



CITY OF BETHLEHEM, PA

CLIMATE ACTION PLAN 2021





In this report

Letter from City Council.....	4
Letter from Mayor	5
Acknowledgements.....	6

Background

1. Executive Summary	9
2. What is a Climate Action Plan?	15
3. Vision and Principles	17
4. Why Bethlehem Needs a Climate Action Plan	19
5. Plan Development Process and Timeline	31
6. Relationship to Other Climate Actions.....	39
7. Greenhouse Gas Inventory	43

Goals and Strategies

8. Goals and Targets	51
9. What You Can Do.....	53
10. How to Read This Plan	57
11. Environmental Justice and Equity	61
12. Mitigation Strategies	69
<i>Municipal Operations</i>	73
<i>Buildings</i>	83
<i>Electricity Sourcing</i>	97

<i>Transportation and Mobility</i>	109
<i>Land Use and Green Space</i>	125
<i>Local Food and Waste</i>	147
<i>Public Engagement</i>	168
<i>Large Organizations and Insitutions</i>	179
13. Adaptation and Resilience Strategies	185

Implementation

14. Implementation Strategy.....	203
15. Partnerships and Commitments.....	211
16. Reporting Process and Accountability	217
17. Next Steps.....	219

Appendix

18. Appendix.....	221
1A. Climate Vulnerability Impacts	222
1B. Community Hazard Mapping.....	246
2. Performance Metrics	250
3. Abbreviation Glossary	264
4. Climate Data Processing and Results	266
5. Community Survey Results	272
6. Community-wide GHG Inventory Summary...	279



Letter from City Council

When I first proposed a Climate Action Plan (CAP) for the City of Bethlehem, I could not have imagined the interest that the idea would generate within our community. Support for designing a plan came from all corners of our city including environmental advocacy groups, educational institutions, businesses, and residents. This inspiring coalition of voices all expressed a desire to take local action on one of the defining issues of our generation.

As the CAP began to come together, it was clear the passion and excitement that our community was bringing to the critical task before us. If not for that enthusiasm, the thorough blueprint for action that follows would not be the impressive document that it is. Bethlehem residents owe the hard-working volunteers involved in the planning process a debt of gratitude for their knowledge and dedication to our city.

The strategies and goals that follow reflect a responsibility to our future. Citywide energy reduction goals, land use policies, and renewable energy commitments are but a few of the important priorities set forth in these pages. The plan is impressive in its comprehensive and detailed approach to sustainability and climate action.

Let me be clear. The work that lays ahead will not be easy. It will take time, effort, and an obligation to re-evaluate and change the framework by which we make decisions on a daily basis. City government and our environmental coalition of community voices must design, create, and implement a vision in which every resident is able to be part of the journey to a more sustainable and equitable Bethlehem.

The first chapter is complete in our work. Our future success will be determined by our ability to educate, involve, and challenge our community to create a more sustainable city.

Let's get to work.

Councilman J. William Reynolds



Letter from the Mayor

Along with my responsibility to the residents of Bethlehem comes a commitment to the environment. During my tenure, enhancing our pledge to a sustainable future has become a priority. We have made innovative and practical decisions to address the challenges of climate change as well as energy. The City of Bethlehem is devoted to reducing greenhouse gas emissions and adapting to the impacts of climate change. I continue to be committed to the U.S. Conference of Mayors' Climate Protection Plan and the Global Covenant of Mayors for Climate and Energy.

As we look to the future, a rapidly changing climate requires establishing a new vision for Bethlehem as an equitable, prosperous, resilient, healthy, and inclusive city that takes actions to mitigate climate change while increasing our preparedness for climate change impacts.

I would like to commend Councilman Reynolds for his leadership on this issue.

The product of more than a year of planning, including input from hundreds of Bethlehem residents, businesses and institutions, the plan lays out ambitious commitments to environmental justice and climate change mitigation aligned with science. We will aim to reduce community-wide greenhouse gas emissions 33% by 2025, 60% by 2030 and reach net-zero emissions by 2040. The city government will lead by example by purchasing 100% renewable electricity for municipal operations and continuing to invest in cost-saving energy reduction initiatives, which have already reduced municipal emissions 38% relative to 2005.

I would like to thank you in advance for taking the time to read the Bethlehem Climate Action Plan.

Robert J. Donchez
Mayor





Acknowledgements

Mayor

Robert J. Donchez

City Council

J. William Reynolds

Municipal Staff

Michael Alkhal, *Director of Public Works/ City Engineer*

Matthew Dorner, *Deputy Director of Public Works/Chief of Engineering*

Mike Simonson, *Chief Building Inspector*

Robert Vidoni, *City Clerk*

Tiffany Wells, *Traffic Superintendent*

Chief Robert Novatnack, *Director of Emergency Management*

Mike Halbfoerster, *Director of Recycling*

Sherri Penchishen, *Director, Chronic Disease Programs*

Jodi Evans, *Recreation Director*

David Shaffer, *City Forester*

Darlene Heller, *AICP, Director of Planning & Zoning*

Project Team

WSP

Jeff Irvine

Jon Dickinson

Matt Aberant

Rawlings Miller, PhD

Kim Grubert

Dan Sobrinski

Katrina Prutzman

Chris Dorney

Allie Reilly

Marc Steuben

Nurture Nature Center

Kate Semmens

Keri Maxfield

Rachel Hogan Carr

Lauren Fosbenner

Climate Action Plan Working Group

Katherine Volpe, *Alliance for Sustainable Communities—Lehigh Valley*

Peter Crownfield, *Alliance for Sustainable Communities—Lehigh Valley*

Ron Unger, *ArtsQuest*

Mark Stein, *Bethlehem Area School District*

Angela DelGrosso, *Bethlehem Chamber of Commerce*

William Reynolds, *Bethlehem City Council*

Ben Guthrie, *Bethlehem Environmental Advisory Committee*

Ben Felzer, *Bethlehem Environmental Advisory Council*

Beth Behrend, *Bethlehem Environmental Advisory Council*

Elisabeth Cichonski, *Bethlehem Environmental Advisory Council*

Lynn Rothman, *Bethlehem Environmental Advisory Council*

Kathy Fox, *Bethlehem Food Coop*

Steven Fernstrom, *Bethlehem Parking Authority*

Doug Roysdon, *Bethlehem Pedestrian Bridge Coalition*

Allison Czapp, *Buy Fresh Buy Local of the Greater Lehigh Valley*

Scott Slingerland, *CAT-Coalition for Appropriate Transportation*

Kim Schaeffer, *Citizens' Climate Lobby (Lehigh Valley chapter)*

Chuck Weiss, *Community Action Lehigh Valley*

Connor Burbridge, *Community Action Lehigh Valley*

Danielle Joseph, Greater Lehigh Valley Chamber of Commerce—liaison for the Hispanic Chamber of Commerce
Olivia Barz, LANTA
Steven Schroyer, LANTA
Breena Holland, Lehigh University
Karen Beck Pooley, Lehigh University
Katharine Targett Gross, Lehigh University
Christa Kraftician, Green Building United
Katie Bartolotta, Green Building United
Kerry Wrobel, Lehigh Valley Industrial Park
Geoff Reese, Lehigh Valley Planning Commission
Greg Zahm, Liberty HS Environmental Club
Liam Caceres, Liberty HS Environmental Club
Don Hougendobler, LVHN
Katherine Velekei, LVHN
Diane White Husic, Moravian College
Marc Rittle, New Bethany Ministries
Anita Forrester, Northampton Community College
Jacqui Pratt, Northampton Community College
Rachel Leon, Northampton Community College Climate Action Network
Anita Forrester, Northampton County Community College
Meredith Dibert, PA Department of Environmental Protection, Energy Programs Office
Justin Dula, PA Department of Environmental Protection, Office of Environmental Justice
Jane George, PPL Electric Utilities
James Rouland, PPL Electric Utilities
John Dieser, ProdHealth

Rachel Rosenfeld, Sierra Club
Tom Schuster, Sierra Club
Jadyn Sharber, Sunrise Movement: Lehigh Valley
Zach Pavlovich, Sunrise Movement: Lehigh Valley
Brian Hillard, Sustainable Energy Fund
Becky Eshbach, UGI
Rhiannon Hazzard, UGI
Keri Maxfield, Watershed Coalition of the Lehigh Valley
Sam Trunzo, Wind Creek Bethlehem

Environmental Justice and Equity Steering Committee

Marc Rittle, New Bethany Ministries
Justin Dula, PA Department of Environmental Protection, Office of Environmental Justice
Rachel Rosenfeld, Sierra Club
Breena Holland, Lehigh University
Peter Crownfield, Alliance for Sustainable Communities – Lehigh Valley
Greg Zahm, Liberty HS Environmental Club
Liam Caceres, Liberty HS Environmental Club
Chuck Weiss, Community Action Lehigh Valley
Danielle Joseph, Greater Lehigh Valley Chamber of Commerce—liaison for the Hispanic Chamber of Commerce
Anita Forrester, Northampton Community College
Rachel Leon, Northampton Community College Climate Action Network
Jadyn Sharber, Sunrise Movement: Lehigh Valley

Zach Pavlovich, Sunrise Movement: Lehigh Valley
Allison Czapp, Buy Fresh Buy Local (Lehigh Valley)
Brian Hillard, Sustainable Energy Fund
Jacqui Pratt, Northampton Community College

Additional Contributions

Marly Rodriguez, Hispanic Center Lehigh Valley
Delia Marrero, Hispanic Center Lehigh Valley
Blake Schuck
Emma Coppock
Mark Kleinginna

Design

Meg Bailey, WSP

Photos

Kelley Andrade
Victoria Bastidas
Jeff Irvine
Lehigh University
Craig Roberts



**“ City government and
our environmental coalition
of community voices must design,
create and implement a vision in
which every resident is able to be
part of the journey to a more
sustainable and equitable
Bethlehem.”**

Councilman Reynolds



1

Executive Summary

The need for action

Climate change presents humanity with an unprecedented challenge in the 21st century. It poses serious threats to Bethlehem's natural resources and our community's jobs, health, and quality of life. The accumulation of atmospheric greenhouse gases (GHG) such as carbon dioxide (CO₂) and methane (CH₄), which primarily result from burning fossil fuels and land-use changes, causes climate change. Scientists expect that current fossil-fuel use trends and increasing temperatures will cause harsher heat waves, droughts, rainstorms, floods, wildfires, and landslides in the near future.

Bethlehem has already experienced climate change effects. Over the past 100 years, Lehigh Valley's annual average temperatures increased 3.8°F and its average yearly precipitation increased 5.9 inches. These trends will worsen without drastic global action to mitigate GHG emissions.

Climate models that factor increasing GHG concentrations through the year 2100 (the high-warming scenario) show that Bethlehem's resulting average annual temperatures will increase more than 9°F. Such increases would lead to annual temperatures roughly similar to those experienced today in Richmond, Virginia. The models also show a total annual precipitation increase of 5 inches (though total yearly precipitation can vary significantly).

Severe temperature and precipitation extremes will accompany these annual increases. Bethlehem's average number of days over 90°F are expected to increase from the current 12 days per year to 36 to 39 days in the near-term and to 50 to 83 days at the end of the century (under the moderate and high future warming scenario, respectively). Heavy precipitation events are expected to increase in number and size in Bethlehem (and across much of the US), which may lead to higher and more frequent flooding.

These climate impacts could negatively affect Bethlehem's economy, natural resources, and community inequities. Potential community risks include:

- Increased mortality
- Negative health impacts
- Higher medical costs



- Higher infrastructure maintenance costs
- Poor water quality
- Higher electricity prices (coupled with decreased electricity supply reliability)
- Increased flood damage (and associated repair costs)

Bethlehem's highest-risk populations often face the most severe impacts and have the fewest resources to mitigate them. Like air pollution, flooding, high-temperature risks, and other environmental challenges, climate change will disproportionately affect Bethlehem's communities of color, residents with low-income, and those with existing health conditions. These communities are also suffering disproportionately from the COVID-19 pandemic, and research shows that long-term exposure to air pollution increases COVID-19 mortality rates.



This Climate Action Plan (CAP) is Bethlehem's comprehensive roadmap for addressing the local effects of climate change. This plan's purpose is to reduce Bethlehem's contribution to global climate change and prepare the city and the Lehigh Valley for the results of a changing climate.

Bethlehem has a rich history that blossoms from its strong industrial heritage to become a diverse center of academic and cultural excellence. The city continues to thrive and attract new generations of talented residents drawn by Bethlehem's economic opportunities and proximity to nature.

However, a rapidly changing climate requires Bethlehem to pursue a new vision as an equitable, prosperous, resilient, healthy, and inclusive city that proactively addresses climate change while preparing for its potential effects.

Bethlehem has a responsibility to take climate action based on science. This Climate Action Plan (CAP) ensures that Bethlehem will remain vibrant and prosperous as it develops and implements innovative climate change action.

The following principles drive this plan:



EQUITABILITY: achieve environmental justice and ensure all residents, regardless of socio-economic status, have access to this CAP's benefits and opportunities



PROSPERITY: reduce energy costs and support growing sectors that provide Bethlehem's future jobs as the US transitions to a clean-energy economy



RESILIENCY: ensure that the city's buildings, infrastructure, and natural and human systems are resilient to projected climate effects



HEALTHFULNESS: provide residents cleaner air, water and environment, while protecting and expanding Bethlehem's green spaces and ensuring city residents access to local, healthy food



INCLUSIVITY: create opportunities for Bethlehem residents to contribute to and implement the CAP's strategies



SCIENCE-BASED: develop and update CAP goals and strategies according to the latest climate science

The opportunity

Bethlehem's current trajectories for population growth, urbanization, and vehicle use will continue to increase GHG emissions unless we significantly change our energy use, land management, and transportation habits. Given climate changes' negative impacts on humanity, we must reduce GHGs and the city's carbon footprint now. Climate action presents opportunities for creating a healthier, safer, and more equitable city as the world transitions to a zero-carbon economy. Bethlehem has an unparalleled opportunity to change in ways that create jobs and benefits for all residents.

In 2017, activities in Bethlehem were responsible for the emission of 1,171,000 metric tons of carbon dioxide equivalent (tCO₂e). Building-energy use was the largest contributor. Electricity, natural gas, and other fuels for residential, commercial, and institutional buildings account for 50% of Bethlehem's GHG emissions. Energy used in industrial and manufacturing buildings adds another 22%. Road transportation, including cars, trucks, and heavy-duty vehicles, is the next largest source and accounts for nearly 19% of Bethlehem's emissions. The remainder (9%) comes from waste treatment and disposal (including within city limits and transported outside).

This CAP is Bethlehem's comprehensive roadmap for addressing climate change's local effects. This plan's purpose is to reduce Bethlehem's contribution to global climate change and prepare the city and the Lehigh Valley for the potential effects. The plan includes specific goals and mitigation strategies to reduce Bethlehem's GHG emissions and the proposed policies, programs, and partnerships to achieve the plan's targets. This plan also analyzes climate model projections under various global GHG emissions scenarios and assesses Bethlehem's public and infrastructure vulnerability under each. The plan's Adaptation and Resiliency section highlights strategies to reduce these vulnerabilities and prepare Bethlehem for various potential conditions.

In addition to GHG reduction and climate resilience, this CAP's initiatives will also produce a wide range of co-benefits to improve the city's overall health, safety, equity, and prosperity. This plan will help create cleaner air, jobs, and improve the quality-of-life for all, including communities of color and low-income residents. It will promote a more just and sustainable Bethlehem.

Bethlehem's commitments

The City of Bethlehem has a long history of supporting climate action. In 2006, Bethlehem Mayor John B. Callahan joined Easton and Allentown's mayoral administrations in signing the Three-City Proclamation, which endorsed the US Conference of Mayors' Climate Protection Agreement committing local communities to meeting or beating the Kyoto Protocol's recommendation of a 7% reduction in the United States' GHG emissions (below 1990 levels) by 2012. More recently, through the combined commitments to the *Global Covenant of Mayors for Climate and Energy*, the *We Are Still In* initiative, and the *Mayors National Climate Action Agenda*, Bethlehem will also set targets and action plans to meet or beat the United States' commitments under the 2015 Paris Climate Agreement.

Unfortunately, climate change science demonstrates that even these positive actions are not enough to fully mitigate climate-change dangers. The Intergovernmental Panel on Climate Change (IPCC) states that limiting global warming to 1.5°C versus 2.0°C could reduce the number of people exposed to climate risks and related poverty by as much as 457 million—but the current global commitments under the 2015 Paris Agreement are insufficient to prevent temperature rise above 2.0°C, let alone 1.5°C.

To act in accordance with the latest science, Bethlehem has established the following community-wide GHG emissions reduction targets (relative to a 2017 baseline):



This CAP includes specific sector objectives for:

- Municipal Operations
- Buildings
- Electricity sourcing
- Transportation and mobility
- Land use and green space
- Local food and waste
- Public engagement
- Large organizations and institutions

Each objective includes a series of intermediate goals.

Community-wide objectives

- Reducing GHG emissions from buildings by 30% by 2030
- Achieving 100% renewable electricity consumption community-wide by 2030
- Reducing GHG transportation emissions by a minimum of 30% by 2030
- Reshaping the built environment to optimize building space, opportunities for short daily trips, and travel mode options
- Maximizing Bethlehem's urban green space and tree canopy to promote carbon sequestration, increasing residents' access to active and passive open space, reducing urban heat island effects, improving the urban ecosystem and stormwater management, and enhancing aesthetic beauty
- Achieving zero waste by 2040
- Creating a "Bethlehem Climate Challenge" program to educate Bethlehem's residents about climate change and its potential impacts and motivate and empower residents and businesses to reduce emissions and participate in creating a resilient community
- Engage Bethlehem's largest businesses, organizations, and institutions to adopt ambitious GHG reduction goals, accelerate adoption of the CAP, and coordinate its implementation.

Municipal operations objectives

Bethlehem's city government reduced greenhouse gas emissions from municipal operations by 38% from 2005 to 2017. This reduction exceeds the United States' 2015 Paris Agreement commitment, which Mayor Donchez's administration endorsed under the *We Are Still In* initiative. To lead by

example, the city government commits to stronger GHG reduction targets for municipal operations (relative 2005 levels):

- 67% reduction by 2025
- Net-zero by 2030

Environmental justice and equity objectives

In Bethlehem and across the world, low-income and black, indigenous, and people of color (BIPOC) communities have contributed the least to climate change, but they are already bearing the worst of its impacts, including extreme heat and flooding. The disproportionate exposure of these frontline communities to climate-related harms is projected to increase as global temperatures rise, making every failure to act quickly and decisively a failure for environmental justice. To achieve this CAP’s vision, Bethlehem commits to:

- Establishing a just and ethical long-term framework for climate action that promotes equity for all Bethlehem residents
- Ensuring that 40% of this CAP’s overall spending benefits go to frontline communities

How the plan was developed

This Bethlehem Climate Action Plan resulted from a collaborative planning approach. Over a span of 10 months, hundreds of Bethlehem community members, businesses, and other stakeholders participated in developing this plan via meetings, surveys, working groups, draft comments, and communicating Bethlehem’s climate change threats and this plan’s remediation benefits.

WSP, a global engineering and design firm with offices in Bethlehem, and science-based community center Nurture Nature Center (NNC) located in Easton, led the CAP development on the city’s behalf. As an initial step, the CAP development team convened the Bethlehem Climate Action Plan Working Group (CAP WG), which consisted of representatives from city government, transportation authorities, utilities, universities, regional planners, corporate and industrial stakeholders, the Bethlehem Area School District, sustainability-focused non-profit organizations, community-focused non-profit organizations, and citizen groups.



COMMUNITY-WIDE GOALS

GHG Emissions Reduction Targets

33%
by 2025

60%
by 2030

net-zero
by 2040

Community-wide Sector Goals



Environmental justice and equity

Ensure that 40% of this CAP’s overall spending benefits go to frontline communities



Municipal operations

Reduce GHG emissions by 67% by 2025; reach net-zero by 2030



Buildings

Reduce GHG emissions from buildings by 30% by 2030



Electricity sourcing

Achieve 100% renewable electricity consumption community wide by 2030



Transportation and mobility

Reduce GHG emissions from transportation by a minimum of 30% by 2030



Land use and green space

Maximize Bethlehem’s urban green space and tree canopy



Local food and waste

Achieve zero waste by 2040



Public engagement

Create a “Bethlehem Climate Challenge” program to educate residents about climate change



Large organizations and institutions

Adopt ambitious GHG reduction goals, accelerate adoption of the CAP, and coordinate its implementation

The CAP WG played a crucial role—members devised and reviewed strategies and policies to achieve targets, identified barriers and solutions to implementing strategies, and helped gather resources for implementation and sustaining effort following the CAP’s release. To elevate Bethlehem’s frontline communities’ voices, the CAP WG formed an Environmental Justice and Equity Steering Committee. The committee drafted the CAP’s environmental justice chapter and reviewed all environmental justice strategies. The committee also provided connections to Bethlehem’s underrepresented groups, including developing a simple questionnaire delivered via community partners to provide participation options beyond the virtual public planning meetings (for which attendance can be difficult for some residents).

The principles of equity, inclusion, and appreciative inquiry guided the plan’s public engagement and participation process. The process worked to ensure that all community sectors, regardless of background, resources, access, and previous political participation, had opportunities for engagement and input. The CAP development team used multiple strategies, including providing online and written information (in multiple languages) and live meetings. The input was as diverse as Bethlehem itself. Through six virtual public planning meetings, two online community surveys, and several in-person engagements focused on frontline communities, Bethlehem’s public helped develop this CAP’s principles, objectives, and strategies.

The path forward

This CAP leverages common-sense approaches and cutting-edge policies that Bethlehem’s government is uniquely positioned to implement, and it proposes a new Bethlehem Office of Sustainability to implement the next steps. When help is needed to achieve a goal, the CAP proposes strategic partnerships with stakeholders and lawmakers to catalyze action. This CAP is a roadmap, not an ordinance—it alone does not change city policies. Instead, it charts and prioritizes critical milestones along the path forward, and its success depends on the teamwork of its execution.

Success will also require building and maintaining community support, activating the necessary city staff and resources to guide implementation, identifying funding sources, and building partnerships. Success will take time, but logistical constraints must be weighed against the need for quickly reducing emissions to avoid the worst effects of climate change. Remediating historic environmental injustice and racism cannot wait. Equity, resiliency, and health are this CAP’s driving principles and the urgent needs of Bethlehem’s most at-risk and underserved communities.

To balance these factors while expediting progress, Bethlehem will implement this CAP in phases, the first being 2021 to 2022. The first phase will focus on a subset of strategies prioritized to create institutional accountability, build public support, promote equity and justice, and progress on community priorities.



Community Action Plan

PHASE 1 - 2021 to 2022*

- Establish CAP governance framework and create institutional accountability
- Improve data to track progress
- Build public support for the CAP
- Implement actions to achieve community priorities
- Act quickly to promote equity and justice
- Achieve “no-regrets” quick wins
- Lay the groundwork for bigger policy changes
- Protect the most vulnerable populations and infrastructure

* See the *Implementation Strategy* chapter for the full list of Phase I strategies



2

What is a Climate Action Plan?

This Climate Action Plan (CAP) is Bethlehem's comprehensive roadmap for addressing the local effects of climate change. This plan's purpose is to reduce Bethlehem's contribution to global climate change and prepare the city and the Lehigh Valley for the results of a changing climate.

The plan includes specific goals and mitigation strategies to reduce the greenhouse gas (GHG) emissions that Bethlehem contributes to climate change and proposed policies, programs, and partnerships to achieve the plan's targets. This plan also analyzes climate model projections under various global GHG emissions scenarios and assesses Bethlehem's public and infrastructure vulnerability under each. The plan's Adaptation and Resiliency section highlights strategies to reduce these vulnerabilities and prepare Bethlehem for various potential conditions.

In addition to GHG reduction and climate resilience, the CAP's initiatives will also produce a wide range of co-benefits to improve the city's overall health, safety, equity, and prosperity. This plan will help create cleaner air, jobs, and an improved quality of life for all, including communities of color and low-income residents. It will promote a more just and sustainable Bethlehem.

This CAP includes actions and goals for both the city's municipal operations and the community. The city government will lead by example, and all Bethlehem residents and businesses will play a role in helping the community prevent and prepare for the effects of climate change. This CAP leverages common-sense approaches and cutting-edge policies that the city government is uniquely positioned to implement, and when the City of Bethlehem alone cannot achieve a goal or strategy, the CAP proposes strategic partnerships with the stakeholders and lawmakers who can catalyze action. This CAP is a roadmap, not an ordinance—it alone does not change city policies. Instead, it charts and prioritizes critical milestones along the city's path forward, and its success depends on its execution. The CAP's implementation section includes the details and responsible parties for each step to ensure this success.

What is climate change?

Human-caused climate change results from the accumulation of GHG such as carbon dioxide (CO₂) and methane (CH₄) in Earth's atmosphere. Fossil fuels and land use changes are the primary sources of these gases. Other significant sources include waste disposal and industry processes, such as cement production.

The natural greenhouse effect is necessary for keeping the earth warm, but it is unnaturally accelerated by human-caused GHGs which trap excessive heat and radiation. Carbon emissions from human activities have risen in recent decades, reaching the highest rates in human history, and they are projected to continue to grow absent dramatic changes to the world's energy systems.

The Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment Report affirms that:

“**warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.**”

Highlights

Explore highlights of the National Climate Assessment including an Overview, the report's 12 overarching findings, and a summary of impacts by region.

[EXPLORE HIGHLIGHTS](#)

Full Report

Explore the entire report covering our changing climate, regions, cross sector topics, and response strategies in full detail.

[EXPLORE THE REPORT](#)

Facebook icon, Twitter icon

[The US National Climate Assessment Report](#) provides additional background about the science of climate change and its impacts in the United States.

3

Vision and Principles

Bethlehem is a city with a rich history, one that blossomed through its strong industrial heritage and has evolved into a diverse center of academic and cultural excellence. The city has continued to thrive and attract new generations of talented residents, drawn to the city's economic opportunities and proximity to nature. However, a rapidly changing climate requires establishing a new vision for Bethlehem as an equitable, prosperous, resilient, healthy, and inclusive city that takes actions to mitigate its contribution to climate change while increasing the preparedness for climate change effects. Bethlehem has a responsibility to take an approach to climate action based on science. This plan embraces the opportunity to ensure that the city remains vibrant and prosperous as it develops and implements innovative climate action approaches. This plan is rooted in the following principles:



Equitability

Climate change impacts are not equally distributed. People of color and low-income populations face increased exposure to climate effects and have limited capacity to adapt to climate change. All residents, regardless of socio-economic status, will have access to the benefits and opportunities outlined in this CAP. By taking an equity-centered approach to climate action, the city will aim to achieve environmental justice for its community members.



Prosperity

Climate change has been called the largest wealth-creation opportunity on the planet. According to the US Bureau of Labor Statistics, two of the three fastest-growing jobs in the US through 2029 will be solar installer and wind technician.¹ At the start of 2020, the clean energy industry already employed more than 3 million workers nationwide.² From renewable energy and green construction to sustainable tourism and urban agriculture, the strategies in this CAP support growing sectors that will provide Bethlehem's jobs of the future as the country accelerates the transition to a clean energy economy. The plan's climate

¹ <https://www.bls.gov/ooh/fastest-growing.htm>

² <https://e2.org/reports/clean-jobs-america-2020/>

protection measures reinvest in local infrastructure and the local economy. The actions in the plan also save energy, which saves money on energy bills, often providing the most benefit to low-income communities. This plan will bring Bethlehem a more prosperous future.



Resiliency

Bethlehem has proven itself to be resilient to economic challenges, a foundational approach now needed in response to climate change. Bethlehem will take action to prepare for chronic and acute climate impacts, to ensure that the city's buildings, infrastructure, and natural and human systems will be ready to quickly recover from projected climate effects.



Healthfulness

Protecting the health and well-being of city residents is a moral responsibility. Bethlehem will reduce fossil fuel use and waste to provide residents cleaner air, water, and environment.

Bethlehem's tree canopy, natural areas, and other green spaces will be protected and expanded to provide recreation opportunities, increase biodiversity, protect native species, reduce the urban heat island effect, and help clean the city's air and water. City residents will have access to local food through farmers markets and backyard gardens.



Inclusivity

Bethlehem's history of diversity and inclusion has long been a core strength. Opportunities to contribute to and implement the CAP's strategies are open to all Bethlehem residents, creating an inclusive plan that incorporates the entire community's needs and interests.



Science-based

Bethlehem's climate goals and actions are based on and will be updated according to the latest climate science.



A photograph of a park with a large tree, a paved path, and greenery. The path is made of cobblestones and leads towards a large tree with a thick trunk. The background is filled with lush green foliage and a clear sky. A yellow square with the number '4' is overlaid on the top left of the image.

4

Why Bethlehem Needs a Climate Action Plan

Introduction

Climate change presents an unprecedented challenge to humanity in the 21st century. It poses a serious threat not just to Bethlehem's natural resources but also to the community's jobs and health. Climate action also presents opportunities for creating a healthier, safer, and more equitable zero-carbon world. Bethlehem has an unparalleled opportunity to make changes in ways that create jobs and benefit all residents.

Scientists expect that with the current trends in fossil fuel use and increasing temperatures, Americans may see more intense heat waves, droughts, rainstorms, floods, wildfires, and landslides in the near future. Bethlehem is no exception. These impacts could drag down the city's economy, stress natural resources, and worsen community inequities. Action is required at all levels, and local governments such as the City of Bethlehem will have a unique role in building low-carbon communities.

Climate change is caused, in part, by the accumulation of greenhouse gases (GHG) such as carbon dioxide (CO₂) and methane (CH₄) in the atmosphere, primarily resulting from burning fossil fuels and land-use changes. Although the natural greenhouse effect is needed to keep the earth warm, a human-enhanced greenhouse effect with the rapid accumulation of GHG in the atmosphere leads to trapping too much heat at the Earth's surface. Carbon emissions from human activities have continued to rise in recent decades, reaching the highest rates in human history in recent decades. About half of all carbon dioxide emitted between 1750 and 2010 occurred in the last 40 years. With the current trajectory of population growth, urbanization, and reliance on personal vehicles, emissions will only continue to rise unless we make significant changes to how we generate and use energy, manage land, and travel. Given the critical impacts of climate change on humanity, the time to act to reduce GHGs and the city's carbon footprint is now.

CLIMATE VERSUS WEATHER

Weather describes current conditions at a given location.

Climate is a statistical average of conditions over 20 to 30 years or more.

Bethlehem's Current Climate Trends

Climate change is already affecting Bethlehem's weather. Temperatures observed at the Lehigh Valley International Airport³ indicate that the Lehigh Valley has experienced an increase of 0.4°F per decade from 1925 to 2019, which translates roughly to a 3.8°F increase in annual temperatures over the past 100 years (see Figure 1).⁴ From 1925–2019, the difference between maximum and minimum temperatures has declined in the summer months, with maximum temperatures increasing by 3.3°F and minimum temperatures increasing by 5°F. This trend is concerning because nighttime cooling allows the human body to recover during extreme heat events and the lack of it can lead to heat-induced illness and fatalities.

According to the National Oceanic and Atmospheric Administration (NOAA), there has been an increase of 0.6 inches of annual precipitation per decade in the Lehigh Valley since 1912, which indicates an increase of 5.9 inches over the past century (Figure 1, right panel). Over the last 50 years, the Northeastern US has experienced some of the greatest increase in heavy precipitation compared to the rest of the country (see Figure 2).⁵ This is consistent with the understanding that warmer air can hold more water than cooler air, allowing for heavier precipitation events and potentially more powerful thunderstorms. Climate change may also contribute to more variability in year-to-year weather.

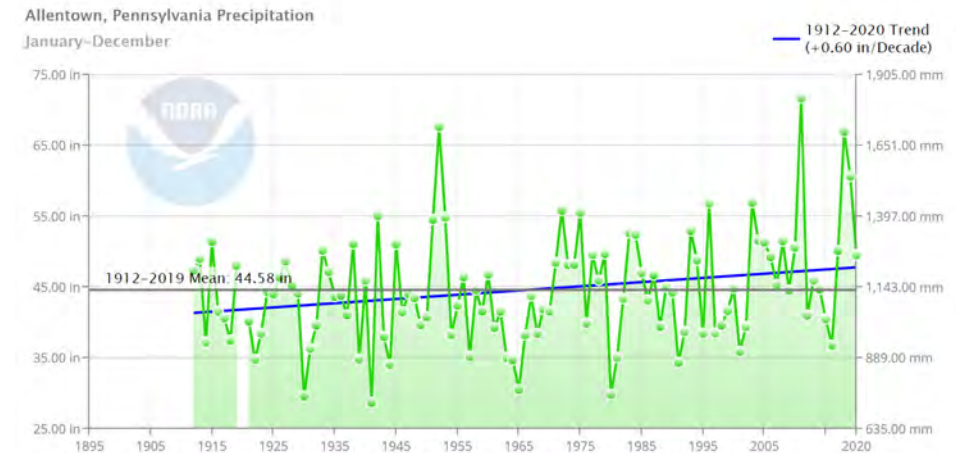
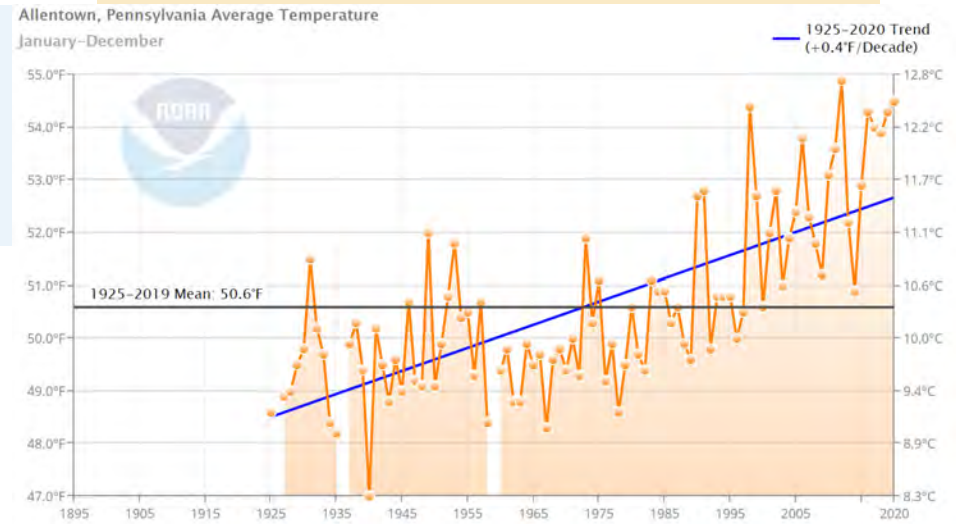


Figure 1. Annual average temperature and precipitation for Allentown, Pennsylvania (NOAA NCDC)

³ https://www.ncdc.noaa.gov/cag/city/time-series/USH00360106/pcp/ann/6/1895-2020?base_prd=true&begbaseyear=1901&endbaseyear=2019&trend=true&trendbase=10&begtrendyear=1895&endtrendyear=2020

⁴ The NOAA NCDC city time series suggests that annual minimum temperatures have increased by 4.1 F, annual maximum temperatures have increased by 3.6 F, and annual average temperatures have increased by 3.8 F. Minimum temperatures rising at a faster rate than maximum temperatures is consistent with trends observed in many locations around the world. However, the decadal trend presents 0.4 F for all temperature analysis.

⁵ USGCRP Indicators 2018

Changes in many extreme weather and climate events have been observed across the US and globally in recent decades.⁶ Some of these changes have been linked to human influence on the climate, including a decrease in extremely cold temperatures, and increases in extremely warm temperatures, sea level rises, and heavy precipitation events. Historically, the City of Bethlehem experiences a range of weather events throughout the year, including winter storms, severe flooding, thunderstorms, and hurricanes. Over the past decade, there were 14 storm events that were recorded in the NOAA Storm Event Database for the City of Bethlehem. Of these events, three of the four flash floods reported property damage totaling \$350,000. There were also five FEMA Disaster Declarations that included Lehigh and/or Northampton counties.

Figure 2. Declared storm events (2010–2020) affecting Bethlehem.

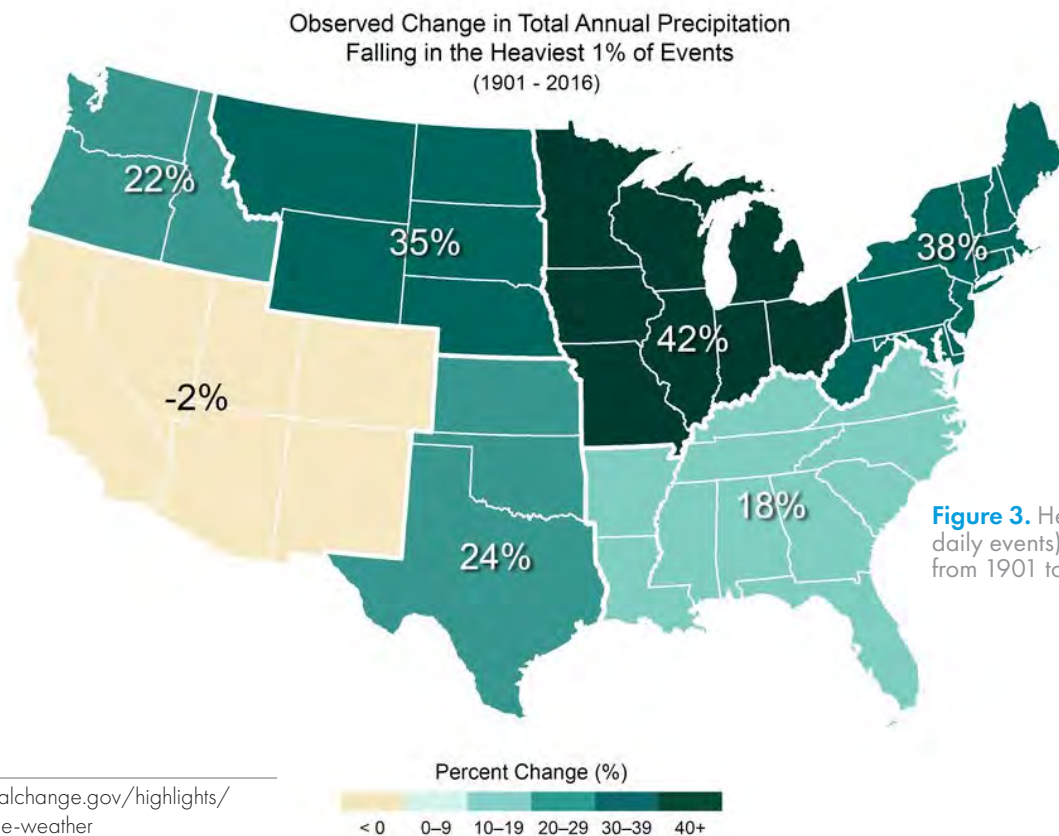
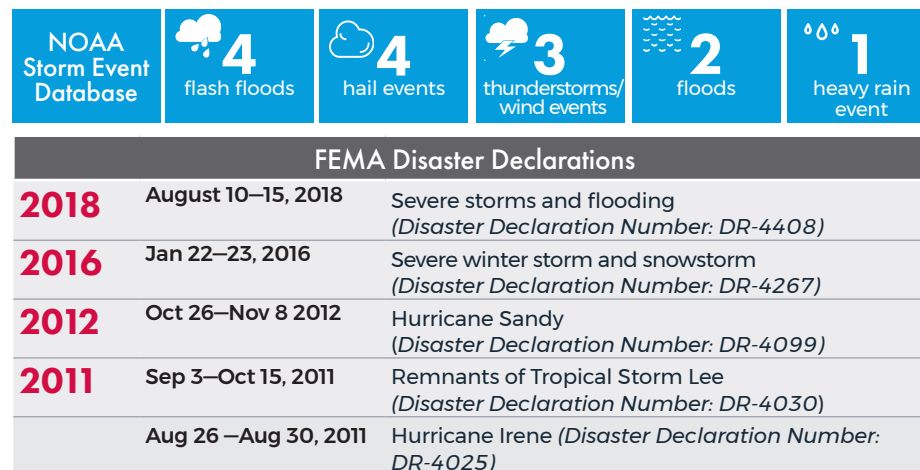


Figure 3. Heaviest precipitation days (i.e., the top 1% of daily events) has been increasing across most of the country from 1901 to 2016. (Source: USGCRP Indicators 2018)

⁶ <https://nca2014.globalchange.gov/highlights/report-findings/extreme-weather>

Projecting Bethlehem's Future Climate

To assess the potential future impacts of climate change on Bethlehem, the Bethlehem CAP team compared the results of daily temperature and precipitation projections from 26 climate models that have been analyzed for three future periods of 2025–2049 (near-term), 2050–2074 (mid-century), 2075–2099 (end-of-century) to a baseline period of 1971–2000.⁷ The climate models simulate two future conditions:

1. A “moderate” warming future scenario where global GHG emissions peak around 2040 and then, through effective climate policies, stabilize atmospheric concentrations at around 540 parts per million (ppm) by 2100
2. A “high” future warming scenario where GHG concentrations continue to increase, rapidly reaching about 940 ppm by 2100.⁸

The terms “moderate” and “high” are used by climate scientists for modeling, but they do not capture the scale and severity of negative consequences for communities and ecosystems across the globe. Both of these scenarios present unprecedented speeds of temperature increase for the planet. Global average atmospheric CO₂ levels have increased by roughly 2.3 ppm per year over the last decade and in 2020 exceeded 410 ppm.⁹ The last time the atmospheric CO₂ levels

⁷ The historic data is based on the observational data provided by Livneh et al (2015). (Livneh, B., T. J. Bohn, D. W. Pierce, F. Munoz-Arriola, B. Nijssen, R. Vose, D. R. Cayan, and L. Brekke, 2015: A spatially comprehensive, hydrometeorological data set for Mexico, the US, and Southern Canada 1950-2013. Scientific Data, v. 2, article 150042 (2015). doi:10.1038/sdata.2015.42)

⁸ <https://www.climatechangeinaustralia.gov.au/en/climate-campus/modelling-and-projections/projecting-future-climate/greenhouse-gas-scenarios/> The moderate future warming scenario is RCP4.5 and high future warming scenario is RCP8.5 (see Appendix 5 for more details).

⁹ <https://www.esrl.noaa.gov/gmd/ccgg/trends/>

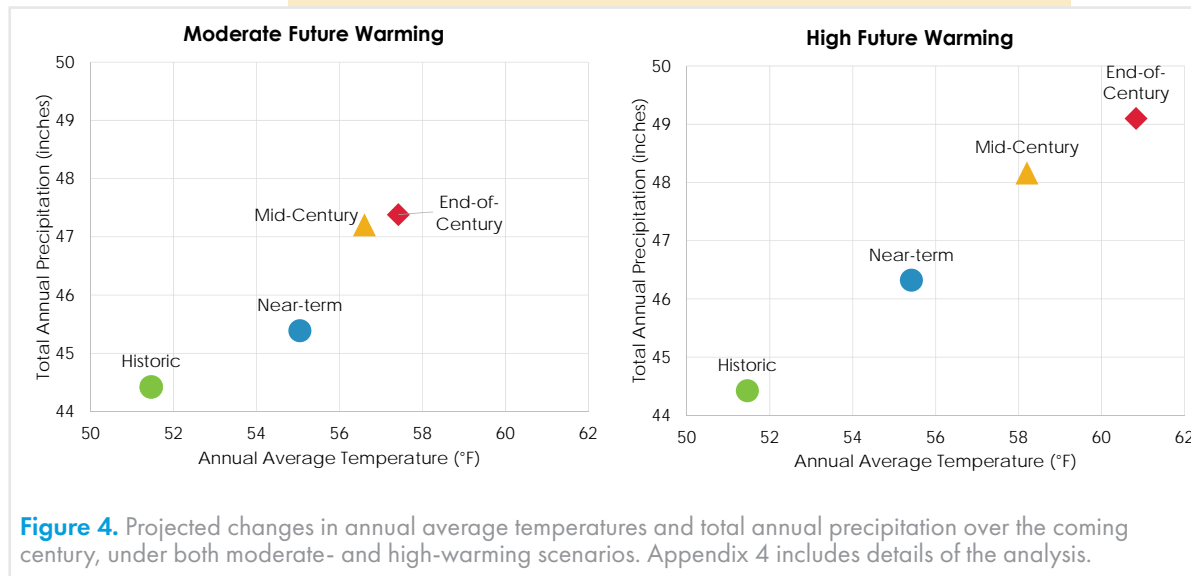


Figure 4. Projected changes in annual average temperatures and total annual precipitation over the coming century, under both moderate- and high-warming scenarios. Appendix 4 includes details of the analysis.

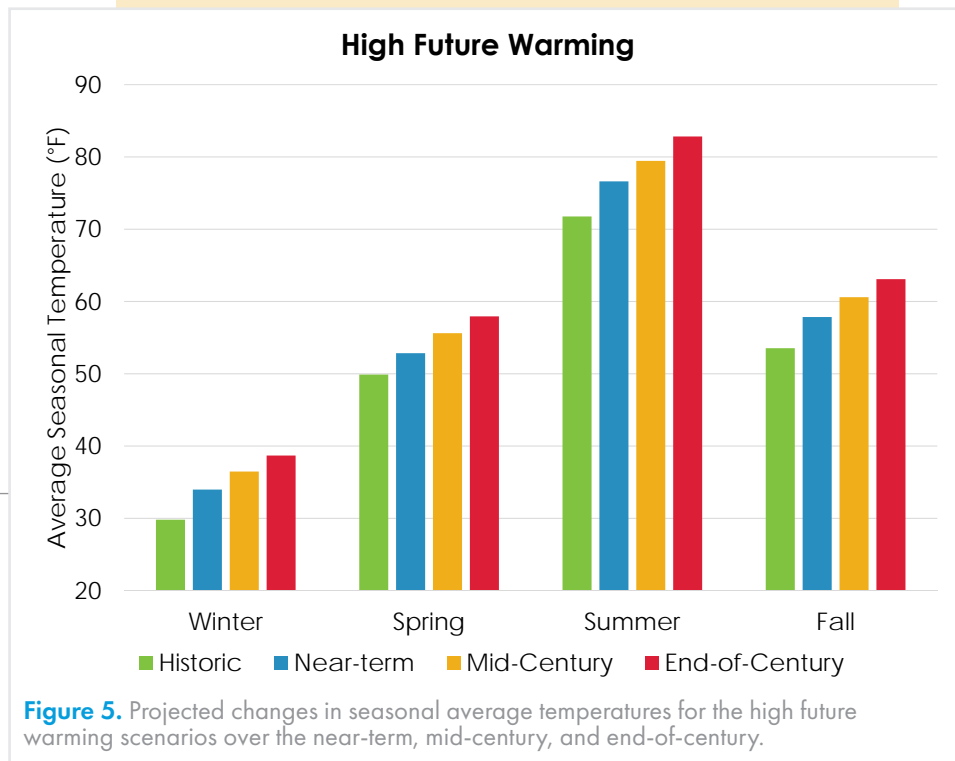


Figure 5. Projected changes in seasonal average temperatures for the high future warming scenarios over the near-term, mid-century, and end-of-century.

were this high was more than three million years ago, when temperatures were 2°-3°C (3.6°-5.4°F) higher than during the pre-industrial era, and sea level was 50–80 feet higher than today.¹⁰

The IPCC estimates that atmospheric levels of CO₂ must be lower than 2016 levels by the end of the century to stabilize average global temperature increases to 1.5°C, the aspirational goal of the Paris Agreement on climate change.¹¹ Neither the moderate nor the high future warming scenario analyzed below would hold global temperatures to the Paris Agreement's objectives. They are analyzed to illustrate the possible climate outcomes Bethlehem can expect without aggressive action.

Annual changes

Bethlehem's annual averages are expected to become warmer and wetter over the coming century (see Figure 4). By the end of the century, the annual temperatures are projected to increase by 6°F for the moderate future warming and by over 9°F for the high future warming scenario. These projected increases represent a greater temperature rise compared to the observed warming trend over the past century, leading to annual average temperatures similar to those experienced today in Richmond, Virginia.¹² Total annual precipitation is projected to increase close to 3 inches under the moderate warming scenario and close to 5 inches under the high warming scenario, although total annual precipitation can vary significantly year-to-year.

Seasonal temperatures

Bethlehem's average seasonal temperatures are also expected to increase (see Figure 5). The projected warming is most notable during the summer. The high future warming scenario forecasts average summer temperatures in year 2050 to exceed the hot summers that Bethlehem currently experiences.

¹⁰<https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>

¹¹https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter2_Low_Res.pdf (2.2.1)

¹²https://www.ncdc.noaa.gov/cag/city/time-series/USW00013740/tavg/12/12/1895-2020?base_prd=true&begbaseyear=1971&endbaseyear=2000&trend=true&trend_base=10&begtrendyear=1895&endtrendyear=2020

Extreme heat

The number of days above 90°F in Bethlehem are expected to increase from the current average of 12 days per year to 36 to 39 days in the near-term and 50 to 83 days at the end of the century under the moderate and high future warming scenario, respectively (see Figure 6). Hot days are also beginning to extend from the summer months into the spring and fall months.

Under the high future warming scenario, Bethlehem is projected to experience at least one day of maximum temperatures reaching 105°F by mid-century and five days by end-of-century. It is important to note that these projections are averages over 25-year periods and do not show year-to-year variability that may occur within the time period. As a result, a specific year within the end-of-century period (2075–2099) may experience significantly more hot days, while another year may only experience a modest increase. Extreme summer heat can stress human health, increase energy demand, damage sensitive infrastructure, and reduce water availability. The Lehigh Valley Hazard Mitigation Plan (2018) notes that extreme heat is responsible for more deaths in the state than all other natural disasters combined.

Monthly precipitation

Under the moderate and high warming scenarios and across all time periods (near-term, mid-century and end-of-century), monthly precipitation totals in Bethlehem are expected to decrease during the summer months due to higher surface temperatures that will reduce soil moisture and contribute to drought conditions when they occur. Overall, winter months are expected to experience an increase in precipitation, though this may be in the form of rain instead of snow due to temperature increases. The Pennsylvania Climate Impacts Assessment Update (2015) suggests that the likelihood of certain kinds of drought will decrease over the coming century.

Heavy precipitation events

Heavy precipitation events are expected to increase in number and size across the country and in Bethlehem, which can lead to flooding. Overall, this means extreme 24-hour precipitation events will become heavier. For example, historically, Bethlehem's heaviest 24-hour precipitation that has occurred every other year is 2.91 inches. Under the high future warming scenario, this same event will increase to 3.20 inches by end-of-century. Under both moderate and high future warming, heavy precipitation events that have occurred once every 50 years on average (or have a 2% chance of occurring in any given year) are projected to occur twice as often in the near term (once every 25 years or have a 4% chance of occurring in any given year). Once-in-100-year precipitation events (those with a 1% chance of occurring in any given year) will happen every 50 years, and the new once-in-100-year events will include more than two additional inches of precipitation.

The Lehigh Valley Hazard Mitigation Plan (2018) suggests that flooding events are generally the result of excessive precipitation.¹³ Urban areas, such as Bethlehem, are more prone to flash flooding because of the number of impervious surfaces that contribute to higher runoff of water and ponding in areas with poor drainage. Overall, changes in precipitation and/or heavy events can affect water quality, flooding of streets, property, and infrastructure, and affect the integrity of the built environment.

¹³ General flooding occurs when a river basin experiences precipitation over a long enough period of time and flash flooding occurs in response to heavy precipitation within a short time period.

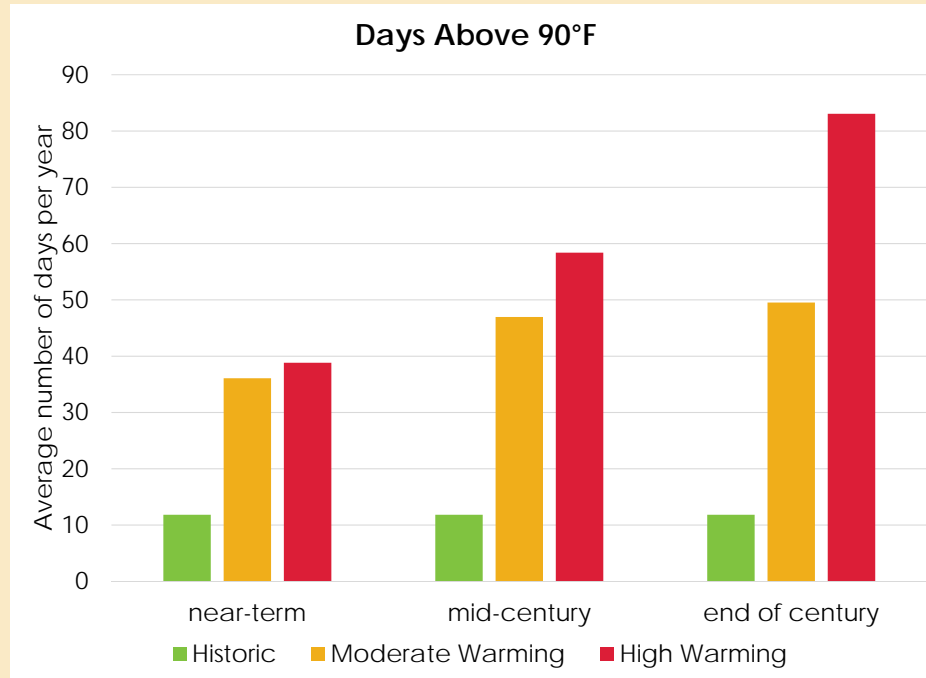
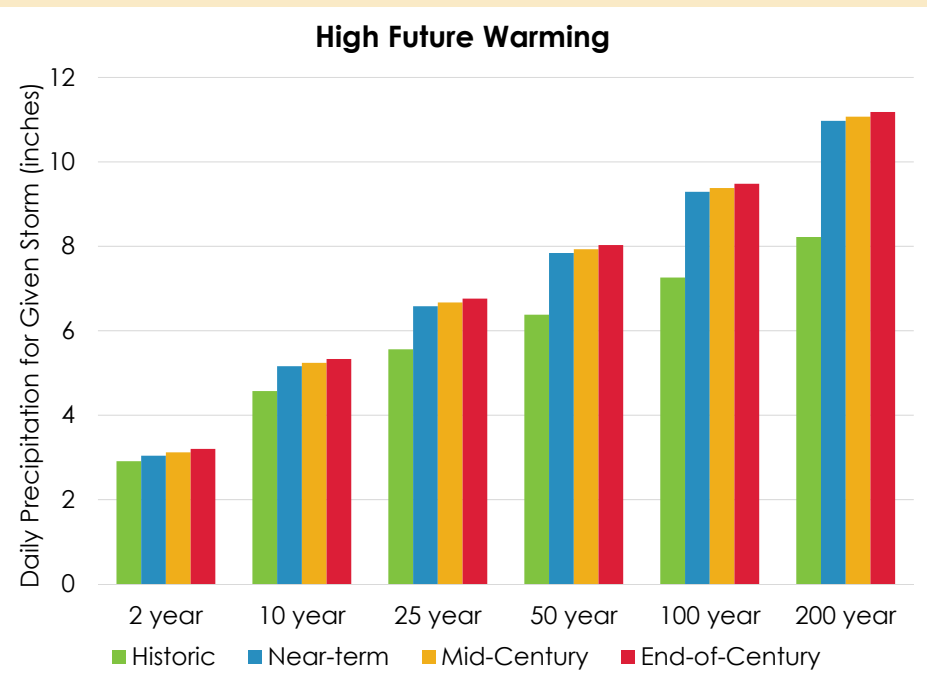


Figure 6. The number of days per year above 90°F based on historic data, the moderate future warming scenario (RCP4.5) and the high future warming scenario (RCP8.5). (See Appendix 4 for more details and other heat variables.)

Figure 7. The expected daily precipitation for storms of different likelihoods in the high future warming scenario compared with the historic data. The storm events are measured as how often that level of precipitation is expected in Bethlehem. The historical once-in-50-year precipitation event is expected to become the once-in-25-year event.



Climate Vulnerabilities

The CAP development team, including the CAP Working Group, assessed Bethlehem's vulnerabilities to extreme heat, drought, heavy precipitation, and flooding, rising average temperatures, and increases in total precipitation. The assessment considered impacts on vulnerable and general populations and infrastructure in the following sectors: buildings, communications, energy, transportation, stormwater management, wastewater management, and water supply and treatment. *Appendix 1A* summarizes vulnerability impacts. The impacts are wide-ranging and serious. Community risks include:

- Increased mortality and medical costs from heat-related health impacts such as heat stroke, dehydration, cardiovascular, respiratory, and cerebrovascular disease
- Reduced ability to be active outside as extreme heat increases, which contributes to obesity problems and other indirect health problems while threatening the livelihoods and safety of outdoor workers
- Increased costs for road maintenance, traffic disruptions, and lower quality roadway surfaces as paving materials expand and buckle under extreme heat
- Adverse water quality as extreme heat increases the potential for algal blooms and other waterborne pathogens in the water system
- Higher electricity prices and risk of brownouts/backouts as extreme temperatures stress electricity supply and production
- Increased costs and dangerous conditions created by the flooding of roads, buildings, and other infrastructure
- Mold and increasing repair costs for homeowners due to flood damage

This is a small sample of the complete list of climate vulnerabilities and impacts in *Appendix 1A*. These impacts are the basis for the adaptation strategies included in the *Adaptation and Resilience Strategy* chapters of the plan.



UNDERSTANDING HEAVY PRECIPITATION EVENTS

The amount of precipitation received during a heavy storm event is projected to increase during storms that occur more often (two-year, ten-year) and storms that rarely occur (100-year, 200-year). [Figure 7](#) presents the increase in daily precipitation totals that are expected to occur for frequent to rarer events. The two-year event is the amount of storm event precipitation that has the probability of occurring every other year. In contrast, a 100-year event is an event that has the probability of occurring once every 100 years. However, since the probability of such an event is 1% in any given year, it is possible that a 100-year event could occur in consecutive years or twice in one year.

Analyzing how precipitation may change in future storms can inform infrastructure and housing design, including whether the current design standards will be adequate to handle future conditions, identifying potential drainage concerns, and serve as input for modeling the impact of future floods.

Community hazard mapping

In the lead up to and following the second public CAP planning meeting, the CAP development team asked Bethlehem residents to help identify climate-related hazards and impacts in their neighborhoods and community, such as extreme heat and flooding. Members of the community added 49 pins to the Bethlehem community hazard map identifying locations within Bethlehem with hazards from high temperatures, such as public places lacking shade or insufficient access to air conditioning, roadways or building flooding, and other climate-related impacts. These hazards identified by the community are described in detail in *Appendix 1B*. The map below shows a snapshot of the community map.

The hazards identified on the community map will help prioritize and focus the implementation of the strategies identified in the CAP's Adaptation chapters. The full list of geographic-specific hazards identified by the community is included in *Appendix 1B*.

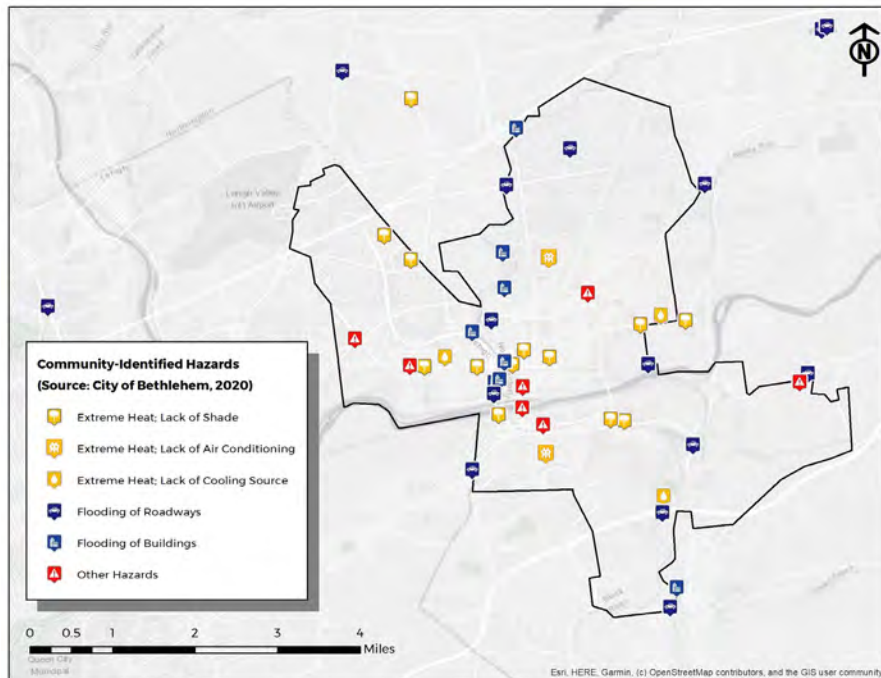


Figure 8. Snapshot of Bethlehem Community Hazard Map created to identify locations of climate-related hazards for the Bethlehem CAP development process.

Frontline communities

Climate change will disproportionately affect Bethlehem's frontline communities, including people of color, low-income residents, and those with existing health conditions. These communities often face the highest flooding risks, local temperatures, and local pollution concentrations. Many in these communities are also suffering disproportionately from the COVID-19 pandemic. Research has found long-term exposure to air pollution increases the risk of dying from COVID-19.¹⁴

Studies also link exposure to air pollution, such as particulate matter (PM), with numerous chronic health challenges and increased mortality. Temperature extremes can worsen many of these chronic conditions, including cardiovascular, respiratory, and cerebrovascular disease and diabetes-related conditions. Frontline communities often have the fewest resources to mitigate the heat. Their housing is often farther from parks and urban green space, they more often take public transit (which includes greater exposure to heat waves), they are less likely to have the financial resources for adequate air conditioning and insulation, and they pay a higher percentage of their monthly budget on energy. Frontline communities are similarly less financially prepared to recover from flood damages despite facing greater risks. This can lead to mold and secondary health impacts.

In summary, Bethlehem's highest-risk populations face the most severe impacts and have the fewest resources to mitigate them. A more detailed list of climate impacts and vulnerabilities for frontline communities is included in the "At-risk Populations" rows of the climate impacts table in *Appendix 1A*. The following maps illustrate the disproportionate spatial distribution of vulnerabilities and the overlap with frontline communities.

¹⁴<https://www.medrxiv.org/content/medrxiv/early/2020/04/27/2020.04.05.20054502.full.pdf>

Social vulnerability

Social vulnerability refers to populations that are particularly vulnerable to adverse impacts and health problems due to natural disasters, human-made disasters, climate change, and extreme weather. The Geospatial Research, Analysis, and Services Program (GRASP) within the CDC created the Social Vulnerability Index (SVI) to help flag areas that will be in greatest need of support and recovery assistance in the case of a disaster or extreme weather event. The index comprises four categories of vulnerability—socioeconomic status, household composition and disability, minority status and language, and housing and transportation.

Bethlehem's areas of highest social vulnerability level are concentrated on the South Side and the far east and west sides. These areas with the most vulnerable populations overlap significantly with climate hazards, as illustrated by [Figures 10, 11, and 12](#).

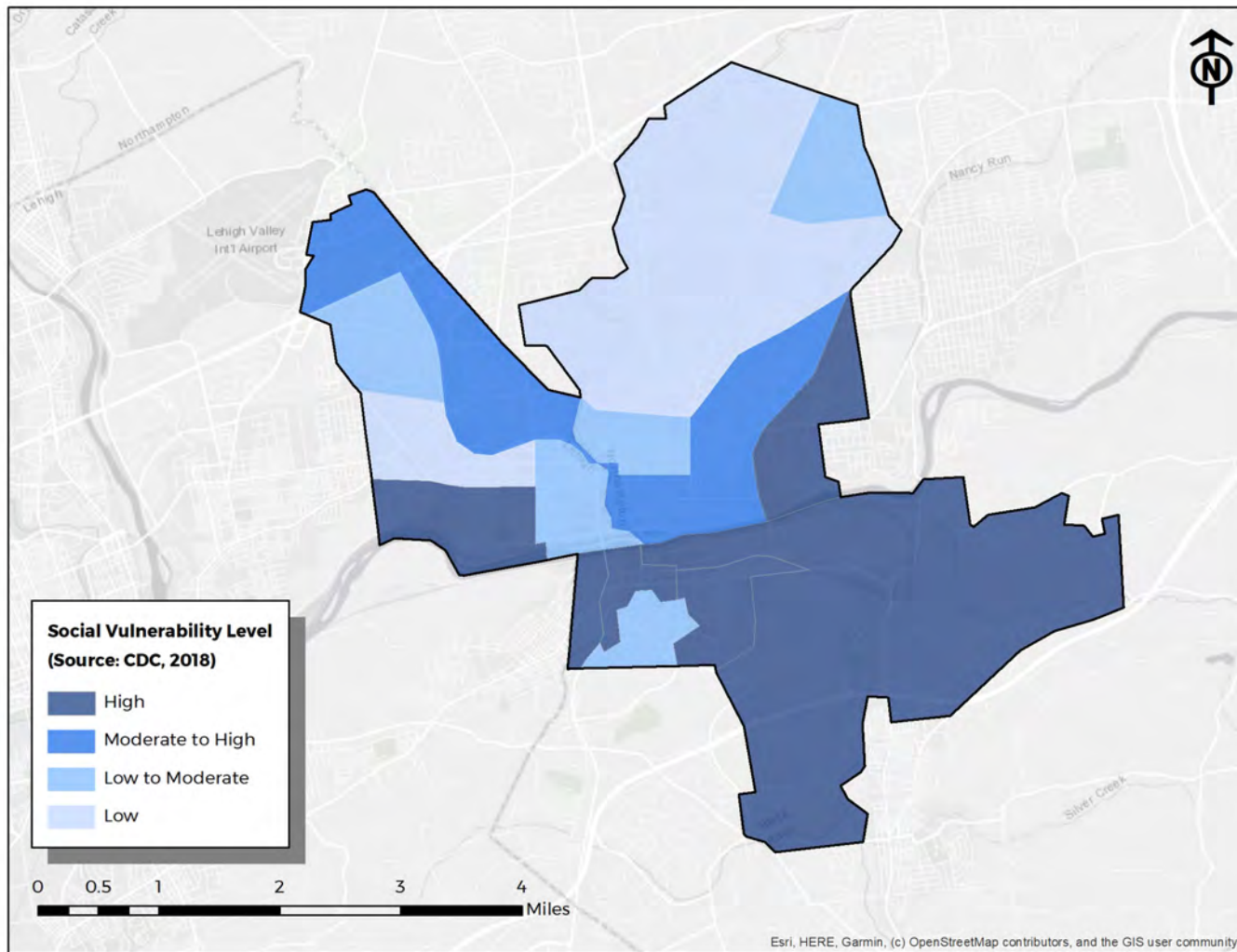


Figure 9. Map of the Social Vulnerability Index (SVI) in Bethlehem as of 2018. Map from PolicyMap.com.

WHAT ARE FRONTLINE COMMUNITIES?

Frontline communities are those that experience “first and worst” the consequences of climate change.

They are those historically harmed by the energy system, and are most often are indigenous communities, communities of color, and low-income populations. There is not a single universally accepted definition or quantifiable threshold to identify frontline communities. In coordination with community stakeholders and the best available science, the City will need to adopt a transparent and functional definition for the purposes of this CAP, which can be iteratively updated over time.¹⁵

¹⁵<https://ecotrust.org/centering-frontline-communities/> and <https://iejusa.org/section-1-defining-energy-justice/>

Urban heat island severity

Federal statistics over 30 years show extreme heat is the leading cause of weather-related deaths in the United States. Extreme heat worsened by urban heat islands can increase respiratory difficulties, heat exhaustion, and heatstroke. These heat impacts significantly affect the most vulnerable—children, the elderly, and those with preexisting conditions. The map above shows where certain areas of Bethlehem are hotter than Bethlehem's average temperature. Urban heat islands are often concentrated in the densest developments of a city that also lack greenery because concrete and asphalt structures (such as buildings, roads, and other infrastructure) absorb and re-emit the sun's heat more than natural landscapes (such as forests and water bodies). The map below shows severity measured on a scale of 1 to 5, with 1 being a relatively mild heat area (slightly above the city's mean) and 5 being a severe heat area (significantly above the city's mean).

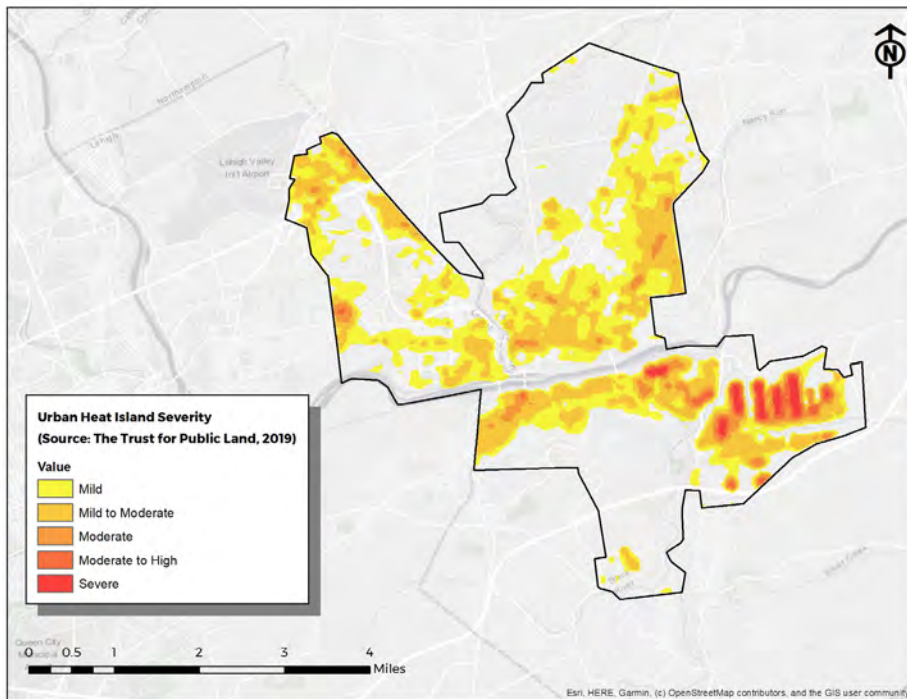


Figure 10. Map of urban heat island severity on Bethlehem as of 2018. Colored areas of the map have temperatures higher than the city average, with darker colors indicating more severe temperatures. Map from The Trust for Public Land.

Park accessibility

Parks and urban green space can help mitigate the urban heat island effect and reduce stormwater runoff and flooding during severe precipitation events. The Trust for Public Land estimates that 17,710 Bethlehem residents are outside a 10-minute walk to a park (Figure 11). Several areas with the highest need for parks overlap with areas of highest social vulnerability.

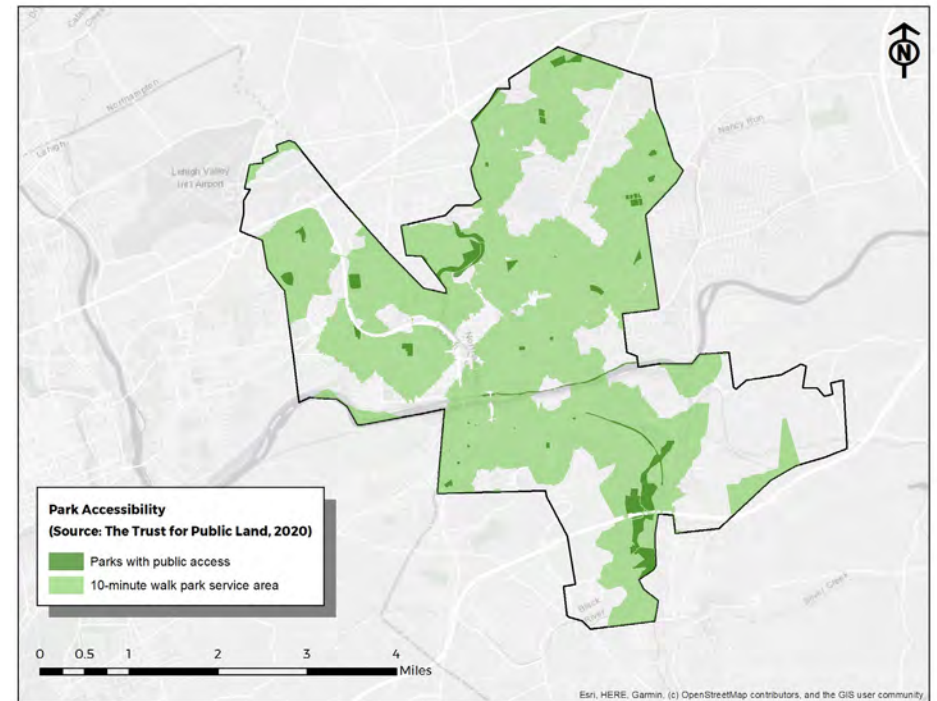


Figure 11. Map of park accessibility and park need in Bethlehem as of 2018 map from The Trust for Public Land.

Flooding

The Lehigh Valley Bi-county Hazard Mitigation Plan recognizes flooding as the most significant natural hazard in the Lehigh Valley. According to FEMA flood maps, 0.55 square miles of Bethlehem (or 3.8% of the city) are located in areas with a 1-in-100 chance of flood inundation each year, while 4% of the city lies in areas with a 1-in-500 chance of flood inundation each year. The estimated population vulnerable in these areas is 74 and 193 residents (respectively). The areas also include numerous local businesses and sites used by Bethlehem's iconic festivals, such as Musikfest. Some non-governmental organizations, such as First Street Foundation, have created models that project a more significant number of residents could be exposed to flooding as climate change progresses. Bethlehem's flood-prone areas are concentrated along Monocacy Creek and the Lehigh River (see Figure 12). Flood planning and mitigation needs to account for differences in riverine and flash flooding. Flash flooding is more of a hazard for the smaller tributaries and with heavy precipitation events increases could be more frequent. They are harder to forecast and can be more erosive and deadly.

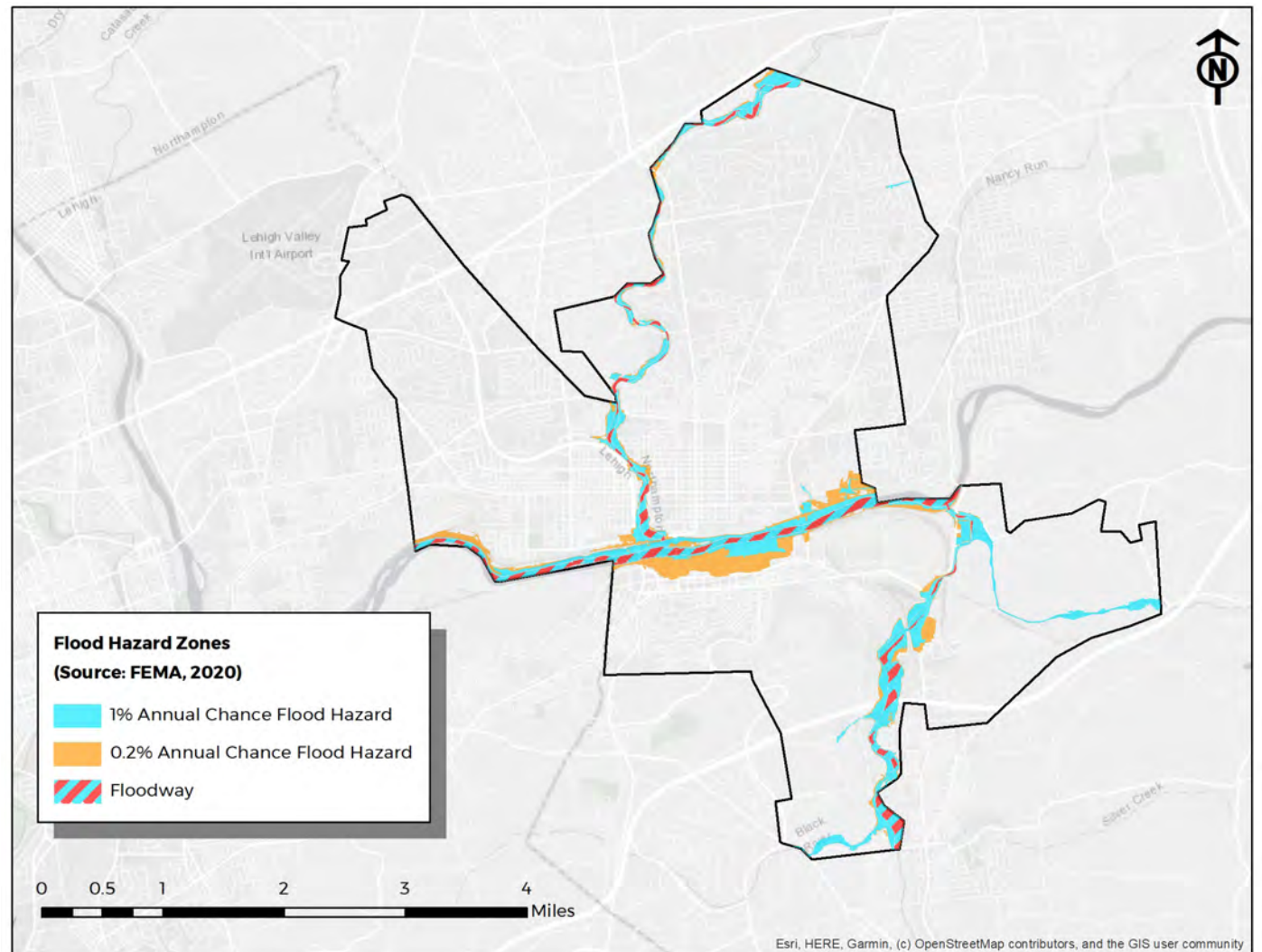


Figure 12. Section of FEMA flood map in Bethlehem. Blue colors indicate the 100-year flood area, while orange areas indicate the 500-year flood area.

The City of Bethlehem has a long history of supporting climate action, dating back 15 years. From 2005 to 2017 the city successfully reduced municipal GHG emissions 38%.





5

Plan Development Process and Timeline

Background

The City of Bethlehem has a long history of supporting climate action and leading by example. In 2006, Bethlehem Mayor John B. Callahan joined the mayoral administrations of Easton and Allentown in signing the Three-City Proclamation, which endorsed *US Conference of Mayors' Climate Protection Agreement*. More recently, Mayor Robert J. Donchez and the city council have committed Bethlehem to the *Global Covenant of Mayors for Climate and Energy*, the *We Are Still In* initiative, the *Sierra Club's Mayors For 100% Clean Energy*, and the *Mayors National Climate Action Agenda*. During that time, the city government has implemented numerous greenhouse gas reduction initiatives, ranging from energy efficiency to renewable energy purchasing, which have reduced municipal GHG emissions 38% from 2005 to 2017.

In February 2017, Bethlehem City Council unanimously passed a resolution endorsing the creation of a Climate Action Plan. The resolution established a Climate Action Group of stakeholders to help advance the city toward developing a plan. It further affirmed, "City Council is committed to doing its part to fight climate change and believes that local government, working collaboratively with interested citizens and community stakeholders, should lead by example by adopting energy conservation, sustainability, and other environmentally-sensitive operating practices."

In June 2019, Mayor Donchez's administration, through the Department of Public Works, issued a request for proposals (RFP) for the preparation of a climate action plan to serve as a comprehensive strategy for addressing climate change in Bethlehem, identifying targeted policies, programs, and projects that will both mitigate the city's contribution to climate change and prepare for its impacts, such as increases in temperature and precipitation. WSP, a global engineering and design firm, with offices in Bethlehem, and science-based community center Nurture Nature Center (NNC), located in Easton, were selected as consultants to manage the development of the CAP with input from Bethlehem's public and

stakeholders, including the Bethlehem Environmental Advisory Council (EAC) and Councilman J. William Reynolds (who played critical roles in developing the CAP initiative).

Engagement approach

This Bethlehem Climate Action Plan is the result of a collaborative planning approach. Over 10 months, hundreds of Bethlehem community members, businesses, and other stakeholders participated in developing the plan via meetings, surveys, working groups, draft comments, and spreading the word about the plan and projected climate impacts in Bethlehem.

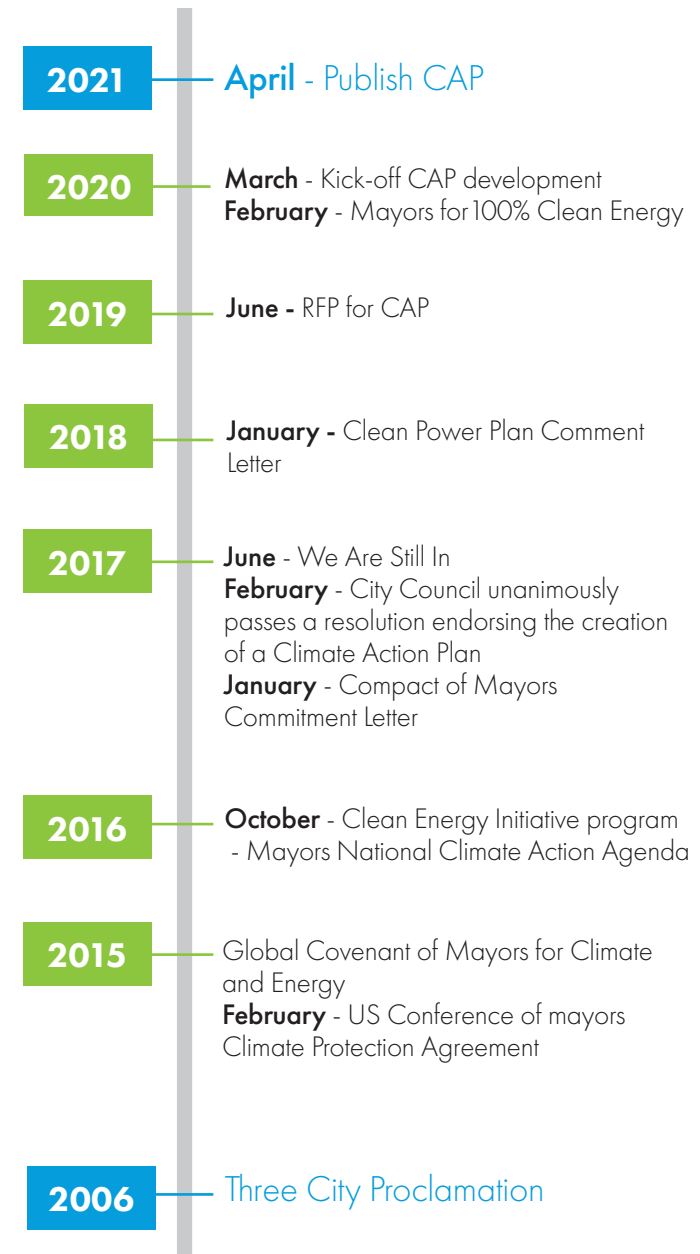
The principles of equity, inclusion, and appreciative inquiry guided the plan's public engagement and participation process. Equity and inclusion require that all community sectors, regardless of background, resources, access, and previous political participation, will have opportunities for engagement and input into the process. The CAP development team utilized multiple strategies for input, including allowing for online or written feedback as well as live meeting participation. Due to the COVID-19 pandemic, the originally planned in-person meetings were adapted to a virtual environment. These virtual sessions occurred at times that accommodated a variety of working schedules. Further, to include Spanish-speaking populations, meeting announcements and minutes were produced in English and Spanish and written and online feedback in both languages were accepted.

Transparency was another key principle maintained through the engagement process. All public meeting attendees and stakeholder participants were briefed on the process, past work, current status, and objectives. A webpage providing plan updates, notes, recordings, and resources was developed and hosted on the city's website. Further, valuing participants' time and input was a critical aim, with multiple means for providing input through surveys, mapping exercise, chat, email, interviews, and facilitated dialogue during meetings.

The objectives of this stakeholder engagement process were:

1. to provide opportunities for stakeholders to participate in the CAP development process, and
2. to enhance the development of the CAP itself to incorporate the details and considerations from a diverse and representative group of Bethlehem stakeholders.

Timeline of Sustainability Initiatives



Leveraging Nurture Nature Center’s approach to facilitating equitable dialogue between residents and policy-makers (using a model known as From Risk to Resiliency), this planning process prioritized discussion and collecting diverse ideas over a need for consensus. The Risk to Resiliency dialogue model was built with appreciative inquiry at its core. Appreciative inquiry calls upon participants to reflect on the strengths and assets available within the community to shape and reach shared goals. As a planning tool, appreciative inquiry practices can help stakeholders identify common goals and strategies for reaching those goals. Appreciative inquiry was employed during the facilitated discussion to focus on strengths and move participants toward a shared vision through goal setting.

The CAP engagement strategy reflected a triple-bottom-line approach to climate mitigation that supports all residents’ health and well-being, responsible stewardship of the natural and built environment, and long-term economic growth. A public health and equity perspective informed all outreach and engagement and is an organizing and unifying concept that resonates positively with most stakeholders—particularly underserved communities that historically have been excluded from critical government decision-making processes and the community-based organizations that represent their interests. Also, the approach looks at GHG mitigation as an integrated system, rather than through more traditional divisions between, for example, energy, natural resources, public health, land use, transportation, and water. This approach provides a forum for stakeholders that otherwise might not coordinate to tackle problems bigger than their individual missions, collectively reinforcing CAP objectives.

CAP Stakeholder Working Group

At the beginning of the process, the CAP development team convened the Bethlehem Climate Action Plan Working Group (CAP WG) consisting of representatives from organizations selected to ensure participation and feedback from Bethlehem’s diverse general public as well as large institutions and other stakeholders anticipated to be critical to implementing recommended actions in the CAP. Members included representatives from city government, transportation authorities, utilities, universities, regional planners, corporate and industrial stakeholders, Bethlehem Area School District, sustainability-focused non-profit organizations, community-focused non-profit organizations, and citizen groups.

The CAP WG played a crucial role in both developing the CAP’s content and engaging the general public. Throughout the development process, working group members engaged their networks and encouraged city residents

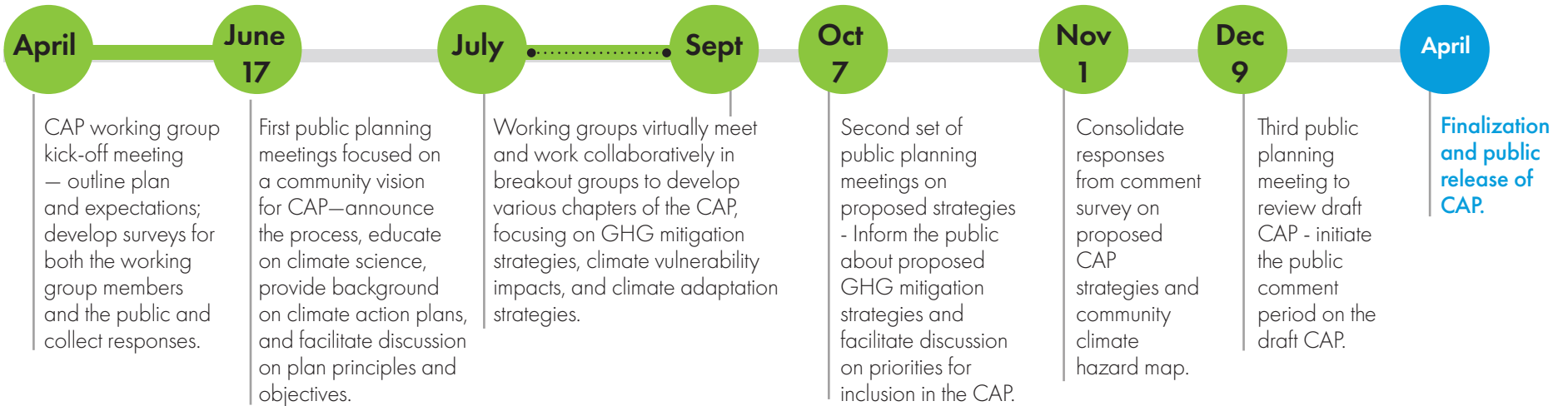


Figure 13. Logos of organizations and stakeholders that participated in the CAP Working Group.

Timeline

2020

2021



and businesses to participate in public meetings. Members also devised and reviewed strategies and policies to achieve targets, identified barriers and solutions to implementing strategies, and helped gather resources for implementation and sustaining effort following the CAP's release. During the strategy and goal development process, the overall CAP WG divided into smaller breakout working groups consisting of topic specialists focused on developing the individual GHG mitigation chapters of the plan: Buildings, Electricity Sourcing, Transportation and Mobility; Land Use and Green Space, Local Food and Waste, Public Engagement, and Large Organizations and Institutions. The CAP development team developed the Municipal Operations chapter in coordination with the city's Public Works Department. All CAP WG members then reviewed the content developed by each breakout group.

For the plan's Adaptation and Resilience chapters, the CAP development team created a list of climate stressors and impacts based on analyses of 26 climate models to represent future conditions in Bethlehem. The full CAP WG reviewed identified impacts and vulnerabilities, adding details on the consequences to the community. The reviewers provided recent examples of the impacts, such as damages from flooding, developed a summary of at-risk assets and populations and assessed emerging or new impacts that could occur if

conditions substantially worsen.

Based on this vulnerability assessment, the CAP development team identified possible adaptation strategies that the City of Bethlehem and other relevant public agencies may take to improve the city's resilience to climate-related risks. The team identified strategies by researching available region-specific climate action plans and WSP's past experience advising public sector agencies on how to adapt to climate risk. The strategies themselves also underwent extensive stakeholder review, including a CAP stakeholder meeting to gather feedback on the proposed strategies and further written feedback following the meeting. The full CAP WG reviewed and expanded the strategy list, assigning priority levels, and responsibilities for implementation.

Like the overall engagement approach, the principles of diversity, equity, and inclusion drove the CAP WG facilitation. The original CAP working group expanded from 28 individuals to 62 after the group discussed these principles and took steps to increase the diversity of voices. The CAP WG also established an Environmental Justice and Equity Steering Committee to guide the plan's development of inclusion and equity. Throughout the drafting process, the CAP Working Group members received summaries of public feedback from meetings and incorporated public input and sentiment into the plan.

338
survey
responses

Impact

Total survey responses

- Initial Working Group Survey: 20 responses
- Initial Community Survey: 216 responses
- Mitigation Strategy Survey: 64 responses
- Community Climate Hazard Map: 49 responses

447
meeting
attendees

Total meeting attendees

- Public Meeting #1: Noon session: 98 attendees; Evening session: 46 attendees
- Public Meeting #2: Noon session: 112 attendees; Evening session: 71 attendees
- Public Meeting #3: Noon session: 84 attendees; Evening session: 36 attendees

600+
individuals
engaged
across CAP
development

Total environmental justice interviews

- 34

Individuals engaged across CAP development

- 600+

“

I am most concerned about impacts on those less fortunate than me, directly economically, indirectly economically due to the general affordability of resources and general opportunity, but also in terms of the health effects. I worry for my children for the same reasons and for the world they are inheriting.

**Community
Voices**



“

Climate change is already having a noticeable impact in terms of severe weather events and shifts in our seasons. We have to make tough decisions to do more to cut our emissions, by a significant amount.

Public Engagements

Due to the COVID-19 pandemic, the CAP development team held the originally planned in-person meetings virtually using interactive webinar software. Recordings, translations, slides, and surveys were all provided on the city's website. For each meeting, the public could choose between two sessions, at noon and 5:30 pm.

Visioning meeting

The first set of public meetings gathered input on Bethlehem residents' vision and objectives for the CAP. An online complementary community survey was also distributed prior to, during, and after the meeting to gather responses. Results of the community survey are summarized in Appendix 5. During the meeting, the CAP development team provided an overview of the climate action planning process, the basics of climate change, projected impacts of climate change in the Lehigh Valley, and the need for a CAP. The meeting then offered participants a chance to offer their opinion on the principles and objectives that should inform the CAP's development. Organizers introduced each topic and then conducted an interactive, real-time poll to solicit input from the audience and drive the discussion.

Strategy meeting

The second public meeting provided attendees an opportunity to review goals and strategies drafted by the CAP WG and provide input on their priorities. The organizers provided an overview of the CAP development timeline and an update on the CAP Working Group process and progress. Similar to the first public meeting, a facilitated discussion followed to gather input from the community. Organizers introduced each GHG mitigation sector chapter's objectives and goals. Participants then rated the priority of strategies to achieve these goals using live, interactive polling software followed by facilitated discussion. Following the meeting, participants received an online survey that asked for specific input on and prioritization of CAP strategies and goals. A community hazard mapping exercise was also sent to participants to drop pins on a map and identify areas of

concern related to flooding, extreme heat, or other hazards. The city’s website and social media platforms also distributed these surveys.

Plan review meeting

The third and final public meeting provided attendees an opportunity to comment on the first draft of Bethlehem’s CAP. The meeting recapped the development process and offered a guided tour through the draft plan’s contents. The meeting’s goal was to help residents, businesses, and stakeholders understand the content and scope of the plan and the procedures for offering comments and feedback. The meeting also included live polls of participants about the draft CAP’s principles, goals, and targets. More than 95% of participants rated the principles as “right for Bethlehem” and all goals and targets were rated “appropriate for Bethlehem” by at least 70% of respondents. The conclusion of the meeting featured videos of stakeholders describing the CAP strategies that most excited them. Following the meeting, the full draft plan was available on the city website for review by the public, along with a form for submitting comments. The public comment period spanned December 11, 2020, to January 6, 2021. At the conclusion of the public comment, the CAP development team reviewed all comments and, where appropriate, incorporated changes into the final CAP.



Figure 14. Example Mentimeter poll ranking mitigation strategies related to Buildings during the 2nd public meeting on CAP strategies, noon session.

“ To manage heat waves in the future being able to have air conditioner that works at home it will be helpful.

“ I had to cancel some of my work because of heat waves.

“ High temperatures affect my daily life because I am no able to take my kids to the park and I have experienced dizziness.

“ I am always at home to prevent dehydration from heat waves.



Environmental justice and equity outreach

Equity and environmental justice are critical objectives for this plan. After holding the first virtual public meeting on community objectives for the plan, it was clear more needed to be done to reach Bethlehem's under-represented communities, including frontline communities and people of color, and ensure their voices inform the plan's goals and strategies and objectives. To elevate these issues and voices, the CAP WG formed an Environmental Justice and Equity Steering Committee with two objectives:

1. Explore and implement COVID-safe approaches to further engage frontline and represented communities in the plan development and review process, and
2. Advise sector-specific working groups developing mitigation and adaptation strategies to ensure the principles of equity, justice, and inclusion are integrated throughout all strategies and goals.

The committee drafted the plan's environmental justice chapter and reviewed all strategies for environmental justice impacts and considerations. Additionally, the committee provided connections to underrepresented groups in Bethlehem and developed a simple questionnaire for reaching out to members of those populations via community partners to overcome limitations to participating in the broader virtual public planning meetings.

As a result of this engagement, the CAP development team conducted a series of one-on-one interviews with community members from Bethlehem's South Side. The CAP development team also partnered with Hispanic Center Lehigh Valley (LVHC) to engage the city's Hispanic population by distributing short surveys on climate vulnerabilities and priorities, holding one-on-one interviews, answering questions about climate change, and distributing materials on energy-saving programs. LVHC performed all engagement during its normal activities serving the Lehigh Valley's Hispanic population and events. All outreach activities included COVID-19 precautions.

While these efforts produced significant input for the plan, the CAP development team and Environmental Justice and Equity Steering Committee had hoped to reach even more members of under-represented communities. The *Environmental Justice and Equity* chapter of the plan includes strategies to build upon the engagement begun during the CAP development process and further center the voices of frontline communities.

Top 12 Priorities

Which of the following goals do you think should guide the development and prioritization of the Climate Action Plan strategies?

- 1 Reduce GHG emissions
- 2 Reduce local air pollution
- 3 Improve equitable outcomes
- 4 Long-term investment and benefits
- 5 Up-front cost-effective and affordable
- 6 Promote jobs and economic opportunities
- 7 Improve resilience
- 8 Create or enhance infrastructure
- 9 Promote workforce development
- 10 Enhance accessibility
- 11 Create immediate impacts
- 12 Demonstrate Bethlehem as a leader

Figure 15. Ranking of proposed CAP goals from a survey given during the first public CAP meeting.

Community input

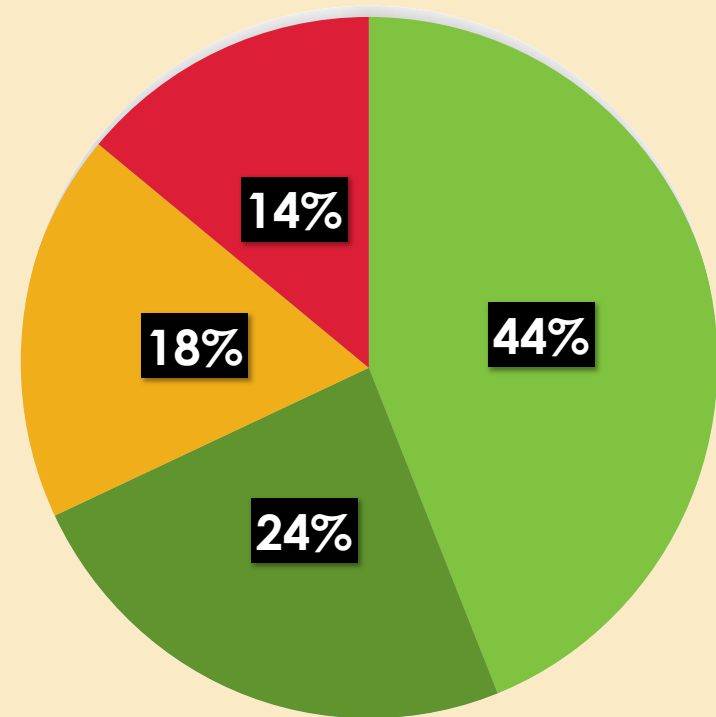
Through six sessions of virtual public planning meetings, two online community surveys, and several in-person engagements focused on frontline communities, Bethlehem's public provided input on the CAP's principles, objectives, and strategies that is as diverse as the city's population itself. But numerous trends and priorities emerged from the feedback. Comments and feedback are highlighted throughout the plan, and the community's consensus priority strategies have been incorporated in the following chapters and highlighted as Community priority in the strategy tables.

In terms of the plan's vision, several principles stood out. The plan should foremost reduce greenhouse gas emissions, but at the same time, it should reduce local air pollution, improve community health, and promote equitable outcomes. It should balance upfront costs with investment for long-term benefits and resiliency. It should create new programs and incentives for sustainability, but it should also emphasize public education and engagement. It should emphasize the co-benefits of climate action, including new jobs and economic opportunities. The graphics below summarize the public feedback that shaped the plan's vision statement and principles.



Figure 16. Word cloud of survey responses received in the CAP public meeting when participants were asked what the plan's objectives should be.

What approach should the city take when setting goals in the climate action plan?



- Set the ambition of goals based on the latest climate science
- Set aspirational goals with greater ambition, even if ability to achieve them is less certain
- Set goals with a high degree of confidence for achievement
- Set the ambition of goals based on current economic or technical feasibility

Figure 17. Public preference for CAP goal-setting approach from a survey given during the first public CAP meeting. A plurality of respondents favored alignment with science. A clear majority (66%) favored aspirational or science-based goals.

6

Relationship to Other Climate Actions

The City of Bethlehem recognizes that it cannot achieve its climate goals on its own. The city also recognizes the achievement of this plan's goals will not on its own be sufficient to solve the global challenge of climate change. For these reasons, it is important to acknowledge and explain the role of this CAP in the broader ecosystem of climate action at the local, regional, state, federal, and global levels.

Integration with local plans

Locally, this CAP builds upon the *City of Bethlehem Comprehensive Plan 2008*. That plan, released in August 2009, charted the course for Bethlehem's development over the last decade. It included goals and actions organized by topic, many of which overlap with the content of this CAP, including land use, housing and neighborhoods, transportation, and parks and recreation. This CAP does not supplant the comprehensive plan, nor is it as expansive in scope. Rather, Bethlehem's CAP complements the master plan by providing a distinctive climate lens. It defines specific goals related to sustainability, resilience, and environmental justice and lays out a pathway for achieving them. In some cases, this pathway deviates from or goes beyond the one defined in the comprehensive plan. This is necessary to achieve the more focused climate-related objectives of the CAP. Primarily, the CAP aims to build upon the comprehensive plan's successes, renew commitment to relevant goals not yet achieved, and expand the city's commitment to a just, sustainable future.

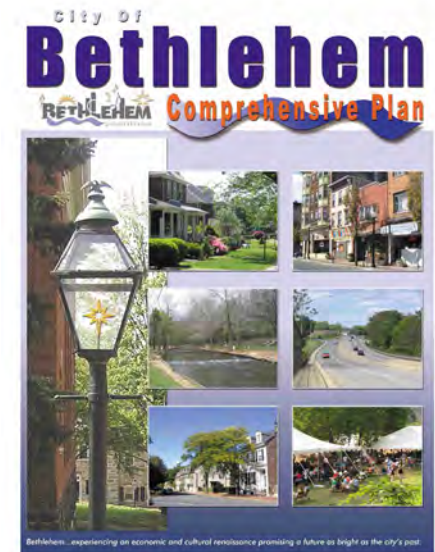


Figure 18. City of Bethlehem Comprehensive Plan 2008

Similarly, several other city plans partially overlap with this CAP. For example, the city has an existing formal emergency management plan. Some of the adaptation strategies in the CAP overlap with those of the emergency management plan. The intent is to emphasize their importance in managing future climate hazards, and highlight how these hazards are changing, presenting new risks and vulnerabilities. This plan's adaptation strategies serve as a planning tool to refine the emergency management plan for Bethlehem's projected climate experience.

Integration with regional plans

Regionally, Lehigh and Northampton counties formed the Lehigh Valley Planning Commission (LVPC) in 1961 to create a comprehensive plan to guide orderly county growth. In addition to guiding the orderly growth, development, and redevelopment of the Lehigh Valley, LVPC's mission includes promoting the conservation of energy, land, water, and air and achieving a safe, well-maintained multimodal transportation system. Bethlehem's CAP objectives require broad changes in transportation and land use patterns that can only be fully achieved at the regional level. Additionally, through regional collaboration, the city can maximize its impact while creating a more sustainable and just Lehigh Valley for all. The successful implementation of Bethlehem's CAP will require close coordination with LVPC. As with Bethlehem's own comprehensive plan, this CAP intends to complement and support the broader *FutureLV Regional Comprehensive Plan* released by LVPC in 2019. The Bethlehem CAP builds upon this regional plan's climate and energy elements by providing Bethlehem-specific mitigation and resiliency strategies and implementation plans. Implementation of the CAP will leverage LVPC's support and resources, including its open space plans, Green Infrastructure Guidelines, and Long-Range Transportation Plan.

LVPC, along with the Lehigh County Emergency Management Agency and Northampton County Emergency Management Services, co-leads the development of the *Lehigh Valley Hazard Mitigation Plan*, which covers Lehigh and Northampton counties and the 62 municipalities that make up the Lehigh Valley. The latest iteration of the plan approved by the Federal Emergency Management Agency in October 2018 includes nearly 1,200 mitigation strategies designed to help protect every municipality in the Lehigh Valley from future disasters. FEMA approval and municipal adoption make

TABLE OF CONTENTS	
Introduction	10
Forward	12
Plan Interrelationships	18
Community Engagement	20
People Have Spoken	22
#Trending	24
Overview	28
Growing	32
Future Forces	40
Building Our Best Future	42
Goals, Policies and Actions	46
Goal 1. Efficient and Coordinated Development Pattern	46
Suburban Corridor Concept	48
FutureLV Map Descriptions	52
General Land Use Plan	56
Goal 2. Connected Mixed-Transportation Region	59
Centers and Corridors	60
Transportation Plan	66
MacArthur Road Concept	71
Density	72
Freight	76
Goal 3. Protected and Vibrant Environment	80
Natural Resources Plan	82
Crossroads Village Concept	86
Farmland Preservation Plan	88
Brownfield Redevelopment Concept	90
Climate Change	92
Goal 4. Competitive Creative and Sustainable Region	96
Shopping Mall Redevelopment Concept	98
Entrepreneurialism	102
Farming as a Business	106
Suburban Infill Concept	108
Funding	110
Goal 5. Safe, Healthy, Inclusive and Livable Communities	114
Canal Trail Eastside Concept	116
Healthy Communities	118
Commuter Trail Westside Concept	122
Parks, Outdoor Recreation, Open Space and Scenic Plan	124
Historic Corridor Revitalization Concept	126
Regional Collaboration	130
Call To Action	132
Implementations	136
Key Initiatives	140
Land Uses of Regional Significance	166
Transportation Funding	182
Unmet Needs	194
Acknowledgments/Thank You	196
Resources	
More Information	

Figure 19. FutureLV Regional Comprehensive Plan 2019.

communities such as Bethlehem eligible for federal funding to help pay for mitigation projects. This CAP intends to supplement the Lehigh Valley Hazard Mitigation Plan by developing additional Bethlehem-specific adaptation strategies, signaling renewed support for strategies already underway, and acknowledging the importance of climate resilience to securing the city's future. The hazard mitigation actions described in the Bethlehem Annex the Lehigh Valley Hazard Mitigation Plan focus primarily on flooding. This CAP aims to expand the city's adaptation actions to address extreme heat and other hazards projected to worsen in Bethlehem due to climate change.

To further support the success of Lehigh Valley climate action, this CAP lays out strategies to integrate with future climate action plans developed by Easton, Allentown, and other Lehigh Valley municipalities. Easton and Allentown are each developing their own climate action plans as part of the Pennsylvania Department of Environmental Protection (DEP) Local Climate Action Program (LCAP). The cities aim to finish their climate action plans by July 2021. Bethlehem has recognized the benefits of acting together on climate with fellow Lehigh Valley municipalities since it joined Easton and Allentown in signing the Three-

City Proclamation in 2006. The implementation of this plan will be coordinated with the CAPs of other Lehigh Valley cities to leverage these relationships and promote broader regional changes necessary to achieve shared climate goals.

Integration with state plans

In 2008, the Pennsylvania Climate Change Act was passed, and requires the Department of Environmental Protection (DEP) to

1. develop an inventory of GHG emissions and update it annually;
2. administer a Climate Change Advisory Committee;
3. set up a voluntary registry of GHG emissions; and
4. prepare a Climate Change Action Plan and Climate Impacts Assessment, both to be updated once every three years.

The most recent *Pennsylvania Climate Change Impacts Assessment* was updated in 2020, and the most recent *Pennsylvania Climate Action Plan* and greenhouse gas inventory were released in 2019. These documents offer information and guidance for local climate action planning in the Commonwealth. The Climate Impacts Assessment provides a scientific basis for potential statewide impacts of global climate change, which can be used alongside available local data to inform community adaptation efforts. The PA Climate Action Plan summarizes statewide greenhouse gas emissions, sets an emissions reduction target, and describes potential mitigation and adaptation actions for residents and businesses, as well as local and state governments. The reduction targets are 26% by 2025 and 80% by 2050 from 2005 levels, consistent with an executive order signed by Governor Wolf in 2019.

To support the achievement of the PA Climate Action Plan's objectives and to align with the latest climate science for limiting global temperature increases to 1.5°C, Bethlehem's GHG reduction targets exceed the statewide targets. This plan aims to inspire other Pennsylvania municipalities with the city's ambitious goals and to help the state meet its climate targets while making Bethlehem's community healthier and more equitable. But Bethlehem cannot achieve its goals without broader action at the state level. Many of the statewide CAP actions are incorporated into or supported in this plan. Further, several strategies in this plan cannot be achieved without changes to state law. These include

Community Choice Aggregation (CCA) and community renewables to help Bethlehem meet its renewable electricity goals. When further state action is required, this CAP commits to supporting these policy changes via resolutions and other communications and working collaboratively with stakeholders across the state to realize the changes.

Integration with federal and global action

In signing the Paris Agreement in 2016, the United States committed to reduce its GHG emissions 26–28% below 2005 levels by 2025 and to make “best efforts” to reduce emissions by 28% in that period. The US has emitted the most cumulative GHG emissions of any country and has a responsibility to act aggressively to mitigate climate change impacts. Many policies at the federal level can help Bethlehem and other municipalities to achieve their climate action goals. For example, federal policies to support increases in renewable electricity, such as a national clean energy standard, will help Bethlehem and 225 other municipalities committed to the Sierra Club's Mayors For 100% Clean Energy achieve this goal. Expansions of the US Department of Energy (DOE) Weatherization Assistance Program will help low-income households reduce their energy costs and support this plan's environmental justice objectives. Federal investment in infrastructure will create new jobs across the country and help the Lehigh Valley transition to a clean energy economy for the 21st Century. There are countless other actions at the federal level that will support Bethlehem's climate objectives and achieving this CAP's goals will help the US to uphold and exceed its commitments under the Paris Climate Accord.

But even if the US acts aggressively on climate, America represents less than 15% of annual global GHG emissions (although much more on both a per capita, consumption-based, and historical bases). Climate change is a global challenge and solving it will require ambitious global action. Just as Bethlehem aims to lead by example by aligning with science and committing to reduce emissions consistent with limiting global warming to 1.5°C, the US must also lead by example to spur global change. Doing so presents an opportunity to create jobs, clean the air, and create a more just and sustainable future. Bethlehem supports this vision, and this CAP is the city's plan for doing its part to achieve it.



7

Greenhouse Gas Inventory

To assess Bethlehem's contribution to climate change, the city conducted its first community-wide greenhouse gas inventory using 2017 as the baseline year. The inventory uses community-wide energy use data, regional traffic modeling data, county waste disposal data, and other local information to calculate the sources and distribution of greenhouse gas emissions from activities in Bethlehem. This accounting guided the development of emission reduction targets and mitigation strategies in this Climate Action Plan. The 2017 inventory also serves as the baseline year for tracking progress toward the city's GHG reduction targets (see *Goals & Targets* below).

Community-wide GHG inventory

In 2017, activities in Bethlehem were responsible for the emissions of 1,171,000 metric tons of carbon dioxide equivalent (tCO₂e). The use of energy in buildings is the biggest contributor. The use of electricity, natural gas, and other fuels used

Bethlehem GHG Emissions (CO₂e) by Sector

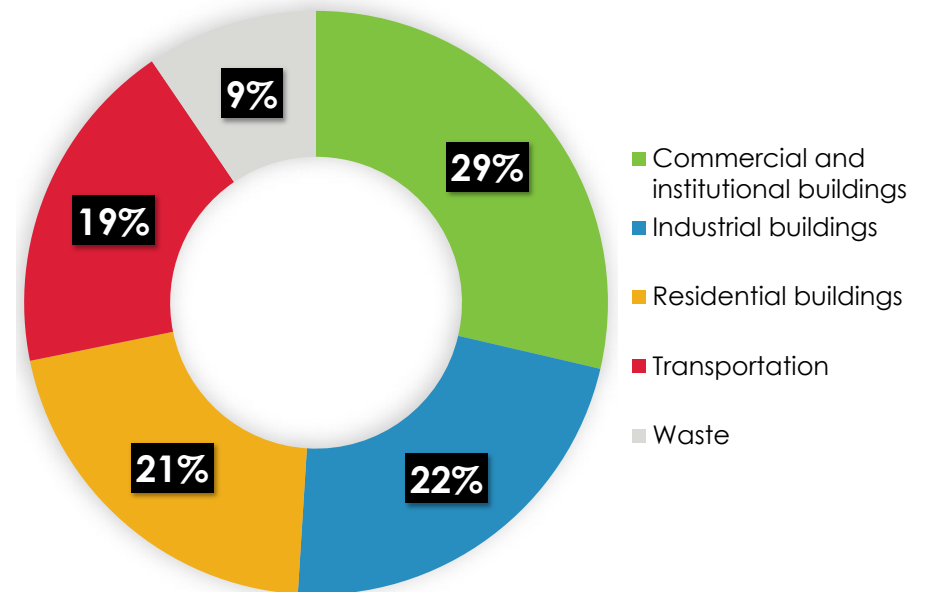


Figure 20. Bethlehem community-wide GHG emissions (CO₂e) by sector. Commercial and industrial building energy consumption is the largest source of GHG emissions.

in residential, commercial, and institutional buildings account for half (50%) of Bethlehem's GHG emissions. Energy used in industrial and manufacturing buildings adds another 22% to the city's total. On-road transportation, including cars, trucks, and heavy-duty vehicles, is the next largest source, accounting for nearly one-fifth (19%) of Bethlehem's emissions. The remainder (9%) comes from the city's waste and wastewater treatment and disposal, whether it is landfilled within city limits or transported elsewhere for treatment.

By energy source, electricity is the largest contributor to Bethlehem's emissions (47%). Burning natural gas is the next largest source, accounting for 16% of the city's emissions. Other building fuel sources, such as fuel oil, are more carbon-intensive per unit of fuel but are used less often and contribute 9% to the city's total. For on-road transportation, gasoline accounts for 14.5% of the city's emissions, while diesel for trucks and heavy-duty vehicles is estimated to contribute 4.5%. The remaining 10% comes from emissions from solid waste disposal, such as methane from landfill disposal.

Bethlehem GHG Emissions (CO₂e) by Source

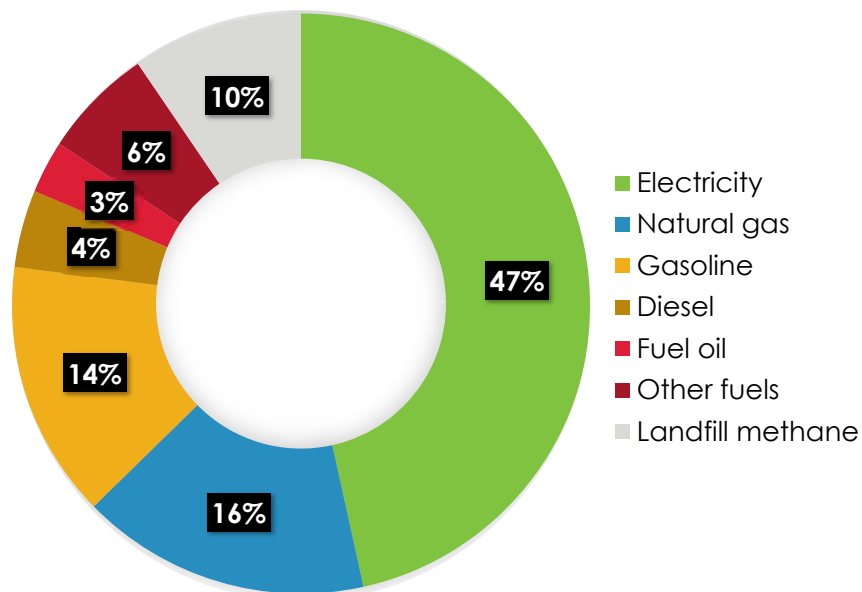
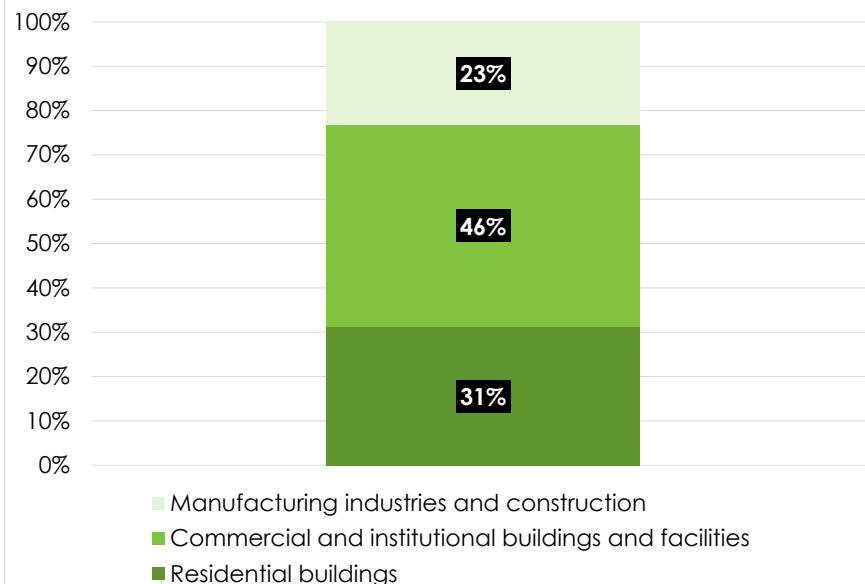


Figure 21. Bethlehem community-wide GHG emissions (CO₂e) by source. Electricity use is the largest contributor to community-wide emissions, accounting for nearly half of the city's emissions.

Electricity GHG Emissions (tCO₂e) by Sector



Fuel GHG Emissions (tCO₂e) by Sector

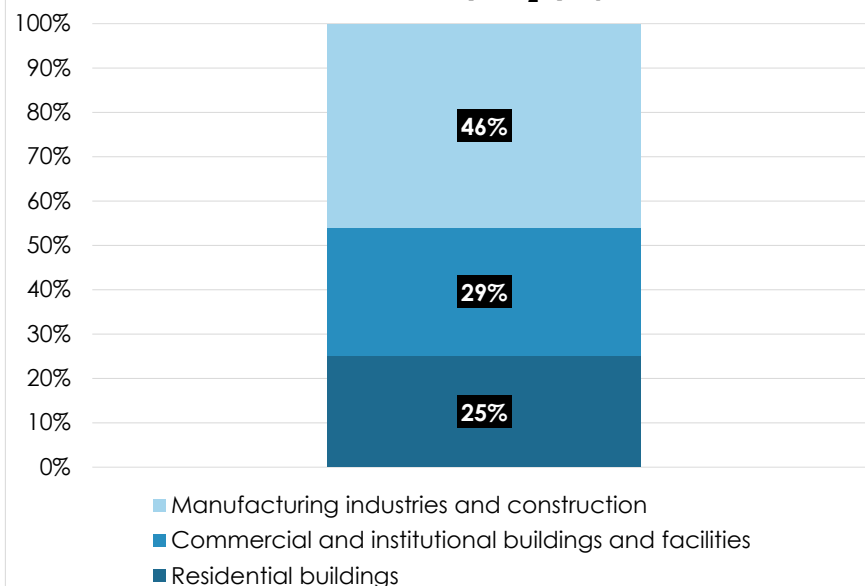


Figure 22. Relative contribution to GHG emissions from electricity use and fuel use by buildings sectors.

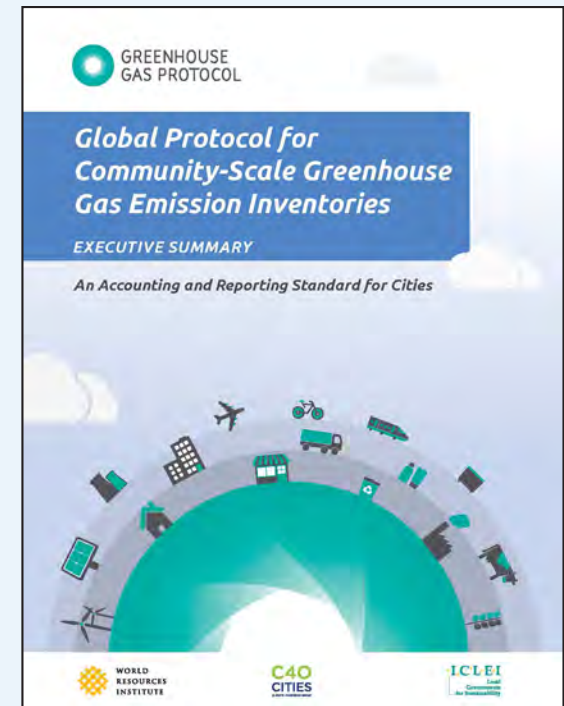
TRACKING AND REPORTING GREENHOUSE GASES

To align with international best practices and facilitate comparison with the inventories of other cities, Bethlehem's greenhouse gas inventory is consistent with the guidance outlined in the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). The GPC offers cities and local governments a robust, transparent, and globally-accepted framework to consistently identify, calculate, and report on city greenhouse gases. It is also the required standard for reporting to the Global Covenant of Mayors for Climate and Energy, to which Bethlehem is a signatory.

How does the city measure greenhouse emissions? Different greenhouse gases have different capacities to trap heat in the atmosphere, known as global warming potentials. For example, methane (CH₄) has 28 times the global warming potential of carbon dioxide (CO₂) over 100 years, and nitrous oxide (N₂O) is 265 times greater over a 100-year time horizon. To allow for a comparison of the impacts of different gases in the GHG inventory, each metric ton of greenhouse gas is converted into the equivalent number of metric tons of carbon dioxide, called carbon dioxide equivalent and abbreviated tCO₂e. This is similar to how distance can be measured as inches, feet, or yards, but conversion to a single unit, such as feet, would be used to compare different measurements.

The GPC requires cities to report emissions by GHG, scope, sector, and subsector, and to add up emissions using two distinct but complementary approaches:

1. **The scopes framework:** This approach totals all GHG emissions by scope 1, 2, and 3, which allows for the separate accounting of all GHG emissions produced within the geographic boundary of the city, consistent with national-level GHG reporting:
 - **Scope 1:** Direct GHG emissions from sources located within the city boundary
 - **Scope 2:** GHG emissions from sources located inside or outside the city boundary occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary
 - **Scope 3:** All other GHG emissions from sources located outside the city boundary that occur as a consequence of activities taking place within the city boundary, such as waste generated within the city boundary but disposed outside of city limits and transportation trips that begin or end beyond city limits.
2. **The city-induced framework:** This approach totals GHG emissions attributable to activities taking place within the geographic boundary of the city. This framework includes two reporting levels: BASIC and BASIC+. Bethlehem's inventory achieves the BASIC level, which includes scope 1 and 2 emissions from stationary energy, transportation, and waste as well as scope 3 emissions from waste disposed of beyond city limits. In the future, the city will aim to add additional activities to the inventory to achieve the BASIC+ level, which includes sources more difficult to calculate, including emissions from agriculture and land use, out-of-boundary transportation, industrial processes, natural gas leakage, electrical transmission losses, and other scope 3 sources.



Per capita GHG emissions

On a per-capita basis, activities in Bethlehem results in the emissions of 15.4 tCO₂e per person. This emissions rate is lower than the average of both Pennsylvania (23 tCO₂e per person) and the US as a whole (20.7 tCO₂e per person). But Bethlehem's per-resident emissions are higher than larger cities such as Philadelphia (11.2 tCO₂e per person) and New York City (5.8 tCO₂e per person). Bethlehem's emission rate is similar to that of Pittsburgh, which was 15.6 tCO₂e per person in 2013.

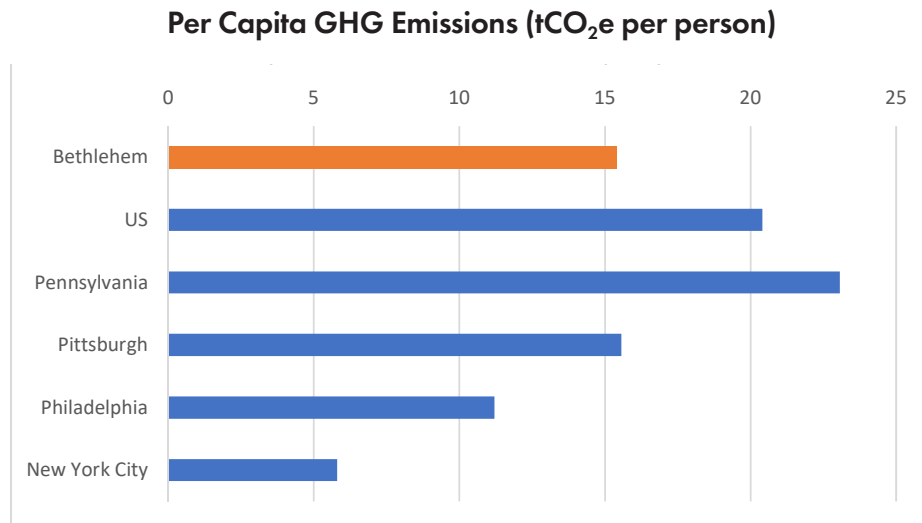


Figure 23. Per capita GHG emissions (tCO₂e per person) for Bethlehem versus the US average, Pennsylvania, and three reference cities. Philadelphia and New York City per capita data from C40. US, Pennsylvania and Pittsburgh per capita emissions are calculated from the following sources: US emissions (EPA); Pennsylvania emissions (WRI); Pittsburgh emissions (Pittsburgh GHG inventory); all populations (US Census).

Enhancements and expansions

Bethlehem's inventory achieves the GPC BASIC level, which includes scope 1 and 2 emissions from stationary energy, transportation, and waste disposed of within city limits and scope 3 emissions from waste disposed of beyond city limits. The primary data used to compile Bethlehem's 2017 data were natural gas use by sector from UGI, electricity use by sector from PPL, and total vehicle miles traveled in Bethlehem from the Lehigh Valley Planning Commission's transportation model. Estimates of vehicle gasoline and diesel consumption were derived from LVPC's vehicle miles traveled data by estimating miles driven by different vehicle classes using Pennsylvania Department of Transportation (PENNDOT) and U.S. Department of Transportation (US DOT) data and applying US DOT average fuel economy rates. Due to a lack of data availability, the smaller sources of fuel use in buildings were estimated using the US Census American Community Survey and the US Energy Information Administration (EIA) State Energy Data System. Primary solid waste data were also not available for the inventory. Bethlehem solid waste volume was estimated using per capita data from Northampton County. Emissions were conservatively estimated, assuming that 100% of solid waste was landfilled with no combustion of landfill methane gas. Flaring methane escaping from landfills is preferred because the CO₂ generated from combustion is a less potent greenhouse gas than methane.

These estimates can be refined using new primary data in future updates to the GHG inventory. In particular, the conservative assumption that all waste is landfilled without combustion of methane gas likely overstates city emissions. For example, the Bethlehem Landfill captures landfill gas and diverts it to an energy plant, which converts the gas to electricity, but data on this was not available at the time of inventory compilation. In many cities, waste emissions account for 1–5% of GHG emissions, so Bethlehem's calculation of 10% emissions from waste is likely to decline as better data are obtained. In the future, the city will aim to engage waste haulers, transfer stations, and the local county governments to refine data and improve these calculations.

Another significant source of emissions that is not yet included in the community-wide inventory is rail transportation emissions. The Norfolk Southern railway travels along the Lehigh River, and there is a Norfolk Southern train yard on Bethlehem's east side near the Saucon Park, among other rail assets within city limits. Emissions from freight trains passing through the city have not yet been

calculated but should be included in the city's transportation Scope 1 emissions in a future inventory update. Other sources of emissions that are likely smaller, including industrial processes and product use, agriculture, forestry, and land use, are not yet calculated and should be reviewed for materiality.

Lastly, the city will aim to increase the emissions inventory to the GPC's BASIC+ level in the future, including scope 3 emissions outside the city boundary that result from Bethlehem's activities. These include electricity transmission losses and emissions from the portions of transportation journeys occurring outside the city boundaries. While emissions from Lehigh Valley International Airport and other regional airports that serve city residents are outside the city's geographic boundary and its emissions inventory, more advanced and mature emission accounting approaches do include air travel-related emissions from its residents as Scope 3. The city has not included this source in its current inventory, nor has it addressed this as part of the CAP. The City of Bethlehem may look to engage local airports in the future and determine if there are ways the City can support the airport in reducing emissions.

As noted in the *Local Food and Waste* chapter, upstream embedded emissions (sometimes referred to as consumption-based emissions), are not currently included in the city's current inventory in accordance with the GPC. Upstream embedded emissions are at the other end of the GHG emissions spectrum from waste. These are the GHG emissions that result from the production and shipment of all the food, water, fuel, building materials, and consumer products produced outside city limits and imported for consumption. This category of emissions would be a significant percentage of the city's overall footprint, but it is difficult to calculate precisely and to influence reductions because it depends on individual consumer decisions. Bethlehem acknowledges the importance of these upstream emissions, and the city will aim to assess these emissions in a future update of this plan as per strategy FW3.2.

These improvements to the community-wide GHG inventory and any other material methodology changes will require an update to the 2017 baseline inventory for the purposes of tracking consistent progress to the city's goals.



ELECTRICITY'S ROLE IN BETHLEHEM'S GHG EMISSIONS

The use of electricity by Bethlehem's residents, workers, and visitors accounts for nearly half of community-wide greenhouse gas emissions.

Emissions from electricity use are calculated using the annual average greenhouse gas emissions per kilowatt-hour (kWh) of delivered electricity on the local electric grid. Since the electric grid is regional, Bethlehem's GHG intensity (tCO₂e per kWh) accounts for emissions from all power generation facilities supplying the grid, not just those within the city boundary. The Eastern Power Grid serves Bethlehem, and for inventory calculations, the city used the EPA's RFC East average grid emissions factor, which covers a region including most of Pennsylvania, New Jersey, Delaware, and parts of Maryland. The city's greenhouse gas inventory found that the Bethlehem Energy Center natural gas-fired power plant located in east Bethlehem emitted 2,072,000 tCO₂e in 2017—nearly double the amount from the activities within the city—but this is not included in the citywide total because electricity from the power plant also supplies other communities in the region.

The RFC East electric grid subregion that includes Bethlehem emits approximately 25% fewer emissions than the US average, but renewables supply only 5.2% of its power. To achieve Bethlehem's emission reduction targets, the city will need to increase the amount of renewable electricity in its power supply significantly. Pennsylvania's electricity market is deregulated, meaning individual customers can choose their own electricity supplier—some of which offer 100% renewable electricity options. The number of households and businesses using such products is not currently estimated in the inventory due to data unavailability, but this will be crucial to measuring progress going forward. The city may also need additional programmatic tools to increase renewable electricity adoption, such as community solar and Community Choice Aggregation (CCA). These programs are not currently available in Pennsylvania, but the Electricity Sourcing chapter includes strategies to grow renewable electricity use in Bethlehem.

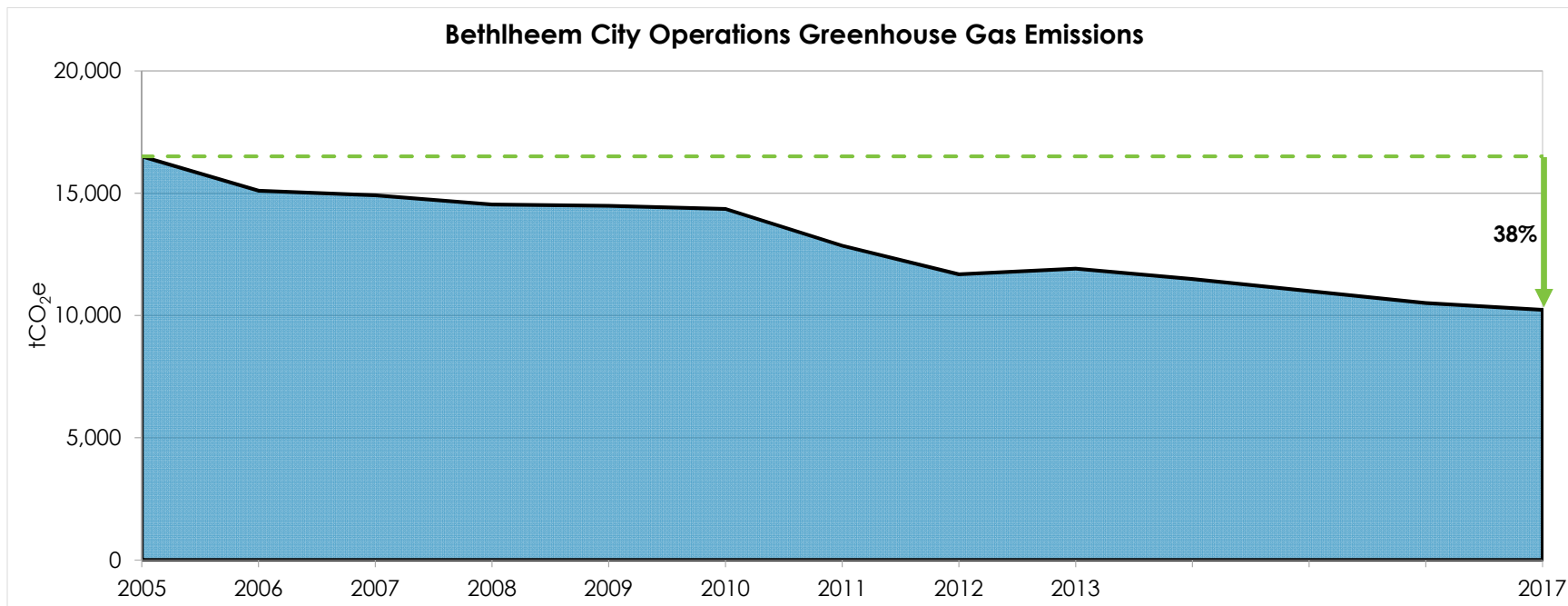


Figure 24. Bethlehem City Operations 2017 GHG emissions (tCO₂e). By 2017, the city achieved a 38% reduction from its 2005 base year. Data was not available for 2014–2016.

City operations GHG emissions inventory

The City of Bethlehem’s local government operations inventory extends back to the city operations baseline year of 2005. In 2017, the city of Bethlehem’s municipal operations resulted in the emission of 10,250 tCO₂e, which is less than 1% of the community-wide total. Historically, the city’s largest energy source has been electricity consumption, which accounted for two-thirds of the total in 2005. Following significant investment in energy conservation measures and the purchase of renewable electricity for 50% of remaining electricity consumption in 2017, the city has reduced its government operations GHG emissions by 38% relative to 2005.

Since 2018, the city has purchased 100% renewable electricity for city operations. This further reduces GHG emissions from electricity and will be reflected in subsequent inventory updates. The remaining emissions primarily result from vehicle fuels (gasoline and diesel), fuel consumption for heat (natural gas and #2 fuel oil), and refrigerants, as shown in [Figure 26](#).

City operations asset	2017 GHG emissions (tCO ₂ e)
Wastewater	3,050
Garage	2,650
Street Lighting	1,950
Water Filtration	850
Buildings except City Center Complex	800
City Center Complex	700
Traffic Signals	200
Golf Course	50
TOTAL	10,250

Figure 25. Bethlehem City Operations 2017 GHG emissions (tCO₂e) by operations asset. Wastewater processing was the largest contributor to city emissions in 2017.

Enhancements and expansions

In the coming years, the city operations inventory will incorporate recent evolutions in GHG accounting protocols and align the city operations inventory with the Local Government Operations Protocol, v 1.1 written by the California Air Resources Board, The Climate Registry and ICLEI—Local Governments for Sustainability USA. As with the community-wide inventory, any material methodology changes to the city operations inventory will require an update to the 2005 baseline inventory for the purposes of tracking consistent progress to the city's goals. The city will also develop an Inventory Management Plan (IMP) that delineates collecting, calculating, maintaining, and completing the annual GHG inventory. This IMP will follow best practices provided by

the United States Environmental Protection Agency (US EPA) and ICLEI. The city will additionally endeavor to make annual updates to the inventory and strive for continuous improvements. Through the Pennsylvania Department of Environmental Protection *Local Climate Action Plan (LCAP) Program*, the city signed up to receive free technical support and resources from ICLEI in 2021. ICLEI is the leading global network of local governments dedicated to sustainability, resilience, and climate action. ICLEI will support the city's first update of its GHG inventory following the release of the CAP.

City Operations GHG Sources Excluding Electricity

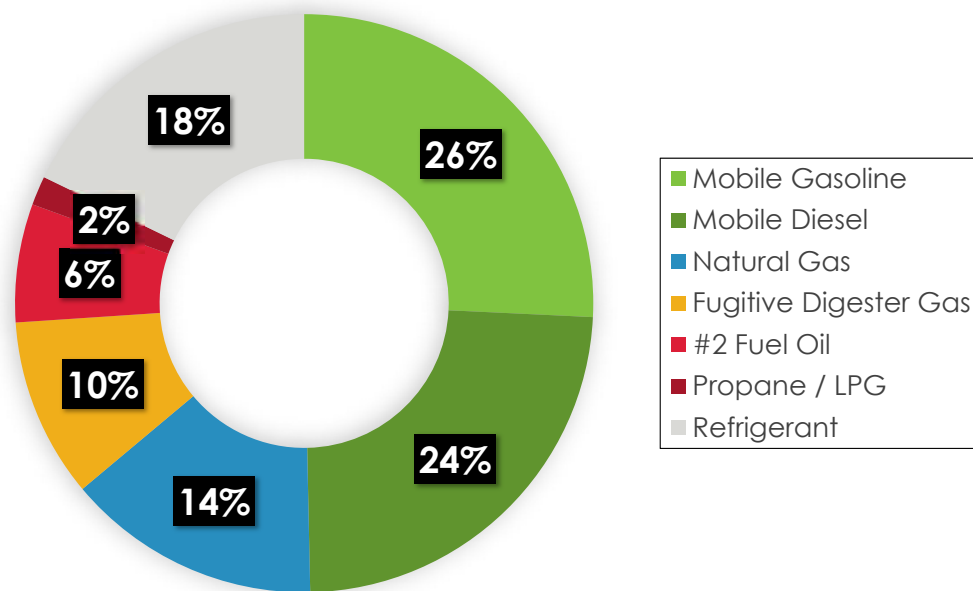


Figure 26. City operations GHG emissions (CO₂e) by source, excluding electricity. Transportation fuels (gasoline and diesel) comprises 50% of the city's non-electricity emissions.



8

Goals and Targets

The City of Bethlehem has a long history of supporting climate action. Although the city has not previously set a community-wide greenhouse gas reduction target, many of its previous climate-related commitments have implied support for ambitious action.

In 2006, Bethlehem Mayor John B. Callahan joined Easton and Allentown's mayoral administrations in signing the Three-City Proclamation, which endorsed the US Conference of Mayors' Climate Protection Agreement. Through this commitment, local communities aimed to meet or beat the GHG emission reduction target recommended for the United States in the Kyoto Protocol, which was a 7% reduction from 1990 levels by 2012.

More recently, through the combined commitments to the *Global Covenant of Mayors for Climate and Energy*, the *We Are Still In* initiative, and the *Mayors National Climate Action Agenda*, Bethlehem has indicated that it will set targets and action plans to meet or exceed the United States' commitments under the 2015 Paris Climate Agreement. This commitment implies reducing emissions 26–28% below 2005 levels by 2025 and laying a path to reducing emissions by 80% by 2050.

Additionally, through the Sierra Club's Ready for 100 initiative, Mayor Robert J. Donchez has indicated Bethlehem's support for a city-wide goal of 100% clean, renewable energy. Achieving such a goal would reduce the city's GHG emissions by at least 40% based on the 2017 community-wide inventory.

However, the science of climate change demonstrates that even this past level of ambition is insufficient to mitigate the dangers presented by global warming. The Intergovernmental Panel on Climate Change's 2018 Special Report on Global

Community-wide Goals

33%
reduction by
2025

60%
reduction by
2030

net-zero
by 2040

NET ZERO EMISSIONS

The IPCC defines net-zero CO₂ emissions as “when anthropogenic CO₂ emissions are balanced globally by anthropogenic CO₂ removals over a specified period.”



Anthropogenic removals refer to the withdrawal of GHGs from the atmosphere as a result of deliberate human activities. These include enhancing biological sinks of CO₂, such as forests and soil, and using chemical engineering to achieve long-term removal and storage, such as through calcification. Carbon capture and storage (CCS) from industrial and energy-related sources, which alone does not remove CO₂ in the atmosphere, can reduce atmospheric CO₂ if it is combined with bioenergy production.

If Bethlehem continues to emit GHG emissions following its net-zero commitment date, it would need to enhance the city’s forests and other carbon sinks to remove these emissions from the atmosphere or purchase credits for removals occurring outside of the city boundary.

Net Zero logo from US EPA

Warming of 1.5°C (SR15) makes clear that every tenth of a degree of warming matters. For example, limiting global warming to 1.5°C versus 2.0°C could reduce the population exposed to climate risks and related poverty by as much as 457 million people.

The current global commitments under the 2015 Paris Agreement, which the city has previously committed to strive for, are insufficient to prevent temperature rise above 2.0°C, let alone 1.5°C. The SR15 report states that limiting warming to 1.5°C implies reaching net-zero CO₂ emissions globally around 2050, with steep reductions occurring in the next decade. An analysis by the Science Based Targets initiative of 1.5°C scenarios modeled for SR15 finds that between 2017 and 2030, the **minimum** compatible emission reduction is 55%.

Community-wide Greenhouse Gas Reduction Targets:

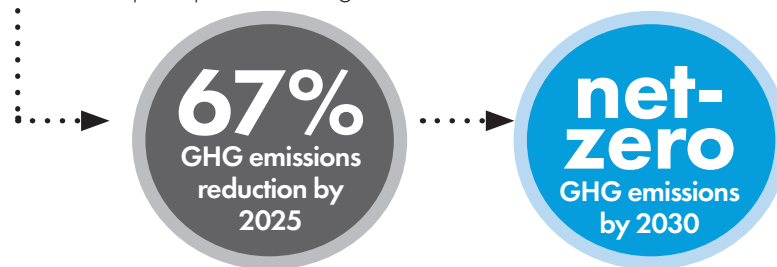
To meet the ambition demanded by the latest science, the City of Bethlehem has established the following community-wide reduction targets relative to a 2017 baseline:

- 33% GHG emissions reduction by 2025
- 60% GHG emissions reduction by 2030
- Net-zero GHG emissions by 2040

•••• Municipal Operations Greenhouse Gas Reduction Targets:

The City of Bethlehem has reduced greenhouse gas emissions from municipal operations by 38% from 2005 to 2017. This reduction exceeds the US commitment from the 2015 Paris Agreement, which the Donchez administration endorsed via We Are Still In. But as the SR15 report finds, the Paris Agreement’s commitments are insufficient to hold warming to 1.5°C.

To lead by example, the city government commits to go further via the following municipal operations targets relative to its 2005 baseline:



9

What You Can Do

There are many things Bethlehem residents can do to help achieve the city's climate goals and make the community more sustainable.

The CAP development team and Bethlehem EAC compiled this short list of actions residents and businesses can take to live more sustainably and reduce energy, water, and other resource consumption. Many of these actions can also save money because reduced utility consumption results in reduced utility bills.

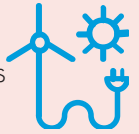


SAVE ENERGY



- Turn off lights and electronics when you leave a room
- Install energy-efficient fixtures, like LED light bulbs and Energy Star appliances
- Determine your eligibility for [state or federal energy programs](#), such as energy efficiency rebate programs, energy assistance programs, energy assessments
- Lower your thermostat in winter and raise it in summer, or use a smart thermostat with scheduling functionality
- Add insulation and weatherstripping to maintain home temperatures
- Raise blinds in winter and lower them in summer to aid heating and cooling
- Unplug seldom-used appliances
- Set your refrigerator temp to 36°

USE RENEWABLE ELECTRICITY



- Use the [PA PowerSwitch website](#) to shop for electricity suppliers that provide renewable electricity. Many renewable options save money relative to the PPL Electric Price to Compare, but pay close attention to contract terms, such as variable pricing, fixed fees (including cancellation, enrollment and monthly feeds), introductory prices that change after a set amount of time, and supply contracts that auto-renew with different pricing after the initial term length. PAPowerSwitch, run by the PA Public Utility Commission (PUC), also provides an [information page about switching suppliers and contract terms](#).
- Install solar panels

MOBILITY



- Use public transportation
- Walk or bike for short trips
- Carpool and rideshare
- Don't idle your engine
- Consider hybrid and electric options if purchasing a new vehicle

REDUCE TOXICITY



- Eliminate mercury from your home and dispose of items containing mercury at an appropriate drop-off facility
- Use alternative household cleaning products that do not contain hazardous chemicals
- Buy the right amount of paint for the job
- Avoid pesticides

RECYCLING AND REDUCING WASTE



- Separate your recyclables from waste
- Wash or clean recyclables to avoid contamination
- Compost appropriate organic waste if you have a composter
- Bring your own reusable bags when you go shopping
- Buy in bulk (but not more than you need)
- Use reusable coffee mugs, water bottles, and silverware
- Support local farmers by shopping at farmers' markets and food co-ops
- Don't know what to recycle? Check out [this easy list!](#)

WATER AND VEGETATION



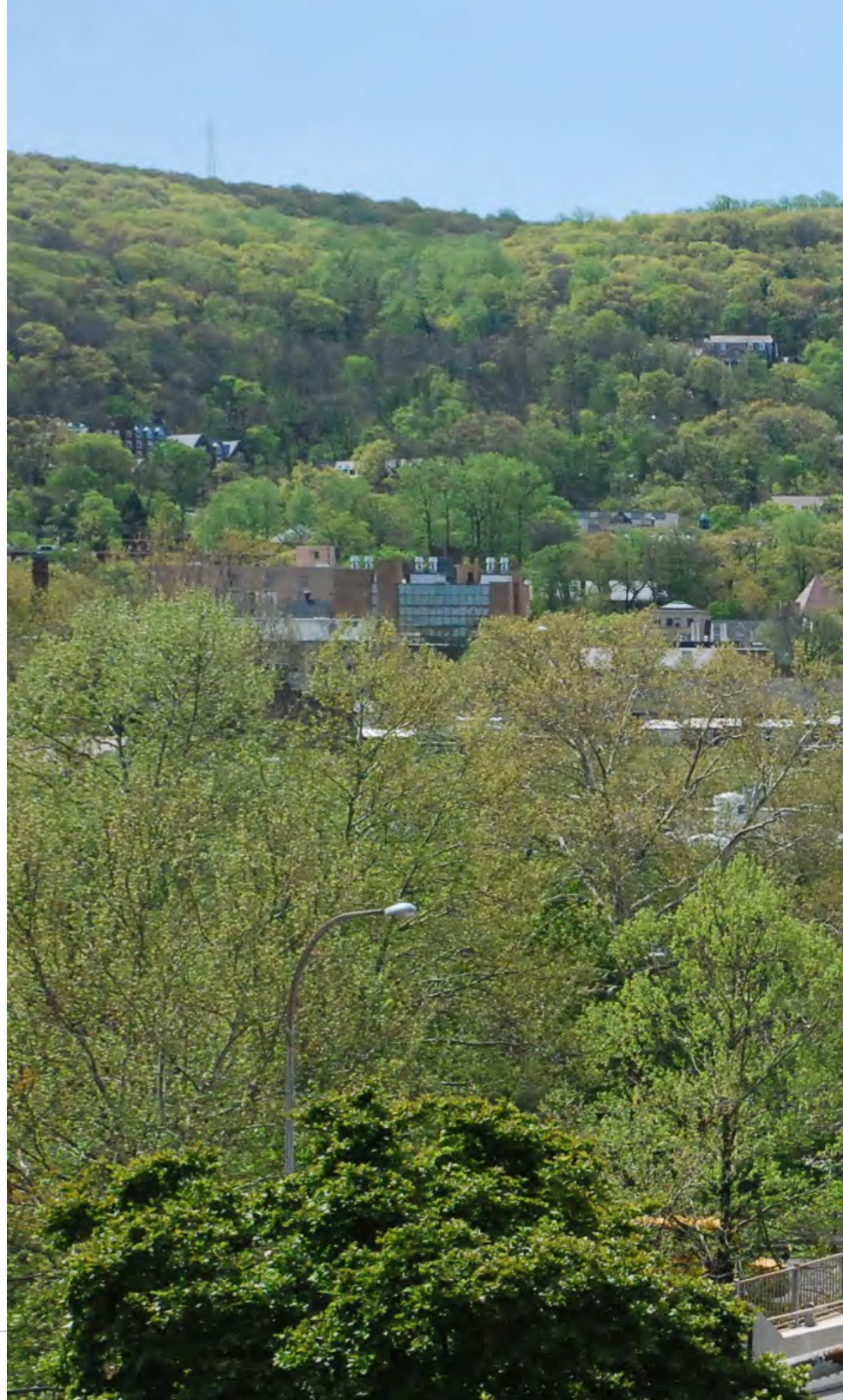
- Limit your shower time
- Wash your clothes in cold water
- Install low-flow fixtures
- Never dump anything down a storm drain
- Plant native species that are already comfortable with our humidity, water, and sunlight levels
- Native species also provide habitats for pollinators such as bees and butterflies



Still have questions?

Many people feel overwhelmed when they first start to think about climate change and the many ways they can help. The following resources list actions you can take that range from quick decisions at the grocery store—eating less meat—to getting involved with community efforts to address climate change.

- [Contact the Environmental Advisory Council \(EAC\)](#) – The EAC advises the City of Bethlehem on environmental issues, recommend actions to protect the health, safety, and welfare of our residents, and preserve the natural resources of the city. Meetings take place on the first Thursday of every month at 7pm. All are welcome.
- [How to Reduce Your Carbon Footprint, New York Times](#) – A variety of effective steps to reduce your own contributions to climate change.
- [Reduce Your Carbon Footprint at Work, Center for Climate and Energy Solutions](#) – Suggestions for energy efficiency and reducing waste specific to the workplace.
- [Teaching Climate: Human Responses to Climate Change](#) – A wide variety of educational resources focused on how individuals, communities, businesses, and governments can respond to climate change.
- [Member Organizations, U.S. Climate Action Network](#) – A list of organizations active on climate change that present opportunities to get involved with others pursuing solutions.



10

How to Read This Plan

Strategies in the plan are grouped in three high-level categories: Environmental Justice and Equity; Mitigation Strategies, which focus on GHG emission reduction; and Adaptation and Resilience Strategies. The Mitigation Strategies section is further sub-divided by sector, such as Buildings and Transportation and Mobility. The Adaptation and Resilience Strategies are divided by strategy type, such as Assessments, Studies, and Plans and Proactive Adaptation Actions.

The Environmental Justice and Equity section and each Mitigation Strategy sector contains a hierarchy of desired outcomes:

- **Objective(s):** the primary desired outcome for the section, usually stated as a quantified target indicator
- **Goal(s):** secondary desired outcomes whose achievement will contribute to the overall Objective(s) of the section

Strategies are grouped according to the section goal that they most directly support. [Figure 27](#) provides a description of the information fields provided for each strategy.

Community priorities



A green check next to a strategy indicates it was rated highly by the public in the strategy priority survey




Community
Voices



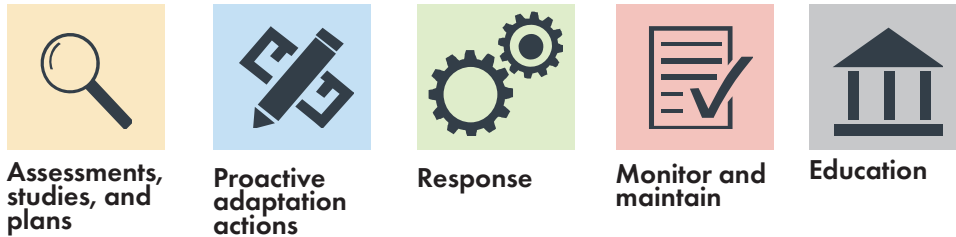
“

In each section of the plan, the CAP includes relevant quotes from community members that were given in the public meetings, surveys, and engagement. These quotations are not intended to be representative of overall feedback. Rather, they provide a sampling of perspectives and voices that were heard throughout the CAP development process.

Figure 27 - How to read the mitigation and environmental justice strategies in this plan. The schematic below provides a description of strategy components in the sections below.

Strategy number	Strategy title				
<p>Timeline Ongoing: already occurring and requiring continued or expanded implementation upon CAP release Immediate: able to be implemented upon CAP release Near: Immediate—2 years Medium: 2—5 years Long: 5+ years</p> <p>Community priority:  A green check mark indicates the strategy was rated as a high priority by the public during the CAP development process.</p>	<p>GHG emissions impact</p> <p>▶ A qualitative scale of GHG emissions reduction potential. Zero filled squares indicates the lowest potential, while five filled squares indicates the highest potential. The potential GHG reductions account for both the city's distribution of emissions (e.g. more emissions result from electricity use than waste) as well as the potential impact of the individual strategy. The scale includes both direct impacts (such as implementing energy efficiency) and indirect impacts (such as administrative changes that enable greater energy efficiency).</p> 	<p>Co-benefits</p> <p>▶ A listing of projected co-benefits from the strategy, such as job creation, reduce inequality and poverty, cost savings, and improve air quality.</p>	<p>City lead</p> <p>▶ The department, bureau or council within Bethlehem city government to coordinate implementation of the strategy.</p>	<p>Partners</p> <p>▶ Additional city departments and external organizations critical to supporting implementation. Listed external organizations have not committed to support the specific strategies as partners; rather, the city will engage these groups to be partners during implementation. This list of partners will inevitably leave off potential future partners. The list included in the CAP is intended as a starting point rather than an ending point, and the city envisions the list of partners to grow as strategies are planned and implemented.</p>	<p>Key Stakeholders</p> <p>▶ Bethlehem populations, communities and organization types that will be impacted by the strategy.</p>
Description of strategy.					
<p>Environmental justice considerations - An explanation of how the strategy can be implemented to promote accessibility, increase equity, mitigate structural racism, and reduce historic inequality and injustice. This section also aims to identify if the strategy may lead to adverse, unintended impacts on vulnerable communities.</p>					
<p>Implementation considerations - A description of any current ordinance, laws or regulations impacting the strategy (at local, state, or federal level). This section also captures current or past initiatives, programs or funding sources that could be leveraged to implement the strategy that could be leveraged. It summarizes the current context, initiatives, and barriers for the strategy along with any relevant examples from other cities or programs.</p>					
<p> Key next step The next action identified for moving the strategy's implementation forward following the release of the CAP.</p>					

The **Adaptation and Resilience Strategies section** does not include specific objectives and goals. Rather, the strategies aim to address the vulnerabilities identified in Appendix 1A. Adaptation strategies are organized into five key categories:



The strategies are organized in this order because, where appropriate, assessments or studies should help guide adaptation actions across the other strategies. Some strategies would be the responsibility of entities other than the City of Bethlehem to implement, such as strategies focused on electrical infrastructure that fall under the purview of the electric utility. The tables themselves are organized into the ten columns described below:

Figure 28 - How to read the adaptation and resilience strategies in this plan. The schematic below provides a description of adaptation strategy components in the sections below.

Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
Describes the proposed strategy	Describes which sectors or asset types to which the strategy applies	A "✓" in any of these 4 columns indicates the strategy is intended to address this hazard				Describes the agency or agencies that are primarily responsible for implementing or enabling implementation of the strategy. These were identified by the stakeholders, including the city	Indicates whether stakeholders determined the strategy was low (L), medium (M), or high (H) priority for implementation	Describes any existing efforts that may serve as a starting point for implementing the strategy.	When applicable, this column describes additional thoughts from stakeholders about the strategy, including barriers, funding needs, key areas of focus, and proactive actions.

The vision for Bethlehem's Climate Action Plan is to implement just and equitable solutions to reduce the city's emissions contributing to global climate change and prepare for the local impacts of increasing temperatures and precipitation.





11

Environmental Justice and Equity

Introduction

The vision for Bethlehem's Climate Action Plan is to implement just and equitable solutions to reduce the city's emissions contributing to global climate change and prepare for the local impacts of increasing temperatures and precipitation. In Bethlehem and across the world, low-income populations and black, indigenous, and people of color (BIPOC) have contributed the least to the problem of climate change but are already bearing the brunt of its impacts, including extreme heat and flooding. The disproportionate exposure of these frontline communities to climate-related harms is only projected to increase as global temperatures rise. In this way, every failure to act quickly and decisively on climate is an environmental justice issue.

The greenhouse gas emissions that contribute to climate change are just one source of environmental justice. The burning of fossil fuels also releases co-pollutants that contribute to local air pollution, including nitrogen oxide (NO_x), sulphur dioxide (SO₂), particulate matter (PM), and volatile organic compounds (VOCs). These pollutants contribute to respiratory illness, including asthma and chronic bronchitis, cancer, and other serious health problems. Total combustion emissions in the US are estimated to account for more than 200,000 premature deaths per year.¹⁶ These health hazards, like pollution, are disproportionately concentrated in communities of color and low-income communities due to environmental racism and historical injustice, such as redlining—the systemic practice of the government and lenders to deny loans, mortgages, and other investment in communities of color.

In addition to the responsibility for righting local environmental injustice, Bethlehem also acknowledges an obligation to at-risk populations worldwide. The city has reaped significant benefits from fossil fuel consumption, which continues to this day. The city's moral responsibility includes helping those less fortunate impacted by the climate changes resulting from this consumption,

¹⁶ <https://www.sciencedirect.com/science/article/abs/pii/S1352231013004548#:~:text=Total%20combustion%20emissions%20in%20the,to%20changes%20in%20ozone%20concentrations.>

including climate refugees. This was evident in 2018 when Category 4 Hurricane Maria devastated Puerto Rico. In the aftermath, local nonprofits assisted nearly 2,400 Puerto Ricans in settling in the Lehigh Valley. They estimate as many as 5,000 people moved to the area in the aftermath of the storm. Initial studies suggest the Lehigh Valley will see a growing number of climate refugees and migrants as temperatures and sea levels continue to rise.¹⁷ Acting as a receiver is not only the right thing to do but also presents an opportunity to strengthen Bethlehem's economy and diversify its culture.

Climate justice is not only about avoiding disparate burdens. To achieve this CAP's vision for climate equity, the City must also ensure a just transition from fossil fuels that equitably distributes the benefits of climate mitigation and resilience programs, addresses past environmental harms, and ensures support and retraining opportunities to workers in affected industries. This includes:

1. Acknowledging that Bethlehem sits on a small part of what was Lenape (sometimes referred to as Lenni-Lenapé) territory and that indigenous people faced injustice and mistreatment due to colonialism
2. Recognizing that at-risk populations, including BIPOC and marginalized genders, will be employed in the projects to implement this transition
3. A commitment to avoiding climate gentrification whereby wealthier, often whiter populations displace lower-income residents and communities of color from areas of lower climate risk.

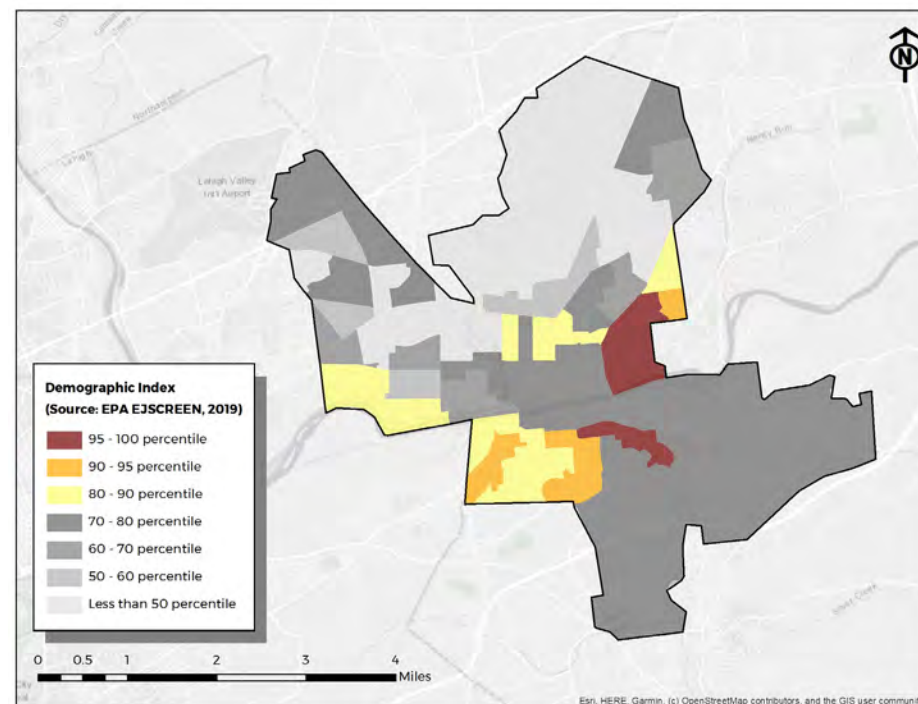


Figure 29. Map of the EPA EJScreen demographic index in Bethlehem.



Goal

Establish ethical framework that supports equity for all Bethlehem residents

40%
of overall benefits to go to frontline communities

“

I live in a leaded apartment I care about the health of my family and we have hard to move everything is very expensive and I am afraid of my family health because we do not have Medical Insurance.

“

I am concerned about what the future holds for us.

“

My concern is not being able to work outside.

¹⁷ <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0227436>

To achieve climate justice, the Climate Action Plan includes the following components:

- Vision (see page 17)
- Equity and justice commitments of this chapter
- Equity and justice strategies to achieve these commitments
- Environmental justice considerations for implementing every strategy in the plan

Bethlehem's frontline communities

Frontline communities are BIPOC communities, low-income communities, and linguistically isolated communities that face disparate amounts of pollution and will experience climate change's worst effects. The EPA's Environmental Justice Screening and Mapping Tool (EJScreen) includes demographic indexes that help identify frontline communities. Based on EJScreen's demographic index, Bethlehem's frontline communities are concentrated on the Southside and East Bethlehem.

These areas coincide with some of the hottest parts of the city, as shown in [Figure 10](#) in the *Vulnerability* section. Highly developed areas lacking vegetation and green space tend to have much higher temperatures due to the urban heat island effect. These hot spots will experience even greater

Community
Voices



“

I'm in good health, but I'm worried about my husband's because allergies affect him a lot.

“

It is not only essential to help more vulnerable communities but make the community understand that burdens of climate change do not fall upon all people equally.

climate change extremes, significant health hazards, and environmental justice concerns.

Objectives

To achieve Bethlehem's vision of just and equitable climate action, the city commits to:

- Establishing a just and ethical long-term framework for climate action supporting equity for all Bethlehem residents
- Ensuring 40% of overall benefits resulting from city spending on implementing this CAP goes to frontline communities




The 40% level in the second objective is a best practice established in the **Biden Environmental Justice Plan**. Similarly, New York State's **Climate Leadership and Community Protection Act** signed in 2019 sets a goal of investing 40% of clean energy program resources to benefit disadvantaged communities. There is not a single universally accepted definition or quantifiable threshold to identify frontline communities. In coordination with community stakeholders and the best available science, the city will need to adopt a transparent and functional definition for the purposes of this CAP, which can be iteratively updated over time. Similarly, the city will need to formalize the definition and measurement of benefits resulting from the CAP. Measurement could consist of dollars from the city budget or less tangible impacts, so long as a clear measurement methodology is developed. This should be done in coordination with the Bethlehem Climate and Environmental Justice Council (EJ1.2).

Government programs serving low-income populations often require applicants establish their eligibility or request an exemption from standard criteria, which imposes barriers on participation because it is time- and resource-consuming, often requires additional knowledge of requirements and procedures, and can be embarrassing. The city should design the programs described in this chapter and those that follow, particularly those serving frontline communities, to avoid imposing excessive administrative burdens and the attendant costs of processing the claims.

Strategies

The list below defines a series of strategies and action steps to achieve the objectives defined above.

GOAL: Establish a just and ethical long-term framework for climate action supporting equity for all Bethlehem residents

EJ1.1		Create a Bethlehem Climate and Environmental Justice Plan			
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Reduce inequality and poverty ▶ Improve public health & well-being ▶ Improve air quality ▶ Improve water quality ▶ Increase climate resilience ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability (Strategy M3.1) 	Partners <ul style="list-style-type: none"> ▶ CAP Environmental Justice & Equity Steering Committee ▶ Organizations representing frontline communities ▶ Dept. of Public Works ▶ City Council ▶ Mayor's Office ▶ EAC 	Key Stakeholders <ul style="list-style-type: none"> ▶ Frontline communities
Community Priority 	Develop a Climate and Environmental Justice Plan for the city. While this CAP aims to integrate the principles and objectives of environmental justice throughout the plan, a separate plan focused exclusively on environmental justice could further move the city toward objectives such as giving frontline communities a direct voice in decisions affecting them, equitable investment, anti-displacement, and local pollution reduction.				
Implementation considerations - A tenet of environmental justice is to let frontline communities speak for themselves and respect lived experience as expertise. The creation of a Bethlehem Climate and Environmental Justice Plan must be done in partnership with these communities in Bethlehem. While the Office of Sustainability (M3.1) will be positioned well to coordinate such an effort, until the office is created Dept. of Public Works should lead this effort given its role in developing the CAP and experience in soliciting proposals to develop plans of similar size and complexity. The City can use the City of Providence, RI, Climate Justice Plan as an model.					
 Key next step Dept. of Public Works to meet with the CAP Environmental Justice & Equity Steering Committee and City Council to determine the best approach for developing the plan.					

EJ1.2		Create a Bethlehem Climate and Environmental Justice Council			
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Reduce inequality and poverty ▶ Improve public health & well-being ▶ Improve air quality ▶ Improve water quality ▶ Increase climate resilience ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Mayor's Office 	Partners <ul style="list-style-type: none"> ▶ CAP Environmental Justice & Equity Steering Committee ▶ Organizations representing frontline communities ▶ Department of Community and Economic Development ▶ City Council ▶ EAC ▶ Environmental justice researchers and experts 	Key Stakeholders <ul style="list-style-type: none"> ▶ Frontline communities
Community Priority 	To inform the development of a Bethlehem Climate and Environmental Justice Plan, the implementation of strategies in this CAP, and future updates to the Bethlehem CAP, the city should create a Climate and Environmental Justice Council. The council could consist of representatives from frontline communities who could gather those communities' concerns and relay them to the city. The council should also include subject-matter experts with experience identifying and quantifying environmental justice impacts of city decisions and plans. These members would help the council and general public understand how proposed city decisions, plans, and policies may impact frontline communities and work with the representatives of these communities to develop council recommendations. The council would create an information pathway between city government and community-level concerns about the environment. The council could also develop a framework of principles for advancing equity and justice in Bethlehem.				
Implementation considerations - The Bethlehem CAP's Environmental Justice and Equity Steering Committee and the connections it made in local communities can serve as a starting point until representatives from frontline communities can be selected in a formal process. The Bethlehem Mayor's Office has convened other committees, referred to as the Mayor's Ad Hoc Committees, including the Financial Advisory Committee and the Latino Advisory Committee. The city should pay representatives of frontline communities as experts for their time on the council helping the City understand how its plans will impact these communities. Compensation will make the council more effective, encouraging participation and removing barriers for those who are already overworked and underpaid.					
 Key next step - Mayor's Office to convene a meeting with the CAP Environmental Justice and Equity Steering Committee to discuss the creation of a formal Council.					

EJ1.3 Codify environmental justice considerations into city ordinances and planning/zoning decisions

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Reduce inequality and poverty
- ▶ Improve public health & well-being
- ▶ Improve air quality
- ▶ Improve water quality
- ▶ Increase climate resilience
- ▶ Improve system sustainability

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ Mayor's Office
- ▶ CAP Environmental Justice & Equity Steering Committee
- ▶ City Council
- ▶ Department of Community and Economic Development

Key Stakeholders

- ▶ Frontline communities

Create a commission to review existing city ordinances and planning and zoning decisions for environmental justice considerations and provide recommendations on updating to enhance environmental justice. Codify these changes into city ordinances and planning/zoning decisions. Develop processes, such as regular forums, to increase the voice frontline communities have on city decisions that impact the environmental quality of their communities.

Implementation considerations - The Bethlehem Environmental Justice Council mentioned in strategy EJ1.2 can serve as a starting point for the commission. As with EJ1.2, the city should pay representatives of frontline communities as experts for their time helping the city understand how its plans will impact these communities. The process should not be seen as all-or-nothing but rather an ongoing process. A full review should be conducted but it should not serve as an excuse to delay the integration of identified environmental justice considerations into city laws and practices. A complement or addition to this strategy would be to pass an ordinance similar to the Newark, NJ, [2016 Environmental Justice and Cumulative Impacts Ordinance](#), which requires industrial and commercial development proposals to include information about cumulative environmental impacts that will allow decisionmakers and the public to make an informed decision if the development meets the city's sustainability goals.

For this strategy to be successful, the city must begin by conducting an environmental analysis of the city, including the work described in strategy EJ 2.4. This would measure existing exposures and risks to communities, identify the most significant problem areas, and then consider how new decisions and policies add to cumulative burdens. As noted in the objectives of this chapter and EJ2.1, the city must also define frontline and environmental justice communities, incorporating into the definition existing environmental threats, not solely race and income. The definition can build from work already begun with the Pennsylvania DEP's Office of Environmental Justice, which engaged local stakeholders to develop a list of potential environmental exposures and risks that could be assessed in a citywide analysis. Any incorporation of environmental justice concerns into ongoing planning and zoning decisions, such as requiring an environmental justice analysis as part of routine planning and zoning decisions, as described in this strategy, should start with an understanding of pre-existing environmental burdens.



Key next step - Mayor's Office to convene a meeting with the CAP Environmental Justice and Equity Steering Committee to discuss the creation of a formal Council, and Planning and Zoning to identify a timeline for the review in this strategy.

CONDUCTING AN ENVIRONMENTAL JUSTICE ASSESSMENT



Formalizing assessment of environmental inequity—as described in EJ1—for project applications and approvals within the city is one way to provide government departments as well as municipal decision boards and commissions with information needed to prevent further burdening environmental justice communities. For instance, such information can be used by the Zoning Hearing Board in its beneficial vs. burden calculations. This information can also increase transparency in government and provide the public with information they need to ask relevant questions about newly proposed projects and to determine whether they support them.



The requirement to complete a formal assessment of environmental impacts on environmental justice communities can be limited to certain kinds of development projects (e.g., industrial and commercial projects already requiring state or federal environmental permits) and the assessment requirements can vary depending on the type of project (e.g., industrial or commercial). A few specific features are also crucial to formalizing environmental justice assessments:

- First, to evaluate whether proposed projects will have negative or positive impacts on vulnerable communities, an existing inventory of environmental assets and hazards must be carried out to define baseline conditions. State and federal departments of environmental protection, as well as other institutional entities committed to environmental research, protection, and conservation may provide sufficient expertise and resources to carry out this baseline assessment.
- Second, the geographical boundaries of environmental justice communities must be identified so that the formal assessment is triggered when a project will have positive or negative impacts on the environment in these communities. For instance, a relevant community could be defined as one in which 35% of the population qualifies as low-income, and/or over 40% of the residents are members of a minority group.
- Third, a list of relevant impacts must be specified (e.g., changes in air pollution, truck trips, stormwater retention and recharge) for different types of projects, so the project applicant knows what impacts require assessment. It is also important to provide an opportunity for the applicant to explain impact mitigation and avoidance strategies that will be adopted.
- Fourth, a process for evaluating and approving the information provided in the assessment must be established through an institutional entity such as Bethlehem's Environmental Advisory Council (EAC). This provides the project applicant an opportunity to get expert guidance and support for completing the assessment and provides decision boards assurance they can proceed with their evaluation of a project based on information in the assessment is complete and accurate.




GOAL: Ensure 40% of overall benefits resulting from City spending on implementing this CAP goes to frontline communities

EJ2.1 Evaluate strategies in this CAP for their benefits to frontline communities



<p>Timeline ▶ Ongoing</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Reduce inequality and poverty 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Office of Sustainability (Strategy M3.1) 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development ▶ CAP Environmental Justice & Equity Steering Committee 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Frontline communities
---	--	---	--	---	--

As strategies in this CAP are implemented, calculate a series of metrics to measure the impact of each strategy on Bethlehem’s frontline communities. These metrics should be made public on the city’s website and tracked to measure progress toward the goal of ensuring 40% of overall CAP benefits from city spending go to frontline communities.

Implementation considerations - To evaluate impact, frontline communities must first be defined. This CAP provides several indexes, including the EPA EJScreen, but the definition for the purposes of this goal and strategy should be created in coordination with the Bethlehem Climate and Environmental Justice Council mentioned in strategy EJ1.2. The definition can build from work already begun with the Pennsylvania DEP’s Office of Environmental Justice, which engaged local stakeholders to develop a list of potential environmental exposures and risks that could be assessed in a citywide analysis. Impact metrics should start with the amount of city funding dedicated to strategy implementation in frontline communities. But measures should be broadened to also account for health impacts, such as cleaner air; job impacts; social amenities, such as access to parks, and other less tangible benefits.


 **Key next step**
Until the creation of an Office of Sustainability (M3.1) to track this metric, the Department of Community and Economic Development will convene a meeting with the CAP Environmental Justice and Equity Steering Committee to begin defining metrics.

EJ2.2 Incorporate the financial cost of health impacts from pollution and climate-related impacts into budget and policy analyses

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Improve water quality ▶ Reduce inequality and poverty ▶ Improve system sustainability 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Mayor’s Office 	<p>Partners</p> <ul style="list-style-type: none"> ▶ City Council ▶ Office of Sustainability ▶ CAP Environmental Justice & Equity Steering Committee ▶ LVPC 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Frontline communities ▶ All Bethlehem residents
---	---	---	--	--	---

Incorporate the financial cost of health impacts from pollution into the assessments of budget and policy decisions, such as whether to invest in lower-emission vehicles. Similarly, integrate the potential cost of future climate stressors and insufficient adaptation into budget and policy decisions.

Implementation considerations - [The latest research](#) shows that the air quality benefits alone are sufficient to more than pay for switching from fossil fuels to clean energy. According to testimony presented at a House Committee on Oversight and Reform, “Over the next 50 years, keeping [the climate] to the 2°C pathway would prevent roughly 4.5 million premature deaths, about 3.5 million hospitalizations and emergency room visits, and approximately 300 million lost workdays in the US.” Once it is formed, the Bethlehem Environmental Justice Council mentioned in strategy EJ1.2 will be a key stakeholder. An economic value of clean air could be based on a methodology found in the [LVPC Return on Environment study](#) that quantifies ecosystem services like water purification and avoided health care costs for air quality improvement.

 **Key next step**
Mayor’s Office and City Council to request Bethlehem Environmental Justice Council to present a methodology for incorporating this strategy into city budgeting and policymaking.

EJ2.3 Create a Climate Action Plan apprenticeship program

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Workforce development
- ▶ Job creation

City lead

- ▶ Office of Sustainability (Strategy M3.1)

Partners

- ▶ CAP Environmental Justice & Equity Steering Committee
- ▶ Organizations representing frontline communities
- ▶ Workforce development programs
- ▶ Private sector CAP implementation partners
- ▶ BAVTS
- ▶ NCC

Key Stakeholders

- ▶ Frontline communities
- ▶ Local youth

Create a city apprenticeship program that gives youth an opportunity to obtain training from city staff and contractors hired to implement CAP strategies and programs.

Implementation considerations - The city can expedite the creation of this program through partnerships with existing workforce development programs. The city should explore partnerships with local schools, such as Bethlehem Area Vocational-Technical School (BAVTS) and Northampton Community College (NCC).



Key next step

Office of Sustainability (M3.1) to review CAP for a list of short-term strategies that offer opportunities for apprenticeships.

EJ2.4 Measure local environmental burdens to inform neighborhood-level investments

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve health and wellbeing
- ▶ Reduce inequality and poverty
- ▶ Improve air quality

City lead

- ▶ Health Bureau

Partners

- ▶ Office of Sustainability
- ▶ South Side Initiative Air Pollution and Asthma working group
- ▶ Lehigh University
- ▶ St. Luke's Community Health Department
- ▶ CAP Environmental Justice & Equity Steering Committee
- ▶ PurpleAir
- ▶ Organizations representing frontline communities

Key Stakeholders

- ▶ Frontline communities

Deploy localized air pollution monitoring to gather neighborhood-level data to prioritize climate and environmental investments in neighborhoods with the greatest burdens.

Implementation considerations - Diesel pollution and PM2.5 are highly-localized but have significant health impacts. According to a [PennEnvironment report](#) based on analysis of U.S. Environmental Protection Agency air monitoring data, the Lehigh Valley had some of the worst air quality in Pennsylvania in 2018, recording 99 days where half or more monitoring stations reported elevated levels of ozone or particulate matter. DEP and EPA monitoring of air quality likely understates levels of pollutants in certain Bethlehem neighborhoods due to the hyper-local variation in pollutants such as PM2.5. The [South Side Initiative Air Pollution and Asthma working group](#) evolved in response to a 2008 Bethlehem Area Health Network study showing that asthma rates for school children on the South Side were three times the national average. The working group has made the local air pollution problem more visible by using hand-held air pollution monitors that measure black carbon air pollution, which is emitted in the largest quantities by diesel vehicles that traverse the city, and also by certain kinds of residential heating. This research is ongoing and integrated into classes on environmental policy at Lehigh University. Over the years, the working group has identified pollution hotspots in South Bethlehem, assessed how traffic is affecting air quality on local streets during rush-hour time periods, studied low-exposure walking routes through the city, and revealed how much a pedestrian bridge across the Lehigh River would reduce pollution exposure for people who cross the river on foot. There are existing monitoring networks in Bethlehem, such as PurpleAir sensors and the federally administered AirNow network, but these could be expanded, particularly in hotspot areas. As of 2020, Bethlehem had just 3 sensors in the PurpleAir network. Implementation of this strategy, as well as EJ1.3, should seek to avoid climate gentrification whereby wealthier, often whiter populations displace lower-income residents and communities of color from areas of lower climate risk.



Key next step

Health Bureau to evaluate options for expanding existing monitoring efforts through city funding and partnerships.

12

Mitigation Strategies

Achieving this CAP's ambitions requires a transformation of nearly every system that Bethlehem residents and businesses use each day. This transformation is an unprecedented undertaking that includes powering our buildings with renewable energy and developing clean transportation alternatives. But it is also an opportunity. The transition to a clean energy economy will create well-paying jobs, cleaner air, and better health outcomes. When implemented with a focus on justice and equity, the transformation will also begin to unravel environmental racism and the historically disproportionate burden on frontline communities.

The following sections provide Bethlehem's roadmap for this transformation. To meet the city's community-wide GHG mitigation goals, the CAP defines objectives for the following sectors:

*The City's
roadmap to success
begins with meeting the
objectives set for each
community-wide sector.*

Community-Wide Sectors

 Municipal Operations	 Buildings
 Electricity Sourcing	 Transportation and Mobility
 Land Use and Green Space	 Local Food and Waste
 Public Engagement	 Large Organizations and Institutions



CLIMATE ACTION CO-BENEFITS

GHG reduction is not the only beneficial outcome of this plan’s mitigation strategies.

There are also co-benefits that will promote a more prosperous community. Each of this plan’s strategies has co-benefits, including:



Each sector’s objectives include a series of goals that create a ladder to achieve it. The CAP’s GHG mitigation strategies for each sector are grouped according to the goal they support.

Together, the sector-specific objectives and strategies chart the course to reach Bethlehem’s targets of a 33% GHG emissions reduction by 2025, 60% by 2030, and net-zero by 2040. This high-level pathway is modeled in [Figure 30](#). The specific reductions attributable to individual strategies depend significantly on the scope and timing of implementation. To guide implementation and prioritize environmental justice, each strategy also includes a list of implementation considerations, environmental justice considerations, and a key next step. [Figure 27](#) in *How to read this plan* provides a description of each component of the mitigation strategies.

The CAP’s overall implementation approach is detailed in the Implementation Strategy chapter. Each mitigation sector below also includes a short implementation plan, which provides sector-specific details and aligns with the overall strategy. The Municipal Operations section is included first because it describes strategies to implement the city’s Climate Action Plan, such as creating a Bethlehem Office of Sustainability with a city Director of Sustainability, which are relevant to all subsequent sections.

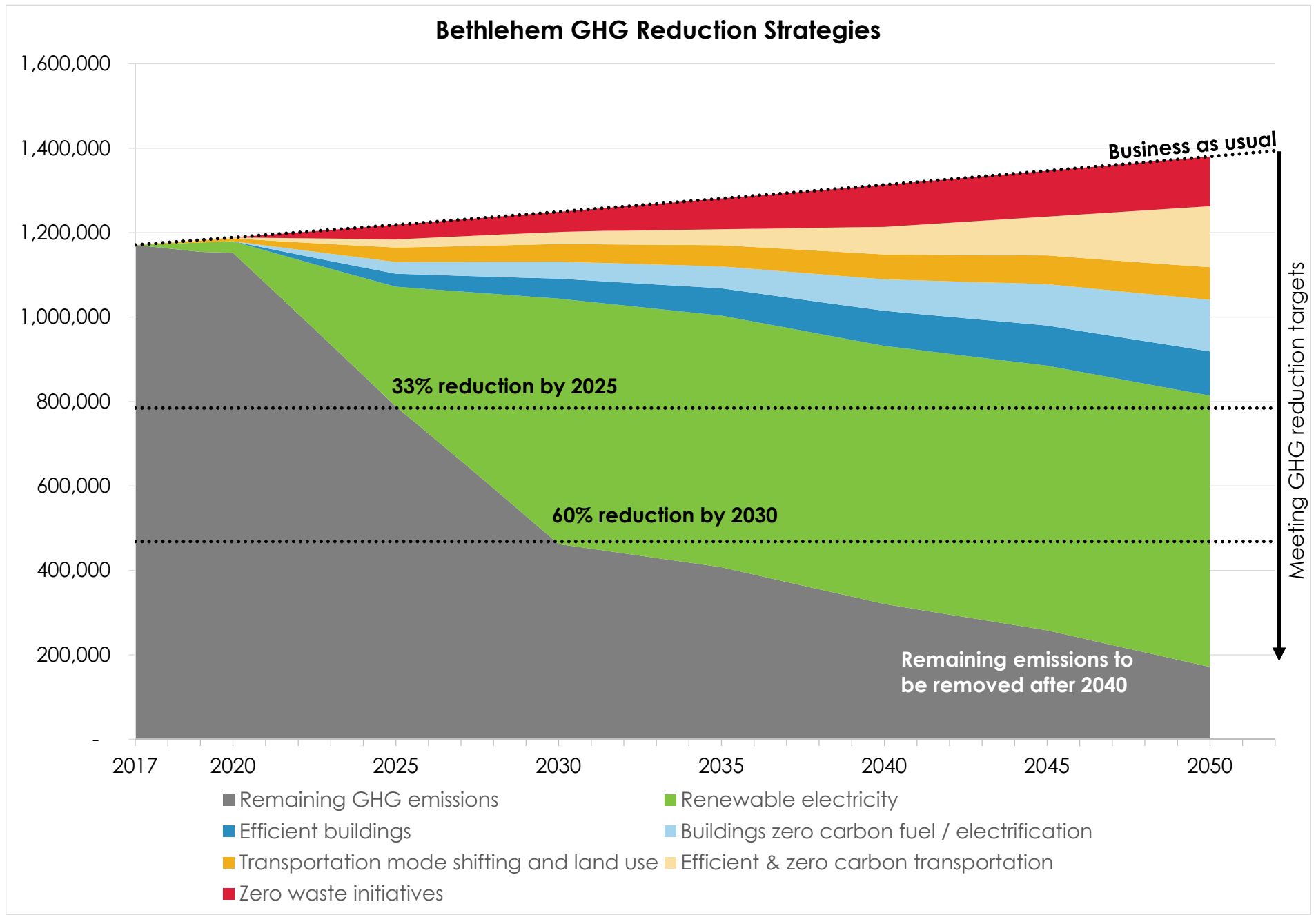


Figure 30. Bethlehem's pathway to meeting its GHG mitigation targets.



Municipal Operations

The city has made significant investments to reduce its municipal operations GHG footprint, which declined 38% from 2005 to 2017.

Introduction

The City of Bethlehem's municipal operations emitted 10,200 metric tons of carbon dioxide-equivalent GHG emissions in 2017. This represents less than 1% of the city's total community-wide emissions. The city has made significant investments to reduce its municipal operations GHG footprint, which declined 38% from 2005 to 2017. Examples of these initiatives include:

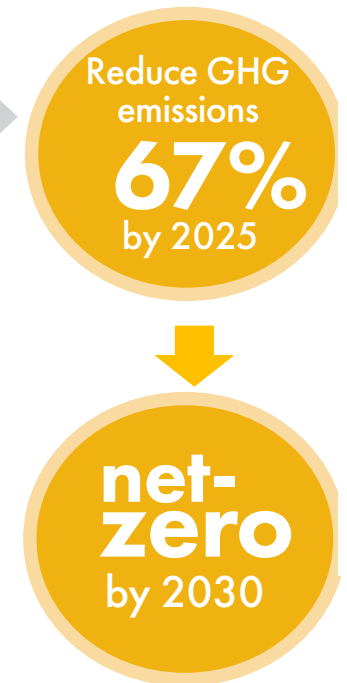
- Purchasing of 50% renewable electricity in 2017 and 100% renewable electricity from 2018 onward
- Upgrading 106 traffic signals to LED—all new signals installed after the upgrade are also LED, saving \$120,000 to \$170,000 per year
- Upgrading all non-decorative streetlights to LED, saving up to \$156,000 per year
- Investing over \$5 million in energy conservation measures in city facilities
- Planting more than 240 trees planted over the last five years via the city's tree shade ordinance
- Collecting more than 66 million pounds of recycling annually, generating more than \$3 million in revenue
- Investing in energy conservation improvements at the Water Filtration Plant, including variable frequency drives (VFDs) resulting in an 18% reduction in electrical costs

- Implementing wastewater treatment plant (WWTP) energy conservations that have reduced WWTP energy use 40% since 2005
 - The WWTP produces biogas as a byproduct of anaerobic digestion. This biogas is comprised partly of methane, which is burned in the boilers to heat water and the digesters

The Bethlehem Authority also owns more than 20,000 acres of watershed property. The Authority maintains a watershed management plan that includes conservation efforts, timbering operations, and the selling of certified carbon credits. An analysis of the forested area indicates a total carbon sequestration value of over 27,500 tons of CO₂ per year.

Prior to accounting for the city's purchase of 100% renewable electricity, electricity consumption emissions would be roughly 60% of city emissions. Now that the city has mitigated those emissions by purchasing 100% renewable electricity, the remaining municipal operations GHG emissions are approximately 50% from vehicle use, 15% from natural gas consumption in buildings, 15% from refrigerants, and from smaller combustion sources, such as fuel oil and propane.

objective →



Objectives

Bethlehem has not completed a GHG inventory for municipal operations since 2017 and recognizes that doing so is a high priority for tracking continued progress and leading by example. The 38% reduction by 2017 from the city operations' 2005 baseline does not include the city's move to 100% renewable electricity purchasing. However, the reduction still exceeds the US commitment from the 2015 Paris Agreement, which the City of Bethlehem endorsed via the We Are Still In pledge. The IPCC has found the commitments of the Paris Agreement are insufficient to hold warming to 1.5°C. As a result of this finding, and to lead by example, the city government commits to the following objectives:

- Reduce GHG emissions from municipal operations 67% relative to a 2005 baseline by 2025
- Achieve net-zero operations by 2030
- Implement the city's Climate Action Plan

These objectives will be accomplished through strategies that target six specific impact goals:

- Continue to purchase 100% renewable electricity for all municipal operations
- Actively evaluate opportunities for electric and other low-emission vehicles and convert the municipal fleet where feasible
- Continue to invest in efficiency projects to reduce residual emissions and the electricity that must be purchased by the city
- Generate carbon removal credits or invest in offset projects to reach net-zero emissions
- Create an office of sustainability with a city Director of Sustainability
- Lead by example and provide a testing ground for strategies that can be scaled to the rest of the community

Strategies & actions

The list below defines a series of strategies and action steps to achieve the objectives defined above.

““

The city can claim, more than any entrepreneur, a public mandate to lead in testing new strategies, and can benefit from leadership.

““



It's not enough to just begin to implement it. The city needs to fully embrace and adopt this as an important part of their mission moving forward.

GOAL: Reduce GHG emissions from municipal operations 67% relative to a 2005 baseline by 2025

M1.1 Continue to purchase 100% renewable electricity for all municipal operations going forward					
Timeline ▶ Ongoing	GHG emissions impact 	Co-benefits ▶ Reduce resource consumption	City lead ▶ Dept. of Public Works	Partners ▶ Office of Sustainability	Key Stakeholders ▶ All municipal staff ▶ All residents and businesses
Community Priority	Commit to long-term purchasing of renewable electricity for all municipal operations. The city currently procures renewable electricity from the open market, but it should also explore opportunities to procure from high-impact renewable electricity projects, such as new installations with co-benefits.				
Environmental justice considerations - The City should conduct an annual review of the sources of its renewable electricity and confirm these generation facilities do not contribute to environmental injustice.					
Implementation considerations - The City of Philadelphia's Power Purchase Agreement (PPA) with an 80-megawatt solar farm in Adams County provides a model for municipal procurement of 100% renewable electricity via PPAs. The city should focus on procuring high-quality renewable electricity backed by Green-e certification from high impact projects, as described by WRI .					
	Key next step Dept. of Public Works to explore options for long-term renewable PPAs that provide greater market impact and long-term stability.				

M1.2 Continue to invest in energy efficiency projects to reduce residual emissions and the amount of electricity that must be purchased by the city					
Timeline ▶ Ongoing	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Improve air quality ▶ Reduce resource consumption ▶ Increase climate resilience	City lead ▶ Dept. of Public Works	Partners ▶ Office of Sustainability	Key Stakeholders ▶ All municipal staff ▶ All residents and businesses
Community Priority	Continue and expand investments in energy efficiency and conservation.				
Environmental justice considerations - The city can lead by example through consideration of environmental justice impacts on all projects. To provide the visibility necessary to encourage similar consideration by the private sector, the city should publish details on how environmental justice has been evaluated for each project.					
Implementation considerations - The Department of Public Works has already completed numerous successful projects, ranging from LED conversions to wastewater treatment plant upgrades. After existing upgrades and the purchase of 100% renewable electricity, the city has a small amount of remaining building-related emissions from natural gas, fuel oil, and propane combustion as well as refrigerants.					
	Key next step Dept. of Public Works to continue to explore opportunities to implement projects reducing residual emissions and operational costs.				

M1.3 Increase energy efficiency standards of city government buildings.

Timeline ▶ Medium Community Priority 	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Cost savings ▶ Improve air quality ▶ Reduce resource consumption ▶ Increase climate resilience 	City lead <ul style="list-style-type: none"> ▶ Dept. of Public Works 	Partners <ul style="list-style-type: none"> ▶ City Council 	Key Stakeholders <ul style="list-style-type: none"> ▶ All municipal staff ▶ All residents and businesses
--	--	--	--	--	---



Require all existing city government buildings to increase energy efficiency to 10% better than applicable energy code by 2030 and at least 50% reduction from a 2020 baseline.

Environmental justice considerations - None noted.

Implementation considerations - The requirements in the existing energy code may need to be reassessed with standards increased prior to the implementation of this strategy to ensure the intended results. The city should also consider the 2030 Districts requirement for existing buildings which is a 50% reduction by 2030 from a 2003 CBECS (Commercial Buildings Energy Consumption Survey) baseline. Baselines can be run for free using [Zero Tool](#) and EUIs can be tracked for free on an annual basis in [ENERGY STAR Portfolio Manager](#).

 **Key next step**
 Dept. of Public Works to evaluate if this strategy would increase efficiency levels beyond those already achieved by the city through extensive prior investment.


M1.4 Actively evaluate opportunities for electric and other low-emission vehicles and convert the municipal fleet where feasible

Timeline ▶ Ongoing Community Priority 	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Cost savings ▶ Improve air quality ▶ Reduce resource consumption 	City lead <ul style="list-style-type: none"> ▶ Dept. of Public Works 	Partners <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ PPL Electric 	Key Stakeholders <ul style="list-style-type: none"> ▶ All municipal staff ▶ All residents and businesses
---	--	---	--	--	---

Convert the municipal vehicle fleet to electric and other low-emission vehicles in stages based on feasibility. Opportunities to convert heavy duty equipment and emergency units are in some cases not yet feasible for these technologies. As a result, the city will focus on opportunities to convert vehicles in the fleet where cost-effective options exist that meet operational requirements.

Environmental justice considerations - As strategy EJ2.2 is implemented, the city should incorporate the financial cost of health impacts from pollution into the assessments of budget decisions for adopting electric vehicles.

Implementation considerations - The Pennsylvania Department of Environmental Protection (DEP) provides [information and resources](#) for adopting electric vehicles, including the Pennsylvania Electric Vehicle Roadmap and various grants and rebates.

 **Key next step**
 Dept. of Public Works to evaluate DEP grant programs and conduct a review of converting light-duty vehicles. This strategy is already underway and will continue.



Carbon removal credits vs. carbon offset credits

Carbon offset credits allow individuals, organizations, and governments to compensate for GHG emissions by purchasing a certificate confirming an equivalent quantity of GHG emissions have been reduced elsewhere.




Traditional offset credits allow the counting of emissions avoided as a result of the credit purchase, such as funding a solar power plant to avoid the need to build a new fossil fuel power plant. These offsets are an important source of green financing, but the emissions equivalent

to the purchased credits continue to accumulate in the atmosphere as a result of the purchaser’s activity. To allow entities to reach “net zero” GHG emissions, a state in which there is no net impact on the climate, the Science-based Targets initiative (SBTi) has placed increasing focus on carbon removal credits. These credits certify that an equivalent quantity of CO₂ has been removed from the atmosphere and sequestered, either through nature-based solutions, such as forests and soil, or technology-based solutions, such as direct air capture.

GOAL: Achieve net-zero operations by 2030

M2.1 Generate carbon removal credits or invest in offset projects to reach net zero emissions					
Timeline ▶ Long	GHG emissions impact 	Co-benefits ▶ Conserve natural resources and biodiversity	City lead ▶ Office of Sustainability	Partners ▶ Bethlehem Authority	Key Stakeholders ▶ All residents and businesses
Community Priority	<p>If the city has remaining GHG emissions from municipal operations in its net-zero goal year, it will purchase carbon offset credits for these residual emissions. The city will aim to align with best practices in purchasing at the time of purchase, such as purchasing carbon removal credits rather than traditional carbon offset credits.</p> <p>Environmental justice considerations - Make social, ecological, and economic co-benefits a criterion for all offset purchasing decisions. If these criteria are determined successful, similar criteria could be applied to all city purchasing decisions for broader impact.</p> <p>Implementation considerations - The Bethlehem Authority owns more than 20,000 acres of watershed property. The Authority maintains a watershed management plan that includes conservation efforts and the selling of carbon credits. These are currently a source of revenue for the Authority but could be retired by the city to meet its goal.</p>				
Key next step Office of Sustainability to engage with the Bethlehem Authority to identify opportunities for offset projects.					

GOAL: Implement the city's Climate Action Plan

M3.1 Create an Office of Sustainability with a city Director of Sustainability					
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Increase climate resilience ▶ Improve system sustainability ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Workforce development ▶ Job creation ▶ Reduce inequality and poverty ▶ Conserve natural resources and biodiversity ▶ Improve water quality ▶ Reduce resource consumption ▶ Cost savings 	City lead <ul style="list-style-type: none"> ▶ Mayor's Office 	Partners <ul style="list-style-type: none"> ▶ City Council ▶ Mayor Donchez ▶ Lehigh Valley Planning Commission 	Key Stakeholders <ul style="list-style-type: none"> ▶ All municipal staff ▶ All residents and businesses
Community Priority 	<p>Create an Office of Sustainability to oversee and implement the programs, policies, and ordinances described in CAP strategies. Successful implementation of the wide array of strategies across different sectors will require a single point of coordination and leadership. Having this be a separate department would allow the Sustainability Office to connect and build relationships among the city's departments, allowing for coordinated climate action. This department would also be able to work with the Lehigh Valley Planning Commission, bringing their initiatives to the city.</p> <p>Environmental justice considerations - Environmental justice experience should be a key qualification for the role of Sustainability Director.</p> <p>Implementation considerations - The EAC wrote a letter to Members of City Council and Mayor Donchez strongly recommending the creation of an Office of Sustainability to oversee and implement the programs, policies and ordinances that will result from the CAP. The primary role of the Office of Sustainability would be to manage and facilitate the implementation of the CAP, as well as to track progress toward goals and to coordinate future CAP updates. The Office, led by a Sustainability Director, would bring subject-matter expertise and a climate focus to city operations, programs, and partnerships. The Office of Sustainability would not implement all strategies in this CAP on its own; rather, it would coordinate and support other departments inside the city government and outside organizations to achieve the vision and goals of the CAP. This could include seeking grant funding, forging new partnerships, and serving as the city's climate subject-matter expert. An Office of Sustainability could also assist each city department in analyzing its operations in terms of climate impact and risk. The Office of Sustainability should ensure sustainable practice and education are integrated across all city departments and bureaus, such as via the employee manual of the city. The Sustainability Director could help to consolidate climate-related public communications and outreach efforts, as described in strategy PE1.4.</p> <p> Key next step Mayor's Office to meet with City Council and identify funding to immediately create an Office of Sustainability and hire a Sustainability Director.</p>				

M3.2 Update the city's GHG emissions inventory

Timeline ▶ Ongoing	GHG emissions impact 	Co-benefits ▶ Improve system sustainability	City lead ▶ Office of Sustainability	Partners ▶ EAC ▶ PPL Electric ▶ UGI ▶ LVPC	Key Stakeholders ▶ All residents and businesses
Community Priority 					

Annually update the city's community-wide and municipal-operations inventories. Pursue continuous improvement of these inventories by integrating more granular data and sectors currently excluded.

Environmental justice considerations - None noted.

Implementation considerations - WSP prepared a memo of recommendations to improve both the community-wide and municipal operations GHG inventory. PA DEP has a [Local Climate Action Plan \(LCAP\) Program](#) to support municipal GHG inventories. Through the LCAP program, the city has signed up to receive in 2021 a year of free technical support and resources from ICLEI – Local Governments for Sustainability. ICLEI is the leading global network of local governments dedicated to sustainability, resilience, and climate action. ICLEI can support the city's first update of its GHG inventory following the release of the CAP. The city should consider extending the ICLEI membership beyond 2021.

Key next step
Dept. of Public Works, in coordination with the EAC, to meet with ICLEI and determine resources available to prepare the 2020 GHG emissions inventory data.

M3.3 Lead by example and provide a testing ground for strategies that can be scaled to the rest of the community

Timeline ▶ Ongoing	GHG emissions impact 	Co-benefits ▶ Increase climate resilience ▶ Improve system sustainability	City lead ▶ Dept. of Public Works	Partners ▶ Office of Sustainability ▶ City Council ▶ EAC	Key Stakeholders ▶ All municipal staff ▶ All residents and businesses
Community Priority 					



From prioritizing native plants to installing on-site solar, the city has numerous opportunities to lead by example in the implementation of the CAP. The city should explore every opportunity to do so, providing opportunities to pilot strategies and demonstrate effectiveness before they are scaled to the general public. Not all strategies require such a pilot, but the city should explore opportunities to continue to lead by example, as it has done on climate action going back to 2005.

Environmental justice considerations - The city should prioritize opportunities to pilot strategies and programs that provide a direct benefit to low-income populations. For example, if the Pennsylvania legislature allows community solar projects to be developed, the city could utilize a municipal rooftop and/or parking lot as a site for a community solar project specifically targeting low-income residents. New York's [Solar for All program](#) provides a model for this approach.

Implementation considerations - Dept. of Public Works should work with the EAC, the Office of Sustainability, and the CAP Stakeholder Working Group to determine the top priorities for demonstration projects. The city should start with a review of city-owned buildings for the potential of rooftop solar. In particular, as described in strategy E1.3, the city can expand renewable energy adoption across Bethlehem by demonstrating the benefits of renewable energy. The city should install on-site renewables on new and existing buildings where feasible, in addition to continuing to source 100% renewable energy for all city needs. In coordination with M3.1, to lead by example, the Office of Sustainability should ensure sustainable practice and education are integrated across all city departments and bureaus, such as via the employee manual of the city. Additionally, the city should lead by example through operational policies that reduce GHG emissions, such as setting a schedule for turning off building and decorative lights overnight. Actions, however small, that are visible publicly will help generate support for the Public Engagement strategies of the CAP.

Key next step
Dept. of Public Works to convene a meeting to determine the top priorities for demonstration projects.


M3.4 Coordinate working groups of key stakeholders to initiate implementation of each CAP section

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Improve system sustainability	City lead ▶ Office of Sustainability	Partners ▶ Dept. of Public Works ▶ CAP WG ▶ EAC ▶ Local community-based organizations	Key Stakeholders ▶ All municipal staff ▶ All residents and businesses
Community Priority 					



Form working groups for each section of the CAP consisting of stakeholders from industry, non-profits, government, the general public and vulnerable communities. Many strategies in the CAP will require coordination across these stakeholder groups. The city should take responsibility for this coordination through the Office of Sustainability.

Environmental justice considerations - The city should actively recruit low-income and frontline communities to participate in these working groups.

Implementation considerations - The CAP Working Group convened to create this plan provides a starting point for these working groups. The groups can operate as part of the Bethlehem Green Ribbon Commission, as described in the Large Organizations and Institutions section, or independently. The city should leverage the Director of Sustainability position to coordinate working groups. For working group coordination support, the city should partner with organizations that directly work with and serve the city's communities, such as Community Action Lehigh Valley (Community Action), CADCB, Hispanic Center Lehigh Valley, and BAPL South Side branch.

 **Key next step**
 Pending the creation of a Director of Sustainability, Dept. of Public Works to hold a meeting with the CAP WG and City Council to discuss how the working group can be expanded and support implementation.

M3.5 Ensure local legal framework is in place to implement CAP strategies

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Increase climate resilience ▶ Improve system sustainability	City lead ▶ City Council	Partners ▶ Mayor's Office ▶ EAC	Key Stakeholders ▶ All municipal staff ▶ All residents and businesses ▶ State of Pennsylvania
Community Priority 					

Consider passing a Right to a Healthy Climate ordinance or Home Rule Charter (local constitution) that allows the city to enact codes or requirements that are stricter than state standards and support the climate strategies proposed in this CAP. For example, such an ordinance or Charter could provide the legal framework for the city to pass a single-use plastics ban when the state currently preempts such local bans or to increase building code standards beyond those adopted by the State.

Environmental justice considerations - A Home Rule Charter (local constitution) could establish a "Community Bill of Rights" that better protects the health and wellbeing of frontline communities from environmental harms, including climate impacts.

Implementation considerations - Pennsylvania's Environmental Rights Amendment to the state constitution, ratified in 1971, states: "§ 27. Natural resources and the public estate. The people have a right to clean air, pure water, and the preservation of the natural, scenic, historic, and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people. (May 18, 1971, P.L.769, J.R.3)" Bethlehem could expand upon this with this proposed ordinance and would serve well to support environmental initiatives in the city.

 **Key next step:**
 City Council to review options and legal precedent for a Right to a Healthy Climate ordinance and hold a meeting on the options with the EAC.

M3.6

Engage municipal authorities to adopt GHG targets and reduce emissions

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Increase climate resilience
- ▶ Improve system sustainability
- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Conserve natural resources and biodiversity
- ▶ Improve water quality

City lead

- ▶ Dept. of Public Works

Partners

- ▶ Mayor's Office
- ▶ City Council

Key Stakeholders

- ▶ Bethlehem Authority
- ▶ Bethlehem Housing Authority
- ▶ Bethlehem Parking Authority
- ▶ Bethlehem Revitalization and Improvement Authority
- ▶ City Center Authority
- ▶ Redevelopment Authority

Engage Bethlehem's municipal authorities, such as the Bethlehem Authority and Bethlehem Parking Authority, to adopt the CAP's municipal operations targets and implement GHG reduction strategies and best practices, as described throughout the CAP.

Environmental justice considerations: If municipal authorities develop their own climate action plans and strategies, environmental justice and equity should be given similar consideration and prominence as in this CAP.

Implementation considerations: Municipal authorities are governmental bodies created to finance and/or operate specific public works projects without tapping the general taxing powers of the municipality. Established via the Municipality Authorities Act of 1945, the municipal authority in Pennsylvania is an alternate vehicle for accomplishing public purposes rather than through direct action of counties, municipalities, and school districts. Although local government plays a role in creation of an authority and appoints the members of its board, the authority is not part of the municipal government. An authority is not the creature, agent, or representative of the municipality but is an independent agency of the commonwealth. As of 2020, it is estimated that Pennsylvania has more than 1,500 active authorities. The City of Bethlehem has several authorities, including the Bethlehem Parking Authority, which acquires constructs, equips, and operates parking in the city, and the Bethlehem Authority, which owns the Water System and leases it to the city. The Authority also acts as the property manager for the 22,000 plus acre watersheds in Carbon and Monroe Counties.



Key next step:

Public Works to convene meeting of authority executive directors to discuss the CAP and how the city can support authorities in setting and implementing similar goals.

Implementation

The implementation of strategies to reduce municipal operations emissions will continue to be performed by the Department of Public Works, which has successfully reduced city emissions by 38% since 2005. The coordination and implementation of the full Climate Action Plan hinge on creating a Director of Sustainability. The City Council and the Mayor will examine the creation of an Office of Sustainability as a first step. The Implementation Strategy chapter provides further details on the timeline for implementing these strategies and coordinating them with other CAP strategies.



FIVE @ FLATS

Fillmore St

EL JEFES

STARBUCKS COFFEE

STARBUCKS COFFEE

ROADWORK CLOSED

Buildings

Energy used to heat, cool, light, and power Bethlehem's buildings is responsible for more than 70% of the city's community-wide total greenhouse gas (GHG) emissions.

Introduction

Energy used to heat, cool, light, and power Bethlehem's buildings is responsible for more than 70% of the city's community-wide total greenhouse gas (GHG) emissions, and mitigating it represents a prime opportunity to attain the city's overarching GHG reduction goals. The city's building stock is varied and diverse and includes single- and multi-family residential, small and large commercial, and older and newer constructed buildings, which will require a suite of strategies to ensure widespread penetration and adoption of actions needed to reach the city's climate goals.

Reducing GHG emissions from the city's buildings will be challenging. 2030 is approaching fast, and action is needed on all fronts. Building occupants will need to change their behavior, and building owners will need to make investments. The city must ensure that strategies to reduce energy and GHG emissions—as well as energy costs—are accessible to all residents. With concerted and ongoing action, Bethlehem can establish policies and programs that will have long-term benefits beyond GHG emissions reduction, yielding improved air quality, public health benefits, and reduced energy costs across all sectors.

objective



Objective and goals

The primary objective of the Buildings section of the Bethlehem Climate Action Plan is to reduce GHG emissions from buildings by 30% by 2030. This objective will be accomplished through strategies that target four specific impact goals:

- Expand public disclosure of building energy use
- Decrease buildings' fuel carbon intensity
- Increase the energy efficiency of existing buildings
- Increase the energy efficiency of new buildings

Strategies & actions

The section below defines a series of strategies and action steps to achieve the objectives defined above. This list was developed by the Bethlehem Climate Action Plan Stakeholder Working Group on Residential & Commercial Buildings with input from the Environmental Justice and Equity Steering Committee and further refined by the full Bethlehem CAP Stakeholder Working Group.

“
The most stringent restrictions should be placed on new buildings.”

“
Benchmarking is a great way to raise awareness and set goals.”

GOAL: Expand public disclosure of building energy use

B1.1 Benchmarking requirement for commercial buildings

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Reduce resource consumption

City lead

- ▶ Office of Sustainability

Partners

- ▶ EAC
- ▶ City Council
- ▶ Sustainable Energy Fund
- ▶ Green Building United

Key Stakeholders

- ▶ Commercial building owners and managers
- ▶ Commercial tenants

Community Priority



Require public disclosure of aggregated energy and water use for all commercial buildings. Size threshold for requirement to be determined by city to ensure adequate capture rate based on building stock characterization. Utilize the free Energy Star Portfolio Manager for benchmarking. Benchmarking could have a huge benefit as building owners and facility managers are able to measure their energy consumption against others. Benchmarking also provides potential buyers or tenants the information they need on energy usage to include in their decision to buy or rent.

Environmental considerations - Knowing energy costs could be helpful to lower-income residents looking for rentals.

Implementation considerations - To comply with energy regulations restricting the public disclosure of customer energy usage information, the disclosed data would be aggregated at the building level. Bethlehem will likely need to pass an ordinance to make this a requirement, following the [Philadelphia energy benchmarking model](#). The Philadelphia Building Energy Benchmarking Ordinance (§ 9-3402) contains provisions to ensure customer privacy under applicable law, and Bethlehem should include similar requirements. Accurate property data can be a barrier, and there are upfront costs of time and capacity to determine an accurate compliance list. Maintaining this list and assisting buildings with compliance requires ongoing resources by the city or a contractor on behalf of the city. Workshops and webinars to provide guidance to building owners and facility managers could reduce uncertainty with the process. Energy Star offers [training opportunities](#).



Key next step

Office of Sustainability to hold input session with commercial building owners and managers.

B1.2 Benchmarking requirement for government buildings

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Reduce resource consumption

City lead

- ▶ Dept. of Public Works

Partners

- ▶ EAC
- ▶ City Council
- ▶ Sustainable Energy Fund
- ▶ Green Building United

Key Stakeholders

- ▶ Municipal staff

Community Priority



Initiate public disclosure of energy use for all city government buildings. The city can lead by example through public disclosure for its buildings starting with a report for 2020, then phasing in the private sector.

Environmental considerations - None stated.

Implementation considerations - To complement strategies B1.1 & B1.3, the city can also measure energy use and savings of its own portfolio over time and provide this information to the public. The program could utilize the free Energy Star Portfolio Manager for benchmarking. Energy Star offers training opportunities, including on-demand recordings.



Key next step

Dept. of Public Works to set up system for disclosure.

B1.3 Benchmarking requirement for multifamily buildings


<p>Timeline</p> <ul style="list-style-type: none"> ▶ Near 	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Cost savings ▶ Reduce resource consumption 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ EAC ▶ City Council ▶ Sustainable Energy Fund ▶ Green Building United 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Multifamily building owners and managers ▶ Multifamily tenants
---	--	---	---	--	--

Community Priority 

Require public disclosure of aggregated energy and water use for all multifamily residential buildings. Size threshold to be determined by city and would not include small multifamily residential buildings (e.g., 4-families or less). Utilize the free Energy Star Portfolio Manager for benchmarking. Benchmarking also provides potential buyers or tenants the information they need on energy usage to include in their decision to buy or rent.

Environmental considerations - Develop resources to educate residents, particularly low-income residents, on what the financial results of energy savings would be. Knowing energy costs could be helpful to lower-income residents looking for rentals.

Implementation considerations - To comply with energy regulations restricting the public disclosure of customer energy usage information, the disclosed data would be aggregated at the building level. Bethlehem will likely need to pass an ordinance to make this a requirement, following the Philadelphia energy benchmarking model. The [Philadelphia Building Energy Benchmarking Ordinance \(§ 9-3402\)](#) contains provisions to ensure customer privacy under applicable law, and Bethlehem should include similar requirements. Accurate property data can be a barrier and there are upfront costs of time and capacity to determine an accurate compliance list. Maintaining this list and assisting buildings with compliance requires ongoing resources by the city or a contractor on behalf of the city. Workshops and webinars to provide guidance to building owners and facility managers could reduce uncertainty with the process. Energy Star offers training opportunities.

 **Key next step**
Office of Sustainability to hold input session with multifamily building owners, managers, and tenants.

B1.4 Require disclosure of energy performance for purchase of homes

<p>Timeline</p> <ul style="list-style-type: none"> ▶ Near 	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Cost savings ▶ Reduce resource consumption 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Planning & Zoning 	<p>Partners</p> <ul style="list-style-type: none"> ▶ City Council ▶ EAC ▶ Sustainable Energy Fund ▶ Green Building United 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Realtors ▶ Homebuyers
---	---	---	---	--	---

Community Priority 

Require disclosure of energy performance for purchase of homes to inform prospective home buyers of home's historic energy performance. Disclosure to require energy intensity and average annual energy costs.

Environmental considerations - Develop resources to educate residents, particularly low-income residents, on what the financial results of energy savings would be. Work with financial institutions to assist the institutions in using energy disclosures to provide more favorable mortgage rates to residents. This would be beneficial to all Bethlehem residents, but would be very important for lower-income residents looking to purchase a home. The net-zero emissions (NZE) building standards in B3.2 and B4.2 may increase initial home purchasing costs while reducing operating costs, providing savings over the mid- to long-term. This increases the importance of educational resources under this strategy.

Implementation considerations - Consider DOE Home Energy Score or [HERS ratings](#) to ensure that homeowners can make apples to apple comparisons. Both metrics also take into account more than just the previous owner's heating and cooling preferences. Also consider a more aggressive recommendation in making certain prescriptive improvements at the time of sale to ensure that there is savings, not just awareness. Boulder, CO, has a similar policy that pertains to rental properties.

 **Key next step**
City Council to evaluate ordinance for requirement.

B1.5 Require energy audits for building permit approval

Timeline ▶ Short	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Reduce resource consumption ▶ Job creation	City lead ▶ Code Enforcement Dept.	Partners ▶ City Council ▶ Bureau of Planning & Zoning ▶ Sustainable Energy Fund ▶ Green Building United	Key Stakeholders ▶ Residential, commercial, industrial building owners ▶ Construction industry
Community Priority					

Require ASHRAE Level 1 energy audits as requirement for building permit for residential, commercial, and industrial renovations or additions. An ASHRAE Level 1 audit is the simplest level of audit, designed to identify serious inefficiencies and recommend zero- to low-cost energy efficiency improvements while highlighting areas requiring more in-depth auditing.

Environmental considerations - Consider how audit requirements could increase cost of housing and explore options to offset costs for low- and middle-income house buyers and renters. Ensure that other policies are in place to develop and maintain adequate supply of low- and middle-income housing in the city.

Implementation considerations - Explore opportunities to reduce cost via Act 129 programs. As an example, [New York City's Local Law 87 \(LL87\)](#) mandates that buildings over 50,000 gross square feet undergo periodic energy audit and retro-commissioning measures. This strategy's implementation can be timed as the next step once benchmarking strategies (B1.1, B1.2, B1.3) are implemented. Once implemented, this strategy will complement the enactment of net-zero emissions (NZE) building standards in B3.2 and B4.2.

Key next step
City Council to evaluate ordinance for requirement.

GOAL: Decrease buildings' fuel carbon intensity

B2.1 Fuel switching requirement for new boilers in commercial buildings

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Improve air quality ▶ Job creation	City lead ▶ Code Enforcement Dept.	Partners ▶ City Council ▶ Bureau of Planning & Zoning ▶ PPL Electric ▶ UGI	Key Stakeholders ▶ Residential, commercial, industrial building owners
Community Priority					

Require commercial buildings with fuel oil boilers to convert to low-GHG options when replacing boilers. These options could include electric boilers, which when coupled with increased supply of renewable electricity will reduce GHG emissions, or natural gas boilers coupled with increased supply of renewable natural gas.

Environmental considerations - Pair with basic efficiency measures to ensure long-term affordability. Provide grants to make conversions accessible for low-income households, which may also benefit the most from newer heating and cooling systems.

Implementation considerations - Conversions are a mixed blessing that will produce immediate reduction in GHG -- but will also lock in infrastructure for 20-30 years. The emphasis must be on converting to electric boilers coupled with renewable electricity or Energy Star natural gas equipment paired with renewable natural gas resources unless other zero-carbon fuels are available and accessible. For some building sizes, heat pumps—especially ground-source heat pumps—might be a better choice. The city will review requirements and recommendations on an ongoing basis. The city recognizes that renewable electricity options are currently available to commercial customers, but the current standard electricity offering is too GHG intense to achieve the goals of this CAP. Similarly, the city recognizes that UGI is seeking renewable natural gas (RNG) supply and expects to have RNG available to Bethlehem as early as 2021, but that the burning of fossil fuel natural gas will not achieve the city's goals. The city also recognizes concerns have been raised about RNG as a long-term climate solution for buildings due to concerns about cost, scale of supply, and the potential of methane release in distribution. The consensus of studies, such as the [United States Mid-Century Strategy for Deep Decarbonization](#) and the [California Energy Commission \(CEC\)'s Deep Decarbonization in a High Renewables Future](#), is that energy efficiency combined with electrification of heating and cooling is the fastest, cheapest pathway to the level of deep decarbonization targeted by this CAP. The city is open to all zero-carbon options in the short-term, while placing an emphasis on investments that align with the strategies described in these deep decarbonization studies. Over the medium- to long-term, the city will evaluate strategies and requirements in this CAP on an ongoing basis and adjust requirements and education materials accordingly, recognizing electrification is the consensus cost-effective long-term solution for decarbonizing building heating and cooling.

Key next step
City Council to evaluate ordinance for requirement.

CASE STUDY



Energy to do more®

Increasing renewable natural gas

Renewable Natural Gas (RNG), also known as biomethane or sustainable natural gas, is the byproduct of naturally decomposing organic matter that has been processed and conditioned to applicable gas quality standards so that it is fully interchangeable with conventional natural gas. RNG may contribute to the achievement of climate goals, particularly to the extent that it:

- results in additional capture of methane from organic wastes, preventing the release of methane to the atmosphere; and
- displaces geologic natural gas or other fossil fuels as a fuel source for heat and energy.

As part of its [ongoing commitment to Environmental, Social and Governance \(ESG\) initiatives](#), UGI plans on expanding its use of RNG. In 2020, the utility finalized RNG gas quality standards, and developed processes to ensure efficient and safe use of RNG. The utility is currently working on written operational procedures, a communications plan, and further refining its safety and training requirements.

The World Resources Institute (WRI) released a [guide for policymakers](#) on challenges and opportunities for using RNG as a climate strategy.

B2.2 Establish a building retrofit program to replace appliances and systems with electric, renewable natural gas, or other low-carbon fuel options in residential and commercial buildings

Timeline

- ▶ Short

Community Priority



GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Job creation

City lead

- ▶ Dept. of Community and Economic Development

Partners

- ▶ Office of Sustainability
- ▶ PPL Electric
- ▶ UGI
- ▶ Sustainable Energy Fund

Key Stakeholders

- ▶ Residential, commercial, industrial building owners

Evaluate best options for replacement of appliances and systems. Partner with electric and/or natural gas utility to replace fossil fuel appliances and systems with high-efficiency electric, renewable natural gas, or other low-carbon fuel options. Partnerships with utilities to provide technical assistance and financial incentives for replacement of boilers and furnaces, hot water heaters, and stoves with electric, renewable natural gas, or other low-carbon fuel alternatives. This initiative must be coupled with the renewable electricity strategies in this CAP to increase supply of renewable electricity to reduce GHG emissions over time.

Environmental considerations - Ensure that there is programmatic and financial support for all residents and businesses to upgrade their homes' and businesses' appliances. Consider greater incentives for low-income residents and businesses serving low-income communities. Pair with basic efficiency measures to ensure long-term affordability.

Implementation considerations - Partner with existing utility and Act 129 energy efficiency programs to reduce energy load and offset potential increased costs from electrification.



Key next step

Dept. of Community and Economic Development to engage utilities and Sustainable Energy Fund on program set up.

GOAL: Increase energy efficiency of existing buildings

B3.1 Develop a program to replace appliances and systems with high-efficiency options

Timeline

▶ Near

GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Job creation

City lead

- ▶ Dept. of Community and Economic Development

Partners

- ▶ Office of Sustainability
- ▶ PPL Electric
- ▶ UGI
- ▶ Sustainable Energy Fund

Key Stakeholders

- ▶ Residential, commercial, industrial building owners and renters

Community Priority



Evaluate high-efficiency equipment replacement options to replace inefficient coal or fuel oil systems. Where electricity is not technically or financially feasible, partner with natural gas utility to ensure replacement appliances are as efficient as possible and fueled with renewable natural gas purchased from the utility.

Environmental considerations - Special programs may be needed for low-income residents. Ensure that there is programmatic and financial support for all residents to upgrade their homes appliances. Consider greater incentives for low-income residents. Pair with basic efficiency measures to ensure long-term affordability.

Implementation considerations - Partner with existing utility and Act 129 energy efficiency programs to reduce energy load and offset potential increased costs from electrification.



Key next step

Dept. of Community and Economic Development to engage utilities and Sustainable Energy Fund on program set up.

B3.2 Implement net-zero emissions (NZE) building standards for substantial renovations of existing buildings

Timeline

▶ Medium

GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Job creation

City lead

- ▶ Bureau of Planning & Zoning

Partners

- ▶ City Council
- ▶ Office of Sustainability
- ▶ Code Enforcement Dept.
- ▶ Green Building United
- ▶ Sustainable Energy Fund
- ▶ Community Environmental Legal Defense Fund (CELDF)

Key Stakeholders

- ▶ Residential, commercial, industrial building owners
- ▶ Construction industry

Community Priority



Require net-zero emissions (NZE) building codes for residential and commercial retrofits by 2030. NZE building standards require buildings to be designed and equipped so that all energy use on an annual basis is highly efficient and comes only from renewable energy sources.

Environmental considerations - Consider how NZE building code requirements could increase cost of housing and explore options to offset costs for low- and middle-income homeowners. NZE standards will reduce operating costs, which should be reflected in rental costs.

Implementation considerations - A date-certain NZE requirement for retrofits should be enacted after a new construction requirement due to a comparative level of difficulty and cost. As this would require enacting standards higher than the state's, implementation may involve the passing a Right to a Healthy Climate ordinance or Home Rule Charter, as described in the Municipal Operations section. The city should consider the [Zero Code](#) as a tool for implementing this strategy. The Zero Code was developed by Architecture 2030 as the first national and international net-zero-carbon standard for new commercial, institutional, and mid- to high-rise residential buildings. The code integrates cost-effective energy efficiency measures and is designed to complement base energy code (IECC/ASHRAE) by specifying a path for meeting a building's energy needs with on-site renewable energy or by procuring renewable energy off-site. Zero Code was added to the 2021 IECC as an appendix, which will likely scale up its adoption in the near future. Pennsylvania's restrictions around code adoption present challenges to passing Zero Code into law at the municipal level. Other municipalities facing similar restrictions on local code adoption have used their planning or zoning codes to incorporate the Zero Code. Bethlehem should consider this approach and coordinate with other Pennsylvania municipalities seeking to adopt the code.



Key next step

Bureau of Planning & Zoning to review potential impacts with stakeholders and move forward following a similar requirement on new construction.



CASE STUDY

Comprehensive home energy improvement plan

Community Action Lehigh Valley’s [Weatherization program](#) makes improvements to the homes of low-income households designed to reduce heating and cooling costs and increase their comfort level. Funded by local utilities and the federal government, Community Action weatherizes more than 1,000 homes per year. The program hires private contractors that perform diagnostics, insulate attics and basements, caulk, weather-strip, and/or repair doors and windows and replace inefficient household appliances.

Community Action continues to improve on the energy efficiency of its Acquisition Rehab projects. These homes are often gut renovations, and Community Action has raised standards on insulation, air sealing, and energy efficient HVAC and water heaters. The program already provides EnergyStar appliances and LED light fixtures. A new initiative for 2022 will be the installation of garden beds in the backyards of Acquisition Rehabs, where appropriate. Community Action hopes to partner with its Seed Farm to provide gardening education for participants.


B3.3 Require retro-commissioning for large commercial and residential buildings

<p>Timeline ▶ Medium</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Cost savings ▶ Improve air quality ▶ Job creation 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Planning & Zoning 	<p>Partners</p> <ul style="list-style-type: none"> ▶ City Council ▶ Office of Sustainability ▶ Code Enforcement Dept. ▶ Sustainable Energy Fund ▶ PPL Electric 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Residential, commercial, industrial building owners ▶ Construction industry
--	--	---	---	--	---

Require periodic energy audits and retro-commissioning of base building systems for large commercial and residential buildings. Requirement to include audit and retro-commissioning report to city every ten years. Building size threshold to be determined by the city to ensure adequate capture rate (e.g., > 25,000 sf).

Environmental considerations - Consider how retro-commissioning requirements could increase the cost of multifamily housing and explore options to offset costs for low- and middle-income home buyers. Ensure that other policies are in place to develop and maintain adequate supply of low- and middle-income housing in the city. Retro-commissioning will reduce operating costs, which should be reflected in rental costs.

Implementation considerations - During implementation, consider developing criteria to include any commercial buildings with high carbon intensity that would not be captured under the square footage size threshold. As an example, [New York City’s Local Law 87 \(LL87\)](#) mandates that buildings over 50,000 gross square feet undergo periodic energy audit and retro-commissioning measures.

 **Key next step**
City Council to evaluate ordinance for requirement and engage stakeholders.

B3.4 Promote implementation of Commercial Property-Assessed Clean Energy (C-PACE) financing

Timeline ▶ Immediate	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Improve air quality ▶ Job creation ▶ Increase climate resilience	City lead ▶ Dept. of Community and Economic Development	Partners ▶ Sustainable Energy Fund ▶ EAC	Key Stakeholders ▶ Commercial, industrial building owners ▶ Renewable energy and energy efficiency providers
Community Priority 					

Work with Sustainable Energy Fund to promote the implementation of Commercial Property-Assessed Clean Energy (C-PACE) financing for energy efficiency, renewable energy, and water conservation initiatives on commercial buildings. Property Assessed Clean Energy (PACE) programs provide financing to allow building owners and developers to upgrade building energy performance and install renewable energy systems, avoiding large upfront down payments or capital expenditures. Payment of PACE loans are made as an addition to the owners' property tax bills. Both Northampton County and Lehigh County have adopted commercial PACE (C-PACE) and named the Sustainable Energy Fund (SEF) as program administrator. The city should partner with SEF to promote the program and increase adoption. Additionally, the Green Energy Loan Fund (GELF) is available for energy retrofits, gut rehabilitation of existing buildings, and new construction. All projects must result in a 25% reduction in total energy consumption.

Environmental considerations - Ensure there is awareness of the program for businesses in low-income neighborhoods. Provide consultation and support to businesses in low-income communities who may benefit from C-PACE but not know about the program or how to utilize it. Evaluate if C-PACE savings are reflected in rents and determine options for requiring owners of rental properties to pass on C-PACE saving to tenants.

Implementation considerations - Northampton County and Lehigh County have adopted commercial PACE (C-PACE) and named the Sustainable Energy Fund (SEF) as program administrator. C-PACE is a financial tool for property owners to obtain low-cost, long-term financing for energy efficiency, renewable energy, and water conservation projects. C-PACE can facilitate a loan for a project by placing a voluntary payment on the property that repays the costs of the upgrades. Nationally, half a billion dollars has been invested through C-PACE loans, and many industry experts expect that number to double in the next few years.

Key next step
Dept. of Community and Economic Development and EAC to meet with SEF to discuss how to promote the C-PACE program.

B3.5 Support Residential Property Assessed Clean Energy (R-PACE) in Pennsylvania

Timeline ▶ Medium	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Improve air quality ▶ Reduce inequality and poverty	City lead ▶ Office of Sustainability	Partners ▶ EAC ▶ City Council ▶ Sustainable Energy Fund	Key Stakeholders ▶ Residential, commercial, industrial building owners ▶ Renewable energy and energy efficiency providers
Community Priority 					

Signal support via a resolution or other means for Residential Property Assessed Clean Energy (R-PACE) in Pennsylvania and encourage the state legislature to pass enabling legislation so that homeowners can access 100% long-term, fixed interest rate financing for energy efficiency upgrades and renewable energy installations repaid by property owners on property tax bills, similar to the C-PACE program currently available to commercial buildings.

Environmental considerations - R-PACE has been criticized by some consumer protection groups because in some cases, borrowers did not receive the projected energy savings and were thus unable to pay back the loan and in others, did not understand the financial obligation. Any R-PACE legislation should incorporate EJ considerations into the PACE program design, including the US Department of Energy's Best Practices Guidelines for Residential PACE Financing, which includes additional consumer protections for low-income households such as recommendations for structuring PACE financing so that it is cost-effective for low-income participants. Several [consumer protection groups](#) have recommended additional measures such as crafting strong rules to protect homeowners from abusive sales practices and screening low-income customers to determine if they could benefit from lower-cost or free improvements via other programs before taking a PACE loan. For buildings with apartments, these programs should require owners to pass on saving to tenants.

Implementation considerations - Guidance in 2010 from the Federal Housing Finance Authority (FHFA) threatened to withhold insurance from homes with residential PACE loans, which caused R-PACE to stall across the country. This has not eliminated the R-PACE market, however. California, for example, agreed to backstop any mortgage impairment due to R-PACE. R-PACE was considered as part of Senate Bill 234 that enabled C-PACE in Pennsylvania but ultimately not included in the legislation.

Key next step
SEF, in coordination with EAC, to evaluate and discuss with City Council the best avenue for signaling support; identify key statewide stakeholders for pushing action.

B3.6 Require cost-effective energy-saving measures on large buildings to help to mitigate the urban heat island effect

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Increase climate resilience	City lead ▶ Bureau of Planning & Zoning	Partners ▶ City Council ▶ Office of Sustainability ▶ Code Enforcement Dept. ▶ Sustainable Energy Fund ▶ PPL Electric	Key Stakeholders ▶ Residential, commercial, industrial building owners ▶ Frontline communities
---------------------------	---------------------------------	---	---	--	---

Pass an ordinance to require all buildings greater than a size threshold to be determined by the city to mitigate the urban heat island effect with white or reflective roofs, partial green roofs, or solar panels. Each of these mitigation options also provides energy efficiency benefits. This will help to mitigate the urban heat island effect, which is currently most pronounced in the warehouses developed on the city's brownfields.

Environmental considerations - Bethlehem's urban heat island effect currently creates the largest temperature increases in frontline communities. Ensure there is awareness of the program for businesses in low-income neighborhoods.

Implementation considerations - Given the synergies between this GHG mitigation strategy and the goals of this CAP's adaptation and resiliency section, ensure there is appropriate coordination between city programs in these areas. The EAC has been working on this issue by advocating for mandatory solar panels on large commercial and multifamily buildings.

Key next step
 City Council to evaluate ordinance for requirement and engage stakeholders..

B3.7 Initiate or expand upon residential energy efficiency programs, especially those serving low-income communities

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Reduce inequality and poverty ▶ Cost savings ▶ Improve air quality ▶ Increase climate resilience	City lead ▶ Office of Sustainability	Partners ▶ Dept. of Community and Economic Development ▶ Community Action ▶ PPL Electric ▶ UGI ▶ Sustainable Energy Fund ▶ Local community groups, such as Lehigh Valley Hispanic Center and NAACP	Key Stakeholders ▶ Residential building owners ▶ Residential tenants ▶ Frontline communities
---------------------------	---------------------------------	---	--	---	--

Partner with the utilities, Community Action and other organizations to expand residential energy efficiency programs, particularly those such as the Weatherization Assistance Program (WAP) that benefit low-income residents. With temperatures expected to significantly rise over the next 20-30 years, residents' summer energy burdens are expected to rise accordingly. Energy efficiency programs have demonstrated to be cost-effective ways to reduce those costs, and will be essential to ensure residents costs, health, and comfort are addressed. Education programs should also be integrated.

Environmental considerations - Low-income residents especially will feel the cost impacts of higher temperatures, with a higher portion of their income dedicated to energy costs. Energy efficiency programs should be linked with home maintenance programs where possible. This allows the combination of energy efficiency, mold remediate, lead abatement, roof repairs and other issues with one inspection and program. Philadelphia is working on a pilot of this method. Low-income populations realize proportionally greater economic benefit from savings, and possibly health benefits. May provide greater budgeting ability for households, critical to their economic security.

Implementation considerations - The Weatherization Assistance Program (WAP) administered by Community Action aids low-income populations but should be expanded upon; the current state of the program is uncertain. There is a need for more education, including 'hands-on' workshops. UGI offers many customer assistance programs to assist with energy efficiency and savings, including CAP, LIURP, LIHEAP, and Operation Share.

Key next step
 Office of Sustainability to engage Community Action, PPL Electric, UGI and other stakeholders to identify partnership opportunities.


B3.8 Encourage existing multi-tenant building owners to submeter their buildings to support increased energy conservation

<p>Timeline ▶ Immediate</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Cost savings 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Office of Sustainability 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development ▶ PPL Electric ▶ Sustainable Energy Fund 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Multifamily, commercial, industrial building owners ▶ Multifamily, commercial, industrial building tenants
---	--	--	--	---	--



Utility submetering allows property owners to bill tenants for individually used electricity or natural gas, potentially reducing energy use (and costs) by providing transparency to property owners and encouraging conservation.

Environmental considerations - This program should be coupled with clear disclosure and education for tenants; it will naturally increase costs for some tenants while decreasing costs for others.

Implementation considerations - Submetering is regulated by the PA PUC and PPL Electric rules, specifically section F of the PPL Electric [Rules for Electric Service](#). Providing submetering is not a regulatory obligation, nor approved by the PUC to be included in rate base. As such, the customer is responsible for paying for any desired submetering. Submetering costs additional money for the meter, which can be expensive with new advanced metering. This will raise customer costs and is not required for utility service. Implementation of this strategy will need to account for these considerations and frame submetering as a recommendation rather than a requirement. Any such provisions not currently supported by current law and regulation and would require a change in the law and may require some approvals by the PA PUC. The program should actively discourage leases that include utilities to create an incentive for using energy efficiently.

 **Key next step**
Office of Sustainability to create engagement plan for building owners.


B3.9 Partner with utilities to increase awareness of opportunities for energy audits, incentives for energy efficiency improvements, and other energy-saving measures

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Reduce resource consumption ▶ Cost savings ▶ Job creation ▶ Increase climate resilience 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Office of Sustainability 	<p>Partners</p> <ul style="list-style-type: none"> ▶ PPL Electric ▶ UGI ▶ Sustainable Energy Fund ▶ Community Action 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses
---	---	--	--	---	---

Partner with utilities and community organizations to increase awareness of energy audit opportunities through PA's Act 129, which can provide residents and businesses with opportunities to reduce energy consumption. Increase awareness of existing rebate and incentives offered by utilities for energy efficiency measures.

Environmental considerations - All education materials should be multilingual. Low-income populations can benefit the most from energy efficiency programs but often have the fewest resources to find out about financial incentives and other programs to encourage energy-saving measures. This program should specifically target EJ areas in its outreach.

Implementation considerations - This strategy should be implemented as a first step toward broader partnerships with utilities to expand energy efficiency programs as described in strategy B3.7.

 **Key next step**
Office of Sustainability to convene a meeting of relevant stakeholders to compile a consolidated list of opportunities, incentives, and marketing materials.

CASE STUDY

LEED GOLD office building



Lehigh Valley Industrial Park (LVIP) constructed a 42,000 square foot office building in 2008 certified to the Leadership in Energy and Environmental Design (LEED) Gold standard. The U.S. Green Building Council provides a series of qualifications for how buildings are planned, constructed, maintained and operated. Based on the number of points achieved, a project then receives one of four LEED rating levels: Certified, Silver, Gold and Platinum.

The [green office building](#) marks the gateway to the non-profit organization's LVIP VII development, and is located on the 1,000-acre site on Bethlehem's South Side that once housed Bethlehem Steel. The building houses LVIP's own offices and the offices of several other tenants.

Constructed by Spillman Farmer Architects, which also holds office space there, the building incorporates numerous environmentally friendly design concepts and features. It is oriented to take advantage of natural daylight but to minimize heat gain and solar glare. To improve energy efficiency and occupants' comfort, sunshades on the south façade and high-performance windows, walls, and roof were included. Energy-saving lighting and water-saving fixtures are also incorporated in the facility. More than 20 percent of the building materials are made from recycled content and more than 30 percent of materials were manufactured within 500 miles of the site.

GOAL: Increase energy efficiency of new buildings

B4.1 Encourage multi-tenant building developers to submeter their buildings to support increased energy conservation

Timeline

- ▶ Immediate

Community Priority



GHG emissions impact



Co-benefits

- ▶ Cost savings

City lead

- ▶ Office of Sustainability

Partners

- ▶ Dept. of Community and Economic Development
- ▶ PPL Electric
- ▶ Code Enforcement Dept.
- ▶ Sustainable Energy Fund

Key Stakeholders

- ▶ Building developers
- ▶ Building owners
- ▶ Building tenants

Utility submetering allows property owners to bill tenants for individually used electricity or natural gas, potentially reducing energy use (and costs) by providing transparency to property owners and encouraging conservation.

Environmental considerations - This program should be coupled with clear disclosure and education for tenants; it will naturally increase costs for some tenants while decreasing costs for others.

Implementation considerations - Submetering is regulated by the PA PUC and PPL Electric rules, specifically section F of the PPL Electric Rules for Electric Service. Providing submetering is not a regulatory obligation, nor approved by the PUC to be included in rate base. As such, the customer is responsible for paying for any desired submetering. Submetering costs additional money for the meter, which can be expensive with new advanced metering. This will raise customer costs and is not required for utility service. Implementation of this strategy will need to account for these considerations and frame submetering as a recommendation rather than a requirement. Any such provisions not currently supported by current law and regulation and would require a change in the law and may require some approvals by the PA PUC. The program should actively discourage leases that include utilities to create an incentive for using energy efficiently. The city could phase in submetering encouragement on new buildings (B4.1) prior to existing buildings (B3.7).



Key next step

Office of Sustainability to create engagement plan for building developers.

B4.2

Implement net-zero emissions (NZE) building standards for new buildings

Timeline

- ▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Job creation

City lead

- ▶ Bureau of Planning & Zoning

Partners

- ▶ City Council
- ▶ Office of Sustainability
- ▶ Code Enforcement Dept.
- ▶ Green Building United
- ▶ Sustainable Energy Fund
- ▶ Community Environmental Legal Defense Fund (CELDF)
- ▶ Habitat for Humanity

Key Stakeholders

- ▶ Residential, commercial, industrial building owners;
- ▶ Building developers
- ▶ Construction industry

Require net-zero emissions (NZE) building codes for residential and commercial new construction by 2030. NZE building standards require buildings to be designed and equipped so that all energy use on an annual basis is highly efficient and comes only from renewable energy sources.

Environmental considerations - Consider how NZE building code requirements could increase cost of housing and explore options to offset costs for low- and middle-income homeowners. Ensure that other policies are in place to develop and maintain adequate supply of low- and middle-income housing in the city. NZE standards will reduce operating costs, which should be reflected in rental costs. Evaluate options to require rental property owners pass on savings to tenants.

Implementation considerations - As this would require enacting standards higher than the state's, implementation may involve the passing a Right to a Healthy Climate ordinance or Home Rule Charter, as described in the Municipal Operations section. Other possible avenues for pushing standards higher include: (1) requiring all-electric buildings and/or banning gas hookups and mandating that all buildings produce on-site or procure off-site renewable energy or (2) adopt Architecture 2030's [Zero Code](#) via the zoning code, which requires a building to meet its minimum energy code and also procure or produce 100% clean energy its operations. The city should consider the Zero Code as a tool for implementing this strategy. The Zero Code was developed by Architecture 2030 as the first national and international net-zero-carbon standard for new commercial, institutional, and mid- to high-rise residential buildings. The code integrates cost-effective energy efficiency measures and is designed to complement base energy code (IECC/ASHRAE) by specifying a path for meeting a building's energy needs with on-site renewable energy or by procuring renewable energy off-site. Zero Code was added to the 2021 IECC as an appendix, which will likely scale up its adoption in the near future. Pennsylvania's restrictions around code adoption present challenges to passing Zero Code into law at the municipal level. Other municipalities facing similar restrictions on local code adoption have used their planning or zoning codes to incorporate the Zero Code. Bethlehem should consider this approach and coordinate with other Pennsylvania municipalities seeking to adopt the code.



Key next step

Bureau of Planning & Zoning to review potential impacts with stakeholders and discuss legal considerations for increasing code standards.

Remaining gaps

This chapter's strategies address the primary emissions sources and reduction opportunities from residential and commercial buildings (which account for roughly 70% of Bethlehem's non-transportation fuel and electricity emissions). However, the strategies and goals above may not sufficiently address emissions from building energy consumption in manufacturing industries, construction activities, and the energy generation industry, which account for the remaining 30%. The strategies above will be a starting point to addressing these sources, but further engagement and tailored strategies for these sectors will be necessary to meet the city's long-term goals. Additionally, GHG emissions from non-energy related industrial activities, such as cement production, and product use, such as HCFC refrigerants, are not included in the city's current community-wide inventory. Strategies can be developed for this sector once the baseline emissions are assessed. These sectors will be addressed more thoroughly in a future update to the plan.

Implementation

To implement the strategies in this chapter, the city will leverage the expertise and existing initiatives of local organizations, such as the Sustainable Energy Fund, Green Building United, Community Action Lehigh Valley (Community Action), and the Bethlehem Environmental Advisory Council (EAC). The strategies will also be implemented in close coordination with the utilities serving Bethlehem—PPL Electric for electricity and UGI for natural gas—and leverage existing programs and funding sources, such as grants from the Pennsylvania Department of Environmental Protection (DEP)'s Energy Programs Office. Act 129 programs and the Weatherization Assistance Program (WAP) administered by Community Action will be critical to aid low-income populations and should be expanded.

Critical first steps for implementation include:

- Form a city buildings working group with representation from city government, utilities, stakeholder organizations, and underserved communities
- Coordinate with City Council and other relevant city departments to review and assess ordinance and code updates to initiate strategies that can be implemented immediately through policy changes
- When the position is created and hired, work with the Bethlehem Sustainability Director to prioritize additional actions
- When the council is created and launched, work with the Bethlehem Climate and Environmental Justice Council to assess energy cost burdens, health hazards, and weatherization opportunities in Bethlehem's buildings serving low-income populations

The Implementation Strategy chapter provides further details on the timeline for implementing this chapter and the coordination of this chapter with the strategies of other sections of the CAP.



© Craig Roberts
Photography

Electricity Sourcing

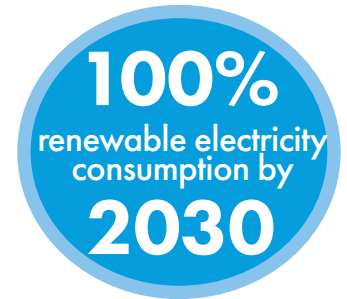
Electricity use is responsible for nearly half of Bethlehem's community-wide GHG emissions.

Introduction

Electricity use is responsible for nearly half of Bethlehem's community-wide GHG emissions. There are uses the city has direct control over, such as city buildings and streetlights, and those which are the responsibility of residential, commercial, industrial, and institutional community members such as residences, hospitals, research labs, and industry. Bethlehem residents and businesses rely on electricity every day. While an important component of the CAP will be to reduce electricity use through efficiency measures, other CAP strategies may rely more heavily on greater electrification and renewable energy use.

Sourcing the balance of the city's electricity needs from clean, renewable sources will be a key pillar of the CAP to achieve the city's goals. Some barriers to this strategy exist in Pennsylvania, including state policies limiting the renewable options of community solar and community choice aggregation (CCA). The lack of these programs reduces energy access and equity, limiting the ability of this CAP to achieve its environmental justice goals. Additionally, per Pennsylvania Public Utility Commission (PUC) requirements, default service must provide the lowest cost over time. The requirements do not currently consider whether energy comes from fossil fuels or renewables. As a result, the default service currently includes a small percentage of renewable generation. The good news is that there are many opportunities already in place to enable community members to choose more renewable electricity through on-site and retail options, and both provide many benefits such as cleaner air, lower costs, and increased resiliency. The city can leverage existing resources such as PAMPowerSwitch and local organizations to encourage greater participation in existing renewable options. Shopping for electricity requires residents to actively monitor their rates and understand the products they choose, including costs—so programs to encourage renewable electricity suppliers must be coupled with

objective



education. Furthermore, as indicated in the Municipal Operations chapter, Bethlehem will continue to demonstrate the benefits of renewable energy by purchasing 100% renewable electricity for its own operations and supporting policy changes that enable more of the community to realize these benefits in support of climate action goals.

Objective and goals

The primary objective of the Electricity Sourcing section of the Bethlehem Climate Action Plan is to achieve 100% renewable electricity consumption community wide by 2030. This objective will be accomplished through strategies that target four specific impact goals:

- Educate the community on the benefits of renewable energy and options available to consumers
- Promote the use of renewable electricity
- Maximize the use of on-site solar, energy storage solutions, and other renewables
- Support policy changes that increase equitable access to local renewable electricity

“

The more people know about their impact, the more they understand how much they contribute and hopefully will be able to act on those realizations.

Strategies & actions

The list below defines a series of strategies and action steps to achieve the objectives defined above. This list was developed by the Bethlehem Climate Action Plan Stakeholder Working Group on Electricity Sourcing with input from the Environmental Justice and Equity Steering Committee and further refined by the full Bethlehem CAP Stakeholder Working Group.



Weatherization and renewable energy should be incentivized in new projects to improve sustainability for the future.

GOAL: Educate the community on the benefits of renewable energy and options available to consumers

E1.1 Educate the community and local businesses on the benefits of renewable energy					
Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Reduce inequality and poverty	City lead ▶ Office of Sustainability	Partners ▶ PPL Electric ▶ PA DEP ▶ Sustainable Energy Fund ▶ Community Action ▶ Dept. of Community and Economic Development ▶ Local community groups, such as Lehigh Valley Hispanic Center and NAACP	Key Stakeholders ▶ All residents and businesses
Community Priority	<p>Promote the availability of renewable and green energy options through use of retail electric shopping programs (such as the PAPowerSwitch website), default service renewable energy options (if and when they exist), and through partnerships with the Sustainable Energy Fund and other reputable programs, to improve community members' understanding of the availability of renewable sourcing, its benefits, potential costs, and local options. This includes how to identify, evaluate, and choose a retail energy supplier that provides electricity from renewable sources, while increasing consumer awareness of contract language that can trap residents with higher rates.</p> <p>Environmental justice considerations - Ensure multilingual education is available. Provide resources to help ratepayers avoid predatory rate structures from energy suppliers. Ensure rate structures and their implications are understood. Develop and make available information on the EJ record of renewable energy suppliers.</p> <p>Implementation considerations - PA law and regulation limits the programs that PPL Electric Utilities can offer; however, PPL Electric and the PA PUC promote the use of PAPowerSwitch to shop for products and services customers seek—including clean energy. The 'PAPowerSwitch Guide to 100% Renewables' can be used as a starting point educational tool to increase awareness and adoption. Education does not require any change in regulation or law, but special care must be taken concerning liability. Any new resource will need to ensure compliance with all Pennsylvania Public Utility Commission (PUC) regulations, as well as address liability concerns from the performance of third-party suppliers. The city should explore promotional opportunities beyond what is already present for utilizing PAPowerSwitch as some stakeholders have heard feedback indicating difficulty navigating the site. For example, the city could consider creating a website that specifically provides options for green electricity. The city would need to determine an efficient and manageable procedure for keeping the new resource up to date. Education materials should indicate if renewable supply offerings support generation sources in Pennsylvania or the territory of PJM regional transmission organization. Many of the renewable offerings currently available from suppliers are for "national" renewable credits that do not support local clean generation, nor do they help local air emissions. These products are positive from a climate perspective but lack direct local benefits. In a decision on PPL Electric's Default Service Proceeding the PA PUC encouraged PPL Electric to continue its efforts to educate customers on the retail electric market and the customer programs offered by PPL Electric. The city can partner with PPL Electric to educate the city's residents and businesses about the retail shopping market and the various programs and services PPL Electric provides to help customers pay their bills and become more energy efficient.</p> <p>Key next step Office of Sustainability to develop engagement plan and evaluate legal and regulatory considerations for developing a city website dedicated to green electricity options. Office of Sustainability to meet with PPL Electric to coordinate marketing materials and resources.</p>				

CASE STUDY

Helping customers go green



PPL Electric offers a variety of services to help customers save energy, calculate their indirect GHG emissions and adopt renewable energy. Customer programs use advisory and educational resources from PPL Electric team members, rebates and incentives, and technology such as meters and online tools. Program offerings include:

- Online resources to make it easier to connect renewable energy resources
- Smartphone apps that allow customers to trace their carbon footprint
- Conservation/home energy performance monitoring
- Low-income weatherization
- High-efficiency lighting

- HVAC test and tune-up
- New construction advisory services
- Education resources on electric vehicles
- Load management options with financial incentives to reduce demand during peak hours
- Appliance removal with incentives for replacement with EnergySmart appliances
- Smart energy profiles and dashboards for monitoring usage and performance
- Energy efficiency education

E1.2 Increase transparency of generation sources and carbon impact for electricity supply sources

Timeline

▶ Near

Community Priority



GHG emissions impact



Co-benefits

City lead

▶ Office of Sustainability

Partners

▶ City Council
▶ Electricity suppliers
▶ Sustainable Energy Fund

Key Stakeholders

▶ PA PUC
▶ Electricity suppliers
▶ PPL Electric
▶ All residents and businesses

Along with pricing, encourage the disclosure of fuel mix for electricity supply providers, including the default utility offering.

Environmental considerations - Ensure resources are available for all populations, and that rate implications are clear and easy to understand. Ensure multilingual education is available. Ensure any ratepayer increased cost impacts do not disproportionately burden low-income households. Ensure that suppliers of cleaner energy are not causing environmental injustice at site of energy generation.



Implementation considerations - This requires a change in Pennsylvania law and regulation for this to be implemented in default service. Retail suppliers can provide transparency if they want to but are not obligated under the law (free market competition). Utilities do not procure from specific power plants—they buy full requirements contracts where the utility has no information on the source(s) of the energy. The city could feature or highlight energy suppliers that do provide this transparency and encourage the PUC to require and enable greater transparency across the board.



Key next step

Office of Sustainability to evaluate best options for encouraging changes to PUC policy and identify options for promoting transparent suppliers.


E1.3 Demonstrate the benefits of renewable energy through city projects

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Improve air quality ▶ Job creation	City lead ▶ Dept. of Public Works	Partners ▶ Office of Sustainability ▶ GRID Alternatives ▶ Sustainable Energy Fund	Key Stakeholders ▶ PPL Electric ▶ All residents and businesses ▶ Renewable energy developers
Community Priority 					



Increase the capacity of new renewable generation on city facilities and land. The city can lead by example and install on-site renewables for new and existing buildings where feasible, in addition to continuing to source 100% renewable energy for all city needs.

Environmental considerations - Partner with the non-profit organization GRID Alternatives, which builds community-powered renewable energy to advance economic and environmental justice, to create solar projects that benefit Bethlehem’s low-income communities. Consider [other policy options](#) to support low-income solar programs, such as on-bill financing, consumer protections, and carveouts and/or incentives for community solar.

Implementation considerations - The city can demonstrate the benefits of renewable energy, which could be used to develop educational materials and case studies and promoted on the city website. If community solar becomes legal in Pennsylvania, the city could offer its rooftops and open space to serve as a host site for a community solar installation benefiting low-income residents.

 **Key next step**
 Dept. of Public Works to conduct a desktop feasibility assessment of city sites for potential to host on-site renewable electricity generation.

E1.4 Promote existing incentives for renewable energy installation and drive creation of new incentives

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Cost savings ▶ Improve air quality	City lead ▶ Office of Sustainability	Partners ▶ Sustainable Energy Fund ▶ PPL Electric ▶ Dept. of Community and Economic Development ▶ Local community groups, such as Lehigh Valley Hispanic Center and NAACP	Key Stakeholders ▶ Residential, commercial, industrial building owners
Community Priority 					

Promote existing renewable energy incentives (federal, state, utility) to Bethlehem residents and businesses. Ensure applicable incentives exist to encourage installation of solar PV and thermal technologies, such as C-PACE financing, Green Energy Loan Fund (GELF), tax credits, or other rebates. The city should explore options to provide its own incentives, such as a property tax abatement based on the value of a solar installation, to further incentive installations and fill gaps needed to reach city goals.

Environmental considerations - Ensure multilingual education is available. Ensure all customers have equal access and eligibility for incentives. Promote incentives that lower both upfront and project lifetime costs.

Implementation considerations - Multiple incentives for installing renewable energy, such as solar photovoltaics (PV), are currently in place. For example, Pennsylvania allows the sale of Solar Renewable Energy Credits (SRECs) as an incentive for solar installations. The federal Investment Tax Credit (ITC) also allows homeowners and businesses to claim a credit for up to 26% of qualified expenditures, although the tax credit is scheduled to step down 22% in 2023 and ultimately phase out for homeowners. Upfront installation costs can be a barrier for many, so the city should promote incentives, financing options, and long-term benefits of on-site renewable options. The city can also support extensions and expansions of state support policies. In implementing this strategy, the city should also encourage large organizations and institutions to help promote existing incentives for renewable energy generation via the Green Ribbon Commission (LOII).

 **Key next step**
 Office of Sustainability to schedule a meeting with key partners to evaluate best methods for promoting incentives.

E1.5 Increase knowledge of renewable energy options in addition to electrical

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Reduce resource consumption
- ▶ Increase climate resilience
- ▶ Job creation

City lead

- ▶ Office of Sustainability

Partners

- ▶ PA DEP
- ▶ Local installation companies
- ▶ Dept. of Community and Economic Development

Key Stakeholders

- ▶ All residents and businesses
- ▶ Retail electricity suppliers

Community Priority



Run a campaign to increase awareness of options for on-site solar PV, solar thermal, and other renewable energy options, with a focus on reducing energy costs for low-income households. Although not suitable in all situations, solar thermal is very effective for some applications at suitable sites — and can help reduce the use of both electricity and on-site fuel consumption.

Environmental justice considerations - All education materials should be multilingual. Operating costs are very low, so this strategy could be very helpful to low-income folks if there is help with the initial investment.

Implementation considerations - None noted.



Key next step

Office of Sustainability to create a repository of existing educational and engagement resources to leverage.

GOAL: Promote the use of renewable electricity

E2.1 Implement a recognition program to incentivize transparency and adoption of renewable energy use

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

City lead

- ▶ Office of Sustainability

Partners

- ▶ EAC
- ▶ Dept. of Community and Economic Development
- ▶ Chamber of Commerce
- ▶ Sustainable Energy Fund
- ▶ Local community groups, such as Lehigh Valley Hispanic Center and NAACP

Key Stakeholders

- ▶ Residential, commercial, industrial building owners
- ▶ Local renewable energy installation companies

Community Priority



Create a city program to promote local residents, business, or organizations that commit to sourcing renewable energy.

Environmental justice considerations - Create multilingual education for all new programs. Ensure there is awareness of the program for businesses in low-income neighborhoods. Provide consultation and support to businesses in low-income communities who may want to source renewable electricity but do not know how. As part of the program, the city should create a review process to ensure it does not “recognize” the use of renewable energy that is the cause of environmental injustices at the source of energy generation. What counts as “renewable energy” at the state or federal level can in some cases also be energy production endeavors that are causing environmental injustice.

Implementation considerations - The city and the EAC can develop this program while enlisting the support of local non-profits and NGOs to promote the program to a broad audience. The Chamber of Commerce could play a similar role for businesses. Such a recognition program could also be incorporated into the broader Bethlehem Climate Challenge program, as described in the Public Engagement chapter, particularly strategy PE1.1.



Key next step

Office of Sustainability to schedule a meeting with key partners to evaluate best methods for promoting local solar projects.

E2.2 Promote adoption of on-site solar

Timeline
▶ Medium

Community Priority 

GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Job creation
- ▶ Reduce inequality and poverty

City lead

- ▶ Office of Sustainability

Partners

- ▶ EAC
- ▶ Dept. of Community and Economic Development
- ▶ Sustainable Energy Fund
- ▶ PPL Electric
- ▶ Chamber of Commerce
- ▶ Local community groups, such as Lehigh Valley Hispanic Center and NAACP


Key Stakeholders

- ▶ Residential, commercial, industrial building owners
- ▶ Local solar installation companies

Develop a "100 solar roofs" target or similar goal to encourage implementation of on-site generation. The city could complement this target by organizing a 'solarize' group purchasing program to engage local residents and businesses while offering limited-time reduced pricing.

Environmental considerations - Partner with [GRID Alternatives](#) to create solar projects that benefit low-income communities, and consider other policy options to support low-income solar programs, such as on-bill financing, consumer protections, and carveouts and/or incentives for community solar when community renewables are allowed in Pennsylvania. Customer renewable energy typically leads to net metering, which is ultimately paid by those customers that do not own such generation. Some low-income advocacy groups and studies show that this impacts moderate and low-income family more because they have limited capability to invest in renewables but pay for more for electricity due to current net metering rules. Although this concern about disparate impacts has been used in bad faith by interest groups to argue against solar energy more broadly, the city takes these concerns seriously and will look for opportunities to ensure low-income and other at-risk populations have opportunities to see the benefits of increasing solar installations in the city.

Implementation considerations - The city could organize a 'solarize' group purchasing program (following in the footsteps of Solarize Lehigh Valley run by Sustainable Energy Fund in 2018) by selecting high quality installers and equipment, and negotiate discounted prices and important consumer protections to help grow its solar market. [Solarize Philly](#) is another example of a successful group-purchasing program. In parallel, the city can streamline permitting and zoning considerations to help reduce the cost and time to install solar. The EAC's Solar Committee has been researching solar assessments, benchmarking, and other city's solar ordinances with the goal of sharing this information with the Planning and Zoning Department, so they can help homeowners make informed decisions. The EAC's Solar Committee considered suggesting revisions to the city's ordinance to require solar for large warehouses.

 **Key next step** - Office of Sustainability to meet with the EAC, SEF and local solar installation companies to discuss an appropriate citywide target and lessons learned from Solarize Lehigh Valley.

GOAL: Maximize the use of on-site solar, energy-storage solutions, and other renewables

E3.1 Ensure a robust net metering program continues to be available to all electricity customers

Timeline
▶ Long

Community Priority 

GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality

City lead

- ▶ Office of Sustainability

Partners

- ▶ EAC
- ▶ City Council

Key Stakeholders

- ▶ Residential, commercial, industrial building owners
- ▶ Local solar installation companies
- ▶ PPL Electric
- ▶ PA PUC

The city should show its support via resolutions and other means for a robust net metering program that is readily available to all consumers. Net metering allows utilities customers with on-site renewable systems, such as solar PV, to export excess power to the grid and be billed for the electricity coming from the grid minus the amount going out. City support could include resolutions for improving the state's net metering regulations, such as crediting annual excess generation at the full retail rate, lifting the 50kW cap on residential systems, and expanding virtual net metering.

Environmental justice considerations - Ensure there are no compensatory increases in fixed cost fees or other disproportionate cost burdens for low-income ratepayers. Since net metering customer compensation is borne by all ratepayers whether or not they have a net-metered renewable energy system, such as solar PV, expansions to net metering should be accompanied by expansions in access to renewables, particularly for low-income ratepayers (e.g., community renewables, as described in E4.1).

Implementation considerations - Net metering is available in Pennsylvania following rules issued by the PA Public Utilities Commission (PUC). Investor-owned utilities must offer net metering in accordance with PUC rules, and it is available in Bethlehem through PPL Electric. Any expansion of the current net metering provisions under the Alternative Energy Portfolio Standards Act would require a legislative change. Rules and limitations of net metering should be highlighted in city promotion efforts. PPL Electric currently offers a robust program, and customers can submit applications online through a portal. Over 75% of applications are approved in 24 hours with PPL Electric's new system.

Key next step - Office of Sustainability to meet with the EAC and City Council to discuss the best options for signaling support.

E3.2 Streamline permitting and zoning considerations for installation of on-site renewable energy systems

Timeline
▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Job creation

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ EAC
- ▶ Office of Sustainability
- ▶ Code Enforcement Dept.
- ▶ City Council

Key Stakeholders

- ▶ Residential, commercial, industrial building owners;
- ▶ Local renewable energy installation companies

Ensure the permitting process for on-site renewable energy systems is efficient and streamlined and consider offering lower fees. The city should also evaluate zoning codes, such as required setbacks for solar PV and variances for historic districts, to ensure they maximize solar potential while balancing safety concerns. The City of Philadelphia offers streamlined electrical and building permits into a single solar permit, as well as lowering permit fees.

Environmental considerations - Ensure equal access to all communities. Consider waiving or reducing permit fees for owner-occupied residences in frontline communities.

Implementation considerations - The EAC's Solar Committee has been researching solar assessments, benchmarking, and other city's solar ordinances with the goal of sharing this information with the Planning and Zoning Department, so they can help homeowners make informed decisions. The EAC's Solar Committee considered suggesting revisions to the city's ordinance to require solar for large warehouses. The city should also utilize permitting and inspection best practices from the US DOE and apply for [SolSmart](#) designation. Other examples to consider include Philadelphia Energy Authority's [EZ Permit](#) for solar installations, and New York State's [Solar Guidebook for Local Governments](#), which includes best practices and sample language for permits and zoning.



Key next step

Bureau of Planning and Zoning to meet with the EAC to review existing recommendations; EAC and Office of Sustainability to evaluate SolSmart criteria and other best practices.

E3.3 Require and incentivize renewable energy integration in new development, construction, and renovation projects

Timeline
▶ Long

Community Priority



GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Job creation

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ EAC
- ▶ Office of Sustainability
- ▶ Green Building United
- ▶ City Council

Key Stakeholders

- ▶ Construction companies
- ▶ Residential, commercial, industrial building owners
- ▶ Local renewable energy installation companies
- ▶ Construction industry

Update building codes to include green standards, including making rooftops solar-ready and requiring a solar assessment for all new construction. The city should explore options to provide its own incentives, such as a property tax abatement based on the value of a solar installation, to further incentive installations.

Environmental considerations - Consider bonuses for low- and moderate-income housing to offset additional costs. Consider waiving or reducing permit fees for owner-occupied residences in frontline communities.



Implementation considerations - Consult with Green Building United to determine how approaches to building design could better allow solar systems; consider integrating cost assessments of both on-site solar and solar+storage projects. Utilize planning and zoning best practices from the US DOE and apply for SolSmart designation. EAC's solar initiative sought to research how to motivate commercial-level solar; it was found some buildings may not be structurally capable to support solar panels. Explore how to improve building codes to ensure all new buildings could support solar systems.



Key next step

Bureau of Planning and Zoning to meet with the EAC to review existing recommendations; Bureau of Planning and Zoning, EAC and Office of Sustainability to meet with Green Building United to evaluate existing codes and possible incentives.


E3.4 Promote evaluation of renewable energy feasibility for existing large industrial and commercial properties

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Cost savings ▶ Improve air quality ▶ Job creation 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	<p>Partners</p> <ul style="list-style-type: none"> ▶ City Council ▶ EAC ▶ Office of Sustainability ▶ Green Building United ▶ Lehigh University Energy Research Center ▶ Code Enforcement Dept 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Commercial and industrial building owners ▶ Local renewable energy installation companies
--	--	---	---	--	---



Require commercial and industrial properties to periodically evaluate rooftop solar to encourage utilization of existing building rooftops or under-utilized land. Size threshold for requirement to be determined by the city to ensure adequate capture rate based on building stock characterization.

Environmental justice considerations - None stated.

Implementation considerations - Consult with Green Building United to determine how approaches to building design could better allow solar systems; consider integrating cost assessments of both on-site solar and solar+storage projects. Utilize planning and zoning best practices from the US DOE and apply for SolSmart designation. EAC's solar initiative sought to research how to motivate commercial-level solar; it was found some buildings may not be structurally capable to support solar panels. Explore how to improve building codes to ensure all new buildings could support solar systems.

 **Key next step**
Bureau of Planning and Zoning to meet with City Council and EAC to determine ordinance for requirement.


E3.5 Promote evaluation of fuel switching options for any on-site energy plant system that is fossil fuel-based

<p>Timeline ▶ Long</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Cost savings ▶ Improve air quality ▶ Increase climate resilience 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	<p>Partners</p> <ul style="list-style-type: none"> ▶ City Council ▶ EAC ▶ Office of Sustainability ▶ Green Building United ▶ Code Enforcement Dept. 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Commercial and industrial building owners
---	--	--	---	---	--

Require periodic evaluation of low-carbon alternatives (e.g., sustainable biofuel, geothermal, cogeneration, energy storage) for any facility energy plant or micro-grid that is fossil fuel-based (e.g., coal boilers, gas co-gen).

Environmental justice considerations - Reduction of on-site pollution can improve local air quality, improving the health of all, including vulnerable populations.

Implementation considerations - Requirements will depend on technical and financial feasibility.

 **Key next step**
Bureau of Planning and Zoning to meet with City Council and EAC to evaluate requirements.

E3.6 Explore alternative energy technologies available to the city

Timeline

- ▶ Long

Community Priority



GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Increase climate resilience
- ▶ Improve system sustainability

City lead

- ▶ Dept. of Public Works

Partners

- ▶ Water and Sewer Resources Dept.
- ▶ EAC
- ▶ Office of Sustainability
- ▶ Bureau of Planning and Zoning

Key Stakeholders

- ▶ All residents and businesses

Explore alternative energy technologies available to the city, such as waste heat generation, river-source cooling, ground loop geothermal utility, central district distribution loop, or water distribution energy recovery. Dependent on technical feasibility, waste energy from local process or available geothermal resources may provide alternative resources for low-carbon electricity generation. The city could also explore other options such as combined heat and power (CHP) for certain applications.

Environmental justice considerations - Evaluate alternative energy projects for localized impacts on EJ communities to ensure there are no unintended negative consequences. Ensure benefits of alternative energy projects are available to frontline communities.

Implementation considerations - Alternative energy technology deployment will depend on technical feasibility. A [2019 study](#) explored the feasibility of using ground-source heat pump (GSHP) systems shared by buildings along a single street segment, or “GeoMicroDistricts.” The city can consider utilizing its ability to establish municipal authorities under the Pennsylvania Municipality Authorities Act to develop and manage clean energy assets to serve residents and businesses.



Key next step

Dept. of Public Works to commission technical review of available technologies.

E3.7 Develop low-cost, local retail renewable electricity options

Timeline

- ▶ Near-Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Cost savings
- ▶ Improve air quality
- ▶ Improve system sustainability

City lead

- ▶ Dept. of Public Works

Partners

- ▶ Water and Sewer Resources Dept.
- ▶ EAC
- ▶ Office of Sustainability
- ▶ Bethlehem Authority

Key Stakeholders

- ▶ All residents and businesses
- ▶ Frontline communities

Explore the possibility of issuing a tax-free municipal bond to finance and develop a wholesale renewable power project. The city or a municipal authority could sell the power to a retail supplier that would sell it back to residential, commercial, and industrial customers in Bethlehem at a price lower than the utility Price to Compare. The retailer would be responsible for complying with licensing and other PA Public Utility Commission (PUC) requirements. The city could help to publicize the option to encourage greater adoption of renewable electricity in the community.




Environmental justice considerations - Evaluate renewable energy projects for localized impacts on EJ communities to ensure there are no unintended negative consequences. Maximize EJ community participating in the project development process, such as through holding community listening sessions and integrating workforce development programs. Ensure benefits of the renewable power project are available to frontline communities. Stipulate that the retail supplier provides clear, understandable rate structures, and prohibit predatory pricing and marketing. All marketing should be multilingual and the city should work with the Bethlehem Climate and Environmental Justice Council (EJ1.2) and trusted community partners to engage low-income residents about the program to ensure they are able to take advantage of any energy bill savings.




Implementation considerations - The [American Cities Climate Challenge Renewables Accelerator](#) provides case studies and tools for US cities to meet 100% renewable electricity goals. This includes a Local Government Renewables Action Tracker with numerous examples and case studies of city procurement actions and policies to reach 100% community-wide renewable electricity. The city can consider utilizing its ability to establish municipal authorities under the Pennsylvania Municipality Authorities Act to develop and manage clean energy assets to serve residents and businesses.



Key next step - Dept. of Public Works to issue a request for information (RFI) to gauge interest in this possibility from project developers and financiers, as well as potential electricity retail suppliers.

GOAL: Support policy changes that increase equitable access to local renewable electricity

E4.1 Support Community Choice Aggregation (CCA) and community renewables					
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Cost savings ▶ Reduce inequality and poverty ▶ Improve air quality 	City lead <ul style="list-style-type: none"> ▶ City Council 	Partners <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ EAC ▶ Sustainable Energy Fund 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ PPL Electric ▶ PA PUC ▶ State lawmakers
Community Priority 	<p>Support changes in Pennsylvania law and regulation that would enable community renewable projects and Community Choice Aggregation (CCA) for renewable sourcing. Both CCA and community renewables could significantly increase renewable electricity consumption in Bethlehem. CCA, also known as municipal aggregation, are programs that allow local governments to procure power on behalf of their residents, businesses, and municipal accounts from an alternative supplier while still receiving transmission and distribution service from their existing utility provider. CCAs enable greater local control over electricity sources, more green power than is offered by default, and lower electricity prices. By aggregating demand, communities gain leverage to negotiate better rates with competitive suppliers and choose greener power sources. Community renewables, by contrast, generate electricity from a central location that is shared by multiple end consumers. This enables members of a community who cannot install renewables on their own property, such as renters and homeowners with heavily shaded roofs, the opportunity to share the benefits of solar power or other renewable electricity.</p> <p>Environmental justice considerations - Ensure that any change in regulation allows for equal access among lower-income or underserved communities. Resources for designing low-income solar programs are provided in the Low-Income Solar Policy Guide. New York’s Solar for All program provides an example of using community solar to support low-income populations.</p> <p>Implementation considerations - Community solar is currently restricted in Pennsylvania but proposed HB 531 is looking to change that. Bethlehem could pass a resolution to indicate support for HB 531 and change in this regulation. A separate Pennsylvania bill, HB 1970, proposes a local solar program that has been described as similar to community solar but is more similar to a green tariff than a traditional community solar program. HB 1970 allows for utilities to charge a premium for solar energy whereas community solar programs are designed to save customers money. The city could support a green tariff program as a policy to expand access to solar, but in parallel the city should prioritize supporting community renewables through HB 531 and similar bills. The city can demonstrate how renewable aggregation would work, highlighting the 4-university initiative. The city should also focus on local generation by identifying underdeveloped space in the city that could be remediated into a solar array project as well as sites and entities willing to host large installations that could serve as community renewables.</p> <p>Key next step  EAC to meet with City Council and determine best way to signal support for HB 531.</p>				

E4.2 Support policies that expand access to renewable energy for consumers					
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Cost savings ▶ Reduce inequality and poverty ▶ Improve air quality 	City lead <ul style="list-style-type: none"> ▶ City Council 	Partners <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ EAC 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ PPL Electric ▶ PA PUC ▶ State lawmakers
Community Priority 	<p>Signal support for Pennsylvania Public Utility Commission (PUC) rules or other regulation that provides greater access to renewable energy for consumers.</p> <p>Environmental justice considerations - The city should include in its messaging to the PUC that it supports rigorous consumer protections and options for low-income solar.</p> <p>Implementation considerations - The city should conduct a policy benchmarking exercise to identify policies and regulations from other states and municipalities that could benefit Bethlehem and Pennsylvania more broadly.</p> <p>Key next step  EAC to conduct a review of policies.</p>				

Remaining gaps

This chapter's strategies address the main sources of emissions and reduction opportunities from electricity sourcing. However, the required policy changes at the state level necessary to achieve 100% renewable electricity consumption create a gap in what the city can achieve directly. As discussed in the strategies above, the city will use its full influence to support PUC regulation and other policy changes that provide greater access to renewable energy for Bethlehem residents and businesses.

Additionally, due to Pennsylvania's deregulated electricity supply market and privacy restrictions on individual electricity usage data, there is currently no means for the city to determine the source of electricity consumed by individual Bethlehem residents and businesses. As a result, barring policy changes, the city will face limitations in tracking progress toward the goal of 100% community-wide electricity consumption and ultimately demonstrating attainment. Until progress can be directly measured, the city will develop alternative, measurable thresholds for supporting renewable energy development and expansion, such as the draft metrics in Appendix 2, which can show residents and businesses the progress being made.

Implementation

Implementation of this chapter will require close coordination with PPL Electric and policymakers at the state level. Critical first steps for implementation include:

- Facilitate the creation of an online resource to provide quick access to information about renewable energy use
- Convene a working group to curate, maintain, and promote educational materials and workshops for the website and community, and appoint a position to oversee these activities
- Evaluate options for a city demonstration project

The Implementation Strategy chapter provides further details on the timeline for implementing this chapter and the coordination of this chapter with the strategies of other sections of the CAP.



BETHLEHEM

Transportation and Mobility

objective



Transportation activities in Bethlehem account for about 20% of the city's total community-wide GHG emissions. This is primarily the result of over 450 million vehicle miles traveled (VMT) over a single year.

Introduction

Transportation activities in Bethlehem account for about 20% of the city's total community-wide GHG emissions. This is primarily the result of over 450 million vehicle miles traveled (VMT) over a single year. The purpose of this section's strategies is to promote the use of low emission or zero-emission vehicles by residents, businesses, and government, to increase public transportation use, improve walkability, increase bicycling, and generally provide safe and alternative transportation modes to fossil fuel vehicles. Switching transportation modes from fossil fuel combustion-engine vehicles and equipment to low and non-emitting modes, such as biking, walking, or public transit, while also shifting vehicles to electric or other zero-emission technologies will have multiple benefits, including positive impacts on public health, improved air quality, a more active population, and reduced GHG emissions.

Many Bethlehem stakeholders have been working toward these ends for years (including the city itself) by adding and maintaining biking trails such as the South Bethlehem Greenway, the Bethlehem Coalition for Appropriate Transportation (CAT, which promotes walking and bicycling through advocacy, education, safety training, and events), and Lehigh and Northampton Transportation Authority (LANATA, whose planning and studies aim to increase public transit ridership, improve service, and link land-use planning with transit). This plan and the strategies identified in this section will build on the work already being done in the transportation sector, better consolidate efforts, and enable broader support from the city.

There are significant challenges in addressing GHG emissions from the transportation sector. Emissions from city government vehicles only make up about 1% of total transportation emissions, most of which come from residential

vehicles, commercial fleets, LANATA, trucking, and freight trains. These sources of emissions outside the city's direct control make VMT data gathering challenging. Currently, the city gets an estimate of total VMT completed by the Lehigh Valley Planning Commission (LVPC) using their travel demand model. While this approach provides a good order-of-magnitude estimate for on-road vehicle traffic, it does not provide data for off-road construction equipment, freight trains, and other smaller sources. The LVPC transportation model will likely not account for the impacts of all the strategies in this plan. A first step will be to review the data model and determine approaches to account for the emission reductions associated with the strategies provided below, including developing new data collection methods and sources. The city will explore potential partnerships with its stakeholders, including those involved in the development of this plan, as well as the LVPC and other local institutions and organizations to accomplish this preliminary step.

CASE STUDY

Bus rapid transit study

On August 29, 2011, the Lehigh and Northampton Transportation Authority (LANTA) implemented a fully re-designed route network, a key component of Moving LANTA Forward, a twelve-year strategic vision for public transportation in the Lehigh Valley. Moving LANTA Forward was completed in accordance with both the bi-county Comprehensive Plan – The Lehigh Valley 2030, which prioritized congestion reduction, suburban growth management, establishment of a link between land use and transportation decisions, revitalization of urban centers and preservation of agricultural land, and the LANTA Strategic Plan 2004-2015, which established a part of LANTA’s mission to “support desired economic and environmental goals”. The Service Plan of Moving LANTA Forward included four elements:

- Core Service Improvement Plan
- Service Coverage Expansion Plan
- Enhanced Bus/Bus Rapid Transit Plan



To further the planning of element 3, the Enhanced Bus/Bus Rapid Transit Plan, LANTA commissioned a [study](#), which includes the preparation of a conceptual enhanced bus/bus rapid transit service plan, identification of regional goals and objectives for the service, analysis of demand and potential benefits within each corridor, identification of a “trunk” corridor or corridors, development of a conceptual design plan for the corridor(s), and a final implementation plan.

Objective and goals

The primary objective of the Transportation and Mobility section of the Bethlehem Climate Action Plan is to reduce overall transportation emissions by a minimum of 30% by 2030. This objective will be accomplished through strategies that target four specific areas of impact:

- Reduce vehicle miles traveled
- Decrease use of fossil transportation fuels
- Increase adoption of electric, alternative fuel, and zero-emitting vehicles
- Improve transportation data collection and tracking

While there is overlap between these impact categories (e.g., EV adoption also decreases fossil fuel use), this categorization helps structure the strategies and target specific outcomes. It also allows the development of tracking metrics and strategy-specific targets and measures of success. Specific targets for each of the four impact categories may be included in the final draft of the plan (e.g., increase residential EV vehicles by 500 and add 20 public electric vehicle chargers throughout the City of Bethlehem).

Strategies & actions

The table defines a series of strategies and action steps to achieve the objectives defined above. This list was developed by the Bethlehem Climate Action Plan Stakeholder Working Group on Transportation and Mobility and further refined by the full Bethlehem CAP Stakeholder Working Group.

“

Many people would love a specific section of town to be free of cars and just include bikes, people walking, and stores.

“

The way the City can encourage biking and walking is by providing the infrastructure for doing it safely.

T1.1 Enhance LANTA Bus Service

Timeline
▶ Medium

Community Priority 

GHG emissions impact



Co-benefits

- ▶ Reduce inequality and poverty
- ▶ Improve air quality
- ▶ Improve system sustainability
- ▶ Improve public health & well-being

City lead

- ▶ Office of Sustainability

Partners

- ▶ LANTA
- ▶ EAC
- ▶ Dept. of Public Works
- ▶ Lehigh Valley Coalition for Appropriate Transportation (CAT)

Key Stakeholders

- ▶ All residents and businesses
- ▶ Other Lehigh Valley municipalities

Maximize ridership through expanded coverage, improved rider experience (convenience, comfort, cleanliness), increased reliability, more frequent service, reduced fares and better communication/technology and advertising to inform and connect with the local public.

Environmental justice considerations - Improving service could benefit low-income communities, and marketing initiatives should be presented in English and Spanish. LANTA does not designate specific buses to specific areas, but it does comply with federal Title VI regulations that stipulate it cannot disproportionately deprive EJ areas of the use of the newer, lower-emissions vehicles. The city should encourage this and monitor feedback from frontline communities to ensure new low-emission buses are regularly servicing EJ communities to reduce local air pollution. Enhanced LANTA services must also be coupled with efforts to de-incentivize car ownership, such that public transit enacts economic justice as well as environmental justice. Advocate that LANTA add bus shelters as part of this enhanced service to provide shade and shelter for those waiting for the bus (as environmental justice areas are often the subject to heat island effect). The city should also work in partnership with LANTA to provide amenity improvements at the Bethlehem Transportation Center (Broad and Guetter) for shelter from rain, snow, and sun, along with other improvements to encourage BTC usage. Provide digital schedule signs that indicate when the next buses will depart to help people navigate schedules. Partner with municipalities across the region to provide sufficient funding to restart the program that made LANTA public transportation free on "ozone action days." This program ran out of money, but when active, ridership on buses went up by 50%, which suggests that cost decreases will increase ridership. LANTA supports this, but it would require a region-wide effort that provides sufficient funding to cover lost revenue on these days. The program would need to cover all of LANTA's service area, not just Bethlehem.

Implementation considerations - The city will coordinate with other Lehigh Valley municipalities, including Allentown and Easton, as well as Northampton and Lehigh Counties to support increased funding for public transportation service to allow for the provision of more frequent service / more convenient transit service. LANTA's Moving LANTA Forward/ Enhanced Bus Service plan would be a big step toward achieving this goal. The [Moving LANTA Forward report](#), begun in 2008, finalized in 2010, and updated since then, identified a high-frequency bus service plan with faster routes covering eight of the busiest corridors through the Valley's three dense city centers. This [Morning Call article](#) discusses the previous LANTA program for free ridership on "ozone action days".



Key next step

Dept. of Public Works to meet with Office of Sustainability and City Council on feasibility of supporting increased public transportation funding in coordination with other Lehigh Valley municipalities.

TI.2 Improve bike mobility and safety

Timeline

- ▶ Near-Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Job creation
- ▶ Reduce inequality and poverty
- ▶ Improve system sustainability

City lead

- ▶ Dept. of Community and Economic Development

Partners

- ▶ Office of Sustainability
- ▶ Dept. of Public Works
- ▶ CAT
- ▶ EAC
- ▶ City Council
- ▶ Lehigh University
- ▶ Moravian College
- ▶ St. Luke's Health Network

Key Stakeholders

- ▶ All residents and businesses

Create a safe, low-stress network of bike routes, which may include dedicated bike lanes, trails, and bicycle boulevards connecting neighborhoods to destinations throughout Bethlehem. Publicize and expand the popular city's free bike-sharing program, "Bike Bethlehem." Provide bike racks and covered storage options downtown for bikers. For example, the city could pass an ordinance to require sheltered/indoor bike parking for buildings over a certain occupancy size, such as college dorms, apartment buildings, or office buildings. Bike parking rooms should include secure access, good lighting, and a visible location. Continue to provide more outdoor bicycle racks around the city for short trips, including stores, restaurants, college lecture halls.

Environmental justice considerations - Ensure Bike Bethlehem rental locations are accessible to low-income communities. Reduced transportation costs benefit lower-income populations; reduced pollution benefits health of vulnerable populations. This strategy should include multilingual education efforts. Create a bicycle ambassador program to allow for community members to speak to other community members. Prioritize safety improvements in EJ communities based on routes that are highly trafficked. Embrace and emphasize the use of other non-motorized modes of transportation in these lanes: skateboards, roller skates and rollerblades, scooters, etc.

Implementation considerations - In coordination with strategy L1.1, the city should aim to redesign streets toward a "complete streets" concept where all modes of travel are accommodated safely, promoting walking, biking, and transit use. Ensure bike lanes are properly marked with a bike icon and wide enough for a bicyclist. Prioritize bike lanes based on ease of implementation such as wider routes (i.e., Broad St., Stefko Blvd) with minimal disturbance; second priority should be creating bike lane "arteries" and corridors that would connect key destinations. Efforts should also integrate both traditional roadways as well as dedicated biking trails (i.e., D&L, Greenway, etc.); successful models demonstrate that pedestrian/biking systems can be constructed quickly and at reasonable costs along appropriate roadways. Some of these actions may require tough decisions tied to a reduction in parking. For example, the construction of a city-wide pedestrian/biking infrastructure system, possibly comprised of two or three barriered inner-city bike routes and the formalization of two environmentally rich corridors north and south of the Lehigh river. Inner-city routes (e.g., along Stefko Blvd., New St., and Broad St.) would require physical barriers and full safety features. Regarding bicycle parking, currently, many bikes are stolen or vandalized when parked outdoors at residences. Also, bikes left outdoors are exposed to weather and rust very quickly. These items are deterrents to effective bicycling.



Key next step

Dept. of Community and Economic Development to hold a meeting with CAT and other key stakeholders to discuss the creation of a bike safety task force to move this strategy forward.

T1.3

Provide “safe routes” for pedestrians in and around town

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Job creation
- ▶ Reduce inequality and poverty
- ▶ Improve system sustainability

City lead

- ▶ Dept. of Community and Economic Development

Partners

- ▶ Bureau of Planning and Zoning
- ▶ City of Bethlehem Citizens Traffic Advisory Committee (CTAC)
- ▶ Coalition for Appropriate Transportation (CAT)
- ▶ Bethlehem Pedestrian Bridge Coalition
- ▶ Office of Sustainability
- ▶ EAC

Key Stakeholders

- ▶ All residents and businesses

Expand and increase the walk-ability of Bethlehem. This could include a new pedestrian bridge, which would be an essential component of a meaningful pedestrian/biking infrastructure.

Environmental justice considerations - Reduced transportation costs can benefit lower-income populations, and reduced traffic pollution can reduce risks to vulnerable populations. Be sure routes provide frontline communities access to greenspace and culturally appropriate outdoor amenities. Walking routes should also purposefully connect green spaces and points of interest across the city to create a marketable city trail system. Such a system can become a tourism feature that can drive people to visit Bethlehem in the spring (blooms) and fall (changing colors). A walking trail system could complement our other seasonal draws (e.g., Musikfest in summer, "Christmas City" in winter) and can be coupled with initiatives to highlight minority-owned businesses along the trails, driving tourist capital to EJ communities. The city should join Pennsylvania's WalkWorks program for assistance in creating routes and walking clubs in EJ communities.

Implementation considerations - Implementation of this strategy starts with a focus on safety. The city can partner with the City of Bethlehem Citizens Traffic Advisory Committee (CTAC) and Lehigh Valley Coalition for Appropriate Transportation (CAT), provide education on pedestrian safety, expand, and enforce crosswalk crossings, and enhance enforcement for speed limits. The city should identify streets with high speeds and/or high crash rates and implement traffic calming and pedestrian safety improvements. Reduce city speed limits on non-arterial streets to 25mph, as has been done with Vision Zero in New York City and Philadelphia. Bethlehem's layout is suitable for walkability, and small investments could go a long way. In coordination with strategy L1.1, the city should aim to redesign streets toward a "complete streets" concept where all modes of travel are accommodated safely, promoting walking, biking, and transit use. There is an opportunity for economic synergies, as local businesses could see increased foot traffic. A key challenge is many dangerous and abrupt shifts in sidewalk levels. The city created a plan to improve walkability in 2009, but the plan was not fully implemented. The city should review this plan and incorporate relevant elements. In 2018, City Council and the Mayor unanimously endorsed and funded an \$80,000.00 feasibility study on the Lehigh River pedestrian/biking bridge. Evaluations of proposals on a new pedestrian bridge are underway. Such a bridge would enhance connections between the North and South downtowns while generating multiple cultural and economic possibilities on both the banks of the Lehigh River. The city can leverage existing state funding and programs including: Community Development Block Grant, Community, Trails, and Recreation Program, and Pennsylvania Department of Health WalkWorks program.



Key next step

Dept. of Community and Economic Development and Bureau of Planning and Zoning to hold a meeting with CTAC, CAT and other key stakeholders to discuss the creation of a pedestrian safety task force to move this strategy forward; feasibility study of Pedestrian Bridge proposal to proceed as planned.

T1.4 Enhance bike-to-work initiatives, events, resources, and benefits

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Cost savings
- ▶ Improve air quality
- ▶ Reduce inequality and poverty
- ▶ Improve system sustainability

City lead

- ▶ Health Bureau

Partners

- ▶ Office of Sustainability
- ▶ Coalition for Appropriate Transportation (CAT)
- ▶ BAPL

Key Stakeholders

- ▶ All residents and businesses

Encourage biking as a commuting option by hosting events, classes providing resources and safe-route options, give-away biking gear, sign-up local business to host events and provide discounted goods and services to bike-commuters.

Environmental justice considerations - Be sure discounted goods and services include items of value/affordability to low-income groups. Set up free bike repair centers throughout the city, such as on Moravian and Lehigh's campuses. Residents can learn how to make repairs and do them themselves in these spaces at no cost.

Implementation considerations - These events could be hosted in conjunction with the completion of biking infrastructure improvements to help advertise and showcase the improvements. Bike-to-work initiatives should be coordinated with the city's free bike-sharing program, "Bike Bethlehem." Bike-to-work programs should also engage large employers to encouraging biking, public transportation, ride-share, and other lower-GHG options for commuting. This could include offering easily-accessible, secure, sheltered bicycle parking.



Key next step

Health Bureau to partner with the Coalition for Appropriate Transportation (CAT).

T1.5 Educate to build a bicycling traffic culture of patience and respect among all road users

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality

City lead

- ▶ Health Bureau

Partners

- ▶ EAC
- ▶ Coalition for Appropriate Transportation (CAT)
- ▶ City of Bethlehem Citizens Traffic Advisory Committee (CTAC)
- ▶ Office of Sustainability

Key Stakeholders

- ▶ All residents

Educate adult bicyclists about best-practices for riding most effectively on city streets. Educate motor vehicle drivers to expect people on bicycles to be riding on city streets. Educate children on bicycles to have a basic understanding of traffic rules and to practice with their parents.

Environmental justice considerations - People with lower income and minimum wage-paying jobs are more likely to be bicycling at night with inadequate headlights/taillights to/from 3rd shift jobs.

Implementation considerations - CAT has a goal to reach 70,000+ residents of the city. The city could also provide headlights and taillights to city residents via these education sessions.



Key next step

Health Bureau to meet with CAT and the City of Bethlehem Citizens Traffic Advisory Committee (CTAC) to determine how to expand existing programming.


T1.6 Develop “vehicle free” zones and new pedestrian hub

<p>Timeline ▶ Medium</p> <p>Community Priority ○</p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Improve system sustainability 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	<p>Partners</p> <ul style="list-style-type: none"> ▶ City Council ▶ Mayor’s Office ▶ Lehigh University ▶ Moravian College ▶ Dept. of Community and Economic Development ▶ Dept. of Public Works 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Downtown businesses ▶ All residents
---	--	--	---	--	---

Create sections of the city where cars are not allowed to encourage pedestrian traffic, including sections of downtown and by linking pedestrian and biking infrastructure.

Environmental justice considerations - This could have an enormous positive impact and, if done well, would benefit local businesses and residents of all communities. “Vehicle Free” zones should include EJ areas where children with respiratory disorders walk and play outside. Spaces should be inclusive to non-motorized vehicle traffic (bikes, skateboards, etc.) to allow for seamless navigation of the city.

Implementation considerations - The city can study and learn from existing street closures and pedestrian zones created during the COVID-19 pandemic to support outdoor dining. As a first step toward implementing this strategy, the city should conduct a feasibility study to determine impacts to city traffic and residents. As part of Lehigh University’s [Pedestrian Experience Connections Initiative](#), in February 2020, the Bethlehem City Council approved the temporary closure of Packer Avenue from Vine Street to Webster Street. No vehicles or parking were permitted for eight weeks, and pedestrian traffic was allowed and encouraged. This test closure was intended to allow the university, the city, and their partners in the community to gauge the long-term feasibility of a permanent closure of that portion of the street. However, as a result of the impact of COVID-19 and Lehigh moving to remote instruction, the temporary closure of Packer Avenue was suspended until a later date, when students return to campus and a true test is feasible. An additional area that could be considered as a pedestrian hub is the relatively open area on the banks of both sides of the Lehigh River. Such a pedestrian hub could include the Banana Factory and its surrounding buildings on the South and the whole of Sand Island with the Ice House on the North.

 **Key next step**
City to support the continued testing of Lehigh University’s initiative to convert Packer Ave; Bureau of Planning and Zoning to study impact and learn how to expand and improve this model.


T1.7 Implement a car-sharing program

<p>Timeline ▶ Medium</p> <p>Community Priority ○</p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Cost savings ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Reduce resource consumption ▶ Improve system sustainability 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Heath Bureau 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development ▶ Coalition for Appropriate Transportation (CAT) 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses
---	---	--	--	--	---


Car-sharing programs provide access to cars when residents need it through some type of fee or membership system. Car-sharing programs reduce the overall cost of car access and vehicle miles driven as the cars are typically only used when necessary and not out of convenience when other active modes of transportation (walking/biking) or public transit options would suffice.

Environmental justice considerations - Could enable broader access to vehicles for low-income residents or reduce the cost of vehicle access allowing low-income residents more flexibility. The program should ensure that car share programs allow for alternative forms of payment for underbanked individuals who may not have credit cards. The city should use money generated by increases in parking fees to subsidize use of car-share by low-income groups. The city should explore grants and non-profit partners, such as Community Action and CADCB, which may facilitate access to low-income residents.

Implementation considerations - Car-sharing should target electric vehicles (EVs) or zero-emissions vehicles (ZEVs) for the program, potentially paired with strategy T1.2. The program should also engage large employers to encouraging ride-sharing, biking, public transportation, and other lower-GHG options for commuting.

 **Key next step**
Health Bureau to review other city non-profit car-shares or even private company options and derive lessons learned.


T1.8 Encourage alternate transportation methods to people who drive cars

Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Cost savings ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Reduce resource consumption 	City lead <ul style="list-style-type: none"> ▶ Health Bureau 	Partners <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ LANTA ▶ CAT ▶ LVPC 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
---------------------------	--	--	--	--	--

Many people who drive single-occupant cars have not considered riding LANTA bus to get to work, for shopping, and to other destinations. Similarly, the city could encourage biking or walking for short trips in the city.

Environmental justice considerations - The city should take the lead to encourage people to look at public transportation as a serious alternative to driving their cars everywhere. In our current state, there is reverse environmental justice, where people with more income are creating more pollution by driving more.

Implementation considerations - CAT’s “Try Transit” Day is an opportunity for city leaders and other government officials to ride LANTA bus to a destination, showing that the bus is viable for anyone. In coordination with the Bethlehem Green Ribbon Commission (LOI1) and Bethlehem Carbon Challenge (LOI2), large organizations and institutions should create incentive programs for employees to start using or continue to use alternate transportation.

 **Key next step**
Health Bureau and LANTA to boost visibility of the “Try Transit” Day opportunities and encourage all residents to participate in the program.


T1.9 Revise building codes and development zoning

Timeline ▶ Medium	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Increase climate resilience ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	Partners <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development; ▶ Code Enforcement Dept. ▶ LANTA ▶ CAT ▶ LVPC ▶ Community Action ▶ CADCB ▶ New Bethany Ministries 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Construction industry
-----------------------------	--	--	--	---	---

Encourage developers and redevelopment projects to increase walkability and access for pedestrians through mixed use spaces (residential, retail and office) and commitments to sustainable transit practices. Provide easily-accessible, secure, sheltered bicycle parking.



Environmental justice considerations - Ensure new developments, especially city amenities, are accessible and connected to (walking, biking, and transit) low-income communities. Give density bonuses for projects that include affordable housing and/or consider requiring affordable units. This provides a win-win, as people in more affordable units are more likely to take transit. Philadelphia provides an example of inclusionary zoning. Multi-unit residences should require green spaces, which can be shared, for residences on the property: yards, rooftop gardens, balconies, or other options to access the outdoors at home for renters.

Implementation considerations - Continue to encourage infill development, especially near traditional commercial corridors. Look to California for ways to reduce on-site parking requirements where appropriate. Encourage large land development projects to incorporate traditional street grid. Locate new city-owned amenities, such as recreational destinations, in places accessible to many residents by walking. Update building codes to require that bicycle racks in or around every multi-use, commercial, educational, and industrial use building.

 **Key next step**
Bureau of Planning and Zoning to review existing permitting and approval process for new developments and determine how they can be altered to encourage walkability, bicycle parking, and transit accessibility.

GOAL: Decrease use of fossil transportation fuels


T2.1 Pass and enforce no-idling laws

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Cost savings ▶ Improve air quality ▶ Reduce resource consumption 	<p>City lead</p> <ul style="list-style-type: none"> ▶ City Council 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Public Works ▶ BASD ▶ EAC 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses ▶ State lawmakers ▶ PennDOT
--	--	---	--	---	---

Pass and enforce a no-idling law and then educate fleet operators and residents about the no-idling law and enforce it consistently, as well as create steeper fines for diesel vehicles, such as buses and construction vehicles and equipment. The city should lead by example with its vehicle fleet and train operators to not idle.

Environmental justice considerations - The city should include multilingual education efforts on the policy and perform particular outreach, through trusted community partners, to services such as landscaping services or contractors that may have a high Spanish-speaking population to not disproportionately affect these contractors.

Implementation considerations - Pennsylvania Act 124 places idling restrictions on diesel-powered vehicles and prohibits localities from new idling restrictions. As such, any new local no-idling law would require first passing a Right to a Healthy Climate ordinance or Home Rule Charter, as described in strategy M3.5. Regardless, the city should enforce existing no-idling laws consistently. Resources to support this strategy include EPA’s [Idle-Free Schools toolkit](#); the [Turn It Off](#) program; and Natural Resources Canada research reports [here](#) and [here](#). Barriers to limiting idling include cultural norms and extreme temperature days in the summer and winter when people use cars for air conditioning. For example, people often leave their cars running with the heat or AC on while waiting in their cars. The city could also evaluate the use of adaptive traffic control systems and further traffic coordination strategies to reduce travel times and idling at traffic lights. For example, avoiding peak-hour traffic jams could be addressed with work time/shift planning with large employers, truck scheduling from freight yards, time of day tolling with EZPass, and other coordination approaches.

 **Key next step**
Dept. of Public Works to institute no-idling rules in municipal operations first to demonstrate leadership; City Council to explore a Right to Healthy Climate ordinance in M3.5, and EAC and Office of Sustainability to work with BASD, prioritizing education for drivers of school buses and trucks.

CASE STUDY

Expanding EV infrastructure



The electric vehicle (EV) market has been growing rapidly and is projected to accelerate in coming years. And EVs are not just cars. Mack Trucks will begin production in Lower Macungie Township of the first fully electric refuse trucks in early 2021.

That future is playing out across Pennsylvania and the Lehigh Valley as state and local leaders prepare to build the infrastructure needed to handle the transition and offer incentives to get people to buy into it. The 10-region Metropolitan Area Planning (MAP) Forum, of which the Lehigh Valley Planning Commission (LVPC) is a member, is creating an interactive map showing alternative fueling corridors and fueling stations throughout the four-state MAP Forum, essentially giving prospective alternative-fueled vehicle buyers a clear picture of where they'll be able to power up away

from home. In addition, the MAP Forum's Resiliency Working Group is moving to expand the multi-region's vehicle electrification and fuel cell technology deployment to assist in its greenhouse gas mitigation efforts. By the end of 2020, Pennsylvania had more than 1,700 public charging outlets at more than 700 locations – more than doubling since 2018. Incentives remain in place to encourage continued growth, with \$3,500 to \$4,500 rebates being offered per plug – funding up to 70% of an installation project – per public access plugs added by individuals, businesses or government entities. The state Department of Environmental Protection is also offering \$3 million to \$6 million in grants to entities looking to replace their pre-2010 diesel trucks. The PA DEP's [Driving PA Forward](#) and [Alternative Fuels Grant Program](#) webpages provide more information.

T2.2 Decrease parking, provide parking discounts, and eliminate minimum parking requirements

Timeline	GHG emissions impact	Co-benefits	City lead	Partners	Key Stakeholders
▶ Long		<ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Reduce resource consumption ▶ Improve system sustainability 	<ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning ▶ Bethlehem Parking Authority (BPA) 	<ul style="list-style-type: none"> ▶ City Council ▶ Office of Sustainability ▶ Mayor's Office ▶ Moravian College 	<ul style="list-style-type: none"> ▶ All residents and businesses ▶ LANTA ▶ Frontline communities
Community Priority					

Decrease parking for fossil-fuel, non-hybrid, non-EV, non-ZEV vehicles by reserving free-spaces for EV and low or zero-emitting vehicles only and provide parking fee discounts for these reserved spaces. Change parking minimum requirements for new developments. Enable more services and encourage less vehicle travel for new development projects.

Environmental justice considerations - There currently is a cost premium for hybrid and EV vehicles, making them less likely to be owned by low-income community members who often purchase second-hand vehicles. The increased cost of parking tickets is also a greater burden on low-income community members. Prior to modifying parking space availability and costs, the city should assess distributional impact of such policies and where there is significant/disproportionate impact on EJ communities, compensate to offset impact impacts to low-income communities and identify solutions to mitigate burdens. For example, the city should dedicate a % of revenue generated from any higher cost spaces toward investment in transit options in lower-income neighborhoods. Additionally, the city should place any higher cost spaces away from public services that need to be accessed by low-income community members (e.g., social services, city administration, courts) and in areas frequented by wealthier residents (e.g., affluent shopping districts that provide parking for employees).

Providing parking fee discounts for EV- and ZEV-reserved spaces will have less direct harm on low-income communities than increasing fees on non-reserved spaces. However, both policies present a distributional impact that disproportionately affects low-income communities. Until alternative modes of transit are confirmed viable for low-income, increased parking fees and decreased availability would primarily punish low-income residents. Implementation should wait until the city has confirmed LANTA service is viable for low-income residents and bike lanes and pedestrian routes are established and expanded, ensuring people have usable alternative options prior to being subject to new fees.

Implementation considerations - There is a risk of over-conversion to EV/plug-in only, which may over-crowd parking decks and reduce access to downtown areas. For an example of eliminating parking space minimum requirements, see [this article](#) about Edmonton, Canada.

Key next step Bureau of Planning and Zoning to review parking requirements for new developments; Bethlehem Environmental Justice Council (strategy EJ1.2) to meet with BPA to evaluate a pilot project for EVs and ZEVs to determine efficacy of larger scale program and potential environmental justice concerns. City Council to work with BPA to evaluate instances of garage spaces offered at less than cost (including depreciation) and work to minimize this practice except for nonprofits.

GOAL: Increase adoption of electric, alternative fuel, and zero-emitting vehicles

T3.1 Increase electric vehicle infrastructure in the city

Timeline ▶ Medium	GHG emissions impact 	Co-benefits ▶ Improve air quality ▶ Improve system sustainability	City lead ▶ Bureau of Planning and Zoning	Partners ▶ Dept. of Community and Economic Development ▶ Office of Sustainability ▶ LVPC ▶ Bethlehem Parking Authority (BPA) ▶ Dept. of Public Works ▶ Neighboring communities ▶ PPL Electric ▶ Pennsylvania DEP	Key Stakeholders ▶ All residents and businesses ▶ EV charging infrastructure providers
-----------------------------	--	--	---	---	---


Community Priority 

Work with neighboring communities and the local utilities to add electric vehicle (EV) charging infrastructure throughout the city and region.

Environmental justice considerations - Any efforts to promote EVs will reduce urban pollution, benefiting the health of all residents. As there is a higher percentage of low-income populations in the urban areas, those would benefit the greatest. There currently is a cost premium for electric vehicles, making them less likely to be owned by low-income community members who often purchase second-hand vehicles. These are the community members who most need additional income from driving for ride-sharing services. This should be considered in the creation of a program to increase EV infrastructure. While not all funding would come from the city itself (due to state and federal grants and private sector funding sources) any influx of city funds into climate-related infrastructure changes that benefit people who can afford EVs should be balanced with an equal or greater influx of city funds to climate-related projects and programs that benefit vulnerable community members.

Until EVs are affordable and accessible to most residents, the city should evaluate any funding for private vehicle infrastructure against clean transportation alternatives, such as investment in developing and strengthening infrastructure for public transit and non-motorized modes of transportation.

Implementation considerations - The Pennsylvania Department of Environmental Protection [Driving PA Forward](#) Level 2 EV Charging Rebate Program allows for 90% rebate for government, 70% rebate for non-government for level 2 chargers. Federal tax credit allows for 30% rebate on chargers (Form 8911). Opportunity for either the city or private businesses to own and operate chargers at near-zero cost. The Bethlehem Parking Authority has utilized the rebate program to install Level 2 EV chargers in some of the city's parking garages. Public Works has familiarity with rebate and grant applications and can help facilitate applications on behalf of the city. City will coordinate with PPL Electric to provide information on the potential cost and resources to install charging infrastructure (i.e. if upgrades to grid are required). PPL Electric supports EV expansion and can help the city with EV infrastructure and the build-out of chargers.

 **Key next step**
 Bureau of Planning and Zoning to work with PPL, LVPC, Office of Sustainability and other stakeholders to map out strategic points for EV chargers, taking note of which type of charger would be desired (level 2 vs. level 3/direct-current fast charger). Review will include a recommendation for where it would make sense for the city or private businesses to own/maintain chargers.

T3.2 Adjust city codes and zoning to expedite EV infrastructure

Timeline ▶ Medium	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve air quality ▶ Reduce resource consumption ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	Partners <ul style="list-style-type: none"> ▶ City Council ▶ Office of Sustainability ▶ Bethlehem Parking Authority (BPA) ▶ Code Enforcement Dept. 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ PPL Electric ▶ EV charging infrastructure providers
-----------------------------	---------------------------------	--	--	---	--

Establish and expedited process for approving and installing public EV chargers and related infrastructure.

Environmental justice considerations - Prioritizing certain zones could account for pollution risks to vulnerable populations.

Implementation considerations - As a first step, the city should hold a meeting with stakeholders to review current ordinances, permits, and other practices that are hindering EV infrastructure expansion in Bethlehem. San Marino, CA, provides an [example ordinance](#) for expedited vehicle charging station permitting.

Key next step
Bureau of Planning and Zoning to work with city code office and industry professionals to identify key opportunities to streamline process.

T3.3 Encourage public and private vehicle fleets to convert to all-electric or ZEVs

Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve air quality ▶ Reduce resource consumption ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development ▶ Dept. of Public Works ▶ DEP ▶ DEPA Coalition ▶ BASD ▶ PPL Electric 	Key Stakeholders <ul style="list-style-type: none"> ▶ Businesses ▶ EV charging infrastructure providers
---------------------------	---------------------------------	--	---	---	--

Partner with public and private fleet operators to work toward a goal of 100% EVs/ZEVs, including school buses, transit buses, locally based trucking/freight and logistics fleets, policy and fire-safety vehicles. Provide information and resources on federal grant opportunities to fund fleet conversion efforts.

Environmental justice considerations - Any efforts to promote EVs will reduce urban pollution, benefiting the health of all residents. In addition, electrifying school buses will reduce children’s exposure to pollution and may improve their cognitive ability ([see study](#)). The city should prioritize encouraging upgrades for fleets, such as LANTA vehicles and school buses, that commonly travel through at-risk communities.

Implementation considerations - The Pennsylvania Department of Environmental Protection Alternative Fuels Incentive Grant (AFIG) program has grant funding available for DC (direct current) fast chargers as well as alternative fuel vehicles, fleets and technologies. Both programs may have timelines, however, and availability of electric school buses may be limited. Additionally, renewable natural gas (RNG) vehicles can qualify for AFIG funding. Prioritizing the municipal fleet switchover will demonstrate the city’s dedication to emissions reduction. Working with the Bethlehem Area School District (BASD) may speed adoption among school buses. Education will be important to increase buy-in by everyone. Events similar to [National Drive Electric](#) might help with public adoption. The Drive Electric PA (DEPA) Coalition meets quarterly and can provide a wealth of info on EV trends, technologies, incentives, and news around the state. PPL Electric can also support fleet conversions to EVs and will provide updates to the city as EV-related information and programs become available.

As of February of 2021, LANTA’s bus fleet will be 100% either compressed natural gas (CNG) or diesel hybrid electric. While these buses have lower emissions than traditional diesel buses, the GHG emissions are not compatible with the city’s long-term net-zero GHG goal. Bethlehem acknowledges that even with the current bus fleet, the expansion of the transit system and increases in LANTA ridership will help to reduce emissions relative to the status quo of individual car culture, helping to achieve community goals. The city recognizes the progress LANTA is making and will encourage LANTA to incorporate electric, zero-emission, near-zero emission, and more fuel-efficient vehicles into the transit fleet as these options re determined to be feasible. Given the investments in CNG infrastructure that have already made, the city also encourages LANTA to explore the use of RNG for the current fleet until upgrades to zero-emission vehicles are made.

Key next step
Dept. of Public Works to explore funding options and feasibility to convert the municipal fleet to 100% EVs/ZEVs. Office of Sustainability to partner with the BASD to identify opportunities to convert school bus fleets as well.

T3.4 Incentivize residential use of EVs and ZEVs

Timeline ▶ Medium	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ Mayor's Office ▶ City Council ▶ Dept. of Community and Economic Development ▶ Bethlehem Parking Authority (BPA) ▶ PPL Electric ▶ CAT 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents ▶ EV charging infrastructure providers
-----------------------------	---------------------------------	--	---	---	---

Provide tax or other incentives (free parking) for residents who purchase or own an EV or ZEV.

Environmental justice considerations - Any efforts to promote EVs will reduce urban pollution, benefiting the health of all residents. There is currently a cost premium for hybrid and EV vehicles, making them less likely to be owned by low-income community members who often purchase second-hand vehicles. These are the community members who most need the additional income from driving for ride-sharing services. This should be considered in the creation of such an incentive program. Additionally, to provide similar incentives and benefits to low-income residents who do not own cars and residents using alternatives to private vehicles, the city should explore options to provide similar tax benefits or other incentives to residents who car-share, walk, and take public transportation. In this way, people with low carbon footprints will also receive benefits, and others will be incentivized to utilize transportation alternatives.

Implementation considerations - This strategy will reduce EV owners' barriers to install chargers; foster greater trust in process. Federal tax credit allows for 30% rebate on chargers (Form 8911).

Key next step
Office of Sustainability to meet with City Council, Bethlehem Environmental Justice Council (strategy E31.2), and other relevant stakeholders to discuss appropriate incentives for EVs/ZEVs while providing similar benefits to residents who take alternative forms transportation.

GOAL: Improve transportation data collection and tracking

T4.1 Improve transportation sector VMT data quality and leverage regional initiatives to reduce emissions

Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ LVPC 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ LANTA
---------------------------	---------------------------------	--	---	--	---

Work with Lehigh Valley Planning Commission (LVPC) to improve transportation sector vehicle miles traveled (VMT) data quality and leverage regional initiatives to reduce emissions.

Environmental justice considerations - Ensure efforts fit with the LVPC Equity analysis.

Implementation considerations - The Lehigh Valley Transportation Study (LVTS) was done by LVPC, the Metropolitan Planning Organization (MPO) for Lehigh and Northampton counties. The role of the MPO is to promote transportation projects, plans, programs, and policies that are consistent with the locally adopted Transportation Improvement Program (TIP) and Lehigh Valley Transportation Plan (LVTP). LVPC's [Lehigh Valley International Airport Area Freight Study](#) included a recommendation to implement a Truck Route Network as a planning tool to address the consistent concern of intermingling of truck traffic with overall vehicular traffic, particularly on residential streets on which large freight trucks cause excessive wear and tear while contributing to local pollution and noise. As an example of strategy T4.1 in action, the city should work with LVPC to implement and enforce truck routes in Bethlehem to divert trucks from local streets. The city should also work with LVPC to reduce environmental injustice by ensuring that truck routes avoid frontline communities.

Key next step
Office of Sustainability to establish a partnership with the LVPC to enhance data quality and promote regional collaboration, with an initial focus on truck routes.

T4.2 | Develop goals, metrics, and data for tracking progress

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Job creation
- ▶ Improve system sustainability

City lead

- ▶ Office of Sustainability

Partners

- ▶ LVPC
- ▶ LANTA
- ▶ CAT

Key Stakeholders

- ▶ All residents and businesses

Community Priority

Develop quantitative data metrics tied to overall GHG reductions goals and individual transportation goals and strategies to track progress and evaluate effectiveness of programs. New data sets for tracking progress could include city-wide transportation fuel sales, annual city resident surveys on transportation habits, vehicle registrations by vehicle and fuel type, city bus ridership by route, and ride-share usage (trips, VMT, GHGs).

Environmental justice considerations - Work with LVPC to gather and expand data on traffic counts through EJ communities in Bethlehem. This will identify hotspots and areas where traffic counters should be placed.

Implementation considerations - Should be a coordinated effort with the action T4.1.



Key next step

Office of Sustainability to refine metric and leverage existing efforts of LVPC, LANTA and CAT.

Remaining gaps

As indicated in the last section of the strategies table, the listed strategies do not address several emission sources, including:

- Freight / Trucking / Logistics Sectors
- Freight Trains / Train Yards
- Emissions from residents taking commercial flights

This is due to both a lack of data and a lack of influence from the City's perspective. Trucking, freight trains, and commercial flights are difficult for the city to influence, and specific emissions data is not currently available for two of the three.

This is due to both a lack of data and a lack of influence from the city's perspective. Trucking, freight trains, and commercial flights are difficult for the city to influence, and specific emissions data is not currently available for two of the three.

Trucking data is included in the VMT data provided by LVPC and therefore included in the emission estimates. While logistics and industrial warehouses are an important element of the economy in the Lehigh Valley, the trucking tied to the operations in this sector is significant. A first step is understanding the trucking routes and identifying traffic patterns, especially during high volume

periods and rush hour when trucks may use local roads through the city to avoid congested highways. The next step is to work with industrial park operators and transportation planners to help identify mitigation efforts as well as direct engagement with logistic companies to reduce impacts on local traffic, especially in low-income neighborhoods and vulnerable communities. As this sector expands, the city will strive to engage with companies, local developers, and building owners to identify methods to reduce VMT and idling and increase the use of low-emitting technologies, such as new-generation EV long haul trucks.

Norfolk Southern railway company has an annual corporate social responsibility report; responds to CDP, a non-profit global environmental impact disclosure platform; and completes an annual GHG inventory. The first step in working to lower emissions from the Norfolk Southern train yard in Bethlehem and the freight trains passing through the city is to get quantitative emissions data from the company. While the public GHG inventory likely does not provide the detail to understand Bethlehem's portion of the company's emission, that data is likely available. Once data is obtained, the city will understand the materiality of Norfolk Southern's contribution and can engage with the company to support their reduction efforts and offer up mutually beneficial solutions.

While emissions from Lehigh Valley International Airport and other regional airports that serve city residents are outside the city's geographic boundary and emissions inventory, more advanced and mature emissions accounting approaches include air travel-related emissions from its residents as Scope 3. The city has not included this source in its current inventory, nor has it addressed this as part of the CAP. The city of Bethlehem may look to engage local airports in the future and determine if there are ways the city can support the airport in reducing emissions. Another option for assessing and addressing air travel emissions is to engage large employers, the local universities and colleges, and other significant destinations within Bethlehem to encourage their employees, students, and attendees to use sustainable travel options.

Implementation

Implementation of this chapter will require close coordination with numerous stakeholders, many of whom have already worked for years to plan and implement actions that align with the goals and strategies of this chapter. These key partners include:

- LANTA
- LVPC
- The Bethlehem EAC
- Bethlehem Pedestrian Bridge Coalition
- The Coalition for Appropriate Transportation (CAT)
- The City of Bethlehem Citizens Traffic Advisory Committee (CTAC)
- Bethlehem Parking Authority
- Large institutions, such as Lehigh University, Northampton Community College, and Moravian College

Critical first steps for implementation include:

- Form a city transportation working group with representation from stakeholder organizations, transportation agencies and authorities, and underserved communities
- Engage LVPC, Norfolk Southern, and other relevant organizations to gather data needed to refine the city's baseline transportation emissions calculations and assess gaps
- Coordinate with City Council, EAC, and relevant city departments to review and assess ordinance updates that can result in quick wins
- When the position is created and hired, work with the Bethlehem Sustainability Director to prioritize additional actions
- Expand upon the "Key Next Step" of each strategy to develop detailed implementation plans, including a timeline, action items, necessary approvals, budget, responsible party, partners, data sources, and measures of success
- When the council is created and launched, work with the Bethlehem Climate and Environmental Justice Council to assess food deserts and equity in Bethlehem's waste and food systems

The Implementation Strategy chapter provides further details on the timeline for implementing this chapter and the coordination of this chapter with the strategies of other sections of the CAP.



Land Use and Green Space

objectives →

The use and distribution of Bethlehem's land affect all GHGs emitted in the city.

Introduction

The use and distribution of Bethlehem's land affect all GHGs emitted in the city. Energy consumption in buildings depends on the density and distribution of those buildings. For example, multifamily housing typically requires less energy per square foot and household member than single-family detached homes. The distribution of buildings also determines commuting distances, public transit accessibility, and the feasibility of substituting walking and biking for car trips. The first objective of the strategies outlined in this section is to reshape the built environment to optimize space used for buildings and maximize opportunities for short daily trips and travel mode options. This maximizes the reductions resulting from the strategies in the plan's Buildings and Transportation chapters. Implementation of the strategies across these sectors must be coordinated closely to achieve these potential synergies.

The second objective of this section is to maximize Bethlehem's green space—its parks, trees, woodlands, wetlands, and other ecosystems. These natural assets provide the only option for the city to both reduce GHG emissions and actively remove carbon from the atmosphere and store it. Trees, vegetation, and soils all absorb carbon from the atmosphere and sequester it for varying amounts of time. Carbon sequestration is not currently accounted for in the city's GHG inventory, but it will be critical to evaluate as the city moves toward a net-zero emissions target. With more than 568 acres of city-owned parks, ecosystems ranging from the woodlands of South Mountain to the wetlands along Saucon Creek, and all the trees lining Bethlehem's streets and yards, the amount of carbon sequestered in the city's vegetation and soils is

substantial. Maintaining and expanding these ecosystems is a critical goal of this plan, as is converting landscape management to organic regenerative methods, which increases carbon sequestration—a finding demonstrated by the nearby Rodale Institute.

There are several barriers to achieving the goals of this chapter. Many land-use decisions are influenced by regional trends, such as the growth of the Lehigh Valley metro area's economy. Residents and businesses lack practical information on the value and upkeep of ecosystems. Land use and green space strategies can also take longer to implement and produce results than other sectors. Despite these challenges, the co-benefits of green space are well established. Parks and forests not only provide sites for recreation, they also supply cleaner air, improve public health outcomes, and increase resiliency to climate change by lowering local temperatures, improving water quality, slowing and reducing stormwater runoff, and providing a barrier to mitigate flooding.

To achieve these co-benefits and the objectives of this chapter, the city will build on recent successful projects and partner with local stakeholders experienced in working toward these shared goals. The city Bureau of Urban Forestry will complete its first citywide tree inventory by December 2020. The Southside Greenway provides a model of how a greenspace concept can become a

Optimize space used for buildings & opportunities for short daily trips

Maximize Bethlehem's urban green space and tree canopy

successful reality. Major flood mitigation projects have been completed along the Monocacy and Saucon riparian zones in the last several years. In July 2020, the city released its Pollution Reduction Plan in compliance with the US Environmental Protection Agency's MS4 Program managed in Pennsylvania by Pennsylvania Department of Protection (DEP).

The city must make green space must equally accessible to all residents. Given the role of land-use decisions in environmental racism and historical lack of access to green space in low-income communities, environmental justice must be at the forefront of this chapter's implementation.

Objective and goals

The primary objectives of the Land Use and Green Space section of the Bethlehem Climate Action Plan are:

1. Reshape the built environment to optimize space used for buildings and maximize opportunities for short daily trips and options for travel mode
2. Maximize Bethlehem's urban green space and tree canopy to promote carbon sequestration, increase residents' access to active and passive open space, help reduce urban heat island effects, improve the urban ecosystem and stormwater management, and add aesthetic beauty to the city.

These objectives will be accomplished through strategies that target seven specific impact goals:

- Promote compact urban design with higher densities and mixed uses through planning and zoning ordinances, especially in development centers and major corridors
- Equitably preserve and expand Bethlehem's urban tree canopy and natural resources
- Improve the quality of urban ecosystems to promote native species, biodiversity, and carbon sequestration
- Increase the conversion of underutilized space to green space
- Increase equity and accessibility in Bethlehem's green space
- Improve stormwater and floodplain management through green infrastructure, reductions in impervious surfaces, zoning changes, and well-designed landscaping

Strategies & actions

The list below defines a series of strategies and action steps to achieve the objectives defined above. This list was developed by the Bethlehem Climate Action Plan Stakeholder Working Group on Land Use and Green Space with input from the Environmental Justice and Equity Steering Committee and further refined by the full Bethlehem CAP Stakeholder Working Group.

“

This is a great time to think about how to decrease the amount people drive to run errands. I think this means changing behaviors along with re-shaping the environment.

“

The Bethlehem Greenway is nice, but would be nicer if it connected to the other side of the river.

GOAL: Promote compact urban design with higher densities and mixed uses through plans and zoning ordinances, especially in development centers and major corridors

L1.1 Review and update land use ordinance and zoning to encourage land-use patterns that mitigate climate change impacts					
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Job creation ▶ Reduce inequality and poverty ▶ Conserve natural resources and biodiversity ▶ Improve water quality ▶ Increase climate resilience ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	Partners <ul style="list-style-type: none"> ▶ LVPC ▶ Bethlehem Zoning Hearing Board (ZHB) ▶ Office of Sustainability ▶ EAC ▶ City Council 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ LANTA
Community Priority 	<p>Work with Lehigh Valley Planning Commission (LVPC) through the FutureLV regional comprehensive plan to update planning and zoning ordinances to encourage compact urban development areas, mixed land uses, and higher densities in urban areas, and land preservation for agricultural and environmental purposes. Review opportunities for the redesign of streets toward a “complete streets” concept where all modes of travel are accommodated safely, promoting walking, biking, and transit use. Review opportunities for enhanced interconnection of sidewalks to each other and to trails, parks, and green spaces, plus interconnection of trails to on-road biking infrastructure.</p> <p>Environmental justice considerations - Consider how this could increase the cost of housing and require the inclusion of low-income units in climate-safe development projects.</p> <p>Implementation considerations - This must be enacted as part of the Subdivision and Land Development Ordinance (SALDO) and zoning ordinances so the Bethlehem Zoning Hearing Board (ZHB) will enforce.</p>				
Key next step	Bureau of Planning and Zoning to meet with LVPC, Office of Sustainability, and EAC to coordinate an overall approach for the city and to leverage LVPC’s existing efforts across the Lehigh Valley.				

L1.2 Integrate land use and transportation to reduce trip lengths and promote multiple modes of travel, including public transit					
Timeline ▶ Long	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Increase climate resilience ▶ Improve system sustainability 	City lead <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	Partners <ul style="list-style-type: none"> ▶ LVPC ▶ CAT ▶ Office of Sustainability ▶ EAC 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ LANTA
Community Priority 	<p>Through the coordination of stakeholders and in conjunction with the transportation strategies of this CAP, improve integration of land use planning and transportation to reduce trip lengths, and promote multiple modes of travel, including transit.</p> <p>Environmental justice considerations - Ensure promotion of multiple modes of travel and improved public transit options are accessible to low-income communities.</p> <p>Implementation considerations - Coordinate efforts with the Lehigh Valley Planning Commission (LVPC) through the FutureLV regional comprehensive plan.</p>				
Key next step	As part of next steps defined in L1.1, Bureau of Planning and Zoning to meet with LVPC, Office of Sustainability, EAC and other relevant stakeholders to develop plan for implementing this strategy.				

CASE STUDY

Transit supportive design



In February 2010, the LANTA Board of Directors adopted the Moving LANTA Forward strategic plan which laid out a vision for the expansion of LANTA’s transit network throughout the Lehigh Valley. In support of the regional vision established in the Comprehensive Plan – Lehigh Valley 2030, the Moving LANTA Forward plan outlines an ambitious vision for transit in the Lehigh Valley. However, the plan also includes a clear recognition that expansion of transit in the region is not feasible without transit supportive concepts being incorporated into the land use and development decisions made by the municipalities, counties, and other regional bodies.

In response, LANTA prepared the “[Transit Supportive Land Use for the Lehigh Valley](#)” white paper, which municipal staffs and Planning Commissions can use to guide their decision making processes regarding land use and development in their communities. The document also acts as a guide to developers in the region looking to facilitate the use of public transportation to their planned developments.

L1.3 Review new developments through the lens of sustainability via a recommending body

Timeline	GHG emissions impact	Co-benefits	City lead	Partners	Key Stakeholders
<ul style="list-style-type: none"> ▶ Near 		<ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Job creation ▶ Improve air quality ▶ Reduce inequality and poverty ▶ Improve water quality ▶ Increase climate resilience ▶ Improve system sustainability 	<ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	<ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning ▶ EAC ▶ Office of Sustainability ▶ LVPC ▶ Mayor’s Office ▶ City Council ▶ Dept. of Public Works ▶ Bethlehem Climate and Environmental Justice Council 	<ul style="list-style-type: none"> ▶ All residents and businesses ▶ Construction industry

Community Priority

New developments should be reviewed through the lens of sustainability by a recommending body, such as the Environmental Advisory Council (EAC). EACs tap the professional resources Bethlehem has in its residents, providing the city a cost-effective means to provide such reviews. All plans should be reviewed by the EAC for comment prior to Planning Commission review.

Environmental justice considerations - The sustainability recommending body should include representation from EJ communities and actively engage members of these communities on EJ considerations for any developments affecting the communities. The Bethlehem Climate and Environmental Justice Council (proposed in EJ1.2) could provide representation or advise on members of the community to fill this role.

Implementation considerations - Reviews of new developments should be coordinated with other strategies in this CAP and should consider how to mitigate impacts from physical climate risks (e.g., prohibit all development in flood plains).

Key next step City Council to name EAC official sustainability recommending body for review of new developments; Dept. of Community and Economic Development to define the process for review.

CASE STUDY



Tree inventory

The Moravian College [tree inventory](#) serves as a master catalog of over 1200 trees on Moravian College's campus. Each tree has been tagged with an identification number and included on an electronic map allowing community members to view its location, age class, common name, genus, and species. Moravian College is proud of its extensive tree inventory and membership as a Tree Campus USA. Not only do the trees beautify the campus grounds (and some have historical significance), but they are also good for carbon sequestration and reducing urban heat island effects. Students, faculty and grounds crew used two small grants (\$1400 total)

to establish a native plant meadow and a rain garden on the Hurd (south) campus. These help to address stormwater runoff issues, slowing runoff and decreasing the amount of debris moving into the Monocacy Creek downslope from campus. The tree inventory and native plant gardens also provide outdoor laboratory space for environmental science courses. On the Main Street (north) campus, an asphalt parking lot was converted to a green space, which has become a popular place for students to hang out in nice weather and was a great place to set up an outdoor tent/classroom during the COVID-19 outbreak.

GOAL: Equitably preserve and expand Bethlehem's urban tree canopy

L2.1 Expand the inventory of Bethlehem's trees and ecosystem services					
Timeline ▶ Near-Medium	GHG emissions impact 	Co-benefits ▶ Improve public health and wellbeing ▶ Conserve natural resources and biodiversity	City lead ▶ Bureau of Urban Forestry	Partners ▶ Moravian College ▶ Lehigh University ▶ LVPC ▶ Housenick/Johnston estate ▶ Burnside Plantation ▶ Other large estates	Key Stakeholders ▶ All residents and businesses
Community Priority					

Building from the city's existing street tree inventory, create a comprehensive citywide tree inventory that includes trees in parks and other public spaces. Phase two of the tree inventory should also include estimates of private tree canopy coverage and could leverage data from Moravian College's and Lehigh University's tree inventories. The city of Bethlehem conducted its first inventory of street trees beginning in September 2020 and completed in February 2021. An expansion from this starting point could create a citywide tree inventory that includes details on tree health, size, and species. The inventory should also estimate carbon sequestration capacity, which would include measuring all trees (not just street trees) within Bethlehem as well as measurements of soil carbon flux. An inventory of ecosystem services can also prioritize important ecological features and identify potential corridors between them.

Environmental justice considerations - The study should assess the distribution of trees and access to green space in low-income neighborhoods and compare to similar benefits and opportunities in neighborhoods across the city. When publicizing the effort, highlight the benefits to residents such as lower energy bills, cooler homes, etc.

Implementation considerations - Understanding and expanding the diversity of the city's trees allows for the promotion of pollinators (many caterpillars require oaks, for instance). Ecosystem services from trees can also be assigned an economic value based on a methodology found in the LVPC [Return on Environment](#) study that quantifies services like water purification and avoided health care costs for air quality improvement. This value can be incorporated into budgetary analyses, such as described in strategy EJ2.3. Conducting an inventory of trees on private property presents challenges due to required permissions and liability. Three possible solutions are:

1. Utilize volunteers in the community to request permission from property owners and, if granted, document the tree location and other fields on the inventory software using a portable tablet. This would require many volunteers and training for those volunteers.
2. A lidar survey of Bethlehem, which would be expensive. A helicopter's Lidar system would be able to calculate the number of trees based off flying over tree canopies.
3. Use satellite imagery to estimate the canopy coverage percentage of private property trees and as a whole for Bethlehem.

Key next step
Bureau of Urban Forestry to review results from the Phase 1 tree inventory update completed in February 2021.


L2.2 Develop an Urban Forest Master Plan

<p>Timeline</p> <ul style="list-style-type: none"> ▶ Near <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Conserve natural resources and biodiversity ▶ Increase climate resilience 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Urban Forestry 	<p>Partners</p> <ul style="list-style-type: none"> ▶ EAC ▶ Office of Sustainability ▶ City Council 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses
--	--	--	--	--	---

Work with the City Forester, the Environmental Advisory Council (EAC), and City Council to gather public input and develop a master plan to detail the programs, ordinances, and policies necessary to expand Bethlehem's urban tree canopy sustainably and equitably.

Environmental justice considerations - The plan should prioritize tree planting in low-income areas that lack trees. Increased tree canopy will reduce the urban heat island effect, improve neighborhood quality of life, and increase property values.

Implementation considerations - Implementation should consider asthma and allergy impacts of recommended trees. Consider the value of native tree species vs. species that may be better suited to urban environments and/or more able to adapt to future climate conditions.

 **Key next step**
City Forester to meet with EAC to discuss possible funding sources and objectives for Urban Forest Master Plan.


L2.3 Prioritize green space development in underserved areas

<p>Timeline</p> <ul style="list-style-type: none"> ▶ Near-Medium <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Reduce inequality and poverty ▶ Improve air quality ▶ Improve public health and wellbeing ▶ Conserve natural resources and biodiversity 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning ▶ Dept. of Public Works ▶ EAC ▶ City Council 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Frontline communities
---	--	--	---	--	--

Using the best available data, including Bethlehem's tree inventory, identify areas of the city—such as the South Side and the [Northside 2027](#) area—that have a disproportionate lack of green space and parks. Prioritize these areas for new green space and green infrastructure development.

Environmental justice considerations - The city should seek input from underserved communities on what they want from parks and green space. Let community leaders take the lead in determining creation and infrastructure development in green space. ["The Nature Gap"](#) illustrates disparities in access to nature for minorities and the poor. The Bethlehem Environmental Justice Council mentioned in strategy EJI.2 can help to gather input from frontline communities.

Implementation considerations - New green spaces should be connected to existing green spaces throughout the city via pedestrian and bike paths. Green spaces (e.g., pocket parks, urban farms, community gardens, and backyard gardens) should utilize native species to help with carbon sequestration, decrease erosion, increase topsoil, and provide habitat for pollinators. Use green spaces as models to educate the public about alternatives for yards.

 **Key next step**
Dept. of Public Works to launch Northside 2027 Project Phase 1 in 2020 and be completed by the end of 2020; Dept. of Community and Economic Development to meet with the Bethlehem Environmental Justice Council to evaluate additional areas lacking access to green space.

L2.4 Expand and create new greenways

Timeline

- ▶ Long

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Conserve natural resources and biodiversity
- ▶ Increase climate resilience

City lead

- ▶ Dept. of Community and Economic Development

Partners

- ▶ Dept. of Public Works
- ▶ Office of Sustainability
- ▶ Lehigh and Northampton counties
- ▶ LPVC
- ▶ Lehigh Valley Greenways Conservation Landscape
- ▶ Bethlehem Historic Society
- ▶ Large estates

Key Stakeholders

- ▶ All residents and businesses

Building off the success of the South Bethlehem Greenway, develop additional greenways in Bethlehem.

Environmental justice considerations - As new greenways are planned, ensure that low-income communities will have access to them. Develop infrastructure on existing greenways that will encourage use and enjoyment by the community it runs through, such as water fountains.

Implementation considerations - Connected greenways make ideal places for walking/biking trails to promote non-fossil fuel modes of transportation and exercise. Greenways can create a sense of pride in the city. New greenways should create connections with other Bethlehem and Lehigh Valley trails creating seamless networks of travel for pedestrians and bikers. [Lehigh Valley Greenways Conservation Landscape](#) supports partnerships and grants to expand greenways across the Lehigh Valley. The South Bethlehem Greenway Master Plan, adopted in 2005, has served as the city's guideline for Greenway development, including during the development of the successful South Bethlehem Greenway. The plan can continue to serve as a resource and model for future greenway development efforts. The city can also learn lessons from the Southside Greenway. Further greenway opportunities are identified in the [Lehigh Valley Greenways Plan](#) and the Lehigh and Northampton county [Livable Landscapes](#) plans developed by LVPC. Leverage these plans to consider making/expanding the following greenways:

Connect existing Greenway to Saucon Rail Trail and to Allentown (via Lehigh Mountain);

Consider new trail between Monocacy and Allentown (using old rail route); and

From the Housenick Estate to Sand Island there is a wonderful opportunity for a greenway and migrant fallout area (good for migrating birds and for birdwatching).



Key next step

Dept. of Community and Economic Development to conduct a review of existing greenway plans and request public and stakeholder input to prioritize development moving forward.

L2.5 Update tree ordinances to protect tree root systems and large legacy trees

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Conserve natural resources and biodiversity
- ▶ Increase climate resilience

City lead

- ▶ Bureau of Urban Forestry

Partners

- ▶ EAC
- ▶ City Council
- ▶ Bureau of Planning and Zoning
- ▶ Office of Sustainability

Key Stakeholders

- ▶ All residents and businesses

Community Priority



Update tree ordinances, including current tree preservation requirements to protect tree root systems and large legacy trees, including during construction, as well as tree replacement requirements for trees that cannot be preserved. Ordinances pertaining to tree replacement requirements for new/re-development should consider number, size, and native species. Revitalize and encourage the street tree replacement process.

Environmental justice considerations - In addition to permit cost, current street tree ordinances require that replacement trees be of a certain size, which is expensive to purchase and plant. The city should provide low-income residents subsidy, labor, expertise, or other resources to cover the cost-of-burden of preservation placed on homeowners who cannot afford to provide proper care of trees. The ordinances could also be adjusted to allow for younger, smaller trees in some circumstances. Additionally, a Tree Tenders group could organize neighborhood plantings, and the city could start a fund for individuals and companies to make donations.

Implementation considerations - See existing [city Zoning Ordinances & Shade Tree Ordinance \(910\)](#) regarding tree protection, spacing, replacement, and landscaping requirements. The city's [subdivision and land development ordinances \(SALDO\)](#) address landscaping and trees on private property. The preparation of urban soils for tree planting will improve the health of urban soils and therefore improve the entire urban environment. Implementation should consider asthma and allergy impacts of recommended trees. Consider the value of native tree species vs. species that may be better suited to urban environments and/or more able to adapt to future climate conditions. The greatest potential for urban forest occurs on residential land, but it is also the area of highest risk of removal of trees. The city should engage homeowners about the effects of their individual decisions on the urban ecosystem. Homeowners may not be aware that they are responsible for maintaining and replacing street trees, or that they need a permit to replace. A tree removal permit gives a homeowner six months to remove and replace a tree. Permit inspections are done every year, and replacement reminders are mailed to those who have failed to replace. Receiving cooperation to replace can be difficult.



Key next step

City Forester to meet with EAC and assess how the current tree ordinances are working and coordinate updates with strategy L3.1.

L2.6 Partner with community organizations to promote tree planting efforts

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Conserve natural resources and biodiversity
- ▶ Increase climate resilience

City lead

- ▶ Bureau of Urban Forestry

Partners

- ▶ Bethlehem Backyards for Wildlife
- ▶ EAC
- ▶ Neighborhood groups

Key Stakeholders

- ▶ All residents and businesses

Community Priority



Partner with local organizations and tree tender groups to provide technical assistance and volunteer labor to plant trees on public property and encourage private property owners to plant trees on their property.

Environmental justice considerations - All new or modified programs should include multilingual education. The city should consult with local residents, particularly in frontline communities, to prioritize areas for tree-planting efforts. The Bethlehem Climate and Environmental Justice Council (proposed in EJ1.2) could help to coordinate community engagement for ideas. The initiative could also plant trees on private property with consent of the owners, without charge if appropriate.

Implementation considerations - Implementation should consider asthma and allergy impacts of recommended trees. Consider the value of native tree species vs. species that may be better suited to urban environments and/or more able to adapt to future climate conditions.



Key next step

City Forester to convene local partners such as Bethlehem Backyards for Wildlife to establish a "Tree Tenders" group to coordinate among partners and manage tree care.

L2.7 Engage and incentivize residents and businesses about the options and benefits of conserving their own land

Timeline ▶ Near-Medium	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Conserve natural resources and biodiversity ▶ Increase climate resilience 	City lead <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	Partners <ul style="list-style-type: none"> ▶ Bureau of Urban Forestry ▶ Office of Sustainability ▶ Bethlehem Backyards for Wildlife ▶ EAC 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
----------------------------------	---------------------------------	---	--	---	--

Develop an education and engagement program to increase residential and commercial conservation, helping to preserve the city's carbon stocks.

Environmental justice considerations - All new or modified programs should include multilingual education. Low-income residents often do not have the ability to own their own land/home, and land conservation is often not a forethought. Community gardens and a sense of ownership of such spaces could be a substitute (see [Michigan example](#)). As such, this strategy should be coordinated with community garden initiatives under FW5.2 and L5.3.

Implementation considerations - Increasing property taxes can be a barrier, but in Pennsylvania, conservation easements do qualify for a lower tax rate. Residents could be further encouraged with tax incentives targeting preservation of the largest trees while offsetting trimming costs for owners. The city could incentivize conservation as a credit for the new Stormwater User Fee created under Article 929.

Key next step
 Dept. of Community and Economic Development and City Forester to meet with Bethlehem Backyards for Wildlife, EAC, and other partners to outline engagement campaign.

L2.8 Preserve land with valuable natural resources in perpetuity using 3rd party conservation easements

Timeline ▶ Long	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Conserve natural resources and biodiversity ▶ Increase climate resilience 	City lead <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning 	Partners <ul style="list-style-type: none"> ▶ Northampton County Open Space ▶ Wildlands Conservancy ▶ Heritage Conservancy ▶ WeConservePA ▶ Nature Conservancy 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
---------------------------	---------------------------------	--	--	--	--

A conservation easement is a voluntary, legal agreement that permanently limits uses of the land in order to protect its conservation values. In the case of 3rd party conservation easements, a conservation, government agency or other third party, holds the easement to ensure the terms of the easement are upheld over time. These structures can protect and conserve land, often at a lower cost to land trusts and public agencies.

Environmental justice considerations - Sometimes the restrictions associated with easements can be a barrier for people, particularly low-income residents.

Implementation considerations - The Pennsylvania General Assembly, through the Conservation and Preservation Easements Act, Act 29 of 2001, and subsequent amendments, recognized the importance and significant public and economic benefit of conservation easements. WeConservePA provides a [guide to PA Act 29 of 2001](#). As an example, the Bethlehem Authority, owner and manager of the city's 22,000-acre watershed in the southern Pocono Mountains section of Carbon and Monroe counties, entered a long-term conservation easement with the Nature Conservancy in 2011.

Key next step
 Bureau of Planning and Zoning to meet with Northampton County Open Space, Wildlands Conservancy, Heritage Conservancy, and other partners to identify opportunities.

L2.9 Prior to sales of existing green spaces, open spaces, and urban forest owned by the City of Bethlehem, evaluate and align impacts of sale with the goals of Bethlehem's CAP

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Conserve natural resources and biodiversity

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ Office of Sustainability
- ▶ Dept. of Public Works
- ▶ Bureau of Urban Forestry
- ▶ City Council
- ▶ EAC
- ▶ Bethlehem Backyards for Wildlife
- ▶ Alliance for Sustainable Communities
- ▶ Lehigh Valley Audubon Society
- ▶ General public for review and comment of plans

Key Stakeholders

- ▶ All residents and businesses

Review sale of any city-owned property, particularly green and open space, for alignment with CAP goals. Maintaining city control of green spaces, including public parks, woodlands, and meadows, will allow the city to ensure forest management best practices are followed and to continue to expand the urban tree canopy. Reducing sales of city open space property that could cost-effectively be converted to green space also helps to maintain the city's urban tree canopy potential.

Environmental justice considerations - Open spaces in socially vulnerable areas on the south side should be evaluated for conversion to green space prior to sale. The city could go further by seeking to buy back privately-owned land to build more green spaces, particularly where this can provide new green space to low-income communities.

Implementation considerations - This action requires a rethinking of development strategy, from the post-Bethlehem Steel 'all development is good' strategy to a focus on sustainable and equitable development and retaining or creating green space instead.



Key next step

Bureau of Planning and Zoning to meet with EAC and other partners to determine the procedure for implementation, including a timeline for notification, review and submission of comments by stakeholders, parameters for consideration (e.g., if funds raised from sale would be better used in areas with less green space, current cost of maintenance), and how input is presented to the public and decision-makers.

GOAL: Improve the quality of urban ecosystems to promote biodiversity and carbon sequestration

L3.1 Update tree ordinances and other applicable regulations/zoning ordinances to prioritize and preserve native species of plants and trees, as well as climate-resistant species

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Conserve natural resources and biodiversity 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Urban Forestry 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Bureau of Planning and Zoning ▶ City Council ▶ Bethlehem Backyards for Wildlife ▶ EAC 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Property developers
--	--	---	--	---	--

Update current development regulations to recommend or require appropriate native trees and plants for new- and re-development, including street trees. Require the use of native plants in landscaping at city-owned properties. Additionally, assess recommendations for climate resistance and incorporate and/or prioritize climate-resistant species of plants. Ensure that landscaping requirements articulated in the zoning code include the preservation of the maximum possible number of existing trees, the use of native plantings and the preservation of natural areas whenever possible. Create local ordinances to prohibit the sale of invasive plants at large box stores located within the city limits.

Environmental justice considerations - Ensure that these policies do not disproportionately increase expenses or violations in low income and minority communities. In addition to permit cost, current street tree ordinances require that replacement trees be of a certain size, which is expensive to purchase and plant. The city should provide low-income residents subsidy, labor, expertise, or other resources to cover cost of burden of preservation placed on homeowners who cannot afford to provide proper care of trees.

Implementation considerations - Incentivize planting native species in residential gardens. Minneapolis' [Lawns to Legumes](#) program has had success getting residents to plant bee-attractant gardens using cost-share funding, workshops, and other resources. Updates to lists of acceptable plants should include a review of the impacts projected from climate change (increased temperatures and precipitation) on plant viability. Updated tree and plant lists should also consider the effects of species on allergic asthma, particularly given that other climate-related impacts may worsen asthma symptoms. All ordinance updates should be accompanied with homeowner engagement and education regarding their responsibilities for tree maintenance and permits.

Homeowners may not be aware that they are responsible for maintaining and replacing street trees, or that they need a permit to replace. A tree removal permit gives a homeowner 6 months to remove and replace a tree. Permit inspections are done every year, and replacement reminders are mailed to those who have failed to replace. Receiving cooperation to replace can be difficult. An initial step could be assessing how the current street tree ordinances are working.

 **Key next step**
City Forester to coordinate recommendations for tree ordinance update with strategy L2.5.

L3.2 Establish and effectively manage native-habitat corridors and areas

Timeline

- ▶ Long

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Conserve natural resources and biodiversity
- ▶ Increase climate resilience

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ Dept. of Public Works
- ▶ Office of Sustainability
- ▶ Lehigh Gap Nature Center
- ▶ Nurture Nature Center
- ▶ BASD
- ▶ Local colleges and universities

Key Stakeholders

- ▶ All residents and businesses

Manage publicly-owned natural areas to enhance and maintain diverse native communities. Create and manage native-habitat corridors along trails and utility easement areas to restore and maintain landscape connectivity. Expand no-mow zone/low maintenance using aesthetically pleasing techniques in areas where public use is low. In areas where corridors are not feasible, create smaller spaces of wildlife habitat, which require little or no maintenance, in areas that the city mows. These areas and corridors should be managed without synthetic fertilizers and pesticides.

Environmental justice considerations - Ensure that these policies do not disproportionately increase expenses or violations in low income and minority communities.

In addition to permit cost, current street tree ordinances require that replacement trees be of a certain size, which is expensive to purchase and plant. The city should provide low-income residents subsidy, labor, expertise, or other resources to cover cost-of-burden of preservation placed on homeowners who cannot afford to provide proper care of trees.

Implementation considerations - Coordinate implementation with the development of greenways in strategy L2.4. There will be a need to engage businesses, churches, campuses, and homeowners to have native landscaping, which can produce multiple co-benefits (e.g., native plant areas help support pollinators, which support farms and agriculture).

[Pennsylvania Natural Heritage Program's](#) (PNHP) Pennsylvania Natural Diversity Inventory Environmental Review Tool ("PNDI Tool") protects threatened and endangered species, and special concern species where applicable, during the administration of permit programs. PNDI sites partially within the city, including Lehigh Mountain, Saucon Creek Wetlands, and Lehigh River—Laubach Island, may require unique management techniques as described by the PNHP. There may be opportunities for student projects in partnership with BASD and local colleges and universities.



Key next step

Bureau of Planning and Zoning to leverage Lehigh Gap Nature Center and the Nurture Nature Center's existing program and guide for native plant habitats.

L3.3 Improve urban soil conditions and carbon sequestration using compost and biomass material

Timeline

- ▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Conserve natural resources and biodiversity
- ▶ Increase climate resilience

City lead

- ▶ Office of Sustainability

Partners

- ▶ Bureau of Urban Forest
- ▶ Rodale Institute
- ▶ Local urban farms and gardens
- ▶ City Yard Waste Facility
- ▶ EAC

Key Stakeholders

- ▶ All residents and businesses

Restore soil and improve carbon sequestration by increasing organic matter, including local composts and properly treated biosolids, and reducing compaction. Encourage sound management practice to limit soil disturbance. Improvement of urban soils is crucial to improving overall ecosystem function, and soil biodiversity has a positive impact on soil carbon sequestration.

Environmental justice considerations - Improvement of soil conditions for carbon sequestration presents opportunities for broader soil remediation to remove toxins and hazards in environmental justice areas. This also provides a pathway to encourage gardening in lots and backyards that are currently unsuitable. In partnership with the city Yard Waste Facility, the city could deliver free compost and mulch for gardens in frontline communities, which would remove the barrier of car ownership for picking up from the facility.

Implementation considerations - If a curbside composting program were to be established, the compost could go back into community gardens and public green spaces. The Rodale Institute paper, "[Regenerative Organic Agriculture and the Soil Carbon Solution](#)," provides details on regenerative agriculture's capacity to remove carbon dioxide from the atmosphere. The US FDA states, "Properly treated manure or biosolids can be an effective and safe fertilizer," and provides a [Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables](#).



Key next step

Office of Sustainability to coordinate with Recycling Bureau, City Forester, and other relevant stakeholders on strategy FW2.1 to develop a city curbside composting program, and map out a plan for collection and creation of compost that could then be utilized as nutrient inputs in community gardens and open spaces.

L3.4 Species diversification/invasive species removal

Timeline
▶ Long



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Conserve natural resources and biodiversity

City lead

- ▶ Bureau of Urban Forestry

Partners

- ▶ PA Department of Agriculture
- ▶ Monocacy Creek Watershed Association
- ▶ PA Department of Conservation & Natural Resources

Key Stakeholders

- ▶ All residents and businesses

Community Priority

Work with the PA Department of Agriculture to halt and reverse the spread of the spotted lanternfly and other invasive species to minimize loss of trees due to pests and disease. Utilize education campaigns to encourage effective public participation and collaboration with efforts.

Environmental justice considerations - All new or modified programs should include multilingual education.

Implementation considerations - Invasive species, such as bamboo, along the Monocacy are a serious challenge. Engage college and high school students for removal projects. Partner with garden stores in Bethlehem to discourage them from selling invasive species (e.g., Butterfly Bush, Burning Bush). The [Penn State Extension website](#) offers information about the spotted lanternfly, including remedies and other control methods.

Key next step
Continue to partner with PA Department of Agriculture to treat Ailanthus (Tree of Heaven) on City of Bethlehem properties to better help control the spotted lanternfly; relay remedies and control methods to residents and businesses via city communications.

L3.5 Reduce pesticide (insecticides and herbicides) and chemical fertilizer use

Timeline
▶ Medium



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Cost savings
- ▶ Conserve natural resources and biodiversity
- ▶ Improve water quality
- ▶ Improve system sustainability

City lead

- ▶ City Council

Partners

- ▶ Dept. of Public Works
- ▶ PA Department of Agriculture
- ▶ Bureau of Urban Forestry
- ▶ Office of Sustainability
- ▶ EAC

Key Stakeholders

- ▶ All residents and businesses
- ▶ Local retailers of landscaping supplies
- ▶ Landscaping companies

Community Priority

Reduce the use of pesticides and chemicals that damage native ecosystems by enhancing city policy beyond the current Pennsylvania Pesticide Control Act and by offering community education.

Environmental justice considerations - None noted.

Implementation considerations - Develop a more stringent city policy for the use of chemical pesticides and fertilizers based on the Pennsylvania Pesticide Control Act. Bethlehem Article 910.09 (Spraying trees) currently states, "All spraying of trees shall be done with approved materials as regulated under current Pennsylvania Pesticide Control Act." A city-licensed tree contractor with a permit is required to apply pesticide or fertilizer on a tree growing on public property.

Key next step
City Council to solicit public input on updating standards for pesticide and fertilizer use.


L3.6 Develop a citywide carbon credits program to quantify and monetize sequestered carbon in urban trees and other natural carbon sinks

<p>Timeline ▶ Medium</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Increased climate resilience ▶ Improve system sustainability 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Office of Sustainability 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Dept. of Public Works ▶ Bureau of Urban Forestry ▶ Bethlehem Authority ▶ Rodale Institute ▶ City Forest Credits ▶ Urban Offsets ▶ EAC 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses
--	--	---	--	--	---

Undertake a study to evaluate the potential to set up a carbon credits program that quantifies and monetizes carbon sequestered through urban trees and carbon sinks. Urban centers are diverse areas with significant potential to increase carbon sequestration and storage, but improved data on carbon sequestration capacity is needed. If successful, these credits may be used as a potential way to fund additional urban forest initiatives, or the credits may be retired by the city toward a carbon-neutral goal. Carbon credit programs require measures to maintain, preserve and protect the urban canopy and thus provide an additional way to support this resource.

Environmental justice considerations - If trees on privately owned land are included in the program, this would disproportionately benefit property owners. The city should invest a percentage of revenue generated from the program into planting new trees and supporting community gardens in low-income communities.

Implementation considerations - Consult with the Bethlehem Authority at the appropriate time to discuss the process involved in creating a carbon credit program. A properly managed organic urban farm could be set up as an offset. Rodale Institute may have experience with this. The City Forest Credits program is being piloted by other cities. Urban Offsets is a company that focuses on urban tree planting for offsets.

 **Key next step**
Office of Sustainability to work with the City Forester to evaluate the city's recent public tree inventory and assess the potential of a carbon credits program.


L3.7 Create education materials to help residents maintain their landscaping and avoid synthetic fertilizers and pesticides to maximize carbon sequestration and healthy soil

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Workforce development ▶ Conserve natural resources and biodiversity ▶ Improve water quality ▶ Reduce resource consumption ▶ Increase climate resilience 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Bureau of Urban Forestry 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Rodale Institute 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Landscaping companies
---	--	--	--	---	--

Most landscaping in the city is residential, which increases the risk of tree removal. Education for residents can help to maintain Bethlehem's tree canopy.

Environmental justice considerations - All education materials should be multilingual. As this program would inevitably be targeted to wealthier people who have large lawns and more trees, it should incorporate a donation program or tree fund so low-income homeowners can plant trees on their property. The city could engage sustainability-related classes at NCC or other local colleges to help draft and develop materials for frontline communities.

Implementation considerations - Work with native plant companies to promote native vegetation (though this does not necessarily imply additional carbon sequestration). Encourage use of electric and manual landscaping equipment to reduce emissions and local air pollution.

 **Key next step**
Bureau of Urban Forestry to convene relevant stakeholders to refine the objective of education materials, determining if the goal is to promote alternatives to lawns, use of natural fertilizers, or maximizing carbon sequestration.

GOAL: Encourage the conversion of underutilized space to green space

L4.1 Promote green roofs

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Increase climate resilience
- ▶ Reduce resource consumption

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ Office of Sustainability
- ▶ Dept. of Public Works
- ▶ EAC

Key Stakeholders

- ▶ All residents and businesses
- ▶ Construction industry

Review building and zoning codes to encourage and expand the use of 'green roofs', which can reduce the urban heat island effect and reduce local building energy requirements.

Environmental justice considerations - If any code changes are made, the city should consider how this could increase the cost of housing. Ensure that other policies are in place to develop and maintain adequate supply of low- and middle-income housing in the city.

Implementation considerations - All new or modified programs should include multilingual education. The city should consider green roofs as a credit for the new Stormwater User Fee created under Article 929.



Key next step

Dept. of Public Works to review city properties to determine if green roofs can be installed on any city-owned facilities; Bureau of Planning and Zoning to review existing building and zoning codes.

L4.2 Recover vacant spaces and brownfields for vegetation or urban agriculture

Timeline

- ▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Job creation
- ▶ Reduce inequality and poverty
- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Increase climate resilience

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ Health Bureau
- ▶ Dept. of Public Works
- ▶ Bethlehem Environmental Justice Council
- ▶ Local organizations representing frontline communities
- ▶ EAC
- ▶ Northampton County
- ▶ Borough of Hellertown
- ▶ Lower Saucon Township

Key Stakeholders

- ▶ All residents and businesses
- ▶ Frontline communities

Vacant lots have a limited capacity for carbon sequestration, so urban agriculture may be an appropriate land use for these spaces. Develop a plan to encourage the conversion of these spaces for urban agriculture or other green space. The plan should address using compost and urban yard waste to improve soil quality and increase crop yields, which will also enhance carbon sequestration. The plan should require dense buffers along areas where residentially zoned properties meet commercially or industrial zoned properties— even if it is a neighboring municipality.

Environmental justice considerations - The city should implement this strategy via community-led processes through trusted local partners to avoid gentrification. Consider the legacy of soil pollution in the siting of urban agriculture. Determine if low-income communities would most benefit from the use of this space for non-development purposes in their communities. Also, the city should prioritize building these spaces in food deserts.

Implementation considerations - As there are inevitably concerns about using brownfields for growing food; EPA provides a [set of resources](#). There may also be possibilities for phytoremediation projects that could be run by local colleges. Ownerships and management of these lots can be a challenge. There are several options, but the long-term management is a big question, especially if the city is to take it on. The Green Building Alliance's [Brownfield Remediation website](#) provides several case studies. Consider modeling the [Brownfield Incentive program in Ypsilanti, MI](#).




The construction of the warehouses on the brownfields east of Hellertown removed the existing tree buffer and part of the Saucon corridor. Because the residences across the street are now so heavily impacted, the residents are lobbying Lower Saucon Township to rezone to industrial. This is an important green corridor that might be lost. The city should consider naturalizing areas in off-ramp land on I-78 and 378.






Key next step

Bureau of Planning and Zoning to meet with Bethlehem Environmental Justice Council (mentioned in strategy EJ1.2) to discuss possible vacant lots for conversions.

GOAL: Increase equity and accessibility in Bethlehem's green space

L5.1 Develop a plan to improve access to diverse recreational opportunities for all residents					
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Reduce inequality and poverty ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Increase climate resilience 	City lead <ul style="list-style-type: none"> ▶ Department of Recreation 	Partners <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning ▶ Bethlehem Environmental Justice Council ▶ Local organizations representing frontline communities ▶ CAT 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Frontline communities
Community Priority 	Develop a plan to improve access to green spaces and to diverse recreational opportunities for all residents, especially for at-risk and low-income communities. Include an analysis of potential improvements based on “enhanced interconnection” of sidewalks to each other and to trails, parks, and green spaces plus interconnection of trails to on-road biking infrastructure, as noted in other strategies, and prioritize these improvements.				
Environmental justice considerations - Ensure active community outreach and engagement, particularly in EJ communities, on development of new green spaces.					
Implementation considerations - With greenways, there could be bike paths integrated into the plans, which would mitigate GHG emissions and result in health co-benefits. This plan should be coordinated with the transportation strategies in this CAP to build and incentivize using public and non-motorized transit options.					
 Key next step	Department of Recreation to meet with Bethlehem Environmental Justice Council (mentioned in strategy EJ1.2) and CAT to define plan stakeholders..				

L5.2 Conduct analysis of urban heat island effect					
Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Reduce inequality and poverty ▶ Improve public health and wellbeing ▶ Increase climate resilience ▶ Job creation 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ Bureau of Planning and Zoning ▶ Bethlehem Environmental Justice Council ▶ LVPC ▶ Dept. of Public Works 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Frontline communities
Community Priority 	Conduct an analysis of vulnerable neighborhoods most impacted by the heat island effect so that these areas can be prioritized for tree planting and green space expansion.				
Environmental justice considerations - Initial data analysis indicates that the urban heat island in Bethlehem overlaps with socially vulnerable and low-income areas. The urban heat island effect can be reduced with low-cost solutions such as painting roofs white and by expanding urban vegetation. Both of these solutions present opportunities to create work opportunities in local communities.					
Implementation considerations - The city should consider creating programs that help low-income communities cope with higher temperatures, such as equipment libraries for things like air conditioners that can be checked out at the library. The city should consider ordinance updates to require heat island mitigation measures on larger commercial buildings, such as painting roofs white or installing green roofs. The Trust for Public Land's urban heat island severity map provides data at 30-meter resolution.					
 Key next step	Office of Sustainability to review existing geospatial data on the urban heat island and determine if a new study is warranted; Office of Sustainability to meet with Bethlehem Environmental Justice Council (mentioned in strategy EJ1.2) to discuss local impacts of heat island effect.				

L5.3 Increase opportunities for voluntary community maintenance of land

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Reduce inequality and poverty
- ▶ Workforce development
- ▶ Cost savings

City lead

- ▶ Department of Recreation

Partners

- ▶ Dept. of Public Works
- ▶ Bethlehem Environmental Justice Council
- ▶ Volunteer Center of the Lehigh Valley

Key Stakeholders

- ▶ All residents and businesses
- ▶ Frontline communities

Community Priority

Create a program for voluntary community maintenance of parks, green space, and urban/community gardens to foster local stewardship.

Environmental justice considerations - If this program is expanded to routine care/maintenance of community gardens, this could increase food access. For example, the city could consider creating space for the sizable Chinese population (who come to the city during the day and awaits bus departures in the evening) to grow traditional foods.

Implementation considerations - This would have to include training for the volunteers. [Rose Garden park volunteers and grants](#) are an example of community support that provides a model that can be replicated across the city.

Key next step

Department of Recreation to review “Adopt a Park” program for opportunities to expand; Department of Recreation to meet with Environmental Justice Council (mentioned in strategy EJ1.2) to discuss promoting volunteer opportunities in frontline communities.

L5.4 Support sustainability in park design, development, maintenance, and management

Timeline

- ▶ Medium

GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve air quality
- ▶ Workforce development

City lead

- ▶ Department of Recreation

Partners

- ▶ Office of Sustainability
- ▶ Dept. of Public Works
- ▶ Bethlehem Environmental Justice Council
- ▶ EAC

Key Stakeholders

- ▶ All residents and businesses

Community Priority

Update city park operations and maintenance procedures to support sustainability in park design, development, maintenance, and management.




Environmental justice considerations - Assess the impact of sustainable best management practices on the use of parks by low-income communities and ensure that new practices do not diminish resources (e.g., pools, BBQ sites, fishing opportunities, etc.). See [Julian Agyeman’s work](#) on sustainable design for all. Conventional urban planning tends to work against people of color and the poor.

Implementation considerations - City parks maintenance staff will need to be trained on the updated sustainable practices to ensure successful implementation. Sustainable best management practices could include using integrated pest management and organic pesticides and fertilizers, composting organic waste collected in the park premises, and transitioning from gasoline to electric leaf blowers and lawnmowers. Rakes and non-motorized tools should be used where effective.

Key next step

Department of Recreation to update city park operations and maintenance procedures to incorporate sustainability best management practices (BMPs).

GOAL: Improve stormwater management through green infrastructure

L6.1 Develop a green infrastructure plan to manage stormwater, filter pollutants, and improve public health					
Timeline ▶ Medium	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality ▶ Conserve natural resources and biodiversity ▶ Increase climate resilience ▶ Job creation ▶ Improve water quality ▶ Reduce resource consumption 	City lead <ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	Partners <ul style="list-style-type: none"> ▶ Dept. of Public Works ▶ Bureau of Planning and Zoning ▶ LVPC ▶ Office of Sustainability ▶ EAC ▶ Monocacy Creek Watershed Association ▶ Watershed Coalition of the Lehigh Valley 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
Community Priority 	<p>Building from the LVPC's Green Infrastructure Guidelines, the Monocacy Creek Act 167 stormwater management plan, and the FutureLV regional comprehensive plan, develop a citywide plan to develop and preserve green infrastructure to increase water retention, improve water quality, and decrease flooding events.</p> <p>Environmental justice considerations - Ensure equitable distribution of green infrastructure assets and local community input during planning and prioritize EJ areas for first implementation. If EJ communities are found to face a disproportionate burden from the city's new Stormwater User Fee, the city should use this strategy to develop green infrastructure in these communities to reduce the fee burden via credits.</p> <p>Implementation considerations - This strategy will help the city fulfill MS4 (Municipal Separate Storm Sewer System) requirements. As suggested in other CAP strategies, this green infrastructure plan could prohibit development in any flood plain (e.g., based on '500-year' boundaries). The city could go further by seeking to buy back privately-owned land on the floodplain. This strategy should be implemented in coordination with the city's 2020 Stormwater Ordinance (Article 929), which creates a "Stormwater User Fee" that allocates stormwater management program costs to property owners based on impervious area. The ordinance creates a Stormwater Management Fund to cover the cost of the city's stormwater management program. It also includes an option to reduce the Stormwater User Fee via credits gained from stormwater management practices that reduce the city's management costs. This strategy (L6.1) can support the Stormwater Management Fund as well as the Stormwater Management Program Credit Policy Manual and vice versa. Properties contributing the most to the urban heat island effect will be paying the most for the Stormwater User Fee, but they will also have the most to gain from the credit program by retrofitting property with green infrastructure. This infrastructure can help with many of the goals of this chapter and the CAP overall. Capturing stormwater runoff in rain gardens, basins, and tree trenches will reduce the amount of flooding, decrease the pressure on the city's aging infrastructure, and add valuable green space in areas currently lacking in it. The Philadelphia Stormwater Management Guidance Manual has been proven effective and has served as a basis of stormwater management implementation in several other municipalities in Pennsylvania.</p>				
 Key next step	Dept. of Community and Economic Development to review the LVPC's Green Infrastructure Guidelines, the Monocacy Creek Act 167 stormwater management plan, and the FutureLV regional comprehensive plan to identify green infrastructure opportunities to implement first.				

L6.2 Restore the riparian corridor along the south side of the Lehigh River.

Timeline

- ▶ Long

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve water quality
- ▶ Conserve natural resources and biodiversity
- ▶ Increase climate resilience
- ▶ Improve public health & well-being

City lead

- ▶ Dept. of Community and Economic Development

Partners

- ▶ Dept. of Public Works
- ▶ Watershed Coalition of the Lehigh Valley
- ▶ Wildlands Conservancy
- ▶ US Army Corps of Engineers
- ▶ PA Department of Environmental Protection
- ▶ Lehigh University

Key Stakeholders

- ▶ All residents and businesses
- ▶ Wind Creek Bethlehem
- ▶ ArtsQuest
- ▶ City of Bethlehem
- ▶ Norfolk Southern

Follow the model of the Monocacy Creek Watershed Assessment and Conservation Management Plan to develop a similar assessment and plan for projects to restore river and wildlife habitat along the south side of the Lehigh River.

Environmental justice considerations - Restoring the corridor along the south side of the Lehigh River would enhance environmental justice by providing a long, linear park Southside residents could use.

Implementation considerations - Funding could be provided by [TreeVitalize](#) or [Keystone 10 Million Trees](#) program. Implementation will also have to consider Norfolk Southern right-of-way along the south bank of the river. Any work involving the levee must involve the US Army Corp of Engineers. The implementation team will need to determine what should be done with steep, rocky banks to support tree growth/naturalization. A live stake planting, if there is enough soil between the rip rap in place, could be an economical way to address the naturalization of this section of the riverbank. This initiative could be a research project for a Lehigh University student.



Key next step

Dept. of Community and Economic Development to develop a riparian restoration plan and conduct a small test planting to see if live stake planting would be successful; work with partners above to develop and monitor a test site.

L6.3 Create and expand permeable parking lots and driveways

Timeline

- ▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Increase climate resilience
- ▶ Improve water quality

City lead

- ▶ Bureau of Planning and Zoning

Partners

- ▶ Dept. of Public Works
- ▶ Office of Sustainability
- ▶ City Council

Key Stakeholders

- ▶ All residents and businesses
- ▶ Construction industry

Expand the use of permeable pavement and use more recycled materials with concrete to control stormwater runoff.

Environmental justice considerations - Cost is a barrier to permeable pavement installation. The city could provide financial support and incentives for low-income communities to utilize permeable pavement in driveway replacement where applicable.

Implementation considerations - As this may require enacting standards higher than the state's, implementation may involve the passing a Right to a Healthy Climate ordinance or Home Rule Charter, as described in strategy O3.6 in the Municipal Operations section. As described in strategy T2.2, reducing parking (and thus reliance on personal vehicle travel) can significantly reduce GHG emissions; in the implementation of this strategy, the city should consider this and strike an appropriate balance with adaptation and stormwater runoff goals. Similar to strategy L6.1, this strategy should be implemented in coordination with the city's 2020 Stormwater Ordinance (Article 929), including the Stormwater User Fee and credit system. Updates to parking lot pavement can be paired with installation of solar carports to provide shade, energy, and cost savings.



Key next step

Bureau of Planning and Zoning to review existing zoning regulations and develop a recommendation for City Council to update standards to increase the use of permeable pavement and recycled materials.

Remaining gaps

This chapter's strategies address the main sources of emissions and reduction opportunities from land use and green space. However, land-use changes are not currently part of the city's GHG inventory. Bethlehem's inventory follows the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), which includes land-use changes in the Agriculture, Forestry, and Other Land Use (AFOLU) sector. Bethlehem's inventory currently complies with the GPC's BASIC reporting level, and AFOLU is included in the more detailed BASIC+ framework, which involves more challenging data collection and calculation processes.

The city should advance to BASIC+ and incorporate AFOLU emissions as soon as it is feasible to establish a baseline and track progress on this chapter. To calculate AFOLU emissions, the GPC recommends cities adopt a simplified approach that consists of multiplying net annual carbon stock change for different land-use (and land-use change) categories by surface area. For example, the city could estimate the net annual carbon stock change resulting from a conversion of city settlements to forest land. Geographic and zoning data from the LVPC and the city's Planning and Zoning department could be used for this purpose.

Additionally, calculation of the AFOLU sector would incorporate any small (presumably immaterial) emissions from livestock and non-CO₂ emissions from sources such as fertilizer applications.

Implementation

To implement this chapter, the city will work closely with the Lehigh Valley Planning Commission (LVPC) and build from its existing reports, including its Green Infrastructure Guidelines, the Monocacy Creek Act 167 Stormwater Management Plan, and the FutureLV Regional Comprehensive Plan. Key partnerships include:

- Bethlehem's Environmental Advisory Council (EAC)
- LVPC
- City of Bethlehem Planning and Zoning, City of Bethlehem Urban Forestry Bureau
- City of Bethlehem Recreation Department
- The Watershed Coalition of the Lehigh Valley and local watershed associations

Critical first steps for implementation include:

- Form a city green-space working group with representation from stakeholder organizations and underserved communities
- Consolidate the data needed to implement the strategies and assess gaps
- Assess how to best leverage and expand the city's first tree inventory
- Coordinate with City Council, EAC, LVPC, the City's Planning and Zoning, Urban Forestry Bureau, and other relevant departments to review and assess ordinance updates and zoning changes that can result in quick wins
- When the position is created and hired, work with the Bethlehem Sustainability Director to prioritize additional actions
- When the council is created and launched, work with the Bethlehem Climate and Environmental Justice Council to assess accessibility and equity in Bethlehem's green space and parks

The Implementation Strategy chapter provides further details on the timeline for implementing this chapter and the coordination of this chapter with the strategies of other sections of the CAP.



Local Food and Waste

objective



Waste sent to landfills decomposes and releases methane, a greenhouse gas 28 times more potent than carbon dioxide in terms of heating the atmosphere. According to the city's 2017 GHG inventory, waste represents nearly 10% of Bethlehem's GHG emissions.

Introduction

Waste sent to landfills decomposes and releases methane, a greenhouse gas 28 times more potent than carbon dioxide in terms of heating the atmosphere. According to the city's 2017 GHG inventory, waste represents nearly 10% of Bethlehem's GHG emissions. In many cities, waste emissions account for 1–5% of GHG emissions, so Bethlehem's percentage may decline as better data are obtained. While it is not the city's largest source of GHG emissions, reducing waste provides broad environmental and social benefits. Landfills and other waste disposal options are often the sources of environmental contamination and injustice. Toxins, leachate, and unpleasant odors from landfills can cause health problems and unpleasant odors for a community, and low-income and frontline communities are often disproportionately affected. Diesel garbage trucks spew NOx and particulate matter (PM), a source of local air pollution and a common cause of respiratory disorders. In addition, landfills use space that could otherwise be used for recreation, ecosystems, agriculture, housing, or business.

The primary objective of this chapter is to achieve Zero Waste in Bethlehem. Many communities around Pennsylvania and the country are also striving toward zero waste, which has been defined in various ways. As stated in the US Conference of Mayors' 2015 adopted resolution In Support of Municipal Zero Waste Principles and a Hierarchy of Materials Management, "zero waste goes beyond recycling and composting at the end of a product's life cycle, to encompass the entire life cycle of a product, beginning with product design, and envisioning the use and management of materials in ways that preserve value, minimize environmental impacts, and conserve natural resources."

Aligning with the Conference of Mayor's definition of Zero Waste, Zero Waste Principles, and Hierarchy of Material Management, Bethlehem aims to achieve zero waste to landfills by 2040.

“

Nutritious food helps brain power. Our children need healthier food choices and far less unhealthy food choices.

“

We need to consolidate waste pickup so that there are not so many haulers making duplicate trips serving the same neighborhood.

Upstream embedded emissions are at the other end of the GHG emissions spectrum from waste. These are the GHG emissions that result from the production and shipment of all the food, water, fuel, building materials, and consumer products produced outside city limits and imported for consumption. This category of emissions would be a significant percentage of the city's overall footprint, but it is difficult to calculate precisely and to influence reductions because it depends on individual consumer decisions. Bethlehem acknowledges the importance of these upstream emissions, but in accordance with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), they are not included in the city's current inventory. The city will aim to assess these emissions in a future update of this plan—but for this document, Bethlehem will focus on the portion of upstream embedded emissions that it can most directly influence, which is also one of the most significant contributors to waste-related GHG emissions—food. Specifically, Bethlehem will work to enhance the local food system.

There are numerous challenges and barriers to achieving the goals in this chapter. The first is the lack of centralized waste data to inform the solutions. Bethlehem uses more than 20 private waste haulers, making it difficult to gather data and coordinate and implement changes. Citywide emissions associated with waste and food are also influenced by systemic factors beyond the city's direct control, requiring significant changes over long timeframes to address. Barriers also exist at the state legislative level, such as the moratorium on local bans on plastic bags. Despite these barriers, there are opportunities. Multiple state bills, including the Zero Waste PA package, currently support this goal. To progress in the immediate term, the city will engage with experienced partners who have been making progress toward zero waste and local food in Bethlehem for years.



Objective and goals

The Local Food and Waste section of the Bethlehem Climate Action Plan's main objective is to achieve zero waste by 2040. This objective will be accomplished through strategies that target five specific impact goals:

- Adopt a "reduce first" approach and minimize waste
- Maximize waste diversion from landfills
- Develop better tracking and understanding of Bethlehem's waste streams
- Reduce the impact of current waste collection and disposal system
- Enhance the local food system

Strategies & actions

The list below presents a series of strategies and action steps to achieve the objectives defined above. This list was developed by the Bethlehem Climate Action Plan Stakeholder Working Group on Local Food and Waste with input from the Environmental Justice and Equity Steering Committee and further refined by the full Bethlehem CAP Stakeholder Working Group.

GOAL: Adopt a "reduce first" approach and minimize waste

FW1.1 Phase out single-use plastics

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Reduce resource consumption
- ▶ Improve water quality

City lead

- ▶ Office of Sustainability

Partners

- ▶ City Council
- ▶ Pennsylvania General Assembly
- ▶ CELDF
- ▶ EAC
- ▶ Dept. of Community & Economic Development
- ▶ Recycling Bureau

Key Stakeholders

- ▶ All residents and businesses
- ▶ State lawmakers

As recommended by the EAC (Environmental Advisory Council), the city should pass an ordinance banning single-use plastic bags and phasing out other single-use plastics. Such an ordinance could ban single-use plastics, including straws and disposable shopping bags, and mandate businesses and restaurants to use environmentally acceptable food packaging (e.g., biodegradable, compostable or recyclable products). The city should also explore the feasibility of establishing a reusable takeout container service and require reusable service-ware for all dine-in situations.

Environmental justice considerations - Multilingual education should be provided on all changes. When the phase-out is implemented, provide free reusable bags to community members purchasing with SNAP at stores in low-income areas, and at farmers markets accepting WIC and nutrition-program vouchers.

Implementation considerations - The city does not have a way of enforcing a plastic bag ordinance at this time due to the State of Pennsylvania having enacted legislation as part of the budget package to prohibit such bans. Although the state preempts a local ban, CELDF (Community Environmental Legal Defense Fund) suggests moving forward anyway in most cases of preemption. The city will need to adopt a Right to a Healthy Climate ordinance prior to pass a single-use plastics ban ordinance, due to the state preemption. In the context of local farmers, evaluate options for communicating to people who are selling products in Bethlehem. Farmers use far less packing than many other retailers, but still put some items in plastic (clamshells, bags of spring greens). Until a comprehensive ordinance similar to the one described in this strategy can be passed, the city should explore other options for transitioning restaurants and other businesses from plastic and Styrofoam takeout containers to compostable or reusable containers.



Key next step - The Pennsylvania state budget currently prohibits such bans on plastic bags, so Bethlehem will first need to pass a Right to a Healthy Climate ordinance as described in strategy M3.5.

FW1.2 Study "Save as You Throw" incentive program for waste reduction and diversion

Timeline

- ▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Reduce resource consumption
- ▶ Improve air quality
- ▶ Improve water quality

City lead

- ▶ Office of Sustainability

Partners

- ▶ Dept. of Community & Economic Development
- ▶ Local waste haulers
- ▶ Recycling Bureau
- ▶ City Council

Key Stakeholders

- ▶ All residents and businesses

Partner with local waste haulers to study implementation options for providing financial incentives to residents who reduce their waste or divert more to recycling, organics, and donation streams.

Environmental justice considerations - Multilingual education should be provided on all changes. Consider passing a portion of savings on to low-income residents. If the program is structured as a 'Pay as You Throw' program, low-income residents should be exempted or have costs rebated in other ways to avoid placing an undue financial burden. Create collective composting opportunities for residents who lack property to do backyard composting. At minimum, provide composting equipment for low-income homeowners who wish to compost.

Implementation considerations - The [Pay as You Throw](#) initiative provides examples of unit-based pricing for waste reduction, although structuring the program around savings rather than additional payments, as [NYC is considering](#), may be more effective. Bethlehem has more than 20 different waste haulers, making it difficult to communicate and coordinate effectively. The city should engage waste haulers to help in this effort and publicize those who do. This strategy would reduce methane produced in landfills and conserve landfill space.



Key next step Office of Sustainability to evaluate capacity to engage with all waste haulers and complete an opportunity assessment.

FW1.3 Implement Zero Waste practices at Bethlehem's large festivals and events


Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Conserve natural resources ▶ Reduce resource consumption	City lead ▶ Dept. of Community & Economic Development	Partners ▶ ArtsQuest ▶ Office of Sustainability ▶ EAC	Key Stakeholders ▶ Vendors at large festivals
---------------------------	--	---	---	---	---

Community Priority 


Work with ArtsQuest and other vendors to apply Zero Waste principles and strategies to the city's iconic festivals and large events.

Environmental justice considerations - Provide multilingual education on all changes for Spanish-speaking contractors. Encourage or require multilingual signage on waste receptacles for festival attendees.

Implementation considerations - This strategy would reduce methane produced in landfills and conserve landfill space. The EPA has compiled a set of [resources](#) summarizing how different communities have defined Zero Waste. This guidebook from the EU provides [Zero Waste Guidelines for Events and Festivals](#). The city could consider mandating certain zero waste standards for permits and for lease of city property. Examples of steps that large festivals can take to reduce waste include: have composting and recycling at every location where trash is accepted; station volunteers at high-traffic waste receptacles to inform attendees as to correct use of compost, recycle, and landfill containers; encourage attendees to use their own reusable utensils and mugs, such as current or old Musikfest mugs; encourage or require vendors to minimize packaging and single-use plastics; encourage bamboo utensils over plastic.

 **Key next step**
 Dept. of Community & Economic Development to meet with ArtsQuest and other stakeholders to review current waste practices and identify opportunities to apply zero waste principles

FW1.4 Increase standards and enforcement for minimizing construction and demolition waste

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Reduce resource consumption	City lead ▶ City Council	Partners ▶ Code Enforcement Dept. ▶ Office of Sustainability	Key Stakeholders ▶ Contractors and construction companies
---------------------------	--	---	------------------------------------	---	---

Community Priority 

To reduce demolition waste and avoid the energy usage related to demolition, adopt policies to encourage preservation and reuse of existing structures.

Environmental justice considerations - Provide multilingual education on all changes for Spanish-speaking contractors.

Implementation considerations - The city should review construction codes and explore opportunities to exceed the Pennsylvania Uniform Construction Code. In cases where the city cannot change or exceed the state code, it can create strong incentives to comply. The city should explore the [International Green Construction Code](#) and relevant LEED standards, such as [Construction and demolition waste management](#).

 **Key next step**
 City Council to review the IGCC and develop a plan for adoption.


FW1.5 Encourage and prioritize preservation, reuse, repurpose, and retrofit of existing structures

Timeline ▶ Near Community Priority 	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Conserve natural resources ▶ Reduce resource consumption ▶ Job creation 	City lead <ul style="list-style-type: none"> ▶ Dept. of Community & Economic Development 	Partners <ul style="list-style-type: none"> ▶ City Council ▶ Office of Sustainability ▶ Bureau of Planning and Zoning ▶ Habitat for Humanity ▶ Local non-profits 	Key Stakeholders <ul style="list-style-type: none"> ▶ Contractors and construction companies
--	--	--	--	--	--

Adopt the International Green Construction Code (IGCC) and develop stronger recycling and reuse requirements for all building-related permits. Require a higher standard of recycling and reuse for real estate developments that receive financial assistance from the city or special zoning approval.

Environmental justice considerations - Provide multilingual education on all changes for Spanish-speaking contractors. Assess the impact of policies on different income groups. Policies requiring or encouraging preservation may burden homeowner with additional costs, posing greater financial burden on people with older homes, many of which are in low-income communities.

Implementation considerations - Habitat for Humanity’s ReStores might be a partner for this strategy. The National Trust for Historic Preservation has a full guide on [Strategies for Revitalization and Reuse](#).

 **Key next step**
 Dept. of Community & Economic Development to meet with City Council to discuss options to incentivize preservation and reuse in the city code.


FW1.6 Develop materials markets and encourage reuse of consumer products

Timeline ▶ Medium Community Priority 	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Job creation ▶ Reduce inequality and poverty 	City lead <ul style="list-style-type: none"> ▶ Dept. of Community & Economic Development 	Partners <ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Community Action ▶ Local non-profits 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
---	--	--	--	---	--

Partner with local non-profit organizations to collect reusable building materials and consumer goods to redistributes them to charities, schools, and other social programs.

Environmental justice considerations - Multilingual education should be provided on all changes. Establish a tool library to encourage DIY repair so that people can borrow the tools they need to repair items and perform home improvement projects.

Implementation considerations - Habitat for Humanity’s ReStores might be a partner for this strategy.

 **Key next step**
 Dept. of Community & Economic Development to partner with local non-profit organizations to collect reusable building materials and consumer goods to redistribute them to charities, schools, and other social programs.



CASE STUDY



Reducing waste through Asa's Attic

Lehigh University has developed a Surplus Property and Logistics Program called [Asa's Attic](#) - where one department's junk can be another department's treasure. Asa's Attic is free for Lehigh departments and serves to reuse items (desks, chairs, lamps, printers, conference tables, bookcases, etc.) across campus and keep them out of landfills. Departments simply "shop" the free online inventory of items and make the request for the item(s) they want. The department purchasing the items is responsible for moving the items and paying any related labor or transportation costs. Items may also be purchased for personal use with personal funds at a low cost. This reuse program is a significant positive benefit because it saves departments money and reduces the amount of furniture and other items that would otherwise go to waste.


FW1.7 Conduct a public education campaign to improve waste management practices

<p>Timeline ▶ Near</p> <p>Community Priority</p> 	<p>GHG emissions impact</p> 	<p>Co-benefits ▶ Reduce resource consumption</p>	<p>City lead ▶ Recycling Bureau</p>	<p>Partners ▶ Waste Reduction Committee of the EAC ▶ Dept. of Public Works ▶ Bethlehem Food Coop ▶ BASD</p>	<p>Key Stakeholders ▶ All residents and businesses ▶ Local waste haulers and transfer stations</p>
--	--	---	--	--	---

The campaign would focus on increasing the quantity and quality of recycled materials, helping residents understand how long food can be safely eaten to reduce food waste, and composting. The campaign could include community workshops, flyers, and stickers that can be used at home, and apps.

Environmental justice considerations - All education materials should be multilingual. The program should consider applying to the Pennsylvania Department of Environmental Protection's (DEP) [Food Recovery Infrastructure Grant Program](#), which provides assistance to registered nonprofit organizations such as food banks for the proper management and operation of food to reduce waste.

Implementation considerations - This strategy should be implemented at the same time that the Bethlehem Food Co-op opens; work with the Co-op to distribute resources. Engage the BASD and leverage their waste-related commitments for this strategy's implementation. For example, the city could conduct a continuing series of workshops showcasing local expertise. American Biosoils is working with Easton to compost food at their farmer's market, and Bethlehem could take a similar approach. The EAC suggests coordinating with the Food Co-op as a possible site to do this in Bethlehem. The Bethlehem compost center is another possible site that would not require outside business support.

 **Key next step**
Recycling Bureau to meet with and leverage the Waste Reduction Committee of the EAC, which has already been looking into this strategy.

GOAL: Maximize waste diversion from landfills

FW2.1 Create curbside composting program

Timeline
▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Job creation
- ▶ Reduce resource consumption

City lead

- ▶ Office of Sustainability

Partners

- ▶ Recycling Bureau
- ▶ EAC
- ▶ ProdHealth
- ▶ Easton Compost Program
- ▶ Bethlehem Food Co-op

Key Stakeholders

- ▶ All residents and businesses
- ▶ Bethlehem Yard Waste Facility

Pilot a “Green Bin” curbside composting program to study its effectiveness and feasibility. If successful, expand the program citywide and educate residents and businesses about composting.



Environmental justice considerations - Multilingual education should be provided on all changes. Education needs to focus on what composting is, how to know what is compostable, and why it should be done. Reduction in volume of edible food should not be coupled with composting, as it conflates two separate issues. The composting program should not be cost prohibitive for low-income residents. If the pilot program has cost to residents, then they should be waived for low-income participants, and bins should be provided for free. If property ownership and associated land is required to compost, find ways to make composting available to renters and apartment dwellers through a city pick-up program or creation of communal composting sites. In time, it will reduce the cost of garbage pick-up for residents because they will have less waste.

Implementation considerations - This strategy can reduce the amount of methane produced in landfill, conserve landfill space, reduce use of synthetic fertilizers, and eventually reduce the cost of garbage collection for residents. To implement a curbside program, the city would initially identify an organization or facility to accept the composted waste. The key difference with such an organization and the city’s existing Yard Waste Facility is that the organization/facility required for this strategy must accept food and other household organic waste not currently accepted by the city compost center. The city could start the pilot as a volunteer drop-off program, similar to the Easton Compost Program, which accepts residential food waste from its members on a self-serve basis behind the Easton Public Market. The EAC’s Waste Reduction Committee has been exploring a similar model to Easton’s for Bethlehem. Following the drop-off pilot, the program could then expand to curbside. The city would likely need separate collection trucks from those used for recycling. To encourage utilization, the city could pass an ordinance mandating all commercial properties have an organic waste diversion plan and enforce it.

ProdHealth, a health consulting firm in Bethlehem, has offered to run a crowdsourcing campaign to raise funds for a Bethlehem compost site. The company would sponsor/fund the difference in order to get started. The proposed program would electronically track weighed compost at drop off for each person and reward people to do so. The proposed program would sell it back out to local farms at a discount in order to keep up with operating costs and donate the remaining to community and school gardens. If individuals donate compost waste, they will enter into a subscription program to pick up fresh compost for their home garden at net even cost with what they donated.

 **Key next step**
Office of Sustainability to hold meeting with EAC Waste Reduction Committee, ProdHealth, and other interested stakeholders to discuss programmatic options.


FW2.2 Establish a curbside textile recycling program

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Job creation ▶ Reduce resource consumption	City lead ▶ Recycling Bureau	Partners ▶ Office of Sustainability ▶ EAC	Key Stakeholders ▶ All residents and businesses
Community Priority 					



In conjunction with other curbside recycling and the proposed curbside composting program (FW2.1), implement a curbside textile recycling program to maximize waste diversion from landfills.

Environmental justice considerations - Multilingual education should be provided on all changes and new programs. While increasing textile recycling rates will reduce GHG emissions, the city should encourage and prioritize reuse and donation of textiles over recycling.

Implementation considerations - Used clothing and textiles are currently accepted at the Theis/Cornfeld Recycling Center. The city has connections to donate the materials collected in the Recycling Center's textile trailer, but this program would increase access to textile recycling and recycling rates. The program should include an education component that partners with local thrift stores to encourage 'reuse' of textile materials before recycling.

 **Key next step**
 Recycling Bureau to hold a meeting with EAC Waste Reduction Committee and other interested stakeholders to discuss programmatic options.

FW2.3 Develop an anaerobic digestion program

Timeline ▶ Medium	GHG emissions impact 	Co-benefits ▶ Job creation	City lead ▶ Recycling Bureau	Partners ▶ PA DEP ▶ PennState Extension, farmers ▶ Local transfer stations ▶ Northampton and Lehigh Counties	Key Stakeholders ▶ Waste hauling companies and transfer stations ▶ Farmers
Community Priority 					

Pre-sort organic waste that is not composted before it reaches the landfill to be processed in an anaerobic digester to produce biogas.

Environmental justice considerations - Ensure the siting of any new waste facilities do not create environmental justice concerns and consult local community leaders.

Implementation considerations - As a first step, the city should consult with PennState Extension College of Agricultural Sciences and local farmers. An alternative would be to partner with farms for making compost to sell or feeding their livestock. Prioritization should be to ensure all organic waste is composted. This strategy will address any organic waste that is not composted. The city's wastewater treatment plant already incorporates anaerobic digestion. Implementation of this strategy would need to be done in coordination with local waste transfer stations and landfills. Costs of an anaerobic digestion system are high; the city would need grant money to pursue.

 **Key next step**
 Dept. of Public Works to meet with PennState Extension College of Agricultural Sciences and local farmers to discuss feasibility.


FW2.4 Require large institutions and businesses to donate, reduce, reuse, or compost their unsold food

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Conserve natural resources ▶ Reduce resource consumption	City lead ▶ City Council	Partners ▶ Office of Sustainability ▶ Dept. of Community & Economic Development ▶ PA DEP ▶ NRDC ▶ EAC ▶ Community Action ▶ Bethlehem Food Co-op ▶ Local food banks	Key Stakeholders ▶ Restaurants and retailers; local colleges and universities
Community Priority 					

Create a city ordinance requiring commercial businesses that generate more than a set amount of organic waste per week to follow a hierarchy of options to minimize disposal, including donation and composting.

Environmental justice considerations - Work to encourage donations to local food banks or shelters over composting where possible. The program's hierarchy of options should indicate food should only be composted when it is unsafe for human consumption; if it is edible, it should be donated. The city can leverage the PA DEP Food Recovery Infrastructure Grant program. This should be coupled with an initiative to expand food assistance in the area, including establishing food banks in the model of the [U-District Food Bank](#) in Seattle.

Implementation considerations - Donating food has strict requirements that may be difficult to meet; however, the [Bill Emerson Good Samaritan Food Donation Act](#) provides strong protections for those who donate in good faith. NRDC has a [Food Matters policy and program toolkit](#) for reducing food waste in cities. NRDC also has a library of resources, case studies, and other tools. There is also a guide for setting up a Food Waste Restaurant Challenge. Many restaurants are already facing challenges due to the COVID-19 pandemic. Similarly, many Bethlehem residents are facing unprecedented economic hardship, including food insecurity. If the implementation of this strategy begins while the COVID-19 pandemic is ongoing, the city should work collaboratively with stakeholders to reduce food insecurity, support local business, and ensure robust COVID-19 safety protocols.

 **Key next step**
 City Council to meet with restaurants, colleges, universities, and other stakeholders to discuss proposed requirements and implementation.


FW2.5 Encourage repair cafes for residents to get broken items fixed instead of throwing away and buying new

Timeline ▶ Medium	GHG emissions impact 	Co-benefits ▶ Job creation ▶ Reduce resource consumption ▶ Reduce inequality and poverty ▶ Improve system sustainability	City lead ▶ Dept. of Community & Economic Development	Partners ▶ Community Action ▶ Local community groups	Key Stakeholders ▶ All residents and businesses
Community Priority 					

Implement a program that encourages volunteers to help fix old appliances and other machines to divert these items from the landfill. The program should provide education and encourage reuse.

Environmental justice considerations - Try to involve people who are bilingual or multilingual to do repairs or translate. This could be a community service opportunity for high school or college students, or an opportunity for retirees.

Implementation considerations - None noted.

 **Key next step**
 Dept. of Community & Economic Development to engage community organizations for piloting a repair day utilizing local volunteers.

FW2.6

Responsible waste management recognition program for local businesses

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Reduce resource consumption

City lead

- ▶ Office of Sustainability

Partners

- ▶ Recycling Bureau
- ▶ Mayor's Office
- ▶ Community Action

Key Stakeholders

- ▶ All residents and businesses

Community Priority



Develop a recognition program or rating system for local businesses to highlight those who are composting and engaging in responsible waste management.

Environmental justice considerations - Ensure there is awareness of the program for businesses in low-income neighborhoods. Provide consultation and support to businesses in low-income communities who may want to diminish their environmental impact but do not know how.

Implementation considerations - There may be an opportunity to partner with Community Action Lehigh Valley (Community Action). The recognition program in this strategy could also be incorporated into the broader Bethlehem Climate Challenge program, as described in the Public Engagement chapter, particularly strategy PE1.1.



Key next step

Office of Sustainability to coordinate with Recycling Bureau to integrate this recognition program with the other recognition programs proposed in the CAP.

FW2.7

Make recycling easier via education and new resources

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Reduce resource consumption

City lead

- ▶ Recycling Bureau

Partners

- ▶ Northampton County
- ▶ Lehigh County
- ▶ Terracycle
- ▶ Roadrunner Recycling

Key Stakeholders

- ▶ All residents and businesses

Community Priority



Build upon the city's online education resources on recycling to provide stickers and multi-lingual education materials to residents and businesses aimed at improving recycling practices and increasing recycling compliance. Grant all residents the right to receive one free pair of recycling bins.

Environmental justice considerations - Expand the e-waste recycling day to two or more a year and host some on Southside. Once a year, curbside pick-up would help carless families. Requiring people to drive and/or pay for e-waste disposal unduly burdens low-income residents and those without cars, as well as adding unnecessary vehicle travel.



Implementation considerations - For small waste such as batteries & CFL lamps, the city should develop partnerships with institutions that already recycle these items and require all haulers to offer curbside pickup at least once per month. Most schools, large businesses, and colleges and universities already have programs to recycle these items; explore ways to partner with them. Partner with Northampton and Lehigh Counties and private vendors to expand the recycling categories accepted by the Theis/Cornfeld Recycling Center to include plastic bags and e-waste. Deposits of these materials could be transferred in bulk by the city to regular drop-off locations for these materials, such as supermarkets and periodic e-waste events. Research RoadRunner Recycling's work in Pittsburgh, Philadelphia, and Washington, DC, and determine if there are existing resources the city can leverage.



Key next step

Recycling Bureau to create simple visual illustrations of waste/recycling guidelines and supply multi-lingual printed material for organizations to disseminate. Recycling Bureau to incorporate waste and recycling facts, solutions, and information in the city's quarterly newsletter.


FW2.8 Enforce existing waste and recycling policies

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Reduce resource consumption 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Recycling Bureau 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Code Enforcement Dept. ▶ Local restaurants ▶ Waste haulers 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Republic Services and other recycling contractors
--	--	---	--	---	--

Increase enforcement of City Ordinance #3821, Article 933.04, which requires all residents of the City of Bethlehem to recycle. Work on policies and enforcement to require all businesses to recycle.

Environmental justice considerations - Ensure any increased enforcement is not disproportionately carried out in low-income areas or other vulnerable populations. Also, ensure that existing curbside recycling service is consistent across all neighborhoods, particularly low-income neighborhoods.

Implementation considerations - In the early stages of implementation, prioritize policies and enforcement for businesses before residents. Business leaders can set an example for residents.

 **Key next step**
Recycling Bureau to review existing enforcement policies and implementation.

GOAL: Develop better tracking and understanding of Bethlehem's waste streams

FW3.1 Develop better understanding of the city's current waste streams

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Reduce resource consumption 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Office of Sustainability 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Recycling Bureau ▶ NRDC ▶ Local waste haulers ▶ Local waste transfer stations and landfills ▶ EAC 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses
--	--	---	--	--	---

Conduct a waste characterization study to understand waste streams and the effectiveness of current diversion programs. Develop a policy to repeat the characterization study every five years to maintain data quality and track progress.

Environmental justice considerations - Utilize the study to ensure that waste is not being disposed of in a way or in a place that disproportionately burdens an environmental justice community outside the city limits. Make waste disposal location and impact on environmental justice community criteria for evaluating waste disposal options/vendors.

Implementation considerations - Implementation will require partnership with local waste haulers and transfer stations. Consider NRDC's '[Food Matters](#)' policy and program toolkit for reducing food waste in cities, including calculator tools for estimating/measuring food waste. All aggregated community-wide waste data should be made public on the city's website. Providing greater transparency on where waste and recycled materials go will increase public confidence in the city's recycling program, particularly given concern about municipalities not recycling materials after China, a formerly common destination for recycling, increased its material standards and stopped accepting as much material from the US.

 **Key next step**
Office of Sustainability to identify funding for a waste characterization study.

CASE STUDY



Food carbon and water footprint tool

Have you ever thought about the carbon and water footprint of the foods you eat? A group of Lehigh University students, faculty, and staff are developing a food carbon and water footprint calculator that suits Lehigh Dining's needs to determine which menu items are the most and least carbon and water intensive. This will allow Lehigh Dining to provide a visual carbon and water footprint scoring system for select menu items in Lehigh Dining locations by 2021. This scoring system will encourage students, faculty, and staff to alter their food choices based on the carbon and water impact of the menu item.

FW3.2

Improve the waste section of the city's greenhouse gas inventory

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Reduce resource consumption

City lead

- ▶ Office of Sustainability

Partners

- ▶ Recycling Bureau
- ▶ Northampton and Lehigh Counties
- ▶ Local waste haulers
- ▶ Local waste transfer stations and landfills

Key Stakeholders

- ▶ Local waste transfer stations and landfills

Community Priority



Refine calculations of the city's waste-related GHG emissions to better track progress toward goals. Such calculations should come from primary waste data. Explore the feasibility of complementing the city's existing GHG inventory methodology with a consumption-based GHG emissions inventory, which would incorporate 'embedded' emissions in products made outside city limits.

Environmental justice considerations - This would make it possible to recognize households with lower per capita carbon footprints, and since less wealthy people have lower carbon footprints, it could progressively benefit low-income households if incentives/benefits proposed in this plan are given and/or prioritized for low-carbon footprints.

Implementation considerations - USDN provides a [Sustainable Consumption Toolkit](#), including approaches for estimating consumption-based emissions and strategies for addressing these emissions. C40 has produced a [report on consumption-based GHG emissions of cities](#).



Key next step

Office of Sustainability to connect with local waste haulers and transfer stations to gather primary waste data for the city's GHG inventory.


FW3.3 Create tracking system for waste carried by private haulers

<p>Timeline ▶ Medium</p> <p>Community Priority ○</p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Reduce resource consumption 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Office of Sustainability 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Recycling Bureau ▶ Office of Sustainability ▶ Northampton and Lehigh Counties ▶ Local waste haulers ▶ Local waste transfer stations and landfills 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ All residents and businesses
--	--	---	--	--	---

To provide easier access to total waste volumes and the effectiveness of diversion rates, require public disclosure of total waste volumes, broken down by landfill waste, recycling, and food waste, carried by private haulers and incorporate into a centralized waste tracking system for the city.

Environmental justice considerations - None noted.

Implementation considerations - Bethlehem has more than 20 different waste haulers, making it difficult to communicate and coordinate effectively. The city should engage waste haulers to help in this effort and publicize those who do.

 **Key next step**
Office of Sustainability to engage with private waste haulers in coordination with other strategies in this chapter and discuss data management.


FW3.4 Provide waste audits to businesses

<p>Timeline ▶ Near</p> <p>Community Priority ○</p>	<p>GHG emissions impact</p> 	<p>Co-benefits</p> <ul style="list-style-type: none"> ▶ Reduce resource consumption ▶ Job creation 	<p>City lead</p> <ul style="list-style-type: none"> ▶ Office of Sustainability 	<p>Partners</p> <ul style="list-style-type: none"> ▶ Recycling Bureau ▶ Dept. of Community & Economic Development ▶ Chamber of Commerce ▶ Pennsylvania Resources Council ▶ EAC 	<p>Key Stakeholders</p> <ul style="list-style-type: none"> ▶ Bethlehem businesses, particularly small businesses
--	--	---	--	--	--

Provide waste audits to businesses to help businesses reduce their waste and increase recycling.

Environmental justice considerations - The program should consider applying to the Pennsylvania Department of Environmental Protection's (DEP) Food Recovery Infrastructure Grant Program, which provides assistance to registered nonprofit organizations such as food banks for the proper management and operation of food to reduce waste. The city should explore options to provide this program at no charge to locally-owned small businesses, particularly those in frontline communities.

Implementation considerations - Pennsylvania Resources Council (PRC)'s [Zero Waste Pennsylvania](#) program provides waste audit services and waste characterization studies.

 **Key next step**
Recycling Bureau to evaluate service options with Pennsylvania Resources Council.

GOAL: Reduce the impact of current waste collection and disposal system

FW4.1 Convert waste-hauling fleets from diesel-powered vehicles to low- or no-emission vehicles					
Timeline ▶ Medium	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Reduce resource consumption ▶ Improve air quality ▶ Cost savings 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ Recycling Bureau ▶ Dept. of Public Works ▶ Private waste and recycling hauling companies ▶ City Council 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
Community Priority	Develop a plan to convert the city's waste and recycling hauling vehicles to low- and eventually no-emission vehicles.				
Environmental justice considerations - Waste-hauling fleets are a significant source of local air pollution. Fleet conversions to low- and no-emission vehicles should be prioritized for low-income areas.					
Implementation considerations - As covered in waste industry media here and here , electric waste hauling trucks are currently available and can provide cost savings. The city could lead by example by implementing requirements for the recycling hauling fleet.					
	Key next step Recycling Bureau and Dept. of Public Works to review budget considerations for electric recycling trucks and present City Council the options for incentivizing or requiring private waste haulers to convert their fleets to no-emission vehicles.				

FW4.2 Reduce waste-hauling truck traffic via route optimization					
Timeline ▶ Medium	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Reduce resource consumption ▶ Improve air quality ▶ Cost savings 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ Recycling Bureau ▶ Private waste and recycling hauling companies 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
Community Priority	Partner with waste-hauling companies to study and pilot route optimization software to reduce mileage by waste-hauling trucks and prevent redundancy.				
Environmental justice considerations - Waste-hauling fleets are a significant source of local air pollution. Route optimization should be prioritized for low-income areas.					
Implementation considerations - Bethlehem Article 1162 (Solid Waste Collection and Enforcement) already dictates allowed hours for waste collection (1162.09). It also states, "The Director of Community and Economic Development or his or her designee shall, to the fullest extent permitted by law, formulate and regulate all aspects of the collection, transportation, and disposal of solid waste from the point of origin to the point of disposal. The Director shall formulate and promulgate rules and regulations necessary to implement all aspects of the minimum standards to be observed for the collection, transportation, and disposal of solid waste" (1162.02). This ordinance could be updated to better coordinate haulers, require best practices, and reduce redundancy. Regardless of route optimization software adoption, the practice of more than 40 waste haulers serving the same neighborhoods will inevitably result in redundancy.					
	Key next step Office of Sustainability to review route efficiency of recycling haulers.				

FW4.3 Encourage best practices for waste management at local transfer stations and landfills

Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve system sustainability ▶ Improve air quality ▶ Improve water quality ▶ Reduce inequality and poverty 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ Recycling Bureau ▶ PA DEP ▶ Waste transfer stations and landfills 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses ▶ Frontline communities
---------------------------	---------------------------------	---	---	---	---

Work with PA DEP and local waste transfer stations to ensure best practices are followed at all local landfills and eliminate DEP violations. Encourage capture/use of released methane to extract as much energy from waste as possible.

Environmental justice considerations - The city should prioritize seeking input from communities surrounding waste transfer stations. Evaluate community impacts of waste disposal at final location as part of evaluation of disposal vendors. The city should not contract with waste disposal facilities that burden environmental justice communities, and the city should explore options to require private hauler to do the same.

Implementation considerations - The Bethlehem Landfill is currently one of 24 operational gas-to-energy projects in Pennsylvania. Gas-extraction wells in the landfill capture methane gas and divert it to an energy plant, which converts the gas to electricity. This practice reduces the amount of methane emitted to the atmosphere from the landfill, which reduces its global warming impact.

Key next step
Office of Sustainability to review waste treatment practices and DEP violation records for landfills that service Bethlehem.

FW4.4 Expand options to ensure proper disposal of refrigerants and other high global-warming potential (GWP) gases

Timeline ▶ Near	GHG emissions impact 	Co-benefits <ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve air quality 	City lead <ul style="list-style-type: none"> ▶ Office of Sustainability 	Partners <ul style="list-style-type: none"> ▶ Recycling Bureau ▶ Northampton and Lehigh Counties 	Key Stakeholders <ul style="list-style-type: none"> ▶ All residents and businesses
---------------------------	---------------------------------	---	---	---	--

Partner with Northampton and Lehigh Counties and the private sector to provide education resources and increased options to ensure proper disposal of CFCs and HCFCs from appliances such as refrigerators, freezers, and air conditioners.

Environmental justice considerations - Multi-lingual education should be provided on all changes and new programs. Develop increased accessibility options and financial reimbursement for individuals who do not have the resources to dispose of these items properly.

Implementation considerations - Refrigerators, freezers, air conditioners, dehumidifiers, and water coolers contain ozone-depleting refrigerants (CFCs / Freon) must be removed by a certified professional. Northampton County provides [limited guidance](#). Payments could be offered for broken refrigerant machinery pickup to encourage proper disposal.

Key next step
Office of Sustainability to meet with Northampton and Lehigh Counties to discuss options for developing improved education resources.

FW4.5

Reduce impacts from wastewater treatment

Timeline

- ▶ Long

GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Improve water quality

City lead

- ▶ Water and Sewer Resources Dept.

Partners

- ▶ Dept. of Public Works
- ▶ PA DEP

Key Stakeholders

- ▶ All residents and businesses

Community Priority



Expand capacity for material and renewable energy recovery at the Bethlehem Wastewater Treatment Plant, including by optimizing biogas production for beneficial use, expanding food waste co-digestion opportunities, and moving toward net-zero energy while reducing fugitive emissions and landfilling of biosolids.

Environmental justice considerations - None noted.

Implementation considerations - The Bethlehem Wastewater Treatment Plant (WWTP) has undergone a series of upgrades over the last decade budgeted at more than \$29 million. Since 2018, WWTP has been disposing 100% of its Class B biosolids via beneficial use, i.e., farmland application, in lieu of disposal at landfills. Annual disposal is approximately 10,000 wet tons of Class B biosolids. PA DEP conducted a survey of WWTP's to gauge interest and capability to process food waste. Bethlehem WWTP cannot at this time but could be evaluated at some future date; this would involve capital investment. A combined heat and power (CHP) system could also be evaluated at some future date as the plant expands and creates more biogas. Biogas production at the plant currently exceeds onsite needs. Excess biogas could be used to generate electricity in a CHP system as part of a future capital improvement.



Key next step

Water and Sewer Resources Dept. to meet with Dept. of Public Works to review options and potential timeline for combined heat and power as part of future plant upgrades.

GOAL: Enhance local food system

FW5.1

Work with schools to promote healthy eating

Timeline

- ▶ Near

GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Reduce inequality and poverty
- ▶ Improve system sustainability

City lead

- ▶ Health Bureau

Partners

- ▶ BASD
- ▶ Kellyn Foundation
- ▶ Buy Fresh Buy Local—Greater Lehigh Valley
- ▶ Community Action
- ▶ ProdHealth
- ▶ Rodale Institute
- ▶ Junior League of the Lehigh Valley
- ▶ Pasa Sustainable Agriculture
- ▶ Bethlehem Food Co-op

Key Stakeholders

- ▶ Bethlehem students
- ▶ Local farmers
- ▶

Community Priority



Partner with Bethlehem Area School District (BASD) to increase and promote the offerings of local, organically grown, healthy food in schools. Increase education and discussion of food and food justice in science and other subjects.

Environmental justice considerations - This will have the biggest impact on low-income students who are on free lunch programs. Offerings should be culturally appropriate and involve strategies that incentivize eating better food versus, for example, adding a piece of fruit next to a pizza. The program should purchase food from non-white farmers, which is a good way to support farm justice and also can help students take an interest in the healthy options provided by food from local farmers.

Implementation considerations - This program should be coupled with initiatives for reducing food waste from retailers and restaurants (strategy FW2.4). Food banks or other recipients of donations can prepare packages of healthy options that can be given to low-income students to take home on Fridays, so they have food over the weekend. The Junior League of the Lehigh Valley has created [community partnerships and programs](#) to help address the issue of food access in the Lehigh Valley.



Key next step

Health Bureau to hold a meeting with BASD, Buy Fresh Buy Local—Greater Lehigh Valley, and other stakeholders to discuss options to increase healthy, local food in schools.

CASE STUDY

Working with nature, not against it



Camel's Hump Farm (CHF) located on the historic 135-acre Archibald Johnston estate is being restored as a nature education center and community garden. The community garden provides a place where the public can grow organic vegetables and flowers for personal use, learn about gardening, and share time outside. The CHF Nature Center provides education programs about the natural world. CHF models best management practices for climate change—working with nature, not against it. The farm takes on some of the climate change challenges like larger storm events and longer periods of draught utilizing catchment systems, rain barrels, green roofs, rain gardens, sheet flow ponds, wetlands, bog restoration, riparian buffer plantings, and permaculture principles of planting on the contour and utilizing companion plantings and vertical gardening to protect plants and decrease water utilization. The farm also removes invasive species and heavily plants natives. Most of all, CHF gets people outdoors so they can understand the changes that are occurring and prepare for them with the hands-on skills taught at the farm.

FW5.2

Support local gardens and urban farms

Timeline

- ▶ Medium

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Reduce inequality and poverty
- ▶ Improve system sustainability
- ▶ Conserve natural resources and biodiversity
- ▶ Reduce resource consumption
- ▶ Workforce development

City lead

- ▶ Health Bureau

Partners

- ▶ Bureau of Planning and Zoning
- ▶ Buy Fresh Buy Local— Greater Lehigh Valley
- ▶ Alliance for Sustainable Communities— Lehigh Valley
- ▶ Penn State Extension: College of Agricultural Sciences
- ▶ Bethlehem Food Co-op
- ▶ Camel's Hump Farm

Key Stakeholders

- ▶ All residents and businesses
- ▶ Local farmers and gardeners

Adopt policies to promote local gardens and urban farming, increasing local, organically grown food availability.

Environmental justice considerations - Healthier food will lead to healthier communities. The program should ensure that soil safety is part of the program for communities that may have a legacy of soil contamination. Allow rooftop gardening for people who don't have yards. Support food-growing skill development in urban youth programs. The policies should expand community gardens where residents can help grow and harvest food in public spaces, which especially benefits renters who have no yard space or rooftop access of their own. Gardens should be in low-income areas, food deserts, and areas with high air pollution and/or little public green space currently. Gardens could provide spaces for growing culturally relevant foods.

Implementation considerations - The city could create an incentive program to encourage local businesses to donate unused land as local gardens. In addition to supporting the siting of local gardens and urban farms, the city could create a volunteer program to help maintain gardens (e.g., remove weeds and keep the garden tidy). Garden and urban farm upkeep present an opportunity for education opportunities and engagement with local schools for class or capstone projects. The city should explore the depression-era & WWII 'Victory Gardens' as an example of what could be done. The Bethlehem Health Bureau should repeat and expand the Bethle-YUM! Program. In the partnership with farmers markets, when visitors purchased a weekly special vegetable product, they received a recipe using that item along with a box of all the other ingredients needed. The Rodale Institute paper, "[Regenerative Organic Agriculture and the Soil Carbon Solution](#)," provides details on regenerative agriculture's capacity to remove carbon dioxide from the atmosphere.



Key next step

Bureau of Planning and Zoning to identify suitable plots of land with appropriate water hookups.

CASE STUDY



Achieves real food challenge goal

Lehigh University recently achieved its Real Food Challenge goal by purchasing 20.3 percent of its food from local, organic, fair trade, and humane sources in the 2019-2020 academic year. [The Real Food Challenge](#) is a national campaign to encourage campuses to increase the ratio of their food purchased from "conventional" to "real" food. Lehigh's Office of Sustainability, Dining Services, Purchasing Services, and Sodexo have collaborated on the challenge for the past seven years. To calculate Lehigh's "real" food, students in the Office of Sustainability used the Real Food Challenge Calculator and analyzed invoices from campus dining locations for foods that are local, fair, ecological, and humane to determine the percentage of the food budget that is being spent on "real" food. Lehigh Dining is expanding on its commitment by collaborating with the Office of Sustainability to develop a Lehigh University Sustainable and Healthful Food Purchasing Policy, which will be released in 2021.

FW5.3 Increase institutional purchase of local foods

Timeline	GHG emissions impact	Co-benefits	City lead	Partners	Key Stakeholders
<p>▶ Near</p> <p>Community Priority </p>		<ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Improve system sustainability ▶ Conserve natural resources and biodiversity ▶ Reduce resource consumption 	<ul style="list-style-type: none"> ▶ Health Bureau 	<ul style="list-style-type: none"> ▶ Dept. of Community & Economic Development ▶ Buy Fresh Buy Local— Greater Lehigh Valley ▶ Food Policy Council ▶ Seed Farm ▶ Community Action ▶ CADC-b (Community Action Development Corporation of Bethlehem) ▶ Penn State Extension: College of Agricultural Sciences ▶ Pasa Sustainable Agriculture ▶ Bethlehem Food Co-op 	<ul style="list-style-type: none"> ▶ Large businesses and institutions ▶ Local colleges and universities

Partner with large institutions and businesses in the city to encourage and promote the purchase of local foods grown without synthetic fertilizers or pesticides, using current, ongoing initiatives as examples.

Environmental justice considerations - Make purchasing from minority-owned farms a priority. When engaging local large institutions and businesses, initially prioritize engagement with organizations most likely to serve people from frontline communities, such as Northampton Community College. The goal of this strategy is to increase demand and ultimately supply of local foods grown with sustainable practices. In the short term, until supply catches up with growing demand, large purchases from organizations that do not serve low-income populations and frontline communities could reduce the supply of local, healthy food for these communities. In coordination with the other strategies in this section, such as FW5.1 and FW5.4, the city should emphasize this point to large organizations and institutions during the implementation of this strategy and work with local community groups to ensure local food supply increases for frontline communities. In particular, through FW5.1, the city should ensure priority for maximizing local foods should be given to BASD.

Implementation considerations - Local for the purpose of this program would mean the Lehigh Valley, allowing up to 25 miles outside the 3-county area (Berks, Lehigh, and Northampton Counties). Lehigh University is developing a Sustainable and Healthful Food Purchasing Policy as a follow on to the Real Food Challenge, which promoted purchasing local foods and ended in 2020. Push all major institutions to shift to healthier food and shift to organic food—many good examples of institutions that have done so. However, institutional purchasing can be challenging because of missing infrastructure in the supply chain and costs. The city should encourage and support efforts to develop a local food hub or aggregations system, as discussed in this [Alliance for Sustainable Communities paper](#).

Key next step - Health Bureau to meet with Buy Fresh Buy Local—Greater Lehigh Valley to strategize the development of a local food hub or aggregations system; Health Bureau to reach out to institutional stakeholders to gauge interest.

FW5.4

Expand education on local and low-impact food options

Timeline

- ▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Improve public health and wellbeing
- ▶ Reduce inequality and poverty

City lead

- ▶ Health Bureau

Partners

- ▶ Dept. of Community & Economic Development
- ▶ Buy Fresh Buy Local—Greater Lehigh Valley
- ▶ Bethlehem Food Co-op
- ▶ BASD
- ▶ Charter/private schools
- ▶ Kellyn Foundation
- ▶ ProdHealth

Key Stakeholders

- ▶ All residents and businesses
- ▶ Local students

Partner with Buy Fresh Buy Local, the Bethlehem Food Co-op, and other local non-profits to educate residents about plant-rich diets, reducing disposal of food that is still edible, and availability of local food. Empower food choices that can provide healthier diets and reduced climate impacts.

Environmental justice considerations - Multilingual education should be provided on all changes and new programs. Identify and publicize minority-owned farms in education materials. Enhance education about seasonal eating. The program should include ethnically diverse diets and focus on culturally appropriate foods for ethnically diverse communities. It should acknowledge that plant-based diets are not medically or financially feasible for all people. Messaging should focus on reduction of meat and dairy intake, not elimination, since a healthy diet can include these. The program should provide additional resources for populations living in food deserts.

Ensure access and affordability of local/fresh food through actions like expanding/promoting farmers markets, selling “imperfect” fruits/vegetables from local farms at discounted prices, etc. Have a demo day in the courtyard outside the library (sponsored by local groups as well as the city) for people and corporations to learn about different initiatives. For example, a farmers’ market or festival with tents of vendors for educational purposes. Programs like [Fresh Food Bucks](#) and [Farmers Market Nutrition Program](#) can help reduce the costs of fresh foods for low-income residents. As part of this effort, the city should engage grocers across the city to adopt policies to sell cosmetically blemished fruit and vegetables, which can make food more affordable.

Implementation considerations - Buy Fresh Buy Local has a [robust library of existing resources](#) for the Lehigh Valley. [ProdHealth app](#) allows members to track daily food consumption and share the environmental impacts of the small changes. In coordination with strategy FW5.1, the city should connect to in-school efforts at Bethlehem Area School District (BASD), charter, and private schools in the city or with a significant number of students from Bethlehem. In coordination with strategy FW5.2, this engagement campaign should incorporate the Health Bureau’s Bethle-YUM! Program.



Key next step - Health Bureau to meet with Buy Fresh Buy Local—Greater Lehigh Valley, Bethlehem Food Co-op, and other stakeholders to gather existing education and engagement resources.

FW5.5

Eliminate food insecurity and inequity in food access

Timeline

- ▶ Near

GHG emissions impact



Community Priority



Co-benefits

- ▶ Reduce inequality and poverty
- ▶ Improve public health and wellbeing

City lead

- ▶ Health Bureau

Partners

- ▶ CADC-B
- ▶ Bethlehem Food Co-op
- ▶ New Bethany Ministries
- ▶ Second Harvest
- ▶ Kellyn Foundation
- ▶ Local food banks
- ▶ Local shelters
- ▶ Bethlehem Environmental Justice Committee

Key Stakeholders

- ▶ Low-income residents

Develop a plan to eliminate food deserts and explore opportunities to address food insecurity while reducing waste. Work with local food banks and shelters to have a repository for food. Provide tax breaks to food provisioning businesses (e.g., restaurants and grocery stores) that develop programs to address food insecurity (e.g., no-cost grocery delivery services, sale of affordable and culturally appropriate food products, job opportunities to local community members, etc.)

Environmental justice considerations - This initiative should be coupled with an initiative to expand food assistance in the area, including establishing food banks in the model of the U-District Food Bank in Seattle.

Partner with community non-profits in food deserts (e.g., Boys & Girls Club, YMCA) to receive produce donations. A “food desert” is an urban area in which it is difficult to buy affordable or good-quality fresh food (i.e., neighborhoods that lack access to a grocery store). Considerations should be made for residents who do not have access to a car.

Implementation considerations - Consider programs such as “gleaning,” where crops that would otherwise be wasted are harvested and donated. The city should utilize the PA DEP’s Food Recovery Infrastructure Grant Program. Provide educational resources to promote more gardening at school, at home, and in community gardens.

Key next step



Health Bureau to assess the infrastructure needs of food pantries and their ability to accept fresh foods; Health Bureau engage local community organizations such as Community Action to complete a comprehensive mapping of Bethlehem’s food deserts.

Remaining gaps

The strategies in this chapter address the main sources of emissions and reduction opportunities in the waste sector—but baseline waste emissions in the city’s community-wide GHG inventory are currently a high-level estimate. Lacking primary data from transfer stations at the time of inventory compilation, the city’s waste emissions calculation conservatively assumes that all waste is landfilled with the direct release of landfill methane gas to the atmosphere. This is acknowledged as a conservative overstatement, as some landfill gas is known to be flared. According to the city’s 2017 GHG inventory, this calculation of waste emissions represents nearly 10% of Bethlehem’s GHG emissions. In many cities, waste emissions account for 1–5% of GHG emissions, so Bethlehem’s percentage is likely to decline as better data is obtained. The city should engage waste haulers, transfer stations, and the local county governments to refine data and improve these calculations.

Additionally, the city’s GHG inventory does not include upstream embedded emissions resulting from the production and shipment of food, water, fuel, building materials, and consumer products produced outside city limits and imported in for consumption. This category, sometimes referred to as consumption-based emissions, would be a significant percentage of the city’s overall footprint, but it is difficult to calculate and influence reductions via human behavior changes precisely. Bethlehem acknowledges the importance of these upstream emissions, but in accordance with the GPC, they are not included in the city’s current inventory. The city will aim to assess these emissions in a future update of this plan as per strategy FW3.2.

Implementation

Multiple state bills, including the Zero Waste PA package, currently support Bethlehem’s zero waste goal. To progress toward the immediate term’s objective, the city will engage with experienced partners who have been making progress toward zero waste and local food in Bethlehem for years. These key partners include:

- Buy Fresh Buy Local
- Bethlehem Food Co-Op
- Community Action [CADC-B, Food Policy Council, Seed Farm, Second Harvest Food Bank]
- Kellyn Foundation
- ProdHealth
- Rodale Institute
- Local farmers’ markets
- Lehigh University’s Sustainable and Healthful Food Purchasing Policy
- The Easton Compost Program

Critical first steps for implementation include:

- Form a city waste working group with representation from stakeholder organizations, private waste haulers and transfer stations, and underserved communities
- Engage private waste haulers, transfer stations, and county governments to gather data needed to refine the city’s baseline waste emissions calculations and assess gaps
- Form a city food working group with representation from stakeholder organizations, local food growers, and underserved communities
- Coordinate with City Council, EAC, and relevant city departments to review and assess ordinance updates that can result in quick wins
- When the position is created and hired, work with the Bethlehem Sustainability Director to prioritize additional actions
- When the council is created and launched, work with the Bethlehem Climate and Environmental Justice Council to assess food deserts and equity in Bethlehem’s waste and food systems

The Implementation Strategy chapter provides further details on the timeline for implementing this chapter and the coordination of this chapter with the strategies of other sections of the CAP.

Public Engagement

objectives

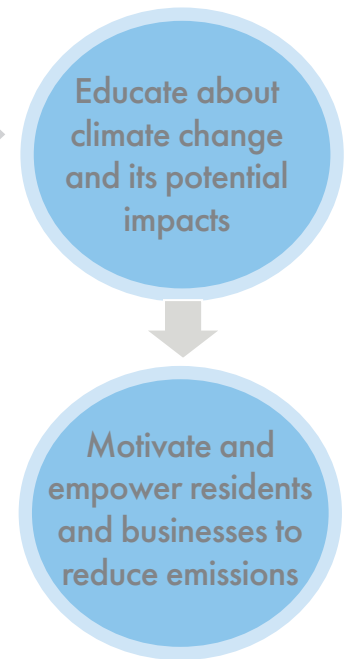
Education is critical to achieving the city’s emissions goals. Through public education and engagement, the City can accelerate behavior changes to mitigate the community’s GHG footprint and to address climate injustice.

From switching to renewable energy, skipping a car trip, or taking public transit, almost every strategy in this plan relies on behavior change. Behavior changes can not only reduce emissions, they can also create support and momentum for more impactful policy changes as people shift their identities to match their actions. The city has an opportunity through public education and engagement to accelerate behavior changes to mitigate the community’s GHG footprint while also working to address climate injustice. Education is the fabric that ties the sections of this plan together, and it is critical to achieving the city’s goals. Nowhere is this truer than in Bethlehem’s schools—from Bethlehem Area School District (BASD) to the local universities and colleges—where education can spark young imaginations and activism to create broader change—within the city and beyond.

This chapter's overall objective is to create a “Bethlehem Climate Challenge” program to educate about climate change and its potential impacts and motivate and empower residents and businesses to reduce emissions and participate in creating a resilient community. To achieve this, the city will build upon the work of many successful local organizations and campaigns, ranging from the Nurture Nature Center and the Alliance for Sustainable Communities — Lehigh Valley to Bethlehem’s three institutions of higher learning. The city must overcome challenges, including the fact that public awareness and prioritization of climate change often do not match the problem's scale. There are numerous competing priorities for public attention, including

those causing more immediate harm, such as COVID-19. Although the city developed this CAP during the COVID-19 pandemic, the strategies of this chapter anticipate a future where in-person outreach can be done safely. As long as in-person engagement presents safety concerns, most of the strategies in this chapter can be adapted and implemented virtually.

The city understands that education or engagement alone do not necessarily lead to behavior change. The desired outcomes for individual strategies in this chapter will determine the behavior change approach that should be used. But an approach grounded in the psychological aspects of behavior change is essential. For example, community-based social marketing, which emphasizes direct contact among community members and removes structural barriers, has successfully fostered sustainable behaviors in many contexts. Lastly, the city must recognize that education may not always be the right term to use as it expands engagement on climate and works toward this goal. As it does, it can help to accelerate systemic change and amplify the effectiveness of all the strategies in this plan.





Objective and goals

The Public Engagement section of the Bethlehem Climate Action Plan's primary objective is to create a "Bethlehem Climate Challenge" program to educate about climate change and its potential impacts and motivate and empower residents and businesses to reduce emissions and participate in creating a resilient community. This objective will be accomplished through strategies that target six specific impact goals:

- Increase understanding of the urgency of climate change, its impacts, and the co-benefits of acting now, especially related to human health
- Increase understanding of powerful climate, health, and environmental impacts of food grown organically without synthetic chemicals
- Increase understanding of recycling guidelines and waste minimization strategies
- Increase awareness of incentives for energy efficiency upgrades
- Increase awareness of opportunities to switch to renewable electricity
- Increase stewardship of the city and its resources

Strategies & actions

The list below defines a series of strategies and action steps to achieve the objectives defined above. This list was developed by the Bethlehem Climate Action Plan Stakeholder Working Group on Public Engagement with input from the Environmental Justice and Equity Steering Committee and further refined by the full Bethlehem CAP Stakeholder Working Group.

Prior to launching the expanded education campaigns described below, the city should investigate and decide a behavior change framework to utilize and guide implementation. Frameworks may vary depending on the specific strategy and associated objectives, but selecting an overall approach, such as community-based social marketing, will result in improved outcomes and more durable behavior change.

“

Without resident understanding and buy-in, this will not be as successful as it has the potential to be.

“

A lot of people are simply not aware of other options they have for energy sources, so this is important because it becomes a consideration in their minds.

“

In this very turbulent time, everyone has a long road to change behavior. It will take a very large educational component and buy in from businesses, government and residents

GOAL: Create a 'Bethlehem Climate Challenge' program to educate, motivate and empower residents and businesses to reduce GHG emissions and make the community more sustainable


PE1.1 Initiate a 'Bethlehem Climate Challenge' public outreach/educational program about the importance of mitigating GHG emissions and creating a resilient community

Timeline	GHG emissions impact	Co-benefits	City lead	Partners	Key Stakeholders
▶ Near		<ul style="list-style-type: none"> ▶ Improve public health and wellbeing ▶ Job creation ▶ Workforce development ▶ Increase climate resilience 	<ul style="list-style-type: none"> ▶ Office of Sustainability 	<ul style="list-style-type: none"> ▶ Health Bureau ▶ EAC ▶ Alliance for Sustainable Communities—Lehigh Valley ▶ Nurture Nature Center ▶ BASD ▶ Bethlehem Area Public Library ▶ Large businesses and employers in Bethlehem 	<ul style="list-style-type: none"> ▶ All residents and businesses
Community Priority					

Develop and run a campaign to generate community-wide understanding of the CAP and support for implementation. This will complement more targeted education programs addressing specific sources of emissions and strategies in the CAP, such as recycling, inequities, and food, as well as engagement programs for K-12 educators. This will provide a more general education campaign related to mitigation and adaptation that reaches the business community, the administration of the higher education institutions, and other key stakeholders.

Environmental justice considerations - Ensure representatives from Bethlehem’s frontline communities are involved in the leadership of the planning process and implementation. The city can leverage the Bethlehem Climate and Environmental Justice Council (EJ1.2). Consider how to leverage the local expertise in the Lehigh Valley to help with this program.

Implementation considerations - Leverage the Bethlehem Area School District (BASD) educational expertise to lead and/or inform this program. Also, leverage the public library to feature relevant climate-related reading, such as create a “Bethlehem Reads” initiative focused on climate education. The program should aim to instill a sense of urgency on the issue of climate change. People have many misconceptions about climate change. Families are focused on the economy, the pandemic, and other perceived short-term issues without a realization that the impacts of climate change, including increasing temperatures and extreme weather events, will exacerbate those underlying conditions and existing stressors.

 **Key next step**
 Until an Office of Sustainability can be created to facilitate this strategy, the Health Bureau will hold a meeting with the EAC to coordinate stakeholders and begin to plan the rollout of the program.

CASE STUDY



Raising community awareness

The Alliance for Sustainable Communities–Lehigh Valley is a community-based nonprofit organization that works to promote and encourage ways to make Lehigh Valley communities more sustainable. The Alliance undertakes numerous initiatives, including an [extensive local internship program](#), contributing to greater awareness and action on campuses, in BASD schools, and in the community.

- In 2006, the Alliance added a Climate Action internship. The first intern helped develop the idea for the Alliance’s Campus Sustainability internship.
- Since 2006, 26 students from all six campuses represented in the Lehigh Valley Association of Independent Colleges (LVAIC) completed the Alliance’s Campus Sustainability internship.
- In 2014, a Climate Action intern from Lehigh University developed a Climate and Sustainability Commitment for BASD; after graduation, she went on to do communications for 350.org.
- In the summer of 2018, five students from different colleges and universities completed a Sustainability Impact Assessment on the proposal to build Da Vinci Science City in Easton; it devoted significant attention to climate impacts.
- In the Fall of 2018, a student from Lehigh analyzed practices in the craft brewing industry, with a major focus on energy and climate impact. The resulting [Brewing Sustainability](#) report included checklists of actions for local craft breweries and brewpubs.
- In the summer of 2019, three students worked with café and restaurant owners and managers with a focus on sustainable practices. The [Sustainability for Cafés and Restaurants](#) report includes tools and best practices for local businesses.
- In the summer and fall of 2019, four students developed a guide for [Climate Action Planning in the Lehigh Valley](#).
- In the fall of 2020, a graduate student from Lehigh developed a proposal to increase access to local and sustainable foods. The [How Can We Connect Local Food Businesses with Local Agriculture?](#) report includes strategies relevant to the Local Food and Waste chapter of this CAP.

PE1.2 Develop a ‘Bethlehem Climate Challenge’ recognition program

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p>	<p>Co-benefits ▶ Improve system sustainability</p>	<p>City lead ▶ Office of Sustainability</p>	<p>Partners ▶ Office of Sustainability</p>	<p>Key Stakeholders ▶ All residents and businesses</p>
---	------------------------------------	---	--	---	---



Develop a recognition program that provides public recognition to students, businesses, and organizations that make significant emission reductions and other commitments to sustainability. This program can also serve as a hub for sharing strategies and best practices. Hold an annual ‘Bethlehem Climate Challenge’ awards ceremony to recognize climate-beneficial actions, including reducing emissions and making the community more resilient, by categories of recipients including students, residents, businesses, and non-profit organizations.

Environmental justice considerations - Ensure there is awareness of the program in low-income neighborhoods. Provide consultation and support to businesses in low-income communities who may want to diminish their environmental impact but do not know how.

Implementation considerations - This strategy would be a sub-component of strategy PE1.1: Establish the ‘Bethlehem Climate Challenge’ program. If the awards ceremony is held, it should minimize its environmental footprint and serve as an example of sustainability best practices to the community. In addition to annual awards, the city could develop a ratings system for businesses/organizations to be revisited on an annual basis.

Key next step Complete strategy PE1.1: Establish the ‘Bethlehem Climate Challenge’ program.


PE1.3 Develop a 'Bethlehem Climate Challenge' funding mechanism that raises awareness about the climate issue

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Improve system sustainability	City lead ▶ Office of Sustainability	Partners ▶ Dept. of Community & Economic Development ▶ Local businesses	Key Stakeholders ▶ All residents and businesses ▶ Low-income communities
Community Priority 					



Create a self-perpetuating funding source for the 'Bethlehem Climate Challenge' that in parallel raises awareness about reducing GHG emissions and increasing resiliency. Examples of such a mechanism include a voluntary 'climate charge' based on the emissions associated with select economic activities.

Environmental justice considerations - A 'climate charge' presents a serious concern that costs could be disproportionately burdened by low-income communities. Ensure these communities are exempted or rebated additional costs. Funds raised through this mechanism should be invested in frontline communities. The Bethlehem Climate and Environmental Justice Council (EJ1.2) should advise on principles and criteria for investment.

Implementation considerations - This strategy would be a sub-component of strategy PE1.1: Establish the 'Bethlehem Climate Challenge' program. Funds could help to run the program as well as invest in frontline communities.

 **Key next step**
Complete strategy PE1.1: Establish the 'Bethlehem Climate Challenge' program.

PE1.4 Consolidate public outreach and education responsibilities within city government

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Improve system sustainability	City lead ▶ Mayor's Office	Partners ▶ Health Bureau ▶ Office of Sustainability	Key Stakeholders ▶ All residents and businesses ▶ Municipal staff
Community Priority 					



Define the position responsible for coordinating sustainability- and climate-related education and outreach across city government, whether this is a newly created position, such as a Bethlehem Sustainability Director, or an existing role. This position or entity will initiate public outreach toward the goals of this CAP, determine appropriate behavior change frameworks, and work toward public recognition of the greater purview of sustainability and climate action versus recycling on its own. At the same time, this position should raise awareness and action throughout city government, including all departments and employees.

Environmental justice considerations - Make environmental justice awareness part of the mission of this office / position. The city could further provide all employees with environmental justice awareness training.

Implementation considerations - The implementation of this strategy should create holistic awareness within city government about the CAP and its implementation. All city employees should be able to discuss how their actions affect city goals for GHG mitigation and climate adaptation. This position should partner with the Health Bureau since many mitigation efforts will also have significant health benefits. This strategy should be implemented in coordination with the creation and hiring of a Sustainability Director position, as described in strategy M3.1. The results of the consolidation described in this strategy will support other engagement efforts, such as strategy PE1.6.

 **Key next step**
Mayor's Office to determine the most appropriate place to sit this position with the city's structure that will facilitate cross-departmental collaboration.

PE1.5 Design education campaigns and resources to ensure that they reduce inequity and increase opportunities for Bethlehem's most vulnerable communities


<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits ▶ Improve system sustainability</p>	<p>City lead ▶ Office of Sustainability</p>	<p>Partners ▶ Lehigh's South Side Initiative ▶ Local colleges and universities ▶ BASD ▶ Bethlehem Environmental Justice Council</p>	<p>Key Stakeholders ▶ All residents and businesses</p>
--	--	---	--	--	---

Make environmental justice and equity key criteria for designing city education campaigns and resources. This includes focusing engagement in traditionally underserved areas, particularly low-income areas where actions to reduce energy can save residents money. Education and engagement materials should be multilingual and meet residents where they live. The city should also expand and improve its methods of communication to include:


1. Human, face-to-face outreach to schools; and
2. Visible messaging in all neighborhoods and high-traffic areas to present climate-related and sustainability content where people live.

Environmental justice considerations - Education should be two-way, and all materials should be multi-lingual. The program should start by learning about energy needs and constraints faced by low-income community members. This avoids the situation of trying to “educate” people about something they cannot control because they lack resources. Education materials should be different depending on whether speaking to renters or homeowners. The program should also develop education targeting landlords (versus renters). Work with BASD to commit to elevating the importance of climate impacts on vulnerable groups in curricula.

Implementation considerations - Consider leveraging existing social and EJ initiatives on local college and university campuses and adapting campus initiatives to citywide programming. The program should develop clear links between climate action and health, but also how saving energy saves money. The initiative should recognize that communications from the city will not be nearly as important as actions taken by schools, small organizations, and faith groups.

 **Key next step**
Office of Sustainability to meet with Bethlehem Environmental Justice Council to determine key community stakeholders and existing EJ initiatives to leverage.

PE1.6 Use the City of Bethlehem newsletter to regularly highlight sustainability-related information on the city's website

<p>Timeline ▶ Near</p> <p>Community Priority </p>	<p>GHG emissions impact</p> 	<p>Co-benefits ▶ Improve system sustainability</p>	<p>City lead ▶ Office of Sustainability</p>	<p>Partners ▶ Dept. of Community & Economic Development ▶ Alliance for Sustainable Communities—Lehigh Valley ▶ BASD</p>	<p>Key Stakeholders ▶ All residents and businesses ▶ Municipal staff</p>
--	--	---	--	--	---


Creating a regular sustainability feature of the newsletter will help make conservation, sustainability, and climate change front-of-mind for residents and businesses while also increasing awareness of resources that can be difficult to find on the city's website.

Environmental justice considerations - This newsletter should be multilingual. The sustainability feature should regularly include Black, Indigenous, and People of Color (BIPOC) voices who are organizing sustainable activities in their communities.

Implementation considerations - Coordinate with the Alliance for Sustainable Communities—Lehigh Valley's sustainability efforts, including incorporating content into the Sustainable Lehigh Valley booklet. Consider the possibility of student internships to write and develop content and assist with other awareness programs. This should be an immediate action, but also continue for the long-term. In parallel to this strategy, the city should work to better highlight sustainability and climate information on the city's website -- preferably with a sustainability office and a designated sustainability officer.

 **Key next step**
Dept. of Community & Economic Development to consult the Office of Sustainability for developing this feature. Until the Office of Sustainability is formed, Dept. of Community & Economic Development will work with Alliance for Sustainable Communities and outside stakeholders.

PE1.7 Encourage the expansion of environmental education in K-12 curricula


Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Workforce development ▶ Job creation ▶ Increase system sustainability	City lead ▶ Office of Sustainability	Partners ▶ BASD ▶ Lehigh University's College of Education ▶ Moravian College ▶ Alliance for Sustainable Communities–Lehigh Valley ▶ Camel's Hump Farm	Key Stakeholders ▶ All residents and businesses ▶ Local students
---------------------------	--	---	--	--	---

Community Priority 

Work with the BASD administration to fulfill its [2014 written commitment](#) to including climate change across its curricula, including public engagement; this will also help raise awareness with students' family members. Engage BASD to evaluate current environmental education courses and explore the expansion of coursework focused on climate and sustainability for all students. Work with (and possibly fund) Lehigh University and Moravian College education and environmental programs to enhance K-12 environmental education in Bethlehem for public and private schools, with a special focus on the climate emergency.

Environmental justice considerations - Incorporate environmental justice education into curricula and create opportunities for community engagement, including events such as Touchstone's Sustainability Forum, which provided local students with opportunities to express themselves on these issues. Ensure environmental education extends beyond environmental science classes (often not available to all students) and includes hands-on learning experiences to appeal to those who learn better by "doing" than by reading/lectures.

Implementation considerations - Coordinate with Lehigh University's College of Education—Al Bodzin specializes in sustainability and environmental education. Moravian College has a strong Education Department and Sustainability Awareness. A M.Ed. program would be a good way to get action research projects to look at some implementation steps. The Alliance for Sustainable Communities [Recommended Action Steps](#) provides opportunities for students' creative work, both written and visual arts.

 **Key next step**
 Office of Sustainability to leverage the Alliance for Sustainable Communities Recommended Action Steps and then convene a meeting of relevant stakeholders, including BASD.

PE1.8 Request and support business groups to develop campaigns and programs to engage local business owners on sustainability


Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Workforce development ▶ Improve system sustainability	City lead ▶ Dept. of Community and Economic Development	Partners ▶ Chamber of Commerce, local businesses ▶ Downtown Bethlehem Association ▶ Office of Sustainability	Key Stakeholders ▶ All residents and businesses
---------------------------	---	--	---	--	---

Community Priority 

Work with the Chamber of Commerce and other local business groups to develop educational workshops, recognition programs, incentives to reduce energy waste, and other engagement programs targeting local Bethlehem businesses.

Environmental justice considerations - Provide grants to small, minority-owned local businesses.

Implementation considerations - Involve WDIY (Lehigh Valley Public Radio), Bethlehem Press. This strategy should be coordinated with engagement of large organizations and institutions, particularly the Bethlehem Green Ribbon Commission (strategy LO11) and Bethlehem Carbon Challenge (LO12).

 **Key next step**
 Dept. of Community and Economic Development to coordinate with Office of Sustainability and integrate this strategy with the large organizations and institutions strategies: Bethlehem Green Ribbon Commission and Bethlehem Carbon Challenge.

Sector-specific strategies

Every strategy in this CAP requires public engagement, but certain sector-specific strategies are focused on outreach and education. In coordination with the general public engagement strategies above, the city will conduct a series of sector-specific public engagement and education campaigns targeted toward GHG mitigation and climate adaptation in specific sectors. These strategies are listed in the sector-specific mitigation and adaptation chapters of the CAP. The following table summarizes the sector-specific engagement strategies so they can be coordinated with the broader Bethlehem Climate Challenge program (PE1.1) and the other general engagement strategies in this chapter.

Sector	Strategy Number	Strategy Name
Municipal Operations	M3.3	Lead by example and provide a testing ground for strategies that can be scaled to the rest of the community
Municipal Operations	M3.4	Coordinate working groups of key stakeholders to initiate implementation of each CAP section
Buildings	B3.4	Promote implementation of Commercial Property-Assessed Clean Energy (C-PACE) financing
Buildings	B3.8	Encourage existing building owners to submeter their buildings to support increased energy conservation
Buildings	B3.9	Partner with utilities to increase awareness of opportunities for energy audits, incentives for energy efficiency improvements, and other energy energy-saving measures
Buildings	B4.1	Encourage building developers to submeter their buildings to support increased energy conservation
Electricity Sourcing	E1.1	Educate the community and local businesses on the benefits of renewable energy
Electricity Sourcing	E1.4	Promote existing incentives for renewable energy installation and drive creation of new incentives
Electricity Sourcing	E1.5	Increase knowledge of renewable energy options in addition to electrical
Electricity Sourcing	E2.1	Implement a recognition program to incentivize transparency and adoption of renewable energy use
Electricity Sourcing	E2.2	Promote adoption of on-site solar
Transportation and Mobility	T1.4	Enhance bike-to-work initiatives, events, resources, and benefits
Transportation and Mobility	T1.5	Educate to build a bicycling traffic culture of patience and respect among all road users
Transportation and Mobility	T1.8	Encourage alternate transportation methods to people who drive cars
Land Use and Green Space	L3.7	Create education materials to help residents maintain their landscaping and avoid synthetic fertilizers and pesticides to maximize carbon sequestration and healthy soil
Land Use and Green Space	L2.7	Engage and incentivize residents and businesses about the options and benefits of conserving their own land
Local Food and Waste	FW1.7	Conduct a public education campaign to improve waste management practices
Local Food and Waste	FW2.6	Responsible waste management recognition program for local businesses
Local Food and Waste	FW2.7	Make recycling easier via education and new resources
Local Food and Waste	FW3.4	Provide waste audits to businesses
Local Food and Waste	FW5.1	Work with schools to promote healthy eating
Local Food and Waste	FW5.4	Expand education on local and low-impact food options

Sector	Strategy Number	Strategy Name
Large Organizations and Institutions	LO11	Bethlehem Green Ribbon Commission
Large Organizations and Institutions	LO12	Bethlehem Carbon Challenge
Adaptation - Education	AE1	Disseminate strategies to help people and businesses to reduce heat gain and cooling demand by installing awnings, light shelves, and other similar approaches
Adaptation - Education	AE2	Continue to educate and expand educational outreach to the public on availability of Low-Income Housing Energy Assistance Program (LIHEAP)
Adaptation - Education	AE3	Educate staff at all infrastructure agencies, including the city Department of Public Works, LANTA, PPL, and others, about projected climate change impacts to inform the agencies' approach to adaptation
Adaptation - Education	AE4	Raise public awareness of energy and water conservation issues, trends, news, and resources through the consistent use of social media, public service announcements and websites, as well as events in the city.
Adaptation - Education	AE5	Actively publicize best practices, both in the home and business, about the appropriate use of renewables, weatherization, reduce/reuse/recycling, strategic daylight harvesting (the use of daylight to offset electric lighting), natural heating/cooling and other conservation efforts to reduce energy consumption and create healthier environments.
Adaptation - Education	AE6	Develop partnerships with local community groups and businesses to encourage climate resilient practices
Adaptation - Education	AE7	Post recommendations to mitigate heat impacts to health at key public locations during the summer months (e.g., public buildings, transit stops, etc.)
Adaptation - Education	AE8	Educate the community on how to prepare, respond, and recover from flood events (including which flooded items inundated by flood waters must be discarded and which can be cleaned and maintained), including preparedness kit, evacuation location, and what resources are available to help recover afterwards.
Adaptation - Education	AE9	Develop relationships between the city and environmental clubs at high schools to inform and deliver climate education efforts
Adaptation - Education	AE10	Develop relationships between the city and retirement/adult communities to inform and deliver climate education efforts

Implementation

To implement the strategies in this chapter, the city will leverage the expertise and existing resources developed by experienced local organizations, such as Alliance for Sustainable Communities—Lehigh Valley, the Bethlehem Food Co-Op, the Nurture Nature Center, and the Environmental Advisory Council (EAC), as well as the wealth of educator talent, knowledge and experience across the faculties of Bethlehem’s higher education institutions and BASD.

Critical first steps for implementation include:

- Define the position responsible for coordinating sustainability- and climate-related education and outreach across city government, whether this is a newly created position, such as the Bethlehem Sustainability Director, or an existing role
- Use the City of Bethlehem newsletter to highlight the release of the CAP and develop a plan to regularly feature sustainability-related information on the city's website and newsletter
- When the council is created and launched, work with the Bethlehem Climate and Environmental Justice Council to assess how effectively the city’s existing outreach and communication methods reach low-income and frontline communities, including a review of multilingual accessibility
- Leverage existing educational materials, such as those created by the EAC, to begin implementing strategies designated as having immediate timeframes in this chapter. In particular, develop and launch a public outreach/education campaign to generate awareness and support for the CAP, including the importance of mitigating emissions and creating a resilient community.

The Implementation Strategy chapter provides further details on the timeline for implementing this chapter and the coordination of this chapter with the strategies of other sections of the CAP.



Large Organizations and Institutions objective

Bethlehem is home to many world-class organizations and institutions, spanning the academic, health care, and arts sectors. These organizations and institutions play a critical role in driving climate action in the City.

Introduction

Bethlehem is home to many world-class organizations and institutions, spanning the academic, health care, and arts sectors. Many of these organizations and institutions are quite akin to small cities, with buildings and facilities, transportation systems, waste management programs, and open space resources to manage—and leverage—to achieve the city’s climate goals. These organizations and institutions play a critical role in driving climate action in Bethlehem by managing large real estate assets and the broad and diverse stakeholder base that makes up their students, patients, visitors, patrons, and employees.

While the city’s large organizations and institutions have a prime opportunity to exert leadership in driving Bethlehem’s climate actions, they face some challenges and barriers. As large, complex entities, organizational leadership is paramount to ensure support for strategies among stakeholders. Competition for funding resources requires focused attention on the most cost-effective strategies, and creative sourcing of alternative funding sources, such as grants.

Perhaps most critically, these organizations and institutions will derive the most significant benefit from Bethlehem’s new climate action plan through partnerships—with each other, with private sector entities, and with the city—to develop and implement strategies that are most appropriate and effective for their unique

characteristics. By sharing best practices, many currently underway, and collaborating on new initiatives, the city’s organizations and institutions can accelerate the city’s climate action strategies.

Objective and goals

The objectives of the Large Organizations and Institutions section of the Bethlehem Climate Action Plan are to:

- Engage Bethlehem’s largest businesses, organizations, and institutions to adopt GHG reduction goals as or more ambitious than the city’s targets
- Leverage the scale and resources of Bethlehem’s largest businesses, organizations, and institutions to accelerate adoption of the CAP’s other strategies and coordinate their implementation
- Facilitate sharing of lessons learned, resources and best-practice examples to encourage and enable other organizations to implement strategies that will help the city meet its emission reduction targets



CASE STUDY

Saving energy and money



Bethlehem Area School District (BASD) is committed to taking action on climate change by reducing energy use and developing a plan for reducing greenhouse gases. Since becoming an EPA Energy Star partner in 2010, BASD has achieved Energy Star certification at 19 of its 22 schools throughout this period. The EPA recognized the District for its environmental leadership in 2015.

The BASD conservation program has avoided \$16 million in costs over its 10 years of conservation program. This has reduced the annual budget by over \$2 million, providing a win for taxpayers. There is zero or no up-front cost for most improvements, which focus on operations, such as reducing equipment run time, adjusting temperature set points, and operating central plants tightly around occupancy.

Broughal Middle School is a Leadership in Energy and Environmental Design (LEED) Gold school, and in 2013 won a U.S. Department of Education Green Ribbon award for environmental excellence. The U.S. Green Building Council provides a series of qualifications for how buildings are planned, constructed, maintained and operated. Based on the number of points achieved, a project then receives one of four LEED rating levels: Certified, Silver, Gold and Platinum. More recently, Nitschmann Middle School was also recognized as achieving the LEED Gold standard. The District also has solar panels at five schools, which supply nine percent of the District's total power needs.

Strategies

The list below presents strategies and action steps to achieve the objectives defined above. This list was developed by the Bethlehem Climate Action Plan Stakeholder Working Group on Large Organizations and Institutions. Because so many of the CAP's strategies are also applicable to its large organizations and institutions, the City of Bethlehem proposes establishing two initiatives that will be led by the city's organizations and institutions, rather than duplicating many of the other strategies found through this CAP.



Adjusting to a sustainable future involves the creation of more jobs and saving money in the long run even though we put money towards it now.



Have bigger businesses be part of the conversation and solution.



Businesses want to be efficient. Energy audits help this goal while simultaneously helping the environment.



LOI.1 | **Bethlehem Green Ribbon Commission**

Timeline

▶ Near

Community Priority



GHG emissions impact



Co-benefits

- ▶ Workforce development
- ▶ Improve system sustainability

City lead

- ▶ Office of Sustainability

Partners

- ▶ Dept. of Community and Economic Development
- ▶ Lehigh University
- ▶ Moravian College
- ▶ Northampton Community College
- ▶ Chamber of Commerce
- ▶ LVPC
- ▶ ArtsQuest
- ▶ LVHN
- ▶ Bethlehem Area School District

Key Stakeholders

- ▶ Large organizations and institutions
- ▶ Local businesses

The Bethlehem Green Ribbon Commission will be a partnership between the city's large organizations, institutions, businesses, and government to develop strategies that have common benefits and implementation paths. The Green Ribbon Commission, modeled after Boston's successful Green Ribbon Commission, will support sector-specific working groups dedicated to supporting city implementation of CAP strategies affecting that sector, devising sector-specific GHG reduction pathways, removing common industry barriers, and sharing industry knowledge on decarbonization and climate preparedness. The Commission would also facilitate collaboration across all members on cross-cutting opportunities and challenges, such as renewable energy purchasing.

Environmental justice considerations - Incorporate environmental justice and equity principles into the Green Ribbon Commission's bylaws and policies. Ensure engagement with frontline communities via the Bethlehem Climate and Environmental Justice Council (EJ1.2) and other community outreach.

Implementation considerations - The city has already laid the foundation of such a body through the establishment of a stakeholder-led process to develop this CAP. As such, the constitution of this commission and its members' commitments would demonstrate the continuity of the CAP development process to create an ongoing presence driving the city's climate action agenda. The city will align and integrate the Green Ribbon Commission with similar future initiatives developed regionally in the Lehigh Valley, such as programs by LVPC. Future regional expansion would support the joint climate goals of the city, its businesses, and the broader Lehigh Valley by increasing participation, information sharing, and collaboration.



Key next step

Until Office of Sustainability is formed to coordinate this effort, Dept. of Community and Economic Development to hold a meeting with committed large organizations and institutions and determine a chairperson for the Green Ribbon Commission to lead efforts.


LOI.2 **Bethlehem Carbon Challenge**

Timeline ▶ Near	GHG emissions impact 	Co-benefits ▶ Workforce development ▶ Improve system sustainability	City lead ▶ Office of Sustainability	Partners ▶ Mayor's Office ▶ Dept. of Community and Economic Development ▶ Lehigh University ▶ Moravian College ▶ Northampton Community College ▶ Chamber of Commerce, ▶ LVPC ▶ LVHN ▶ Bethlehem Area School District	Key Stakeholders ▶ Large organizations and institutions ▶ Local businesses
Community Priority 					

Bethlehem’s large organizations and institutions have a prime opportunity to lead the process to achieve the city’s carbon reduction goals. The Bethlehem Carbon Challenge will be a voluntary leadership initiative between the Mayor’s Office and the city’s private, public, and not-for-profit organizations, institutions, and businesses to commit to achieving carbon reduction goals more ambitious than the city’s overall carbon reduction goal. Spearheaded and coordinated by the Mayor’s Office, the Carbon Challenge will clearly demonstrate the potential to achieve rapid, substantial carbon emissions reductions by implementing energy efficiency, renewable energy, low-carbon transportation, and waste reduction initiatives.

Environmental justice considerations - Incorporate environmental justice and equity principles into the Bethlehem Carbon Challenge rules and policies. Ensure engagement with frontline communities via the Bethlehem Climate and Environmental Justice Council (EJ1.2) and other community outreach. Focus on engaging businesses in frontline communities to participate in the program and receive its benefits. All materials should be multilingual.

Implementation considerations - Modeled after the successful NYC Mayor’s Carbon Challenge, the Bethlehem Carbon Challenge will provide industry-specific guidance and support to organizations in achieving their carbon reduction goals. In coordination with the Bethlehem Green Ribbon Commission, the Bethlehem Carbon Challenge will disseminate to participants tools for calculating GHG emissions inventories and tracking progress, as well as best practices and case studies to support success. Organizations that achieve their targets will be recognized prominently by the city. The city will align and integrate the Bethlehem Carbon Challenge with similar future initiatives developed regionally in the Lehigh Valley, such as programs by LVPC. Future regional expansion would support the joint climate goals of the city, its businesses, and the broader Lehigh Valley by increasing participation, information sharing, and collaboration.

 **Key next step**
 Until Office of Sustainability is formed to coordinate this effort, Dept. of Community and Economic Development to meet with Mayor’s Office to determine program details and develop a launch plan in coordination with committed large organizations and institutions.

Implementation

To implement the strategies in this chapter, the city will leverage the foundation laid through the CAP’s Working Group on Large Organizations and Institutions and the resulting commitments to the proposed strategies in this chapter. Committed organizations and institutions are listed in the table in the Partnerships and Commitments chapter. Following the release of the CAP, the city will endeavor to expand this list and coordinate with LVPC on regional efforts.

Critical first steps for implementation include:

- Formalize the Bethlehem Green Ribbon Commission and designate a representative from a large organization or institution to serve as chair to lead the rollout process

- Develop the policies, rules, and marketing for the Bethlehem Carbon Challenge
- Dept. of Community and Economic Development to work with the Chamber of Commerce and other stakeholders to engage organizations, businesses, and institutions in Bethlehem to join the Green Ribbon Commission and commit to the Carbon Challenge.

The Implementation Strategy chapter provides further details on the timeline for implementing this chapter and the coordination of this chapter with the strategies of other sections of the CAP.

CASE STUDY

Green revolving fund



It can be daunting to launch sustainability programs at large institutions. Despite interest from employees and students, organizations often get “stuck” in trying to determine where to start. To begin modestly and build on early successes, Moravian College set up a green revolving fund.

Thanks to a donation by an alumnus and his family, in 2015 Moravian established the [Green Hounds Fund](#)—a revolving loan fund for campus-based projects that advance operational efficiency and reduce the College’s environmental impact. The energy-use reductions lead to cost savings which, in turn, are used to “pay back” the loan enabling support for future projects. To date, the projects have involved conversion to LED lighting in the campus field house and gym, building floodlights and parking lot lighting, exit signs in buildings and in over 200 campus lampposts. Such a fund can be quite modest at the beginning and then build over time.

As the initial energy cost savings from these projects were determined, staff grew excited about how up-front investments could have significant

payoffs in terms of reducing operational costs (energy, maintenance, etc.). Now, several residence halls and the student union building have been renovated with LED lighting and occupancy sensors, campus heating and cooling systems have been revamped to be more energy efficient, and former water fountains have been refitted water bottle filling stations. When maintenance is needed, plumbing fixtures are replaced with water-saver fixtures. The College has developed a “[Green Guide](#)” for students and employees with simple ideas of how to reduce waste and minimize our individual and collective environmental impact.

These projects are not only are good for reducing environmental impact but are also used for educational opportunities and student service-learning projects. The practice of starting small and building from successful ideas helps an institution get “unstuck” and move forward towards making substantial sustainable change.



13

Adaptation and Resilience Strategies

The *Why Bethlehem Needs a Climate Action Plan* chapter of this plan explains the climate stresses Bethlehem can expect to experience if the world does not take immediate and significant action to reduce GHG emissions. By the end of the century, Bethlehem's annual average temperatures would be similar to Richmond, Virginia's climate from 1971 – 2000. The city will face increasing extreme heat, including 50 to 83 days above 90°F, and more frequent heavy precipitation. Historic once-in-100-years precipitation events will happen every 50 years, and the new once-in-100-year events will include more than two additional inches of precipitation.

Appendix 1A details the challenges the city will face as a result of these worsening climate hazards. These include impacts on vulnerable and general populations and vulnerabilities of infrastructure in the following sectors: buildings, communications, energy, transportation, stormwater management, wastewater management, and water supply and treatment. This chapter includes strategies to adapt to these challenges, reduce the city's risks, and make Bethlehem a more resilient city. As these strategies are implemented, the city will continue to strive for an equitable, community-driven climate preparedness process.

The tables below summarize the adaptation strategies, which are organized into five key categories:



**Assessments,
studies, and
plans**



**Proactive
adaptation
actions**



Response



**Monitor and
maintain**



Education

The strategies are organized in this order because, where appropriate, assessments or studies should help guide adaptation actions across the other strategies. Some strategies would be the responsibility of entities other than the City of Bethlehem to implement, such as strategies focused on electrical infrastructure that fall under the purview of the electric utility.

The tables themselves are organized into the 11 columns described below:

1	2	3	4	5	6	7	8	9	10	11
Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
The # of the proposed strategy.	Describes the proposed strategy.	Describes which sectors or asset types to which the strategy applies.	✓ Indicates whether the strategy is meant to address this hazard.	✓ Indicates whether the strategy is meant to address this hazard. Note that wildfire occurrence is also included within the drought column.	✓ Indicates whether the strategy is meant to address hazards, including storms, precipitation, and flooding.	✓ Indicates whether the strategy is meant to address changes in annual average temperature and precipitation.	Describes the agency or agencies that are primarily responsible for implementing or enabling implementation of the strategy. These were identified by the stakeholders, including the city.	Indicates whether stakeholders determined the strategy was low (L), medium (M), or high (H) priority for implementation.	Describes any existing efforts that may serve as a starting point for implementing the strategy.	When applicable, this column describes additional thoughts from stakeholders about the strategy, including barriers, funding needs, key areas of focus, and proactive actions.



Assessments, Studies, and Plans

The table below includes proposed actions to better understand future climate risk to key assets and systems. The purpose of these strategies is to guide and steer future actions. The category includes conducting systemwide or asset-level vulnerability assessments to understand future climate-related risks to the city's infrastructure. Further, these actions include high-level plans and strategies to prepare for future climatic conditions, such as a citywide heat event.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AA1	Conduct a city-wide vulnerability analysis to assess infrastructure and building exposure to current and future hazards (e.g., flooding, extreme heat, etc.) and prioritize assets for more detailed study.	Transportation Energy Communication Buildings	✓	✓	✓	✓	City of Bethlehem Public Works PennDOT LANTA	H		For transportation and transit, this could be done for stops and transit centers. Should also be done for roads by PennDOT and the city
AA2	Conduct vulnerability study to assess climate impacts to public health	Populations	✓	✓	✓	✓	City of Bethlehem	H		
AA3	Conduct a study to assess impacts of climate change on water supply and quality	Drinking Water	✓	✓	✓	✓	City of Bethlehem Water & Sewer Resources (WSR)	M	Build off of possible existing work (e.g., the Alliance supported by the William Penn Foundation)	
AA4	Update citywide drought management plan and strategy for drinking water to account for revised future climate change projections. This could include considering strategies for reduced cooling flows for energy, measures that would be implemented during a drought to conserve water usage (including usage of municipal effluent or brackish water; irrigation and water distribution efficiencies), and management of the Poconos (Wild Creek) water source.	Drinking Water		✓						PPL Electric is a stakeholder and potential partner to enable implementation.
AA5	Develop a stormwater model for the city to assess capacity of the drainage system for future conditions and the potential for toxin runoff.	Drainage				✓	City of Bethlehem Public Works	H		
AA6	Develop a community-focused heat response plan and heat reduction strategy, which could include deploying strategies such as implementing cooling centers, cool pavement, water fountains, and increasing urban shade. This strategy should be particularly concerned with areas that are socioeconomically vulnerable or have a high proportion of health-compromised populations.	Populations	✓				City of Bethlehem	H		Key focus area: Community education, coordination, and engagement

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AA7	Re-evaluate adopted design standards that guide construction for transportation, communications, and building infrastructure.	Transportation Communication	✓	✓	✓	✓	City of Bethlehem Community & Economic Development (CED) PPL Electric PennDOT	M	PPL Electric already addressing this for energy infrastructure, as implementing new standards for infrastructure and improving grid reliability and resilience is a tenet of the utility.	This strategy should be coordinated with the CAP's mitigation strategies to update design standards and codes, such as M1.3, B3.2, B3.3, B3.6, B4.2, E3.2, E3.3, E3.4, T1.9, T3.2, L4.1, and FW1.5.
AA8	Conduct facility-level analyses of climate adaptation options for each infrastructure asset or building (including historic properties) identified as being exposed to climate hazards in the city-wide vulnerability analysis. Actions following an assessment may include hard armoring techniques, elevating assets, and/or relocation, among others.	Transportation Energy Communication Buildings Wastewater	✓	✓	✓	✓	City of Bethlehem Public Works LANTA City of Bethlehem WSR PennDOT	M		Key focus area: data and analysis. PPL Electric is a stakeholder and potential partner to enable implementation. Transit: look at where stops and transit centers fall in relation to this analysis and create plans to adjust accordingly for safety and damage prevention. LANTA has minimal facilities in the city but could be a party to this process as a stakeholder. Water: The highest priority would be a review of the wastewater treatment plant which is surrounded by a man-made dike and the Saucon Creek.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AA9	Identify entry points to integrate climate-related risks into capital improvement plans to build facility resilience against current and potential future risk	Wastewater Drainage Drinking Water Transportation Buildings	✓	✓	✓		City of Bethlehem Public Works City of Bethlehem Planning & Zoning City of Bethlehem WSR PennDOT PPL Electric LANTA	M	WSR has an ongoing Inflow & infiltration (I&I) mitigation plan to reduce introduction of stormwater into sanitary waste system; increased attention and capital investment in this program is warranted. LANTA already has a Transit Asset Management program that regularly assesses conditions. PPL Electric already addressing this for energy infrastructure, as implementing new standards for infrastructure and improving grid reliability and resilience is a tenet of the utility.	For some assets, this could be done in conjunction with damage assessments (using damage assessment to justify where funding is needed to prevent climate-related damages) but funding may need to be provided by the city to make those enhancements.
AA10	Conduct a study to identify existing vegetation, identify where vegetation is needed (for shading, cooling, etc.), and identify drought-tolerant species and species that can survive under future climatic conditions.	Landscaping Parks and Rec	✓	✓	✓	✓	City of Bethlehem Department of Public Works	M		

Proactive Adaptation Actions



The table below includes proposed actions Bethlehem can take to prepare for and mitigate climate impacts. The purpose of these strategies is to implement strategies that reduce future risk and impacts to the city. They range from establishing citywide cooling centers for high heat events to installing battery back-up technologies. These actions are meant to improve the overall resilience of the community in advance of future climatic conditions.

CASE STUDIES



Adaptation and grid reliability

Falling trees, raging floodwaters or even curious squirrels can affect the performance of the grid. That's why PPL Electric works continuously to monitor, maintain and enhance the reliability and resiliency of the transformers, power lines, substations and other equipment used to transport electricity to customers. PPL Electric's parent company, PPL Corporation, continues to invest in its networks to continue improving reliability. Across three utility service areas, including PPL Electric, it plans to invest approximately \$14 billion from 2020 through 2024 in infrastructure investments to modernize and strengthen the grid, with projects including:

- Replacement of aging system equipment
- Installation of smart grid technology
- Construction of new lines and substations
- Rebuilding of existing lines with stronger poles and wires
- Line clearing
- Devices to guard against damage from lightning and animals
- Assessing flood risks at critical facilities, such as substations and power plants, and installing defenses where necessary

In 2019, PPL Electric's investment activities included:

- Completed a \$471 million project to replace all 1.4 million meters on its network with advanced digital meters.
- Developed a system to safely and automatically cut power to downed lines.
- Developed a distributed energy resource management system that allows better management of renewable power coming onto the grid.

Vegetation management

Effective vegetation management along distribution and transmission lines is a critical part of maintaining the reliability that PPL Electric's customers rely on. PPL Electric's vegetation management programs are designed to promote the safe and reliable operation of the electric grid, while making sure that the utility is sensitive to the concerns of property owners and its obligations to electricity customers. PPL Electric works with conservation, land management and environmental groups to advance common goals of electric reliability and environmental stewardship.

Trees and other tall vegetation need to be kept away from power lines. If they get too close, power outages can result. PPL Electric conducts tree clearance trimming throughout its service area on a consistent and planned cycle to maintain reliable service. The utility uses integrated vegetation management practices, which reduce the need for pesticides, promote healthy ecosystems, and provide measurable results, such as greater natural species diversity along rights-of-way and better control of invasive species.

CASE STUDY



High quality shelters and bus stops

High-quality bus stops with shelters are critical to making public transit more enticing to riders and also to protect riders from the extreme heat and weather that climate change is projected to bring to the Lehigh Valley. In 2013, LANTA announced plans to install up to 200 additional bus stop shelters across the Lehigh Valley. Although there is high demand for shelters from passengers, the total number of installed new shelters has fallen short thus far. Challenges include cooperation from private property owners and lack of space in urban locations to allow clearance for pedestrians on the sidewalk.

For high quality shelters and bus stops to be installed, city governments and property owners must work together with LANTA. One innovative solution pioneered by LANTA is the SolStop Bench, which provides a space-saving two-seat bench, touchless activation of a solar-powered light, and permanent schedule signage for routes serving the location. A stop on Bethlehem’s South Side received the first SolStop installation in the nation in January 2021.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AP1	Develop a strategy to retrofit critical buildings with aging electrical wiring that cannot absorb the air conditioning load.	Buildings	✓				City of Bethlehem Building Department	H	Whenever new mechanical upgrades are submitted to the Building Department the existing conditions are assessed as part of the plan review process to ensure they are capable of handling the proposed load.	Key focus area: Government infrastructure. This strategy should be coordinated with the CAP's mitigation retrofit strategies, such as M1.2, M1.3, B2.2, B3.2, and B3.3, which can reduce the electric load from air conditioning and other sources.
AP2	For areas already prone to flooding, consider purchasing property on floodplain to remain undeveloped or other approaches to ban development.	Buildings			✓		City of Bethlehem Public Works	H		
AP3	Establish cooling centers citywide.	Buildings Populations	✓				City of Bethlehem	H		

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AP4	<p>Assess zoning and building codes to identify ways to improve resilience and incorporate green building standards.</p> <p>Resilience:</p> <ul style="list-style-type: none"> – Reduce impervious surfaces – Reduce development in floodplains – Incentivize elevation of private property <p>Green strategies:</p> <ul style="list-style-type: none"> – Energy efficiency – Water conservation – Native landscaping – Light-colored roofing materials 	Buildings Energy	✓	✓	✓	✓	<p>City of Bethlehem Community & Economic Development (CED) Building Department</p> <p>City of Bethlehem Planning and Zoning</p>	H	<p>Building Department: All new construction and significant addition/renovations are subject to an energy review as part of the plan review process. This is a comprehensive review and includes almost all of the items in the action item box</p> <p>The city has adopted the 2015 International Building Codes, which includes the 2015 Energy Code, which allows for the incorporation of green building practices</p>	<p>Key focus area: energy efficiency and conservation (EE&C).</p> <p>Should link with already established standards and funding/grants. This strategy should be coordinated with the CAP's mitigation strategies to update zoning and building codes, such as M1.3, B3.2, B3.3, B3.6, B4.2, E3.2, E3.3, E3.4, T1.9, T3.2, L4.1, and FW1.5.</p>
AP5	<p>Improve building energy, cooling system, and manufacturing efficiencies and demand response capabilities (e.g., smart grid) possibly through the administration of community grants</p>	Buildings Energy	✓				<p>City of Bethlehem Public Works Building Department</p> <p>City of Bethlehem (Planning & Zoning) Private sector building owners Developers</p>	H	<p>The city has adopted the 2015 International Building Codes, which includes the 2015 Energy Code, which allows for the incorporation of green building practices</p>	<p>This strategy should be coordinated with the mitigation goals and strategies in the CAP's Buildings chapter. PPL Electric is a stakeholder and potential partner to enable implementation.</p>
AP6	<p>Review energy backup supply plan for grid interruptions</p>	Energy	✓	✓	✓		City of Bethlehem	H		

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AP7	Develop a working group to establish coordination between communications companies, utilities, and the city to facilitate cooperation for climate adaptation efforts	Communication Energy	✓	✓	✓	✓	Could be coordinated by future Sustainability Officer, Homeowners Associations (HOAs) of new communities	H		
AP8	Develop energy strategies to (1) diversify energy supply chain with renewable sources that are not water-dependent and to evaluate dry/hybrid cooling technologies, and (2) improve reliability of grid systems and reduce dependence on regional grid through backup power supply, intelligent controls, and distributed generation	Energy Wastewater Drinking Water	✓	✓	✓		City of Bethlehem WSR Electric distribution company (EDC): Grid reliability and infrastructure Customers: Back-up generation	H	City of Bethlehem overall has a renewable electric portfolio for municipal operations. Water & Sewer Resources (WSR) will contemplate co-generation using a combined heat/power plant at some point when economically justified. WSR in process of upgrading its back-up emergency power systems	Key focus areas: city-specific infrastructure and distributed generation. This strategy should be coordinated with the mitigation goals and strategies in the CAP's <i>Electricity Sourcing</i> chapter.
AP9	Review and enhance emergency response plans and coordination to deal with events of a severity that have not been seen before locally	Energy Transportation Drinking Water Wastewater Drainage	✓	✓	✓		City of Bethlehem: Future Sustainability Office could coordinate action between various sectors, LANTA, PPL Electric, PennDOT, police department, fire department, emergency medical services	H	City Water & Sewer Resources (WSR) has an emergency response plan; incorporating potential climate related impacts warranted in the future	

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AP10	Develop a strategy to increase shade across the city using tree species capable of withstanding future climatic conditions	Landscaping	✓				City of Bethlehem Forester Also: Planning & Zoning (ordinances), Public Works Could be coordinated through Sustainability Office City/Developers	H		This strategy should be coordinated with the mitigation goals and strategies in the CAP's Land Use and Green Space chapter, including L2.1 through L2.9 and L3.1 through L3.6.
AP11	Update strategy to clean and maintain culverts to make sure they are functioning properly and can handle increased flows	Culverts			✓		City of Bethlehem Public Works	H	Existing culvert cleaning strategy	
AP12	Enhance forest management near drinking water supply to reduce the risk of wildfires and runoff-induced sediment/debris that may occur after wildfire and storm events	Drinking Water Wastewater Drainage		✓	✓		City of Bethlehem WSR	H	WSR has an active forest management plan in place and has engaged a contract forester for many years to assist with timbering, controlled burns, tree plantings, carbon credits, runoff control, etc.	
AP13	Develop ways to encourage and require greater use of graywater systems to reduce demand for treated water	Drinking Water		✓			City of Bethlehem WSR	M		This strategy should be coordinated with L6.2 and other related mitigation strategies.
AP14	Enhance water treatment capabilities to address long-term changes to source water quality (e.g., stormwater runoff surges during heavy precipitation events/turbidity)	Drinking Water Wastewater Drainage			✓		City of Bethlehem WSR	M		
AP15	Practice water conservation and demand management through water metering, rebates for water-conserving appliances/toilets, and/or rainwater harvesting tanks, which may involve updating the existing drought management plan administered by WSR	Drinking Water		✓			City of Bethlehem WSR	M	WSR Drought Management Plan	This strategy should be coordinated with L6.2 and other related mitigation strategies in the Land Use & Green Space chapter.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AP16	Review whether regional water connections can be expanded to allow for water trading in times of service disruption or shortage	Drinking Water		✓			City of Bethlehem WSR	M	WSR is currently working with adjacent water utilities to evaluate and eventually recommend expansion of existing interconnects which would allow utilities to back each other up in cases of service disruptions or shortages	
AP17	Establish a city-issued grant program to provide capital to property owners to retrofit private properties.	Buildings	✓		✓		City of Bethlehem Building Department	M		Key focus area: Private properties. This strategy should be coordinated with the CAP's mitigation retrofit strategies, such as M1.2, M1.3, B2.2, B3.2, and B3.3. Allocation of city capital should be evaluated relative to other uses that align with the CAP's objectives.
AP18	Set aside land to support potential future flood-proofing needs (e.g., berms, dikes, and retractable gates)	Buildings			✓		City of Bethlehem Public Works City of Bethlehem Planning & Zoning LANTA	M	LANTA already has a Transit Asset Management program that regularly assesses conditions.	For public transit, this could be done in conjunction with damage assessments (using damage assessment to justify where funding is needed to prevent climate-related damages). Funding may need to be provided by the city to make those enhancements.
AP19	Adjust landscape maintenance plans to require less maintenance, such as reduced water use and use species capable of withstanding future climate conditions and landscape with a goal of stormwater management	Landscaping Parks and Recreation Transportation (e.g., transit stops)	✓	✓		✓	City of Bethlehem Public Works Developers PennDOT LANTA (in cases of bus stops)	M		This strategy should be coordinated with L6.1, L6.2, L6.3, and other related mitigation strategies in the <i>Land Use & Green Space</i> chapter.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AP20	Identify transit stops that would benefit from the installation of protective shelters from extreme heat and/or heavy precipitation	Transit	✓		✓		LANTA City of Bethlehem	M	LANTA has been identifying stops along enhanced service routes that will have improved shelter amenities, but most stops will remain just a sign. The city could work with LANTA to investigate ways to shade stops.	LANTA's shelter and street furniture budget is limited. Additional funding is needed to expedite these improvements. Consider corporation sponsored shelters to raise capital. This strategy should be coordinated with related mitigation strategies in the CAP's Transportation & Mobility chapter, such as T1.1.
AP21	Develop a strategy to pre-position equipment, materials, and other resources to respond to a disruption and/or support recovery	Roads Bridges Culverts			✓		City of Bethlehem Public Works	M		Key focus area: Emergency preparedness
AP22	Conduct preventative maintenance, including vegetation management, on power lines and other essential system infrastructure	Fixed Line			✓		Power-lines—PPL Electric Power line maintenance is the responsibility of the electric distribution company (EDC)—it should not be conducted by anyone other than the utility.	M	PPL Electric has a robust tree-trimming program in place.	Key focus area: Improve reliability
AP23	Develop relationships between the city and prominent community groups that engage with Black and brown communities to facilitate meaningful engagement	Populations	✓	✓	✓	✓	City of Bethlehem	M		These strategies should be coordinated through the Bethlehem Climate and Environmental Justice Council once it is established via EJ1.2.
AP24	Install battery-backup technologies or other energy-storage systems, such as solar PV link to battery, in publicly owned housing complexes to support air conditioning usage on high-demand days	Energy Buildings	✓				Outside partner: SunRun	L		This is only an issue if grid reliability wanes or there is an outage during extreme heat. This strategy should be coordinated with mitigation strategies focused on distributed generation in the Electricity Sourcing chapter, such as E3.2, E3.3, and E3.4.
AP25	Consider providing/generating funding for electric energy efficiency and conservation (EE&C) measures for private property owners.	Energy Buildings	✓			✓	City of Bethlehem	L		This strategy should be coordinated with the mitigation goals and strategies in the CAP's Buildings chapter, particularly B2.2, B3.1, and B3.3.

Response



The table below includes proposed actions Bethlehem can take during and following a climate-related event. The purpose of these strategies is to improve the resilience of event-response capabilities and to improve resilience immediately following an event such as a severe storm. These strategies focus on emergency management and improving systems during recovery from climate-related events.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AR1	Develop record keeping to track damages, repair costs, and loss of service duration during events	Transportation Energy Drinking Water Wastewater Communications	✓		✓		PPL Electric City of Bethlehem WSR PennDOT LANTA	H	City of Bethlehem already has a mechanism for tracking costs due to storms or other events.	Key focus area: Data & Analysis Identify areas of degradations and focus on adaptation for those identified areas LANTA could look into what damages/emergency route changes have been required
AR2	Create flood emergency detour routes for roads that commonly flood	Transportation			✓		City of Bethlehem Public Works LANTA	H		Key focus area: Emergency Preparedness Anticipatory emergency routing could save a lot of time and chaos as these events become more prevalent. Use vulnerability studies to plan routing needs. Could develop a brochure, similar to what is developed for snow emergencies
AR3	Following an event, implement betterments (design enhancements to prevent a repeat failure) rather than opting to build back as before	Roads Bridges Culverts			✓		City of Bethlehem Public Works PennDOT	H		Establish a task force to assess events and impacts to understand damage and loss and then make recommendations to “build back better”

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AR4	Ensure reliable backup power to cell towers with sufficient fuel supply for extended grid power outages.	Mobile Line	✓		✓		Telecom networks and private cell tower owners	H		<p>Key focus area: emergency preparedness</p> <p>Begin with coordination with telecom companies. Consider designating mobile phone service 'essential' with required backup systems in place.</p> <p>Broader coordination required but unclear who pulls those levers.</p> <p>Barrier: ownership is a tangled web of independent private companies.</p>
AR5	Establish accessible evacuation centers, particularly for frontline communities, and ensure they are outside of climate hazard zones in the future. Make these centers known to communities before an event.	Buildings Populations At Risk Populations			✓		City of Bethlehem Emergency Management	M		Key focus area: emergency preparedness
AR6	Prepare an emergency management plan to provide alternate means for communicating during extreme events for city emergency staff and to alert the public of key information	Fixed Line Mobile Line			✓		City of Bethlehem Emergency Management Telecommunication companies	M		Key focus area: emergency preparedness
AR7	Establish a city volunteer landscape corps to plant climate resilient vegetation and improve shade across the city	Public spaces	✓	✓	✓	✓	City of Bethlehem Public Works	L		This strategy should be coordinated with strategy AP10 as well as the mitigation goals and strategies in the CAP's Land Use and Green Space chapter, including L2.1 through L2.9 and L3.1 though L3.6.

Monitor and Maintain



The table below includes proposed actions for Bethlehem city departments to take to maintain data on, and an awareness of, asset conditions. The key to successfully improving resilience is assessing the state of infrastructure and maintaining it based on these assessments. The following strategies are focused on implementing practices to continue monitoring the state of assets and collecting data that will help inform infrastructure resilience strategies and actions, such as adjusted maintenance schedules.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AM1	Monitor transportation asset performance for roads, culverts, bridges, and rail during extreme weather events and take adaptive action at poorly performing assets	Transportation	✓		✓		City of Bethlehem Public Works LANTA PennDOT	H		Create a flood emergency detour brochure and list similar to what is used for snow emergencies
AM2	Continue monitoring surface water conditions, including water quality, in receiving bodies	Wastewater			✓		City of Bethlehem WSR	H	Watch area for future regulatory action by EPA/PA DEP/DRBC City's WWTP NPDES permit renewal currently under review by PA DEP which may be impacted by restrictions on receiving waters	
AM3	Monitor and control populations of disease-carrying insects using pesticides or treatments that are not harmful to people or wildlife	Populations At Risk Populations				✓	City of Bethlehem Health Dept. in cooperation with hospitals & universities	H		This strategy should be coordinated with the CAP's mitigation-related strategies for species diversification and invasive species removal (L3.4). It should also be implemented without synthetic fertilizers and pesticides in coordination with L3.5.

Education



The table below includes proposed actions to inform the public and relevant agencies about future risks and methods to prepare for these risks. The purpose of these strategies is to build awareness and understanding of climate adaptation measures that city residents, as well as city staff, can take to improve community resilience. These actions focus on developing or improving existing engagement opportunities for the public and educating relevant city staff about the future impacts of climate change. As there are both the potential for overlap with the mitigation chapters of this CAP and significant synergies in combining education on climate adaptation and mitigation, all of the following strategies should be coordinated with those described in the *Public Engagement* chapter.

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AE1	Disseminate strategies to help people and businesses to reduce heat gain and cooling demand by installing awnings, light shelves, and other similar approaches	Buildings	✓			✓	City of Bethlehem Building Department	H		
AE2	Continue to educate and expand educational outreach to the public on availability of Low-Income Housing Energy Assistance Program (LIHEAP)	Energy Populations	✓				City of Bethlehem PPL Electric Community Action Lehigh Valley	H	PPL Electric already does this, but additional information/ educational outreach is always welcome.	Focus area: public education
AE3	Educate staff at all infrastructure agencies, including the city Department of Public Works, LANTA, PPL, and others, about projected climate change impacts to inform the agencies' approach to adaptation	Transportation Energy Water supply Wastewater Communication Buildings	✓	✓	✓	✓	City of Bethlehem Public Works	H		

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AE4	Raise public awareness of energy and water conservation issues, trends, news, and resources through the consistent use of social media, public service announcements and websites, as well as events in the city.	Energy Drinking Water Populations		✓		✓	City of Bethlehem WSR Bethlehem Area School District (BASD) city Sustainability Office in coordination with pertinent city departments. BASD could support, collaborate with Lehigh University, Moravian College, and Northampton Community College, PPL Electric (energy issues)	M	Should be coordinated as part of BASD Climate and Sustainability Commitment.	Focus area: adaptation and education—public awareness
AE5	Actively publicize best practices, both in the home and business, about the appropriate use of renewables, weatherization, reduce/reuse/recycling, strategic daylight harvesting (the use of daylight to offset electric lighting), natural heating/cooling and other conservation efforts to reduce energy consumption and create healthier environments.	Energy Populations	✓			✓	City of Bethlehem future Sustainability Office in coordination with pertinent city departments, City of Bethlehem BASD, PPL Electric, Bethlehem Water Authority	M		Focus area: Electric Energy Efficiency & Conservation (EE&C), public education
AE6	Develop partnerships with local community groups and businesses to encourage climate resilient practices	Buildings Populations	✓	✓	✓	✓	City of Bethlehem	M		
AE7	Post recommendations to mitigate heat impacts to health at key public locations during the summer months (e.g., public buildings, transit stops, etc.)	Populations	✓				City of Bethlehem future Sustainability Office in coordination with Health Dept. and BASD	M		Focus area: public education

Strategy #	Response	Sector / Asset	Extreme Heat	Drought	Storm & Flooding	Annual Changes	Responsibility	Priority	Existing Relevant Plans and/or Strategies	Additional Notes (as applicable)
AE8	Educate the community on how to prepare, respond, and recover from flood events (including which flooded items inundated by flood waters must be discarded and which can be cleaned/maintained), including preparedness kit, evacuation location, and what resources are available to help recover afterwards.	Populations			✓		City of Bethlehem in coordination with BASD	M	Should be coordinated as part of BASD Climate and Sustainability Commitment.	Focus area: public education
AE9	Develop relationships between the city and environmental clubs at high schools to inform and deliver climate education efforts	Populations	✓	✓	✓	✓	City of Bethlehem (future Sustainability Office) in coordination with BASD	L	Should be coordinated as part of BASD Climate and Sustainability Commitment.	
AE10	Develop relationships between the city and retirement/adult communities to inform and deliver climate education efforts	Populations	✓	✓	✓	✓	City of Bethlehem (future Sustainability Office)	L		

14

Implementation Strategies

The success of any plan comes down to implementation. This CAP is no exception. The plan's successful implementation will require building and maintaining community support, putting in place the city staff and resources to guide the plan's execution, identifying funding sources, and building partnerships to set the plan's strategies in motion. Laying this foundation for success will take time, but the city must weigh logistical constraints against the imperative to reduce emissions quickly to avoid the worst effects of climate change. Additionally, addressing historic environmental injustice and racism cannot wait. Equity, resiliency, and health are not just principles informing this CAP; they are the urgent needs of Bethlehem's most at-risk and underserved communities.

To strike an appropriate balance of these factors while expediting progress, the city will use a phased implementation approach. The first phase will be executed from 2021 to 2022 and prioritize implementation of a subset of strategies prioritized to achieve the following goals:

- Establish CAP governance framework and create institutional accountability
- Improve data to track progress
- Build public support for the CAP
- Implement actions to achieve community priorities
- Act quickly to promote equity and justice
- Achieve "no-regrets" quick wins
- Lay the groundwork for bigger policy changes
- Protect the most vulnerable populations and infrastructure

The second phase of implementation will include the continuation and expansion of phase 1 strategies and the full execution of all other strategies in this CAP. The full list of strategies for phase 2 is not included below, as all strategies are described in detail in the chapters above, including an implementation timeline designation. **However, the inclusion of a strategy in phase 2 does not mean it should lie dormant until 2023. Rather, all strategies should proceed with the identified "Key Next Step" as soon as possible.** Phase 2 strategies should then continue implementation to the extent feasible, as determined by the city lead and relevant stakeholders following the key next step. The phased



implementation approach is intended to prioritize achievement of strategies rather than serve as an excuse to delay action. Where appropriate, individual strategies will also be implemented using a phased approach, starting with pilot projects, and scaling to citywide programs.

The keystone to implementation is creating a Bethlehem Office of Sustainability and associated city Sustainability Director to guide the roll-out of the CAP.

Until that position is created, to move priority actions forward Public Works will coordinate with the EAC, City Council, and the city department and bureaus listed as “City Lead” for each strategy. Additionally, the CAP Working Group established to develop this CAP will be maintained and expanded to provide guidance and support the plan's launch via commitments and partnerships. Expansion of working groups and sector-specific implementation priorities are detailed in the Implementation sub-section of each mitigation chapter.

Establish CAP governance framework and create institutional accountability

The following 2021–2022 strategies will create the machinery for launching, coordinating, and updating the CAP going forward.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
M3.1	Create an Office of Sustainability with a city Director of Sustainability	Establish position and fund in city budget	City Council and Mayor's Office
M3.4	Coordinate working groups of key stakeholders to initiate implementation of each CAP section	Formalize working groups, engage stakeholders to expand membership, invite new members, and lead implementation of Phase 1 strategies	Dept. of Public Works transitioning to Office of Sustainability
M3.5	Ensure local legal framework is in place to implement CAP strategies	Pass a “Right to a Healthy Climate” ordinance, Home Rule Charter, or similar legislation to facilitate passing codes stricter than state standards	City Council
E1.4	Consolidate public outreach and education responsibilities within city government	Define the position responsible for coordinating sustainability- and climate-related education and outreach across city government	Mayor's Office

Improve data to target policies and track progress

The following 2021–2022 strategies will improve the city's ability to target the implementation of strategies in areas where they are needed most and to measure progress against the CAP goals.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
M3.2	Update the city's GHG emissions inventory	Update the community-wide and municipal government greenhouse gas inventory	Public Works transitioning to Office of Sustainability
L2.1	Expand the inventory of Bethlehem's trees and ecosystem services	Review results of Phase 1 tree inventory update (scheduled for December 2020 completion) and identify plan for Phase 2	Bureau of Urban Forestry
L5.2	Conduct analysis of urban heat island effect	Conduct analysis if existing geospatial data on heat islanding is determined insufficient	Bureau of Planning and Zoning transitioning to Office of Sustainability
FW3.1	Develop a better understanding of the city's current waste streams	Conduct characterization study	Recycling Bureau transitioning to Office of Sustainability
T4.1	Improve transportation sector VMT data quality and leverage regional initiatives to reduce emissions	Partner with LVPC to improve transportation sector vehicle miles traveled data	Dept. of Community & Economic Development transitioning to Office of Sustainability

Build public support for the CAP

The following 2021–2022 strategies will engage Bethlehem's residents and businesses with the goals of incentivizing action, creating excitement, and fostering shared responsibility.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
E1.1	Initiate a 'Bethlehem Climate Challenge' public outreach/ educational program about the importance of mitigating GHG emissions and creating a resilient community	Launch program.	Health Bureau transitioning to Office of Sustainability
E1.2	Develop a 'Bethlehem Climate Challenge' recognition program	Launch program.	Health Bureau transitioning to Office of Sustainability
LOI.1	Bethlehem Green Ribbon Commission	Launch program and expand membership beyond initial commitments.	Dept. of Community & Economic Development transitioning to Office of Sustainability
LOI.2	Bethlehem Carbon Challenge	Launch program and expand membership beyond initial commitments.	Dept. of Community & Economic Development transitioning to Office of Sustainability
E1.6	Use the City of Bethlehem newsletter to regularly highlight sustainability-related information on the city's website	Add regular segment to newsletter.	Dept. of Community & Economic Development with Office of Sustainability
E1.11	Evaluate the expansion of environmental education in K-12 curricula	Work with the BASD administration to include climate change across its curricula	Dept. of Community & Economic Development transitioning to Office of Sustainability
E1.15	Request and support business groups to develop campaigns and programs to engage local business owners on sustainability	Create engagement program with Chamber of Commerce and other local stakeholders.	Dept. of Community and Economic Development

Implement actions to achieve community priorities

The following 2021–2022 strategies emerged as community priorities during the public engagement that informed the CAP development, including surveys and public meetings.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
E3.2	Streamline permitting for installation of on-site renewable energy systems	Update Bethlehem's solar ordinance to require solar assessments for proposed buildings/developments over a certain size to determine viability for solar project	City Council with Bureau of Planning and Zoning
FW5.2	Support local gardens and urban farms	Support creation or expansion of at least 5 new local gardens or urban farms	Health Bureau
T1.2	Improve bike mobility and safety	Create a safe, low-stress network of bike routes, which may include dedicated bike lanes, trails, and bicycle boulevards connecting neighborhoods to destinations throughout Bethlehem	Dept. of Community & Economic Development
L2.3	Prioritize green space development in underserved areas	Launch a new green space initiative in an underserved area	Dept. of Community & Economic Development
E3.3	Require and incentivize renewable energy integration in new development, construction, and renovation projects	Update codes.	City Council with Bureau of Planning and Zoning
E1.4	Promote existing incentives for renewable energy installation at the federal, state, and utility level, and drive creation of new incentives to fill any gaps.	Develop and launch a promotion campaign.	Dept. of Community & Economic Development transitioning to Office of Sustainability

Act quickly to promote equity and justice

The following 2021–2022 strategies will reduce inequity and address vulnerabilities for at-risk populations in the short-term while creating a framework for Bethlehem's long-term vision of justice and equity.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
EJ1.1	Create a Bethlehem Climate and Environmental Justice Plan	Issue RFP for plan development.	Dept. of Community & Economic Development transitioning to Office of Sustainability
EJ1.2	Create a Bethlehem Climate and Environmental Justice Council	Formalize Council and invite members.	Mayor's Office
EJ1.3	Codify environmental justice considerations into city ordinances and planning/zoning decisions	Review and update all city ordinances.	City Council with Bureau of Planning and Zoning
EJ2.2	Incorporate the financial cost of health impacts from pollution and climate-related impacts into budget and policy analyses	Develop and test methodology.	Mayor's Office with City Council
EJ2.4	Measure local environmental burdens to inform neighborhood-level investments	Expand existing air pollution monitoring.	Health Bureau

Achieve “no-regret” quick wins

The following 2021–2022 strategies are already underway or can launch quickly to start reducing GHG emissions and increasing resiliency.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
B2.1	Fuel switching requirement for new boilers in commercial buildings	Pass ordinance.	City Council with Code Enforcement Dept.
B3.6	Require cost-effective energy-saving measures on large buildings to help to mitigate the urban heat island effect	Pass ordinance.	City Council with Bureau of Planning and Zoning
E2.2	Promote adoption of on-site solar	Launch a ‘solarize’ campaign.	Dept. of Community & Economic Development transitioning to Office of Sustainability
T1.3	Provide “safe routes” for pedestrians in and around town	Continue to move forward with review of pedestrian bridge; create pedestrian safety task force.	Dept. of Community & Economic Development with Bureau of Planning and Zoning
L2.6	Partner with community organizations to promote tree planting efforts	Establish a “Tree Tenders” group.	Bureau of Urban Forestry
FW2.7	Make recycling easier via education and new resources	Create simple visual illustrations of waste/recycling guidelines and supply multi-lingual printed material	Recycling Bureau
FW5.3	Increase institutional purchase of local foods	Work with Buy Fresh Buy Local—Greater Lehigh Valley to establish large institutional partnerships.	Health Bureau
M3.3	Lead by example and provide a testing ground for strategies that can be scaled to the rest of the community	Implement a demonstration project for CAP strategies, such as installing solar panels on a city building.	Dept. of Public Works
LOI.1	Bethlehem Green Ribbon Commission	Launch the Commission and expand membership.	Dept. of Community & Economic Development transitioning to Office of Sustainability
LOI.2	Bethlehem Carbon Challenge	Launch the Carbon Challenge and expand commitments.	Dept. of Community & Economic Development with Mayor’s Office transitioning to Office of Sustainability

Lay the groundwork for bigger policy changes

The following 2021–2022 strategies may not achieve tangible results in the short-term, but they are necessary precursors for achieving Bethlehem’s long-term targets in the aggressive timelines established in this CAP.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
B3.5	Support Residential Property Assessed Clean Energy (R-PACE) in Pennsylvania	Write letter of support to relevant state legislators and stakeholder groups.	Office of Sustainability with EAC
E3.1	Ensure a robust net metering program continues to be available to all electricity customers	Write letter of support to relevant state legislators and stakeholder groups.	Office of Sustainability with EAC
E3.7	Develop low-cost, local retail renewable electricity options	Issue RFI to evaluate feasibility of this strategy and gauge interest of developer, financier, and retail supplier partners.	Dept. of Public Works
E4.1	Support Community Choice Aggregation (CCA) and community renewables	Pass a resolution or write letter of support to signal support for HB 531.	City Council with EAC and Office of Sustainability
E4.2	Support policies that expand access to renewable energy for consumers	Pass a resolution or write letter of support.	City Council with EAC and Office of Sustainability
B4.2	Implement net-zero emissions (NZE) building standards for new buildings	Pass and implement Architecture 2030’s Zero Code	City Council with Bureau of Planning & Zoning and Code Enforcement Dept.
L1.1	Review and update land use ordinance and zoning to encourage land use patterns that mitigate climate change impacts	Integrate and support LVPC’s existing efforts.	City Council with Bureau of Planning and Zoning

Protect the most vulnerable populations and infrastructure

The table below includes 2021–2022 strategies to prioritize implementation of the highest priority adaptation and resiliency strategies. These strategies are taken from the Assessments, Studies, and Plans category of adaptation actions because assessments and studies should help guide adaptation actions across the other adaptation strategies. There are numerous other adaptation actions labeled as ‘high’ priority in the Adaptation and Resilience Strategies section of the CAP. If possible, these should not be put on hold while the priority actions in the table below are implemented.

The city’s Public Works Department should convene an internal climate adaptation working group with representatives from the Emergency Management Department, Health Bureau, and Water and Sewer Resources Department. This group should then review all of the CAP’s adaptation and resilience strategies to determine next steps for implementation and move as many strategies forward as is feasible. Many of the CAP’s adaptation strategies will be led by agencies outside the city government, including the utilities, LANTA, and private companies, such as telecom networks. The city adaptation working group should engage the relevant stakeholders following its review of adaptation and resilience strategies and hand off implementation duties where appropriate.

Strategy #	Strategy Name	2021 - 2022 goal	Lead
AA1	Conduct a city-wide vulnerability analysis to assess infrastructure and building exposure to current and future hazards (e.g., flooding, extreme heat, etc.) and prioritize assets for more detailed study.	Release RFP to conduct study.	Emergency Management Dept. with Dept. of Public Works
AA2	Conduct vulnerability study to assess climate impacts to public health	Release RFP to conduct study.	Health Bureau with Emergency Management Dept.
AA4	Update citywide drought management plan and strategy for drinking water to account for revised future climate change projections. This could include considering strategies for reduced cooling flows for energy, measures that would be implemented during a drought to conserve water usage (including usage of municipal effluent or brackish water; irrigation and water distribution efficiencies), and management of the Poconos (Wild Creek) water source.	Update drought management plan.	City of Bethlehem Water & Sewer Resources

15

Partnerships and Commitments

Bethlehem's city government cannot achieve this plan's goals on its own. Partnerships between the city and non-governmental organizations, businesses, community groups, and institutions will be critical to the CAP's success. The city has numerous ongoing partnerships with stakeholders throughout the community, including the CAP Working Group that helped develop this plan. The city will maintain this CAP Working Group during the implementation of the plan and formalize its management and structure as an official city advisory body. Additionally, Bethlehem expects and welcomes the opportunity to forge new partnerships to help achieve the CAP objectives.

At the time of publishing, the organizations listed on the following pages have agreed to support the CAP in implementation, such as through partnerships with the city and making their own ambitious climate commitments. Additional partnership opportunities and commitments, beyond those mentioned in the chapters above, are also included. The city will work to expand this list during implementation.



CAP SUPPORTERS



Additional PARTNERSHIP Opportunities



- The City of Bethlehem secured a one-year membership to ICLEI via PA DEP's Local Climate Action Program (LCAP). The city will leverage access to the ICLEI technical staff and ClearPath inventory tool to support CAP implementation.



- Lehigh University and the city engaging in co-operative planning and engagement for climate change and resiliency, including supporting the city in local climate change risk early warning, monitoring, and adaptation.
- Lehigh University developing a sustainability partnership with the local community that catalyzes climate action and resiliency.
- Lehigh University establishes a program to support faculty, staff, and student projects in collaboration with the city and local area groups that enhance sustainability goals.
- Lehigh University and the city working together to transition vehicle fleets to run exclusively on alternative fuels.
- There could be potential project opportunities for Lehigh students to work on Bethlehem-based projects through the [Lehigh Valley Social Impact Fellowship](#) through Lehigh's Office of Creative Inquiry.
- There could be potential experiential learning opportunities for Lehigh students to work on city CAP projects through Lehigh's Industrial Assessment Center and Energy Systems Engineering as well as research opportunities with the Energy Research Center.
- Lehigh and the city could explore the possibility of developing a joint composting program between Lehigh University and the city.
- Lehigh and the city could partner on Lehigh's baseline campus tree inventory to help inform the city's overall tree inventory.
- Lehigh and the city could partner on the food carbon and water footprint calculator (once completed) to potentially expand its use to Bethlehem restaurants.



- Moravian College can be an active partner in developing public educational materials.
- Moravian College share ideas of how to get started on sustainability initiatives, especially linked to energy conservation and efficiency.
- Moravian College can be a partner on city-wide initiatives related to tree canopy, waste reduction, recycling, and other elements of the CAP.
- Moravian College research on revegetation and its off-site forested property could be considered for carbon credits in offset programs. The college has engaged in a number of carbon onsetting projects, including the organic native plant garden and rain garden on the south campus, which also address stormwater runoff concerns, and the campus tree inventory and Tree Campus USA status.



- PA DEP—Energy Programs Office has several programs that could help Bethlehem achieve its CAP goals. These include various alternative fuel grant programs, an EV charging station rebate program, a clean energy grant program, and GELF funding for energy efficiency projects.
- PA DEP is also putting together an outreach program with Penn State Extension to host webinars or potentially in person events with local governments to discuss solar land leasing (myths and facts) and a solar issues forum where local governments can participate in regular meetings to discuss a specific topic



- PPL Electric can be a partner on energy efficiency and conservation, providing information related to the available programs to city residents and businesses.
- PPL Electric can be a partner to the city on educating residents and businesses about the opportunities they have to shop for renewable power, as well as programs and services PPL Electric provides to help customers pay their bills.
- PPL Electric can be a partner in helping with EV infrastructure and working with the city on the build-out of EV chargers. PPL Electric can also support Bethlehem in educating city staff, residents, and businesses as new EV-related information and programs become available.
- PPL Electric can be a partner and stakeholder in the city's adaptation and resilience strategies—both seeking to work with the city to improve the environment and to mitigate impacts where possible.

Additional COMMITMENTS



- ArtsQuest has committed to participate in the following CAP strategies for large organizations and institutions:
 - Bethlehem Green Ribbon Commission



Bethlehem Parking Authority
Established in 1988

- 100% LED lighting in all parking garages.
- 75% LED lighting in all parking lots.
- Adaptive parking garage lighting with scheduled lighting, dimming capabilities and integrated occupancy sensors in the New Street Parking Garage.
- 1 EV charging stations available at the North Street Garage, Walnut Street Garage, New Street Garage, Upper Commons Garage and the Broad Street Lot.
- Sustainable cleaning practices, including the use of Parking Garage scrubbing machines that use 70 percent less water and use no cleaning products.
- Implementation of sustainability related office practices including robust recycling practices.
- Low flow, sensor controlled water fixtures in all office spaces.
- Light occupancy sensors in office spaces.
- Procurement of sustainable cleaning products.



BETHLEHEM AREA SCHOOL DISTRICT

- Bethlehem Area School District has committed to participate in the following CAP strategies for large organizations and institutions:
 - Bethlehem Green Ribbon Commission
 - Bethlehem Carbon Challenge



- Lehigh University has committed to participate in the following CAP strategies for large organizations and institutions:
 - Bethlehem Green Ribbon Commission
 - Bethlehem Carbon Challenge
- Lehigh University has made numerous goals and commitments in its Lehigh's Sustainability Strategic Plan 2030 that align with the goals of the city CAP. These include:
 - Working with the City of Bethlehem to participate in co-operative planning and engagement for climate change and resiliency. Lehigh will support the city in local climate change risk early warning, monitoring, and adaptation.
 - Offsetting 100% of electricity consumption with renewable energy in 2023, through a combination of off-site and on-site projects, energy conservation, and renewable energy credits.
 - Developing a plan to fully transition the campus bus and vehicle fleet to run exclusively on renewable energy by 2030.
 - Replacing all non-LED fixtures as per the Climate Action Strategy and Central Utility Plan Master Plan
 - Transitioning certain departments from cars and vans to electric golf carts by 2023 and 2025.
 - Installing additional electric vehicle charging infrastructure.
 - Establishing a taskforce to develop a broader campus zero-waste strategy by 2024 that outlines a roadmap to a zero-waste campus by 2030.
 - Ensuring all construction jobs including minor renovations (projects between \$250,000 and \$5 million, where dumpsters are provided) achieve a minimum of 65% by 2022 and 85% by 2025 construction waste recycling. All major construction projects (\$5 million+) must comply with the waste diversion goals of LEED Silver or equivalent, or higher.
 - Completing a baseline campus tree inventory by 2022 and repeat the inventory every five years.
 - Developing and implementing a Sustainable and Healthful Food Policy that sets new standards for measuring the ecological, social, and health impacts of on-campus food preparation and consumption by 2021.
- Lehigh is also developing a Climate Action Strategy (expected release April 2021). It will establish a carbon neutrality date for Lehigh (subject to board approval).
- Lehigh has a newly updated (as of August 2019) energy and water conservation policy.

Additional COMMITMENTS



- Lehigh Valley Health Network has committed to participate in the following CAP strategies for large organizations and institutions:
 - Bethlehem Green Ribbon Commission
 - Bethlehem Carbon Challenge



- Moravian College has committed to participate in the following CAP strategies for large organizations and institutions:
 - Bethlehem Green Ribbon Commission
 - Bethlehem Carbon Challenge
- Moravian College is one of 515 institutions of higher education that signed the Talloires Declaration which is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities.
- Moravian College is a signatory to the We're Still In initiative.
- Moravian College has held accredited observer status and been active participants in the United Nations Framework Convention on Climate Change since 2009.
- Moravian College has a commitment to better understanding its energy usage, promoting energy efficiency, and using sustainable systems and products in new construction and when doing repairs of systems. The college is exploring electric vehicles for its busses that go between the two campuses and would be open to experimenting with other technologies, such as a hydrogen powered bus or van.



- Northampton Community College (NCC) has committed to participate in the following CAP strategies for large organizations and institutions:
 - Bethlehem Green Ribbon Commission
 - Bethlehem Carbon Challenge
- NCC is committed to purchasing 100 percent of its electricity from renewable energy sources. NCC is the largest community college consumer of green power in the nation.



- As per the Pennsylvania Climate Action Plan 2018, Pennsylvania has set the following GHG reduction targets: 26 percent reduction in GHG emissions by 2025, and 80 percent reduction in GHG emissions by 2050.



- PPL's corporate goal is to reduce carbon emissions at least 80% from 2010 levels by 2050, with at least a 70% reduction by 2040



- ProdHealth is a Bethlehem-based digital health company that aims to improve the chronic illness epidemic by focusing on improved nutrition with its users. This approach will open up many partnership opportunities with the CAP to address greenhouse gas emissions that currently come from our food system. The ProdHealth mobile app will be tracking improved food intake of users, and therefore also be able to calculate a rough environmental footprint of the same food. This results in potential data analysis collaborations to analyze food intake data and come up with ways to improve them.

Partnerships between the city and non-governmental organizations, businesses, community groups, and institutions will be critical to the CAP's success. The city has numerous ongoing partnerships with the stakeholders throughout the community, including those noted here.



16

Reporting Process and Accountability

The City of Bethlehem recognizes the importance of monitoring the implementation of the CAP's actions to ensure their efficacy. Robust monitoring and public reporting on implementation progress will allow the city to report progress toward GHG emissions reduction targets and mitigate climate risk to its residents, business, and institutions. This regular monitoring and reporting will hold the city—and all stakeholders responsible for successful CAP implementation—accountable to ensure collaboration and successful implementation.

When it is created, as proposed in this CAP, the city's Office of Sustainability will take responsibility for monitoring and public reporting on the CAP's implementation. Until this department is created, Public Works will develop monitoring procedures and report on progress in conjunction with the EAC and City Council.

Bethlehem's GHG inventory will be updated biennially, providing a key indicator of the success of the CAP's GHG mitigation initiatives and progress made toward the city's GHG mitigation targets. As needed, actions may need to be amended or augmented to ensure the city is on track to meet its overall GHG reduction targets, including a 30% reduction in GHG emissions by 2025, a 60% reduction by 2030, and achieving net zero emissions by 2040. Adjustments to strategies may also be made to ensure the achievement of the sector-specific goals that ladder up to the city's overall commitments.

The city will also draft metrics to track the progress of each of the CAP's actions. An initial list of progress metrics for each chapter is included in Appendix 2. Progress made toward achieving each action will be reported regularly on the city's website to allow full public access to track the CAP's implementation. The city will also release an annual CAP progress report that summarize these metrics and the overall progress toward strategy implementation and the city's goals. As this CAP is updated in future years, the tracked metrics will support revisions as needed to ensure the achievement of the CAP's goals.





12

Hotel Bethlehem



NO PARKING



Hotel Bethlehem

17

Next Steps

The immediate next step toward implementing the priority Phase 1 strategies identified in the sections above is to convene the relevant stakeholders and responsible city departments to help advance these initiatives. To kick off the implementation phase, the city Public Works Department will organize a virtual kickoff meeting consisting of the members of City Council, the Bethlehem CAP WG, key city staff anticipated to have responsibility for priority strategy implementation, and the EAC. In addition to implementing priority Phase 1 strategies, the city will aim to initiate all other strategies in this plan in the first year so they can be fully implemented during Phase 2.



18 Appendices

1A Climate Vulnerability Impacts

1B Community Hazard Mapping

2 Performance Metrics

3 Abbreviation Glossary

4 Climate Data Processing and Results

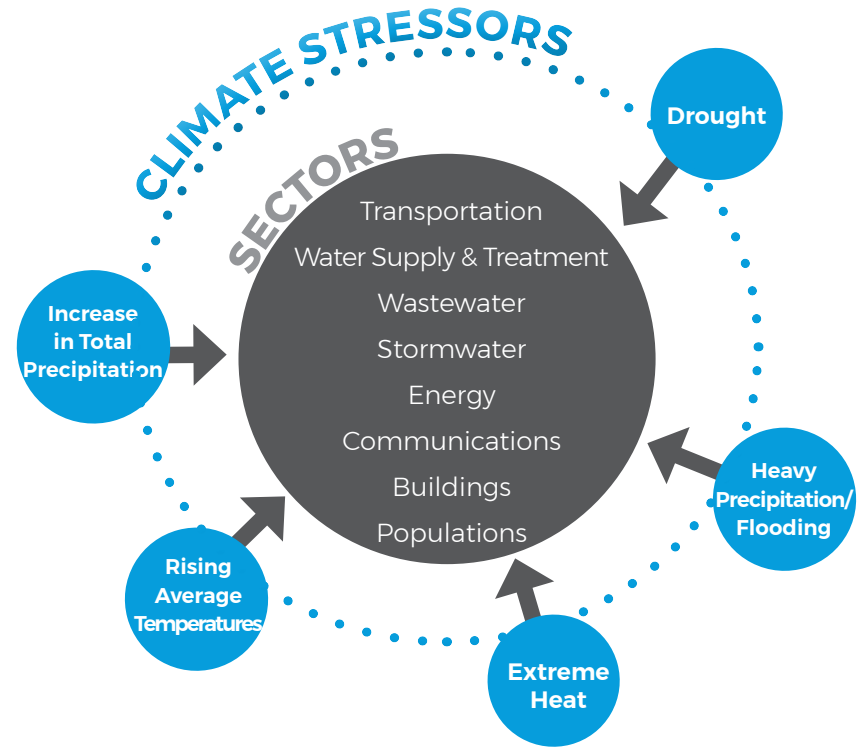
5 Community Survey Results

6 Community-wide GHG inventory
summary

Appendix 1A

Climate Vulnerability Impacts

This appendix includes a set of tables that explore impacts of climate stressors on the City of Bethlehem’s infrastructure and community. The CAP Working Group reviewed these tables and provided feedback for both acute events, such as heavy precipitation events, and changes in baseline conditions, such as rising average temperatures. The analysis considered vulnerabilities on different infrastructure sectors and populations from the following climate stressors:



The tables below consist of the following columns:

1	2	3	4	5	6
Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Infrastructure, assets, and populations	Who owns these assets and/ or shares responsibility. This designation is not definitive, as ownership and responsibility may be shared by multiple parties, some of whom were not part of the assessment process.	List of impacts based on CAP WG stakeholder review and literature review	Description of issues that occurred during past events that affected the asset(s). If known, the location/date and any conditions that amplified the impact are identified. The CAP WG compiled this list, but it is not comprehensive.	Description of emerging or new impacts that could occur if conditions substantially worsen (e.g., heat events occur with regularity throughout the summer).	If the asset(s) were damaged or service lost, what are the consequences to the community. Where applicable, includes particular locations within the city that would be most adversely affected.w

EXTREME HEAT

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Transportation					
Roads	▶ City	<ul style="list-style-type: none"> ▶ Infrastructure: Paving materials expand and crack/rut/buckle in temperature conditions beyond those for which the materials are designed. ▶ Infrastructure: Shortening of pavement design life. ▶ Operations/Maintenance: Interruptions in service if pavement buckles ▶ Operations/Maintenance: Introduce material and load restrictions, limiting transportation operations. ▶ Operations/Maintenance: Limit construction activities and on-time repairs/projects leading to increased costs. ▶ Operations/Maintenance: Increases in overheated vehicles and tire deterioration leading to road safety and congestion concerns. 		<ul style="list-style-type: none"> ▶ Increased road maintenance activity and traffic disruptions/impacts. ▶ Projected increases in temperatures, particularly in the summer, may cause additional issues with paving materials expanding and contracting. ▶ Projected increases in temperatures, may cause pavement design life to decrease. ▶ Projected increases in temperatures, may cause the pavement to buckle more frequently and more intensely. ▶ Projected increases in temperature may cause increasing issues with the pavement which may require additional restrictions on transportation operations, including additional weight restrictions. ▶ Projected increases in temperature may cause construction activities to be limited to halted, resulting in increased costs and time lags. ▶ Projected increases in temperature could cause more vehicles to overheat and tires to deteriorate more quickly. ▶ Road closures increasing motor vehicle traffic on traversable roads. 	<ul style="list-style-type: none"> ▶ Increased costs for road maintenance and/or lower quality roadway surfaces. ▶ Infrastructure issues and the need for increased and more frequent repairs. ▶ Infrastructure issues and the need for increased and more frequent repairs could impact commerce and the supply chain in the area. ▶ Impact to commerce and could cost businesses and organizations additional time and money. ▶ The general public and commerce traffic could be impacted by more cars overheating and the need to replace tires more frequently. Emergency personnel could be called out more frequently too due to potential increase in road safety. ▶ People commute across the valley for work, mostly by personal motor vehicle. A growing number of cars would vie for space on a diminishing number of roads as roads increasingly close for maintenance. This increases the urgency of mitigating this impact by expanding public transit.
Bridges / Culverts	▶ City	<ul style="list-style-type: none"> ▶ Infrastructure: Extra stresses through thermal expansion and increased movement leading to structural damage/failure. 		<ul style="list-style-type: none"> ▶ Shorter service life and more frequent repairs. ▶ More bridges could experience severe stress and movement which could lead to more structural damage/failure 	<ul style="list-style-type: none"> ▶ Increased costs for bridge maintenance/replacement. ▶ This could cause an increase in traffic and congestion if more bridges are down for service/repair.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Rail	▶ Private	<ul style="list-style-type: none"> ▶ Infrastructure: Rail-track deformities due to expansion and buckling. ▶ Operations/Maintenance: Trigger speed restrictions to avoid derailment. 		<ul style="list-style-type: none"> ▶ More rail fix projects due to expansion and buckling of rail-track. ▶ Additional rail speed restrictions may be imposed going forward to avoid derailment. 	<ul style="list-style-type: none"> ▶ This could cause rail delays due to service/repair and could lead to more rail safety issues and possible rail accidents. ▶ This could cause rail delays due to speed restrictions.
Public Transit	▶ LANTA	▶ Operations/Maintenance: Increases in overheated vehicles and tire deterioration.		<ul style="list-style-type: none"> ▶ Future increases in temperatures and prolonged heat waves could cause more frequent overheating of fleet vehicles, leading to delayed trips, stranded passengers, and the need for more back-up vehicles and drivers in stock. ▶ Costs associated with infrastructure necessary to keep passengers protected from heat and heavy precipitation at bus stops, and costs associated with maintaining vehicles impacted by extreme heat. 	▶ Riders may experience increased delays in service and potential late arrival times due to being stuck waiting for a replacement vehicle. This may also cause delays in traffic if a bus overheats or breaks down in a busy area.
Public Transit	▶ LANTA	▶ Health/Safety of Riders: Unsafe to wait at unsheltered stops.		▶ Future increases in temperatures and prolonged heat waves poses a threat to riders waiting at stops that are not shaded or otherwise protected from the heat, especially for elderly, young, and disabled riders, and riders in areas known as heat islands (commonly located in urban, minority, and low-income areas).	▶ Dangerous health concerns may arise from waiting in extreme heat for prolonged periods of time without adequate protection and hydration. Health hazards such as heat stroke, dehydration, and hyperthermia may increase, especially among elderly and disabled riders in disproportionately hot urban areas.

Water Supply and Treatment

Drinking Water Infrastructure	▶ City	<ul style="list-style-type: none"> ▶ Watershed/reservoirs: increased evaporation rate; adverse impact on ecological balance which may affect vegetation and reservoir water quality; risk of invasive species; increased potential for algal blooms and other waterborne pathogens; increased risk of forest fires. ▶ Operations/Maintenance: Increased O&M and water treatment costs to eliminate toxins, algal growth, invasive species that can affect source water quality. 	<ul style="list-style-type: none"> ▶ Recent invasive species include spotted lanternfly and Japanese knotweed (which may or may not be climate related) require additional effort and cost to eradicate. ▶ Bethlehem has a unique water supply situation with the reservoir in the Wild Creek area in the Poconos. The surrounding forests and protected land are a form of resilience. 	<ul style="list-style-type: none"> ▶ Algal blooms and increase in pathogens may pose significant challenge for treatment. ▶ Lack of clean drinking water impacts every resident, as well as businesses, manufacturing, and institutions (hospitals/schools). Clean water is essential for health & wellbeing. Extreme heat may also increase the demand for water. 	<ul style="list-style-type: none"> ▶ Potential for adverse water quality would impact the entire water system including city and surrounding communities. ▶ Cause people and businesses to relocate outside of Bethlehem or choose not to locate in the city.
--------------------------------------	--------	---	---	--	---

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Wastewater Infrastructure	▶ City	▶ Environmental: Reduction in Lehigh River and/or Delaware River water quality and flow may lead to more stringent requirements for wastewater discharge and higher treatment costs, and capital improvements.		▶ Potential for more stringent requirements in subsequent revisions to the Bethlehem WWTP NPDES Permit which can increase treatment costs and other O&M requirements.	▶ Minimal.
Energy					
Energy supply and production	▶ Independent power producers	<p>▶ Operations/Maintenance: Cooling systems for power plants will not perform effectively in periods of extremely high temperatures, leading to reduced/deferred production and increased cooling requirements.</p> <p>▶ Operations/Maintenance for Hydropower: Increased evaporation from reservoirs reduces available water supply and therefore generation capacity.</p>		▶ Reduced generating capacity of water-dependent electric generating facilities. Reduced facility output could result in less efficient facilities being called on to generate, or reduced electricity availability. Extreme result could result in brownouts/blackouts.	▶ Higher generation prices resulting in higher electricity prices. Extreme risk of brownouts/backouts.
Transmission and distribution	▶ PPL/UGI	<p>▶ Infrastructure: Sustained periods of very hot temperatures can lead to failure/reduced service life of power transformers.</p> <p>▶ Infrastructure: Increased sag of overhead line conductors, potentially compromising statutory ground clearances if the sag is too much.</p> <p>▶ Operations/Maintenance: Increased stress on transmission infrastructure and grid, leading to disruption of supply. Extreme heat can reduce the efficiency of transmission lines.</p> <p>▶ Operations/Maintenance: Increased demand for energy (from all end users) for cooling leading to brownouts</p>	<p>▶ None noted.</p> <p>▶ PPL Electric has specifically implemented a litany of planning and operation activities to improve grid reliability—due to climate change issues, or just general weather and customer demand.</p>	<p>▶ Requires increased investment in T&D assets, beyond planned investments. Reduced efficiency and/or reliability.</p> <p>▶ Natural gas distribution systems are typically not affected by periods of extreme heat. CHP can provide an alternative to reliance on the electric grid</p> <p>▶ Consider proactive implementation of CHP systems and other distributed generation to offset impact.</p> <p>▶ Change in customer consumption patterns may impact the PJM dispatch curve, resulting in different or additional resources being called on to meet peak demand.</p> <p>▶ Increased T&D investments to meet new peak demand (focus in summer seasons) to ensure maintenance of grid reliability.</p>	<p>▶ Impact to grid reliability and power quality.</p> <p>▶ Increased price of electricity during peak periods (summer, mid-day).</p> <p>▶ Increased T&D infrastructure costs.</p>

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Communications					
Fixed line network (cable)	▶ Private	▶ Infrastructure/Operations: Power outages affecting service (e.g., switch failures, general telecommunication outages)		▶ More power outages that will impact service.	▶ A lack of service more frequently and for longer periods of time.
Mobile line network (cellular)	▶ Private	▶ Infrastructure/Operations: Power outages affecting service (e.g., backup generators at cell sites may function normally, but may not be able to sustain operation for the long duration of the outage)		▶ More power outages that will impact service.	▶ A lack of service more frequently and for longer periods of time.
Buildings					
Electrical systems	▶ City / Private	▶ Infrastructure: Fuses blown due to air conditioning load and/or aging electrical wiring with deteriorating insulation.			
Cooling systems	▶ City / Private	▶ Infrastructure: Older HVAC systems may not be reliable or effective during extreme heat events depending on system specifications.			
Building Footprint	▶ City / Building code	▶ Infrastructure: Buildings and parking lots can experience substantially hotter surface temperatures than surrounding green areas. ▶ Monetary Costs: Increased energy costs	▶ Especially older people do not use their AC due to the costs and some cases have been fatal. ▶ Action to take now: Require white or green roofs to help minimize actual impact.	▶ Raised temperatures in cities. ▶ Increase of fatal cases due to more people not being able to afford AC while the temperatures rise.	▶ Heat index rises in the summer and will require more air conditioning, which is expensive and not always achievable for some population groups. This may further require adaptation measures such as light-colored surfaces, shading trees etc.
Building	▶ City / Private building owner	▶ Infrastructure: vulnerability to fires due to spreading wildfires and dry surrounding vegetation. ▶ Environmental: loss of shading trees. ▶ Infrastructure: Wells run dry with low precipitation.	▶ Drier summers will dry out wooded areas and make those vulnerable to wildfires—similar to the fires on Blue Mountain.	▶ Wildfires will occur in more areas throughout the Lehigh Valley. ▶ Higher demand for energy to cool without shading trees.	▶ Loss of forests and buildings. ▶ Fire trucks need to supply water.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Populations / Community					
Populations	▶ NA	<ul style="list-style-type: none"> ▶ Health: Direct health impacts such as heat stroke, dehydration, cardiovascular, respiratory, and cerebrovascular disease; more people cramped in close air-conditioned spaces can increase spread of communicable disease. ▶ Health: Indirect impacts such as less time being active outside due to heat, which contributes to obesity problems. Added stress: being inside for longer periods of time in small spaces; increasing energy bills. ▶ Health: Reduced air quality due to the presence of ground-level ozone, resulting in health impacts and exacerbating existing conditions; higher temperatures create temperature inversions that lock in ground level air pollutants. ▶ Exposure: Greater exposure to high-heat temperatures for those who commute by walking or by utilizing public transit or non-motorized vehicles (bikes, skateboards, scooters, etc.). 	<ul style="list-style-type: none"> ▶ Forced to stay inside more and use more air conditioning. ▶ Worse air quality due to heat may exacerbate asthma and complications due to COVID-19 or other respiratory illnesses. 	<ul style="list-style-type: none"> ▶ Increasing electricity usage due to need for more air conditioning. ▶ Increased health concerns due to worsen air quality and exposure to future pandemics. ▶ Reduced outdoor activity during hot summer months. 	<ul style="list-style-type: none"> ▶ Increased mortality and medical costs. ▶ Summer will no longer be season to enjoy outdoor activities (other than in water), so more similar to the deep South. ▶ Black, brown, and low-income residents remain the most at risk as they are likely to be uninsured or underinsured and have other undiagnosed comorbidities that can be exacerbated by extreme heat.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
At-Risk Populations (health-related, job-related, income-related, cohort-related)	<ul style="list-style-type: none"> ▶ NA 	<ul style="list-style-type: none"> ▶ Health: Increase mortality and illness due to less access to air conditioning / cooling. ▶ Health: Increase mortality and illness for at-risk populations unable to regulate body temperatures as effectively (e.g., young children, pregnant women, older adults) as well as other vulnerable populations with comorbidities; increased risk of spread of communicable disease in cooling centers set up for homeless people and those who lack air conditioning. ▶ Exposure: Greater exposure to high-heat temperatures for those waiting for transit. ▶ Exposure: Greater exposure to high-heat temperatures for those who spend significant amounts of time outside of climate-controlled environments including homeless populations, construction workers, landscape workers, factory workers, and others. ▶ Monetary Costs: Increased financial burden of increased use of air conditioning and lack of air conditioning in vehicles and some public transport. ▶ Monetary Costs: Costs associated with maintenance of personal vehicles due to problems caused by overheating. 		<ul style="list-style-type: none"> ▶ Will require more cooling spaces distributed so they are accessible to all neighborhoods. These will need to operate even during future pandemics. ▶ Increased mortality if unable to get adequate cooling. 	<ul style="list-style-type: none"> ▶ Increased mortality and medical costs. ▶ Increased energy cost burden on residents for air conditioning etc. ▶ Increase mortality due to heat stress from those unable to maintain AC, especially the sick and elderly. ▶ Increased pressure on hospital and healthcare systems to cope with increased rates of heat-related illness and death. ▶ Black, brown, and low-income residents remain the most at risk as they are less likely to have the economic means to address increased health and energy costs.

DROUGHT

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Transportation					
Roads	▶ City	<ul style="list-style-type: none"> ▶ Infrastructure: Dry spells can reduce soil moisture, causing pavement cracks/bumps and shrinkage of subsurface soils. ▶ Operations/Maintenance: If drought leads to wildfires outside the city, smoke may affect visibility and safety of drivers and construction operations. 		<ul style="list-style-type: none"> ▶ Increased road maintenance activity and traffic disruptions/impacts. ▶ Dry spells in the summer months may increasingly cause pavement to crack, bump, or shrink subsurface soils. 	<ul style="list-style-type: none"> ▶ Increased costs for road maintenance and/or lower quality roadway surfaces. ▶ This could cause roadway issues which could cause delays due to the need for increased repairs. ▶ More frequent days where visibility is impaired.
Bridges/ Culverts	▶ City	▶ Unknown		▶ Shorter service life and more frequent repairs.	▶ Increased costs for bridge maintenance/replacement.
Rail	▶ Private	▶ Operations/Maintenance: If drought leads to wildfires outside the city, smoke may affect visibility reducing speeds		▶ Dry spells could increase the risk of wildfires and thus the incidence of smoke.	▶ More frequent days where traffic has to slow down due to visibility issues, thus increasing travel time.
Public Transit	▶ LANTA	▶ Infrastructure: Damage to roadways may damage fleet vehicles, increasing the need for more frequent maintenance and replacements.		▶ Damage to roadways, such as cracks and bumps, as a result of drought may cause damage to the vehicles. This may increase the required frequency of maintenance and replacement of vehicles or parts.	▶ Higher maintenance and repair costs may have to be reflected in ticket prices.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Water Supply and Treatment					
Drinking Water Infrastructure	▶ City	<ul style="list-style-type: none"> ▶ Watershed/Reservoirs: Increased risk of wildfires; reduced snowfall/snowmelt to replenish the reservoirs; increased concentration of nutrients and sediment in lower reservoir levels; degradation of wetlands and other vegetation. ▶ Operations/Maintenance: Increased O&M and water treatment costs to eliminate nutrients and sediment from source water ▶ East Allen Twp Well Systems: Reduction in well yield during drought conditions due to low ground water/aquifer levels. ▶ Demand: Implementation of voluntary or mandatory water conservation measures. 	<ul style="list-style-type: none"> ▶ Reservoir dropped to “Drought Watch” level in early 2017 following year of low rainfall/snowfall; no drought warning or conservation measures implemented. ▶ Even in Bethlehem, it is conceivable that a severe or protracted drought could necessitate some form of water-use restrictions or rationing (as it has in Lehigh County within the last 10 or 15 years). ▶ Bethlehem has a unique water supply situation with the reservoir in the Wild Creek area in the Poconos. The surrounding forests and protected land are a form of resilience. 	<ul style="list-style-type: none"> ▶ Implementation of city-wide water conservation measures (voluntary and/or mandatory). ▶ Implementation of conservation measures at East Allen well systems; delivery of drinking water by tanker to replenish supplies. ▶ If any restrictions are necessary, we would need to plan ahead to make sure people’s water use is prioritized over other uses, especially people with an increased need for water due to health conditions. ▶ If there are restrictions on watering lawn or landscape, they could require any such watering to be completed before 9a to avoid evaporation and allow for groundwater recharge. ▶ Wetlands function to filter pollutants and sediment from water, slow stormwater and reduce flooding. See impacts of flooding below. Wetlands also provide wildlife habitat. ▶ Loss of riparian vegetation causes greater sediment load during heavy rain events and loss of habitat. ▶ Competition for water will exacerbate inequities in community. ▶ People will use bottled water, which is an added expense, increases plastic waste and ingestion of plastic. It also increases the energy required to manufacture bottled water. 	<ul style="list-style-type: none"> ▶ Implementation of water conservation measures (voluntary and/or mandatory) which can impact residential, commercial, and industrial customers. ▶ Potential economic impact. ▶ Cause people and businesses to relocate outside of Bethlehem or choose not to locate in the city.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Wastewater Infrastructure	▶ City	<ul style="list-style-type: none"> ▶ Environmental: Reduction in Lehigh River and/or Delaware River water quality and flow may lead to more stringent requirements for wastewater discharge and higher treatment costs, and capital improvements. ▶ Operation/Maintenance: increase in influent organic load concentration at WWTP at lower sanitary sewer flows; potential for increase in treatment costs. 		<ul style="list-style-type: none"> ▶ Potential for more stringent requirements in subsequent revisions to the Bethlehem WWTP NPDES Permit which can increase treatment costs and other O&M requirements. ▶ Higher water temperature will affect fishing. Note: Saucon Creek is rated Class A Trophy Trout Stream. 	▶ Minimal
Energy					
Energy supply and production	<ul style="list-style-type: none"> ▶ PPL ▶ UGI 	<ul style="list-style-type: none"> ▶ Operations/Maintenance for Hydropower: Increased evaporation from reservoirs reduces available water supply and therefore generation capacity. ▶ Operations/Maintenance: Fuel refining operations will likely need alternative water supplies or be shut down temporarily. 	▶ None.	<ul style="list-style-type: none"> ▶ Reduced hydro generation facility capacity and operation due to lower water level (or need for water releases to support downstream water levels). ▶ Reduced generating capacity and operation for facilities utilizing water as a cooling source for combustion operations (e.g., coal, oil facilities). 	<ul style="list-style-type: none"> ▶ Reduced operating capability results in additional resources—typically less efficient—to be called on to meet customer demand. This could increase emissions (depending on resource) and will raise the cost of energy. ▶ Lack of hydro facility operations decreases renewable energy resources on the grid, in favor of fossil fuel emitting sources.
Transmission and distribution	<ul style="list-style-type: none"> ▶ PPL ▶ UGI 	▶ Infrastructure: Increased risk of wildfire threatening transmission lines and other energy infrastructure connected outside of the city.	▶ None	<ul style="list-style-type: none"> ▶ Wildfires that result in T&D line outages would impact customer reliability and could destabilize the grid in regions impacted. ▶ This could also result in increased regulation by the PA PUC and FERC (e.g., California Commission recently implementing new rules on utilities – such as PSEG). 	▶ T&D outages due to wildfires would impact customer reliability for those regions affected (e.g., impacts from California wildfires).
Communications					
Fixed line network (cable)	▶ Private	▶ Infrastructure: Increased risk of wildfire threatening cable lines if connected outside of the city.		▶ Concerns about cable lines being more greatly impact by wildfire going forward.	▶ Customers experiencing an increase in cable outage issues.
Mobile line network (cellular)	▶ Private	▶ Unknown.			

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Buildings					
Building Footprint	▶ City/private	▶ Infrastructure: Vulnerability to wildfires.		▶ Loss of buildings as well as habitats.	
Populations / Community					
Populations	▶ NA	<ul style="list-style-type: none"> ▶ Health: Water shortages affecting livability and water quality. ▶ Health: Stress from rising cost of water, fear of poor water quality, less use of water for improving quality of life (regular bathing and cooling and fun outdoor activities). ▶ Health: If drought leads to wildfires outside the city, smoke may affect air quality, leaving vulnerable populations at risk. Both direct health risk if in/near fire area, and health issues related to worsened air quality. ▶ Agriculture/food supply: drought in Lehigh Valley may reduce availability of local food. 	<ul style="list-style-type: none"> ▶ The Lehigh Valley has had summers with restrictions to water usage. ▶ More water used for irrigation further depletes water supply 	<ul style="list-style-type: none"> ▶ Restrictions and water rationing during drought periods might get heightened to preserve water. ▶ In the event of increased fires, smoke could also create serious air quality concerns with resulting health impacts. 	<ul style="list-style-type: none"> ▶ Need to adapt to periodic water shortages. ▶ Black, brown, and low-income residents remain the most at risk as they are less likely to have the economic means to address increased water and healthcare demands.
At-Risk Populations	▶ NA	<ul style="list-style-type: none"> ▶ Food: Water shortages affecting those who grow food for personal consumption. ▶ Health: Water shortages affecting those using water for cooling purposes (when combined with extreme heat). ▶ Health: Higher air pollution. ▶ Financial: Low-income populations lack financial resources for water purification systems, for appliance upgrades that reduce demand, for piping changes that improve water quality. 			<ul style="list-style-type: none"> ▶ Increased food insecurity. ▶ Increased mortality and medical costs. ▶ Increase of asthma rates, which are already high in the Lehigh Valley.

HEAVY PRECIPITATION / FLOODING

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Transportation					
Roads	▶ City	<ul style="list-style-type: none"> ▶ Infrastructure: Precipitation-triggered landslides can cover roads causing a safety hazard, damaging infrastructure, and/or impeding service (including emergency services). ▶ Infrastructure: Roadway embankment erosion on roads paralleling floodplains. ▶ Operations/Maintenance: Flooding associated with precipitation events can inundate roads requiring increased costs in maintenance and debris removal and reduce service life. ▶ Operations/Maintenance: Reduced traveler speeds and increased risk of accidents can lead to road safety and congestion concerns. ▶ Operations/Maintenance: Periodic or sudden inundation may overwhelm existing drainage systems, causing flooding of road surfaces and/or weakening of earthen road support (may lead to a damming situation upstream). ▶ Emergency Response: Increased flooding of major road that may impede of emergency personnel from delivering aid. 	<ul style="list-style-type: none"> ▶ Recent heavy rains have caused road closures and damage and clogging of drainage systems. Significant city staff time is required to clean and clear roadways and repair damages. 	<ul style="list-style-type: none"> ▶ Additional city staff time and costs to address issues. ▶ An increase in heavy precipitation could increase the incidence of landslides which could cover roads. ▶ An increase in heavy precipitation could leak to more embankment erosion on roads. ▶ More roads may be inundated by flooding. ▶ An increase in heavy precipitation could lead to more accidents and reduced speeds due to unsafe driving conditions. ▶ Sudden inundation could cause more drainage systems to be overwhelmed resulting in more roadway flooding. ▶ More flooding could result in the need for more emergency personnel to respond to issues. 	<ul style="list-style-type: none"> ▶ Additional city staff time and costs to address issues. ▶ Flooding of roads damages the support of the roadway causing sink holes etc. ▶ Consequences could include road safety issues and damage to infrastructure. ▶ Residents may be impacted directly by the flooding or indirectly by the results of the flooding, such as poor roadway conditions and roadway debris. ▶ There could be more accidents and reduced speeds which could increase commuting travel times. ▶ Emergency personnel may be delayed in delivering aid resulting in more deaths.
Bridges / Culverts	▶ City	<ul style="list-style-type: none"> ▶ Infrastructure: Precipitation-related scour at bridge foundations, weakening supports. ▶ Infrastructure: Water/debris hitting bridge and potentially overtopping the bridge deck (or reduced clearance) and/or approach roadways. 		<ul style="list-style-type: none"> ▶ Additional bridge maintenance and/or shorter useful service life. ▶ Additional time and costs to clean/repair culverts. ▶ More bridges may have weakened supports leading to more safety issues. ▶ More frequently overtopping of bridge deck with water and debris could make travel more difficult and result in the need for more repairs. 	<ul style="list-style-type: none"> ▶ Additional costs for bridge maintenance and replacement. ▶ Additional costs to repair and replace culverts. ▶ More bridge repairs may be needed resulting in some bridges being down, which will result in an increase of traffic. ▶ More repairs and impassable bridges will cause safety issues for community and increased traffic.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Rail	▶ Private	▶ Infrastructure/ Operations: Riverine flooding and debris caused by heavy precipitation events and flows may disrupt rail service.		▶ Rail service may be disrupted more frequently due to riverine flooding and debris.	▶ Customers may experience an increase in rail delays or cancellations and potential rail safety issues/concerns.
Public Transit	▶ LANTA	<ul style="list-style-type: none"> ▶ Infrastructure/Operations: Flooded routes may cause delays and damage to vehicles. ▶ Operations/Health: Dangerous driving conditions could present hazards to drivers and passengers, as well as potentially causing delays. ▶ Infrastructure: Flooding and storms may damage transit centers, garages, and stops. 		<ul style="list-style-type: none"> ▶ Flooded roads may cause detours or closures that significantly delay buses, or driving through flooded roadways may cause flood damage to the vehicles. ▶ Costs associated with infrastructure necessary to keep passengers protected from heat and heavy precipitation at bus stops. ▶ Heavy rain and flooded roadways may present hazards to drivers and riders as it could lead to an increase in accidents. Cautious driving during these events may also lead to delays in service. ▶ Some transit centers, stops, and garages may be located in flood zones. Flooding during heavy precipitation events could cause damage to property and equipment. 	<ul style="list-style-type: none"> ▶ Delays in service will be inconvenient and disruptive to passengers' schedules. ▶ Safety hazards may be present for riders if an accident occurs as a consequence of hazardous driving conditions. Delays in service will be inconvenient and disruptive to passengers' schedules. ▶ Increased costs to replace and repair property and equipment may have to be reflected in ticket prices.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Water Supply and Treatment					
Drinking Water Infrastructure	▶ City	<ul style="list-style-type: none"> ▶ Watershed/reservoirs: Increased flow over spillway may damage infrastructure and erode downstream receiving water basin; increased runoff from watershed may create erosion and sedimentation concerns, increase levels of organic matter, nutrients, and pathogens in the reservoirs. ▶ Operations/Maintenance: Increase in O&M and treatment costs due to adverse water supply quality. ▶ Precipitation Event Post Wildfire: Runoff and flash floods from burned areas can increase sedimentation in reservoirs, reducing their capacity and effective service lifespan. Higher pollutant loads in reservoirs can lead to higher turbidity, algal bloom, and subsequent higher treatment costs. ▶ Demand: Disruptions will cause competition for water resources/water availability concerns. 		<ul style="list-style-type: none"> ▶ Erosion and sedimentation; drop in reservoir water quality; infrastructure damage and cost to repair. ▶ Shortage of drinking water due to droughts and low water levels in water reservoirs. ▶ Buildup of debris in water ways need to be cleaned more regularly. ▶ Short-term competition for water during heavy precipitation events will exacerbate inequities in community. ▶ Financial burden to city (passed on to taxpayers) to replace/repair infrastructure. ▶ If reservoirs used for recreation (fishing, boating, swimming) diminished water quality will impact these activities. ▶ People will use bottled water, which increases plastic waste and ingestion of plastic, as well as the cost of water. 	<ul style="list-style-type: none"> ▶ Flooding may impact property downstream of reservoirs. ▶ Restrictions of water usage. ▶ Could cause people and businesses to relocate outside of Bethlehem or choose not to locate in the city.
Wastewater Infrastructure	▶ City	<ul style="list-style-type: none"> ▶ Operations/Maintenance: Increase in occurrence of Combined Sewer Overflows (CSO) which by design diverts high inflow at the WWTP to the Lehigh River. ▶ Operations/Maintenance: Increase in occurrence of Sanitary Sewer Overflows (SSO) at localized areas in the collection system, e.g., manhole overflows. 	<ul style="list-style-type: none"> ▶ CSO's are currently an infrequent event; most recent CSO's occurred in August 2018 and August 2020 due to heavy rain events. ▶ Inflow and Infiltration locations continue to be identified and corrected. 	<ul style="list-style-type: none"> ▶ Potential for more frequent CSO's. ▶ Potential for more frequent SSO's. ▶ Potential need to increase WWTP capacity to treat all storm water events—significant capital investment needed. ▶ Sewage entering waterways poses potential for disease and adverse impact to aquatic life. 	<ul style="list-style-type: none"> ▶ Adverse impact on Lehigh and Delaware Rivers; potential for increased regulatory scrutiny.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Stormwater					
Drainage (culverts/ pipes, pumps, drainage ponds)	▶ City	<ul style="list-style-type: none"> ▶ Operations/Maintenance: Power failure resulting in storm pump failure. ▶ Operations/Maintenance: Storm pumps may be overwhelmed by strong storm events or heavy precipitation events. 	▶ City does not currently have storm pumps for municipal use. The city used to years ago at Lehigh River Levee.	▶ Sewage entering waterways poses potential for disease and adverse impact to aquatic life.	
Energy					
Energy supply and production	▶ PPL/UGI	<ul style="list-style-type: none"> ▶ Infrastructure: More frequent instances of landslides due to heavy rains will increase the risk of damage to possible gas pipelines. ▶ Infrastructure: Decreased generating capacity if equipment or infrastructure is damaged through flooding, erosion, and subsidence. ▶ Operations/Maintenance: Potential flooding of power plants (oil/gas/coal), with consequences for interruption to generation and supply. ▶ Operations/Maintenance: Higher operational costs to manage onsite drainage and runoff. ▶ Operations/Maintenance: Water flow that exceeds the storage capacity of reservoirs necessitates storage conservation and/or causes spills that reduce effective generating capacity. ▶ Operations/Maintenance: Increased soil erosion and sedimentation can result from heavy downpours occurring after dry periods, reducing hydropower output. ▶ Monetary Costs: Extreme precipitation events can result in higher maintenance costs and stricter safety protocols for dam operations. 	<ul style="list-style-type: none"> ▶ Few recent issues in Bethlehem (flooding near Monocacy Creek led to a few temporary shut-offs), but generally natural gas meters cannot function when waterlogged and must be temporarily shut off. ▶ Natural gas supply concerns are minimal in the event of flooding. ▶ Hydro generating facility water releases due to high rainfall and reservoir limit reached. ▶ Flooding of low-lying areas with may include generating resources (includes run-off and erosion issues). 	<ul style="list-style-type: none"> ▶ In some areas, landslides could also impact electrical transmission and distribution. ▶ Fuel impacts—erosion and flooding could impact fuel supply lines (rail and coal; pipelines—gas and oil). ▶ Reduced generating capacity due to fuel shortages (outages). ▶ Physical impacts to facilities—flooding, erosion, mudslides. ▶ Potential for down-stream flooding due to hydro generating facility water releases (to maintain dam integrity). 	<ul style="list-style-type: none"> ▶ Increased power costs—due to a reduction in capacity as a direct result of fuel interruptions or facility flooding/erosion. ▶ Down-stream flooding risk. ▶ Power quality issues.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Electrical Transmission and distribution	▶ PPL	<ul style="list-style-type: none"> ▶ Infrastructure: Increased risk of disruption and downtime due to damage to distribution infrastructure and result in reduced system reliability. ▶ Infrastructure: Increased risk of flooding of transmission substations. 	▶ Substation flooding due to high rainfall.	<ul style="list-style-type: none"> ▶ Increased T&D line outages. ▶ Equipment impacts—damage of T&D infrastructure in low-lying areas. 	<ul style="list-style-type: none"> ▶ Potential for increased outages in low-lying areas with T&D assets. ▶ Grid power quality and reliability issues. ▶ Increased costs to customers to replace damaged equipment.
Natural gas distribution	▶ UGI	▶ Infrastructure: high rainfall leading to mudslides, damaging distribution infrastructure.	▶ Natural gas supply concerns are minimal in the event of flooding.	▶ Impact to natural gas distribution lines.	▶ Could result in natural gas fuel interruptions to generating facilities and end-use customers.
Communications					
Fixed line network (cable)	▶ Private	<ul style="list-style-type: none"> ▶ Infrastructure: Flooding of exchanges, manholes, and underground pits. If storm includes significant wind or ice, damage to aboveground transmission infrastructure during storm events (e.g., falling trees, icing leading to breakage of transmission lines). ▶ Operations/Maintenance: If significant storm event, may cause power outages that may exceed the length of time that backup batteries and fuel to power generators could supply communications. ▶ Emergency Response: If significant storm event, loss of communication service in emergency situations. 		<ul style="list-style-type: none"> ▶ More frequent damage to aboveground transmission infrastructure. ▶ More frequent damage to communication service. 	▶ More frequent and prolonged outages for customers.
Mobile line network (cellular)	▶ Private	<ul style="list-style-type: none"> ▶ Operations/Maintenance: If significant storm event, may cause power outages that may exceed the length of time that backup batteries and fuel to power generators could supply communications. ▶ Emergency Response: If significant storm event, loss of communication service in emergency situations. 		<ul style="list-style-type: none"> ▶ More frequent damage to communication service. ▶ Serious power outages will also make it more challenging for many people to recharge their phones, leaving them vulnerable if they need help. 	▶ More frequent and prolonged outages for customers.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Buildings					
Electrical	▶ City / Private	▶ Infrastructure: Appliances and/or electrical systems located in exposed areas to flooding may be damaged.		▶ Additional costs and effort to repair/replace infrastructure damaged by flooding.	▶ Increased maintenance costs.
Lower levels	▶ City / Private	▶ Infrastructure: Riverine flooding may cause flooding of buildings resulting in structural damage and/or mold. ▶ Maintenance/Operations: Sump pumps and other flood mitigation strategies may be overwhelmed by strong storm events or heavy precipitation events. ▶ Monetary Costs: Replacing and repairing damaged buildings and assets.	▶ Flooding of sand island and other low-lying areas.	▶ The public storm water system is overloaded, and water finds its way into basement as well as first floors.	▶ Impact on significant/historic buildings—renovations might be required—provide help to families which do not have the means to clean up their homes and purchase lost items.
Foundation	▶ City / Private	▶ -Increased number of sink holes.	▶ Allentown lost a building on Hamilton Street a few years ago. The properties by the Promenade area are prone to sink holes.	▶ Stability of foundations, cracks in structure, safety of occupants.	

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Populations / Community					
Populations	▶ NA	<ul style="list-style-type: none"> ▶ Health: Risk of drowning and getting washed away in floodwaters. ▶ Health: Exposure to mold growth in properties and exposure to reduced indoor air quality. ▶ Health: Increased prevalence of disease carrying insects like mosquitos, decreased water quality contaminated by industrial and other chemicals and oils. ▶ Health: Reduction of access to essential goods and services if trapped by floodwaters. ▶ Monetary Costs: Potential displacement from flood damaged properties. ▶ Environmental: Decreased water quality contaminated by industrial and other chemicals and oils affecting wildlife and habitats. ▶ Psychological: depression, anxiety, PTSD, and other mental health challenges due to displacement from home, family, and community (safety/security network) during and after traumatic flood incident. 	<ul style="list-style-type: none"> ▶ Standing water has been the cause of more mosquitos ▶ Extreme flooding of Saucon Park and east side of Creek Road during and following heavy rain in early August 2020 ▶ Cars stranded in flood events and even some people washed away. ▶ Flooding in homes requiring remediation. ▶ Public events, like Musikfest, temporary closures due to flooding. 	<ul style="list-style-type: none"> ▶ Act now to prohibit any building or building expansion in flood plains. Use the so-called 500-year flood plain maps ▶ Flood plains may need to be revised to account for future extreme precipitation events ▶ Increased housing demands as more properties become vulnerable to flood and mold damage ▶ More occurrences of Lyme disease (both one-off cases and chronic Lyme) due to increasing tick populations (also related to temperature increases). 	<ul style="list-style-type: none"> ▶ Increased mortality and medical costs. ▶ Need to adapt infrastructure to increased future flooding ▶ Cost of housing (owning and renting) increases outside of flood zones; property values decrease in flood zones, pushing economically vulnerable residents into areas prone to flooding. ▶ Most home insurance doesn't cover flooding, and many people cannot afford flood insurance as it is. Increased flooding will only exacerbate the issue. This will increase the likelihood of inability to recover from a flood event.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
At-Risk Populations (health-related, job-related, income-related, cohort-related)	<ul style="list-style-type: none"> ▶ NA 	<ul style="list-style-type: none"> ▶ Monetary Costs: Inability to meet economic burden of recovering from a flood event and/or reach out for health care. ▶ Equity: Non-English speakers may have difficulty navigating directions on how to avoid risk during disaster. ▶ Equity: Non- and less-mobile people (health compromised) less capable of avoiding flooding disaster by leaving home, less able to prepare and prevent damage to home prior to disaster, less able to adapt and escape threats in home during disaster. ▶ Equity: Damage to community resources such as local grocers can have larger impact on those without transportation or who are not physically mobile. 			<ul style="list-style-type: none"> ▶ Increases in homelessness due to potential displacement and being priced out of both the housing and renting markets.

RISING AVERAGE TEMPERATURES AND TOTAL PRECIPITATION

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Transportation					
Roads	▶ City	<ul style="list-style-type: none"> ▶ Infrastructure: Potential reduction in frost heave and road damage; freeze occurring later and thawing earlier with shorter freeze season lengths. ▶ Infrastructure: If more rain falls as rain than snow in winter/early spring, may see increased risk of landslides, slope failures, floods from runoff leading to road washouts/closures. ▶ Maintenance/Operations: Increase in soil moisture levels that could become too high, affecting structural integrity. ▶ Maintenance/Operations: Potential shift in budgets from salt/snow removal to heat-related road repairs, reducing road salt pollution. ▶ Maintenance/Operations: Changes in environmental parameters like soil moisture affecting pavement integrity. ▶ Maintenance/Operations: Increase vegetation growth along roadways hampering visibility. ▶ Maintenance/Operations: Shift in ideal times of year and times of day for road construction/repairs. 		<ul style="list-style-type: none"> ▶ Increased road maintenance activity and traffic disruptions/impacts. ▶ Risk of sink holes. ▶ A shift in the normal schedule of frost heave and thawing will result in a shift in the scheduling of repairs and infrastructure needs. ▶ An increase in temperature may lead to more rain and less snow so an increase in landslides. ▶ An increase in structural integrity issues of roads. ▶ An increase in pavement integrity as an issue. ▶ More vegetation growth with a warmer, wetter climate leading to visibility issues and the need for more frequently mowing. ▶ Increased public transit use when cars are not feasible due to impacts. 	<ul style="list-style-type: none"> ▶ Increased costs for road maintenance and/or lower quality roadway surfaces. ▶ Seasonal impacts to the community may be seen later than they normally would. ▶ More roadway repairs will be needed thus increasing travel times due to traffic and congestion. ▶ More accidents due to visibility challenges. ▶ Increased traffic at certain times of the year, which may impact holiday travel.
Bridges/ Culverts	▶ City	▶ See above		▶ Shorter service life and more frequent repairs.	<ul style="list-style-type: none"> ▶ Increased costs for bridge maintenance/replacement. ▶ Increased traffic at certain times of the year, which may impact holiday travel.
Rail	▶ Private	<ul style="list-style-type: none"> ▶ Maintenance/Operations: Shift in budgets from salt/snow removal to heat-related rail repairs. ▶ Maintenance/Operations: Increase vegetation growth along railways. 		▶ More vegetation growth with a warmer, wetter climate leading to the need for more frequent mowing. Minimal impact to rail travel.	

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Public Transit	▶ LANTA	<ul style="list-style-type: none"> ▶ Maintenance/Operations: Increased vegetation growth along roadways may hide signs/stops. ▶ Operations/Infrastructure: Increased rain days may require more shelters at stops for riders to be protected from weather 		<ul style="list-style-type: none"> ▶ Increased precipitation and temperature may lead to increased vegetation growth along roadways, which may obstruct stops and signs. This could require increased maintenance at stops. ▶ A wetter climate may lead to more days with rainy weather, requiring more stops to have protective shelters for riders to stay out of the rain. Building these shelters would incur a large cost. 	<ul style="list-style-type: none"> ▶ Buses may miss stops that they cannot see, leaving riders stranded. There may also be increased costs from increased stop maintenance. ▶ Riders may have to wait in unpleasant or dangerous weather if shelters cannot be built, and there may be increased costs from shelter installation.
Water Supply and Treatment					
Drinking Water Infrastructure	▶ City	<ul style="list-style-type: none"> ▶ Watershed/Reservoirs: adverse impact on ecological balance which may affect flora, fauna, and reservoir water quality; potential impact on reservoir mixing and stratification which can impact water quality; risk of invasive species; increased potential for algal blooms and other waterborne pathogens. ▶ Operations/Maintenance: Increased O&M to manage changing ecosystem at the watershed, increased water treatment costs to eliminate toxins, algal growth, invasive species that can affect source water quality. 		<ul style="list-style-type: none"> ▶ Poorer water quality will pose significant challenge for treatment. ▶ Increase costs to city and, as a result, taxpayers. 	▶ Potential for adverse water quality would impact the entire water system including city and surrounding communities.
Wastewater Infrastructure	▶ City	<ul style="list-style-type: none"> ▶ Operations/Maintenance: Increase in average inflow to the WWTP over time will require increase in O&M costs and capital expenditures to increase treatment capacity. ▶ Operations/Maintenance: Increase in flow in the collection system will require increase in O&M costs to reduce blockages and reduce occurrence of Sanitary Sewer Overflows (SSO) at localized areas in the collection system, e.g., manhole overflows. 	▶ Inflow and Infiltration locations continue to be identified and corrected; more aggressive attention will be needed.	<ul style="list-style-type: none"> ▶ Potential for more frequent SSO's. ▶ Potential need to increase WWTP capacity to treat all storm water events—significant capital investment needed. 	▶ Adverse impact on Lehigh and Delaware Rivers; potential for increased regulatory scrutiny.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Stormwater					
Drainage (culverts/ pipes, pumps, drainage ponds)	▶ City	<ul style="list-style-type: none"> ▶ Maintenance/Operations: Ongoing monitoring and maintenance to maintain level of service/adapt to accommodate more water. ▶ Maintenance/Operations: Need for storm pump capacity increase. ▶ Maintenance/Operations: Increased use, resulting in new maintenance schedule/budget. 	▶ City does not currently have storm pumps for municipal use. The city used to years ago at Lehigh River Levee.	▶ Increase costs to city and, as a result, taxpayers.	
Energy					
Energy supply and production	▶ PPL/UGI	▶ Maintenance/Operations: Reliability of power supplies, particularly power generation facilities, may be reduced due to increased seasonal variation of freshwater supplies used for cooling equipment.			
Electrical Transmission and distribution	▶ PPL	<ul style="list-style-type: none"> ▶ Increased demand in summer season (high-heat; measured with cooling degree days, CDD). ▶ Decreased demand in winter seasons due to increased temperatures (measured with heating degree days, HDD). 			▶ Overload on power supply will lead to outages.
Natural gas distribution	▶ UGI	▶ Unknown.			
Fixed line network (cable)	▶ Private	▶ Unknown.			
Mobile line network (cellular)	▶ Private	▶ Unknown.			

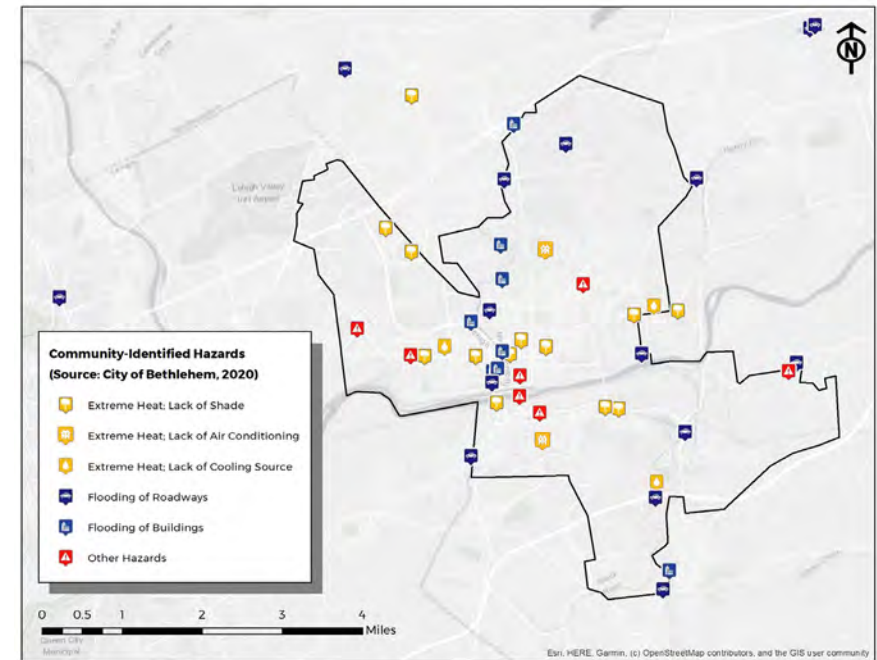
Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
Buildings					
Buildings	▶ City / Private	<ul style="list-style-type: none"> ▶ Electrical: Increased stress on electrical wiring during longer durations of cooling demand. ▶ Lower levels: Higher water tables and/or saturated grounds may increase flooding exposure. 		<ul style="list-style-type: none"> ▶ Additional costs and effort to repair/replace infrastructure damaged by flooding. ▶ Flooded basements and first floors, mold, larger area of flood plains. ▶ More stress on electrical wiring and the need to do some major retrofits. ▶ More flooding exposure. 	<ul style="list-style-type: none"> ▶ Increased maintenance costs. ▶ More frequently outages. ▶ More frequently building water inundation events.
Populations / Community					
Populations	▶ NA	<ul style="list-style-type: none"> ▶ Shifting health needs: Increased mortality for high heat events, but decrease mortality from cold-related stress (which is already lower than mortality from heat-related events). ▶ Health: Worsened air quality during hotter summers will increase prevalence of cardiac and respiratory illnesses along with worsened water quality. ▶ Health: Increased prevalence of vector-borne diseases. ▶ Health: Exposure to mold growth in properties and exposure to reduced indoor air quality. ▶ Health: Stress from weather threats may lead to long-term negative health impacts, particularly for at-risk populations. 		<ul style="list-style-type: none"> ▶ High cases of asthma in the Lehigh Valley ▶ Warmer winters increase insect overwintering, which will also increase disease, since insects are common vectors ▶ Increased need for cooling spaces, which must be located in neighborhoods throughout the city, and must be open even during future epidemics. ▶ Lack of adequate shelter/ protection from heat and/or floods. ▶ Agricultural changes will impact farmers (what crops will grow and thrive, what crops might no longer be economically viable, etc.) and community (food shortages). 	<ul style="list-style-type: none"> ▶ Increased mortality and medical costs. ▶ Increased pressure on hospital and healthcare systems, esp. in the summer months ▶ Rising costs of healthcare, utilities, food, etc. add economic and financial stress.

Category/ Assets	Asset Ownership/ Responsibility	Overarching Impacts	Recent Issues Experienced	Future Concerns	Consequences to the Community
At-Risk Populations (health-related, job-related, income-related, cohort-related)	<ul style="list-style-type: none"> ▶ NA 	<ul style="list-style-type: none"> ▶ Health: Expanding stress on these populations due to inability to cope and/or mitigate threats described above, which will likely have a greater impact on at-risk populations already under greater stress. ▶ Equity: Non-English speakers less likely to pursue increased need for health care due to difficulty of navigating health care system as non-English speaker. ▶ Equity: Low income populations less likely to escape from/avoid contraction and spread of disease made more likely by population density. 			<ul style="list-style-type: none"> ▶ Increased mortality, illness, and homeless rates in vulnerable populations.

Appendix 1 B

Community Hazard Mapping

In the lead up to and following the second public CAP planning meeting, the CAP development team asked Bethlehem residents to help identify climate-related hazards and impacts in their neighborhoods and community, such as extreme heat and flooding. Members of the community added 49 pins to the Bethlehem community hazard map identifying locations within Bethlehem with hazards from high temperatures, such as public places lacking shade or insufficient access to air conditioning, roadways or building flooding, and other climate-related impacts. These hazards identified by the community are provided in the table below. The City of Bethlehem has not yet independently validated the community-identified hazards, but it will assess the needs and severity of these potential hazards as it implements the CAP's adaptation strategies.



Climate stressor	Vulnerability	Location type	Street	City	Zip code	Description
Extreme Heat	Lack of Air Conditioning	Commercial or other building	Dewberry Ave	Bethlehem	18017	High school has no air conditioning.
Extreme Heat	Lack of Air Conditioning	Commercial or other building	Centennial Dr	Bethlehem	18015	Being in a college dorm (without air conditioning) I have noticed from just my first year here that the last month or so of summer can be unbearably hot in the dorms and areas around campus, and I can imagine it getting worse in the upcoming years.
Extreme Heat	Lack of nearby cooling source		Fire Ln	Bethlehem	18015	Saucon pool closed several years ago
Extreme Heat	Lack of nearby cooling source		Garfield St	Bethlehem	18017	Highly populated area with no access to cooling source
Extreme Heat	Lack of nearby cooling source		W Burton St	Bethlehem	18018	Lack of cooling source or water feature/fountain to cool off during hot summer periods. The city used to have many areas of cooling pools or fountains for citizens, but has shut them down over maintenance and costs. Water features are good for cooling during summer periods at parks and recreation areas.
Extreme Heat	Lack of Shade	Bus Stop	N Guetter St	Bethlehem	18018	Broad & Guetter Bethlehem Transportation Center has no shade in its southern platform. The northern platform has limited shade. People waiting 30-60 minutes for a bus in the summer would benefit from shelter from the heat, rain, and snow.

Climate stressor	Vulnerability	Location type	Street	City	Zip code	Description
Extreme Heat	Lack of Shade	Park or Public Gathering Point	E North St	Bethlehem	18018-4243	Friendship park has only a few trees and is largely unshaded
Extreme Heat	Lack of Shade	Park or Public Gathering Point	Westfield Ter	Bethlehem	18017	Westgate Shopping Center - underutilized parking lot - no shade.
Extreme Heat	Lack of Shade	Park or Public Gathering Point	Steel Ave	Bethlehem	18015	We need more trees.
Extreme Heat	Lack of Shade	Sidewalks	W Broad St	Bethlehem	18018-5528	West Broad St is an immense heat island with its 50' wide roadway and limited tree cover. Heat in the summer is serious for pedestrians.
Extreme Heat	Lack of Shade	Sidewalks	Washington St	Bethlehem	18017	Common walking route and municipal park - very few trees
Extreme Heat	Lack of Shade	Sidewalks	Bathgate Rd - Curbside	Bethlehem	18017	Hospital grounds have little shade
Extreme Heat	Lack of Shade	Sidewalks	Hill To Hill Brg S	Bethlehem	18015	Plant more trees everywhere
Extreme Heat	Lack of Shade	Sidewalks	E 3rd St	Bethlehem	18015-2048	No street trees [in some areas of East 3rd Street, such as 1200 block]
Extreme Heat	Lack of Shade	Sidewalks	Jacksonville Rd	Bethlehem	18017	Long stretch of sidewalk without any trees
Extreme Heat	Lack of Shade	Sidewalks	Pembroke Rd	Bethlehem	18017-7133	Very little shade trees along this much used walkway.
Extreme Heat	Lack of Shade	Sidewalks	W Broad St	Bethlehem	18018-4921	Very few shade trees
Extreme Heat	Lack of Shade	Sidewalks	E Union Blvd	Bethlehem	18018-4062	Few shade trees along Union Blvd.
Flooding	Buildings	Commercial or other building	PA-378 N	Bethlehem	18018	After heavy rains, this tributary carries massive amounts of water near the Martin Tower construction site, emptying into the Monocacy Creek.
Flooding	Buildings	Commercial or other building	Main St	Bethlehem	18018-3801	After heavy rain, the buildings in the historic Industrial Quarter suffer from flooding and Musikfest routinely is flooded out.
Flooding	Buildings	Commercial or other building	Monocacy Creek Rd	Bethlehem	18017	The water over the dam in Monocacy Park becomes a raging flood after a heavy rain, partially engulfing the small pavilions on either side, bringing massive logs over the dam, and inundating the area between there and Illick's Mill road.
Flooding	Buildings	Commercial or other building	Front St	Hellertown	18055	Severe (2-3 ft.) in August 2020, shows importance of not allowing development in flood plans!

Climate stressor	Vulnerability	Location type	Street	City	Zip code	Description
Flooding	Buildings	Commercial or other building	Front St	Hellertown	18055	Severe (2-3 ft.) in August 2020, shows importance of not allowing development in flood plans!
Flooding	Buildings	Commercial or other building	Conestoga St	Bethlehem	18018-5622	Apartments flood (Conestoga)
Flooding	Buildings	Commercial or other building	Old York Rd	Bethlehem	18018	Historic Bethlehem Properties suffer severe flood damage and it is occurring more frequently.
Flooding	Buildings	Private Residence	Park Pl	Bethlehem	18017-2474	extreme flooding due to stormwater culvert that runs below Rt. 22 towards the creek
Flooding	Buildings	Private Residence	Monocacy St	Bethlehem	18018-1928	This block of Monocacy Creek about the 1500 block, I believe has a drain that comes from the street and goes under ground to an open drain/culvert pipe that delivers huge amounts of stormwater down the hill behind the houses that have back yards facing the creek. The land the houses sits on is compromised and is eroding away rapidly. This needs to be a concern due to the impact on the creek plus the properties it is eroding.
Flooding	Roadway		Broadway	Fountain Hill	18015-2620	Broadway gets flooded during heavy rains.
Flooding	Roadway		Easton Ave	Bethlehem	18020-4258	Easton Ave and Willow Park Rd - flooding during extreme rain events
Flooding	Roadway		Market St	Bethlehem	18017	East Market St near PPL substation - wash out area across roadway during heavy rain events; forces frequent road closures
Flooding	Roadway		Creek Rd	Bethlehem	18015-5007	Near intersection of Friedensville and Creek Rds - heavy flooding along Saucon Creek during heavy rains
Flooding	Roadway		Johnston Dr	Bethlehem	18017-1859	Low point on Johnston floods
Flooding	Roadway		W Macada Rd	Bethlehem	18017	Flood roadway and RR tracks
Flooding	Roadway		Applebutter Rd	Bethlehem	18015-6000	Road flooding - runoff from the landfill.
Flooding	Roadway		Hellertown Rd	Bethlehem	18015	Saucon Creek overflowed onto Hellertown Road during largest rainfall event in summer 2020.

Climate stressor	Vulnerability	Location type	Street	City	Zip code	Description
Flooding	Roadway		College Dr	Bethlehem	18015	Saucon Creek overflowed onto College Ave (probably Silvex Rd too) during largest rainfall event in summer 2020.
Flooding	Roadway		W Locust St	Bethlehem	18018	Flooded parking lot and industrial site
Flooding	Roadway		4992 Airport Rd	Allentown	18109-9401	Intersection floods in heavy rains
Flooding	Roadway		Farmersville Rd	Bethlehem	18020-9766	Pond floods over road after a lot of rain
Flooding	Roadway		Green Pond Rd	Easton	18045	Pond floods on roadway after heavy rain
Flooding	Roadway		Mickley Rd	Whitehall	18052	Flooded roadway intersection after heavy rains
Flooding	Roadway		Hill To Hill Brg S	Bethlehem	18018	Flooding under bridge
Other Hazards			Applebutter Rd	Bethlehem	18015-6000	Calpine Energy- Oil Control, major and hazardous air pollutant
Other Hazards			Hamilton Ave	Bethlehem	18017-5126	Sinkholes
Other Hazards			1566 W Broad St	Bethlehem	18018-6418	West Broad Street, West Union Blvd is dangerous for biking and pedestrians, limiting access to carbon-reducing modes of transportation
Other Hazards			New St	Bethlehem	18015	The New Street bridge linking the North and South sides do not support bicyclists or pedestrians. This limits peoples' access to carbon reducing modes of transportation.
Other Hazards			W Union Blvd	Bethlehem	18018	Dangerous or unavailable bicycle and pedestrian access points to groceries. This limits integration of carbon reducing transportation options.
Other Hazards			312 E 3rd St	Bethlehem	18015-1310	Traffic Calming would aid in making Third Street along its entire length a more walkable and pedestrian friendly zone. Increased traffic also promotes increased levels of exhaust fumes and related environmental hazards.
Other Hazards			1 W Church St	Bethlehem	18018-5821	Drivers turning right off of New St. do not stop before turning.

Appendix 2

Performance Metrics

The following tables include draft performance metrics for each of the GHG mitigation sections of the CAP:

 **Municipal Operations**

 **Buildings**

 **Electricity Sourcing**

 **Transportation and Mobility**

 **Land Use and Green Space**

 **Local Food and Waste**

 **Public Engagement**

 **Large Organizations and Institutions**

These measures will be updated by the Office of Sustainability during the implementation phase, but their inclusion here is intended to provide a starting point to show how the city and general public can measure progress toward the sector objective and goals. The draft metrics are organized by the goals of each sector. These metrics can be either output-based (e.g., percent of lighting energy covered by LEDs) or outcome-based (e.g., kWh energy saved from LED retrofits). The proposed indicators follow the SMART framework: Specific, Measurable, Achievable, Relevant and Time-based.

Municipal Operations

Reduce GHG emissions from municipal operations 67% relative to a 2005 baseline by 2025

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
100% renewable electricity	Contracts for 100% renewable electricity consumption across municipal operations	► City energy contracts	Tracked
% GHG reduction	% GHG reduction from 2005 baseline	► City municipal GHG inventory	Tracked—but inventory requires updating

Achieve net-zero operations by 2030

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Residual emissions	Metric tons of CO ₂ -equivalent GHGs remaining prior to purchase of carbon offset credits	► City municipal GHG inventory	Tracked—but inventory requires updating
Net emissions	Net GHG emissions after the purchase of carbon removal credits	► City municipal GHG inventory	Requires development—gross emissions tracked, but inventory requires updating and process for tracking carbon removal credits required to monitor net emissions.

Implement the city's Climate Action Plan

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
City Sustainability Director hired	Creation of the Office of Sustainability and hiring of the Sustainability Director	<ul style="list-style-type: none"> ▶ City budget and staffing documentation 	Tracked
Strategies initiated	The number or percentage of CAP strategies that have been initiated as measured by the completion of the identified "Key Next Step"	<ul style="list-style-type: none"> ▶ New internal CAP tracking database ▶ New public CAP progress webpage 	Requires development—this would require new databases to be developed as the CAP is implemented.
Strategies implemented	The number or percentage of CAP strategies that have been fully implemented	<ul style="list-style-type: none"> ▶ New internal CAP tracking database ▶ New public CAP progress webpage 	Requires development—this would require new databases to be developed as the CAP is implemented.
Community-wide GHG emissions	Community-wide GHG emissions as measured by the city's GHG inventory	<ul style="list-style-type: none"> ▶ City community-wide GHG inventory 	Currently tracked, but inventory requires updating.



Buildings

Expand public disclosure of building energy use

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
# of commercial buildings complying with disclosure requirements	Metric would be further developed once disclosure requirements are instituted	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.
# of multifamily buildings complying with disclosure requirements	Metric would be further developed once disclosure requirements are instituted	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.
# of government buildings complying with disclosure requirements	Metric would be further developed once disclosure requirements are instituted	<ul style="list-style-type: none"> ▶ City energy bills and energy management system ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.
% of commercial buildings' floor area complying with disclosure requirements	Metric would be further developed once disclosure requirements are instituted	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.
% of multifamily buildings' floor area complying with disclosure requirements	Metric would be further developed once disclosure requirements are instituted	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
% of floor area complying with disclosure requirements	Metric would be further developed once disclosure requirements are instituted	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.
Energy intensity (kBtu/ft ²) of commercial buildings	Energy intensity measured in kBtu/ft ² is standard benchmark used by EPA's Portfolio Manager	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.
Energy intensity (kBtu/ft ²) of multifamily residential buildings	Energy intensity measured in kBtu/ft ² is standard benchmark used by EPA's Portfolio Manager	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.
Energy intensity (kBtu/ft ²) of government buildings	Energy intensity measured in kBtu/ft ² is standard benchmark used by EPA's Portfolio Manager	<ul style="list-style-type: none"> ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—tracking would need to be developed following the institution of disclosure requirements.

Decrease buildings' fuel carbon intensity

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
# of boilers replaced with less carbon intensive options	The total number of boilers replaced per year with less carbon intensive alternatives, annual and cumulative.	<ul style="list-style-type: none"> ▶ New programmatic database 	Requires development—tracking would need to be developed following the launch of retrofit programs in the CAP
# of appliances replaced with less carbon intensive options	The total number of appliances replaced per year with less carbon intensive alternatives, annual and cumulative	<ul style="list-style-type: none"> ▶ New programmatic database 	Requires development—tracking would need to be developed following the launch of retrofit programs in the CAP

Increase energy efficiency of existing buildings

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Number of buildings renovated to NZE standard	Cumulative and annual total number of buildings renovated to NZE standard.	<ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	Requires development—once NZE standards are implemented, the City could track this as part of the building permit process
Energy intensity (kBtu/ft ²) of government buildings	Energy intensity measured in kBtu/ft ² is standard benchmark used by EPA's Portfolio Manager.	<ul style="list-style-type: none"> ▶ City energy bills and energy management system ▶ Energy Star Portfolio Manager ▶ New city benchmarking website, similar to City of Philadelphia's 	Requires development—city energy use and building footprint data are tracked, but these will need to be combined and tracked as an energy intensity metric.
# of commercial and large residential buildings undergoing audits and retro-commissioning each year	Metric would be further developed once audit and retro-commissioning programs are instituted	<ul style="list-style-type: none"> ▶ New programmatic database ▶ Dept. of Community and Economic Development 	Requires development—tracking would need to be developed following the launch of retrofit programs in the CAP
Total number of PACE loans, total PACE funding provided	Metric would be specific to C-PACE until R-PACE is allowed and available in Pennsylvania	<ul style="list-style-type: none"> ▶ Sustainable Energy Fund 	Tracked—SEF acts as the Program Administrator of C-PACE in Northampton and Lehigh Counties.

Increase energy efficiency of new buildings

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
# of new buildings constructed to NZE standard	Total number of new buildings constructed to NZE standard, annual and cumulative	<ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	Requires development—once NZE standards are implemented, the City could track this as part of the building permit process



Electricity Sourcing

Educate the community on the benefits of renewable energy and options available to consumers

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
# of residents engaged about renewable electricity	The total number of residents engaged through different channels, both virtual and in person, such as information sessions/workshops held with community organizations (e.g., Community Action, Hispanic Center Lehigh Valley, BASD, local church groups, and local colleges or universities)	<ul style="list-style-type: none"> ▶ New programmatic database ▶ Dept. of Community and Economic Development 	Requires development—tracking would need to be developed following the launch of engagement programs in the CAP
# of businesses engaged about renewable electricity	The total number of residents engaged through different channels, both virtual and in person, such as information sessions/workshops held with business groups, such as the Chamber of Commerce	<ul style="list-style-type: none"> ▶ New programmatic database ▶ Dept. of Community and Economic Development 	Requires development—tracking would need to be developed following the launch of engagement programs in the CAP
# of city renewable energy demonstration projects completed	Total number of renewable energy projects on city properties	<ul style="list-style-type: none"> ▶ Dept. of Public Works 	Tracked—type of information would already be tracked but a procedure for disseminating it to the public would need to be developed

Promote the use of renewable electricity

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
# of residents and businesses recognized for renewable energy use	Once a recognition program is established, set goals for new members each year (e.g., 10-12 first year, 25-35 second year, 100-150 by year 5).	<ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	Requires development—tracking would need to be developed following the launch of recognition programs in the CAP
# of notices sent out about net metering and renewable energy	Provide regular reminders to residents and businesses about net metering and renewable energy	<ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	Requires development—tracking would need to be developed following the launch of engagement programs in the CAP
Community-wide renewable energy consumption %	This could be measured as a percentage or indirectly via the number of consumers switching to/ utilizing a renewable energy supply through their electricity provider	<ul style="list-style-type: none"> ▶ PA PUC 	Not available—due to privacy restrictions, data is not available on the electricity supplier choice of individual customers. The City would need to engage the PA PUC for options to indirectly measure progress.

Maximize the use of on-site solar, energy storage solutions, and other renewables

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
# of residential solar installations in the city	Total number of buildings with on-site solar PV power	► Dept. of Community and Economic Development	Tracked—type of information would already be tracked but a procedure for disseminating it to the public would need to be developed
# of commercial solar installations in the city	Total number of buildings with on-site solar PV power	► Dept. of Community and Economic Development	Tracked—type of information would already be tracked but a procedure for disseminating it to the public would need to be developed
Total kilowatts (kW) of solar capacity installed in the city	Total power capacity of all on-site solar PV installed in city limits	► Dept. of Community and Economic Development	Requires development—Unclear if solar capacity is tracked in any public database
Solar permit processing time	Average number of days required for issuing of permits to install rooftop solar PV	► Dept. of Community and Economic Development	Requires development—Unclear if permit processing time is currently tracked

Support policy changes that increase equitable access to local renewable electricity

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Public indications of support issued	Through ordinances, letters of support, or other means, demonstrate the city's support for statewide policies that increase equitable access to local renewable electricity, such as CCA and community renewables	► City Council	Requires development—indications of support are publicly released but a tracking system requires development

Transportation and Mobility

Reduce vehicle miles traveled

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Vehicle Miles Traveled (VMT)	Total miles traveled by vehicle type and sector in Bethlehem	<ul style="list-style-type: none"> ▶ LVPC ▶ A new comprehensive multimodal transportation data collection program that includes vehicle-miles-traveled (VMT) 	Tracked—but improvement in data sensitivity required. LANTA can track ridership along each route and stop, so it can be analyzed for just those routes and stops that are within the city.
Transportation mode-share	Percentage of trips or VMT for each (walking, bicycling, transit, driving alone and carpooling), and route selection	<ul style="list-style-type: none"> ▶ LVPC ▶ Routine traffic counts for both roadways and bicycle routes. ▶ LANTA ridership data ▶ Recurring bike/pedestrian counts at key intersections in business districts 	Requires development—not tracked at the level of detail required. There is LANTA Origin-Destination data available. The US Census American Community Survey includes commuting data that can inform mode share. Urban planning software, such as Replica, could also be used to track progress if Bethlehem is included in the software's database.

Decrease use of fossil transportation fuels

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Total Gasoline/Diesel Consumption	Gallons of fossil transportation fuels by vehicles in Bethlehem	<ul style="list-style-type: none"> ▶ Fuel Sales, Tax data, Distributors/retailers 	Requires development—not currently tracked.

Increase use of electric and alternative fuel zero-emitting vehicles

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Total number of EVs owned	Measure total increase in number of EVs owned within the city	<ul style="list-style-type: none"> ▶ PennDOT; PA EV Roadmap 	Unknown—data have not been requested.
Total number of EV charging stations	Measure total number of publicly available EV charging stations	<ul style="list-style-type: none"> ▶ Various EV charger apps; BPA, Conduct pre-and post- survey of EVSE within the city 	Unknown—data have not been requested.
Municipal fleet EV adoption	Increase number of municipal EVs	<ul style="list-style-type: none"> ▶ Municipal data 	Tracked
Number of residentially-owned EVs	Resident EV ownership	<ul style="list-style-type: none"> ▶ State Vehicle Registration Data 	Unknown—data have not been requested.

Improve transportation data collection and tracking system

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Data availability for metrics identified above	Assessment of whether the data described above is available on an annual or bi-annual basis for tracking	▶ City Assessment	Requires development—data availability can be compiled during CAP implementation.
Norfolk Southern GHG emissions in Bethlehem	Train yard and freight train GHG emissions in Bethlehem.	▶ Norfolk Southern	Requires development—train miles traveled are likely tracked but emission factors would need to be applied to estimate GHG emissions.

Land Use & Green Space

Promote compact urban design with higher densities and mixed uses through plans and zoning ordinances, especially in development centers and major corridors

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Ordinances reviewed and/or updated	Work with LVPC and build a check-list of ordinances and codes to review or update, and track progress against the list.	<ul style="list-style-type: none"> ▶ City Council ▶ Bureau of Planning & Zoning ▶ EAC ▶ LVPC 	Requires development—to be developed as strategies are implemented.
City population density	City population per unit of land area	▶ Bureau of Planning & Zoning	Tracked
Percentage of mixed use or multifamily housing	Percentage of building stock classified as mixed use or multifamily housing, which provide indicators of density and compact urban design	▶ Bureau of Planning & Zoning LVPC	Tracked
Transit accessibility	% of residents within a specific distance of regular public transit. The specific distance can be tailored based on stakeholder feedback.	<ul style="list-style-type: none"> ▶ LVPC Equity Analysis ▶ Bureau of Planning & Zoning LANTA 	Requires development—underlying data is tracked but metric would likely need to be developed.

Equitably preserve and expand Bethlehem's urban tree canopy and natural resources

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Tree canopy coverage	The proportion of ground covered by tree crowns	<ul style="list-style-type: none"> ▶ 2020 city tree inventory 	Partially tracked—the tree inventory will assess individual trees on public property but not private property. A full tree canopy coverage assessment would require an aerial assessment using a tool such as LIDAR.
Greenspace distribution equity	% of residents with adequate green space access	<ul style="list-style-type: none"> ▶ Trust for Public Land ParkScore ▶ LVPC Equity Analysis ▶ EPA EJScreen 	Requires development—the TPL ParkScore metric provides a baseline but it is not clear if it would be updated frequently enough to track progress. Neither the LVPC Equity Analysis nor the EPA EJScreen tool exclusively measures greenspace distribution equity. There is little consistency in the academic literature on methods and definitions for this metric.

Improve the quality of urban ecosystems to promote native species, biodiversity, and carbon sequestration

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Ecosystem projects implemented	Number of projects supporting quality urban ecosystems implemented by the city or its partners	<ul style="list-style-type: none"> ▶ Dept. of Public Works 	Requires development—projects can be tracked based on public data as they are completed.
Carbon credits generated	Carbon offset or removal credits generated from tree planting and preservation in city limits	<ul style="list-style-type: none"> ▶ Rodale Institute ▶ City Forest Credits™ ▶ Urban Offsets 	Requires development—tracking would have to be developed in conjunction with implementation, potentially in partnership with the credit certifier.

Increase the conversion of underutilized space to green space

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Acres of new green space	Acres of new green space developed in city limits	<ul style="list-style-type: none"> ▶ Bureau of Urban Forestry ▶ Recreation Department ▶ LVPC 	Tracked

Increase equity and accessibility in Bethlehem's green space

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Greenspace distribution equity	% of residents with adequate green space access	<ul style="list-style-type: none"> ▶ Trust for Public Land ParkScore ▶ LVPC Equity Analysis ▶ EPA EJScreen 	Requires development—the TPL ParkScore metric provides a baseline but it is not clear if it would be updated frequently enough to track progress. Neither the LVPC Equity Analysis nor the EPA EJScreen tool exclusively measures greenspace distribution equity. There is little consistency in the academic literature on methods and definitions for this metric.
Community surveys	Survey of community satisfaction with green space and recreation options, with engagement in low-income neighborhoods to ensure opportunities to respond	<ul style="list-style-type: none"> ▶ A new regularly conducted survey by Recreation Dept. or other city department 	Requires development—surveys and outreach mechanisms/partnerships would need to be developed during implementation of the CAP.

Improve stormwater and floodplain management through green infrastructure

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Flooding events	Number of flooding events in city limits	<ul style="list-style-type: none"> ▶ Emergency Management Dept. ▶ FEMA 	Tracked
Green infrastructure projects completed	Number of green infrastructure projects implemented by the city or its partners	<ul style="list-style-type: none"> ▶ Dept. of Public Works ▶ LVPC 	Tracked—projects can be tracked based on public data as they are completed.



Local Food & Waste

Adopt a "reduce first" approach and minimize waste

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Waste landfilled	Tons of waste disposed of in landfills annually. Ideally, this data could be broken down by sector and time to identify trends, such as waste from large festivals and evaluating business waste independently from residential waste.	<ul style="list-style-type: none"> ▶ Northampton & Lehigh Counties ▶ Private transfer stations ▶ Local waste haulers 	Requires development—requisite data likely exist but must be aggregated.

Maximize waste diversion from landfills

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Diversion rate	Percentage of total waste that is diverted away from landfills, including reuse, composting, and recycling	<ul style="list-style-type: none"> ▶ Northampton & Lehigh Counties ▶ Recycling Bureau 	Requires development—requisite data likely exist but must be aggregated.
Recycling rate	Percentage of waste diverted for recycling that is successfully recycled	▶ Recycling Bureau	Unknown—data are likely available, but this needs to be confirmed.
Compost volume	Tons of waste composted. This could start with the Bethlehem Yard Waste Facility and expand to include curbside programs as they are developed.	▶ Recycling Bureau	Unknown—data are likely available, but this needs to be confirmed.

Develop better tracking and understanding of Bethlehem's waste streams

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Waste study completed	Waste characterization study of Bethlehem completed to inform strategies	<ul style="list-style-type: none"> ▶ Northampton & Lehigh Counties ▶ Local waste haulers ▶ Recycling Bureau 	Requires development—can be monitored as CAP is implemented.

Reduce impact of current waste collection and disposal system

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
% of low-emission hauling vehicles	Percentage of total waste and recycling collection vehicles operating in Bethlehem that are either electric, run on zero-GHG emission fuels, or meet other low-emission standards	<ul style="list-style-type: none"> ▶ Northampton & Lehigh Counties ▶ Local waste haulers ▶ Recycling Bureau 	Requires development—may be tracked by individual waste haulers but data need to be aggregated.
% of haulers utilizing route optimization	Percentage of total waste and recycling vehicle routes based on route optimization software to minimize distance traveled and idling.	<ul style="list-style-type: none"> ▶ Northampton & Lehigh Counties ▶ Local waste haulers ▶ Recycling Bureau 	Requires development—may be tracked by individual waste haulers but data need to be aggregated.
Localized air pollution stats (e.g., PM2.5)	Local air quality index and levels of key pollutants, such as ozone and PM2.5	<ul style="list-style-type: none"> ▶ EPA ▶ PA DEP ▶ AirNow.gov ▶ PurpleAir 	Requires development—data are available but likely not monitored at a sufficiently granular scale to assess intracity variance and EJ areas; PM2.5, for example, drops off quickly—needs very localized monitoring.

Enhance the local food system

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
# of programs implemented	Number of local food programs and campaigns completed	<ul style="list-style-type: none"> ▶ Dept. of Community and Economic Development 	Enhance the local food system
Local food consumed	Tons of local food consumed by residents	<ul style="list-style-type: none"> ▶ Large institutions ▶ Sodexo ▶ Buy Fresh Buy Local—Greater Lehigh Valley 	Unknown—data are likely available, but this needs to be confirmed.

Public Engagement

Create a “Bethlehem Climate Challenge” program to educate about climate change and its potential impacts and motivate and empower residents and businesses to reduce emissions and participate in creating a resilient community

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Launch of Bethlehem Climate Challenge	Full implementation of the Bethlehem Climate Challenge and associated strategies in the CAP	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Tracked—program can be tracked based on CAP implementation.
Resident support for climate action	Public survey of residents to determine percentages who support climate action or not	<ul style="list-style-type: none"> ▶ City survey 	Requires development
Engagement campaigns run	Number of targeted engagement campaigns completed	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Requires development—this would require new databases to be developed as the CAP is implemented.
Contacts made	Number of Bethlehem residents contacted via education campaigns, whether in-person or via another medium	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Requires development—this would require new databases to be developed as the CAP is implemented.



Large Organizations and Institutions

Engage Bethlehem’s largest businesses, organizations, and institutions to adopt GHG reduction goals as or more ambitious than the city’s targets

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Organizations committed to the Bethlehem Carbon Challenge	Number of large organizations and institutions committed to achieving GHG reduction targets as or more ambitious than the city’s as part of the Bethlehem Carbon Challenge program.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Tracked—program can be tracked based on CAP implementation.
Total emissions covered under the Bethlehem Carbon Challenge	Total GHG emissions (metric tons CO ₂ e) represented by large organizations and institutions committed to the Bethlehem Carbon Challenge program.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development ▶ Program participants 	Requires development—commitments can be tracked as the Bethlehem Carbon Challenge is implemented.
Total emissions reduced under the Bethlehem Carbon Challenge	Total GHG emission reductions (metric tons CO ₂ e) from large organizations and institutions committed to the Bethlehem Carbon Challenge program.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development ▶ Program participants 	Requires development—commitments can be tracked as the Bethlehem Carbon Challenge is implemented.
# of organizations meeting their targets under the Bethlehem Carbon Challenge	Number of large organizations and institutions that achieve their targets set as part of the Bethlehem Carbon Challenge program.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Requires development—commitments can be tracked as the Bethlehem Carbon Challenge is implemented.

Leverage the scale and resources of Bethlehem’s largest businesses, organizations, and institutions to accelerate adoption of the CAP’s other strategies and coordinate their implementation

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Organizations committed to the Bethlehem Green Ribbon Commission	Number of large organizations and institutions committed to the Bethlehem Green Ribbon Commission.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Tracked—program can be tracked based on CAP implementation.
Total emissions covered under the Bethlehem Carbon Challenge	Total GHG emissions (metric tons CO ₂ e) represented by large organizations and institutions committed to the Bethlehem Carbon Challenge program.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development ▶ Program participants 	Requires development—commitments can be tracked as the Bethlehem Carbon Challenge is implemented.

Facilitate sharing of lessons learned, resources and best-practice examples to encourage and enable other organizations to implement strategies that will help the City meet its emission reduction targets

Performance Metric	Description	Existing or Possible Data Source	Currently Available / Requires Development Tracking
Organizations committed to the Bethlehem Green Ribbon Commission	Number of large organizations and institutions committed to the Bethlehem Green Ribbon Commission.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Tracked—program can be tracked based on CAP implementation.
# of Green Ribbon Commission meetings	Working group meetings and information-sharing meetings held as part of the Bethlehem Green Ribbon Commission.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Tracked—program can be tracked based on CAP implementation.
# of businesses engaged	Number of local businesses engaged on climate change, regardless of their participation in the Bethlehem Green Ribbon Commission.	<ul style="list-style-type: none"> ▶ Office of Sustainability ▶ Dept. of Community and Economic Development 	Requires development—this would require new databases to be developed as the CAP is implemented.

Appendix 3

Abbreviation Glossary

AC: Air conditioning

ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers

BAPL: Bethlehem Area Public Library

BASIC: Not an abbreviation. BASIC is a level of reporting coverage for the city-induced framework of the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. The BASIC level covers scope 1 and scope 2 emissions from stationary energy and transportation, as well as scope 1 and scope 3 emissions from waste.

BPA: Bethlehem Parking Authority

BTC: Bethlehem Transportation Center

CDC: Centers for Disease Control and Prevention

CDP: Carbon Disclosure Project, a not-for-profit charity running the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts.

CFCs: Chlorofluorocarbons, a class of gases with high ozone depleting potential and global warming potential that were used as refrigerants, aerosol propellants and cleaning solvents. Sales of CFCs were phased out in accordance with the Montreal Protocol.

CNG: Compressed natural gas

D&L: Delaware & Lehigh Canal National and State Heritage Corridor, notably the D&L Trail, which in Bethlehem follows the canal towpath along the Lehigh River

DIY: Do it yourself

EDT: Eastern Daylight Time

EJ: Environmental justice

EPA: United States Environmental Protection Agency

EUI: Energy use intensity

EV: Electric vehicle

EVSE: Electric vehicle supply equipment

GEV: Generalized extreme value distribution

GPC: Global Protocol for Community-Scale Greenhouse Gas Emission Inventories

HCFCs: Hydrochlorofluorocarbons, a class of gases designed to replace CFCs as refrigerants and other applications. HCFCs have medium ozone depleting potential and medium to high global warming potential. HCFCs are being phased out in line with the Montreal Protocol.

HS: High school

HVAC: Heating, ventilation, and air conditioning

ICLEI: ICLEI – Local Governments for Sustainability, an international non-governmental organization that promotes sustainable development and provides technical consulting to local governments to meet sustainability objectives.

LEED: Leadership in Energy and Environmental Design, the most widely used green building rating system in the world.

LV: Lehigh Valley

LVCP: Lehigh Valley Planning Commission

NCC: Northampton Community College

NG: Natural gas

NGO: Non-governmental organization

NRDC: Natural Resources Defense Council, a US-based non-profit international environmental advocacy group

NYC: New York City

O&M: Operations and maintenance

PA: Pennsylvania

PA DEP: Pennsylvania Department of Environmental Protection

PJM: a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states, including Pennsylvania, and the District of Columbia.

PNDI: Pennsylvania Natural Diversity Inventory

PPL: PPL Electric Utilities, the electric utility serving Bethlehem

PV: Photovoltaic

RFC East: an electric grid subregion, which includes Pennsylvania. RFC East is part the responsibility region of ReliabilityFirst, a Regional Entity responsible for ensuring electricity.

SNAP: Supplemental Nutrition Assistance Program

UGI: UGI Utilities, the natural gas utility serving Bethlehem

WDIY: Lehigh Valley Public Radio

WIC: Special Supplemental Nutrition Program for Women, Infants, and Children

ZEV: Zero-emissions vehicle

Appendix 4

Climate Data Processing and Results

For the analysis presented in *Projecting Bethlehem's Future Climate*, the CAP development team used statistically downscaled climate data. Specifically, the team analyzed statistically downscaled World Climate Research Programme's (WCRP) Coupled Model Intercomparison Project (CMIP5) data that relies on a method known as the Localized Constructed Analogues (LOCA) technique, developed by the Scripps Institute of Oceanography at the University of California, San Diego.¹⁸ The CAP development team processed daily temperature and precipitation projections across four grid cells (see Figure 28; daily values were averaged across the four grid cells prior to processing) and two future scenarios, a moderate future warming scenario (RCP4.5) and a high future warming scenario (RCP8.5) across an ensemble of climate models.¹⁹ The LOCA data is also the statistically downscaled climate projections used to inform the "Pennsylvania Climate Impacts Assessment Update" (2015).²⁰ The analysis used a baseline period of 1971–2000, and three future time periods of 2025–2049, 2050–2074, 2075–2099. The team incorporated two emissions scenarios to serve as an indication of uncertainty associated with how future society may evolve over the coming century. The assessment also provides the percentiles of the future values to show the range in values across the climate models, an indication of model uncertainty.

It is important to recognize the estimates resulting from the assessment are averages over a time period and the year-to-year variability can be much greater or less than the averages. The results are based on an ensemble of climate models which are developed to provide results on a climate-based timeframe (i.e., a minimum of 20- to 30-year averages).

The table below presents the variables that were developed for Bethlehem under these time periods and future warming scenarios.



Figure 28. LOCA grid cells used for this analysis

Table 4-1. Temperature and precipitation variables and stressors assessed for this study

Temperature Variables/Stressors	Precipitation Variables/Stressors
<ul style="list-style-type: none"> ▪ Annual Average Temperature ▪ Monthly Average Temperature (Jan-Dec) ▪ Seasonal Average Temperature (DJF, MAM, JJA, SON) ▪ Average Annual Tmax ▪ Monthly Tmax (Jan-Dec) ▪ Seasonal Tmax (DJF, MAM, JJA, SON) ▪ Average Annual Tmin ▪ Monthly Tmin (Jan-Dec) ▪ Seasonal Tmin (DJF, MAM, JJA, SON) ▪ Number of days Tmax is above 90, 95, 100, 105, 110 degrees F 	<ul style="list-style-type: none"> ▪ Annual Precipitation ▪ Monthly Precipitation (Jan-Dec) ▪ Seasonal Precipitation ▪ Number of days per year with precipitation (greater than trace of 0.01 inches) ▪ Number of days per year above 2 inches ▪ 2, 10, 25, 50, 100, and 200 24-hour return periods (also known as the annual exceedance probabilities of ½, 1/10, 1/25, 1/50, 1/100, and 1/200)

¹⁸ https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/

¹⁹ Climate models include: access1-0; access1-3; bcc-csm1-1; bcc-csm1-1-m; canesm2;ccsm4; cesm1-bgc; cesm1-cam5; cmcc-cm; cmcc-cms; cnrm-cm5;csiro-mk3-6-0;fgoals-g2;gfdl-cm3;gfdl-esm2g;gfdl-esm2m;hadgem2-ao;hadgem2-cc;hadgem2-es;inmcm4;ipsl-cm5a-lr;ipsl-cm5a-mr;miroc-esm;miroc-esm-chem;miroc5;mpi-esm-lr;mpi-esm-mr;mri-cgcm3;and noresm1-m.

²⁰ https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html

²¹ Tmax is the maximum daily temperature and Tmin is the minimum daily temperature.

Methodology

Future Temperature Change. The process of estimating future change for temperature variables for a given future warming scenario:

1. Estimate the 30-year average for baseline years (1971–2000) for one climate model simulation (e.g., climate model under the given future warming scenario).
2. Estimate the 30-year average for a future time period (e.g., 2025–2049) for the same climate model simulation.
3. Estimate the future change for the climate model simulation by subtracting the baseline value from the future value.
4. Repeat these steps for each climate model simulation. Based on all climate models used per future warming scenario, estimate the median, 10th percentile, 90th percentile.

Future Precipitation Change. The process of estimating future change for precipitation variables for a given future warming scenario:

1. Estimate the 30-year average for baseline years (1971–2000) for one climate model simulation (e.g., climate model under the given future warming scenario).
2. Estimate the 30-year average for a future time period (e.g., 2025–2049) for the same climate model simulation.
3. Estimate the future percent change for climate model simulation by subtracting the baseline value from the future value and then dividing by the baseline value.
4. Repeat these steps for each climate model simulation. Based on all climate models used per future warming scenario, estimate the median, 10th percentile, 90th percentile. The exception is that precipitation variables that are tailored to number of days per year a threshold occurs were developed consistent with that described above for temperature variables.

Extreme precipitation. The process of estimating the future change in 24-hour return periods for 2, 10, 25, 50, 100, and 200-year:

1. Identify the annual duration for each climate model simulation for the entire time period.
2. For each climate model simulation, use the Process-informed Nonstationary Extreme Value Analysis (ProNEVA) model²² to estimate future change in return periods in the mid-points of the future time horizons (2037, 2062, and 2087). This MATLAB-based model uses a GEV distribution fit and allows for nonstationarity. The analysis team have found results using ProNEVA for extreme precipitation to be more consistent with expected conditions.
3. For each future warming scenario, average the future percent change across the climate model simulations and calculate the 10th percentile and 90th percentile.
4. Compare these values to the 24-hour NOAA Atlas 14 return periods.

Tabular Results

The following tables provide the future projections for Bethlehem. Note that the average projections in orange font are greater than one standard deviation of the historical average (i.e., the range of 68% of the distribution from 1971–2000) and average projections in red font are greater than two standard deviations of the historical average (i.e., the range of 95% of the distribution from 1971–2000). In other words, values in red font suggest the future average is outside the year-to-year variability historically experienced.

²² http://amir.eng.uci.edu/publications/19_AWR_ProNEVA.pdf

Table 4-2. Temperature Projections (F) under the moderate warming scenario (RCP4.5)

4.5		Obs	2025_2049	10th	90th	2050_2074	10th	90th	2075_2099	10th	90th
Tavg	Annual	51.5	55.0	54.2	56.5	56.6	54.7	58.5	57.4	55.3	60.0
	Jan	27.5	31.8	30.0	33.8	33.2	31.1	35.4	34.2	31.1	36.7
	Feb	30.6	33.6	32.3	35.6	35.5	33.6	37.9	36.6	34.4	39.0
	Mar	39.3	41.9	40.6	43.3	43.2	41.2	45.6	43.8	42.1	46.6
	Apr	49.9	52.6	51.5	54.7	54.0	51.7	56.3	55.0	53.2	57.5
	May	60.5	64.0	62.6	65.4	65.5	63.5	67.4	66.1	63.8	68.9
	Jun	69.1	73.1	71.4	74.3	74.8	73.0	76.4	75.3	73.5	78.0
	Jul	74.0	78.6	76.8	79.7	80.2	77.9	82.5	80.5	78.2	84.3
	Aug	72.1	76.1	75.0	77.9	77.7	75.5	80.9	78.3	76.1	83.5
	Sep	64.5	68.1	66.6	69.6	69.6	67.8	72.4	70.4	67.9	74.2
	Oct	53.1	57.1	55.4	58.3	58.6	56.3	60.3	59.4	56.7	62.3
	Nov	43.1	47.3	45.6	49.0	48.1	46.9	50.2	49.6	46.8	51.6
	Dec	33.0	37.2	35.2	39.2	38.7	36.6	41.1	39.5	37.0	42.6
	Winter	29.8	33.7	33.0	35.5	35.2	34.6	38.3	36.1	34.7	41.6
	Spring	49.9	52.9	51.8	54.2	54.2	52.4	56.5	54.9	53.2	57.4
	Summer	71.8	76.0	74.5	77.2	77.6	75.7	80.0	78.2	76.1	82.1
Fall	53.5	57.5	56.3	58.9	58.8	57.1	60.6	59.6	57.2	62.7	
Tmax	Annual	61.4	65.1	63.9	66.3	66.6	64.4	68.6	67.3	65.2	70.2
	Jan	35.6	39.6	37.9	41.5	40.7	38.7	43.0	41.7	38.7	44.4
	Feb	39.5	42.1	41.1	44.0	43.9	41.9	46.4	44.9	42.4	47.9
	Mar	49.0	51.6	50.2	53.3	53.0	50.7	55.2	53.4	51.6	55.9
	Apr	60.9	63.6	62.1	65.8	65.2	62.6	67.5	66.2	63.8	68.2
	May	71.6	75.1	73.2	76.6	76.6	74.2	78.8	77.6	75.0	80.0
	Jun	79.8	83.9	82.1	85.1	85.7	83.4	87.2	86.2	83.7	88.7
	Jul	84.5	89.4	87.4	90.6	91.1	88.3	93.8	91.1	89.0	95.3
	Aug	82.6	87.0	85.6	88.7	88.6	85.8	91.6	89.0	86.3	94.7
	Sep	75.0	79.0	77.5	80.6	80.2	78.0	83.2	81.1	78.0	85.1
	Oct	63.8	68.1	66.4	69.3	69.3	66.7	71.4	70.4	67.4	73.5
	Nov	52.2	56.8	55.0	58.6	57.6	56.1	59.8	58.3	56.1	61.2
	Dec	40.9	45.1	42.6	47.2	46.4	44.2	49.3	47.2	44.6	51.0
	Winter	37.9	41.5	39.4	42.5	42.9	40.4	44.5	43.8	40.8	45.3
	Spring	60.5	63.7	62.3	64.8	65.0	62.7	66.5	65.8	63.8	67.4
	Summer	82.3	86.8	85.2	88.1	88.7	86.1	90.9	88.8	86.5	93.1
Fall	63.7	67.8	66.8	69.4	69.2	67.2	70.9	70.1	67.5	73.3	
Days Above 86F	33	65	52	72	77	58	87	80	60	98	
Days Above 90F	12	36	26	43	47	29	59	50	32	73	
Days Above 95F	2	11	7	17	18	8	30	19	10	44	
Days Above 100F	0	2	1	6	4	1	13	5	2	21	
Days Above 105F	0	0	0	1	1	0	4	1	0	9	
Days Above 110F	0	0	0	0	0	0	1	0	0	3	
Tmin	Annual	41.6	45.1	44.1	46.6	46.7	45.0	48.8	47.4	45.5	50.1
	Jan	19.5	24.3	22.4	26.1	25.8	23.4	28.2	26.9	23.4	29.1
	Feb	21.8	25.2	23.3	27.3	26.9	25.0	29.6	28.0	25.8	30.6
	Mar	29.6	32.0	30.4	33.6	33.3	31.6	35.7	34.0	32.4	36.2
	Apr	38.9	41.6	40.6	43.2	42.9	40.9	45.6	43.9	42.1	47.2
	May	49.4	52.6	51.7	54.4	54.4	52.5	56.5	55.0	52.6	57.9
	Jun	58.5	62.3	60.8	63.6	63.9	62.0	65.7	64.6	62.6	67.4
	Jul	63.4	67.7	66.2	68.9	69.2	67.4	71.4	70.0	67.6	73.3
	Aug	61.6	65.3	64.2	67.2	67.1	64.9	70.1	67.8	65.4	72.5
	Sep	53.9	57.3	55.8	58.9	58.8	57.3	61.6	59.5	57.7	63.2
	Oct	42.4	46.4	44.3	47.4	47.6	45.5	49.3	48.6	45.9	51.4
	Nov	33.9	37.8	36.1	39.6	38.7	37.2	41.1	40.0	37.3	42.8
	Dec	25.2	29.2	27.7	31.5	30.7	29.0	32.9	31.3	29.4	34.6
	Winter	21.7	25.9	25.4	28.1	27.4	26.8	30.8	28.3	27.5	34.7
	Spring	39.3	42.1	41.3	43.4	43.6	41.8	45.6	44.1	42.5	46.8
	Summer	61.2	65.2	64.0	66.4	66.9	65.1	69.0	67.5	65.5	71.2
Fall	43.4	47.1	45.7	48.6	48.5	46.9	50.3	49.3	47.0	52.2	

Table 4-3. Temperature Projections (F) under the high warming scenario (RCP8.5)

8.5		Obs	2025_2049	10th	90th	2050_2074	10th	90th	2075_2099	10th	90th
Tavg	Annual	51.46	55.42	54.30	56.72	58.20	56.37	59.89	60.83	58.08	63.21
	Jan	27.54	32.26	30.42	33.79	34.46	32.47	37.11	37.23	33.45	39.52
	Feb	30.64	34.04	32.82	36.04	36.53	34.69	39.10	38.90	36.25	42.81
	Mar	39.30	42.15	40.43	43.61	44.09	42.25	47.25	45.87	43.51	49.32
	Apr	49.89	52.71	50.96	54.42	55.40	53.02	57.50	57.77	55.25	60.59
	May	60.46	63.89	62.62	65.82	66.73	64.86	68.90	69.63	66.44	71.94
	Jun	69.11	73.57	72.28	74.63	76.70	74.67	78.11	79.39	76.15	81.73
	Jul	73.98	78.97	77.15	80.90	81.89	79.90	84.43	85.03	81.96	88.43
	Aug	72.08	76.81	75.46	78.75	79.43	77.54	83.30	83.73	79.64	87.93
	Sep	64.47	68.57	67.15	70.18	71.40	69.65	73.82	74.66	71.61	78.21
	Oct	53.10	57.35	55.69	58.87	60.34	57.55	61.72	62.66	60.55	66.15
	Nov	43.06	47.41	45.86	48.73	50.03	47.87	51.67	51.93	49.66	54.50
	Dec	33.05	37.86	35.65	39.60	40.03	38.11	42.07	42.11	38.94	45.47
	Winter	29.81	33.98	32.72	35.60	36.47	33.64	38.10	38.68	34.13	40.65
	Spring	49.88	52.84	51.71	54.64	55.61	53.50	57.58	57.93	55.21	60.27
	Summer	71.75	76.61	75.10	77.92	79.44	77.46	81.91	82.83	79.08	85.96
Fall	53.54	57.84	56.40	58.96	60.59	58.85	62.14	63.09	60.79	66.08	
Tmax	Annual	61.36	65.36	64.19	66.55	68.23	66.31	70.06	70.62	68.07	73.63
	Jan	35.59	39.72	38.34	40.88	42.07	39.69	45.20	44.47	40.74	47.67
	Feb	39.51	42.86	41.47	44.25	45.07	42.92	47.57	47.62	44.12	50.91
	Mar	49.03	51.32	49.91	53.51	54.30	51.56	56.39	55.78	53.30	58.68
	Apr	60.92	63.90	61.80	65.14	66.58	63.74	68.55	69.06	65.78	71.59
	May	71.56	75.15	73.56	76.86	78.11	75.76	80.17	81.21	77.05	83.50
	Jun	79.77	84.16	82.75	85.64	87.30	85.09	89.10	90.08	86.53	93.56
	Jul	84.51	89.72	87.58	91.72	92.45	90.60	95.65	95.86	92.71	100.15
	Aug	82.56	87.54	86.08	89.47	90.15	88.14	94.36	94.22	90.08	99.44
	Sep	75.01	79.35	77.69	81.05	82.29	80.18	84.70	85.42	81.84	89.49
	Oct	63.81	68.33	66.59	69.69	71.25	68.69	73.19	73.78	71.16	77.27
	Nov	52.20	56.84	55.15	57.82	59.26	57.30	61.28	61.29	59.13	63.95
	Dec	40.90	45.51	43.27	47.46	47.58	45.55	50.21	49.81	46.75	53.51
	Winter	37.89	41.77	39.95	42.99	44.21	42.13	46.30	46.32	43.65	49.26
	Spring	60.50	63.44	62.22	65.13	66.55	63.78	67.89	68.99	65.32	70.72
	Summer	82.31	87.26	85.62	88.73	90.02	88.06	93.22	93.45	89.78	97.50
Fall	63.67	68.07	66.62	69.36	71.02	69.31	72.59	73.59	71.04	76.87	
Days Above 86F	33	68	56	76	88	72	98	108	86	122	
Days Above 90F	12	39	28	47	58	43	72	83	57	100	
Days Above 95F	2	14	8	20	26	17	42	47	25	71	
Days Above 100F	0	3	1	6	9	4	20	20	8	43	
Days Above 105F	0	0	0	1	2	0	8	6	1	21	
Days Above 110F	0	0	0	0	0	0	2	1	0	8	
Tmin	Annual	41.56	45.48	44.40	46.91	48.33	46.38	49.88	50.88	48.15	53.47
	Jan	19.50	24.36	22.54	26.62	27.07	24.96	29.02	29.51	26.33	31.93
	Feb	21.77	25.41	24.15	27.49	28.19	26.42	30.51	30.21	27.93	34.64
	Mar	29.57	32.35	30.77	33.77	34.07	32.65	37.37	35.88	34.02	39.06
	Apr	38.86	41.57	40.28	43.71	44.19	42.12	46.58	46.59	44.80	49.79
	May	49.35	52.85	51.61	54.69	55.35	53.94	57.70	58.31	55.83	60.97
	Jun	58.46	62.97	61.58	63.99	65.89	64.01	67.30	68.66	65.49	70.68
	Jul	63.45	68.32	66.71	69.75	71.10	69.18	73.34	74.07	71.02	76.81
	Aug	61.60	66.06	64.83	67.98	68.81	66.97	71.92	72.94	68.96	76.40
	Sep	53.92	57.85	56.28	59.36	60.67	58.80	63.01	63.92	61.08	66.93
	Oct	42.40	46.61	44.94	48.11	49.38	47.07	50.73	51.93	49.16	55.03
	Nov	33.91	38.09	36.51	39.58	40.10	38.15	42.40	42.82	39.65	45.76
	Dec	25.19	29.60	28.02	31.93	32.06	30.16	34.52	34.25	31.38	37.91
	Winter	21.73	26.18	25.18	28.22	28.72	26.32	30.47	31.04	26.87	32.93
	Spring	39.27	42.28	41.27	43.60	44.52	43.04	46.96	47.06	44.95	49.46
	Summer	61.20	65.89	64.59	67.14	68.85	66.80	70.85	72.09	68.33	74.35
Fall	43.40	47.56	46.18	48.78	50.11	48.21	51.90	52.76	50.09	55.48	

Table 4-4. Precipitation projections (inches) under the moderate future warming scenario (RCP4.5)

	Obs	2025_2049	10th	90th	2050_2074	10th	90th	2075_2099	10th	90th
Annual	44.42	45.39	42.78	49.79	47.20	43.24	51.22	47.38	44.82	51.02
Jan	3.71	3.94	3.42	4.65	4.10	3.46	4.85	4.05	3.49	4.89
Feb	2.63	3.46	2.96	4.01	3.64	2.93	4.00	3.48	3.11	4.12
Mar	3.32	3.29	2.72	3.69	3.22	2.75	3.78	3.28	2.85	3.96
Apr	3.66	3.49	3.07	3.98	3.51	3.01	4.10	3.48	3.19	4.17
May	4.02	3.84	3.44	4.56	3.88	3.35	4.64	3.95	3.60	4.83
Jun	3.87	3.80	3.33	4.36	3.87	3.28	4.48	3.85	3.31	4.75
Jul	3.91	3.21	2.72	3.54	3.17	2.78	3.87	3.24	2.90	3.82
Aug	4.57	4.08	3.41	4.89	4.20	3.48	4.92	4.23	3.60	5.26
Sep	4.17	3.39	2.94	4.07	3.42	2.99	4.12	3.52	2.96	3.91
Oct	3.42	3.60	2.87	4.10	3.60	2.89	4.38	3.69	3.03	4.51
Nov	3.78	3.78	2.95	4.67	3.81	3.30	4.65	3.92	3.14	4.75
Dec	3.41	3.30	2.69	3.79	3.32	2.82	4.04	3.32	2.92	4.07
Winter	9.69	10.14	9.20	11.38	10.72	9.20	12.16	10.94	9.76	12.35
Spring	11.01	10.14	9.38	11.16	10.77	9.66	11.94	10.78	9.59	12.24
Summer	12.28	10.46	9.41	11.82	11.03	9.86	12.59	11.24	9.82	12.78
Fall	11.33	10.18	9.55	11.45	10.89	9.50	12.07	10.97	9.65	12.26
Number of Days above 2inches	1.03	1.34	0.98	1.62	1.38	1.04	1.78	1.52	1.10	1.97
Days of Precip (above 0.01 in)	174.92	167.16	161.53	176.02	167.58	160.32	177.99	167.20	160.27	176.22
Return Period - 2yr	2.91	3.05	2.97	3.12	3.13	3.00	3.25	3.22	3.04	3.38
Return Period - 10yr	4.57	5.16	4.64	7.11	5.25	4.68	7.24	5.35	4.72	7.37
Return Period - 25yr	5.56	6.55	5.63	10.22	6.65	5.67	10.34	6.76	5.72	10.49
Return Period - 50yr	6.38	7.77	6.45	13.13	7.88	6.49	13.25	7.99	6.54	13.38
Return Period - 100yr	7.26	9.15	7.33	16.56	9.26	7.38	16.71	9.38	7.42	16.86
Return Period - 200yr	8.22	10.73	8.29	20.65	10.84	8.34	20.82	10.97	8.38	20.99

Table 4-5. Precipitation projections (inches) under the high warming scenario (RCP8.5)

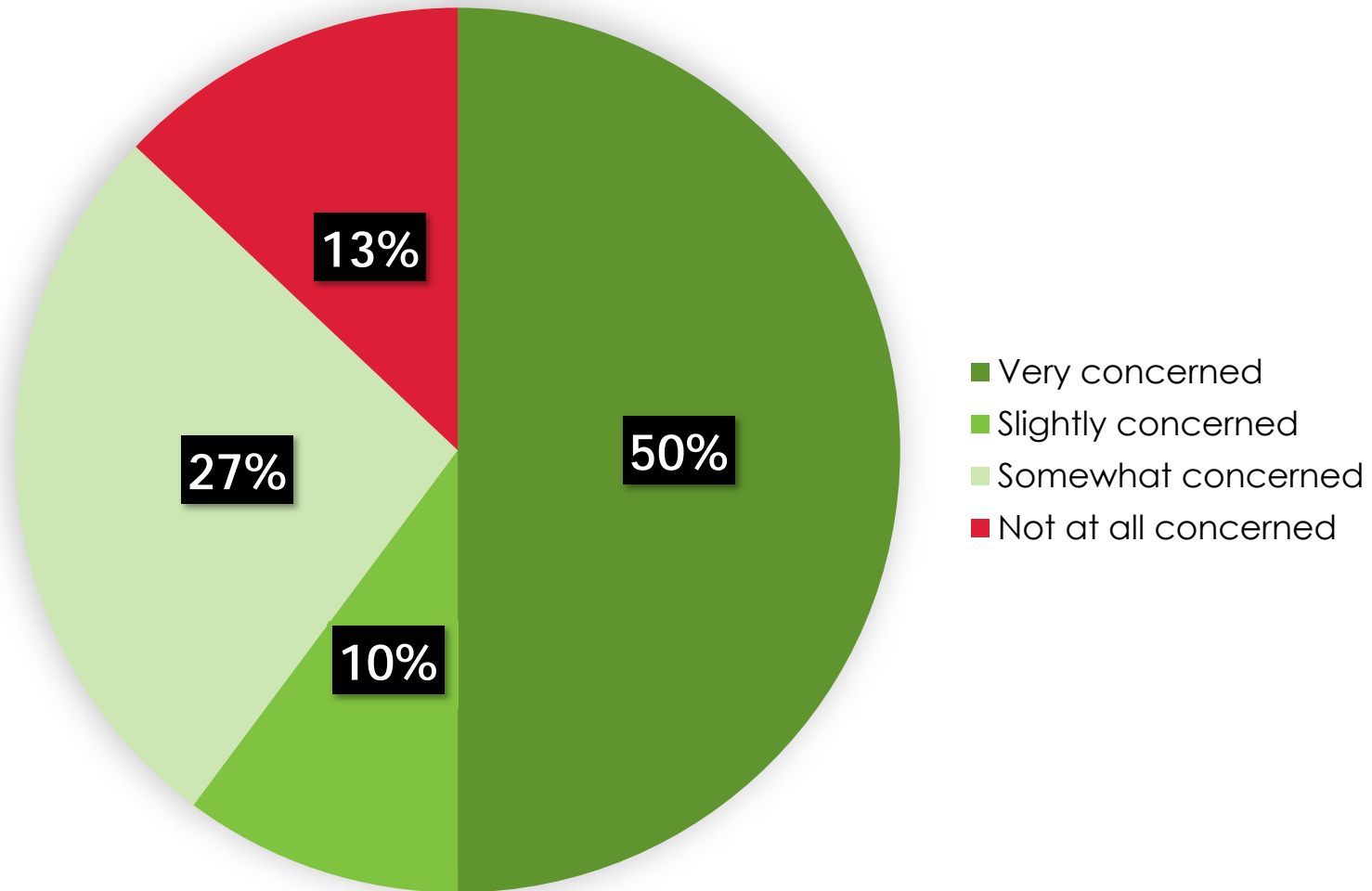
	Obs	2025_2049	10th	90th	2050_2074	10th	90th	2075_2099	10th	90th
Annual	44.42	46.32	42.79	49.42	48.16	43.71	51.64	49.10	44.50	54.47
Jan	3.71	4.03	3.18	4.76	4.28	3.57	5.58	4.59	3.74	5.39
Feb	2.63	3.46	2.72	4.10	3.76	3.00	4.81	3.78	3.29	5.03
Mar	3.32	3.33	2.56	3.84	3.41	2.73	4.42	3.81	2.98	4.17
Apr	3.66	3.58	2.78	4.21	3.84	3.11	4.54	3.95	3.34	4.75
May	4.02	3.99	3.24	4.69	4.29	3.26	5.20	4.37	3.70	5.32
Jun	3.87	3.88	3.11	4.58	4.14	3.17	5.36	4.20	3.53	5.21
Jul	3.91	3.18	2.72	3.79	3.47	2.85	4.26	3.67	3.01	4.25
Aug	4.57	4.12	3.47	5.04	4.48	3.34	5.81	4.58	3.61	5.71
Sep	4.17	3.59	2.76	4.14	3.90	2.92	4.42	3.79	3.16	4.94
Oct	3.42	3.64	2.86	4.31	3.92	2.98	5.00	4.16	3.17	4.88
Nov	3.78	3.78	3.01	4.74	4.26	3.13	5.34	4.18	3.55	5.42
Dec	3.41	3.28	2.75	3.92	3.66	2.74	4.47	3.84	3.01	4.45
Winter	9.69	10.21	9.10	12.38	11.22	9.99	13.04	12.03	10.14	13.30
Spring	11.01	10.67	9.50	11.90	11.34	9.98	12.73	11.58	10.38	13.46
Summer	12.28	10.97	10.09	12.44	11.67	10.21	13.34	11.93	10.43	13.56
Fall	11.33	10.91	9.38	11.97	11.58	9.89	13.01	11.74	10.34	13.89
Number of Days above 2inches	1.03	1.32	0.90	1.72	1.61	1.09	2.02	1.66	1.22	2.34
Days of Precip (above 0.01 in)	174.92	166.34	159.54	174.99	166.43	152.76	176.67	164.29	151.55	180.66
Return Period - 2yr	2.91	3.04	2.95	3.14	3.12	2.98	3.28	3.20	3.00	3.43
Return Period - 10yr	4.57	5.16	4.61	7.19	5.24	4.64	7.34	5.33	4.67	7.39
Return Period - 25yr	5.56	6.58	5.60	10.43	6.67	5.63	10.63	6.76	5.65	10.84
Return Period - 50yr	6.38	7.84	6.42	13.54	7.93	6.45	13.77	8.03	6.47	14.02
Return Period - 100yr	7.26	9.29	7.30	17.33	9.38	7.33	17.60	9.48	7.35	17.87
Return Period - 200yr	8.22	10.97	8.26	21.98	11.07	8.29	22.28	11.18	8.31	22.59

Appendix 5

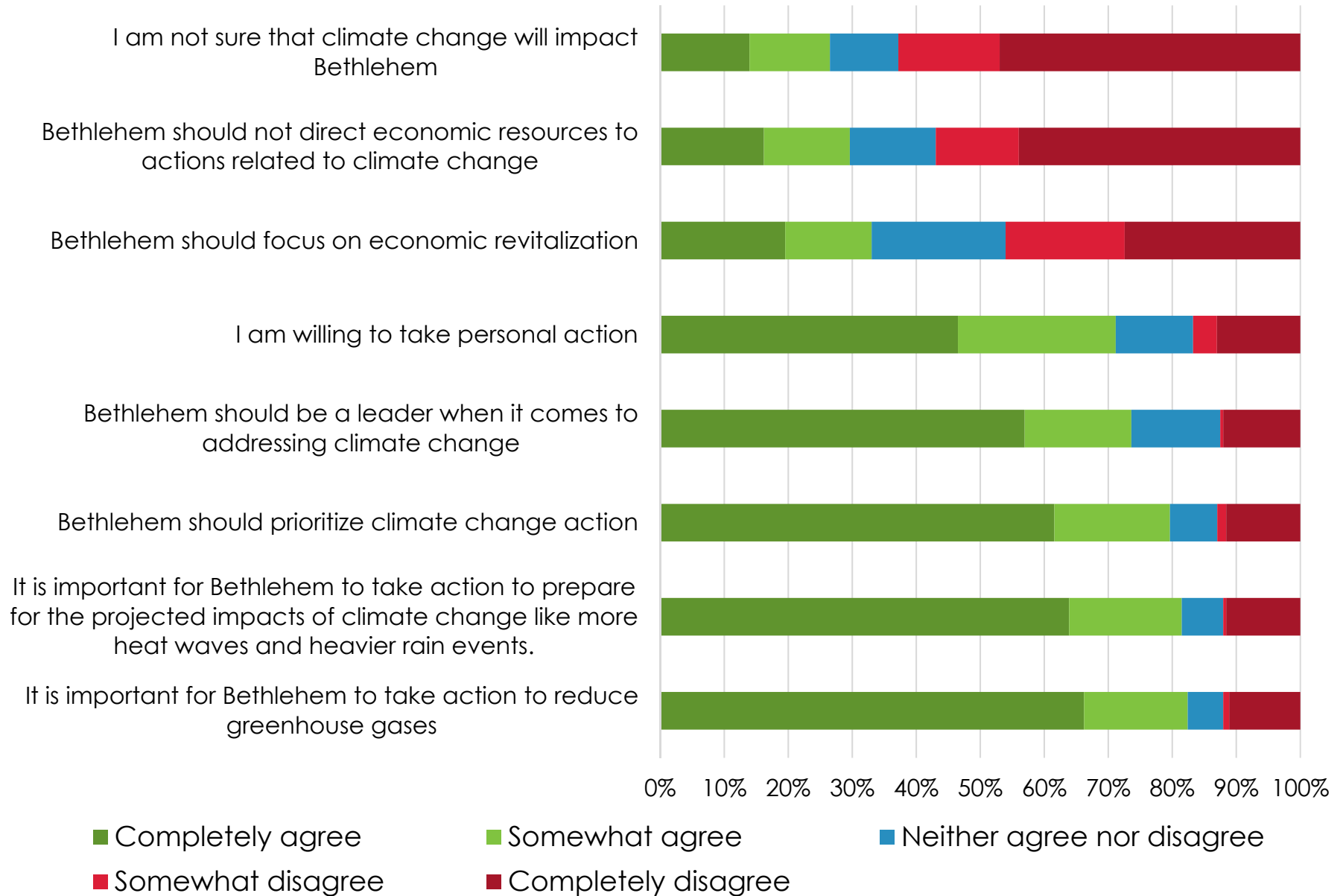
Community Survey Results

The following charts summarize results from the CAP community survey released prior to the initial public visioning meeting held June 17, 2020. The survey was open to the public throughout the CAP development process from May through November. More than 80% of responses were submitted in May and June.

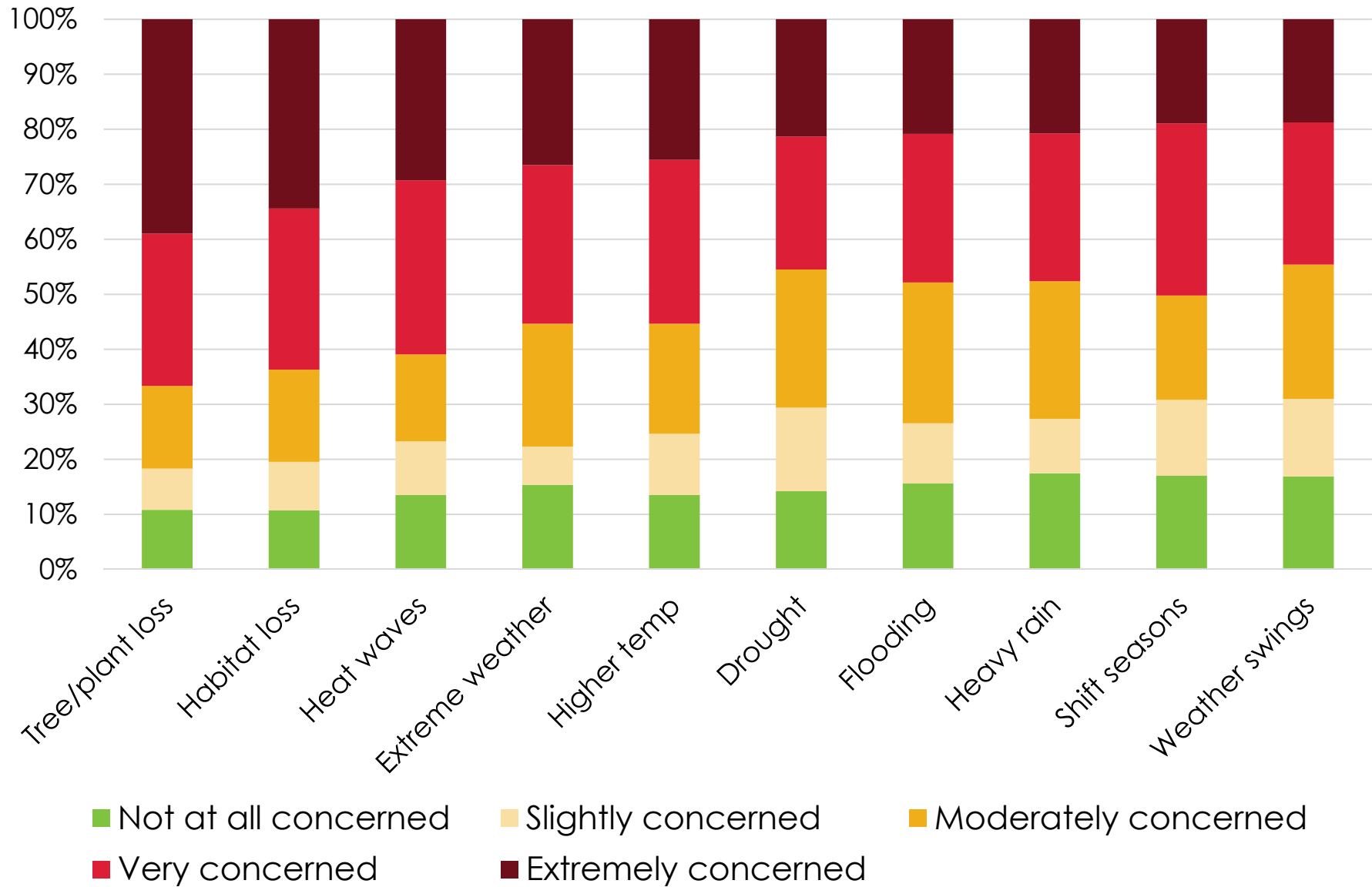
Are you concerned about climate change impacts in general for Bethlehem?



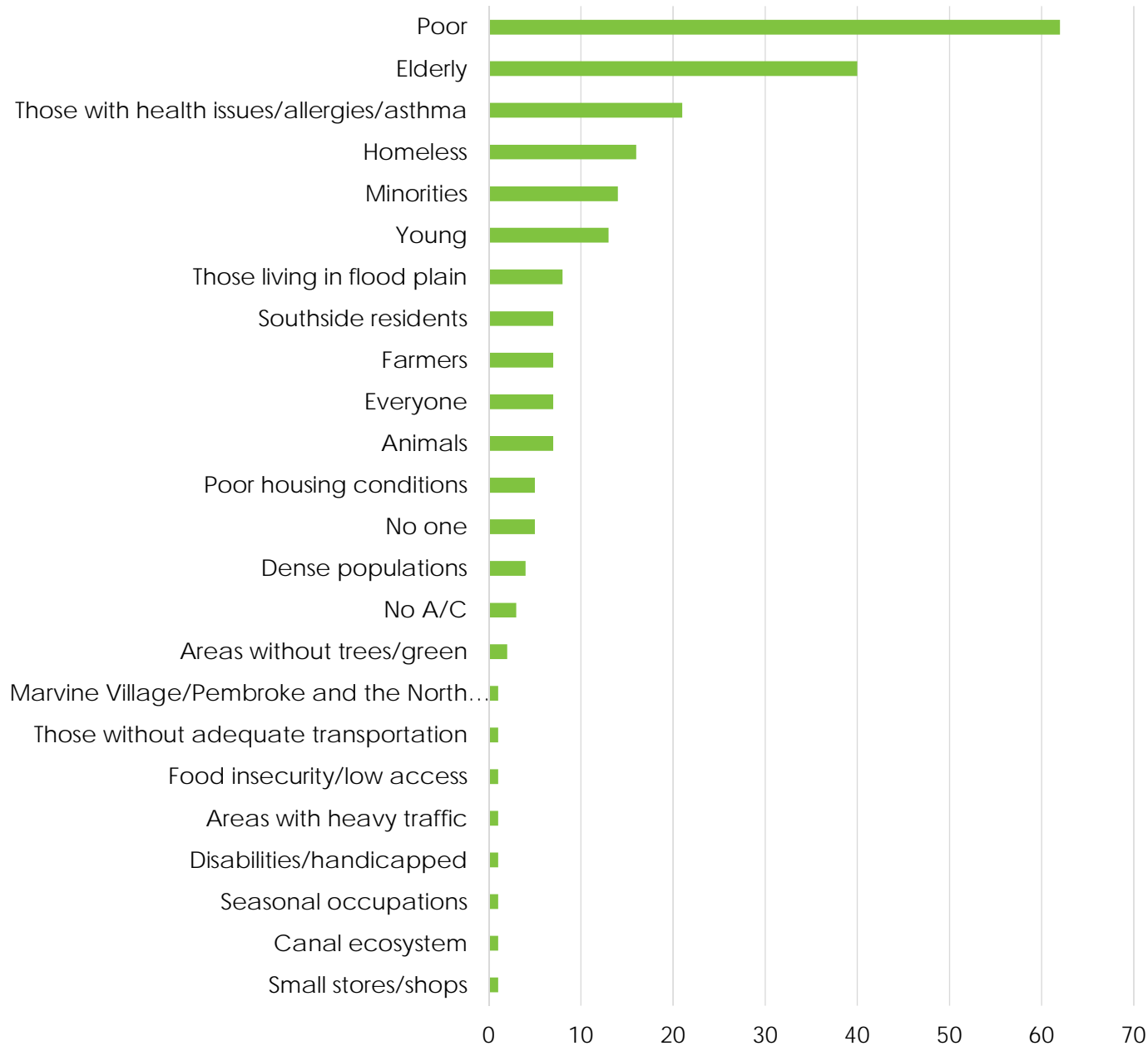
How much do you agree with the following statements:



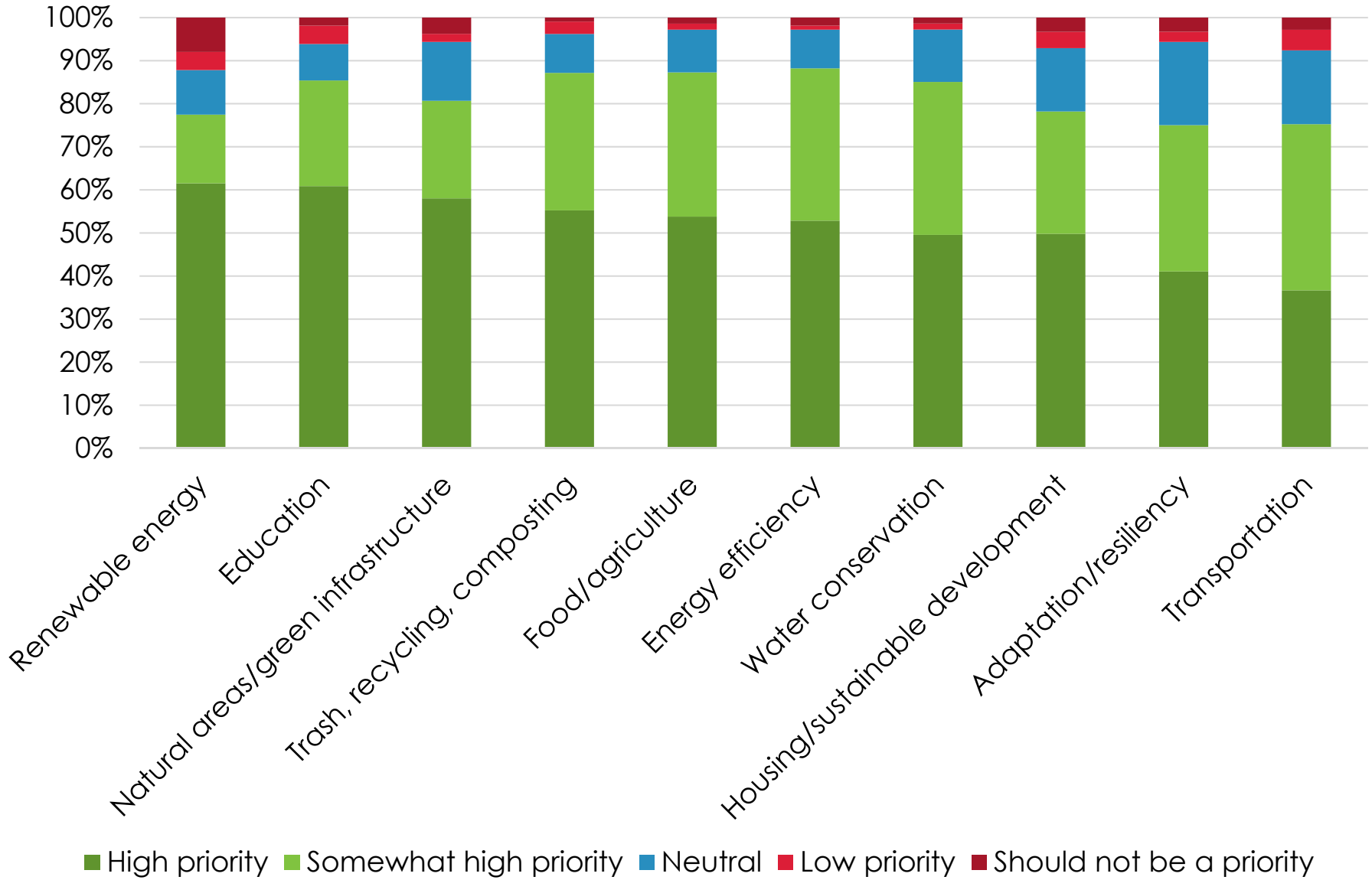
How concerned are you about the following impacts that are projected for the future in Bethlehem?



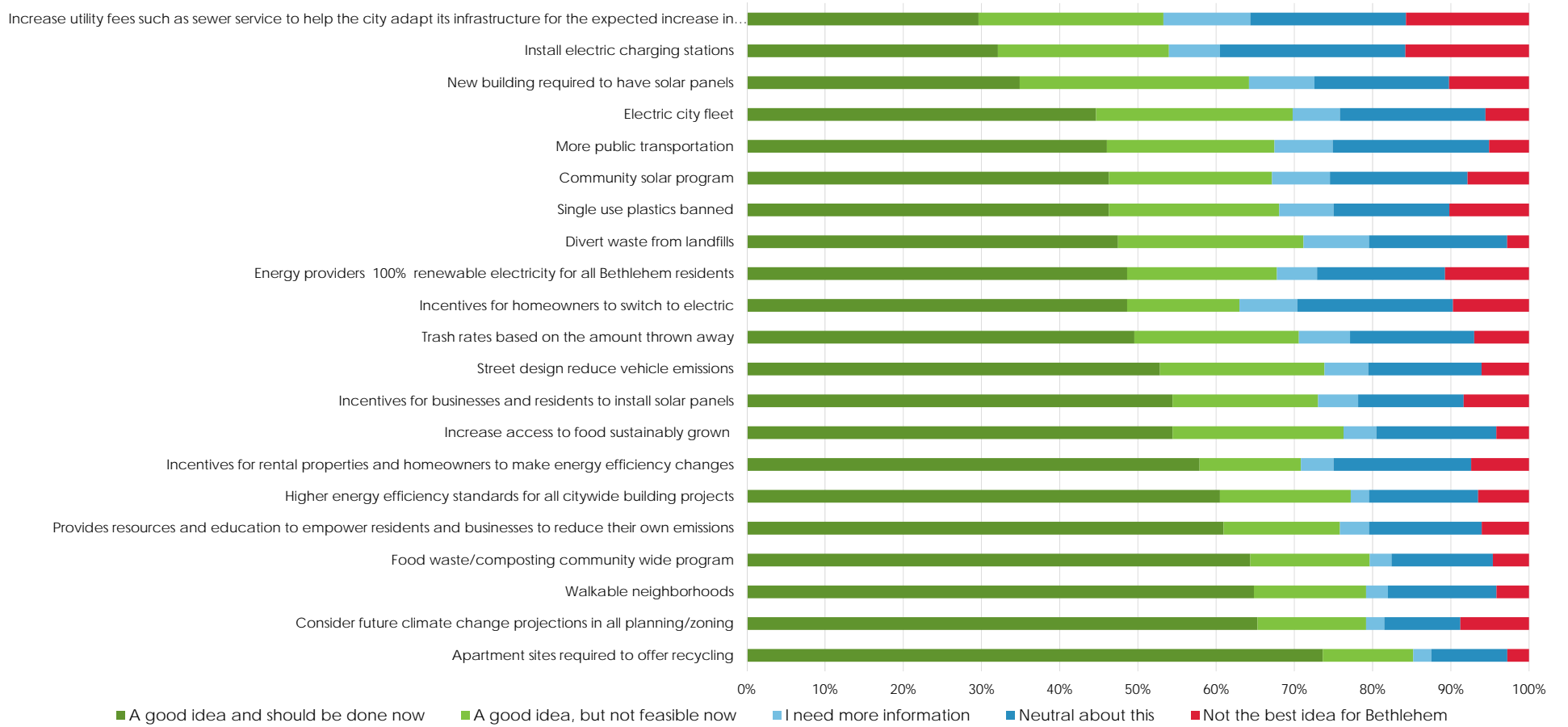
Who do you think are the most vulnerable communities/populations in Bethlehem considering the changes projected from climate change?



Please rank the following environmental priorities in terms of their importance to you



I think the following strategies are...



Appendix 6

Community-wide GHG inventory summary

The following table presents a summary of Bethlehem's 2017 community-wide GHG inventory.

Sector	Greenhouse gases (tCO ₂ e)
BUILDINGS: FUEL	
Residential	74,000
Commercial and institutional	86,000
Manufacturing	136,000
BUILDINGS: ELECTRICITY	
Residential	170,000
Commercial and institutional	249,000
Manufacturing	126,000
TRANSPORTATION	219,000
WASTE	111,000
Total	1,171,000

