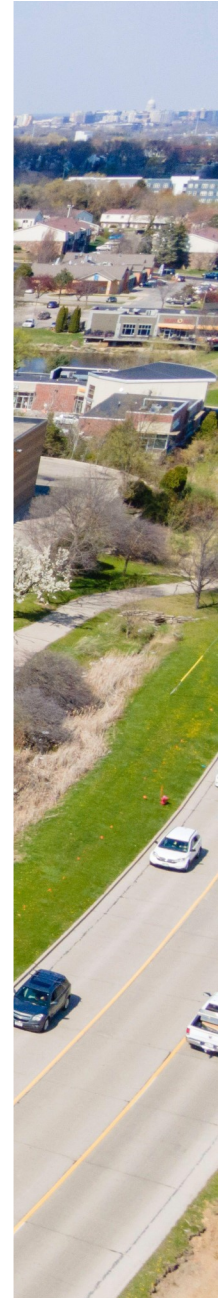
Sustainable Economy

Strategic Goal Recommendations — Community Wide

Based on the reviews outlined in this section, we recommend the City of Fitchburg explore establishing the following Sustainable Economy Strategic Goals:

Adaptation

- SE 1: Capture economic value of Sustainability.
- SE 2: Support equitable workforce development and entrepreneur opportunities of Sustainability in the economy.
- SE 3: Support local businesses operations in increasing their sustainability and building resilience in the face of climate change.



Section

A1

Appendix 1 Reference Map



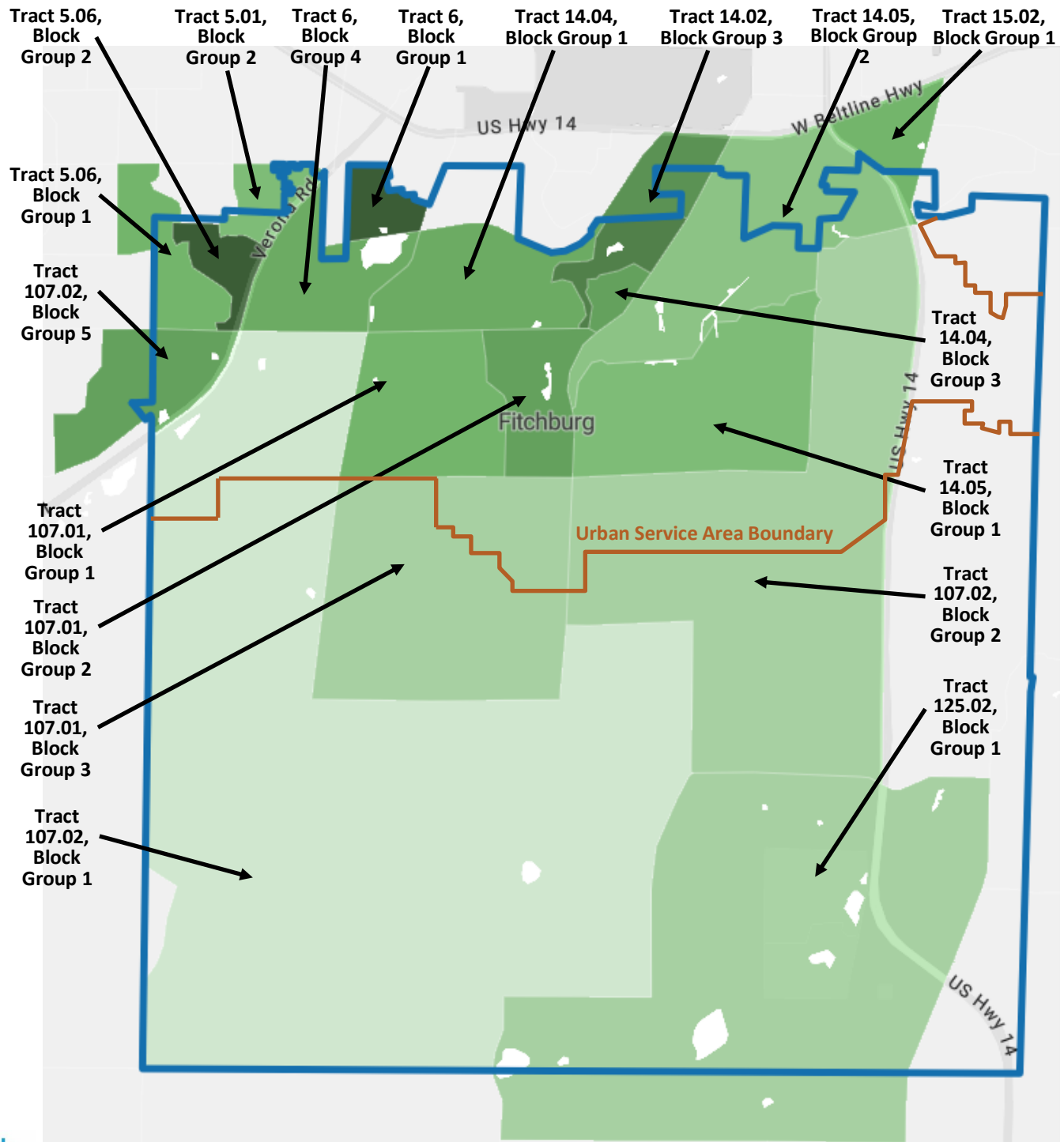
[Click here to
return to TOC](#)

City of Fitchburg Reference Map

This assessment includes population data or maps at the Census Tract or Block Group level, as needed to relate to relevant US Census Bureau data. Census boundaries may differ from actual community boundaries. All areas within the official community boundaries are included in the plan this Baseline Document supports, even if not shown on a map. Other assessments might use data at the Census "Place" or city boundary level, leading to differences in reported population counts due to Census boundary variations.

The map on the following page indicates census areas which may be referenced in this report. City boundary and census area boundaries are based on 2020 US Census.





Prepared by:



2515 White Bear Ave, A8
Suite 177
Maplewood, MN 55109

Contact:

Ted Redmond
tredmond@paleBLUEdot.llc

