



# DETROIT

## CLIMATE ACTION PLAN



**DETROITERS** WORKING FOR  
**ENVIRONMENTAL JUSTICE**

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Greetings,

Detroit is a city of immense possibility, with a remarkable history of innovation, creativity, exploration, and success. We must commit ourselves—businesses, government, educational and arts organizations, as well as communities block by block, every individual—to a vision of a clean, safe, healthy, and resilient city that raises up all its people.

The Detroit Climate Action Plan, Detroit's first, is the result of the tireless work of a wide spectrum of Detroit organizations—business, governmental, academic, nonprofits—with input from residents from every community in the city. The plan reflects the collaborative and cooperative nature of many looking to become one—one city with a clear commitment to its growth and greening.

This plan is about more than climate change. It is about how we live, how we work, how we navigate this city. It is about prosperity.

I ask everyone reading this to join me in celebrating the possibilities as we make smart, sustainable choices. We can reduce costs. We can create jobs. We can have safe, affordable housing and a more reliable, resilient infrastructure. All while improving air quality and water quality and the public health.

If we embark on this journey, fully committed, we will be a safer, more resilient, more inclusive city than we are today. Our children are counting on us. I, for one, don't intend to disappoint them.

Sincerely,

Mayor  
City of Detroit, MI

# INTRODUCTION

***DWEJ envisions Detroit as the global model of a vibrant urban center where all thrive in environmental, economic and social health.***

***DWEJ champions local and national collaboration to advance environmental justice and sustainable redevelopment. We foster clean, healthy and safe communities through innovative policy, education and workforce initiatives.***

Detroiters Working for Environmental Justice (DWEJ) grew out of the follow-up to Detroit's First Environmental Justice Gathering on June 18, 1994. A dedicated group of volunteers had served as the organizing committee for the Gathering and decided that the cause of environmental justice in Detroit was worthy of an organized and perpetual effort.

Ever since then DWEJ has been working at the forefront of many of the most pressing issues as they relate to solving problems that keep us here in Detroit from having the best possible health and economic outcomes. Since 2007, with the advent of our Build Up Detroit vision for a sustainable city, we have been especially focused on building alliances and calling forth a vision that recognizes the role of our built environment and related elements of society as either barriers or agents of change by which we can claim victory.

It is within this historical backdrop that we moved forward courageously and thankfully were joined quickly by others who heard and responded to our call.

## Why does Detroit need a Climate Action Plan?

You may be curious what all the fuss is about regarding cities, Paris Climate accords, climate action plans all over the country, and so what if Detroit doesn't have one?

We at Detroiters Working for Environmental Justice were mulling over these same questions several years ago. Our Senior Policy Director had traveled overseas to participate in worldwide climate talks in Copenhagen. She witnessed the attention to what many saw as a threat to the lives and lifestyles of billions of people. She examined the progress





here in the United States among cities and realized that Detroit was the only major city in the country that wasn't putting a formal plan in place to address the ongoing impacts of climate change.

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We need to arm ourselves with a deeper understanding of what's up in our neighborhoods and the current level of suffering, as well as recognize that we will create a path for ameliorating some of these most egregious conditions by setting a course toward lowering our generation of greenhouse gases.

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From that point onward, our internal dialogue focused not only on what about Detroit, but on who would take the initiative to set something in motion. Our team agreed that the need and time urgency was great for our city and that we needed to do everything we could to make something happen.

You might be curious why DWEJ? As we examined the array of high-level needs in our

city that best matched up with our vision and mission and skillset, taking initiative for a citywide climate resilience plan seemed one of the most important things around which we could make the most difference.

Thankfully, we were able to enlist a broad array of allies in this effort. Many people and local entities saw the value in joining forces to help generate momentum and to accumulate resources that could be mobilized to help the city eventually put in place a useful and powerful strategy to address the coming impacts to our community from climate change. Keeping in mind the financial status of the city and the political priorities of 4 years ago, we all knew it would take some time before this type of conversation would be entertained by the city government. Our hope was that by the time government was ready to "take the reins" as had been done in other cities, there would be something well vetted and ready to implement available.

In 2017, Mayor Mike Duggan joined 350 other mayors across the country to uphold the commitments of the Paris Climate Accord, or, more accurately, the agreements made at the



15th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21).

The recent establishment and staffing of the City of Detroit's Office of Sustainability is evidence that the timing of our hopes and vision is at hand.

Just think of it...100°F temperatures in places like Portland, Oregon, and San Francisco, California, this summer. And the recent string of 3 record-breaking hurricanes in succession, as well as the ravaging fires in northern California, all within 7 weeks. The tremendous damages they brought underscore the need and urgency for our communities to be prepared to endure these types of onslaughts from Mother Nature and be resilient enough to bounce back fully and swiftly.

We need to arm ourselves with a deeper understanding of what's up in our neighborhoods and the current level of suffering, as well as recognize that we will create a path for ameliorating some of these most egregious conditions by setting a course toward lowering our generation of greenhouse gases.

We can accomplish this by putting in place systems of design and social responsiveness that rise to meet or exceed the opportunities for greatness we have at hand.

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As you read these pages, we urge you to listen with your mind's eye for what you can do to play a role in the city's success.

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To highlight only two areas for major opportunity, think about the large amount of open land that could support a strong locally-based food economy; and recognize the direct connection between public health concerns and changes in environmental policy that can afford 3 for 1 benefits around cleaner air, improved health, and lower energy bills, particularly at the residential level.

Within the pages of this plan are specific ideas and attainable goals with benchmarks that we intend to serve as a stimulus for generating public and political support for action. As you read these pages, we urge you to listen with your mind's eye for what you can do to play a role in the city's success. ■



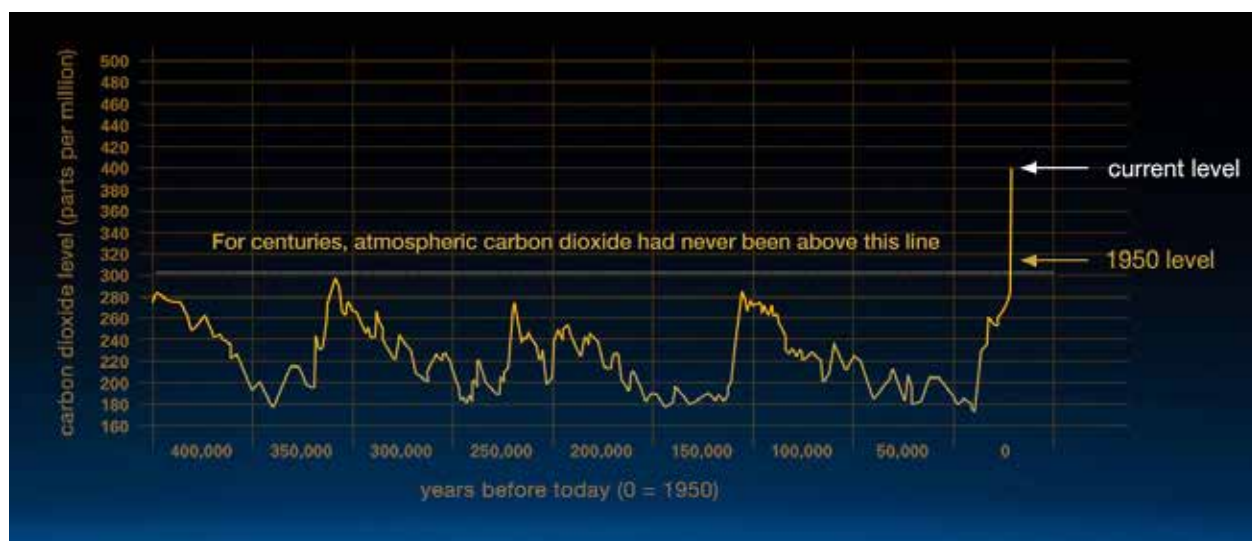
# WHAT IS CLIMATE CHANGE?

One scientific definition of climate change tells us that climate change refers to an average of the changes that happen to weather patterns across decades or longer. The fundamental question for us here is not if climate changes, rather how much and for what reasons.

The amount of carbon dioxide and other carbon-related compounds such as methane—collectively known as greenhouse gases (GHG)—in the air covering the earth play a major role in climate changes. While it is true that there are many natural sources of these greenhouse gases to the atmosphere, earth was created with other natural features that absorb the gases and left all by itself the earth would operate in balance. We and the majority of scientists who study these issues believe that the tremendous amount of carbon that human activity is adding to the natural balance has grown to a level that is causing

major changes that otherwise would not be occurring. The most famous of these phenomena is the gradual and steady warming of the earth.

The human-caused GHG emissions come about mainly because of worldwide population size and economic activity, resource use, energy use, and land use. Some of the most common impacts on the environment that are linked to climate change are wildfires, droughts, heat waves, and flooding. Dramatic weather events such as hurricanes, thunderstorms, and tornadoes are expected to increase in size and frequency, as well as duration. This all adds up to costs that will burden future generations while jeopardizing public health, infrastructure, and economic growth in the present day. These changes to climate are also felt here in Detroit in some dramatic and some not so dramatic ways.



*This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO<sub>2</sub> has increased since the Industrial Revolution. (Credit: Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO<sub>2</sub> record.) <https://climate.nasa.gov/evidence/>*



There is now broad recognition that communities must do something about the release of greenhouse gases and prepare for the changes in our climate we know are coming to reduce the potential impact of the worst effects of climate change. Emergence of the City from an historic municipal bankruptcy in December 2014 provides an opportunity to seize new investments in the health and well-being of the people, economy, and the environment. Detroit has a strong community of advocates and allies willing to help. The future looks bright with new investments in technology, healthcare, manufacturing, and innovative urban planning. But the City will need to make special provisions for those people we know are especially vulnerable to the harms of climate change.

## How does climate change impact Detroit?

We needed primary information about Detroit and our local area in order to produce a plan rooted in great science that could inspire equally great policies and new best practices.

Fortunately, we have been able to focus our conversations and planning work around 3 very important and locally produced bodies of research DWEJ commissioned. The School of Environment & Sustainability at the University of Michigan (formerly known as the School of Natural Resources

& Environment) produced the first-ever inventory of GHG releases for Detroit. In addition, Great Lakes Integrated Sciences & Assessments (GLISA) created a climatology study that shows weather trends for our area. These were complemented by the University of Michigan Taubman College of Architecture & Urban Planning's study of areas of special vulnerability in Detroit.

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What we learned from this research in short confirmed the scientific basis for what people had been experiencing in their neighborhoods for years—abundant flooding, rising temperatures, and health concerns due to unhealthy air.

## The power of belief & vision & lots of work

In 2011, Detroiters Working for Environmental Justice established the Detroit Climate Action





Collaborative (DCAC) to address the challenges of climate change in Detroit, as addressed above, and to explore the idea of a climate action plan. DCAC has grown from a handful of key stakeholders to more than 25 active members, all of whom have supported the Detroit Climate Action Plan and its vision of Detroit as a healthy, safe, resilient place to live and work.

What you are reading here is that idea made real. Thousands of hours of volunteer efforts by at least 50 individuals and 27 organizations have resulted in this condensed, easy-to-read and easy-to-implement version of the work of 5 workgroups: Solid Waste; Public Health; Businesses & Institutions; Parks, Public Spaces, & Water Infrastructure; and Homes & Neighborhoods. Each group was committed to developing the most efficient, effective, and implementable climate change mitigation and adaptation strategies possible for all of Detroit. In addition, a dedicated core of leaders has been serving as the Steering Committee for the DCAC and handling issues

of governance and internal decision making. We are also pleased to observe that as the project has continued, partners have worked together to follow their respective inspiration for what you might think of as “spin off” projects. These projects are early examples of what can happen on a large scale once the people of the city are onboard with a shared vision. Some examples of these projects are the youth climate summits with their partnership between the Detroit Public Schools, Wayne RESA, EcoWorks, and DWEJ. And the Smart Neighborhood workforce training that has resulted in low income residents building their skills and finding employment in the energy efficiency sector.

Formal sessions were held in which outside reviewers provided feedback, in areas like Businesses & Institutions and Public Health. With input from businesses and institutions, the lifeblood of every neighborhood, where you work and shop, doctor, play, and turn to for information, education, and support, we knew we could shape a climate action plan



*DWEJ organized and hosted 3 Youth Climate Action Summits.*

that supported health and resilience without compromising economic growth. DWEJ partnered with the University of Michigan Erb Institute for Global Sustainable Enterprise to develop and launch a Sustainability Toolbox for small- to medium-sized businesses. With an awareness of the relationship of health and the responsibilities of the public sector around health in the era of life-changing climate change, we are all empowered to make a difference, for ourselves and for others.

Additionally, DWEJ organized and hosted Youth Climate Action Summits. Our future is dependent on making sure the young have opportunities to learn about and explore the impacts of climate change on their futures; we have hosted three summits, the second of which was selected as a partner of the U.S. Department of Energy, Michigan Science Center, Detroit Public Schools, Wayne RESA, The Wild Center, National Oceanic and Atmospheric Administration, and the Association of Science-Technology Centers. In 2015, DWEJ and EcoWorks sent a joint team to the climate change conference, COP21, in Paris—including youth.

It was important that the Plan be written with the voices of Detroit residents in our ears. We knew that with those voices we would have a plan that you cared about, that you helped craft, that you could support. Additionally, the Detroit Climate Ambassadors program was created so that neighborhoods across the city could meet to develop projects and opportunities that would help everyone understand what climate change is and what can be done on a grassroots, block-by-block, neighborhood level. Surveys, focus groups, and meetings with City of Detroit officials added additional perspectives. With Detroiters, city government employees, and the business community talking, we knew we could be successful.

The Detroit Climate Action Plan is the result of the commitment, belief, experience, and knowledge of every member of each workgroup.

# WE CAN MAKE THIS HAPPEN

The total of all we have learned over the term of this project has made it clear that at least two things are essential and possible.

First, it is essential for Detroit to play its part in the worldwide effort to reduce human contributions to climate change. And possibly most important to understand is that all of us are responsible for the fate of this success.

We have at hand several recommended courses of action that you will see in this report. In each case, there is something we can contribute whether it be at home or at work or at play.

**NO MATTER OUR LEVEL OF STATUS  
OR PERCEIVED POWER, WE CAN BE PROACTIVE  
AND INDEED WE ARE ALL CONNECTED  
IN THE SEARCH AND ACHIEVEMENT  
OF SOLUTIONS.**

# TAKING ACTION

*“It really boils down to this: that all life is interrelated. We are all caught in an inescapable network of mutuality, tied into a single garment of destiny. Whatever affects one destiny, affects all indirectly.”*

— DR. MARTIN LUTHER KING JR.

Climate change is here. And we have some serious, and life-impacting, decisions to make. Now. Scientists around the world acknowledge that climate change will have serious environmental, public health, and economic consequences from which it will be increasingly difficult to recover. Whether Detroiters know it or not, we are impacted by those changes in our daily lives. This is not business as usual. The truth, however, is that we can make changes in our own community—neighborhoods, businesses large and small, City operations—that will work toward a healthy, sustainable tomorrow. Tomorrow will soon be today.

The Intergovernmental Panel on Climate Change (IPCC), the world’s leading group of climate scientists, formed in 1988 by the

Two important terms to understand in conversations about climate change are:

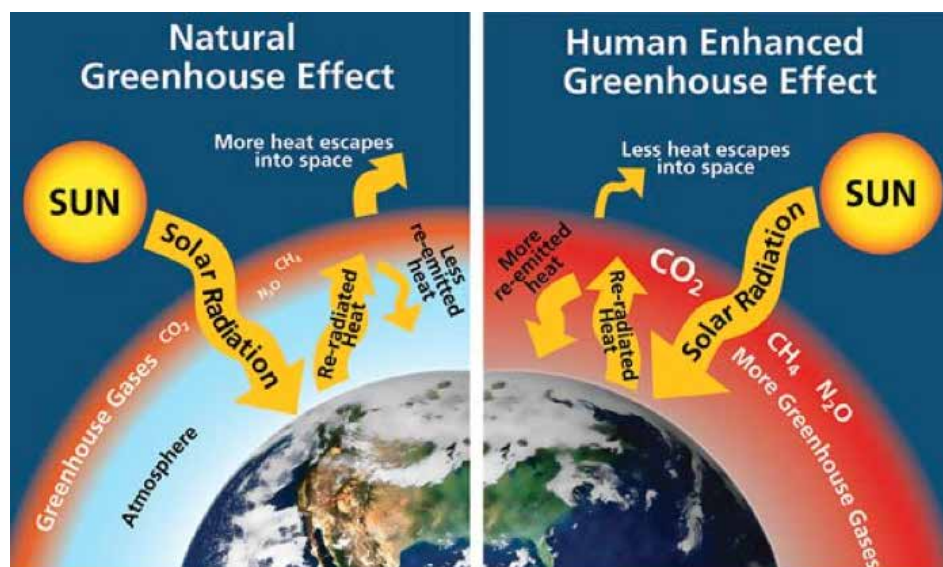
## MITIGATION

Reducing impacts that cause climate change.

## ADAPTATION

Adjusting to the inevitable effects of climate change that will occur despite mitigation efforts.

World Meteorological Organization and the United Nations Environment Programme, has identified a global average temperature increase of 3.6°F (2°C). So, what does a degree or so mean? Well, in terms of the planet, and our lives on it, a lot. The difference between

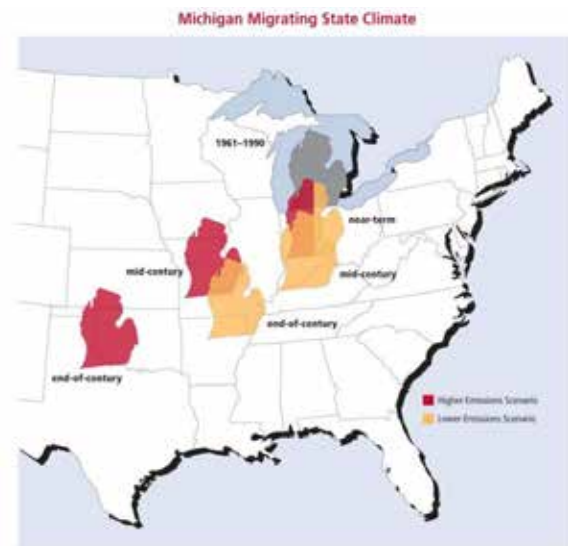


*The Greenhouse Effect, Source: IPCC 5th Assessment*



3.6°F and 4.6°F is 1°F, or a little less than 1/3 more. According to NASA scientists, 1/3 more increase in global temperature raises the impact by about the same fraction: heat waves would last around 1/3 longer, rainstorms would be 1/3 more intense, and the increase in sea level would be about 1/3 more, for example.

Urban households are at a high risk from exposure to extreme heat, but urban low-income households are at even a higher risk. Detroit is the poorest major city in the United States, with 39.3% living below the poverty level. Preliminary results from a recent University of Michigan study show that temperatures inside the homes of Detroit participants in July–September 2016 were, on average, 4°F warmer than the outdoor temperature. 36% of the homes studied registered an average indoor temperature above 80°F across that same period.



*Projection Of Mi Climate.*

*Source: Union Of Concerned Scientists*

## UNDERSTANDING THE IMPACT OF CLIMATE CHANGE IN DETROIT

In anticipation of the climate-adjustment work Detroit would need to do in terms of mitigation and adaptation, DWEJ commissioned 3 studies working in conjunction with reputable, scientific-based organizations in our backyard.

- 1) a greenhouse gas inventory,
- 2) a climatology report, and
- 3) a vulnerability report

Following is a simplified summary of each of those findings. Without these reports and the efforts of these organizations, we would not have had the foundations from which to build what we envisioned as the most useful and most understandable Detroit Climate Action Plan we could create. The full reports can be found online at [detroitenvironmentaljustice.org/](http://detroitenvironmentaljustice.org/).

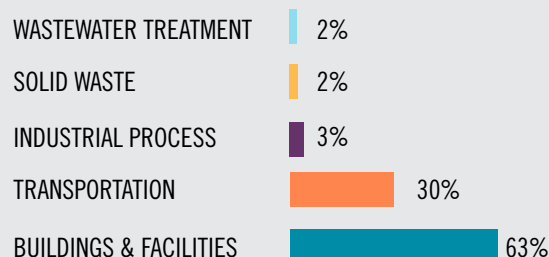
# DETROIT'S GREENHOUSE GAS INVENTORY

Detroit's first Greenhouse Gas (GHG) Inventory was conducted by graduate students from the University of Michigan School for Environment & Sustainability (SEAS). The inventories for 2011 and 2012 provide a reference point to measure Detroit's progress toward reductions. The mitigation of GHG emissions will ensure a livable landscape for the most regions possible.

Detroit's total GHG accounting included carbon dioxide, methane, and nitrous oxide. To provide for simple figures, greenhouse gases are translated to their comparable amount of warming relative to carbon dioxide. Each greenhouse gas has a different potency, or global warming potential, by which they trap heat in our atmosphere. Methane traps 28 times more heat and nitrous oxide traps 265 times more heat than carbon dioxide over 100 years.

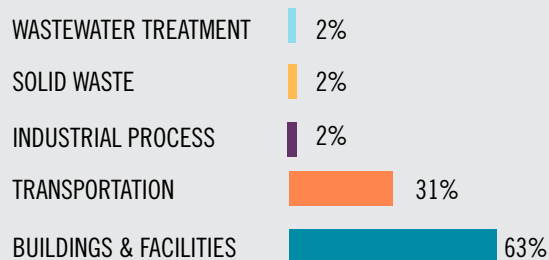
The accounting of emissions followed the GHG Protocol, standards generally accepted by Fortune 500 companies and others, and included Scopes 1–3. Scope 1 emissions are

## 2011 GHG Emissions (10.6 Mt CO<sub>2</sub>e)



Source: GHG Protocol

## 2012 GHG Emissions (10.6 Mt CO<sub>2</sub>e)



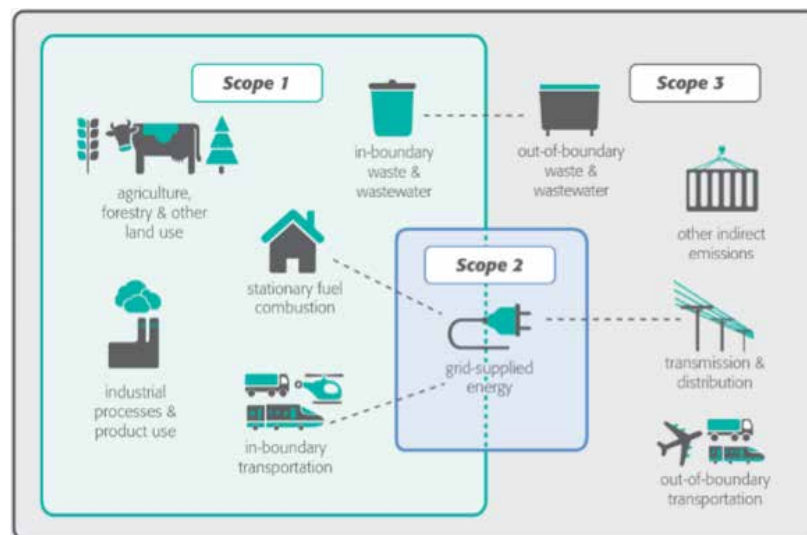
Source: GHG Protocol

## Detroit Greenhouse Gas Inventory

<b>Buildings</b>	residential, commercial, institutional, industrial, and municipal
<b>Transportation</b>	municipal and personal
<b>Industrial</b>	not including petroleum
<b>Solid Waste</b>	municipal disposal, incineration
<b>Wastewater</b>	municipal disposal non-energy producing
<b>Land Use</b>	tree canopy vs. development

direct GHG emissions from sources located within the city boundary: e.g., emissions from combustion in boilers, furnaces, vehicles, chemical production, and process equipment. Scope 2 activities refer to GHG emissions that result from production of electricity consumed by Detroit from the grid, heat, steam, and cooling. Scope 3 activities are other emissions outside the city boundary that result from activities within the city, such as electricity lost when carried through power lines. The study did not include boats, airplanes, and freight trains; or food and goods that are consumed in the city but produced elsewhere. The units used were metric tons (t), the international standard for measuring emissions. One metric ton is approximately 1.1 U.S. tons, or about 2,205 lbs.

In 2012, 63% of Detroit's 6.7 million metric tons of CO<sub>2</sub> emissions were a result of electricity and natural gas use in Detroit's buildings and facilities. Stationary sources accounted for 69% of emissions. Of stationary sources, 41% of emissions were concentrated in the following zip codes: 48209, 48211, 48217, and 48226. The commercial and institutional sector accounted for half of the buildings and facilities total emissions in 2012. Passenger cars, trucks, and on-road freight accounted for 30% of total emissions. Of the total emissions for 2012, 11% were generated from municipal sources with the Detroit Public Lighting Authority, the City of Detroit Water & Sewerage Department, and the City of Detroit Public Works Department.



**Read the full report**

**[detroitenvironmentaljustice.org/climate-action-plan](http://detroitenvironmentaljustice.org/climate-action-plan)**

Greenhouse Gas (GHG) Inventory prepared by University of Michigan School for Environment & Sustainability (SEAS)

## RESEARCH SUMMARY

# DETROIT'S CLIMATOLOGY STUDY

Greenhouse gas emissions that drive climate change are global. The consequences of greenhouse gas emissions, and how people adapt to those consequences, are local. The Climatology Report prepared by Great Lakes Integrated Sciences & Assessments (GLISA) provided foundational information for this Plan.

In Detroit, we can expect to see our environment changing primarily through precipitation patterns and temperature fluctuations. Projections based on historical data show increases in temperature and precipitation, and changes in the frequency and intensity of precipitation events are in store for Detroit.

Historical trends show that temperature has been increasing over time in Detroit. The 30-year average annual temperature increased by 1.4°F, comparing 1961–1990 to 1981–2010.

Average overnight temperatures increased 4.3°F from 1959 to 2011. During the same period, the number of hot, humid days and the number of hot, dry days in the summer increased by 3.5 days (172%) and 3 days (338%), respectively. Conversely, the number of cool, dry days has decreased by 10.5 days, or 70%.

This trend can be expected to continue. The extent and severity of temperature increases will depend on the amount of future greenhouse gas emissions. If greenhouse gas emissions are significantly decreased (a lower emissions scenario), the number of days over 90°F degrees will still increase, but will be limited to 30 (from 15 at present) days per year by the end of the century. Under a higher emissions scenario, there will be around 65 days warmer than 90°F. Days over 100°F would be 5 and 23, respectively, for lower and higher emissions scenarios.





Warmer temperatures pose threats that can have severe consequences. Low income households located in urban areas are at increased risk for exposure to extreme heat. Warmer overnight temperatures are dangerous during heat waves because people have less opportunity to cool down and recover from warmer days.

Air quality will also become compromised during hot days. This is due to two factors. Warmer temperatures increase ground level ozone and drive up the demand for electricity. Most electricity generated for Detroit is created by burning coal. Increases in coal burning drive up the level of soot and other air pollutants such as sulfur dioxide. Poor air quality is known to exacerbate respiratory and cardiovascular conditions, potentially leading to more hospitalizations as climate change worsens air quality.

Total annual precipitation in southeast Michigan has increased 11% from the

1961–1990 average when compared to the 1981–2010 average. Extreme precipitation events have become more frequent and more severe. From 1958 to 2012, the Midwest has seen a 37% increase in the amount of precipitation falling in the heaviest 1% of precipitation events. Most models predict that the trend toward more frequent and more severe rain events will continue. As temperatures warm, more of Detroit's precipitation is likely to be in the form of rain rather than snow.

There are several consequences of changing precipitation patterns. Inland flooding is likely to happen more frequently. We have already begun to see some of these effects in basement and road flooding over the last several years. It is also a threat to our stormwater infrastructure, which wasn't built to handle the influx of water that it is now experiencing. Severe rain events overwhelm the combined sewer system, leading to overflows of partially treated and untreated water into the Detroit River.

**READ THE FULL REPORT**

**[detroitenvironmentaljustice.org/climate-action-plan](http://detroitenvironmentaljustice.org/climate-action-plan)**

Climatology Report prepared by Great Lakes Integrated Sciences & Assessments (GLISA)

# DETROIT'S VULNERABILITY REPORT

The University of Michigan Taubman College of Architecture & Urban Planning worked with DWEJ to create a vulnerability report for Detroit. The University of Michigan team's report, entitled *Foundations for Community Climate Action: Defining Climate Change Vulnerability in Detroit*, shows the areas of Detroit that are the most vulnerable to climate change impacts. This information is a crucial component of climate action planning because it allows us to identify neighborhoods that will need direct investment and resilience planning. Additionally, this information helps us understand how to tailor recommendations to be relevant for Detroit's most vulnerable areas.

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In a city that already faces a disproportionate amount of the negative health and environmental consequences of dirty energy, reducing greenhouse gas emissions gives us a chance to breathe cleaner air, reduce the household economic burden of energy bills, and connect our neighborhoods to needed amenities.

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A community's vulnerability to climate change is determined by two factors—exposure and sensitivity. Exposure is the extent to which an individual or community might experience the impacts of climate change. For example, a coastal community would be at risk of exposure to hurricanes and inundation from rising sea levels. In Detroit, heat and flooding are two physical impacts of climate change to which people are exposed.



Sensitivity means to what extent being exposed to a climate impact will affect an individual or community. Are the individuals seniors or very young? Do they lack transportation to get to safety? Are they impoverished, ill, or socially isolated? All these factors can influence how and whether people can handle climate impacts. Many people in Detroit are sensitive in some way to climate change impacts.

Building our adaptive capacity, preparing for expected changes, and expecting the unexpected can reduce our vulnerability to climate change. Adaptive capacity is a term that is generally accepted to mean the whole of capabilities, resources, and institutions of a country or region to implement effective adaptation measures. For the purposes of this report, adaptation means “adjusting to the inevitable effects of climate change that will occur despite mitigation efforts.” In other words, we can prepare for climate change, and if we prepare well, we can reduce the negative impacts that climate change can have on our lives.

In a city that already faces a disproportionate amount of the negative health and environmental consequences of dirty energy, reducing greenhouse gas emissions gives us a chance to breathe cleaner air, reduce the household economic burden of energy bills, and connect our neighborhoods to needed amenities. Accomplishing this would reduce our vulnerability and create a healthier world for those who will inherit the consequences of the decisions we make today.

Additionally, the expanding economic opportunities in climate change work (clean energy manufacturing and technology, environmental services, education, etc.) would provide

some relief for a long-excluded workforce. As Detroit is rebuilding, it makes sense to do so in a way that will ameliorate the existing environmental and health burdens, and will protect the investments that we're making today for the long term. However, ignoring climate change and sustainability puts us at risk for worsening air quality, inundated and unprepared infrastructure, missed economic opportunities, and increased financial burden at the household and city level.

The vulnerability assessment for Detroit focuses on the impacts of heat and flooding because these are the manifestations of global climate change in Detroit.

**READ THE FULL REPORT**  
**[detroitenvironmentaljustice.org/climate-action-plan](https://detroitenvironmentaljustice.org/climate-action-plan)**

Vulnerability Report prepared by  
University of Michigan Taubman College of Architecture & Urban Planning

# DETROIT'S MUNICIPAL WASTE INCINERATOR: WE NEED A NEW WAY

In the late 1970s, plans were set in motion that resulted in the construction of one of the largest municipal waste incinerators in the country, in the center of Detroit. The heat from the incinerator is harnessed to some degree and used for multiple purposes including producing electricity. Back in the 1980s that may have seemed like a much better idea for our city than it does today.

According to the Public Health Action Plan published in 2017 by Community Action to Promote Healthy Environments (CAPHE), a partnership housed out of the University of Michigan School of Public Health, air pollution is accountable for more than 600 deaths per year in our area and there is so much lost time from work and school due to illnesses related to air pollution that the drag on our local economy has hit nearly \$6 billion per

year. Among the top 10 recommendations of how to address or mitigate this situation, CAPHE suggests controlling and reducing emissions from industrial facilities as well as making a shift to nonpolluting energy sources such as wind and solar power.

It is important to grasp the connection between how we generate power and the impact on health as well as climate. Detroit is not alone in needing to modernize its energy infrastructure. The way we produce, consume, and dispose of products and food account for 42% of all GHG emissions in the United States.

That is why you will see in the report that we call for a Zero Waste approach. This strategy creates 10 times more jobs per ton than landfills and incinerators. By keeping dollars and materials circulating through local areas,



Source: <https://sites.google.com/a/cornell.edu/the-detroit-incinerator/>



instead of burying them in landfills, going for Zero Waste strengthens the local economy. In fact, we see the greatest GHG benefits from recycling, well above waste to energy (WTE), collection, plastic to oil, methane capture and use, composting, anaerobic digestion, engineered fuel, and gasification.

Significant amounts of money can be gained by having sophisticated analyses of the waste stream. Processing costs become significant for waste conversion technologies. Currently, incineration is considered renewable by Michigan law....it was “grandfathered” when the energy law of 2012 was enacted, as were other existing incinerators of this design. Below is an illustration of the preferred hierarchy for handling waste according to the U.S. Environmental Protection Agency (EPA).

In Detroit, our current system (though in transition) is the exact opposite of current best practices. We are excited that there are several opportunities at hand over the next 5 to 10 years that if we make the decision and choose to adopt EPA’s recommended set of choices, we can make great gains. Gains economically and for the health of our residents.

Renewable energy, as defined by the U.S. Energy Information Administration (USEIA), is an energy source that is regenerative or virtually inexhaustible. Waste incineration

consists of discarded materials such as plastics made from petroleum, which are not renewable. Burning these materials to generate electricity creates a demand for “waste” and discourages much needed efforts to conserve resources, reduce packaging and waste, and encourage recycling and composting. More than 90% of materials currently disposed of in incinerators and landfills can be reused, recycled, and composted.

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If the U.S. were to recycle 75% of its discarded materials, over 1.5 million new jobs could be created.

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On a nationwide basis, USEIA says capital costs for waste incinerators are 60% more than nuclear power, and over twice that of coal. Operating and maintenance costs of WTE plants are 10 times more than coal power plants. Due to the low energy density in municipal waste, incinerators are only able to make small amounts of energy while destroying large amounts of reusable materials. While older incinerators generate electricity at very low efficiency rates of 19%–27%, a recent United Kingdom study found that conversion efficiencies of new incineration technologies are even lower. Incineration emits nearly 25% more CO<sub>2</sub> per unit of electricity than coal (WTE: 2,988 lbs./MWh CO<sub>2</sub> compared with coal: 2,249 lbs./MWh CO<sub>2</sub>).

If the U.S. were to recycle 75% of its discarded materials, over 1.5 million new jobs could be created. According to the U.S. EPA, incineration produces more CO<sub>2</sub> per megawatt hour than any other form of power generation, including coal, the dirtiest fossil fuel.



The background of the page is a photograph of the Detroit skyline at night, with several skyscrapers illuminated. In the foreground, a large, dark, abstract sculpture is visible, partially obscuring the view of the buildings. The overall color scheme is dark blue and black, with white text.

# DETROIT'S PLAN FOR ACTION

In the following section, you will see how we have laid out a strategy around 5 major themes. Each theme had a workgroup of participants who have worked long and diligently to advance our best vision for the future of Detroit as a climate resilient city. A city that is healthier, safer, more economically expansive, and a joyous place to live and work—for everyone.

Each section represents thousands of volunteer hours by people who represent a spectrum of interested stakeholders, including businesses, academic institutions, nonprofits, and government organizations. Without their vision and commitment, there would be no Detroit Climate Action Plan.

**SOLID WASTE**

**PUBLIC HEALTH**

**BUSINESSES & INSTITUTIONS**

**PARKS, PUBLIC SPACES, & WATER INFRASTRUCTURE**

**HOMES & NEIGHBORHOODS**

## DETROIT CLIMATE ACTION PLAN

# SOLID WASTE

*“It is not acceptable that as Detroiters move toward citywide recycling and reducing the amount of their waste that goes to the incinerator, they are subject to poor air quality and respiratory health issues due to waste from other communities.”*

—SANDRA TURNER-HANDY, MICHIGAN ENVIRONMENTAL COUNCIL

Detroit is home to one of the nation’s largest waste-to-energy incinerators, which produces GHGs, air particulates, and contractually displaces citywide recycling. The City of Detroit currently provides curbside recycling only to single family homes and units up to 4. Detroit’s solid waste infrastructure includes the solid waste incinerator Detroit Renewable Power (DRP), transfer stations, and a hazardous waste disposal facility. Approximately 70% of Detroit’s residential waste is incinerated at the DRP. Waste-to-energy incinerators emit more CO<sub>2</sub> per ton than energy produced by burning coal. Detroit’s solid waste incineration emissions accounted for approximately 250,000 metric tons CO<sub>2</sub> in 2012.

Incineration or landfilling produces fewer jobs than recycling and destroys materials that have potential for reuse. All solid waste has a lifetime of circulation within the economy. This life cycle includes raw materials extraction, processing, manufacturing, transportation, usage, and disposal, and each step emits GHG emissions. Diversion of solid waste from disposal will reduce GHG emissions by reducing demand for virgin materials and energy spent recreating the product.

Nationally, 34%, or 87 million tons, of solid waste is recycled or composted. In 2016 cities recycled at rates of:

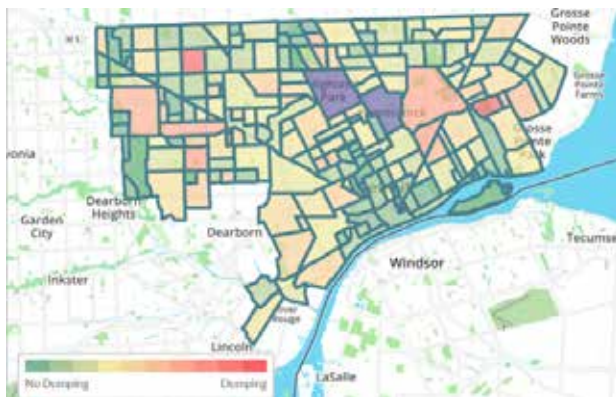
Los Angeles 76%

Seattle 58%

Ann Arbor 47%

New York City 19%

Chicago 10%



Detroit Illegal Dumping Density Source: Motor City Mapping

The state of Michigan had a total recycle rate of 15% in 2014. 22% of Detroit households in 2017 were enrolled in the curbside recycling. The Motor City Mapping project found 7,755 lots with illegal dumping in the city. Solid waste includes packaging, paper, food, yard trimmings, textiles, metals, electronics, tires, batteries, and other everyday items.

## Solutions

A well-managed Zero Waste stream can generate economic development, positively impact quality of life, reduce associated health impacts, and mitigate greenhouse gases. The U.S. Environmental Protection Agency (EPA) conducted a national assessment of the state of the waste stream and found the most successful communities had:

- a) automatic curbside roll cart collection,
- b) the service was single-stream collection, and
- c) local municipalities actively encouraged use.

Often, successful cities require private haulers to provide recycling service. The EPA also recommends clear and understandable guides for sorting, and planning across Municipal Recovery Facility-Sheds to maximize logistical benefits.

### Barriers to Success

#### **Detroit's Financial Condition**

Low capital investment in a Zero Waste system.

#### **Habits of Residents and Businesses**

Citizens will need to change behavior to sort waste.

#### **Commercial**

Recycling is not comprehensive or simple for commercial operations.

#### **Active Choice**

Recycling program not automatic and no comprehensive citywide education.

### Community Voices

A snapshot of suggestions received at public gatherings:

- ✓ Provide recycling containers to all residents and businesses.
- ✓ Shut down the waste-to-energy plant Detroit Renewable Power.
- ✓ Expand bottle deposit rules to more bottle types, ban plastic bags or ban bottled water.
- ✓ Make it easier to know what we can recycle.



## SOLID WASTE

### GOAL

1

Offer universal recycling and organic waste collection for everyone in Detroit: at home, work, businesses, events (80% by 2022). (mitigation)

### Summary of Goal

Accessibility and ease of use are key to participation in waste reduction and recycling, and thus greenhouse gas reduction. The most successful municipal materials recovery (recycling) systems are universal and mandated at all levels and in all venues.

### Near-Term Action Steps

1. Create a citywide community education program.
2. Increase curbside recycling participation rate to 40%.
3. Initiate household food waste collection demonstration projects.
4. Implement 100% Zero Waste practices in municipal buildings.
5. Encourage recycling in multi-family housing.

### Long-Term Action Steps

1. Increase participation in recycling, organic waste collection, and composting.
2. Require waste contracts to employ Zero Waste methods.
3. End City contract with Detroit Renewable Power (incinerator) by 2021.
4. Recycling and Waste Reduction subcommittee of the Green Task Force evaluates City ordinances on construction and demolition waste.

### Indicators for Success

1. Tonnage recovered from recycling increases from 3,020 tons (2016) to 10,000 tons by 2019, 100,000 tons by 2030.
2. Increased number of multi-family units instituting recycling.
3. Organic material curbside demonstration protocols refined.
4. City ordinances adopted to support materials diversion from disposal.

### Appropriate Methods for Assessment

1. Contracted hauler reports.
2. Detroit waste reports to Wayne County.
3. Business sustainability EPA reports.



## SOLID WASTE

### GOAL

2

Ensure that waste hauler contracts in 2019 align with the City Charter. (mitigation)

### Summary of Goal

The City of Detroit Public Works Department shall prepare, implement, and update as necessary a comprehensive citywide Recycling Plan for the city of Detroit that provides for the capture of the city's waste stream prior to disposal, as specified in Sec 7-403 of City Charter. The language in the contracts with waste haulers is very important: incentivizing waste reduction and recovery of materials rather than merely the collection of "garbage" will build the culture of Zero Waste in city structures.

### Near-Term Action Steps

1. Communicate the importance of waste reduction and materials recovery to the financial health of the City to staff/administrators and City Council members.
2. Recycling and Waste Reduction subcommittee of Green Task Force will lead development of waste minimization strategies.
3. Add household composting to waste hauler contracts in 2019.
4. Conduct education outreach in neighborhoods and with businesses.

### Long-Term Action Steps

1. Establish budget line item for information and education.
2. Achieve a diversion rate of at least 35% by 2022, 70% by 2030, and Zero Waste (over 90%) by 2040.
3. Establish contract terms for materials management that reflect priority of Zero Waste policies.
4. Require recycling in all multi-family units by 2021.

### Indicators for Success

1. Establishment of annual report and review of waste stream management plans.
2. Citywide waste collection system includes residential and commercial properties and incentives for recycling and collection of organic material.
3. City ordinances are adopted to support materials diversion from disposal stream. 100% diversion is the goal.
4. Collection route efficiency is maximized.

### Appropriate Methods for Assessment

1. Reports from haulers.
2. Annual Detroit GHG Inventory of waste.
3. City ordinances on waste in place and working effectively and efficiently.

## SOLID WASTE

### GOAL

3

Commit to Zero Waste and full implementation of the City Charter section 7-403. (mitigation and adaptation)

### Summary of Goal

Section 7-403 of the 2011 City Charter mandates that the City give priority to materials recovery “prior to disposal.” This vision aligns with a Zero Waste system. The City should work hard to reduce barriers to participation in recycling and other efforts to capture up to 100% of our waste. To that end, it is important to be clear about the nature of the waste stream and plan accordingly to simplify the process and increase participation rates.

### Near-Term Action Steps

1. Work with City officials to enforce mandate of materials recovery, prior to disposal, as stated in City Charter.
2. Work with businesses to increase recycling.
3. Ensure that infrastructure projects support waste reduction and materials recovery.
4. Conduct outreach in neighborhoods and with businesses to provide education on waste recovery.

### Long-Term Action Steps

1. Track data on recycling and waste management to refine additional incentive programs.
2. Update Charter if necessary.
3. Align policy incentives for business initiatives to support waste reduction and recycling.
4. Minimize landfilling and end incineration.

### Indicators for Success

1. Capture of materials (recycling) is increased to 70% of waste stream by 2030.
2. Annual report and review of waste stream management plan is published annually.
3. Decreased rates of waste GHG emissions.

### Appropriate Methods for Assessment

1. U.S EPA standards.
2. Annual GHG Inventory.
3. Data from annual report and waste stream management plan.

# PUBLIC HEALTH

*“I know that our bodies were made to thrive only in pure air,  
and the scenes in which pure air is found.”*

—JOHN MUIR

The American Public Health Association, the U.S. Centers for Disease Control & Prevention, and the World Health Organization all consider climate change to be among the most significant threats to public health, as extreme weather events become frequent and intense. Climate projections from the Great Lakes Integrated Sciences & Assessment program tell us that Detroit is expected to experience more frequent and longer extreme heat events, increased heavy rain events, flooding, and other extreme weather.

Global temperature records reach back to 1880, and the warmest years on record have been the last 3. Detroit experienced the warmest summer in 2016, with 21 days over 90°F. The number of cool-dry days has decreased by 10.5 days. Severity of temperature increases will depend on future GHG emissions. If GHG emissions are significantly decreased, days over 90°F will be limited to around 36–72 days annually, from 15 presently, by the end of the century. Days over 100°F may increase to 5–23 days annually depending on the scenario.

The urban heat island (UHI) effect is the increase in local temperature due to urbanization. Concrete absorbs heat during the day, and emits heat throughout the night. Impervious surfaces like concrete do not provide the protection from heat that tree canopy

naturally provides. The greatest areas of heat vulnerability include Downtown and adjacent neighborhoods northwest of Downtown. UHIs can increase temperatures by 1.8°F–5.4°F compared with outlying areas.

The most vulnerable residents are the elderly, less educated, low-income, and those without vehicle access. For example, according to a University of Michigan School of Public Health study, mortality increases by around 18% among the elderly in the Detroit Metropolitan area during extreme heat days. These groups may not have access to air conditioning or a vehicle when heat conditions become extreme and require escape to cooler buildings. Only 29% of the population is within a 15-minute walking distance of designated cooling centers.



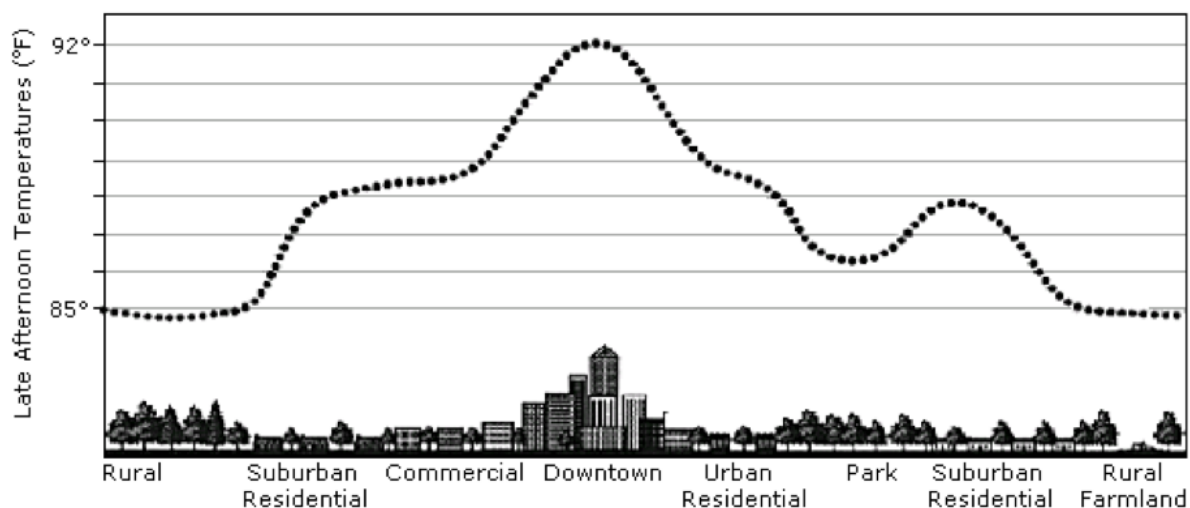
Cooling Centers and Heat Vulnerability  
Source: Defining Climate Vulnerability in Detroit

Warmer temperatures increase ground level ozone and drive up the demand for electricity. Ground level, or “bad,” ozone is not emitted directly into the air but is created by chemical reactions between oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOC) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NO<sub>x</sub> and VOC. Breathing ozone can trigger a variety of health problems, particularly for children, the elderly, and people of all ages who have lung diseases such as asthma. Ground level ozone can also have harmful effects on sensitive vegetation and ecosystems. Diseases transmitted by food, water, and insects such as West Nile virus and Lyme disease will increase in part because of their greater survival rates in mild winters.

Strong short-term and temporary increases in energy demand, such as when we have heat waves, require utilities to activate power-generating plants known as “peaker plants” to meet the demand. These facilities typically are fueled by coal or other fossil fuels that increase the release of GHG and other pollutants. This in turn reduces our air quality.

Poor air quality is known to worsen respiratory and cardiovascular conditions, leading to more hospitalizations as air quality drops. Detroiters report more chronic health problems than other Michigan residents, with high rates of reported hypertension, chronic obstructive pulmonary disease, and cardiovascular disease. A longer growing season means higher pollen production and prolonged pollen season. Plant species are migrating from the equator to each pole, and that migration changes the mix of pollen in the air. Researchers have even noted an increase in abundance of poison ivy due to warmer temperatures. Rates of asthma hospitalization in Detroit are 3 times higher than in Michigan statewide. Asthma is also the leading chronic cause of school absenteeism in Detroit. The prevalence of asthma among Detroit adults is higher than among Michigan residents.

In a study released in May 2017, the University of Michigan School of Public Health found that people in the Detroit area are dying from air quality related illness at the rate of more than 600 people a year. The cost to our local economy of time missed from work and school is calculated at nearly \$6 billion per year.



Urban Heat Island Effect. Source: [https://weather.msfc.nasa.gov/urban/urban\\_heat\\_island.html](https://weather.msfc.nasa.gov/urban/urban_heat_island.html)

In 2014, Detroit experienced the second highest rainfall on record since 1925, causing water to reach heights of 14 inches on roadways. More than 6 inches fell in 24 hours. Freeway pump stations were not designed to address flash floods. This storm resulted in \$1 billion in damages, including flooded basements (many remain unrepaired and some still flooded), totaled vehicles, washed-out slopes, sinkholes, and dramatic stress on bridges. The Michigan Department of Health & Human Services warned of exposure to sewage water, fast-moving currents, debris, mold, and poisoning from carbon sources.

In particular, City Council District 4 on the city's Eastside near the Detroit River rests at a lower elevation than most of the city. In Jefferson Chalmers, old housing stock, and its location near overloaded storm sewers, as

well as large amounts of impervious surface cover, make this area susceptible to flooding. Detroit is vulnerable to significant damage to its infrastructure during intense storm events, and these may cause displacement of families and disruption of energy delivery, especially affecting those who rely on electricity for treatments such as kidney dialysis and oxygen.

Detroit's infrastructure is very old and contributes to ongoing flooding in many parts of the city on a regular basis, not only in extreme weather events. Some neighborhoods such as many in Southwest Detroit are cut off from the rest of the city by flooding in viaducts and other low-lying areas. It is important to understand that the combination of these conditions is widespread across the city.



## Solutions

Evidence from a white paper released earlier this year by the University of Michigan Water Center suggests that increased vegetation—if designed with safety in mind and maintained—can reduce the negative environmental health effects of urban heat islands and aid stormwater management. For instance, urban forests or green roofs, if strategically placed, may increase the uptake of carbon emissions and create cooling effects from increased shade in urban heat islands. Green infrastructure manages water with plants, slows water movement, and prevents sewage overflow by absorbing water on-site. Green buffers between automobile traffic and neighborhoods can filter air through natural processes and can reduce sound and light pollution.

Increased outreach can inform decision makers and residents on the health effects of climate change and public health best practices. Healthcare professionals, community leaders, social service providers, emergency preparedness experts, business leaders, and city planners all play a role in protecting public health through programs and policies. Also, by developing and communicating strategies with communities, we build neighborhood capacity and resiliency.

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## Barriers to Success

### Health Policy

Detroit lacks centralized public health policies focused on interagency implementation of climate planning efforts.

### Health Impact Assessments

Climate change data has not historically been included in assessments for land use and planning.

### Education

Some agency staff and residents lack knowledge on how climate change impacts health.

### Health in All Policies Culture

Healthy and equitable best practices in all policymaking needs to be applied.

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## Community Voices

A snapshot of suggestions received at public gatherings:

- ✓ Modernize city building codes to reflect environmental and human health concerns.
- ✓ Require Community Benefit Agreements for new developments.
- ✓ Communicate the harms of a meat-heavy diet on health and the environment overall.
- ✓ Hear our voices early in the land use planning process. Neighborhoods matter too.

## GOAL

1

Inform decision makers and residents of Detroit about climate change health risks and evidence-based responses. (mitigation and adaptation)

### Summary of Goal

Increased outreach will help Detroit's decision makers and residents understand the expected health effects of projected climate change and create awareness for current and future public health best practices aimed at preventing negative outcomes. Health care professionals, community leaders, public health practitioners, social service providers, emergency preparedness experts, business leaders, and city planners, among others, all play a role in protecting public health and it is important they have resources providing coordinated direction. Communicating strategies that households and individuals can take is also important for building a first layer of self- and neighborhood-level resiliency. For instance, installation of rain gardens to support management of stormwater, reduction of driving on ozone action days, household weatherization to promote effective heating and cooling, and establishing a plan in case of emergencies like storms, floods, or high heat.

### Near-Term Action Steps

1. Promote practical emergency and community alert systems for extreme weather events and ozone action days.
2. Create health promotion materials with climate adaptation and mitigation strategies.
3. Build capacity for policy advocacy through community organizing networks.
4. Establish baseline data on participants using citywide interventions and resources.

5. Establish baseline data on vulnerable communities enrolled in alert systems.

### Long-Term Action Steps

1. Update climate- and health-related interventions for residents and community groups, with focus on vulnerable populations.
2. Implement policy changes consistent with shared goals and strategies.
3. Consider innovative, sustainable, healthy, and equitable best practices.
4. Centralize implementation of climate and health recommendations

### Indicators for Success

1. Establishment of a documented communication network focused on improving and increasing the reach of health promotion materials (10% by 2020, 30% by 2025, 60% by 2030).
2. Increased number of participants using



citywide interventions and resources particularly the most vulnerable populations (10% by 2020, 30% by 2025, 60% by 2030).

3. Increased number of representatives from vulnerable communities enrolled in alert systems with reasonable access to interventions (10% by 2020, 30% by 2025, 60% by 2030).
4. Establishment of a cross-departmental and community-based team that reviews and collaborates on community planning and public health issues; meeting quarterly by 2021.

### **Appropriate Methods for Assessment**

1. Assessment of emergency and community alerts systems and climate-related health promotion materials.
2. Assessment of climate and health-related interventions.

## PUBLIC HEALTH

### GOAL

2

Ensure that citywide and agency emergency response plans address public health risks of climate change. (adaptation)

### Summary of Goal

Decision makers from City departments and agencies, hospitals, schools, nongovernmental entities, and public health organizations will review and update emergency response plans regularly to reflect projected climate changes. Effective plans include: 1) integration and maintenance of extreme weather mass notification systems; 2) prevention, mitigation, and response strategies for extreme weather events; 3) indicators and measures for evaluating these emergency response strategies, such as the tracking use of warning systems or recruitment and training of volunteers or key personnel; and 4) specific strategies for locating and addressing vulnerable populations, as identified by the vulnerability maps developed for the Detroit Climate Action Plan.

### Near-Term Action Steps

1. Conduct review of existing plans alongside vulnerability assessments (by 2020).
2. Update emergency response plans to include resources and strategies indicated by the review (by 2025).

### Long-Term Action Steps

1. Ensure vulnerable populations are included in emergency response plans.
2. Update heat and flooding vulnerability assessments to inform revisions of interventions.

### Indicators for Success

1. Increased percentage of emergency response plans addressing vulnerable populations (10% by 2020, 30% by 2025, 60% by 2030).
2. Increased percentage of neighborhood and business associations trained on Hazards Emergency Preparedness and Planning, including climate-related components (10% by 2020, 30% by 2025, 60% by 2030).
3. Increased percentage of vulnerable communities with representatives who will lead during emergencies (10% by 2020, 30% by 2025, 60% by 2030).

### Appropriate Methods for Assessment

1. Surveys and focus groups.
2. Emergency response plans.
3. Breadth of participation in trainings.
5. Analysis of community contacts database.



## GOAL

3

Assess health impacts of land use decisions affecting urban heat islands, air quality, and stormwater management. (adaptation)

### Summary of Goal

It is crucial to integrate public health evidence and residents' input when making land use decisions, especially as they relate to future transportation plans, zoning, development or demolition plans, stormwater infrastructure, and air and water quality permits at city, regional, and state levels.

This may entail the use of Health Impact Assessments to assist cross-sector, interagency, and community-engaged decision making. For instance, industrial facilities or transportation infrastructure (e.g., commercial highways, rail yards) may lead to increased greenhouse gas emissions, contributing to a host of public health implications such as cardiovascular or respiratory illnesses.

The building of accessible transit-oriented developments, bike lanes, or pedestrian-friendly pathways—as part of a Complete Streets approach—may, alternately, reduce greenhouse gas emissions and promote physical activity.

### Near-Term Action Steps

1. Ensure climate-related health metrics are included in the Detroit Master Plan.
2. Train land-use professionals on climate-related health impacts and interventions.
3. Train public health officials on land use planning process.

### Long-Term Action Steps

1. Identify and codify healthy and sustainable alternatives for traditional infrastructure such as transportation, stormwater, and wastewater systems.

2. Establish a taskforce or board for conducting Health Impact Assessments of major land use developments, policies, or permitting decisions in Detroit.
3. Standardize health impact assessment process for planners, developers, engineers, and the construction community.

### Indicators for Success

1. Increased percentage of land use requests for proposals (RFPs), etc., that include consideration of climate change and health impacts as elements of selection criteria (10% by 2020, 30% by 2025, 60% by 2030).
2. Inclusion of climate-related health metrics and vulnerability metrics in city planning: e.g., Detroit Master Plan, recreation plan, transportation plan, RFP criteria.
3. Creation of a cross-departmental and community team for integrating public health and vulnerability issues; meeting quarterly by 2021.
4. Climate and vulnerability metrics added to city planning RFP process.

### Appropriate Methods for Assessment

1. Health Impact Assessments that include climate change health risks.
2. Infrastructure permits or minutes of public health team meetings.
3. Summary and review of formal recommendations.

## PUBLIC HEALTH

### GOAL

4

Increase monitoring of climate-related health outcomes, such as heat-related hospitalizations, injury or death from extreme weather events, and asthma-related outcomes. (mitigation and adaptation)

### Summary of Goal

Public health surveillance is the ongoing, systematic collection, analysis, and interpretation of health-related data essential to the planning, implementation, and evaluation of public health practice. To ensure ongoing climate adaptation and mitigation efforts are informed by evidence, public health surveillance is needed to: 1) detect baseline and changing climate-related health patterns in Detroit; 2) identify risk factors of climate-related morbidity and mortality, as well as vulnerable populations most likely to experience these risk factors; 3) test related hypotheses to better understand climate change's impacts on health, generally and in Detroit; and 4) evaluate related program, policy, or land use interventions, including those proposed in the Detroit Climate Action Plan. Improving surveillance will likely require enhancement and/or expansion of local and state surveillance systems, such as the Michigan Inpatient Database and the Michigan Syndromic Surveillance Systems, which are used to track hospitalizations and emergency department visits.

### Near-Term Action Steps

1. Educate healthcare providers and community planning staff on environmental triggers of disease to improve identification of climate change-related conditions (e.g., heat, ozone, pollen, and mold).
2. Determine a baseline for climate and health educational materials provided by healthcare providers.

3. Create a cross-sectoral communication strategy by 2020 with the goal of increasing variety and use of surveillance data that inform public health and healthcare provider practices along with decision making in City departments.

### Long-Term Action Steps

1. Analyze data from Federally Qualified Health Centers (FQHCs), hospitals, and healthcare providers during extreme climate-related events (e.g., temperature, humidity, precipitation, flooding, and air quality).

### Indicators for Success

1. Relevant agencies have attended training on surveillance systems (10% by 2020, 30% by 2025, 60% by 2030).
2. Level of knowledge and interaction of healthcare providers with patients has increased (10% by 2020, 30% by 2025, 60% by 2030).
3. Increased level of awareness and use of climate and health educational materials provided by healthcare providers by 5% annually.
4. Cross-sectoral communication strategy established.

### Methods for Assessment

1. Level of attendance at training sessions.
2. Data from surveys of healthcare providers.

# BUSINESSES & INSTITUTIONS

*“Earth provides enough to satisfy every man’s need, but not every man’s greed.”*

—MOHANDAS K. (MAHATMA) GANDHI

As Detroit grows, there is an urgency to reduce harm from economic activity. Between 2000 and 2010, Detroit lost 37% of jobs and filed for bankruptcy in 2013. But in 2014 the City emerged from Chapter 11 Bankruptcy solvent and prepared for growth. Detroit must contend with 900 parcels of abandoned industrial sites, with 2/3 of those smaller than 10,000 square feet.

Detroit cannot have a thriving economy without clean air, water, and land. Two of the state’s most environmentally impaired zip codes are in Southwest Detroit, 48209 and 48217. This community houses 150 facilities emitting air particulates and greenhouse gas pollution. Disproportionate numbers of residents suffer cancer, kidney failure, asthma, and other respiratory illness downwind. Clean Air Act rules do not sum the impact of concentrated pollution from multiple sources to account for the total impact of pollution. Each facility’s air pollution limits are set without concern for the number or size of nearby facilities. Air quality permits were intended to set limits for releases to protect health, but the current system is failing Detroiters. Zip codes 48209 and 48217 show the highest levels of greenhouse gas (GHG) emissions in the city. Climate change and other hazards are a threat to public health.

Passenger car, truck, and on-road freight traffic comprised the largest single segment of emissions in Detroit at 30% of the total: emissions were 3 million metric tons of CO<sub>2</sub>. The next largest source of greenhouse gas emissions is commercial and institutional electricity use with 2.9 million metric tons CO<sub>2</sub> emitted.

Petroleum refining from Michigan’s only oil refinery produced 237,000 metric tons of CO<sub>2</sub>. In 1986, the Detroit incinerator was built. One of the largest in the country, it emits nitrogen oxides, sulfur dioxide, carbon monoxide, lead, substances that disrupt our nervous systems like mercury and dioxin, and much more into the atmosphere. According to Zero Waste Detroit, the City of Detroit spent more than \$1.2 billion in debt payments for the construction of, and upgrades to, the incinerator now operated by Detroit Renewable Power. In 2015, for example, 650,000 tons of trash were burned to generate the pollution with only 19% of the trash originating from within Wayne County.

## Solutions

Just and sustainable redevelopment in Detroit requires a powerful and shared vision for upgrading our quality of life. The business community in the city can play a vital role in the success of achieving gains by emphasizing business models that value people, the planet, and profit simultaneously. This is often called The Triple Bottom Line approach to evaluating business success—in other words, increasing the proportionate value of protecting the environment while honoring input from the people most directly impacted by a business’s operations. Businesses of all sizes will need to contribute to the goal of reducing locally generated GHG emissions. Many already are.

For example, Ford Motor Company, General Motors, and Fiat Chrysler Automobiles each have set emissions reductions goals for their fleet and facilities as well as goals to reduce production-related waste and water use in their sustainability plans.

The medical sector also holds great potential for yearly progress toward reducing GHG emissions. Detroit Medical Center, Henry Ford Health System, and St. John Providence Health System joined the sustainability organization Practice Greenhealth, and each has committed to reducing energy, water use, and recycling through the Healthier Hospitals Initiative.

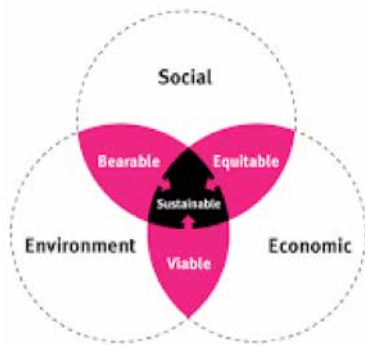
In May 2017, DTE Energy announced a commitment to reduce greenhouse gas emissions by 80% by 2050 and eliminate all coal-fired power plants by 2040. DTE Energy partnered with Mayor Duggan in 2016 to site 2 megawatts of solar on 10 acres in O’Shea Playground near Greenfield and I-96. The 6,500 panels are enough to power 450 homes.



*Detroit Marathon Refinery. Source: <http://hallengineering.com/projects/east-refinery-upgrade-for-dhoup-expansion/>*

Stronger economies are founded on addressing climate change as a business opportunity: minimizing harm, lowering risks, and adapting to change. Businesses are rethinking models and objectives as they consider climate change consequences. Adaptation requires investment, but the status quo will cost far more. Local employment sectors are embracing environmentalism: green construction, circular economy, smart manufacturing, and green healthcare. Business best practices and collaboration can reduce climate impacts, prepare for risks, protect health, and reduce costs.

## The Triple Bottom Line



## Barriers to Success

### Funding

Insufficient resources to implement and sustain programs.

### Participation

Too few intentional activities to broaden business membership.

### Law

Lack of coordination of legal incentives on city, county, state, or federal level.

### Culture

Changes are needed to business-as-usual.

## Community Voices

A snapshot of suggestions received at public gatherings:

- ✓ Corporate Social Responsibility programs should fund local community projects.
- ✓ We need to highly prioritize job opportunities in agriculture, energy efficiency, and green energy to help address both sustainability as well as the unemployment crisis in the city.
- ✓ Why not launch a Divest Fossil Fuels Detroit campaign to remove fossil fuel investments from public and private portfolios?
- ✓ Polluting industries need to pay for the damages they incur.
- ✓ Why not collect fines and use that money to pay for clean energy or more recycling?



## BUSINESSES & INSTITUTIONS

### GOAL

1

Reduce greenhouse gas emissions among businesses and institutions, in the areas of transportation, energy, and the built environment (Baseline 2012 emissions: 10% by 2022, 30% by 2032, 80% by 2050). (mitigation)

### Summary of Goal

Reducing greenhouse gas emissions makes business sense, and it's imperative that Detroit area businesses and institutions, especially those in transportation, energy, and the built environment, lead the way. These companies will exhibit their leadership by creating a Detroit business and institution climate coalition. Determining the business value is not always easy, or the path to take clear; therefore, to achieve this goal, we must promote the benefits of, and need for, reducing greenhouse gas emissions, as well as provide resources, technical assistance, incentives, and opportunities to highlight leadership and positive case studies. These activities are intended to stimulate the use of clean energy, reduction of fossil fuel consumption, and increased energy efficiency throughout Detroit.

### Near-Term Action Steps

1. Establish a Detroit greenhouse gas business index, a rating system to compare greenhouse gas emissions of each company by subcategories.
2. Establish a Detroit business and institution climate coalition to recruit and engage businesses in the above-mentioned Index.
3. Establish a business-to-business model that provides incentives and engages external partners.

### Long-Term Action Steps

1. Demonstrate collective progress in all stated areas.
2. Evaluate progress toward emission-reduction goals annually.

### Indicators for Success

1. Reductions in aggregate GHG emissions for Detroit.
2. Reductions in GHG emissions of coalition partner companies.
3. Increased number of pledges and companies enrolled in the coalition.

### Appropriate Methods for Assessment

1. Data from an annual Detroit GHG Inventory.
2. U.S EPA Portfolio Manager aggregates report for Detroit greenhouse gas business index within the boundaries of Detroit.
3. Published reports from public utilities, Southeast Michigan Council of Governments, Detroit Department of Transportation, Michigan Department of Transportation, etc.

## BUSINESSES & INSTITUTIONS

### GOAL

2

Create resilient institutions and a green business-to-business culture. (mitigation and adaptation)

### Summary of Goal

The primary purpose of this goal is to work with local business leaders, organizations, associations, and universities to increase awareness of climate change impacts and actions that can be taken to help mitigate these impacts. Activities include showcase what local businesses, universities, and neighborhoods have done, and are doing, to prevent climate change and reduce their overall carbon footprint; set up networking opportunities and industry events to spread the word about these projects; and measure the change in attitudes of business leaders and the number of green jobs created annually.

### Near-Term Actions Steps

1. Promote the business Sustainability Toolbox.
2. Highlight sustainable business practices that create economic value.
3. Host an annual event to celebrate successes.

### Long-Term Action Steps

1. Expand the Detroit business and institution climate coalition.
2. Evaluate, maintain, and improve the coalition vision, mission, and governance.

### Indicators for Success

1. An increase in the number of businesses with sustainability plans by 15% annually.
2. Increased number of businesses that create climate risk assessments.
3. Active outreach and marketing activity, such as print media, radio, TV, and social media.

### Appropriate Methods for Assessment

1. Results of an annual survey of coalition members.
2. Annual green career day.
3. Track mentions in media outlets.
4. Surveys of schools and businesses that participate.

## BUSINESSES & INSTITUTIONS

### GOAL

3

Preserve and conserve water quantity and water quality.  
(mitigation and adaptation)

### Summary of Goal

The primary purpose of this goal is to manage and reduce energy usage as it relates to water collection, treatment, distribution, and end-use in our buildings and industries. Efforts are intended to create more synergy between policy development at the regional level and business investment strategies and needs at the neighborhood level. These intentional and interconnected design practices will address current water-related concerns that are resulting in environmental pollution.

### Near-Term Actions Steps

1. Engage with City of Detroit Water & Sewerage Department and stakeholders in the community.
2. Establish training by retirees (possibly with the Retired Engineers Technical Assistance Program) for high school students to conduct energy and water audits.
3. Develop strategies for stormwater management such as on-site green/blue infrastructure, rain gardens, and sustainable development.

### Long-Term Action Steps

1. Engage with City of Detroit Water & Sewerage Department and monitor progress annually.
2. Revisit and revise goals and strategies every 2 years based on results and new developments.
3. Support policy changes in how the Federal Emergency Management Agency floodplain data is used.

### Indicators for Success

1. Increased number of businesses and institutions with water efficiency literacy, water quality plans, and stormwater management strategies in place.
2. Increased number of individuals trained in water auditing and management.
3. Quantity of water saved through efforts in gallons.

### Appropriate Methods for Assessment

1. Annual Detroit business survey.
2. Number of certificates issued by trainers.

## BUSINESSES & INSTITUTIONS

### GOAL

4

Increase awareness of career options in sustainable development. (mitigation and adaptation)

### Summary of Goal

The primary purpose of this goal is two-fold: educating/engaging the community about sustainability and career pathways in sustainability, and creating opportunities in these career pathways. This will be achieved through outreach (e.g., lunch 'n' learns, forums, green career day, formal education on these topics in the school system) and career training partnerships and feeder programs.

### Near-Term Action Steps

Create a collaborative “societal” marketing campaign that includes:

- Investing in public education with youth education, library programs.
- Promoting career pathways in sustainability and climate change for students of all stages and ages, including veterans and the differently-abled with lunch 'n' learns, forums, conferences, green career days.
- Encouraging partnerships in career training.

### Long-Term Action Steps

1. Encourage schools to include sustainability themes in their curriculums.
2. Evaluate, maintain, and improve marketing campaign.

### Indicators for Success

1. More students pursuing sustainability career pathways (5% annually).
2. More partnerships established between the coalition and schools and training centers (5% annually).
3. Increased number of sustainable living and green career events (5% annually).

### Appropriate Methods for Assessment

1. Reports from colleges and technical training schools.
2. Survey partners.



## DETROIT CLIMATE ACTION PLAN

# PARKS, PUBLIC SPACES, & WATER INFRASTRUCTURE

*“In a time of severe drought around the world, damage to any fresh water system is cause for alarm and a call for action. Detroit’s Climate Action Plan is a step in the right direction.”*

—ERMA LEAPHART-GOUCH, MICHIGAN CHAPTER SIERRA CLUB

The Great Lakes comprise 1/5 of the world’s fresh surface water. Detroit has the potential to greatly benefit from this rich water resource and has the responsibility to protect the watershed from threats. Environmental conditions include fluctuating lake levels, aquatic invasive species, harmful algal blooms, native species extinction, and loss of habitat. Increased presence of toxins and pollutants cause fish advisories, beach closures, and drinking water contamination. Michigan has an economy dependent on the health of the Great Lakes for fishing, water recreation, food production, freight transportation, and tourism.

Parks, public spaces, and water infrastructure will be adversely affected by rising

temperatures and changing precipitation. Heavy rain events strain drainage systems by flooding roads and properties, causing pollution in the watershed.

Poor water quality and flooding can make parks and beaches unusable due to pollutants such as E. coli. Additional reductions in water quality kill fish and harm the tourism industry, which is reliant on clean landscapes and safe beaches. Leaks in the drinking water supply are costly and result in toxins leaching into waterways. In addition, financial conditions within the City of Detroit Water & Sewerage Department (DWSD) have contributed to increased drinking water shutoffs in the city, where at least 1 in 12 households have gone without drinking water in recent years.





## Solutions

Commonly accepted guidelines for measuring high quality of life in cities say that Detroiters should be within walking distance, or 1/2 mile, of a local park. Psychological benefits abound from access to nature, and increasing aesthetically pleasing landscapes would dramatically change the public image of the city. According to a study by The Trust for Public Land, in 2014 77% of Detroiters lived within walking distance of a park.

Detroit has 20 square miles of vacant land available for a robust open space network and innovative stormwater management. An engagement strategy for promoting stewardship opportunities such as Adopt-a-Park can leverage existing partnerships and pilot stewardship projects to build community interest in Detroit open spaces.



SE Detroit Flood Map. Source: *Defining Climate Vulnerability in Detroit*

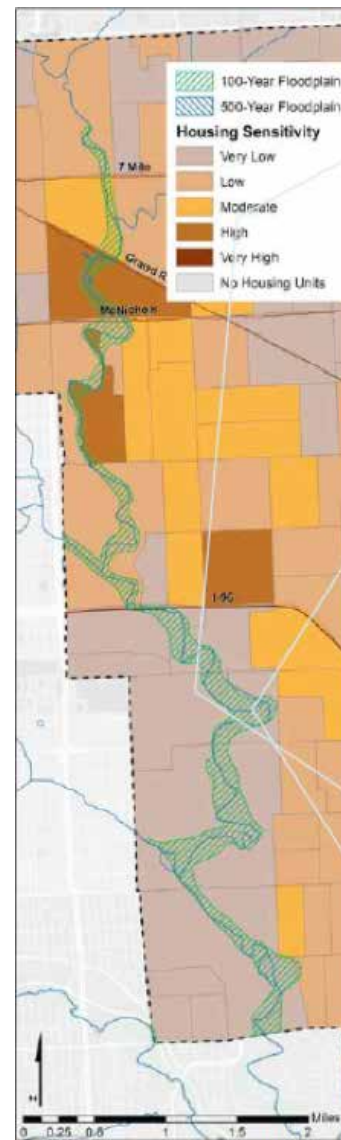


Detroit Riverfront Before and After revitalization  
Source: <http://www.crainsdetroit.com/article/20120819/FREE01/308199991/from-vision-to-action>

It is encouraging that multiple conversations on these topics have already been underway convened by groups such as Detroit Future City, the Michigan Department of Natural Resources, and the Fred A. and Barbara M. Erb Family Foundation. Another promising development is the recent establishment of the Detroit Office of Sustainability. In the ideal, the leadership of this office will be afforded the responsibility and resources to guide a comprehensive citywide set of implementation strategies.

Currently, DWSD is purposefully applying green infrastructure design. This practice opens up versatile reuse options for land and can directly increase our resilience as a city. Detroit is planning to leverage parks and public spaces to aid existing wastewater infrastructure with native landscaping known to filter water and penetrate the water table where it falls. DWSD, The Greening of Detroit, and Detroit Future City have implemented pilot projects to create green buffers between industrial use and neighborhoods, rain gardens, and prairie and forests as carbon sinks on vacant lots.

Detroit Riverfront Conservancy and other citywide revitalization initiatives highlight opportunities to expand access to public spaces. Utilizing the Complete Streets concept provides access with low-GHG transportation options such as biking, biking, or walking. Some streets may be suitable for excluding motorized vehicles altogether.



*Rouge River Flood Map.  
Source: Defining Climate  
Vulnerability in Detroit*

## Barriers to Success

### Ordinances

Clear and fair systems that reward or mandate green infrastructure or climate responsiveness are needed.

### Central Leadership

The city would benefit from improved cross-departmental planning and coordination.

### Urban Ecosystem

No baseline is in place for evaluating the value or impact of ecosystem services.

## Community Voices

A snapshot of suggestions received at public gatherings:

- ✓ Identify and support stewards of local parks.
- ✓ Use biomimicry to design new built environments—use lower-impact methods from nature.
- ✓ Establish a community land trust to protect public spaces and prevent privatization of rivers and waterways held in the public trust.
- ✓ We need more of those greenways with rain gardens in them.

GOAL

1

Protect, enhance, and quantify the benefits of carbon sinks. (mitigation and adaptation)

### Summary of Goal

Parks as carbon sinks improve public health, reduce the heat island effect, filter stormwater runoff, and create other benefits. Due to these benefits, we need to establish a data-driven plan to identify target areas within the city for protecting and enhancing parkland.

A park enhancement plan's planting list should include climate smart and other approved species of trees, shrubs, and grasses that act as the most effective carbon sinks. In addition to increasing tree canopies, it would be valuable to create a citywide green infrastructure plan to further identify opportunities for implementation and assure collaboration and effective implementation of best management practices. The city has a rich network of potential nonprofit sector partners who also should be included in this effort.

### Near-Term Action Steps

1. Develop data-driven plan(s) and program(s) to increase tree canopy citywide.
2. Develop a citywide green infrastructure plan to manage stormwater, filter pollutants, and improve public health.

### Long-Term Action Steps

1. Support new design efforts being led by the City of Detroit Planning & Development Department.
2. Implement data-driven plan(s) and program(s) to increase tree canopy citywide.
3. Increase opportunities for voluntary community maintenance of land.
4. Daylight water systems, i.e., tributaries, streams, rivers, and wetlands.

### Indicators for Success

1. Increased tree canopy coverage or trees planted at a faster pace.
2. Energy savings at DWSD due to land use changes.
3. Increased number of neighborhood stewards for each park.

### Appropriate Methods for Assessment

1. Tracking the level of tree canopy in the city.
2. GIS measurement of land use.

## PARKS, PUBLIC SPACES, & WATER INFRASTRUCTURE

### GOAL

2

Increase the resilience of ecosystem services.  
(adaptation)

### Summary of Goal

The 40 square miles of open space within the city give an opportunity to expand natural habitat areas and create “no-mow” zones that will serve as corridors for wildlife as well as diverse recreational opportunities. We need to create a citywide natural resources inventory that identifies and prioritizes ecologically important areas and promising connections or corridors between these ecological “hot spots.” These areas need then be protected as important natural habitat or enhanced to provide improved ecosystem services. In addition, these areas can help offset the heat island effect of having large concentrations of buildings and paved surfaces.

### Near-Term Action Steps

1. Establish citywide ecosystem services inventory.
2. Implement the City’s open space plan.

### Long-Term Action Steps

1. Expand, protect, and maintain environmental/ecological/natural resources and corridors that provide habitat value.
2. Designate ecologically important areas as “permanent natural features.”
3. Provide access to diverse recreational opportunities for all residents.

### Indicators for Success

1. Expanded no-mow zone/low maintenance using aesthetically pleasing techniques in areas where public use is low.
2. Installed educational signage explaining no-mow zones and other alternative uses.

### Appropriate Methods for Assessment

1. Data from the ecosystem services inventory.
2. City of Detroit Planning & Development Department and Parks & Recreation Department progress reports on implementing the new open space plan.



GOAL

3

Prioritize investments to green infrastructure. (adaptation)

### Summary of Goal

Thousands of low-income households in Detroit have had their water services shut off due to nonpayment of water bills. This situation may not at first look related to climate change. What we know is the cost of providing water by DWSD (now teamed with the Great Lakes Water Authority) is higher than it might otherwise be due to the need to make extensive and expensive repairs. We contend that continued investment in technologies such as green infrastructure will enable the water utility companies to continue to drive down their costs, address drinking water quality concerns in areas where the flow of water has been cut off, and reduce supply losses due to leaks, etc.

### Near-Term Action Steps

1. Continue to invest in DWSD's asset management infrastructure.
2. Develop a citywide green infrastructure plan that supports implementing stormwater management best practices.

### Long-Term Action Steps

1. Implement asset management plan.
2. Implement green infrastructure plan.

### Indicators for Success

1. Improved operational efficiency for DWSD (15% reduction in retail costs).
2. Water service shutoffs of residential customers are reduced by 90%.

### Appropriate Methods for Assessment

1. Reports of the number of DWSD customers enrolled in programs to address drinking water affordability and wastewater fees.
2. Up-to-date data on the number of residential customers without water.

## PARKS, PUBLIC SPACES, & WATER INFRASTRUCTURE

### GOAL

# 4

Quantify how much and what kind of green infrastructure investment will improve water quality in the region. (mitigation and adaptation)

### Summary of Goal

The City of Detroit has a longstanding problem with the fundamental design of its stormwater management system in that heavy rainstorms often create overflows of the system and releases of untreated water by the millions of gallons to our local rivers.

Green infrastructure and other stormwater management features are being evaluated and implemented citywide as alternatives to more costly and traditional, “gray” infrastructure improvements. To increase the efficiency and likely success of such projects, Detroit needs to be able to analyze the interaction of several key data sources—what type of green infrastructure is being installed, the location of those installations, and the cumulative impact of planned and existing projects on reducing the overflows.

### Near-Term Action Steps

1. Develop a citywide asset management plan for drinking and wastewater infrastructure.
2. Develop citywide green infrastructure plan supporting stormwater management best practices.

### Long-Term Action Steps

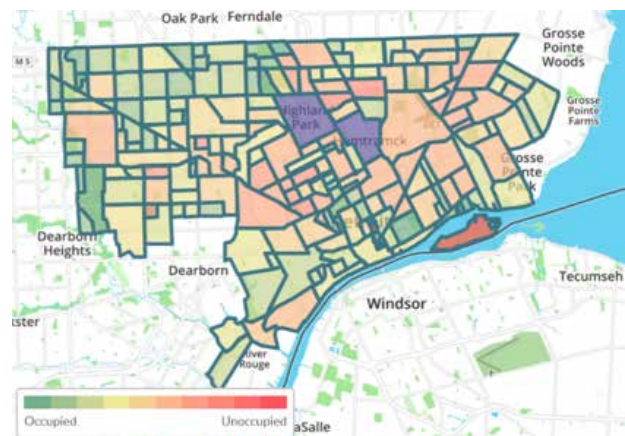
1. Implement asset management plan.
2. Implement green infrastructure plan.

### Indicators for Success

1. Increased amount of money invested in green infrastructure projects.
2. Increased number of acres of green infrastructure projects implemented in the city.
3. Establishment of asset management plan and green infrastructure plan.

### Appropriate Methods for Assessment

1. Asset management plan
2. Green infrastructure plan.



*Detroit Vacancy by Neighborhood. Source: Motor City Mapping*



LED Coverage. Source: Detroit Public Lighting Authority

# HOMES & NEIGHBORHOODS

*“The path toward sustainable energy sources will be long and sometimes difficult. But America cannot resist this transition; we must lead it. We cannot cede to other nations the technology that will power new jobs and new industries; we must claim its promise.”*

—PRESIDENT BARACK OBAMA

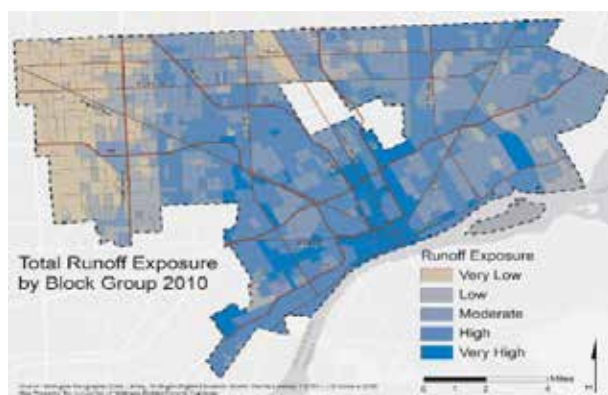
Building a resilient Detroit demands addressing aging housing stock. The American Housing Survey found 12.6% of occupied units in Detroit were built in 1939 or earlier, and 69% of occupied units in Detroit were built in 1979 or earlier. The aging infrastructure has high utility and maintenance costs, which is echoed in the 2.4 million metric tons of CO<sub>2</sub> emitted to power, heat, and cool our homes. The energy demands of satisfying our housing needs emitted 23% of Detroit’s total GHG footprint.

Climate change can be understood within existing neighborhood concerns such as cost,

comfort, and community incentive programs. Resident concerns are local and practical: hazards, mold, trash pickup, and pollution. Underserved communities lack information on existing programs. The Detroit Climate Ambassadors program is a resident-led effort to educate, prepare, and tackle climate challenges in neighborhoods. This group is actively applying strategies to address community concerns such as affordability for efficiency renovations, aging infrastructure, comfort, and accessibility.

The Taubman College of Architecture & Urban Planning at the University of Michigan worked with DWEJ to create a Detroit vulnerability assessment of areas in Detroit that are the most defenseless against extreme weather events. We know that as in all cities across the country, climate change will expose Detroit to temperature extremes, especially heat and flooding. A community’s vulnerability is determined by two factors: exposure and sensitivity.

Exposure relates to the household’s closeness to floodplains, or volume of runoff from surface water. Land cover type, soil drainage type, elevation, and slope (angle) each play a role in exposure. Sensitivity refers to how



*Detroit Runoff Exposure by Block Group 2010*  
Source: *Defining Climate Vulnerability in Detroit*

well prepared or responsive a household can be with their own resources. Sensitivity to flooding is measured by housing age, household income, resident age, and transportation access. Building adaptive capacity means preparing for expected changes, and expecting the unexpected.

Detroit has a combined system for sewage and stormwater. When heavy rain events overwhelm the system, untreated sewer water flows into waterways in a combined sewer overflow. Areas with tree canopy hold more water and release runoff more slowly, and areas with impervious (waterproof) surfaces or steep slopes contribute the most. Detroit is a flat city with little elevation change. Overall, the highest elevation occurs at 8 Mile Road and gently slopes downward toward Downtown and the Detroit River. Each block's role in flooding is reliant on the input of runoff from surrounding blocks. If a block has high runoff but the surrounding blocks do not, the reference block is less likely to flood. If several connecting blocks have high runoff, then it is more likely that there will be flooding. Overlaps between flood exposure and housing sensitivity demonstrate vulnerable blocks.

Areas of Downtown and the Woodward corridor, Southwest Detroit, and the Eastside are particularly susceptible to flooding. The exposure assessment followed 100- and 500-year floodplains according to the Federal Emergency Management Agency (FEMA). If a house is in a 100-year floodplain, it has a 1% chance of flooding, while a house in a 500-year floodplain has a 1 in 500 or 0.2% chance in any given year.

The assumptions used by FEMA to determine likelihood of flooding do not reflect climate changes and require extra precaution. Homes built before 1940 used porous concrete for basement construction, which allows higher water flow. Flooding will have disproportionate impacts on lower-income households who cannot afford to miss work, rent a hotel room, make the repairs to their homes after a flood, or apply for FEMA assistance.



## Solutions

The City of Detroit Water & Sewerage Department's new billing rules for all properties encourage installation of permeable paving and green and blue infrastructure. Detroit and Michigan are developing strategies to encourage energy efficiency, lower utility costs, more jobs, and better health. Newer construction in Detroit is moving away from single-family housing.

Detroit is burdened with negative health and environmental consequences of fossil fuel and nonrenewable energy. Renewable energy will prevent air pollution, reduce utility costs, and reduce healthcare costs. Expanding economic opportunities in work such as solar panel installation can provide good employment opportunities for all skill levels. Nonmotorized and public transportation options reduce carbon emissions from travel. In Detroit, citywide transportation GHG emissions are dominated by private passenger car, truck, and on-road freight.

Energy mortgages are mortgages with underwriting standards that include energy costs in addition to principal, interest, taxes, and insurance. Energy efficiency is rewarded based on measurable standards.

### Barriers to Success

#### Funding

Need outreach, education, and demonstration projects.

#### Law

Must support sustainable redevelopment.

#### Deconstruction

Insufficient education regarding deconstruction methods as safe and profitable, considering labor costs, speed of projects compared with traditional demolition.

#### Deconstruction Market Development

Lack of understanding of the potential in this market.

### Community Voices

- ✓ Incorporate natural lighting solutions into architecture in the city.
- ✓ Incentivize solar, highly reflective, or white roofs to alleviate urban heat islands.
- ✓ Promote mixed-use and mixed-income neighborhoods.
- ✓ We need help lowering and paying our electric bills.

## HOMES & NEIGHBORHOODS

### GOAL

1

Improve energy efficiency and durability of homes.  
(mitigation)

### Summary of Goal

Implementing energy efficiency efforts reduces carbon emissions and lowers energy costs for users. Improving the durability of homes goes hand in hand with energy efficiency efforts by helping families save money over the long-term. In addition to access to clean, renewable energy, knowledgeable residents and contractors are essential for success

### Near-Term Action Steps

1. Maximize Detroit Climate Ambassadors program.
2. Provide information on energy efficiency, conservation, etc., with presentations in neighborhoods, at libraries and community centers, for example.
3. Partner with the school system on climate change education initiatives (i.e., energy efficiency, clean/renewable energy, climate resilience).
4. Host home retrofitting training and weatherization workshops.

### Long-Term Action Steps

1. Build demonstration houses.
2. Sponsor or coordinate programs for education and best practices for lowering energy bills.
3. Generate resources to replicate the home retrofitting and training project and bring it to scale.

### Indicators for Success

1. Increased number of homes energy audited.
2. Increased number of homes retrofitted.
3. Increased number of community meetings for outreach.
4. Increased number of homes with advanced and efficient mechanical systems.

### Appropriate Methods for Assessment

1. Contractor reports.
2. GHG Inventory.
3. Utility reports.

### GOAL

2

Improve and update the Detroit energy grid.  
(mitigation and adaptation)

### Summary of Goal

Today the electric power grid in Detroit is outdated and serving a much lower population over more distance than it was initially designed to cover. The infrastructure is aging and in need of being updated. In addition to upgrades, the system must maximize the ability of Detroiters to benefit from the new energy laws in Michigan.

These laws allow for the establishment of what are called micro-grids. Micro-grids are the way of the future. Perhaps the largest barrier to this type of overhaul to the city's grid is the upfront cost of replacing this infrastructure. On the other hand, there is wasted energy across the whole of the grid due to the lack of density in much of Detroit. As a result, we are producing and charging for energy that is not being used by consumers.

We envision a transition to a citywide system of connected micro-grids that will add versatility and increase reliability. This should drive down the cost of providing energy and allow for the development of decentralized power generation. Investing in micro-grids at hospitals, universities, fire stations, and other similar institutions initially would also help them with power-outage and climate-change preparedness. These facilities would serve as "anchors" for beginning to create a patchwork of micro-grids. This will increase reliability and bring more resilience to the system.

### Near-Term Action Steps

1. Frequently collect data on the Detroit electric grid for performance and accounting.
2. Establish micro-grids in neighborhoods with hospitals, universities, and municipal buildings as anchors.
3. Work with utility companies to update transmission lines for distributed energy sources to move away from centralized power plants.

### Long-Term Action Steps

1. Continue to monitor energy usage.
2. Expand micro-grids to include low income communities.

### Indicators for Success

1. Energy savings result from infrastructure improvements.
2. Fewer brownouts.
3. Reduction in CO2 emissions.

### Appropriate Methods for Assessment

1. Energy Audits to maintain efficiencies.
2. DTE Energy.
3. Michigan Integrated Resource Plans filed by utility companies.

## HOMES & NEIGHBORHOODS

### GOAL

3

Reduce dependency on cars as primary transportation.  
(mitigation)

### Summary of Goal

Increasing options for reliable and versatile transportation will reduce greenhouse gas emissions from cars and light trucks, which, within the transportation sector, are the dominant sources of these emissions. The benefits to be enjoyed from shifting people from individual vehicles to other modes of transportation include improved air quality and increased cost savings. Lastly, having additional transportation options will improve access to amenities, healthcare, and economic opportunities. Lower fuel costs mean that residents can spend more money on other areas of the economy.

To enjoy these benefits, we need to look at transportation in the city and implement systemic change to support positive changes already in development. The QLINE Detroit streetcar, new hybrid buses, and investments in infrastructure for active transportation along off-street paths, greenways, and the like are examples of recent improvements. Due to recently approved investments, Detroit is positioned to enter the top 5 in the nation for these types of amenities.

### Near-Term Action Steps

1. Encourage development of multimodal connections, such as bike storage at bus and light rail stations.
2. Promote safe options for walking and biking, such as bikeshare and public events.
3. Increase the convenience and reach of public transportation options.

### Long-Term Action Steps

1. Implement demonstration projects and promote existing ones such as greenways and Complete Streets.
2. Encourage Complete Street design for new development and redevelopment.
3. Incentivize business development in underserved areas.

### Indicators for Success

1. Increased number of miles of Complete Streets installed.
2. Increased number of bike racks and bike-share stations in the city.
3. Increased number of miles of greenways, sidewalks, and bike lanes.
4. Reduction in vehicle-miles traveled.

### Appropriate Methods for Assessment

1. Surveys by City of Detroit Public Works Department.
2. Data from City of Detroit Planning & Development Department.
3. Reports from MoGo, City of Detroit Department of Transportation, Michigan Department of Transportation, Southeast Michigan Council of Governments.

### GOAL

# 4

Encourage the use of new construction methods and technology through education. (adaptation and mitigation)

### Summary of Goal

Technology in the construction world and building science is rapidly changing and constantly evolving. These advances reduce the energy required to operate buildings through maximizing the energy efficiency in buildings, infrastructure, and built environment. Keeping professionals informed of new construction methods and technology, and educating homeowners and occupants on efficient operations and monitoring their building's energy and operations, all maximize potential energy savings, cost savings, and greenhouse gas reductions.

### Near-Term Action Steps

1. Convene educational seminars for general contractors, architects, and professionals.
2. Encourage green building accreditation, certification, audits, and reporting.
3. Update building codes to support emerging technology and methods for reducing energy consumption.
4. Provide training for building inspectors such as credentialing and education.
5. Host a Detroit tour of green technology for City of Detroit Department leaders.

### Long-Term Action Steps

1. Include reporting by contractors on new construction methods and technology in Section 3 Plans.
2. Create a homeowner operation and maintenance manual.
3. Create municipal incentives to support new methods such as fast-tracking, bid points, reduced permitting fees.

### Indicators for Success

1. Increased attendance levels of accredited green development professionals.
2. Increased quantity of certified buildings, such as LEED, Energy Star, Living Building Challenge.
3. Increased number of contractors including green construction methods and technologies in Section 3 Plans.
4. Energy and GHG reductions.

### Appropriate Methods for Assessment

1. LEED, Energy Star, and other registries.
2. Builders reports.
3. U.S. Housing & Urban Development Department (HUD) reports.
4. Utilities.



GOAL

5

Reduce waste from construction and demolition.  
(mitigation)

### Summary of Goal

Construction materials require a tremendous amount of energy to produce. According to the U.S. EPA, nationwide, the recycling rate from construction and demolition is between 20% and 30%. Working with others across the city to increase recycling and create better, more efficient overall waste management strategies will reduce construction and demolition waste that is landfilled or incinerated. Landfills and incinerators both release greenhouse gases into the atmosphere; reducing those activities will reduce greenhouse gas emissions. Additionally, a more efficient waste management system that reduces overall waste has co-benefits for public health (reducing the toxins associated with incineration) and offers employment opportunities.

### Near-Term Action Steps

1. Advance a policy requiring salvaged material be used in major projects.
2. Expand deconstruction activities and boost the market for reused, and products from salvaged, material.
3. Provide training for building inspectors (through credential maintenance requirements, continuing education units, etc.).
4. Create opportunities for developers and realtors to come together to make the field of sustainability more mainstream in their respective businesses.

### Long-Term Action Steps

1. Research case studies and implement deconstruction best management practices.
2. Award extra points in bid processes for having buildings third-party-certified for energy efficiency and sustainability (i.e., Energy Star and LEED standards).
3. Create a reuse marketplace/website allowing consumers to browse residential and commercial reused building materials.

### Indicators for Success

1. Increased total square footage of deconstructed buildings.
2. Increased number of building inspectors who have attended trainings.
3. Increased tons of material diverted from landfill.
4. Increased number of Living Building Challenge, LEED, and Energy Star certified structures.
5. Increased number of contracts requiring salvaged material.

### Appropriate Methods for Assessment

1. Builders reports.
2. City of Detroit Planning & Development Department reports.
3. City of Detroit Buildings, Safety Engineering & Environmental Department reports.

# EPILOGUE

*“We want to see instant results. That’s not something that’s going to happen with climate change. You need to just keep pursuing it and know that generations down the road will reap the benefits.”*

—MICHELLE GIERACH, NASA JET PROPULSION LABORATORY

Our hope in offering this compilation of information and recommended action steps is that our work will be of service to accelerating the pace of positive transformation of Detroit’s built environment, energy use practices, and energy generation options. That the combined impact of these changes will contribute more than our fair share toward addressing the worldwide releases of greenhouse gases.

When you consider the entirety of recommendations proposed here, the task at hand may seem overwhelming. However, consider one major accomplishment—how 65,000 LED streetlights were installed across the entire city—as an example of the improvements. The Public Lighting Authority finished the relighting one year ahead of schedule and under budget. The reduction of the amount of energy used compared to the old lights was substantial. Yes, we can do this.

We also hope that new and innovative policies and an increasing focus on health and other quality-of-life indicators in our neighborhoods as they relate to climate change impacts will help Detroit become a national, if not global, leader in our level of preparation and of resilience. And in our level of respect for, and engagement with, our residents in all neighborhoods.

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# RESOURCES

## GOVERNMENT

Detroit Area Agency on Aging  
Detroit Building Authority  
Detroit City Council Green Task Force  
Detroit Health Department  
Detroit Housing & Revitalization Department  
Detroit Land Bank Authority  
Detroit Mayor's Office  
Detroit Parks & Recreation Department  
Detroit Planning & Development Department  
Detroit Planning Commission  
Detroit Public Schools  
Detroit Public Works Department  
Detroit Transportation Department  
Detroit Water & Sewerage Department  
Michigan Agency for Energy  
Michigan Association of Planning  
Michigan Department of Environmental Quality  
Michigan Department of Health & Human Services—Climate & Health Adaptation Program  
Michigan Department of Natural Resources  
Michigan Department of Transportation  
Michigan Energy Options  
Michigan Office of the Great Lakes

Michigan Public Service Commission  
National Weather Service  
Southeast Michigan Regional Energy Office  
Southeast Michigan Regional Transit Authority  
U.S. Department of Energy  
U.S. Department of Health & Human Services  
U.S. Department of Homeland Security  
U.S. Department of Housing & Urban Development  
U.S. Environmental Protection Agency  
Wayne County Building Authority  
Wayne County Community College District  
Wayne County Roads Division  
Wayne Metro Community Action Agency

## NGO/NONPROFIT

5 Lakes Energy  
Alliance for the Great Lakes  
American Institute of Architects  
Architecture 2030 District (Detroit and Ann Arbor)  
ASHRAE  
Belle Isle Conservancy  
Black Family Development Inc.  
Community Development Advocates of Detroit

Detroit Economic Growth Corporation  
Detroit Green Map  
Detroit Greenways Coalition  
Detroit Housing Commission  
Detroit Public Lighting Authority  
Detroit Riverfront Conservancy  
Detroit Thermal  
Detroit Youth Energy Squad  
Detroitters Working for Environmental Justice (DWEJ)  
Eastern Market Corporation  
Eastside Community Network  
Ecology Center  
EcoWorks  
Erb Family Foundation  
Focus Hope  
General Service  
Great Lakes Bioneers Detroit  
Greater Detroit Resource Recovery Authority  
Green Living Science  
Henry Ford Health System  
Institute for Population Health  
Keep Growing Detroit  
Lawrence Technological University  
Metropolitan Organizing Strategy Enabling Strength (MOSES)  
Michigan Solar Works (Srinergy)  
Michigan Interfaith Power & Light  
Michigan Saves

Michigan State University  
 Nation Association for the  
 Advancement of Colored  
 People  
 Northend Christian  
 Community Development  
 Corporation  
 Parjana  
 Power Panel  
 RecoveryPark  
 Recycle Here!  
 Red Cross  
 Rizzo Environmental Services  
 Inc.  
 Rocky Mountain Institute  
 Sierra Club  
 Six Rivers Land Conservancy  
 Southwest Detroit  
 Community Benefits Coalition  
 Southwest Detroit  
 Environmental Vision (SDEV)  
 Southwest Housing Solutions  
 The Greening of Detroit  
 The Nature Conservancy  
 Transportation Riders United  
 University of Detroit Mercy  
 University of Michigan–Ann  
 Arbor  
 University of  
 Michigan–Dearborn  
 U.S. Green Building

Council–Detroit Chapter  
 Wayne State University  
 Wayne State University Civil  
 Engineering Department  
 Workshop Detroit  
 Young Detroit Builders  
 Michigan  
 Zero Waste Detroit

#### **BUSINESS**

Advanced Disposal  
 Architectural Salvage  
 Warehouse of Detroit (ASWD)  
 Bedrock Real Estate  
 Detroit Medical Center  
 Detroit Regional Chamber of  
 Commerce  
 DTE Energy  
 Farbman Real Estate  
 Ford Motor Company  
 Future Build Construction  
 Group  
 General Motors  
 Illich Holdings  
 NextEnergy  
 Tetra Tech  
 Walker-Miller Energy Services  
 LLC  
 Zachary & Associates Inc.  
 Neighborhood Business  
 Groups (Jefferson Ave, Live6,

8 Mile, Oakwood Heights,  
 Midtown business alliance)

#### **INTEREST GROUP**

American Society of  
 Heating Refrigeration & Air  
 Conditioning Engineers  
 Building Operations &  
 Maintenance Association  
 Detroit Green Skills Alliance  
 Engineering Society of Detroit  
 Great Lakes Renewable  
 Energy Association  
 International Brotherhood of  
 Electrical Workers  
 League of Michigan Bicyclists  
 Mechanical Contractors  
 Association of Detroit  
 Metro Matters  
 Michigan Municipal League  
 Midwest Energy Efficiency  
 Alliance  
 Southeast Michigan Council  
 of Governments (SEMCOG)  
 Southeast Michigan  
 Sustainable Business Forum

# GLOSSARY

**Adaptation:** Adjusting to the inevitable effects of climate change that will occur despite mitigation efforts.

**Adaptive Capacity:** The ability of a system to adjust to climate changes, moderate potential damages, or seize opportunities.

**Asset Management Plan:** A plan developed for the lifetime management of infrastructure assets using multidisciplinary techniques in a cost-effective manner for a level of service.

**Biodiversity:** The variety of genes, species, habitats, landscapes, ecosystems, and all biota and their relationship to air, land, and water.

**Bioswales:** Landscape topography designed to remove silt and pollution from surface runoff water.

**Blue Infrastructure:** Water and coastal habitat of a watershed used for stormwater treatment instead of traditional engineered piping.

**Building Envelope:** A building's exterior shell including surfaces that drain moisture and rainwater, and the materials sealing the interior from the exterior.

**Built Environment:** Infrastructure built by humans.

**Carbon Dioxide (CO<sub>2</sub>):** A crucial gas in natural processes; also, a by-product of fossil fuel combustion and a major contributor to increases in climate change and ocean acidification.

**Carbon Sink:** A natural environment quantified by the ability to absorb CO<sub>2</sub> from the atmosphere.

**Climate Change:** Any significant change in the measures of climate for a period of decades or longer, including temperature, precipitation, wind patterns, among others.

**Climate-Related Public Health Interventions:** Responses reduce the harm from climate change, such as heat wave cooling centers, transportation access, home weatherization programs, stormwater management infrastructure, health impact monitoring and alert systems, or emergency response planning.

**Climate System (or Earth System):** The five physical components of atmosphere, hydrosphere, cryosphere, lithosphere, and biosphere that are responsible for the climate and its variations.

**Climate Vulnerability:** A community's exposure to climate-change-related events, its sensitivity, and its adaptive capacity. Exposure describes the susceptibilities of a place that exist due to the magnitude, frequency, duration, and geographic factors.

**Co-Benefit:** Separate benefits or arguments in favor for an action taken.

**Combined Sewer Overflow (CSO):** During a weather event when a combined (sanitary and stormwater) sewer system cannot handle the volume of water and relieves untreated wastewater directly into the watershed. There are dangerous implications for life owing to the toxic nature of sewage.

**Complete Streets:** Transportation designed to be accessible and safe for pedestrians, bicyclists, transit users, and motorists.

**Compost:** Organic material made from combining yard trimmings, food wastes, or manures in proper ratios; adding bulking agents (e.g., wood chips); and allowing decomposition to produce a nutrient-rich growing amendment.

**Connectivity:** Structural connectivity refers to the physical relationship between landscape elements whereas functional connectivity describes the degree to which landscapes aid or impede the movement of organisms and processes.

**Cooling Center/Shelter:** A temporary air-conditioned public space as shelter from heat wave.

**Deconstruction:** Dismantling a structure and salvaging its components and materials, rather than demolishing and landfilling as waste.

**Detroit GHG Business Index:** A proposed summary of GHG emissions data compiled from Detroit businesses designed to offer a simple representation of progress toward GHG emission-reduction goals.

**Detroit Renewable Power:** The company operating one of the country's largest municipal waste incinerators, located in the center of Detroit.

**DWSD Water Audits:** Data gathered by the DWSD used to improve Detroit's water infrastructure.

**Ecological Integrity:** The ability of an ecosystem to support and maintain ecological processes and a diverse community of organisms, and withstand and recover from stress.

**Ecological Inventory:** The process of identifying occurrences of species and classifying the amount of biodiversity in a specified area.

**Ecology:** The relationships amongst biota and abiota.

**Ecosystem Services:** Direct economic benefits from the ecosystem that would require costly infrastructure to replace (e.g., water filtration, air filtration, erosion control).

**Emissions:** The release of a substance from an industrial process as a by-product.

**Energy Audit:** A report on the consumption and cost of a building: utility bills, electric usage, water usage, and heating load.

**Energy Conservation:** Behavior reducing energy use.

**Energy Efficiency:** Technology that uses less energy to perform a target function.

**Energy Star:** Department of Energy and the Environmental Protection Agency certification of energy-efficient products.

**Environmental Corridors:** Landscape providing natural areas, biking and pedestrian pathways, open space, and migration routes for species. Corridors often lie along streams, rivers, or other natural features.

**Environmental Science:** The study of the Earth's environment across multiple disciplines.

**EPA Portfolio Manager:** Online tool provided by the EPA to measure and track the energy use, water use, and GHG emissions of buildings.

**Fauna:** Animals

**Flora:** Flowers or plants

**Food Insecurity:** Reduced quality, variety, or desirability of diet; disrupted eating patterns and reduced food intake.

**Fossil Fuel Consumption:** The measurable use of hydrocarbon energy sources including combustion of coal, petroleum, or natural gas.

**General Services Department (GSD):** Created on July 1, 2006, to streamline city services common to different city departments.

**Green Alleys:** An alley landscaped using environmentally sustainable design.

**Green Infrastructure:** The use of vegetation, soils, and natural processes to manage for human uses, generally in urban environments, such as bioswales, rain gardens, retention ponds.

**Green Jobs:** Occupations that provide for the needs of the present generation without causing undue harm to the needs of the environment or future generations.

**Green Roofs:** Roofs that absorb rainwater with vegetation. Green roofs decrease combined sewer overflow, typically have a long life, and have a higher albedo (reflectivity) than traditional roofs, allowing for decreased summer temperatures.

**Greenhouse Gas (GHG):** Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride.

**Greenhouse Gas Baseline:** The initial inventory of greenhouse gas emissions which serves as a benchmark to compare future data to measure progress.

**Greywater:** Water after use in showers, sinks, washing machines, dishwashers, and/or bathtubs.

**Health Disparity:** Differences in health status between groups (sometimes referred to as health inequities or inequalities).

**Health Impact Assessment:** A process evaluating data sources and analytic methods, including stakeholders, to determine the health effects of a proposed action.

**Health Promotion Communication Network:** City of Detroit formal communication lines about emergencies, events, or planning activities that also tie into community organizations, healthcare websites, media, social media, etc., regarding climate effects on health and access to public health services.

**Health Promotion Materials:** Educational materials that translate scientific language into understandable information to improve health literacy.

**Heat Island Effect:** Refers to the tendency of urban areas to be warmer than rural areas owing to the higher percentage high heat-absorbing impervious surfaces.

**Heat Wave:** A prolonged period of excessive heat often combined with excessive humidity.

**Heat/Health Warning System (HHWS):** A system based on weather-health relationships, as determined by observed daily variations in human mortality.

**Heating, Ventilation, Air Conditioning (HVAC):** The field of technology that provides indoor fresh air, thermal comfort, heating, and cooling inside buildings.



**Impervious Surface:** Any surface that does not allow water to soak into the ground such as roofs, driveways, and patios.

**Innovative Emergency and Community Alert Systems:** Imminent threat or illness distress communication such as EPA Air Quality Index, National Weather Service Advisories, social media, phone alerts, 211, reverse 911, phone trees, radio, or Meals on Wheels.

**Intergenerational:** Interaction between members of different generations.

**Invasive Species:** Non-native species that disrupt ecosystems and replace native species.

**Irrigation Water Management:** The management of practices associated with supplying water to land or agriculture.

**Land Use:** The way in which humans develop land.

**Landfill:** Land waste disposal site in which waste is generally spread in thin layers, compacted, and covered with a fresh layer of soil each day.

**Leadership in Energy and Environmental Design (LEED):** U.S. Green Building Council program to certify a building based on a scorecard of performance in energy, environmental improvements, water management, use of environmentally-friendly materials and community engagement.

**Mitigation:** Reducing impacts that cause climate change.

**Mixed-Use Neighborhoods:** Neighborhoods including residential, commercial, and industrial uses together as opposed to segregated.

**Morbidity:** The state of being diseased or unhealthy within a population.

**Mortality:** The number of people who have died within a population.

**Multimodal Connections:** Pathways and systems that allow commuters, workers and residents to easily move from one mode of transportation to another.

**Natural Environment:** Made by natural systems.

**Natural Light Solutions:** Using the sun to reduce reliance on electric lighting.

**Ozone:** A gaseous atmospheric constituent that is the triatomic form of oxygen (O<sub>3</sub>). In the troposphere, it is created by photochemical reactions involving gases from natural sources and human activities (photochemical smog). In high concentrations, tropospheric ozone can be harmful if breathed and occurs at the ground level during high heat.

**Passive Cooling:** Cooling a space without mechanical systems (HVAC). Operable windows have long been used to cool spaces but now taller buildings as well. Architectural elements may make use of cooler temperatures underground or may be designed to catch the wind such as in Persian and Arabic architecture.

**Photovoltaics:** Colloquially referred to as solar panels, photovoltaics often refers to the technology of producing electric current through solar cells.

**Playlot:** A plot of ground allocated for recreation; a playground.

**Property Assessed Clean Energy (PACE):** A program to issue bonds used for clean energy and retrofit improvements.

**Recycling:** Collecting and reprocessing a resource for reuse.

**Renewable Energy:** Energy from fuel sources that restore themselves over short periods of time and do not diminish such as the sun, wind, moving water, and the Earth's core heat.

**Resilience:** A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

**RETAP:** The Retired Engineer Technical Assistance Program within Michigan's Department of Environmental Quality, used to connect retired engineers and businesses to prevent pollution.

**Retrofits:** Renovations to a building to increase energy efficiency.

**Sanitary Sewer:** A sewer dedicated to the removal of residential, industrial and commercial sewage, as opposed to stormwater.

**Sewage:** Water from drains that contain human waste.

**Shelter-in-Place:** Selecting a small, interior room with no or few windows to take refuge.

**Smart Growth:** A planning approach that considers social, economic, and environmental factors in community design. Co-locates housing and transportation options near jobs, social services, stores, and schools.

**Social Support:** Assistance one has through social network. This may include informational, emotional, and instrumental support.

**Societal Marketing:** Business marketing and planning that balances profits with society's best interests.

**Solar Energy:** Harnessing the power of the sun for energy.

**Stormwater:** Precipitation during weather events.

**Stormwater Management:** Practices that minimize water pollution and damage to the natural and built environment from water.

**Strategic Air Conditioning Systems:** HVAC that uses passive systems methods to preheat or precool a medium by way of the Earth's natural temperature. Geothermal wells take advantage of the underground constant 55°F–57°F (13°C–14°C).

**Sustainability Plan:** An actionable, measurable strategy for a group to meet the goal of sustainable living.

**Sustainability:** Practices that meet the needs of the present without compromising the long-term needs of the environment, the economy, and the community.

**Tree Canopy:** The above-ground branches and foliage of a tree that provide cover from the sun.

**Triple Bottom Line:** Theory of business to consider people, planet, and profit when making decisions.

**Universal Recycling:** Recycling for households, multi-family units, and businesses. All waste generating sources would be included.

**Urban Heat Island (UHI):** Increased surface and air temperatures in urban areas relative to surrounding suburban and exurban areas.

**Vulnerability:** The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

**Walkability:** Ability to walk safely to and from points of interest that are within a proximate distance.

**Waste Incineration:** Combustion of solid and liquid waste in controlled environment.

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City of Detroit Buildings, Safety Engineering, & Environmental Department

City of Detroit General Services Department

Detroit Green Skills Alliance

Detroit Salt Company

DTE Energy

EcoWorks

Ford Motor Company

General Motors

Great Lakes Environmental Law Center, Wayne State University Law School

Great Lakes Integrated Sciences & Assessments

The Greening of Detroit

McNeely Building Group LLC

Michigan Department of Health & Human Services

Michigan Environmental Council

National Wildlife Federation

Newman Consulting Group LLC

Pure Eco Environmental Solutions

Sierra Club

Southwest Detroit Community Benefits Coalition

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Zero Waste Detroit



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